Review of Environmental Factors

Currowan Creek Crossing Upgrade

Shoalhaven City Council

Prepared by: Caitlin Battersby

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Note: Sensitive Aboriginal Heritage Information has been redacted from this report.

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Executive Summary

The environmental assessment and determination of the proposal have been undertaken in accordance with Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). For this proposal, Shoalhaven City Council (SCC) acts as both the public authority proponent (EP&A Act s5.3) and the determining authority (EP&A Act s5.1). The REF has been prepared in accordance with Section 171 of the EP&A Regulation (2021) and the Guidelines for Division 5.1 Assessments.

The proposed works are for the design and construction of a concrete bridge to replace an existing culvert crossing, in which East Coast Civil Construction have been engaged to undertake . The site of the existing culvert and proposed bridge is located on Western Distributor Road, and crosses Currowan Creek, Currowan.

The site is classified under the Great Soil Group (GSG) as less fertile Yellow Podzolic Soils and under the Australian Soil Classification (ASC) as Kurosols. Testing was undertaken to determine the risk of acid sulphate soils and level of pH being present. The levels of sulphates and pH determined are negligible. Soil salinity is not considered a risk, and erosion from the works are within reasonable extent. The site is not mapped as contaminated land.

Currowan Creek flows northeast through the site, joining the Clyde River about 10 km east of the activity area. It is a level 6 watercourse approximately 53 km long, with a width of 4 m at the site and situated 1 m below the current culvert deck. NSW Fisheries has mapped this area as Australian Grayling habitat, marking it as sensitive. The existing culvert, identified by NSW Fisheries as a barrier to fish passage, will be replaced with a bridge to improve hydrology. All work will occur within the already disturbed footprint, with the creek bed reinstated to its natural condition. The new bridge, positioned above water level, will improve water flow.

The works are located within vegetation mapped as PCT 3188 - South Coast River flat Peppermint Forest, which relates to the Threatened Ecological Community (TEC) River-flat eucalypt forest on coastal floodplains under both the BC and EPBC Acts. Vegetation removal for bridge construction will be minimized, prioritizing tree retention. Any removal on the northwestern side will be documented to limit impacts. A 7-Part Test concluded that the works are unlikely to have lasting effects on the TEC, with no extensive clearing or long-term impacts expected

A desktop biodiversity assessment identified 12 threatened flora species and 39 threatened fauna species within a 5 km radius of the site. Although suitable habitat for 9 flora species was present, an on-site survey confirmed no individuals within the project area, with alternative, more suitable habitats nearby. Of the 39 fauna species, 18 were considered likely to occur on-site, but 6 highly mobile bird species were determined to be transient, requiring no further assessment. A significance test for the remaining 12 fauna species concluded that the proposed bridge replacement is unlikely to adversely impact them. Considering the limited vegetation removal, altered road reserve conditions, and extensive suitable habitats nearby, the works are unlikely to impact any threatened species.

Currowan Creek, designated as Key Fish Habitat with "Fair" Fish Community Status, provides critical habitat for the threatened Australian Grayling (Prototroctes maraena), confirmed by NSW Fisheries mapping. To protect this species, in-stream construction will be restricted to a planned 8-week period outside of its migration and spawning seasons (end of March to early July and early September to end of December). Sediment and erosion control measures will be implemented to maintain habitat quality. An Assessment of Significance (see Appendix B) concludes that the project will not adversely impact the species. By replacing a culvert with a bridge, the works will improve fish passage, water flow, and habitat availability, supporting the National Recovery Plan for the Australian Grayling.

No Aboriginal or non-Aboriginal sites were identified at the site, and due to prior disturbances from road construction, it is unlikely that any new artifacts will be uncovered. An Aboriginal site was found in the surrounding area, however due to the distance between the site and the artefact, no impact is expected to occur. The location of this site is to be classified as a no-go area and no disturbance is to occur. Noise and air quality disturbances are projected to be minimal, with waste management strategies addressing debris, excavated materials, and spoil waste efficiently. While the temporary bypass track during construction may inconvenience residents, measures will be taken to minimize the duration of the bypass and mitigate impacts.

Overall, the proposed project presents a low risk to biodiversity and the environment while addressing critical infrastructure on. Through careful planning and compliance with environmental regulations.

The following key information, in extension to the key points identified within this summary, can be found in the subsequent locations of this report:

Table 1: Key review of environmental factors findings

Environmental Safeguards and Mitigation Measures	Section 5
Biodiversity	Section 3.4 and Appendix B
Aboriginal Heritage	Section 3.5 and Appendix C

Additional works required includes: .

- The REF shall be published on the NSW Planning Portal prior to the commencement of works.
- Part 7 permit under the NSW Fisheries Management Act 1994 (FM Act) is required
- The Construction Environmental Management Plan (CEMP) is to be provided to DPI Fisheries a minimum of two weeks prior to any works commencing on site.
- Public and stakeholder engagement in relation to the works and closure of the road will be required to the commencement of works, following Council's community engagement policy and inline with the safeguards identified within the REF.

1. Introduction

The proposed activity involves the activities necessary for the design and construction of a concrete bridge which enables fish passage, funded by the Department of Regional NSW – DPI Fisheries' (Fisheries) Marine Estate Management Strategy (MEMS) Program. The existing culvert crossing has been identified by Fisheries as a significant barrier for fish passage, and therefore requires an upgrade to a bridge structure to allow fish to pass through this crossing. Additionally, the upgrade of this structure will enable a more disaster resilient access, reducing the risk for future disruption for surrounding residents, road users, and land and emergency management authorities.

The environmental assessment and determination of the proposal has been undertaken in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). For this proposal, Shoalhaven City Council is both a public authority proponent (EP&A Act s5.3) and the determining authority (EP&A Act s5.1). The REF has been prepared in accordance with Section 171 of the NSW *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation 2021) . Table 1 below outlines the proponent contact details.

Table 2: Proponent details

Project Name	**Currowan Creek Crossing Upgrade**
Proponent (Council) Name	Shoalhaven City Council
Project Manager	Paul McKenzie
Position	Project Engineer
Contact Details	paul.mckenzie@shoalhaven.nsw.gov.au

1.1. Project Description and Background

1.1.1. Detailed Scope of Works

The proposed works include the activities necessary for the design and construction of a concrete bridge to replace an existing culvert crossing. A bypass track will be constructed upstream of the current Currowan Creek crossing to enable access for the duration of the construction period. Refer to Appendix A for the 'Issued for Construction' Plan set, which demonstrated the crossing upgrade and bypass track.

Site photos can be viewed using the following link: Site Photos

Figure 1. Site image – view up stream

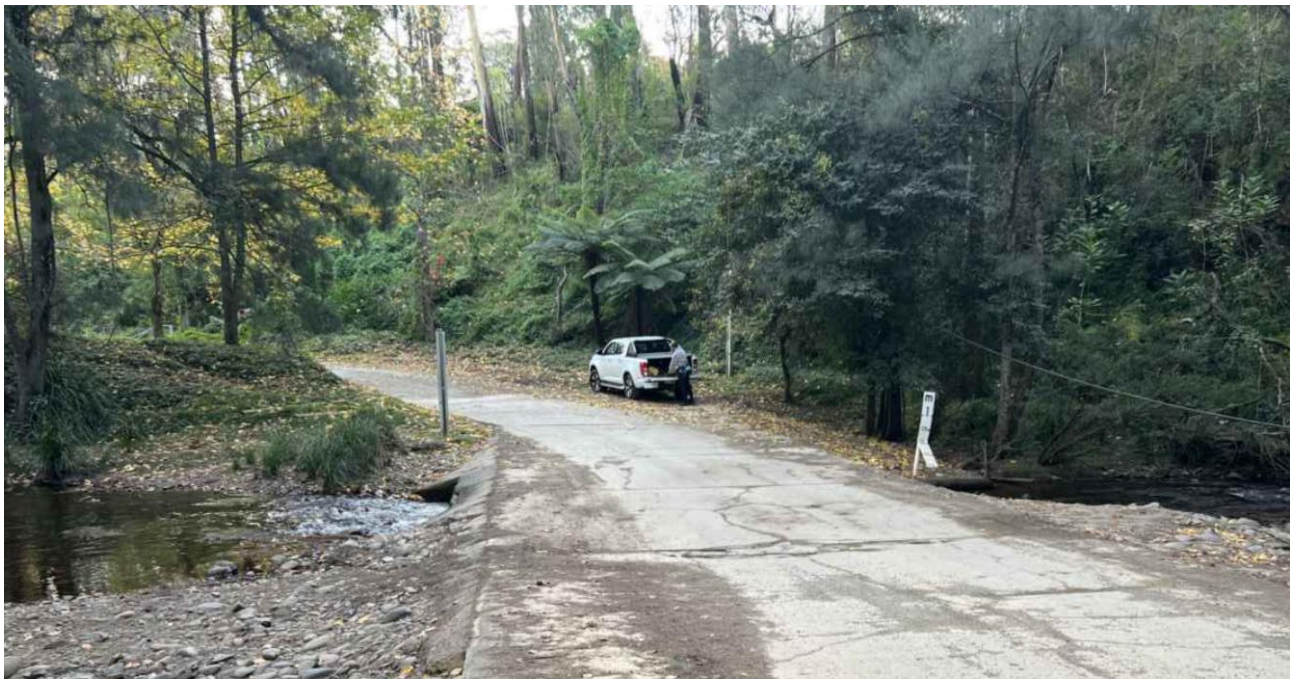


Figure 2. Site image – view west

An indication of the works staging is outlined below:

Stage 1 - Design Phase

a) Initial Conceptual Design

- Develop an initial design that aligns with local Council regulations, Department of Primary Industry – NSW Fisheries guidelines and policies, Australian Bridge Standards, geotechnical requirements (Appendix E) and aesthetics of the surrounding area.

b) Detailed Design

- Perform structural analysis and detailed design of the bridge and its components.
- Develop detailed design reports, including all assumptions and methodologies used. This design is contained within Appendix A.
- Review the design against Australian Bridge Standards and T44 load requirements.
- Adjust design as necessary in response to feedback.

Stage 2 Construction Phase

a) Pre-construction

- Part 7 permit under the NSW *Fisheries Management Act 1994* (FM Act) shall be obtained.
- Public and stakeholder engagement in relation to the works and possible delays will be undertaken in accordance with Shoalhaven City Councils (SCC) and Eurobodalla Shire Council's (ESC) community engagement policy.
- REF shall be published on the NSW Planning Portal.
- Prepare and submit a construction environmental management plan (CEMP), which should include safety protocols, traffic management, environmental considerations, and other site-specific issues.
- CEMP will be provided to NSW DPI Fisheries at least two weeks prior to any work commencing.
- Secure any other necessary approvals and permits.
- Procure materials as per design specifications.
- Service search prior to any excavation work commencing.

b) Construction

Prior to construction work occurring, the following activities need to occur:

- Establish a site compound, lunchroom, office & toilet facilities, in a central location to facilitate the site.
- Delineate areas/zones/paths of movement on site to ensure visibility for pedestrians and operators of plant to help control the interface of plant and pedestrians.
- Implement the CEMP and set up environmental controls for the site. This could include silt curtains along each side of the riverbank to trap floating sediment as result of placing rock on the riverbed and hydrocarbon booms to capture any contaminants in the event of a hydraulic failure or oil leak whilst working in or near the water.
- Delineate temporary stockpile locations and set up appropriate sediment controls.
- Clear and prepare access routes and constructions zones, including vegetation removal where necessary.

The construction process is as follows, with Appendix A containing the Issued for Construction approved design plan set:

- Construct the temporary bypass track, and install the temporary bailey bridge upstream of existing culvert crossing.
- Demolish and remove the existing causeway utilizing 35T excavator, loading onto truck to be hauled and disposed of at a licensed recycling depot on Mugga Lane, Hume, ACT.
- Undertake foundational works through preparing and excavating the abutment area. 75- dia reinforced concrete piers with permanent steel liners, founded on Class III MetaSiltstone.
- Headstocks will be installed through utilization of a crane, lifting the prefabricated headstocks into place for installation.
- Place the rock protection on either abutment, including a layer of geofabric between the creek bed/abutment and rock, and ensuring clean rock is utilized.
- Utilise a crane to install the M-Lock beams, including edge beams with castellated kerb.
- Prepare approach slab location, including compaction and reinforcement in preparation for concrete being poured.
- Regrade and compact approaches to required distance on either side of the concrete approach slabs, including reshaping accompanying table drains.
- Remove temporary Bailey Bridge

Requirements for notification to WorkSafe NSW are below, both requirements extracted direct from WorkSafe website. Demolition notification requirements will apply to:

- a structure, or a part of a structure, that is load-bearing, or otherwise related to the physical integrity that is over 6m high
- load shifting machinery on a suspended floor
- explosives

Requirements for a restricted demolition license are below. You need this license to demolish or partly demolish any structure or part of a structure that is loadbearing or otherwise related to the physical integrity of the structure and:

- is between 6-15m high

- involves using load-shifting machinery on a suspended floor, such as bulldozers, cranes, excavators, front-end and skid-steer loaders

This project will not include any load shifting equipment or plant on the culvert crossing and the crossing to riverbed measurement is 1 m. Due to this, notification to safe work or the requirement to have a restricted demolition license is not required.

c) Post-construction

Handover, Defects, Demobilize and Restoration

- A final inspection will be carried out on the bridge as part of the handover process. If any defects are found, they can be addressed in this period.
- Site compounds will be demobilized, and any areas disturbed by construction works be regraded and seeded.
- All environmental controls will be removed from the river. Minor sediment controls can be left in place to prevent silt run-off into the creek, until the grass has established on the new formation batters.
- Rehabilitation works to occur to all disturbed battered and surrounding areas as per the Fisheries Permit requirements, including placement of jute mesh and planting of native species on the disturbed banks, and spray seeding.

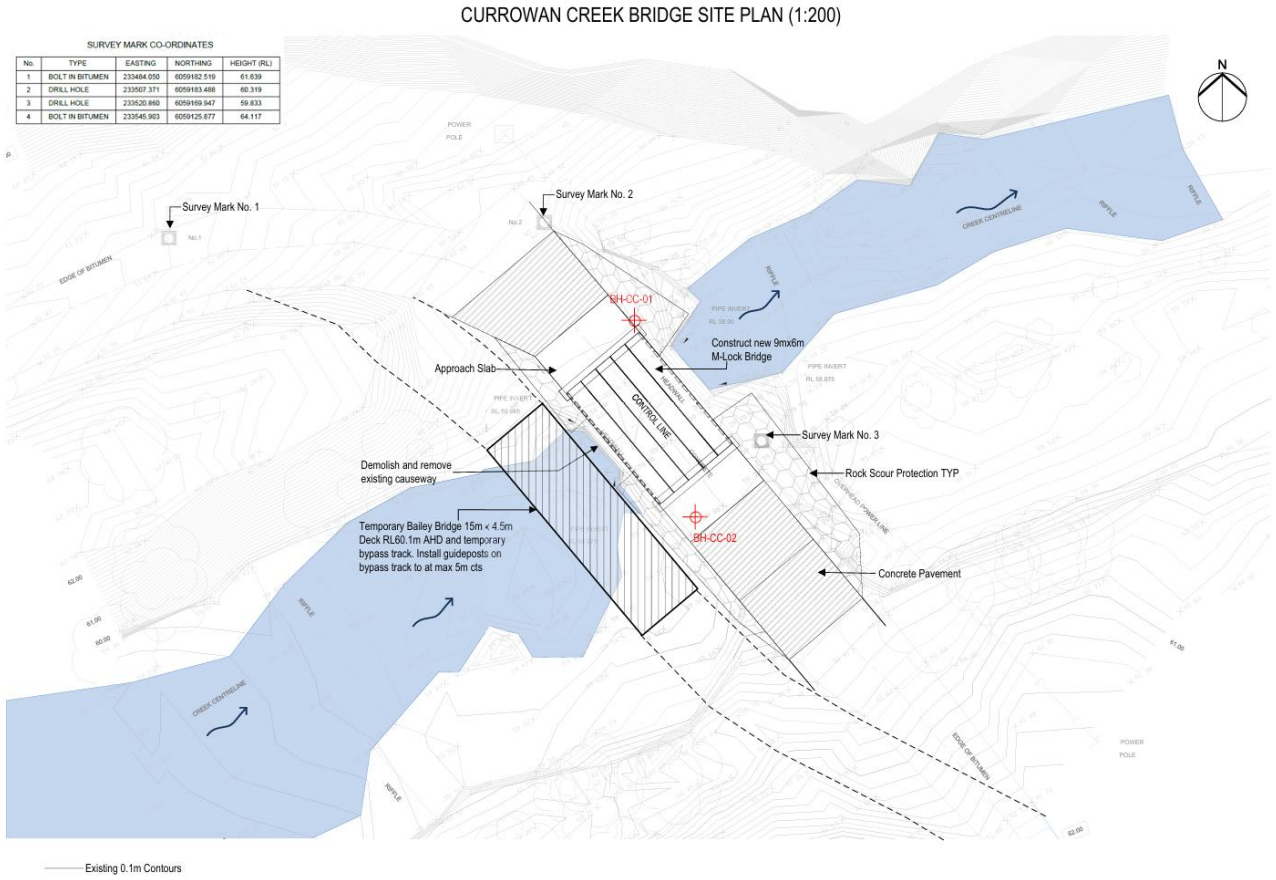


Figure 3. Site Plan

1.1.2. Machinery and Equipment

Machinery and equipment used for the works will include.

- Excavator
- Hydraulic Grabs
- Dawson Impact Hammer
- Water Cart
- Roller
- Grader
- Rigid Truck or Truck and Dog
- Hand Tools
- Other as Required

1.1.3. Access and Ancillary Works

Storage and compound areas will be confirmed once the contract has been awarded and REF updated with the details. A bypass track will be established directly upstream to the existing crossing to enable access during the works. Location and details are to be confirmed during the design process, this REF will be updated with the details appropriately.

1.1.4. Duration and Working Hours

The works are short term, as outlined in Table 3.

Table 3: Project timeframes

Commencement Date	Late June 2025
Work Duration	The estimated total timeframe for the proposed works is: 8 weeks (Design Phase) 10 weeks (Construction Phase)
Work Hours	Standard construction hours: • Monday to Friday 7:00am to 6:00pm • Saturdays 8:00am to 1:00pm • No work on Sundays or Public Holidays

1.2. Project Location and Context

1.2.1. Location of the Proposed Activity

The site of the existing culvert and proposed bridge is located on Western Distributor Road, and crosses Currowan Creek, Currowan. The site is located 25km from the main centre of Batemans

Bay, with the surrounding lots being 20/-/DP755951, 1/-/DP707475 and 1/-/DP263922. The coordinates for the works are -35.575367, 150.059323.

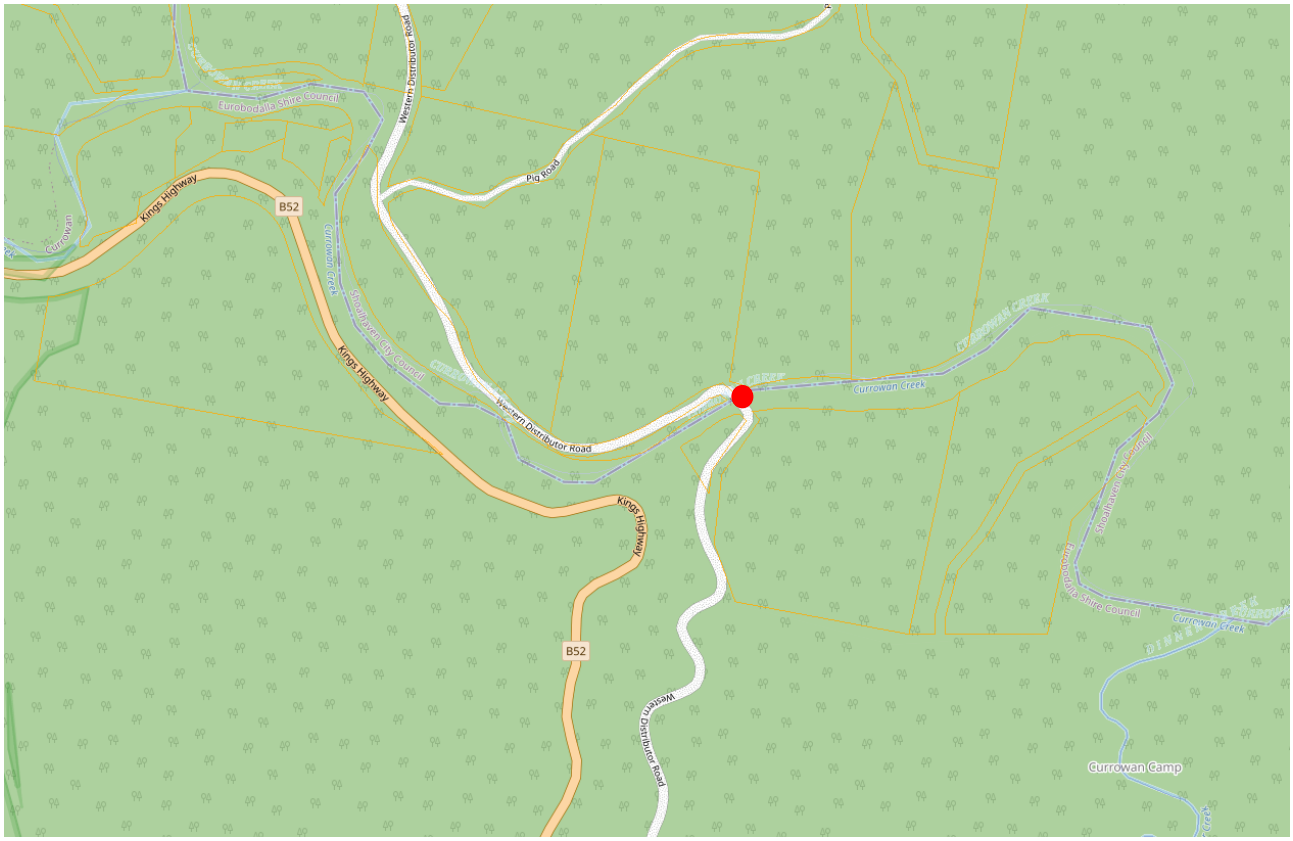


Figure 4. Map of Area

Figure 5. Currowan Creek Culvert Crossing, Western Distributor Road over Currowan Creek

1.2.2. Site Context

Shoalhaven City Council (SCC) is located on the south coast of NSW and covers an area of 4,567m^2. The area stretches from Berry's Bay (Shoalhaven Heads) on the northern end to North Durras on the southern end and includes the main townships of Ulladulla, Sussex Inlet, Huskisson, and Nowra.

Eurobodalla Shire Council (ESC) is located on the far south coast of NSW and covers an area of 3,400m^2. The area stretches from South Durras on the northern end to Akolele on the southern end and includes and main townships of Batemans Bay, Moruya and Narooma.

The site is located on the border of Shoalhaven City Council (SCC) and Eurobodalla Shire Council (ESC), within dense forest, zoned as rural residential. SCC are executing this project. The proposed activity site is located approximately 25km west from the coastline within the locality of Currowan. The surrounding context of the sites are rural bushland, cleared farmland and ForestNSW forestry land.

The water catchment, Currowan Creek is heavily dependent on rainfall, being classed as a large scale named watercourse with various natural, unnamed creeks flowing into it. The surrounding runoff from the proposed activity site drains into Currowan creek and efforts shall be made to mitigate negative impacts during the works. The creek flows northeast at the site and joins the Clyde River approximately 10 km to the east of the project area, as shown in figure 6.

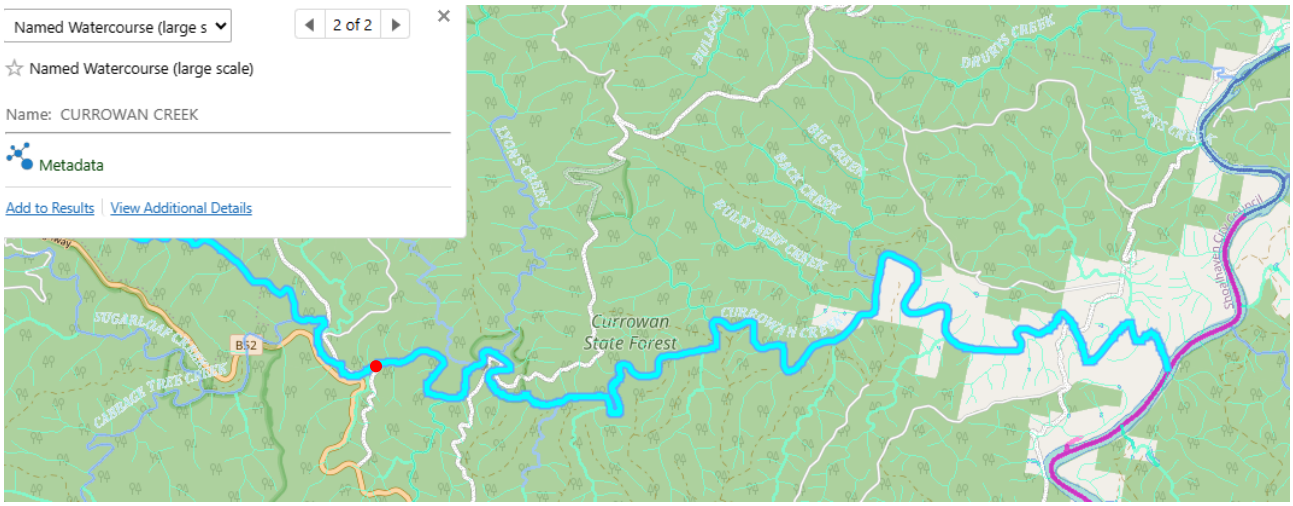


Figure 6. NSW Hydrography – Named Watercourse Currowan Creek

The site is surrounded by Wet Sclerophyll Forests (shrubby sub-formation), Dry Sclerophyll forests (shrubby sub-formation) and cleared land. There are two Endangered Environmental Communities (EEC's) mapped in the vicinity of the site, being River-flat Eucalypt Forest in coastal floodplains and Swamp Oak Floodplain Forest. The terrain of the proposed site is predominantly flat off the western side and hilly on the southern side. The road leads into the gully where the creek is found and trails

back up at either side of the culvert. This can be viewed within Figure 7 which displays the Creeks's water catchments and mountains.

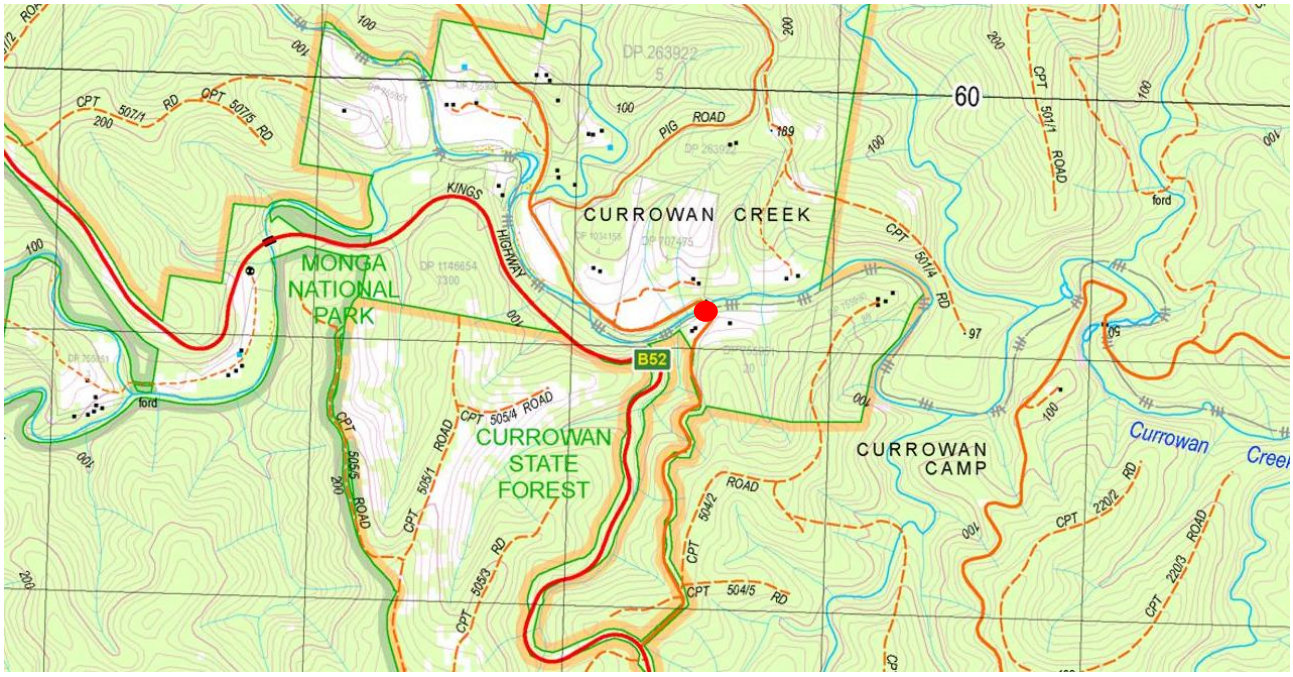


Figure 7. Topographic Map

1.2.3. Land use and ownership

The zoning for this site consists of W1 Natural Waterways, RU1 Primary Production and RU2 Rural Landscape. The land is owned and maintained by both Eurobodalla Shire Council and Shoalhaven City Council. The surrounding land is privately owned. No works impinge on National Park or land managed by National Parks and Wildlife Service (NPWS).

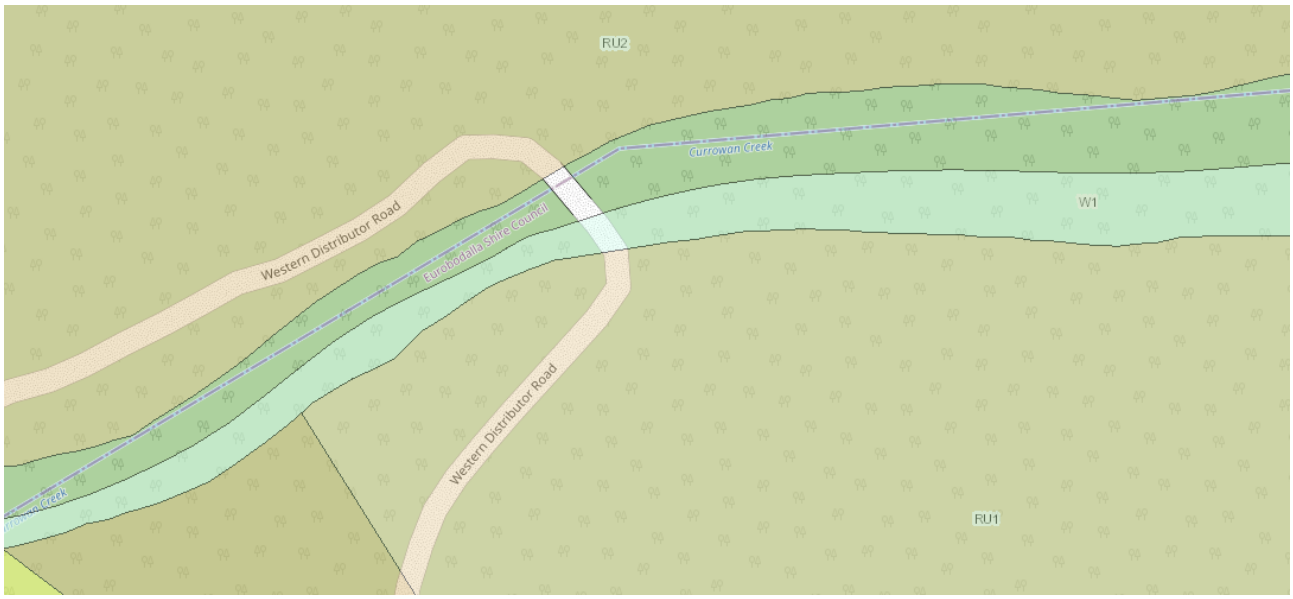


Figure 8. Land Zoning

1.2.4. Project Justification and Consideration of Alternatives

This project is an infrastructure upgrade project funded under the Department of Regional NSW – DPI Fisheries' Marine Estate Management Strategy (MEMS) Program. The existing culvert has been identified as a barrier to fish passage, specifically migratory, threatened fish species. Fisheries have identified the culvert as requiring an upgrade to a bridge structure in order to reinstate fish passage. Additionally, the replacement of the culvert will reduce the risk for future disruption for surrounding residents, visitors, NSW Forestry, Emergency Services, and other government agencies who utilise these roads. The replacement and upgrade of this infrastructure poses several additional benefits in comparison to the existing. Advantages include:

1. Enhanced safety: Old or damaged culvert crossings can pose a significant risk to drivers, pedestrians, and cyclists. Through the upgrade of this crossing, a safer and more resilient access would be provided to the community, visitors, bushwalkers and 4WD's. Within this instance, under heavy rain the culvert becomes overtopped with water cutting-off access.

Therefore, the upgrade will assist in minimising the risk of failure / overtopping occurring, which could result in the inability to access properties in such an event.

2. Improved durability: Through upgrading the infrastructure and approaches, the proposed bridge will be more durable compared to the existing culvert. This means, the surface can withstand increased traffic, resist erosion, and remain stable under severe weather conditions and associated waterflows.
3. Infrastructure maintenance: Regular maintenance and upgrades to infrastructure is necessary to ensure they remain functional and safe. Through this project, issues with the current infrastructure will be addressed which will prevent further deterioration of the existing infrastructure.
4. Enhanced Drainage: Upgrades to the bridge infrastructure will enhance the drainage and assist with ensuring fish passage is maintained.
5. Environmental Benefits: Through upgrading the infrastructure, fish passage will be enhanced, reducing blockages, and assisting with migration and movement.
6. Reduced Flooding: Through upgrading the infrastructure, more stormwater movement will occur which will reduce the impact that heavy rainfall will exert onto the infrastructure. This will assist with residents accessing properties, visitors travelling along this road, and entities such as NSW Forestry, NSW National Parks and Wildlife Service and emergency services who utilise the road.

2. Statutory and Planning Context

2.1. Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) provide the framework for development and environmental assessment in NSW.

Due to the provisions of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (Transport and Infrastructure SEPP), this work is permissible without (development) consent. Accordingly, SCC must satisfy Sections 5.5, 5.6 and 5.7 of that Act by examining, and taking into account to the fullest extent possible, all matters which are likely to affect the environment. This REF is intended to address council's compliance with the EP&A Act including Sections 5.5, 5.6 and 5.7 and the requirements of Section 171 of the EP&A Regulation 2021. Environmental Planning Instruments made under the EP&A Act 1979 may also be relevant and are addressed below.

2.2. State Environmental Planning Policy (Transport and Infrastructure) 2021

The Transport and Infrastructure SEPP aims to facilitate the delivery of infrastructure across NSW by identifying whether certain types of infrastructure require consent, can be carried out without consent or are exempt development.

Pursuant to clause 2.109 of the SEPP, development for the purpose of a road or road infrastructure facilities may be carried out by or on behalf of a public authority without development consent on any land. As the proposed activity does not require development consent, and as it constitutes an 'activity' for the purposes of Part 5 of the EP&A Act, being carried out by (or on behalf of) a public authority, environmental assessment under Part 5 of the EP&A Act is required. This REF provides this assessment.

2.3. Other Environmental Legislation

Table 4 outlines how the project has been considered under other relevant Commonwealth and State environmental legislation.

Table 4: Other environmental legislation

Legislation	Relevance to the Proposed Activity
COMMONWEALTH LEGISLATION	
***Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)**	The EPBC Act protects matters of National Environmental Significance (NES), such as threatened species and ecological communities, migratory species (protected under international agreements), and National Heritage places (among others). *Matters of NES, including the Australian Grayling, have been identified on and near the site as outlined in section 3.3. An assessment of the activity has been undertaken in accordance with Significant Impact Criteria in the Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013) and is contained in Appendix B. A significant impact is not likely to result and therefore a referral to the Commonwealth Department of Environment is not required.*
STATE LEGISLATION	
***Biodiversity Conservation Act 2021* (BC Act)** **Part 7**	Part 7 of the BC Act provides the environmental assessment requirements for activities being assessed under Part 5 of the EP&A Act 1979. If a significant impact is likely, a Species Impact Statement is required. A biodiversity development assessment report may also be required if the proponent elects for this. Section 7.2(1)(a) and 7.3 describe the assessment requirements and thresholds for what is considered a significant impact. *Threatened species and communities listed under this Act were identified as potentially being impacted by the works as contained in Appendix B. Assessments of Significance were undertaken for these matters, contained in Appendix B, and concluded that a significant impact is not likely to result and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.*
State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BC Act)	Koala Habitat Protection chapters of the SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for *Phascolarctos cinereus* (Koala) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.

Legislation	Relevance to the Proposed Activity
Chapter 3 Koala Habitat Protection 2020 & Chapter 4 Koala Habitat Protection 2021	Koala Habitat Protection applies to development under part 5 of the EP&A Act 1979. As the proposed activity is not 'development', Koala Habitat Protection doesn't apply. Regardless, consideration of impacts to koala and koala habitat are still relevant. The area of the proposed works has not been identified as an Area of Regional Koala Significance (ARKS).
State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BC Act) ***Chapter 2 Vegetation in non-rural areas***	Chapter 2 Part 2.2 Section 2.7 of the SEPP states that an authority to clear vegetation under this policy is not required if it is a clearing authorised under s60(O) of the Local Land Services Act 2013. Section 60(O) provides an exemption for clearing under Part 5 of the EP&A Act and therefore consent is not required under the SEPP (Vegetation in Non-Rural Areas). *Threatened species and communities listed under this Act were identified as potentially being impacted by the works. Assessments of Significance were undertaken for these matters, as contained in Appendix B, and concluded that a significant impact is not likely to result and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.*
***Local Land Services Act 2013* (LLS Act)**	The objects of the LLS Act include 'to ensure the proper management of natural resources in the social, economic and environmental interests of the State, consistently with the principles of ecologically sustainable development. The Act regulates the clearing of native vegetation; however section 60(O)(b)(ii) excludes the need for consent under the LLS Act where the clearing is an activity carried out by a determining authority within the meaning of Part 5 of the EP&A Act 1979.
***Fisheries Management Act 1994* (FM Act)**	FM Act provides for the protection, conservation, and recovery of threatened species, populations and ecological communities of fish and marine vegetation and fish habitats, as well as promoting the development and sharing of fishery resources in NSW. *The development involves dredging and reclamation works and therefore a Part 7 permit under the FM Act is required. Regarding the other provisions and controls in the Act the proposed activity:* • *would not affect declared aquatic reserves (Part 7, Division 2 of the Act);*

Legislation	Relevance to the Proposed Activity
	• *would not involve blocking the passage of fish (s.219);* • *would not impact mangroves (Part 7, Division 4);* • *would not involve disturbance to gravel beds where salmon or trout spawn (s.208 of the Act);* • *does not involve the release of live fish (Part 7, Division 7);* • *does not involve the construction of dams and weirs (s.218);* • *would not result in the blocking of the passage of fish;* • *would not use explosives in a watercourse (Clauses 70 and 71 of the Fisheries Management (General) Regulation 2019).*
National Parks and Wildlife Act 1974 **(NPW Act)**	The NPW Act regulates the control and management of all national parks, historic sites, nature reserves, and Aboriginal areas. The main aim of the Act is to conserve the natural and cultural heritage of NSW. Where works will disturb Aboriginal objects, an Aboriginal Heritage Impact Permit (AHIP) is required. *The proposed activity is of low impact according to the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW 2010). No further assessment is required. The proposed activity is unlikely to harm Aboriginal objects and therefore a permit under the NP&W Act is not required. A site was identified near the proposed activity location; however, there will be no impact, as contained in Appendix C.*
Heritage Act 1977	The proposed activity does not involve an item or place listed on the NSW State Heritage Register or the subject of an interim heritage order or listing and is therefore not a controlled activity. Approval of works on the site is therefore not required under Part 4 of the Heritage Act. The main aim of the act is to conserve the natural and cultural heritage of NSW. Where works will disturb Aboriginal Objects, an Aboriginal Heritage Impact Statement (AHIP) is required.

Legislation	Relevance to the Proposed Activity
Protection of the Environment Operations Act 1997 **(POEO Act)**	The POEO Act is the key environmental protection and pollution statute. The POEO Act is administered by the EPA and establishes a licensing regime for waste, air, water and pollution. Relevant sections of the Act are listed below: • Part 5.3 Water Pollution • Part 5.4 Air Pollution • Part 5.5 Noise Pollution • Part 5.6 Land Pollution and Waste Any work potentially resulting in pollution must comply with the POEO Act. Relevant licences must be obtained if required. *An Environmental Protection Licence (EPL) for the proposed activity is not required.*
Water Management Act 2000 **(WM Act)**	The WM Act's main objective is to manage NSW water in a sustainable and integrated manner that will benefit today's generations without compromising future generations' ability to meet their needs. Section 91E of the Act establishes an approval regime for controlled activities within waterfront land. However local councils are exempt from s.91E(1) of the Act in relation to all controlled activities that they carry out in, on or under waterfront land by virtue of clause 41 of the Water Management (General) Regulation 2018. The proposal would not interfere with the aquifer and therefore an interference licence is not required (s.91F). Note: Although formal approval under the WM Act is not required, if the proposed activity is within 40m of a waterway, an attempt should be made to comply with the requirements of controlled activities in order to reduce risks to waterways as per the Fact Sheet 'Controlled Activities – Guidelines for riparian corridors on waterfront land'.
Roads Act 1993	Section 88 of the *Roads Act* states that a roads authority may, despite any other Act or law to the contrary, remove or lop any tree or other vegetation that is on or overhanging a public road if, in its opinion it is necessary to do so for the purposes of carrying out road work or removing a traffic hazard. However, the environmental

Legislation	Relevance to the Proposed Activity
	safeguards outlined in this REF still apply and an assessment of the impact of any tree of vegetation removal is still required.
Biosecurity Act 2015	The *Biosecurity Act 2015* and regulations provide requirements for state level priority weeds. The Act regulates all plants, with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. If weeds are identified onsite which pose as a biosecurity risk, the landowner/manager is required to ensure they are disposed at an approved green waste/recycling facility where mitigation measures such as solar radiation to kill seeds/roots before disposal will occur. The contractor is required to prevent the importation of the listed weeds to site.
State Environmental Planning Policy (Hazards and Resilience) 2021	The area of the proposed activity is not mapped as comprising coastal wetlands or littoral rainforest for the purpose of this SEPP. Other considerations of the SEPP are not applicable to the proposed activity. *The proposed activity is not located on land subject to the SEPP.*

3. Existing Environment and Impact Assessment

3.1. Landform, Geology and Soils

3.1.1. Existing Environment

Westen Distributor Road at Currowan Creek is located approximately 300m north-east of the Kings Highway in Currowan and can be accessed from a junction on the Kings Highway. The existing piped culvert is comprised of a low-level concrete piped culvert which channels creek flow through four x 600 mm diameter pipes.

Figure 9. Subject Site

The great soil group (GSG) for the site is Yellow Podzolic Soils – Less fertile, shown in figure 10. The soil classification (ASC) is shown in figure 11 and is Kurosols surrounded by Dermosols and Kandosols. Soil salinity is not mapped to be a risk at this site. Erosion due to the creek is present but is considered within the reasonable and expected extent.

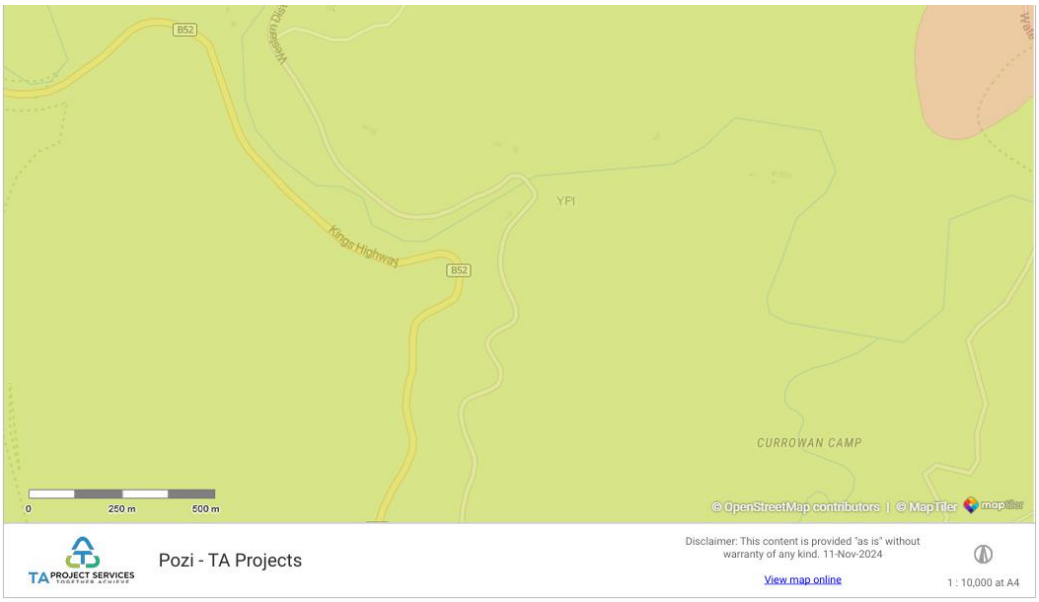


Figure 10. Soil Type Map Great Soil Group

Figure 11. Soil Classification Map

3.1.2. Impact Assessment

A geotechnical investigation was undertaken by Stantec, as contained in Appendix E, which indicates that the sites are underlain by Alluvial Flood plain deposits which consists of QH_ad – silt, very fine to medium grained sand, and clay which is overlying metasiltstone rock. Table 5 and 6 below provide a summary of subsurface units and depth identified during the investigation.

Table 5: Summary of Subsurface Units

Unit	Material Type	Description of Layer
1A	Alluvium	Sand: Find to coarse grained sand, with fine to medium gravel, brown to grey, trace cobbles and boulders, loose to medium dense.
1B		Sandy Gravel: Find to coarse gravel, fine to coarse grained sand, brown to grey, trace cobbles and boulders, loose to very dense.
2	Rock	Metasiltstone: Fine grained, pale-grey to grey, horizontally bedded with quartz veining up to.

Table 6: Depth to Top of Subsurface Units

BH ID	Depth to top of Unit (mBGL)			Termination Depth (mBGL)	Termination Reason
	1A	1B	2		
BH01	0.00	2.00	3.88	8.28	Target Depth
BH02	0.00	1.20	2.55	8.00	Target Depth

This project has sensitive environments which are located in or nearby the projects footprint that are likely to receive the stormwater discharge. This includes the creek which contains threatened fish habitat and connects to state forests and national parks downstream. Any disturbance of

groundwater presents a risk for erosion and runoff entering the watercourse. Through implementation of safeguards prescribed in this REF, this impact can be reduced and mitigated.

3.2. Contaminated Land and Acid Sulfate Soils

3.2.1. Existing Environment

Testing was undertaken to determine the risk of acid sulphate soils and level of pH being present. The levels of sulphates and pH determined are negligible within the Geotechnical report contained within Appendix E.

No records returned on a search of the NSW EPA Public Register in relation to Contaminated Land.

3.2.2. Impact Assessment

Disturbance of acid sulphate soils can generate large amounts of sulfuric acid leachate which can impact the surrounding environment. The potential impacts include water quality and upon flora and fauna. Testing was undertaken to determine the risk of acid sulfate soils being present as contained in Appendix E, with the level of sulphates and pH determined as negligible. No records returned on a search of the NSW EPA Public Register in relation to contaminated land. Therefore, the impact of contaminated lands and acid sulfate soil within this project is undetectable and therefore not expected to occur.

3.3. Water Quality and Hydrology

3.3.1. Existing Environment

Currowan Creek flows northeast at the site and eventually joins the Clyde River approximately 10km to the east of the proposed activity area. The creek is classified as a large scale, level 6 named watercourse, being approximately 53 km in length. At the point of the proposed activity, the creek has a width of 4m and is located 1m below the existing culvert deck level. Australian Grayling habitat is mapped to be present within this aspect of the creek by NSW Fisheries. Therefore, this location is classified as having habitat sensitivity. However, this culvert has been identified by NSW Fisheries as a barrier to fish passage and therefore the proposed activity would improve the hydrology of the area. All work will occur within the existing disturbed footprint and the creek bed will be reinstated to natural condition. The volume of water will be reduced due to the culvert being replaced by a bridge which is increased to being above water level.

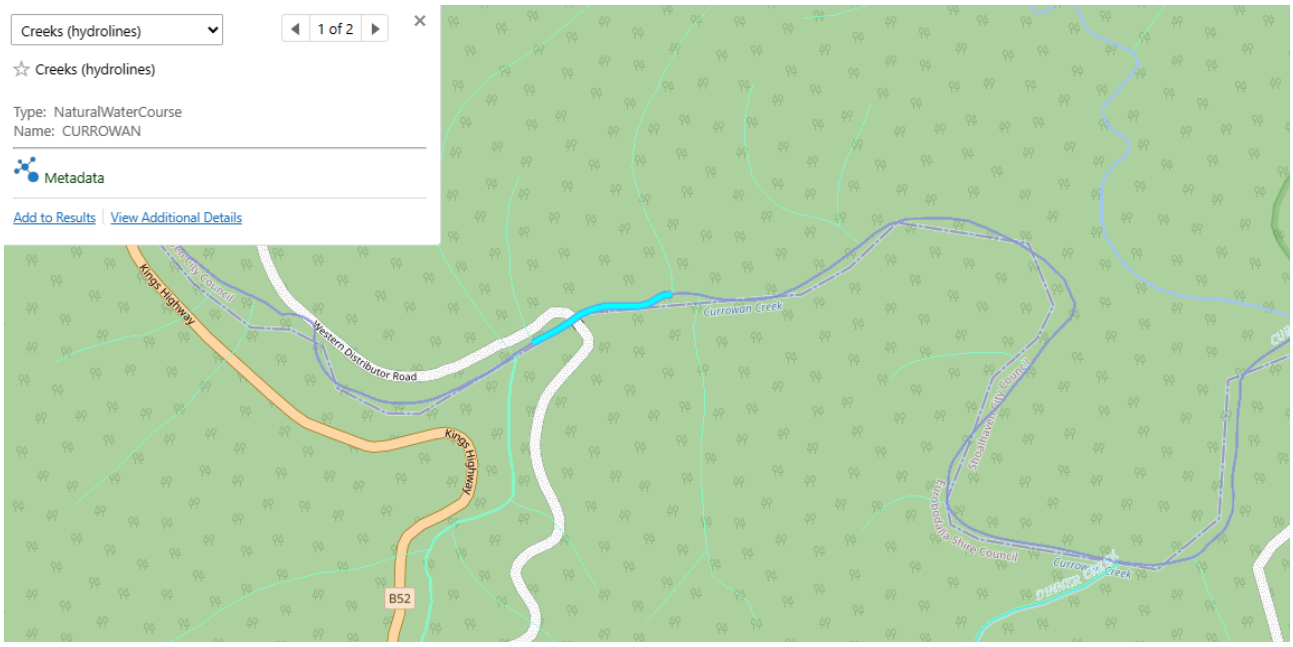


Figure 12. NSW Hydrograph – Named Watercourse – Currowan Creek

3.3.2. Impact Assessment

The proposed work has potential for erosion and sedimentation, and the movement of sediment into Currowan Creek. To manage for erosion and sedimentation during construction, an erosion and sediment control plan (ESCP) shall be prepared and implemented. Managing Urban Stormwater soils and construction Vol 1 (Landcom, 2004) and other associated guidelines would be used. An ESCP plan shall form part of the CEMP, and the CEMP is to be provided to regulatory authorities (Fisheries) two weeks prior to any works commencing on site.

The culvert will be removed, and a temporary bypass track will be constructed to enable access. Standard measures considered for this bypass track included the implementation of a bailey bridge, culverts, or use of no-fines rock that is wrapped in geofabric with interrupted waterflow around the construction site via flexible pipes and/or pumps if required (depending on the volume of water needing to be diverted around the construction site). The preferred option at this site is a bailey bridge due to ease of construction and lower environmental impacts than the other options.

A site inspection confirmed that the creek bed primarily consists of river stone and has limited aquatic vegetation. Therefore, the impact on aquatic vegetation should be minimal. Dredging will occur to enable demolition of the existing structure and the construction of the piles and abutment for the proposed bridge.

3.3.3. Management and mitigation

Works adjacent to Currowan Creek (stockpiling of materials/equipment) should be carefully undertaken with suitable sediment and erosion controls, which should include primary and secondary systems as applicable, such as:

- Land-based Primary & Secondary Containment
  - Earth containment bund / windrow
  - Geofabric-wrapped rock edge bund (temporary working platforms)
  - Sediment fence
  - Spill kits

  - Sandbags or bulka bags (filled with washed river sand)
  - Coir logs
- Over Water Primary Containment
  - Concrete formwork containment
  - Earth containment bund / windrow
  - Sandbags
  - Self-bunded plant and equipment
  - Plant nappies / trays
  - Rubber or steel concrete delivery lines
  - Concrete kibbles
  - Concrete washout trays and management of alkaline curing water (if any is generated by works)
- Over Water Secondary Containment
  - Floating hydrocarbon absorbent boom
  - Floating hydrocarbon containment boom
  - Floating silt curtains
  - Concrete delivery line containment (sheet pile, pipes or casings)
  - Nappies around discharge end of boom pump line or kibble during extension / retraction over water
  - Dirty water extraction containment (sheet pile, pipes or casings)
  - Spill kit

Works staff should be aware of weather forecast conditions and minimize the exposure of disturbed areas and risk of sediment laden runoff in this area. Risks associated with flooding should be included within the contractor's safety management plan and construction environmental management plan. It is suggested that Flood Emergency Procedures are prepared, where upon flood warnings, the contractors take certain steps in order to minimise the impact upon plant, sediment booms and fences, and material/equipment storage which have the potential of being washed downstream. This could include implementing measures to ensure these items are secured at higher areas, or removed from site. Sediment and erosion controls should remain in place until all disturbed ground is stabilised with native grasses etc.

As the works will involve pumping of concrete into the formwork bridge structures, there is a risk of concrete accidentally entering the creek. This can be managed through standard control measures for concrete pours, including using low flow concrete, and higher-level formwork so concrete does not need to reach the top edge.

3.4. Biodiversity

3.4.1. Vegetation and Threatened/ Endangered Ecological Communities

The works are located in vegetation mapped as PCT 3188 - South Coast Riverflat Peppermint Forest, which corresponds to the River-flat eucalypt forest on coastal floodplains Threatened Ecological Community (TEC). This community is listed as a TEC under both the Biodiversity Conservation (BC) Act and the Environment Protection and Biodiversity Conservation (EPBC) Act when it meets certain condition thresholds, as outlined in Section 5.2 of the Conservation Advice. Vegetation surrounding the site is also mapped as Wet Sclerophyll Forests and is consistent with this PCT. Although the site experienced significant disturbance from prior road construction, the vegetation has since regenerated and now largely resembles the mapped PCTs and surrounding vegetation types.

Vegetation removal required for bridge construction will be minimized, with a focus on retaining trees where feasible. Any necessary removal of vegetation or trees on the northwestern side of the works will be documented and assessed to minimize impacts.

A 5-Part Test of significance, located in Appendix B, assessed the impact on the TEC and concluded that the proposed works are unlikely to have any lasting effect on the TEC. No extensive clearing is planned, and the works are not expected to result in long-term impacts on these ecological communities.

Figure 13. Vegetation at the proposed works location is not specifically mapped along the road corridor. However, the adjacent vegetation is classified as Wet Sclerophyll Forests (Shrubby Sub-formation), indicating that similar ecological characteristics may be present in the immediate area.

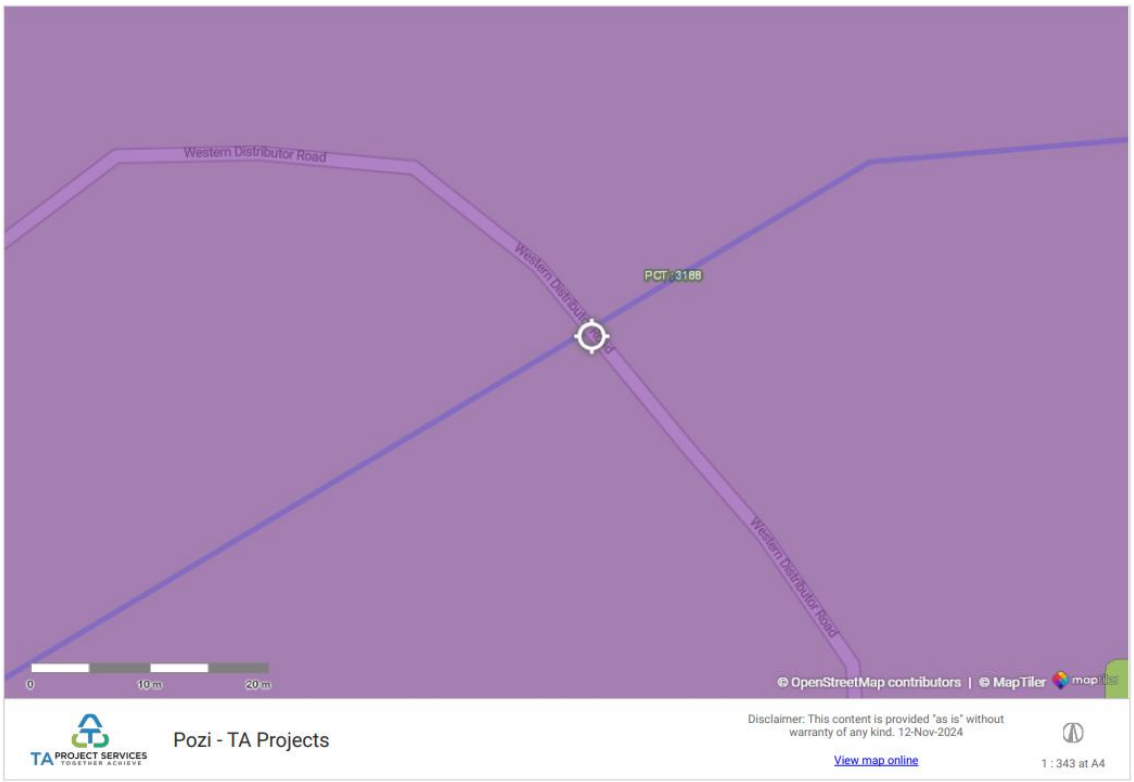


Figure 14. Plant Community Type (PCT) at proposed works location is mapped as PCT 3188 - South Coast Riverflat Peppermint Forest

3.4.2. Threatened Flora Species

A desktop biodiversity assessment identified 12 threatened flora species within a 5 km radius of the project site. However, none of these species had multiple recorded sightings in the area according to NSW BioNet. While the habitat of 9 of the species aligns with the site's habitat, an on-site assessment confirmed that no individuals of these species are present within the project site or its immediate vicinity. Additionally, the surrounding area contains numerous alternative habitats that are more suitable for these species. Detailed information on the identified species can be found in Appendix B.

3.4.3. Threatened Fauna Species

A desktop biodiversity assessment identified 39 threatened fauna species within a 5 km radius of the site. Each species was assessed based on recorded sightings from NSW BioNet and its habitat suitability relative to the existing conditions on site. Of these, 18 species were considered likely to occur on-site. However, 6 of these species are highly mobile bird species, and their presence on-site was determined to be transient, meaning further assessment was not required. A test of significance was conducted for the remaining 12 species (see Appendix B), concluding that the proposed bridge replacement is unlikely to have adverse impacts on them.

The proposed works are located within a previously disturbed road reserve. While access and ancillary tracks, including a bypass track, will be required, vegetation removal will be minimized, and tree retention will be prioritized where feasible. The more suitable established habitat areas, particularly on the northwestern side of the works, will be thoroughly documented and assessed to ensure impacts are minimized. Given the limited scope of vegetation removal, the altered condition of the road reserve and batter slopes, and the availability of more extensive suitable habitats nearby, the proposed works are unlikely to adversely impact any of the listed threatened species.

The surrounding environment offers abundant, more suitable habitats for these species. Further details on the identified species can be found in Appendix B. Furthermore, minimal effects on nearby species are anticipated for the following reasons:

- vegetation removal will be kept to a minimum, with efforts made to avoid it wherever possible.
- Breeding resources such as logs and burrows will be retained and similar habitats are widespread in the locality;
- A significant area of foraging resources will be retained and similar resources are widespread in the locality;
- Similar or higher-quality habitat is widespread in the region;
- Breeding resources will be retained where possible and similar habitats are widespread in the locality.
- Appropriate sediment control will be used (See 3.3.3. above)

3.4.4. Threatened Fish Species & Key Fish Habitat

The section of Currowan Creek designated as a Key Fish Habitat by NSW Fisheries has a "Fair" Fish Community Status and provides essential habitat for the Australian Grayling. To protect this species, in-stream construction activities will be restricted during its spawning and migration seasons. Additionally, effective sediment and erosion control measures will be implemented to maintain habitat quality. An Assessment of Significance for the Australian Grayling, provided in Appendix B, concludes that the proposed works will not have an adverse effect on the species.

Habitat modifications resulting from construction activities are expected to be short-term and limited in extent, without causing habitat fragmentation or isolation. The works will involve replacing a culvert with a bridge, which will improve fish passage, as culverts are known to act as barriers to fish movement. The bridge construction will increase the flow of the water through removing the blockages (current crossing) and expand habitat availability. Restoring fish passage beyond these barriers is highly beneficial for the Australian Grayling and aligns with the objectives of the National Recovery Plan.

Figure 15: Key Fish Habitat Mapping

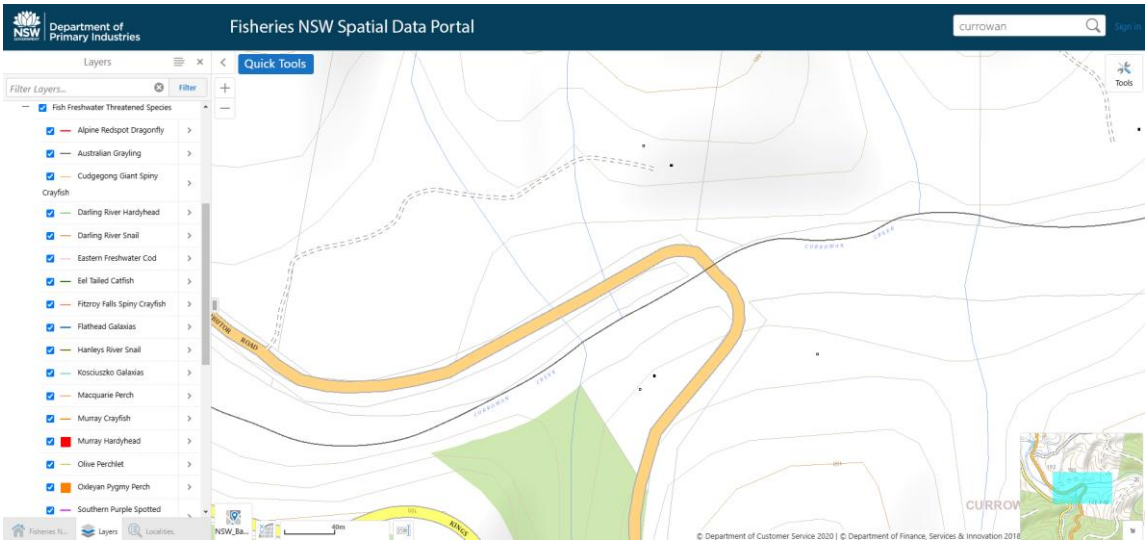


Figure 16: Fish Freshwater Threatened Species – Australian Greyling Habitat

3.4.5. Other MNES

The EPBC Search returned a total of 9 migratory species, with 3 being vulnerable, and 2 being critically endangered. One of these species, the White Throated Needletail (*Hirundapus caudacutus*) has had multiple recordings within 5 km of the site (NSW Bionet). However, given their highly mobile nature, any observations are likely to be transient. The risk of impacting migratory species is considered very low, as any construction-related disturbances will be short-term and involve minimal vegetation removal. Additionally, the surrounding area provides abundant, higher-quality habitat, further reducing the likelihood of any significant impacts on migratory species. The proposed construction works will not produce significant noise impacts outside of normal daily operating hours, as work will be carried out during designated construction times (7am-6pm, Monday to Friday; 8am-1pm Saturday). No ongoing noise emissions would occur. Detailed information regarding the migratory species identified can be found in Appendix B.

There are no other matters of NES, such as world heritage properties, national heritage properties, wetland of national importance or commonwealth marine areas, identified within proximity to the proposed activity site.

3.5. Aboriginal Heritage

3.5.1. Existing Environment

The proposed activity is within the existing footprint of the culvert, roadway and waterway, with the area being highly disturbed. An AHIMS Web Service Search was conducted on 8th November 2024 for an area surrounding the proposed activity site and concluded there was one site within a 200m radius of the proposed activity site. [redacted] Therefore, the mapped location identified in the AHIMS search is to be taken and mitigation measures implemented to prevent impact occurring to the known site. It is noted that the site is located beside the road reserve and not located within the proposed works extent. An exclusion zone (no-go zone) should be

implemented to ensure damage to the artefact does not occur. This includes no laydown, stockpiles or machinery to enter or be stored at this location.

Figure 17. AHIMS Report (redacted)

3.5.2. Impact Assessment

Due to the location of the known Aboriginal object being located outside of the proposed works site, the is a low likelihood of any impact occurring to it. The proposed activity is considered to be of low impact according to the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW 2010). No further assessment is required.

3.5.3. Management and mitigation

Follow the generic due diligence process outlined in the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW, 2010)

Step 1. Will the activity disturb the ground surface? Yes

Step 2a. Search the AHIMS database and use any other sources of information of which you are already aware.

Search undertaken for the site and one site is located within 200m of the proposed disturbance area. However, the site is highly modified and previously disturbed by road construction. The proposed activity is within the existing footprint of the existing bridge and roadway and the identified site is not located within this area.

Step 2b. Activities in areas where landscape features indicate the presence of Aboriginal objects.

Potentially, the site contains one known site regarding its locations as high propensity for aboriginal objects. It has been confirmed via the information available that the recorded site is not located at the crossing. Due to the disturbed nature and footprint of proposed activities due to the existing erosion and accretion forces of the creek, road construction and crossing, the likelihood of unearthing a new heritage object is low.

Step 3 and 4. Can potential disturbance be avoided and/or does visual inspection confirm the presence or likely presence of Aboriginal heritage objects. Disturbance cannot be avoided. Surface has been disturbed due to previous erosion and accretion forces of the creek, roadworks and crossing constructions. Therefore, presence of objects is unlikely.

Recommended procedure for carrying out works:

- Proceed with caution when excavating any soil over the site.
- If while undertaking your activity you find an Aboriginal object you must stop work, notify Council's Environmental Operations Officer – Southern District, Heritage NSW and you may need to apply for an AHIP.
- Some works may not be able to resume until you have been granted an AHIP and you follow the conditions of the AHIP.
- Further investigation may be required depending on the type of Aboriginal object that is found. If human skeletal remains are found during the activity, you must stop work immediately, secure the area to prevent unauthorised access and contact NSW Police and Heritage NSW (when authorised by NSW Police).

The NPW Act requires that, if a person finds an Aboriginal object on land and the object is not already recorded on AHIMS, they are legally bound under s.89A of the NPW Act to notify OEH as soon as possible of the object's location. This requirement applies to all people and to all situations, including when you are following this code. If a person finds an Aboriginal heritage object which is not recorded on AHIMS, they should contact Heritage NSW (of the NSW Department of Climate Change, Energy, the Environment and Water) as soon as practicable. Refer link below:

https://www.heritage.nsw.gov.au/applications/aboriginal-objects-and-places/

3.6. Non-Aboriginal Heritage

3.6.1. Existing Environment

There are no items of non-aboriginal heritage in the immediate vicinity of the site. Located approximately 1.5km east from the site is the former "Black Diamond" gold mine (*circa* 1891) which is listed as heritage item in the Shoalhaven Local Environmental Plan 2014.

The former mine is associated with the development of reef gold mining following the discovery of gold at Yalwal to the north in the 1850s. Physical evidence is contained within the property and does not extend to the site of the proposed activity.

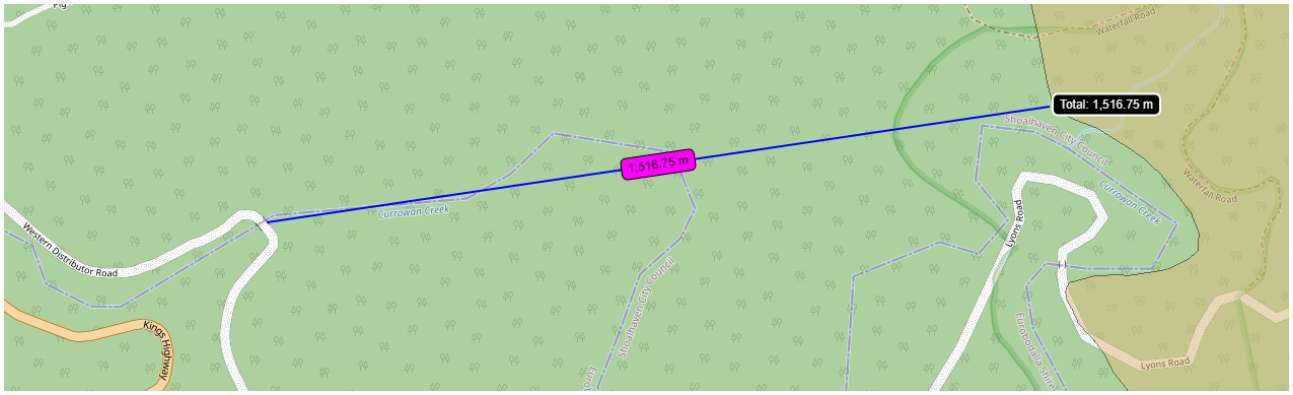


Figure 18. Non-Aboriginal Heritage Site

3.6.2. Impact Assessment

The proposed activity it not likely to result in any impacted to the known non-aboriginal heritage site.

3.7. Noise and Vibration

3.7.1. Existing Environment

The existing noise level of the site is consistent with what would be expected for the surrounding area which is predominately forest and cleared rural farmland.

3.7.2. Impact Assessment

Construction works should ensure that DECC noise guidelines are not exceeded. All vehicles travelling to the site should consider nearby residences when travelling. The proposed short term construction works will not produce significant noise impacts outside of normal daily operating hours, as work will be carried out during designated construction times (7am-6pm, Monday to Friday; 8am-1pm Saturday). No ongoing noise emissions would occur. No noise monitoring is deemed necessary to evaluate potential noise impacts.

3.7.3. Management and mitigation

The management of construction related noise should be completed inline with the Interim Construction Noise Guideline, (DECC, 2009) and AS2436- 2010 "Guide to Noise Control on Construction, Maintenance and Demolition Sites".

Vehicle noise and pollution emissions shall be limited by ensuring that all plant and equipment meet Work Cover regulations and are fitted with correct noise reduction devices in accordance with manufacturer's recommendations:

- Regular servicing of construction equipment shall be undertaken.
- Working hours to be restricted to comply with EPA and Council regulations and these should be confirmed prior to undertaking any of the proposed works outside of the prescribed times.
- Consultation with affected nearby residents and informing them in advance as to the extent and timing of works and responsibly advising when noise levels during such works may be relatively high.
- Where readily available, deploying plant having lower noise emission levels.
- Properly maintaining plant to ensure rated noise emission levels are not exceeded.
- Providing a contact telephone number for the public to seek information or make a complaint. A log of complaints will be maintained and actioned by the site superintendent and Council representative in a responsive manner.
- Undertaking construction activities guided by AS2436-2010 "Guide to Noise Control on Construction, Maintenance and Demolition Sites".

Furthermore, construction work is to give due consideration to the amenity of site neighbours and any complaints are to be noted and addressed where possible.

3.8. Air Quality

3.8.1. Existing Environment

The existing air quality at the site is consistent with what would be expected for the surrounding area which is predominately forest and cleared rural farmland.

3.8.2. Impact Assessment

Construction: Limited dust generation will occur from the proposed works. Any exposed soil from these works should be covered as soon as practicable. It is unlikely soils will require to be imported/exported from the site. Following the completion of construction works, the proposed works would not have any dust impacts on air quality.

Operation: No dust impacts would occur once the bridge is installed.

3.8.3. Management and mitigation

The CEMP for the works should include soil and water management, including consideration of wind-blown dust. This can be managed through the use of covers over truck loads and any stockpiled soils/sand. The following mitigation measures should be employed to reduce any potentially adverse air quality impact from dust during construction:

- Stockpiles should be kept to a minimum;
- Excess spoil should be promptly removed from site if required.

3.9. Waste and Chemical Management (non-asbestos)

3.9.1. Potential Waste sources

The following major waste streams are identified and methods for their management provided below. During construction the following waste streams will be produced:

- Bulk earthworks material – excavated material for new abutments will be reused as backfill on site where possible. Excess material will be removed from site by the contractor prior to completion.
- Existing culverts– culverts removed from the river bed, will be removed from site and disposed of at a licenced waste facility.

- General construction waste – construction at the site will generate general construction waste such as paper, plastics, and metal.

3.9.2. Management and mitigation

The following mitigation measures are to be implemented:

- Transport of materials from construction site to sites of reuse or disposal will be done using covered trucks where possible.
- Securely store other waste on site until it is removed so that it does not become litter. Skip bins or other containers will be used on-site for the collection of general waste which will be taken off-site at end of works to an approved waste disposal/recycling facility.
- In the event of any oil waste occurring on-site, this would be collected and transported to the nearest oil recycling facility.
- Chemical and potentially hazardous substances that are likely to be used for the proposed works will be hydrocarbons, including oils, greases, and fuels. No temporary fuel or chemical storage will be required.
- A hydrocarbon spill kit should be available whilst machinery is operating to manage any hydrocarbon spills.
- Where refuelling of machinery is undertaken on site, ensure a hydrocarbon spill kit is located close to the refuelling location and bund all fuel contained on the site. All fuel should be stored, bunded, at least 50m away from waterways.
- Undertake any refuelling away from creeks and road drains.
- A spill management procedure shall be prepared by the contractor. The spill management procedure shall include at a minimum:
    - Contact appropriate authorities, if necessary, generally Fire, Council and EPA.

- Isolate spill from transfer to the environment, either through collection, bunding, diversion or other means.
- Undertake necessary clean-up.

3.10. Traffic

3.10.1. Potential impact

Access to the site will be along the Western Distributor Road via the Kings Highway, Currowan. Impacts on traffic and access due to the proposed activities will be the result of:

- Temporary bypass track to cross Currowan creek
- Partial road closures
- Additional vehicle movement associated with machinery and deliveries to site
- Parking and storage of materials

A traffic management plan shall be developed by the Construction Contractor and approved by the relevant Road Authorities (Eurobodalla and Shoalhaven) which will address these issues. Stakeholders such as residents and NSW Forestry and National Parks and Wildlife Service will be engaged and notified of the changes and potential delays. Warning signage (*e.g.* through variable message boards) will be implemented prior to construction occurring to notify any road users of the upcoming works.

3.10.2. Management and mitigation

A bypass track and bailey bridgewill be constructed to ensure vehicle access is maintained throughout thee construction period. The construction tender will request contractors to provide a suitable traffic management plan that will be assessed during the tender evaluation process. Engagement with stakeholders, including the community, Forestry, NPWS and emergency services

in relation to the works will occur prior to construction commencing. Signage and/or VMS boards will be instated to provide notification prior to, and throughout the construction process.

3.11. Visual Amenity/ Landscape

3.11.1. Potential impact

Visual amenity will be temporarily disturbed by construction at the site. Likely impacts will be the result of barrier fencing, temporary signage, machinery, material stockpiles, and earth stockpiles. As works are minor in nature and in length, visual amenity would not be impacted severely. All waste materials and stockpiles will be removed at the conclusion of the proposed activity.

3.12. Socio-Economic Considerations

3.12.1. Potential impact

The majority of safety hazards at the site will be the result of construction activities. Contractors will be required to identify and implement management measures. These should be included in Safe Work Method Statements (SWMS). Contractors will be required to implement work, health and safety procedures for the works site. These should include, but are not limited to:

- Preventing unauthorised access to work sites
- Details on management of parking for the construction machinery and workers vehicles to minimise impacts on road users.
- Working near a waterway- low risk as long as out of heavy rainfall period.
- Working at heights
- Traffic hazards

3.13. Cumulative Impacts

3.13.1. Potential impact

There are no known additional works happening in the area at the proposed time of construction, therefore it is considered any cumulative impacts to the area to be negligible.

4. Section 171(2) of the EP&A Regulation 2021

Section 171(2) of the EP& A Regulation sets out 16 factors that need to be considered when assessing environmental impact under Part 5 of the EP&A Act.

Table 7: Section 171(2) Assessment if the EP&A Regulation 2021

Relevant Clause	Impact Assessment (Positive/Negative/Neutral)	Reason
(a) Any environmental impact on a community?	Positive	The new bridge will remove existing barriers identified to fish passage from the existing culvert system. The proposed bridge will improve the safety and resilience of the access, along with minimising the risk of failure occurring during a disaster event; positively impacting the community.
(b) Any transformation of a locality?	Neutral	The proposed works will not transform the locality. The locality would remain a waterway crossing.
(c) Any environmental impact on the ecosystem of the locality?	Positive	The new bridge will removal barriers identified to fish passage improving the ecosystem.
(d) Any reduction of the aesthetic, recreational, scientific, or other environmental quality or value of a locality?	Neutral	Visual amenity will be temporarily disturbed during construction, however no negative long-term impacts will occur.
(e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural,	Neutral	The proposed works will not cause any negative social or cultural impacts as no harm will occur to an Aboriginal or Non-Aboriginal item, or place of significance.

Relevant Clause	Impact Assessment (Positive/Negative/Neutral)	Reason
historical, scientific, or social significance or other special value for present or future generations?		
(f) Any impact on the habitat of protected animals (within the meaning of the *Biodiversity Conservation Act 2016*)?	Neutral	The proposed works are not expected to pose any impact upon the habitat of a protected animal species.
(g) Any endangering of any species of animal, plant or other form of life whether living on land in water or in the air?	Neutral	The proposed works will cause minor temporary disruption during construction; however no long-term impacts are anticipated.
(h) Any long-term effects on the environment?	Positive	The new bridge will remove the existing barrier to fish passage, imposing a positive long term environmental impact.
(i) Any degradation of the quality of the environment?	Neutral	The proposed works will not cause any degradation to the equality of the environment.
(j) Any risk to the safety of the environment?	Neutral	The proposed works do not pose any risk to the safety of the environment. Rather, the new bridge will offer a safe access in events such as large rainfall or floods due to the additional height.

Relevant Clause	Impact Assessment (Positive/Negative/Neutral)	Reason
(k) Any reduction in the range of beneficial uses of the environment?	Neutral	The proposed works will not reduce any beneficial uses of the environment, with the proposed activity use consistent with current use. Dedicated river crossings and public roads ensure vehicles do not enter the waterway and vegetated areas, alleviating negative impacts associated.
(l) Any pollution of the environment?	Neutral	The proposed works will not cause any degradation of the quality of the environment.
(m) Any environmental problems associated with the disposal of waste?	Neutral	The proposed works will not cause any environmental problems due to the disposal of waste. All waste is to be disposed of correctly as outlined within this REF.
(n) Any increased demand on resources (natural or otherwise) which are, or are likely to become, in short supply?	Neutral	The proposed works will not increase demand on existing resources.
(o) Any cumulative environmental effect with other existing or likely future activities?	Neutral	The proposed works will not pose a cumulative environment effect. No further works in Currowan Creek are planned or are known by the proponent.
(p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?	Neutral.	The proposed works are not within an area which will be impacted by coastal process and hazards.

Relevant Clause	Impact Assessment (Positive/Negative/Neutral)	Reason
(q) Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1?	Neutral	The proposed activity is consistent with Planning Priority 2 (Delivery Infrastructure) of Shoalhaven 2040 Land-use Planning Statement. The Proposed activity is not inconsistent with the Illawarra Shoalhaven Regional Plan 2041
(r) Any other relevant environmental factors?	Neutral	The proposed works are consistent with the current land use and consider all impacts to threatened flora and fauna which could reside at the sites. Works will improve the infrastructure for the community, providing an increased level of safety, resilience and accessibility for the community, emergency services etc.

5. Environmental Safeguards and Mitigation Measures

Table 8: Environmental Safeguards and Mitigation Measures

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
Soils- Erosion	Any disturbance of ground over presents potential risks for erosion, this can be minimised through implementation of the following safeguards.	• Site management shall incorporate best management erosion and sediment control practices such as those found in the Landcom's "Blue Book (4th Edition) on erosion and sediment control. • Linear sediment fencing to be installed down slope of all affected areas and stockpiles. Sediment fencing will be installed before any excavation begins. • Sandbags, straw bales wrapped in geotextile fabric etc. will be used to slow water flow and trap sediment. No hay bales are to be used. • All erosion and silt control devices will be visually inspected weekly to ensure effectiveness as well as after each rainfall event. • Risks associated with flooding should be included within the contractor's safety management plan and construction environmental management plan. It is suggested that Flood Emergency Procedures are prepared, where upon flood warnings, the contractors take certain steps in order to minimise the impact	Contractor

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
		upon plant, sediment booms and fences, and material/equipment storage which have the potential of being washed downstream. • The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with Landcom's "Blue Book (4th Edition) on sediment and erosion control. • Construct temporary drainage structures in accordance with the 'Technical Guideline - Temporary Stormwater Drainage for Road Construction' (TfNSW 2011) • Overburden will be placed in the form of a bund upslope of the site where necessary to reduce surface water entering the site. • Stockpiles will be designed, established, operated and decommissioned in accordance with Landcom's "Blue Book (4th Edition) on sediment and erosion control.	
Contaminated Land/ **Acid Sulfate Soils**	Testing was undertaken to determine the risk of acid sulphate and pH soil being present, with both considered negligible. Disturbance of acid sulphate soils can generate large amounts of sulphuric acid leachate which can impact the surrounding environment.	Acid Sulfate soils are not anticipated to occur at this location.	-

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
	No records returned on a search of the NSW EPA Public Register in relation to Contaminated Lands. Potential impacts include water quality impacts and impacts on flora and fauna.		
Water Quality/ Hydrology	Disturbance of groundcover, use of chemicals and generation of waste all have the potential to impact the surrounding waterways via runoff.	• Visual monitoring of local water quality (ie turbidity, hydrocarbon spills/slicks) is to be undertaken on a regular basis to identify any potential spills or deficient erosion and sediment controls. • Water quality control measures are to be used to prevent any materials (eg. concrete, grout, sediment etc) entering waterways. • No dirty water may be released into waterways. • Prevent sediment moving off-site and sediment laden water entering any water course. • Reduce water velocity and capture sediment on site. • Divert clean water around the site.	Contractor

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
		• Store fuels, chemical and hazardous materials in secure, bunded areas within temporary construction ancillary facilities, and at least 50m from all waterways. • Capture and dispose of spill and contaminated materials from temporary construction ancillary facilities at a licensed facility. • Provide spill kits around temporary construction ancillary facilities.	
Biodiversity	Mapped Endangered Ecological Communities (EECs) and Threatened Ecological Communities (TECs) are present in the vicinity of the proposed activity. Vegetation removal will be minimized, prioritizing tree retention where feasible. Any necessary removal of vegetation or trees on the northwestern side of the works will be documented and assessed to reduce impacts. A desktop assessment indicated that threatened flora and fauna	General: • As part of the site induction process, provide all site personnel with information on the biodiversity values of the study area, including threatened species, no-go areas, and responsibilities under relevant environmental legislation. • Should unexpected, threatened fauna be located at any time during construction, cease work immediately in the area to prevent further harm to the individual. Contact Council's Environmental Officer and /or a suitably qualified ecologist to determine if further assessment or management plans are required. Clearing of Vegetation: Pre-clearing: • Trees that are to be trimmed will be clearly marked. Any vegetation to be protected adjacent to the work area will be protected with exclusion fencing.	Contractor

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
	species are likely to occur on-site due to habitat suitability and recorded sightings. However, an on-site assessment confirmed the absence of threatened flora species. An Assessment of Significance was conducted for the threatened fauna species, concluding that the proposed works will not adversely impact or threaten local populations. The site provides habitat for the Australian Grayling. An Assessment of Significance confirmed that the proposed works will not pose a threat to this species, as construction will be restricted during critical times to protect the species. Additionally, upgrading to a bridge will enhance fish passage and aligns with the National	Clearing of vegetation – general safeguards • Remove minimum required vegetation and minimise disturbance to remaining vegetation • If any damage occurs to vegetation outside of the boundaries of the work site as a result of the implementation of the proposal, the Project Manager will be notified and will establish strategies for mitigation of impacts and site restoration. Loss of threatened species and their habitats: • Minimise removal of native vegetation and fauna habitat. • Implement exclusion zones to protect threatened ecological communities and threatened species habitat. • Works are not to harm threatened fauna. • Works are not to create a barrier to fauna movement. Aquatic habitats and Riparian Zones: • Manage riparian areas in accordance with TfNSW's 'Biodiversity Management Guidelines Guide 10: Aquatic Habitats and Riparian Zones' (TfNSW 2024). • Should alteration of fish passage occur during construction consult with NSW Department of Primary Industries to determine if a permit under Section 219 of the FM Act is required.	

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
	Recovery Plan for the Australian Grayling.	Invasion of Exotic Species: • Manage vegetation within the road reserve and adjacent to areas of vegetation clearing in accordance with Guide 6 Weed Management and Guide 10 Aquatic Habitats and Riparian Zones of Roads and Maritime's Biodiversity Guidelines (TfNSW, 2024) to reduce invasion of noxious weed species. • Use weed-free topsoil in landscaping and revegetate disturbed sites with locally indigenous species. • Construction machinery should be washed prior to entering and leaving site to ensure weed propagules are not transported. Stockpiling: • Only place stockpiles in low value vegetation, where cleared sites are unavailable. • Stockpiles should be no taller than 2m height. • Use existing stockpiles before creating new ones. Site Restoration: • The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with: ○ Landcom's "Blue Book (4th Edition) on sediment and erosion control	

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
		○ TfNSW Landscape Guidelines; ○ TfNSW Guidelines for Batter Stabilisation Using Vegetation.	
Aboriginal Heritage	An identified Aboriginal site is located in close proximity to the proposed activity. [redacted] Therefore, the mapped location identified in the AHIMS search is to be taken and mitigation measures implemented to prevent impact occurring to the known site. It is noted that the site is located beside the road reserve and not located within the proposed works extent.	Awareness: • All personnel working on site will receive training to ensure awareness of location of existing Aboriginal objects within the Study Area and immediate surrounds, and relevant statutory responsibilities. Management of existing (known) items: • No laydown, stockpiles or machinery is to enter or be stored within the location of known sites. Unexpected Finds: • If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and Shoalhaven City Councils Environmental Operations Officer shall be contacted immediately.	Contractor
Historic Heritage	There are no items of non-aboriginal heritage in the	Unexpected Finds:	Contractor

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
	immediate vicinity of the site. Located approximately 1.5km east from the site is the former "Black Dimond" gold mine which is listed as heritage item.	• If heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Shoalhaven City Council's Environmental Operations Officer shall be contacted immediately. The procedures outlined in Part 6 of the Heritage Act 1977 should be followed.	
Noise and Vibration	Construction works should ensure that DECC noise guidelines are not exceeded. All vehicles travelling to the site should consider nearby residences when travelling. The proposed construction works will not produce significant noise impacts outside of normal daily operating hours. No ongoing noise emissions would occur. No noise monitoring is deemed necessary to evaluate potential noise impacts.	Notification: • All sensitive receivers (e.g local residents) likely to be affected will be notified at least five working days prior to the start of any works associated with the activity that may have an adverse noise or vibration impact. Standard Hours of Operation: • Works to be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Any work that is performed outside normal work hours or on Sundays or public holidays may not be permitted and, if permitted, works are to minimise noise impacts. Out of hours: • Where out-of-hours activities are required, a Noise and Vibration Management Plan will be prepared and implemented in consultation with sensitive receivers.	Contractor

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
Air Quality	Limited dust generation will occur from the proposed works. Any exposed soil from these works should be covered as soon as practicable. Following the completion of construction works, the proposed works would not have any dust impacts on air quality.	• Measures to minimise or prevent air pollution or dust are to be used including watering or covering exposed areas. • Works are not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely • Vegetation or other materials are not to be burnt on site. • Vehicles and vessels transporting waste or other materials that may produce odours or dust are to be covered during transportation • Vehicles and equipment are to be maintained in good working order. • Monitor work areas and stockpiles for dust generation and seed/cover/spray to suppress. • Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust • Do not leave vehicles idling	Contractor
Waste/ Chemical Management	During construction three major waste streams will be produced. Bulk earthworks materials will be reused as backfill onsite where	• All surplus material, off cuts, and other debris resulting from the work shall be removed from site and disposed of by a licensed contractor to a licensed waste management facility.	Contractor

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
	possible. Excess fill will be transported toa councils' stockpile for reuse in other areas. Existing bridge material will be sorted, removed from site and either disposed of at a licenced waste facility or stockpiled for reuse. General construction waste will be sorted and disposed of at a licenced waste facility.	• Waste material, other than vegetation and tree mulch, is not to be left on site once the works have been completed. • Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day. • Transport of waste materials shall be done using covered trucks. • Securely store other waste onsite until it is removed so it does not become litter.	
Traffic	The works will include a temporary bypass track which will enable access to be maintained. Additional vehicles will be traveling along the road, effects are to be mitigated.	• Where possible, current traffic movements and property accesses are to be maintained during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays. • As traffic disturbance is unavoidable, a Traffic Management Plan (TMP) will be prepared in accordance with Council's requirements and approved by Council. • Comply with Council requirements regarding traffic control, access and road/ pedestrian access. • Erect signs regarding proposed works, temporary road closures, diversions etc.	Contractor

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
		• Conduct engagement with stakeholders, residents and other bodies who utilise this road to provide notice of road closures.	
Visual Amenity/ Landscape	Visual amenity will be temporarily disturbed by construction at the site. Likely impacts will be the result of barrier fencing, temporary signage, machinery, materials stockpiles, and earth stockpiles.	• Contain all work within the boundaries designated on the site plan • Restore work sites to as close to their original condition as possible • Minimise spread of stockpiles, waste, and parking	Contractor
Socio-Economic Factors	No impacts are proposed to occur on local businesses, on street parking arrangements, places/items of social value, or change the visibility of any business, farms, or tourist attractions. Pedestrian access will be altered to the bypass track during construction. Access to properties will be temporarily altered during	• Contain all work within the boundaries designated on the site plan. • Restore work sites to as close to their original condition as possible. • Display public information signs until site restoration is complete. • Carry out community and stakeholder consultation before works start . • Notify the Works Supervisor and Asset Manager immediately of any complaints or any accidental damage to property. • Locate services on DBYD search and peg out no-go areas to avoid service-disruption	Contractor

Impact Type	Description of Potential Impact	Mitigation Measures	Responsibility for Implementation
	through the use of a bypass track.	• All Council staff and contractors shall exercise courtesy in dealing with the community	

6. Consultation

Chapter 2, Part 2.2, Division 1 of the Transport and Infrastructure SEPP (T&I SEPP) Provides recommendations for consultation with affected stakeholders (Table 7).

Table 9: Infrastructure SEPP Consultation Requirements

T&ISEPP Clause	**Clause Reference**	**Consultation Required**
Section 2.10	**Impacts on council-related infrastructure or services** Consultation is required if the public authority is of the opinion that the development: *(a) will have a substantial impact on stormwater management services provided by a council, or* *(b) is likely to generate traffic to an extent that will strain the capacity of the road system in a local government area, or* *(c) involves connection to, and a substantial impact on the capacity of, any part of a sewerage system owned by a council, or* *(d) involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council, or* *(e) involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential, or* *(f) involves excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the Roads Act 1993 (if the public authority that is carrying out the development, or on whose behalf it is being carried out, is not responsible for the maintenance of the road or footpath).*	Eurobodalla Shire Council have been informed/engaged in regard to the proposed works and are supportive of the works occurring. The councils Engineering Environmental Support Officer has been provided with a copy of this REF for information and review.
Section 2.11	**Impacts on local heritage** Consultation is required if the development:	No – Local Heritage items

T&ISEPP Clause	Clause Reference	Consultation Required
	(a) is likely to have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area, and *(b) is development that this Policy provides may be carried out without consent.*	are not being impacted.
Section 2.12 and Section 2.13	**Impacts on flood liable land** *In this clause, flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled Floodplain Development Manual: the management of flood liable land published by the New South Wales Government and as in force from time to time.*	No - Location is not flood liable land. Consultation with SCC and NSW State Emergency Services is not required.
Section 2.14	***Consultation with councils – development with impacts on certain land within the coastal zone*** *Consultation is required if the development is:* *(a) On land that is within a coastal vulnerability area and is inconsistent with a certified coastal management program that applies to the land*	No – Location is not within a vulnerable coastal area.
Section 2.15	***Consultation with public authorities other than councils*** *Consultation is required if the development is:* *(a) development adjacent to land reserved under the National Parks and Wildlife Act 1974 or to land acquired under Part 11 of that Act— the Office of Environment and Heritage,* *(b) development on land in Zone C1 National Parks and Nature Reserves or in a land use zone that is equivalent to that zone, other than land reserved under the National Parks and Wildlife Act 1974 —the Office of Environment and Heritage,* *(c) Development comprising of a fixed or floating structure in or over navigable waters – transport for NSW*	No - Location is not subject to any conditions detailed with this section.

T&ISEPP Clause	Clause Reference	Consultation Required
	(d) development that may increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map—the Director of the Observatory, *Note. The dark sky region is land within 200 kilometres of the sliding spring Observatory.* *(e) development on defence communications facility buffer land within the meaning of clause 5.15 of the Standard Instrument—the Secretary of the Commonwealth Department of Defence* *Note. Defence communications buffer land is located around the defence communications facility near Morundah. See the Defence Communications Facility Buffer Map referred to in clause 5.15 of the Lockhart Environmental Plan 2012, Narrendera Local Environmental Plan 2013 and Urana Local Environmental Plan 2011* *(f) Development on land in a mine subsidence district within the meaning of the Mine Subsidence Compensation Act 1961 – the Mine Subsidence Board.* *(g) Development on, or reasonably likely to have an impact on, a part of the Willandra Lakes Region World Heritage Property – The world Heritage Advisory Committee and Heritage NSW* *(h) Development within a Western City Operational area specified in the Western Parkland City Authority Act 2018, Schedule 2 with a capital investment value of $30 million or more – the Western Parkland City Authority constituted under the Act.* *Note. Clause 18A (2) of State Environmental Planning Policy (Sydney Region Growth Centres) 2006 requires public authorities (or persons acting on their behalf) to consult with the Department of Planning and Infrastructure before carrying out any development comprising the clearing of native vegetation on certain land within a growth centre (within the meaning of that Policy). The land concerned is land other than the subject land (within the meaning of Part 7 of Schedule 7 to the Threatened Species Conservation Act 1995). The subject land is generally land to which precinct plans apply under that Policy.*	

T&ISEPP Clause	Clause Reference	Consultation Required
Section 2.16	***Consideration of Planning for Bushfire Protection*** *Development for the following purposes may be carried out without development consent:* *(a) Health service facilities* *(b) Correctional Centres* *(c) Residential accommodation*	No – Works are not covered under the listed development types.

7. Conclusion

In conclusion, this environmental assessment, conducted in accordance with Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act), has evaluated the impacts of replacing the existing culvert with a concrete bridge on Western Distributor Road over Currowan Creek. Shoalhaven City Council has acted as both the proponent and determining authority for this project, with the assessment prepared in line with the EP&A Regulation and Division 5.1 guidelines.

The project will enhance fish passage and hydrology in Currowan Creek, which serves as critical habitat for the Australian Grayling. The construction work will occur within an already disturbed footprint, with all impacts carefully managed to prevent long-term effects on sensitive habitats. Mitigations include restricting in-stream activities to avoid spawning and migration seasons, implementing sediment and erosion controls, and minimizing vegetation removal to protect the surrounding Threatened Ecological Community (TEC), the South Coast Riverflat Peppermint Forest.

Desktop and field biodiversity assessments identified threatened flora and fauna species in the vicinity, but no individuals were found on-site. Suitable alternative habitats nearby further reduce potential impacts. An Assessment of Significance found the bridge replacement unlikely to adversely affect any threatened species, with only minimal, short-term habitat modifications expected.

Currowan Creek is designated as Key Fish Habitat with "Fair" Fish Community Status and provides critical habitat for the threatened Australian Grayling (Prototroctes maraena), confirmed by NSW Fisheries mapping. To protect this species, in-stream construction will be restricted to a planned 8-week period outside of its migration and spawning seasons (end of March to early July and early September to end of December). Sediment and erosion control measures will be implemented to maintain habitat quality. An Assessment of Significance (see Appendix B) concludes that the project will not adversely impact the species. By replacing a culvert with a bridge, the works will improve fish passage, water flow, and habitat availability, supporting the National Recovery Plan for the Australian Grayling.

Additionally, the project is designed to mitigate other environmental impacts, including noise, air quality, and waste. The temporary bypass track will be managed to minimize disruption to residents. No Aboriginal or non-Aboriginal heritage sites were identified on-site.

In summary, the proposed works present a low risk to the environment and biodiversity. Through strict adherence to environmental guidelines and proactive planning, the project will meet infrastructure needs while maintaining environmental integrity.

Additional work required includes:

- Part 7 permit under the NSW Fisheries Management Act 1994 (FM Act) is required
- Bridge design will form part of the Construction Environmental Management Plan (CEMP) to be provided to NSW Fisheries a minim of two weeks prior to any work commencing.
- This REF shall be published on the NSW Planning Portal prior to the commencement of works.
- Public and stakeholder engagement in relation to the works will be required prior to commencement of works, following councils community engagement policy.

8. REF Determination, Certification and Review

This REF provides a true and fair review of the proposal in relation to its potential effects on the environment. It has assessed the likely environmental impacts of the proposal by Shoalhaven City Council for a proposed upgrade to Currowan Creek which involves the removal of an existing culvert which has been identified as a blockage to fish passage, and the construction of a bridge. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal. It identifies the likely impacts of the proposal on the environment and details the environmental safeguards and mitigation measures to be implemented to minimise the potential impact to the environment.

In light of the above assessment of the proposed activity, it is considered that the overall impact on the environment is not likely to have a significant impact on the environment and therefore an EIS is not required. The proposed activity will not be carried out in a declared area of outstanding biodiversity value.

Through implementation of proposed mitigation measures and construction time restrictions, is not likely to significantly affect threatened species, populations or ecological communities, or their habitats or impact biodiversity values, meaning a SIS and/or BDAR is not required. The long-term benefits of the activity will have a cumulative positive impact on the safety of road users and the activity should proceed accordingly. The proposed mitigation measures within this REF will be adopted and implemented; Implementation of these mitigation measures will reduce the potential environmental impact of the proposed activity.

REF Author

Signature: 

Name: Caitlin Battersby

Title: TA Project Services, Project Manager

Date: 15/05/2024

Signature: 

Name: Tegan Leisegang

Title: TA Project Services, Project Officer

Date: 15/05/2024

I certify that I have reviewed and endorsed the contents of this REF document, 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.

Reviewed and endorsed by:

Signature: 

Name: Robert Bruke

Title: TA Project Services, Project Director

Date:26/05/2025

I certify that I have reviewed the contents of this REF document, 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. I therefore determine that the activities outlined within this REF are authorised to occur. This REF is not required to be referred to additional bodies. This REF is required to be published (NSW Planning Portal).

Authorising Manager's approval

Signature: 

Name: Craig Exton

Title: Manager - Technical Services

Date: 30/05/2025

Appendix A – Scope and Design Plans

FAIRLIGHT CONSULTING ENGINEERS

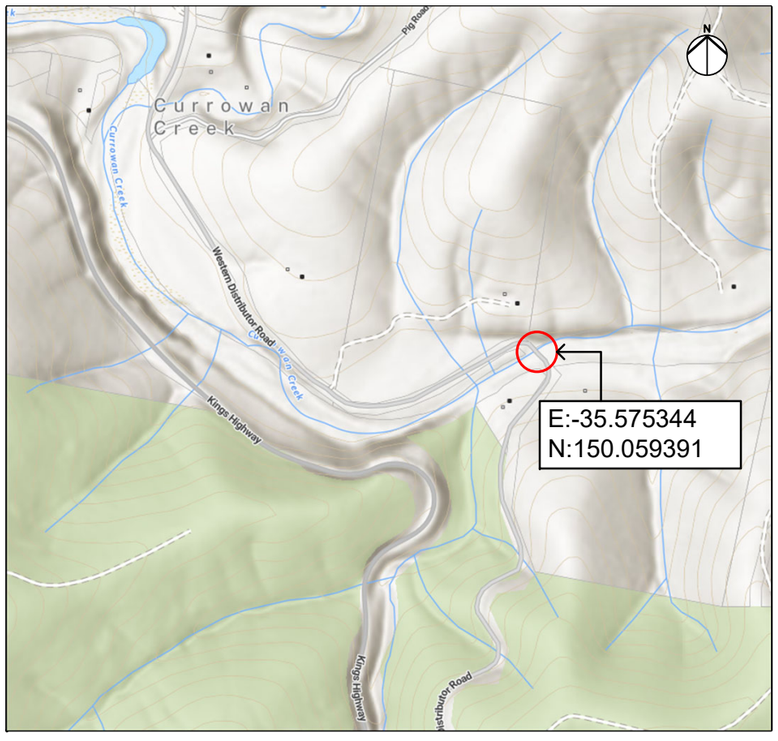
East Coast × CIVIL CONSTRUCTION

ABN: 70 654 541 214
P.O. Box 30 Gerringong NSW 2534
Ph : 0439 999 286
Email : steve@fairlight-engineers.com.au

PROJECT: PROPOSED NEW BRIDGE OVER CURROWAN CREEK ON WESTERN DISTRIBUTER ROAD STRUCTURAL PLANS & DETAILS

CLIENT: EAST COAST CIVIL CONSTRUCTION

Location Plan



DRAWING LIST	TITLE	REVISION
SHEET 1	TITLE SHEET	E
SHEET 2	GENERAL NOTES	E
SHEET 3	SITE PLAN	E
SHEET 4	BRIDGE PLAN & ELEVATION	E
SHEET 5	BRIDGE DETAILS AND SET OUT	E
SHEET 6	PAVEMENT & SIGNAGE PLAN	E
SHEET 7	EROSION & SEDIMENT CONTROL PLAN	E
SHEET 8	BYPASS TRACK PLAN	E

ISSUE A: 80% DESIGN	25/3/2025
ISSUE B: 80% DESIGN	7/4/2025
ISSUE C: 100% DESIGN	24/4/2025
ISSUE D: 100% DESIGN	12/5/2025
ISSUE E: IFC	15/5/2025

DESIGNED BY

Stephen Debeck

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Stephen Debeck
(BEng,MIEa, NER (Civil, Structural)

GENERAL NOTES

1. All Dimensions on these plans should be checked on site by the builder and verified on site and by using other other contract documents. Discrepancies should be referred to the Engineer.
2. It is not implied or guaranteed that all structural designs and details shown in these plans are complete. The scope of work has been determined by the engineer based on the information supplied by the client or the clients consultants. Further designs may be required.
3. Do not Scale from these plans
4. Design loads in accordance with AS 1170 and AS5100-2017 Bridge Design Code
5. Roadways W80/A160/S1600/M1600 vehicular loadings

BRIDGE DESIGN LOADING & CONSTRUCTION NOTES

1 – SM1600 as per AS5100.2 incl. Impact @ 100km/h
2 – Kerb Performance 15kN/m
3 – Earthquake loading Design Category = BEDC-1 (EQ analyses not req'd)
4 – WindLoading as per AS5100.2-2017 section 17
Wind Region=A3, Terrain Category=2, Average Recurrence Interval (1:2000 for ULS), Average Recurrence Interval (1:20 for SLS permanent effects only), Design Windspeed = 41m/s in conjunction with Traffic loads (see previous)
Net Pressure Coefficient as per APP D2 of AS1170
5 – Flood Data (as bridge relates to watercourse)

AEP	Flow Q(m3/s)	Vel(m/s)	Debris Height(m)	
1:20	172	2.18	3	SLS case scour & deflection
1:100	327	2.71	3	
1:2000	850	3.85	3	ULS case structural strength

EXCAVATIONS FOR EXTERNAL CONSTRUCTIONS
-excavate and/or fill as required for external area slabs and footings
consolidate ground under all paths, pads or paved areas.
CERTIFICATE
Provide a practising civil or structural Engineer's Certificate for bearing pressure of foundation material.
SOIL AND WATER MANAGEMENT
Ensure that soils from the site are not transported beyond the boundaries. Site clearing and soil retention measures must comply with the Act. Refer to PRELIMINARIES: Environmental Protection – Soil and Water Management
GROUND WORKS
Benchmark
Relate all levels to the survey benchmark
Foundation Test Pits/Bore logs
Where foundation test pits/bore logs have been carried out
- re-excavate pits found under footings, slabs or pavements or within the "zone of influence"
- angle of zone of influence below horizontal:
- 30^0 for sand foundation material
- 45^0 for clay foundation material
- replace the backfill material in compacted layers. (SEE COMPACTION)

SUPERVISION AND TESTING
Arrange for the site filling and compacting to be supervised by a qualified geotechnical engineer: .
-tests to be undertaken by a NATA registered laboratory
-provide 2 copies of test results to the Principal
rejection:
-if compacting is not up to the standard specified: carry out further compacting uniformly over the whole area until the specified standard is achieved and provide a further series of tests.
-Provide certificate from practising soil laboratory or engineer for compaction of fill.
SITE CLEARING
GENERAL
- clear and remove all stumps & other impediments and retain good ground cover where possible
- remove old pavings, footings, rubbish and debris from the whole of the site

noxious plants :
- eradicate from whole of the site blackberries, onion &oxalis weeds, nut grass & any other plant classified by Pastures Protection Board for the area as a "Proclaimed Noxious Plant or Weed"
- remove by grubbing out roots and/or by poison spray if such treatment is approved as effective

removal of trees and stumps: remove trees only as noted on the drawings and grub all stumps including those of trees previously removed
TOPSOIL, STORAGE AND REMOVAL
- remove topsoil from those areas of the site to be built upon and/or excavated including buildings, carparks, driveways, driving areas, paving and stockpile on site ready for re-spreading. Protect stockpile from contamination
- remove 100mm minimum depth of the surface layer of the natural ground
- remove from site and replace any contaminated topsoil. Refer to PRELIMINARIES:

Environmental Protection Disposal of Contaminants and Refuse :
- remove surplus excavated material on completion

SITE EXCAVATIONS
GENERAL
Excavate in material "as found". No variation to the contract will be allowed with respect to the type of material excavated
- backfill excavations taken below contract depth with concrete of equivalent strength to work immediately above at no variation to the contract
- remove surplus excavated material from the site
- provide a minimum clearance of 400mm to the underside of timber floor structures

rock excavation : where rock or shale is encountered scabble surface to level and solid bearing. Remove loose boulders and treat holes as above in backfilling
trenches : provide and maintain all necessary planking and strutting to excavations in sand or any other loose formation:
- where bearing capacity is affected by the removal of tree stumps, fence posts, rock floaters, etc. , excavate to solid bearing and backfill with concrete.

SERVICE TRENCHES
Excavate trenches to required depths to allow regulation cover over service lines:
- maintain sides of excavations vertical
- generally maintain straight runs between access holes, inspection points, and the like
- grade bottoms of trenches to provide uniform bearing. Dig bell holes after grading trench bottom
- keep trench base free of objects greater than 75mm
- keep main runs 600mm minimum clear of footings and concrete paths.

sewer and stormwater drainage:
Refer to PLUMBING AND SANITARY PLUMBING and DRAINAGE.
underground electrical mains: Refer to ELECTRICAL WORKS.
underground water mains and gas lines: Refer to DRAINAGE and GAS SERVICE.**FILLING MATERIALS**
GENERAL
Provide filling free from organic matter, from soil recovered from the site excavations or imported onto the site from an approved source. Filling must be in accordance with Engineer's drawings.
FILLING TYPES
hardcore fill: Fill with hardcore, made up of broken brick or stone, not larger than 75mm gauge.
crushed rock fill: Fill with crushed igneous rock, not larger than 40mm gauge with a minimum clay content.
granular fill: Fill with loose granular fill with minimum clay content.
SITE PREPARATION AND BULK FILLING
AREAS UNDER CONSTRUCTION WORKS
Where cut and fill is required under the building areas, carparks, driveways and pavings:
-carry out filling in accordance with Engineer's drawings
-grade area to solid and undisturbed bearing before filling
-fill in layers not exceeding 200mm loose thickness and each layer compacted.
AREAS OTHER THAN THOSE UNDER CONSTRUCTION WORKS
Filling is to be clean sandy loam fill taken from site excavations, and clean imported fill.
imported fill:
-is to be a friable, sandy loam
-comprise not less than 65% sand and not more than 15% silt and clay
-to have a pH between 5.5 to 6.5.

GRADES AND FALLS
Carry out grading and filling of site to finished levels on drawings:
-grade site to fall from buildings & paths, having a fall of 1:100 at least one metre from building
-maximum slope for grassed areas is 1:4 (25%) and mowable.

backfilling: backfill as required and consolidate to level of surrounding area.
batters: cut and fill as required to banks and retaining walls to form batter.
FINISHED TOPSOIL AREAS
Fill in with approved topsoil. Refer to LANDSCAPE WORKS -Materials.
FINISH LEVELS
Grade site so that grassed and planting areas finish flush with paths and paving, or as detailed.
COMPACTION
GENERAL
-provide compaction to filled areas in accordance with Engineer's drawings
-under buildings, roads, carparks, driveways and paving and within zone of influence of footings (except for loose granular filling used as formwork) to 98% minimum dry density ratio
-In areas where excessive settlements create tripping hazards or result in the formation of differential levels (such as backfill around manholes, at back of kerbs and against other minor concrete structures (i.e., pits, headwalls, retaining walls, etc) or places where the extent of differential settlements justifies future maintenance by topping up backfill (sewer and drainage trenches), compact to 95% dry density ratio.
-over other areas including loose granular filling used as formwork to 85% minimum dry density ratio.

BITUMINOUS PAVINGS
Where bituminous pavings are required, all work must be carried out in accordance with an approved construction specification

FOUNDATIONS
1. If not otherwise specified footings design based on minimum allowable soil bearing pressure of 150KPa. See specific details in these plans where higher magnitude bearing pressures for certain structural elements are required.
2. The design only applies for ground and foundation levels as shown on the drawings
3. Backfill foundation walls so that the level of fill on one side of the wall is never more than 450 above the level on the other side except where detailed retaining walls are used

CONCRETE
1. All concrete work in accordance with AS 3600-2018 and all bridge/culvert construction work to be in accordance with AS5100-2017
2. Concrete to be formed as required by AS 3610 and compacted in accordance with AS 3600 and AS 3610 to achieve specified or relevant density durability and strength
3. All reinforcing fabric to be lapped one mesh panel minimum and reinforcement bars lapped 40 bar diameters U.N.O.
4. Provide concrete strengths below to relevant structural items

Pad Footings	f'c = 40 MPa	Strip footings	f'c = 40 MPa
Ground Slab	f'c = 40 MPa	Slabs Beams and Columns	f'c = 40 MPa
Other Specify	Slabs & Concrete Panels exposed to open environment within 1 km of coast f'c=40 MPa		
Maximum slump of	75mm	Maximum aggregate size	20mm

5. Sizes of concrete elements do not include thickness of applied finishes
6. Do not make any construction joints, holes or chases in the concrete elements unless shown or approved by the Engineer
7. Do not place pipes or conduits within the concrete cover to reinforcement
8. Reinforcement notation

N = Grade 500 deformed bar to AS 4671	T = Top of element	TM = Trench Mesh
R = Grade 250 plain round bar to AS 4671	B = Bottom of element	EW = Each Way
SL = Grade 500 square mesh to AS 4671	UNO = Unless Noted Otherwise	
CTS = Centres	C/S = Courses	
RL = Grade 500 rectangular mesh to AS 46	L = Grade 500 trench mesh to AS 4671	

eg 8 N16 @ 200T = 8 deformed bars 16 diameter at 200 centres placed at top of element

9. Provide clear concrete cover to reinforcement as follows: UNO

ELEMENT	INTERIOR	EXTERIOR	EXTERIOR(against ground)
Footings	NA	NA	45mm
Columns, Pedestals	30mm	50mm	45mm
Slabs, Walls	30mm	50mm	45mm
Beams	25mm	50mm	45mm
Block work	20mm from appropriate outside face		

10. Recommend using maximum bar chair spacing of 60 diameters for supporting bars and 75 diameters for fabric
11. Provide laps only at locations shown unless otherwise approved by the Engineer. Min.Lap length=40db UNO
12. For rectangular fabrics place top fabric main wires uppermost and bottom fabric main wires lowermost in direction of arrows
13. Supply and lay fabric in flat sheets., overlap 1st and 2nd cross wires of each sheet by 30mm at laps
14. Do not weld reinforcement unless shown or approved by the Engineer
15. Reinforcement is shown diagrammatically and not necessarily in true position
16. All concrete shall be placed and cured in accordance with Section 19 AS 3600. Where curing compound is used it must be applied (A) onto slabs within 2 hrs of finishing operation and (B) onto walls and columns immediately after removal of framework

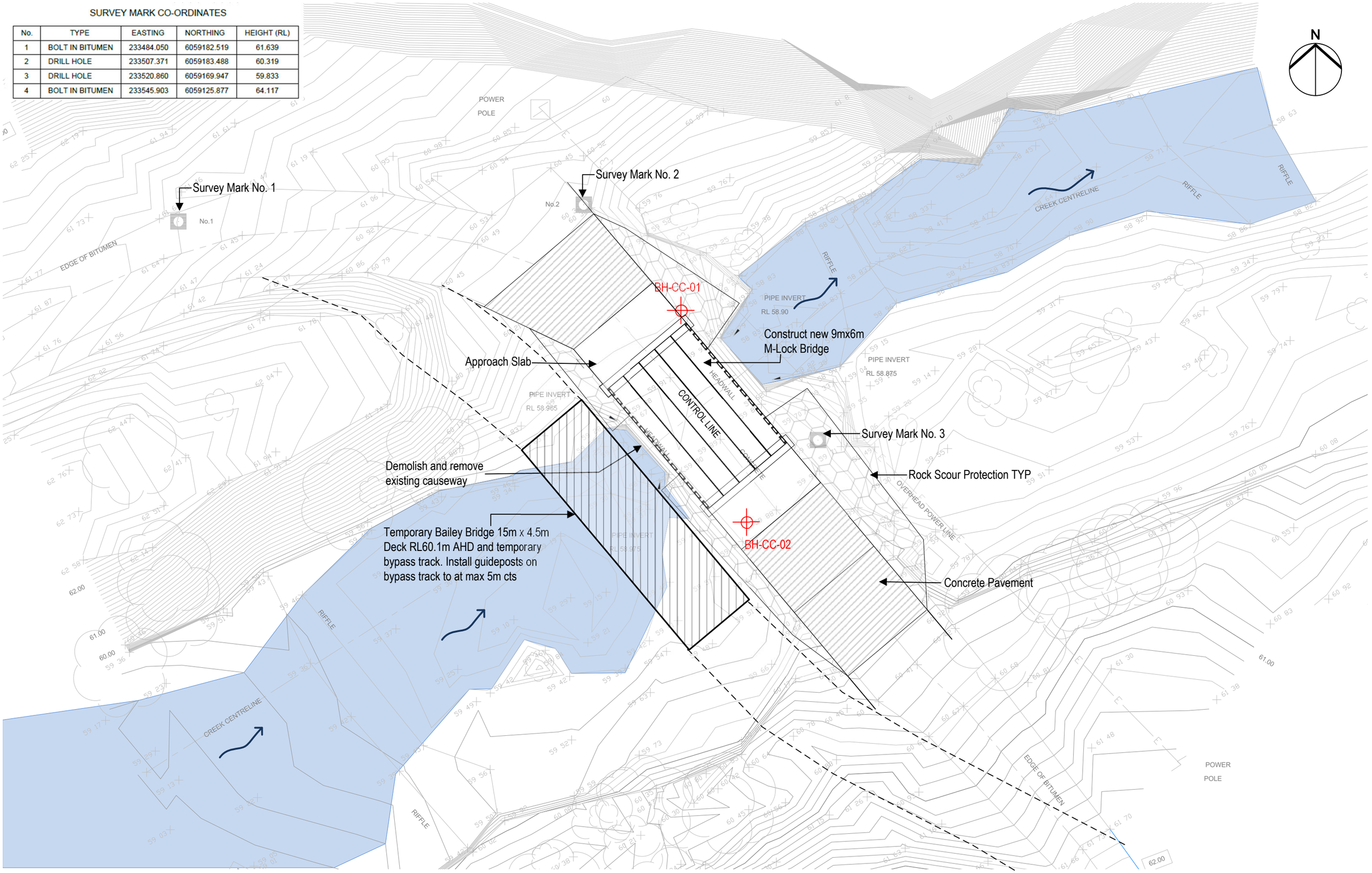
CONSTRUCTION HOLD POINTS

(for inspection as per Specification requirements)
A) Suitable rock strength for bored Piles
B) Pre-concrete pour reinforcement to Piles & Approach slabs
C) Abutment Backfilling & Road approach construction (compaction & CBR tests per AS3798 earthworks code)
D) Final (completion and certification) includes scour protection, guardrails, signage etc

CURROWAN CREEK BRIDGE SITE PLAN (1:200)

SURVEY MARK CO-ORDINATES

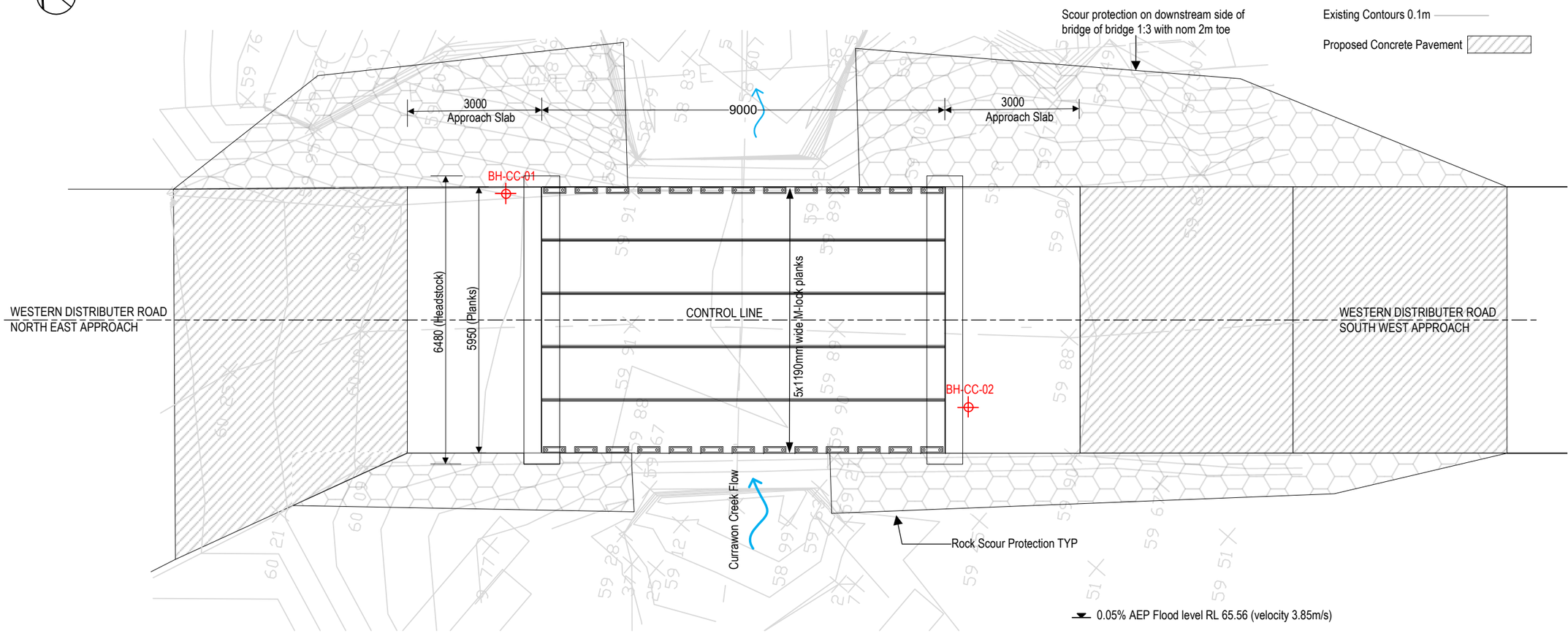
No.	TYPE	EASTING	NORTHING	HEIGHT (RL)
1	BOLT IN BITUMEN	233484.050	6059182.519	61.639
2	DRILL HOLE	233507.371	6059183.488	60.319
3	DRILL HOLE	233520.860	6059169.947	59.833
4	BOLT IN BITUMEN	233545.903	6059125.877	64.117



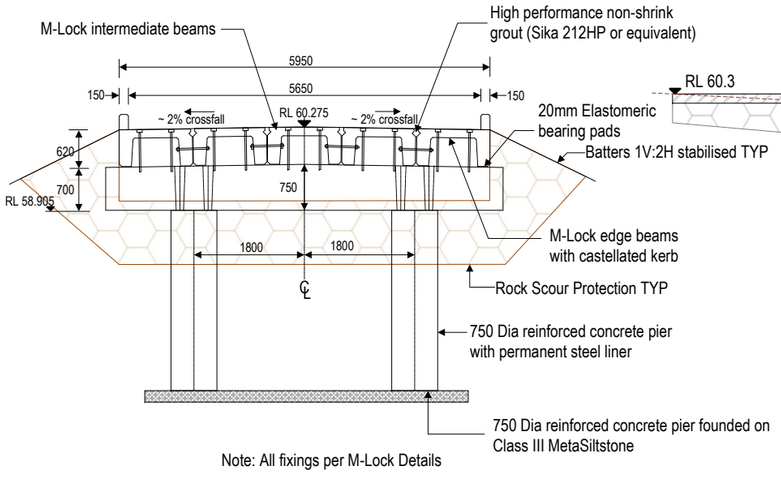
Existing 0.1m Contours

BRIDGE OVER CURROWAN CREEK	FAIRLIGHT CONSULTING ENGINEERS	Size: A3	Rev: E	Scale: 1:200	SHEET 3 OF 8

CURROWAN CREEK BRIDGE PLANS AND ELEVATIONS

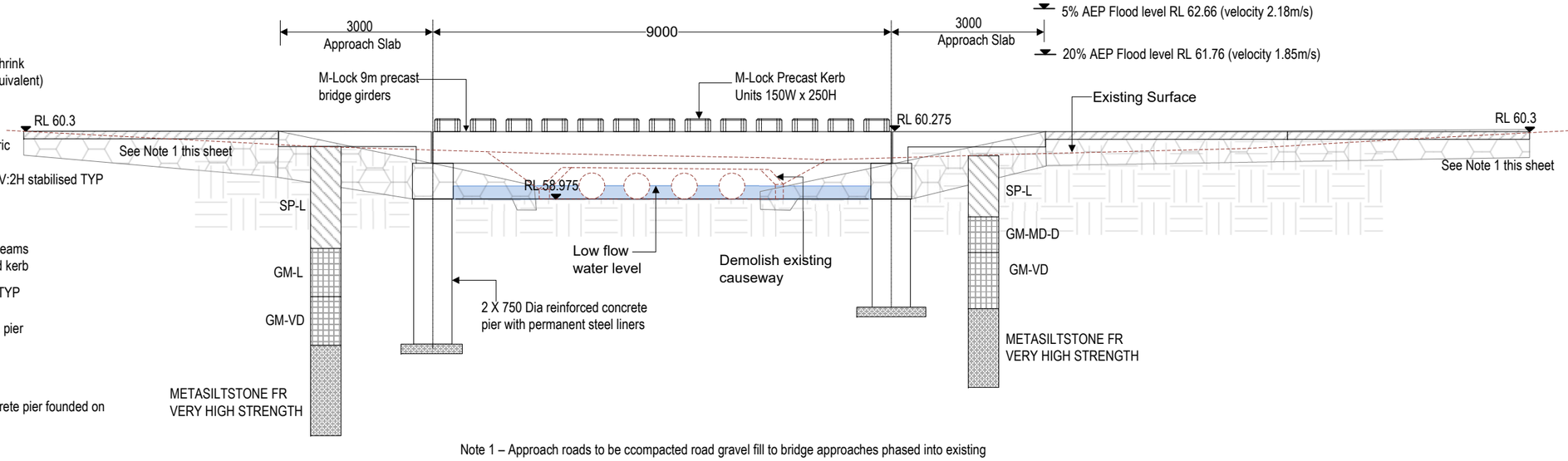


ABUTMENT ELEVATION TYP (1:100)



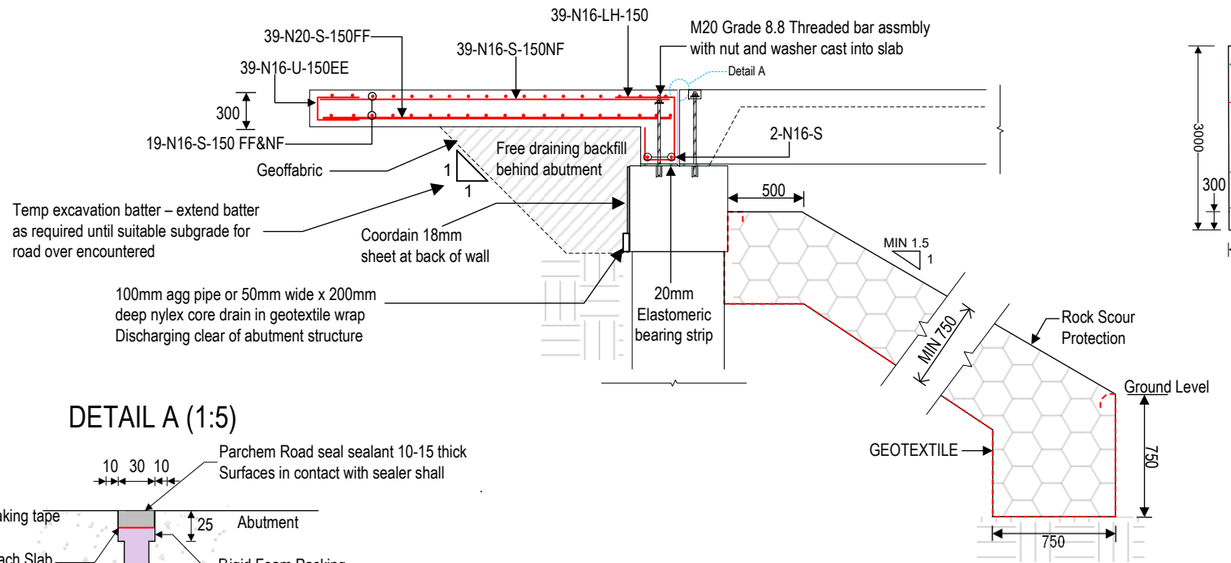
Note: All fixings per M-Lock Details

BRIDGE SIDE ELEVATION TYP (1:100)

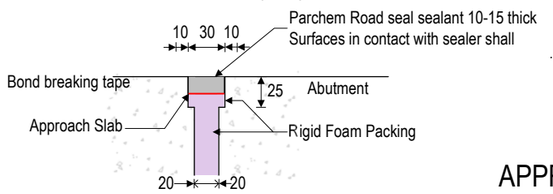


Note 1 – Approach roads to be ccompacted road gravel fill to bridge approaches phased into existing road surface using an acceptable safe approved vertical alignment
Note 2 - The placement of the bridge in relation to centerline of the creek should be such that the major flow path of the flood water is located approximately central between abutments.
Note 3: Contractor to physically locate and protect existing services prior to commencement of works

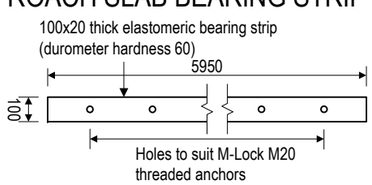
ABUTMENT DETAIL (1:50)



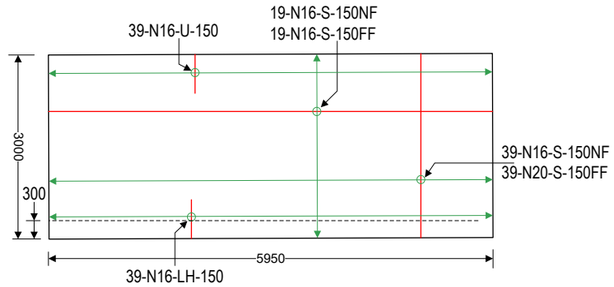
DETAIL A (1:5)



APPROACH SLAB BEARING STRIP (1:0)



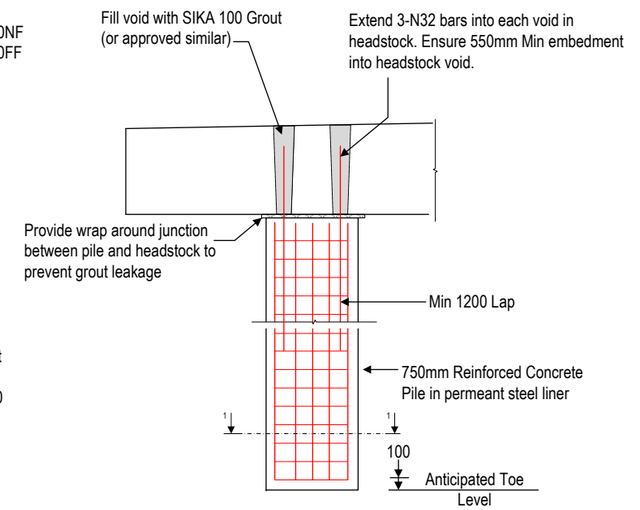
APPROACH SLAB REINFORCEMENT PLAN (1:100)

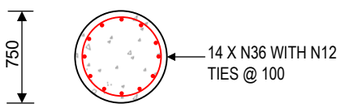


Scour Protection
Scour protection to be RIP rap rock facing at abutment embankments and meet the following requirements as a minimum:
Be hard dense durable angular and resistance to weathering extend in width to be at 2m from abutment edges and to bottom of embankment.
Be placed in their layout of minimum 750 mm thickness rock to have a minimum D50 of 600 mm and rock to be well graded throughout the rip rap layer.
Geotextile fabric shall be placed under rock in accordance with manufacturers specification and to be Bidim A39 or approved equivalent
During construction of the scour protection, geotextile shall be folded over edge of rock to maximise the contact area between rock and geotextile

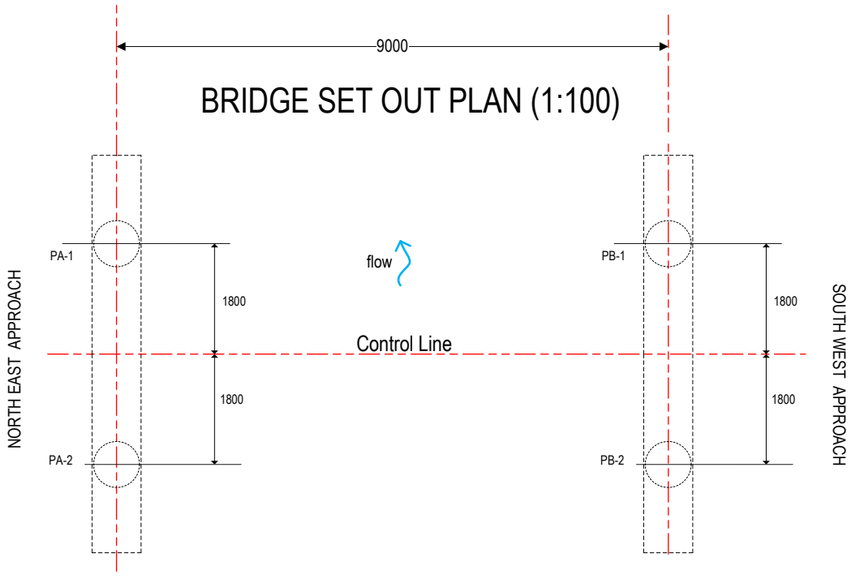
PRECAST CONCRETE ELEMENTS SCHEDULE				
MARK	NO. OF ELEMENTS	WEIGHT PER UNIT (kg)	TOTAL WEIGHT (kg)	DESCRIPTION
P-HS1	2	8750	17500	M-LOCK HEADSTOCK TO SUIT 6M BRIDGE
P-EG1	2	9315	18630	M-LOCK 9M EDGE GIRDER WITH CASTELLATED KERB
P-1G1	3	9231	27693	M-LOCK 9M INTERMEDIATE GIRDER

ABUTMENT PILE ELEVATION TYP (1:50)





SECTION 1 (1:50)



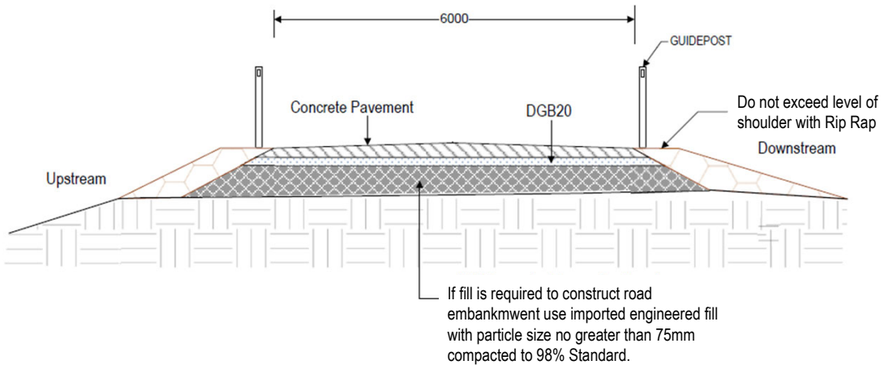
Set Out Notes
1. The Contractor to measure all precast units on site to verify set out information
2. Survey Contractor to verify set out information using survey data

PIER DETAILS									
MARK	TYPE	ULTIMATE DESIGN LOADS			TOP OF PILE (M)	ANTICIPATED TOE LEVEL (M)	~ LENGTH (M)	EASTING	NORTHING
		AXIAL (KN)	SHEAR (KN)	BENDING (KNm)					
PA-1	900 PIER	709	510	514	58.905	56.055	2.85	233512.2662	6059176.2892
PA-2	900 PIER	709	510	514	58.905	56.055	2.85	233509.4728	6059174.0183
PB-1	900 PIER	709	510	514	58.905	56.745	2.16	233517.9434	6059169.3057
PB-2	900 PIER	709	510	514	58.905	56.745	2.16	233515.150	6059167.0348

Bored Pier Notes
-Dimensions in millimetres.
-Co-ordinates and reduced levels to local site datum only.
-Exposure Classification : Mild
-Concrete strength f'c 40MPa, 20mm Agg, 180mm slump Tremie Concrete (Slump Tolerance +/- 40mm)
- Concrete exposure classification B1.
-Clear cover to reinforcement nearest to the concrete surface:
-Cast in forms or casing 45 mm
-Cast against ground 75 mm
-The nominated loads and moments apply to the structure as designed. Any proposed changes to the piles and pile layout may significantly alter the behaviour of the structure, as well as the pile loads and moments, and shall be submitted to the Engineer for approval.
-Cutoff level is given as 50mm above underside of headstock
-Founding Levels are indicative only
-Permanent pile casings are required as material overlying rock strata contains sands.
-Bored piles must be founded in High Strength MetaSiltstone bedrock material
-Assumed minimum ultimate capacities for bedrock material are;
Class III MetaSiltstone: 20MPa Ultimate end bearing and 400kPa Ultimate skin friction

Geotechnical Investigation Report
RFQ 8558E Currowan Creek - Geotechnical Investigation Report
Ref 304001135-001 Dated 8/12/2023
By Stantec
Survey
Detail survey over Lot 1 in D.P. 707475
No.190 Western Distributer Road, Currowan
By Cahill & Cameron Surveys
Ref C23197 dated 28/5/2023
M-Lock Precast Girder and Headstock Specifications by CivilMart
Design in accordance with AS5100-2017 for use with SM1600 Traffic Loads
Concrete Exposure Classification B2
Preliminary Design
Currowan Creek – Fish Passage Draft Detailed Design
Rev A Dated 9/8/2023 AWC Ref # 231758 Sheets 1 to 7

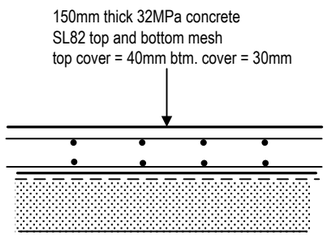
SECTION AA (1:200)



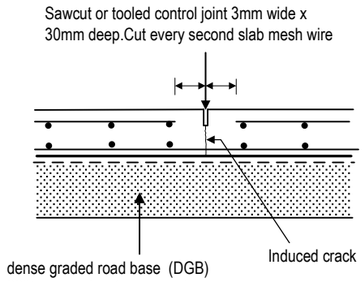
Note: Earthworks batters and Any disturbed area be covered in 200mm of topsoil, dry land grassed and bitumen straw mulched.

CONCRETE PAVEMENT STRUCTURAL DETAILS (1:10)

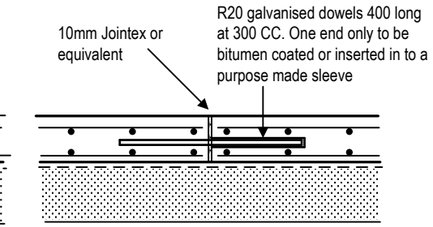
TYPICAL PAVEMENT DETAIL



SAWCUT OR TOOLED JOINT



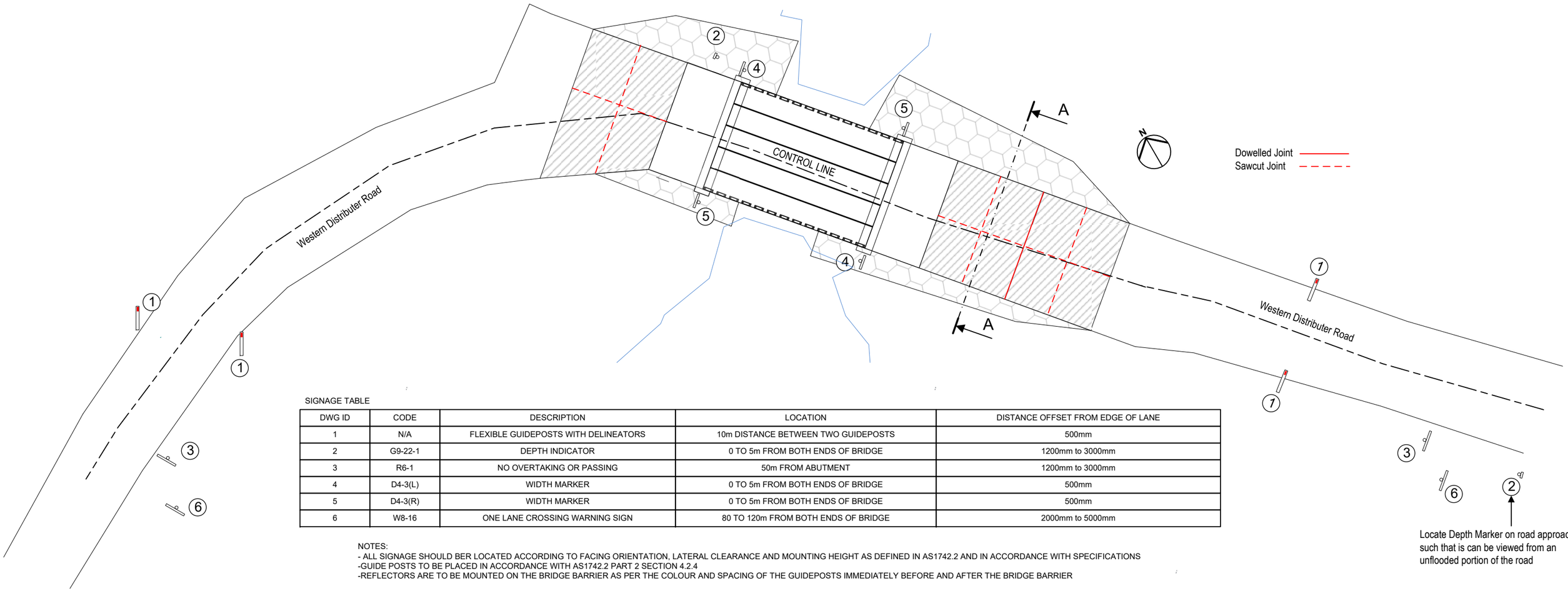
DOWELLED JOINT



CONCRETE PAVEMENT SLABS (APPROX 95M2)
-150mm thick with 32MPa concrete
-Use SL82 top and bottom mesh(40 top cover – 30 bottom cover)
-200mm thick DGB 20 under

Control joints required at max. 6m spacings on 100mm thick gravel subgrade compacted to 98% max. dry density and a CBR of 20%

WESTERN DISTRIBUTER ROAD - SIGNAGE LAYOUT FOR BRIDGE (1:200)

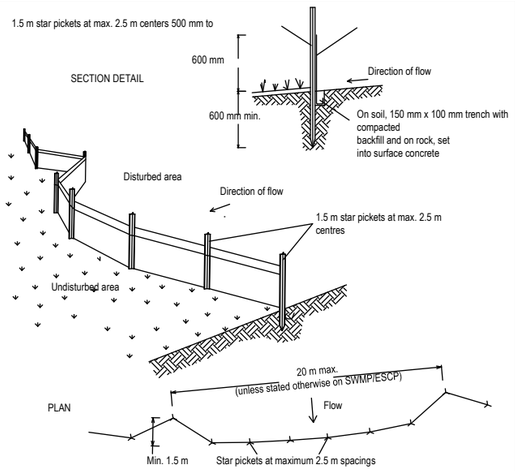


SIGNAGE TABLE

DWG ID	CODE	DESCRIPTION	LOCATION	DISTANCE OFFSET FROM EDGE OF LANE
1	N/A	FLEXIBLE GUIDEPOSTS WITH DELINEATORS	10m DISTANCE BETWEEN TWO GUIDEPOSTS	500mm
2	G9-22-1	DEPTH INDICATOR	0 TO 5m FROM BOTH ENDS OF BRIDGE	1200mm to 3000mm
3	R6-1	NO OVERTAKING OR PASSING	50m FROM ABUTMENT	1200mm to 3000mm
4	D4-3(L)	WIDTH MARKER	0 TO 5m FROM BOTH ENDS OF BRIDGE	500mm
5	D4-3(R)	WIDTH MARKER	0 TO 5m FROM BOTH ENDS OF BRIDGE	500mm
6	W8-16	ONE LANE CROSSING WARNING SIGN	80 TO 120m FROM BOTH ENDS OF BRIDGE	2000mm to 5000mm

NOTES:
- ALL SIGNAGE SHOULD BER LOCATED ACCORDING TO FACING ORIENTATION, LATERAL CLEARANCE AND MOUNTING HEIGHT AS DEFINED IN AS1742.2 AND IN ACCORDANCE WITH SPECIFICATIONS
-GUIDE POSTS TO BE PLACED IN ACCORDANCE WITH AS1742.2 PART 2 SECTION 4.2.4
-REFLECTORS ARE TO BE MOUNTED ON THE BRIDGE BARRIER AS PER THE COLOUR AND SPACING OF THE GUIDEPOSTS IMMEDIATELY BEFORE AND AFTER THE BRIDGE BARRIER

EROSION AND SEDIMENT CONTROL PLAN (1:200)



Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm oveNGLap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

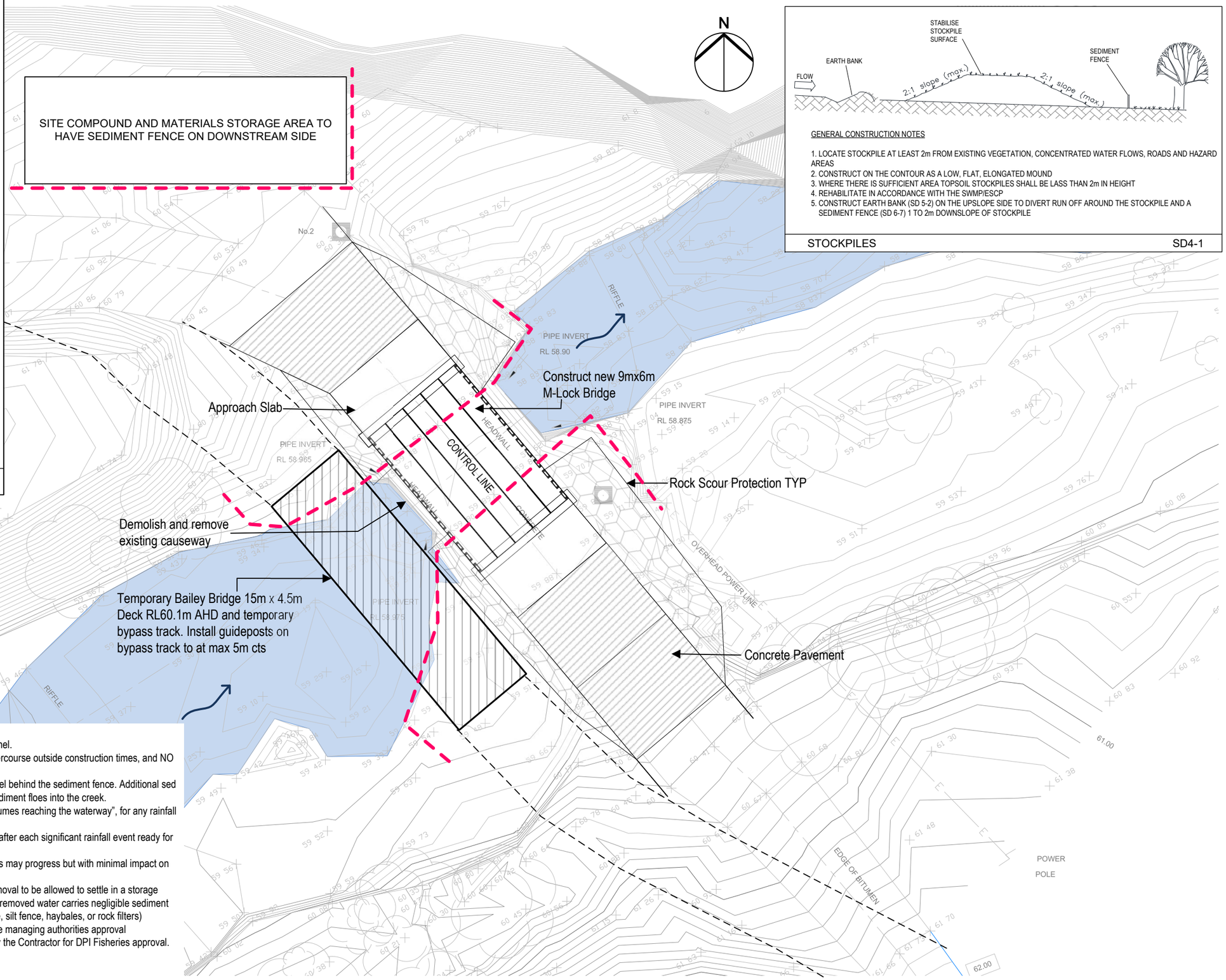
SEDIMENT FENCE SD 6-8

SITE COMPOUND AND MATERIALS STORAGE AREA TO HAVE SEDIMENT FENCE ON DOWNSTREAM SIDE

GENERAL CONSTRUCTION NOTES

1. LOCATE STOCKPILE AT LEAST 2m FROM EXISTING VEGETATION, CONCENTRATED WATER FLOWS, ROADS AND HAZARD AREAS
2. CONSTRUCT ON THE CONTOUR AS A LOW, FLAT, ELONGATED MOUND
3. WHERE THERE IS SUFFICIENT AREA TOPSOIL STOCKPILES SHALL BE LASS THAN 2m IN HEIGHT
4. REHABILITATE IN ACCORDANCE WITH THE SWMP/ESCP
5. CONSTRUCT EARTH BANK (SD 5-2) ON THE UPSLOPE SIDE TO DIVERT RUN OFF AROUND THE STOCKPILE AND A SEDIMENT FENCE (SD 6-7) 1 TO 2m DOWNSLOPE OF STOCKPILE

STOCKPILES SD4-1



Sediment & Erosion Control Notes:

1. Flow in Creek is typically minor and contained within the invert of the channel.
2. Contractor must not leave any loose equipment or materials within the watercourse outside construction times, and NO WORK DURING HIGH WATERFLOWS.
3. All works on the new bridge to be undertaken from outside the creek channel behind the sediment fence. Additional sed fence, sand bags and coir logs to be implemented as necessary to control sediment floes into the creek.
4. The Contractors aim must be to achieve an outcome of "no visible turbid plumes reaching the waterway", for any rainfall event up to a 1 in 2 year Annual Recurrence Interval (ARI) event).
5. All sediment control structures to be regularly maintained and cleaned out after each significant rainfall event ready for the next storm
6. Construction area boundaries to be kept to a minimum to ensure that works may progress but with minimal impact on vegetation and surrounding services or property
7. Stormwater runoff collection in the main excavation that requires pump removal to be allowed to settle in a storage facility, then pumped to grassed areas close to the construction area so than removed water carries negligible sediment and is further filtered as it moves downslope to the sediment control device(ie, silt fence, haybales, or rock filters)
8. Areas of native vegetation that will be disturbed must be rehabilitated to the managing authorities approval
9. ESCP control plan is indicative only. Staged ESCP plans to be provided by the Contractor for DPI Fisheries approval.

Existing 0.1m Contours Sediment Fence

BRIDGE OVER CURROWAN CREEK	FAIRLIGHT CONSULTING ENGINEERS	Size: A3	Rev: E	Scale: 1:200	SHEET 7 OF 8

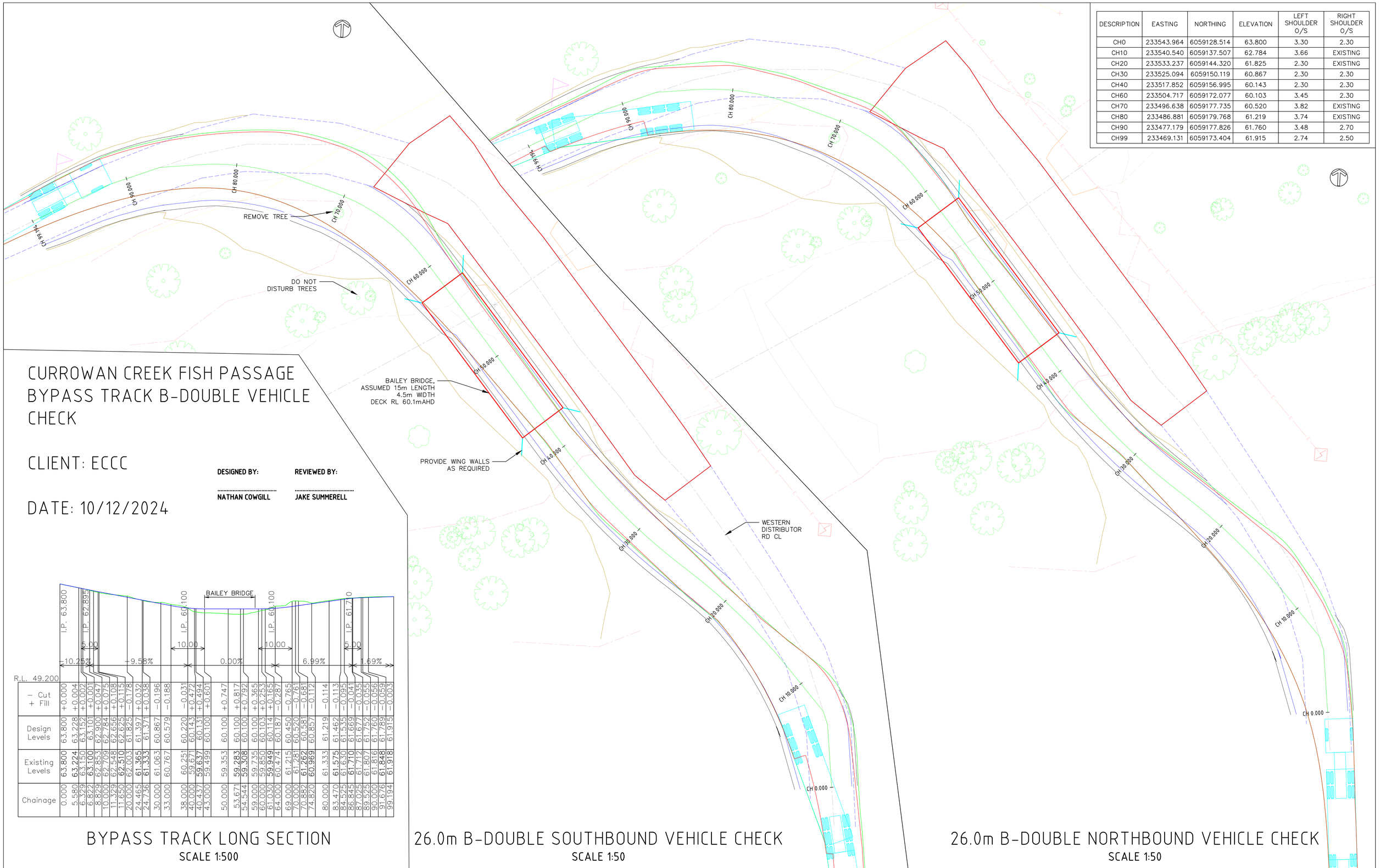
CURROWAN CREEK FISH PASSAGE BYPASS TRACK B-DOUBLE VEHICLE CHECK

CLIENT: ECCC

DATE: 10/12/2024

DESIGNED BY:	REVIEWED BY:
NATHAN COWGILL	JAKE SUMMERELL

DESCRIPTION	EASTING	NORTHING	ELEVATION	LEFT SHOULDER O/S	RIGHT SHOULDER O/S
CH0	233543.964	6059128.514	63.800	3.30	2.30
CH10	233540.540	6059137.507	62.784	3.66	EXISTING
CH20	233533.237	6059144.320	61.825	2.30	EXISTING
CH30	233525.094	6059150.119	60.867	2.30	2.30
CH40	233517.852	6059156.995	60.143	2.30	2.30
CH60	233504.717	6059172.077	60.103	3.45	2.30
CH70	233496.638	6059177.735	60.520	3.82	EXISTING
CH80	233486.881	6059179.768	61.219	3.74	EXISTING
CH90	233477.179	6059177.826	61.760	3.48	2.70
CH99	233469.131	6059173.404	61.915	2.74	2.50



Chainage	− Cut + Fill	Design Levels	Existing Levels
0.000	+0.000	63.800	63.800
5.580	+0.004	63.228	63.224
6.329	+0.002	63.152	63.150
6.822	+0.001	63.101	63.100
8.829	+0.047	62.900	62.853
10.000	+0.075	62.784	62.709
11.329	+0.108	62.656	62.548
11.650	+0.115	62.625	62.510
20.000	−0.178	61.825	62.003
24.465	+0.032	61.397	61.365
24.736	+0.038	61.371	61.333
30.000	−0.196	60.867	61.063
33.000	−0.188	60.579	60.767
38.000	−0.031	60.220	60.251
40.000	+0.472	60.143	59.671
40.437	+0.494	60.131	59.637
43.000	+0.601	60.100	59.499
50.000	+0.747	60.100	59.353
53.671	+0.817	60.100	59.283
54.544	+0.792	60.100	59.308
59.000	+0.365	60.100	59.735
60.000	+0.253	60.103	59.850
61.030	+0.165	60.114	59.949
64.000	−0.287	60.187	60.474
69.000	−0.765	60.450	61.215
70.000	−0.761	60.520	61.281
70.882	−0.681	60.581	61.262
74.820	−0.112	60.857	60.969
80.000	−0.114	61.219	61.333
83.470	−0.113	61.462	61.575
84.525	−0.095	61.535	61.630
86.845	−0.041	61.669	61.710
87.025	−0.055	61.677	61.732
89.565	−0.055	61.722	61.807
90.000	−0.056	61.760	61.816
91.676	−0.059	61.789	61.848
99.194	−0.003	61.915	61.918

BYPASS TRACK LONG SECTION
SCALE 1:500

26.0m B-DOUBLE SOUTHBOUND VEHICLE CHECK
SCALE 1:50

26.0m B-DOUBLE NORTHBOUND VEHICLE CHECK
SCALE 1:50

JSA ENGINEERING SOLUTIONS PTY LTD

REV	DESCRIPTION	DATE
A	BYPASS TRACK VEHICLE CHECK AND L-SEC	10/12/24

SCALES
PLAN
LONGITUDINAL SECTION HORIZONTAL
VERTICAL
CROSS SECTION

SURVEYED	
DRAWN	NC
DESIGN	NC
CHECKED	JS
DATE	10/12/24

DATUM	AHD
CLIENT	ECCC

Main Office
Bega NSW 2550
Ph : 0409909386
Email : jake@jsaengineering.com.au

PROJECT: CURROWAN CREEK FISH PASSAGE			
DESCRIPTION: BYPASS VEHICLE CHECK AND L-SEC			
JOB NAME. 137-ECCC	PLAN No. 137	SHEET No. 1 OF 1	A1

Appendix B – Biodiversity Assessment

Date: 12 November 2024

Author: Tegan Leisegang (MSc)

Organisation: TA Project Services

Assessment Background

Section 7.2 of the BC Act provides that development under the Environmental Planning and Assessment Act 1979 (EP&A) is likely to significantly affect threatened species if:

a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3, or
b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or
c) it is carried out in a declared area of outstanding biodiversity value. Information about declared areas of outstanding biodiversity value is available at http://www.environment.nsw.gov.au/biodiversity/outstandingbiodivvalue.htm

For an activity under Part 5 of the EP&A Act clause (b) does not apply.

For an activity under Part 5, an assessment of an activity that is likely to significantly affect a threatened species must be accompanied by a species impact statement or, if the proponent elects to participate in the biodiversity offsets scheme, a BDAR.

A comprehensive list of threatened species and ecological communities that have been previously recorded or listed as having potential to occur in the locality has been developed using the following resources:

- Threatened species profiles providing information on species morphology, behaviour, habitat and threats. Searches by region, habitat and type of species can also be performed www.environment.nsw.gov.au/threatenedspeciesapp/
- BioNet (www.bionet.nsw.gov.au) including:
    - BioNet Atlas for records of flora and fauna sightings
    - Vegetation Information System (VIS) Flora Survey database for vegetation site data

    - Threatened Biodiversity Data Collection data on threatened species and ecological communities.
- Protected Matters Search Tool
    - Threatened Ecological Communities
    - Threatened Species
    - Migratory Species
- Seed Database
    - Vegetation

Species and Communities identified in the desktop assessment underwent an assessment of likelihood of occurrence.

Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the site inspection and professional judgement.

Table B.1: Likelihood of Occurrence Criteria

Likelihood of Occurrence	Description
Known	The species was or has been observed on the site.
Likely	A medium to high probability that a species uses the site.
Potential	Suitable habitat for a species occurs on the site, but there is insufficient information to categorize the species as likely to occur or unlikely to occur.
Unlikely	A very low to low probability that a species uses the site.
No	Habitat within the study area and in the vicinity is unsuitable for the species.

Species which had a likelihood of occurrence status of' 'Potential' 'Likely'; or 'known' underwent the 'Test of Significance'.

It has been observed that certain threatened animal species with significant mobility, expansive ranges, and vagrant behaviours might occasionally utilize sections of the research site for foraging purposes. In the case of these animal species, the habitat in question and its potential impact are

deemed not crucial to their well-being, especially considering the abundance of similar habitat across the surrounding landscape. Consequently, conducting a significance test in accordance with State or Commonwealth legislation was deemed unnecessary.

Limitations of this Assessment

The inventory of flora and fauna species documented in this assessment should not be interpreted as exhaustive; rather, it serves as an indication of the species observed during the survey period. Consequently, the conclusions drawn in this report rely on available data and field surveys, providing a general overview of the environmental condition within the proposed area at the time of assessment. It's important to acknowledge that site conditions, including the presence of threatened species, may fluctuate over time.

A precautionary approach was adopted regarding the presence of threatened species in areas deemed to have suitable habitat, where evidence might be insufficient to conclusively rule out their presence due to seasonal variations or other limitations.

It's essential to recognize that database information, especially broad-scale vegetation mapping, should be utilized cautiously as an indicator of potential habitat content. Broad-scale vegetation mapping relies on predictive modeling incorporating factors like geology, soil, and elevation, which can introduce inaccuracies. Moreover, records of threatened species can be contributed by any member of the public and may lack verification. Geographical errors and underreporting are common issues with such records. These information sources typically offer preliminary insights to guide on-site survey methodologies.

The habitat assessment was conducted using ground-level surveys and/or photographs provided, limiting observations to the visible range. It's plausible that some trees may possess hollows or features not discernible in these surveys/photos.

Likelihood of Occurrences Tables

Table B.2: Listed Threatened Ecological Communities

Community Name	Threatened Category	PMST occurrence probability	Likelihood of Occurrence	Test of Significance Required
Lowland Grassy Woodland in the South East Corner Bioregion	E	Community may occur within the buffer area	Unlikely, this community is not directly associated with the mapped PCT.	Yes
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	CE	Community may occur within the buffer area	Possible, PCT associated with this TEC has been mapped adjacent to the site location. This community is closely related to the riverflat forest types and shares similar ecological characteristics with the Peppermint Forest, particularly in the coastal floodplain areas.	No
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	CE	Community likely to occur within feature area	Unlikely, this community is not directly associated with the mapped PCT.	No
Araluen Scarp Grassy Forest	CE	Community likely to occur within feature area	Unlikely, this community is not directly associated with the mapped PCT.	No
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	E	Community likely to occur within feature area	Unlikely, this community is not directly associated with the mapped PCT. This community can sometimes overlap with river flat environments, though it primarily occurs in coastal swamps rather than the wet sclerophyll forest type.	No
Lowland Grassy Woodland in the South East Corner Bioregion	E	Community may occur within the buffer area	Unlikely, this community is not directly associated with the mapped PCT.	No
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	CE	Community may occur within the buffer area	Unlikely, this community is not directly associated with the mapped PCT.	No

Image B.1. Vegetation at the proposed works location is not specifically mapped along the road corridor. However, the adjacent vegetation is classified as Wet Sclerophyll Forests (Shrubby Sub-formation), indicating that similar ecological characteristics may be present in the immediate area.

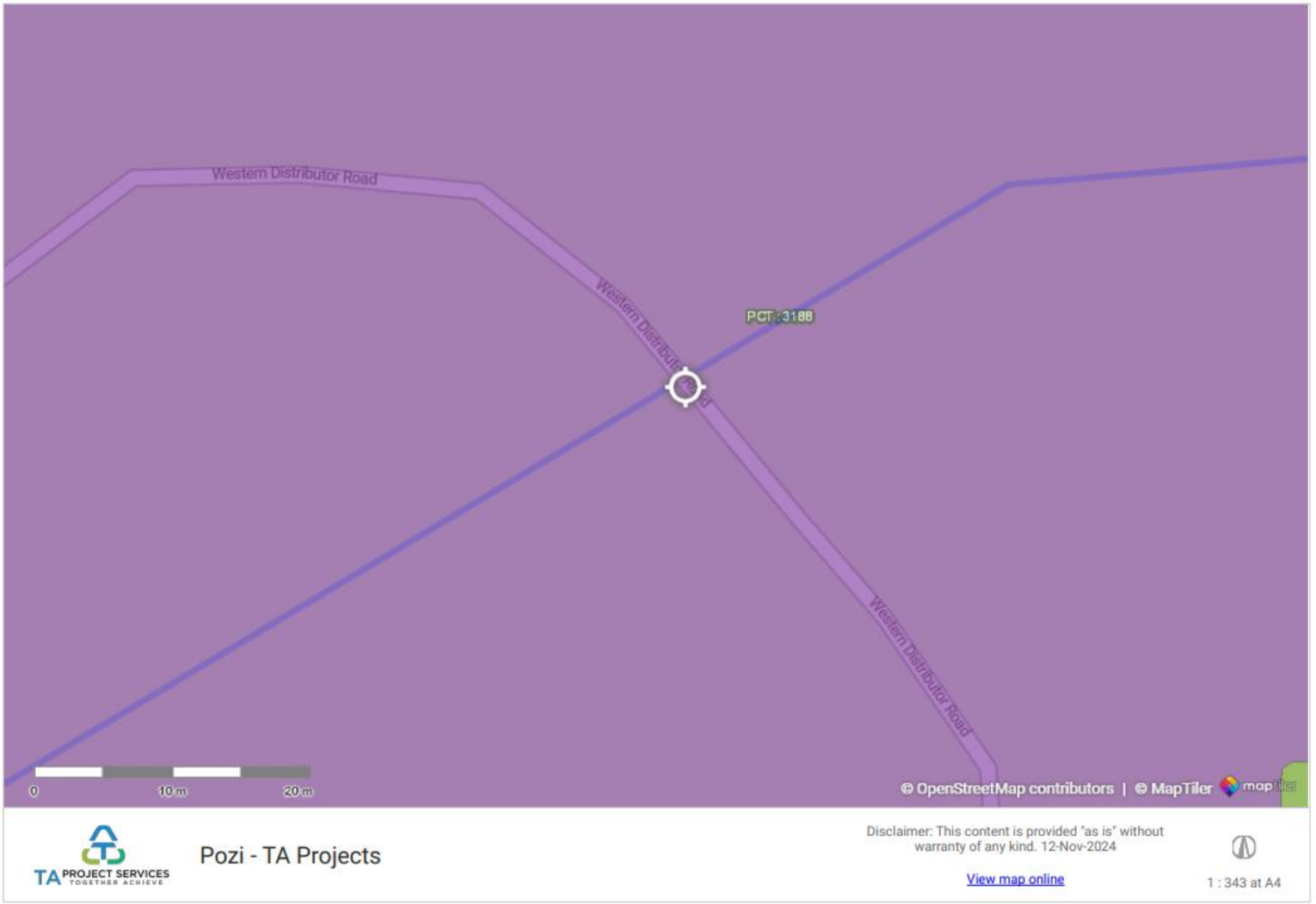


Image B.2. Plant Community Type (PCT) at proposed works location is mapped as PCT 3188 - South Coast Riverflat Peppermint Forest

PCT ID: 3188

PCT Name: South Coast Riverflat Peppermint Forest

PCT Description:

Tall to very tall moist shrubby sclerophyll open forest of sheltered flats on larger creeks and rivers within coast and hinterland ranges of the northern South East Corner and southern Sydney Basin bioregions. This PCT occurs from Tanja north to Wandandian, and west to Yowrie, Merricumbene and Yadboro, at elevations of 3-250 metres asl in areas receiving 900-1250 mm mean annual rainfall, commonly on sedimentary and occasionally granitic substrates. A mid-dense tree stratum commonly contains Eucalyptus elata, occasionally with Angophora floribunda or rarely Eucalyptus botryoides or Eucalyptus baueriana. A sparse shrub layer may include occasional taller Acacia irrorata or Acacia mearnsii, with lower species including very frequent Rubus parvifolius, commonly with Breynia oblongifolia, Melicytus dentatus, Myrsine howittiana and Notelaea venosa, and occasionally Rubus rosifolius. The ground layer tends to be closed to mid-dense and very frequently includes ferns Pteridium esculentum and Adiantum aethiopicum, grasses Oplismenus imbecillis, Entolasia marginata and Microlaena stipoides, tall sedge Carex longebrachiata, and soft forbs Dichondra repens, Glycine clandestina, Lobelia purpurascens, Stellaria flaccida and Pseuderanthemum variabile. Common accompanying species include Poa ensiformis, Tylophora barbata, Doodia aspera, Lomandra longifolia, Clematis glycinoides, Cissus hypoglauca, Gahnia melanocarpa, Eustrephus latifolius and Pellaea falcata, with occasional dense clumps of Hypolepis muelleri. On smaller headwater drainages in lower coastal catchments this community may be replaced by PCT 3272, while in deep wet sheltered gullies it may be replaced by PCT 3045.

This PCT relates to the Threatened Ecological Community River-flat eucalypt forest on coastal floodplains which is considered a TEC on both BC and EPBC Act where it satisfies condition thresholds as per section 5.2 of the Conservation Advice.

Table B.3: Threatened Flora Species

Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Haloragis exalata subsp. exalata	Wingless Raspwort, Square Raspwort	V	V	Species or species habitat may occur within area	0	Typically found in riparian zones along streams and in moist forests.	Yes – Suitable, as it can thrive in moist and shaded forest environments like Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No, site inspection confirmed species is not present in works location
Correa baeuerlenii	Chef's Cap	V	V	Species or species habitat known to occur within area	3	Found in moist forests, especially along creeks and rivers in NSW.	Yes – Adapted to shaded, moist environments, making Wet Sclerophyll Forests suitable for this species.	Unlikely - Under three Bionet sightings within 5km of the site location, no sightings at the location itself	No, site inspection confirmed species is not present in works location
Hibbertia acaulothrix	null	E	E	Species or species habitat may occur within area	0	Occurs in sandy soils within heathlands and open woodlands.	No – Prefers sandy soils in more open environments; not well-suited to dense, shrubby forest undergrowth.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Baloskion longipes	Dense Cord-rush	V	V	Species or species habitat known to occur within area	0	Wetland areas, swamps, and damp forests in southeastern Australia.	Yes – Thrives in damp forest areas and is likely to find suitable microhabitats within Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No, site inspection confirmed species is not present in works location
Caladenia tessellata	Thick-lipped Spider-orchid, Daddy Long-legs	V	V	Species or species habitat likely to occur within area	0	Occupies open woodlands, grasslands, and forest margins.	No – Prefers open, lightly forested habitats with less dense undergrowth than found in Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No

Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Rhizanthella slateri	Eastern Underground Orchid	E	V	Species or species habitat may occur within area	0	Grows in dense forests with heavy shade, often among leaf litter.	Yes – The shrubby sub-formation of Wet Sclerophyll Forests provides the shaded, dense habitat suitable for this orchid.	Unlikely - No species recorded (Bionet) within 5km of the site location	No, site inspection confirmed species is not present in works location
Pomaderris gilmourii var. gilmourii	null	E	E	Species or species habitat may occur within area	0	Found in shrubby forests and along riverbanks in eastern NSW.	Yes – Adapted to shrubby forests, aligning with the site's Wet Sclerophyll Forest habitat.	Unlikely - No species recorded (Bionet) within 5km of the site location	No, site inspection confirmed species is not present in works location
Pomaderris cotoneaster	Cotoneaster Pomaderris	V	E	Species or species habitat likely to occur within area	0	Moist forests and along watercourses in southeastern Australia.	Yes – Can thrive in moist, dense forest environments found within Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No, site inspection confirmed species is not present in works location
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Species or species habitat likely to occur within area	1	Moist, shaded woodlands and forests in eastern Australia.	Yes – Prefers moist and shaded forest environments that Wet Sclerophyll Forests can provide.	Unlikely - Under three Bionet sightings within 5km of the site location, no sightings at the location itself	No, site inspection confirmed species is not present in works location
Eucalyptus aggregata	Black Gum	V	V	Species or species habitat may occur within area	0	Grows in seasonally waterlogged or moist soils in woodlands.	No – Prefers more open, waterlogged habitats rather than dense forest canopies found in Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No

Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Pomaderris brunnea	Rufous Pomaderris, Brown Pomaderris	V	E	Species or species habitat may occur within area	0	Inhabits wet sclerophyll forests and moist areas in southeastern Australia.	Yes – Adapted to Wet Sclerophyll Forest environments, especially in moist forested areas.	Unlikely - No species recorded (Bionet) within 5km of the site location	No, site inspection confirmed species is not present in works location

Table B.4: Threatened Fauna Species

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Reptile	Aprasia parapulchella	Pink-tailed Worm-lizard, Pink-tailed Legless Lizard	V	V	Species or species habitat may occur within area	0	Rocky outcrops and grassy woodlands with loose, rocky soil in southeastern Australia.	No – Prefers rocky, open woodland environments with loose soils rather than dense forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Mammal	Potorous tridactylus trisulcatus	Long-nosed Potoroo (southern mainland)	V	V	Species or species habitat likely to occur within area	0	Dense undergrowth in wet forests and coastal heaths.	Yes – Requires dense vegetation cover and prefers moist forest environments similar to Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	Yes- Although no sightings have been recorded the habitat is considered suitable
Mammal	Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat	E	E	Species or species habitat may occur within area	0	Inhabits woodlands and dry sclerophyll forests with rocky outcrops.	No – Prefers drier forests with rocky outcrops, which are not typical of Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No - No sightings and suitable eucalyptus species not present
Mammal	Phascolarctos cinereus	Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)	V	E	Species or species habitat likely to occur within area	0	Eucalypt forests, especially with specific food tree species.	Yes – May use Wet Sclerophyll Forests if suitable eucalypt species are present for food.	Unlikely - No species recorded (Bionet) within 5km of the site location	No - No sightings and suitable eucalyptus species not present
Mammal	Petaurus australis australis	Yellow-bellied Glider (south-eastern)	V	V	Species or species habitat known to occur within area	0	Wet sclerophyll forests with large, hollow-bearing trees.	Yes – Suited to Wet Sclerophyll Forests, particularly with availability of hollow-bearing trees for nesting.	Unlikely - No species recorded (Bionet) within 5km of the site location	Yes- Although no sightings have been recorded the habitat is considered suitable

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Mammal	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern)	E	E	Species or species habitat likely to occur within area	0	Dense, shrubby ground cover in forests and heathlands.	Yes – Requires dense undergrowth, which is available in the shrubby sub-formation of Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	Yes- Although no sightings have been recorded the habitat is considered suitable and onsite investigation recorded possible bandicoot holes
Mammal	Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Not Listed	V,P	Not Listed	1	Occupies forests, woodlands, and mangroves near water sources.	Yes – Can adapt to Wet Sclerophyll Forests, especially with nearby water sources and forest edge habitat.	Unlikely - Under three Bionet sightings within 5km of the site location, no sightings at the location itself	Yes- Although no sightings have been recorded the habitat is considered suitable
Mammal	Dasyurus maculatus	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	E	V	Species or species habitat known to occur within area	15	Prefers wet forests with dense vegetation and rocky areas.	Yes – Wet Sclerophyll Forests provide suitable dense vegetation and cover needed by this species.	Likely - Multiple species recorded (Bionet) within 5km of the site location	Yes- Habitat is suitable and multiple sightings within 5km of the site
Mammal	Petauroides volans	Greater Glider (southern and central)	E	E	Species or species habitat known to occur within area	79	Tall, mature eucalypt forests, especially wet sclerophyll types.	Yes – Primarily found in Wet Sclerophyll Forests where large, hollow trees are available.	Likely - Multiple species recorded (Bionet) within 5km of the site location	Yes- Habitat is suitable and multiple sightings within 5km of the site

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Mammal	Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Foraging, feeding or related behaviour known to occur within area	13	Forests and woodlands, often near fruiting and flowering trees.	Yes – Can use Wet Sclerophyll Forests as roosting and foraging sites if food resources are present.	Likely - Multiple species recorded (Bionet) within 5km of the site location	Yes- Habitat is suitable and multiple sightings within 5km of the site
Mammal	Petrogale penicillata	Brush-tailed Rock-wallaby	V	E	Species or species habitat may occur within area	0	Rocky escarpments and cliffs, often in woodland or forest edges.	No – Prefers rocky habitats, which are not characteristic of Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Mammal	Pseudomys novaehollandiae	New Holland Mouse, Pookila	V	Not found	Species or species habitat may occur within area	0	Heathlands, grasslands, and open woodlands.	No – Prefers open, grassy areas rather than the denser undergrowth of Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Mammal	Cercartetus nanus	Eastern Pygmy-possum	Not Listed	V,P	Not Listed	1	Wet forests, woodlands, and heaths, especially with dense flowering plants.	Yes – Dense, shrubby forest undergrowth provides suitable cover and food resources.	Unlikely - Under three Bionet sightings within 5km of the site location, no sightings at the location itself	Yes- Although minimal sightings have been recorded the habitat is considered suitable
Frog	Litoria watsoni	Southern Heath Frog, Watson's Tree Frog	E	E	Species or species habitat may occur within area	0	Heathlands, swamps, and wet forests near water bodies.	Yes – May utilize moist microhabitats within Wet Sclerophyll Forests, especially near water sources.	Unlikely - No species recorded (Bionet) within 5km of the site location	Yes- Although no sightings have been recorded the habitat is considered suitable

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Frog	Mixophyes balbus	Stuttering Frog, Southern Barred Frog (in Victoria)	V	E	Species or species habitat may occur within area	0	Rainforests and wet sclerophyll forests along streams.	Yes – Well-suited to Wet Sclerophyll Forests with moist conditions and available water sources.	Unlikely - No species recorded (Bionet) within 5km of the site location	Yes- Although no sightings have been recorded the habitat is considered suitable
Frog	Heleioporus australiacus	Giant Burrowing Frog	V	V	Species or species habitat may occur within area	0	Heathlands and woodlands near temporary or permanent water.	No – Prefers heathlands and more open woodland, generally avoiding dense forest undergrowth.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Fish	Prototroctes maraena	Australian Grayling	V	E	Species or species habitat may occur within area	0	Coastal rivers and streams, migrates between fresh and estuarine water.	No – Requires flowing water and open river systems, not typically found in dense Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Anthochaera phrygia	Regent Honeyeater	CE	CE	Foraging, feeding or related behaviour likely to occur within area	0	Dry woodlands with flowering eucalypts and mistletoes.	No – Prefers dry, open woodlands and does not commonly inhabit dense Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Dasyornis brachypterus	Eastern Bristlebird	V	E	Species or species habitat may occur within area	0	Dense heath and grassy woodlands.	No – Prefers heathlands and grassier forests with less canopy cover than Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Stagonopleura guttata	Diamond Firetail	V	V	Species or species habitat likely to occur within area	0	Grassy woodlands and open forests.	No – Prefers more open environments with grassy ground cover rather than dense Wet Sclerophyll undergrowth.	Unlikely - No species recorded (Bionet) within 5km of the site location	No

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Bird	Neophema chrysostoma	Blue-winged Parrot	V	V	Species or species habitat may occur within area	0	Coastal heaths, grasslands, and open woodlands.	No – Inhabits open, coastal environments and grasslands rather than dense forest interiors.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Rostratula australis	Australian Painted Snipe	E	E	Species or species habitat likely to occur within area	0	Shallow wetlands and vegetated mudflats.	No – Prefers wetland areas with low vegetation and open water rather than dense forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Callocephalon fimbriatum	Gang-gang Cockatoo	E	E	Species or species habitat known to occur within area	41	Prefers wet sclerophyll forests and cooler forests, often at higher elevations.	Yes – Well-suited, as it naturally occurs in Wet Sclerophyll Forests.	Likely - Multiple species recorded (Bionet) within 5km of the site location	Yes- Habitat is suitable and multiple sightings within 5km of the site
Bird	Melanodryas cucullata cucullata	South-eastern Hooded Robin, Hooded Robin (south-eastern)	E	E	Species or species habitat may occur within area	0	Open woodlands and grasslands in southeastern Australia.	No – Prefers open woodlands with scattered trees, not dense forest undergrowth.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Aphelocephala leucopsis	Southern Whiteface	V	V	Species or species habitat may occur within area	0	Dry open woodlands, grasslands, and shrublands.	No – Inhabits more open, arid landscapes and would not find suitable habitat in Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Hirundapus caudacutus	White-throated Needletail	V	V	Species or species habitat known to occur within area	5	Migratory, often observed over forests and open areas.	No – Typically seen in flight over open areas; does not rely on forest habitat structure.	Unlikely - Migratory species, any sightings are likely transient	No

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Bird	Grantiella picta	Painted Honeyeater	V	V	Species or species habitat likely to occur within area	0	Woodlands with mistletoe-bearing trees in arid and semi-arid regions.	No – Prefers mistletoe-rich woodlands in drier areas, which are unlike Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Botaurus poiciloptilus	Australasian Bittern	E	E	Species or species habitat likely to occur within area	0	Dense reedbeds and wetlands in southeastern Australia.	No – Requires wetland habitat with reeds and sedges, not forested environments.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Pycnoptilus floccosus	Pilotbird	V	Not found	Species or species habitat known to occur within area	5	Dense, shrubby understory in wet sclerophyll forests.	Yes – Adapted to dense shrubby forest understory, suitable for Wet Sclerophyll Forests (Shrubby sub-formation).	Likely - Multiple species recorded (Bionet) within 5km of the site location	Yes- Habitat is suitable and multiple sightings within 5km of the site
Bird	Falco hypoleucos	Grey Falcon	V	V	Species or species habitat may occur within area	0	Arid and semi-arid areas, open woodlands, and grasslands.	No – Prefers open, arid landscapes, not densely forested environments like Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Calidris acuminata	Sharp-tailed Sandpiper	V	Not found	Species or species habitat may occur within area	0	Wetlands, estuaries, and coastal mudflats.	No – Primarily a wetland and estuarine species; forested areas are not suitable.	Unlikely - No species recorded (Bionet) within 5km of the site location	No
Bird	Haliaeetus leucogaster	White-bellied Sea-Eagle	Not Listed	V,P	Not Listed	1	Coastal regions, near large water bodies and rivers.	No – Prefers large water bodies and open coastal areas rather than dense forest interiors.	Unlikely - Under three Bionet sightings within 5km of the site location, no sightings at the location itself	No

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Bird	Lophoictinia isura	Square-tailed Kite	Not Listed	V,P, 3	Not Listed	1	Woodlands, forest edges, and areas with sparse canopy cover.	No – More commonly found in open forests and woodland areas rather than dense, shrubby forest environments.	Unlikely - Under three Bionet sightings within 5km of the site location, no sightings at the location itself	No
Bird	Glossopsitta pusilla	Little Lorikeet	Not Listed	V,P	Not Listed	7	Eucalypt woodlands and forests in eastern Australia.	Yes – Can inhabit Wet Sclerophyll Forests, especially if eucalypt species are present for feeding.	Likely - Multiple species recorded (Bionet) within 5km of the site location	No – This bird species is highly mobile, and any sightings are likely transient. The area may be used for foraging, but no nesting hollows or active nests are present on-site.

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Bird	Ninox connivens	Barking Owl	Not Listed	V,P, 3	Not Listed	1	Eucalypt woodlands, forests, and edges of wetlands.	Yes – Adapted to a variety of forested habitats, including Wet Sclerophyll Forests, if prey is available.	Unlikely - Under three Bionet sightings within 5km of the site location, no sightings at the location itself	No – This bird species is highly mobile, and any sightings are likely transient. The area may be used for foraging, but no nesting hollows or active nests are present on-site.
Bird	Ninox strenua	Powerful Owl	Not Listed	V,P, 3	Not Listed	21	Dense forests with tall trees, including wet sclerophyll forests.	Yes – Requires tall trees and dense vegetation, making Wet Sclerophyll Forests suitable for nesting and hunting.	Likely - Multiple species recorded (Bionet) within 5km of the site location	No – This bird species is highly mobile, and any sightings are likely transient. The area may be used for foraging, but no nesting hollows or active nests are present on-site.

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Bird	Tyto novaehollandiae	Masked Owl	Not Listed	V,P, 3	Not Listed	20	Eucalypt forests and woodlands with dense understory.	Yes – Prefers dense forested areas with good cover, aligning with Wet Sclerophyll Forests.	Likely - Multiple species recorded (Bionet) within 5km of the site location	No – This bird species is highly mobile, and any sightings are likely transient. The area may be used for foraging, but no nesting hollows or active nests are present on-site.
Bird	Tyto tenebricosa	Sooty Owl	Not Listed	V,P, 3	Not Listed	33	Dense wet forests, including rainforests and wet sclerophyll forests.	Yes – Well-adapted to the dense canopy and structure of Wet Sclerophyll Forests.	Likely - Multiple species recorded (Bionet) within 5km of the site location	No – This bird species is highly mobile, and any sightings are likely transient. The area may be used for foraging, but no nesting hollows or active nests are present on-site.

Class	Scientific Name	Common Name	EPBC Act	BC ACT	EPBC - Presence	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Bird	Daphoenositta chrysoptera	Varied Sittella	Not Listed	V,P	Not Listed	2	Eucalypt forests and woodlands, especially with rough-barked trees.	Yes – Can inhabit Wet Sclerophyll Forests, as it uses trees for foraging and nesting.	Unlikely - Under three Bionet sightings within 5km of the site location, no sightings at the location itself	No – This bird species is highly mobile, and any sightings are likely transient. The area may be used for foraging, but no nesting hollows or active nests are present on-site.

** Habitat suitability has been gauged against the PCT and vegetation formation mapped at the site*

Table B.5: Migratory Bird Species

Class	Scientific Name	Common Name	EPBC Act	Migratory Category	Bionet Sightings	Habitat	Habitat Suitability*	Likelihood of Occurrence	Test of Significance Required
Bird	Apus pacificus	Fork-tailed Swift	Not listed	Migratory Marine Birds	0	Open forests, woodlands, and urban areas, typically found soaring at high altitudes.	No – Fork-tailed Swifts are aerial and do not rely on dense forest habitats; Wet Sclerophyll Forests are unsuitable for their foraging and nesting needs.	Unlikely - No species recorded (Bionet) within 5km of the site location & site habitat not suitable	No
Bird	Calidris melanotos	Pectoral Sandpiper	Not listed	Migratory Wetlands Species	0	Mudflats, shallow wetlands, and coastal habitats, particularly during migration.	No – This species prefers open, coastal mudflats and wetland areas, which are not found in Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location & site habitat not suitable	No
Bird	Cuculus optatus	Oriental Cuckoo, Horsfield's Cuckoo	Not listed	Migratory Terrestrial Species	0	Woodlands, forests, and plantations, often in the presence of host species for parasitism.	No – While forested habitats are used, Wet Sclerophyll Forests are not specifically suitable for these cuckoos, who typically prefer more open woodlands.	Unlikely - No species recorded (Bionet) within 5km of the site location & site habitat not suitable	No
Bird	Actitis hypoleucos	Common Sandpiper	Not listed	Migratory Wetlands Species	0	Shorelines, riverbanks, and mudflats, especially in wetlands and coastal regions.	No – Prefers open, watery habitats like riverbanks and mudflats, which Wet Sclerophyll Forests do not provide.	Unlikely - No species recorded (Bionet) within 5km of the site location & site habitat not suitable	No

Bird	Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Migratory Wetlands Species	0	Mudflats, estuaries, and coastal wetlands, particularly during migration periods.	No – Prefers coastal mudflats and estuaries, habitats not found in Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location & site habitat not suitable	No
Bird	Calidris acuminata	Sharp-tailed Sandpiper	Vulnerable	Migratory Wetlands Species	0	Coastal mudflats, estuaries, and wetlands, typically found during migration or in the summer months.	No – Requires coastal or wetland habitats, which Wet Sclerophyll Forests do not offer.	Unlikely - No species recorded (Bionet) within 5km of the site location & site habitat not suitable	No
Bird	Hirundapus caudacutus	White-throated Needletail	Vulnerable	Migratory Terrestrial Species	5	Open forests, woodlands, and grasslands, often seen foraging in aerial habitats.	No – As an aerial forager, this species does not rely on dense forest habitats, making Wet Sclerophyll Forests unsuitable.	Unlikely - Migratory species, any sightings are likely transient	No
Bird	Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	Critically Endangered	Migratory Wetlands Species	0	Coastal mudflats, estuaries, and intertidal zones, where they forage for invertebrates.	No – Prefers coastal and intertidal zones for foraging, habitats that are not available in Wet Sclerophyll Forests.	Unlikely - No species recorded (Bionet) within 5km of the site location & site habitat not suitable	No
Bird	Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Vulnerable	Species or species habitat likely to occur within area	0	Wetlands, coastal swamps, and grassy areas with soft, muddy soils.	No – Prefers wetland habitats with soft, muddy ground, not found in Wet Sclerophyll Forests, which are often drier and less suitable for foraging.	Unlikely - No species recorded (Bionet) within 5km of the site location & site habitat not suitable	No

Biodiversity Conservation Act Section 7.3 - Test of Significance

The following species are likely to occur within the proposed work area, based on recorded sightings and suitable habitat conditions. Due to the nature of the project, species have been grouped for assessment under the seven-part test of significance. This test, conducted in accordance with the Biodiversity Conservation Act 2016 Section 7.3, concluded that the project would not have a significant impact on these species.

Tree Mammals

Petaurus australis australis	Yellow-bellied Glider (south-eastern)
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat
Petauroides volans	Greater Glider (southern and central)
Pteropus poliocephalus	Grey-headed Flying-fox
Cercartetus nanus	Eastern Pygmy-possum

Ground Mammals

Potorous tridactylus trisulcatus	Long-nosed Potoroo (southern mainland)
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern)
Dasyurus maculatus	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)

Frogs

Litoria watsoni	Southern Heath Frog, Watson's Tree Frog
Mixophyes balbus	Stuttering Frog, Southern Barred Frog (in Victoria)

Birds

Callocephalon fimbriatum	Gang-gang Cockatoo
Pycnoptilus floccosus	Pilotbird

1. In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

   Yes ☐ No ☒

   The proposed activity is located within a previously disturbed road reserve. Although access and ancillary tracks will be required, along with a bypass track, vegetation removal will be minimized, and tree retention will be prioritized wherever feasible. The more suitable habitat areas, particularly on the northwestern side of the works, will be thoroughly documented and assessed to ensure impacts are minimized. Given the limited scope of vegetation removal, the already altered condition of the road reserve and batter slopes, and the presence of more extensive suitable habitats nearby, the proposed works are unlikely to adversely impact the lifecycle of any of the listed threatened species or place a viable local population at risk of extinction.

2. In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
   i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
   ii. Is likely to substantially and adversely modify the composition of the ecological community such that its occurrence is likely to be placed at risk of extinction

   Yes ☐ No ☒

   The Plant Community Type (PCT) mapped within the works area is associated with the River-flat Eucalypt Forest on Coastal Floodplains, which qualifies as a Threatened Ecological Community (TEC) under both the Biodiversity Conservation Act (BC Act) and the Environment Protection and Biodiversity Conservation Act (EPBC Act), provided condition thresholds in section 5.2 of the Conservation Advice are met. The proposed works are primarily confined to the road reserve, with some minor encroachment into this TEC. However, the impacts on this community will be minimal and will not compromise its local occurrence or place it at risk of extinction. Upon completion of the works, all disturbed areas will be remediated according to the guidelines set out in this REF.

3. In relation to the habitat of a threatened species or ecological community:

i. The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

Yes ☐ No ☒

The proposed works are largely contained within the road reserve, with minimal encroachment into the species' habitat for access tracks, a temporary bypass, and batter slopes. This activity will not significantly remove or modify habitat in a way that would impact the identified species. Habitat areas will remain connected and will not become fragmented or isolated as a result of the proposed works. Additionally, the vegetation to be removed is of low importance to the long-term survival of the species, as it is part of a disturbed road reserve area. The more suitable habitat areas, particularly on the northwestern side of the works, will be thoroughly documented and assessed to ensure impacts are minimized. In contrast, more suitable and undisturbed habitat exists nearby, providing a better environment for the species' long-term needs.

4. Whether the proposed development or activity is likely to have an adverse effect on ant declared area of outstanding biodiversity value (either directly or indirectly)

   Yes ☐ No ☒

   The area has not been designated as critical habitat or identified as an area of outstanding biodiversity value. The vegetation removal involved in the bridge replacement works is minimal and will not impact the area's biodiversity. These works are limited to replacing existing bridges and will not alter the land's composition or usage.

5. Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threating process.

   Yes ☐ No ☐

   N/A

Fisheries Management Act 1994 – 7-Part Test of Significance

Species: Australian Grayling

Location: Currowan

The *Australian Greyling* is known in the area and given the nature of the project likely to be the more potentially impacted of the species. Currowan Creek is mapped as a habitat area and therefore restrictions surrounding construction times are applicable. A 7-part test of significance has been conducted as per the Fisheries Management act, which concluded that a significant impact would not be imposed upon the species.

1. In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

   Yes ☐ No ☒

   The species are mapped to have habitat located within Currowan Creek. Works are therefore restricted to be completed outside of migration and spawning times to prevent an impact from occurring to this species.

2. In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the lifecycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

   Yes ☐ No ☒

   The species are mapped to have habitat located within Currowan Creek. Works are therefore restricted to be completed outside of migration and spawning times to prevent an impact from occurring to this species. Therefore, no impact is proposed to occur on the population to place them at risk of extinction.

3. In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

   i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. Is likely to substantially and adversely modify the composition of the ecological community such that its occurrence is likely to be placed at risk of extinction

Yes ☐ No ☒

No major effect will occur to the community to place them at risk of extinction. By working outside the migration and spawning period, risks will be managed and no impact is proposed to occur to the species.

4. In relation to the habitat of a threatened species, population, or ecological community:
   i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and
   ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
   iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

   Yes ☐ No ☒

   No habitat will be removed, that will affect the species as a result of the proposed works. By replacing the existing culvert with a bridge, fish passage will be reinstated and therefore additional habitat will be provided.

5. Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

   Yes ☐ No ☒

   Mitigation measures will be implemented to reduce the effect on the critical habitat. Works are therefore required to be completed within the restricted contraction times due to migration.

6. Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

   Yes ☒ No ☐

   Culverts are considered a barrier to fish movement/migration. Construction of a bridge will increase flows and habitat. Restoring fish passage past barriers will be of major benefit to the Australian Grayling and is part of the National Recovery Plan.

7. Whether the action proposed constitutes or is of a Key threatening process or is likely to result in the operation of, or increase the impact of, a key threating process.

   Yes ☐ No ☐

   N/A

Appendix C – Aboriginal Cultural Heritage Due Diligence Checklist & AHIMS Report

This checklist is intended to act as a guide in carrying out due diligence under the *National Parks and Wildlife Act 1974* (NSW) (Act). This checklist should be used in conjunction with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* published by the Department of Environment, Climate Change, and Water and dated 1st September 2010 (Code).

It is an offence under s86(2) of the National Parks and Wildlife Act 1974 (NSW) to harm an Aboriginal object. It is a defence to a prosecution for this offence if the Defendant shows that they exercised due diligence to determine whether the act or omission constituting the offence would harm an Aboriginal object and reasonably determine that no Aboriginal object would be harmed. Compliance with the Code is taken to constitute due diligence for the purposes of this defence, under cl57 of the National Parks and Wildlife Regulation 2019 (Regulations). There are also a number of industry specific due diligence guidelines, which can be sed under cl 57 of the Regulations instead of the Code, these industry specific guidelines are not considered in this checklist.

Compliance with the Code does not provide a defence to the offences of harming or desecrating an object that the person knows to be an Aboriginal object (under s86(1) of the Act) or an Aboriginal place (under s86(4) of the Act). However, use of this checklist can assist in identifying whether a site is an Aboriginal place or contains an Aboriginal object, to avoid committing these offences.

Record should be kept recording the searches conducted and, and evidencing the matters considered in completing this checklist. These records should be included within this appendix and maintained on file.

Table C.1: Aboriginal Cultural Heritage Due Diligence Checklist

Project Details	
Project Name	Currowan Creek Crossing Upgrade
Address	Western Distributor Road, Currowan
Lot and DP	Surrounding lots: 20/-/DP755951, 1/-/DP707475 and 1/-/DP263922
Description of the project site	Disturbed road reserve which contains a culvert crossing over Currowan Creek

Description of the proposed works	Upgrade of the crossing to enhance fish passage
Type of works	☐ New Development ☐ Major Maintenance ☐ Minor Maintenance ☒ Upgrade
Disturbance footprint (including ancillary or laydown areas)	Crossing Upgrade & Bypass Track: 25m L x 10m W (approx.) Laydown Area/Stockpiles: 6m x 6m (approx.)
Located on disturbed land (including ancillary or laydown areas)	☒ Located on Disturbed Land ☐ Not located on Disturbed land ☐ Located both on and off disturbed land Refer to definition of 'disturbed land' in cl58(4) of the Regulations
Plant and equipment required	• Excavator • Gudraulic Grabs • Dawson Impact Hammer • Water Cart • Roller • Grader • Rigid Truck or Truck and Dog • Hand Tools • Other as Required

Exemptions from the offences in s86(1)-(4)

Refer to ss 87A-87B of the Act

Is the activity subject to one of the following exemptions:

☐ Yes	☒ No	Work for the conservation or protection of an Aboriginal object or place carried out by or at the direction of the National Parks and Wildlife Service
☐ Yes	☒ No	Any emergency fire fighting or emergency bush fire hazard reduction work authorised under the *Rural Fire Act 1997*
☐ Yes	☒ No	Authorised under the State Emergency and Rescue Management Act 1989 in relation to an emergency and being reasonably

		necessary in order to avoid an actual or imminent threat to life or property
☐ Yes	☒ No	Specifically required or permitted under a conservation agreement entered into or modified under the Act after 1 October 2010
☐ Yes	☒ No	Traditional cultural activities (except commercial activities) carried out by Aboriginal People

If 'yes' to any of the above, the activity is exempt from the offences in s86(1)-(4) of the Act and can proceed without carrying out further due diligence.

Trivial or negligible acts

Refer to definition of 'harm' in s5 of the Act

☐ Yes ☒ No

Is the act or omission trivial or negligible. Examples include:

☐ Gardening (resulting in a small Aboriginal object below the surface being broken)

☐ Walking, picnicking, camping, or similar recreational activities (resulting in a small Aboriginal object being crushed)

This requires consideration of the act or omission, as well as the extent of harm caused. Acts that are trivial or negligible are not 'harm' for the purposes of the Act. If 'yes' to any of the above, provided that the act does not otherwise desecrate a known Aboriginal object or place, the act can proceed without carrying out further due diligence. If you are unsure as to weather the act would discrete an Aboriginal object or place, you should carry out search in "Known Aboriginal objects and places" below, to confirm that there is no known Aboriginal object or place in the vicinity of the project.

Low impact act or omission (excluding known Aboriginal objects and placed)

Refer to cl58 of the Regulations

Is the activity one of the following low impact acts or omissions:

☒ Yes ☐ No

On land that has been disturbed, maintenance of:

☒ Existing road, fire and other trails and tracks

☐ Existing utilities and similar services

☐ Yes ☒ No

On land that has been disturbed, the following kinds of farming and land management work:

☐ Cropping and leaving paddocks fallow

☐ The construction of water storage works

☐ The construction of fences

☐ The construction of irrigation infrastructure, ground water bores or flood mitigation works

☐ Yes	☒ No	☐ The construction of erosion control or soil conservation work
		Farming and land management work that involves the maintenance of:
		☐ Grain, fiber or fertilizer storage areas
		☐ Water storage works (such as farm dams or water tanks)
		☐ irrigation infrastructure, ground water bores or flood mitigation works
		☐ Fences
		☐ Erosion control or soil conservation works (such as contour banks)
☐ Yes	☒ No	
☒ Yes	☐ No	Grazing of animals
☐ Yes	☒ No	On land that has been disturbed, exempt development or complying development
		On land that has been disturbed, mining exploration work of the following kind:
		☐ Costeaning
		☐ Bulk sampling
☐ Yes	☒ No	☐ Drilling
		Work of the following kind:
		☐ Geological mapping
		☐ Surface geophysical surveys (excluding seismic surveys)
		☐ Sub-surface geophysical surveys that involve downhole logging
		☐ Sampling and coring using hand-held equipment (excluding archaeological investigations)
☐ Yes	☒ No	
☐ Yes	☒ No	The removal of isolated, dead or dying vegetation with minimal disturbance to the surrounding ground surface
		On land that has been disturbed, work of the following kind:
		☐ Seismic surveying

☐ Yes ☒ No ☐ The construction and maintenance of groundwater monitoring bores

Environmental rehabilitation work, including temporary silt fencing, tree planting, bush regeneration and weed removal (but excluding erosion control or soil conservation works).

If 'yes' to any of the above, carry out the search in the below section "Known Aboriginal objects and placed" to confirm:

☐ Yes ☒ No Is there any known Aboriginal object or place in the vicinity of the project?

☐ Yes ☒ No Will any harm be caused to an Aboriginal culturally modified tree?

See cl58 for fill details of the above exemptions, including the definitions of 'disturbed land', 'harm' and 'culturally modified tree'.

If 'yes' to any of the questions under 'is the activity one of the following low act or omissions' but 'no' to both of the above questions, the act can proceed without carrying out any further due diligence. However, while these acts are exempt from the offence in s86(2) of the Act, in many circumstances, it may still prudent with complete the due diligence process to prevent any unintended harm to Aboriginal objects.

Known Aboriginal Objects and Places

Conduct an AHIMS search: 08/11/2024

AHIMS search reference number: [redacted]

Are any of the following identified:

☐ Yes ☒ No Aboriginal objects in the vicinity of the project

☐ Yes ☒ No Aboriginal places in the vicinity of the project

List site card reference numbers: [redacted] (outside scope of works, no impact)

If a known Aboriginal object or Aboriginal place is identified, obtain copies of the relevant records from AHIMS, include them in this appendix and proceed to 'can harm be avoided' below.

Due Diligence process under Part 8 of the Code

Will the activity cause disturbance?

Step 1 of the Code.

Will the activity disturb:

☒ Yes ☐ No The surface of the ground (including the use of machinery to dig into the ground or removing vegetation)

☐ Yes ☒ No Any aboriginal culturally modified tree (also known as a scar tree)

If 'yes' to either of the above, continue to the next question.

If 'no' to both, the activity can proceed, although you need to stop work if any Aboriginal objects are found.

Is there a low likelihood of encountering Aboriginal objects?

Step 2 of Code

And determine the following:

☐ Yes ☒ No Is the project on land that is not disturbed

☒ Yes ☐ No Are there any of the associated landscape features present:

☒ Within 200m of waters (including a river, stream, lake, lagoon, swamp, wetland, natural watercourse or the high water mark of tidal waters)

☐ Located on a sand dune system (i.e. sand ridges and hills, usually occurring near deserts, lakes, rovers or coastal areas)

☐ Located on a ridge top, ridge line or headland

☐ Located within 200m below or above a cliff face

☐ Located 20m of a cave, rock shelter or a cave mouth

These landscape features indicate a likelihood of Aboriginal objects, although see also DECCW the Fact Sheet 'What is an Aboriginal Cultural Landscape' (April 2010) in relation to the significance of the landscape as a whole.

If 'yes' to both of the above, continue to the next question.

If 'no' to either, 9i.e. the project is on disturbed land or no associated landscape features are present), the activity can proceed, although work is required to stop if any Aboriginal objects are found.

Can harm be avoided?

Step 3 of the Code.

☐ Yes ☐ No ☐ N/A If an Aboriginal place is identified, can the activity be -relocated to be carried out outside of the place?

☐ Yes ☐ No ☐ N/A If an Aboriginal object is identified, can the activity be carried out without harming the Aboriginal object?

Note the definition of 'harm' is very broad and council include any potential disturbance of the object.

☐ Yes ☐ No ☐ N/A If there is a high likelihood of Aboriginal objects being encountered, can the activity be carried out away from the associated landscape features or on disturbed land?

If 'no' to any of the above, continue to the next section.

If harm can be avoided, the activity can proceed, although work is required to stop if any Aboriginal objects are found.

Desktop assessment and visual inspection

Step 4 of Code

If the due diligence assessment has reached this stage, a desktop analysis is required to be conducted and a visual inspection of the site to confirm whether Aboriginal objects can be identified or are likely to be present below the surface of the ground.

The desktop analysis is an assessment of any existing records or documents related to an Aboriginal object, place pr previous surveys. The analysis should consider the entire area in the vicinity of the project, and include consideration of previous heritage and archaeological studies.

A visual (in person) inspection of the site is also required. While the code indicates that it is acceptable for an Aboriginal person or landholder to carry out the visual inspection, if they have experience in locating and identifying Aboriginal objects, there are risks involved in engaging someone without formal qualifications and this is not recommended. Therefore, in order to comply with the Code, the visual inspection of the site must be carried out by a person with expertise (like an archaeologist) in identifying Aboriginal Objects.

While consultation is not a requirement of the code, it is required prior to applying for an Aboriginal Heritage Impact Permit (AHIP), so may also be useful to undertake at this stage.

Note: If the desktop assessment and inspection indicate that there are unlikely to be any Aboriginal objects, the activity can proceed, although work is required to stop if any Aboriginal objects are found.

Detail findings of these investigations if applicable:

Further Investigations and impact assessment

Step 5 of the Code

If uncertainty remains as to whether the proposed activity could potentially harm any Aboriginal objects or places, a detailed investigation and impact assessment, including consultation with the local Aboriginal community, will be required to determine whether an Aboriginal Heritage Impact Permit (AHIP) is required.

Council will need to engage a qualified archaeologist to carry out this investigation.

Detail findings of these investigations if applicable:

See: Guide to Investigating, Assessing and Reporting Aboriginal Cultural Heritage in New South Wales, published by OEH and dated 1 April 2011 and related guidelines on Heritage NSW's Website.

Note: Sensitive Aboriginal Heritage Information has been redacted from this report.

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Level 6, 10 Valentine Ave, Parramatta 2150
Locked Bag 5020 Parramatta NSW 2124
Tel: (02) 9585 6345

ABN 34 945 244 274
Email: ahims@environment.nsw.gov.au
Web: www.heritage.nsw.gov.au

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Appendix D – Unexpected Finds Protocol

Purpose and Scope

The purpose of this protocol is to provide a consistent method for managing unexpected heritage items (both Aboriginal and non-Aboriginal) that may be discovered during construction works. This protocol will apply to all construction activities undertaken under this Review of Environmental Factors but should be reviewed by the client and updated with their applicable protocol if requested to ensure consistency is maintained. When applicable, the contractor's procedure should be reviewed and relevant aspects updated within their and this procedure.

Types of Unexpected Heritage Items and their Legal Protection.

An 'unexpected heritage item' means any unanticipated discovery of an actual or potential heritage item, for which the client or contractor does not have approval to disturb or does not have a safeguard in place (apart from this procedure) to manage the disturbance.

These discoveries are categorised as either:

- Aboriginal Objects
- Historic (non-Aboriginal) heritage items
- Human skeletal remains

Aboriginal Objects

The National Park and Wildlife Act 1974 protects Aboriginal objects which are defined as:

"Any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains"

Examples of Aboriginal objects include stone tool artefacts, shell middens, axe grinding grooves, pigment or engraved rock art, burial sites, and scarred trees.

Historic Heritage

The Heritage Act 1977 protects relics which are defined as:

“Any deposit, artefact, object or material evidence that relates to the settlement of the area that comprises NSW, not being Aboriginal settlement; and is of State or local heritage significance”.

Historic (non-Aboriginal) heritage items may include: Archaeological ‘relics’; Other historic items (i.e. works, structures, buildings or movable objects).

Relics are archaeological items of local or state significance which may relate to past domestic, industrial or agricultural activities in NSW, and can include bottles, remnants of clothing, pottery, building materials and general refuse.

Human Skeletal Remains

Human skeletal remains can be identified as either an Aboriginal object or non-Aboriginal relic depending on ancestry of the individual (Aboriginal or non-Aboriginal) and burial context (archaeological or non-archaeological). Remains are considered to be archaeological when the time elapsed since death is suspected of being 100 years or more.

All bones must be treated as potential human skeletal remains and work around them must stop while they are protected and investigated urgently.

Responsibilities

Table D.1: Table of Responsibilities

Role	Responsibility
Project Manager	Ensure the process for unexpected finds is included as part of all site inductions. Ensure that this protocol is implemented, and all personnel are aware of their responsibilities.

Construction Supervisor	Ensure this protocol is understood and implemented on site. Stops works immediately adjacent to any unexpected archaeological finds until they have been assessed in accordance with this protocol. Report any unexpected finds to the Project Manager.
Aboriginal or Historical archaeologist	On call to provide professional assistance should there be an unexpected find.
LALC	On call to provide professional assistance should there be an unexpected find.
Environmental Officer	On call to provide professional assistance should there be an unexpected find.
All personnel	Be familiar with this protocol and report any unexpected finds to their construction supervisor or project manager.

Unexpected Heritage Items Procedure

Table D.2: Unexpected items procedure

Step	Action
1	**Stop work, protect item and inform the site supervisor**
1.1	Stop all work in the immediate area of the item and notify the Project Manager
1.2	Establish a 'no-go zone' around the item. Use high visibility fencing, where practical.
1.3	Inform all site personnel about the no-go zone.
1.4	Inspect, document and photograph the item.
1.5	Is the item likely to be bone? Where it is obvious that the bones are human remains, you must notify the local police by telephone immediately. They may take command of all or part of the site. Where human remains are likely to be aboriginal ancestral remains, also contact the OEH.
1.6	Confirm with the site environment representative that the site is unexpected and if a permit is in place.

2	**Contact Environmental Officer and client to engage an Aboriginal or Historical archaeologist and/or an Aboriginal heritage consultant**
2.1	Contact a qualified Aboriginal or Historical archaeologist to discuss the location and extent of the item and arrange a site inspection, if required. If requested, provide photographs.
3	**Preliminary assessment and recording of the find**
3.1	In a minority of cases, the Aboriginal or Historical archaeologist or LALC Rep may determine from the photographs that no site inspection is required because no archaeological constraint exists for the project (e.g., the item is not a 'relic', a 'heritage item' or an 'Aboriginal object'). Any such advice should be provided in writing (e.g. via email) and confirmed by the Project Manager.
3.2	Arrange site access for the Aboriginal or Historical archaeologist/Aboriginal heritage consultant to inspect the item as soon as practicable
3.3	Subject to the Aboriginal or Historical archaeologist/Aboriginal heritage consultant's assessment, work may recommence at a set distance from the item. Existing protective fencing established in Step 1 may need to be adjusted to reflect the extent of the newly assessed protective area. No works are to take place within this area once established.
3.4	The Aboriginal or Historical archaeologist/Aboriginal heritage consultant may provide advice after the site inspection and preliminary assessment that no heritage constraint exists for the project (e.g. the item is not a 'relic' or a 'heritage item' or an 'Aboriginal item'. Any such advice should be provided in writing (e.g. via email or letter with the consultant's name and company details clearly identifiable) to the Project Manager.
3.5	Where required, seek additional specialist technical advice (such as a forensic or physical anthropologist to identify skeletal remains). The Aboriginal or Historical archaeologist consultant can provide contacts for such specialist consultants.
3.6	Where the item has been identified as a 'relic' or 'heritage item' or an 'Aboriginal object' the Aboriginal or Historical archaeologist should formally record the item. Where an Aboriginal object is recorded it must be registered on the Aboriginal heritage information management system (AHIMS) in accordance with section 89A of the NPW Act.
3.7	OEH (Heritage Division for non-Aboriginal relics and Planning and Aboriginal Heritage Section for Aboriginal objects) can be notified informally by telephone at this stage by the Environment and Cultural Heritage Manager. Any verbal conversations with regulators must be noted on the project file for future reference. • Heritage NSW ph.: 131 555

	• Email: info@environment.nsw.gov.au Registered aboriginal parties (RAPs) will be notified at this point to inform them of unexpected find.
4	**Aboriginal or Historical Archaeologist to prepare management requirements for site**
4.1	An archaeological or heritage management plan is developed outlining management actions to ensure damage to the site is minimised and work can recommence. This plan will be developed by the Aboriginal or Historical archaeologist in consultation with the RAP's, OEH and DPE as required.
5	**Notify the regulator, if required.**
5.1	If notification is required, complete the template notification letter, including the archaeological/heritage management plan and other relevant supporting information. For historical relics a s146 notification form will be required to be submitted to the Heritage Division.
5.2	Forward the signed notification letter to OEH.
5.3	A copy of the final signed notification letter, archaeological or heritage management plan and the site recording form is to be kept on file and a copy sent to the Project Manager.
6	**Resume Work**
6.1	The management plan is implemented and the project construction environmental management plan (CEMP) is updated to reflect any additional controls and requirements
6.2	Seek written clearance to resume project work from the Environment and Planning Manager and the Aboriginal or Historical Archaeologist/Aboriginal heritage consultant. Clearance would only be given once all archaeological excavation and/or heritage recommendations and approvals (where required) are complete. Resumption of project work must be in accordance with all relevant project/heritage approvals/determinations.
6.3	If required, ensure archaeological excavation/heritage reporting and other heritage approval conditions are completed in the required timeframes. This includes artefact retention repositories, conservation and/or disposal strategies

Contact Details

Table D.3: Unexpected Finds Contact Details

Position	Name	Phone Number
Project Manager	Paul McKenzie	0456 628 101
Environmental Officer	Geoff Young	0478 307 936
Consultant Archaeologist	TBC	TBC

Appendix E – Geotechnical Report

RFQ 8558E - CURROWAN CREEK – Geotechnical Investigation Report

Prepared for:

Shoalhaven City Council

Prepared by:

Stantec Australia Pty Ltd

Report Reference:

304001135-001

8 December 2023

304001135-001 RFQ 8558E - CURROWAN CREEK

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Prepared by 

Nicholas Issa

Reviewed/Approved by 

David Ronchi

Revision	Description	Author		Review	
0	First Issue	8/12/2023	NI	8/12/2023	DR

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

Shoalhaven City Council (SCC) has engaged Stantec Australia Pty Ltd (Stantec) to undertake a geotechnical investigation for bridge replacement at the Currowan creek causeway. The work has been undertaken in accordance with Stantec's proposal prepared for Shoalhaven City Council – "RFQ 8558E – Currowan Creek", dated 31st October 2023.

The investigation area is located at Currowan Creek Causeway, which is situated along Western Distributor Road, Currowan NSW. The investigation location is given in **Figure 1-1** below with most recent aerial imagery (Nearmap, 2023).

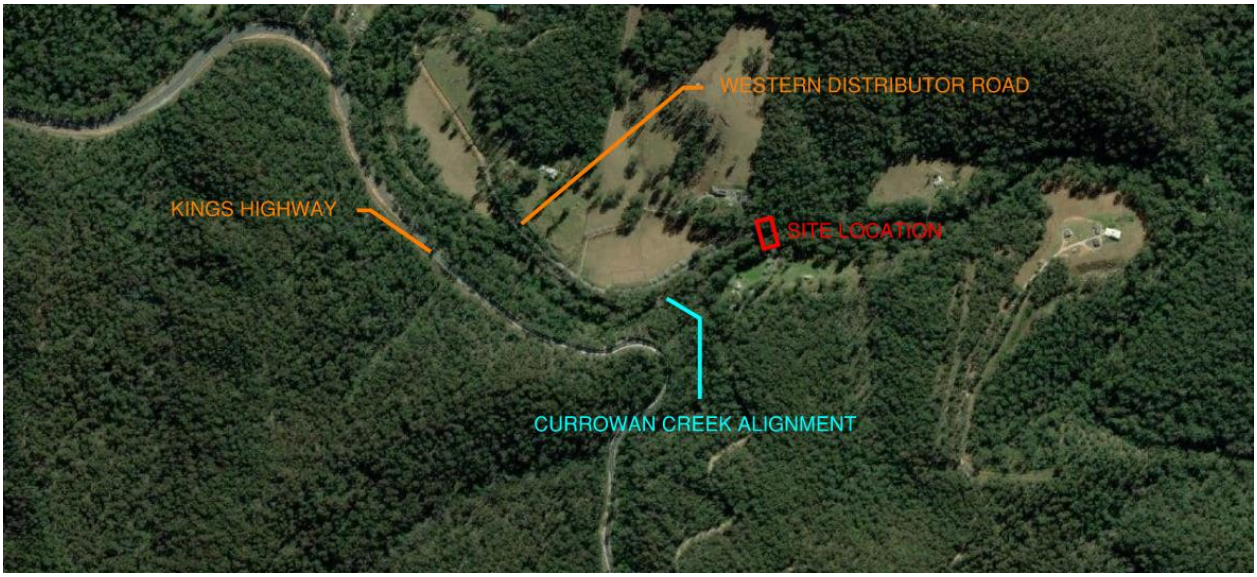

Figure 1-1 Project Location

1.2 OBJECTIVES

A geotechnical investigation was conducted to provide geotechnical data relevant to the proposed bridge replacement. The results from the investigation methods undertaken are collated in this Geotechnical Investigation Report, which comprises:

- Introduction, overview, and background of the investigation.
- Review of published information regarding the site including site geology, topography, acid sulfate soils and soil landscape maps.
- Site investigation and fieldwork description.
- Investigation results including fieldwork results, borehole plans, in situ tests, subsurface conditions and groundwater conditions (if encountered).

- Laboratory testing results.
- Recommendations for viable foundation systems and appropriate design parameters.
- Discussion regarding settlement and scouring of overburden materials.

1.3 AVAILABLE DATA

The following data was made available for development of this report:

- Concept design plans provided by SCC ref. “Currowan Creek – Fish Passage Options Analysis – Concept Design”, dated 6th July 2023.

2.0 SITE OVERVIEW

2.1 SITE DESCRIPTION

The site is located along Western Distributor Road approximately 10km northwest of Nelligen. The crossing is approximately 280m from the King’s Highway. Currowan Creek flows in a north westerly direction and connects to the Clyde River approximately 10km east of the site. Land use comprised farms located north and south of the site.

The southern approach to the site is an unsealed road single lane road and traverses a ridge before a sweeping left-hand bend prior to the creek crossing. The northern approach is an unsealed single lane road and hugs the river course along alluvial terrace environment prior to a sharp right hand turn to the creek crossing. The crossing currently contains four 600mm diameter piped culverts with water flowing in a north easterly direction.

General site photos are provided in Figure 2-1 and Figure 2-2 below.

Figure 2-1 Site looking southeast


Figure 2-2 Site looking northwest

2.2 REGIONAL GEOLOGY

An assessment of the regional geology has been undertaken through review of MinView spatial geology website (NSW Department of Planning, Industry and Environment, 2023) which indicated the site is underlain by the following geological units as shown in **Figure 2-3** below.

- Alluvial Floodplain Deposits – QH_af – silt, very fine to medium grained sand, and clay.
- Abercrombie Formation – Oada – fine to coarse grained sandstone, interbedded with laminated siltstone and mudstone.

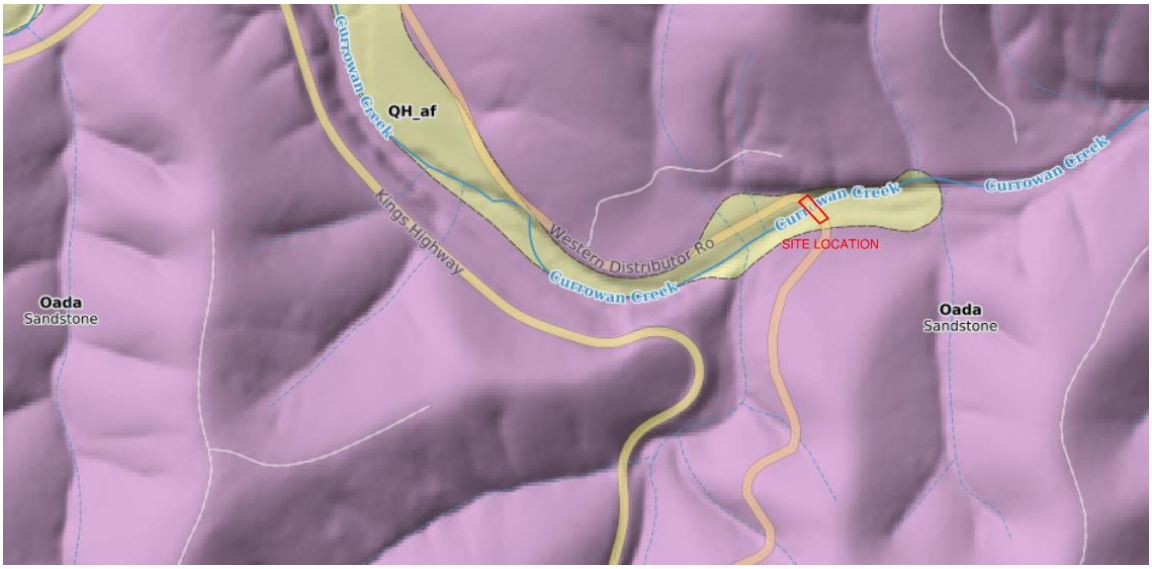

Figure 2-3 Regional Geology

3.0 GEOTECHNICAL INVESTIGATION

3.1 SITE WALKOVER

A site walkover was conducted by a Geotechnical Engineer from Stantec on 3rd October 2023 to allocate borehole locations, conduct underground service clearance of the proposed borehole locations and make site observations to assist in the production of this geotechnical report.

The following observations are provided:

- The site is heavily vegetated on both sides of the creek with mature native casuarina trees.
- The existing site conditions did not appear to show any signs of significant scour at the crossing or adjacent banks, it is however noted that some minor scour of soil was present on the northern and southern sides of the site (west and east of the bridge facing Batemans Bay).
- rock outcropping was observed on the western embankment of the bridge, surrounding a medium sized tree. No rock outcropping was observed on the eastern embankments or within the riverbed.
- The eastern and western side of the crossing contained minor scour causing undermining of some trees.
- Small to medium dead tree logs were observed at various points along the banks and inside the creek. It is also noted that the riverbed comprised mainly cobble size rock with some boulders indicating high water flows and velocities during peak events.

Photos of the eastern and western sides of the crossing are shown below in Figure 3-1 and Figure 3-2 below.

Figure 3-1 Eastern side of crossing

Figure 3-2 Western side of crossing

3.2 SITE INVESTIGATION

3.2.1 Preparation of Investigation, Safety and Environmental Plans

Prior to commencement of the geotechnical investigation, Stantec conducted the following due diligence:

- Safety documentation in accordance with Stantec's HSSE process for projects to identify items related to fieldwork, such as access considerations, health and safety issues and potential environmental factors.
- A Before You Dig Australia (BYDA) request was undertaken prior to commencement of fieldwork by Stantec to identify subsurface utilities present within the proposed borehole locations.

3.2.2 Service Location

Underground utility location was undertaken by an accredited contractor and comprised of clearing of borehole locations using a cable avoidance tool prior to any intrusive investigations commencing. A service location clearance report was presented on-site to Stantec's site representative prior to breaking ground.

3.2.3 Aboriginal Heritage

An Aboriginal Heritage Information Management (AHIMS) request was undertaken prior to the commencement of fieldwork by Stantec to identify any protected heritage areas within the designated test area. No heritage items were identified inside or near the investigation area.

3.2.4 Intrusive Investigation

An intrusive investigation was undertaken on 24th May 2023 and comprised the following:

- Drilling of two (2) boreholes (BH01 and BH02) to depths of 8.28m and 8.00m respectively, targeting collection of at least 2m of medium strength rock core.
- Soil drilling was carried out by using solid flight auger technique, and continued using HQ coring techniques upon auger refusal until the target depth was achieved.
- Standard Penetration Tests (SPTs) were conducted at nominal 1.50m intervals in conjunction with auger drilling at the borehole locations to assess the in-situ strength characteristics of the encountered materials and to allow sample retrieval for laboratory testing.
- Dynamic Cone Penetrometer (DCP) testing conducted from surface at test locations to a maximum 3.0m depth below ground level or prior refusal, to assist with the assessment of the in-situ soil strength conditions at each borehole location.
- Engineering assessment of the subsurface profiles encountered in accordance with AS1726 – 2017 (Standards Australia Limited, 2017) by a geotechnical engineer from Stantec.
- Sampling of material considered representative of soil units encountered for subsequent laboratory assessment, including geotechnical and acid sulfate soil sampling.
- Once complete, the boreholes were backfilled with drill cuttings, compacted with back auger rotation and crowbar, and returned to existing surface level.
- Point load testing was undertaken on all recovered cores on site following core box photography.

The geotechnical investigation site plans consisting of approximate borehole locations and geological units are provided in Appendix A. Engineering logs of the boreholes are presented in Appendix B together with explanatory notes.

3.2.5 Test Locations

The test locations were recorded by a hand-held GPS device with a ±5 m accuracy in plan.

The approx. borehole investigation plan is provided in Appendix A and summary of borehole locations is presented in Table 3-1 below. Locations relative to site features is presented in Figure 3.3 below.

Table 3-1 Summary of Borehole Locations

Borehole	Easting (m)	Northing (m)	Termination Depth (mbgl)
BH01	233495	6059194	8.28
BH02	233530	6059152	8.00

Notes:

- mBGL: Meters below ground level

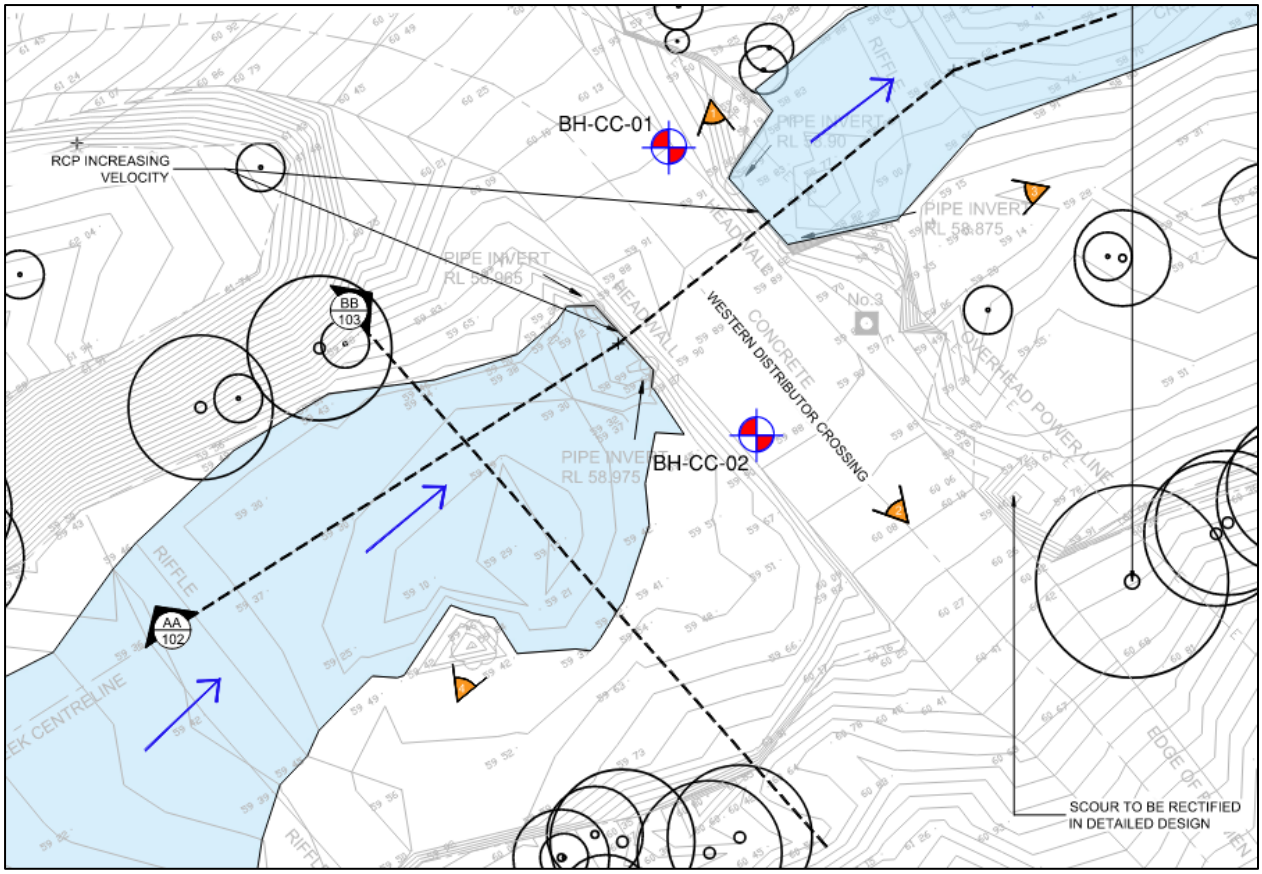

Figure 3-3: Investigation locations

3.3 SUBSURFACE CONDITIONS

Materials encountered in the boreholes were similar to that of expected from the geological map, indicating alluvial floodplain deposits overlying metasiltstone rock. For a detailed description of the subsurface ground conditions encountered, geotechnical borehole logs in Appendix B should be referred to. In summary, subsurface conditions encountered in the boreholes are provided in **Table 3-2** and **Table 3-3** below.

Table 3-2 Summary of Subsurface Units

Unit	Material Type	Description of Layer
1A	ALLUVIUM	SAND: fine to coarse grained sand, with fine to medium gravel, brown to grey, trace cobbles and boulders, loose to medium dense.
1B		Sandy GRAVEL: fine to coarse gravel, fine to coarse grained sand, brown to grey, trace cobbles and boulders, loose to very dense
2	ROCK	METASILTSTONE: fine grained, pale-grey to grey, horizontally bedded with quarz veining up to

Table 3-3 Depth to Top of Subsurface Units

BH ID	Depth to top of Unit (mBGL)			Termination Depth (mBGL)	Termination Reason
	1A	1B	2		
BH01	0.00	2.00	3.88	8.28	Target depth
BH02	0.00	1.20	2.55	8.00	Target depth

Notes:
- mBGL: meters below ground level

For a detailed description of the subsurface ground conditions, the borehole logs in Appendix B should be referred to.

3.4 GROUNDWATER OBSERVATIONS

Groundwater and seepage were not observed in any of the boreholes during investigation. Given the proximity to the creek and inferred high permeability of the riverbed sediments, it is expected that a shallow (<1m depth) groundwater will be present which will fluctuate corresponding to the adjacent creek water levels.

Where core drilling is carried out, introduction of drilling fluid precludes identification of standing water levels. It is also noted that boreholes were immediately backfilled following drilling which precluded longer term monitoring of groundwater levels. It should be noted that groundwater levels are likely to fluctuate with variations in climatic and site conditions.

3.5 IN SITU TESTING

3.5.1 Standard Penetration Test (SPT)

SPT tests were undertaken at 1.5m intervals with the borehole to assist with assessment of material strength parameters in accordance to AS 1289.6.3.1 2016 (Standards Australia Limited, 2016).

A SPT test is undertaken on the drill rig and involves the raising and dropping of a 63.5kg weight a standard distance of 760mm. Blow counts are counted for every 150mm increments over three increments, totaling 450mm. The first increment is classed as the seating drive, with the next two increments classed as the test. The total blow counts over the test become the 'N' value. If the hammer is bouncing, or 30 blows causes less than 100 mm penetration at any stage, is defined as refusal.

3.5.2 Dynamic Cone Penetrometer (DCP)

Dynamic Cone Penetrometer testing was carried out in accordance with method AS 1289.6.3.2 (Standards Australia Limited, 1997). DCP testing involves raising and dropping a 9.0kg hammer to drive a steel cone on the end of a rod shaft through the underlying layers. The number of blows it requires to penetrate the rod across 100mm increments is measured until target depth is reached or the cone is bouncing, causing refusal (blow counts > 25).

Testing was undertaken within proximity of each borehole location to assist in determining subsurface strength properties. The tests were undertaken from surface level to 3.00mbgl, or prior refusal. The DCP results are presented in the engineering logs provided in Appendix B.

3.6 LABORATORY TESTING

Laboratory testing conducted on strategically selected samples recovered during the fieldwork comprised the following:

- Two (2) Moisture Content tests.
- Two (2) Atterberg & Linear Shrinkage tests.
- Two (2) Particle Size Distribution tests.
- Two (2) Uniaxial Compressive Strength tests on rock recovered.
- Four (4) Soil Aggressivity Suite tests.
- Eight (8) pH screenings.

Point load testing was undertaken in accordance with AS4133.4.1-2007 on all recovered HQ cores on site following core box photography, and selected core samples.

Testing was performed by NATA-accredited laboratories Australian Soil and Concrete Testing (ASCT) Illawarra laboratory and Eurofins Environmental Testing Australia. Laboratory test report sheets and certificates are included in Appendix C.

3.6.1 Soil Testing

Selected samples from the boreholes were tested at NATA accredited laboratories for testing. A summary of mechanical geotechnical laboratory test is presented in **Table 3-4** below and the test certificates are presented in Appendix C.

Table 3-4 Plasticity Index and Particle Size Distribution Results Summary

BH ID	Depth Range (m)	Unit	% GRAVEL	% SAND	% FINES	LL (%)	PL (%)	PI (%)	MC (%)
BH01	0.40-0.50	1A	19	75	6	21	16	5	13.1
BH02	1.20-1.30	1A	49	46	5	20	17	3	5.4

Notes:
- MC: Moisture Content
- LL: Liquid Limit

- PL: Plastic Limit
- PI: Plasticity Index

3.6.2 Rock Testing

Uniaxial Compressive Strength (UCS) testing was undertaken on two (2) samples and is summarised in **Table 3-5** below. Laboratory test certificates are attached in Appendix C.

Table 3-5 Uniaxial Compressive Strength Testing

Borehole	Depth Range (m)	Unit	UCS (MPa)	Failure Mode	Moisture Content (%)
BH02	5.42-5.66	2A	93.4	Single Shear	0.30
BH02	7.34-7.54	2A	95.0	Axial Multiple	0.10

Notes:
- USC: Uniaxial Compressive Strength

3.6.3 Chemical Testing

Soil aggressivity and pH screen testing was undertaken and is summarised in **Table 3-6** and **Table 3-7** below. Laboratory test certificates are attached in Appendix C.

Table 3-6 Soil Aggressivity Summary

Borehole	Depth (m)	Unit	Soil Type	Chloride (mg/kg)	EC (µS/cm)	pH	Resistivity (ohm.m)	Sulfate (mg/kg)	MC (%)
BH01	1.00	1A	SAND	<10	17	6.1	590	13	19
BH01	2.00	1B	Sandy GRAVEL	<10	<10	6.2	1200	<10	19
BH02	1.00	1A	SAND	<10	<10	6.0	1000	<10	18
BH02	2.87-3.20	2	Metasiltstone	<10	<10	7.3	1300	<10	11

Notes:
- EC: Electrical Conductivity

Table 3-7 pH Screen Test Summary

Borehole	Depth (m)	Unit	pH-F	pH-FOX	RR
BH01	0.50	1A	6.6	4.7	1.0
BH01	1.00	1A	6.4	4.4	1.0
BH01	1.50	1A	6.5	3.8	1.0
BH01	2.00	1A	6.6	4.6	1.0
BH01	2.50	1A	6.6	4.4	1.0
BH02	0.50	1A	6.5	3.7	4.0
BH02	1.00	1A	6.4	3.0	4.0
BH02	1.50	1A	6.5	3.6	1.0
BH02	2.00	1A	6.6	3.9	1.0
BH02	2.50	1A	6.6	3.9	1.0

Notes:
- pH-F = Field pH test
- pH-FOX = Field pH Peroxide test

- RR = Reaction Ratings

In accordance with AS2159-2009 'Piling-Design and Installation' (Standards Australia Limited, 2009), the exposure classification has been assessed for in-ground concrete structures (Table 6.4.2 (C)) and in-ground steel structures (Table 6.5.2 (C)) as follows:

For in-ground concrete structures:

- Mild (all soils below ground water with high permeability soils).
- Non-aggressive (all soils above ground water or low permeability soils).

For in-ground steel structures:

- Non-aggressive (all soils below ground water with high permeability soils).
- Non-aggressive (all soils above ground water or low permeability soils).

For design purposes, it is recommended the worst-case classification be taken i.e. all soils below ground water with high permeability soils.

4.0 RECOMMENDATIONS

4.1 FOUNDATION SYSTEMS

Shallow mass concrete type footings are unlikely to be feasible and appropriate deep foundation systems may comprise of bored cast in-situ (bored) concrete piles. Driven piles may present constructability challenges based on the following features of the profile:

- Rounded cobbles and boulders within the overlying alluvial sediments may present driving obstructions.
- Variable depth to bedrock.
- Lack of weathered profile prior to encountered fresh high strength rock to allow for embedment and potential difficulties in drivability.
- Presence of quartz veining and non-homogenous rock conditions potentially presented challenges for drivability.

Whilst bored piles are considered feasible, the following elements will require consideration during construction:

- Permanent casing socketed into top of rock will likely be required to prevent ingress of alluvial sands and gravels.
- Piling platforms to be designed to support piling rigs due to the loose alluvial sediments at surface.

Whilst it is understood that a bridge is proposed, should a box culvert be considered the following advantages and disadvantages shall be considered based on “Austroads 2019 – Guide to Bridge Technology Part 8 – Hydraulic Design of Waterway Structures.”

Table 3.1: Advantages and disadvantages of bridges and culverts

Structure	Advantages	Disadvantages
Bridges	• Less susceptible to clogging with debris • Waterway increases with rising water surface until water surface begins to submerge superstructure • Scour increases waterway opening • Minimal impact on aquatic environment and wetlands • Widening does not usually affect hydraulic capacity	• Require more structural maintenance than culvert • Spill slopes susceptible to erosion and scour damage • Piers and abutment susceptible to failure from scour • Buoyant, drag and impact forces are hazards to bridges • Susceptible to stream channel migration
Culverts	• Changes to vertical geometry and road width can generally be accommodated by extending culvert ends • Require less structural maintenance than bridges • Capacity increases with stage • Usually easier and quicker to build than bridges • Scour is localised, more predictable and easier to control • Storage can be used to reduce peak discharge	• Silting may require periodic cleaning • No increase in waterway as stage rises above soffit • Susceptible to clogging with debris • Susceptible to scour at outlets • Susceptible to abrasion and corrosion damage • Extension may reduce hydraulic capacity • Inlets of flexible culverts susceptible to failure by buoyancy • Rigid culverts susceptible to separation at joints • Susceptible to failure by piping

4.2 PILED FOOTINGS

Metasiltstone rock encountered within the study area has been classified based on classification system for shale proposed by Pells et al. (1998), summarised in table below.

Table 2b: Classification for shale

Class	Unconfined compressive strength q_u (MPa)	Defect spacing (mm)	Allowable seams
I	>16	>600	<2%
II	>7	>200	<4%
III	>2	>60	<8%
IV	>1	>20	<25%
V	>1	N.A.	N.A.

Piled footings should be assessed based on the parameters provided in Table 4-1 below for the design of piles founded in rock. These parameters are compatible with AS2159-2007 which follows a limit state method.

Table 4-1 Pile Parameters for Bored Piles

Geotechnical Material	Uniaxial Compressive Strength (UCS (MPa)	Poisson's ration v'	Adopted ultimate end bearing (MPa)	Adopted ultimate shaft adhesion (kPa)[3]	Adopted serviceability end bearing (MPa)[4]
CLASS V Meta-Siltstone	>1	0.3	3	100	0.7
CLASS IV Meta-Siltstone	>1	0.25	5	150	1.0
CLASS III Meta-Siltstone	>2	0.25	20	400	3.0
CLASS II Meta-Siltstone	>7	0.2	30	800	5
CLASS I Meta-Siltstone	>16	0.2	120	1000	8

Notes:

- 1. Skin friction (fs) and base resistance (fb) as defined in AS2159-2009.
- 2. Ignore bored pile shaft within 1 m of ground surface to account for potential site disturbance and moisture change effects.
- 3. Ultimate shaft adhesion based on a clean rock socket with roughness category R2 or better.
- 4. End bearing to cause settlement of <1% of minimum footing dimension.

Piles should be designed for both ultimate and serviceability conditions. Ultimate end bearing and shaft adhesion values are to be used with appropriate load factors and geotechnical strength reduction factors to assess ultimate capacity. The geotechnical strength reduction factor will depend on various influences such as the level of information available for the rock and the level of construction control. Based on the above influence factors applicable for the site and uncertainty with construction method and quality control

etc., an average risk rating, ARR and geotechnical strength reduction factor, Φgb should be calculated. For limit state strength design, a geotechnical strength reduction factor (Φgb) of 0.45 can be applied to the ultimate capacity presented in Table 4-1. It is recommended that piles found a minimum of 2 pile diameters into rock.

Pile testing requirements will be dependent on AS2159-2009. For piles subject to uplift loads, the geotechnical strength should be multiplied by a factor of 0.7 in addition to the geotechnical strength reduction factor.

The design values require good construction practices which includes socket cleaning and concreting in a continuous process without delay. It is recommended that an experienced geotechnical engineer or engineering geologist observes pile drilling as well as shaft and mechanical base cleaning to confirm the adequacy of founding strata. Such observations would be undertaken from the piling platform level and would include observation of returned cuttings and drill rig performance, as well as the effectiveness of shaft roughening (if required) and down-hole cleaning.

4.3 SCOUR PROTECTION MEASURES

The stream bed comprises predominately gravel and sand and any scour can expected to occur quickly. No flood study has been conducted. It is recommended that a hydrology study and formal scour assessment be conducted to determine appropriate scour protection required based on peak water velocities likely to be encountered. Inputs (Austroads Ltd., 2013) provide the recommended rock class and section thickness for various peak water velocity ranges and rock particle size distribution for each rock class as provided in Table 4-2 and Table 4-3.

Table 4-2 Design of Rock Slope Protection

Velocity (m/s)	Class of rock protection (tonne)	Section thickness, T(m)
<2	None	-
2.0-2.6	Facing	0.50
2.6-2.9	Light	0.75
2.9-3.9	¼	1.00
3.9-4.5	½	1.25
4.5-5.1	1.0	1.60
5.1-5.7	2.0	2.00
5.7-6.4	4.0	2.50
>6.4	Special	-

Table 4-3 Standard Classes of Rock Slope Protection

Rock Class	Rock size (m)	Rock mass (kg)	Minimum percentage of rock larger than
Facing	0.40	100	0
	0.30	35	50
	0.15	2.5	90
Light	0.55	250	0
	0.40	100	50
	0.20	10	90
¼ tonne	0.75	500	0
	0.55	250	50
	0.30	35	90
½ tonne	0.90	1000	0
	0.70	450	50
	0.40	100	90
1 tonne	1.15	2000	0
	0.60	1000	50
	0.55	250	90
2 tonne	1.45	4000	0
	1.15	2000	50
	0.75	500	90
4 tonne	1.80	8000	0
	1.45	4000	50
	0.90	100	90

5.0 CLOSURE

We appreciate the opportunity to work collaboratively with you on this project. Our team looks forward to bringing our high level of expertise to deliver successful outcomes in your future projects.

Your attention is drawn to the appended document titled "*Important Information about this Geotechnical Report"* found in Appendix D*.* This document is intended to clarify to the reader what the realistic expectations of this report should be, and what is the correct use of the document. Misinterpretation of geotechnical information presents significant risk to projects: The document includes a discussion on general limitations of geotechnical services, which by nature, are based extensively on opinion and judgement.

The statements included in this document are not intended to be exculpatory clauses or to reduce the general responsibility accepted by Stantec, but rather to identify where Stantec and our Client's responsibilities lie. The statements ensure that all parties that may rely on the report are aware of their respective responsibilities.

For further enquiries, please do not hesitate to contact Stantec on the information supplied.

6.0 REFERENCES

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Appendix A SITE PLAN & GEOLOGY MAP

Site Plan

Currowan Creek
Currowan, NSW

Project Code: 304001135-GS-001
Drawn By: MS, Checked By: SM
Rev: 01
Date: 2023-12-13

Legend

- Borehole
- 1m Contour
- Watercourse
- Cadastre

BH-CC-01
BH-CC-02
Currowan
WESTERN DISTRIBUTOR ROAD
CURROWAN CREEK
KINGS HIGHWAY
4//1034158
1//707475
1//263922
2//263922
20//755951
89//755930

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Basemap (NSW LPI Imagery, 2014)
2. Cadastre & Watercourse (NSW SS, 2023)
3. 1m Contour derived from LIDAR (NSW SS, 2016)

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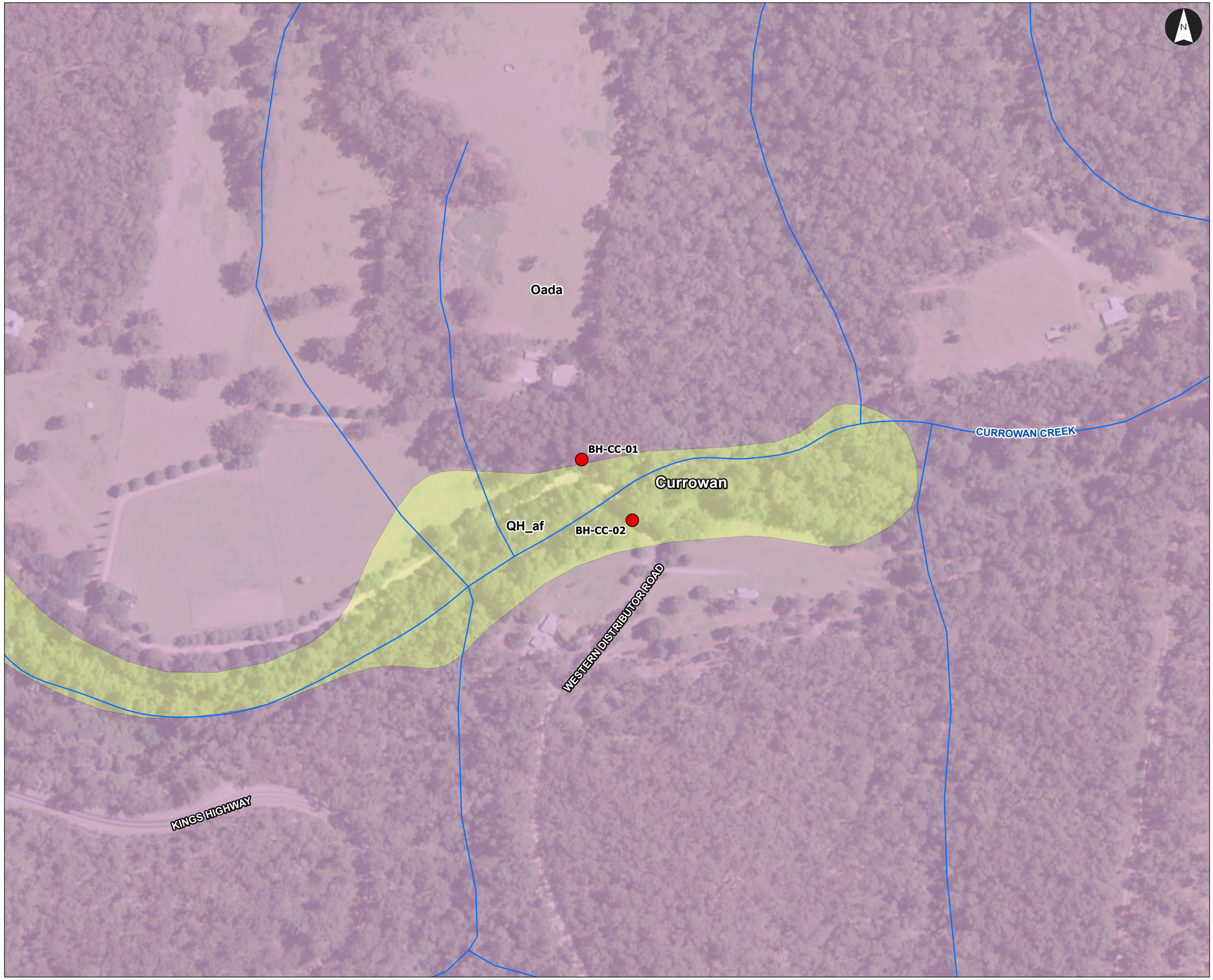
0 20 40 60 80 100 Metres

Scale at A3: 1:2,500

Geology Plan

Currowan Creek
Currowan, NSW

Project Code: 304001135-GS-001
Drawn By: MS, Checked By: SM
Rev: 01
Date: 2023-12-13



Legend

- Borehole
- Watercourse

NSW Seamless Geology

- Oada,Brown and buff to grey, thin- to thick-bedded, fine- to coarse-grained mica-quartz (±feldspar) sandstone, interbedded with laminated siltstone and mudstone. Sporadic chert-rich units.
- QH_af,Silt, very fine- to medium-grained lithic to quartz-rich sand, clay.

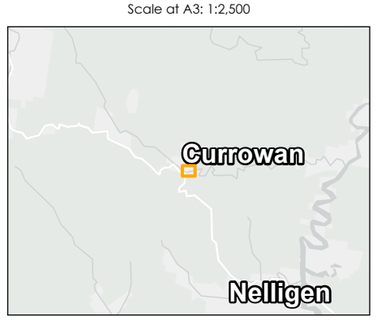
Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Basemap (NSW LPI Imagery 2014)
2. NSW Seamless Geology (GSNSW, 2021)
3. Watercourse (NSW SS, 2023)

Stantec

0 20 40 60 80 100 Metres

Scale at A3: 1:2,500



Appendix B SUBSURFACE LOGS

Explanatory Notes

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. 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
R	Ripper
H	Hydraulic Hammer
X	Existing excavation
N	Natural exposure
Manual drilling: hand operated tools	
HA	Hand Auger
Continuous sample drilling	
PT	Push tube
PS	Percussion sampling
SON	Sonic drilling
Hammer drilling	
AH	Air hammer
AT	Air track
Spiral flight auger drilling	
AS	Auger screwing
AD/V	Continuous flight auger: V-bit
AD/T	Continuous spiral flight auger: TC-Bit
HFA	Continuous hollow flight auger
Rotary non-core drilling	
WB	Washbore drilling
RR	Rock roller
Rotary core drilling	
PQ	85mm core (wire line core barrel)
HQ	63.5mm core (wire line core barrel)
NMLC	51.94mm core (conventional core barrel)
NQ	47.6mm core (wire line core barrel)
DT	Diatube (concrete coring)

Sampling is conducted to facilitate further assessment of selected materials encountered.

Sampling method	
Soil sampling	
B	Bulk disturbed sample
D	Disturbed sample
C	Core sample
ES	Environmental soil sample
SPT	Standard Penetration Test sample
U	Thin wall tube ‘undisturbed’ sample
Water sampling	
WS	Environmental water sample

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

Field testing	
SPT	Standard Penetration Test
HP/PP	Hand/Pocket Penetrometer
Dynamic Penetrometers (blows per noted increment)	
DCP	Dynamic Cone Penetrometer
PSP	Perth Sand Penetrometer
MC	Moisture Content
VS	Vane Shear
PBT	Plate Bearing Test
IMP	Borehole Impression Test
PID	Photo Ionization Detector

If encountered, refusal (R), virtual refusal (VR) or hammer bouncing (HB) of penetrometers may be noted.

The quality of the rock can be assessed by the degree of natural defects/fractures and the following.

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

Notes on groundwater conditions encountered may include.

Groundwater	
Not Encountered	Excavation is dry in the short term
Not Observed	Water level observation not possible
Seepage	Water seeping into hole
Inflow	Water flowing/flooding into hole

Perched groundwater may result in a misleading indication of the depth to the true water table. Groundwater levels are also likely to fluctuate with variations in climatic and site conditions.

Notes on the stability of excavations may include.

Excavation conditions	
Stable	No obvious/gross short term instability noted
Spalling	Material falling into excavation (minor/major)
Unstable	Collapse of the majority, or one or more face of the excavation

Explanatory Notes: General Soil Description

The methods of description and classification of soils used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, a material is described as a soil if it can be remoulded by hand in its field condition or in water. The dominant component is shown in upper case, with secondary components in lower case. In general descriptions cover: soil type, plasticity or particle size/shape, colour, strength or density, moisture and inclusions.

In general, soil types are classified according to the dominant particle on the basis of the following particle sizes.

Soil Classification		Particle Size (mm)
CLAY		< 0.002
SILT		0.002 0.075
SAND	fine	0.075 to 0.21
	medium	0.21 to 0.6
	coarse	0.6 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 may be qualified by the presence of minor components on the basis of field examination methods and/or the soil grading.

Terminology	In coarse grained soils		In fine soils
	% fines	% coarse	% coarse
Trace	≤5	≤15	≤15
With	>5, ≤12	>15, ≤30	>15, ≤30

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

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

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

Relative Density	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 plasticity of cohesive soils is defined by the Liquid Limit (LL) as follows.

Plasticity	Silt LL	Clay LL
Low plasticity	≤ 35%	≤ 35%
Medium plasticity	N/A	> 35% ≤ 50%
High plasticity	> 50%	> 50%

The moisture condition of soil (*w*) is described by appearance and feel and may be described in relation to the Plastic Limit (PL), Liquid Limit (LL) or Optimum Moisture Content (OMC).

Moisture condition and description	
Dry	Cohesive soils: hard, friable, dry of plastic limit. Granular soils: cohesionless and free-running
Moist	Cool feel and darkened colour: Cohesive soils can be moulded. Granular soils tend to cohere
Wet	Cool feel and darkened colour: Cohesive soils usually weakened and free water forms when handling. Granular soils tend to cohere

The structure of the soil may be described as follows.

Zoning	Description
Layer	Continuous across exposure or sample
Lens	Discontinuous layer (lenticular shape)
Pocket	Irregular inclusion of different material

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

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

Soil origin and description	
Fill	Anthropogenic deposits or disturbed material
Topsoil	Zone of soil affected by roots and root fibres
Peat	Significantly organic soils
Colluvial	Transported down slopes by gravity/water
Aeolian	Transported and deposited by wind
Alluvial	Deposited by rivers
Estuarine	Deposited in coastal estuaries
Lacustrine	Deposited in freshwater lakes
Marine	Deposits in marine environments
Residual soil	Soil formed by in situ weathering of rock, with no structure/fabric of parent rock evident
Extremely weathered material	Formed by in situ weathering of geological formations, with the structure/fabric of parent rock intact but with soil strength properties

The origin of the soil generally cannot be deduced solely on the appearance of the material and the inference may be supplemented by further geological evidence or other field observation. Where there is doubt, the terms ‘possibly’ or ‘probably’ may be used

Explanatory Notes: General Rock Description

The methods of description and classification of rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, if a material cannot be remoulded by hand in its field condition or in water, it is described as a rock. In general, descriptions cover: rock type, grain size, structure, colour, degree of weathering, strength, minor components or inclusions, and where applicable, the defect types, shape, roughness and coating/infill.

Rock types are generally described according to the predominant grain or crystal size, and in groups for each rock type as follows.

Rock type	Groups
Sedimentary	Deposited, carbonate (porous or non), volcanic ejection
Igneous	Felsic (much quartz, pale), Intermediate, or mafic (little quartz, dark)
Metamorphic	Foliated or non-foliated
Duricrust	Cementing minerology (iron oxides or hydroxides, silica, calcium carbonate, gypsum)

Reference should be made to AS1726 for details of the rock types and methods of classification.

The classification of rock weathering is described based on definitions in AS1726 and summarised as follows.

Term and symbol		Definition
Residual Soil	RS	Soil developed on rock with the mass structure and substance of the parent rock no longer evident
Extremely weathered	XW	Weathered to such an extent that the rock has 'soil-like' properties. Mass structure and substance still evident
Distinctly weathered	DW	The strength is usually changed and may be highly discoloured. Porosity may be increased by leaching, or decreased due to deposition in pores. May be distinguished into MW (Moderately Weathered) and HW (Highly Weathered).
Slightly weathered	SW	Slightly discoloured; little or no change of strength from fresh rock
Fresh Rock	FR	The rock shows no sign of decomposition or staining

The rock material strength can be defined based on the point load index as follows.

Term and 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 1.0
High	H	1.0 to 3
Very High	VH	3 to 10
Extremely High	EH	> 10

It is important to note that the rock material strength as above is distinct from the rock mass strength which can be significantly weaker due to the effect of defects.

A preliminary assessment of rock strength may be made using the field guide detailed in AS1726, and this is conducted in the absence of point load testing.

The defect spacing measured normal to defects of the same set or bedding, is 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

Terms for describing rock and defects are as follows.

Defect Terms			
Joint	JT	Sheared zone	SZ
Bedding Parting	BP	Seam	SM
Foliation	FL	Vein	VN
Cleavage	CL	Drill Lift	DL
Crushed Seam	CS	Handling Break	HB
Fracture Zone	FZ	Drilling Break	DB

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	RF
Undulose	UN	Smooth	S
Irregular	IR	Slickensided	SL
Stepped	ST	Polished	POL
Discontinuous	DIS		

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

Infill and Coating		
Clean	CN	
Stained	SN	
Carbonaceous	X	
Minerals	MU	Unidentified mineral
	MS	Secondary mineral
	KT	Chlorite
	CA	Calcite
	Fe	Iron Oxide
	Qz	Quartz
Veneer	VNR	Thin or patchy coating
Coating	CT	Infill up to 1mm

Graphic Symbols Index

CLAY	SILT	SAND	GRAVEL
Silty CLAY	Clayey SILT	Clayey SAND	Clayey GRAVEL
Sandy CLAY	Sandy SILT	Silty SAND	Silty GRAVEL
Gravelly CLAY	Gravelly SILT	Gravelly SAND	Sandy GRAVEL
Silty Gravelly CLAY	Clayey Sandy SILT	Clayey Silty SAND	Clayey Silty GRAVEL
Silty Sandy CLAY	Clayey Gravelly SILT	Clayey Gravelly SAND	Clayey Sandy GRAVEL
Sandy Gravelly CLAY	Sandy Gravelly SILT	Silty Gravelly SAND	Silty Sandy GRAVEL

COBBLES & BOULDERS	Sedimentary rock: fine, mostly clay (CLAYSTONE)	Igneous rock: Felsic, fine (RHYOLITE)
PEAT, highly organic soil	Sedimentary rock: fine, mostly silt (SILTSTONE)	Igneous rock: Felsic, coarse (GRANITE)
TOPSOIL	Sedimentary rock: fine, silt and clay (MUDSTONE, SHALE, LAMINITE)	Igneous rock: Mafic, fine to medium (BASALT, DOLERITE)
FILL	Sedimentary rock: medium (SANDSTONE, GREYWACKE)	Igneous rock: Mafic, coarse (GABBRO)
FILL: Asphalt or Bituminous Seal	Sedimentary rock: fine to coarse, angular (BRECCIA)	Metamorphic rock: Foliated, fine to medium (SLATE, PHYLLITE, SHIST)
FILL: Ballast	Sedimentary rock: coarse, rounded (CONGLOMERATE)	Metamorphic rock: Foliated, coarse (GNEISS)
FILL: Concrete	Sedimentary rock: Organic (COAL)	Metamorphic rock: Non-foliated (QUARTZITE, HORNFELS, MARBLE)
FILL: Roadbase	Sedimentary rock: Carbonate (LIMESTONE, DOLOMITE)	
	Sedimentary rock: Volcanic (TUFF, VOLCANIC BRECCIA, AGGLOMERATE)	

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BOREHOLE LOG SHEET

Client: Shoalhaven City Council
Project: RFQ 8558E Geotech - Currowan Creek
Location: Currowan Creek Crossing

Hole No: BH-CC-01

Job No: 304001135 **Sheet:** 1 of 4

Position: E233495.000 N6059194.000 56H MGA20 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: HYDRAPOWER SCOUT **Mounting:** Truck **Driller:** HF
Casing Diameter: HW **Contractor:** ADF
Data Started: 17/11/23 **Date Completed:** 17/11/23 **Logged By:** AC **Checked By:** DR

Drilling				Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing	Water	Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	F	HW	Not Observed	D 0.40 - 0.50 m		0.5		SP	SAND: fine to coarse grained, brown, with fine to medium grained, rounded gravel, trace clay, trace cobbles and boulders, rounded	M	L	ALLUVIUM
				ES 0.50 m SPT 0.50 - 0.95 m 2, 2, 2 N=4		1.0						0.50 m: SPT Recovery: 0.45 m
				ES 1.00 m		1.5						
				ES 1.50 m SPT 1.50 - 1.85 m 0, 2, 25/50mm N=R		2.0			2.00m			1.50 m: SPT Recovery: 0.35 m; SPT refusal on inferred cobble/boulder
				ES 2.00 m				GM	Sandy GRAVEL: fine to medium, rounded, grey, coarse grained sand, with silt	W		
				ES 2.50 m	Hammer Bounce	2.5						
	VH			S 3.00 - 3.09 m SPT 3.00 - 3.09 m 25/90mm N=R		3.0					VD	3.00 m: SPT Recovery: 0.09 m; SPT refusal on inferred cobble/boulder
						3.5			3.88m			
									Continued as Cored Drill Hole			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

Stantec Australia PTY LTD

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CORE LOG SHEET

Client: Shoalhaven City Council
Project: RFQ 8558E Geotech - Currowan Creek
Location: Currowan Creek Crossing

Hole No: BH-CC-01

Job No: 304001135 **Sheet:** 2 of 4

Position: E233495.000 N6059194.000 56H MGA20	**Angle from Horizontal:** 90°	**Surface Elevation:**
Rig Type: HYDRAPOWER SCOUT	**Mounting:** Truck	**Driller:** HF
Casing Diameter: HW **Bit Type:** impreg	**Bit Condition:** good	**Contractor:** ADF
Data Started: 17/11/23 **Date Completed:** 17/11/23	**Logged By:** AC	**Checked By:** DR

Coring						Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ● - Axial O - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
					0.5 1.0 1.5 2.0 2.5 3.0 3.5							
							3.88m START CORING AT 3.88m					
HQ		100	0					F				3.88 - 3.94 m: FZ 3.94 - 3.96 m: SM, GRAVEL, Quartz;

DRILLING
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller
- PQ Rotary core (85mm)
- HQ Rotary core (63.5mm)
- NMLC Rotary core (51.94mm)
- DT Diatube concrete coring
- PT Push tube
- PS Percussion sampling
- SON Sonic drilling
- AH Air hammer

WATER
- Water Level on date shown
- water inflow
- water outflow

ROCK QUALITY DESCRIPTIONS
- RQD Rock Quality Designation (%)
- TCR Total Core Recovery (%)

ROCK STRENGTH
- EH Extremly High
- VH Very High
- H High
- M Medium
- L Low
- VL Very Low

ROCK WEATHERING
- FR Fresh
- SW Slightly Weathered
- DW Distinctly Weathered
- MW Moderately Weathered
- HW Highly Weathered
- XW Extremly Weathered

DEFECT TYPE
- JT Joint
- SZ Sheared zone
- BP Bedding Parting
- SM Seam
- FL Foliation
- VN Vein
- CL Cleavage
- CS Crushed Seam
- FZ Fracture Zone
- DL Drift Lift
- HB Handing Break
- DB Drilling Break

PLANARITY
- CU Curved
- DIS Discontinuous
- IR Irregular
- PR Planar
- ST Stepped
- UN Undulose

ROUGHNESS
- VR Very Rough
- RF Rough
- S Smooth
- SL Slockensided
- POL Polished

COATING
- CN Clean
- SN Stained
- VNR Veneer (thin or patchy)
- CT Coating (up to 1mm)

INFILL MATERIALS
- X Carbonaceus
- MU Unidentified minteral
- MS Secondary mineral
- KT Chlorite
- CA Calcite
- Fe Iron Oxide
- Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

Stantec Australia Pty Ltd

Stantec

CORE LOG SHEET

Client: Shoalhaven City Council
Project: RFQ 8558E Geotech - Currowan Creek
Location: Currowan Creek Crossing

Hole No: BH-CC-01

Job No: 304001135 **Sheet:** 3 of 4

Position: E233495.000 N6059194.000 56H MGA20 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: HYDRAPOWER SCOUT **Mounting:** Truck **Driller:** HF
Casing Diameter: HW **Bit Type:** impreg **Bit Condition:** good **Contractor:** ADF
Data Started: 17/11/23 **Date Completed:** 17/11/23 **Logged By:** AC **Checked By:** DR

Coring						Material Description			Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ● - Axial O - Diametral (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	Average Natural Defect Spacing (mm) (20, 60, 200, 600, 2000)	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
HQ	0% Water LOSS	100	0				METASILTSTONE, layered, grey / pale grey, quartz veins (2-6mm thick), horizontally bedded *(continued)*	F				30mm thick 4.00 m: BP, 0°, IR, RF, CN 4.06 m: BP, 0°, IR, RF, CN 4.08 m: BP, 0°, IR, RF, CN 4.15 m: BP, 0°, IR, RF, CN
		100	24		4.5							4.27 m: BP, 0°, IR, RF, CN 4.39 m: BP, 0°, IR, RF, CN 4.44 m: BP, 0°, IR, RF, CN 4.46 m: BP, 0°, IR, RF, CN 4.47 m: BP, 0°, IR, RF, CN 4.50 m: BP, 0°, IR, RF, CN 4.54 m: BP, 0°, IR, RF, CN 4.55 m: BP, 0°, IR, RF, CN 4.61 m: BP, 0°, IR, RF, CN 4.74 m: BP, 0°, IR, RF, CN 4.77 m: BP, 0°, IR, RF, CN 4.78 m: BP, 0°, IR, RF, CN 4.79 m: BP, 0°, IR, RF, CN 4.80 m: BP, 0°, IR, RF, CN 4.81 m: BP, 0°, IR, RF, CN 4.83 m: BP, 0°, IR, RF, CN 4.85 m: BP, 0°, IR, RF, CN 4.88 m: BP, 0°, IR, RF, CN 4.90 m: BP, 0°, IR, RF, CN 4.91 m: BP, 0°, IR, RF, CN 4.93 m: BP, 0°, IR, RF, CN 4.96 m: BP, 0°, IR, RF, CN 5.06 m: BP, 0°, IR, RF, CN 5.08 m: BP, 0°, IR, RF, CN 5.09 m: BP, 0°, IR, RF, CN 5.12 m: BP, 0°, IR, RF, CN 5.15 m: BP, 0°, IR, RF, CN 5.19 m: BP, 0°, IR, RF, CN 5.27 m: BP, 0°, IR, RF, CN 5.32 m: BP, 0°, IR, RF, CN 5.45 m: BP, 0°, IR, RF, CN 5.46 m: BP, 0°, IR, RF, CN 5.52 m: BP, 0°, IR, RF, CN 5.61 - 5.67 m: FZ, 0°, IR, RF, CN 5.76 m: BP, 0°, IR, RF, CN 5.88 m: BP, 0°, IR, RF, CN 5.85 - 5.94 m: JT, 80°, IR, RF, CN 5.93 m: BP, 0°, IR, RF, CN 5.94 m: BP, 0°, IR, RF, CN 5.97 m: BP, 0°, IR, RF, CN 6.06 m: BP, 5°, IR, RF, CN 6.11 m: BP, 5°, IR, RF, CN 6.17 m: BP, 5°, IR, RF, CN 6.19 m: BP, 5°, IR, RF, CN 6.21 m: BP, 5°, IR, RF, CN 6.23 m: BP, 5°, IR, RF, CN 6.32 m: BP, 5°, IR, RF, CN
		100	20		5.0 5.5							
		100	0		6.0		6.40m					
					6.5		CORE LOSS 0.15m (6.40-6.55) CORE LOSS 6.55m					
		81	33		7.0		METASILTSTONE, layered, grey / pale grey, quartz veins (2-6mm thick), horizontally bedded	F				6.55 - 6.75 m: FZ 6.80 m: BP, 0°, IR, RF, CN 6.82 m: BP, 0°, IR, RF, CN 6.91 m: BP, 0°, IR, RF, CN 6.97 m: BP, 25°, CU, RF, CN 7.00 m: BP, 5°, IR, RF, CN 7.06 m: BP, 25°, IR, RF, CN 7.08 m: DB 7.19 m: JT, 80°, PR, RF, CN 7.21 m: BP, 5°, CU, RF, CN 7.26 m: BP, 5°, CU, RF, CN 7.30 m: BP, 5°, CU, RF, CN 7.41 m: BP, 5°, CU, RF, CN 7.45 m: JT, 90°, PR, RF, CN 7.49 - 7.58 m: FZ, 90 mm 7.60 m: BP, 5°, CU, RF, CN 7.63 m: BP, 5°, CU, RF, CN 7.69 m: BP, 5°, CU, RF, CN 7.73 m: BP, 5°, CU, RF, CN 7.79 m: BP, 5°, CU, RF, CN 7.87 m: BP, 5°, CU, RF, CN 7.94 m: BP, 5°, CU, RF, CN
		100	10		7.5							

DRILLING
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller
PQ Rotary core (85mm)
HQ Rotary core (63.5mm)
NMLC Rotary core (51.94mm)
DT Diatube concrete coring
PT Push tube
PS Percussion sampling
SON Sonic drilling
AH Air hammer

WATER
Water Level on date shown
water inflow
water outflow

ROCK QUALITY DESCRIPTIONS
RQD Rock Quality Designation (%)
TCR Total Core Recovery (%)

ROCK STRENGTH
EH Extremely High
VH Very High
H High
M Medium
L Low
VL Very Low

ROCK WEATHERING
FR Fresh
SW Slightly Weathered
DW Distinctly Weathered
MW Moderately Weathered
HW Highly Weathered
XW Extremely Weathered

DEFECT TYPE
JT Joint
SZ Sheared zone
BP Bedding Parting
SM Seam
FL Foliation
VN Vein
CL Cleavage
CS Crushed Seam
FZ Fracture Zone
DL Drift Lift
HB Handing Break
DB Drilling Break

PLANARITY
CU Curved
DIS Discontinuous
IR Irregular
PR Planar
ST Stepped
UN Undulose

ROUGHNESS
VR Very Rough
RF Rough
S Smooth
SL Slickensided
POL Polished

COATING
CN Clean
SN Stained
VNR Veneer (thin or patchy)
CT Coating (up to 1mm)

INFILL MATERIALS
X Carbonaceous
MU Unidentified minteral
MS Secondary mineral
KT Chlorite
CA Calcite
Fe Iron Oxide
Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

Stantec Australia Pty Ltd

Stantec

CORE LOG SHEET

Client: Shoalhaven City Council
Project: RFQ 8558E Geotech - Currowan Creek
Location: Currowan Creek Crossing

Hole No: BH-CC-01

Job No: 304001135 **Sheet:** 4 of 4

Position: E233495.000 N6059194.000 56H MGA20 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: HYDRAPOWER SCOUT **Mounting:** Truck **Driller:** HF
Casing Diameter: HW **Bit Type:** impreg **Bit Condition:** good **Contractor:** ADF
Data Started: 17/11/23 **Date Completed:** 17/11/23 **Logged By:** AC **Checked By:** DR

Coring						Material Description			Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ● - Axial O - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
HQ		100	10				METASILTSTONE, layered, grey / pale grey, quartz veins (2-6mm thick), horizontally bedded *(continued)*	F				8.00 m: BP, 5°, CU, RF, CN 8.08 m: BP, 5°, CU, RF, CN 8.16 m: BP, 5°, CU, RF, CN 8.18 m: BP, 5°, CU, RF, CN 8.23 m: BP, 5°, CU, RF, CN 8.26 m: BP, 5°, CU, RF, CN 8.28 m: BP, 5°, CU, RF, CN
						8.28m	TERMINATED AT 8.28 m Target depth					

8.5
9.0
9.5
10.0
10.5
11.0
11.5

DRILLING
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller
PQ Rotary core (85mm)
HQ Rotary core (63.5mm)
NMLC Rotary core (51.94mm)
DT Diatube concrete coring
PT Push tube
PS Percussion sampling
SON Sonic drilling
AH Air hammer

WATER
Water Level on date shown
water inflow
water outflow

ROCK QUALITY DESCRIPTIONS
RQD Rock Quality Designation (%)
TCR Total Core Recovery (%)

ROCK STRENGTH
EH Extremly High
VH Very High
H High
M Medium
L Low
VL Very Low

ROCK WEATHERING
FR Fresh
SW Slightly Weathered
DW Distinctly Weathered
MW Moderately Weathered
HW Highly Weathered
XW Extremly Weathered

DEFECT TYPE
JT Joint
SZ Sheared zone
BP Bedding Parting
SM Seam
FL Foliation
VN Vein
CL Cleavage
CS Crushed Seam
FZ Fracture Zone
DL Drift Lift
HB Handing Break
DB Drilling Break

PLANARITY
CU Curved
DIS Discontinuous
IR Irregular
PR Planar
ST Stepped
UN Undulose

ROUGHNESS
VR Very Rough
RF Rough
S Smooth
SL Slockensided
POL Polished

COATING
CN Clean
SN Stained
VNR Veneer (thin or patchy)
CT Coating (up to 1mm)

INFILL MATERIALS
X Carbonaceus
MU Unidentified minteral
MS Secondary mineral
KT Chlorite
CA Calcite
Fe Iron Oxide
Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

Stantec Australia Pty Ltd

Stantec

BOREHOLE LOG SHEET

Client: Shoalhaven City Council
Project: RFQ 8558E Geotech - Currowan Creek
Location: Currowan Creek Crossing

Hole No: BH-CC-02

Job No: 304001135 **Sheet:** 1 of 3

Position: E233530.000 N6059152.000 56H MGA20 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: HYDRAPOWER SCOUT **Mounting:** Truck **Driller:** HF
Casing Diameter: HW **Contractor:** ADF
Data Started: 17/11/23 **Date Completed:** 17/11/23 **Logged By:** AC **Checked By:** DR

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 100 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	F	HW	Not Observed	D 0.40 - 0.50 m		0.5		SP	SAND: fine to coarse grained, brown, with fine to medium grained, rounded gravel, trace clay, trace cobbles and boulders, rounded	M	MD	ALLUVIUM
				ES 0.50 m SPT 0.50 - 0.95 m 4, 7, 10 N=17	Refusal							
				ES 1.00 m		1.0						
				D 1.20 - 1.30 m					1.20m			
				ES 1.50 m SPT 1.50 - 1.95 m 4, 16, 14 N=30		1.5		GP	Sandy GRAVEL: fine to coarse, rounded, brown, fine to coarse grained sand, trace clay		MD - D	
	VH			ES 2.00 m		2.0					VD	
				ES 2.50 m SPT 2.50 - 2.55 m 25/50mm HB N=R		2.5			2.55m			
						3.0			Continued as Cored Drill Hole			
						3.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

Stantec Australia PTY LTD

Stantec

CORE LOG SHEET

Client: Shoalhaven City Council
Project: RFQ 8558E Geotech - Currowan Creek
Location: Currowan Creek Crossing

Hole No: BH-CC-02

Job No: 304001135 **Sheet:** 2 of 3

Position: E233530.000 N6059152.000 56H MGA20	**Angle from Horizontal:** 90°	**Surface Elevation:**
Rig Type: HYDRAPOWER SCOUT	**Mounting:** Truck	**Driller:** HF
Casing Diameter: HW **Bit Type:** impreg	**Bit Condition:** good	**Contractor:** ADF
Data Started: 17/11/23 **Date Completed:** 17/11/23	**Logged By:** AC	**Checked By:** DR

Coring						Material Description				Defect Description			
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ● - Axial O - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
					0.5							
					1.0							
					1.5							
					2.0							
					2.5		2.55m START CORING AT 2.55m					
HQ	0% Water LOSS	0	0				CORE LOSS 0.45m (2.55-3.00) CORELOSS					
		61	0		3.0		3.00m METASILTSTONE, layered, grey / pale grey, quartz veins (2-6mm thick), horizontally bedded	SW				2.90 m: BP, 5°, CU, RF, SN, Fe 3.00 - 3.07 m: FZ, 70 mm 3.07 m: BP, 10°, IR, RF, SN, Fe 3.09 m: BP, 10°, IR, RF, SN, Fe 3.11 m: BP, 10°, IR, RF, SN, Fe 3.12 m: BP, 10°, IR, RF, SN, Fe 3.15 m: BP, 10°, IR, RF, SN, Fe 3.23 - 3.26 m: FZ 3.26 - 3.29 m: JT, 90°, IR, RF, SN, Fe 3.29 - 3.37 m: FZ 3.46 m: BP, 5°, IR, S, CN 3.52 m: BP, 5°, IR, S, CN 3.46 - 3.61 m: JT, 90°, PR, S, CN 3.54 m: BP, 5°, IR, S, CN 3.55 m: BP, 5°, IR, S, CN 3.58 m: BP, 5°, IR, S, CN 3.59 m: BP, 5°, IR, S, CN 3.61 m: BP, 5°, IR, S, CN 3.63 m: BP, 5°, IR, S, CN 3.64 m: BP, 5°, IR, S, CN
		100	0		3.5		3.72m	F				
		76	33				CORE LOSS 0.12m (3.72-3.84) CORELOSS 3.84m METASILTSTONE, layered, grey / pale grey, quartz veins (2-6mm thick), horizontally bedded	F				

DRILLING
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller
- PQ Rotary core (85mm)
- HQ Rotary core (63.5mm)
- NMLC Rotary core (51.94mm)
- DT Diatube concrete coring
- PT Push tube
- PS Percussion sampling
- SON Sonic drilling
- AH Air hammer

WATER
- Water Level on date shown
- water inflow
- water outflow

ROCK QUALITY DESCRIPTIONS
- RQD Rock Quality Designation (%)
- TCR Total Core Recovery (%)

ROCK STRENGTH
- EH Extremly High
- VH Very High
- H High
- M Medium
- L Low
- VL Very Low

ROCK WEATHERING
- FR Fresh
- SW Slightly Weathered
- DW Distinctly Weathered
- MW Moderately Weathered
- HW Highly Weathered
- XW Extremly Weathered

DEFECT TYPE
- JT Joint
- SZ Sheared zone
- BP Bedding Parting
- SM Seam
- FL Foliation
- VN Vein
- CL Cleavage
- CS Crushed Seam
- FZ Fracture Zone
- DL Drift Lift
- HB Handing Break
- DB Drilling Break

PLANARITY
- CU Curved
- DIS Discontinuous
- IR Irregular
- PR Planar
- ST Stepped
- UN Undulose

ROUGHNESS
- VR Very Rough
- RF Rough
- S Smooth
- SL Slockensided
- POL Polished

COATING
- CN Clean
- SN Stained
- VNR Veneer (thin or patchy)
- CT Coating (up to 1mm)

INFILL MATERIALS
- X Carbonaceus
- MU Unidentified minteral
- MS Secondary mineral
- KT Chlorite
- CA Calcite
- Fe Iron Oxide
- Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

Stantec Australia Pty Ltd

Stantec

CORE LOG SHEET

Client: Shoalhaven City Council
Project: RFQ 8558E Geotech - Currowan Creek
Location: Currowan Creek Crossing

Hole No: BH-CC-02

Job No: 304001135 **Sheet:** 3 of 3

Position: E233530.000 N6059152.000 56H MGA20 **Angle from Horizontal:** 90° **Surface Elevation:**
Rig Type: HYDRAPOWER SCOUT **Mounting:** Truck **Driller:** HF
Casing Diameter: HW **Bit Type:** impreg **Bit Condition:** good **Contractor:** ADF
Data Started: 17/11/23 **Date Completed:** 17/11/23 **Logged By:** AC **Checked By:** DR

Coring						Material Description			Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ● - Axial O - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
HQ	0% Water LOSS	76	33		4.5		METASILTSTONE, layered, grey / pale grey, quartz veins (2-6mm thick), horizontally bedded *(continued)*	F				4.00 m: BP, 0°, IR, RF, CN 4.02 m: BP, 0°, IR, RF, CN 4.09 m: BP, 0°, IR, RF, CN 4.11 m: BP, 0°, IR, RF, CN 4.12 m: BP, 0°, IR, RF, CN 4.14 m: BP, 0°, IR, RF, CN 4.17 m: BP, 0°, IR, RF, CN 4.18 m: BP, 0°, IR, RF, CN 4.19 m: BP, 0°, IR, RF, CN 4.20 m: BP, 0°, IR, RF, CN 4.21 - 4.26 m: JT, 50°, IR, RF, CN 4.26 m: BP, 5°, IR, RF, CN 4.31 m: BP, 5°, IR, RF, CN 4.33 m: BP, 5°, IR, RF, CN 4.44 m: BP, 5°, IR, RF, CN 4.54 m: BP, 10°, IR, RF, C 4.62 m: BP, 10°, IR, RF, C 4.80 m: JT, 50°, IR, RF, CN
		100	16		5.0							5.00 - 5.20 m: JT, 90°, IR, RF, CN 5.20 m: BP, 0°, IR, S, CN
		100	40		5.5							5.39 m: BP, 5°, IR, S, CN 5.42 m: BP, 5°, IR, S, CN 5.66 m: BP, 10°, IR, S, CN 5.68 m: BP, 10°, IR, S, CN 5.67 - 5.71 m: JT, 75°, IR, S, CN 5.77 m: BP, 10°, IR, S, CN 5.80 - 5.83 m: FZ
		100	10		6.0 6.5 7.0							6.02 m: BP, 5°, IR, S, CN 6.08 m: BP, 5°, IR, S, CN 6.24 m: BP, 5°, IR, S, CN 6.29 m: BP, 5°, IR, S, CN 6.35 m: BP, 5°, IR, S, CN 6.40 m: BP, 5°, IR, S, CN 6.45 m: BP, 5°, IR, S, CN 6.50 m: BP, 5°, IR, S, CN 6.54 m: BP, 5°, IR, S, CN 6.66 m: BP, 5°, IR, S, CN 6.70 m: BP, 5°, IR, S, CN 6.74 m: BP, 5°, IR, S, CN 6.80 m: BP, 5°, IR, S, CN 6.82 m: BP, 5°, IR, S, CN 6.83 m: BP, 5°, IR, S, CN 6.85 m: BP, 5°, IR, S, CN 6.90 m: BP, 5°, IR, S, CN 6.95 - 7.00 m: FZ 7.06 m: BP, 3°, IR, S, CN 7.09 m: BP, 3°, IR, S, CN 7.16 m: BP, 3°, IR, S, CN 7.20 m: JT, 30°, IR, RF, CN 7.27 m: BP, 10°, IR, S, CN 7.28 m: BP, 10°, IR, S, CN 7.33 m: BP, 10°, IR, S, CN 7.34 m: BP, 10°, IR, S, CN
		100	60		7.5		8.00m TERMINATED AT 8.00m Target depth					7.54 m: BP, 10°, IR, S, CN 7.63 m: JT, 45°, IR, RF, CN 7.66 m: BP, 5°, IR, S, CN 7.81 m: BP, 5°, IR, S, CN 7.90 m: BP, 5°, IR, S, CN

DRILLING
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller
PQ Rotary core (85mm)
HQ Rotary core (63.5mm)
NMLC Rotary core (51.94mm)
DT Diatube concrete coring
PT Push tube
PS Percussion sampling
SON Sonic drilling
AH Air hammer

WATER
Water Level on date shown
water inflow
water outflow

ROCK QUALITY DESCRIPTIONS
RQD Rock Quality Designation (%)
TCR Total Core Recovery (%)

ROCK STRENGTH
EH Extremly High
VH Very High
H High
M Medium
L Low
VL Very Low

ROCK WEATHERING
FR Fresh
SW Slightly Weathered
DW Distinctly Weathered
MW Moderately Weathered
HW Highly Weathered
XW Extremly Weathered

DEFECT TYPE
JT Joint
SZ Sheared zone
BP Bedding Parting
SM Seam
FL Foliation
VN Vein
CL Cleavage
CS Crushed Seam
FZ Fracture Zone
DL Drift Lift
HB Handing Break
DB Drilling Break

PLANARITY
CU Curved
DIS Discontinuous
IR Irregular
PR Planar
ST Stepped
UN Undulose

ROUGHNESS
VR Very Rough
RF Rough
S Smooth
SL Slockensided
POL Polished

COATING
CN Clean
SN Stained
VNR Veneer (thin or patchy)
CT Coating (up to 1mm)

INFILL MATERIALS
X Carbonaceus
MU Unidentified minteral
MS Secondary mineral
KT Chlorite
CA Calcite
Fe Iron Oxide
Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

Stantec Australia Pty Ltd

Appendix C LABORATORY TEST CERTIFICATES

ASCT Illawarra
Postal: 2/15 Miall Way, Albion Park Rail NSW 2527
Lab: 2/15 Miall Way, Albion Park Rail NSW 2527
Telephone: +61 (02) 4256 1684
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

WB080 - Rev 31, 04/10/2023

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	**26-1279-MQ**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	5/12/2023
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	RFQ 8558E Geotech - Currowan Creek	Project No:	26
Material Used:	-	Request/Order:	304001135
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 27/11/2023 to 01/12/2023	Control Line:	BH-CC-01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
18118	**17/11/2023**	**-**	**-**	**BH-CC-01**	**0.4-0.5**

Sampling & Test Methods (Results relate only to the items sampled/tested) **(** NATA accreditation does not cover the performance of this service)**

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.3.6.1 Coarse: (2009)Determination of the particle size distribution of a soil
AS 1289.3.1.1: (2009)Determination of Liquid Limit (4 point Casagrande)
AS 1289.3.3.1: (2009)Calculation of the Plastic Index of a soil
AS 1289.1.1: (2001)Preparation of disturbed soil samples
AS 1289.3.6.1 Fine: (2009)Determination of the particle size distribution of a soil
AS 1289.3.2.1: (2009) Determination of the Plastic Limit

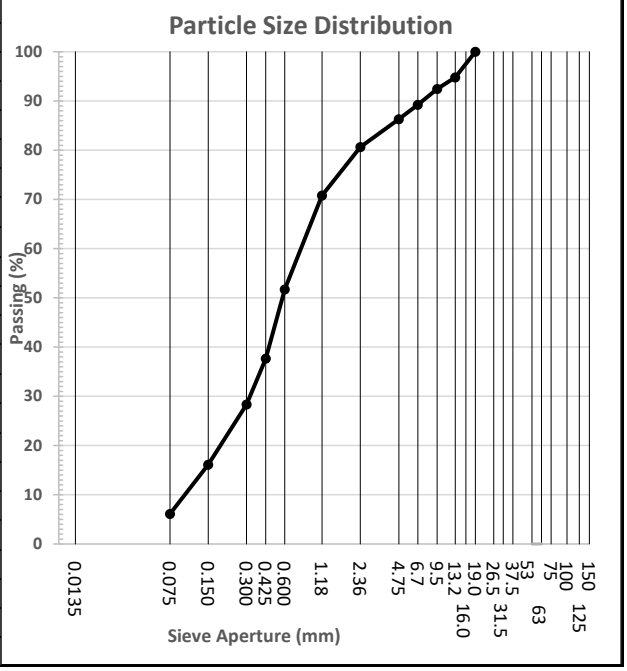
Report Remarks & Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
Approved Signatory

Specification Name				**Graphical Representation**
Particle Size Distribution (WASHED)	Units	**Result**	**Specification Limits**	
Passing 150mm Sieve	%			
Passing 125mm Sieve	%			
Passing 100mm Sieve	%			
Passing 75.0mm Sieve	%			
Passing 63.0mm Sieve	%			
Passing 53.0mm Sieve	%			
Passing 37.5mm Sieve	%			
Passing 31.5mm Sieve	%			
Passing 26.5mm Sieve	%			
Passing 19.0mm Sieve	%	**100**		
Passing 16.0mm Sieve	%			
Passing 13.2mm Sieve	%	**95**		
Passing 9.5mm Sieve	%	**92**		
Passing 6.7mm Sieve	%	**89**		
Passing 4.75mm Sieve	%	**86**		
Passing 2.36mm Sieve	%	**81**		
Passing 1.18mm Sieve	%	**71**		
Passing 0.600mm Sieve	%	**52**		
Passing 0.425mm Sieve	%	**38**		
Passing 0.300mm Sieve	%	**28**		
Passing 0.150mm Sieve	%	**16**		
Passing 0.075mm Sieve	%	**6**		
Passing 0.0135mm Sieve	%			



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WB080 - Rev 31, 04/10/2023

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	**26-1279-MQ**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	5/12/2023
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	RFQ 8558E Geotech - Currowan Creek	Project No:	26
Material Used:	-	Request/Order:	304001136
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 27/11/2023 to 01/12/2023	Control Line:	BH-CC-01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
18118	**17/11/2023**	**-**	**-**	**BH-CC-01**	**0.4-0.5**

Plasticity	Units	Result	Specification Limits	Remarks
Liquid Limit	%	**21**		Oven Dried & Dry Sieved
Plastic Limit	%	**16**		Oven Dried & Dry Sieved
Plastic Index	%	**5**		Oven Dried & Dry Sieved

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WB080 - Rev 31, 04/10/2023

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	**26-1280-MQ**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	6/12/2023
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	RFQ 8558E Geotech - Currowan Creek	Project No:	26
Material Used:	-	Request/Order:	304001135
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 27/11/2023 to 01/12/2023	Control Line:	BH-CC-02

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
18119	**17/11/2023**	**-**	**-**	**BH-CC-02**	**1.2-1.3**

Sampling & Test Methods (Results relate only to the items sampled/tested) **(** NATA accreditation does not cover the performance of this service)**

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.1.1: (2001)Preparation of disturbed soil samples
AS 1289.3.6.1 Coarse: (2009)Determination of the particle size distribution of a soil
AS 1289.3.6.1 Fine: (2009)Determination of the particle size distribution of a soil
AS 1289.3.1.1: (2009)Determination of Liquid Limit (4 point Casagrande)
AS 1289.3.2.1: (2009) Determination of the Plastic Limit
AS 1289.3.3.1: (2009)Calculation of the Plastic Index of a soil

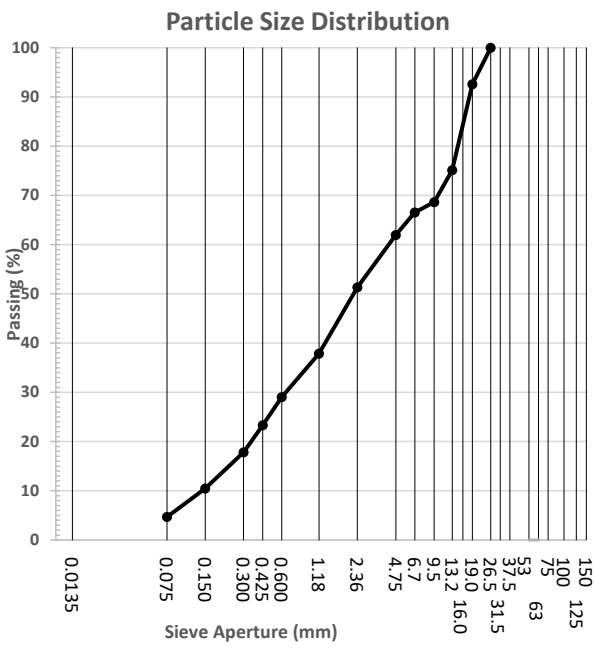
Report Remarks & Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
Approved Signatory

Specification Name				**Graphical Representation**
Particle Size Distribution (WASHED)	Units	**Result**	**Specification Limits**	
Passing 150mm Sieve	%			
Passing 125mm Sieve	%			
Passing 100mm Sieve	%			
Passing 75.0mm Sieve	%			
Passing 63.0mm Sieve	%			
Passing 53.0mm Sieve	%			
Passing 37.5mm Sieve	%			
Passing 31.5mm Sieve	%			
Passing 26.5mm Sieve	%	**100**		
Passing 19.0mm Sieve	%	**93**		
Passing 16.0mm Sieve	%			
Passing 13.2mm Sieve	%	**75**		
Passing 9.5mm Sieve	%	**69**		
Passing 6.7mm Sieve	%	**67**		
Passing 4.75mm Sieve	%	**62**		
Passing 2.36mm Sieve	%	**51**		
Passing 1.18mm Sieve	%	**38**		
Passing 0.600mm Sieve	%	**29**		
Passing 0.425mm Sieve	%	**23**		
Passing 0.300mm Sieve	%	**18**		
Passing 0.150mm Sieve	%	**10**		
Passing 0.075mm Sieve	%	**5**		
Passing 0.0135mm Sieve	%			



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WB080 - Rev 31, 04/10/2023

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	**26-1280-MQ**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	6/12/2023
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	RFQ 8558E Geotech - Currowan Creek	Project No:	26
Material Used:	-	Request/Order:	304001136
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 27/11/2023 to 01/12/2023	Control Line:	BH-CC-02

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
18119	**17/11/2023**	**-**	**-**	**BH-CC-02**	**1.2-1.3**

Plasticity	Units	Result	Specification Limits	Remarks
Liquid Limit	%	**20**		Oven Dried & Dry Sieved
Plastic Limit	%	**17**		Oven Dried & Dry Sieved
Plastic Index	%	**3**		Oven Dried & Dry Sieved

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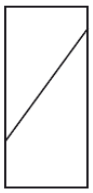
Report on Uniaxial Compressive Strength (UCS)

Client:	**Stantec Australia Pty Ltd**	Report No:	**1281**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	5/12/2023
Project:	**Geotechnical Testing**	Report Page:	Page 1 of 1
Works Component:	RFQ 8558E Geotech - Currowan Creek	Project No:	26
Material Used:	-	Test Request:	304001135
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 04/12/2023	Control Line:	BH-CC-02
Sample Date:	17/11/2023	**Sample Number:**	**18120**

Uniaxial Compressive Strength

Client ID Number	**BH-CC-02**	Failure Mode	(a) Single Shear
Borehole	**BH-CC-02**	Failure Sketch	
Depth	**5.42-5.66**		
Lithological Description	Igneous		
Type of Testing Machine	ILLACON02		
Date of Test	4/12/2023		
Height (mm)	152		
Diameter (mm)	60.7		
Test Duration (mins)	14.00	Rate Displacement (mm/min)	0.10
UCS (Mpa)	**93.4**	Moisture Content (%)	0.3

Specimen - Before Testing

Specimen - After Testing

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Client: Results apply to the sample/s as received. **
Client: Test specimens selected by the client.
As Received: Samples stored & Tested in as received condition.
AS4133.4.2.1: (2007) Determination of Uniaxial Compressive Strength (50MPa & greater)
AS4133.1.1.1: (2005) Determination of moisture content of rock, oven drying.

(NATA accreditation does not cover the performance of this service)**

Report Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
Approved Signatory

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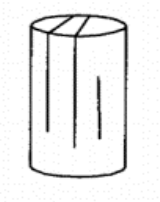
Report on Uniaxial Compressive Strength (UCS)

Client:	**Stantec Australia Pty Ltd**	Report No:	**1282**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	5/12/2023
Project:	**Geotechnical Testing**	Report Page:	Page 1 of 1
Works Component:	RFQ 8558E Geotech - Currowan Creek	Project No:	26
Material Used:	-	Test Request:	304001135
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 04/12/2023	Control Line:	BH-CC-02
Sample Date:	17/11/2023	**Sample Number:**	**18121**

Uniaxial Compressive Strength

Client ID Number	**BH-CC-02**	Failure Mode	(AM) Axial Multiple
Borehole	**BH-CC-02**	Failure Sketch	
Depth	**7.34-7.54**		
Lithological Description	Igneous		
Type of Testing Machine	ILLACON02		
Date of Test	4/12/2023		
Height (mm)	152		
Diameter (mm)	60.7		
Test Duration (mins)	8.20	Rate Displacement (mm/min)	0.10
UCS (Mpa)	**95.0**	Moisture Content (%)	0.1

Specimen - Before Testing

Specimen - After Testing

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Client: Results apply to the sample/s as received. **
Client: Test specimens selected by the client.
As Received: Samples stored & Tested in as received condition.
AS4133.4.2.1: (2007) Determination of Uniaxial Compressive Strength (50MPa & greater)
AS4133.1.1.1: (2005) Determination of moisture content of rock, oven drying.

(NATA accreditation does not cover the performance of this service)**

Report Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
Approved Signatory

Stantec Australia Pty Ltd
Level 22, 570 Bourke Street
Melbourne
VIC 3000

Attention: **Aaron Coghlan**

Report **1047528-S**
Project name RFQ 8558E GEOTECH - CURROWAN CREEK
Project ID 304001135
Received Date Nov 24, 2023

Client Sample ID			**BH_CC_01_0.5 M**	**BH_CC_01_1.0 M**	**BH_CC_01_1.5 M**	**BH_CC_01_2.0 M**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**W23-No0060843**	**W23-No0060844**	**W23-No0060845**	**W23-No0060846**
Date Sampled			**Nov 17, 2023**	**Nov 17, 2023**	**Nov 17, 2023**	**Nov 17, 2023**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.6	6.4	6.5	6.6
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.7	4.4	3.8	4.6
Reaction Ratings*[S05]	0	-	1.0	1.0	1.0	1.0
Chloride	10	mg/kg	-	< 10	-	< 10
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	-	17	-	< 10
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	6.1	-	6.2
Resistivity*	0.5	ohm.m	-	590	-	1200
Sulphate (as SO4)	10	mg/kg	-	13	-	< 10
Sample Properties						
% Moisture	1	%	-	19	-	19

Client Sample ID			**BH_CC_01_2.5 M**	**BH_CC_02_0.5 M**	**BH_CC_02_1.0 M**	**BH_CC_02_1.5 M**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**W23-No0060847**	**W23-No0060848**	**W23-No0060849**	**W23-No0060850**
Date Sampled			**Nov 17, 2023**	**Nov 17, 2023**	**Nov 17, 2023**	**Nov 17, 2023**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.6	6.5	6.4	6.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.4	3.7	3.0	3.6
Reaction Ratings*[S05]	0	-	1.0	4.0	4.0	1.0
Chloride	10	mg/kg	-	-	< 10	-
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	-	-	< 10	-
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	-	6.0	-
Resistivity*	0.5	ohm.m	-	-	1000	-
Sulphate (as SO4)	10	mg/kg	-	-	< 10	-
Sample Properties						
% Moisture	1	%	-	-	18	-

Client Sample ID			BH_CC_02_2.0 M	BH_CC_02_2.5 M	BH_CC_02_2.87-3.20M
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**W23-No0060851**	**W23-No0060852**	**W23-No0060853**
Date Sampled			**Nov 17, 2023**	**Nov 17, 2023**	**Nov 17, 2023**
Test/Reference	LOR	Unit			
Acid Sulfate Soils Field pH Test					
pH-F (Field pH test)*	0.1	pH Units	6.6	6.6	-
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.9	3.9	-
Reaction Ratings*[S05]	0	-	1.0	1.0	-
Chloride	10	mg/kg	-	-	< 10
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	-	-	< 10
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	-	7.3
Resistivity*	0.5	ohm.m	-	-	1300
Sulphate (as SO4)	10	mg/kg	-	-	< 10
Sample Properties					
% Moisture	1	%	-	-	11

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

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

Description	Testing Site	Extracted	Holding Time
Acid Sulfate Soils Field pH Test	Sydney	Dec 01, 2023	7 Days
- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests			
Chloride	Sydney	Nov 29, 2023	28 Days
- Method: LTM-INO-4270 Anions by Ion Chromatography			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	Sydney	Nov 29, 2023	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25 °C as rec.)	Sydney	Nov 29, 2023	7 Days
- Method: LTM-GEN-7090 pH by ISE			
Sulphate (as SO4)	Sydney	Nov 29, 2023	28 Days
- Method: In-house method LTM-INO-4270 Sulphate by Ion Chromatograph			
% Moisture	Sydney	Nov 24, 2023	14 Days
- Method: LTM-GEN-7080 Moisture			

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Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

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+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	Site# 25079 & 25289

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Site# 2370

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NZBN: 9429046024954

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IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Company Name: Stantec Australia Pty Ltd (NSW/ACT)
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Melbourne
VIC 3000

Order No.:
Report #: 1047528
Phone: (02) 9493 9700
Fax:

Received: Nov 24, 2023 1:59 PM
Due: Dec 1, 2023
Priority: 5 Day
Contact Name: Aaron Coghlan

Project Name: RFQ 8558E GEOTECH - CURROWAN CREEK
Project ID: 304001135

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Acid Sulfate Soils Field pH Test	Aggressivity Soil Set	Moisture Set
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	BH_CC_01_0.5M	Nov 17, 2023		Soil	W23-No0060843	X		
2	BH_CC_01_1.0M	Nov 17, 2023		Soil	W23-No0060844	X	X	X
3	BH_CC_01_1.5M	Nov 17, 2023		Soil	W23-No0060845	X		
4	BH_CC_01_2.0M	Nov 17, 2023		Soil	W23-No0060846	X	X	X
5	BH_CC_01_2.5M	Nov 17, 2023		Soil	W23-No0060847	X		
6	BH_CC_02_0.5M	Nov 17, 2023		Soil	W23-No0060848	X		
7	BH_CC_02_1.0M	Nov 17, 2023		Soil	W23-No0060849	X	X	X
8	BH_CC_02_1.5M	Nov 17, 2023		Soil	W23-No0060850	X		

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

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Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	Site# 25079 & 25289

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NATA# 2377
Site# 2370

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

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Penrose,	Mount Wellington,	Rolleston,	Gate Pa,
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+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Company Name: Stantec Australia Pty Ltd (NSW/ACT)
Address: Level 22, 570 Bourke Street
Melbourne
VIC 3000

Order No.:
Report #: 1047528
Phone: (02) 9493 9700
Fax:

Received: Nov 24, 2023 1:59 PM
Due: Dec 1, 2023
Priority: 5 Day
Contact Name: Aaron Coghlan

Project Name: RFQ 8558E GEOTECH - CURROWAN CREEK
Project ID: 304001135

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						Acid Sulfate Soils Field pH Test	Aggressivity Soil Set	Moisture Set
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X
9	BH_CC_02_2.0M	Nov 17, 2023		Soil	W23-No0060851	X		
10	BH_CC_02_2.5M	Nov 17, 2023		Soil	W23-No0060852	X		
11	BH_CC_02_2.87-3.20M	Nov 17, 2023		Soil	W23-No0060853		X	X
Test Counts						10	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

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

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

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

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

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**ppm:** parts per million
µg/L: micrograms per litre	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit	**Colour:** Pt-Co Units	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

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

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 70 – 130%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Conductivity (1:5 aqueous extract at 25 °C as rec.)			uS/cm	< 10			10	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Chloride	W23-No0060844	CP	mg/kg	< 10	< 10	<1	30%	Pass	
Conductivity (1:5 aqueous extract at 25 °C as rec.)	S23-No0027760	NCP	uS/cm	16	14	8.2	30%	Pass	
pH (1:5 Aqueous extract at 25 °C as rec.)	S23-No0027760	NCP	pH Units	5.4	5.3	<1	30%	Pass	
Resistivity*	S23-No0027760	NCP	ohm.m	640	690	8.2	30%	Pass	
Sulphate (as SO4)	W23-No0060844	CP	mg/kg	13	11	14	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	W23-No0060844	CP	%	19	19	<1	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	W23-No0060852	CP	pH Units	6.6	6.6	pass	20%	Pass	
pH-FOX (Field pH Peroxide test)*	W23-No0060852	CP	pH Units	3.9	3.8	pass	0%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised by:

Ursula Long	Analytical Services Manager
Ryan Phillips	Senior Analyst-Inorganic

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

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

Appendix D IMPORTANT INFORMATION

Important Information about this Geotechnical Report

Scope of Work

The purpose of this report and any associated documentation is expressly stated in the document. This document does not form a complete assessment of the site, and no implicit determinations about Stantec's scope can be taken if not specifically referenced. Whilst this report is intended to reduce geotechnical risk, no level of detail or scope of work can entirely eliminate risk.

The nature of geotechnical data typically precludes auxiliary environmental assessment without undertaking specific methods in the investigation. Therefore, unless it is explicitly stated in the scope of work, this report does not provide any contamination or environmental assessment of the site or adjacent sites, nor can it be inferred or implied from any component of the document.

The scope of work, geotechnical information, and assessments made by Stantec may be summarised in the report; however, all aspects of the document, including associated data and limitations should be reviewed in its entirety.

Standard of care

Stantec have undertaken investigations, performed consulting services, and prepared this report based on the Client's specific requirements, data that was available or was collected, and previous experience.

Stantec's findings and assessment represent its reasonable judgment, diligence, skill, with sound professional standards, within the time and budget constraints of its commission. No warranty, expressed or implied, is made as to the professional advice included in this report.

Data sources

In preparing this document, or providing any consulting services during the commission, Stantec may have relied on information from third parties including, but not limited to; sub-consultants, published data, and the Client including its employees or representatives. This data may not be verified and Stantec assumes no responsibility for the adequacy, incompleteness, inaccuracies, or reliability of this information.

Stantec does not assume any responsibility for assessments made partly, or entirely based on information provided by third parties.

Variability in conditions and limitations of data

Subsurface conditions are complex and can be highly variable; they cannot be accurately defined by discrete investigations. Geotechnical data is based on investigation locations which are explicitly representative of the specific sample or test points. Interpretation of conditions between such points cannot be assumed to represent actual subsurface information and there are unknowns or variations in ground conditions between test locations that cannot be inferred or predicted.

The precision and reliability of interpretive assessment between discrete points is dependent on the uniformity of the subsurface strata, as well as the frequency, detail, and method of sampling or testing.

Subsurface conditions are formed by various natural and anthropogenic processes and therefore are subject to change over time. This is particularly relevant with changes to the site ownership or usage, site boundary or layout, and design or planning modifications. Aspects of the site may also not be able to be determined due to physical or project related constraints and any information provided by Stantecca cannot apply following modification to the site, regulations, standards, or the development itself.

It is important to appreciate that no level of detail in investigation, or diligence in assessment, can eliminate uncertainty related to subsurface conditions and thus, geotechnical risk. Stantec cannot and does not provide unqualified warranties nor does it assume any liability for site conditions not observed or accessible during the investigations.

Verification of opinions and recommendations

Geotechnical information, by nature, represents an opinion and is based extensively on judgement of both data and interpretive assessments or observation. This report and its associated documentation are provided explicitly based on Stantec's opinion of the site at the time of inspection, and cannot be extended beyond this.

Any recommendations or design are provided as preliminary until verified on site during project implementation or construction. Inspection and verification on site shall be conducted by a suitably qualified geotechnical consultant or engineer, and where subsurface conditions or interpretations differ from those provided in this document or otherwise anticipated, Stantec must be notified and be provided with an opportunity to review the recommendations.

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