ENVIRONMENTAL ASSESSMENT
LEVEL 2 - MINOR WORKS

East Seaham Road Guardrail Installation

23 May 2024

REPORT PREPARATION			
Name	**Title / Position**	**Qualification(s)**	**Organisation**
Natalie Nowlan	Project Support Environmental Officer	BSc (Env Bio) Dip IWCM Dip EnvLaw	Port Stephens Council

DOCUMENT CONTROL			
Version No.	**Date**	**Description**	**Author/ Reviewer**
1	17/04/2024	Draft	Natalie Nowlan

DOCUMENT PURPOSE

This document is An Environmental Assessment (EA) for the proposed activity as required under Division 5.1 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). This activity is permitted without consent in accordance the *NSW State Environmental Planning Policy (Transport and Infrastructure) 2021* SEPP (T&I). This EA has been prepared in accordance with Part 8 Division 1 of the *NSW Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) and Division 5.1 of the EP&A Act.

Pursuant to section 5.1 (1) of the EP&A Act, Port Stephens Council (PSC) is prescribed as a 'public authority' for the purposes of being a 'determining authority' within the meaning of Part 5 Division of the EP&A Act. This is only permitted where a proposal is permitted without consent on land vested in, leased by or otherwise under the ownership, care, control or management of Council. For the purposes of this activity, Council is both the proponent and determining authority.

This EA enables Council to assess the potential environmental impact of the activity and detail the protective mitigation measures for implementation prior to activities commencing, whilst activities are occurring onsite, once activities are complete and during operation and maintenance. In doing so this EA helps to fulfil the requirements of section 5.5 of the EP&A Act, that Council examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

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Declarations

ASSESSOR DECLARATION

As the Assessor of the activity:

- I am delegated to undertake this assessment.
- This EA provides a true and accurate review of the activity in relation to its likely impacts on the environment and contains neither false nor misleading information.
- The environmental impacts of the activity are NOT likely to be significant and therefore an EIS is NOT required.
- The activity is NOT within a declared area of outstanding biodiversity value and is NOT likely to have a significant impact on threatened species, threatened ecological communities or their habitat. Therefore, a SIS and/or BDAR is NOT required.

Name	Title / position	Service unit	Signature	Date
Natalie Nowlan	Project Support Environmental Officer	Capital Works	*N.Nowlan*	31/05/2024

PORT STEPHENS COUNCIL PROJECT MANAGER SIGNOFF

As the Project Manager of the activity:

- I certify to the best of my knowledge that this EA adequately reflects the proposed activity.
- I also understand that completion of this EA does not imply permission to undertake the proposed activity, but provides a collated report suitable for the appropriately Delegated Officer to consider the proposal and determine if the activity should be undertaken, given any potential harmful impacts on the local environment.

Name	Title / position	Service unit	Signature	Date
Dylan Brake	Civil Project Manager	Capital Works	[redacted]	03/06/2024

PORT STEPHENS COUNCIL DETERMINATION

As the Determining Officer of the activity:

- I am delegated to authorise this EA on behalf of Council as the determining authority
- The activity has been adequately assessed in accordance with Council's EMS 3.0 Environmental Assessment Procedure
- I have reviewed and endorse the contents of this EA and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the Guidelines approved under clause 170 of the EP&A Regulation, and the information it contains is neither false nor misleading.
- The environmental impacts of the activity are NOT likely to be significant, therefore no EIS or SIS and/or BDAR is required, and the activity may proceed subject to the implementation of all mitigation measures set out in Section 8 of the REF document.

Name	Title / position	Service unit	Signature	Date
Phil Miles	Capital Works Manager	Capital Works	[redacted]	03~~02~~/06/2024

PORT STEPHENS COUNCIL

PUBLISHING REQUIREMENTS		
Publishing threshold	**Yes**	**Publishing location**
Project has a Capital Investment of more than $5 million	☐	
An approval or permit for an activity that requires approval under:		
NSW Fisheries Management Act 1994 (FM Act) sections: • 144 Aquaculture. • 201 Dredging and reclamation. • 205 Harm to marine vegetation. • 219 Blockage of fish passage.	☐	
NSW Heritage Act 1977 (Heritage Act) section 57 State Heritage Register listed or items under an interim heritage order.	☐	
NSW National Parks and Wildlife Act 1974 (NP&W Act) section 90 Aboriginal Heritage Impact Permit	☐	
NSW Protection of the Environment Operations Act 1977 (POEO Act) sections: • 47 Scheduled development work. • 48 Scheduled Activities (premises-based). • 49 Scheduled Activities (not premises based). • 122 Environmental Protection Licence (Water Pollution).	☐	
If the determining authority considers it to be in the public interest (for further guidance refer to Point 6 in Attachment A of the Department of Planning and Environment, Guidelines for Division 5.1 assessments, February 2022).	☐	
Environmental Assessment to be published in accordance with Decision pathway – Publishing EAs on the Council website Record Number22/168216		

1. Project details

Activity details	
Activity name	East Seaham Road Stage 5 Guardrail Installation
Job number	N/A
Section	Capital Works – Civil
Timing & duration	The activity will take a period of approximately 1 – 2 days within the month of May or June.

Locality map

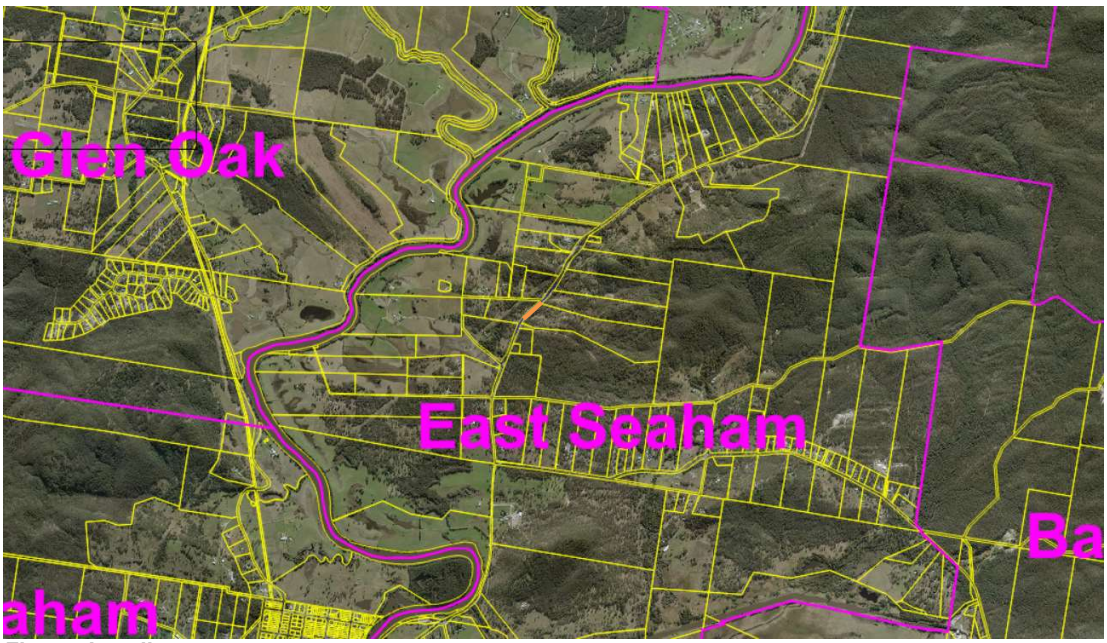

Figure: Locality map

Permissibility

SEPP (T&I)	***Part***	***Division***	***Subdivision***	***Section***
	2.3	17	1	2.113

PS LEP	***Lot***	***DP***	***Zoning***	***Permitted***
	East Seaham Road, road reserve, Segment 110		RU1 Primary Production	☒

Site details, ownership and requirements

Street address	Lot	DP	Land owner[1]	Requirements[2]	Status
Segment 110 East Seaham Road, East Seaham	N/A	N/A	Council road reserve	N/A	N/A

1 eg. Council, privately owned, Transport for NSW Lands, Crown Lands managed by Council, Crown Lands managed by other Authority.

2 eg. Voluntary acquisition process in accordance with the *NSW Land Acquisition (Just Terms Compensation) Act 1991* and/ or permit to enter for survey works, activities during works, revegetation etc, Crown Lands Licence, check of Aboriginal Land Claim Register.

Land acquisitions & Crown Lands map

Land acquisitions map

No land acquisitions will occur as part of the activity.

NSW Crown Lands reserve map

Activity is not occurring on Crown Lands.

Native Title and Aboriginal Land Claims

Native Title

Activity is not occurring on Crown Lands.

Aboriginal Land Claims

Activity is not occurring on Crown Lands

Activity description

Brief description

Installation of 240m of guardrail and 4 CAM signs along an existing section of sealed road at East Seaham Rd. The guardrail will be aligned along the existing edge of bitumen.

Background and need

East Seaham Road in this section of roadway has been subject to previous accidents, which are often high speed and resulting in serious harm primarily due to the proximity of the trees to the road and lack of adequate shoulder width. The activity proposes to install 240m of guardrail and 4 CAM signs along an existing section of sealed road at East Seaham Road along the edge of bitumen to help improve road safety.

Objectives

Port Stephens Community Strategy Plan 2018-2028

P2 Infrastructure and facilities Our community's infrastructure and facilities are safe, convenient, reliable and environmentally sustainable

- P2.1 Plan civil and community infrastructure to support the community.
- P2.2 Build Council's civil and community infrastructure to support the community.
- P2.3 Maintain Council's civil and community infrastructure to support the community.

Local Strategic Planning Statement

Planning Priority 6 | Plan infrastructure to support communities.

Objectives

The objective of the activity is to improve road safety.

Relationship to other activities

Past road upgrades along East Seaham Road have been completed and further works are proposed to improve the safety of the entire road alignment. These works contribute in part to the overall works. These upgrades have been occurring over the past 10 years.

Due to the period between the activities and distances between the activities localised impacts such as dust, odours, noise, vibration, water pollution, erosion and sedimentation, community disturbance, public access, traffic and aesthetics are likely to be minimal due the impacts being predominately contained to the construction period. The activity will not remove or impact threatened biodiversity and cumulative impacts to threatened biodiversity are unlikely. The activity will not alter or change hydrology or stormwater runoff and therefore cumulative impacts are unlikely.

Other cumulative impacts include:

- Emissions: Due to short duration and minor nature of the cumulative activities and provided the mitigation measures are implemented, impacts are likely to be minor.
- Land use: The activities will have a long-term transformative impact by improving accessibility and safety of the road environment. .
- Waste: All waste from previous activity was disposed of at verified waste disposal facilities. Due to the short duration and minor nature of the cumulative works and provided the mitigation measures are implemented, the pollution and safety risks will be minimised and any affects likely to be minor. Once the activity is complete and due to the nature of use of the site, minimal waste generation is expected.
- Use of hazardous and dangerous goods and other chemicals: Due to the short duration and minor nature of the cumulative activities and provided the mitigation measures are implemented to minimise pollution and safety risks, any impacts are likely to be minor.
- Natural resource use: Due to short duration and minor nature of the cumulative works and provided the mitigation measures are implemented, impacts are likely to be minor.
- Heritage impacts are site specific and have been addressed in each of the individual environmental assessments.

Works description

Activities prior to works commencing

- Environmental impact assessment in accordance with Council's EMS.
- Risk assessment in accordance with Council's Risk Management System.
- Undertaking the following:
  - Project site inspections.
  - Invasive species site inspection
  - Due diligence assessment.
- Preparation of the following plans:
  - Design plans.
  - Traffic guidance scheme.
- Site survey and set out.
- Site establishment including:
  - Site facilities e.g. work shed, toilets, parking etc.
  - Site fencing and restricted entry signage erected.
- Community and stakeholder consultation.
- Establishment and implementation of mitigation measures including:
  - Traffic management controls.
- Transport of machinery, equipment, and materials (excluding stockpile materials) to the project site.
- Site induction.

Activities during works

- Maintenance and inspection of mitigation measures.
- Site visits for project management, work health safety and environmental compliance.
- Spoil and waste management.
- Removal of existing signage and other infrastructure.
- Excavation for guardrail footings.
- Installation of guardrail footings and guardrail.
- Backfilling around guardrail
- Installation of reflectors if required.

Activities upon completion of works

- General site clean-up, rubbish removal and removal of any excess waste.
- Removal of site facilities, restrictive access signage and fencing and traffic controls.
- Site visits for practical completion of works.

Operation and maintenance

The operation and maintenance of the site will be covered by a maintenance Environmental Assessment in accordance with the Port Stephens Council's EMS 3.0 Environmental Assessment Procedure. Specify EA:	Road Maintenance
Activities	Activities for maintenance may include site inspections, rubbish removal and replacement of vandalised or otherwise damaged infrastructure.

Plant & equipment

- Crane truck
- Delivery truck.
- Pneumatic jackhammer
- Jackhammer
- Light vehicles
- Small hand tools
- 1.7tonne tracked excavator
- Site truck <20Tonne

Materials

Materials List	Galvanised steel guardrail		
Imported materials	***Material***	***Source***	***Amount***
	Galvanised steel guardrail and footings	Ingal	240m
Exported materials	***Material***	***Source***	***Amount***
	No exported materials		
Amount of material being disturbed onsite	Negligible		
Maximum excavation depth	800mm		

Traffic

Traffic control required. Single lane closures with access to the road restricted but maintained. Traffic control required for vehicles entering and exiting the site.

Hours of operation

Standard operating hours Monday to Friday 7am to 6pm and Saturday 8am to 1pm. No night works.

Extent of Works & Site Compound

Extent of works

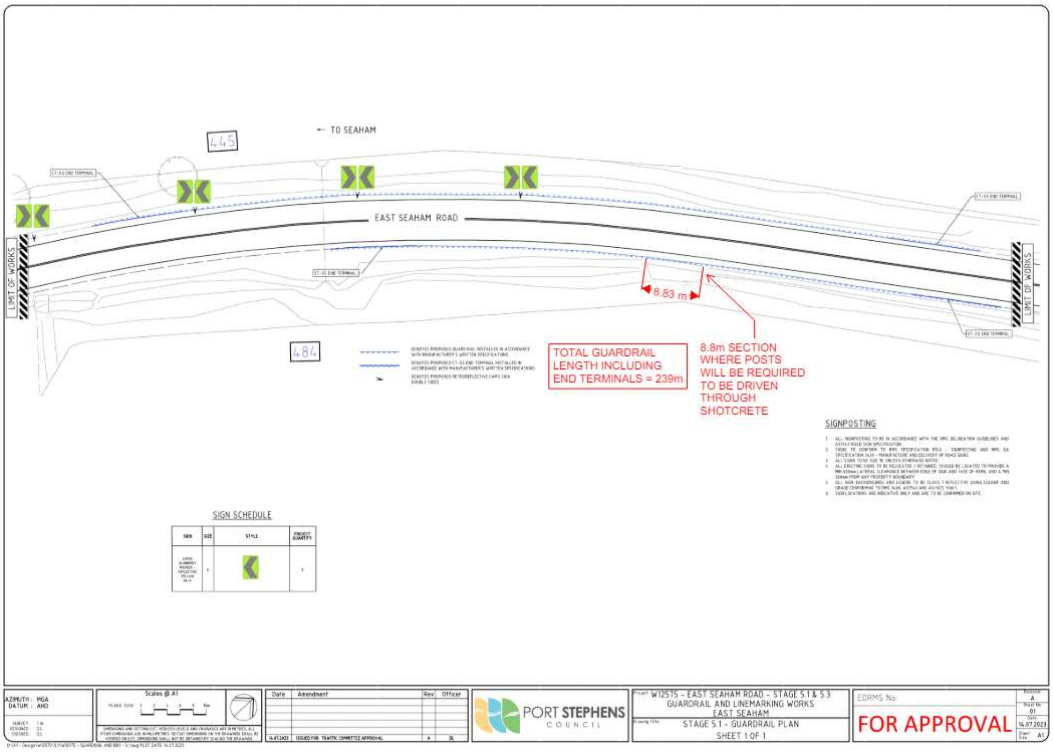

Figure: Extent of works

Site compound location

No site compound due to minor nature of the works.

2. Evaluation of alternatives

Evaluation of alternatives

Criteria	Do nothing	Full implementation
Ability to satisfy the proposal objectives.	Objectives relating to improving road safety not achieved.	Achievement of objectives relating to road safety achieved
Relative financial costs.	No cost.	Higher cost for construction and maintenance.
Relative other costs such as environmental and safety.	Unsafe conditions degrading over time.	Improved water quality management and control of nuisance flooding.
Acceptability of environmental impacts and/ or any identified environmental objectives.	High acceptability due to no disturbance	Moderate to high acceptability due to limited degree of disturbance.
Acceptability of environmental risks and uncertainties.	High acceptability due to no disturbance.	Moderate to high acceptability due to limited degree of disturbance.
Reliability of proposed environmental impact mitigation measures.	N/A	Environmental impacts during operation and maintenance to controlled through physical and process mitigation measures in accordance with approved Environmental Assessment for the activities.

Efficient use of land, raw materials, energy and resources.	Less material, energy and resource usage in short term, and minimal expenditure of nature resources.	Higher use of materials, energy and resources in short term and medium to long term due to asset site inspections and maintenance.

Option selection and justification

Full Implementation to assist to improve road safety.

Design refinement

Refinement	Justification for refinement
N/A	N/A

3. Consultation

Applicable mandatory consultations under Part 2.2 Division 1 of the NSW SEPP (Transport and Infrastructure) 2021 and *NSW Crown Land Management Act 2016*

Works	Consultation required	App	Comments received	Date	Corro. location	Planned actions
Activities on flood liable land.	State Emergency Services	☒ Yes ☒ No	N/A	N/A	N/A	Notification of Works.
Activities comprising of a fixed or floating structure in navigable waters.	Transport for NSW	☐ Yes ☐ No	The activity is not adjacent to or including works to a fixed or floating structure in navigable waters.			
Activities adjacent to land reserved under the NP&W Act.	NSW NPWS	☐ Yes ☒ No	The activity is not located within or adjacent to lands reserved under the NP&W Act.			
Activities on NSW Crown Lands not classified or subject to Plan of Management.	NSW Crown Lands	☐ Yes ☒ No	The activity is not located within or adjacent to NSW Crown Lands			
Activity occurring on Crown Lands subject to Aboriginal Land Claim.	Claimant	☐ Yes ☒ No	Works are not occurring on lands subject to an Aboriginal Land Claim.			
Activity occurring on Crown Lands subject to Native Title Land Claim.	Native Title Manager Claimant	☐ Yes ☒ No	No Native Title Land Claims on the subject site.			
Activity occurring on lands other than Council lands or Crown Lands.	Land Owner	☐ Yes ☒ No	Activity is occurring on Council lands and Crown lands.			
Activity likely to impact utilities.	Utility Owner	☐ Yes ☒ No	Dial before you dig completed. No potential impact on utilities.			

Community

Person/ group	Matter discussed	Date	Corro. location	Response
General Community	Notification of activity	Within 2 weeks prior to commencement of activity	On file	Respond to enquiries as required

Other Stakeholders or Interested Parties

Stakeholder	Matter discussed	Date	Corro. location	Planned actions

4. Site description

4.1 Land use & sensitive receivers (e.g. bushland, residences, commercial and industrial premises/ precincts, recreational lands, educational precincts, hospitals etc)

Historical land use

Following is and excerpt from Biosis (2023, see Attachment 1):

- The Williams River flows through the Hunter Region and provided fertile banks upon which many small agricultural communities were established in the early 1800s. The river also offered a prolific route of transport for trade and thoroughfare. Villages along the river were subject to intense development, particularly with regards to the timber, soap, leather, flower, and beer industries. Timber in particular became key to the region's economy; beginning as early as 1804, timber clearing was undertaken for preparing land for settlement and agriculture, commercial sale, construction purposes, and fuel.
- The Australian Agricultural Company had been established in 1824 as part of a collective whose purpose was to improve waste lands for agriculture and farming, but mainly for the production of wool. The Macarthur family initially held most of the committee positions, who advised the company directors on local conditions and matters within the colony. Survey-General John Oxley was consulted on the most appropriate location for a land grant; after rejecting the Liverpool Plains and head of the Hastings River, the Company settled on Port Stephens.
- By 1828, 23 pastoral stations had been established in Port Stephens, all connected by roadways, with multiple farms and gardens to provide food for a population of almost 600.
- In 1833, half of the Port Stephens grant was exchanged for land on the Peel River and at Warrah. While the agricultural endeavours of the Company failed at Port Stephens, settlers were encouraged to settle on the Port Stephens Estate.
- The County of Gloucester was officially marked off in 1829. Three more prominent towns had emerged to significance along the Williams River by the 1820s and 1830s; Clarence Town, Raymond Terrace, and Seaham, largely driven by the timber industry.
- Clarence Town, which sits across from the study area, saw economic activity in the form of cedar cutting by convict labourers as early as 1801, and is thought to be the seventh oldest colonial settlement in Australia.
- The local region, which was being progressively cleared, proved to be increasingly prolific as grounds for dairy farming, grazing, and agriculture. Infrastructure in the region developed, namely post offices, roads, and boating yards.
- Grants of land in the region were allocated to new and existing settlers, closely tied to how wealthy the recipient was, or if they were retired from military or naval service.
- Local infrastructure is not especially well-documented. While many notices and articles referencing roads are abundant in contemporary newspapers, the terminology used to identify them are not definitive. East Seaham Road was officially named in 1990, previously known as New Line Road (which retains a southern portion named as such), and a more general 'East Seaham road'.
- Before local roads were definitively named, they were identified by the two locations they connect and contemporary sources can therefore be ambiguous. An article discussing 'the road from Raymond Terrace to Clarence Town,' for example, could be referencing several such roads. The first in text reference to a road more definitively identifiable as East Seaham Road comes from 1918, and it was likely the road referred to as 'East Seaham Road' that appears in numerous articles throughout the rest of the 20th century. Despite this, the physical 'East Seaham Road' can be seen on maps dated significantly earlier.

Current & adjacent land use

The site is a largely disturbed agricultural large lot rural residential environment. The Williams River lies approximately 1km to the west of the site and the township of East Seaham is approximately 3.5km south of the site. The area contains large tracts of bushland, including bushland within Wallaroo National Park to the north east of the site and Columbey National Park and State Conservation Area to the north west of the site.

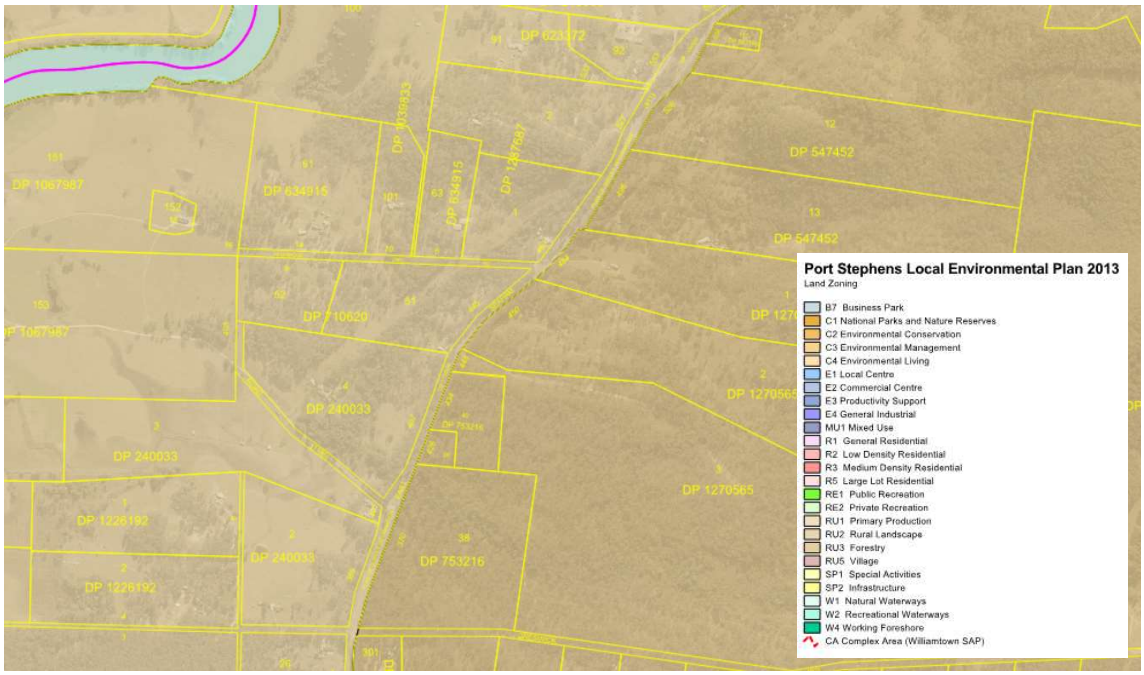

Figure: Current land zoning map indicating current land uses

Sensitive receivers

Within 50m	Residential properties and bushland
Within 100m	As per 50m.
Within 200m	As per within 100m.

4.2 Landform, geology and soils

Topography and landscape

Following is an exerpt from Cardo (2017, see Attachment 2).

- Topographically, the section of East Seaham Road is situated on the foot slopes of a south-west to northeast trending dominant ridgeline located further to the east of the site. Slopes in the area generally fall from the ridgeline to the north-west towards lower lying terrain coincident with the Williams River. The road section traverses gently undulating terrain associated with gullies and spurs that descend from the ridgeline. The following site features were also observed at the time of fieldwork.
- The existing road alignment has been constructed predominantly on-grade with minor cut and fill in the order of 0.5-1.0m involving cut on the uphill side of the road and fill on the downhill as well as in proximity to culverts in the gullies.
- Generally informal and shallow table drains parallel to the road formation.
- The existing vertical alignment traverses the gently undulating terrain, commencing at RL 32.94 m and finishes at RL 11.98 m.

Geology

Source

- NSW Seamless Geological Map.
- 1:100 000 Port Stephens Soil Landscape Map.
- Espade

Description

Geology of the site (eSpade) is:

- Gilmore Volcanic Group: lithic sandstone, partly welded brown to grey rhyodacitic and dacitic ignimbrite.
- Martins Creek Ignimbrite Member: blue grey partly to thoroughly welded andesitic ignimbrite.
- Mosman Swamp Andesite: andesitic pitchstone, ignimbrite, tuffs, dacitic ignimbrite.
- Eagleton Volcanics: dellenitic and rhyolitic toscanite, volcanic and pyroclastic rocks.
- Italia Road Formation: lithic sandstone, shale, coal, chert, ignimbrites, tuff.
- Balickera Conglomerate: coarse polymictic boulder conglomerate.

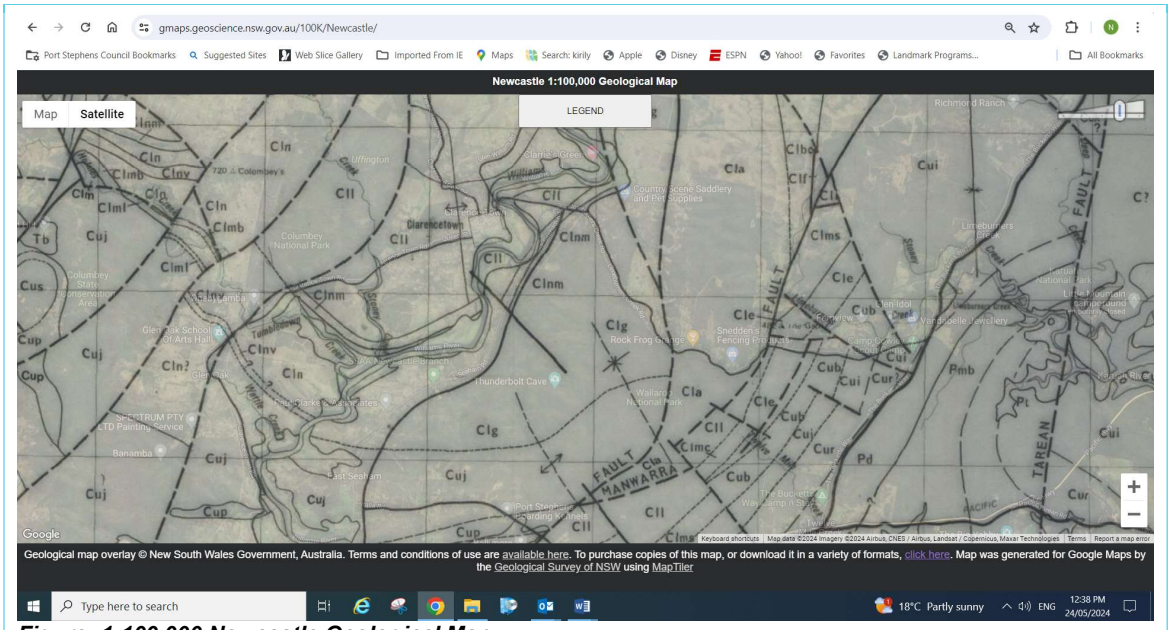

Figure: 1:100 000 Newcastle Geological Map

1:100 000 Newcastle Geological Map identifies the geology as Cuj: conglomerate, tuff, sandstone, shale of the Mount Johnson Formation of the Namurian-westphalian steganian epoch, carboniferous period and Palaeozoic era.

Soils

Majority of the works are located within the Ten Mile Road Soil Landscape Group.

Soil limitations include:

-
- Very high erodibility.
- Very high permeability.
- Very low fertility.
- Very strongly acid.
- Low available water-holding capacity.
- Hardsetting surface (localised).

Landscape limitations include:

- Low to very low wet bearing strength.
- Moderate shrink-swell potential.
- High erodibility.
- High plasticity.
- Sodicity/dispersion.
- Seasonally hardsetting.
- Strong acidity.
- Potential to high aluminium toxicity.
- Stoniness (localised).
- Hard setting surface.
- Very strong acidity.
- Very low fertility.
- Low permeability.
- Low available water-holding capacity.

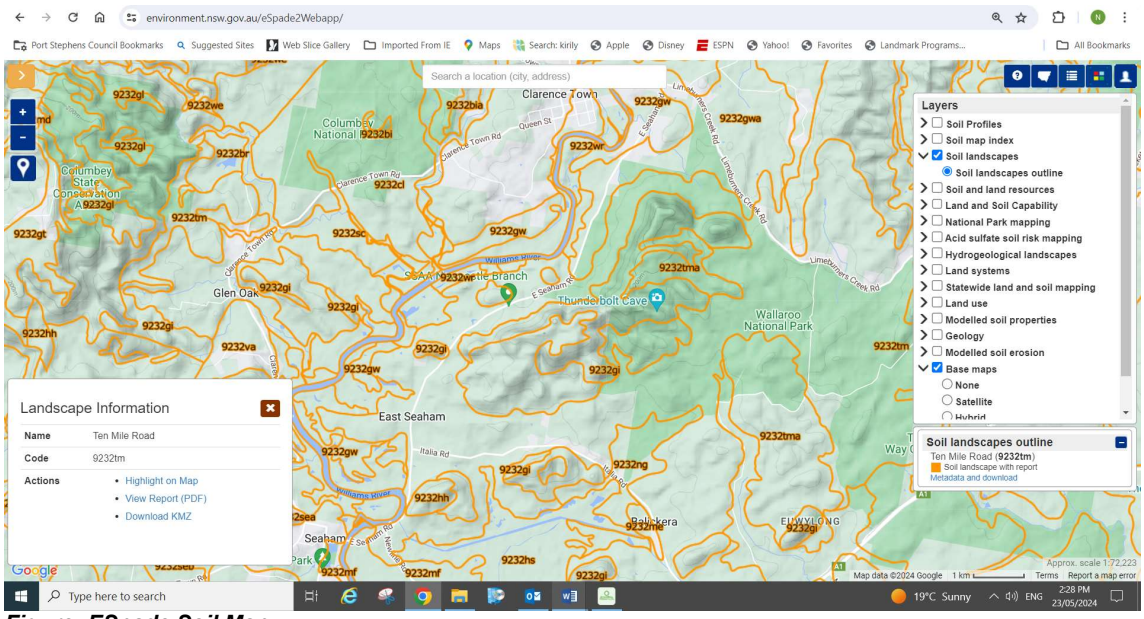

Figure: ESpade Soil Map

Landslip Risk

The site is not mapped as having a landscape risk rating or slopes over 20 degrees.

4.3 Site hydrology

Site hydrology

See Topography and landscape.

There is a watercourse with a stream order of 1 to the north of the site, and two stormwater culverts (pipes) under East Seaham Road within the works area assisting water to drain westwards towards the watercourse and to the Williams River, approximately 1.5km downstream from the site,

Figure: Waterways

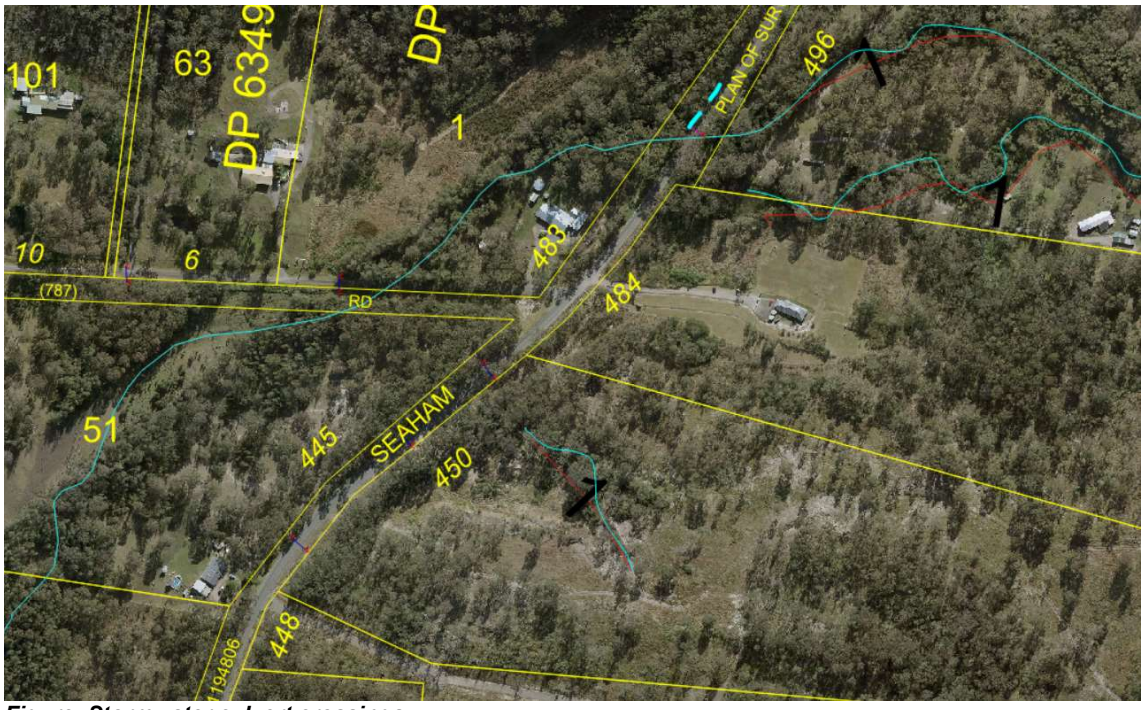

Figure: Stormwater culvert crossings

Waterway health & water quality

Existing stormwater runoff would consist of road runoff which has the potential to be contaminated with gross pollutants, oils, grease, heavy metals and other chemicals. Stormwater runoff from surrounding agricultural residential lands may consist of sediment and any pesticides, herbicides or fertilisers applied to the land and/ or animal faeces Stormwater runoff would lead to water pollution of downstream receiving environments including the Williams River.

Groundwater

Works are not expected to be of a depth where groundwater will be encountered.

Site drainage to a watercourse within 200m of the site or watercourse(s) located onsite

The site is not located with 200m of a watercourse, the site drains to the Williams River approximately 1.5km to the west of the site.

Watercourse/ drainage or other map if applicable.

N/A

4.4 Biodiversity

Terrestrial vegetation description

Based on previous REFs for Stage 2, 3 and 4, the predominant vegetation type onsite is Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion, which is listed as an endangered ecological community under the BC Act 2016, however, is not listed under the EPBC Act 1999. The vegetation is a mix of remnant forest, regrowth and is disturbed and weeds are common.

Terrestrial fauna habitat

There is disturbed terrestrial fauna habitat present including habitat trees, corridors and connectivity, bush rock, fallen logs, winter flowering eucalypts and nectar and fruit resources and perch sites. there is also evidence of seedling recruitment onsite.

Threatened terrestrial biodiversity with a moderate to high likelihood or known occurrence

See Attachment 3.

Marine habitat description

N/A

Key fish habitat

The site drains to key fish habitat within the Williams River approximately 1.5km to the west of the site.

Estuarine macrophytes

N/A

Threatened marine species (excluding birds) with a with a moderate to high likelihood or known occurrence

N/A

Threatened and/ or migratory species and habitat onsite or adjacent to the site

N/A

Biodiversity values mapping

The site is not mapped.

Fauna corridors mapped onsite or present onsite as observed on site visit

Fauna corridor map

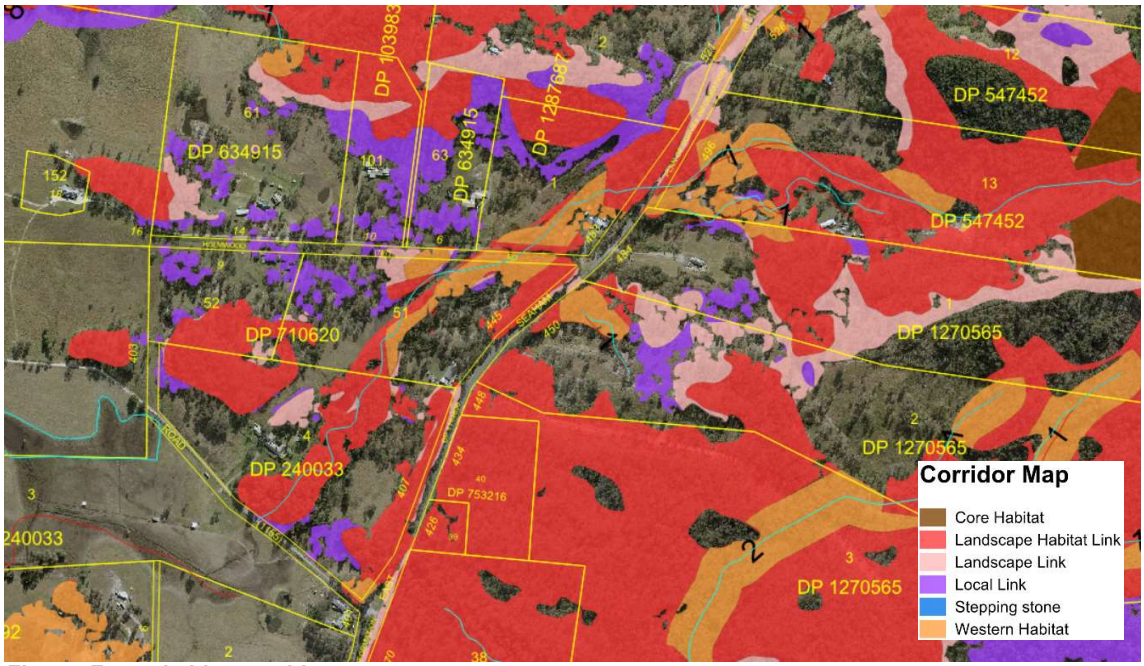

Figure: Fauna habitat corridors

Roadside vegetation (mapped onsite)

Figure: Roadside Vegetation Low Ecological Value

Significant trees (mapped onsite or adjacent to the site)

No significant trees are mapped onsite or adjacent to the site.

Koala habitat (mapped onsite, observed onsite after site visit, koala BioNet records within the locality and/ or koala feed trees present onsite. Identify mapping category, site observations and/ or koala feed trees present onsite)

Koala habitat

The Comprehensive Koala Plan of Management mapping identifies the site as containing Mainly Cleared Land and Marginal Habitat. There is Preferred Koala Habitat and Preferred Koala Habitat Buffer over Cleared Land adjacent to the site to the west. There are numerous Koala NSW BioNet records within the locality and koala feed trees are present in bushland adjacent to the activity. Koalas may traverse the site, however, due to a lack of suitable bushland habitat and frequency of use of the site and surrounds, the site is unlikely to be habitat critical to the survival of the koala.

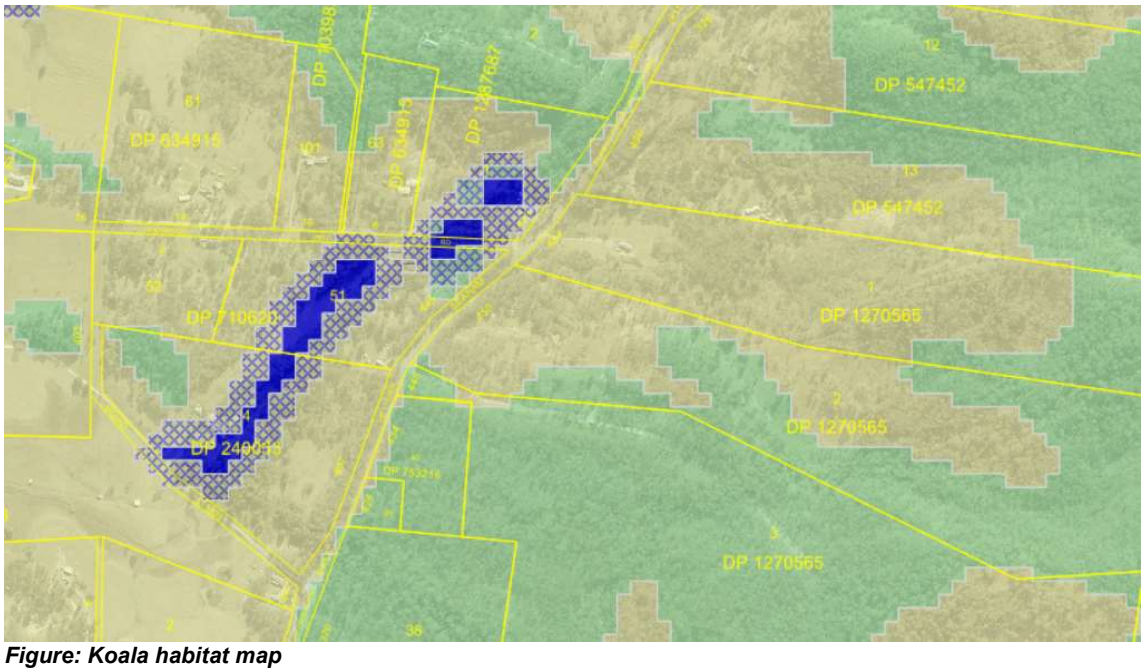

Figure: Koala habitat map

Koala feed tree planting onsite or adjacent to site

There are no koala feed tree plantings onsite.

Biosecurity

Weeds mapped onsite or within 200m of the site

Priority Weeds mapped onsite include Mother of Millions and Chinese Violet is mapped as occurring within 200m of the site. A referral was sent to Council's Invasive Species Officer for advice. Infestations of Bitou Bush, Lantana and Morning Glory observed onsite. No priority weeds were observed.

Pest animals likely to frequent the site

Pest animals likely to frequent the site may include fox, rabbit, feral mice and rats, feral cats and dogs and pest bird species.

Key threatening processes

Key threatening processes that are or may be active onsite or that the site has been subject to in the past include:

- Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners, Manorina melanocephala (Latham, 1802).
- Anthropogenic Climate Change.
- Clearing of native vegetation (as defined and described in the final determination of the Scientific Committee to list the key threatening process).
- Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus.
- Competition from feral honey bees, Apis mellifera.
- Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments (as described in the final determination of the Scientific Committee to list the key threatening process).
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
- Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations.
- Infection of native plants by Phytophthora cinnamomi.
- Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae.
- Invasion and establishment of exotic vines and scramblers.
- Invasion, establishment and spread of Lantana (Lantana camara).
- Invasion of native plant communities by African Olive Olea europaea subsp. cuspidate.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of hollow-bearing trees.
- Predation and hybridisation by Feral Dogs, Canis lupus familiaris.
- Predation by the European Red Fox Vulpes vulpes.
- Predation by the Feral Cat Felis catus.
- Removal of dead wood and dead trees.

4.5 Heritage

Indigenous heritage

AHIMS Basic/ Extensive Search conducted within the last 12 months and confirmed site records

An AHIMS Search conducted By Biosis (2023, see Attachment 1). [redacted] are the closest sites to the proposed activity.

Landscape features (with 200m of waters, located within a sand dune system, located on a ridge top, ridge line or headland, located within 200m below or above a cliff face, within 20m of or in a cave, rock shelter, cave mouth

The site is not 200m of waters.

Culturally modified trees

There are no culturally modified trees onsite.

Aboriginal history of the area

Following is a summary of information presented in Biosis (2023, see Attachment 1):

- The study area is located within the traditional lands of the Worimi people, whose territory extends from north of the Hunter River to Forster near Cape Hawke, along the coastline, encompassing Port Stephens and stretching inland close to Gresford, and as far south as Maitland, however, records of encounters with Worimi people indicate that this boundary may be larger being bounded by the sea from the Manning as far south and Norah Head and possibly to the Hawkesbury and as far west as Barrington Tops, which was visited in the summer months.
- The territories of the Worimi were established to include a variety of habitats rich in raw materials and food resources and trade, intermarriage, and the sharing of ceremonial places were central to the Worimi's interaction with neighbouring tribal groups, such as the Awakabal, Kamilaroi. Guringai, Wanaruah and other tribes in the region.
- Little is known about the size of the population of the Worimit tribe within Port Stephens before European settlement, however, it is agreed that numbers declined rapidly after contract. sources from the early 1900s to 1840s vary in their estimates from 120 within a single camp to 500 Worimi individuals within the Port Stephens area in 1837. By 1839 there were reports that the population of the Awakabal people around the Lake Macquarie area to the south of Worimi territory had declined to as low as 20. exposure to diseases introduced by European settlers, the destruction of food

resources and instances of hostile relations between Worimi and Awakabal people would have contributed significantly to this decline.

- It was reported that 5 convicts who escaped from Parramatta in 1790 were shipwrecked at Port Stephens. The convicts lived among the Worimi for 5 years until they were recaptured. Following this, a small garrison of soldiers was established in the 1820s at a place now known as Soldiers Point approximately 20km northeast of the proposed activity, to aid in the recapture of convicts that escaped from Port Macquarie.
- Relations between escaped convicts and local tribes were good natured and signified the introduction of products of European civilisation. Colonel Paterson upon exploring the Hunter region in 1801, commented upon the possible use of European axes by Aboriginal tribes, and perhaps convicts who lived among them, to cut down trees. This introduction to European resources would have led to the establishment of more fruitful relations between the Aboriginal people of the Hunter region and European penal authorities in aiding the recapture of escaped convicts.
- Hostile relations between Europeans and Worimi seemed to have originated from early interactions with timber-getters exploiting good quality cedar along the coastal regions of NSW. Accounts of hostilities between timber-getters and the Aboriginal people in the area are recorded as early as 1804.

Aboriginal heritage investigations

The installation of guardrail is being installed within the extents of Stage 1 works for East Seaham Road upgrade. The Aboriginal sites register was searched on 28 March 2000 by HLA Envirosciences, 2000 that found no sites within the vicinity of the proposed site. However a more recent extensive search conducted on 3 November 2023 by Biosis (2023) found [redacted] Aboriginal archaeological sites within a 23km search area. None of the sites are within the site of the proposed activity. The closest sites are sites [redacted] that are located approximately [redacted] the site.

Following is a summary of information presented in Biosis (2023, see Attachment 1) and HLA Envirosciences (2000, on file):

- A predictive model was developed indicating the sites most likely to be encountered:
  - Flaked stone artefact scatters and isolated artefacts: Moderate
  - Potential Archaeological Deposits (PADs): Low
  - Ceremonial Ring (Stone or Earth): Low.
  - Stone arrangements: Low.
  - Shell middens: Low.
  - Quarries: Low.
  - Modified trees: Low.
  - Grinding grooves: Low.
  - Burials: Low.
  - Rock shelters with art and/ or deposit: Low.
  - Aboriginal Ceremony and Dreaming sites: Low.
  - Post-contact sites: Low.
  - Aboriginal places: Low.
- The area has varying levels of disturbance. The majority of the area has been subject to extensive vegetation clearance, which would have affected both surface and subsurface deposits.
- Soils at locations of vegetation clearing would have higher levels of displacements and re-deposition in shallow layers.
- The development of East Seaham Road involved the modification of landform for utilities, sewer, water and electricity which are visible throughout the area. Disturbance of this nature is characterised as high. The excavation undertaken to construct the road would have displaced the soils and thus completely disturbed that region resulting in high disturbance levels. Disturbances of this nature would likely result in the limited preservation of intact archaeological deposits in sub surface layers.
- Background research indicates that the area is situated within an ideal location for the procurement of resources that would allow for long-term occupation. The proximity of the Williams River, associated freshwater streams that bisect East Seaham Road indicate that freshwater, aquatic and terrestrial resources would have been in abundance and accessible on a perennial basis. The positioning of the study area at the foothills of the higher elevation ranges in the adjacent national park provides sufficient shelter from the elements which further adds to the desirable nature of the area. Geologically raw materials suitable for the manufacture and for grinding groove sites are present in the Newtown Formation and Wallaringa Formation respectively. The deeper soils, particularly the majority occupying the Glen William Landscape are likely to have retained evidence of this occupation.
- Past archaeological investigations have determined that proximity to water and intensity of occupation of the area intrinsically linked, with occupation zones tending to be located within 100m of waterlines. Flat elevated landforms in proximity to natural resources are frequently associated with archaeological sites. This combination of features further supports that the area is likely to have been utilised by Aboriginal people.
- Field investigations and land use history, however, have revealed East Seaham Road to have been subject to continuous and intensive disturbance since at least the 1860s. These disturbances have involved vegetation clearance of land within road corridors, landform modification and levelling of the landscape which have contributed to the overall disturbance of the archaeological record that may have been preserved in the upper soils. The disturbances range between less than a metre and up to 4m laterally and up to 1m vertically with the installation of drainage systems, electrical poles, fence lines and road grading. Some areas adjacent to the roadside do indicate the presence of natural soils which is undisturbed may retain artefact deposits.
- A foot survey on 9 May 2000 by representatives from HLA Envirosciences and Worimi Aboriginal Land Council. Coverage was limited by the densely vegetated roadside corridor of crests and slope. The low visibility was a constraint on the survey with the areas of greatest visibility being along the road where exposed areas showed signs of being disturbed. Disturbances includes driveways, culverts, grading and addition of foreign material such as gravel. No Aboriginal artefacts or sites were found during the course of the survey.

Envirosciences (2000, on file) identified that the road surface had been previously graded and imported fill added so the potential of any sites being found is negligible and that the potential for Aboriginal sites exists in the roadside areas particularly those on ridges or near to the water source of the Williams River. Envirosciences (2000, on file) observed that much of the road

corridor had been disturbed by road maintenance, land clearing and the introduction of culverts and therefore the potential for significant Aboriginal sites is low and does not pose an obstacle to the project.

Non-indigenous heritage

Non-indigenous history

Following is a summary of information presented in Biosis (2023, see Attachment 1) on the non-indigenous history of the locality:

- The first instance of European contact with Port Stephens took place in 1770, when Captain James Cook and the *Endeavour* passed the harbour on 11 May, naming it for Sir Phillip Stephens, Secretary to the Admiralty. Around 2 years after the arrival of the First Fleet in 1788, a group of escaped convicts are believed to have entered the region. The convict ship *Salamander* entered the harbour in late 1791, of which a sketch was made of some of its waterways. In February 1795, Surveyor-General Charles Grimes visited Port Stephens on the order of Lieutenant-Governor Paterson; Grimes reported that the land was low and sandy and did not recommend further visits. In August, the HMAS *Providence* took shelter in the harbour, where the captain, W.R.Broughton, encountered four surviving convicts who had escaped from Parramatta and were living with the Worimi people. The following year a fishing boat was driven ashore nearby.
- Further visits were made to the Port Stephens area in the first few decades of the 19th century. In December 1811 and January 1812, Governor Lachlan Macquarie and his wife inspected Port Stephens as part of a plan to establish a settlement north of Newcastle. Macquarie noted that while the port was good, safe and capacious, the land was not inviting to settlement and farming. As a result no government settlement was made. John Oxley and a team including Surgeon John Morris and Surveyor Evans surveyed the coastline from Port Macquarie to Newcastle as part of his 1818 expedition to western and norther NSW. By 1823 a successful cedar getting industry had developed within the region, but the area became over exploited and resources dwindled within several years. However, once the Australian Agricultural Company were offered a land grant at Port Stephens in 1825, the area began to be more fully explored.
- The Williams River which flows through the Hunter region provided fertile banks upon which many small agricultural communities were established in the early 1800s. The river also offered a prolific route of transport for trade and thoroughfare. villages along the river were subject to more intense development, particularly with regards to the timber, soap, leather, flower and beer industries. Timber in particular became key to the region's economy; beginning as early as 1804, timber clearing was undertaken for preparing land for settlement and agriculture, commercial sale, construction purposes and fuel.
- The Australian Agricultural company had been established in 1824 as part of a collective whose purpose was to improve waste lands for agriculture and farming, mainly for the production of wool. The Macarthur family initially held most of the committee positions, who advised the company directors on local conditions and matters within the colony. Survey-General John Oxley was consulted on the most appropriate location for a land grant; after rejecting the Liverpool Plains and head of the Hastings River, the Company settled on Port Stephens. By 1828, 23 pastoral stations had been established in Port Stephens, all connected by roadways, with multiple farms and gardens to provide food for a population of almost 600. In 1833, half of the Port Stephens grant was exchanged for land on the Peel River and at Warrah. While the agricultural endeavours of the Company failed at Port Stephens, settlers were encouraged to settle on the Port Stephens Estate.
- The County of Gloucester was officially marked off in 1829. Three more prominent towns had emerged to significance along the Williams River by the 1820s and 1830s, Clarence Town, Raymond Terrace and Seaham, largely driven by the timber industry. Clarence Town saw economic activity in the form of cedar cutting by convict labourers as easly as 1801, and is though to be the seventh oldest colonial settlement in Australia. The local region which was being progressively cleared, proved to be increasingly prolific as ground for dairy farming, grazing and agriculture. Infrastructure in the region developed, namely post offices, roads and boating yards. Grants of land in the region were allocated to new and existing settlers, closely tied to how wealth the recipient was, or if they were retired from military or naval service.
- Local infrastructure is not well documented. While many notices and articles referencing roads are abundant in contemporary newspapers, the terminology used to identify them are not definitive. East Seaham Road was officially named in 1990, previously known as New Line Road (which retains a southern portion names as such) and a more general East Seaham Road. Before local roads were definitively named, they were identified by the two locations they connect and contemporary sources can therefore be ambiguous. The first in text reference to a road more definitively identifiable as East Seaham Road comes from 1918. Despite this the physical East Seaham Road can be seen on maps and dated significantly earlier.
- The local orientation of the road appears to have changed several times over the course of its history. The earliest depiction of the area subject to the proposed activity was found was within a map of proposed roads between Dungog and Maitland in 1839. Originally, the main crossing to Clarence Town crossing the Williams River was a ford that would consistently flood with the river and become unusable. The main crossing was rerouted to a bridge towards the northeast of town constructed in 1879. As multiple early maps show East Seaham Road reaching the southeast corner of Clarence Town, it is assumed that this was the location of the original ford location.
- The Church and School Corporation was established in 1825 under the Church of England for the purposes of amassing the revenue needed to provide schools, churches and livelihoods for their clergy and teaching staff. A seventh of the Crown lands in each NSW county were granted to the Corporation to support this cause. Between its inception in 1825 and its dissolution in 1833, the Church and School Corporation was established in 1825 under the Church of England for the purposes of amassing the revenue needed to provide schools, churches and livelihoods for their clergy and teaching staff. Between its inception in 1825 and its dissolution in 1833, the Church and Schools Corporation was awarded a large grant of land that stretched along the east side of the Williams River, including the area where the activity is proposed.
- A map from 1904 demonstrates the changes to the landscape of the study area during the late half of the 19th century and into the 20th century. The map shows that East Seaham Road has extended to meet Limeburners Creek Road, which would then be the primary access route to Clarence Town across the new bridge. The previous road leading to the ford is still present. The stretch of East Seaham Road within the area was not consistently classed as a public road at this time.

- The East bank of the Williams River was still largely used for dairying and grazing and agriculture. These riverside farms supported a relatively small population but East Seaham Road likely received a reasonable degree of traffic. The region was well placed along the route between Raymond Terrace and Dungog as well as between Maitland and Port Stephens.
- The land further inland from the river to the east of East Seaham Road is now largely National Park, described as mountainous and inhospitable. The park was declared in the early 1920s in an effort by the Crown to regulate and bolster forestry as a means of combating unemployment. As this regulation continued, the area dedicated to State forests expanded. Wallaroo was a source of high-quality hardwood employing approximately 100 individuals by the late 1930s.
- Various improvements and works were completed upon the East Seaham Road throughout the 20th century including buildings, culverts, gravelling clay sections and rolling. In 1953 a notice was published discussing the prospects of using timber along East Seaham Road, though it was thought risky due to the numerous fences in the area that would be impacted by falling trees. \
- East Seaham Road is valued by local residents due to it providing evidence of historic culverts, native vegetation and original alignments. The historic development of vegetation within the area is observable with historic aerial imagery. the earliest available aerial image is from 1958 which shows trees sporadically lining the road to various degrees of density, with the portion within the Dungog LGA the most uniform. Trees are sparse on the west side of the most northern portion of the area within the Port Stephens LGA. The historical aerial photograph from 1974 shows that the trees have been further thinned or even partially cleared further to the north of the proposed activity. Further tree was undertaken for the establishment of power lines. A historical aerial from 1984 shows further changes with vegetation within the National Park increasing in density, however, vegetation directly adjacent to the road has been subject to further tree clearing.
- During the mid to late 1980s Port Stephens Council made upgrade to parts of East Seaham Road, notably sealing short sections at either end. The historical image from 2001 shows that throughout the area the vegetation has grown much denser.
- Further upgrades to East Seaham Road in 2015 by Port Stephens Council involved adding material to the road surface within the existing alignment.

PS LEP & NSW State Heritage Register Search Results & Heritage Significance

The road alignment is recognised in the Port Stephens Local Environment Plan 2013 Item I5 for the following criterion (takjen from the heritage inventory sheet):

- Criterion A: An item is important in the course, or pattern or NSW's cultural or natural history (or the cultural and natural history of the local area): An early road forming links with Raymond Terrace, Seaham, Clarence Town on the eastern side of the Williams River.
- Criterion B: An item has strong or special association with the life or works of a person, or group pf persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area): Associated with two early local landholders John Melbourne Ireland and John McLean.
- Criterion C: An item is important in demonstrating aesthetic characteristics and/ or a high degree of creative or technical achievement in NSW (or the local area): A richly tree-lined rural road, high tree canopy numerous older trees link to form a beautiful overarching, tunnel effect. This gives the road a special character.
- Criterion D: An item has a strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons): A special character of this tree-lined road is highly esteemed by members of the local community.
- Criterion E: An item has the potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area): Not addressed.
- Criterion F: An item possesses uncommon, rare or endangered aspects of the area's cultural or natural history (or the cultural or natural history of the local area): There are few roads left of this type in the Port Stephens area and is the last remaining in this local area.
- Criterion G: An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places, or cultural or natural environments (or a class of the local area's cultural or natural places, or cultural or natural environments): [Not addressed].

The following statement of significance is taken directly from the heritage inventory sheet for the heritage item"
East Seaham Road is valued not only for its relationship to early transport but because its alignment, vegetation and construction are, qualities that represent early access roads throughout the LGA. The alignment of East Seaham Road follows closely the original alignment of New Line Road in relation to the lie of the adjacent properties, the proximity to the Williams River and Wallaroo Nature Reserve, A fine example of a richly tree-lined rural road with high conservation and aesthetic values.

Heritage investigations

A foot survey on 9 May 2000 by representatives from HLA Enviroscience (2000, on file) found no potential relics.

World Heritage Areas or National Heritage Sites

There are no World Heritage Areas or National Heritage Sites within the Port Stephens LGA. NSW State Heritage or Local Heritage item onsite or within 200m of the site.

4.6 Traffic

General description

East Seaham Road is a narrow two-lane single carriageway, unsealed rural road approximately 12.4km in length that traverses between Seaham and east of Clarence Town along the east side of the Williams River in a south-west to north-east direction.

Road category (if activity is not occurring on roadway, specify entry road category)

Distributor Road

Main road category

East Seaham Road is not a main road.

Road infrastructure onsite

Road infrastructure assets onsite or within 50m of the proposed activity include safety barriers.

Public and/ or school bus route and/ or B Double Haulage Route

The road is a school bus route.

Maintenance responsibility

East Seaham Road is maintained by Port Stephens Council.

4.7 Waste

Existing material onsite

The site is relatively free of waste, however the following waste may be present onsite or have the potential to occur onsite:

- Litter.
- Illegal dumping.
- Green waste such as fallen branches, trees and grass.

4.8 Social

Amenity and views

The site is located within an area of scenic amenity. The scenic amenity values include views over the adjacent rural lands and ambience of the mature tree lined roadway.

Pedestrian access

The site is accessible by pedestrians, however being a rural roadside environment pedestrian use of the roadway is likely to be infrequent.

Accessibility for intended and non-intended use

The site is accessible by pedestrians, however being a rural roadside environment pedestrian use or use for non-intended purposes is likely to be infrequent. Littering from cars may be likely.

Recreation

The site has limited recreation value.

Scientific value

The scientific value of the site when considered exclusively is limited, however, the site forms part of a larger land and river system, which has intrinsic value. The locality has not been extensively scientifically researched and. The locality has been used to, and has further potential to provide information that will contribute to our understanding of rural land management practices.

4.9 Pollution

Soil contamination

The contaminated lands register was checked on 22/05/2024 and no sites were identified within the locality. Material within the road corridors would meet the definition for Excavated Public Road Material under the Excavated Public Road Material Order 2014 and Excavated Public Road Material Exemption.

Abestos

Council's asbestos register was checked on 22/05/2024 and no registered sites were identified. There are no buildings or structures onsite that were constructed prior to 1990.

Existing water pollution

Existing water pollution would include:

- Road runoff that has the potential to be contaminated with gross pollutants, oils, grease, heavy metals and other chemicals.
- Runoff from residential lands that may consist of sediment and any pesticides, herbicides or fertilisers applied to the land and/ or animal faeces.
- Runoff would come overland from upstream of the site and lead to water pollution of downstream receiving environments.

See also Section 4.3 Site Hydrology.

Existing Air & odour pollution

Existing air and odour pollution within the locality would include:

- Vehicle emissions from road use.
- Residential emissions such as use of plant, machinery and equipment, burning of wood fires, use of chemicals such as paints, petrol etc.

Existing noise pollution

Noise pollution within the locality would include:

- Transport such as traffic and garbage collection.
- Residential sources including lawn mowing, barking dogs, house repairs, loud music, air conditioners etc.

Existing possible vibration sources

Existing vibration sources would include road traffic.

Existing light sources

Existing light sources within the locality would include street lighting and lighting from residential premises.

4.10 Natural resource use

Natural resource use onsite

Existing natural resource use onsite would include:

- Use of fuel and other raw materials for transport and works on the adjacent lands.
- Use of fuel and other raw materials for operation and maintenance activities.

4.11 Coastal processes and hazards

Coastal processes & hazards active onsite

There are no coastal process and/ or hazards active onsite.

Climate change

The effects of climate change are already well visible by increasing air temperatures, melting glaciers and decreasing polar ice caps, rising sea levels, increasing desertification, as well as by more frequent extreme weather events such as heat waves, droughts, floods and storms. Locally within Port Stephens climate change is likely to result in increased average land and sea temperatures, larger natural variation in rainfall patterns, increased fire danger and rising sea levels. Based on projections from AdaptNSW and findings of the Port Stephens Design Flood Levels Climate Change Review (WMAwater, November 2010):

- Maximum temperatures will rise by 0.7oC by 2030 and 2.01oC by 2070.
- Average rainfall will increase by 1.8% by 2030 and 7.2% by 2060-79 with the distribution in rainfall also changing:
- Summer change of -2.9% by 2030 and 9.6% by 2060-79.
- Autumn change by 12.7% by 2030 and 13.1% by 2060-79.
- Winter change of -1.3% by 2030 and -2.8% by 2060-79.
- Spring change of -0.1% by 2030 and 2.4% by 2060-79.
- Number of cold nights (nights under 2oC) will decrease -5.9 by 2030 and -15.6 by 2060-79.
- Number of high fire danger days will increase by 0.2 days by 2030 and 0.9 days by 2060-79.
- Number of hot days (days over 35oC) will increase 4.7 days by 2030 and 14 days in 2060-79.
- A climate change induced rainfall increase of up to 30% (which is above the levels predicted by AdaptNSW) will raise flood levels in the Port Stephens estuary by less than 0.1m.

The NSW Policy Statement on Sea Level Rise (October 2009 – Reference 13) also indicates that the “best national and international projections of sea level rise along the NSW coast are for a rise relative to 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100. However, the Intergovernmental Panel on Climate Change in 2007 has acknowledged that higher rates of sea level rise are possible.

The site would be vulnerable to climate change including changes in the weather and sea level rise.

Bushfire prone lands

As a result of the bushfires in Christmas 2001, the NSW government introduced legislation to ensure residential and other developments such as child care facilities, hospitals and aged care facilities are not unduly exposed to any major bushfire risk. Council works with the NSW Rural Fire Service to identify bushfire prone areas within Port Stephens and a set of Bushfire Zone Maps were developed. The maps were developed by analysing factors such as vegetation type and patterns of existing development, and are constantly being updated.

The site is mapped as bushfire prone.

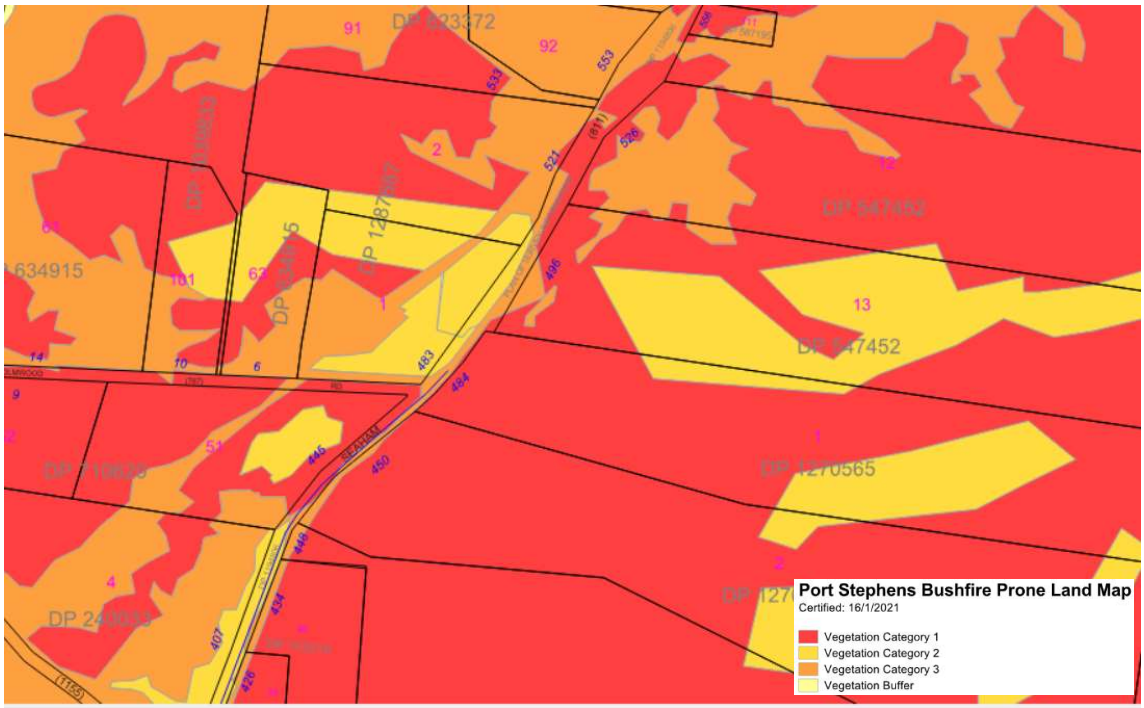

Figure: Bushfire prone lands

Floodprone lands

The site where the works are not mapped as floodprone, however, access to and from the site is mapped as being floodprone.

5. Environmental Impact Assessment

Impact Assessment Explanation	
Type of Impact Definitions	
Direct	The impacts that usually occur at the same time as the project and in the vicinity of the site
Indirect	The impacts that occur as a consequence of the project or the direct impacts of a project. They may be delayed and happen further away from the site.
Cumulative	Impacts that are a result of incremental, sustained and combined effects of human action and natural variations over time, both positive and negative, or by the compounding effects of a single project or multiple projects in an area, and by the accumulation of effects from past, current and relevant future projects. Refer to definition for 'relevant future projects' to understand scope of projects to be included.
Mitigation measure	Actions or measures to avoid, minimise, rectify (by repairing, rehabilitating or restoring) and/or reduce or eliminate over time (by preservation and maintenance) the adverse environmental impacts.
Type of impact	The characteristics of impacts that are likely to affect the environment.
Size	Amount , quantity, volume, mass or other of the impact.
Duration	duration of the impacts considering construction, operations, and any decommissioning elements i.e. time length, period, interval, term, continuation or other.

Note: Where a moderate/ major impact triggers a Level 3 environmental assessment, the moderate impact has not been included as an option after mitigation measures have been applied.

5.1 Landform, Geology and Soils

	Consideration	App.	Extent		Size	Duration	Type	Impact before MM	Impact after MM
5.1.1	Site is within landslip areas or areas with >20% slope onsite. Possible impacts to safety of people, destruction of infrastructure, damage to the land and loss of natural resources.	☐ Yes ☒ No			Small scale/ volume			Choose an item.	Choose an item.
5.1.2	Activity will include earthworks where ground disturbance will occur. Possible detrimental impacts to environmental functions and processes, neighbouring uses, cultural or heritage items or features of surrounding land. *Note: For Impacts to:* • *Environmental functions and processes see 5.1. 5.2, 5.3, 5.6, 5.7, 5.9, 5.11.* • *Neighbouring uses see Section 5.10.* • *Cultural or heritage items see Section 5.4.* • *Features of surrounding* land *see Section 5.1, 5.2, 5.3, 5.4, 5.8, 5.9, 5.10.*	☐ Yes ☒ No	Disruption of and/ or detrimental effect on drainage patterns and/ or disruption of and/ or detrimental effect soil stability	• For impacts on drainage patterns, see Section 5.2.3. • The activity has the potential to cause erosion and sedimentation. The footings for the guardrail will be directly driven into the ground, some overburden may occur as a result which if required will be spread in the vicinity of the footing. • There also a minor risk of erosion and sedimentation also from vehicles tracking material onto the road.	N/A	2 days	Direct and indirect	Negligible: Minimal to no erosion disturbance or release of sediment.	Negligible: Minimal to no erosion disturbance or release of sediment.
			Impacts from the quality of the fill or the soil to be excavated and/ or removed from the site. This includes the risk of contaminated fill or other material being taken offsite and inappropriately disposed of.	No material will be lost offsite; excavation volume is minimal and will be lost onsite.	N/A	N/A	N/A	Negligible: Contamination is not known within the site and no material will be taken offsite.	Negligible: Contamination is not known within the site and no material will be taken offsite.
			Source and destination of material and use on site and end-uses. This includes risk of contaminated fill being imported or exported from the site and inappropriately managed and/ or disposed of.	No material will imported or exported from the site, excavation volume is minimal and will be lost onsite.	N/A	N/A	N/A	Negligible: Contamination is not known within the site and no material is being imported to the site.	Negligible: Contamination is not known within the site and no material is being imported to the site.
5.1.3	Site contains acid sulfate soils and excavation likely to be at a depth that will encounter acid sulfate soils. *Note: For activities that will encounter acid sulfate soils an Acid Sulfate Soil Management Plan must be prepared in accordance with template QF-ENV-DRAFT - Acid Sulfate Soil Management Plan (CAP WORKS).*	☐ Yes ☒ No						Choose an item.	Choose an item.
5.1.4	Site is listed on the contaminated land record of notices or contaminating practices have been historically undertaken on the land[1].	☐ Yes ☒ No						Choose an item.	Choose an item.

5.1 Landform, Geology and Soils

	Consideration	App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
	Note: For activities that will encounter contaminated or potentially contaminated lands engage an accredited site assessor and conduct a site investigation and potential site remedial action plan in accordance with NSW EPA requirements and guidelines.							
5.1.6	Site is in a PFAS Management Zone. *Note: Any PFAS analysis and on-site stockpiling, storage and containment should be in compliance with Section 10 to 14 off the most current version of the PFAS National Environmental Management Plan*	☐ Yes ☒ No					Choose an item.	Choose an item.

Mitigation measures

Prior to construction

- Drive to conditions on unsealed roads and/ or onsite.
- Monitor weather conditions for adverse weather that may increase impacts and where possible schedule works to avoid these periods. Do not undertake works during inclement weather to minimise the risk of damage to assets and ensure there is no compromise of site safety. Where severe weather is forecast, undertake all reasonable precautions to prepare and secure the site for a storm event and help minimise the potential for damage.
- If heavy rain is forecasted in the next 24 hours delay commencement or cease works until such time a suitable dry period of weather is forecasted.
- Induct all personnel working onsite including workers and contractors are aware of the mitigation measures and environmental safeguards for example through site inductions and 'toolbox talks' and by providing a summary of relevant project requirements for quick reference (such as a noticeboard).

During construction

- Complete all works in accordance with the approved plans.
- Signpost designated access points, routes, vehicle manoeuvring areas parking areas and ensure site personnel, contractors and delivery trucks are aware of the requirements to help reduce site disturbance.
- Where possible wash equipment, machinery or works vehicles offsite at an approved facility.
- Restrict vehicles and personnel to designated tracks, trails and parking areas. Where possible park and turn-around on hard, well drained surfaces. Only hard well-drained surfaces will be used for parking and as turn-around points.
- All machinery, plant, equipment, vehicles and boots should be clean prior to entry to the site.

Upon completion of construction

Leave the site clean and free of debris.

[l] Acid/alkali plant and formulation, Agricultural/horticultural activities, Airports, Asbestos production and disposal, Chemicals manufacture and formulation, Defence works, Drum re-conditioning works, Dry cleaning establishments, Electrical manufacturing (transformers), Electroplating and heat treatment premises, Engine works, Explosives industry, gas works or iron and steel works, Landfill sites, Metal treatment, Mining and extractive industries, Oil production and storage, Paint formulation and manufacture, Pesticide manufacture and formulation, Power stations, Railway yards, Scrap yards, Service stations, Sheep and cattle dips, Smelting and refining, Tanning and associated trades, Waste storage and treatment, Wood preservation

5.2 Water

	Consideration	App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.2.1	Activity likely to extend to a depth where groundwater will be encountered. *Note: Provide justification for a 'No' response.*	☐ Yes ☒ No	Excavation works will be 800mm depth and groundwater is not expected to be encountered due to the shallow excavation, elevation of the land and small extent of excavation proposed.				Choose an item.	Choose an item.
5.2.2	Activity likely to directly interfere with a waterbody.	☐ Yes ☒ No					Choose an item.	Choose an item.
5.2.3	Activity involves direct discharge into a waterway or stormwater drain and/ or changes to site hydrology/ drainage infrastructure	☐ Yes ☒ No					Choose an item.	Choose an item.
5.2.4	Activity is occurring in a drainage problem area.	☐ Yes ☒ No					Choose an item.	Choose an item.
5.2.5	Aquatic structures onsite or within 50m of the site.	☐ Yes ☒ No					Choose an item.	Choose an item.
5.2.6	The activity will impact on lands mapped as Wetlands under the PSLEP. Consideration of the provisions of section 7.9(3)(a) whether the activity is likely to have a significance adverse effect on the following: • The condition and significance of native fauna and flora on the land. See Section 5.3. • The provision and quality of habitats on the land for indigenous and migratory species. See Section 5.3.	☐ Yes ☒ No					Choose an item.	Choose an item.

5.2 Water

Consideration		App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
	• The surface and groundwater characteristics of the land, including water quality, natural water flows and salinity. See Section 5.2 and Section 5.10. Consideration of the provisions of section 7.9(4). through design and implementation of environmental mitigation measures: • The activity is designed/ sited and managed to avoid significant adverse environmental impact. • Whilst the impact cannot be reasonably avoided the activity has been designed, sited and will be managed to minimise that impact. • The impact cannot be minimised however the activity can be managed to minimise the impact.							
5.2.7	The activity is located within the Williams River Catchment as defined in the PSLEP. • Consideration of provisions of section 7.10(3) of the PSLEP whether the activity has considered that the activity: • Promotes the sustainable use of land, water, vegetation and other natural resources within the Williams River catchment. • Promotes the protection and improvement of the environmental quality of the Williams River catchment • Will have any significant adverse impacts on water quality within the Williams River catchment • Is consistent with the Williams River Catchment Regional Planning Strategy of the Department of Planning and Infrastructure for the Williams River catchment. *Note: Williams River Catchment Regional Planning Strategy has been repealed.*	☒ Yes ☐ No	The site is located within the William Rivers Catchment. Due to the small scope and short duration of the works, the impacts are not expected to be significant. For mitigation measures see Section 5.1.2	240m^2	2 days	Direct Indirect	Minor: The activity will not contribute to the protection and will not cause temporary or permanent environmental harm to the environmental quality of the Williams River Catchment.	Minor: The activity will not contribute to the protection and will not cause temporary or permanent environmental harm to the environmental quality of the Williams River Catchment OR potential temporary environment harm can be mitigated through standard pr
5.2.8	The activity is located within the Hunter Water Drinking Water Catchment or Drawn Down Area or Special Areas. *Note: Consider provisions of Protecting our Drinking Water Catchments: Guidelines for developments in the drinking water catchments 2017. See QF-ENV-DRAFT – EA Activities in the Drinking Water Catchment (CAP WORKS).*	☒ Yes ☐ No	The site is mapped as Hunter Water Special Area. Due to the small scope and short duration of the works, the impacts are not expected to be significant. For mitigation measures see Section 5.1.2	240m^2	2 days	Direct Indirect	Negligible: The activity will not result in impacts to water quality in the drinking water catchment.	Negligible: The activity will not result in impacts to water quality in the drinking water catchment.
5.2.9	Site is within, adjacent to or is within 200m and/ or drains to Port Stephens Marine Park. *Note: Consider provisions of NSW Marine Parks Permit Policy 2015 assessment criteria - other requirements. See QF-ENV-DRAFT – EA Activities in Port Stephens and Great Lakes Marine Parks (CAP WORKS).*	☐ Yes ☒ No					Choose an item.	Choose an item.
5.2.10	Site is located within, adjacent to, is within 200m of and/ or drains to Kooragang RAMSAR Wetland and is likely to be impacted by the activity. *Note: Consider where the activity is likely to impact on Kooragang RAMSAR Wetland an impact assessment in accordance with the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance.*	☐ Yes ☒ No					Choose an item.	Choose an item.
Mitigation Measures								
See SECTION 5.1.2								

5.3 Biodiversity

Consideration		App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.3.1	The activity will include clearing of vegetation.	☐ Yes ☒ No					Choose an item.	Choose an item.
5.3.2	Threatened biodiversity present onsite or that have the potential to occur onsite listed under the BC Act, EPBC Act and/ or FM Act. *Note: Impact assessments for threatened biodiversity must be conducted in accordance with the Significant Impact Guidelines 1.1 Matters of National Environmental Significance and other relevant guidelines and NSW Threatened Species Test of Significance Guidelines 2018 using QF-ENV-DRAFT - EA Threatened Biodiversity Assessments (CAP WORKS).*	☒ Yes ☐ No	Possible impacts include noise, dust, pollution and physical harm to fauna wandering through the site. Due to the small scope and short duration of the works a general assessment in accordance with the Significant Impact Guidelines 1.1 Matters of National Environmental Significance and other relevant guidelines and NSW Threatened Species Test of Significance Guidelines 2018 using QF-ENV-DRAFT - EA Threatened Biodiversity Assessments (CAP WORKS) has been conducted (See Attachment 3) was conducted. No significant impacts likely.	N/A	2 days	Indirect	Minor: Threatened biodiversity habitat is present onsite but not removed. Possible minor impacts from noise, dust, pollution and/ or physical harm to fauna wandering through the site or flora present.	Minor: Threatened biodiversity habitat is present onsite but not removed OR <0.5ha of habitat being removed and impacts have been assessed and are not significant. Possible minor impacts from noise, dust, pollution and/ or physical harm to fauna wander
5.3.3	Activity is occurring in key fish habitat or mitigation measures unlikely to prevent indirect impacts to key fish habitat.	☐ Yes ☒ No						

5.3 Biodiversity

Consideration		App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
	Note: Consideration of factors considered in and application for NSW Fisheries Part 7 Permit.							
5.3.4	Activity will involve direct or indirect or cumulative harm to mangroves or other protected marine vegetation and/ or the activity involves the dredging or reclamation or blockage of fish passage. *Note: Consideration of factors considered in and application for NSW Fisheries Part 7 Permit.*	☐ Yes ☒ No						
5.3.5	Priority and environmental weeds mapped onsite or within 200m.	☒ Yes ☐ No	Possible spread of environmental weeds affecting native vegetation and habitats through poor hygiene practices.	N/A	2 days	Indirect	Minor: Priority and environmental weeds within 200m of the works, however, located outside the costruction footprint.	Minor: Priority and environmental weeds within 200m of the works, however, located outside the costruction footprint. Weed threat can be managed in accordance with standard procedures.
5.3.6	Pest species likely to frequent the site.	☒ Yes ☐ No	Pest animals hunt and prey on native species and compete for food and habitat resources. Pest animals also threaten native plant species and degrade the environment. Due to the small nature and short duration of the activity, pest species are unlikely to be further introduced to the site and the activity is unlikely to exacerbate pest species.	N/A	2 days	Indirect	Minor: Pest species likely to frequent the site, however, pose no or minimal threat to the activity and the activity will not exacerbate the threat.	Minor: Pest species likely to frequent the site, however, pose no or minimal threat to the activity and the activity will not exacerbate the threat.
5.3.7	Site is mapped as containing Koala Habitat and/ or koala feed trees are present onsite or directly adjacent to the site	☒ Yes ☐ No	Assessment in accordance with PS CKPoM using QF-ENV-DRAFT - EA CKPoM Assessment (CAP WORKS) and the activity meets the criteria and no significant impact on koalas is likely and no offsetting is required. See Attachment 4.	N/A	2 days	Indirect	Minor: Koala habitat onsite will not be removed. Koalas may frequent the site and the activity may cause accidental harm.	Minor: Koala habitat onsite will not be removed OR <0.5ha koala habitat will be removed which reduces the availability of feed and habitat trees and the activity satisfies the performance criteria in Appendix 4 of the CKPoM. Koalas may frequent the site an
5.3.8	Hollow bearing trees present onsite or directly adjacent to the site.	☒ Yes ☐ No	No hollow bearing trees will be removed as part of the activity. Hollow bearing trees are present adjacent to the site and have the potential to be impacted by inappropriate machine usage or accidental damage.	N/A	2 days	Indirect	Minor: Hollow bearing trees present onsite or directly adjacent to the site which do not represent suitable fauna habitat and unlikely to be utiised or the activity due to limited scope, short duration and small magnitude is unlikely to impact hollow depen	Minor: Hollow bearing trees present onsite or directly adjacent to the site which do not represent suitable fauna habitat and unlikely to be utiised or the activity due to limited scope, short duration and small magnitude is unlikely to impact hollow depen
5.3.9	Site mapped as containing wildlife corridors and/ or corridors evident onsite.	☒ Yes ☐ No	Vegetation to be removed consists of dense weed infestation No vegetation, koala feed trees or habitat trees will be removed other than existing grassed areas which consist of a mix of common native and exotic grass species. It is unlikely due to the cleared and disturbed nature of where the activity is occurring that the site would be a key wildlife corridor, however, have some corridor functionality for species more commonly found in disturbed urban bushland environments. There is the possibility for accidental disturbance of surrounding more intact bushland if appropriate environmental mitigation measures are not implemented.	N/A	Duration of works	Indirect	No removal of vegetation will occur and the activity is of a scope, duration and/ or magnitude which is unlikely to impact use of the corridor.	Minor: No removal of vegetation will occur and the activity is of a scope, duration and/ or magnitude which is unlikely to impact use of the corridor OR vegetation removal may occur and/ or the activity is of a scope, duration and/ or magnitude that may cause minor fragmentation or interrupt use of the corridor, however, impacts can be mitigated onsite and a significant impact on threatened species is unlikely.
5.3.10	Site contains or is adjacent to Grey-headed Flying Fox colony. *Provide justification for 'No' response.*	☐ Yes ☒ No	During various site visits, no Grey-headed Flying Fox were observed onsite and the site is not located adjacent to a Grey-headed Flying Fox colony. Grey-headed Flying Fox have the potential to occur onsite.					
5.3.11	Site contains or is adjacent to a raptor nest. *Provide justification for 'No' response.*	☐ Yes ☒ No	During various site visits no raptor nests were observed onsite and the site is not located adjacent to a raptor nest.					
5.3.12	Activity includes artificial lighting and/ or will include night works with temporary night lighting.	☐ Yes ☒ No		N/A	N/A			

Mitigation Measures

Prior to construction

- Induct all personnel working onsite including workers and contractors are aware of the mitigation measures and environmental safeguards for example through site inductions and 'toolbox talks' and by providing a summary of relevant project requirements for quick reference (such as a noticeboard). Emphasize the following:
  - Sensitivity of surrounding vegetation and possible threatened species habitat.
  - Unexpected finds procedures.
- Reduce the need for reversing or movement alarms and manage access and movement around the site to reduce disturbance.

5.3 Biodiversity

Consideration	App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM

- Reduce noise as much as practically possible by prioritising work during the least sensitive time period and where possible, schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) to make the most of opportunities to reduce construction noise intruding above background noise. Where possible, schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) to make the most of opportunities to reduce construction noise intruding above background noise.
- Plan to optimise the number of vehicle trips to and from the site. For example to minimise noise and congestion, where possible, organise amalgamated loads rather than using several vehicles with smaller loads.

During construction

- Complete all works in accordance with the approved plans.
- Avoid unnecessary dropping of materials from a height and metal-to-metal contact on equipment.
- Where feasible and reasonable, adopt less-annoying alternatives to 'beeper' alarms, such as smart alarms that adjust their volume to the ambient level of noise and 'broadband' alarms.
- Where practicable, identify and use equipment with the lowest noise emissions in its class to complete a specific task. Prioritise the use of super-silenced compressors, silenced jackhammers and damped bits. Select the most effective mufflers, enclosures and low-noise tool bits and blades. Seek the manufacturer's advice before modifying plant, equipment or vehicles to reduce noise.
- Operate equipment in a quiet and efficient manner. Reduce throttle setting and turn off vehicles, plant and equipment when not in use.
- Minimise or avoid the need for reversing or movement alarms. Alarms shall be those specified and supplied by the manufacturer of the plant, vehicle, equipment or machinery.
- Use portable plant, machinery or equipment with the potential to create high levels of noise that incorporates effective noise control.
- Inspect and maintain equipment to ensure it is in good working order and is operated in accordance with the manufacturer's instructions. For equipment fitted with enclosures, check that acoustic doors and seals are in good working order and that doors close properly against the seals. Ensure that air lines on pneumatic equipment do not leak. Where atypically high noise levels and/or annoying characteristics occur because of inappropriate use, or due to faults or poor maintenance, the equipment should not be operated until repaired or replaced.
- Where feasible and reasonable, implement quiet work methods for diesel and petrol engines and pneumatic units (such as hydraulic or electric-controlled units) and where there is no electricity supply, consider an electrical generator away from residences or within an acoustic enclosure.
- Conduct daily fauna checks prior to works commencing. If fauna are encountered during the daily check or during works follow the Unexpected Finds Procedure.
- If damage occurs to vegetation, fauna or their habitat notify the site Team Leader and implement the Environment Incident Procedure. Any corrective or preventative works must be implemented onsite in a timely and efficient manner.
- Ensure materials, plant and equipment are not be placed in a manner that could result in damage to surrounding vegetation and located outside any exclusion zones.
- Minimise work during excessively wet or muddy conditions where possible.
- Restrict vehicles and personnel to designated tracks, trails and parking areas. Where possible park and turn-around on hard, well drained surfaces.
- If priority weeds not previously identified are observed, cease works in the vicinity and follow the Unexpected Finds Procedure.
- Minimise work during excessively wet or muddy conditions where possible.
- all machinery, plant, equipment, vehicles and boots should be clean prior to entry to the site.

Upon completion of construction

- Leave the site clean and free of debris.

5.4 Heritage

	Consideration	App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
Indigenous heritage								
5.4.2	Activity will not disturb the natural ground surface and/ or not extend beyond areas already disturbed OR Activity will disturb the natural ground surface and extend into undisturbed or minimally disturbed ground AND An AHIMS Basic/ Extensive Search was conducted within the last 12 months AND There are no AHIMS sites or other associated landscape features or information within the locality of the activity. *Note: no landscape features means not within 200m of waters, not within a sand dune system, not located on a ridgetop, ridgeline or headland, not located within 200m above or below a cliff face and is not within 20m of, or within, a cave, rock shelter or cave mouth) identified within the locality of the activity.*	☐ Yes ☒ No						
5.4.3	Activity will disturb the natural ground surface and extend beyond areas already disturbed AND An AHIMS Basic/ Extensive Search was conducted within the last 12 months AND There are confirmed AHIMS sites or other associated landscape features or information identified within the locality of the works. *Note: no landscape features means not within 200m of waters, not within a sand dune system, not located on a ridgetop, ridgeline or headland, not*	☒ Yes ☐ No	A due diligence assessment including a site walkthrough with Aboriginal representatives was conducted by HLA Envirosciences (2000, on file) that identified that the road surface had been previously graded and imported fill added so the potential of any sites being found is negligible and that the potential for Aboriginal sites exists in the roadside areas particularly those on ridges or near to the water source of the Williams River. Envirosciences (2000, on file) observed that much of the road corridor had been disturbed by road maintenance, land clearing and the introduction of culverts and therefore the potential for significant Aboriginal sites is low and does not pose an obstacle to the project. The installation of the footings for the guardrail will be on the road edge, in areas already previously disturbed for road construction when East Seaham road was original built and modifications overtime, including the earthworks and associated road construction activities undertaken for the road widening in the year 2000 for Stage 1 of the East Seaham Road Upgrade. The activity is unlikely to disturb Aboriginal artefacts or sites.	<240m^2	2 days	Direct	Low potential for Aboriginal heritage impacts unlikely. Permit not required.	Low potential for Aboriginal heritage impacts unlikely. Permit not required.

	located within 200m above or below a cliff face and is not within 20m of, or within, a cave, rock shelter or cave mouth) identified within the locality of the activity. *Note: Consider preparation of a Due Diligence Assessment in accordance with the NSW Due Diligence Code of Practice.*							
5.4.4	Culturally modified trees are present within the construction footprint or within 20m of the site. *Provide justification for 'No' response.*	☐ Yes ☒ No	No culturally modified trees are present within the construction footprint. No trees are proposed for removal a part of the activity. In the instance of an unexpected cultural find, the Unexpected Finds Procedure will be implemented in accordance with C45.					
5.4.5	Activity is occurring within lands identified as Birubi Aboriginal Place or Soldiers Point Aboriginal Place. *Note: Impact assessment must be guided by and prepared in accordance with relevant Aboriginal Place Plan of Management 2018.*	☐ Yes ☒ No	The activity is not occurring in an Aboriginal place.					
Non-indigenous heritage								
5.4.6	Local or NSW State Heritage item onsite or within 200m of the activity. *Note: Where the activity will impact a Local or NSW State Heritage including views and vistas to and from the heritage item and/ or cultural landscape in which is it sited seek advice from Council's heritage officer and if required prepare a Statement of Heritage Impact in accordance with the Guidelines for the preparation of a Statement of Heritage Impact 2023.*	☒ Yes ☐ No	The road alignment of East Seaham Road is recognised in the Port Stephens Local Environment Plan 2013 Item I5. Following is a brief assessment of the relevant criterion and possible impacts: • Criterion A: An item is important in the course, or pattern or NSW's cultural or natural history (or the cultural and natural history of the local area): An early road forming links with Raymond Terrace, Seaham, Clarence Town on the eastern side of the Williams River. The addition of guardrail will not change the course or pattern of the road or road linkages. The road has already been augmented as part of the Stage 1 works for the East Seaham Road upgrade. • Criterion B: An item has strong or special association with the life or works of a person, or group pf persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area): Associated with two early local landholders John Melbourne Ireland and John McLean. The addition of guardrail will not alter the importance or significance of the linkages and associated of the John Melbourne Ireland and John McLean. The road has already been augmented as part of the Stage 1 works for the East Seaham Road upgrade. • Criterion C: An item is important in demonstrating aesthetic characteristics and/ or a high degree of creative or technical achievement in NSW (or the local area): A richly tree-lined rural road, high tree canopy numerous older trees link to form a beautiful overarching, tunnel effect. This gives the road a special character. The road has already been augmented as part of the Stage 1 works for the East Seaham Road upgrade. The installation of the guardrail will not involve the removal of any additional trees. • Criterion D: An item has a strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons): A special character of this tree-lined road is highly esteemed by members of the local community. The addition of guardrail will not alter the importance or significance of the linkages and associations with the local community. The road has already been augmented as part of the Stage 1 works for the East Seaham Road upgrade. The installation of the guardrail will not involve the removal of any trees. • Criterion F: An item possesses uncommon, rare or endangered aspects of the area's cultural or natural history (or the cultural or natural history of the local area): There are few roads left of this type in the Port Stephens area and is the last remaining in this local area. The road has already been augmented as part of the Stage 1 works for the East Seaham Road upgrade. The installation of the guardrail will not involve the removal of any trees and is unlikely to significantly impact on the historical aspects of the road. Overall, whilst the installation of guardrail will introduce a visual element to the landscape, the visual element is low to the ground and in keeping with the road environment. Stage 1 of the East Seaham Road upgrade involved the upgrading of a narrow gravel surfaced road to a widened bitumen sealed road. The existing unsealed surface was between 7 to 8m in width and the new road having a 7m bitumen sealed pavement with 2m cleared shoulders bringing the total impact width to 11m (HLA Envirosciences REF, 2000). The previous works removed 0.6ha of roadside vegetation. The addition of 240m guardrail into this already highly disturbed environment is unlikely to result in a significant impact to heritage item I5 East Seaham Road.	<240m^2	2 days	Direct	Minor: Low potential for impacts to non-indigenous heritage. Permit not required.	Minor: Low potential for impacts to non-indigenous heritage. Permit not required.
5.4.7	World Heritage Areas or National Heritage Sites within the Port Stephens LGA.	☐ Yes ☒ No	There are no World Heritage Areas or National Heritage Sites within the Port Stephens LGA.					
Mitigation Measures								

Prior to construction
• Induct all personnel working onsite including workers and contractors are aware of the mitigation measures and environmental safeguards for example through site inductions and 'toolbox talks' and by providing a summary of relevant project requirements for quick reference (such as a noticeboard). Emphasize the following:
  ○ Statutory obligations in relation to Aboriginal and non-Indigenous heritage.
  ○ Unexpected finds procedure.								

During construction

- Signpost designated access points, routes, vehicle manoeuvring areas parking areas and ensure site personnel, contractors and delivery trucks are aware of the requirements to help reduce site disturbance.
- If suspected Aboriginal objects such as stone artefacts or shell middens are located or human remains found, cease works within the vicinity, cordon off the area and follow the Unexpected Finds Procedure.
- Minimise work during excessively wet or muddy conditions where possible.

Upon completion of construction

- Remove all physical construction elements from the site included vehicles, plant and equipment.
- Leave the site clean and free of debris.

5.5 Traffic

Consideration		App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.5.1	The activity is occurring within or adjacent to a road or will increase traffic volumes as a result of truck and vehicle movements.	☒ Yes ☐ No	The activity will involve one-way lane temporary land closure for the period of the construction of the proposed activity. Due to the minor nature of the activity there is unlikely to be a significant increase in traffic volumes. Traffic however will be impacted by the use of traffic control and blockages of movement between areas. This may locally increase traffic congestions at peak road use periods leading to increased drive times and potential frustration by local road users.	240m^2	2 days	Indirect	Moderate: Works occurring on a road. Temporary lane or road closure and diversion required.	Minor: Activity involves temporary diversion or road closures of non-main road or is occurring adjacent to a main road. Traffic impacts effectively managed through a site specific traffic guidance scheme.
5.5.2	The activity is occurring on a school bus route or heavy haulage route.	☒ Yes ☐ No	The activity is occurring on a school bus route. No road closures will occur; however, one way temporary lane closure for the period of construction will occur. This may locally increase traffic congestions at peak road use periods leading to increased drive times and potential delay of students arriving at school.	240m^2	2 days	Indirect	Minor: Activity is located within the roadway and will result in minor short term temporary impacts on bus/ heavy haulage routes.	Minor: Activity is located within the roadway and will result in minor short term temporary impacts on bus/ heavy haulage routes.
5.5.3	The activity is occurring on a road utilised by services such as utilities, waste services and emergency services	☒ Yes ☐ No	The activity is occurring on a road utilised by services such as utilities, waste services and emergency services. No road closures will occur; however, one way temporary lane closure for the period of construction will occur. This may locally increase traffic congestions at peak road use periods leading to increased drive times and potential delay of persons receiving emergency care, result in delays or increased times for waste collection and delay the servicing of utilities by utility providers.	240m^2	2 days	Indirect	Minor: Activity is located within the roadway and will result in minor short term temporary impacts on services routes.	Minor: Activity is located within the roadway and will result in minor short term temporary impacts on bus/ heavy haulage routes.
5.5.4	The activity is occurring on a classified road and involve a deviation or alteration of the road or construction of a bridge tunnel or level crossing.	☐ Yes ☒ No						
5.5.5	The activity has a value of over $2 million.	☐ Yes ☒ No						
5.5.6	The activity will affect the development or further development of a main road, tollway or transitway.	☐ Yes ☒ No						
5.5.7	The activity includes the provision of conduits across a public road for the carriage of utility services.	☐ Yes ☒ No						
5.5.8	The activity includes the use of traffic control on aclassified road.	☐ Yes ☒ No						
5.5.9	The activity includes the construction, erection, installation, maintenance, repair, removal or replacement of a traffic light control.	☐ Yes ☒ No						

Mitigation measures

Prior to construction

- Prepare a traffic guidance scheme (TGS) as appropriate. Traffic controls if using barrier devices such as concrete jersey kerbs or water filled barriers must have provision for fauna escape with a 2-300mm gap for every 2 barriers or climbable fauna structures secured to the barrier devices.
- Notification should be provided before and during construction through an appropriate method, within reasonable timeframes and commensurate to the risk of noise impact. Where appropriate, information should also be provided on a site information board displayed in a prominent location with the name and contact details of the organisation responsible for the site. Include:
  - After-hours contact details, including a contact phone number and email address for enquiries and complaints.
  - Basic information on the conditions of approval, such as the hours of work.
- Those affected by the works are to be informed about the project. Notify surrounding residences and businesses of the intention to carry out works in accordance with Councils Communication and Engagement Approach for Infrastructure Projects. At a minimum correspondence should include:

- When the work will take place and its expected duration.
- Mitigation measures including complaints handling procedure.

- Notify emergency and waste services, local bus companies and/ or haulage companies as appropriate of the intention to carry out works in accordance with Councils Communication and Engagement Approach for Infrastructure Projects.
- Induct all personnel working onsite including workers and contractors are aware of the mitigation measures and environmental safeguards for example through site inductions and 'toolbox talks' and by providing a summary of relevant project requirements for quick reference (such as a noticeboard). Emphasize the following:
  - Traffic management requirements in accordance with the Traffic Guidance Scheme prepared for the works.
  - Emergency response procedures.
  - Plan and stage works as much as possible to minimise disruption to traffic especially at peak times, nights, weekends, holiday periods or special events.
- Install traffic controls in accordance with the approved Traffic Guidance Scheme.

During construction

- Plan and stage works as much as possible to minimise disruption to traffic especially at peak times, nights, weekends, holiday periods or special events.
- Minimize the number of vehicular and/ or truck movements to and from the site through amalgamation of loads and schedule arrivals and departures to minimize the number arriving at any one time.
- Leave all controls in place during works, undertake weekly checks and also conduct checks before and after rainfall and promptly correct any issues. Keep records of any checks and issues onsite and ensure they are on request. Relevant controls including traffic controls.
- Keep a record of the TGS onsite at all times. Keep a record of any inspections and/ or corrective actions.
- In a serious incident occurs, cease works in the vicinity and immediately notify the Team Leader follow the requirements of the relevant Safe Work Method Statement.
- Drivers of vehicles, plant and equipment shall comply with NSW Road Rules and the TMP and take care when entering and exiting the site to avoid incidents.
- Personnel on site where possible shall not be within 3 m of moving vehicles, plant or equipment.
- Check traffic management signs and devices regularly to ensure they are:
  - Still relevant, in good mechanical condition, clean, not faded and if necessary have good night-time visibility.
  - Clearly visible to road users and are not obscured by vegetation, vehicles, plant, equipment or other signs and devices
  - Displayed in the correct sequence.
  - Ensure traffic control is conducted by traffic controllers with a traffic controller qualification.
- Visually monitor traffic for excessive delays or que lengths. Notify the Team Leader and appropriate Manager (if required) and amend the TGS (if required).
- Provide temporary trafficable access to properties for the duration of the works

Upon completion of construction

Remove all physical construction elements from the site included vehicles, plant and equipment and traffic controls.

5.6 Waste

Consideration		App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.6.1	The site has a building or other structure on site that was built prior to 1990 and/ or Asbestos Register Record onsite, summarise details from Asbestos Record.	☐ Yes ☒ No						
5.6.2	Generation of waste.	☒ Yes ☐ No	Waste generated onsite will include recyclables and litter. Waste has the potential to cause: • Odour emissions from waste generated and/ or stored on site with the potential to create unsightly odours, a health hazard or environmental harm. • Visual impacts of waste onsite. • Visual and health impacts of dust emissions. Waste generated onsite is likely to be restricted to personal waste from the activities, only small amounts of recyclables and litter will be produced. The litter is unlikely to be of a volume where odour or visual amenity are a matter of concern.	240m^2	2 days	Direct Indirect Cumulative	Minor: Minor amounts of waste produced and limited opportunity for waste to cause environmental harm.	Minor: Minor amounts of waste produced and limited opportunity for waste to cause environmental harm OR moderate amounts of waste produced but waste managed in accordance with standard procedures.
5.6.3	Activity will involve generating, handling, storing, transporting or disposing of special (e.g. asbestos, clinical, tyres), liquid, hazardous (batteries, coal tar, lead paint waste etc.), or restricted solid waste (e.g. contaminated soil etc.), dangerous goods, or controlled chemicals.	☐ Yes ☒ No	Dangerous goods maybe transported to the site, used on site and disposed of offsite as required. Dangerous good used onsite are likely to be restricted to negligible. No storage of dangerous good will occur onsite. The volumes are is unlikely to be of a small magnitude and	Small quantities	2 days	Direct Indirect Cumulative	Minor: Activity involves negligible use or storage or handling of dangerous goods with a low likelihood of environmental harm.	Minor: Activity involves negligible use or storage or handling of dangerous goods with a low likelihood of environmental harm OR use or storage or hadling of dangerous goods that can be managed in accorandance with standard procedures.

Mitigation measures

At all times

- Maintain a clean site that is free of litter and unnecessary debris with all wastes stored securely to avoid/ minimise the risk of pollutants escaping.
- Inspect and maintain equipment to ensure it is in good working order and operated in accordance with the manufacturer's instructions. Where atypically high noise levels and/or annoying characteristics occur because of inappropriate use, or due to faults or poor maintenance, the equipment should not be operated until repaired or replaced.
- Use, maintain, service and store vehicles, plant, equipment and materials in accordance with all relevant Council, manufacturing and Australian standards and procedures and regularly inspect for leaks. Repair leaks immediately or remove the leaky equipment from site and have it replaced.

During construction

- Where possible avoid, reuse and recycle spoil and waste generated. Manage waste that cannot be avoided, reused or recycled in accordance with the NSW Waste Avoidance and Recovery Act 2011, and classify the waste in accordance with the NSW Waste Classification Guidelines and only dispose of the waste at a facility licenced to accept such waste(s) with supporting documentation.
- Ensure the provision and regular service of portable self-contained toilets by contractors as required.
- Provide a sufficient number of suitable and labelled receptacles for generated waste and recyclable materials and clean receptacle as required to avoid overflows.
- Use and store all hazardous and dangerous goods in accordance with all relevant statutory standards and procedures and manufacturer's MSDS. Retain a copy of all relevant MSDS onsite.
- Remove, transport and dispose of hazardous and dangerous goods in accordance with the NSW Waste Classification Guidelines and dispose of at a waste facility licenced to accept such waste. Any transport of dangerous goods must occur with a driver possessing a dangerous goods drivers licence and dangerous good vehicle licence. All dangerous goods transport shall be in accordance with NSW Dangerous Goods (Roads and Rail Transport Act 2008 and NSW Dangerous Goods (Road and Rail) Transport Regulation 2014.
- Ensure hazardous goods are be labelled in accordance with the requirements of the Australian Dangerous Goods Code.

Upon completion of construction

- Remove all physical construction elements from the site included vehicles, plant and equipment, fencing such as tree protection fencing and exclusion fencing and traffic controls.
- Leave the site clean and free of debris.

5.7 Air quality & odour, noise, vibration & light

Consideration		App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.7.2	Site has sensitive receivers close to the site.	☒ Yes ☐ No	The activity may produce the following impacts onsite and offsite: • Visual impacts from dust emissions. • Dust emissions causing a localised decline in air quality. • Noise disturbance from use of plant, machinery and equipment, and general noise such as yelling, shouting, radios and truck reversing alarms, which may cause disturbances to fauna, roosting and use of the site and disturbance of daily activities. There are a minor number of residential receivers. • Possible odours from vehicular emissions and waste onsite. There is 1 residential receiver within 50m of the activity and another 2 within 1050m of the activity. The activity if minor in nature and short in duration (approximately 2 days) and is therefore likely to result in only minor impacts to the residential receivers provided appropriate consultation occurs.	240m^{-2}	2 days	Indirect	Low number of sensitive receivers. Activity has short duration, small magnitude and limited scope and is likely to only cause limited impacts	Low number of sensitive receivers. Activity has short duration, small magnitude and limited scope and is likely to only cause limited impacts. Impacts mitigated in accordance with standard procedures.

Mitigation measures

At all times

- Handle enquiries and complaints in accordance with Council's complaints handling procedures and eliminate or reduce the source where practical.
- Maintain a clean site that is free of litter and unnecessary debris with all wastes stored securely to avoid/ minimise the risk of pollutants escaping.
- Avoid the use of radios, stereos, open two-way radios and public address systems outdoors where they are likely to be audible at sensitive receivers beyond the site boundary.
- Avoid shouting, talking loudly, slamming vehicle doors or making any other unnecessary noise.

Prior to construction

- Notification should be provided before and during construction through an appropriate method, within reasonable timeframes and commensurate to the risk of noise impact. Where appropriate, information should also be provided on a site information board displayed in a prominent location with the name and contact details of the organisation responsible for the site. Include:
  - After-hours contact details, including a contact phone number and email address for enquiries and complaints.
  - Basic information on the conditions of approval, such as the hours of work.
- Those affected by the works are to be informed about the project. Notify surrounding residences and businesses of the intention to carry out works in accordance with Councils Communication and Engagement Approach for Infrastructure Projects. At a minimum correspondence should include:
  - When the work will take place and its expected duration.
  - The likely noise impact of the work without understating its effect.
  - Any work activities or equipment that will be particularly noisy or noticeable.
  - Mitigation measures to manage noise impacts, including complaints handling procedures.
- Induct all personnel working onsite including workers and contractors are aware of the mitigation measures and environmental safeguards for example through site inductions and 'toolbox talks' and by providing a summary of relevant project requirements for quick reference (such as a noticeboard). Emphasize the following:
  - Site sensitivities and their relevance to the proposal.
  - Noise management requirements.
  - Traffic management requirements in accordance with the Traffic Guidance Scheme prepared for the works.
  - Public access and safety requirements.
  - Emergency response procedures.
- Personnel onsite are to be trained and proficient in the operation of plant, equipment and vehicular procedures for the required tasks and ways to reduce impacts such as odours, noise, dust and emissions.
- Inspect and maintain equipment to ensure it is in good working order and operated in accordance with the manufacturer's instructions. For equipment fitted with enclosures, check that acoustic doors and seals are in good working order and that doors close properly against the seals. Ensure that air lines on pneumatic equipment do not leak. Where atypically high noise levels and/or annoying characteristics occur because of inappropriate use, or due to faults or poor maintenance, the equipment should not be operated until repaired or replaced.
- Fit and maintain plant and equipment with approved exhaust systems to maintain exhaust emissions within acceptable standards and with manufacture approved reversing alarms and lights to ensure onsite safety.
- Reduce the need for reversing or movement alarms and manage access and movement around the site to reduce disturbance
- Reduce noise as much as practically possible by prioritising work during the least sensitive time period and where possible, schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) to make the most of opportunities to reduce construction noise intruding above background noise. Where possible, schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) to make the most of opportunities to reduce construction noise intruding above background noise.
- Design the worksite to maximise noise mitigation through careful location of equipment and work activities and shielding:
- Avoid the need for vehicles to engage reversing alarms by designing the site to eliminate the need to reverse. This could include one-way systems and drive-throughs for parking and deliveries.

During construction

- Minimize the number of vehicular and/ or truck movements to and from the site through amalgamation of loads and schedule arrivals and departures to minimize the number arriving at any one time.
- Avoid unnecessary dropping of materials from a height and metal-to-metal contact on equipment.
- Where feasible and reasonable, adopt less-annoying alternatives to 'beeper' alarms, such as smart alarms that adjust their volume to the ambient level of noise and 'broadband' alarms.

- Where practicable, identify and use equipment with the lowest noise emissions in its class to complete a specific task. Prioritise the use of super-silenced compressors, silenced jackhammers and damped bits. Select the most effective mufflers, enclosures and low-noise tool bits and blades. Seek the manufacturer's advice before modifying plant, equipment or vehicles to reduce noise.
- Operate equipment in a quiet and efficient manner. Reduce throttle setting and turn off vehicles, plant and equipment when it is not being used. Minimise or avoid the need for reversing or movement alarms. Alarms shall be those specified and supplied by the manufacturer of the plant, vehicle, equipment or machinery.
- Inspect and maintain equipment to ensure it is in good working order and is operated in accordance with the manufacturer's instructions. For equipment fitted with enclosures, check that acoustic doors and seals are in good working order and that doors close properly against the seals. Ensure that air lines on pneumatic equipment do not leak. Where atypically high noise levels and/or annoying characteristics occur because of inappropriate use, or due to faults or poor maintenance, the equipment should not be operated until repaired or replaced.
- Where feasible and reasonable, implement quiet work methods for diesel and petrol engines and pneumatic units (such as hydraulic or electric-controlled units) and where there is no electricity supply, consider an electrical generator away from residences or within an acoustic enclosure.
- Periodically check the site, nearby residences and other sensitive land uses to proactively identify noise issues and feasible and reasonable mitigation.
- Conduct all works between the daylight hours of 7am to 6pm, Monday to Friday, and 8am to 1pm, Saturdays, with no works occurring on Sundays or public holidays.

Upon completion of construction

- Remove all physical construction elements from the site included vehicles, plant and equipment, fencing such as tree protection fencing and exclusion fencing and traffic controls.
- Leave the site clean and free of debris.
- Wherever possible any remaining waste will be reused or recycled where possible, be managed in accordance with the principles of the NSW Waste Avoidance and Recovery Act 2011, be classified in accordance with the NSW Waste Classification Guidelines and only disposed of at a facility licenced to accept such waste(s) with supporting documentation.

See also Section 5.3 Biodiversity and Section 5.5 Traffic.

5.8 Visual amenity and social considerations

Consideration		App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.8.1	Site is located within an area of high scenic and/ or landscape value and/ or site is located in an area where views/ vistas are likely to be impacted by the activity e.g. water views, ridges and hillsides, hinterland, wetlands, conservation areas.	☒ Yes ☐ No	The site is located with a rural roadside reserve. East Seaham Road has rural landscape views and is heritage listed as Item I5 in the Port Stephens LEP 2013 as it is a richly tree-lined rural road, high tree canopy numerous older trees link to form a beautiful overarching, tunnel effect. This gives the road a special character. The road has already been augmented as part of the Stage 1 works for the East Seaham Road upgrade. The installation of the guardrail will not involve the removal of any trees and is in keeping with the road environment and associated infrastructure. During works, views will be interrupted with additional plant, equipment and machinery onsite and traffic control. The duration of the activity is only 2 days and likely to have a negligible impact with complaints for interruption of views unlikely.	240m^2	Direct	Direct	Negligible: No to limited impact on scenic or landscape values.:	Negligible: No to limited impact on scenic or landscape values.:
5.8.3	Site is located within or adjacent to an active or passive recreation area.	☐ Yes ☒ No						
5.8.4	Activity is located within a high tourist activity area and/ or on a tourist route.	☐ Yes ☒ No						
5.8.5	Activity is located along a major pedestrian route (e.g. shopping centre, foreshore, sporting venue etc).	☐ Yes ☒ No	The site is not located along a major pedestrian route.					

Mitigation measures

At all times

- Maintain a clean site that is free of litter and unnecessary debris with all wastes stored securely to avoid/ minimise the risk of pollutants escaping.

Prior to construction

- Notification should be provided before and during construction through an appropriate method, within reasonable timeframes and commensurate to the risk of noise impact. Where appropriate, information should also be provided on a site information board displayed in a prominent location with the name and contact details of the organisation responsible for the site. Include:
  - After-hours contact details, including a contact phone number and email address for enquiries and complaints.
  - Basic information on the conditions of approval, such as the hours of work.

5.9 Hazards & coastal matters

Consideration		App.	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.9.1	Site or entrance and exit roads to the site are mapped as bushfire prone.	☒ Yes ☐ No	The site and site access is mapped as bushfire prone and have the potential to cause harm to human health and the environment. There ois a risk	N/A	2 days	Direct	Site or access is bushfire prone and has the potential for harm to human health and the environment.	Site or access is bushfire prone with potential for harm to human health and the environment managed in accordance with standard procedures.

5.9.2	Site or entrance and exit roads to the site are mapped as flood prone.	☒ Yes ☐ No	The site access is mapped as floodprone. The site is not mapped as floodprone. There is a risk of isolation during flooding and safety risk of personnel operating onsite that flooding may cause personal harm.	N/A	2 days	Direct	Site or access is floodprone and has the potential for harm to human health and the environment.	Site or access is floodprone with potential for harm to human health and the environment managed in accordance with standard procedures.
5.9.3	Site is subject to severe weather events.	☒ Yes ☐ No	The site is subject to severe weather events. There is a risk of a severe weather event occurring during the activity period. During a severe weather event, there is a safety risk to personnel operating onsite that weather may cause personal harm. Severe weather may also cause damage to plant, vehicles and equipment onsite. Severe weather also has the potential to cause environmental harm, particularly if the site not appropriately secured appropriately leading to erosion and sedimentation, leaching of fuels, oils and other harmful chemicals from plant, vehicles and equipment stored onsite that have the potential to cause water pollution and harm to the sensitive marine life in the adjacent waters. During a severe weather event, items left onsite also have the potential to cause damage to structures and the local environment due to impact.	N/A	2 days	Direct	Site or access is subject to severe weather events and has the potential for harm to human health and the environment.	Site or access is subject to severe weather events and has the potential for harm to human health and the environment managed in accordance with standard procedures.
5.9.4	Site is located within, within the proximity area or drains to a Coastal Wetland within 200m of the site.	☐ Yes ☒ No						
5.9.5	Site is located within, within the proximity area or drains to Littoral Rainforest within 200m of the site.	☐ Yes ☒ No						
5.9.6	Site is located within Coastal Environment Area.	☐ Yes ☒ No	Adverse impact on the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment					
			Adverse impact on coastal environmental values and natural coastal processes					
			Adverse impact on the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1.					
			Adverse impact on marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms					
			Adverse impact on existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability					
			Adverse impact on Aboriginal cultural heritage, practices and place					
			Adverse impact on the use of the surf zone					
5.9.7	Site is located within Coastal Use Area.	☐ Yes ☒ No	Adverse impact on existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability					
			Adverse impact on overshadowing, wind funnelling and the loss of views from public places to foreshores					
			Adverse impact on the visual amenity and scenic qualities of the coast, including coastal headlands					
			Adverse impact on Aboriginal cultural heritage, practices and places					
			Adverse impact on cultural and built environment heritage					
			The development is designed, sited and will be managed to avoid adverse impacts, or if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or if that impact cannot be minimised—the development will be managed to mitigate that impact					
			The development takes into account the surrounding coastal and built environment, and the bulk, scale and size of the proposed development					
5.9.8	Site is located within an area that fulfils the definition of a Coastal Vulnerability Area and coastal processes are active onsite.	☐ Yes ☒ No	Erosion and sediment deposition caused by waves and tidal action					
			Shoreline recession.					
			Coastal/ Tidal inundation.					
			Coastal winds and sand drift.					
			Coastal cliff or slope instability.					
			Future sea level rise.					

Mitigation measures
At all times • Drive to conditions on unsealed roads and/ or onsite. • Monitor weather conditions for adverse weather that may increase impacts such as dust, noise, vibration, emissions, odour and where possible schedule works to avoid these periods. Do not undertake works during inclement weather to minimise the risk of damage to assets and ensure there is no compromise of site safety. Where severe weather is forecast, undertake all reasonable precautions to prepare and secure the site for a storm event and help minimise the potential for damage. • If heavy rain is forecasted in the next 24 hours delay commencement or cease works until such time a suitable dry period of weather is forecasted. **Prior to works** • Include emergency management for bushfire, flooding and severe weather events in the Safe Work Method Statement(s) relevant to/ prepared for the proposed works. • Induct all personnel working onsite including workers and contractors are aware of the mitigation measures and environmental safeguards for example through site inductions and 'toolbox talks' and by providing a summary of relevant project requirements for quick reference (such as a noticeboard). Emphasize the following: • Emergency response procedures. **During works** • Complete all works in accordance with the approved plans, Construction Environmental Management Plan and relevant Safe Work Method Statement(s).

5.10 Land & natural resource use

Consideration		Applicable	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.10.1	Alteration of existing land use	☒ Yes ☐ No	There will be temporary access restrictions during construction. The site is a rural residential road and unlikely to regularly frequented by pedestrians. The main restrictions will be traffic impacts, see Section 5.5.1.	Minor	2 days	Indirect Cumulative	N/A	Minor: Minimal alteration of existing land use consistent with surrounding environment/ use of land.
5.10.2	Restriction of access	☒ Yes ☐ No	There will be traffic control used during the construction period. See Section 5.5.1 for traffic impacts. The site is a rural residential road and unlikely to regularly frequented by pedestrians.	See Section 5.5.1	See Section 5.5.1	See Section 5.5.1	See Section 5.5.1	See Section 5.5.1
5.10.3	Use/ destruction of natural resources	☒ Yes ☐ No	The activity will include the use, wastage, destruction of natural resources through the use of minimal quantities of fuel and other resources during works. Materials will be used such as steel for production of the guard rail etc.	Minor	2 days	Indirect Cumulative	Minor: Small/ negligible use/ impacts on natural resources,	Minor: Small/ negligible use/ impacts on natural resources,
5.10.4	Adjacent to NSW NPWS Lands	☐ Yes ☒ No						
5.10.5	Adjacent to Commonwealth Lands	☐ Yes ☒ No						

Mitigation measures

See Sections 5.5.1 for mitigation measures.

Prior to construction

- Personnel onsite are to be trained and proficient in the operation of plant, equipment and vehicular procedures for the required tasks and ways to reduce impacts such as odours, noise, dust and emissions.
- Inspect and maintain equipment to ensure it is in good working order and operated in accordance with the manufacturer's instructions. For equipment fitted with enclosures, check that acoustic doors and seals are in good working order and that doors close properly against the seals. Ensure that air lines on pneumatic equipment do not leak. Where atypically high noise levels and/or annoying characteristics occur because of inappropriate use, or due to faults or poor maintenance, the equipment should not be operated until repaired or replaced.
- Fit and maintain plant and equipment with approved exhaust systems to maintain exhaust emissions within acceptable standards and with manufacture approved reversing alarms and lights to ensure onsite safety.

During construction

- Minimize the number of vehicular and/ or truck movements to and from the site through amalgamation of loads and schedule arrivals and departures to minimize the number arriving at any one time.
- Where possible avoid, reuse and recycle spoil and waste generated. Manage waste that cannot be avoided, reused or recycled in accordance with the NSW Waste Avoidance and Recovery Act 2011, and classify the waste in accordance with the NSW Waste Classification Guidelines and only dispose of the waste at a facility licenced to accept such waste(s) with supporting documentation.
- Provide a sufficient number of suitable and labelled receptacles for generated waste and recyclable materials and clean receptacle as required to avoid overflows.

Upon completion of construction

- Wherever possible any remaining waste will be reused or recycled where possible, be managed in accordance with the principles of the NSW Waste Avoidance and Recovery Act 2011, be classified in accordance with the NSW Waste Classification Guidelines and only disposed of at a facility licenced to accept such waste(s) with supporting documentation.

5.11 Pollution

Consideration			Applicable	Extent	Size	Duration	Type	Impact before MM	Impact after MM
5.11.1	Air pollution	Dust	☒ Yes ☐ No	• Dust emissions due to soil exposure and disturbance with the potential to create a health hazard or environmental harm. • Dust emissions from the operation of plant and equipment with the potential to create a health hazard or environmental harm. • Unnecessary vehicle, plant and equipment movements creating unnecessary dust emissions with the potential to create a health hazard or environmental harm. • Dust emissions from vehicles transporting materials to and from the site with the potential to create a health hazard or environmental harm. • Dust emissions from handling stockpiled material onsite with the potential to create a health hazard or environmental harm. • Exposed areas not stabilised resulting in dust emissions with the potential to create a health hazard or environmental harm.	240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Dust generated during activity but confined to the site	Minor: Dust generated during activity but confined to the site
		Odours	☒ Yes ☐ No	• Vehicle, plant and equipment releasing emissions (gases, liquid droplets or solid particles) with the potential to create unsightly odours, a health hazard or environmental harm • Chemical usage related emissions with the potential to create unsightly odours, a health hazard or environmental harm. • Wind borne rubbish with the potential to create unsightly odours, a health hazard or environmental harm. • Generation of carbon dioxide from vehicle emissions associated with driving to and from the site and operation of plant and machinery on the site with the potential to create a health hazard or environmental harm. • Odour emissions from waste generated and/ or stored on site with the potential to create unsightly odours, a health hazard or environmental harm	240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Minor odour detectable during works with complaints unlikely.	Minor: Minor odour detectable during works with complaints unlikely.

5.11 Pollution

		Emissions	☒ Yes ☐ No	• Vehicle, plant and equipment releasing emissions (gases, liquid droplets or solid particles) with the potential to create unsightly odours, a health hazard or environmental harm. • Chemical usage related emissions with the potential to create unsightly odours, a health hazard or environmental harm. • Wind borne rubbish with the potential to create unsightly odours, a health hazard or environmental harm. • Generation of carbon dioxide from vehicle emissions associated with driving to and from the site and operation of plant and machinery on the site with the potential to create a health hazard or environmental harm. • Odour emissions from waste generated and/ or stored on site with the potential to create unsightly odours, a health hazard or environmental harm. • No burning activities will occur.	240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Minor emissions release short-term.	Minor: Minor emissions release short-term.
5. 11.2	Light pollution		☐ Yes ☒ No						

5. 11.3	Noise disturbance		☒ Yes ☐ No	• See attached Standard and Non-Standard Noise Mitigation Assessment. Overall ranking is LOW-MEDIUM risk. MEDIUM-HIGH risk impacts include:
				  ○ Duration of the activity: Medium-duration work (e.g. lasting several weeks).
				  ○ Noise-making equipment and processes including use of medium-sized equipment (e.g. light to medium excavators, graders and loaders). Use of hand-held jackhammers and small rock breakers and medium sized drills and cutting machines. Light and medium-sized vehicles on the worksite. Occasional deliveries and removals by large vehicles.
				• Proximity to sensitive receivers: Minimal distances between the worksite and noise sensitive receivers (e.g. tens of metres).
				• Containment of noise: Outdoor activities with minimal isolation or containment from sensitive receivers and limited opportunities available to control noise at the source and in the path.
				• Number of people affected: Moderate numbers of sensitive receivers.
				• Other impacts include disruption of the roosting or breeding of, or have other impacts on native fauna.
					240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Minor noise detectable during works with complaints unlikely.	Minor: Minor noise detectable during works with complaints unlikely.

5. 11.4	Vibration likely to impact structures		☐ Yes ☒ No						
5. 11.5	Water	Dust, erosion and sedimentation	☒ Yes ☐ No	• Increased erosion and sedimentation through exposure of soil onsite, tracking of dirt onto sealed roadways and rainfall washing dirt into the location drainage system or receiving waterbodies contributing to sediment plumes and: • Smothering of habitats. • Damaging the health of aquatic fauna. • Increasing the turbidity levels and decreasing the amount of light available for aquatic plants. • Increased nitrification of waterways due to increased sedimentation of nutrient laden sediment. • The impacts of erosion and sediment on the terrestrial areas onsite are expected to be minimum as the majority of the biodiversity values of the site are uphill of the activity area. • Minor increase in impervious area through construction of concreted areas. Due to a minor increase in relation to imperviousness of the surrounding catchment, and location within the existing shore rock environment, the activity is unlikely to increase stormwater runoff volumes and velocity such that an increase in sedimentation and erosion impacts would occur.	240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Erosion disturbance and release of sediment but contained within the site.	Minor: Erosion disturbance and release of sediment but contained within the site.
		Mircobiological	☐ Yes ☒ No	• Inappropriate disposal of sewage onsite. • Introduction of microbiological contaminants from offsite.	240m^2	2 days construction Operation and maintenance			

		Chemical	☒ Yes ☐ No	• Chemical pollution including:
				  ○ Poor storage of chemicals and oils, grease etc leading to leakages.
				  ○ Poor storage, use and management of chemicals and oils, grease etc leading to leakages of substances.
				  ○ Poorly maintained vehicles, plant and equipment leading to leakages of substances.
				  ○ Use of vehicles, plant and equipment leading to heavy metal pollution through runoff.
				  ○ Incomplete site cleanup leaving hazardous materials onsite with the potential to leak.
				  ○ Use of pesticides onsite leading to increased toxicity in aquatic marine life in the adjacent waters.
				• The chemical water pollution produced by the activity, would be minor in comparison to the existing pollutant sources such as the local marina operations and boat usage, pollutants from stormwater runoff from local roads and use of pesticides and herbicides for weed control in local reserves, commercial premises and local residential premises for garden maintenance.
					240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Chemical pollution has the potential to occur but contained within the site.	Minor: Chemical pollution has the potential to occur but contained within the site.

		Thermal	☐ Yes ☒ No						
		Oxygen depletion	☐ Yes ☒ No						
5. 11.6	Soil/ Land Contamination		☒ Yes ☐ No	• Gross pollutants from littering with the potential to cause unsightly aesthetics and water pollution and environmental harm.	240m^2	2 days construction Operation and maintenance	Direct Indirect	Moderate: Contamination is known within the site which has	Minor: Contamination is known within the site but won't be

5.11 Pollution

			• Release of chemicals, oils or heavy metals or other similar pollutants/ contaminants into soil, drainage systems, channels or watercourses through accidental leaks and spills with the potential to cause unsightly aesthetics and water pollution and environmental harm. • Minor increase in impervious area through construction of concreted areas. Due to a minor increase in relation to imperviousness of the surrounding catchment, and location within the existing shore rock environment, the activity is unlikely to increase stormwater runoff volumes and velocity such that an increase in sedimentation and erosion impacts would occur.				the potential to be disturbed: or contaminants are used and have the potential to be released.	disturbed: or contaminants are used but will not be released.
5. 11.7	Visual pollution	☒ Yes ☐ No	• Illegal dumping resulting in environmental damage and harm. • Littering and inappropriate disposal of waste by personnel onsite resulting in environmental damage and harm. • Environmental footprint and/ or inappropriate disposal of construction waste. • Environmental footprint and/ or inappropriate disposal of sewage onsite. • Waste left behind from construction such as erosion and sediment fencing or exclusion fencing, tree tags, litter etc. resulting in environmental damage and harm. • Increased patronage of the activity will increase the waste generation of the site increasing the potential for environmental harm due to inappropriate disposal and environmental footprint for disposal and/ or recycling. • Incomplete removal of stockpiles leaving visual change to the landscape.	240m^2	2 days construction Operation and maintenance	Direct	Minor: Minor impact during works with complaints unlikely.	Minor: Minor impact during works with complaints unlikely.
5. 11.8	Plastic pollution	☒ Yes ☐ No	• Plastics from gross pollutants produced onsite e.g. littering with the potential to cause unsightly aesthetics and water pollution.	240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Plastic pollution has the potential to occur but unlikely to cause impacts beyond the site.	Minor: Plastic pollution has the potential to occur but unlikely to cause impacts beyond the site;
5. 11.9	Ozone and greenhouse gas emissions	☒ Yes ☐ No	• Clearing of a small amount of vegetation. • Greenhouse gas emissions from production of materials such as steel and cement and transport of materials, plant, machinery and equipment to and from the site. • Greenhouse gas emissions from fuel combustion from vehicles, plant, machinery and equipment to and from the site.	240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Activity will contribute minor emissions to ozone and greenhouse gas emissions in the short term.	Minor: Activity will contribute minor emissions to ozone and greenhouse gas emissions in the short term.
5. 11.10	Physical damage	☒ Yes ☐ No	• Tree pruning may occur which has the potential to decrease the viability of the tree and potential habitat or food source it provides. Tree pruning would occur in accordance with AS4373-2007 • Unauthorized vehicle or plant movements, storage of equipment and materials or rubbish dumping causing damage to or destruction of habitat. • Potential impacts of noise and vibration that may disrupt the roosting or breeding of, or have other impacts on native fauna. • Damage to existing built or natural elements onsite, outside the approved plans. • Physical damage of the marine environment from working within the waterway.	240m^2	2 days construction Operation and maintenance	Direct Indirect	Minor: Physical damage is unlikely to occur due to small scale and/ or short duration of the activity. .	Minor: Physical damage is unlikely to occur due to small scale and/ or short duration of the activity.

Mitigation measures

At all times

- Drive to conditions on unsealed roads and/ or onsite.
- Handle enquiries and complaints in accordance with Council's complaints handling procedures and eliminate or reduce the source where practical.
- Use, maintain, service and store vehicles, plant, equipment and materials in accordance with all relevant Council, manufacturing and Australian standards and procedures and regularly inspect for leaks. Repair leaks immediately or remove the leaky equipment from site and have it replaced.
- Monitor weather conditions for adverse weather that may increase impacts such as dust, noise, vibration, emissions, odour and where possible schedule works to avoid these periods. Do not undertake works during inclement weather to minimise the risk of damage to assets and ensure there is no compromise of site safety. Where severe weather is forecast, undertake all reasonable precautions to prepare and secure the site for a storm event and help minimise the potential for damage.
- If heavy rain is forecasted in the next 24 hours delay commencement or cease works until such time a suitable dry period of weather is forecasted.
- Maintain a clean site that is free of litter and unnecessary debris with all wastes stored securely to avoid/ minimise the risk of pollutants escaping.
- Avoid the use of radios, stereos, open two-way radios and public address systems outdoors where they are likely to be audible at sensitive receivers beyond the site boundary.
- Avoid shouting, talking loudly, slamming vehicle doors or making any other unnecessary noise.

Prior to construction

- Notification should be provided before and during construction through an appropriate method, within reasonable timeframes and commensurate to the risk of noise impact. Where appropriate, information should also be provided on a site information board displayed in a prominent location with the name and contact details of the organisation responsible for the site. Include:
  - After-hours contact details, including a contact phone number and email address for enquiries and complaints.
  - Basic information on the conditions of approval, such as the hours of work.
- Those affected by the works are to be informed about the project. Notify surrounding residences and businesses of the intention to carry out works in accordance with Councils Communication and Engagement Approach for Infrastructure Projects. At a minimum correspondence should include:
  - When the work will take place and its expected duration.
  - The likely noise impact of the work without understating its effect.
  - Any work activities or equipment that will be particularly noisy or noticeable.
  - Mitigation measures to manage noise impacts, including complaints handling procedures.
- If noise impacts are likely to impact on sensitive receivers, beyond what would be considered acceptable for construction works, consult the noise sensitive receivers about scheduling of activities, as appropriate.
- Induct all personnel working onsite including workers and contractors are aware of the mitigation measures and environmental safeguards for example through site inductions and ‘toolbox talks’ and by providing a summary of relevant project requirements for quick reference (such as a noticeboard). Emphasize the following:
  - Complaints management procedures.
  - Noise management requirements.
  - Emergency response procedures.

5.11 Pollution

- Personnel onsite are to be trained and proficient in the operation of plant, equipment and vehicular procedures for the required tasks and ways to reduce impacts such as odours, noise, dust and emissions.
- Inspect and maintain equipment to ensure it is in good working order and operated in accordance with the manufacturer's instructions. For equipment fitted with enclosures, check that acoustic doors and seals are in good working order and that doors close properly against the seals. Ensure that air lines on pneumatic equipment do not leak. Where atypically high noise levels and/or annoying characteristics occur because of inappropriate use, or due to faults or poor maintenance, the equipment should not be operated until repaired or replaced.
- Fit and maintain plant and equipment with approved exhaust systems to maintain exhaust emissions within acceptable standards and with manufacture approved reversing alarms and lights to ensure onsite safety.
- Plan and stage works as much as possible to:
    - Reduce the exposure of soils or open excavations.
    - Reduce the need for reversing or movement alarms and manage access and movement around the site to reduce disturbance.
    - Reduce noise as much as practically possible by prioritising work during the least sensitive time period and where possible, schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) to make the most of opportunities to reduce construction noise intruding above background noise. Where possible, schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) to make the most of opportunities to reduce construction noise intruding above background noise.
- Avoid the need for vehicles to engage reversing alarms by designing the site to eliminate the need to reverse. This could include one-way systems and drive-throughs for parking and deliveries.
- Plan to optimise the number of vehicle trips to and from the site. For example to minimise noise and congestion, where possible, organise amalgamated loads rather than using several vehicles with smaller loads.
- Install erosion and sediment controls in accordance with Managing Urban Stormwater: Soils and Construction (Landcom Vol 1, 4th Ed, 2004) and the approved plans.

During construction

- Complete all works in accordance with the approved plans, Construction Environmental Management Plan and relevant Safe Work Method Statement(s).
- Reduce noise and vibration as much as practically possible by:
    - Minimize the number of vehicular and/ or truck movements to and from the site through amalgamation of loads and schedule arrivals and departures to minimize the number arriving at any one time.
    - Leave all controls in place during works, undertake weekly checks and also conduct checks before and after rainfall and promptly correct any issues. Keep records of any checks and issues onsite and ensure they are on request. Relevant controls include:
    - Erosion and sediment controls
- Soil and water pollution and dust emissions.
- Keep an emergency spill response kit onsite at all times and monitor the kit for replenishment of contents. Make all staff aware of the location of the spill kit and ensure that they are trained in its use. If a spill occurs, follow the EMS Incidence Response Procedure and immediately notify the Project Manager and/ or EMS Manager.
- Avoid refuelling of equipment or chemical handling activities onsite. Conduct the activities offsite.
- Wash equipment, machinery or works vehicles offsite at an approved facility.
- Avoid unnecessary dropping of materials from a height and metal-to-metal contact on equipment.
- Where feasible and reasonable, adopt less-annoying alternatives to 'beeper' alarms, such as smart alarms that adjust their volume to the ambient level of noise and 'broadband' alarms.
- Where practicable, identify and use equipment with the lowest noise emissions in its class to complete a specific task. Prioritise the use of super-silenced compressors, silenced jackhammers and damped bits. Select the most effective mufflers, enclosures and low-noise tool bits and blades. Seek the manufacturer's advice before modifying plant, equipment or vehicles to reduce noise.
- Operate equipment in a quiet and efficient manner. Reduce throttle setting and turn off vehicles, plant and equipment when it is not being used. Minimise or avoid the need for reversing or movement alarms. Alarms shall be those specified and supplied by the manufacturer of the plant, vehicle, equipment or machinery.
- Optimise the number of vehicle trips to and from the site. For example to minimise noise and congestion, where possible, organise amalgamated loads rather than using several vehicles with smaller loads.
- Use portable plant, machinery or equipment with the potential to create high levels of noise that incorporates effective noise control.
- Inspect and maintain equipment to ensure it is in good working order and is operated in accordance with the manufacturer's instructions. For equipment fitted with enclosures, check that acoustic doors and seals are in good working order and that doors close properly against the seals. Ensure that air lines on pneumatic equipment do not leak. Where atypically high noise levels and/or annoying characteristics occur because of inappropriate use, or due to faults or poor maintenance, the equipment should not be operated until repaired or replaced.
- Where feasible and reasonable, implement quiet work methods for diesel and petrol engines and pneumatic units (such as hydraulic or electric-controlled units) and where there is no electricity supply.
- Undertake daily checks of site drainage systems and undertake maintenance when required to ensure site drainage systems are operating at capacity e.g. removal of debris and that there is no increase in turbidity (sediment laden water). Ensure there is no release of dirty water into drainage lines and/ or watercourse.
- Visually monitor work sites, general work areas and stockpiles for dust generation and water down with clean water or cover with tarpaulins in the event of dry and/ or windy conditions.
- Conduct all works between the daylight hours of 7am to 6pm, Monday to Friday, and 8am to 1pm, Saturdays, with no works occurring on Sundays or public holidays.
- Use and store all hazardous and dangerous goods in accordance with all relevant statutory standards and procedures and manufacturer's MSDS. Retain a copy of all relevant MSDS onsite.
- Remove, transport and dispose of hazardous and dangerous goods in accordance with the NSW Waste Classification Guidelines and dispose of at a waste facility licenced to accept such waste. Any transport of dangerous goods must occur with a driver possessing a dangerous goods drivers licence and dangerous good vehicle licence. All dangerous goods transport shall be in accordance with NSW Dangerous Goods (Roads and Rail Transport Act 2008 and NSW Dangerous Goods (Road and Rail) Transport Regulation 2014.
- Ensure hazardous goods are be labelled in accordance with the requirements of the Australian Dangerous Goods Code.
- Ensure materials, plant or equipment is not placed in a manner that could result in damage to surrounding vegetation and located outside any exclusion zones.
- Minimise work during excessively wet or muddy conditions where possible.
- Restrict vehicles and personnel to designated tracks, trails and parking areas. Where possible park and turn-around on hard, well drained surfaces.
- Where possible avoid, reuse and recycle spoil and waste generated. Manage waste that cannot be avoided, reused or recycled in accordance with the NSW Waste Avoidance and Recovery Act 2011, and classify the waste in accordance with the NSW Waste Classification Guidelines and only dispose of the waste at a facility licenced to accept such waste(s) with supporting documentation.
- Provide a sufficient number of suitable and labelled receptacles for generated waste and recyclable materials and clean receptacle as required to avoid overflows.

Upon completion of construction

- Leave erosion and sediment controls in place until the site is fully stabilized. Undertake weekly checks and conduct checks before and after rainfall and promptly correct any issues. Keep records of any checks and issues onsite and ensure they are available on request.
- Remove all physical construction elements from the site included vehicles, plant and equipment, fencing such as tree protection fencing and exclusion fencing and traffic controls.
- Leave the site clean and free of debris.
- Wherever possible any remaining waste will be reused or recycled where possible, be managed in accordance with the principles of the NSW Waste Avoidance and Recovery Act 2011, be classified in accordance with the NSW Waste Classification Guidelines and only disposed of at a facility licenced to accept such waste(s) with supporting documentation.

6. Consideration of Clause 171(2) Factors

Consideration	Section	Summary Comments	Impacts	
			Short	Long
Any environmental impact on a community?	Sections 5.5, 5.7, 5.8, 5.10 & 5.11	Environmental impacts on the community will include a reduction in air quality, minor odours and noise and restriction of access for recreational use of the site and a decline in aesthetic value. These impacts would persist for the construction period only. The activity will formalise the existing use. Additional constructed elements will be present onsite, however, these will be minor and in keeping with the road environment.	Negative short-term	Neutral long term
Any transformation of a locality	Sections 5.8 & 5.10	The activity will formalise the existing use and ensure the long-term use of the road environment. Additional constructed elements will be present onsite, however, these will be minor and in keeping with the road environment.	Neutral short-term	Neutral long term
Any environmental impact on the ecosystems of the locality?	Sections 5.1, 5.2, 5.3, 5.6, 5.7, 5.9, 5.10 & 5.11	Potential impacts include reduction in air quality, minor odours and noise and water pollution that would be restricted to the construction period only. There would be a minor risk of pollution impacts during operation and maintenance activities however; this would be low risk provided appropriate mitigation measures are implemented. There will be no long-term environmental impacts on the ecosystems of the locality.	Negative short-term	Neutral long term
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?	All sections	Potential impacts include interruption of recreational use and decline in aesthetic values, reduction in air quality, minor odours and noise impacts that would be restricted to the construction period only. There would be a minor risk of pollution impacts during operation and maintenance activities however; this would be low risk provided appropriate mitigation measures are implemented. There will be no reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality as a result of the activity.	Negative short-term	Neutral long term
Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?	Sections 5.4 & 5.10	The site is within a heritage item, however due to the minor nature of the activity, no significant impacts to heritage likely.	Negative short-term	Neutral long term
Any impact on the habitat of any protected animals (within the meaning of the BC Act)	Sections 5.3, 5.7, 5.11 & Attachment 3	There is the potential for accidental harm of native flora and fauna, disturbance of breeding and nesting habitats due to noise pollution. There is a risk for the potential spread of weeds. Provided the mitigation measures are implemented the impacts on habitats of native flora and fauna in the locality are unlikely to be significant.	Negative short-term	Neutral long term
Any endangering of any species of animal, plant or other form of	Sections 5.3, 5.7, 5.11 &	No significant impacts to threatened species. Due to the short duration and small scale of	Neutral short-term	Neutral long term

Consideration	Section	Summary Comments	Impacts	
			Short	Long
life, whether living on land, in water or in the air	Attachment 3	the activity, the activity is unlikely to endanger any species.		
Any long-term effects on the environment	Section 5	Impacts relating to reduction in air quality, minor odours, noise impacts and interruption of aesthetic values restricted to construction period only. Once the activity is complete the site will be formalised based on the existing use and the activity will ensure improved road safety. Additional constructed elements will be present onsite. There will be a minor increase in operation and maintenance activities in comparison to activities undertaken prior to the activity occurring due to the addition of an asset onsite.	Negative short-term	Neutral long term
Any degradation of the quality of the environment?	Section 5	There is a risk of pollution impacts during the activity and to a lesser extent when operation and maintenance activities are occurring that present a risk to the safety of the environment. Provided the mitigation measures are implemented the environmental risks of the activity is low. Due to the small scale of the activity and short duration and minimal operational and maintenance activity requirements, the activity is unlikely to lead to any long-term degradation of the quality of the environment.	Negative short-term	Neutral long term
Any risk to the safety of the environment?	Sections 5.1, 5.2, 5.3, 5.6, 5.7. 5.9, 5.10 & 5.11	There is a risk of pollution impacts during the activity and to a lesser extent when operation and maintenance activities are occurring that present a risk to the safety of the environment. Provided the environmental mitigation measures are implemented during construction activities and operation and maintenance activities the environmental risks of the activity is low.	Negative short-term	Neutral long term
Any reduction of the range of beneficial uses of the environment?	All sections	The activity will improve the safety of the site. The activity will not result in an reduction of beneficial uses of the environment.	Negative short-term	Neutral long term
Any pollution of the environment?	Section 5.11	There is a risk of pollution impacts during the activity and to a lesser extent when operation and maintenance activities are occurring that present a risk to the safety of the environment. Provided the environmental mitigation measures are implemented, the risk of pollution of the environment is low.	Negative short-term	Neutral long term
Any environmental problems associated with the disposal of waste?	Section 5.6	There is the potential for the disposal of waste if waste is left onsite; or inappropriately disposed of. Provided the mitigation measures are implemented environmental problems associated with the disposal of waste are low.	Negative short-term	Neutral long term
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?	Section 5.10	The activity will include the use, wastage, destruction of natural resources with fuel and other resources during the activity. In particular, raw and manufactured materials will be used. There will also be additional water use onsite and use of grease, fuels and oils in the operation of plant, vehicles, machinery and other equipment. Operation and maintenance will also use natural resources, however to less extent.	Negative short-term	Negative long-term

Consideration	Section	Summary Comments	Impacts	
			Short	Long
Any cumulative environmental effect with other existing or likely future activities?	Section 1.6 & Section 5	Due to the small scope and short duration of the activity, timing of the activity outside high tourist visitation periods and provided the mitigation measures are implemented there is likely to be little cumulative effect with existing or future activities.	Neutral short-term	Neutral long term
Any impact on coastal processes and coastal hazards including those under projected climate change conditions	Section 5.9	N/A	Not applicable	Not applicable
Any applicable local strategic planning statements, regional strategic plans or district plans made under the Act, Division 3.1	Section 1.6 & Section 5	The activity will assist in the delivery of the objectives of the local strategic planning statement.	Not applicable	Positive long-term

PORT STEPHENS COUNCIL

7. Supporting Documentation

Matter for consideration	Required	Section	Attachment
Database/ Web Searches			
Commonwealth Protected Matters Search Tool	☒	4.2 4.3 4.5	Attachment 5
NSW BioNet	☒	4.3	Attachment 6
NSW Aboriginal Heritage Information Management System	☒	4.4	Attachment 1
NSW State Heritage Register	☒	4.4	22/05/2024
NSW Contaminated Lands Register	☒	5.1	22/05/2024
ESpade (Soils, Landscape and Geology and acid sulfate soil characteristics)	☒	5.1	22/05/2024
NSW Geological Survey of NSW (Site geology)	☒	5.1	22/05/2024
NSW Fisheries Spatial Portal (Key Fish Habitat, Estuarine Macrophytes)	☒	5.3	22/05/2024
Port Stephens and Great Lakes Marine Park Zoning Map	☐		
Assessments			
Geotechnical Investigation	☒		Attachment 2
Acid Sulfate Soils Investigation	☐		
Biodiversity Survey	☐		
Matters of National Significance Impact Assessment (excluding biodiversity)	☒		22/05/2024
Threatened Biodiversity Impact Assessment (including endangered ecological communities, threatened species and migratory birds)	☒	5.3	Attachment 3
Due Diligence Assessment/ Aboriginal Cultural Heritage Report	☒	5.4	Hard copy on file
Other, specify e.g. Contaminated Lands Assessment, Visual and Landscape Assessment, Statement of Heritage Impact etc	☐		
Plans			

Site Specific Acid Sulfate Soils Management Plan	☐		
Dewatering Management Plan	☐		
Traffic Guidance Scheme	☒	4.5 & 5.5	To be developed by contractor
Other, specify e.g. Waste Management Plan, Stockpile Management Plan, Environmental Management Plan for Contaminated Lands, Vegetation Management Plan	☐		
Permits, licences & approvals			
Water Access Licence of Water Supply Works Approval under NSW Water Management Act 20000	☐		
NSW Fisheries Permit	☐		
NSW Marine Parks Permit	☐		
Aboriginal Heritage Impact Permit	☐		
Section 60 Heritage Works Approval	☐		
Other, specify	☐		

8. Conclusion

Matter for consideration	Agreement
This environmental assessment has assessed the proposed activity and any potential impacts. The activity is unlikely to significantly affect the environment, and therefore an EIS is not required	☒
The activity is unlikely to significantly affect threatened species, populations, ecological communities or their habitats and therefore an SIS and/or BDAR is not required	☒
The activity is to significantly affect threatened species, populations, ecological communities or their habitats and therefore an SIS and/or BDAR is required (see Attached SIS and/or BDAR).	☐

9. Attachments

Attachments	
1	Due Diligence Report
2	Geotechnical Report
3	QF-ENV-DRAFT - EA Threatened Biodiversity Assessments (CAP WORKS)
4	QF-ENV-DRAFT - EA CKPoM Assessment (CAP WORKS) INTRA
5	Matters and National Environmental Significance Protected Matters Search Tools Results
6	NSW BioNet Search Results
7	QF-ENV-DRAFT - EA Unexpected Finds Procedures INTRA
8	Design

East Seaham Road, East Seaham

Aboriginal Due Diligence Assessment

DRAFT REPORT

Prepared for Port Stephens Council

30 November 2023

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Document control

Version	Internal reviewer	Date issue
DFT01	Samantha Keats	29/11/2023

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- Port Stephens Council: Dylan Brake and Adam Smith

Biosis staff involved in this project were:

- Jenny Beckius (mapping)

Glossary

AHIMS	Aboriginal Heritage Information Management System
DECCW	NSW Department of Department of Environment, Climate Change and Water
GSV	Ground Surface Visibility
Heritage NSW	Heritage NSW, Department of Planning and Environment
LEP	Local Environment Plan
LGA	Local Government Area
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
PAD	Potential Archaeological Deposit
SHI	State Heritage Inventory
Study area	East Seaham Road, East Seaham
The Code	The Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW

Summary

Biosis Pty Ltd has been commissioned by Port Stephens Council to undertake an Aboriginal Due Diligence Assessment (ADDA) for the proposed upgrades to East Seaham Road, at East Seaham in New South Wales (NSW) (the study area). The project involves the widening of East Seaham Road over a length of 3.6 kilometres. The proposed development will be assessed against Part 6 of the *Environmental Planning and Assessment Act 1979 NSW*.

An extensive search of the Aboriginal Heritage Information System (AHIMS) databased identified [redacted] Aboriginal archaeological sites within [redacted] kilometres of the study area. None of these sites are located within the study area.

The environmental context of the study area determined that the network of resource bearing freshwater associated with Williams River coupled with the topographically sheltered landscape provided an ideal location for long term occupation of local Aboriginal people. Underlying geological units and surrounding floral and faunal resources would have equally contributed to the overall favourability of this study area for long term use. However, due to the extensive disturbance of the study area since the mid-19th century, any evidence of this occupation is unlikely to be intact.

An archaeological investigation of the study area was undertaken on 13 November 2023 by Molly Crissell (Biosis, Heritage Consultant). During the field investigation extensive landscape modification was observed throughout the study area. No new Aboriginal sites or objects were identified, and the study area has been assessed to hold low potential to contain archaeological deposits.

Prior to any impacts occurring within the study area, the following is recommended:

Recommendation 1: No further archaeological assessment is required.

No further archaeological work is required in the study area due to the entire study area assessed as having low archaeological potential.

Recommendation 2: Discovery of unanticipated Aboriginal objects.

All Aboriginal objects and Places are protected under the *National Parks and Wildlife Act 1974 (*NPW Act). It is an offence to knowingly disturb an Aboriginal site without a consent permit issued by the Heritage NSW, Department of Planning and Environment (Heritage NSW). Should any Aboriginal objects be encountered during works associated with this proposal, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal object, the archaeologist will provide further recommendations. These may include notifying the Heritage NSW and Aboriginal stakeholders.

Recommendation 3: Discovery of Aboriginal ancestral remains.

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. If any suspected human remains are discovered during any activity, you must:

1. Immediately cease all work at that location and not further move or disturb the remains.
2. Notify the NSW Police and Heritage NSW Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location.
3. Not recommence work at that location unless authorised in writing by Heritage NSW.

Contents

Tables

Figures

Photographs

1. Introduction

1.1. Background

Biosis Pty Ltd has been commissioned by Port Stephens Council to undertake an ADDA for the proposed project type at East Seaham Road, at East Seaham in NSW. The project involves the widening of East Seaham Road over a length of 3.6 kilometres. The proposed development will be assessed against Part 6 of the *Environmental Planning and Assessment Act 1979 NSW*.

An assessment in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010a) has been undertaken for the study area in order to inform responsibilities with regards to Aboriginal cultural heritage in the area. In addition to the basic tasks required for a due diligence assessment, an extended background review, as well as an archaeological survey in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b) (the code) was conducted, in order adequately map areas of high, moderate and low archaeological potential.

1.2. Location of the study area

The study area is located within the Port Stephens Local Government Area (LGA), Parish of Wilmot, County of Gloucester as show in Figure 1. The study area incorporates approximately 3.6 kilometres of East Seaham Road. It is bound to the east by Wallaroo National Park and to the west by rural lands and residential properties. It encompasses approximately 14.2 hectares of public land currently zoned in majority as RU1 – Primary Production and to a smaller extent as C1 – National Parks and Nature Reserves (Figure 2).

1.3. Planning approvals

The proposed development will be assessed against Part 6 of the *Environmental Planning and Assessment Act 1979 NSW*. Other relevant legislation and planning instruments that will inform the assessment include:

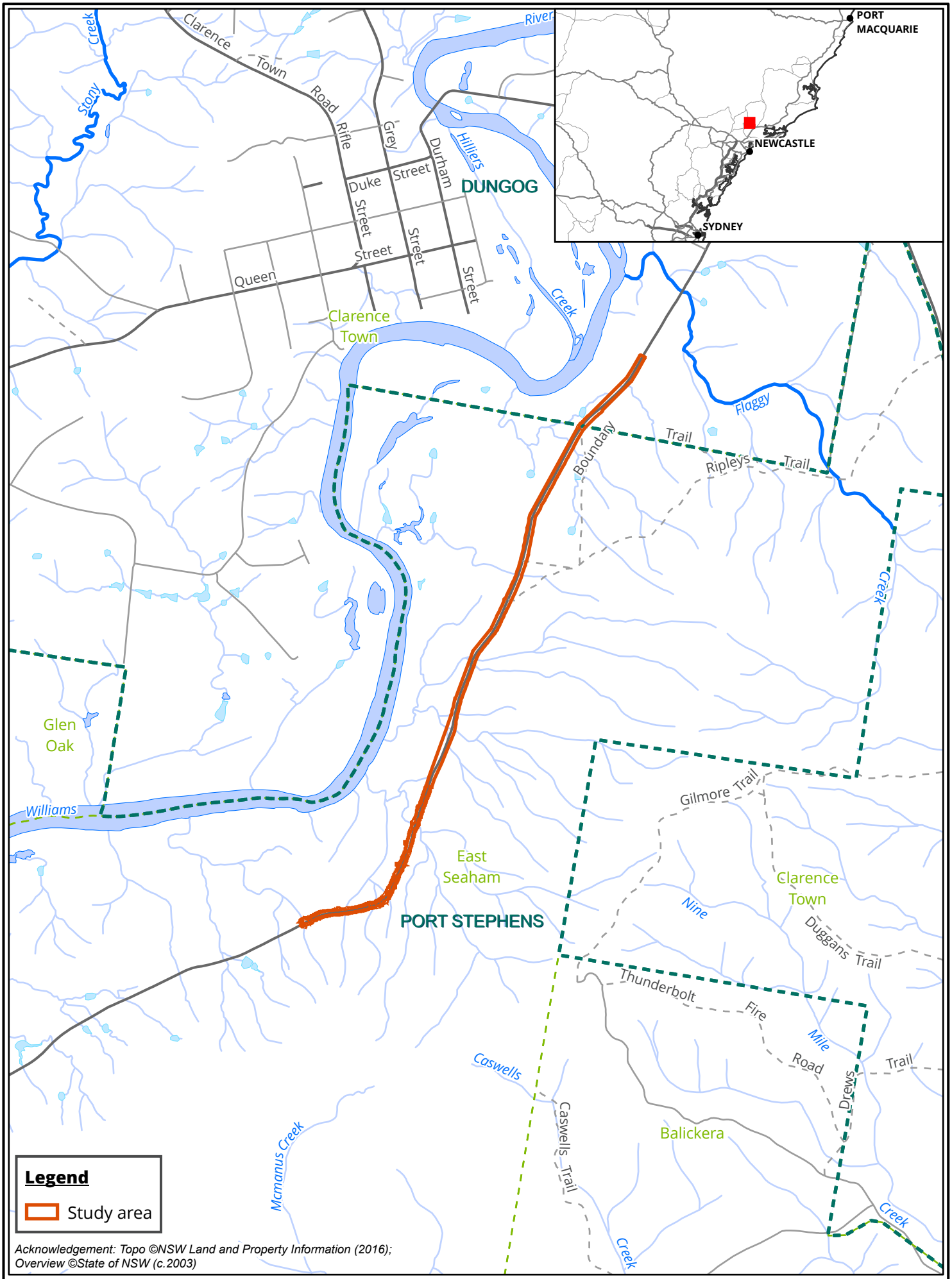
- NPW Act.
- *National Parks and Wildlife Amendment Act 2010* (NSW).
- *Port Stephens Local Environmental Plan 2013* (LEP).
- *Port Stephens Development Control Plan 2014*.

1.4. Scope of the assessment

The following is a summary of the major objectives of the assessment:

- Conduct background research in order to recognise any identifiable trends in site distribution and location, including a search of the AHIMS.
- Undertake archaeological survey as per requirement 5 of the code, with particular focus on landforms with high potential for heritage places within the study area, as identified through background research.
- Record and assess sites identified during the survey in compliance with the guidelines endorsed by Heritage NSW.
- Determine levels of archaeological and cultural significance of the study area.

- Make recommendations to mitigate and manage any cultural heritage values identified within the study area.



biosis

Figure 1 Location of the study area

Matter: 39631, Date: 03 November 2023,
Prepared for: MC, Prepared by: JB, Last edited by: jbeckius
Location: P:\39600s\39631\Mapping\
39631_ADDA_EastSeahamRd
Layout: 39631_ADDA_F1_Locality

0 200 400 600 800 1,000
Metres
Scale 1:25,000@ A4, GDA 1994 MGA Zone 56

N

Legend

- Study area
- Lot

Figure 2 Study area detail

0 100 200 300 400

Metres

Scale: 1:12,000@ A3

Coordinate System:
GDA 1994 MGA Zone 56

N

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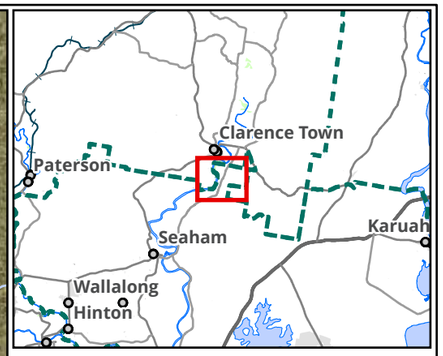
Matter: 39631, Date: 03 November 2023,
Prepared for: MC, Prepared by: JB, Last edited by: jbeckius
Location: P:\39600s\39631\Mapping\
39631_ADDA_EastSeahamRd,
Layout: 39631_ADDA_F2_StudyArea



Legend

- Study area
- Lot
- Stage 5 and 6 Extent of works

Acknowledgements: Basemap © Land and Property Information 2016; public/NSW_Imagery: © Department of Customer Service 2020; Proposed extent of works supplied by Port Stephens Council 2023

Figure 3 - Proposed works

0 100 200 300 400

Metres

Scale: 1:12,000@ A3

Coordinate System:
GDA 1994 MGA Zone 56

N

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Matter: 39631, Date: 10 November 2023,
Prepared for: MC, Prepared by: JB, Last edited by: amackegard
Location: P:\39600s\39631\Mapping\
39631_ADDA_EastSeahamRd,
Layout: 39631_ADDA_F3_PropWorks_Overview

2. Desktop assessment

A brief desktop assessment has been undertaken to review existing archaeological studies for the study area and surrounding region. This information has been synthesised to develop some Aboriginal site predictive statements for the study area and identify known Aboriginal sites and/or places recorded in the study area. This desktop assessment has been prepared in accordance with requirements 1 to 4 of the Code.

2.1. Landscape context

It is important to consider the local environment of the study area for any heritage assessment. The local environmental characteristics can influence human occupation and associated land use and consequently the distribution and character of cultural material. Environmental characteristics and geomorphological processes can affect the preservation of cultural heritage materials to varying degrees or even destroy them completely. Lastly, landscape features can contribute to the cultural significance that places can have for people.

2.2. Geology, soils and landforms

The study area is located within the North Coast Bioregion, which occupies a total of 5,924130 hectares of land, 96.1% of which is located within NSW. The bioregion spans from Tweed Heads in the north, to Nelson Bay in the south and is bound by the coastline. It reaches an average of 75 kilometres inland to the Great Escarpment. The eastern extent of the North Coast Bioregion is characterised by a coastal sand barrier, which transitions to low foothills and ranges, ending with steep slopes and gorges associated with the Great Escarpment in the west (NSW Department of Planning and Environment 2016). The study area itself is positioned at the base of foot slopes east of Wallaroo National Park and west of Williams River, though the landforms associated with both have been modified via grading for the creation of East Seaham Road.

The study area is overlapping several geological units made complex due to the association with a dense network of hydrological structures stemming from Williams River. Figure 4 reveals Alluvial valley deposits to be located throughout the southern portion of the study area where 1st to 3rd order tributaries cut through. These units overlay the Newtown Formation, which encompasses the study area's northern extent and approximately 200 metres of the southern extent, and the Vacy Ignimbrite Member, which occupies the southern length of the study area. A small portion of the Wallaringa Formation encompasses the northern most 150 metres of the study area. Descriptions of each of these units can be found in Table 1. Raw materials suitable for artefact manufacture may have been acquired from gravels and cobbles transported within alluvial deposits and quarries from tuff deposits located within the Newtown Formations. Should appropriately sizes outcroppings be available, sandstone associated with the Wallaringa formation have the potential to be associated with grinding grooves due to the availability of free-flowing water throughout the study area surrounds. However, due to the overall level of disturbance present throughout the study area, it is unlikely that such features will be present or intact. The Vacy Ignimbrite Member, being associated with very coarse-grained materials, is not suitably associated with the site types commonly associated with the Port Stephens regions, further detailed in section 3.3.

Table 1 Geological Units present within the study area (Roberts et al. 1991)

Geological Unit	Description
Alluvial Valley Deposits	Silt, clay, (fluvially deposited) lithic to quartz-lithic sand, gravel
Newtown Formation	Red to purple lithic sandstone, red, purple, or green siltstone, pebble conglomerate with interbedded rhyolitic and rhyodacitic ignimbrite and tuff
Vacy Ignimbrite Member	Red micaceous rhyodaciic ignimbrite (overlain by a) grey micaceous dacitic ignimbrite
Wallaringa Formation	Pink to brown, thickly bedded lithic sandstone, conglomerate and granitoids, minor sandstone

Stream order is recognised as a factor which aids in the development of predictive modelling in Aboriginal archaeology. Predictive models which have been developed for the region tend to favour high order streams as the locations of campsites as they would have been more likely to provide a stable source of water and by extension other resources which would have been used by Aboriginal groups (Dyall 1979, Mary Dallas 1985, Umwelt 2004, AECOM 2014, AECOM 2015, Biosis 2018, Biosis 2021a). Several permanent fresh water sources are located within close proximity to the study area.

The stream order system used for this assessment was originally developed by Strahler (1952). It functions by adding two streams of equal order at their confluence to form a higher order stream, as shown in Photo 1. As stream order increases, so does the likelihood that the stream would be a perennial source of water.

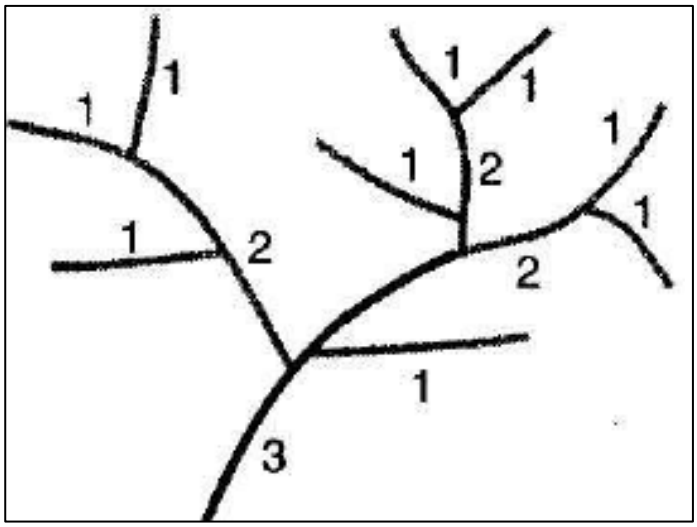


Photo 1 Diagram showing Strahler stream order (Ritter, Kochel, & Miller 1995, p. 151)

The study area and its surrounds are populated by a dense network of streams associated with Williams Rivers, a 7th order waterway which runs mostly parallel to the study area (approximately 200 metres east at its closest point). Thirteen streams (1st order n=9, 3rd order n=3, 2nd order n=1) associated with this main water body consistently bisect the study area throughout its length (Figure 6). The densest population of streams is located towards the south. The waterways feed Williams River from the higher elevation landforms that are located to the east of the study area. With such a large water resource located in proximity to the study area, a high-density network of lower order streams and shelter provided by the surrounding landscape, ample resources would have been readily available within the locality and the area would have represented a favourable location for long term occupation.

Soil landscapes have distinct morphological and topological characteristics that result in specific archaeological potential. They are defined by a combination of soils, topography, vegetation and weathering conditions. Soil landscapes are essentially terrain units that provide a useful way to summarise archaeological potential and exposure.

The Glen William Variant A and Ten Mile Road soil landscapes are present within the study area (refer to Table 2 and Table 3 descriptions) (Figure 6).

The Glen William Variant A soil landscape, which occupies the majority of the study area, is associated with shallow to moderately deep (70-130 cm) well to imperfectly drained Yellow Podzolic Soils on foot slopes and well-drained Brown Podzolic Soils. Some imperfectly drained Yellow Podzolic Soils can be found within alluvial terraces. Volcanics and sediments and generally associated with well drained bleached loams ranging between 50 to 250 centimetres in depth (Department of Planning, Industry and Environment 2023a). The depths of the soils associated with foot slopes may be indicative of intact archaeological deposits where soils are relatively undisturbed.

The Ten Mile Road soil landscape is generally associated with moderately deep to deep (55-200 centimetres) well to perfectly drained brown Soloths and shallow (45 centimetres) well drained leach loams. These soils are associated with high water erosion hazards (Department of Planning, Industry and Environment 2023b). Given the contact of multiple streams with this landscape within the study area, it can be assumed that any archaeological deposits that may have located within the Ten Mile Road soil landscape will have been subject to movement a redeposition from their original contexts.

Table 2 Glen William erosional soil landscape characteristics (Department of Planning, Industry and Environment 2023a)

Soil material	Description
Gw1- Brown crumbly weakly pedal loam (topsoil – A horizon)	Brown (7.5YR 4.3), brownish black (10YR 3/2), dark brown (10YR 3/4, 10YR 2/3) loam sandy through clay loam sandy to silty clay loam. Weak to moderate structure, 10 to 20 millimetres sub-angular block peds or two to five millimetres crumb peds with rough ped fabric. The topsoil layer is moderately to slightly acidic (pH 5.5 to 6.5). The exposed condition is occasionally soft but commonly firm to hardsetting with very weak crumbly dry consistence.
Gw2- Weakly pedal brown sandy loam (topsoil- A1 horizon)	Brownish black (10YR 3/2, 7.5YR 3/2) sandy loam to loam sandy weak, 20 to 50 millimetres of sub-angular blocky peds, with occasional massive and earthy rough ped. The A2 layer is moderately to slightly acidic (pH 5.5-6.0). Inclusions within the layer are few sub-angular gravels with common roots. The exposed condition is hardsetting when dry, soft when moist.
Gw3- Bleached dull yellowish brown sandy clay loam (topsoil – A2 horizon)	Dull yellowish brown (10YR 5/3, 10 YR 5.4) to occasionally dark brown (10YR 3/3, 10YR ¾), few faint orange mottles may occur. Dry colour is commonly bleached light grey (10YR 8/1, 10YR 8/2). The texture consists of light sandy clay loam to find sandy clay loam or silty clay loam. The structure consists of massive, occasionally week 20 to 50 millimetres of sub-angular blocky peds, which are earthy and occasionally rough peds. The layer is moderately to slightly acid (pH 5.5 to 6.0). Occasionally many gravels occur with very few roots. The soil is hardsetting when dry.
Gw4- Brown blocky stiff plastic clay (subsoil – B2 horizon)	Brown (10YR 4/4), yellowish brown (10YR 5/6) to occasionally dull reddish brown (5YR 4/4) or greyish yellow brown (10YR 5/2), occasionally few to common red or brown mottles occur. The texture consists of stiff, plastic, medium to medium heavy clay, occasionally sandy. The structure is strong with 20 to 50 millimetres angular blocky or prismatic peds. The pH of the B2 subsoil is moderately to slightly acidic (pH 5.0-6.0). When exposed, the soil is sticky, with a weak plastic moist consistence with the surface cracking to 50 millimetres with a fine surface ped mulch when dry.
Gw5- Dull yellow orange mottled	Dull yellow orange (10YR 6/4) to brown (10YR 4.6) with few to common distinct orange mottles and common brown staining down root channels. The texture consists of light to

Soil material	Description
prismatic clay (subsoil – B horizon)	medium sandy clay with moderate to strong structure with 50 to 100 millimetres primastic or rarely columnar peds, which part to 20 to 50 millimetres angular to sub-angular smooth ped. The pH of Gw5 consists of moderately to slightly acidic (pH 5.0-6.0). The exposed condition of the soil includes surface cracking to 20 millimetres, surface sealing when dry with very firm to moderately strong dry consistence.

Table 3 Ten Mile Road soil landscape characteristics (Department of Planning, Industry and Environment 2023b)

Soil material	Description
Tm1– Weakly pedal brown sandy loam (topsoil – A1 horizon)	Brownish black (10YR 3/2) to dark brown (10YR 3/3, 7.5YR 3/3) loamy sand to loam sandy. The structure is weak, 5 to 10 millimetres, sub-angular blocky peds which may part from 20 to 50 millimetres sub-angular blocky peds with rough occasionally earth peds. The pH is slightly acidic at pH 6.0. The inclusions include very few to few rounded to sub-angular gravels to cobbles with common to many fine roots (<1 millimetres). The exposed condition is hardsetting when dry and soft when moist.
Tm2- Bleached sandy loam (topsoil – A2 horizon)	Greyish yellow brown (10YR 5/2, 10YR 6/2 and 10YR 4/2) to dull yellowish brown (10YR 5/3) or dull yellow orange (10YR 6/4) moist, dull yellow orange (10YR 7/2, 10YR 7/3) or light grey (10YR 8/1) commonly when dry. The texture consists of sandy loam, through light sandy clay loam to sandy clay loam. The structure consists of massive to occasionally weak 50-to-100-millimetre sub-angular block peds. The fabric of the soil is earth with occasionally rough peds. The pH of the soil is slightly to moderately acid (pH 6.0 to 5.0). The inclusions include few to many rounded to angular gravels and cobbles with occasionally few charcoal fragments occur with few fine to medium (<2 to 5 millimetre) roots. The exposed condition is hardsetting when dry.
Tm3- Brown dense medium clay (subsoil – B horizon)	Brown (10YR 4/4) to dull yellow brown (10YR 5/3, 10YR 5/4) or yellowish brown (10YR 5/6), few to common red mottles may occur. The texture is light to medium to medium clay with coarse sand grains occasionally sandy clay. The structure consists of moderate 20 to 50 millimetres or 10 to 20 millimetres prismatic or sub-angular blocky peds which part to 10 to 20 millimetres angular blocky or polyhedral peds. Occasionally, 50 to 100 millimetres sub-angular blocky or prismatic peds occur. The pH consists of slightly to moderately acid (pH 6.5 – 5.0). The inclusions consist of very few to many gravels and occasionally cobbles, with few 1 to 5 millimetre roots with slow to moderate permeability. The exposed condition consists of slightly to moderately sticky and labile when moist and tough when dry with surface sealing and moderate rill erosion in batter.

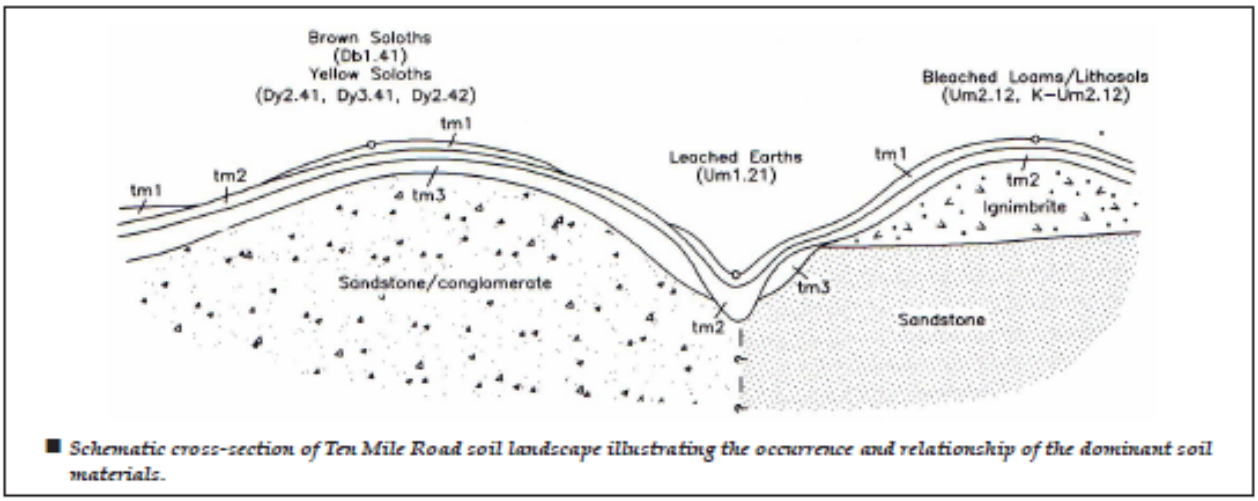
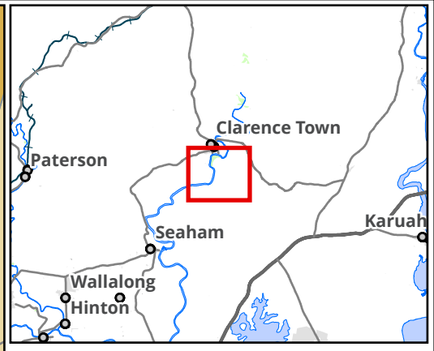


Photo 2 **Schematic cross-section of Ten Mile Road soil landscape illustrating the occurrence and relationship of the dominant soil materials.**



Legend

Study area

Geological units

- Cgin,Newtown Formation
- Cginv,Vacy Ignimbrite Member
- Cugw,Wallaringa Formation
- Curim,Martins Creek Ignimbrite Member
- Cutj,Mount Johnstone Formation
- QH_af,Alluvial floodplain deposits
- QP_at,Alluvial terrace deposits
- Q_a,Alluvium
- Q_ab,Alluvial backswamp deposits
- Q_acw,Alluvial channel deposits - subaqueous
- Q_al,Alluvial levee/overbank deposits
- Q_ap,Alluvial palaeochannel deposits
- Q_av,Alluvial valley deposits
- Q_avf,Alluvial fan deposits

Figure 4 Geological units in the vicinity of the study area

0 100 200 300 400

Metres

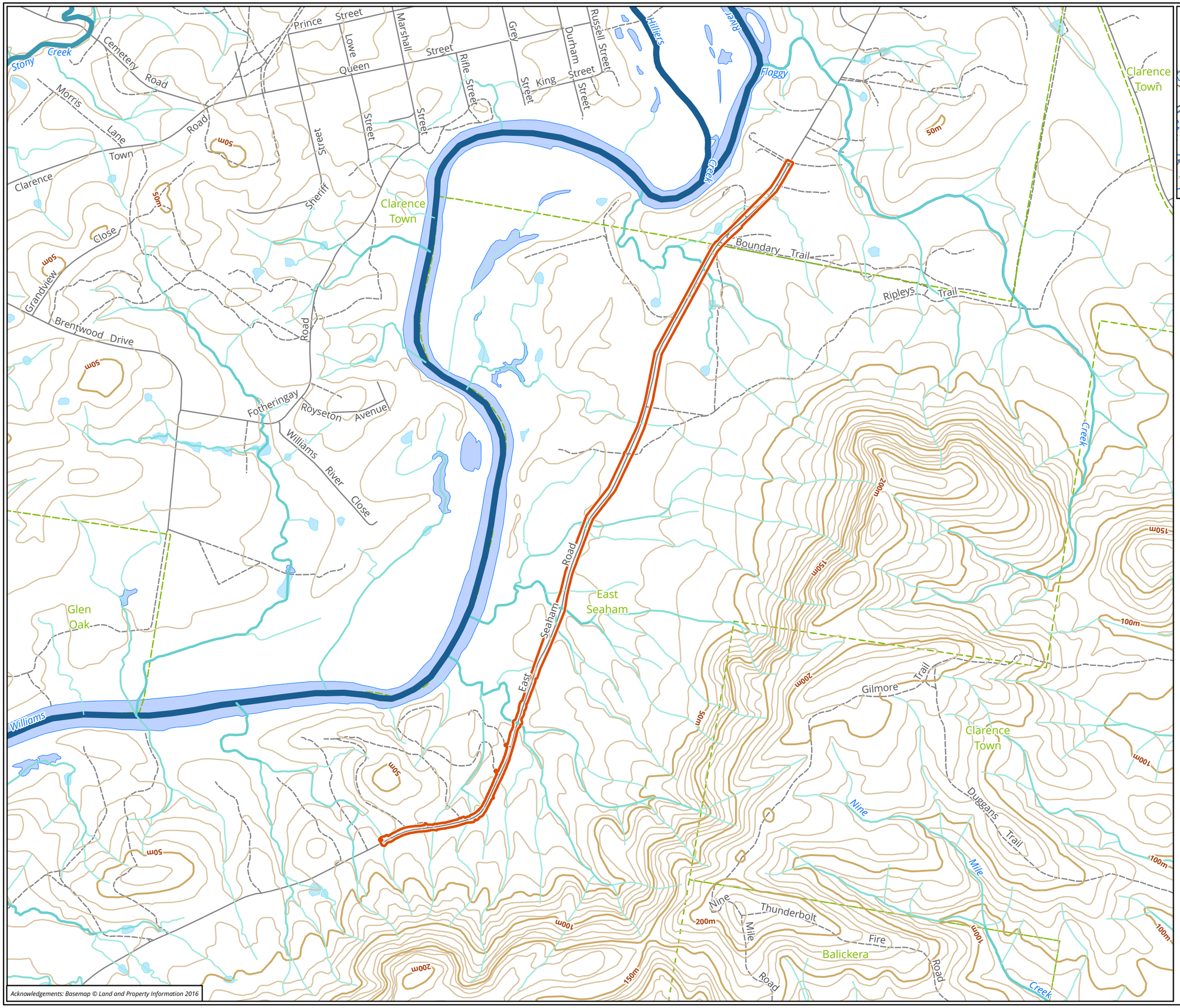
Scale: 1:15,000@ A3

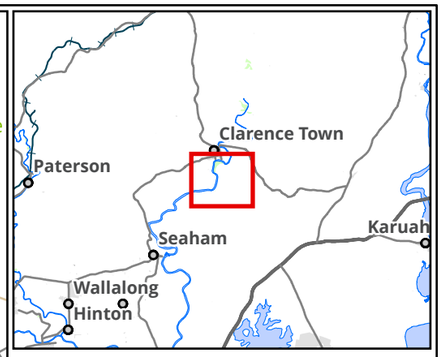
Coordinate System:
GDA 1994 MGA Zone 56

N

biosis

Matter: 39631, Date: 03 November 2023,
Prepared for: MC, Prepared by: JB, Last edited by: jbeckius
Location: P:\39600s\39631\Mapping\
39631_ADDA_EastSeahamRd,
Layout: 39631_ADDA_F4_Geology





Legend

- Study area
- Contour (10m)

Strahler Order

- 1
- 2
- 3
- 5
- 7

Figure 5 Hydrology and topography in the vicinity of the study area

0 100 200 300 400

Metres

Scale: 1:15,000@ A3

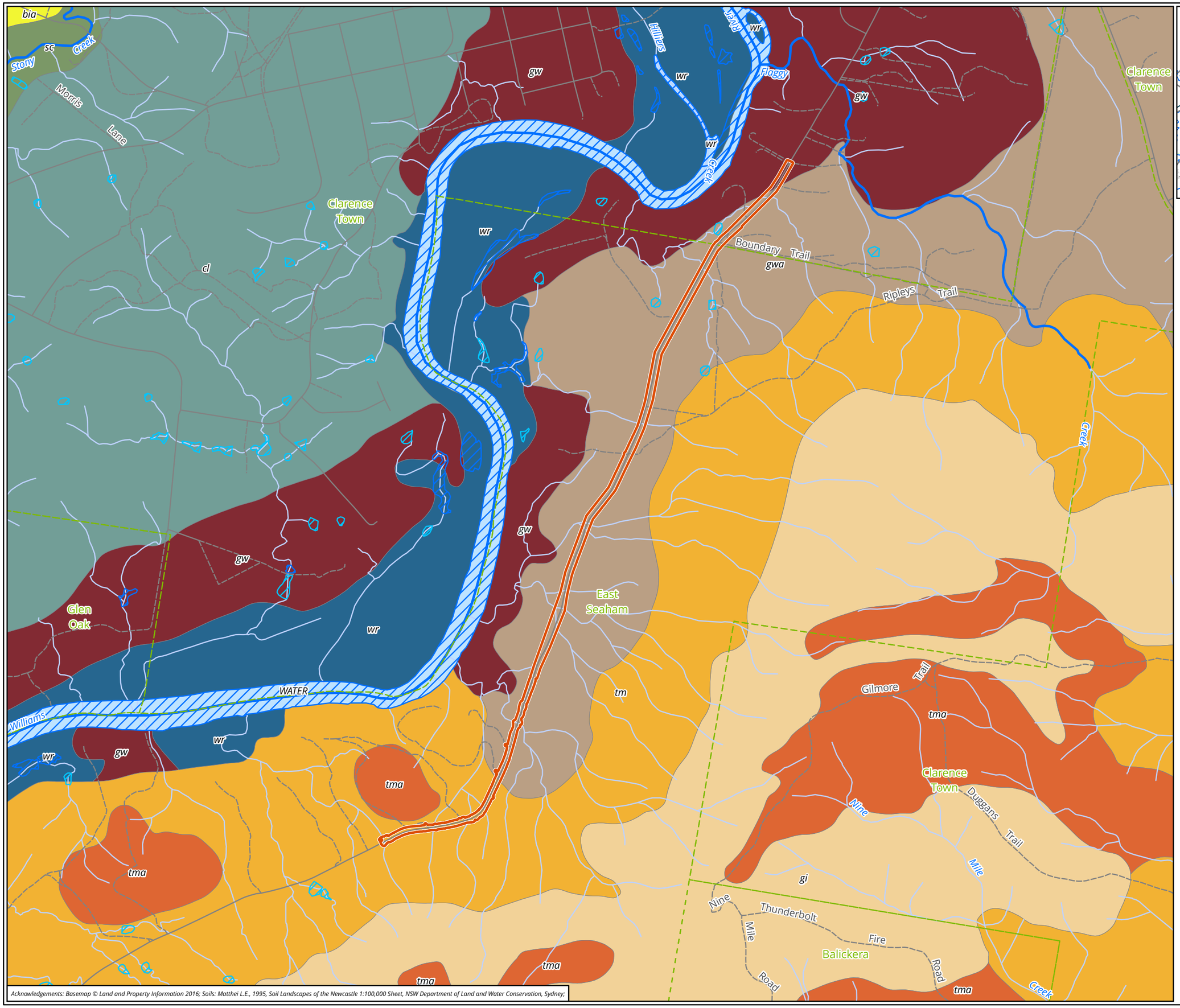
Coordinate System: GDA 1994 MGA Zone 56

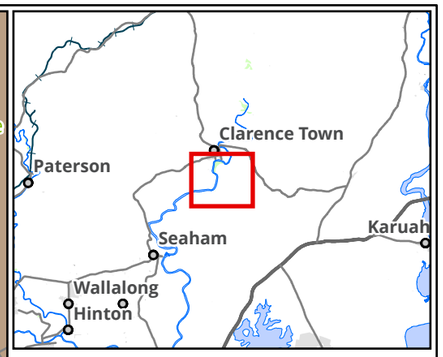
N

biosis

Matter: 39631, Date: 03 November 2023,
Prepared for: MC, Prepared by: JB, Last edited by: jbeckius
Location: P:\39600s\39631\Mapping\,
39631_ADDA_EastSeahamRd,
Layout: 39631_ADDA_F5_Hydrology

Acknowledgements: Basemap © Land and Property Information 2016





Legend

Study area

Soil landscape units

- bia - BIRDSVIEW variant a
- cl - CLARENCETOWN
- gi - GILMORE HILL
- gw - GLEN WILLIAM
- gwa - GLEN WILLIAM variant a
- sc - SANDY CREEK
- tm - TEN MILE ROAD
- tma - TEN MILE ROAD variant a
- WATER - WATER
- wr - WILLIAMS RIVER

Figure 6 Soil landscapes in the vicinity of the study area

0 100 200 300 400

Metres

Scale: 1:15,000@ A3

Coordinate System:
GDA 1994 MGA Zone 56

N

biosis

Matter: 39631, Date: 03 November 2023,
Prepared for: MC, Prepared by: JB, Last edited by: jbeckius
Location: P:\39600s\39631\Mapping\
39631_ADDA_EastSeahamRd,
Layout: 39631_ADDA_F6_Soils

Acknowledgements: Basemap © Land and Property Information 2016; Soils: Matthei L.E., 1995, Soil Landscapes of the Newcastle 1:100,000 Sheet, NSW Department of Land and Water Conservation, Sydney;

2.3. Flora and fauna

The wider Port Stephens region includes distinct ecological zones, including open forest and open woodland, with riparian vegetation extending along many of the watercourses. Each ecological zone hosts a different array of floral and faunal species, many of which would have been utilised according to seasonal availability. Aboriginal inhabitants of the region would have had access to a wide range of avian, terrestrial and aquatic fauna and repeated firing of the vegetation would have opened up the foliage allowing ease of access through and between different resource zones.

Plant resources were used in a variety of ways. Fibres were twisted into string, which was used for many purposes, including the weaving of nets, baskets, and fishing lines. String was also used for personal adornment. Bark was used in the provision of shelter; a large sheet of bark being propped against a stick to form a gunyah (Department of Planning, Industry and Environment 2020).

Vegetation species associated with the Ten Mile Road soils landscape include Spotted Gum *Eucalyptus maculate*, White Mahogany *E. acmenoides*, White Stringybark *E. globoidea,* Grey Ironbark *E. paniculata*, Forest Red Gum *E. tereticornis*, Grey Gum *E. punctata,* Tea-tree *Leptospermum spp.*, Smooth-barked Apple *Angophora costata*, Red Bloodwood *Eucalyptus gummifera* and Black She-Oak *Allocasuarina littoralis*. The Glen William landscape is associated with Spotted Gum *Eucalyptus maculata*, Grey Ironbark *E. paniculata*, Broad-leaved Ironbark *E. fibrosa*, Red Ironbark *E. siderophloia,* Thin-leaved Stringybark *E. eugenioides,* Tea-tree *Leptospermum polygalifolium*, Wattle *Acacia irrorate*, Smooth-barked Apple *Angophora costata* , Narrow-leaved Ironbark *Eucalyptus crebra*, Thin-leaved Stringybark *E. eugenioides,* Forest Oak *Allocasuarina torulosa,*Spotted Gum *Eucalyptus maculate* and Tallowwood *E. microcorys* . Due to the level of clearing that has been undertaken, mature vegetation which may hold evidence for resource gathering is unlikely to be present within the study area.

As well as being important food sources, animal products were also used for tool making and fashioning a myriad of utilitarian and ceremonial items. For example, tail sinews are known to have been used to make fastening cord, while 'bone points', which would have functioned as awls or piercers, have been identified in the archaeological record. Animals such as Brush-tailed Possums were highly prized for their fur, with possum skin cloaks worn fastened over one shoulder and under the other. Kangaroo teeth were incorporated into decorative items, such as head bands (Attenbrow 2002).

Animal species that have been commonly observed with the study area and the surrounds include the Red-necked Wallaby *Notamacropus rufogriseus*, Common Brushtail Possum *Trichosurus vulpecula*, Swamp Wallaby *Wallabia bicolor*, Koala *Phascolarctos cinereus* and Short Beaked Echidna *Tachyglossus aculeatus*. Australian Magpie *Gymnorhina tibicen,* Kookaburra *Dacelo (Dacelo) novaeguineae*, Grey Fantail *Rhipidura (Rhipidura) albiscapa,* Superb Fairy-wren *Malurus (Malurus) cyaneus*, and Australian Raven *Corvus coronoides* are amongst the most frequently observed avian species. Reptilian species such as the Lace Monitor *Varanus varius*, Eastern Brown Snake *Pseudonaja textilis,* Snake-necked Turtle *Chelodina (Chelodina) longicollis,* and Common Bearded Dragon *Pogona barbata* have been frequently observed within five kilometres of the study area (Atlas of Living Australia 2023).

2.4. Land use history

Historical aerial imagery allows for modern developments and land use to be identified within the study area. The Stage Heritage Inventory (SHI) listing of East Seaham Road (LEP #I5, Department of Planning and Environment 2023) indicates the current alignment to be reflective of New Line Road, which linked Raymond Terrace, Seaham and Clarence Town. This road was constructed between 1840-1860 with the original proposed alignment being depicted in an 1830's parish maps (Photo 3). Mentions of East Seaham Road in the

written record do not appear until 1926 where reference is made to nearby maintenance in the Dungog Chronicle and Gloucester Advertiser (The Dungog Chronicle and Gloucester Advertiser, 1926). Reference to the road in this article indicates the realignment of the original Newline Road had occurred prior to this. The alignment of the road appears to have shifted between 1914 and 1958, which may be indicative of the transition of the road from New Line Road to East Seaham Road (Photo 4). The 1958 imagery depicts East Seaham Road in its current alignment and further modification to the road structure cannot be observed from 1958 (Photo 5). The SHI listing does note the road has been subject to upgrades in the 1980s and most recently in 2015 Department of Planning and Environment 2023). These works have involved upgrading the gravel and sealing portions of the road, and later adding to the surface structure. Areas surrounding the study area appear to have also remained unchanged since the mid-20th century with the exception of the installation of electrical powerlines through Wallaroo National Park, parallel to the study area (Photo 6, Photo 7, Photo 8).

Photo 3 **Map depicting proposed road between Dungog and Maitland, 1939 (Source: NSW Land Registry Services)**

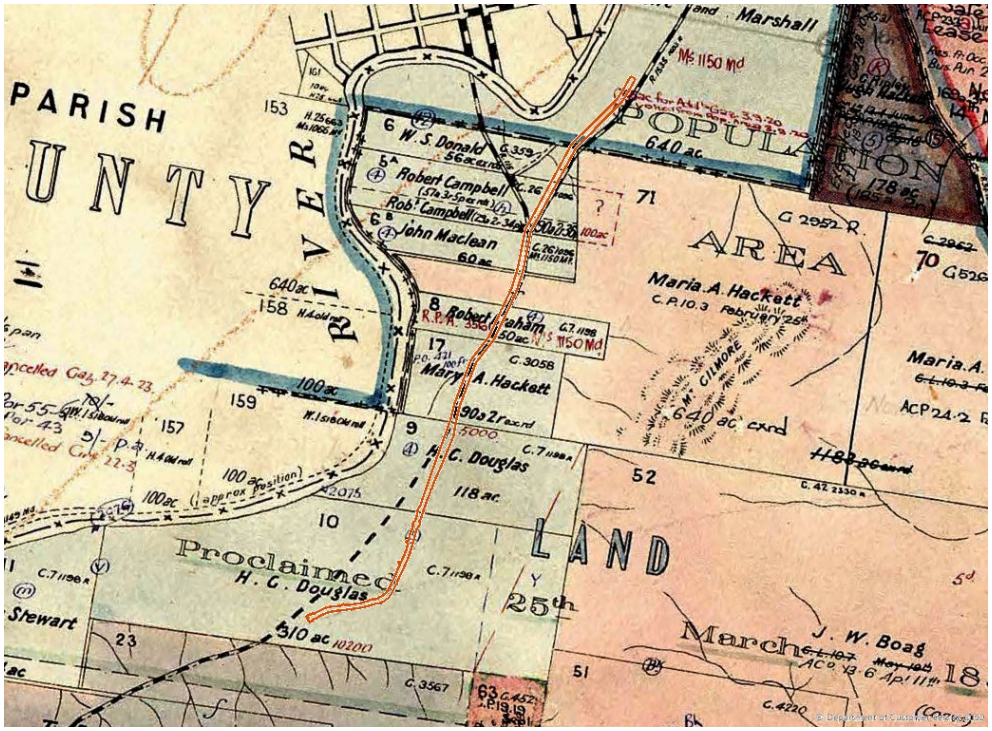


Photo 4 **1914 Parish Map (Source: NSW Land Registry Services)**

Photo 5 **1958 Aerial Imagery of the study area (depicted in orange) (Source: NSW Spatial Services)**

Photo 6 **1974 Aerial Imagery of the study area (depicted in orange) (Source: NSW Spatial Services)**

Photo 7 **1984 Aerial Imagery of the study area (depicted in orange) (Source: NSW Spatial Services)**

Photo 8 2001 Aerial Imagery of the study area (depicted in orange) (Source: NSW Spatial Services)

3. Aboriginal context

3.1. Ethnohistory and contact history

Our knowledge of Aboriginal people and their land-use patterns and lifestyles prior to European contact is mainly reliant on documents written by non-Aboriginal people. These documents are affected by the inherent bias of the class and cultures of their authors, who were also often describing a culture that they did not fully understand - a culture that was in a heightened state of disruption given the arrival of settlers and disease. Early written records can, however, be used in conjunction with archaeological information and surviving oral histories from members of the Aboriginal community in order to gain a picture of Aboriginal life in the region.

Despite a proliferation of Aboriginal heritage sites there is considerable ongoing debate about the nature, territory and range of pre-contact Aboriginal language groups in the greater Hunter region. These debates have arisen largely because, by the time colonial diarists, missionaries and proto-anthropologists began making detailed records of Aboriginal people in the late nineteenth century, pre-European Aboriginal groups had been broken up and reconfigured by European settlement activity. The following information relating to traditional boundaries of the Worimi is based on such early records.

It is well accepted that the study area is located within the traditional lands of the Worimi people (Dean-Jones 1990, p. 64). According to Tindale, the Worimi territory extends from north of the Hunter River to Forster near Cape Hawke, along the coastline, encompassing Port Stephens and stretching inland close to Gresford, and as far south as Maitland (Tindale 1974, p. 201). However, Enright recounts that Worimi people occupied the 'Country' "bounded by the seashore from the Manning as far south as Norah Head and possibility to the Hawkesbury". The territory then supposedly extended as far west as Barrington Tops, which was visited in the summer months (Enright 1933, p. 161).

According to Sokoloffnov (1977, p. 16), the territories of the Worimi were established to include a variety of habitats rich in raw materials and food resources. Trade, intermarriage, and the sharing of ceremonial places were central to the Worimi nation's interaction with neighbouring tribal groups, such as the Awabakal, Kamilaroi, Guringai, Wanaruah, and other tribes within the region.

Little is known about the size of the population of the Worimi tribe within Port Stephens before European settlement; however, it is agreed that numbers declined rapidly after contact (Dean-Jones 1990, p. 68). Sources from the early 1800s to the 1840s vary in their estimates, from 120 within a single camp, to 500 Worimi individuals within the Port Stephens Area in 1837 (refer to Dean-Jones 1990, p.68). Threkeld reports that by 1839, the population of the Awabakal people around the Lake Macquarie area, to the south of Worimi territory had declined to as low as 20 (in Dean-Jones 1990, p.68). Exposure to diseases introduced by European settlers, the destruction of food resources, and instances of hostile relations between Europeans and the Worimi and Awabakal people would have contributed significantly to this decline.

The earliest account of contact between Europeans and the Worimi is recorded by David Collins. It was reported that five convicts who had escaped from Parramatta in 1790 were shipwrecked at Port Stephens. The convicts lived among the Worimi for 5 years until they were recaptured (Bramble 1981). Following this, a small garrison of soldiers was established in the 1820's at a place now known as Soldiers Point, located 20 kilometres north-east of the study area, to aid in the recapture of convicts who had escaped from Port Macquarie.

Bramble (1981) accounts that relations between escaped convicts and local tribes were good natured, and signified the introduction of products of European civilisation. Colonel Paterson upon exploring the Hunter

region in 1801, commented upon the possible use of European axes by Aboriginal tribes, and perhaps convicts who lived among them, to cut down trees (in Bramble 1981). This introduction to European resources would have led to the establishment of more fruitful relations between the Aboriginal people of the Hunter region and European penal authorities, in aiding in the recapture of escaped convicts.

Hostile relations between Europeans and the Worimi tribes of Port Stephens seemed to have originated from early interactions with timber-getters exploiting good quality cedar along the coastal regions of NSW. Accounts of hostilities between timber-getters and the Aboriginal people in the region are recorded from as early as 1804 (Bramble 1981). Dawson, having arrived in Newcastle in 1825 after free-settlement was made available in the Hunter region in 1820, comments upon the hostile relations which existed between European timber-getters and the Worimi Tribe of Port Stephens. This consequently set a precursor to relations between Europeans or white settlers and local tribes within the Port Stephens Area (Dawson 1831, in Bramble 1981):

> *"The timber-cutting parties... were the first people who came in contact with the natives in the neighbourhood of the sea; and as they were composed of convicts and other people not remarkable either for humanity or honesty, the communication was not at all to the advantage of the poor natives, or subsequently to the settlers who succeeded those parties. The consequence of the behaviour of the cedar getters was, that the natives inflicted vengeance upon almost every white man they came in contact with, and as convicts were frequently running away from the penal settlement of Port Macquarie to Port Stephens ...numbers of them were intercepted by the natives and sometimes detained whilst those who fell into their hands and escaped with life, were uniformly stripped of their clothes."*

3.2. Regional context

A number of Aboriginal cultural heritage investigations have been conducted for the Maitland region. Models for predicting the location and type of Aboriginal sites with a general applicability to the Maitland region and thus relevant to the study area have also been formulated, some as a part of these investigations and others from cultural heritage investigations for relatively large developments.

Resource Planning Pty Ltd (1992) prepared a report for RZM Pty Ltd detailing the results of an archaeological investigation of a dune adjacent to Moffats Swamp that had previously been mined for its mineral sand by RZM Pty Ltd (located approximately 20 kilometres south-east of the study area). A number of artefacts had been identified prior to the report within the reject pile of material dredged up from the base of the dune. Artefacts were also noted at the base of the dune. The stone artefacts comprised range of raw materials considered to be closely relatable to other sites within the Newcastle Bight Area, such as white tuff, silcrete, yellow mudstone, pink mudstone/tuff, quartz, quartzite, and chert. It was recommended that RZM Pty Ltd apply for to National Parks and Wildlife Services for a permit for Consent to Destroy. The permit was approved with the condition that salvage work be carried out.

Resource Planning Pty Ltd (1993) carried out subsurface testing for RZM Pty Ltd of a series of large vegetated dune crests located at Moffats Swamp, Medowie, where heavy mining for titanium minerals was intended. Two stone artefact scatters were identified (MS2 and MS3). MS2 was assessed and considered not to be of any danger of destruction from dredge mining. MS3 on the other hand was at risk, and Resource Planning Pty Ltd advised RZM Pty Ltd to apply for a permit for Consent to Destroy, so that artefacts from the site might be salvaged in a controlled manner.

Dagg (1996) completed an archaeological assessment of the proposed Rutherford industrial estate, approximately 27 kilometres south-west of the current study area. Dagg's survey located a total of eight artefact sites and three PADs. Dagg's assessment noted that the absence of other site types was due to the

absence of appropriate environmental features, including sandstone formations and mature trees. The artefact scatters were largely bounded by the edges of areas of exposure rather than a lack of artefacts, and it was considered that sub-surface investigation would show these boundaries to be arbitrary, and that the concentration of artefacts extended over larger areas.

All but one of the identified sites were located within 50 metres of an unnamed tributary of Stony Creek, and artefact concentrations on the surface ranged between 1 and 66. The dominant raw material type in the assemblage was silcrete, with flaked pieces being the dominant artefact type.

Umwelt (1997, 1998) undertook subsurface investigations for the proposed Rutherford Industrial Estate, following on from the 1996 assessment conducted by Dagg. A total of five PADs were investigated by the two assessments. Excavations were conducted on KS9 and KS10 (sites adjacent to unnamed tributaries). A total of 41 artefacts were recovered from both areas, with predominant raw materials of mudstone, silcrete, and quartz. Artefact types included retouched flakes, flakes, broken flakes and flaked pieces. Excavations at KS1, KS4, and KS6 recovered 458 artefacts from areas adjacent to waterlines or drainage plains, with mudstone and silcrete dominant materials.

Umwelt (1999) investigated the Aboriginal archaeological potential of the site of the proposed sewage reticulation works, in Sutton Park Estate, Medowie, NSW located approximately 15 kilometres south-east of the study area. No Aboriginal sites or objects were identified during the archaeological survey of the 25 kilometre sewage pipeline corridor. Consultation with Aboriginal community members suggested that the area would have been considered 'unattractive' for occupation, particularly when in comparison with the nearby dune field. No further archaeological investigations were recommended.

Mary Dallas Consulting Archaeologists (2008) undertook a partial salvage excavation of an Aboriginal site at Aberglasslyn, approximately 25 kilometres south-west of the current study area. The site was identified as a part of testing undertaken by Mary Dallas Consulting Archaeologists in 2007 and was located approximately 100 metres above the edge of Oakhampton Swamp, suggesting that the site represented adjacent usage. A total of 1,111 artefacts were recovered from the excavations, giving an average density of 23.64 artefacts per metre square. It was noted that the stratigraphic integrity of the deposits was high, with clear horizons observed.

South East Archaeology (2008) undertook salvage excavations 25 kilometres south-west of the study area along an unnamed tributary of Stony Creek, in advance of sewerage upgrades in the area. The works took place within the 'Heritage Green' area assessed by Dagg (1996) and Umwelt (Umwelt 1997, Umwelt 1998). The salvage took the form of surface salvage, mechanical trench excavation along the alignment, with hand dug test pits being placed in areas of higher potential.

Background presented by South East Archaeology suggested that Aboriginal occupation was largely focussed within 100 metres of water courses in the area, particularly Stony Creek and its tributaries. The favoured stone materials include silcrete and tuff, and the discard of backed artefacts occurred on site, but it was uncertain if these were manufactured on site. There was no firm statement about how the site was used, with the archaeological evidence possibly representing occupation from a variety of circumstances from transitory movement to the congregation of larger groups. Excavations occurred along an unnamed tributary of Stony Creek.

Over 80% of the excavated assemblage was comprised of silcrete, with another 13% consisting of tuff, and low frequencies of other materials such as volcanic, quartz, chert, quartzite, petrified wood, and acidic volcanic. The assemblage was dominated by complete flakes, flake portions, and lithic fragments, with very low frequencies of other artefact types occurring. Despite perceived high levels of ground disturbance, excavations at the [redacted] site yielded a high density of artefacts in relatively *in situ* deposits. This shows that

even in areas where the ground disturbance is high, there is potential for deposits with research potential to exist. Based on the results, a model of occupation was created for the area. It suggested that in the vicinity of the study area, occupation was focused on the zones within 100 metres of water courses, particularly Stony Creek and its higher order tributaries (with excavations taking place along a second order tributary of the creek). Occupation was considered to take the form of short-term temporary encampments, and potentially for the procurement of food or transitory movement.

McCardle (2009) undertook an Aboriginal archaeological assessment encompassing an area approximately 30 kilometers south-west of the study area. The purpose of this investigation was to identify any areas of indigenous cultural heritage value in order to determine potential impacts to the area and to develop management strategies. Background research for the project developed a general model for occupation in the area which, in conjunction with the local context of the site, provided specific statements about the nature of occupation in the study area. McCardle made the following broad statements about the Central Lowlands region:

> *a wide variety of site types are represented in the study area with open campsites and isolated artefacts by far the most common. Lithic artefacts are primarily manufactured from mudstone and silcrete with a variety of other raw materials also utilised but in smaller proportions. Site numbers and artefact volumes are greatest within close proximity to water. There appears to be a secondary peak in site numbers and artefact volumes at distances over 100 metres from water creek lines. Crest/ridges and slopes are the most archaeologically sensitive landforms. (McCardle Cultural Heritage 2009, p. 19)*

McCardle noted that site numbers peaked within 50 metres of water, then again over 100 metres from water, with relatively few sites being identified between 50 and 100 metres from water. McCardle also noted that all grinding groove sites were identified within 50 metres of water, as water sources are important in the grinding process. Low numbers of other site types were present in the area, making predictive statements relating to them unreliable. It was predicted that assemblages would be from the mid to late Holocene (owing to the age of the soils, with the A horizon dating to the Holocene). Sites were expected to be dominated by silcrete and mudstone. It was noted that these statements were affected by past disturbances, particularly those associated with human activity (ploughing and grazing). This disturbance also meant that surface manifestations of sites were no indicator of subsurface deposits. The survey identified 10 artefact sites (seven artefact scatters and three isolated finds) and three PADs. All sites were identified in close proximity to water sources, and the PADs were created to encompass a 20 or 50 metre buffer around the water courses in the study area.

Umwelt (2018) undertook an Archaeological Technical Report for Health Infrastructure for the new Maitland Hospital (the study area) located approximately 25 kilometres south-west of the current study area. An archaeological survey was undertaken, the survey identified that the project area had been subject to high levels of historic and modern disturbances including bulk topsoil stripping and removal. The archaeological survey did not re-identify the previously recorded isolated find located within the project area (AHIMS 38-4-1684/NMH1) and did not identify any Aboriginal cultural heritage materials/object or areas of archaeological potential. The area was assessed as having low archaeological potential and low archaeological significance.

Biosis (2019) conducted an Aboriginal and historical archaeological constraints assessment for 31-33 Bourke Street, Maitland, located approximately 6.5 kilometres north-west of the study area. Research identified that the site was located within a residual soil landscape, thus holding the potential to contain intact archaeological deposits. It was noted that predictive modelling conducted for the study area indicated that Aboriginal archaeological sites are frequently located within flat, elevated landform units in close proximity to water, and other natural resources such as flora and fauna and raw stone material. Aboriginal sites and objects have been recorded previously in low lying areas within the Maitland region; however, they are generally situated within close proximity to secondary landforms such as crests, ridgelines, and spurs, and are

within close proximity to lower order tributaries of the Hunter River. However, previous archaeological assessments identified high levels of flooding in the study area and high level of disturbance from development. No further investigation was recommended.

Biosis (2023a) undertook an ADDA on behalf of Turner and Townsend Pty Ltd in response to the proposal for the installation of a car park at Maitland Health Campus located approximately 25.7 kilometres south-west of the current study area. The assessment was conducted upon land that has been subject to significant modification in which most natural soils have been removed, buried, or otherwise significantly disturbed. The visual inspection concluded that no further investigation was required as no Aboriginal heritage values were detected, and it was determined the degree of impact that had been inflicted upon the study area removed any likelihood of subsurface deposits being founds in the study area.

Biosis (2018, 2021b) completed two Aboriginal Cultural Heritage Assessments (ACHAs) for 530 Raymond Terrace Road, Thornton, located approximately 21 kilometres south-west of the study area. 530 Raymond Terrace Road, Thornton had been previously assessed by Hamm (2004), and McCardle (2010). Hamm (2004) identified [redacted] sites within the study area, including [redacted] artefact scatters and [redacted] isolated finds. A search of the AHIMS register also indicated that [redacted] However, a review of the site card for site 38-4-0124, confirmed that the site is not located within the study area. During the field investigations [redacted] previously unrecorded Aboriginal heritage sites were recorded within the study area. [redacted] Following the results of the field investigations, a test excavation program was undertaken. The test excavation program identified [redacted] The ACHAs recommended that an AHIP be applied for sites [redacted] If impacts were unable to be avoided, further archaeological assessment would be required for [redacted]

Biosis (2020) completed an ADDA for 23 John Renshaw Drive, Black Hill, located approximately 25 kilometres south-west of the study area. Background research conducted as part of this assessment found that artefact sites and PADs are typically located upon crests, slopes with gradients of less than 10 degrees, and well drained topographies within close proximity to fresh water sources or swamp lands. A field investigation identified [redacted] artefact site [redacted]. Areas of low, moderate and high archaeological potential were also identified across the study area. Areas of low archaeological potential were observed to have undergone previous ground disturbance or were located within landforms not commonly associated with the presence of Aboriginal sites (drainage depressions, swamp lands). Areas of moderate archaeological potential were identified upon slopes with gradients of less than 10 degrees, where surface artefact sites had been previously recorded throughout the study area. Areas of high archaeological potential were attributed to elevated flats and crests within close proximity to fresh water sources and resource gathering zones. Based upon the results of predictive modelling previously undertaken within the region, it was anticipated that areas of high archaeological potential are more likely to contain intact subsurface archaeological deposits that represented foci points for Aboriginal occupation. Areas of moderate archaeological potential will likely contain lower density artefact scatter sites that represent transient activities associated with resource gathering and movement through the study area.

Biosis (2023b) undertook an ACHA on behalf of Loxford Project Management Pty Ltd for a proposed residential development 35 kilometres west of the current study area. A total of 42 test pits were excavated across the site. Soils varied from shallow to moderately deep. Soils within the upper slopes and crests were moderately deep, well preserved, and stony in nature with higher levels of gravel inclusions upon the crest. Soils within the lower slopes/creek banks were sandy, and deep where low levels of erosion and geomorphological impacts had occurred. Test excavations identified [redacted]The results of the assessment are considered to be consistent with predictive modelling for the local region which found that artefact sites are the most common site type and are likely to consist of either isolated finds or artefact scatters made of tuff or silcrete (South East Archaeology Pty Ltd 2008, McCardle 2009, McCardle 2022)

3.3. Local context

EMM (2013) conducted an ACHA for the proposed Gloucester pipeline realignment, with reference to the ACHA prepared by AECOM in 2009. The realignment runs north to south approximately 2 kilometres west of the study area. The AECOM report identified [redacted] Aboriginal sites – [redacted] It was predicted in the report by EMM that stone artefact sites will be the most likely sites to occur in the vicinity of the pipeline alignment, typically within 100 meres of watercourses. The survey did not identify any specific values, sites, objects, or PADs.

Ecological (2016) conducted an environmental constraints assessments on the study area in order to determine the impacts associated with widening East Seaham Road on behalf of Port Stephens Council. The study determined the risk of impacts to artefact scatters to be medium due to the proximity of Williams River to the study area. PADs, scarred trees and axe grinding grooves were determined to be low as their likelihood of occurrence was concluded to be limited.

Brayshaw & Associates Consultant Archaeologists (1983) conducted an archaeological investigation of a proposed hard rock quarry site, approximately 5.5 kilometres south of the study area. It was predicted that stone arrangements, quarries, open sites and scarred trees could be expected at the site. However, the rock outcropping as well as the distance from permanent water meant this site would not have a large concentration of stone artefacts. The dry gullies and local bedrock provided an unlikely environment for grinding grooves. Few mature trees were present within the assessment area which could be presented features associated with culturally modified trees. From the survey, marked trees were found outside of the proposed development which indicated a trail.

McCardle Cultural Heritage (2017) conducted an Indigenous Heritage Impact Assessment for the proposed hard rock quarry located off Italia road, Balickera, approximately 5 kilometres south-east of the study area. The predictive model of the site determined there is high potential for isolated finds and artefact scatters to be located along Seven Mile Creek and moderate potential near the other drainage lines that run through the assessment area. The remainder of the assessment area had low potential due to distance from reliable water and landforms that are steep slopes.

Myall Coast Archaeological Services (2020) conducted various ACHAs to inform the proposed development of the Kings Hill Urban Release Area, located approximately 8.5 kilometres south of the study area. Caves and rock shelters sites were located within the assessment area which was not transferred across to electronic databases before the survey. The elevated ridgeline connecting the highest points within the Kings Hill urban

release area is of extremely high Aboriginal Heritage significance, as well as the associated ridgeline, the wetlands and connectivity to the Williams River. The rest of the urban release area was not considered significance.

3.3.1. Identified Aboriginal archaeological sites

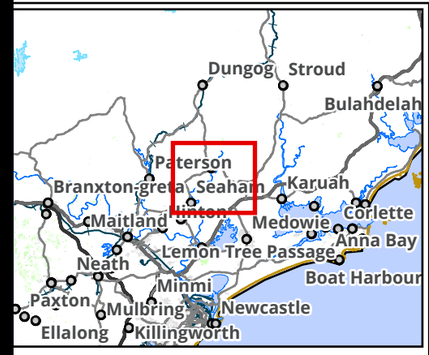
An extensive search of the AHIMS database was conducted on 3 November 2023 (Client service ID: [redacted]). The search identified [redacted] Aboriginal archaeological sites within a 23 kilometre search area, centred on the proposed study area (Table 2 and Table 3). None of these registered sites are located within the study area (Figure 6). The mapping coordinates recorded for these sites were checked for consistency with their descriptions and location on maps from Aboriginal heritage reports where available. These descriptions and maps were relied upon where notable discrepancies occurred.

It should be noted that the AHIMS database reflects Aboriginal sites that have been officially recorded and included on the list. Large areas of NSW have not been subject to systematic, archaeological survey; hence AHIMS listings may reflect previous survey patterns and should not be considered a complete list of Aboriginal sites within a given area.

Table 4 AHIMS sites within the study area

Site type	[redacted]	[redacted]
Artefact		
PAD		
Grinding Groove		
Modified Tree (Carved or Scarred)		
Burial		
Ceremonial Ring (Stone or Earth)		
Stone Arrangement		
Total		

A simple analysis of the Aboriginal cultural heritage sites registered within 23km of the study area indicates that the dominant site type is artefacts sites, representing 42.50%% (n=17), followed by PAD representing 32.50% (n=13), grinding groov[redacted] All the sites were located within proximity to the reliable sources of water.



Legend

Study area

AHIMS

NOT TO BE MADE PUBLIC

Figure 7 AHIMS within the vicinity of the study area

0 500 1,000 1,500

Metres

Scale: 1:60,000@ A3

Coordinate System:
GDA 1994 MGA Zone 56

N

biosis

atter: 39631, Date: 03 November 2023,
repared for: MC, Prepared by: JB, Last edited by: jbeckius
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9631_ADDA_EastSeahamRd,
ayout: 39631_ADDA_F7_AHIMS

3.3.2. Predictive statements

A series of predictive statements have been formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist throughout the study area and where they are more likely to be located.

These statements are based on:

- Local and regional site distribution in relation to landform features identified within the study area.
- Consideration of site type, raw material types and site densities likely to be present within the study area.
- Findings of the ethnohistorical research on the potential for material traces to present within the study area.
- Potential Aboriginal use of natural resources present or once present within the study area.
- Consideration of the temporal and spatial relationships of sites within the study area and surrounding region.

Based on this information, a predictive model has been developed, indicating the site types most likely to be encountered during the survey and subsequent sub-surface investigations across the present study area (Table 4). The definition of each site type is described firstly, followed by the predicted likelihood of this site type occurring within the study area.

Table 5 Aboriginal site prediction statements

Site type	Site description	Potential
Flaked stone artefact scatters and isolated artefacts	Artefact scatter sites can range from high-density concentrations of flaked stone and ground stone artefacts to sparse, low-density 'background' scatters and isolated finds.	Moderate: Stone artefact sites have been previously recorded in the region on level, well-drained topographies near reliable sources of fresh water. Due to the level of disturbance of the study area it is unlikely artefacts will be detected within the roadway, though the potential for artefacts to be present in the immediate surrounds as surface finds is moderate.
Potential Archaeological Deposits (PADs)	Potential sub surface deposits of cultural material.	Low: Sufficiently undisturbed areas and appropriately structured landforms are not present within the study area to be associated with PAD sites.
Ceremonial Ring (Stone or Earth)	Raised earth ring(s) associated with ceremony	Low: Due to ongoing disturbance within the study area since the mid-19th century, sufficiently undisturbed areas are not present within the study area to host evidence of ceremonial rings.
Stone arrangements	Areas containing stones placed in a certain way to form circles, semi-circles, lines and routes. Smaller stones are used to keep larger ones in place. Sometimes used to identify ceremonial grounds or boundaries.	Low: Due to ongoing disturbance within the study area since the mid-19th century, sufficiently undisturbed areas are not present within the study area to host evidence of stone arrangements.
Shell middens	Deposits of shells accumulated over either singular large resource gathering events or over longer periods of time.	Low: Shell midden sites have not been recorded within the vicinity of the study area. There is a very low potential for shell middens to be located in the study area due

Site type	Site description	Potential
		to the level of disturbance within the study area.
Quarries	Raw stone material procurement sites.	Low: There is no record of any quarries being within or surrounding the study area. Sufficient outcroppings are also not available within the study area for it to have been utilised as a quarry site.
Modified trees	Trees with cultural modifications	Low: While scarred trees have been observed within the surrounding locality, a limited number of native and mature trees are present within the study area. There is therefore low potential for this site type to occur in the study area.
Grinding grooves	Grooves created in stone platforms through ground stone tool manufacture.	Low: The geology is generally suited to this site type, though suitable horizontal sandstone rock outcrops are not available within the study. The likelihood of this site type being present in the study area is low.
Burials	Aboriginal burial sites.	Low: No burials have been recorded within close proximity of the study area.
Rock shelters with art and / or deposit	Rock shelter sites include rock overhangs, shelters or caves, and generally occur on, or next to, moderate to steeply sloping ground characterised by cliff lines and escarpments. These naturally formed features may contain rock art, stone artefacts or midden deposits and may also be associated with grinding grooves.	Low: The sites will only occur where suitable sandstone exposures or overhangs possessing sufficient sheltered space exist. These outcroppings do not occur in the study area and therefore, the potential for this site type to occur is considered low.
Aboriginal Ceremony and Dreaming sites	Such sites are often intangible places and features and are identified through oral histories, ethnohistoric data, or Aboriginal informants.	Low: There are currently no recorded mythological stories for the study area.
Post-contact sites	These are sites relating to the shared history of Aboriginal and non-Aboriginal people of an area and may include places such as missions, massacre sites, post-contact camp sites and buildings associated with post-contact Aboriginal use.	Low: There are no post-contact sites previously recorded in the study area and historical sources do not identify one.
Aboriginal places	Aboriginal places may not contain any 'archaeological' indicators of a site but are nonetheless important to Aboriginal people. They may be places of cultural, spiritual or historic significance. Often, they are places tied to community history and may include natural features (such as swimming and fishing holes), places where Aboriginal political events commenced or particular buildings.	Low: There are currently no recorded Aboriginal historical associations for the study area.

4. Archaeological investigation

An archaeological investigation of the study area was undertaken on 13 November 2023 by Molly Crissell (Biosis, Heritage Consultant). The survey sampling strategy, methodology and a discussion of results are provided below.

4.1. Archaeological survey aims

The principle aims of the survey were to:

- Undertake a systematic survey of the study area targeting areas with the potential for Aboriginal heritage.
- Identify and record Aboriginal archaeological sites visible on the ground surface.
- Identify and record areas of Aboriginal archaeological and cultural sensitivity.

4.2. Survey methods

The survey was conducted on foot. Recording during the survey followed the archaeological survey requirements of the code and industry best practice methodology. Information that recorded during the survey included:

- Aboriginal objects or sites present in the study area during the survey.
- Survey coverage.
- Any resources that may have potentially been exploited by Aboriginal people.
- Landform elements, distinguishable areas of land approximately 40m across or with a 20m radius (CSIRO 2009).
- Photographs of the site indicating landform.
- Ground surface visibility (GSV) and areas of exposure.
- Observable past or present disturbances to the landscape from human or animal activities.
- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

Where possible, the identification of natural soil deposits within the study area was undertaken. Photographs and recording techniques were incorporated into the survey including representative photographs of survey units, landform, vegetation coverage, GSV and the recording of soil information for each survey unit were possible. Any potential Aboriginal objects observed during the survey were documented and photographed. The location of Aboriginal cultural heritage and points marking the boundary of the landform elements were recorded using a hand-held Global Positioning System and the Map Grid of Australia (94) coordinate system.

4.3. Constraints to the survey

With any archaeological survey there are several factors that influence the effectiveness (the likelihood of finding sites) of the survey. The factors that contributed most to the effectiveness of the survey within the study area were the reduced visibility from the extensive grass coverage on the northern and southern portion due to the vegetated shoulders of the East Seaham Road. Ground disturbances which reduced the

effectiveness of the survey included the pre-existing gravel road which ran throughout the corridor of the study area.

4.4. Visibility

In most archaeological reports and guidelines visibility refers to GSV, and is usually a percentage estimate of the ground surface that is visible and allowing for the detection of (usually stone) artefacts that may be present on the ground surface (DECCW 2010b). Visibility in southern portion of study area was moderate (50%) and obscured by ground disturbances, including the gravelled road (Photo 9). GSV was also moderate (50%) in areas subjected to high levels of ground disturbances in the central portions of the study area (Photo 10). Visibility in the boundaries of the gravel road, which ran the extent of the study area was mostly obscured by dense vegetation (0-5%) (Photo 11).

Photo 9 East Seaham Road, facing east depicting 50% visibility of the study area

Photo 10 East Seaham Road, facing north depicting 50% GSV associated with middle portion of road

Photo 11 5% GSV associated with the majority of the road side spanning the study area

4.5. Exposure

Exposure refers to the geomorphic conditions of the local landform being surveyed and attempts to describe the relationship between those conditions and the likelihood the prevailing conditions provide for the

exposure of (buried) archaeological materials. Whilst also usually expressed as a percentage estimate, exposure is different to visibility in that it is in part a summation of geomorphic processes, rather than a simple observation of the ground surface (Burke & Smith 2004, p. 79, DECCW 2010b).

Overall, the study area displayed limited areas of exposure, ranging between 0–10% on the road corridors. The central section of the study area had the highest levels of exposure, due to ground disturbances from the pre-existing exposed gravel road in areas where vehicles had driven (Photo 12). In the shoulders on the boundary of the road, exposure was minimal (0–5%) and was limited by areas that were densely vegetated (Photo 13).

Photo 12 Moderate exposure (10%) associated with vehicular use

Photo 13 0% exposure associated with road shoulder, dense vegetation coverage and leaf litter

4.6. Disturbances

Disturbance in the study area is associated with natural and human agents. Natural agents generally affect small areas and include the burrowing and scratching in soil by animals, such as wombats, foxes, rabbits and wallabies, and sometimes exposure from slumping or scouring. Disturbances associated with human action a generally cover large sections of the land surface. The agents associated with human disturbance include the construction of roads and associated landscaping and utilities.

Disturbance levels within the study area were assessed during the visual inspection. Levels of disturbance were categorised through an inspection of the ground surface, landforms, and aerial imagery. Disturbance levels within the study area have been categorised according to the following criteria:

- High disturbance—the landform has been heavily disturbed and all natural soil horizons have been displaced or removed, these areas are unlikely to contain Aboriginal cultural material.
- Moderate disturbance—the landform has undergone disturbances to a certain degree, but the extent and nature of these disturbances cannot be fully quantified. Aboriginal cultural material may be present within these locations but is unlikely to be *in situ*.
- Low disturbance—the landform has not been significantly disturbed and is highly likely to contain intact soil horizons. Aboriginal cultural material if present is likely to be *in situ*.

The study area has experienced varying levels of disturbance over time. The majority of the study area has been subjected to extensive native vegetation clearance, with no large, mature vegetation remaining in the East Seaham Road extent, and limited vegetation at the shoulders of the road.

Disturbance throughout the study area would have impacted both surface and subsurface deposits. Soils at locations of vegetation clearing experience higher levels of displacements and re-deposition in shallow layers. The development of East Seaham Road involved the modification of the landform for utilities, sewer, water

and electricity which are visible throughout the study area (Photo 14, Photo 15, Photo 16). Disturbance of this nature is characterised as high. The excavation undertaken to construct the road would have displaced the soils and thus completely disturbed that region resulting in high disturbance levels. Disturbances of this nature would likely result in the limited preservation of intact archaeological deposits in subsurface layers.

Photo 14 Example of drainage structures located throughout the study area, photo taken facing south-east

Photo 15 Example of drainage structures located throughout the study area. Photo taken facing northeast

Photo 16 Disturbance associated with electricity installation and fence line. Photo taken facing north

Photo 17 Disturbance associated with road grading and construction. Photo taken facing east

4.7. Investigation results and discussion

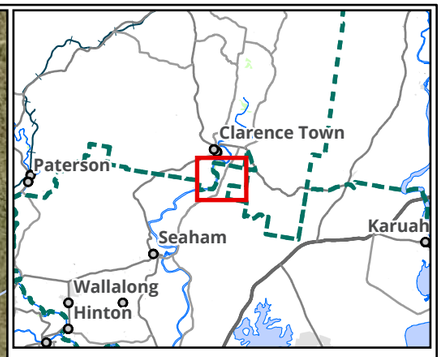
The archaeological investigation consisted of [redacted] across the entire study area. The results in the field investigation have been summarised below and transect locations are provided in Figure 8.

Background research has indicated that the study area is situated within an ideal location for the procurement of resources that would allow for long term occupation. The proximity of Williams River, and the associated freshwater streams that bisect East Seaham Road indicate that fresh water, aquatic and terrestrial resources would have been in abundance and accessible on a perennial basis. The positioning of the study area at the foothills of the higher elevation ranges in the adjacent national park provides sufficient shelter from the elements, which further add to the desirable nature of the study area. Geologically, raw materials suitable for the manufacture of stone tools and for grinding groove sites are present in the Newtown Formation and Wallaringa Formation respectively. The deeper soils, particularly the majority occupying Glen William landscape, are likely to have retained evidence of this occupations.

Past archaeological investigations have determined that proximity to water and intensity of occupation area intrinsically linked, with South East Archaeology (2008) and McCardle (2009) demonstrating that occupation zones tend to be located within 100 metres of waterlines. Further to this, Biosis' (2019) investigation in the Maitland locality revealed flat elevated landforms in proximity to natural resources were frequently associated with archaeological sites. This combination of features is present within the study area, further supporting that it is likely to have been utilised by Aboriginal populations.

Field investigations and land use history; however, have revealed East Seaham Road to have been subject to continuous and intensive disturbance since at least the 1860s. These disturbances have involved vegetation clearance of land within the road corridors, landform modification and levelling of the landscape along the length of the study area, which have each contributed to the overall disturbance of the archaeological record that may have been preserved in the upper soils. The field investigation indicates that these disturbance range between less than a metre and up to four metres laterally and up to a metre vertically with the installation of drainage systems, electrical poles, fence lines and road grading. Some areas adjacent to the roadside do indicate the presence of natural soils which, if undisturbed may retain artefact deposits. As the proposed works are limited to a 0.5 metres buffer on either side of East Seaham Road, these deposits will not be affected by any road maintenance works.

During the archaeological survey, no Aboriginal sites or objects were identified. While the environmental context of the study area is reflective of an area that may have been intensively occupied, the continuous and extensive disturbance associated with the construction and maintenance of East Seaham Road has likely destroyed any material evidence relating to site use. As such, the study area is considered to hold low archaeological potential.



Legend

- Study area
- Lot
- Survey tracks

Archaeological potential

- Low

Figure 9 Survey effort and results

0 100 200 300 400

Metres

Scale: 1:12,000@ A3

Coordinate System:
GDA 1994 MGA Zone 56

N

biosis

Matter: 39631, Date: 22 November 2023,
Prepared for: MC, SdJ, DB. Prepared by: HL, Last edited by: hliswoyo
Location: P:\39600s\39631\Mapping\
39631_ADDA_EastSeahamRd,
Layout: 39631_ADDA_F9_SurveyResults_overview

5. Conclusions and recommendations

5.1. Conclusions

This assessment has determined that there is low potential for Aboriginal sites to be located within the study area, and the field investigation caried out by Biosis did not identify any new archaeological sites. The results of the assessment are also demonstrated in the due diligence flowchart provided by the code (Figure 9).

5.2. Recommendations

The following management recommendations have been developed relevant to the study area and influenced by:

- Predicted impacts to Aboriginal cultural heritage.
- The planning approvals framework.
- Current best conservation practise, widely considered to include:
  - Ethos of *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance, 2013*.
  - The Code.

Prior to any impacts occurring within the study area, the following is recommended:

Recommendation 1: No further archaeological assessment is required

No further archaeological work is required in the study area due to the entire study area assessed as having low archaeological potential.

Recommendation 2: Discovery of unanticipated Aboriginal objects

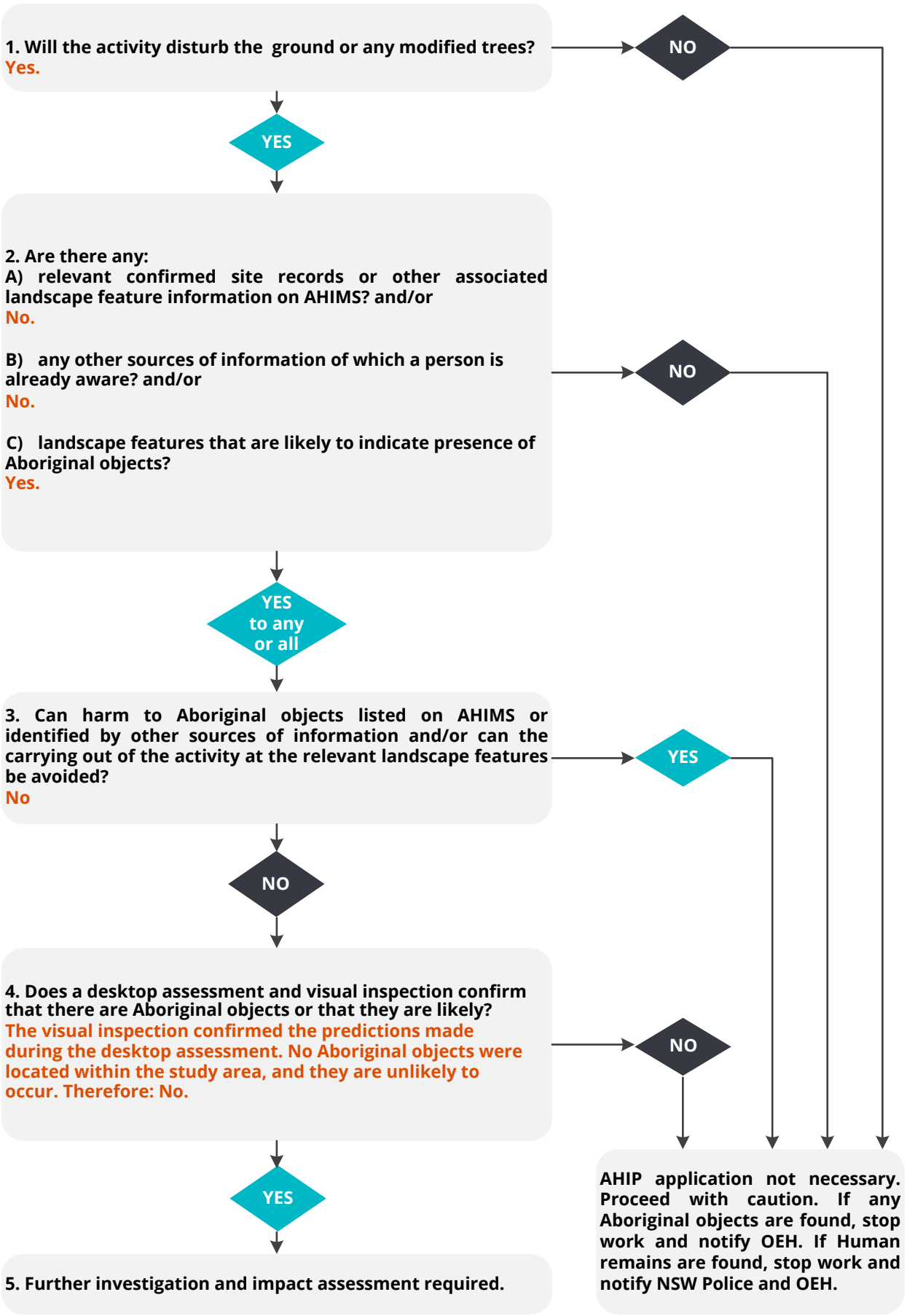
All Aboriginal objects and Places are protected under the NPW Act. It is an offence to knowingly disturb an Aboriginal site without a consent permit issued by the Heritage NSW. Should any Aboriginal objects be encountered during works associated with this proposal, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal object, the archaeologist will provide further recommendations. These may include notifying the Heritage NSW and Aboriginal stakeholders.

Recommendation 3: Discovery of Aboriginal ancestral remains

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. If any suspected human remains are discovered during any activity, you must:

1. Immediately cease all work at that location and not further move or disturb the remains.
2. Notify the NSW Police and Heritage NSW' Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location.
3. Not recommence work at that location unless authorised in writing by Heritage NSW.

Figure 9: Due Diligence Flow Chart



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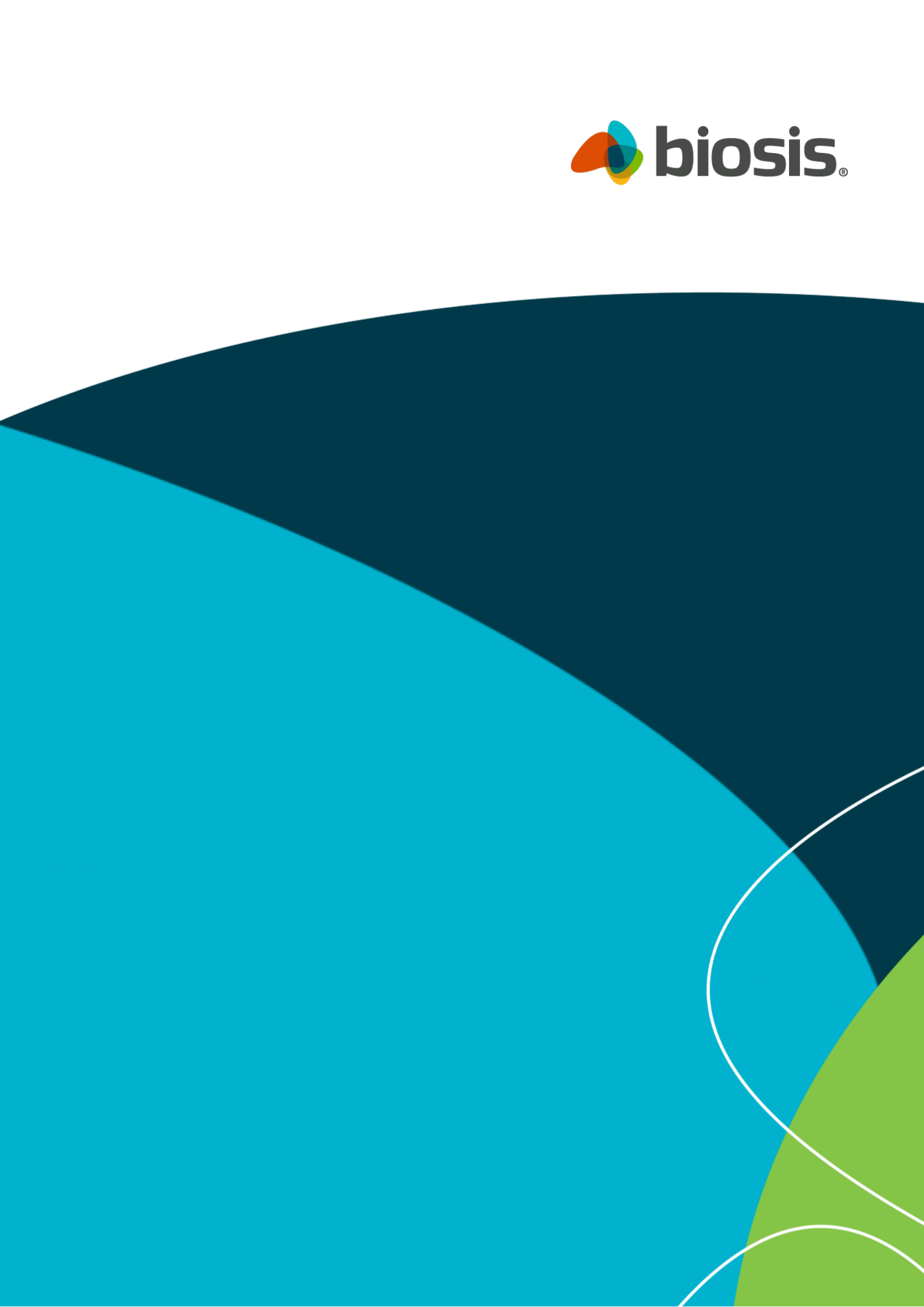
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Report on Pavement Investigation

East Seaham Road, Stage 5
East Seaham

82218013

Prepared for
Port Stephens Council

October 2017

Cardno
Shaping the Future

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1 Introduction

This report presents the results of a pavement investigation and design undertaken by Cardno for Port Stephens Council (PSC) on a section of East Seaham Road, East Seaham. The section of road being investigated is known as Stage 5 of the East Seaham Road Works and is approximately 1.2 kilometres in length. The work was commissioned by Mr. Steven Startin of PSC.

With reference to the supplied Request for Quotation (RFQ) documentation, it is understood that the proposed works comprise of:

> Widening and sealing of the gravel road;

> Upgrading of existing drainage culverts; and

> Formation of new table drains.

It is also understood that a realignment of the existing road section is being considered where the large bend in the alignment is to be elevated and straightened. Referring to the supplied drawing file DWG survey of the horizontal alignment titled "PSC_SURVEY_S3_4_5_Design.dwg", the bend is located approximately between chainages Ch 3500–3700 m. The existing horizontal alignment is described in Section 2.

The purpose of the investigation was to obtain geotechnical information on subsurface conditions as a basis for the following comments and recommendations:

> Assessment of existing pavement material and the potential suitability for reuse in reconstruction.

> Evaluation of existing subgrade conditions with field testing.

> Pavement thickness designs for the range of potential reconstruction and rehabilitation options.

> Recommendations for earthworks procedures and guidelines.

The RFQ document supplied by Port Stephens Council also contained aerial imagery highlighting the extent of the investigation and was adopted into our investigation planning. Additionally, the following documents were supplied to Cardno by PSC:

> A drawing of the stage 4 pavement design by ACOR Consultants (NNSW) Pty Ltd titled "TYPICAL CROSS SECTION AND PAVEMENT DETAILS" (Project No. NE150093, Dwg. No. C03-01, Drawn 02.11.16)

> An initial planning sketch of the vertical alignment titled "HU170024-SK01 REV B.pdf"

> A drawing file survey of the horizontal alignment titled "PSC_SURVEY_S3_4_5_Design.dwg"

These documents have been utilised in the design to determine approximate chainages of test pits, indications of design and design levels.

2 Site Description

East Seaham Road is a narrow two-lane, single carriageway, unsealed, rural road approximately 12.4km in length that traverses between Seaham and east of Clarence Town along the east side of the Williams River in a south-west to north-east direction.

The Stage 5 section of East Seaham Road is approximately 1.2 kilometres in length, extending from a point in the road adjacent the northern boundary of 747 East Seaham Rd to 70 m south of the driveway to 873 East Seaham Rd. The section will be referred to herein as having an initial and final chainage of Ch 3180 m and Ch 4334 m respectively as displayed in the supplied documents. It is worth noting all other intermediate chainages are approximated using the supplied aerial image, survey data, vertical alignment and constructed drawing (dwg) files.

The site surroundings include;

> Land heavily vegetated with grass, shrubs and mature gum trees on both the eastern and western sides of the road corridor;

> Rural residential properties on the western side of the road corridor separating East Seaham road and Williams River;

> Stage 4 of the East Seaham road upgrade adjoining the southern site, which was currently undergoing construction at the time of investigation; and

> Existing East Seaham Road continuing for approximately another 4 km before intersecting with Limeburners Creek Rd on the northern side of the road section site extent.

Topographically, the section of East Seaham Road is situated on the foot slopes of a south-west to north-east trending dominant ridgeline located further to the east of the site. Slopes in the area generally fall from the ridgeline to the north-west towards lower lying terrain coincident with the Williams River. The road section traverses gently undulating terrain associated with gullies and spurs that descend from the ridgeline. The following site features were also observed at the time of fieldwork.

> The existing road alignment has been constructed predominantly on-grade with minor cut/fill in the order of 0.5-1.0 m involving cut on the uphill side of the road and fill on the downhill as well as in proximity to culverts in the gullies.

> The road crosses a south-east to north-west flowing gully at approximately chainage 3188 m, with a concrete culvert constructed in the gully approximately 1.5 m below the existing road level and a fill embankment in proximity to the culvert.

> Generally informal and shallow table drains parallel to the road formation.

> The existing vertical alignment traverses the gently undulating terrain, commencing at RL 32.94 m and finishes at RL 11.98 m.

3 Investigation Methodology

3.1 Fieldwork

Fieldwork was undertaken on the 10 August 2016, under full traffic control provided by RMS accredited traffic controllers, and comprised the following.

> Location of services and marking out of test bore locations by an accredited service locater.

> A total of fifteen test bores (TB01-TB15) were drilled along East Seaham Road by a 300 mm mechanical auger mounted to a 3.5 tonne mini excavator as follows:

- The majority of test bores (TB01, TB03-TB06 & TB08-TB15) were bored in the existing road pavement, covering both lanes of the two-lane road. All test bores refused on rock at depths between

0.2 m and 1.2 m, with TB01 in proximity to the culvert unable to be advanced potentially due to the auger jamming on cobbles in fill material (or possible rock refusal) at approximate 1.7 m below ground level (bgl).

- TB07 was drilled outside of the road alignment, inside the existing bend noted to assess the subsurface conditions within the proposed road straightening area. Refusal on rock was encountered at 1.5m bgl.
- TB02 was also drilled adjacent the existing road pavement on the southern side.

> Dynamic Cone Penetrometer (DCP) testing was intended to be conducted within test bores at approximate subgrade level to assess the in situ soil strength conditions. However, due to the presence of shallow rock and coarse-grained materials, the DCPs within TB07 and TB14 were the only tests able to be conducted to a significant depth (1.35 m and 1.2 m depth respectively).

> Engineering assessment and logging of the subsurface profiles encountered by a geotechnical engineer from Cardno. Engineering logs of the test bores are contained within Appendix B.

> Sampling of material considered representative of existing pavement and subgrade materials encountered for the purpose of laboratory assessment.

> Backfilling of the test bores with excavation spoil and roadbase type gravel.

The bores were identified by evenly dividing the total site length by the number of boreholes requested by PSC, targeting areas of interest where required. A .kmz place mark file was generated and the locations were marked out during the location of services using a hand-held tablet. During the field investigation, consistent conditions were encountered and several proposed locations were not investigated in the northern site portion following discussion with the PSC representative. The approximate bore locations are shown on site plans Figure 1 and Figure 2 attached in Appendix A.

3.2 Laboratory Testing

Laboratory testing was undertaken on samples recovered during fieldwork for the purpose of geotechnical assessment. The geotechnical testing was conducted at Cardno's NATA accredited construction materials testing laboratory and comprised of the following testing.

Existing Pavement

> Three (3) four-day soaked California Bearing Ratio (CBR) tests on subgrade samples.

> Five (5) Atterberg Limit on pavement material samples.

> Five (5) Particle Size Distributions (PSD) on pavement material samples.

Proposed Realignment

> One (1) four-day soaked California Bearing Ratio (CBR) test on a subgrade sample.

Laboratory test results are summarised in Section 4.3 and shown, in full, on report sheets attached in Appendix C.

4 Investigation Findings

4.1 Published Data

Reference to the Newcastle Coalfield Regional Geology map, Geological series sheet 9231 [1], indicates that the subject section is underlain by undifferentiated strata. Such area is known to comprise of Tuff and ignimbrite interbedded with conglomerate, sandstone, shale and residual soils derived from the decomposition of these rocks.

4.2 Subsurface Conditions

The subsurface conditions encountered in the test bores at the time of fieldwork have been categorised and summarised as follows:

> Existing FILL/PAVEMENT; Silty Gravelly SAND and Silty Sandy GRAVEL brown in colour, with a component of cobbles in all test bores located in travelling lanes (TB03-TB06, TB08-TB15) to depths of 0.15m to 0.6m bgl. Fill material was encountered in TB01 to a depth of 1.7m associated with the filling of the natural gully surrounding the concrete culvert. A thin layer of FILL was also encountered adjacent the existing travelling lanes in TB02 to a depth of 0.05m.

> Existing RESIDUAL Soil Subgrade materials; Residual Soils comprising Silty Sandy CLAY, Clayey Silty SAND and Clayey Sandy SILT were encountered to depths of 1.2 m in test bores TB02, TB05, TB08-10, TB12-15. All other bores (excluding TB07) encountered shallow extremely weathered rock directly beneath the existing FILL/PAVEMENT (refer below).

> Existing SLOPEWASH Subgrade materials; Clayey Sand SILT material of probable SLOPEWASH origin, with high moisture content encountered adjacent the existing road alignment at the inside of the bend (TB07) to depths of 1.4m.

> BEDROCK; Extremely Weathered ROCK (Igneous and Conglomerate observed on site) material encountered in most test bores (TB02-TB15) at depths of 0.2m to 1.5m below ground level.

The existing residual subgrade materials were assessed as dense to very dense and stiff to hard consistency from DCP testing and tactile assessment. The probable slopewash materials were of firm to hard consistency.

No seepage or groundwater was encountered during the investigation. It should be noted that groundwater levels are likely to fluctuate with variations in climatic and site conditions.

For further details of subsurface conditions encountered, reference should be made to the engineering logs attached in Appendix B.

4.3 Laboratory Test Results

The results of standard compaction and CBR testing are summarised below in Table 4-1.

Table 4-1 Laboratory CBR test results

Bore No.	Depth (m)	Material description	W (%)	SOMC (%)	SMDD (t/m^3)	Swell (%)	CBR (%)
TB07	0.6-0.8	Clayey Sandy SILT	15.8	13.0	1.9	-0.5	8.0
TB08	0.7-0.9	Silty Sandy CLAY	12.4	14.5	1.8	1.5	4.0
TB13	0.5-0.8	Clayey Silty SAND	6.7	11.0	1.95	0.0	16.0
TB15	0.4-0.7	Clayey Silty SAND	6.7	11.0	1.93	0.0	20.0

Notes to table
W Field moisture content
SOMC Standard Optimum Moisture Content
SMDD Standard Maximum Dry Density

CBR testing was undertaken on remoulded specimens compacted to a target 100% maximum standard density and soaked for four days. Samples were surcharged with 4.5 kg prior to soaking.

Results of material quality testing including Atterberg Limits and PSD testing on samples of the existing pavement materials are summarised below in Table 4-2.

Table 4-2 Material quality test results

Bore No.	Depth (m)	Material description	Passing 2.36 mm (%)	Passing 75 µm (%)	LL (%)	PL (%)	PI (%)
TB03	0.1-0.3	Silty Gravelly SAND (existing pavement)	60	18	21	14	7
TB06	0.0-0.2	Silty Gravelly SAND (existing pavement)	64	16	18	15	3
TB09	0.0-0.3	Silty Gravelly SAND (existing pavement)	60	17	21	15	6
TB12	01-0.4	Silty Sandy GRAVEL (existing pavement)	59	19	22	14	8
TB15	0.1-0.3	Silty Gravelly SAND (existing pavement)	67	27	22	14	8

Notes to table
LL: Liquid Limit
PL: Plastic Limit
PI: Plasticity Index

For details of the laboratory testing conducted, reference should be made to report sheets attached in Appendix C.

5 Discussion and Comment

5.1 Reconstruction and Remedial Options

5.1.1 Existing Material Quality

Laboratory tests were undertaken to assess the suitability of the existing fill materials to be reused in the construction of the proposed Stage 5 East Seaham Road. The results of PSD, Atterberg limits and CBR tests, shown in Table 4-1 and Table 4-2 were compared with the required engineering properties of granular base and subbase, and material to be bound materials from RMS QA specification [2].

The available results indicate that the existing materials do not conform to the requirements of RMS QA Specification 3051 [2] for use as unbound granular base, subbase or material to be bound. All tested materials met the plasticity index requirements for both DGS20 and DGS40, however do not consistently meet the grading requirements. The PSD testing indicates that generally the existing pavement materials contain excess sand and clay/silt fines which are detrimental to material quality with reference to RMS 3051 [2]. The existing pavement material would have limited suitability for re-use in new pavements, and it is recommended suitable quality basecourse and subbase materials are imported, as discussed further below.

5.1.2 Geotechnical Considerations

The following factors have been considered during assessment of pavement rehabilitation suitability, and recommendations made in Section 6 below.

> Based upon the initial concept design provided, proposed pavement levels are generally at or above the existing pavement, with maximum fill in the range of 0.5-0.7 m, and as such material import will be required.

> Rehabilitation through granular overlay and in-situ stabilisation would be expected to provide a significantly shorter design life and higher maintenance requirement considering the relatively low quality of the existing pavement material as discussed.

> The adjoining Stage 4 upgrade that is currently under construction, with similar pavement and subgrade conditions, comprises construction of a new flexible pavement from imported materials.

> Rehabilitation options not involving full reconstruction are of higher risk as they do not address the variability of existing subsurface conditions, along with drainage issues and existing subgrade conditions.

5.1.3 Recommended Reconstruction

Considering the existing pavement material quality, the proposed vertical alignment and interfacing with the adjoining Stage 4 works, full pavement reconstruction is recommended for the section. A full depth pavement reconstruction utilising flexible unbound granular material is provided in Section 6 below.

It is critical that drainage conditions are improved as part of the works, particularly reforming / deepening of roadside drains as excess water is responsible for the majority of pavement failures.

6 Pavement Thickness Design

6.1 Design Parameters

Pavement thickness design has been performed in accordance with Austroads AGPT02-12 Guide to Pavement Technology, Part 2: Pavement Structural Design [4] based on the design traffic parameters outlined in **Error! Reference source not found.**.

Table 6-1 Design traffic based on the project specific data

Design period (years)	Annual Growth Rate (%)	Annual Average Daily Traffic	Direction Factor	Lane Direction factor	Average Percentage of Heavy Vehicles (%)	Average Number of Axle Group/HV	Design Traffic (DESA)
30	2	561	0.5	1.0	11	2.49	8.0×10^5

The design traffic in **Error! Reference source not found.** has been determined on the basis of the following d ata and assumptions and considering Austroads [4] AGPT02-12 Example traffic load distribution (TLD).

> A Pavement Design Life of 30 years as provided by PSC.

> Annual Average Daily Traffic (AADT) of 561 vehicles per day as provided by PSC.

> A percentage of heavy vehicles (HV) of 11% provided by PSC.

> A heavy vehicle growth rate of 2% per year assumed in the absence of supplied data.

The details of design traffic calculation are attached in Appendix E. Where input data varies from the information provided, review of pavement design may be required.

6.1.2 Subgrade Conditions

The design subgrade has been determined in accordance with Section 5 of Austroads 2012 [4], on the basis of both laboratory and field testing results, taking into consideration the effects of pavement surcharge.

Referring to the subsurface conditions encountered in the test bores, subgrade conditions along the proposed Stage 5 road section predominantly consist of residual soil from the shallow bearing rock underneath with the exception of locations near culverts containing fill material at subgrade level. Consequently, sampling difficulties were encountered due to the thinness of the subgrade layers in test bores containing shallow rock, limiting the available sampling locations and laboratory testing of the subgrade materials. As outlined in Section 4.2, the subgrade material varied and included Silty Sandy CLAY, Clayey Silty SAND and Clayey Sandy SILT.

Deeper Residual soils of poorer quality were found adjacent the existing road pavement on the inside of the bend in the road alignment existing approximately at chainages Ch 3560 to Ch 3700. A CBR test was conducted on the silty material (TB07) of high moisture content at subgrade level to assess the subgrade conditions in this location as it is associated with the proposed straightening of the road alignment. A CBR value of 8.0% was returned on the Clayey Sandy SILT material located at a chainage of Ch 3587. A clayey subgrade of similar colour in the adjacent test bore (TB08) at Chainage Ch 3642 returned a CBR of 4%. Based on the CBR results a design CBR of 4% is considered appropriate for pavement thickness design around these locations.

Residual clay material was also encountered in TB02 at chainage 3268m to a depth of approximately 0.45 m, where the pavement design level is expected to be raised 0.1-0.2m according to the supplied civil plan. The pavement at this location therefore has to be designed using a CBR of 4%. This results in a 440mm pavement and removal of most of the clay and replacement with subbase. Potentially a more economical option is over excavation of the minimal depth of clay and replacement with select material, in which case the 10% design CBR option could be adopted. Vertical alignment of the final alignment should also be considered along with the subsurface conditions described in this report when assessing the subgrade conditions and appropriate design option. The existing, site-won pavement materials should prove to be a

suitable select material depending on the moisture conditions at the time of construction; however, reference should be made to Section 7.2.1 for specification and compaction requirements.

The northern portion of the site between TB12 (Ch 4012) and TB15 (Ch 4192) contained subgrade conditions of similar material returning CBR's in TB13 and TB15 of 16% and 20% respectively. Although relatively deeper soil profiles were encountered in these locations (up to 1.2m to rock) these CBR results indicate that a design CBR of 10% can be adopted.

Referring to the provided initial planning sketch, the design levels are to only involve minor fill in some locations up to 0.6-0.7m and generally following existing levels. For this reason, pavement will be founded on relatively shallow rock in many areas as encountered in the field, and in such areas, a design CBR of 10% will be adopted. Areas of proposed fill must have general fill material complying with the material specifications and compaction requirements of Table 7-1 in order for the pavement design to be a valid design.

It is worth noting that the recommendations in this report, including design subgrade levels, are based on the assumption that the provided design levels are final. If any changes to the proposed design levels occurs, the pavement recommendations need to be reconsidered and will no longer be valid.

Considering the aforementioned, the road has been subdivided into sections based on subgrade performance and the vertical alignment and are summarised in Table 6-2. Also worth noting is that the chainages are indicative and based on assumptions by delineation test bores and observing vertical alignment.

Table 6-2 Summary of Road Section for Pavement Design

Chainage (m)	Section Identifier	Length of Section (m)	Adopted Design CBR
3220-3280(1) & 3560- 3700	2, 4	280	4%
3180-3220, 3280-3560 & 3700-4334	1, 3 & 5	240 & 634	10%

Notes:
(1) Chainages are indicative and based on assumptions via delineating test bores and observing vertical alignment. Where pavement is to be founded on clay material subgrade will need to adopt a design CBR of 4% or removal and replacement of clay material with select

6.2 Pavement Reconstruction: Flexible Unbound Pavement

Pavement reconstruction utilising flexible unbound pavement materials is detailed below in Table 6-3 and it is noted that the layer thicknesses are minimum thicknesses regardless of construction tolerances.

Table 6-3 New pavement reconstruction: flexible unbound pavement recommendations

Section	Ch 3220-3280(4) Ch 3420-3700m	Ch 3180-3220, Ch 3280-3560 & Ch 3700-4334m
Design Subgrade CBR	4%	10%
Wearing Surface (1)	Two-coat spray seal	Two-coat spray seal
Basecourse (2)	150mm	150mm
Subbase (2)	290mm	150mm
Select Material	150mm(3) – 300mm(4)	-
Total Thickness	440 mm	300mm
Design Traffic	8.0 x 10^5 DESA	8.0 x 10^5 DESA

Notes to table
(1) Final wearing course design shall be confirmed in consultation with the sealing contractor
(2) Refer to 7.2.1 for material specification and compaction requirements
(3) A select layer may be required as a construction platform for compaction of the overlying layer where clay subgrade is encountered depending on weather conditions at the time of construction and should be assessed during construction. The existing pavement materials should prove to be a suitable select material depending on the moisture conditions at the time of construction however, reference should be made to Section 7.2.1 for specification and compaction requirements
(4) Over excavation of the minimal depth of clay between Ch 3220 and 3280m and replacement with select material could be conducted, in which case the 10% design CBR Pavement option could be adopted. The final vertical alignment of the road should also be considered along with the subsurface conditions described herein when assessing the subgrade conditions and appropriate design option

7 Construction Notes

7.1 Construction Procedures

7.1.1 Subgrade Preparation

Where construction of the new pavement or widening is proposed, subgrade preparation for pavement formation should be in general accordance with the relevant council construction specifications and the following procedures.

> Excavation to design subgrade level, with the stockpiling of the existing pavement material for reuse as select (if required). Care should be exercised during excavation to avoid contamination of suitable granular material with subgrade materials.

> Where reconstruction of pavement occurs in areas with fill or existing pavement materials present at subgrade level, ripping and recompaction of a minimum of 300mm below subgrade level is required.

> Ripping and recompaction of rock subgrade, where encountered, to a minimum depth of 300 mm below subgrade level.

> Elimination of abrupt changes between subgrade conditions, such as transition from rock to soil subgrade or granular to clay subgrade. This could be conducted by methods such as selective grading or mixing of material to provide a transition between material types and moisture/density control of subgrade compaction.

> Static proof-roll the exposed subgrade using a heavy (minimum 10 tonne) roller under the direction of an experienced geotechnical consultant.

> Loose or yielding areas should be excavated and replaced with compacted select fill or suitable subgrade replacement. To prevent zones of variable permeability, which may trap moisture and lead to subgrade deformation, material of similar consistency to the subgrade shall be utilised in the case where localised replacement is required.

> Where filling or subgrade replacement is required, the materials employed shall be free of organic materials or other deleterious material and could comprise the existing pavement materials. The material should also have a maximum particle size of 100 mm or two thirds of the layer thickness and have a CBR value greater than 10%.

> Compaction of the subgrade, general filling or select material should be to a minimum 100% of SMDD in layers of not greater than 300 mm loose thickness. Moisture contents should be within 0 to -3% of SOMC.

Following satisfactory preparation of the subgrade, the pavement should be placed in accordance with the requirements of the appropriate section of this report, depending on the proposed pavement type.

The soils likely to be exposed following excavation to design subgrade level are expected to comprise sand, silt and clay soils, rock and granular filling. Depending on weather conditions prior to and during the works, difficulties in trafficability and compaction during construction on any clayey or silty subgrade could potentially be experienced. As such, allowances should be made for appropriate technique and construction plant.

7.2 Materials

7.2.1 Specification and Compaction Requirements

Pavement materials and compaction requirements for new pavement construction and granular pavement overlay should conform to PSC requirements and the following requirements.

Table 7-1 Material Specification and Compaction Requirements

Pavement Course	Material Specification	Compaction Requirements
Basecourse High quality crushed rock base material	Material complying with RMS QA Specification 3051 [3]	Min 98% Modified (AS1289 5.2.1) or Min 102% Standard (AS1289 5.1.1) (60-90% of OMC)
Subbase Quality crushed rock subbase material	Material complying with RMS QA Specification 3051 [3]	Min 95% Modified (AS1289 5.2.1) or Min 100% Standard (AS1289 5.1.1) (60-90% of OMC)
Select Crushed rock or gravel	CBR ≥ 15%	Min 100% Standard (AS1289 5.1.1) (60-90% of SOMC)
Subgrade or replacement	Clay Subgrade - minimum CBR 3% Silty Clayey SAND Subgrade - minimum CBR 10%	Min 100% Standard (AS1289 5.1.1) (3% dry of SOMC to SOMC)

All granular pavement material quality should be in general accordance with RMS QA Specification 3051 for Traffic Category C "Medium". Although our design traffic suggests a Traffic Category of D corresponding to light traffic, a conservative consideration has been taken.

Minimum testing on all potential imported pavement materials should include four-day soaked CBR, Atterberg Limits, Particle Size Distribution analysis and Wet/Dry strength determination. Pre-treatment of materials prior to testing would be advisable for material subject to breakdown.

7.2.2 Alternative Construction Materials

Based on laboratory test results, pavement materials salvaged from the pavement are considered suitable for use as a select however are generally not suitable basecourse or subbase material.

This suitability for reuse would be subject to weather conditions prior to and during construction, and moisture conditioning may be required.

Other materials used in the construction should comply with the specifications indicated in this report and Cardno should be consulted prior to the use of alternate materials. Contractors should specify materials to be used in construction at the time of tendering, with all materials to be approved by PSC prior to incorporation in the works.

7.2.3 Wearing Courses

Wearing Courses should be designed in accordance with PSC specifications with consideration to RMS Sprayed Sealing Guide [6] and QA Specifications R106 [7] and R111 [8]. The design and construction of wearing courses should be done in consultation with the preferred supplier taking into account traffic volume and type.

7.3 Drainage

The pavement thickness designs have been provided assuming drained pavement conditions. The selection, construction and maintenance of appropriate drainage mechanisms is required for adequate performance. Particular care is required to provide a waterproof seal for the pavement materials, together with adequate surface and sub-surface drainage of the pavement and adjacent areas. The use of low permeability material in the verge areas will also assist with the prevention of moisture ingress into the pavement and reduce moisture variation within the pavement.

Provision of adequate cross fall to direct runoff from the pavement to drainage lines should be achieved regardless of the option adopted and as a minimum, roadside open drains should be reformed and adequately maintained. The drains should be provided where the road is on grade or in cut and be constructed so that the base of the drain is below subgrade level along both the sides of the road. The subgrade should also be constructed with sufficient cross fall (approximately 3%) to assist in any moisture entering the pavement not becoming trapped.

7.4 General Construction Considerations

7.4.1 Pavement Compaction

It is essential to ensure that compaction is achieved through the full thickness of any pavement layers, particularly where bound pavements are utilised. A rough interface and bond is required between all pavement layers. This would generally be achieved by scarification of the first layer prior to placement and compaction of the second and subsequent layers.

7.4.2 Pavement Interface and Tie in

Where new pavement construction abuts an existing pavement, care should be exercised to either create a clean vertical construction joint or bench in the basecourse layer for a minimum of 0.5 m for the entire pavement width.

Adequate compaction of the subgrade and pavements in this area is essential to maximise the performance of the pavement. It is noted that where variable pavements are abutted, the potential for localised failure is generally greater and sealing of cracks that may develop between existing and new pavements should be conducted. The use of a strain relieving membrane along with intra-pavement drainage at the interface may also be appropriate.

7.4.3 Inspections

Where reconstruction is undertaken, the subgrade will require inspection by an experienced geotechnical consultant after boxing out or filling to design subgrade level. The purpose of inspections is to confirm design parameters, assess the suitability of the subgrade to support the pavement, and delineate areas which may require subgrade replacement or remedial treatment prior to construction.

7.4.4 References for Construction

All works and materials used in construction should be designed and constructed in accordance with PSC specifications or as specified within this report. Where discrepancies may occur clarification should be sought from Council.

Earthworks and testing should generally be undertaken in accordance with AS 3798-2007 Guidelines on Earthworks for Commercial and Residential Developments [8] where not otherwise specified.

8 Limitations

Cardno have performed investigation and consulting services for this project in general accordance with current professional and industry standards. The extent of testing was limited to discrete test locations and variations in ground conditions can occur between test locations that cannot be inferred or predicted.

A geotechnical consultant or qualified engineer shall provide inspections during construction to confirm assumed conditions in this assessment. If subsurface conditions encountered during construction differ from those given in this report, further advice shall be sought without delay.

Cardno, or any other reputable consultant, cannot provide unqualified warranties nor does it assume any liability for the site conditions not observed or accessible during the investigations. Site conditions may also change subsequent to the investigations and assessment due to ongoing use.

This report and associated documentation was undertaken for the specific purpose described in the report and shall not be relied on for other purposes. This report was prepared solely for the use by Port Stephens Council and any reliance assumed by other parties on this report shall be at such parties own risk.

References

[1] Newcastle Coalfield Regional 1:100 000 Geology Map, "Geological Series Sheet 9231, and part of 9131, 9132 and 9232 (Edition 1)," Geological Survey of NSW, Department of Mineral Resources, 1995.

[2] RMS QA Specification 3051 (Ed 6 Rev 2), "Granular Base and Subbase Materials for Surfaced Road Pavements," Roads and Maritime Services, April 2011.

[3] Austroads AGPT02-12, "Guide to Pavement Technology Part 2: Pavement Structural Design," Austroads Ltd, 2012.

[4] RMS TP-GLD-001 (Ed 2), "Sprayed Sealing Guide," Roads and Maritime Services, February 1997.

[5] RMS QA Specification R106 (Ed 4 Rev 0), "Sprayed Bituminous Surfacing (with Cutback Bitumen)," Roads and Maritime Services, August 2006.

[6] RMS QA Specification R111 (Ed 2 Rev 0), "Spayed Bituminous Surfacing (with Bitumen Emulsion)," Roads and Maritime Services, August 2006.

[7] RMS QA Specification R37 (Ed 4 Rev 1), "Intra-pavement Drains," Roads and Maritime Services, June 2011.

[8] Australian Standard AS3798-2007, "Guidelines on Earthworks for Commercial and Residential Structures," Standards Australia, 2007.

East Seaham Road, Stage 5
East Seaham

APPENDIX A

DRAWINGS

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NOTES:

Image underlay adapted from nearmaps aerial imagery.

LEGEND:

TBXXX Approximate test bore locations and numbers.

0 50m

SCALE 1:1500 @A3

NORTH

Cardno
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Web: www.cardno.com.au

Drawn	JG	Date 02/08/2017
Checked		Date 02/08/2017
		Date
Verified		Date
Approved		

Client: Port Stephens Council

Project: Geotechnical Investigation and Pavement Design
East Seaham Road, Stage 5
East Seaham

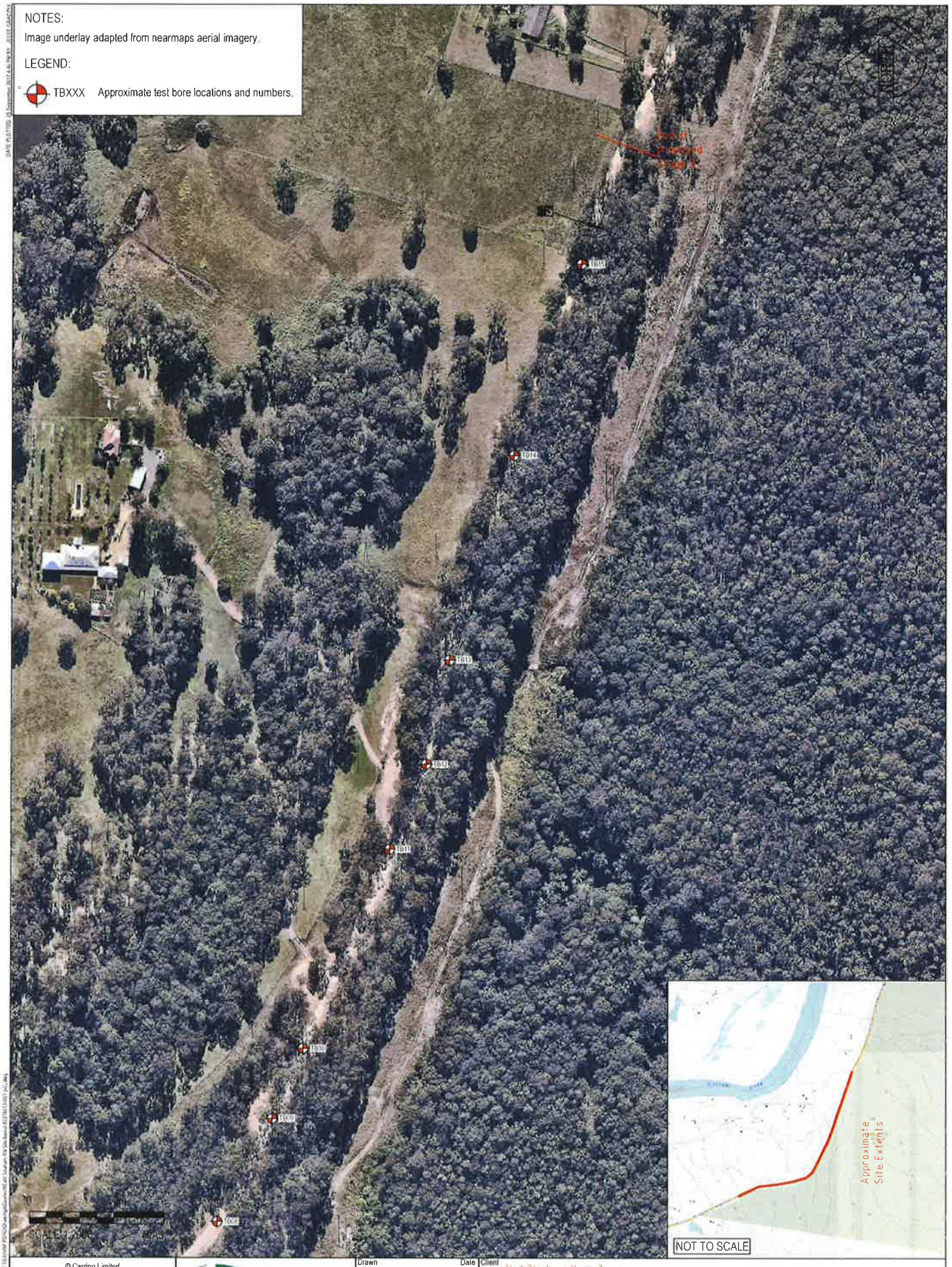
Title: Site Map and Test Layout

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale: 1:1500 Size: A3

Drawing Number: Figure 1

Revision: A



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Drawn JG	Date 02/08/2017	
Checked	Date 02/08/2017	
	Date	
Verified	Date	
Approved		

Client: Port Stephens Council

Project: Geotechnical Investigation and Pavement Design
East Seaham Road, Stage 5
East Seaham

Title: Site Map and Test layout Part 2

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale: 1:2000 | Size: A3

Drawing Number: Figure 2 | Revision: A

East Seaham Road, Stage 5
East Seaham

APPENDIX B

ENGINEERINGS LOGS

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Explanatory Notes

The methods of description and classification of soils and rocks used in this report are based on *Australian Standard 1726-2017 Geotechnical Site Investigations* Code. Material descriptions are deduced from field observation or engineering examination, and may be appended or confirmed by in situ or laboratory testing. The information is dependent on the scope of investigation, the extent of sampling and testing, and the inherent variability of the conditions encountered.

Subsurface investigation may be conducted by one or a combination of the following methods.

Method	
Test Pitting: excavation/trench	
BH	Backhoe bucket
EX	Excavator bucket
X	Existing excavation
Natural Exposure: existing natural rock or soil exposure	
Manual drilling: hand operated tools	
HA	Hand Auger
Continuous sample drilling	
PT	Push tube
Hammer drilling	
AH	Air hammer
AT	Air track
Spiral flight auger drilling	
AS	Large diameter short spiral auger
AD/V	Continuous flight spiral auger: V-Bit
AD/T	Continuous flight spiral auger: TC-Bit
Rotary non-core drilling	
WS	Washbore (mud drilling)
RR	Rock roller
Rotary core drilling	
HQ	63 mm diamond-tipped core barrel
NMLC	52 mm diamond-tipped core barrel
NQ	47 mm diamond-tipped core barrel
Concrete coring	
DT	Diatube

Subsurface investigation may be conducted by one or a combination of the following methods.

Sampling method	
Disturbed sampling	
B	Bulk disturbed sample
D	Disturbed sample
ES	Environmental sample
Undisturbed sampling	
SPT	Standard Penetration Test sample
U#	Undisturbed tube sample (# mm diameter)
WS	Water sample
EW	Environmental water sample

Field testing may be conducted as a means of assessment of the in-situ conditions of materials encountered.

Field testing	
SPT	Standard Penetration Test
HP/PP	Hand/Pocket penetrometer
Dynamic Penetrometers (blows/150 mm)	
	DCP Dynamic Cone Penetrometer
	PSP Perth Sand Penetrometer
VS	Vane Shear
PBT	Plate Bearing Test

If encountered with SPT or dynamic penetrometer testing, refusal (R), virtual refusal (VR) or hammer bouncing (HB) may be noted.

The quality of the rock can be assessed by the degree of fracturing and the following.

Rock quality description	
TCR	Total core recovery (%) (Length of core recovered, divided by the length of the core run)
RQD	Rock Quality Designation (%) (sum of axial lengths of core greater than 100 mm long divided by the length of the core run)

Notes on groundwater conditions encountered may include the following.

Groundwater	
Not encountered	Excavation is dry in the short term
Not observed	Groundwater observation not possible
Seepage	Groundwater seeping into hole
Inflow	Groundwater flowing/flooding into hole

Notes on the stability of excavation may include the following.

Rock quality description	
Spalling	Material falling into excavation, may be described as minor or major spalling
Unstable	Collapse of the majority, or one or more face of the excavation

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Explanatory Notes – General soil Description

The methods of description and classification of soils and rocks used in this report are *based on Australian Standard 1726-2017 Geotechnical Site Investigations Code*. In practice, if the material can be remoulded by hand in its field condition or in water it is described as a soil. The dominant soil constituent is given in capital letters, with secondary textures in lower case. In general, descriptions cover: soil type, strength / relative density, moisture, colour, plasticity and inclusions.

Soil types are described according to the dominant particle size on the basis of the following assessment.

Soil classification	Particle size (mm)	
CLAY	< 0.002	
SILT	0.002 to 0.075	
SAND	*fine*	0.075 to 0.21
	medium	0.21 to 0.60
	coarse	0.60 to 2.36
GRAVEL	*fine*	2.36 to 6.7
	medium	6.7 to 19
	coarse	19 to 63
COBBLES	63 to 200	
BOULDERS	> 200	

Soil types are qualified by the presence of minor components on the basis of field examination or grading.

Terminology	In coarse grained soils		In fine grained soils
	% Fines	% coarse fraction	% Sand/gravel
Trace	≤ 5	≤ 15	≤ 15
With	> 5 to ≤ 12	> 15 to ≤ 30	> 15 to ≤ 30

The strength of cohesive soils is classified by engineering assessment or field/laboratory testing as follows

Strength	Symbol	Undrained shear strength (kPa)
Very Soft	VS	≤12
Soft	S	>12 to ≤25
Firm	F	>25 to ≤50
Stiff	St	>50 to ≤100
Very Stiff	VSt	>100 to ≤200
Hard	H	>200

Cohesionless soils are classified on the basis of relative density as follows.

Strength	Symbol	Density Index (%)
Very Loose	VL	≤15
Loose	L	>15 to ≤35
Medium Dense	MD	>35 to ≤65
Dense	D	>65 to ≤85
Very Dense	VD	>85

The moisture condition of soil is described by appearance and feel and may be described in relation to the Plastic Limit (PL) or Optimum Moisture Content (OMC). For granular soils, the following guide is adopted.

Moisture condition	Description
Dry	Non-cohesive and free-running
Moist	Cool feel and darkened colour, soils tends to stick together
Wet	Cool feel and darkened colour, free-water forms when handling, soils tend to cohere

The following guide is adopted for cohesive soils.

Moisture condition	Description
Moist, dry of PL	w < PL
Moist, near PL	$w \approx$ PL
Moist, wet of PL	w > PL
Wet, near LL	$w \approx$ LL
Wet, wet of LL	w > LL

The plasticity of cohesive soils is defined as follows.

Plasticity	LL for Silt (%)	LL for Clay (%)
Low	≤50	≤35
Medium	N/A	>35 to ≤50
High	>50	>50

The structure may include; defects such as softened zones, fissures, cracks, joints and root-holes; and coarse grained soils may be described as strongly/weakly cemented.

The soil origin may also be noted if possible to deduce.

Soil origin	Description
Fill	Man-made deposits or disturbed material
Topsoil	Material affected by roots and root fibres
Colluvial soil	Transported down slopes by gravity
Aeolian soil	Transported and deposited by wind
Estuarine soil	Deposited in coastal estuaries
Alluvial soil	Deposited by streams and rivers
Lacustrine soil	Deposited in freshwater lakes
Marine soil	Deposited in marine environment
Extremely weathered material	Developed from in-situ weathering, with structure/fabric of parent rock intact
Residual soil	Developed from in-situ weathering, with structure/fabric of parent rock

The origin of the soil generally cannot be deduced on the appearance of the material and may be assumed based on further geological evidence or field observation. Where there is doubt, the terms 'possibly' or 'probably' shall be used.

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Explanatory Notes – General Rock Description

The methods of description and classification of soils and rocks used in this report are *based on Australian Standard 1726-2017 Geotechnical Site Investigations Code*. In practice, if the material can be remoulded by hand in its field condition or in water it is described as a soil. The dominant soil constituent is given in capital letters, with secondary textures in lower case. In general, descriptions cover: soil type, strength / relative density, moisture, colour, plasticity and inclusions.

Sedimentary rock types are generally described according to the predominant grain size as follows

Rock Type	Description
CONGOLMERATE	Large rounded gravel sized fragments > 2 mm cemented in a finer matrix
BRECCIA	Angular/irregular rock fragments > 2 mm in a finer matrix
SANDSTONE	Sand sized particles defined by grain size and often cemented by other materials fine 0.06 mm to 0.2 mm medium 0.2 mm to 0.6 mm coarse 0.6 mm to 2 mm
SILTSTONE	Predominantly silt sized particles
SHALE	Fine particles (silt or clay) and fissile
CLAYSTONE	Predominantly clay sized particles

The classification of rock weathering is described based on definitions outlined in AS 1726-2017 as follows

Term	Symbol	Definition
Residual Soil	RS	Soil developed on extremely weathered rock; mass structure and substance are no longer evident
Extremely weathered	XW	Weathered to such an extent that it has 'soil' properties. Mass structure and substance still visible
Distinctly weathered	DW	Strength usually changed and may be highly discoloured. Porosity may be increased by leaching, or decreased due to deposition in pores
Slightly weathered	SW	Slightly discoloured; little/no change of strength from fresh rock
Fresh	FR	Rock shows no sign of decomposition or staining

Rock strength (distinct from mass strength which can be significantly weaker due to the effect of defects) can be defined based on point load index as follows

Term	Symbol	Point Load Index I_{s50} (MPa)
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	> 10

For preliminary assessment and in cases where no point load testing is available, the rock strength may be assessed using the field guide specified in AS 1726-2017.

The defect spacing and bedding thickness of rocks measured normal to defects of the same set or bedding can be described as follows.

Definition	Defect spacing (mm)
Thinly laminated	< 6
Laminated	6 to 20
Very thinly bedded	20 to 60
Thinly bedded	60 to 200
Medium bedded	200 to 600
Thickly bedded	600 to 2000
Very thickly bedded	> 2000

Defects in rock mass are described by the following

Terms		Terms	
Joint	JT	Sheared zone	SZ
Bed parting	BP	Sheared surface	SS
Contact	CO	Seam	SM
Dyke	DK	Crushed Seam	CS
Decomposed zone	DZ	Infilled Seam	IS
Fracture	FC	Foliation	FL
Fracture Zone	FZ	Vein	VN

The shape and roughness of defects in the rock mass are described using the following terms

Planarity		Roughness	
Planar	PR	Very Rough	VR
Curved	CU	Rough	R
Undulating	U	Smooth	S
Irregular	IR	Polished	POL
Stepped	ST	Slickensided	SL

The coating or infill associated with defects in rock mass are described as follows

Definition	Symbol	Description
Clean	CN	No visible coating
Stain	SN	No visible coating; surfaces are discoloured
Veneer	VNR	Visible coating of soil or mineral, too thin to measure; may be patchy
Coating	CT	Visible coating or infilling of soil or mineral substance (up to 1 mm)

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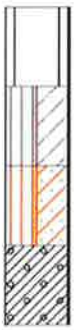
Graphics Symbol Index

CLAYS



CLAY

Silty CLAY

Sandy CLAY

Gravelly CLAY

GRAVELS

GRAVEL

Clayey GRAVEL

Silty GRAVEL

Sandy GRAVEL

METAMORPHIC ROCK

SLATE/PHYLLITE

SCHIST

GNEISS

QUARTZITE

SILTS

SILT

Clayey SILT

Sandy SILT

Gravelly SILT

FILL STRATA

FILL

ASPHALT

CONCRETE

IGNEOUS ROCK

GRANITE

RHYOLITE

BASALT

DOLERITE

VOLCANIC

TUFF

SANDS

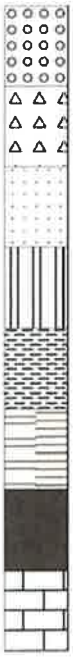
SAND

Clayey SAND

Sandy SAND

Gravelly SAND

SEDIMENTARY ROCKS



CONGLOMERATE

BRECCIA

SANDSTONE

SILTSTONE

SHALE

MUDSTONE
/CLAYSTONE

COAL

LIMESTONE

OTHER SOILS

High plasticity
ORGANIC
CLAYS & SILTS

TOPSOIL

COBBLES &
BOULDERS

BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham		**Job No: 82218013**	**Hole No: TB01** **Sheet: 1 of 1**
Position: 2m OS CL Northlane Approx Ch 3190		**Angle from Horizontal: 90°**	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller: ARSK Civil**
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed: 10/8/17**	**Logged By: JG**	**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Excavating: Auger 'TC' Bit	Excavating: Washbore	Excavating: Hand Auger	Excavating: Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
0						Not Encountered							FILL/PAVEMENT; Silty Gravelly SAND, fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry to moist
							B 0.40 - 0.70 m						
0.5													
1.0													
1.5													BOREHOLE TERMINATED AT 1.70 m Refusal

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client:	**Port Stephens Council**		**Hole No:**
Project:	**East Seaham Rd Stage 5**		
Location:	**East Seaham Rd, East Seaham**	**Job No: 82218013**	**Sheet: 1 of 1**
Position: 5m OS CL Southlane Approx Ch 3268		**Angle from Horizontal: 90°**	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller: ARSK Civil**
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed: 10/8/17**	**Logged By: JG**	**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered							FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry to moist
													Silty Sandy CLAY; low to medium plasticity, brown, trace of organic materials, moisture content dry of plastic limit, RESIDUAL
0.5													Extremely Weathered ROCK; Distinctly to Extremely Weathered, Low Strength
													BOREHOLE TERMINATED AT 0.50 m Refusal
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham		**Job No: 82218013**	**Hole No: TB03** **Sheet: 1 of 1**
Position: 1.5m OS CL Northlane Approx Ch 3330		**Angle from Horizontal: 90°**	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller: ARSK Civil**
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed: 10/8/17**	**Logged By: JG**	**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered	B 0.10 - 0.30 m						FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, dry
													Extremely Weathered ROCK; Distinctly to Extremely Weathered, Low Strength
0.5													BOREHOLE TERMINATED AT 0.40 m Refusal
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham		**Job No:** 82218013	**Hole No: TB04** **Sheet:** 1 of 1
Position: 1.5m OS CL Southlane Approx. Ch 3376		**Angle from Horizontal:** 90°	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller:** ARSK Civil
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed:** 10/8/17	**Logged By:** JG	**Date Logged:** 10/8/17

Depth (m)	Excavating: Auger 'V' Bit	Excavating: Auger 'TC' Bit	Excavating: Washbore	Excavating: Hand Auger	Excavating: Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered							FILL/PAVEMENT; Silty Sandy GRAVEL; fine to coarse grain, sub-rounded conglomerate to sub-angular igneous, brown with gravels ranging pale white, red, blue to darker colours, trace of sub angular cobbles (70-80mm)
													Extremely Weathered ROCK; pale brown-grey, find sand particle size, distinctly to Extremely Weathered, Low Strength
													BOREHOLE TERMINATED AT 0.20 m Refusal
0.5													
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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Broadmeadow NSW 2292
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FAX: +61 2 4965 4666

BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham			**Hole No: TB05**
	Job No: 82218013		**Sheet: 1 of 1**
Position: 1.5m OS CL Northlane Approx. Ch 3446	**Angle from Horizontal: 90°**		**Surface Elevation:**
Rig Type: 3.5t Excavator	**Bit:**		**Driller: ARSK Civil**
Casing Diameter:	**Contractor:**		
Date Started : 10/8/17 **Date Completed: 10/8/17**	**Logged By: JG**		**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered							FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry to moist
													Clayey Silty SAND; fine to medium grained, light brown, trace of gravel and organic material including roots and rootlets, potential extremely weathered conglomerate, RESIDUAL
0.5													
													Extremely Weathered ROCK; Distinctly to Extremely Weathered, Low Strength
1.0													BOREHOLE TERMINATED AT 1.00 m Refusal
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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FAX: +61 2 4965 4666

BOREHOLE LOG SHEET

Client: Port Stephens Council			**Hole No: TB06**
Project: East Seaham Rd Stage 5			
Location: East Seaham Rd, East Seaham	**Job No:** 82218013		**Sheet:** 1 of 1
Position: 1.5m OS CL Southlane Approx. Ch 3513	**Angle from Horizontal:** 90°		**Surface Elevation:**
Rig Type: 3.5t Excavator	**Bit:**		**Driller:** ARSK Civil
Casing Diameter:	**Contractor:**		
Date Started : 10/8/17 **Date Completed:** 10/8/17	**Logged By:** JG		**Date Logged:** 10/8/17

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered	B 0.00 - 0.20 m						FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, orange-brown, gravels fine coarse, rounded to angular, trace of cobbles, dry to moist
													Silty Sandy CLAY; low to medium plasticity, brown, trace of organic materials, moisture content dry of plastic limit, RESIDUAL
													Extremely Weathered ROCK; Distinctly to Extremely Weathered, Low Strength
													BOREHOLE TERMINATED AT 0.40 m Refusal
0.5													
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

1/10 Denney Street
Broadmeadow NSW 2292
PH: +61 2 4949 4300
FAX: +61 2 4965 4666

BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham			**Hole No: TB07**
	Job No: 82218013		**Sheet: 1 of 1**
Position: 7m OS North of Road Edge Approx. Ch 3587	**Angle from Horizontal: 90°**		**Surface Elevation:**
Rig Type: 3.5t Excavator	**Bit:**		**Driller: ARSK Civil**
Casing Diameter:	**Contractor:**		
Date Started : 10/8/17	**Date Completed: 10/8/17**	**Logged By: JG**	**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered	B 0.20 - 0.40 m		3 8 12				Clayey Sandy SILT; low to medium plasticity, red, trace of gravels and organic material including rootlets etc, moisture content above plastic limit, probably SLOPEWASH
0.5							B 0.60 - 0.80 m		11 7 6				Clayey Sandy SILT; low to medium plasticity, brown-pale grey mottled orange-red with gravels, fine to coarse, and trace of organic material and cobbles (70mm), Moisture Content well above plastic limit, probably SLOPEWASH
1.0							B 1.10 - 1.30 m		8 16 32 R				As above slight change in colour to more grey, increased moisture content to almost wet
													Extremely Weathered ROCK; Distinctly to Extremely Weathered, Low Strength
1.5													BOREHOLE TERMINATED AT 1.50 m Refusal

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client: Port Stephens Council			**Hole No: TB08**
Project: East Seaham Rd Stage 5			
Location: East Seaham Rd, East Seaham	**Job No:** 82218013	**Sheet:** 1 of 1	
Position: 1.5m OS CL Southlane Approx. Ch 3642	**Angle from Horizontal:** 90°	**Surface Elevation:**	
Rig Type: 3.5t Excavator	**Bit:**	**Driller:** ARSK Civil	
Casing Diameter:	**Contractor:**		
Date Started : 10/8/17 **Date Completed:** 10/8/17	**Logged By:** JG	**Date Logged:** 10/8/17	

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered							FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry
0.5							B 0.70 - 0.90 m						Silty Sandy CLAY; low to medium plasticity, light brown mottled orange, with rock fragments, fine to coarse, sub-rounded to angular, moisture content well dry of plastic limit, RESIUDAL
1.0													Extremely Weathered ROCK; Extremely Weathered, Low Strength
1.5													BOREHOLE TERMINATED AT 1.10 m Refusal

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham			**Hole No: TB09**
		Job No: 82218013	**Sheet: 1 of 1**
Position: 1.5m OS CL Northlane Ch 3722		**Angle from Horizontal: 90°**	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller: ARSK Civil**
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed: 10/8/17**	**Logged By: JG**	**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Excavating: Auger 'TC' Bit	Excavating: Washbore	Excavating: Hand Auger	Excavating: Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered	B 0.00 - 0.30 m						FILL/PAVEMENT: Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry to moist
													Silty Sandy CLAY: low to medium plasticity, brown, less than trace of organic materials, grading to extremely weathered rock, moisture content dry of plastic limit, RESIDUAL
0.5													Extremely Weathered ROCK; Extremely Weathered, Low Strength
													BOREHOLE TERMINATED AT 0.50 m Refusal
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client: Port Stephens Council			**Hole No: TB10**
Project: East Seaham Rd Stage 5			
Location: East Seaham Rd, East Seaham	**Job No:** 82218013		**Sheet:** 1 of 1
Position: 1.5m OS CL Northlane Ch 3767	**Angle from Horizontal:** 90°		**Surface Elevation:**
Rig Type: 3.5t Excavator	**Bit:**		**Driller:** ARSK Civil
Casing Diameter:	**Contractor:**		
Date Started : 10/8/17	**Date Completed:** 10/8/17	**Logged By:** JG	**Date Logged:** 10/8/17

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered							FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, dry to moist
							B 0.20 - 0.50 m						Clayey Gravelly SAND; low to medium plasticity, light brown, grading to extremely weathered rock, moisture content dry of plastic limit, RESIDUAL
0.5													Extremely Weathered ROCK; Distinctly weathered to extremely Weathered, Low Strength
													BOREHOLE TERMINATED AT 0.60 m Refusal
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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FAX: +61 2 4965 4666

BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham		**Job No:** 82218013	**Hole No: TB11** **Sheet:** 1 of 1
Position: 1.5m OS CL Northlane Approx. Ch 3895		**Angle from Horizontal:** 90°	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller:** ARSK Civil
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed:** 10/8/17	**Logged By:** JG	**Date Logged:** 10/8/17

Depth (m)	Excavating: Auger 'V' Bit	Excavating: Auger 'TC' Bit	Excavating: Washbore	Excavating: Hand Auger	Excavating: Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered							FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry to moist
													Extremely Weathered ROCK; Distinctly weathered to extremely Weathered, Low Strength
													BOREHOLE TERMINATED AT 0.28 m Refusal
0.5													
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client:	**Port Stephens Council**		**Hole No: TB12**
Project:	**East Seaham Rd Stage 5**		
Location:	**East Seaham Rd, East Seaham**	**Job No: 82218013**	**Sheet: 1 of 1**
Position: 1.5m OS CL Southlane Approx. Ch 3949		**Angle from Horizontal: 90°**	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller: ARSK Civil**
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed: 10/8/17**	**Logged By: JG**	**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered	B 0.10 - 0.40 m						FILL/PAVEMENT; Silty Sandy GRAVEL; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry to moist
													200 to 250mm wide boulder encountered about 0.2-0.3m deep
0.5													Silty Sandy CLAY; low to medium plasticity, brown with gravels, fine to coarse, sub-roudned to angular, trace of organic materials including a 10mm thick root at 0.4m, moisture content below plastic limit, RESIDUAL
													BOREHOLE TERMINATED AT 0.60 m Refusal
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham			**Hole No: TB13**
		Job No: 82218013	**Sheet: 1 of 1**
Position: 1.5m OS CL Northlane Approx. Ch 4012		**Angle from Horizontal: 90°**	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller: ARSK Civil**
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed: 10/8/17**	**Logged By: JG**	**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered							FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry
													Clayey Silty SAND; fine to medium, brown, trace of organic materials and gravel, fine to coarse, moisture content dry of plastic limit, RESIDUAL
0.5							B 0.50 - 0.80 m						
													Extremely Weathered ROCK: Distinctly weathered to extremely Weathered, Low Strength
1.0													BOREHOLE TERMINATED AT 1.00 m Refusal
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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BOREHOLE LOG SHEET

Client: Port Stephens Council			**Hole No: TB14**
Project: East Seaham Rd Stage 5			
Location: East Seaham Rd, East Seaham	**Job No:** 82218013		**Sheet:** 1 of 1
Position: 1.5m OS CL Northlane Approx. Ch 4140	**Angle from Horizontal:** 90°		**Surface Elevation:**
Rig Type: 3.5t Excavator	**Bit:**		**Driller:** ARSK Civil
Casing Diameter:	**Contractor:**		
Date Started : 10/8/17	**Date Completed:** 10/8/17	**Logged By:** JG	**Date Logged:** 10/8/17

Depth (m)	Excavating: Auger 'V' Bit	Auger 'TC' Bit	Washbore	Hand Auger	Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered			32				FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry
0.5									21				Clayey Silty SAND; fine to medium, brown-grey, trace of organic materials including roots upto 5-10mm thick at 0.4m and gravel, fine to coarse, moisture content dry of plastic limit, RESIDUAL
									17				
									27				
1.0									13				
									40				
1.5													BOREHOLE TERMINATED AT 1.20 m Refusal

See Standard Sheets for details of abbreviations & basis of descriptions

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FAX: +61 2 4965 4666

BOREHOLE LOG SHEET

Client: Port Stephens Council **Project:** East Seaham Rd Stage 5 **Location:** East Seaham Rd, East Seaham		**Job No: 82218013**	**Hole No: TB15** **Sheet: 1 of 1**
Position: 1.5m OS CL Southlane Approx. Ch 4192		**Angle from Horizontal: 90°**	**Surface Elevation:**
Rig Type: 3.5t Excavator		**Bit:**	**Driller: ARSK Civil**
Casing Diameter:		**Contractor:**	
Date Started : 10/8/17	**Date Completed: 10/8/17**	**Logged By: JG**	**Date Logged: 10/8/17**

Depth (m)	Excavating: Auger 'V' Bit	Excavating: Auger 'TC' Bit	Excavating: Washbore	Excavating: Hand Auger	Excavating: Tooth bucket	Groundwater (m)	Sample or Field Test	Recovered	DCP	RL (m AHD)	Graphic Log	USCS Symbol	Description (SYMBOL, SOIL NAME, plasticity/particle characteristics, colour, minor components, moisture, consistency, structure, ORIGIN)
						Not Encountered	B 0.10 - 0.30 m						FILL/PAVEMENT; Silty Gravelly SAND; fine to medium, brown, gravels fine coarse, rounded to angular, trace of cobbles, dry to moist
							B 0.40 - 0.70 m						Clayey Silty SAND; fine to medium, brown-grey, trace of organic materials including roots and gravel, fine to coarse, moisture content dry of plastic limit, RESIDUAL
0.5													
													BOREHOLE TERMINATED AT 0.70 m Refusal
1.0													
1.5													

See Standard Sheets for details of abbreviations & basis of descriptions

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Broadmeadow NSW 2292
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East Seaham Road, Stage 5
East Seaham

APPENDIX

C

LABORATORY TESTS RESULTS

Cardno
Shaping the Future

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
Unit 1, 10 Denney Street
Broadmeadow NSW 2292

Laboratory: Newcastle Laboratory
Phone: 02 4965 4555 Fax: 02 4946 4666

Email: Newcastle@constructionsciences.net

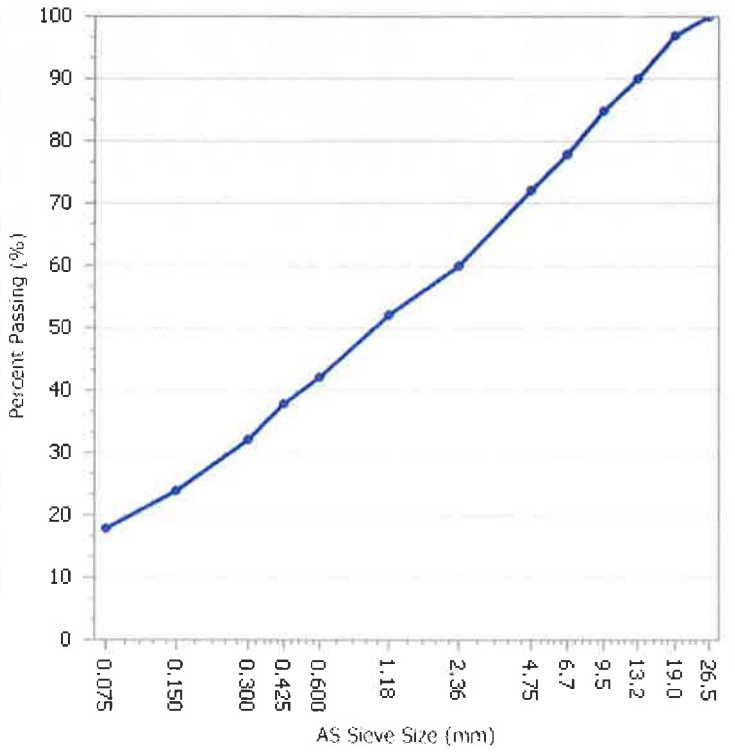
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10587-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 1 of 5

Test Procedures:	AS1289.3.6.1			
Sample Number	16822/S/39297	Sample Location		
Sampling Method	Tested As Received	Bore No.		TB03
Date Sampled	10/08/2017	Sample Type		Bulk
Sampled By	Client Sampled	Sample Depth	m	0.1-0.3
Date Tested	29/08/2017			
Material Source	-	Material Type	-	

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
26.5		**100**	
19.0		**97**	
13.2		**90**	
9.5		**85**	
6.7		**78**	
4.75		**72**	
2.36		**60**	
1.18		**52**	
0.600		**42**	
0.425		**38**	
0.300		**32**	
0.150		**24**	
0.075		**18**	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks: Re-Issued Report Replaces Report No 16822/R/10587-1.

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NATA

Accreditation Number: 1986
Corporate Site Number: 16822

Approved Signatory: Joseph Stallard
Form ID: W9Rep Rev 2

Construction Sciences

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Email: Newcastle@constructionsciences.net

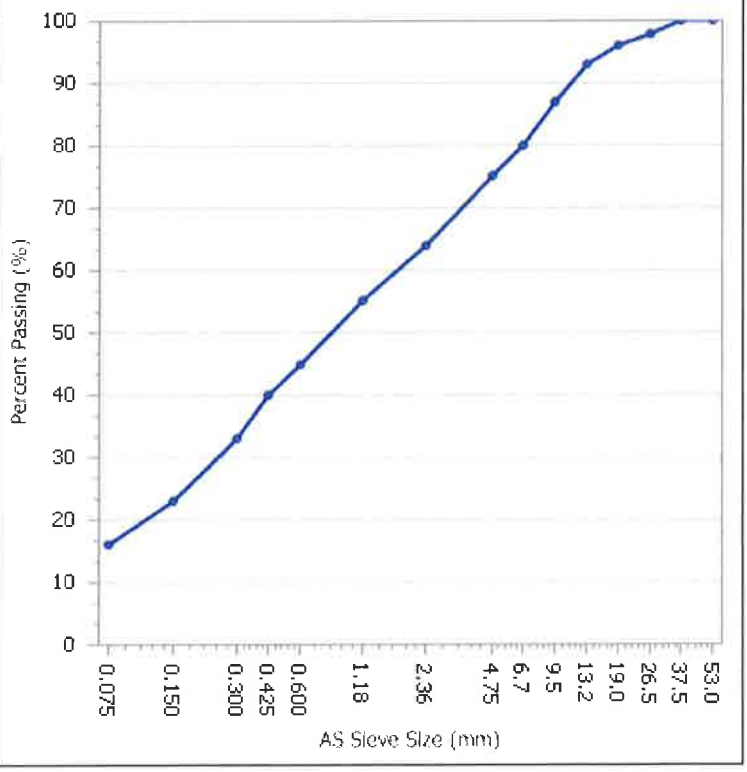
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10587-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 2 of 5

Test Procedures:	AS1289.3.6.1		
Sample Number	16822/S/39298	Sample Location	
Sampling Method	Tested As Received	Bore No.	TB06
Date Sampled	10/08/2017	Sample Type	Bulk
Sampled By	Client Sampled	Sample Depth m	0.0-0.2
Date Tested	4/09/2017		
Material Source	-	Material Type	-

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
53.0		**100**	
37.5		**100**	
26.5		**98**	
19.0		**96**	
13.2		**93**	
9.5		**87**	
6.7		**80**	
4.75		**75**	
2.36		**64**	
1.18		**55**	
0.600		**45**	
0.425		**40**	
0.300		**33**	
0.150		**23**	
0.075		**16**	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks	Re-Issued Report Replaces Report No 16822/R/10587-1.

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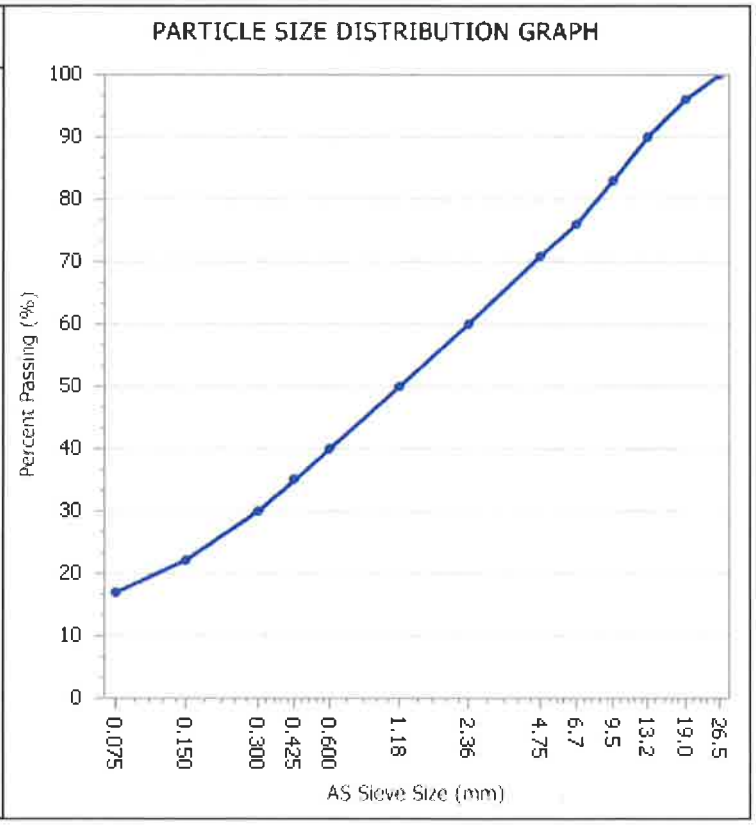
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10587-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 3 of 5

Test Procedures:	AS1289.3.6.1			
Sample Number	16822/S/39301	Sample Location		
Sampling Method	Tested As Received	Bore No.		TB09
Date Sampled	10/08/2017	Sample Type		Bulk
Sampled By	Client Sampled	Sample Depth	m	0.0-0.3
Date Tested	29/08/2017			
Material Source	-	Material Type	-	

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
26.5		**100**	
19.0		**96**	
13.2		**90**	
9.5		**83**	
6.7		**76**	
4.75		**71**	
2.36		**60**	
1.18		**50**	
0.600		**40**	
0.425		**35**	
0.300		**30**	
0.150		**22**	
0.075		**17**	



Remarks	Re-Issued Report Replaces Report No 16822/R/10587-1.

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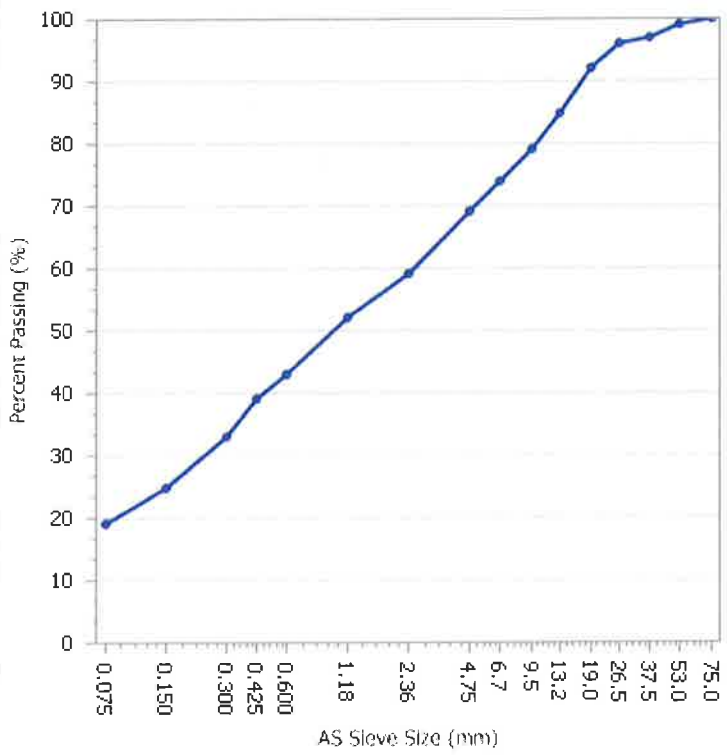
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10587-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 4 of 5

Test Procedures:	AS1289.3.6.1			
Sample Number	16822/S/39302	Sample Location		
Sampling Method	Tested As Received	Bore No.		TB12
Date Sampled	10/08/2017	Sample Type		Bulk
Sampled By	Client Sampled	Sample Depth	m	0.1-0.4
Date Tested	4/09/2017			
Material Source	-	Material Type	-	

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
75.0		100	
53.0		99	
37.5		97	
26.5		96	
19.0		92	
13.2		85	
9.5		79	
6.7		74	
4.75		69	
2.36		59	
1.18		52	
0.600		43	
0.425		39	
0.300		33	
0.150		25	
0.075		19	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks: Re-Issued Report Replaces Report No 16822/R/10587-1.

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Email: Newcastle@constructionsciences.net

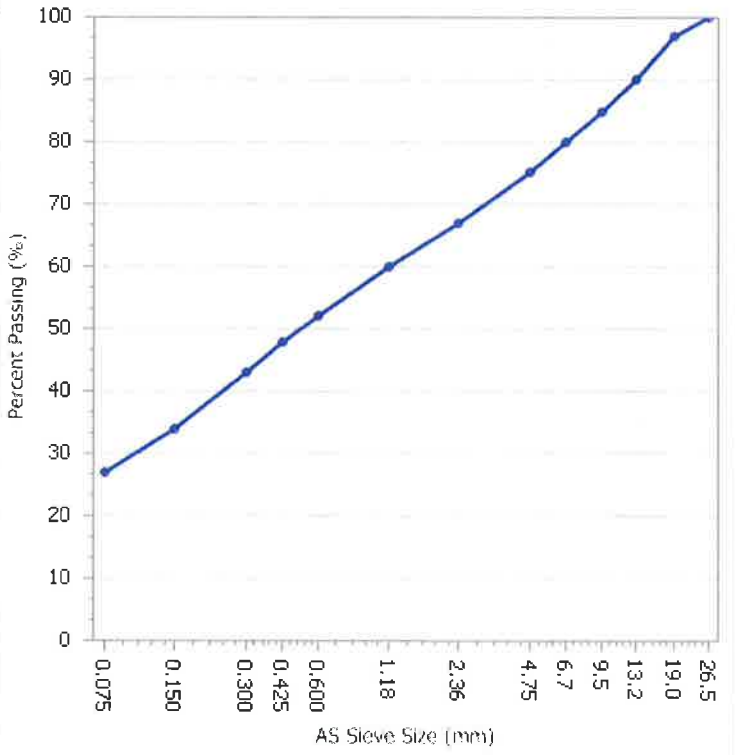
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10587-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 5 of 5

Test Procedures:	AS1289.3.6.1		
Sample Number	16822/S/39303	Sample Location	
Sampling Method	Tested As Received	Bore No.	TB15
Date Sampled	10/08/2017	Sample Type	Bulk
Sampled By	Client Sampled	Sample Depth m	0.1-0.3
Date Tested	29/08/2017		
Material Source	-	Material Type -	

AS Sieve (mm)	Specification Minimum	Percent Passing (%)	Specification Maximum
26.5		100	
19.0		97	
13.2		90	
9.5		85	
6.7		80	
4.75		75	
2.36		67	
1.18		60	
0.600		52	
0.425		48	
0.300		43	
0.150		34	
0.075		27	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks	Re-Issued Report Replaces Report No 16822/R/10587-1.

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Approved Signatory: Joseph Stallard
Form ID: W9Rep Rev 2

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CALIFORNIA BEARING RATIO REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10595-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 1 of 4

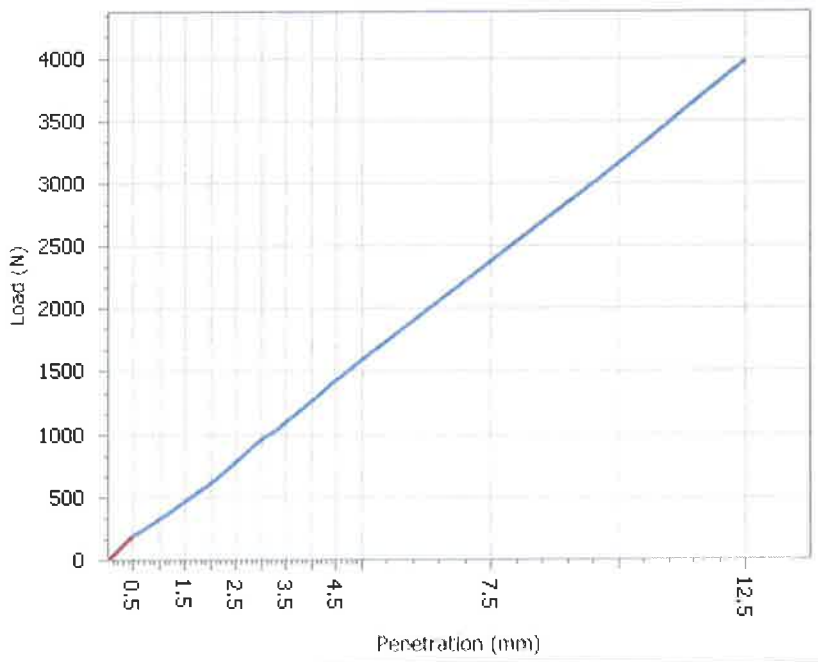
Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

		Sample Location		
Sample Number	16822/S/39299	Bore No.		TB07
Sampling Method	Tested As Received	Sample Type		Bulk
Date Sampled	10/08/2017	Sample Depth	m	0.6-0.8
Sampled By	Client Sampled			
Date Tested	8/09/2017			
Material Source	-	Material Limit Start		-
Material Type	-	Material Limit End		-
Client Reference	-	Compactive Effort		Standard

Material Description	Clayey Sandy SILT, brown grey mottled orange

Maximum Dry Density (t/m³):	1.90
Optimum Moisture Content (%):	13.0
Field Moisture Content (%):	15.8
Sample Percent Oversize (%)	6.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.90
Placement Dry Density Ratio (%):	100.0
Placement Moisture Content (%):	12.8
Placement Moisture Ratio (%):	98.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.91
Total Curing Time (hrs)	n/a
Liquid Limit Method	Estimation
Moisture (top 30mm) After Soak (%)	12.9
Moisture (remainder) After Soak (%)	12.7
CBR Swell (%):	-0.5
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**8**

CBR PENETRATION PLOT



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Email: Newcastle@constructionsciences.net

CALIFORNIA BEARING RATIO REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10595-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 2 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1
Sample Number	16822/S/39300
Sampling Method	Tested As Received
Date Sampled	10/08/2017
Sampled By	Client Sampled
Date Tested	8/09/2017
Material Source	-
Material Type	-
Client Reference	-

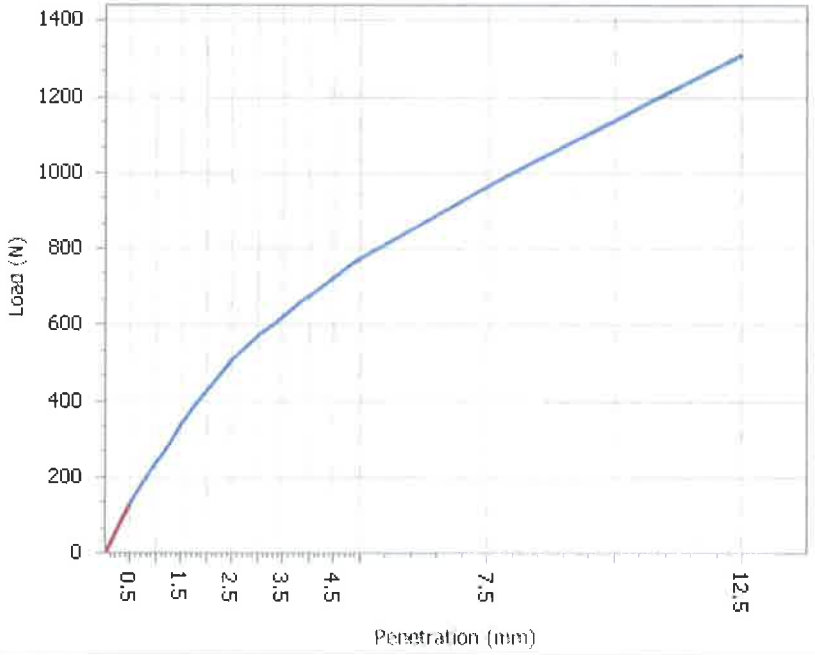
Sample Location		
Bore No.		TB08
Sample Type		Bulk
Sample Depth	m	0.7-0.9

Material Limit Start	-
Material Limit End	-
Compactive Effort	Standard

Material Description: Silty Sandy CLAY, light brown mottled orange

Maximum Dry Density (t/m³):	1.80
Optimum Moisture Content (%):	14.5
Field Moisture Content (%):	12.4
Sample Percent Oversize (%)	2.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.79
Placement Dry Density Ratio (%):	99.5
Placement Moisture Content (%):	14.3
Placement Moisture Ratio (%):	99.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.76
Total Curing Time (hrs)	n/a
Liquid Limit Method	Estimation
Moisture (top 30mm) After Soak (%)	19.8
Moisture (remainder) After Soak (%)	17.6
CBR Swell (%):	1.5
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**4.0**

CBR PENETRATION PLOT



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Email: Newcastle@constructionsciences.net

CALIFORNIA BEARING RATIO REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10595-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 3 of 4

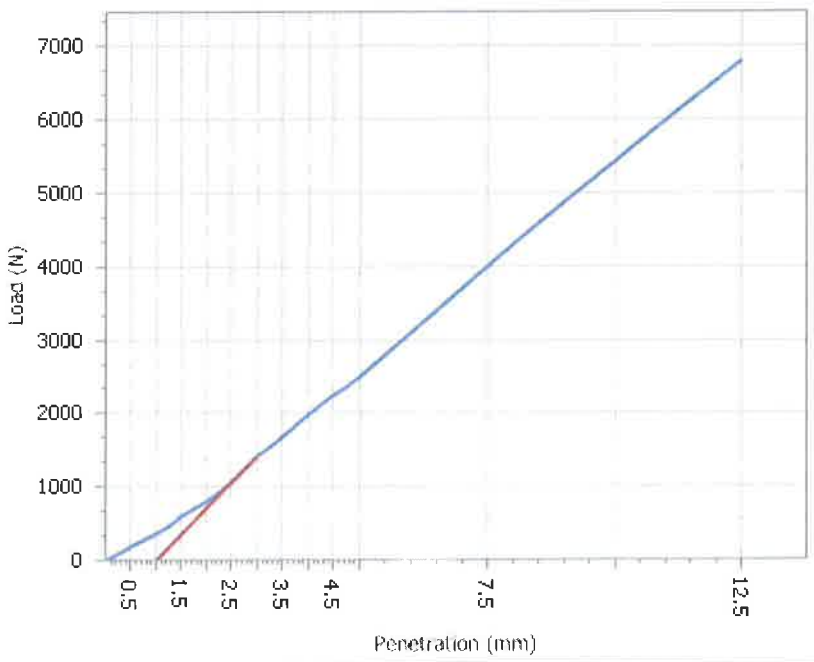
Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1

		Sample Location		
Sample Number	16822/S/39304	Bore No.		TB13
Sampling Method	Tested As Received	Sample Type		Bulk
Date Sampled	10/08/2017	Sample Depth	m	0.5-0.8
Sampled By	Client Sampled			
Date Tested	8/09/2017			
Material Source	-	Material Limit Start		-
Material Type	-	Material Limit End		-
Client Reference	-	Compactive Effort		Standard

Material Description	Clayey Sandy SILT, brown-grey

Maximum Dry Density (t/m³):	1.95
Optimum Moisture Content (%):	11.0
Field Moisture Content (%):	6.7
Sample Percent Oversize (%)	4.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.95
Placement Dry Density Ratio (%):	100.0
Placement Moisture Content (%):	11.2
Placement Moisture Ratio (%):	101.0
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.95
Total Curing Time (hrs)	n/a
Liquid Limit Method	Estimation
Moisture (top 30mm) After Soak (%)	11.5
Moisture (remainder) After Soak (%)	11.1
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**16**

CBR PENETRATION PLOT



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Email: Newcastle@constructionsciences.net

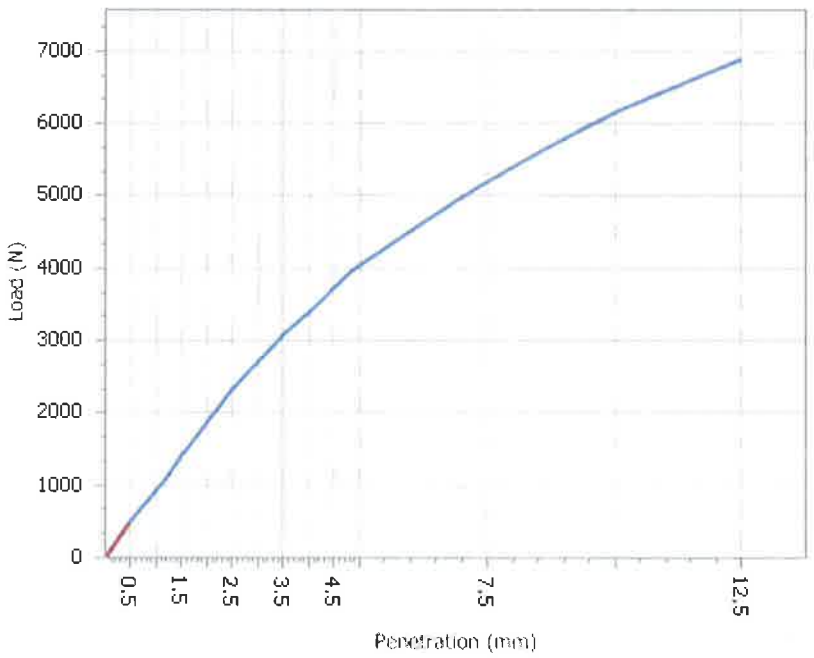
CALIFORNIA BEARING RATIO REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10595-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 4 of 4

Test Procedures	AS1289.6.1.1, AS1289.5.1.1, AS1289.2.1.1			
Sample Number	16822/S/39305	Sample Location		
Sampling Method	Tested As Received	Bore No.		TB13
Date Sampled	10/08/2017	Sample Type		Bulk
Sampled By	Client Sampled	Sample Depth	m	0.4-0.7
Date Tested	4/09/2017			
Material Source	-	Material Limit Start		-
Material Type	-	Material Limit End		-
Client Reference	-	Compactive Effort		Standard
Material Description	Clayey Sandy SILT, brown-grey			

Maximum Dry Density (t/m³):	1.93
Optimum Moisture Content (%):	11.0
Field Moisture Content (%):	6.7
Sample Percent Oversize (%)	2.0
Oversize Included / Excluded	Excluded
Target Density Ratio (%):	100
Target Moisture Ratio (%):	100
Placement Dry Density (t/m³):	1.93
Placement Dry Density Ratio (%):	100.0
Placement Moisture Content (%):	10.9
Placement Moisture Ratio (%):	97.5
Test Condition / Soaking Period:	Soaked / 4 Days
CBR Surcharge (kg)	4.5
Dry Density After Soak (t/m³):	1.92
Total Curing Time (hrs)	n/a
Liquid Limit Method	Estimation
Moisture (top 30mm) After Soak (%)	15.1
Moisture (remainder) After Soak (%)	12.0
CBR Swell (%):	0.0
Minimum CBR Specification (%):	-
CBR Value @ 5.0mm (%):	**20**

CBR PENETRATION PLOT



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ATTERBERG LIMITS REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10687-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 1 of 5

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1			
Sample Number	16822/S/39297	Sample Location		
Sampling Method	Tested As Received	Bore No.		TB03
Date Sampled	10/08/2017	Sample Type		Bulk
Sampled By	Client Sampled	Sample Depth	m	0.1-0.3
Date Tested	13/09/2017			
Att. Drying Method	Oven Dried	Material Source	-	
Atterberg Preparation	Dry Sieved	Material Type	-	
Material Description	Silty Gravelly SAND, brown			

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		21	
Plastic Limit (%)		14	
Plasticity Index (%)		7	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Re-Issued Report Replaces Report No 16822/R/10687-1.

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ATTERBERG LIMITS REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10687-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 2 of 5

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1			
Sample Number	16822/S/39298	Sample Location		
Sampling Method	Tested As Received	Bore No.		TB06
Date Sampled	10/08/2017	Sample Type		Bulk
Sampled By	Client Sampled	Sample Depth	m	0.0-0.2
Date Tested	13/09/2017			
Att. Drying Method	Oven Dried	Material Source	-	
Atterberg Preparation	Dry Sieved	Material Type	-	
Material Description	Silty Gravelly SAND			

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**18**	
Plastic Limit (%)		**15**	
Plasticity Index (%)		**3**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Re-Issued Report Replaces Report No 16822/R/10687-1.

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ATTERBERG LIMITS REPORT

Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10687-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 3 of 5

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1

Sample Number	16822/S/39301		Sample Location	
Sampling Method	Tested As Received	Bore No.		TB09
Date Sampled	10/08/2017	Sample Type		Bulk
Sampled By	Client Sampled	Sample Depth	m	0.0-0.3
Date Tested	13/09/2017			
Att. Drying Method	Oven Dried	Material Source	-	
Atterberg Preparation	Dry Sieved	Material Type	-	
Material Description	Silty Gravelly SAND, brown			

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**21**	
Plastic Limit (%)		**15**	
Plasticity Index (%)		**6**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

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Client:	Cardno (NSW/ACT) Pty Ltd	Report Number:	16822/R/10687-2
Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 4 of 5

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	16822/S/39302	Sample Location	
Sampling Method	Tested As Received	Bore No.	TB12
Date Sampled	10/08/2017	Sample Type	Bulk
Sampled By	Client Sampled	Sample Depth m	0.1-0.4
Date Tested	13/09/2017		
Att. Drying Method	Oven Dried	Material Source -	
Atterberg Preparation	Dry Sieved	Material Type -	
Material Description	Silty Sandy GRAVEL		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**22**	
Plastic Limit (%)		**14**	
Plasticity Index (%)		**8**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

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Client Address:	1/10 Denney Street, Broadmeadow	Project Number:	16822/P/77
Project:	East Seaham Rd Stage 5, Pavement Investigation	Lot Number:	
Location:	1/10 Denney Street Broadmeadow	Internal Test Request:	16822/T/8403
Component:		Client Reference/s:	82218013
Area Description:		Report Date / Page:	15/09/2017 Page 5 of 5

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	16822/S/39303	Sample Location	
Sampling Method	Tested As Received	Bore No.	TB15
Date Sampled	10/08/2017	Sample Type	Bulk
Sampled By	Client Sampled	Sample Depth m	0.1-0.3
Date Tested	13/09/2017		
Att. Drying Method	Oven Dried	Material Source	-
Atterberg Preparation	Dry Sieved	Material Type	-
Material Description	Silty Gravelly SAND, brown		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		22	
Plastic Limit (%)		14	
Plasticity Index (%)		8	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Re-Issued Report Replaces Report No 16822/R/10687-1.

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East Seaham Road, Stage 5
East Seaham

APPENDIX

D

DESIGN TRAFFIC CALCULATION

Cardno
Shaping the Future

Design Traffic Calculation

Client: Port Stephens Council
Project Reference: 82218013
Project Name: East Seaham Road
Road Section: Stage 5
Location: East Seaham

Traffic Information	
Annual Average Daily Traffic (AADT)	561 vehicles/day
Direction Factor	0.5
Percentage Heavy Vehicles	11.0 %
Lane Distribution Factor	1.00
Traffic Loading	
Number of Axle Groups per Heavy Vehicle (N_{HVAG})	2.5
Traffic Load Distribution	AGPT02-12 Example TLD
Design Life	
Design Period	30 years
Heavy Vehicle Growth Rate	2.0% p.a.

Design Traffic	
Cumulative Heavy Vehicle Axle Groups (HVAG)	**1.14E+06**
Average number of ESA per Heavy Vehicle Axle Group (ESA/HVAG)	0.70
Design number of Equivalent Standard Axles (DESA)	**8.00E+05**
Standard Axle Repetitions per ESA for damage type k (SARk/ESA)	
Fatigue of asphalt: SAR_a/ESA	1.1
Rutting and shape loss (subgrade strain): SAR_s/ESA	1.6
Fatigue of cemented materials: SAR_c/ESA	12
Design number of Standard Axle Repetitions for damage type k (DSARk)	
Fatigue of asphalt: $DSAR_a$	8.80E+05
Rutting and shape loss (subgrade strain): $DSAR_s$	1.28E+06
Fatigue of cemented materials: $DSAR_c$	9.60E+06

Calculated by: IG
Checked by: DGS
Date: 16/5/2017

Activity/ Procedure	Comprehensive Koala Plan of Management Performance Criteria Assessment			
Procedure No.	DRAFT	**Revision**	1	21/07/2023
Prepared by	Natalie Nowlan – Project Support Environmental Officer			
Valid to	01/07/2024 or applicable statutory/ guideline updates			
Approved by	DRAFT			
Next Review Date	01/06/2024			

1. Notification

Trigger	Capital Works Project Environmental Assessment	
Purpose	Activities if carried out may result in negative environmental impacts including impacts on the koala population. Without appropriate consideration and implementation of appropriate environmental mitigation measures a negative health and environmental impact may occur. This form has been prepared to help determine the appropriate environmental mitigation measures for the proposed activity to help prevent or minimise health and environmental harm to koalas.	
Scope	The scope of this list form is limited to providing recommendations for the subject site and proposed activity only. It is the objective of this form to provide actions and advice to help minimise the proposed activity from causing environmental harm, specifically impacts to koalas. The impact assessment is based on the performance criteria identified in Appendix 4 of the Port Stephens Council Comprehensive Koala Plan of Management 2002.	
Action	Conduct an assessment of proposed activity and possible impact on koalas and their habitat to determine whether the proposed activity is consistent with the principles of the Port Stephens Comprehensive Koala Plan of Management.	Project Support Environment Officer
Action	Include impacts identified in the Environmental Assessment.	Project Support Environment Officer
Guidance	Port Stephens Council Comprehensive Koala Plan of Management 2002	
Check	Where inconsistency exists with the Port Stephens Comprehensive Koala Plan of Management revise proposed action to reduce impacts and ensure works are consistent with the principles of the Port Stephens Comprehensive Koala Plan of Management.	

2. Project

East Seaham Road Guard Rail

3. Assessment

a. Minimise the removal or degradation of native vegetation within Preferred Koala Habitat or Habitat Buffers.

The works will not involve the removal or degradation of native vegetation within Preferred Koala Habitat.

b. Maximise retention and minimise degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas.
The works will not involve the removal or degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas.
c. Minimise the removal of any individuals of preferred koala food trees, where ever they occur on a development site. In the Port Stephens LGA these tree species are Swamp Mahogany (Eucalyptus robusta), Parramatta Red Gum (Eucalyptus parramattensis), and Forest Red Gum (Eucalyptus tereticornis), and hybrids of any of these species. An additional list of tree species that may be important to koalas based on anecdotal evidence is included in Appendix 8.
No koala feed trees will be removed as a result of the works.
d. Make provision, where appropriate, for restoration or rehabilitation of areas identified as Koala Habitat including Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land. In instances where Council approves the removal of koala habitat (in accordance with dot points 1-4 of the above waive clause), and where circumstances permit, this is to include measures which result in a "net gain" of koala habitat on the site and/or adjacent land.
There is no provision for the restoration or rehabilitation of areas identified as Koala Habitat proposed as part of the works due to no clearing of koala habitat occurring.
e. Make provision for long term management and protection of koala habitat including both existing and restored habitat.
Council has a Comprehensive Koala Plan of Management which includes actions to provide for the long term management and protection of koala habitat. The site will be managed in accordance with the Plan of Management. Council's Environmental Operations Team has a proactive weed control program that occurs throughout the PS LGA. The site would be managed in accordance with the provisions of this program.
f. Not compromise the potential for safe movement of koalas across the site. This should include maximising tree retention generally and minimising the likelihood that the proposal would result in the creation of barriers to koala movement, such as would be imposed by certain types of fencing. The preferred option for minimising restrictions to safe koala movement is that there be no fencing (of a sort that would preclude koalas) associated with dog free developments within or adjacent to Preferred or Supplementary Koala Habitat, Habitat Buffers or Habitat Linking Areas. Suitable fencing for such areas could include: **i. fences where the bottom of the fence is a minimum of 200 mm above ground level that would allow koalas to move underneath;** **ii. fences that facilitate easy climbing by koalas; for example, sturdy chain mesh fences, or solid style fences with timber posts on both sides at regular intervals of approximately 20m; or** **iii. open post and rail or post and wire (definitely not barbed wire on the bottom strand).** **iv. be restricted to identified envelopes which contain all buildings and infrastructure and fire fuel reduction zone. Generally there will be no clearing on the site outside these envelopes. In the case of applications for subdivision, such envelopes should be registered as a restriction on the title, pursuant to the Conveyancing Act 1919**
No tree removal is occurring as part of the proposed works
Guardrail will be installed, the base rail is of a height which would not inhibit the movement of koalas underneath.
g. Include measures to effectively minimise the threat posed to koalas by dogs, motor vehicles and swimming pools by adopting the following minimum standards. **i. The development must include measures that effectively abate the threat posed to koalas by dogs through prohibitions or restrictions on dog ownership. Restrictions on title may be appropriate.** **ii. The development must include measures that effectively minimise the threat posed to koalas from traffic by restricting motor vehicle speeds, where appropriate, to 40 kph or less.** **The development must reduce the risk of koala mortality by drowning in backyard swimming pools. Appropriate measures could include: trailing a length of stout rope (minimum diameter of 50mm), which is secured to a stable poolside fixture, in the swimming pool at all times; designing the pool in such a way that koalas can readily escape; or enclosing the pool with a fence that precludes koalas. This last option should include locating the fence away from any trees which koalas could use to cross the fence.**

The proposed works do not include the introduction of dogs onto the site and do not include the construction or modification of swimming pools. No swimming pools currently exist onsite. The works will not change the use of the site and will not result in an increase in patronage to the site. The speed limit during works will be reduced to 40kmph however, once works are complete the existing speed limit will be reinstated.

4. Date	
Date	02/06/2024

5. Completed By	
Name	Natalie Nowlan
Position	Project Support Environmental Officer

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. Please see the caveat for interpretation of information provided here.

Report created: 02-Jun-2024

Summary

Matters of National Environment 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 (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	47
Listed Migratory Species:	15

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	2
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Hunter estuary wetlands	10 - 20km upstream from Ramsar site	In feature area

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area	In feature area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area	In feature area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community may occur within area	In feature area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area	In feature area
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anthochaera phrygia			
Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Botaurus poiciloptilus](#) Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Callocephalon fimbriatum](#) Gang-gang Cockatoo [768]	Endangered	Species or species habitat likely to occur within area	In feature area
[Calyptorhynchus lathami lathami](#) South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
[Climacteris picumnus victoriae](#) Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Erythrotriorchis radiatus](#) Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
[Falco hypoleucos](#) Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Grantiella picta](#) Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hirundapus caudacutus			
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor			
Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Melanodryas cucullata cucullata			
South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat may occur within area	In feature area
Neophema chrysostoma			
Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pycnoptilus floccosus			
Pilotbird [525]	Vulnerable	Species or species habitat may occur within area	In feature area
Rostratula australis			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Stagonopleura guttata			
Diamond Firetail [59398]	Vulnerable	Species or species habitat likely to occur within area	In feature area
FROG			
Litoria aurea			
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area	In feature area
Mixophyes balbus			
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
Chalinolobus dwyeri			
Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Dasyurus maculatus maculatus (SE mainland population)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area	In feature area
Notamacropus parma			
Parma Wallaby [89289]	Vulnerable	Species or species habitat may occur within area	In feature area
Petauroides volans			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area	In feature area
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In feature 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]	Endangered	Species or species habitat known to occur within area	In feature area
Potorous tridactylus tridactylus			
Long-nosed Potoroo (northern) [66645]	Vulnerable	Species or species habitat may occur within area	In feature area
Pseudomys novaehollandiae			
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
PLANT			
Arthraxon hispidus			
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area	In feature area
Asperula asthenes			
Trailing Woodruff [14004]	Vulnerable	Species or species habitat may occur within area	In feature area
Caladenia tessellata			
Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area	In feature area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area	In feature area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area	In feature area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In feature area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat may occur within area	In feature area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Tetratheca juncea](#) Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Thesium australe](#) Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
[Cuculus optatus](#) Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat likely to occur within area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat likely to occur within area	In feature area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat likely to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area overfly marine area	In feature area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Sterna striata White-fronted Tern [799]		Migration route may occur within area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State	Buffer Status
North East NSW RFA	New South Wales	In feature area

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Gloucester Coal Seam Methane Gas Project	2008/4432	Controlled Action	Post-Approval	In feature area
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species
Report generated on 11/06/2024 8:47 PM

Kingdom	Class	Scientific Name	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	*Crinia tinnula*	Wallum Froglet	V,P		32	
Animalia	Amphibia	*Uperoleia mahonyi*	Mahony's Toadlet	E1,P	E	30	
Animalia	Reptilia	*Caretta caretta*	Loggerhead Turtle	E1,P	E	11	
Animalia	Reptilia	*Chelonia mydas*	Green Turtle	V,P	V	50	
Animalia	Reptilia	*Eretmochelys imbricata*	Hawksbill Turtle	P	V	2	
Animalia	Reptilia	*Hoplocephalus stephensii*	Stephens' Banded Snake	V,P		1	
Animalia	Aves	*Dromaius novaehollandiae*	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		2	
Animalia	Aves	*Ptilinopus magnificus*	Wompoo Fruit-Dove	V,P		2	
Animalia	Aves	*Apus pacificus*	Fork-tailed Swift	P	C,J,K	1	
Animalia	Aves	*Ardenna grisea*	Sooty Shearwater	P	J	2	
Animalia	Aves	*Ardenna pacifica*	Wedge-tailed Shearwater	P	J	17	
Animalia	Aves	*Ardenna tenuirostris*	Short-tailed Shearwater	P	C,J,K	49	
Animalia	Aves	*Macronectes giganteus*	Southern Giant Petrel	E1,P	E	1	
Animalia	Aves	*Macronectes halli*	Northern Giant-Petrel	V,P	V	1	
Animalia	Aves	*Pterodroma leucoptera leucoptera*	Gould's Petrel	V,P	E	4	
Animalia	Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P		114	
Animalia	Aves	*^^Pandion cristatus*	Eastern Osprey	V,P,3		9	
Animalia	Aves	*Burhinus grallarius*	Bush Stone-curlew	E1,P		2	
Animalia	Aves	*Esacus magnirostris*	Beach Stone-curlew	E4A,P		2	
Animalia	Aves	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		24	
Animalia	Aves	*Haematopus longirostris*	Pied Oystercatcher	E1,P		10	
Animalia	Aves	*Charadrius leschenaultii*	Greater Sand-plover	V,P	V,C,J,K	1	
Animalia	Aves	*Calidris alba*	Sanderling	V,P	C,J,K	1	
Animalia	Aves	*Calidris ruficollis*	Red-necked Stint	P	C,J,K	1	
Animalia	Aves	*Limosa lapponica*	Bar-tailed Godwit	P	C,J,K	8	
Animalia	Aves	*Limosa limosa*	Black-tailed Godwit	V,P	E,C,J,K	1	
Animalia	Aves	*Numenius madagascariensis*	Eastern Curlew	P	CE,C,J,K	7	
Animalia	Aves	*Numenius phaeopus*	Whimbrel	P	C,J,K	5	
Animalia	Aves	*Tringa brevipes*	Grey-tailed Tattler	P	C,J,K	1	
Animalia	Aves	*Xenus cinereus*	Terek Sandpiper	V,P	V,C,J,K	1	
Animalia	Aves	*Stercorarius parasiticus*	Arctic Jaeger	P	C,J,K	3	
Animalia	Aves	*Stercorarius pomarinus*	Pomarine Jaeger	P	C,J,K	1	
Animalia	Aves	*Gelochelidon nilotica*	Gull-billed Tern	P	C	2	
Animalia	Aves	*Hydroprogne caspia*	Caspian Tern	P	J	5	
Animalia	Aves	*Onychoprion fuscata*	Sooty Tern	V,P		1	

Animalia	Aves	*Sterna hirundo*	Common Tern	P	C,J,K	1
Animalia	Aves	*Sternula albifrons*	Little Tern	E1,P	C,J,K	9
Animalia	Aves	*Thalasseus bergii*	Crested Tern	P	J	38
Animalia	Aves	*^^Callocephalon fimbriatum*	Gang-gang Cockatoo	E1,P,3	E	3
Animalia	Aves	*^Calyptorhynchus lathami lathami*	South-eastern Glossy Black-Cockatoo	V,P,2	V	3
Animalia	Aves	*Glossopsitta pusilla*	Little Lorikeet	V,P		3
Animalia	Aves	*Lathamus discolor*	Swift Parrot	E1,P	CE	2
Animalia	Aves	*^^Ninox strenua*	Powerful Owl	V,P,3		10
Animalia	Aves	*^^Tyto longimembris*	Eastern Grass Owl	V,P,3		1
Animalia	Aves	*^^Tyto novaehollandiae*	Masked Owl	V,P,3		3
Animalia	Aves	*Daphoenositta chrysoptera*	Varied Sittella	V,P		2
Animalia	Aves	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		2
Animalia	Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	2
Animalia	Mammalia	*Phascolarctos cinereus*	Koala	E1,P	E	3448
Animalia	Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V,P		12
Animalia	Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	15
Animalia	Mammalia	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		1
Animalia	Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V,P		1
Animalia	Mammalia	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	E	1
Animalia	Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		2
Animalia	Mammalia	*Miniopterus australis*	Little Bent-winged Bat	V,P		16
Animalia	Mammalia	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V,P		3
Animalia	Mammalia	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	37
Animalia	Mammalia	*Dugong dugon*	Dugong	E1,P		6
Animalia	Mammalia	*Eubalaena australis*	Southern Right Whale	E1,P	E	2
Animalia	Mammalia	*Physeter macrocephalus*	Sperm Whale	V,P		1
Plantae	Flora	*Senecio spathulatus*	Coast Groundsel	E1		1
Plantae	Flora	*Chamaesyce psammogeton*	Sand Spurge	E1		3
Plantae	Flora	*Prostanthera densa*	Villous Mint-bush	V	V	128
Plantae	Flora	*^^Callistemon linearifolius*	Netted Bottle Brush	V,3		7

Plantae	Flora	*Melaleuca groveana*	Grove's Paperbark	V		17
Plantae	Flora	*Syzygium paniculatum*	Magenta Lilly Pilly	E1	V	11
Plantae	Flora	*^Cryptostylis hunteriana*	Leafless Tongue Orchid	V,P,2	V	12
Plantae	Flora	*^Diuris arenaria*	Sand Doubletail	E1,P,2		4390
Plantae	Flora	*^Diuris praecox*	Rough Doubletail	V,P,2	V	2

Activity/ Procedure	Unexpected Finds Procedures			
Procedure no.	DRAFT	**Revision**	2	10/07/2023
Prepared by	Project Support Environment Officer – Natalie Nowlan			
Valid to	01/07/2024 or applicable statutory/ guideline updates			
Approved by	DRAFT			
Next Review Date	01/06/2024			

1. Notification

Trigger	Unexpected find of land contamination, acid sulfate soils, groundwater, asbestos, Aboriginal and non-Aboriginal heritage, native and threatened fauna, threatened flora and priority weeds during construction of the proposed activity.	
Purpose	Whilst all efforts are made whilst assessing the impacts of a project in the development of the Environmental Assessment, unexpected finds during construction may occur. Unexpected finds may include land contamination, acid sulfate soils, groundwater, asbestos, Aboriginal and non-Aboriginal heritage, native and threatened fauna, threatened flora and priority weeds. This procedure will ensure that in the event of any unexpected finds, potential impacts are avoided and minimised.	
Scope	The scope of this procedure is limited to the items stated only and providing recommendations for the subject site and proposed activity only. These procedures contain advice to help minimise the proposed activity from causing environmental harm.	
Action	In the event of an unexpected find of land contamination, acid sulfate soils, groundwater, asbestos, Aboriginal and non-Aboriginal heritage, native and threatened fauna, threatened flora and priority weeds, follow the applicable steps identified in this procedure.	Construction personnel Project Manager Project Support Environment Officer
Action	Undertake actions as recommended by technical advice (contractor, consultant, agency or internal staff).	Construction personnel Project Manager
Guidance	This procedure has included as part of the requirements for the proposed activity based on the potential impacts identified in the Environmental Assessment.	
Check	N/A	

2. Procedures

2.1. Contamination

1. Notify Site Team Leader.

2.	Team Leader notifies the Project Manager and EMS Manager.
3.	Project Manager to engage a Certified Environmental Practitioner (Site Contamination) by the Environment Institute of Australia and New Zealand or a certified Professional Soil Scientist Contaminated Site Assessment and Management by Soil Science Australia.
4.	Consultant undertakes assessment in accordance with the Consultants reporting on contaminated land: Contaminated Land Guidelines (April, 2020).
5.	Excavations within vicinity of the find do not recommence until the extent of the contamination has been assessed as advised by the consultant.
6.	Any necessary controls implemented as advised by the environmental consultant.
7.	Where material is removed, classify and dispose of the material in accordance with the NSW Waste Classification Guidelines (2014) under advice of the environmental consultant.

2.2. Acid Sulphate Soils

1.	Notify Site Team Leader.
2.	Team Leader notifies Project Manager and EMS Manager.
3.	Project Manager to engage a Geotechnical Engineer with experience in dealing with acid sulphate soils.
4.	Consultant undertakes assessment in accordance with the NSW Acid Sulfate Soils Manual (1998) and National Acid Sulfate Soil Guidelines (June, 2018) which includes: • National acid sulfate soils sampling and identification methods manual (June, 2018). • Guidance for dewatering of acid sulfate soils in shallow groundwater environments (June, 2018). • Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management (June, 2018). • Overview and management of monosulfidic black ooze accumulations in waterways and wetlands (June, 2018).
5.	Excavations within vicinity of the find do not recommence until the extent of the acid sulphate soil has been assessed as advised by the consultant.
6.	Any necessary controls implemented as advised by the consultant.
7.	Where material is removed, classify and dispose of the material in accordance with the NSW Waste Classification Guidelines (2014) under advice of the environmental consultant.

2.3. Groundwater

1.	Notify Site Team Leader.
2.	Team Leader notifies Project Manager and EMS Manager.
3.	Project Manager to engage a suitably qualified and experienced consultant to develop a dewatering plan in accordance with the Environmental Management of Construction Dewatering Technical Guidelines (NSW RTA, 2 April 2011).
4.	Appropriate licencing sought, where required, from NSW Department of Primary Industries Water.
5.	Consultant develops dewatering plan in accordance with Environmental Management of Construction Dewatering Technical Guidelines (NSW RTA, 2 April 2011). The dewatering plan must be approved by the Senior Environmental Planner prior to works recommencing.
6.	Excavations within vicinity of the find will not recommence until the dewatering plan has been approved.

7.	Any necessary controls implemented in accordance with the approved dewatering plan and as advised by the environmental consultant and in accordance with any permits or approvals.

2.4. Asbestos

1.	Cordon off the area.
2.	Notify Site Team Leader.
3.	Team Leader notifies Project Manager and EMS Manager.
4.	Further activities to be undertaken in accordance with the Safe Work Method Statement for Asbestos Identification and Removal in Public Amenities and Public Space and Code of Practice for the Safe Removal of Asbestos (National Occupational Health and Safety Commission, 2005).

2.5. Aboriginal Heritage

1.	Notify Site Team Leader.
2.	Team Leader notifies Project Manager and EMS Manager.
3.	If human skeletal remains are identified the Project Manager must contact NSW local Police to receive an initial assessment as to whether the remains are part of a crime scene or possible Aboriginal remains. If non-skeletal object/s or police determine the skeletal remains are Aboriginal proceed to Step 5.
4.	Project Manager to notify Heritage NSW via the Enviroline 131 555 and applicable Local Aboriginal Land Council.
5.	Project Manager to engage a suitably qualified and experienced Archaeologist to ensure the site is adequately assessed and managed. If an Aboriginal Cultural Heritage Assessment is recommended, it must be prepared in accordance with the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales (Heritage NSW), Code of Practice for Archaeological Investigation in NSW (Heritage NSW) and Aboriginal Cultural Heritage Consultation Requirements for Proponents (Heritage NSW). If the activity will directly or indirectly harm an Aboriginal object or declared Aboriginal Place an Aboriginal Heritage Impact Permit is required. The application must include an Aboriginal Cultural Heritage Assessment, completed Aboriginal Cultural Heritage Assessment Report Cover Sheet (Heritage, NSW) and AHIP application form (Heritage, NSW).
6.	Any necessary controls implemented as advised by the consulting archaeologist and/ or in accordance with the AHIP where required.

2.6. Non-Indigenous Heritage

1.	Notify Site Team Leader.
2.	Team Leader notifies Project Manager and EMS Manager.
3.	Project Manager to notify Heritage NSW in accordance with Section 146 of the *NSW Heritage Act 1977* (as amended).
4.	The archaeological relic must be avoided. If it is not practical to avoid the relic the Project Manager is to engage a suitably qualified and experienced consultant to ensure the site is adequately managed and assessed. If an Archaeological Assessment is recommended, it must be prepared in accordance with Assessing Significance for Historical Archaeological Sites and Relics (NSW Heritage) and any relevant existing Heritage Council of NSW Policy and Guidelines. If the activity will directly or indirectly impact a heritage item a section 60 works approval or excavation permit may be required. A section 60 works approval under section 60 of the *NSW Heritage Act 1977* must be submitted using a section 60 fast track application form (Heritage NSW) or works application form (Heritage NSW). An excavation permit under section 151 of the *NSW Heritage Act 1977* must be submitted using an Excavation Permit Application Form (Heritage NSW).
5.	Any necessary controls implemented as advised by the consulting archaeologist and/ or in accordance with the section 60 works approval or excavation permit where required.

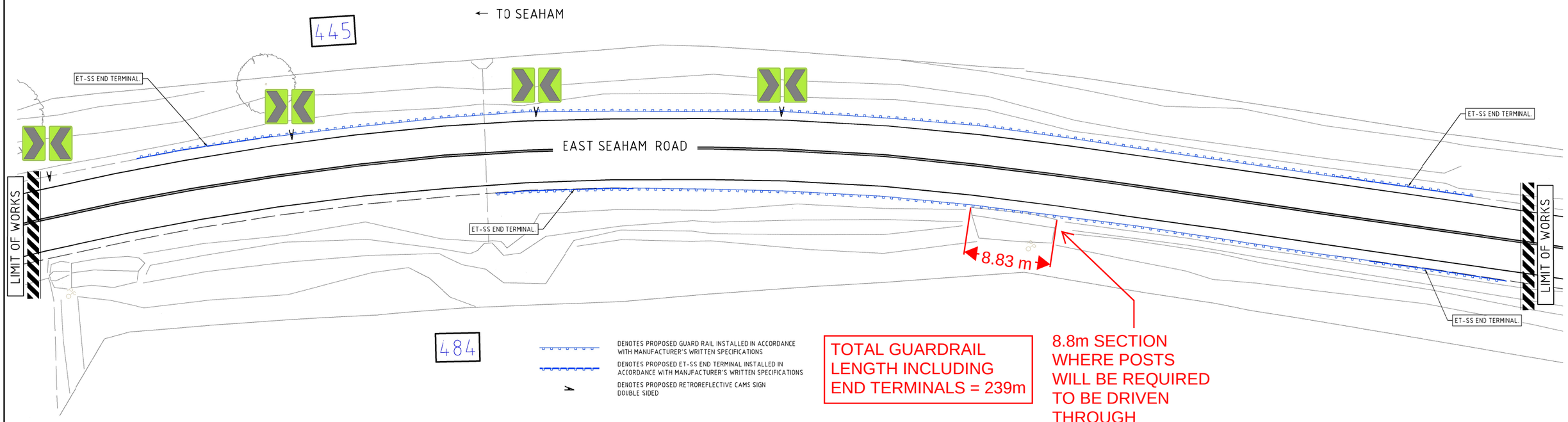
2.7. Native and Threatened Fauna	
1. Notify Site Team Leader.	
2. If fauna are passing through the site, stop works within 100 m of the fauna and allow fauna to move through the site without undue duress or harassment.	
3. If the fauna is not passing through the site, Team Leader notifies Project Manager and the Project Manager notifies the Environmental Risk Officer or Project Support Environmental Officer.	
4. If any injured fauna are present, they must be cared for. Injured fauna should be taken to the veterinary clinic. Contact native wildlife carer to come and transport the fauna to medical care.	
Non-threatened species	*Threatened species*
5. Agitate tree or nearby vegetation to encourage fauna to vacate (if fauna poses no threat to human safety).	Issue a 48 hour stop work order and allow fauna to vacate.
6. If not vacating Project Manager to engage suitably qualified and licenced fauna spotter/ catcher or contact a native wildlife carer to relocate fauna (contact native wildlife carer for juveniles. The ability for the parents to continue to care for the juvenile fauna should be considered). Hunter Wildlife Rescue 24 hour emergency hotline 0418 628 483. Port Stephens Koalas 1800 775 625 (1800 PS KOALAS)	If not vacated within 48 hours contact NSW Biodiversity Conservation Division for further advice.
7. Relocate fauna captured and not requiring treatment into the same habitat near the point of rescue at dusk or leave inside the removed hollow outside the works area.	Implement actions in accordance with advice of NSW Biodiversity Conservation Division.
8. Record all findings and email to Environmental Risk Officer and Project Support Environmental Officer and resume works.	

2.8. Threatened Flora	
1. Notify Site Team Leader.	
2. Team Leader notifies Project Manager and the Project Manager notifies the Environmental Risk Officer or Project Support Environmental Officer.	
3. The area where the threatened flora species occur must be avoided and roped off with stake and string and fluro ties or other suitable exclusion fencing alternative.	
4. Project Manager to engage a suitably qualified and experienced ecological consultant to undertake targeted survey if required or	
5. PM to provide Environmental Risk Officer and Project Support Environment Officer targeted survey findings.	
6. Project Support Environment Officer to provide technical advice based on avoid, mitigate and offset approach and develop an Environmental Assessment Amendment and include or revise any Tests of Significance or Assessments of Significance as required under *NSW Biodiversity Conservation Act 2016* and *Commonwealth Environment Protection Biodiversity Conservation Act 1999*. Advice to be provided to avoid significant impact.	
Significant impact unlikely	*Significant impact likely.*
7. PM to arrange sign off of Environmental Assessment Amendment.	Project Manager to liaise with NSW Biodiversity Conservation Division for further advice.

8.	Works to proceed based on advice provided by Project Support Environment Officer in Environmental Assessment Amendment.	Advice from NSW Biodiversity Conservation Division implemented.

2.9. Priority Weeds

1.	Notify Site Team Leader.
2.	Team Leader notifies Project Manager.
3.	Project Manager notifies Environmental Operations Team Leader.
4.	Further activities to be undertaken in accordance with the advice provided by the Environmental Operational Team Leader and/ or Invasive Species Planner to ensure compliance with the *NSW Biosecurity Act 2015*.



TOTAL GUARDRAIL LENGTH INCLUDING END TERMINALS = 239m

8.8m SECTION WHERE POSTS WILL BE REQUIRED TO BE DRIVEN THROUGH SHOTCRETE

SIGNPOSTING

1. ALL SIGNPOSTING TO BE IN ACCORDANCE WITH THE RMS DELINEATION GUIDELINES AND AS1743 ROAD SIGN SPECIFICATION.
2. SIGNS TO CONFORM TO RMS SPECIFICATION R143 - SIGNPOSTING AND RMS QA SPECIFICATION 3400 - MANUFACTURE AND DELIVERY OF ROAD SIGNS.
3. ALL SIGNS TO BE SIZE 'B' UNLESS OTHERWISE NOTED.
4. ALL EXISTING SIGNS TO BE RELOCATED / RETAINED, SHOULD BE LOCATED TO PROVIDE A MIN 600mm LATERAL CLEARANCE BETWEEN EDGE OF SIGN AND FACE OF KERB, AND A MIN 300mm FROM ANY PROPERTY BOUNDARY.
5. ALL SIGN BACKGROUNDS AND LEGEND TO BE CLASS 1 REFLECTIVE USING COLOUR AND GRADE CONFORMING TO RMS 3400, AS1743 AND AS/NZS 1906.1.
6. SIGN LOCATIONS ARE INDICATIVE ONLY AND ARE TO BE CONFIRMED ON SITE.

SIGN SCHEDULE

SIGN	SIZE	STYLE	PROJECT QUANTITY
CURVE ALIGNMENT MARKER - REFLECTIVE YELLOW D4-6	A		8

AZIMUTH : MGA
DATUM. : AHD

SURVEY : T.N
DESIGNED : D.L
CHECKED : D.L

Scales @ A1

PLANS 1:200 0 2 4 6 8 10m

DIMENSIONS AND SETTING OUT, REDUCED LEVELS AND CHAINAGES ARE IN METRES, ALL OTHER DIMENSIONS ARE IN MILLIMETRES. SETOUT DIMENSIONS ON THE DRAWINGS SHALL BE VERIFIED ON SITE. DIMENSIONS SHALL NOT BE OBTAINED BY SCALING THE DRAWINGS.

Date	Amendment	Rev	Officer
14.07.2023	ISSUED FOR TRAFFIC COMMITTEE APPROVAL	A	DL

PORT STEPHENS COUNCIL

Project: W12575 - EAST SEAHAM ROAD - STAGE 5.1 & 5.3 GUARDRAIL AND LINEMARKING WORKS EAST SEAHAM

Drawing Title: STAGE 5.1 - GUARDRAIL PLAN SHEET 1 OF 1

EDRMS No:

FOR APPROVAL

Revision: A
Sheet No: 01
Date: 14.07.2023
Sheet Size: A1

D:\A1 - Design\W12575\5.1\W12575 - GUARDRAIL AND BB1 - 5.1.dwg PLOT DATE: 14.07.2023