

# SRAPC Garie Road reinstatement

Review of Environmental Factors

November 2023



# Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land on which we work and live.

We pay our respects to Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.





## Approval and authorisation

Title:	SRAPC Slope 80232, Garie Road reinstatement Review of Environmental Factors
Accepted on behalf of Transport for NSW by:	Sam Singh Project Manager – Special Projects, ConnectSydney SRAPC Service Provider for Harbour Zone
Signed:	
Date:	9 November 2023

# Executive summary

## The proposal

Transport for NSW (Transport) proposes to reinstate and re-open Garie Road (the proposal) in the Sutherland Shire local government area (LGA). This section of road has experienced damage due to extreme weather events in early 2022, which has left the road unuseable for staff and visitors of the Royal National Park. Typically, Garie Road is a two lane road with one lane in each direction and provides the only vehicular route to Garie Beach.

The works have been identified as part of the flood recovery program of works for the continual maintenance and management of roads which comprise of the Sydney Roads Asset Performance Contract (SRAPC). The SRAPC is a 9-year operational contract covering the maintenance and management of classified State roads within the Eastern Harbour City zone.

Key features of the proposal would include:

- new anchored bored pile wall comprising 89 reinforced bored capped piles (about 900 millimetre in diameter) spaced at 1.5 metres apart. The rock anchors (about 150 millimetres in diameter) would be installed into the existing bedrock at 45 degrees
- new flexible guard fence along the edge of the road to tie into existing fence at one metre spacing
- realignment of the existing road surface away from slip area including excavation works and tree clearing
- installation of at-ground and elevated walkways attached to capping beam to allow maintenance crew access
- installation of a new swale drainage system including the replacement of two existing culverts. A grass lined channel would be installed along Garie Road to the south of the replaced culvert, and a concrete lined channel to the north. Swale drains would be connected to a PVC piped system to carry water away from slope.
- establishment of three temporary ancillary facilities including the NPWS helipad ancillary facility, Governor Game Lookout ancillary facility and the Garie Road ancillary facility on existing cleared land.

The proposal would be located mostly within the road corridor, with a portion located on National Parks and Wildlife Service (NPWS) Estate (about 504 square metres including the temporary NPWS helipad ancillary facility and the temporary Governor Game Lookout ancillary facility). Key features of the proposal that are located on Royal National Park Estate include:

- rock anchors at 45 degrees (about 150 millimetres in diameter). The rock anchors would be installed into the existing bedrock
- realignment of the existing road surface away from slip area including excavation works and tree clearing
- installation of a new swale drainage system including the replacement two existing culverts. A grass lined channel would be installed to the south of the slip area, and a concrete lined channel to the north
- establishment of two temporary ancillary facilities including the NPWS helipad ancillary facility and Governor Game Lookout ancillary facility on existing cleared land.

## Need for the proposal

Garie Road serves as the only vehicular connection to Garie Beach, a popular tourist destination within the Royal National Park. The road failure has left the road unusable and as a result Garie Road is currently completely closed to the public in order to protect visitors and staff, restricting access to Garie Beach, Governor Game lookout and the Royal National Park. The proposal is needed to re-open the road and re-establish access to Garie Beach.

The proposed works would stabilise the slope, road surface and reduce the risk of tension cracking in the future, as well as improve the level of service from less frequent road closures and increase the resilience of existing road infrastructure by ensuring that another road failure from similar future climatic conditions would not be experienced.



## Proposal objectives

The objectives of this proposal tie into the overarching SRAPC proposed outcomes of Safety and Performance. These include:

- reopening Garie Road
- improving safety for road users by reinstatement of slope stability to minimum Assessed Risk Level (ARL) 3
- enabling safe construction.

## Options considered

The identified options for the proposal include:

- Option 1: Do-nothing (observe only) option. This option would involve monitoring the slope hazard and the degradation of the slope. No road reinstatement works would occur as part of this option and Garie Road would remain closed to the public, removing access to Garie Beach. Option 1 would not encroach into National Park Estate as no works are proposed as part of this option.
- Option 2: Reinstatement the road within the existing road corridor. This option involves complete reinstatement of the road to the original alignment. Design features include piles and the reinstatement of two lanes. Option 2 would not encroach into the National Park Estate as the proposal would remain within the existing road corridor.
- Option 3: Re-align the road to the west of the existing road corridor. This option involves the re-alignment of the road to the west of the existing road corridor, with a portion of the road outside of the existing road corridor. Option 3 would encroach into National Parks Estate by 504 square metres.

Option 3 (re-align the road to the west of the existing road corridor) was selected as the preferred option for Garie Road as it met the proposal objectives of re-opening Garie Road, improving safety for road users and enabling safe construction. This option would reduce the risk to motorists and improve the level of service as a result of less frequent road closures. Option 3 was selected as the preferred option in consultation with TfNSW.

## Statutory and planning framework

The proposal is for a road and is to be carried out by Transport for NSW and can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

Garie Road is within the Royal National Park and is therefore subject to authorisation under the *National Parks and Wildlife Act 1974*. For this portion of the works, National Parks and Wildlife are the consent authority.

## Community and stakeholder consultation

Transport has engaged with the community regarding the proposed works. Engagement activities for the proposal to date include:

- Media release in September 2022 regarding the closure of Garie Road and Garie Beach. The media release/notification letter detailed the closure of Garie Road until mid-2023 and detailed the ongoing public safety risks of the failed slope.
- Fortnightly meetings since September 2022 with National Parks Wildlife Service (NPWS) and Transport in attendance
- A workshop with Transport and NPWS was held on the 25th May 2023 to discuss key environmental issues of the proposal, particularly those that would impact NPWS land.

Various government agencies and key stakeholders have been directly consulted about the proposal, including consultation with (but not limited to):

- Sutherland Shire Council
- Garie Beach Surf Life Saving Club
- Garie beach holiday cabin residents
- National Parks and Wildlife Services (NPWS) under Section 2.15 of the SEPP (Transport and Infrastructure) 2021

The issues raised by the community, government agencies and key stakeholders were considered in the proposal design, options assessment and/or addressed in the REF (Section 5). ConnectSydney would continue to consult and inform the community throughout the proposal on an as needed basis and provide contact details to the community in the event of enquiries or complaints.

## Environmental impacts

The main environmental impacts for the proposed modification are:

### Biodiversity

Three plant community types (PCTs) were recorded within the biodiversity assessment report (BAR) study area, with one of these PCTs (PCT 3134) aligning with a threatened ecological community (TEC). However, this PCT is located outside of the direct proposal area, meaning it is anticipated that it would not be impacted. The proposal would involve clearing of 0.296 hectares of native vegetation. This includes 0.164 hectares of PCT 3155 and 0.132 hectares of PCT 3153. Neither PCTs within the proposal boundary are associated with any TECs. The vegetation surrounding the Governor Game Lookout ancillary facility is assumed to be a TEC (NSW Southern Sydney Sheltered Forest), with vegetation surrounding the NPWS helipad ancillary facility assumed to be TEC Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions. There would be minimal direct impact from these ancillary facilities, however some trimming of branches may be required.

72 trees across the 0.296 hectares of vegetation removal may provide habitat for several threatened species identified with a moderate or high likelihood of occurrence. About 28 of these trees are classified as small trees (Diameter at Breast Height [DBH]  $\geq$  5cm to  $<$ 20 cm), 37 trees classified as medium sized trees (DBH  $\geq$  20 to  $<$ 50 cm) and seven trees classified as large sized trees (DBH  $\geq$  50 to  $<$ 100cm). The proposal would avoid impacting hollow bearing trees. If the hollow bearing tree within the subject land (or anywhere else) is to be impacted by the proposal, further surveys and assessments would be recommended to confirm presence or absence of several threatened hollow dwelling and dependent species.

Targeted surveys were carried out for threatened flora, which resulted in 16 occurrences of scrub turpentine, which is listed as critically endangered under the *Biodiversity Conservation Act 2016* and the *Environment Protection and Biodiversity Conservation Act 1999*. The proposal design was amended to avoid removing these plants. In addition, an exclusion zone would be established around the plants with a minimum 2.5 metre buffer zone at its closest point within a larger fixed environmental exclusion zone to avoid accidental impacts.

Targeted threatened fauna surveys were carried out for the red-crowned toadlet, which was not detected in the BAR study area. All other threatened fauna species with a moderate likelihood of occurrence in the BAR study area were deemed unlikely to be impacted by the proposal.

The existing culvert at the proposal area does not provide fish passage. Therefore, removing the culvert during construction is not expected to impact aquatic dependent fauna. The provision of the new culvert follows similar drainage course and would not be expected to substantially change hydrology.

Injury and mortality of fauna would be impacted through the construction of the proposal due to the clearing of native vegetation, however this is anticipated to be of a minor extent given the location of the proposal largely within the existing road corridor. The proposal is considered unlikely to impact groundwater dependent ecosystems.

The operation of the proposal has been assessed as being unlikely to significantly increase traffic volume compared with pre-slope failure conditions, meaning the long-term injury and mortality of wildlife is unlikely to be impacted. Additionally, wildlife connectivity and habitat fragmentation is unlikely to be affected by the operation of the proposal given the existing road corridor already acts as a fragment between areas of vegetation. The invasion and spread of weeds, pests and pathogens is unlikely as a result of the operation of the proposal.



No offset thresholds would be triggered as a result of the proposal, however tree replacement would be required. A tree and hollow replacement plan would be prepared or alternatively a contribution to Transport's conservation fund would be required as part of the proposal. In the context of plant community type classification, trees and shrubs have been classed as per BioNet Vegetation Classification. However, for the purpose of offsetting, trees have been defined in line with the Transport Tree and Hollow Replacement Guidelines (July 2022) and as per Australian Standard 4970-2209. A tree is considered a "Long lived woody perennial plant greater than (or usually greater than) 3m in height with one or relatively few main stems or trunks (or as defined by the determining authority)".

## Soils

The proposal would require removal of pavement and vegetation, stripping of topsoil and earthworks (removal of scarps, the creation of the access ramp and benches) and backfilling of earthworks that would expose soils and could potentially lead to erosion of soils and mobilisation of sediment to nearby creeks. This is of particular concern, as the soil landscapes in the area (Hawkesbury and Watagan) have extreme/severe soil erosion potential and present a mass movement hazard. As such the likelihood for soils to move offsite during construction presents a moderate to high risk. Material would be appropriately stored and stabilised on site prior to its final location to avoid material going off site.

Drainage channels are located around 16 metres to the north (South Rill) of the proposal and 350 metres to the south (Black Gin Gully) of the proposal. However, due to the distance of the works to these channels, the risk of erosion and sedimentation impacting the efficiency of the drainage channels is considered low.

The NPWS helipad ancillary facility contains asbestos cement sheeting debris within a mixed gravel fill layer on the upper ground surface of the site. There is a risk of personnel being exposed to asbestos during site establishment and ancillary facility operation. To ensure worker safety, the NPWS Asbestos Risk Assessment and Management Plan (Getex 2023) would be implemented at the NPWS helipad ancillary facility to manage the risk of asbestos. If unexpected areas of contamination are found, the unexpected finds procedure would be followed as is outlined in the CEMP.

The NPWS helipad ancillary facility located on National Park Estate would not require excavation and would use the existing cleared area. The key functions of the proposed ancillary facility located on National Park land include storage of materials, plant and equipment and a diesel generator to power the site including temporary site sheds, amenities and lighting towers. These activities have the potential to lead to contamination of soil as a result of accidental spills and leaks. Concrete washout areas would also be required and established at the NPWS helipad ancillary facility. Concrete wash water has the potential to pollute surrounding land and further contaminate land within the ancillary facility if not managed properly. It is also proposed to temporarily store excavated material, including spoil at the NPWS helipad ancillary facility. If not stored correctly, there is a risk of soil erosion from the ancillary facility to Little Garie Beach (about 190 metres) and Black Gin Gully (about 240 metres). However, due to the distance and topography between the ancillary facility to these waterways, the risk of erosion and sedimentation impacting the efficiency of the drainage channels as well as polluting Little Garie Beach is considered low.

The proposed Governor Game lookout ancillary facility located on National Park land would be used for site sheds, amenities and a diesel generator to power the site. A portion of the Governor Game lookout parking area would be used for personnel light vehicle parking. The diesel generator would be double skinned or similar to capture any accidental spills. Spill kits and detailed emergency spill management measures specific to each site would be available to reduce the impact in the case of an accidental spill or leak.

The Garie Road ancillary facility would be used for temporary site sheds and offices, an ablution block, equipment storage, a small diesel generator and a water tank. The operation of the small diesel fuel generator has the potential to lead to contamination of soil as a result of accidental spills and leaks.

Erosion, sediment and water quality controls would be implemented and regularly maintained during the construction period to avoid any soil movement offsite to the surrounding sensitive environment and watercourses. Clean water from upslope of the proposal would be diverted around the site, and dirty water and sediment on site would be captured.

The operation of the proposal would stabilise the slope failure, which would improve soil stability in the proposal area and reduce the risk of soil erosion to nearby waterways. Therefore, the operation of the proposal is anticipated to have an overall benefit on the soil environment of the proposal area and its surrounds.

## Surface water, groundwater and flooding

Also discussed as part of the soil impact assessment, the proposal has the potential to mobilise soils and sediments outside the proposal footprint and pollute waterways. This could potentially contribute to increased turbidity in these watercourses as well as other water quality impacts.

The movement of soils and sediments outside the proposal footprint may also impact the existing stormwater harvesting/reuse system located on the eastern side of the proposal footprint. Stormwater captured as part of this system is reused in the toilet facilities located at the Garie Beach carpark. If unmitigated, the build-up of



soils and sediment may impact the operation of the stormwater harvesting/reuse system as well as the operation of the toilets.

There would be the potential for harmful substances to be released to the surface water environment at the works zone as a result of refuelling and inappropriate handling or maintenance of equipment and plant. Contamination of exposed soils or mobilisation of contaminated soils and liquids into local watercourses could result in water quality impacts and impacts to sensitive receiving environments.

While there are no works within watercourses, there would be concrete pouring works at areas of water flow paths. These activities have the potential for concrete to move offsite and pollute waterways as well as existing stormwater harvesting/reuse system. During drainage works and piling, adequate water quality control measures would need to be implemented to prevent concrete leaving site.

Due to the surrounding sensitive environment, refuelling of equipment and plant would, where possible, not occur onsite or at the ancillary facilities and would be refuelled at an appropriate offsite facility. If refuelling needs to occur at of the NPWS helipad ancillary facility and the Governor Game ancillary facility, this is to be carried out in an appropriately bunded area, away from the boundary of the ancillary facility. Due to the small size and unsuitable topography of the Garie Road ancillary facility ie. located on top of a steep slope, refueling of equipment and plant would not occur at this location. Concrete washout areas would also be required and established at the NPWS helipad ancillary facility. Concrete washout material can also increase the pH of surrounding waters including nearby drainage channels of South Rill and Black Gin Gully with the potential to harm aquatic life and cause pollution of waters. Concrete washout locations would be located away from sensitive environments i.e. surrounding vegetation and drainage channels, and adequately controlled with all wash downs contained within designated impervious bunding. Temporary stockpiles and storage of materials at the NPWS helipad ancillary facility would be adequately managed in fenced / bunded areas to minimise the potential for sediment laden runoff to be discharged offsite.

There is not anticipated to be any ongoing adverse surface or groundwater impacts from the operation of the proposal. The proposal would also include updated drainage infrastructure including the installation of a new swale drainage system, the replacement of the existing culvert, a concrete lined channel, a rock apron at the culvert outlet to reduce water velocity, sub-horizontal drainage as well as weep holes to facilitate groundwater movement.

### **Traffic and transport**

During construction, Garie Road would remain temporarily closed to ensure the safety of the general public and NPWS staff. This would continue to restrict access to Garie Beach and the Coastal Walking Track. Advanced messaging Variable Messaging Signs (VMS) would be used to inform the public of road closures or changed traffic conditions. The potential for an increase in traffic on surrounding roads such as the Princes Highway, McKell Avenue and Sir Bertram Stevens Drive due to the closure of Garie Road would impact on traffic efficiency, increasing delays for travellers throughout the area. The Park Connection bus route has temporarily ceased operations due to the road closure and would reopen after construction.

Concrete and material deliveries would be required for Standard and OOHW periods during road closures. Access to the construction and compound sites would contribute to minor, short-term increased vehicle movements for the duration of construction including heavy vehicle traffic on the local road network. However, deliveries during construction would not put additional strain on the road network.

During construction, the NPWS helipad ancillary facility would not be available for use as informal parking by Little Garie Cabin Community residents to mitigate potential safety concerns with plant and vehicle movement and public vehicles and users. Temporary parking measures have been proposed to accommodate the residents of the 'Little Garie Cabin Community', being the use of an existing widened verge area of Garie road adjacent and west of the Garie Beach Fare Booth. This is about 75 metres north-west of the NPWS helipad ancillary facility. Minor trimming of understorey vegetation would be required to allow for parking. During construction, the proposed ancillary facility would require about all of the NPWS helipad area ie 1,950 square metres, with this area no longer being available to 'Little Garie Cabin Community' for informal parking. This temporary parking arrangement would be managed in agreement with NPWS to facilitate pedestrian access to the cabins for residents of the 'Little Garie Cabin Community'.

The Governor Game lookout proposed ancillary facility would be located on existing hardstand at the Governor Game lookout carpark and is within National Park Estate land. A portion of the carpark would be fenced off in agreement with NPWS, with the remainder of the carpark providing light vehicle parking for work personnel. This area would continue to not be available for use by members of the public during construction.

During operation, the proposal would stabilise the existing slope and road surface hazards on Garie Road. The proposal would also reinstate vehicular access to Garie Beach and surrounding recreational areas/facilities. The proposal would improve safety for all road users and as well as the resilience of the existing road infrastructure to future extreme weather events. There would be no further operational impacts to traffic and transport as a result of the proposal.

### **Noise and vibration**

The assessment of construction noise impacts was done using the Transport for NSW Construction Estimator tool. Predicted noise levels are dependent on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver and represents a worst-case assessment. Where activity moves away from each receiver, or less equipment is operating, predicted levels would decrease.

During construction, noise calculation results indicate that impact to the nearest sensitive receiver (the Little Garie Cabin Community) during out of hours working hours would experience noticeable level of noise impacts. However, due to the short-term nature and the isolated location of the works as well as undulating topography providing substantial noise attenuation, these are anticipated to be inaudible during construction. Noise impacts from the establishment and use of ancillary facilities is unlikely to be audible at nearby sensitive receivers due to the distance of these facilities from receivers and the undulating topography of the area.

The proposal would not have any operational impacts on noise and vibration.

### **Socio-economic**

The socio-economic impact assessment was prepared in line with the Roads and Maritime Environmental Impact Assessment Practice Note on Socio-economic assessment (EIA-05). A basic level of assessment was carried out based on the scale and magnitude of impacts to the socio-economic environment within the study area. The proposal is anticipated to have a low adverse socio-economic impact.

The potential construction socio-economic impacts of the proposal include continued restricted access to Garie Beach due to the complete closure of Garie Road as well as restricted access to the Governor Game lookout area. This, however, is no different to the existing environment, in which Garie Road (and as a result, Garie Beach and the Governor Game lookout area) is completely closed to protect visitors and staff. Certain walking tracks within the Royal National Park such as the Coast track would also remain closed between Garie Beach and Little Garie Beach during construction to minimise the potential risk of erosion and rockfalls on pedestrians. As such, the impacts are expected to be temporary and minor.

Other socio-economic impacts that would result due to the construction of the proposal include the potential for increased traffic due to increased volume of construction vehicles within the Royal National Park, particularly along the Princes Highway through Waterfall, McKell Avenue and Sir Bertram Stevens Drive. The average vehicles per dwelling is 1.2, which suggests residents rely on their personal vehicles for transport. This has potential to cause localised delays for the community travelling on these roads. However, this potential impact would be temporary, as the completion of works would see the removal of the construction vehicles from the National Park.

Construction of the proposal may result in potential noise and visual impacts for the residents of the 'Little Garie Cabin Community', due to the presence and use of plant and equipment within the area. These potential impacts would be temporary and would be returned back to their existing state on completion of the proposal.

During operation, the proposal would improve the safety and reliability of Garie Road for the local community and re-establish vehicular access to Garie Beach.

## **Justification and conclusion**

The proposal is required to minimise the risk of slope instability along Garie Road, and to re-establish vehicular connection to Garie Beach. By carrying out the proposal it would meet the proposal objectives of re-opening Garie Road, improving overall safety for road users and preserving the life of existing infrastructure, as well as minimising the environmental impacts of the work. Improving the stability of the slope along Garie Road would also improve access into and traffic movement through the Royal National Park.

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# 1. Introduction

This chapter introduces the proposal and provides the context of the environmental assessment. In introducing the proposal, the objectives and project development history are detailed and the purpose of the report provided.

## 1.1 Proposal identification

Transport for NSW (Transport) proposes to reinstate and reopen Garie Road (the proposal) in the Sutherland Shire local government area (LGA). This section of road has experienced damage due to extreme weather events in early 2022 and further damage due to storm events, which has left the road unuseable for staff and visitors of the Royal National Park. Typically, Garie Road is a two lane road with one lane in each direction and provides the only vehicular route to Garie Beach.

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- realignment of the existing road surface away from slip area including excavation works and tree clearing
- installation of at-ground and elevated walkways attached to capping beam to allow maintenance crew access
- installation of a new swale drainage system including the replacement of two existing culverts. A grass lined channel would be installed along Garie Road to the south of the replaced culvert, and a concrete lined channel to the north. Swale drains would be connected to a PVC piped system to carry water away from slope
- establishment of three temporary ancillary facilities including the NPWS helipad ancillary facility, Governor Game Lookout ancillary facility and the Garie Road ancillary facility on existing cleared land.

The proposal would be located mostly within the road corridor, with a portion located on National Parks and Wildlife Service (NPWS) Estate (about 504 square metres, the temporary NPWS helipad ancillary facility and the temporary Governor Game Lookout ancillary facility). Key features of the proposal that are located on Royal National Park Estate include:

- rock anchors at 45 degrees (about 150 millimetres in diameter). The rock anchors would be installed into the existing bedrock
- realignment of the existing road surface away from slip area including excavation works and tree clearing
- installation of a new swale drainage system including the replacement two existing culverts. A grass lined channel would be installed to the south of the slip area, and a concrete lined channel to the north
- establishment of two temporary ancillary facilities including the NPWS helipad ancillary facility and Governor Game Lookout ancillary facility on existing cleared land.

The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. Chapter 3 describes the proposal in more detail.



Figure 1-1: Location of the proposal





Figure 1-2 The proposal

## 1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by ConnectSydney on behalf of Transport for NSW. For the purposes of these works, Transport for NSW is the proponent and the determining authority under for portions of work within the road reserve (considered outside of the Royal National Park), and National Parks and Wildlife is the determining authority for areas within the Royal National Park, in line with Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail mitigation and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been carried out in the context of Section 171 of the Environmental Planning and Assessment Regulation 2021, the factors in *Guideline for Division 5.1 assessments*, DPE 2022, I (DUAP 1996), the *National Parks and Wildlife Act 1974*, the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of:

- Section 5.5 of the EP&A Act including that Transport for NSW examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act.
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in Section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report.
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured.

The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of Climate Change, Energy, the Environment and Water for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

## 2. Need and options considered

This chapter describes the need for the proposal in terms of its strategic setting and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

### 2.1 Strategic need for the proposal

Extreme weather events in March 2022 resulted in a slope failure along a section of Garie Road. This has resulted in part of the road surface falling away and tension cracking along the remaining road surface. The continually shifting tension cracking of the road pavement has resulted in Garie Road being completely closed to the public as the road has been classified as unstable as well as unusable. The closure of this road means that Garie Beach is not accessible by vehicle.

The proposed works would reinstate the road, preserve the life of existing infrastructure as well as improve the resilience of existing road infrastructure by reducing the potential for road failure from similar weather events.

These works form part of the SRAPC Maintenance Program. Transport for NSW outcomes for SRAPC include:

- Customer Focus: enabling safe seamless journeys for people and goods
- Safety and Performance: every customer enjoys safe travel. Striving to continuously improve road worker safety and deliver network and contract efficiency
- Sustainability: economically and environmentally sustainable, aligning to United Nations Sustainable Development Goals
- Successful Places: enhancing and maintaining the liveability, amenity and economic success of communities and places that the asset interfaces with
- Innovation: working with industry to innovate in our provision of road and intelligent transport services.

#### 2.1.1 NSW policy context

##### Greater Sydney Region Plan: A Metropolis of Three Cities

The Greater Sydney Region Plan: A Metropolis of Three Cities (2018) is a 20-year plan that has been prepared along with the Future Transport Strategy and the State Infrastructure Strategy 2018-2038, to align land use, transport and infrastructure outcomes for the Greater Sydney region. The Plan has developed 10 directions (made up of 40 objectives) to manage social, economic and environmental changes. To address these changes, the objectives encourage the transformation of the Greater Sydney region into three self-sustaining, connected cities:

- The Eastern Harbour City
- The Central River City
- The Western Parkland City.

The proposal falls into the Eastern Harbour City district.

The Sydney Roads Asset Performance Contract (SRAPC) is a 9-year operational contract covering the maintenance and management of classified State roads within the Eastern Harbour City zone. The proposal is in relation to the maintenance of a road in the Eastern Harbour City and would contribute to the objectives of the Eastern Harbour City within the Greater Sydney Region Plan, including optimised infrastructure use, a reduction in exposure to natural and urban hazards, and adapted infrastructure to meet future needs.

##### Future Transport Strategy

The NSW Government's Future Transport Strategy (Transport, 2022a) sets the direction for continuing to improve every part of the NSW transport system for the benefit of customers, the community and the economy. It puts people and places at the centre of decision making. It has been developed with the aim of developing the NSW transport system to assist in making NSW the most liveable state in the world, and an economic powerhouse with vibrant, sustainable communities where citizens have choice and opportunity.



The Future Transport Strategy is built on five principles:

- More choice, better access
- Environmentally responsible
- Thriving places
- Maximising the use of our network
- Resilient communities.

The proposal would contribute to the 'resilient communities' principle through minimising identified safety risks for road users by reinstating existing road infrastructure. Improved resilience of Garie Road against extreme weather events would also ensure continued access to Garie Beach.

### **State Infrastructure Strategy 2022-2042**

The State Infrastructure Strategy 2022-2042 (Infrastructure NSW, 2022) is a 20-year strategy that identifies infrastructure needs and strategic priorities for the State. The 2022 SIS is the fourth edition since the first SIS was released in 2012, and while much has changed since the first SIS was released, the need for long-term strategic infrastructure planning remains unchanged. The SIS builds on the extensive program of infrastructure investment delivered over the past decade and seeks to leverage the ambitious pipeline of investments already committed by the NSW Government.

The proposal closely aligns with the SIS as it would allow the existing Garie Road to be used by motorists again. The proposal would also allow for the management and performance of the road to be optimised through design by mitigating against future slope failures from similar extreme weather events. By increasing the resilience of existing road infrastructure would reduce the need for regular maintenance or repair activities and would ensure continued access to Garie Beach.

### **2026 Road Safety Action Plan – Toward zero trauma on NSW roads**

The 2026 Road Safety Action Plan – Towards zero trauma on NSW roads (Transport, 2017) seeks to build on the success of the Road Safety Plan 2021 with new road trauma reduction targets for 2030, setting NSW on a path towards zero road trauma by 2050. The Plan was developed following extensive engagement and community consultation, as well as analysis of trauma trends, best practice approaches and research evidence. The plan aims to halve fatalities on NSW roads and reduce serious injuries by 30 per cent on NSW roads by 2030 through five key priority areas:

- Creating safer country roads and urban places
- Enhancing road safety in local communities
- Increasing the safety of light vehicles, heavy vehicles and protective equipment
- Making safer choices on our roads
- Ensuring the safety of vulnerable and other at-risk road users.

The proposal would reinstate and reopen the existing Garie Road as well as improve the resilience of the road from future rainfall events. This would meet the priority areas of safer roads and communities through the improved safety and resilience of the road.

### **NSW Visitor Economy Strategy 2030**

The NSW Visitor Economy Strategy 2030 (NSW Government, 2021) aims to make NSW the premier visitor economy of the Asia Pacific by 2030. The tourism sector in NSW has been greatly impacted by the 2019/20 bushfires and the COVID-19 pandemic, which has led to this strategy being released to capture a global market after these events.

The strategy is built on five strategic pillars:

- Road to recovery
- Build the brand
- Showcase our strength

- Invest in world-class events
- Facilitate growth.

As part of the 'facilitate growth' pillar, the NSW Government aims to invest in infrastructure and industry resilience to ensure the continued growth and prosperity of the NSW visitor economy. This pillar includes increased investment into visitor infrastructure and improved access to visitor destinations and attractions. The proposal would reinstate Garie Road, which would ensure continued access to Garie Beach. Garie Beach and the surrounding Royal National Park are popular tourist destinations in Greater Sydney, meaning the proposal would facilitate continued access to these visitor attractions.

## 2.1.2 Local policy context

### **Our Shire Towards 2032**

The *Our Shire Towards 2032* (Sutherland Shire Council, 2022a) is a community strategic plan that outlines the vision and priorities for the future of the Sutherland Shire community, and includes the strategies designed to accomplish them. The community plan was designed in collaboration with council, government agencies, organisations and residents of the Sutherland Shire, with six desired outcomes.

The six strategic outcomes include:

- strong civic leadership trusted by an informed and engaged community
- a beautiful, protected and healthy natural environment
- a creative, healthy and caring community that celebrates culture and diversity
- a prosperous and well-educated community with a diverse range of economic opportunities
- an active community that enjoys safe, accessible and diverse open places and spaces
- a high-quality urban environment that supports a growing and liveable community.

The Plan aims to deliver these strategic community outcomes to improve social, environmental and economic systems within the community to promote community resilience throughout the Sutherland Shire. The proposal objectives focus on the need to improve road safety for users and preserve the life of existing Garie Road infrastructure. These objectives align with the outcomes of the community strategic plan by promoting safe, accessible and healthy spaces to improve the resilience and livability of the community.

### **Sutherland Shire Local Strategic Planning Statement 2020**

The Sutherland Shire Local Strategic Planning Statement (Sutherland Shire Council, 2020) is a guide to planning principals to manage change within the Sutherland Shire over the next 20 years. It outlines the priorities of land use within the LGA and determines the actions required to accomplish them as the community continues to develop. This planning statement focuses on four themes:

- Infrastructure and collaboration
- Liveability
- Productivity
- Sustainability.

Through these themes, the Planning Statement prioritises risk management to reduce risk to life and property as well as investing in existing infrastructure to support recreational areas and tourism destinations. The proposal would reinstate Garie Road creating a safe and usable road as well as reinstate access to Garie Beach, a popular tourist destination.

### **Sutherland Shire Environment and Sustainability Strategy 2012**

The Sutherland Shire Environment and Sustainability Strategy (Sutherland Shire Council, 2012) documents the council's commitment to the regulation of land use and the delivery of environmental outcomes. The strategy sets out a framework with six priority strategies to realise the desired outcomes of the community.

The six strategies include:

- protect our environment
- conserve natural resources
- deliver integrated transport options
- respect and value all heritage and culture
- look after our people
- provide effective and integrated infrastructure.

Through the ‘look after our people’ strategy, the council prioritises an annual road safety action plan. Road safety is one of the main objectives that would be addressed through the proposal. The proposal would reinstate Garie Road allowing safe vehicular access to Garie Beach. The reinstatement of Garie Road would also ensure continued access and road reliability against future extreme weather events.

### Safer Communities Strategy 2022-2032

The Safer Communities Strategy 2022-2032 (Sutherland Shire Council, 2022b) aims to provide safe, accessible and welcoming spaces throughout the Sutherland Shire and is directly aligned with the community strategic plan. The strategy promotes security, safety and wellbeing for residents and visitors within the community. There are three main focus areas of the strategy, including:

- prevent and reduce crime in our community
- a shire for everyone
- safe spaces now and forever.

The safety and security of open spaces within the Sutherland Shire for present and future generations is a key point of this strategy. The proposal involves reinstating Garie Road allowing for safe and continued use of existing road infrastructure, as well as maintaining continued access to open spaces.

## 2.2 Limitations of existing infrastructure

Garie Road has collapsed as a result of the adjacent slope failure and has closed vehicular access to Garie Beach. Temporary access measures have been considered, however, were not deemed feasible as a result of extensive tension cracking and the continued instability of the slope. Therefore, in order to maintain public safety, the road currently remains closed. This road is typically a two-way, access road to Garie Beach, connecting Sir Bertrams Stevens Drive to the beach as shown in Figure 1-1.

The *Roads and Maritime Guide to Slope Risk Analysis and Slope Asset Management Policy PN 292* determines the risk rating of a slope by combining the likelihood and consequence of a hazard. The higher the assessed risk level (ARL) rating (i.e. ARL 5) the lower the risk to property and human life. The ARL risk rating criteria is summarised in Table 2-1.

Table 2-1: Assessed Risk Level Matrix

Likelihood	Consequence class				
	C5 (negligible consequences to property and safety)	C4	C3	C2	C1 (severe consequences to property and safety)
L1 (most likely to occur)	ARL3	ARL2	ARL1	ARL1	ARL1
L2	ARL4	ARL3	ARL2	ARL1	ARL1
L3	ARL5	ARL4	ARL3	ARL2	ARL1
L4	ARL5	ARL5	ARL4	ARL3	ARL2
L5	ARL5	ARL5	ARL5	ARL4	ARL3
L6 (least likely to occur)	ARL5	ARL5	ARL5	ARL5	ARL4

Garie Road has been given a high-risk classification of ARL1 due to the failed road and the instability of the adjacent slope. The ARL1 rating means that the road does not meet current safety standards and poses an immediate safety risk i.e. the Roads and Maritime Guide to Slope Risk Analysis (Roads and Maritime, 2002). The purpose of the proposal would be to carry out work to reinstate the road and reduce limitations and the risk level from ARL1 classification to an ARL3, 4 or 5 classification.

## 2.3 Proposal objectives and development criteria

### 2.3.1 Proposal objectives

The objectives of this proposal tie into the overarching SRAPC proposed outcomes of Safety and Performance. These include:

- reopening Garie Road
- improving safety for road users by reinstatement of slope stability to minimum Assessed Risk Level (ARL) 3
- enabling safe construction.

## 2.4 Alternatives and options considered

This section summarises the strategic alternatives, main options and sub-options that were considered for the proposal and details the justification of why the preferred option was chosen.

### 2.4.1 Methodology for selection of preferred option

The options considered for the proposed works were assessed against the proposal objectives outlined in section 2.3. The options considered are provided in the following sections.

### 2.4.2 Identified options

The identified options for the proposal include:

- Option 1: Do-nothing (observe only) option. This option would involve monitoring the slope hazard and the degradation of the slope. No road reinstatement works would occur as part of this option and Garie Road would remain closed to the public, removing access to Garie Beach. Option 1 would not encroach into National Park Estate as no works are proposed as part of this option.
- Option 2: Reinstatement the road within the existing road corridor. This option involves complete reinstatement of the road to the original alignment. Design features include piles and the reinstatement of two lanes. Option 2 would not encroach into the National Park Estate as the proposal would remain within the existing road corridor.
- Option 3: Re-align the road to the west of the existing road corridor. This option involves the re-alignment of the road to the west of the existing road corridor, with a portion of the road outside of the existing road corridor. Option 3 would encroach into National Parks Estate by 504 square metres.

### 2.4.3 Analysis of options

#### Analysis of options

Table 2-2 presents a qualitative analysis of the options considered for the reinstatement of Garie Road against the proposal objectives.

Table 2-2: Analysis of options

Proposal objectives	Option 1: Do-nothing (observe only) option	Option 2: Reinststate the road within the existing road corridor	Option 3: Re-align the road to the west of the existing road corridor
Re-opening of Garie Road	<ul style="list-style-type: none"> <li>No works are proposed as part of this option.</li> <li>The existing slope hazard would remain and Garie Road would not reopen to the public.</li> </ul>	<ul style="list-style-type: none"> <li>Garie Road would be reopened for public use through the reinstatement of the road to the original alignment.</li> <li>This option would take about six months to construct</li> </ul>	<ul style="list-style-type: none"> <li>Garie Road would be reopened to the public through the realignment of the road to the west of the original corridor.</li> <li>This option would take between five to seven months to construct.</li> </ul>
Improving safety for road users	<ul style="list-style-type: none"> <li>The ARL risk and safety level would remain unchanged.</li> </ul>	<ul style="list-style-type: none"> <li>Safety and the ARL would improve.</li> <li>Identified safety hazards to road users would be reduced as a result of road reinstatement.</li> </ul>	<ul style="list-style-type: none"> <li>Safety and the ARL would improve.</li> <li>Identified safety hazards to road users would be reduced as a result of road reinstatement as well as slope stabilisation.</li> </ul>
Enable safe construction	<ul style="list-style-type: none"> <li>No works proposed</li> </ul>	<ul style="list-style-type: none"> <li>This option presents a high risk to construction workers due to working on unstable ground. It is not feasible to stabilise slope along existing alignment without endangering construction crew.</li> </ul>	<ul style="list-style-type: none"> <li>Due to scarp progression, it is significantly safer for construction workers to access and install piles to the west of the existing road corridor.</li> </ul>

### 2.4.4 Preferred option

Option 3 (realign the road to the west of the existing road corridor) was selected as the preferred option for Garie Road as it best met the proposal objective of enabling the safe construction of Garie Road compared to Option 1 and Option 2. Option 3 also met the proposal objectives of improving road safety for road users. It is preferred to have the road operational and available for public use as soon as possible as it provides the only vehicular access to Garie Beach.

Option 2 was not selected as there is a potential safety risk to construction workers on an unstable slope as more mobile soils are located within a large portion of the existing road corridor. Construction of the piled wall within an active landslide would also be complex due to the mobility of the soils. This construction risk may contribute to a longer construction timeframe i.e. construction may take longer than six months, than Option 3.

Option 1 (do nothing) was not considered suitable as it did not meet any of the objectives of the proposal and would not provide vehicular access to Garie Beach.



## 2.4.5 Sub-option assessment

### Sub-options

The sub-options below refer to the engineering solutions that would be employed to re-align the road corridor and reinstate the road. The assessment considered the following sub-options:

- Sub-option 1: Anchored soldier pile wall. This option includes the installation of a single row of piles and two rows of anchors to support the new road alignment
- Sub-option 2: Soil nailing onto upslope rock face. This option would involve cutting the up-slope rock face. Soil nails would be installed to retain the rockface.
- Sub-option 3: 'L' shaped wall. This option would involve the construction of an 'L' shaped wall to retain the existing soil material at the landslip location.

### Analysis of sub-options

Table 2-3 presents a qualitative analysis of the sub-options considered for the proposal against particular criteria. The sub-options are outlined in Figure 2-1 to Figure 2-3.

Table 2-3: Analysis of sub-options

Selection criteria	Sub-option 1 – Anchored soldier pile wall	Sub-option 2- Soil nailing	Sub-option 3- ‘L’ shaped wall
Stabilise existing slope hazard and reduce the risk level from ARL1	<ul style="list-style-type: none"> <li>Slope stabilisation works are proposed</li> <li>The ARL risk level would improve with the aim to reduce the risk level to a minimum of ARL3 or better.</li> </ul>	<ul style="list-style-type: none"> <li>Slope stabilisation works are proposed</li> <li>The ARL risk level would improve with the aim to reduce the risk level to a minimum of ARL3 or better.</li> </ul>	<ul style="list-style-type: none"> <li>Slope stabilisation works are proposed</li> <li>The ARL risk level would improve with the aim to reduce the risk level to a minimum of ARL3 or better.</li> </ul>
Ease and duration of construction	<ul style="list-style-type: none"> <li>Piling works involved to treat slope failure would be greater than Sub-Option 2 and 3</li> <li>Smaller construction crew required to carry out construction tasks within the same construction duration</li> <li>Piling wall technique is a proven and easy method to stabilise the slope as there is less chance of encountering unknown conditions. This minimises risk to delays to program.</li> <li>Road would take 6-months to construct</li> </ul>	<ul style="list-style-type: none"> <li>No piling works involved as part of this Sub-Option</li> <li>Reduced geotechnical investigations and earthworks along the failed portion of Garie Rd than Sub-Option 1 and 3</li> <li>Road is realigned further west than Sub-Options 1 and 3 as it requires cutting into the adjacent upslope rock face</li> <li>Soil nailing technique may cause construction delays past the anticipated construction program due to high likelihood of boulders inhibiting nail installation.</li> <li>Road would take 5-months to construct</li> </ul>	<ul style="list-style-type: none"> <li>Piling works involved to treat slope failure would be less than Sub-Option 1 but greater than Sub-Option 2</li> <li>Larger excavation footprint than Sub-Option 1 to excavate to depth of bottom of L-shape wall</li> <li>Additional civil works, disturbance and timeframe to install L-shape wall after piling</li> <li>Road would take 7-months to construct</li> </ul>
Preserve the life of existing infrastructure	<ul style="list-style-type: none"> <li>Road is reinstated with new support infrastructure</li> <li>Improvement in existing stormwater system through the rebuilding of existing stormwater pipes. This would preserve the life of the existing stormwater system whilst also improving stormwater infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Road is reinstated with new support infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Road is reinstated with new support infrastructure</li> </ul>
Minimise impact to National Park Estate and environmental impact of the works	<ul style="list-style-type: none"> <li>Realignment to the west of the existing alignment would require vegetation removal. Vegetation removal would be less than Sub-Option 2</li> </ul>	<ul style="list-style-type: none"> <li>Greater encroachment into Royal National Park and removal of up-slope rock as well as vegetation compared to Sub-Option 1 and Sub-Option 3</li> </ul>	<ul style="list-style-type: none"> <li>Excessive excavation downslope would be required to provide a suitable foundation for the wall structure.</li> <li>Excavation works would encroach into the Royal National Park land. However, this encroachment would be less than Sub-Option 1 and Sub-Option 2.</li> </ul>

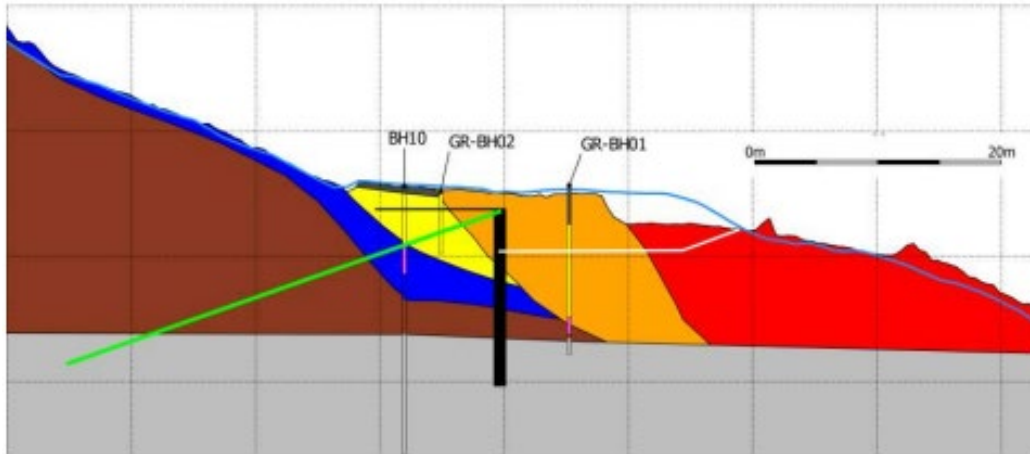


Figure 2-1: Sub-option 1: Anchored soldier pile wall

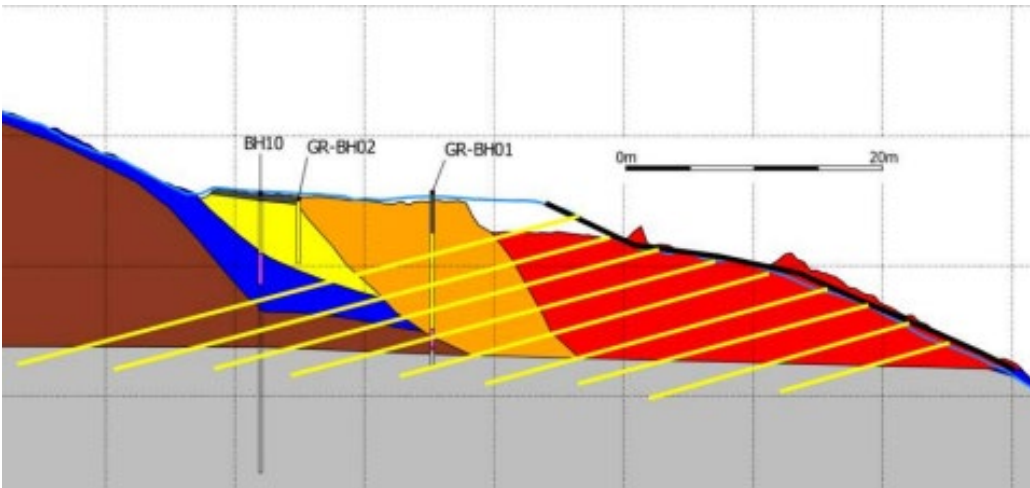


Figure 2-2 Sub-option 2: Soil nailing

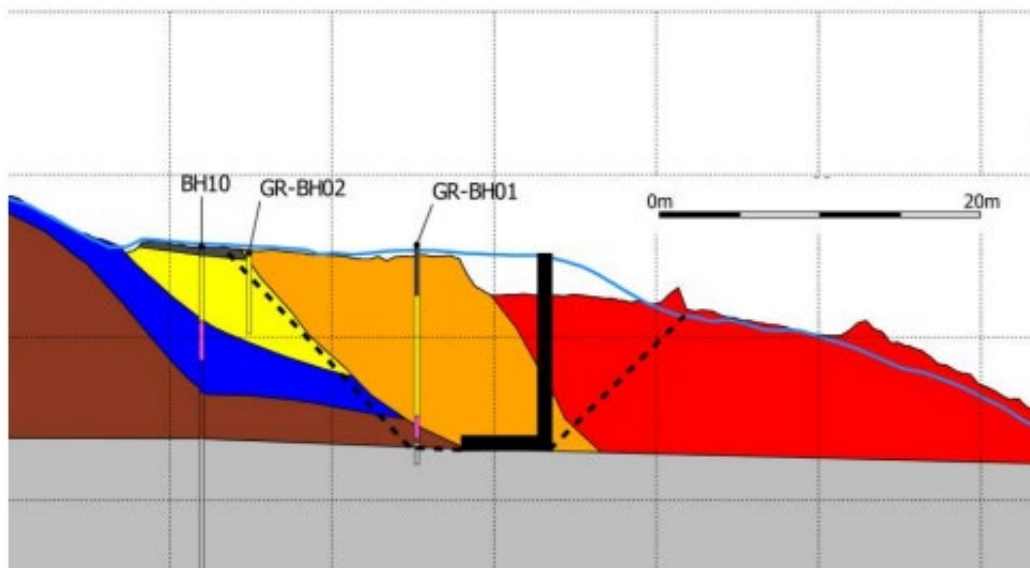


Figure 2-3 Sub-option 3: 'L' shaped wall

Review of environmental factors (for national parks)

**Preferred sub-option**

Sub-option 1-install new anchored soldier pile wall was selected as the preferred option as it met the proposal objective of reinstating Garie Road and reducing the risk for delays to program, maintaining the 6-month program to construct and re-open the road. This option would reduce the ARL risk level, creating a more robust and resilient road as well as reducing the potential for another similar road failure due to climate events. In addition, this option moves the road away from the main zone of instability and would allow for simpler and more efficient construction.

Sub-option 2 was not selected as soil nailing was not considered feasible after ground investigations due to the size of the landslide, as well as the construction risk due to the active landslide and extensive impacts to the National Park Estate. Sub-option 3 was not progressed due to additional civil works, disturbance and timeframe to install L-shape wall after piling, as well as the lengthy time to construct.

**2.5 Design refinements**

Throughout the detailed design process, design refinements have occurred in order to avoid or minimise impacts to biodiversity as well as facilitate constructability. These design refinements are summarised in Table 2-4.

**Table 2-4 Design refinements**

Refinement	Reason
Design shifted to the east	Sub-option 1 has been refined after a biodiversity field investigation identified a number of threatened flora <i>Rhodamni</i> s individuals within the proposal area. <i>Rhodamni</i> s are a critically endangered species. Design refinements have been made to avoid impacts on the identified individuals within the proposal area.
Pile quantities have increased and rock anchors have decreased	The pile quantities have increased as a result of continued investigations. It has been assessed that the current design is optimised to enable retention of material. The use of rock anchors has decreased as the handling of anchors is complex and additional anchors would introduce potential construction clashes with existing assets such as culverts.
Removal of the retaining wall extension from the scope	The installation of retaining wall extension from the new pile caps has been removed from the scope as the capping beam was raised to finish surface level, removing the need for a retaining wall.
Elevated and at-ground walkways attached to capping beam	It is proposed to install both elevated and at-ground walkways attached to the capping beam. This addition is to provide sufficient space for maintenance crew to access the strand anchor heads during maintenance.

## 3. Description of the proposed modification

This chapter describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

### 3.1 The proposal

Transport proposes to reinstate and re-open Garie Road (the proposal) in the Sutherland Shire LGA. This section of road has experienced damage due to extreme weather events in early 2022, which has left the road unuseable for staff and visitors of the Royal National Park. Typically, Garie Road is a two lane road with one lane in each direction and provides the only vehicular route to Garie Beach.

The works have been identified as part of the flood recovery program of works for the continual maintenance and management of roads which comprise of the Sydney Road and Asset Performance Contract (SRAPC). The SRAPC is a 9-year operational contract covering the maintenance and management of classified State roads within the Eastern Harbour City zone.

Key features of the proposal includes:

- new anchored bored pile wall comprising 89 reinforced bored capped piles (about 900 millimetre in diameter) spaced at 1.5 metres apart. The rock anchors (about 150 millimetres in diameter) would be installed into the existing bedrock at 45 degrees
- new flexible guard fence along the edge of the road to tie into existing fence at one metre spacing
- realignment of the existing road surface away from slip area including excavation works and tree clearing
- installation of at-ground and elevated walkways attached to capping beam to allow maintenance crew access
- installation of a new swale drainage system including the replacement of two existing culverts. A grass lined channel would be installed along Garie Road to the south of the replaced culvert, and a concrete lined channel to the north. Swale drains would be connected to a PVC piped system to carry water away from slope
- establishment of three temporary ancillary facilities including the NPWS helipad ancillary facility, Governor Game Lookout ancillary facility and the Garie Road ancillary facility on existing cleared land.

The proposal would be located mostly within the road corridor, with a portion located on National Parks and Wildlife Service (NPWS) Estate (about 504 square metres, the temporary NPWS helipad ancillary facility and the temporary Governor Game Lookout ancillary facility). Key features of the proposal that are located on Royal National Park Estate include:

- rock anchors at 45 degrees (about 150 millimetres in diameter). The rock anchors would be installed into the existing bedrock
- realignment of the existing road surface away from slip area including excavation works and tree clearing
- installation of a new swale drainage system including the replacement two existing culverts. A grass lined channel would be installed to the south of the slip area, and a concrete lined channel to the north
- establishment of two temporary ancillary facilities including the NPWS helipad ancillary facility and Governor Game Lookout ancillary facility on existing cleared land.

Key features of the proposal are shown in detail in Figure 3-1, Figure 3-2 and Figure 3-3. Figure 3-1 shows key features of the proposal overlaid with Lidar imagery which displays cleared areas and the failed slope and road area. Figure 3-2 shows key features of the proposal that are located within National Parks Estate as well as assumed Transport road corridor. Figure 3-3 shows the key features of the proposal in a cross-sectional layout. There is no corresponding Lot/DP for the proposal as it is within the Royal National Park.



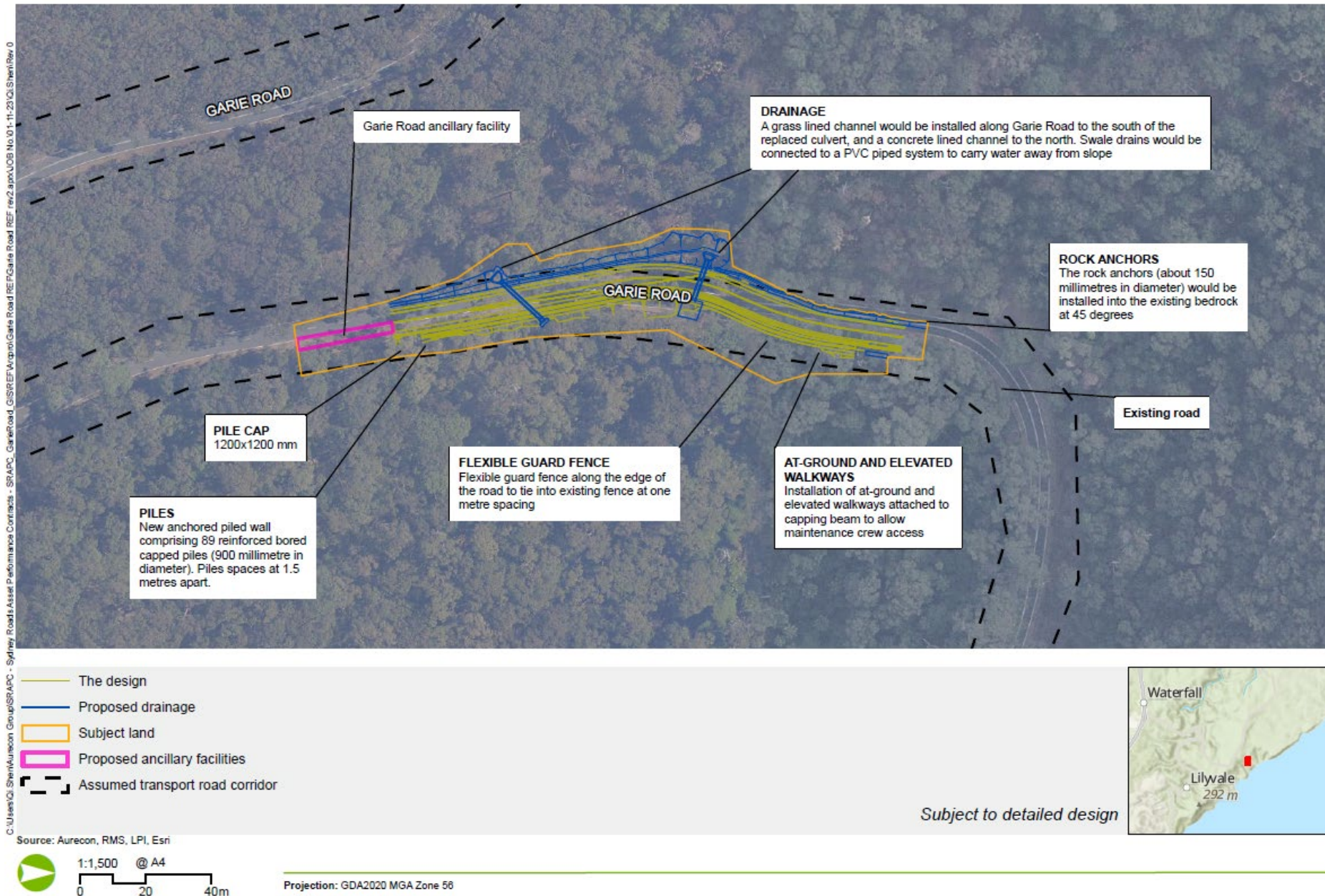


Figure 3-1: Key features of the proposal



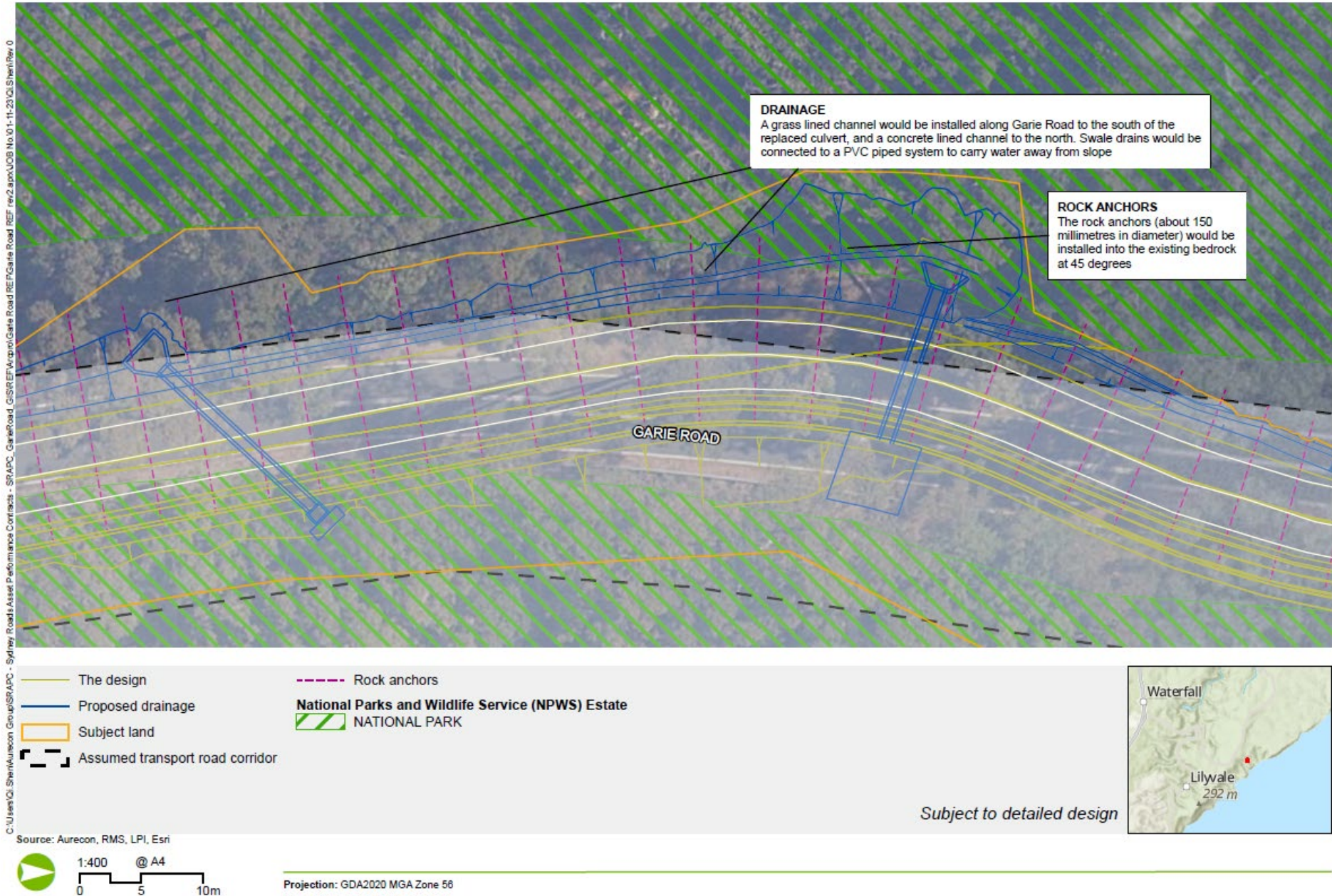


Figure 3-2 Key features of the proposal within National Parks

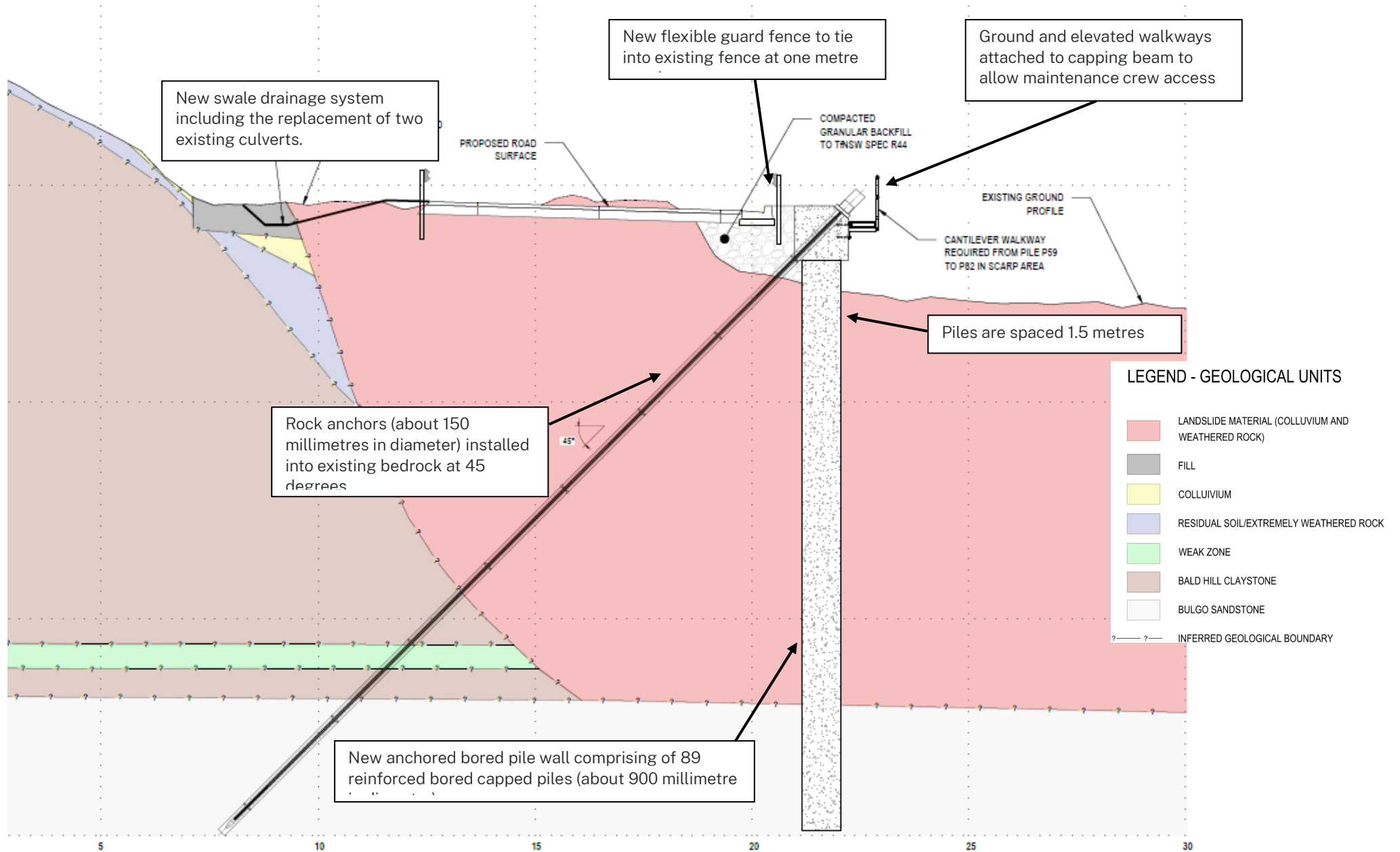


Figure 3-3: Key features of the proposal (cross-section)

## 3.2 Design

### 3.2.1 Design criteria

The road would be reinstated in line with Transport specifications and Austroads Guide to Road Design Part 3. The following guidelines and standards also adopted for this proposal include:

- Roads and Maritime Guide to Slope Risk Analysis (Roads and Maritime, 2002)
- Slope Asset Management Policy PN 292
- AGRD Guide to Road Design Part 6: Roadside Design, Safety and Barriers 2010 Edition
- AGRD Guide to Road Design Part 3 Geometric Design 2021 Edition
- Roads & Maritime Services Supplement to Austroads Guide to Road Design (Latest versions)
- AS1741.2-2009 Manual of uniform traffic control devices, Part 2: Traffic control devices for general use
- Relevant TfNSW QA Roadworks Specifications.

### 3.2.2 Engineering constraints

The following engineering constraints would be considered for the proposal:

Constraint	How has it been addressed in the proposal design
<b>Located within the Royal National Park with narrow roads making it difficult to get to and from the site</b>	Design of piles and road has taken into consideration sizing of plant required. This has been reviewed so that the plant and equipment required can be brought to the Garie Road site given the narrow roads.
<b>Ongoing slope stability issues</b>	Design has been developed as a robust solution which considers any potential future slope movement
<b>Design must tie into existing Garie Road</b>	Alignment design has been revised to optimise the geotechnical design solution. However, alignment must still tie back into the existing Garie Road and road design must consider existing parameters such as lane widths and speed environment.
<b>The existing rock profile dictates the limits of the geotechnical design</b>	Site investigations have been conducted to inform the geotechnical design.

### 3.2.3 Major design features

#### **Piled wall with rock anchors, walkway and guard fencing**

The proposal would require the installation of a new anchored bored pile wall comprised of 89 reinforced bored capped piles (about 900 millimetres in diameter) spaced at 1.5 metres apart. The piles would be installed into the existing sandstone bedrock which would provide additional support and stability to the slope.

Rock anchors would be required to stabilise the failed slope and retain the existing soil behind the piles. The rock anchors would be installed behind the piled wall and inclined about 45 degrees into the existing sandstone bedrock to provide for additional support and stability.

An elevated and at-ground walkway would be attached to the capping beam, providing maintenance crew access. In areas where the capping beam is at ground level, the walkway would be made of flexible pavement to accommodate soil movement. In areas where the ground is not level with the top of the capping beam and soil infilling cannot be achieved, the walkway would be above ground.

A portion of the road surface would be re-aligned to the west of the existing road corridor and a new Transport approved kerbside safety barrier would be installed into the backfilled material behind the retaining wall. The new flexible guard fence would tie into the existing safety fence with one metre spacing. A cross-section of the proposed piled wall with rock anchor and new guard fencing is displayed in Figure 3-4.



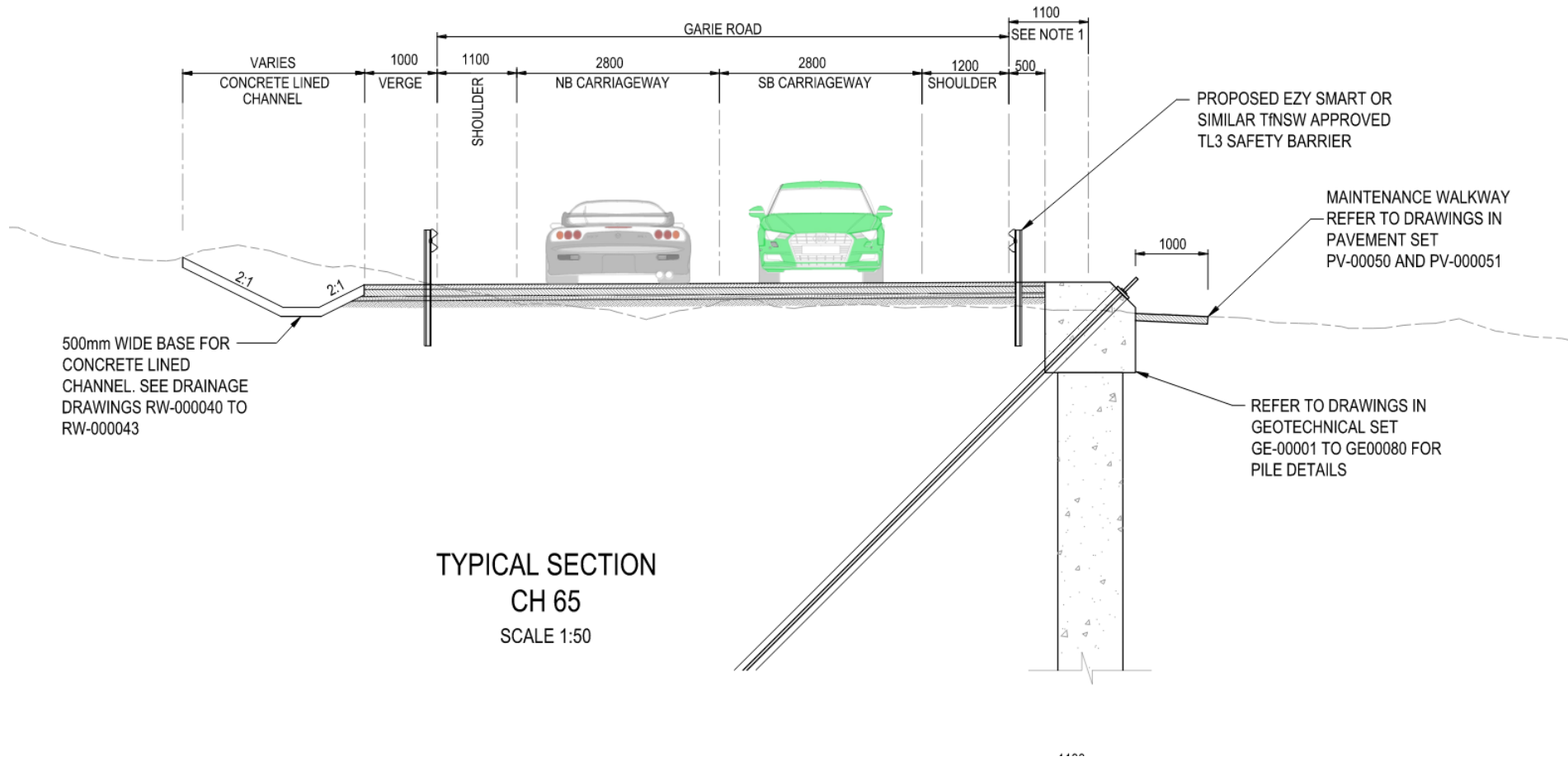


Figure 3-4 Cross-section of the proposed piled wall with rock anchor, retaining wall and new guard fencing



### **Drainage infrastructure**

A new swale drainage system would be installed, including replacing the existing 900-millimetre culvert on the northern side of the slope. An 85-metre-long grass lined channel would be installed on the southern end of Garie Road on the up-slope side of the road, with a 40-metre concrete lined channel on the northern side end of Garie Road on the up-slope. A rock apron would be installed at the culvert outlet to reduce water speed as it leaves the culvert, reducing the risk of erosion of the receiving downslope soil (Figure 3-5). The concrete lined channel would have reinforced shotcrete underneath to fill uneven ground and depressions, as well as have geotextile fabric lining the concrete between the soil. The culvert inlet would be reinforced shotcrete and would capture water flow from the incoming concrete lined channel, directing it to the replaced culvert.

Sub-horizontal drains (about 15 metres by 50 millimetres) would be installed in between the piles and attached to the base of the capping beam. The drains would be connected to a longitudinal PVC pipe which would divert water at the northern end of the capping beam.

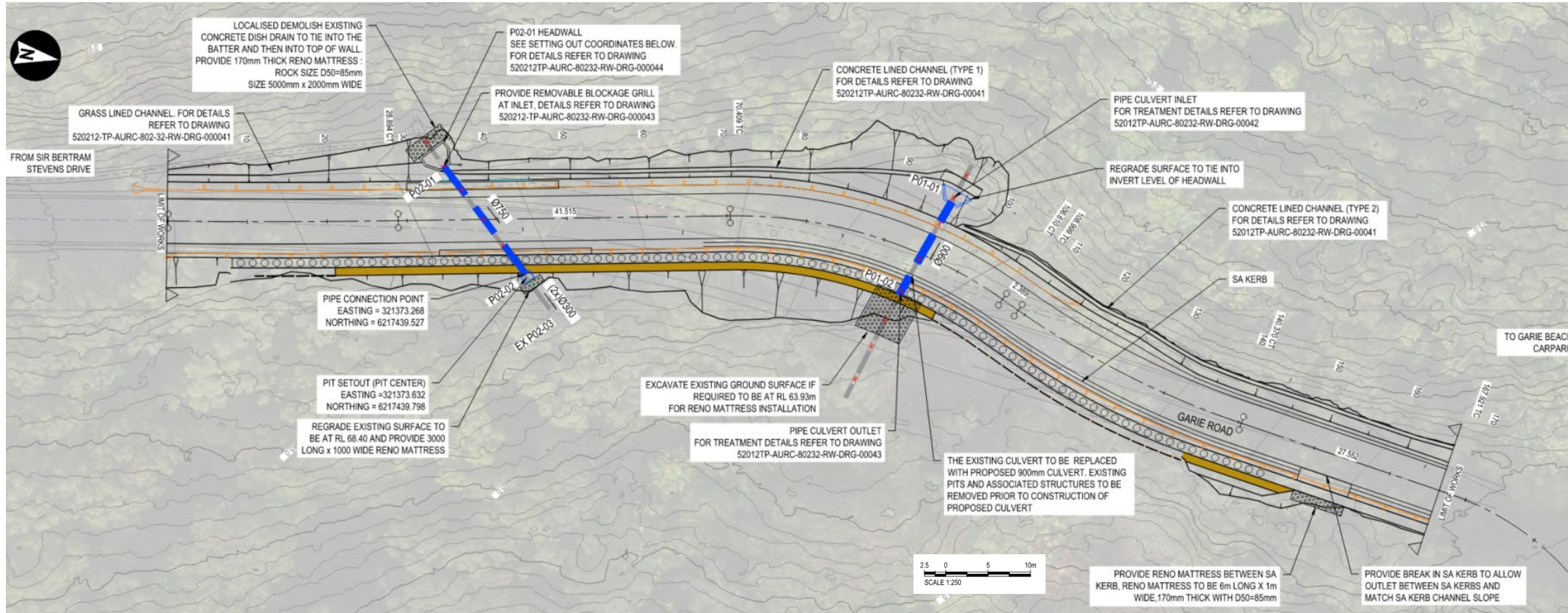
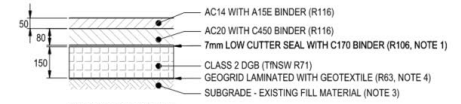


Figure 3-5 Aerial of proposed drainage infrastructure

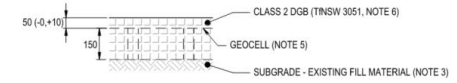
### **Road pavement and signage installation**

A portion of the road surface would be moved to the west of the existing road corridor. This would require vegetation clearing, earthworks and installation of new kerbside safety barrier. About 1,000 square metres of new asphalt pavement would be installed for the movement of the road surface, the pavement detail has been shown in Figure 3-6.

The existing signage on the southern side of Garie Road would be retained, with two additional speed signs and supporting signposts, to be installed on the southbound lane, towards the northern side of the road (Figure 3-7).



**PAVEMENT TYPE 1**  
ASPHALT ON GRANULAR BASE



**PAVEMENT TYPE 2**  
MAINTENANCE FOOTPATH WITH GEOCELL

**LEGEND**

- ROAD DESIGN
- EXISTING SURVEY
- PAVEMENT TYPE 1
- PAVEMENT TYPE 2
- CARRIER PIPE
- NO FINES CONCRETE PAD
- HEADWALL

**NOTES:**

1. FOR PAVEMENT TYPE DETAILS REFER TO DRAWING PV-0051.

Figure 3-6 Pavement profiles



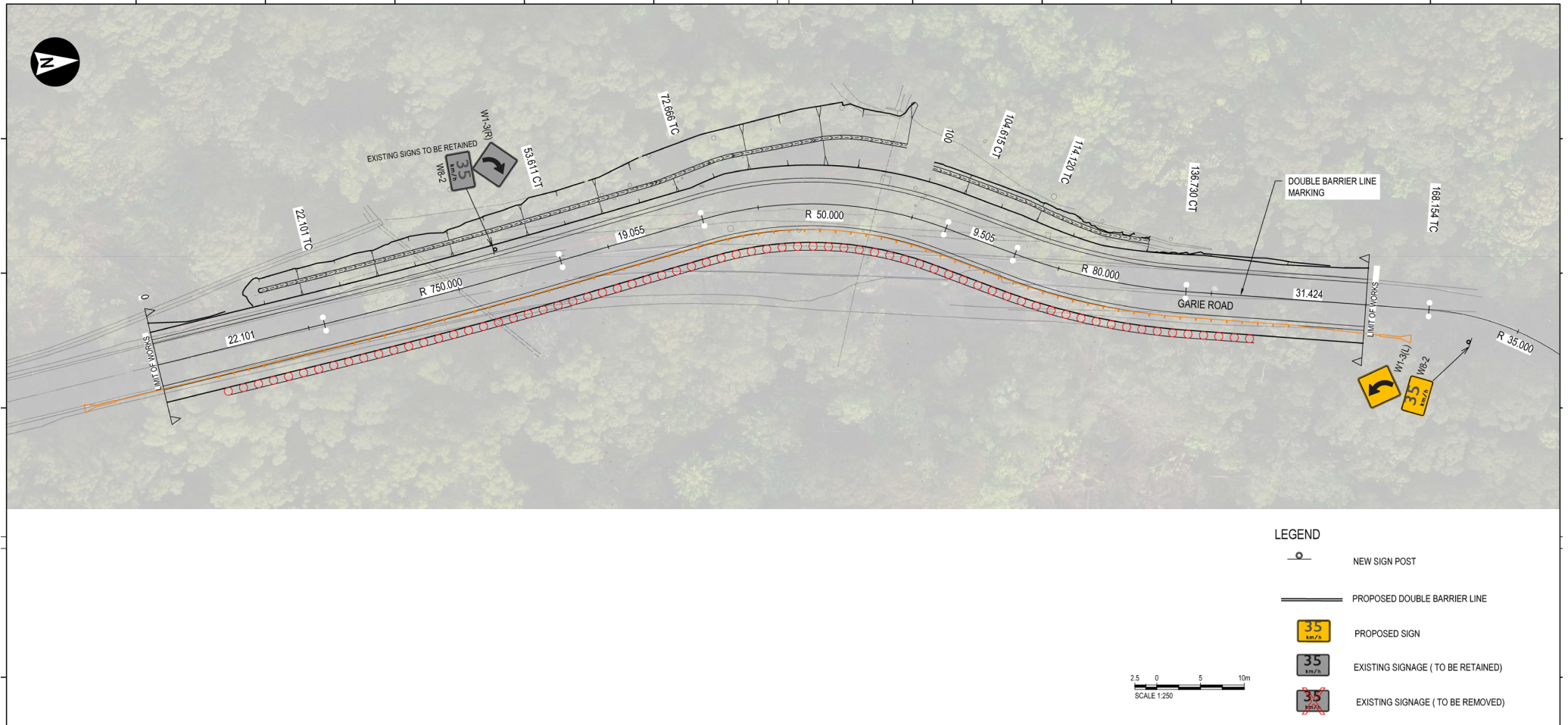


Figure 3-7 Proposed road signage

### 3.3 Construction activities

This section summarises the likely method, work hours, plant and equipment and associated activities for construction of the proposal. The proposal would be built in line with Transport construction specifications and would follow the SRAPC Construction Environmental Management Plan (CEMP).

However, the actual work method may vary from the description provided in this section due to the identification of additional engineering constraints, feedback from the community as well as contractor requirements and limitations.

#### 3.3.1 Work methodology

It is anticipated that the proposal would commence in November 2023 and be completed within six months. The proposed construction activities are summarised in Table 3-1 with indicative Staging Diagrams and constructability presentation in Appendix C.

**Table 3-1: Construction activities for the proposal**

Activity	Associated work
<b>Site establishment and environmental protection</b>	<ul style="list-style-type: none"> <li>• Implementation of the Traffic Management Plan (TMP), prior to works commencing and Traffic Guidance Scheme (TGS)</li> <li>• Establish environmental controls around the proposal area</li> <li>• Notify the community and relevant stakeholders of upcoming work</li> <li>• Conduct pre-clearing surveys, as required</li> <li>• Install temporary fencing to mark any environmentally sensitive areas to be avoided (no-go areas).</li> </ul> <p><u>NPWS helipad ancillary facility</u></p> <ul style="list-style-type: none"> <li>• Establish temporary amenities, waste bin, concrete washout areas, mulching areas, small diesel generator (to support amenities), plant/equipment storage and stockpiling locations</li> <li>• Set up temporary fencing around the ancillary facility</li> <li>• Set up environmental controls</li> </ul> <p><u>Governor Game lookout ancillary facility</u></p> <ul style="list-style-type: none"> <li>• Delivery and set-up of site sheds, amenities and small diesel generator to power site</li> <li>• Set up temporary fencing and signage around site</li> <li>• Set up environmental controls</li> </ul> <p><u>Garie Road ancillary facility</u></p> <ul style="list-style-type: none"> <li>• Establish temporary site sheds and offices, ablution block, small diesel generator, water tank and equipment storage locations</li> <li>• Set up jersey barriers (or similar) to protect the ancillary facility from plant and vehicular movements in and out of the adjacent workzone</li> <li>• Set up environmental controls</li> </ul>
<b>Cut and stabilisation</b>	<ul style="list-style-type: none"> <li>• Progressive excavation of the site using an excavator from the southern end and moving progressively towards the northern end of Garie Road. Excavation would include: <ul style="list-style-type: none"> <li>– removing cracked pavement</li> <li>– earthworks to remove scarps</li> <li>– creating a level platform which would be benched at the required intervals to support plant and equipment.</li> </ul> </li> <li>• Cut and stabilise ground to required level. Excavation would occur about two metres below the existing ground level for the proposed pile wall. As part of</li> </ul>



Activity	Associated work
	the stabilisation works, a piling platform (steel plate) would be established. As works move along the site, the piling platform would be moved.
<b>Vegetation removal</b>	<ul style="list-style-type: none"> <li>• Removal of 72 native trees / 0.296 hectares of vegetation across the proposal area</li> <li>• Two Hollow-bearing trees near the proposal on the downslope side would be retained with exclusion zones established</li> <li>• Minor tree trimming ie. less than 10 per cent of the tree canopy at the NPWS helipad ancillary facility to facilitate access and egress of larger vehicles and deliveries</li> <li>• Minor trimming of understorey vegetation to allow for temporary parking for the 'Little Garie Cabin Community' during the life of the project. Parking is proposed on the western extension of road, adjacent to the Garie Beach Fare Booth.</li> <li>• Minor tree trimming ie. less than 10 per cent of the tree canopy at the Governor Game lookout ancillary facility to facilitate access and egress of larger vehicles and deliveries</li> <li>• Slashing of grasses adjacent to Garie Road to allow the site establishment of the Garie Road ancillary facility</li> <li>• Minor tree trimming ie. less than 10 per cent of the canopy to facilitate required construction works within work-zones including larger plant and equipment and their movement</li> </ul>
<b>Concrete deliveries</b>	<ul style="list-style-type: none"> <li>• Concrete deliveries to occur during standard hours in addition to Out of Hours Work (OOHW)</li> <li>• Deliveries required outside standard construction hours are required due to supply/availability and distance and haulage from available batch plants to align with the B80 concrete bridge specification.</li> </ul>
<b>Concrete pours</b>	<ul style="list-style-type: none"> <li>• Concrete pours to occur during standard hours in addition to OOHW</li> <li>• Concrete pours required to be undertaken within tight timeframes when concrete agitator trucks arrive at site locations in satisfying the B80 concrete bridge specification.</li> </ul>
<b>Other vehicle movements –Oversize Overmass Load Carrying Vehicles</b>	<ul style="list-style-type: none"> <li>• Permitted hours as per New South Wales Class 1 Load Carrying Vehicle Operator's Guide (2130-0530 and 1600-1800 within the NSW Urban Zone)</li> <li>• Floating of heavy plant e.g. piling rigs; excavators and movement of large plant.</li> </ul>
<b>Other vehicle movements –waste materials for disposal/recycling</b>	<ul style="list-style-type: none"> <li>• Other vehicles movements – waste materials for disposal/recycling to occur during standard hours in addition to OOHW.</li> </ul>
<b>Installation of piles</b>	<ul style="list-style-type: none"> <li>• Excavation of working platform to pile level</li> <li>• Install piles. Piles would be installed sequentially from Garie Road southern end along the proposed line of piles.</li> <li>• 10 concrete agitator trucks to perform night-time deliveries of concrete for piling works. Consecutive night-time deliveries of up to 8 weeks during piling works</li> <li>• Install pile cage (reinforced steel) and pour concrete in pile cage progressively along the site.</li> </ul>
<b>Construction of capping beam, subsoil drainage and anchors</b>	<ul style="list-style-type: none"> <li>• Install 900-millimetre diameter sub-soil drainage between piles after piles installed</li> <li>• Construct capping beam progressively in sections after sub-soil installation</li> <li>• Construct anchors drilled and installed through the pile capping beam, after pile capping beam installation.</li> </ul>

Activity	Associated work
Installation of drainage culvert, subsoil drains and outlet structure	<ul style="list-style-type: none"> <li>Excavation using an excavator to create trenches for the construction of the culverts</li> <li>Install 900-millimetre diameter drainage culvert and outlet structures. A rock apron would be installed at the new culvert outlet to reduce water speed as it leaves the culvert, reducing the risk of erosion of the receiving downslope soil</li> <li>Remove damaged pipe of existing culvert</li> <li>Reinstate existing culvert on the southern side of Garie Road.</li> </ul>
Compact and backfill ground	<ul style="list-style-type: none"> <li>Backfilling of ground profile to design level using clean general fill.</li> </ul>
Installation of elevated and at-ground walkways	<ul style="list-style-type: none"> <li>Ground adjacent to the capping beam will be compacted to correct level and flexible pavement laid on top with granular material and compacted</li> <li>Elevated walkway to be attached to side of capping beam with anchor bolts once capping beam gains sufficient strength. This would be constructed from the road pavement</li> </ul>
Installation of permanent pavement, traffic barrier, fall protection barrier and swale drain	<ul style="list-style-type: none"> <li>Reinstate road surface asphalt</li> <li>Installation of culvert inlets, swale drainage system (southern-western side of Garie Road) and 40 metre concrete lined channel on the northern side of Garie Road</li> <li>Installation of two additional speed signs and supporting signposts on the southbound lane towards the northern side of the road</li> <li>Reinstate the traffic/crash barrier and link with existing barrier</li> </ul>
Site clean-up / demobilisation	<ul style="list-style-type: none"> <li>Rehabilitate disturbed areas</li> <li>Remove temporary environmental, safety and traffic controls once site is stabilised</li> <li>Clean up the site and ancillary facility and dispose of waste materials.</li> </ul>

### 3.3.2 Construction workforce

Construction of the proposal is likely to require up to 30 construction workers. However, the number of construction workers at any one time may vary.

### 3.3.3 Construction hours and duration

Construction would be carried out during standard hours as well as occurring OOHW as defined by the Interim Construction Noise Guideline (ICNG; DECC, 2009) and summarised in

Table 3-2.

Table 3-2: Construction hours

Period of works	Monday to Friday	Saturday	Sunday and Public Holidays
<b>Standard hours</b>	7am – 6pm	8am – 1pm	No work
<b>OOHW Period</b>	6pm – 10pm 10pm – 6am	6pm – 10pm 10pm – 6am	6pm – 10pm 10pm – 6am

### 3.3.4 Plant and equipment

The plant and equipment needed to build the proposal would be typical of any road construction project and would vary depending on the construction activity being carried out. An indicative list of plant and equipment required for the proposed works are summarised in Table 3-3.

**Table 3-3: Construction plant and equipment**

Phase	Plant, vehicle and equipment types
NPWS helipad ancillary facility establishment	<ul style="list-style-type: none"> <li>• Light and heavy vehicles, including tipper truck</li> <li>• Excavator</li> <li>• Hand tools</li> <li>• Generators</li> <li>• Lighting towers</li> <li>• Smooth drum roller</li> </ul>
Governor Game lookout ancillary facility establishment	<ul style="list-style-type: none"> <li>• Generators</li> <li>• Lighting towers</li> <li>• Light and heavy vehicles, including flatbed trucks</li> <li>• Hand tools</li> </ul>
Garie Road ancillary facility establishment	<ul style="list-style-type: none"> <li>• Generators</li> <li>• Light and heavy vehicles, including flatbed trucks</li> <li>• Hand tools</li> </ul>
Ancillary facility operation	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Hand tools</li> <li>• Generators</li> <li>• Lighting towers</li> <li>• Mulcher</li> </ul>
Worksite establishment	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Hand tools</li> <li>• Generator</li> </ul>
Vegetation removal	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Excavator</li> <li>• Mulcher</li> <li>• Hand tools</li> </ul>
Cut and stabilisation	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Excavator/dozer (up to 30 tonne)</li> <li>• Soil stabilizer</li> </ul>
Installation of piles	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Concrete agitator (18 tonne)</li> <li>• Piling rig (20 to 30 tonne)</li> <li>• Excavator</li> <li>• Crane</li> </ul>
Construction of capping beam	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Hand tools</li> </ul>

Phase	Plant, vehicle and equipment types
	<ul style="list-style-type: none"> <li>• Excavator/dozer (up to 30 tonne)</li> <li>• Skid steer</li> <li>• Compressor</li> <li>• Generator</li> </ul>
Installation of drainage culvert, subsoil drains and outlet structure	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Hand tools</li> <li>• Skid steer</li> <li>• Concrete pumps/trucks (up to 30 tonne)</li> </ul>
Compact and backfill ground	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Hand tools</li> <li>• Roller</li> </ul>
Installation of permanent pavement, traffic barrier and fall protection barrier	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Hand tools</li> <li>• Pavement laying machine</li> <li>• Roller</li> <li>• Profiler</li> <li>• Asphalt truck and sprayer</li> <li>• Water cart</li> </ul>
Installation of elevated and at-ground walkways	<ul style="list-style-type: none"> <li>• Excavator</li> <li>• Small compactor</li> <li>• Hand tools</li> </ul>
Rehabilitate disturbed areas	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Skid steer</li> <li>• Hand tools</li> </ul>
Remove temporary environmental safety and traffic control	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Hand tools</li> </ul>
Site clean up	<ul style="list-style-type: none"> <li>• Light and heavy vehicles</li> <li>• Hand tools</li> <li>• Road sweeper</li> <li>• Water cart</li> </ul>

### 3.3.5 Earthworks

The proposal would include piling of 89 reinforced bored capped piles and supporting soil nails. It is anticipated that the proposal would generate up to 4,480 cubic metres of spoil from all earthwork activities. Where possible, material extracted would be reused on site. Unsuitable material (such as alluvial soils) would be removed from site to a licensed premise or facility that is legally able to accept that type of waste.

Backfill is required as part of the proposal to reinstate to the required surface level of the road. Where it is not suitable for existing site material to be reused, material would be imported. It is anticipated that the proposal would require up to 2, 240 cubic metres of imported clean general fill from earthwork activities. Fill would be obtained from licensed facilities.

### 3.3.6 Source and quantity of materials

The proposal would require the following materials:

- between 800 to 1,000 cubic metres of reinforced concrete
- between 750 to 900 tonnes of steel within the reinforced concrete
- about 1,000 square metres of asphalt.

All materials would be sourced from licensed providers.

### 3.3.7 Traffic management and access

A Traffic Management Plan (TMP) would be prepared to suit the site conditions and would be implemented for the duration of the proposal.

#### **Estimated construction traffic numbers**

It is estimated across the proposal area, including operation of ancillary facilities, during each shift for construction there would be around:

- 20 construction vehicles (heavy vehicle and light vehicle) over 15hr (day) period
- 20 construction vehicles (heavy vehicle and light vehicle) over a 9hr (night) period

#### **Road closures**

The proposed traffic management for the proposal requires the continued full closure of Garie Road from the Sir Bertram Stevens Drive /Garie Road intersection. This would continue to restrict public vehicle access to Garie Beach as well as the Governor Game lookout, via Garie Road during construction. Transport and traffic impacts are discussed further in section 6.4.

#### **Access management**

Garie Road is currently closed with no vehicular or pedestrian access to Garie Beach. As Garie Road is the only road/access point to Garie Beach, there are no possible vehicular detours to access Garie Beach. Garie Beach can be accessed by pedestrians via the Curra Moors Loop walking track off Sir Bertram Stevens Drive, and the Coast track connecting with the Curra Moors Loop towards the coast (about 4.4 kilometres). The Garie Beach huts can be accessed by residents via the NPWS helipad area (about 230 metres). This access track from the NPWS helipad location would be temporary during construction and would not be available during operation of the proposal as access to Garie Beach and the Coast track from Garie Beach would be reinstated (about 650 metres).

Public access to Governor Game lookout and nearby public parking would not be available during construction as this area would be used as an ancillary facility as well as parking for personnel. However, this is unchanged from what it is currently.

The proposal is expected to generate light and heavy vehicle movements that would typically be associated with:

- delivery of construction materials including concrete (including night-time concrete deliveries for piling works) and precast structural elements
- delivery of site sheds and amenities
- spoil removal
- importation of fill material for earthworks
- delivery and removal of construction equipment and machinery
- construction worker labour force travelling to work and during work.

Concrete and material deliveries would be required for Standard and OOHV periods during road closures. This is due to the availability of materials and heavy vehicles required for transporting materials, as well as distances required to travel to ancillary facilities and the Garie Road worksite.

The utilisation of light vehicles, smaller heavy vehicles e.g. flatbed truck, and smaller plant are a preferred option under the proposal as they would be able to navigate the narrow roads within the Royal National Park.



Where there is a need for oversized vehicles to be utilised, an appropriate assessment, i.e. survey/turn paths or similar will be carried out prior to determine the appropriateness in using such vehicles.

During construction, the NPWS helipad ancillary facility, Governor Game lookout ancillary facility and Garie Road ancillary facility would be accessed by construction vehicles via Garie Road. Access to the piled wall worksite would be accessed from the southern side of Garie Road only with the piles and road progressively established.

Communication between work crews and traffic control would be maintained through two-way radios. When approaching site, work crews are to inform traffic control of their intentions as advanced warning and once reaching the established work site, traffic control are to guide the work crew vehicles into the work site.

Public traffic is to be managed by the traffic management plan in place in line with the approved Traffic Guidance Scheme and Road Occupancy Licence.

### 3.4 Ancillary facilities

The proposal would require one minor ancillary facility. This is summarised in Table 3-4 and displayed in Figure 3-8 and Figure 3-9.

Table 3-4: Ancillary facilities

Ancillary facility	Location / description	Nearest sensitive receiver
<p>NPWS helipad ancillary facility</p>	<p>The proposed ancillary facility is located on an existing helipad, around 325 metres from the works. This helipad is owned by NPWS and is currently used by the 'Little Garie Cabin Community' as a carpark, although there are no designated parking spots within the area.</p> <p>The ancillary facility would require all of the helipad (about 1,950 square metres).</p> <p>The ancillary facility would be used for temporary amenities, storage of materials, including excavated material (about 4,480 cubic metres), mulching activities as well as facilitating large vehicle movement. Soil profiles would be kept separate onsite, where feasible.</p> <p>A designated temporary concrete clean-out area will also be established at this ancillary facility. Asbestos cement sheeting debris within a mixed gravel fill layer is present on the upper ground surface of the site. The asbestos contamination is sporadically located throughout the mixed gravel fill material across the site. The ground surface below the gravel fill material is comprised of a hard sandstone material, therefore unlikely that there would be any asbestos contamination below the immediate ground surface.</p> <p>The ancillary facility would utilise already established cleared area and would require no vegetation clearing or earthworks. However, there would be minor tree trimming i.e. less than 10 per cent of the tree canopy in order to facilitate access and egress in and out of the area.</p> <p>This ancillary facility would have temporary security fencing and signage around the perimeter as well as lighting towers to create a safe environment during the day during adverse weather conditions i.e. overcast/raining conditions.</p> <p>Temporary parking would also be provided to the 'Little Garie Cabin Community' during the life of the project for vehicle parking on the western extension of road, adjacent to the Garie Beach Fare Booth. This location is approximately 75 metres north-west from the entrance of the proposed NPWS helipad ancillary facility as reflected in Figure 3-8 below. Minor trimming of understorey vegetation would be required to allow for parking. Traffic management controls will be required to be in place for implementation purposes to facilitate a safe environment for the Garie Cabin Community when entering, parking and exiting this location.</p>	<p>The nearest sensitive receivers are the beach huts around 230 metres away from the ancillary facility. It is noted however that the beach huts do not serve as permanent residences.</p>
<p>Governor Game Lookout ancillary facility</p>	<p>The proposed ancillary facility is located on existing hardstand/asphalt, around 930 metres from the proposed works. This area is owned by NPWS and is currently used as public parking for Governor Game lookout. There are no designated parking spots in this parking area.</p>	<p>The nearest sensitive receivers are the beach huts around 730 metres away from the ancillary facility. It is noted however that the beach huts do not serve as permanent residences.</p>

Ancillary facility	Location / description	Nearest sensitive receiver
	<p>A portion of this area would be used as an ancillary facility (about 220 square metres) with the remainder of the site used for light vehicle parking for personnel (about 220 metres).</p> <p>The ancillary facility would be used for site sheds and amenities. A diesel fueled generator would be used to power the site. The generator would be double bunded to contain any spills. The ancillary facility would utilise an already established cleared area and would require no vegetation removal or earthworks. However, there would be minor tree trimming i.e. less than 10 per cent of the tree canopy in order to facilitate access and egress in and out of the area.</p> <p>This ancillary facility would have temporary security fencing and signage around the perimeter as well as lighting towers to create a safe environment during the day during adverse weather conditions i.e. overcast/raining conditions.</p>	
<p>Garie Road ancillary facility</p>	<p>The proposed ancillary facility is located within the assumed transport road corridor directly adjacent to Garie Road and south of the workzone.</p> <p>The proposed ancillary facility would be about 120 square metres and would be used for temporary site sheds and offices, an ablution block and equipment storage. A small diesel generator would be used to power the site. The generator would be double bunded to contain any spills. A temporary water tank would also be installed to support site shed, offices and the ablution block.</p> <p>The ancillary facility would utilise an already disturbed area ie. grassed verge and would require no vegetation clearing or earthworks. However, there would be slashing of grass to facilitate site establishment.</p> <p>This ancillary facility would have a concrete jersey barrier (or similar) between Garie Road and the ancillary facility to protect the ancillary facility from plant and vehicular movements in and out of the adjacent workzone.</p>	<p>The nearest sensitive receivers are the beach huts around 500 metres away from the ancillary facility. It is noted however that the beach huts do not serve as permanent residences.</p>



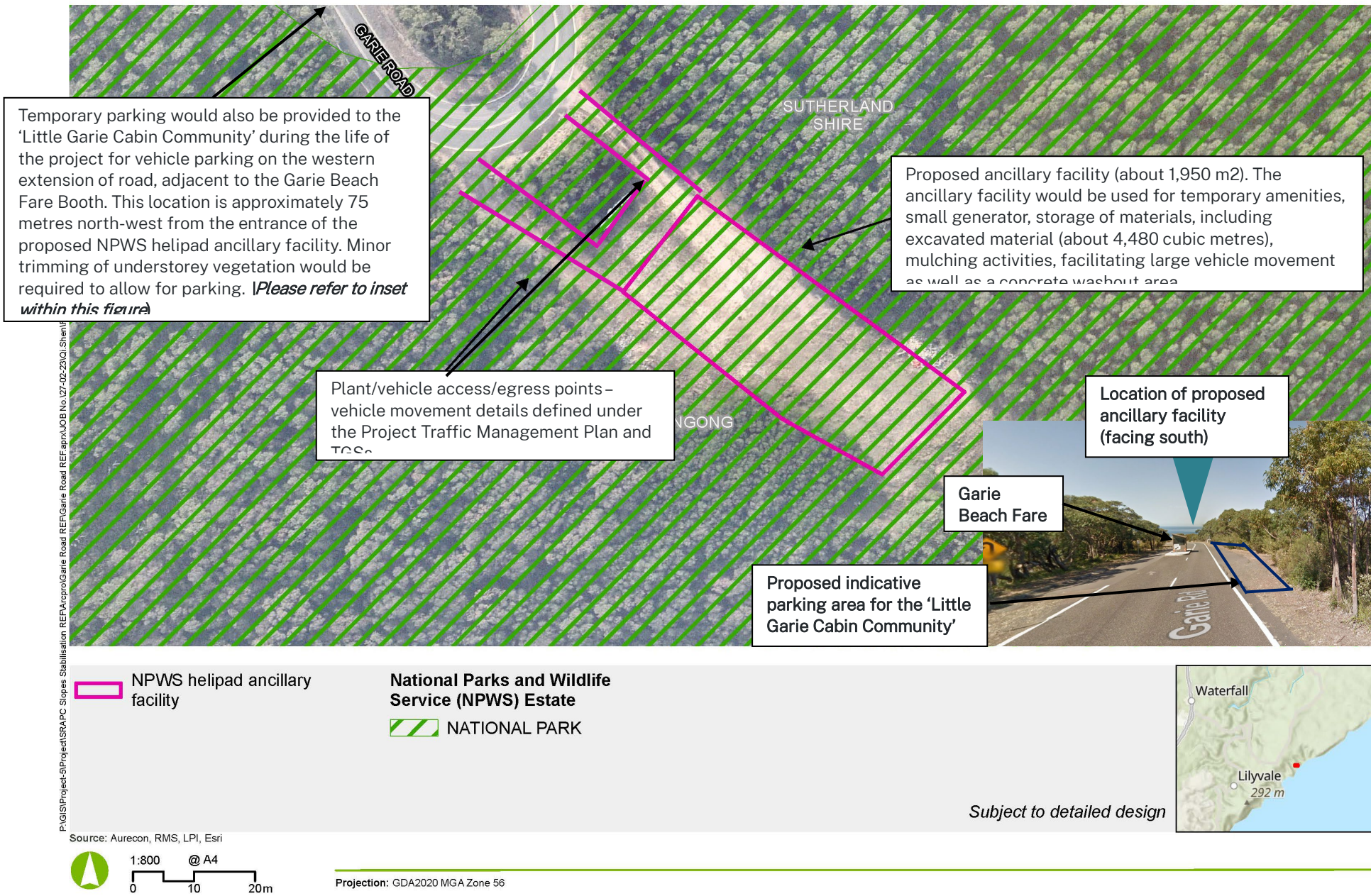


Figure 3-8: NPWS helipad ancillary facility





Figure 3-9 Governor Game lookout ancillary facility



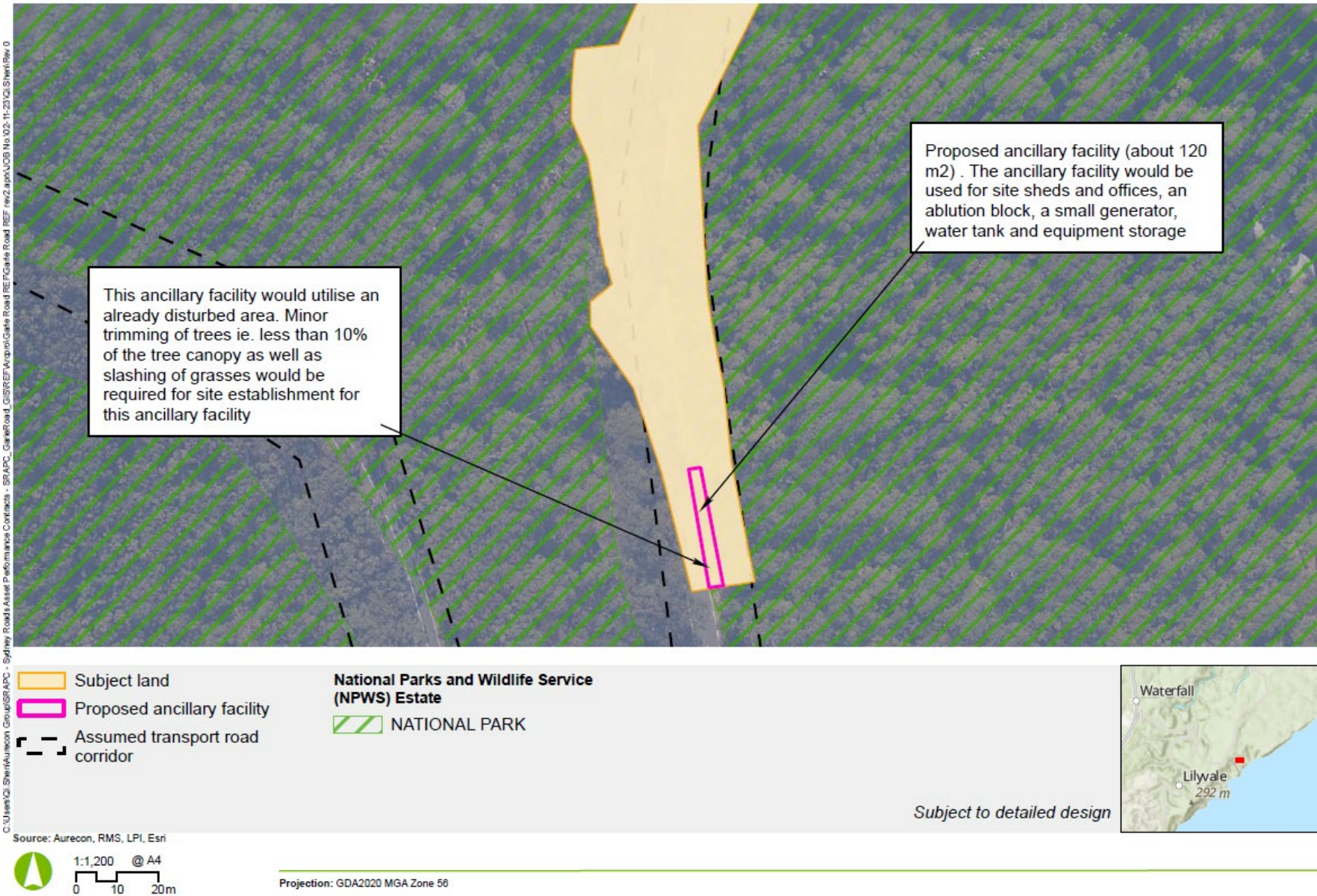


Figure 3-10 Garie Road ancillary facility

Review of environmental factors (for national parks)

### 3.5 Public utility adjustment

No public utility adjustments are required for the proposal.

### 3.6 Property acquisition

Transport would continue to consult with NPWS to discuss the proposal encroachment of about 504 square metres into National Park Estate. Any potential property acquisition would be discussed and negotiated between Transport and NPWS after the REF has been determined.

## 4. Statutory and planning framework

### 4.1 Environmental Planning and Assessment Act 1979

This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

#### 4.1.1 State Environmental Planning Policies

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides a statutory basis for planning and environmental assessment in NSW. The EP&A Act provides a framework for environmental planning and development approvals and includes provisions to ensure that the potential environmental impacts of a development are assessed and considered in the proposal approval process. The proposal is subject to assessment under Division 5.1 of the EP&A Act.

##### **State Environmental Planning Policy (Transport and Infrastructure) 2021**

Section 2 (Infrastructure) of SEPP (Transport and Infrastructure) aims to facilitate the effective delivery of infrastructure across the State. Section 2.109 of SEPP (Transport and Infrastructure) permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a road and is to be carried out by Transport for NSW, it can be assessed under Division 5.1 of the Environmental Planning and Assessment Act 1979. Development consent from council is not required.

Sections of the proposal are not located on land reserved under the *National Parks and Wildlife Act 1974* and do not require development consent or approval under:

- State Environmental Planning Policy (Planning Systems) 2021
- State Environmental Planning Policy (Precincts – Central River City)
- State Environmental Planning Policy (Precincts – Eastern Harbour City)
- State Environmental Planning Policy (Precincts – Regional) 2021
- State Environmental Planning Policy (Precincts – Western Parkland City) 2021.

There are however sections of the proposal that are located on land reserved under the *National Parks and Wildlife Act 1974* and therefore would require development consent or approval.

Section 2.10 to 2.15 of SEPP (Transport and Infrastructure) contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by SEPP (Transport and Infrastructure) (where applicable), is discussed in section 5 of this REF.

##### **State Environmental Planning Policy (Resilience and Hazards) 2021**

The Resilience and Hazards SEPP commenced on 1 March 2022 superseding several previous SEPPs. Chapter 2-Coastal Management of the Resilience and Hazards SEPP considers coastal planning provisions which replaced three repealed policies including SEPP 26 (Littoral Rainforests).

A search of the ePlanning Spatial Viewer indicates that the proposal and ancillary facilities are near the 'Proximity area for Littoral Rainforest' on the Coastal Wetlands and Littoral Rainforests Map:

- the proposal is about 91 metres
- the NPWS helipad ancillary facility is less than 50 metres
- the Governor Game lookout ancillary facility is 150 metres
- the Garie Road ancillary facility is about 271 metres.

The proposal and ancillary facilities in relation to mapped areas of Coastal Wetlands and Littoral Rainforests is displayed in (Figure 4-1).



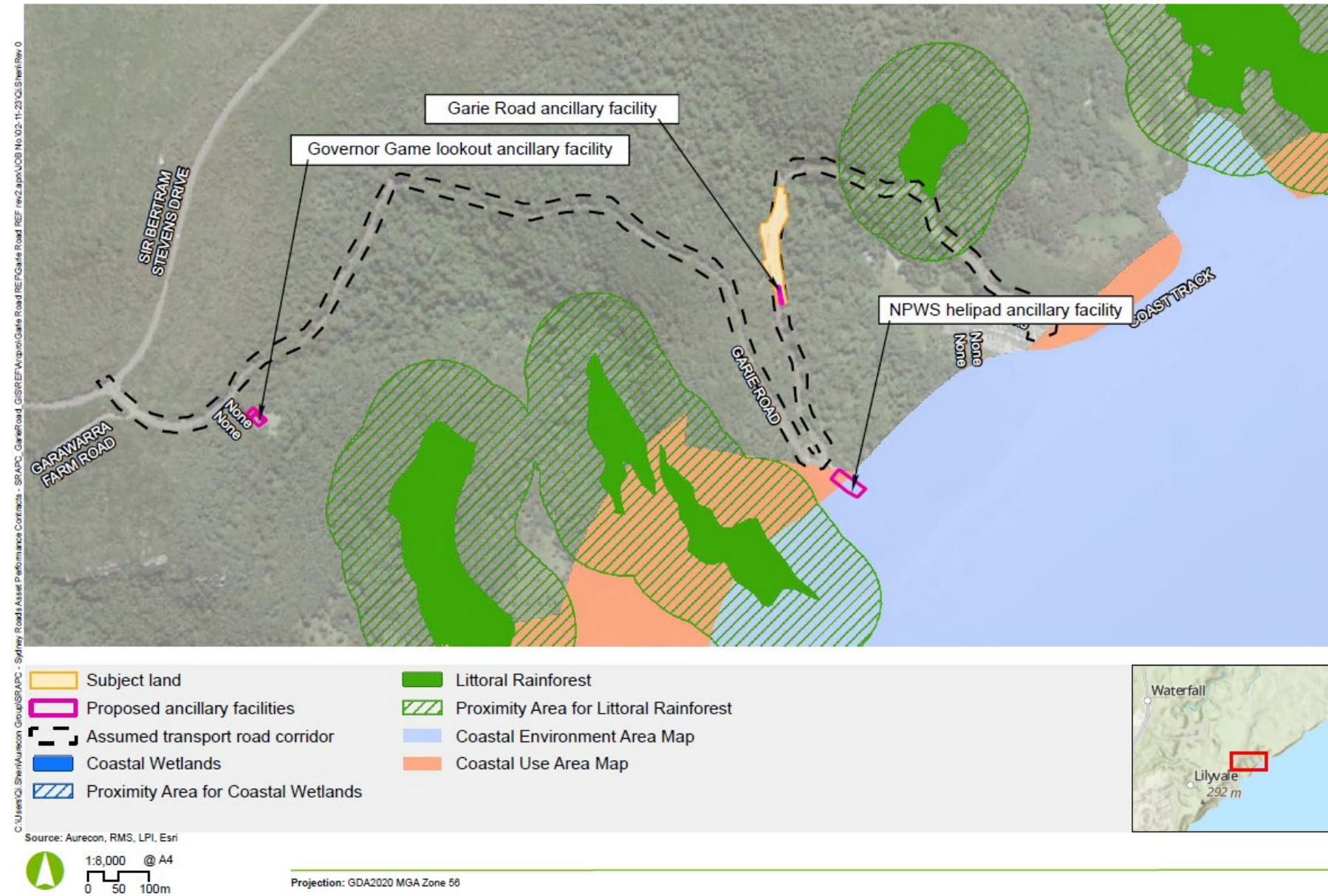


Figure 4-1 SEPP (Resilience and Hazards) 2021

Review of environmental factors (for national parks)



The proposal is also about 380 metres from areas mapped as 'Coastal Environment Area. The Governor Game lookout ancillary facility is about 860 metres from these areas and the Garie Road ancillary facility about 200 metres from these areas. However, the NSW Helipad ancillary facility overlaps with the 'Coastal Environment Area'. Although the ancillary facility is temporary, impacts of the site establishment and operation on Coastal Environment Area are considered as part of the REF. The matters of consideration for the coastal use and coastal environment areas are also located within the REF proposal area and where they are considered in the REF is detailed in Table 4-1.

Table 4-1 State Environmental Planning Policy (Resilience and Hazards) 2021 Matters for consideration

Area	Matter for consideration	Where addressed in the REF
Coastal environment area (Cl. 2.10)	(1) Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following –	
	(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,	Section 6.1 Section 6.3
	(b) coastal environmental values and natural coastal processes,	Section 6.3
	(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1.	Section 6.3
	(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,	Section 6.1
	(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,	Section 6.6
	(f) Aboriginal cultural heritage, practices and places,	Section 6.7
	(g) the use of the surf zone.	N/A
Coastal use area (Cl. 2.11)	(1) Development consent must not be granted to development on land that is within the coastal use area unless the consent authority –	
	(a) has considered whether the proposed development is likely to cause an adverse impact on the following –	
	(i) existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,	Section 6.6
	(ii) overshadowing, wind funnelling and the loss of views from public places to foreshores	Section 6.6 Section 6.7
	(iii) the visual amenity and scenic qualities of the coast, including coastal headlands	Section 6.7
(iv) Aboriginal cultural heritage, practices and places	Section 6.7	
(v) cultural and built environment heritage	Section 6.7	

## 4.1.2 Local Environmental Plans

### **Sutherland Shire Local Environmental Plan 2015**

The proposal would be located within the Sutherland Shire LGA and development within this area is controlled by Sutherland Shire Council under the Sutherland Shire Local Environment Plan (LEP) 2015. The proposal including the Governor Game Lookout ancillary facility and the Garie Road ancillary facility would be located on land zoned C1-National Parks and Nature Reserves.

Clause 2.109 of the SEPP (Transport and Infrastructure) permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. The proposal is therefore permitted without consent from Sutherland Shire Council. Land zoning for the proposal area is outlined in Figure 4-2.

### **Wollongong Local Environmental Plan 2015**

The temporary NPWS helipad ancillary facility would be located within the Wollongong LGA, with development in this area controlled by Wollongong City Council under the Wollongong Local Environment Plan (LEP) 2009. This ancillary facility would be located on land zoned C1-National Parks and Nature Reserves. Land zoning for the proposal area is outlined in Figure 4-2.

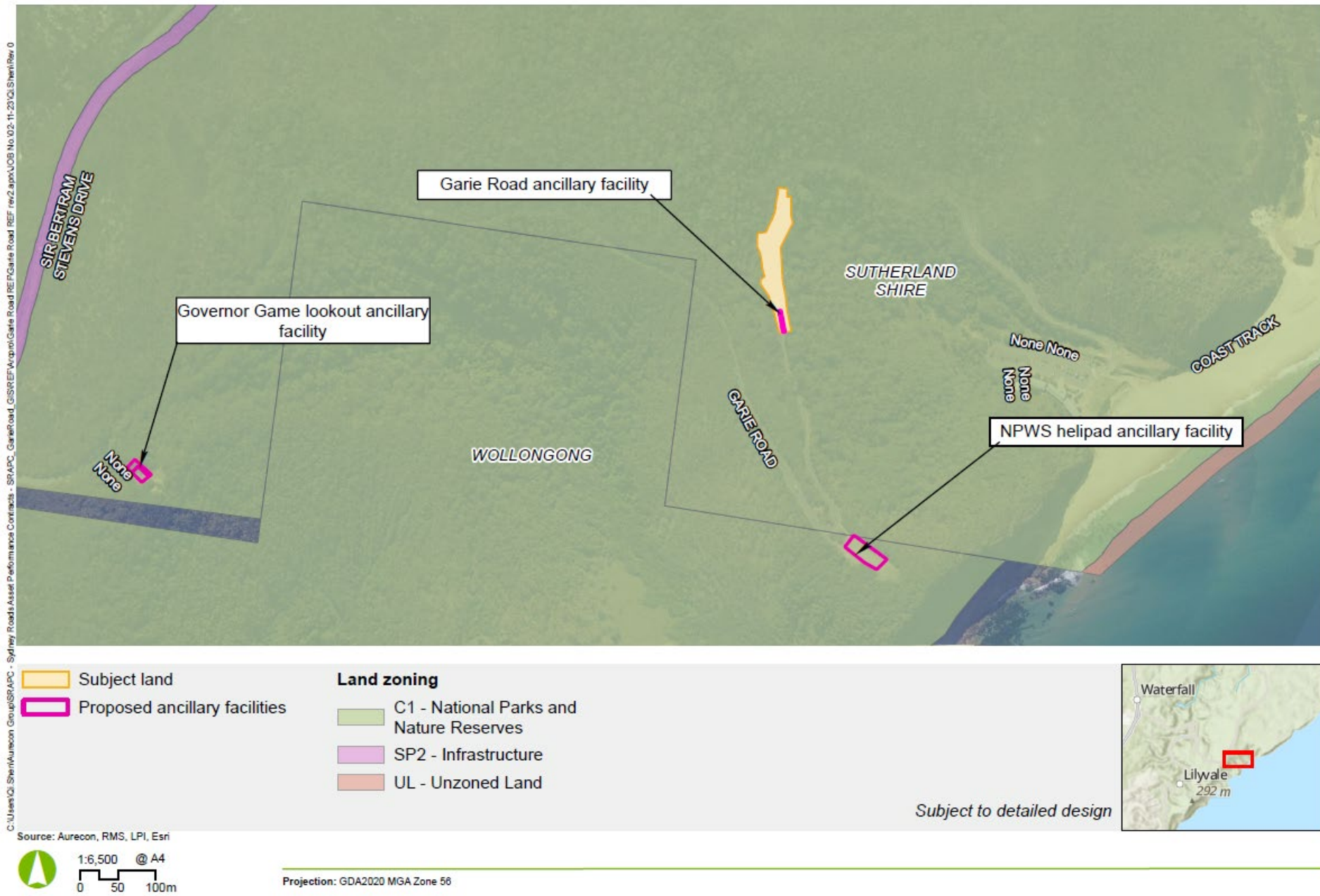


Figure 4-2 Land zoning of the proposal area and the ancillary facilities

## 4.2 Other relevant NSW legislation

### 4.2.1 Roads Act 1993

The *Roads Act 1993* (The Roads Act) provides guidance on the use and access of public roads, including procedures regarding the opening and closure of public roads. The Act also classifies roads and identifies the functions of road authorities.

The *Roads Act* states that a road authority may carry out road work on any public road for which it is the road authority and on any other land under its control (Division 1, Clause 71). If the road is not under the control of the authority carrying out the works, then consent is required.

The proposal is located on roads that are managed by Transport. A ROL would be required from the Traffic Management Centre by the Contractor for road works and any temporary road closures during construction of the proposal.

### 4.2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) regulates land, air, noise and water pollution in NSW. It also aims to provide opportunity for increased public involvement and access to information regarding environmental protection.

An environment protection licence (EPL) is required for scheduled activities or scheduled development work outlined in Schedule 1 of the POEO Act. The following scheduled activities apply to road projects:

- Road construction if it results in four or more traffic lanes (not including bicycle lanes or lanes used for entry or exit), where the road is classified or proposed to be classified as a main road for at least three kilometres of its length in the metropolitan area, and for at least five kilometres in any other area
- Road construction resulting in four or more traffic lanes, where road is classified or proposed to be classified, as a freeway or tollway for at least one kilometre in a metro area
- Extractive activities, where excavation required for the proposal is greater than 30,000 tonnes per year
- Cement or lime handling, meaning the handling of cement, fly ash, powdered lime (other than agricultural lime) or any other similar dry cement products.

The proposal does not meet any of the criteria for an EPL. Therefore, an EPL would not be required for the proposal.

### 4.2.3 National Parks and Wildlife Act 1974 (NPW Act)

The *National Parks and Wildlife Act 1974* (NPW Act) aims to conserve nature, habitat, ecosystems, ecosystem processes and biological diversity at the community, species and genetic levels. The proposal is consistent with the objects of the Act and is needed to protect existing infrastructure.

The proposal is permissible under the NPW Act in line with Section 39 of the NPW Act which states that the reservation of land does not impact the uses permitted under existing interest. Given the road and the associated modified slope (that is, the cutting) are considered existing interests, the proposal is therefore considered permissible under the NPW Act.

The NPW Act also provides legislative protection for Aboriginal heritage in NSW. Part 6, Section 86 of the Act refers to Aboriginal objects and places and prevents persons from impacting on an Aboriginal place or relic, without consent or a permit. An Aboriginal heritage impact permit (AHIP) is required under Section 90 of the NPW Act to harm an Aboriginal heritage object. Consideration of Aboriginal heritage has been carried out in section 6.7.

The proposal is partially located on land contained within the Royal National Park under the *National Parks and Wildlife Act 1974* (NPW Act). It is permissible under the NPW Act in line with the management principles outlined in Section 30E of the NPW Act. Under Section 81(4) of the NPW Act, all operations carried out on national park land have to be in line with any plan of management adopted for that park. In line with Section 81, the proposal is consistent with the Royal National Park, Heathcote National Park and Garawarra State Conservation Area Plan of Management.

### Consistency with NPWS policies

NPWS have a variety of policies that are designed to protect native plants, animals and ecosystems while meeting the needs of business operators and visitors. The policies typically cover how visitors should conduct themselves within national parks and reserves in order to protect native plants, animals and ecosystems. They also dictate how National Parks and Wildlife Service and businesses operate within reserves and their responsibilities, as well as the responsibilities of neighbours and visitors.

The proposal would be constructed in line with the following policies (Table 4-2).

Table 4-2 Consistency with NPWS policies

Policy name	How proposal is consistent
<b>Developments adjacent to National Parks and Wildlife Service lands Policy (NPWS 2020)</b>	The proposal is consistent with this policy as part of the proposal is located within the road corridor. Transport would consider and assess environmental impacts on the Royal National Park, its values and NPWS management of the park. As part of this REF the key risks to NPWS land that have been identified by this policy have been assessed and mitigation measures proposed (refer to Chapter 6). The potential for cumulative impacts from this proposal immediately adjoining NPWS land have been considered as part of this assessment.
<b>Landslides and Rockfalls Policy (NPWS 2021)</b>	Through this policy, NPWS prioritises the protection of visitors, workers, and the local community from landslides and rockfalls, particularly within areas of high visitation. The proposal is consistent with this policy as the proposal design would help to minimise the risk of landslides and rockfalls to visitors travelling along Garie Road within the Royal National Park. The proposal would also improve the resilience of the existing infrastructure to minimise the potential for future damage. As part of this REF, Transport have implemented NPWS Landslides and Rockfalls procedures with the maintenance of Garie Road to further support NPWS duty of care to park visitors.
<b>Revocation, recategorisation and road adjustment Policy (NPWS 2017)</b>	The proposal is consistent with this policy as the road adjustments outlined in this REF would support the primary function, structural integrity, and safe use of Garie Road within the Royal National Park. In addition, the works as outlined in this REF would not result in a significant reduction in size or value of the reserved land within the Royal National Park.
<b>Vehicle access Policy (NPWS 2021)</b>	This policy outlines NPWS management of safe vehicle access to parks for visitors and staff while limiting impacts on the park environment. The proposal is consistent with this policy as it would reinstate Garie Road with the aim to re-open the road and to continue to provide safe vehicular access to Garie Beach and other areas throughout the national park. Transport would consider the impact to the park environment in the selection and further development of the proposal design. The proposal would improve road infrastructure resilience to promote safety for present and future road users within the Royal National Park and minimise impacts to the local park environment.
<b>Visitor safety Policy (NPWS 2017)</b>	The proposal is consistent with the following policy as the proposal would improve road safety for all road users within the Royal National Park. The proposal would also improve existing road infrastructure resilience, minimising the potential for future damage under similar weather events. The proposal would support NPWS duty of care to visitors by allowing continued safe access to the national park.

### 4.2.4 NSW Wilderness Act 1987

The objectives of the NSW Wilderness Act 1987 are:



- to provide for the permanent protection of wilderness areas;
- to provide for the proper management of wilderness areas; and
- to promote the education of the public in the appreciation, protection and management of wilderness. The proposal is not located within an area listed under the *NSW Wilderness Act 1987*.

The proposal is not located within an area listed under the *NSW Wilderness Act 1987*.

#### 4.2.5 *Biodiversity Conservation Act 2016 (BC Act)*

The *Biodiversity Conservation Act 2016 (BC Act)* seeks to conserve biological diversity, promote ESD, prevent extinction and promote the recovery of threatened species, populations and ecological communities and to protect areas of outstanding biodiversity value.

Section 7.3 of the BC Act and Part 7A of the FM Act require that the significance of the impact on threatened species, and endangered ecological communities is assessed using a five-part test. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared by an accredited assessor in line with the Biodiversity Assessment Method (BAM) (DPIE, 2020).

A total of three plant community types were recorded within and near to the proposal boundary. These included:

- PCT 3153: Illawarra Escarpment Bangalay x Blue Gum Wet Forest
- PCT 3155: Illawarra North-Pittwater Bangalay Moist Forest
- PCT 3134: Illawarra Seacliffs Littoral Rainforest.

Of these, only PCT 3134 contained a threatened ecological community, however this PCT was only found within a small area of the proposal area i.e. less than 0.004 hectares. PCT 3153 and PCT 3155 both did not contain a threatened ecological community.

PCT 3591 Southern Sydney Sheltered Forest is located directly adjacent to the Governor Game Lookout ancillary facility. PCT 3591 relates to NSW Southern Sydney Sheltered Forest TEC which is listed under the BC Act as an Endangered Ecological Community. For the purpose of this assessment, the area outside the ancillary facility is assumed to be the PCT 3591 TEC.

One species of threatened flora, the scrub turpentine, was found to occur on the north-eastern side of Garie Road. Habitat for the scrub turpentine is already segmented due to the existing road corridor and the proposal has been amended to avoid known locations of the species, meaning impacts to this threatened species would be minimal. All other threatened flora species with a moderate or high likelihood of occurring within the proposal area were not recorded during targeted surveys. Targeted fauna surveys were carried out for the red-crowned toadlet, which was not detected within the biodiversity assessment report study area. Further detail on the biodiversity impacts of the proposal can be found in section 6.1.

#### 4.2.6 *Waste Avoidance and Resource Recovery Act 2001*

The *NSW Waste Avoidance and Resource Recovery Act 2001* promotes the waste hierarchy to avoid resource consumption and implement resource recovery in the form of material reuse and recycling in preference to waste disposal. The Act acknowledges that certain materials present either human or environmental risk, requiring classification, treatment and disposal in line with specific waste management provisions. Waste generated during construction and operation of the proposal would be managed in line with the waste hierarchy and where required, disposed of in line with waste classifications and relevant legislation and guidelines.

#### 4.2.7 *Biosecurity Act 2015*

To prevent, eliminate and minimise biosecurity risks posed by biosecurity matter and carriers, the NSW Government established the *Biosecurity Act* in 2015, repealing the *Noxious Weeds Act 1993*. The *Biosecurity Act 2015* promotes biodiversity and the management of:

- Pests, diseases, contaminants, and other biosecurity matter that are economically significant for primary production industries

- Threats to terrestrial and aquatic environments arising from pests, diseases, contaminants, and other biosecurity matter
- Public health and safety risks arising from contaminants, non-indigenous animals, bees, weeds, and other biosecurity matter known to contribute to human health problems
- Pests, diseases, contaminants, and other biosecurity matter that may have an adverse effect on community activities and infrastructure.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant or who knows (or ought to know) of any biosecurity risk has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Weeds were identified across the proposal area and would be managed in line with the requirements of the Biosecurity Act. Further information is provided in section 6.1.

#### 4.2.8 *Rural Fires Act 1997*

The *Rural Fires Act 1997* (RF Act) aims to protect life and property through the following objectives:

- To prevent, mitigate and suppress bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts
- The co-ordination of bush firefighting and bush fire prevention throughout the State
- To protect persons from injury or death, and property from damage, arising from fires
- To protect infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires
- To protect the environment by requiring certain activities to be carried out having regard to the principles of ecologically sustainable development.

Under this Act, NPWS is the prescribed fire authority and is responsible for the control and suppression of all fires on lands that are under NPWS management. To assist in bush and other fire management, the fire management strategy provides information for managing outbreaks of fire, operational guidelines for hazard reduction work and information to help assess bushfire threats. The relevant fire management strategy for this proposal is the Royal and Heathcote National Parks and Garawarra State Conservation Area Fire Management Strategy (NPWS, 2016).

Part 4 of this Act deals with the prevention and minimisation of the spread of bushfires throughout the state. The potential for the proposal to be a bushfire risk is considered in section 6.7 of this REF. This proposal is consistent with the RF Act and the fire management strategy as it meets the objectives of minimising and preventing bush and other fires from this proposal. The proposal is also aiming to make Garie Road operational again and re-establish access to parts of the Royal National Park, which would assist with future fire-fighting efforts.

### 4.3 Commonwealth legislation

#### 4.3.1 *Environment Protection and Biodiversity Conservation Act 1999*

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix E and section 6.1 of this REF.

A referral is not required for proposed road activities that may affect nationally listed threatened species, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

Potential impacts to these biodiversity matters are also considered as part of section 6.1 of the REF and in Appendix E.

### Findings – matters of national environmental significance

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of Climate Change, Energy, the Environment and Water under the EPBC Act.

### Findings – nationally listed biodiversity matters (where the strategic assessment applies)

The assessment of the proposal's impact on nationally listed threatened species, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Section 6.1.4 of the REF describes the safeguards and management measures to be applied.

## 4.3.2 Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act a future act includes proposed public infrastructure on land or waters that affects native title rights or interest.

A search of the Native Title Tribunal Native Title Vision website was carried out, with one Native Title holder/claimant identified (South Coast People NC2017/003).

Notification to the Native Title Service for NSW and ACT Aboriginal Community does not in this instance apply as the substantive construction works as part of the proposed Garie Road works are within an area where native title has been extinguished, noting the Garie Road was constructed prior to 1993, and consistent with the definition of a "public work" under s253 and s251D of the Commonwealth Native Title Act 1993.

Under those provisions, a "public work" includes, relevantly:

- **the road carriageway;** and
- any adjacent land that was needed during the construction or establishment of the road;
- and
- any adjacent land that is needed for the operation of the road; and
- any **adjacent land that is, or was, connected or associated with** the construction, establishment or **operation of the road.**

Applying this definition:

1. The construction works for each Project are within the road carriageway itself, meeting the first limb of the definition copied above; and
2. In the case of the Garie Road, the works include stabilisation works of the adjoining land (to prevent a landslip) such that is "adjacent land" that is "connected...with the...operation of the road", which falls comfortably within the final limb of the definition above.

## 4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. This REF would be issued to NPWS to determine the portion of the proposal located on national park land as per Section 2.109 of the SEPP (Transport and Infrastructure).

The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the EP&A Act and the *National Parks and Wildlife Act 1974*.

Transport for NSW is the determining authority for the proposal outside of the Royal National Park and National Parks and Wildlife Service are the determining authority for the works within the National Park. This REF fulfils

Transport for NSW's obligation under Section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

The proposal is permissible under the NPW Act and fully consistent with the National Parks and Wildlife Services Policy.

## 5. Consultation

This chapter discusses the consultation carried out to date for the proposal and the consultation proposed for the future.

### 5.1 Consultation strategy

Transport has engaged with the community regarding the proposed works. Engagement activities for the proposal to date include:

- Media release in September 2022 regarding the closure of Garie Road and Garie Beach. The media release/notification letter detailed the closure of Garie Road until mid-2023 and detailed the ongoing public safety risks of the failed slope.
- Fortnightly meetings since September 2022 with National Parks Wildlife Service and Transport in attendance
- A workshop with Transport and NPWS was held on the 25<sup>th</sup> May 2023 to discuss key environmental issues of the proposal, particularly those that would impact NPWS land

### 5.2 Aboriginal community involvement

The potential Aboriginal heritage impacts of the proposal have been considered in line with the requirements of Transport's Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) (Roads and Maritime Services, 2011). Table 5-1 summarises the stages of the PACHCI.

**Table 5-1: Summary of Transport's Procedure for Aboriginal Cultural Heritage Consultation and Investigation**

Group	Issue raised
Stage 1	Initial Transport for NSW assessment
Stage 2	Site survey and further assessment
Stage 3	Formal consultation and preparation of a cultural heritage assessment report
Stage 4	Implement environmental impact assessment recommendations

A Stage 1 PACHCI has been completed for the proposal. Stage 1 PACHCI consultation was undertaken, with an assessment outcome letter issued on the 1<sup>st</sup> June 2023 (Appendix D). The AHIMS search showed no Aboriginal heritage sites or heritage items within the proposed work location and NPWS helipad ancillary facility. The assessment outcome letter identified that the proposal was unlikely to impact on Aboriginal cultural heritage (refer to Section 6.7 for more detail on Aboriginal cultural heritage). Disturbance of the ground surface or the removal of mature vegetation is not proposed as part of site establishment and operation of the Governor Game lookout and the Garie Road ancillary facility and therefore a Stage 1 PACHCI was not required for these locations.

A search of the Native Title Tribunal Native Title Vision website was carried out, with one Native Title holder identified (South Coast People NC2017/003). Transport would provide a notice of the proposal to NTSCORP under Section 24KA of the Act and would consult with NTSCORP regarding the proposal.

### 5.3 SEPP (Transport and Infrastructure) consultation

Appendix B contains a Transport and Infrastructure SEPP consultation checklist that documents how Transport and Infrastructure SEPP consultation requirements have been considered.

In line with the Transport and Infrastructure SEPP, the following agencies have been consulted about the proposal:



- National Parks and Wildlife Service (NPWS) under Section 2.15 of the SEPP.

Issues raised from this consultation are outlined in Table 5-2 below.

Table 5-2: Issues raised through SEPP (Transport and Infrastructure) consultation

Agency	Issue raised	Response / where addressed in REF
NPWS	<ul style="list-style-type: none"> <li>Flagged the presence of critically endangered species under the BC Act, Scrub Turpentine <i>Rhodamnia rubescens</i></li> <li>Foraging habitat of Powerful Owls</li> </ul>	<p>The proposal has been designed to avoid removing and/or impacting any of the identified Scrub Turpentine <i>Rhodamnia rubescens</i>. Impacts to the foraging habitat of the Powerful Owl would be negligible as there is only potential hunting habitat within the proposal footprint as no hollow bearing trees to be removed as part of the proposal. The proposal is not expected to have an impact on the livelihood of the species.</p> <p>The impact of the proposal to biodiversity is addressed in Section 6.1 of this REF and also in Appendix E Biodiversity Assessment Report</p>
	<ul style="list-style-type: none"> <li>Road realignment partially into the Royal National Park requiring the land to be acquired</li> </ul>	<p>Transport would continue to consult with NPWS to discuss the proposal encroachment of about 504 square metres into National Park Estate. Any potential property acquisition would be discussed and negotiated between Transport and NPWS after the REF has been determined.</p> <p>This is discussed in Section 3.6 Property acquisition.</p>
	<ul style="list-style-type: none"> <li>Existing stormwater harvesting/reuse system located within close proximity to the proposal footprint</li> </ul>	<p>Soil and erosion control measures would be implemented and would avoid sediment and contaminants leaving the site and entering nearby waterways and existing stormwater harvesting/reuse system.</p> <p>This is captured in Section 6.3.3 under Surface water, groundwater and flooding impacts</p>
	<ul style="list-style-type: none"> <li>Soil profiles separate during stockpiling at the NPWS helipad ancillary facility</li> </ul>	<p>Excavated material including spoil would be temporarily stored at the NPWS helipad ancillary facility. Soil profiles would be kept separate within the ancillary facility. This is discussed further in Section 3.4 Ancillary facilities and Section 6.2.4 Soil safeguards and mitigation measures.</p>
	<ul style="list-style-type: none"> <li>Planting densities including preferred species for the grassed swale</li> </ul>	<p>Planting of the grassed swale would be undertaken in consultation with NPWS. Planting densities as well as preferred species would be included as part of the Flora and Fauna Management Plan and/or the Tree and Hollow Replacement Plan.</p>
	<ul style="list-style-type: none"> <li>Asbestos present in the NPWS Helipad ancillary facility</li> </ul>	<p>Asbestos cement sheeting debris within a mixed gravel fill layer is present on the upper ground surface of the NPWS helipad ancillary facility. The asbestos contamination is sporadically located throughout the mixed gravel fill material across the area. The ground surface below the gravel fill material is comprised of a hard sandstone material, therefore unlikely that there would be any asbestos</p>

Agency	Issue raised	Response / where addressed in REF
		contamination below the immediate ground surface. Contaminated land is discussed under Section 6.2 Soils of this REF.
	<ul style="list-style-type: none"> <li>Discharge velocities of the new stormwater drainage infrastructure</li> </ul>	Water velocities have been provided to NPWS. As part of the proposal, a rock apron would be installed at the culvert outlet to reduce water speed as it leaves the culvert reducing the risk of erosion of the receiving downslope soil. Surface water impacts during operation is discussed under Section 6.3.3.

## 5.4 Government agency and stakeholder involvement

Various government agencies and stakeholders would be consulted about the proposal including:

- Sutherland Shire Council
- Garie Beach Surf Life Saving Club
- Garie beach holiday cabin residents.

Issues that have been raised from consultation with these agencies and stakeholders would be addressed by ConnectSydney.

## 5.5 Ongoing or future consultation

ConnectSydney would continue to consult and inform the community throughout the proposal on an as needed basis and provide contact details to the community in the event of enquiries or complaints.

## 6. Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of:

- Potential impacts on matters of national environmental significance under the EPBC Act.
- The factors specified in the guidelines Guideline for Division 5.1 assessments, DPE 2022 and as required under Section 171(1) of the Environmental Planning and Assessment Regulation 2021 and the *Roads and Related Facilities EIS Guideline* (DUAP 1996). The factors specified in Section 171(2) of the Environmental Planning and Assessment Regulation 2021 are also considered in Appendix A.
- Site-specific safeguards and management measures are provided to ameliorate the identified potential impacts.

### 6.1 Biodiversity

A biodiversity assessment report (BAR) has been produced for the proposal and can be found in Appendix E.

#### 6.1.1 Methodology

##### Background research

Background research was carried out to collect and review information relevant to the presence and likelihood of occurrence of threatened ecological communities, terrestrial and aquatic threatened species and their habitat, important habitat for migratory species and areas of outstanding biodiversity value. Searches were carried out in November 2022, September 2023 and October 2023 using NSW and Commonwealth databases, including the Atlas of NSW Wildlife (BioNet), the Threatened Biodiversity Data Collection (TBDC) and the Protected Matters Search Tool.

##### Vegetation assessment

Native vegetation within the proposal area has been mapped and classified in line with the Plant Community Type (PCT) classification system which is described in the BioNet Vegetation Classification (Veg-C). Vegetation mapping of the proposal area was ground-truthed by collecting rapid data points and plot floristic data in line with the BAM. Plot based data collected between 25 to 30 November 2022 was analysed and used to further refine vegetation mapping.

PCTs within the proposal area were assigned a condition class. The vegetation within the proposal area was intact and showed very little variation. Vegetation integrity scores from plot data, past disturbances to vegetation and the presence of exotic vegetation were used to assign vegetation zones to each PCT. No areas of non-native vegetation were found to occur within the proposal area.

In the context of plant community type classification, trees and shrubs have been classed as per BioNet Vegetation Classification. However, for the purpose of offsetting, trees have been defined in line with the Transport Tree and Hollow Replacement Guidelines (July 2022) and as per Australian Standard 4970-2209. A tree is considered a “Long lived woody perennial plant greater than (or usually greater than) 3 metres in height with one or relatively few main stems or trunks (or as defined by the determining authority)”.

##### Threatened species assessment

A threatened species habitat assessment was carried out as part of the BAR. The likelihood of occurrence ratings for each threatened species were allocated to reflect desktop and on-ground findings. BioNet, PMST and species credit species list (generated from BAM-C associated PCTs) were used to generate a list of potential threatened species that use the proposal area. Where background information, sightings records or targeted survey is lacking, the precautionary principle has been applied and a ‘moderate’ rating assigned. As the proposal area is within one kilometre of the coastline but consists entirely of bushland vegetation, threatened marine entities were excluded from the threatened species assessment.



Targeted surveys were carried out for all threatened flora considered as having a moderate or higher likelihood of occurrence. Surveys were conducted across several days on 28 November 2022, 1 December 2022, 8 December 2022, 9 February 2023, 10 March 2023 and 17 March 2023 and comprised a total of 74 person hours. Survey efforts consisted of parallel field traverses of 5 metre separation or less (surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method (DPIE, 2020)). All vegetation zones were searched except for the lower slope of the landslide that was unstable at the time of survey. Figure 6-1 shows the proposal area, study area as well as field survey locations Targeted fauna surveys were carried out for the Red-Crowned Toadlet (*Pseudophryne australis*) to rule out presence. As there is no breeding habitat to be impacted for birds and mammals and many of the species are ecosystem credit species under the BAM and do not strictly require survey, these species were not surveyed.

**Aquatic surveys**

One creekline (South Rill) occurs within the proposal area and was assessed for habitat features in line with the NSW DPI (Fisheries) *Policy and Guidelines for fish habitat conservation and management* (update 2013). Waterway habitat assessment was carried out on 28 November 2022.

**6.1.2 Existing environment**

**Landscape**

The landscape context of the proposal area and wider BAR study area is described in Table 6-1.

**Table 6-1 Proposal landscape features**

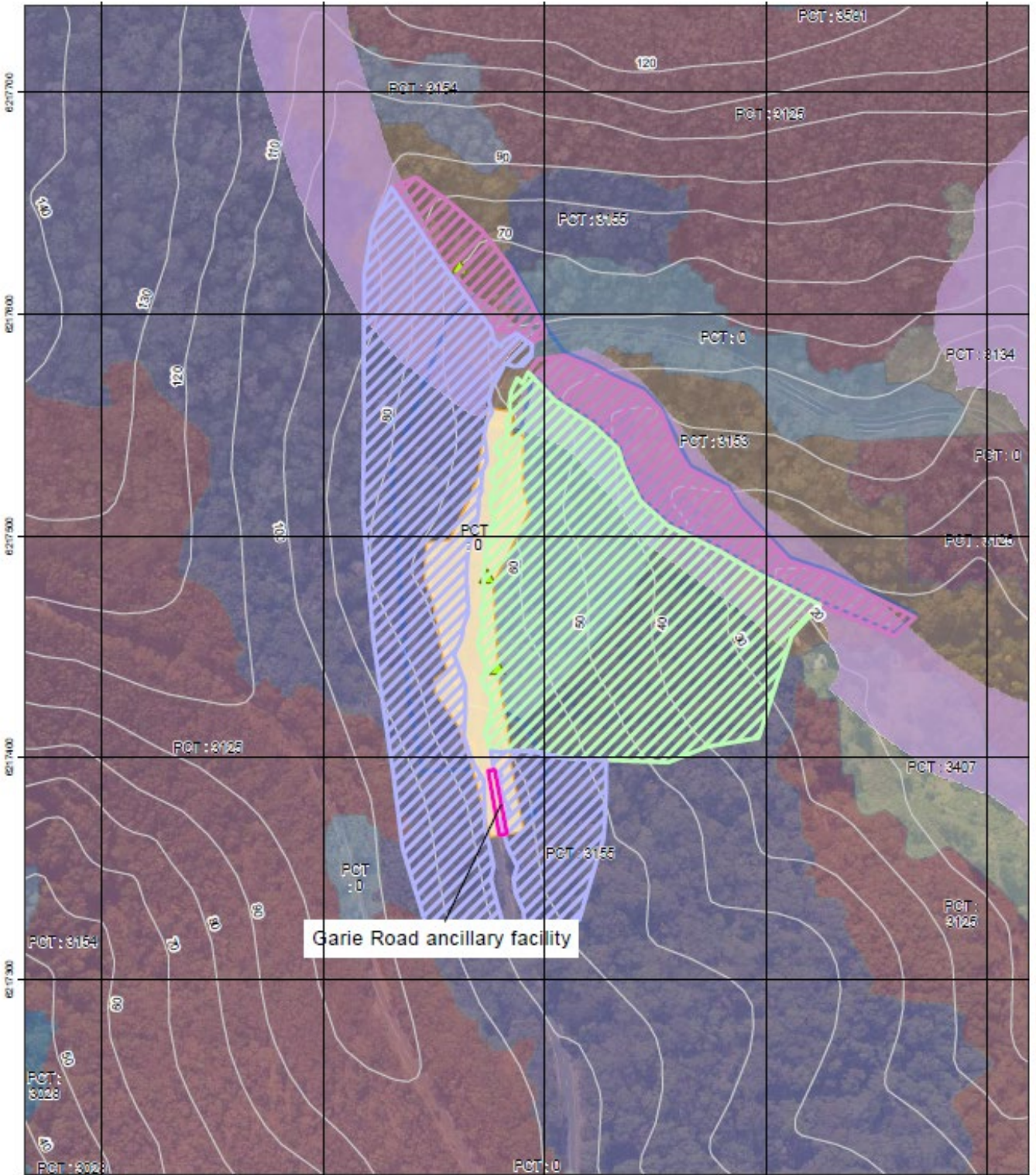
Landscape feature	Proposal area
IBRA bioregions and subregions	Sydney Cataract IBRA sub-region of the Sydney Basin Bioregion
NSW Landscapes Region (Mitchell Landscapes)	Woronora Plateau: Extensive plateau occurring on triassic quartz sandstone. Locally steep valleys are present with a general elevation of 50 to 150 metres and local relief of 80 metres. Soils on slopes consist of gradational soils. Rocky outcrops are absent to rare on slopes.
Soils and geology	Hawkesbury Sandstone, Narrabeen Group and Quaternary (Holocene) geologies
Rivers and streams	Two waterways intersect Garie Road at the proposal area; South Rill and an unnamed ephemeral waterway.
Wetlands	No local or important wetlands are present within the proposal area. The Towra Point Nature Reserve is the closest wetland of international importance and is located around 20 kilometres north of the proposal area.
Areas of geological significance and soil hazard features	Acid Sulphate Soils are not expected to be encountered in the proposal area (including the nominated ancillary facility).
Key fish habitat	South Rill does not meet the threshold for key fish habitat under the Policy and guidelines for fish habitat conservation and management (DPI, 2013).

**Plant community types and vegetation zones**

Three PCTs were observed within the proposal area and are outlined in Table 6-2 and Figure 6-1 below. The proposal area includes the construction and operation footprint of the proposal, while the BAR study area includes the proposal area and a 10-metre buffer.

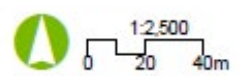
Table 6-2 Plant community types and vegetation zones within the proposal area

Veg zone	Plant community type (PCT)	Threatened ecological community	Area (ha)		Area (ha) within RNP (as a subsection of previous column)	
			Proposal area	BAR study area	Proposal area	BAR study area
Zone 2	PCT 3153: Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Not a TEC	0.132 ha	0.478ha	0.018 ha	0.334ha
Zone 1	PCT 3155: Illawarra North-Pittwater Bangalay Moist Forest	Not a TEC	0.164 ha	0.776 ha	0.080 ha	0.624ha
Zone 3	PCT 3134: Illawarra Seacliffs Littoral Rainforest	BC Act, Endangered: Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South-East Corner Bioregions.  EPBC Act, Critically Endangered: Littoral Rainforest and Coastal Vine Thickets of Eastern Australia.	0 ha	0.004 ha	0 ha	0.002 ha



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<ul style="list-style-type: none"> <li> Hollow Bearing Trees - To be retained</li> <li> Subject land</li> <li> Proposed ancillary facilities</li> <li>10m contour</li> <li><b>PCT (Plant Community Type)</b></li> <li> PCT : 0, Not classified</li> <li> PCT : 3028, Illawarra Escarpment Warm Temperate Rainforest</li> </ul>	<ul style="list-style-type: none"> <li> PCT : 3125, Illawarra Seaciff Banksia-Bangalay Forest</li> <li> PCT : 3134, Illawarra Seaciffs Littoral Rainforest</li> <li> PCT : 3153, Illawarra Escarpment Bangalay x Blue Gum Wet Forest</li> <li> PCT : 3154, Illawarra Blackbutt Moist Forest</li> <li> PCT : 3155, Illawarra North-Pittwater Bangalay Moist Forest</li> <li> PCT : 3407, Central Headland Grassland</li> </ul>	<ul style="list-style-type: none"> <li> PCT : 3591, Southern Sydney Sheltered Forest</li> <li><b>Biodiversity Values</b></li> <li> Biodiversity Values</li> <li> Biodiversity Values added in the last 90 days</li> <li><b>Survey</b></li> <li> Targeted Survey Location</li> <li> Unsurveyed</li> </ul>	<ul style="list-style-type: none"> <li><b>PCTs - Validated</b></li> <li> 3134 Illawarra Seaciffs Littoral Rainforest</li> <li> 3153 Illawarra Escarpment Bangalay x Blue Gum Wet</li> <li> 3155 Illawarra North-Pittwater Bangalay Moist Forest</li> </ul>
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Projection: GDA2020 MGA Zone 56

SRAPC Garie Road

Figure 6-1 Plant community types and vegetation zones



### Threatened ecological communities

One threatened ecological community occurs within the BAR study area but outside the proposal area. PCT 3134 Illawarra Seacliffs Littoral Rainforest is listed under State and Commonwealth legislation. Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South-East Corner Bioregions is listed as Endangered under the BC Act 2016 and Littoral Rainforest and Coastal Vine Thickets of Eastern Australia is listed as Critically Endangered under the EPBC Act 1999.

PCT 3591 Southern Sydney Sheltered Forest is located directly adjacent to the Governor Game Lookout ancillary facility. PCT 3591 relates to NSW Southern Sydney Sheltered Forest TEC which is listed under the BC Act as an Endangered Ecological Community. For the purpose of this assessment, the area outside the ancillary facility is assumed to be the PCT 3591 TEC.

The NPWS Helipad ancillary facility and the 'Little Garie Cabin Community' temporary parking location have not been surveyed and assessed during site inspections. These areas are associated with PCT 3407 Central Headland Grassland and PCT3125 Illawarra Seacliff Banksia-Bangalay Forest. The former of which is associated with BC Act listed TEC (Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions). However, this TEC is a grassland which is therefore unlikely to be associated with the surrounding vegetation, which is dense and taller.

The Garie Road ancillary facility would be located within PCT 3155 Illawarra North-Pittwater Bangalay Moist Forest. This PCT is not associated with a known TEC.

Key threatening processes that are involved with the proposal that have the potential to impact upon the TECs are listed below. None of these would occur directly within either of the TECs as they are all contained to the subject land (which does not directly incorporate the TEC associated with PCT 3134 nor PCT 3591).

- BC Act:
  - Clearing of native vegetation
  - Bushrock removal
  - Removal of dead wood and dead trees.
- EPBC Act
  - Land clearance

### Groundwater dependent ecosystems

No groundwater dependent ecosystems (GDEs) occur within the BAR study area. Four patches containing GDEs are mapped outside of the BAR study area and are unlikely to be impacted by the proposal.

### Threatened flora

Targeted surveys were conducted for all species that were considered to have a moderate or higher likelihood of occurring (Table 6-3) Targeted surveys revealed one threatened species within the proposal area, Scrub Turpentine *Rhodamnia rubescens* which is listed as critically endangered under the BC Act and the EPBC Act. A total of 16 individuals were observed on the north-eastern side of Garie Road. The indicative locations of the *Rhodamnia rubescens* can be seen in Figure 6-2. Separate surveys were conducted for the Bauer's Midge Orchid during its flowering season in March 2023. The species was not found within the BAR study area.



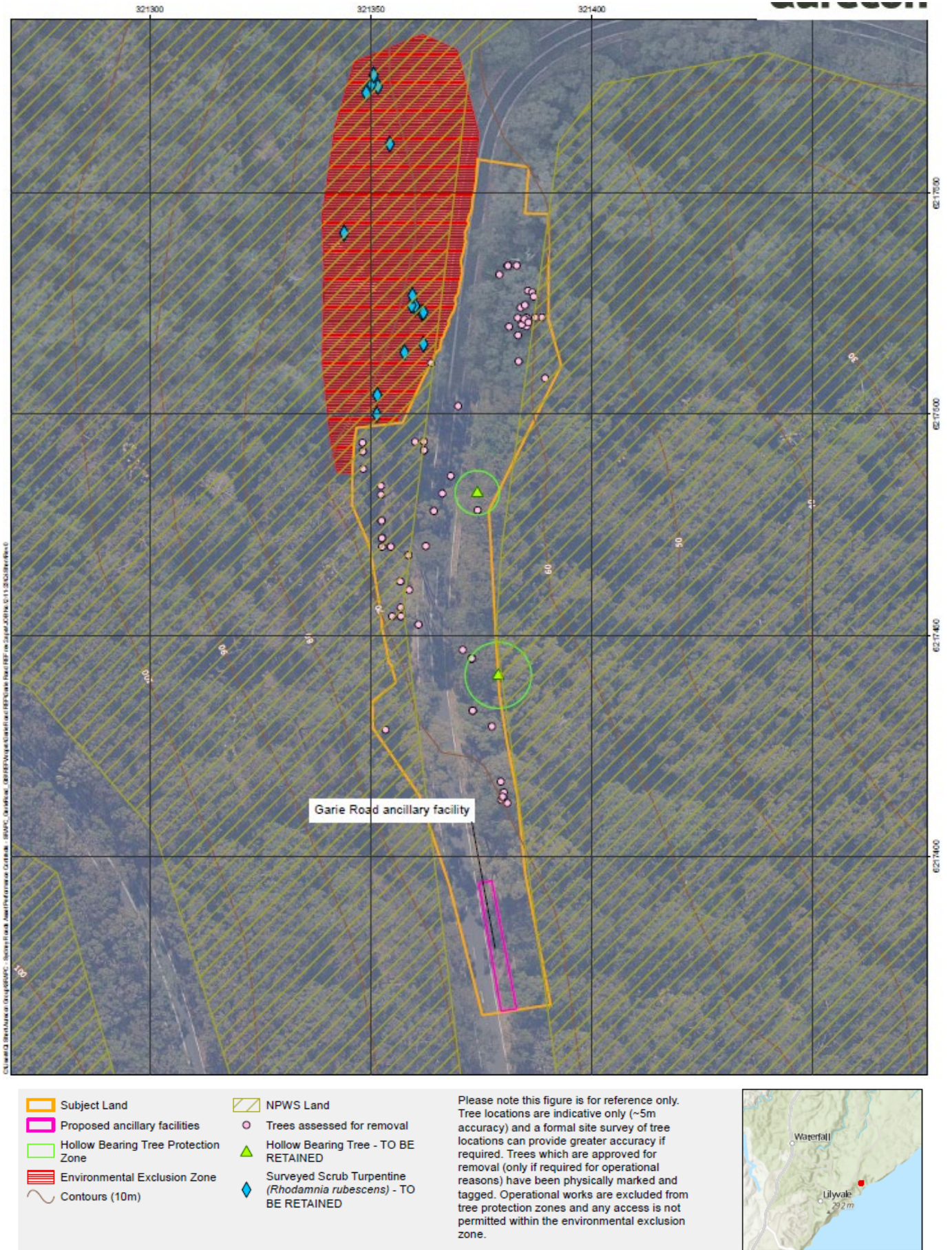


Figure 6-2 Locations of endangered plant species *Rhodamnia rubescens* and trees proposed for removal

Threatened flora survey results are outlined in Table 6-3.

**Table 6-3 Threatened flora survey results**

Species name	EPBC Act	BC Act	Identification method (not recorded, assumed, recorded, expert report)	Results
<i>Astrotricha crassifolia</i>	V	V	Not recorded	Marginal habitat present on the upslope but species not recorded after adequate survey.
<i>Prostanthera densa</i>	V	V	Not recorded	Marginal habitat present on the upslope but species not recorded after adequate survey.
<i>Callistemon linearifolius</i>	Not listed	V	Not recorded	Habitat present on the upslope, but species not recorded after adequate survey.
<i>Rhodamnia rubescens</i>	CE	CE	Recorded	A total of 16 individuals were recorded within the study area. They are located on the slope above Garie Rd in PCT 3155 Habitat for Scrub Turpentine occurs on the lower slopes beneath Garie Road. As the slope is considered unstable and prone to landside the area was not surveyed.
<i>Syzygium paniculatum</i>	V	E	Not recorded	Habitat present on the upslope, but species not recorded after adequate survey.
<i>Genoplesium baueri</i>	E	E	Not recorded	Marginal habitat present but species not recorded after adequate survey during flowering time (February to March).

### Threatened fauna

Habitat assessment and incidental surveys were carried out on 28 November 2022 to determine the likelihood of presence of threatened mammals, avifauna and amphibians. Several fauna species were considered to have a moderate or high likelihood of occurrence within the BAR study area.

A number of avifauna, bats and gliders were identified as having a moderate to high likelihood of occurrence. As no hollow bearing trees would be removed for the proposal, targeted surveys of these species were not deemed necessary. If hollow bearing trees are to be impacted by the proposal, further targeted surveys for these fauna groups and impact assessments would be required.

The Red-crowned Toadlet was considered to have a moderate likelihood of occurrence. Targeted aural-visual surveys were conducted across four dates in March 2023 (10 March, 17 March, 20 March and 22 March). Weather for these surveys was mostly dry however were after some rain events. Toadlet calls were played from speakers at various locations across the BAR study area and around South Rill. No evidence (visual or aural) of the Red-crowned Toadlet was identified on any of the four afternoons.



### Aquatic environment

The proposal area is located within the South Rill catchment, which is intersected by Garie Road. The vegetation surrounding the creekline is in high condition. The creekline has had several modifications including a small weir to dam water, pipes to supply water to infrastructure at Garie Beach and a culvert that lies beneath Garie Road. South Rill is a first order stream located about 16 metres from the proposal area at its closest point. It does not meet the threshold for key fish habitat under the Policy and guidelines for fish habitat conservation and management (DPI, 2013).

South Rill is 2 to 4 metres across, with a bank height of 1 to 2 metres. The reach contained no aquatic vegetation as the steep creekline was rocky and well shaded. Water was flowing within the creekline at the time of the survey and varied from 5 to 20 centimetres deep. The creek bed consisted of boulders, gravels and sand. Garie Road intersects the watercourse and a culvert transports water beneath the road. On the lower side of Garie Road, natural and artificial barriers to fish passage are present. Rock gabions have been installed to minimise erosion and enhance the stability of the creek bank and surrounding slope.

### Areas of outstanding biodiversity value

No areas of outstanding biodiversity value occur within the BAR study area or proposal area.

### Wildlife connectivity corridors

The proposal area is located partially within the Royal National Park which contains about 15,000 hectares of near continuous vegetation. A series of national parks and special areas (water catchments) link the proposal area to millions of hectares of bushland with minimal interruptions from barriers such as roads. The existing road alignment separates two large areas of the Royal National Park, however the existing road is unlikely to prevent fauna from traversing between the gap in bushland nor is it likely to impede the dispersal of flora. The proposal closely follows this existing road alignment.

## 6.1.3 Potential impacts

### Construction

During construction, the proposal could potentially diminish biodiversity values within the footprint. Further indirect impacts may occur extending beyond the proposal boundary. This section details the construction impacts from the proposal including clearing threatened species habitat. The location of vegetation removal can be seen in Figure 6-2 as well as in Appendix C Detailed Design and Staging Diagrams.

### Removal of native vegetation

As is detailed in Table 6-4, the proposal would involve clearing of 0.296 hectares of native vegetation. This includes 0.164 hectares of PCT 3155 and 0.132 hectares of PCT 3153. Neither PCTs within the proposal boundary are associated with any TECs.

Table 6-4 Summary of direct impacts on native vegetation

Plant community type (PCT)	Broad condition class	TEC	Area to be impacted (ha)	Area to be impacted (ha) within RNP only (as a sub-section of total area)
PCT 3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	High	No associated TECs	0.132 ha	0.018 ha
PCT 3155 Illawarra North-Pittwater Bangalay Moist Forest	High	No associated TECs	0.164 ha	0.080ha
<b>Total</b>			0.296	0.098

The vegetation surrounding the Governor Game Lookout ancillary facility is assumed to be a TEC (NSW Southern Sydney Sheltered Forest). The NPWS helipad ancillary facility is assumed to be a TEC (Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions). Direct and indirect impacts can occur with site establishment and operation of these ancillary facilities. Direct impacts would include trimming of small outer branches of trees to allow for access and egress as well as facilitate larger vehicle movement, however, no removal of vegetation is expected for the use of this facility. Trimming is to be restricted to smaller branches and no hollow bearing limbs. Indirect impacts such as the movement of pathogens, weeds and trampling of TEC may occur.

The Garie Road ancillary facility would be located within PCT 3155 Illawarra North-Pittwater Bangalay Moist Forest. Direct impacts to this PCT would include slashing of grasses only. However, no removal of trees would occur for the use of this ancillary facility. Indirect impacts include the potential spread of pathogens and weeds.

### Removal of threatened fauna habitat

Up to 72 trees across 0.296 hectares of vegetation would be removed which may provide habitat for several threatened species identified with a moderate or high likelihood of occurrence. Assessments of significance were conducted for these species (refer to Appendix D of the BAR). Table 6-5 provides a summary of the tree sizes proposed to be removed as part of the proposal.

Table 6-5 Sizes of trees to be removed

Species name		Very large tree (DBH ≥100cm)	Large tree (DBH ≥50 to <100cm)	Medium tree (DBH ≥20 to <50 cm)	Small tree (DBH ≥ 5cm to <20 cm)
Common name	Scientific name				
Hickory wattle	<i>Acacia implexa</i>	0	0	0	1
Bangalay	<i>Eucalyptus botryoides</i>	0	4	10	4
Grey ironbark	<i>Eucalyptus paniculata</i>	0	3	9	10
N/a	<i>Eucalyptus saligna x botryoides</i>	0	0	4	2
Cabbage tree palm	<i>Livistona australis</i>	0	0	6	3
Turpentine tree	<i>Syncarpia glomulifera</i>	0	0	7	8
Sydney red gum	<i>Angophora costata</i> subsp. <i>costata</i>	0	0	1	0
<b>Total</b>		<b>0</b>	<b>7</b>	<b>37</b>	<b>28</b>

The proposal would avoid impacting hollow bearing trees. If the hollow bearing tree within the BAR study area (or elsewhere) is to be impacted by the proposal, further surveys and impact assessments would be recommended to confirm the presence or absence of several threatened follow dwelling and dependent species.

As has been discussed in section 6.1.2, no evidence of the Red-crowned Toadlet was found after targeted surveys were carried out.

### Removal of threatened flora

Following identification of several scrub turpentines, the design of the proposal has been amended to avoid removing these plants. An exclusion zone has been placed around the area where they were identified with a minimum 2.5 metre buffer zone at its closest point within a larger fixed environmental exclusion zone. The condition of the Scrub Turpentine habitat may potentially reduce in quality from adjacent construction work. 0.296 hectares of PCT 3153 and PCT 3155 would be cleared noting that 0.016 hectares of this is within tree protection zones (and therefore may have residual impacts). However, no Scrub Turpentines were identified within the area that would be cleared. A BC Act test of significance and EPBC Act assessment of significance



were conducted indicating that there would not be a significant impact, despite potential direct impact to the closest Scrub Turpentines to the subject land.

No further threatened flora were identified. Therefore, minimal impact is expected to threatened flora. No mortality, removal or relocation is necessary or expected for threatened flora as a result of the proposal. Minor tree trimming may be required for the NPWS helipad ancillary facility, Governor Game Lookout ancillary facility, the Garie road ancillary facility, the proposal work area and the 'Little Garie Cabin Community' parking location about 75 metres north-west of the NPWS helipad ancillary facility with no further impact to flora.

A summary of direct impacts to threatened fauna is contained in Table 6-6.

**Table 6-6 Direct impacts on threatened fauna habitat**

Species name	EPBC Act	BC Act	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha or individuals)
<i>Astrotricha crassifolia</i>	V	V	Moderate	None	No impacts as species not detected
<i>Prostanthera densa</i>	V	V	Moderate	None	No impacts as species not detected
<i>Callistemon linearifolius</i>	Not listed	V	High	PCT 3155	No impacts as species not detected
<i>Rhodamnia rubescens</i>	CE	CE	Recorded	PCT 3155, PCT 3153,	No impacts as species not detected
<i>Syzygium paniculatu</i>	V	E	High	PCT 3153	No impacts as species not detected
<i>Genoplesium baueri</i>	E	E	Moderate	None	No impacts as species not detected

### Aquatic impacts

Drainage channels are located around 16 metres to the north (South Rill) of the proposal area and 350 metres to the south (Black Gin Gully) of the proposal area. Due to the distance of the proposal to these channels, and the implementation of soil erosion and sediment control measures from the commencement of construction, the risk of erosion and sedimentation impacting the efficiency of the drainage channels is negligible.

Construction activities may generate liquid and solid waste that, if not managed correctly, could potentially impact nearby waterways.

The current culvert does not provide fish passage. Therefore, removing the culvert during construction is not expected to impact aquatic dependent fauna. The provision of the new culvert follows similar drainage course and would not be expected to substantially change hydrology.

The proposal is not expected to have any construction impacts or changes to flooding regimes, shading regimes and temperature. Acid sulphate soils are not expected to be encountered in the proposal area (including the nominated ancillary facilities).

No earthworks are required for the ancillary facilities. Potential spills and leaks may occur from plant and equipment on site that if not appropriately prevented and managed could lead to aquatic impacts downstream.

### Injury and mortality

The proposal footprint is located largely within and directly next to the existing road corridor that travels through the Royal National Park. However, clearing of around 0.296 hectares of land is required to meet the objectives of the proposal noting that 0.016 hectares of this is within tree protection zones (and therefore may have residual impacts). When Garie Road was operational (i.e. prior to slope failure), it was not often

susceptible to heavy disturbance (in contrast to a road in a highly urbanised area for example). Injury and mortality would have occurred on occasion from road vehicles and it is possible that disturbance sensitive species are currently present in the area. In its current operation, Garie Road segments dense wet sclerophyll forests where fauna are highly likely to inhabit and therefore attempt to traverse.

It is likely that the highest risk of injury and mortality to fauna would occur during vegetation clearing where multiple trees, shrubs and other natural habitat would be impacted and cleared. However no hollow bearing trees would be impacted by the clearing.

The culvert that would be removed is unlikely to contain vertebrates due to its size and a build-up of debris.

Further, machinery and plant are also a source of fauna injury and mortality during construction. When Garie Road was operational, there would have likely been more injury and mortality impacts from road vehicles than is expected during construction.

### **Groundwater dependent ecosystems**

There are no GDEs within or directly next to the proposal footprint.

To further manage and mitigate potential impacts to GDEs in the broader landscape, standard sedimentation and erosion control measures would be put in place. In addition, no non-native grasses would be planted as part of the grass swale.

### **Operation**

#### **Edge effects on nearby native vegetation and habitat**

The removal of 0.296 hectares of native vegetation would increase the edge to core ratio. However, the proposal area is within the Royal National Park in a largely undisturbed area of dense native vegetation and is parallel to the existing roadway. Increasing the edge to core ratio can encourage more weed growth and decrease foraging habitat. Linear infrastructure developments are known to cause negative impacts associated with edge effects and habitat fragmentation. However, design of the proposal has meant that the road would largely follow the footprint of the existing road with minimal additional clearing. Therefore, this impact is expected to be minimal.

#### **Wildlife connectivity and habitat fragmentation**

The proposal would not create new fragments within the Royal National Park. The distance between fragments either side of the existing road would increase as a result of 0.296 hectares of clearing (necessary to meet the objectives of the proposal). While the proposal is a linear infrastructure development, it follows a similar footprint to the existing road, which would not fragment vegetation and wildlife connectivity further.

The Royal National Park is known for its range of wildlife. The existing culvert is unlikely to provide habitat or passage for wildlife due to its small size and build-up of debris, however new culvert design should consider the potential for fauna movement. Mobile species such as birds would unlikely be impacted by the minor increase in gap between areas of bushland and the slight road realignment. Less mobile fauna species would still be able to traverse the gap. The proposal is not expected to prevent the dispersal of flora. Reinstating access to Garie Beach is expected to return road use to pre-slope failure levels. Therefore, there is not expected to be an increase in operational traffic, meaning there would not be an expected increase in roadkill.

#### **Injury and mortality**

Garie Road is a two-way road that, when operational, may lead to injury and mortality of fauna due to motor vehicles. However, the proposal in operation is not expected to encourage more traffic to the area. Therefore, the proposal would not have a negative change from the existing environment (prior to the slope failure).

Fauna fencing is not included in the current design and is not considered necessary to be implemented.

#### **Invasion and spread of weeds**

Clearing vegetation and soil disturbance, including machine work, may result in an increase in the invasion and further spread of exotic flora throughout the native vegetation patches. Machinery may colonise weed propagules which would exacerbate weed growth. This could lead to lowering the native vegetation condition.

Several annual, biannual and perennial weeds were identified along the existing road edge such as Crofton weed and Spear thistle. However, the proposal area is largely undisturbed and less weeds were located

further from the road edge. Mitigation and weed control measures, during and following construction, would reduce the potential for the invasion and spread of weeds.

### **Invasion and spread of pests**

Proposal activities have the potential to disperse pests out of the proposal area. Machinery that enters the site should be subject to biosecurity controls including cleaning to remove potential pest species to limit any that may be transported into the proposal and surrounding area. The impact is likely to be low and mitigation measures are likely to be effective.

### **Invasion and spread of pathogens and disease**

Myrtle rust is known to have infected all scrub turpentines within the vicinity of the proposal area. These individuals would not be directly impacted by the proposal.

As well as myrtle rust, phytophthora (*phytophthora cinnamomi*) and chytrid fungus (*batrachochytrium dendrobatidis*) are also known in NSW to impact biodiversity as a result of transferal and infection through construction. All these pathogens should be treated as a potential risk during construction. Pathogen dispersal most commonly occurs through earthworks, movement of soil, and plant matter attaching to vehicles and equipment during construction and operation.

As myrtle rust is known to be detrimental to the health of scrub turpentines, it is also important to ensure that this fungus and other potential pathogens are not spread from the proposal site as there are other populations of scrub turpentine are within the Royal National Park. Therefore, mitigation measures should be implemented to prevent the spread of myrtle rust to these populations or any other populations of plants in the family *myrtaceae* that might be susceptible to the fungus.

Spread of pathogens and disease would be managed in line with the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011). The main mitigation measure to minimise the spread of pathogens would be ensuring there is no access within the scrub turpentine exclusion zone prior to or during construction.

### **Changes to hydrology**

The proposal design does not result in any major direct changes to hydrology. Given the proposal is located on a steep incline, no indirect impacts to hydrology are expected upslope. However, construction of the proposal would likely impact downslope from plant and equipment. Sedimentation and erosion from construction may cause substantial changes in flow rates in South Rill, in turn negatively impacting ecosystem functioning.

### **Noise, light, dust and vibration**

The existing environment is relatively undisturbed meaning there is little artificial light, dust, noise and vibration with the exception of road vehicles that pass through. Operation of the proposal would not increase traffic generation when compared to the pre-slope failure existing environment. Therefore, there is not expected to be an increase in operational noise, light, dust and vibration.

### **Conclusion on significance of impacts**

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation Act 2016* or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required.

The proposal is not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.



## 6.1.4 Safeguards and management measures

Table 6-7 Biodiversity safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing
B1	Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in line with Transport for NSW's Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas</li> <li>requirements set out in the Landscape Guideline (RMS, 2008)</li> <li>pre-clearing survey requirements</li> <li>procedures for unexpected threatened species finds and fauna handling</li> <li>procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013)</li> <li>protocols to manage weeds and pathogens.</li> </ul>	Transport / contractor	Detailed design / pre-construction
B2		Measures to further avoid and minimise native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Transport / contractor	Detailed design / pre-construction
B3	Removal of native vegetation	<p>Pre-clearing surveys will be carried out in line with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). An ecologist and/or fauna handler would be required to be on site. The location of any hollow-bearing trees (HBTs) is to be re-confirmed prior to construction.</p>	Contractor	Pre-construction
B4		<p>Vegetation removal will be carried out in line with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Trees assessed for removal will be marked with spray paint. However, where possible, trees would only be removed if necessary for operational reasons. Trees not marked are not permitted to be removed.</p>	Contractor	Construction
B5		Native vegetation will be re-established in line with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity</i>	Transport / contractor	Post construction

No.	Impact	Environmental safeguards	Responsibility	Timing
B6		<p><i>Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).</p> <p>The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.</p>	Contractor	Construction
B7		<p>If trimming is required, this must be conducted in accordance with Australian Standard AS 4373-2007. Trimming is to be limited to small outer branches of trees that do not contain fauna habitat features (i.e. hollows and/or nests). If trimming is expected to impact the structural integrity of the tree further impact assessment would be required. Trimming is to be limited to the below locations:</p> <ul style="list-style-type: none"> <li>• Governor Game Lookout ancillary facility</li> <li>• NPWS Helipad ancillary facility</li> <li>• Understorey vegetation removal at the 'Little Garie Cabin Community' temporary parking location about 75 metres north-west of the NPWS helipad ancillary facility road shoulder on Garie Road 70 metres from the NPWS Helipad ancillary facility to provide additional temporary parking for the 'Little Garie Cabin Community'</li> <li>• Proposal work zone</li> </ul>	Transport Contractor	Construction
B8		<p>Vegetation surrounding the ancillary facilities is to be marked out with exclusion fencing. No plant, equipment, personnel etc are to go beyond the exclusion fencing and onto any vegetation, with the exception of minor tree trimming (see above mitigation measure), without further ecological surveys and assessment. Consequences of damage and impact to the plant community assumed to be a TEC will be discussed during toolbox talks and non-conformances to be reported to Transport.</p>	Contractor	Prior to construction Construction
B9		<p>In accordance with the TfNSW Tree and hollow replacement guidelines, tree and hollows that require replacement will be identified prior to the commencement of works and:</p> <ul style="list-style-type: none"> <li>• A Tree and Hollow Replacement Plan will be prepared to address the impacts prior to the commencement of works; OR</li> <li>• Payment will be made to a Conservation Fund</li> </ul>	Transport / contractor	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
B10	Removal of threatened fauna habitat	If fauna is encountered, they will be managed in line with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction
B11		Habitat will be replaced or reinstated in line with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Already fallen or cutdown logs, trees or stags should not be mulched and/or taken offsite. Instead, they should be placed around site particularly closer to flattened areas. They should not be reinstated in environmentally sensitive areas including areas along and directly next to South Rill.	Transport / contractor	Construction
B12		No hollow bearing trees would be impacted by the proposal. If the hollow bearing tree located within the proposal area or any other hollow bearing tree is to be impacted, further survey and impact assessment would be recommended to determine impacts to hollow dwelling and hollow dependent threatened fauna. Where assessed hollow bearing trees are to be removed, they are to be replaced as per the <i>Tree and Hollow Replacement Guidelines</i> (Transport 2022b).	Transport / contractor	Pre-construction / construction
B13	Removal of threatened flora	An environmental exclusion zone will be placed around identified threatened flora (scrub turpentine) within which a minimum 3.5 metre buffer around each individual is also to be established. Consequences of damage and impact to listed threatened species will be discussed during toolbox talks with all non-conformances to be reported to Transport.	Transport / contractor	Pre-construction / construction
B14	Aquatic impacts	Potential impacts to aquatic habitat will be minimised through detailed design to limit the potential for erosion. Mitigation measures to control sedimentation and drainage impacts will be implemented prior to the commencement of construction and would be maintained throughout the construction period in line with the NSW 'Blue Book' <i>Managing Urban Stormwater: Soils and construction - Volumes 1 and 2C</i> (NSW Government, March 2004; DECC, 2008).	Transport / contractor	Detailed design / construction
B15		Aquatic habitat will be protected in line with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and</i>	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		<i>guidelines for fish habitat conservation and management Update 2013</i> (DPI (Fisheries NSW) 2013).		
B16	Changes to hydrology and groundwater dependent ecosystems	Changes to existing surface water flows and interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design to limit the potential for erosion.	Transport / contractor	Detailed design / construction
B17	Edge effects on nearby native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in line with <i>Guide 2: Exclusion zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Transport / contractor	Detailed design / construction
B18		<p>Tree Protection Zones (TPZs) will be placed around all hollow bearing trees. The two hollow bearing trees adjoining /within the proposal area (one <i>Eucalyptus botryoides</i> and one <i>Eucalyptus saligna x Eucalyptus botryoides</i>) require a TPZ. All protective measures for the TPZ around hollow bearing trees must be in accordance with the Australian Standard for the protection of trees on development sites (AS 4970-2009). Fencing around trees should be installed prior to site establishment (before any machinery or materials are brought on site) and should remain until the completion of works. The fencing should be approved by the project arborist/ecologist.</p> <p>Tree protection fencing should comply with the following requirements:</p> <ul style="list-style-type: none"> <li>• Fence post supports (e.g. star pickets) should have a diameter greater than 20 mm and should not impact surface tree roots</li> <li>• Fencing height minimum of 1.8 m</li> <li>• Shade cloth, paraweb, wire mesh panels or similar should be attached to the fencing posts</li> <li>• Signage should be installed stating “Vegetation Protection Zone - No Entry”</li> <li>• The tree protection fencing must remain in place until construction is completed</li> <li>• No vehicular or pedestrian access, trenching or soil excavation is to occur within the Tree Protection Zone</li> </ul> <p>No storage or dumping of tools, equipment or waste is to occur within the Tree Protection Zone.</p>	Transport / contractor	Detailed design / construction



No.	Impact	Environmental safeguards	Responsibility	Timing
B19	Invasion and spread of weeds	Weed species will be managed in line with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction
B20		The grass swale on the upslope of the design would be revegetated with native vegetation only with no exotic grass species. Low lying shrubs native to PCT 3155 could be included in the design such as <i>Lomandra filiformis</i> , <i>L. confertifolia</i> , and <i>L. longifolia</i> .	Contractor	Detailed design
B21	Invasion and spread of pests	Pest species will be managed within the proposal site.	Contractor	Construction
B22	Invasion and spread of pathogens and disease	Pathogens will be managed in line with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Daily biosecurity controls, as detailed in the contractors Construction Environmental Management Plan, are to be implemented for vehicles and equipment entering the site.	Contractor	Construction
B23	Noise, light, dust and vibration	Shading and artificial light impacts will be minimised through detailed design.	Transport	Detailed design
B24	Biodiversity Policy	The proposal will be undertaken in accordance with the TfNSW Biodiversity Policy, 2022.	Contractor	Pre-construction Construction

### 6.1.5 Biodiversity offsets

Table 6-8 details the assessment of direct impacts on native vegetation and threatened species habitat against the thresholds outlined in the 'No Net Loss Guidelines' (Transport, 2022b). Any biodiversity offsetting required for the proposal would be in accordance with the Transport for NSW Tree and hollow replacement guidelines (Transport 2022b).

**Table 6-8 Assessment of vegetation impacts against thresholds**

Veg zone	Plant community type (PCT)	Condition	TEC	Impact area (ha)	Threshold triggered?
Zone 2	PCT 3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	High	Not a TEC	0.132 ha	No. Tree replacement required.
Zone 1	PCT 3155 Illawarra North-Pittwater Bangalay Moist Forest	High	Not a TEC	0.164 ha	No. Tree replacement required.

Provided mitigation measures are followed, the proposal is unlikely to impact TECs, thereby the offsetting thresholds would not be triggered under the No Net Loss Guidelines. Clearing of threatened species habitat

does not exceed one hectare, therefore the threshold relating to threatened flora and species credit fauna species has not been reached.

As biodiversity offsetting scheme thresholds have not been triggered under the No Net Loss Guidelines, a biodiversity offset strategy is not required. However, a Tree and Hollow Replacement Plan would be prepared in accordance with the Transport for NSW Tree and hollow replacement guidelines (Transport 2022b).

## 6.2 Soils

### 6.2.1 Methodology

The methodology for this assessment included a desktop review of the proposal area on 30 September 2022, including a review of:

- geology, soil and topography
- acid sulfate soil (ASS) risk map
- NSW Environment Protection Authority (EPA) databases on the contaminated land record.

### 6.2.2 Existing environment

#### **Geology, geomorphology and topography**

The desktop review of the proposal area identified the soil and geological landscapes are predominantly comprised of the Hawkesbury landscape, with portions located within the Watagan landscape. The NPWS helipad ancillary facility and Garie Road ancillary facility soil and geological landscape was comprised of Hawkesbury landscape, with the Governor Game lookout ancillary facility comprised of the Bundeena landscape. Both the Hawkesbury and Watagan landscapes comprise of steep hills with slope gradients 20-70 per cent and 25-70 per cent respectfully. The Bundeena landscape comprises of slope gradients less than 20 per cent. These landscapes have also been identified as having a risk of extreme soil erosion, with Hawkesbury and Watagan landscapes having mass movement hazards. The potential for these hazards is increased with the presence of steep slopes and after severe weather events such as storms and when the soil is saturated.

#### **Contaminated land**

A search of the EPA's List of Contaminated Sites Notified to the EPA (as of 1<sup>st</sup> August 2023) was carried out which indicated there are no contaminated sites within 100 metres of the proposal area and ancillary facilities.

An Asbestos Risk Assessment and Management Plan was prepared for NPWS (Getex 2019) for the NPWS helipad ancillary facility to assess the risk of asbestos contamination. Site surveys found asbestos cement sheeting debris within a mixed gravel fill layer on the upper ground surface of the site. The asbestos contamination was assessed to be sporadically located throughout the mixed gravel fill material across the site. The ground surface below the gravel fill material were assessed to be of a hard sandstone material, therefore it was considered unlikely that there would be any asbestos contamination below the immediate ground surfaces.

#### **Soil types and properties**

A desktop review of Acid Sulphate Soils mapping revealed that it is unlikely to encounter Acid Sulfate Soils (ASS) in the proposal area, including the nominated ancillary facilities.

The proposal falls within the Hawkesbury, Watagan and Bundeena soil landscapes. The soil types, a brief description, the type of vegetation present and the portion of the proposal that would be located within National Parks Estate are displayed in Table 6-9 and Figure 6-3.

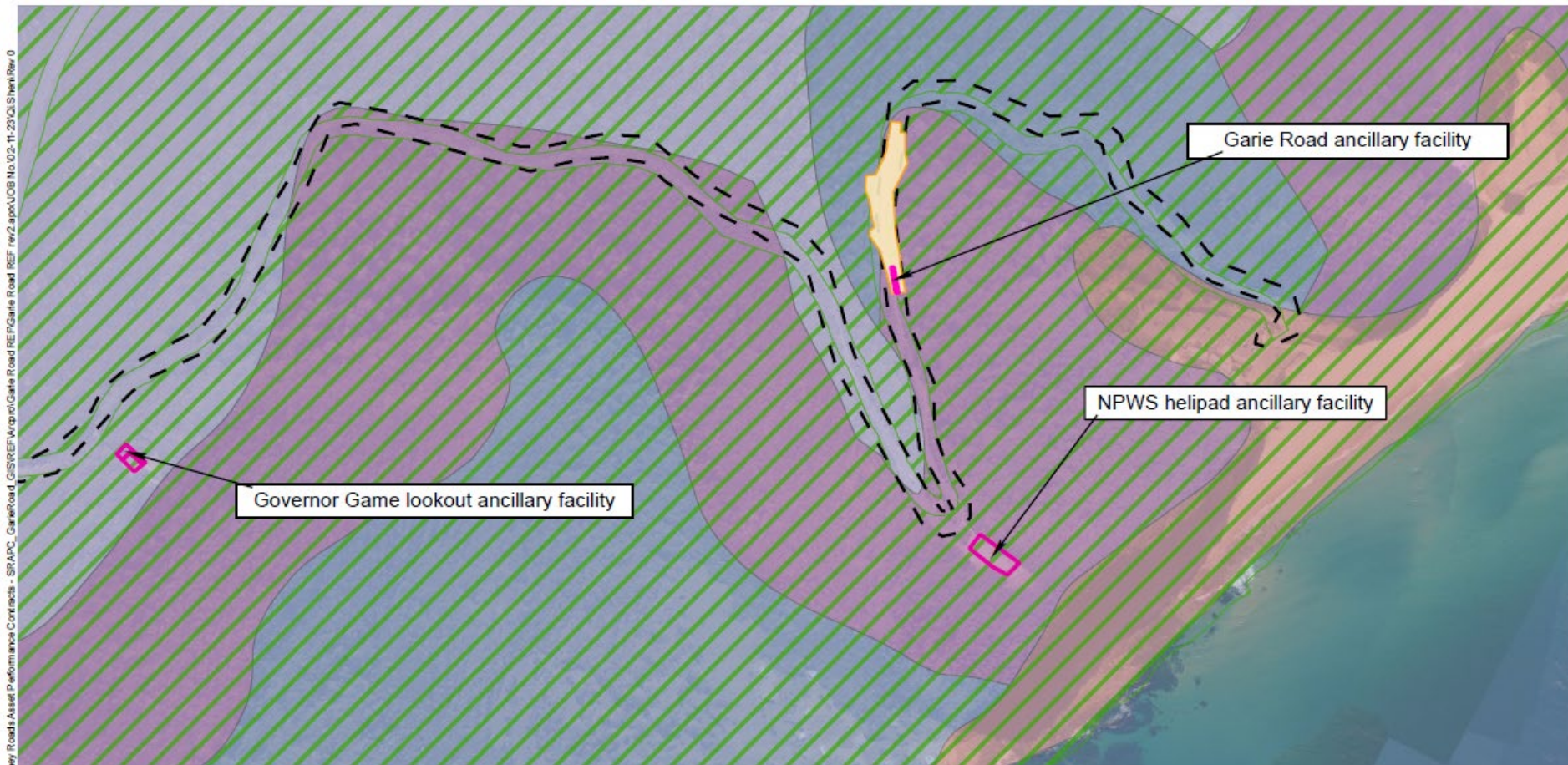
Table 6-9 Soil landscapes and vegetation present

Landscape	Description	Vegetation	Erodibility of soil	Portion of proposal located on NP Estate
Hawkesbury (9029ha)	<p>Landscape: Hawkesbury Sandstone— medium to coarse-grained quartz sandstone with minor shale and aminate lenses. Sandstones are either massive or cross-bedded sheet facies with vertical or sub vertical joint sets. The combination of bedding planes and widely spaced joints gives sand-stone outcrops a distinctive blocky appearance</p> <p>Rolling to very steep hills. Local relief 100–200 m, slope gradients 20–70%. Crests and ridge are convex and narrow, and &lt;100 metres wide. Slopes are moderately inclined to precipitous. Valleys are narrow (20-100 metres) and incised. Rock outcrop is common and occurs as horizontal benches and broken scarps up to 10 metres high. Rock outcrops and surface boulders and cobbles up to 50% of the ground surface.</p> <p>Soils: Shallow (&lt;50cm), discontinuous Lithosols/Siliceous Sands (Uc1.21, Uc6) associated with rock outcrop; Earthy Sands (Uc5.11, Uc5.23), Yellow Earths (Gn2.21) and locally deep sands on inside of benches and along joints and fractures; localised</p>	<p>Mostly uncleared woodland and open-forest (dry sclerophyll forest) with pockets of tall open forest (wet sclerophyll forest) and occasional closed-forest (rainforest) in sheltered gullies. On exposed crests and ridges woodland and open-forest contain red bloodwood, narrow-leaved stringybark, snappy gum, hard-leaved scribbly gum, blue mountains mallee ash and old man banksia. On the more sheltered sideslopes open-forest (dry sclerophyll forest) containing silvertop ash, Sydney peppermint, smooth-barked apple and black she-oak predominates. The understorey is dominated by shrub species of the families Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. Tall open-forest includes coastal white box, gull gum and yellow stringybark. Closed-forest occur along watercourses in sheltered narrow valleys. Emergent trees include blackbutt and Sydney blue gum. Water gum and occasional stands of coach-wood, black wattle, native myrtle and bracken often form a closed scrubby understorey.</p>	<p>The topsoil (ha1) has low erodibility. It consists of highly permeable, loose, coarse sands and organic matter. ha1 is highly susceptible to concentrated flow erosion, especially when the organic matter is removed by hot bushfires. ha2 and ha3 have moderate erodibility. They have low organic matter contents and weak fabrics. When coherent fabric is disrupted, these soils are highly erodible.</p>	<p>The proposal area, Garie Road ancillary facility and the 'Little Garie Cabin Community' temporary parking is located within this soil landscape does not encroach into NPWS Estate. However, the NPWS helipad ancillary facility would be located completely on National Parks Estate within this soil landscape.</p>



Landscape	Description	Vegetation	Erodibility of soil	Portion of proposal located on NP Estate
Watagan (9029wn)	<p>Yellow Podzolic Soils and Red Podzolic Soils (Dy4.11, Dr5.41, Dy5.21) associated with shale lenses; Siliceous Sands (Uc1.21) on narrow valley flats.</p> <p>Landscape: Narrabeen Group of sediments, mostly inter bedded aminate and shale with siltstone, red brown claystone and shale. The Clifton subgroup consists of quartz (often pebbly) and lithic sandstones and red, green and grey shales. Rolling to very steep low hills. Local relief is 50–150 m. Slope gradients are 25–70%. Crests and ridges are convex and narrow (10–20 m). Hill slopes are steep with talus slopes containing sandstone boulders. Occasional sandstone benches and colluvial benches are present. Slopes with gradients &gt;70% often have cliffs and scarps &gt;10 m high.</p> <p>Soils: Shallow to deep (30–200 cm) Lithosols/Siliceous Sands (Um6.2, Uc6.2) and Yellow Podzolic Soils (Dy4.41) on sandstones and steep sideslopes; moderately deep (100–200 cm) Brown Podzolic Soils (Dy3.21). Red Podzolic Soils (Dr3.41) on shales on moderately steep sideslopes. Gleyed Podzolic Soils (Dg2.21)</p>	<p>Mostly uncleared, tall open-forest (wet sclerophyll forest) and closed forest (Rainforest) in steep gullies and river valleys. Much of the native vegetation on the south coast headlands has been cleared. Open-forest and tall open-forests (dry and wet sclerophyll forest) grow on drier, more exposed, slopes and crests. Tree species include spotted gum, grey ironbark, Sydney blue gum, turpentine, bangalay, rough-barked apple and forest oak. Rainforest grows on sheltered slopes. Characteristic tree species include lilly pilly, cheese tree, coachwood, red cedar and cabbage tree palm.</p>	<p>wn1 has low erodibility, consisting dominantly of highly permeable coarse sand grains. The other soil materials have moderate erodibility. There is much sand bound in a porous and coherent fabric. Where wn4 is dispersible, it is highly erodible; otherwise, it has low erodibility.</p>	<p>About 504 square metres of the proposal area located on this soil landscape encroaches into National Park Estate on the western side Garie Road.</p>

Landscape	Description	Vegetation	Erodibility of soil	Portion of proposal located on NP Estate
	from shales where poorly drained.			
Bundeena (9029bu)	<p>Landscape: Very low rolling rises on exposed Hawkesbury Sandstone coastal headlands. Local relief up to 80 m; slope gradients &lt;20%. Ridges and crests are broad, up to 200 m wide. Gently inclined slopes with occasional benches up to 50 m wide. Small swamps and seepage areas are common on benches and along drainage lines. Rock outcrop occurs over 30–50% of the land surface</p> <p>Soils: Siliceous Sands (Uc1.2) and Earthy Sands (Uc5.3) occur on benches, with Yellow Earths (Gn2.21) on mid slopes and Gleyed Podzolic Soils (Dg4.21) on lower slopes. Acid Peats in areas of poor drainage [Acid Peats (O)].</p>	<p>Predominantly uncleared open-heath, closed-heath and scrub, with patches of eucalypt low woodland. Shrub she-oak and/or heath banksia may be locally dominant. Other shrubs such as spiky hakea may be locally dominant. Other shrubs such as spiky hakea may be locally dominant in areas subject to seepage or prolonged saturation. Shrub such as dagger hakea may be locally dominant in areas with impeded drainage. Shrub species diversity is high and includes various spider flowers, eggs and bacon, tea-tree and native health.</p> <p>Isolated occurrences of low eucalypt open woodland with scrub understorey. Red bloodwood, yellow-top ash and scribbly gum are common. Native trees rarely attain a height of 10 m.</p>	<p>Severe sheet erosion can occur when storms follow bushfires or when there is damage to or destruction of vegetative ground cover.</p> <p>Poorly planned and maintained roads, fire trails, walking tracks and bridle trails are subject to severe erosion, often to bedrock.</p>	The Governor Game lookout ancillary facility would be located completely on National Parks Estate within this soil landscape.

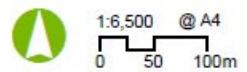


- Subject land
  - Proposed ancillary facilities
  - Assumed transport road corridor
  - National Parks and Wildlife Service (NPWS) Estate**
  - NATIONAL PARK
- | <b>Soil landscape</b>  |            |
|--|------------|
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #d8bfd8; border: 1px solid black; margin-right: 5px;"></span> | Bundeena   |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #9932cc; border: 1px solid black; margin-right: 5px;"></span> | Hawkesbury |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #6495ed; border: 1px solid black; margin-right: 5px;"></span> | Watagan    |
| <span style="display: inline-block; width: 15px; height: 10px; background-color: #ff8c00; border: 1px solid black; margin-right: 5px;"></span> | Wollongong |



*Subject to detailed design*

Source: Aurecon, RMS, LPI, Esri



Projection: GDA2020 MGA Zone 56

Figure 6-3 Soil landscapes within National Parks and the road corridor

Review of environmental factors (for national parks)



## 6.2.3 Potential impacts

### Construction

The overall impact of the proposal to soil would be low, adverse. Details of construction impacts to soil are outlined below.

#### Soil quality, land stability and drainage channels

The proposal would require removal of pavement and vegetation, stripping of topsoil and earthworks (removal of scarps, the creation of the access ramp and benches) and backfilling of earthworks that would expose soils and could potentially lead to erosion of soils and mobilisation of sediment to nearby creeks. This is of particular concern, as the soils landscapes in the area (Hawkesbury and Watagan) have extreme/severe soil erosion potential and a mass movement hazard. Garie Road has a steep unstable slope on the upslope and downslope which would increase the likelihood of soil mobilisation. As such, the likelihood for soils to move offsite during construction presents a moderate to high risk.

Vegetation removal as part of the proposal (72 trees across 0.296 hectares) would be required that would expose this area of soil and could lead to soil erosion. This has the potential to carry sediment to outside of the proposal footprint potentially polluting nearby waterways and drainage channels.

Drainage channels are located around 16 metres to the north (South Rill) of the proposal and 350 metres to the south (Black Gin Gully) of the proposal. However, due to the distance of the works to these channels, the risk of erosion and sedimentation impacting the efficiency of the drainage channels is low.

Where possible, backfilling and filling of the ground profile to design level would aim to reuse excavated material onsite. Backfilling and filling activities if not managed correctly may travel outside of the proposed footprint and pollute nearby waterways. Material would be appropriately stored and stabilised on site prior to its final location to avoid material going off site.

Erosion, sediment and water quality controls would be implemented and regularly maintained during the construction period to avoid any soil movement offsite to the surrounding sensitive environment and watercourses. Clean water from upslope of the proposal would be diverted around the site, and dirty water and sediment on site would be captured. For example, sandbags and sediment fencing may be used and would involve the construction of a weir-like system on the lower side of the slope for diverted water. Erosion and sediment controls would be nominated by the construction contractor, documented in an Erosion and Sediment Control Plan prior to construction in line with the 'Blue Book'.

#### Contaminated soils

The NPWS helipad ancillary facility contains asbestos cement sheeting debris within a mixed gravel fill layer on the upper ground surface of the site. This area is proposed to be used as an ancillary facility for the proposal, including using the area for a site office, storage of materials and temporary storage of excavated materials (about 4,480 cubic metres). There is a risk of personnel being exposed to asbestos during site establishment and ancillary facility operation. Activities that may expose personnel include movement of materials including spoil, movement of plant and equipment i.e. dirt and mud tracking and setting up of amenities. To ensure worker safety, the NPWS Asbestos Risk Assessment and Management Plan (Getex 2023) would be implemented at the NPWS helipad ancillary facility to manage the risk of asbestos.

Although it is not anticipated that additional contaminated soils would be encountered during construction, it is possible that unexpected areas of contamination are identified. If unexpected areas of contamination are found, the unexpected finds procedure would be followed as is outlined in the CEMP.

#### Ancillary facilities

All of the ancillary facilities would not require excavation and would use existing cleared areas. There would be no impact to soil quality or land stability during construction.

The key functions of the proposed NPWS helipad ancillary facility located on National Park land includes amenities, storage of materials, plant and equipment and a diesel generator to power the site and lighting towers. These activities have the potential to lead to contamination of soil as a result of accidental spills and leaks. The diesel generator would be double bunded to capture any accidental spills. Spill kits and detailed emergency spill management measures specific to each site would be available to reduce the impact in the

case of an accidental spill or leak. Proper storage procedures for the plant and equipment, as well as adequate bunding for fuel, oils and chemicals would be put in place to minimise the risk of soil contamination.

Concrete washout areas would also be required and established at the NPWS helipad ancillary facility. Concrete wash water is alkaline (pH of around 12) and contains high levels of chromium, with the potential to pollute surrounding land and further contaminate land within the ancillary facility if not managed properly. Concrete washout locations would be located away from sensitive environments i.e., surrounding vegetation and drainage channels, and adequately controlled with all wash downs contained within designated impervious bunding.

It is proposed to temporarily store excavated material, including spoil at the NPWS helipad ancillary facility. If not stored correctly, there is a risk of soil erosion from the ancillary facility to Little Garie Beach (about 190 metres) and Black Gin Gully (about 350 metres). However, due to the distance between the ancillary facility to these waterways, the risk of erosion and sedimentation impacting the efficiency of the drainage channels as well as polluting Little Garie Beach is considered low.

Additionally, given the ancillary facility would be next to the littoral rainforest buffer, sediment fencing would be installed around the ancillary facility to minimise impacts to nearby waterways of sediment-laden runoff during rainfall events.

The proposed Governor Game lookout ancillary facility located on National Park land would be used for site sheds, amenities and a diesel generator to power the site. A portion of the Governor Game lookout parking area would be used for personnel light vehicle parking. The diesel generator would be double bunded to capture any accidental spills. Spill kits and detailed emergency spill management measures specific to each site would be available to reduce the impact in the case of an accidental spill or leak.

The proposed Garie Road ancillary facility would be used for temporary site sheds and offices, an ablution block, equipment storage, a small diesel generator and a water tank. The diesel generator would be double bunded to capture any accidental spills. Spill kits and detailed emergency spill management measures specific to each site would be available to reduce the impact in the case of an accidental spill or leak.

### **Operation**

The proposal would stabilise the slope next to Garie Road. This would improve the resilience of the existing road infrastructure by stabilising the ground and reducing large scale soil erosion. The proposal would have long-term positive benefits to the environment from the improved stability of the slope. This would result in better outcomes for the nearby waterway as a result of decrease in likelihood for a similar slope failure event, moving soil and sediment into the nearby waterway.

During operation, the proposal would not have any ongoing impacts in relation to soil and contamination on both NPWS Estate and Transport owned land. As the NPWS helipad ancillary facility, the 'Little Garie Cabin Community' parking area, the Governor Game lookout ancillary facility and the Garie Road ancillary facility would be temporary and the areas reinstated to their original condition, no operational impacts are expected within these areas.

Overall, the operation of the proposal would have a neutral or beneficial impact on soil.



## 6.2.4 Safeguards and management measures

The following section provides a list of mitigation measures that should be applied during the proposal (Table 6-10).

**Table 6-10 Soil and contamination safeguards and management measures**

No.	Impact	Environmental safeguards	Responsibility	Timing
SGC1	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager	Contractor	Construction
SGC2	Contaminated land	The NPWS Asbestos Risk Assessment and Management Plan (Getex 2023) would be implemented at the NPWS helipad ancillary facility to manage the risk of asbestos	Contractor	Construction
SGC3	Accidental spill	Site-specific emergency spill-management measures will be developed in line with the Transport Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines.  The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport EPA officers).	Contractor	Construction
SGC4	Spill control	Spill Kits are located close to the works and maintained to ensure they are fully stocked.	Contractor	Construction
SGC5	Spill control – ancillary facilities	Ancillary facilities would minimise storage of fuel, oil, chemicals or other dangerous goods on site, through efficient and timely ordering	Contractor	Construction
SGC6	Spill control – ancillary facilities	Chemicals fuels, oils and chemicals to be stored inside impervious bunds of sufficient capacity to contain 110% of the stored volume.  Bunded areas must have sufficient cover to prevent ingress of rain and must have appropriate signage	Contractor	Construction
SGC7	Spill control – ancillary facilities	Materials removed from the bunded storage area for use are to be returned to the bund at the end of each shift	Contractor	Construction
SGC8	Spill control – ancillary facilities	No contaminated water to be discharged from bunded areas into site drainage system. Contaminated water to be removed by appropriately licensed contractor & taken to a suitably licensed waste facility.	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
SGC9	Erosion and Sedimentation	Erosion and sediment control measures, such as sediment fencing, would be implemented and maintained to: <ul style="list-style-type: none"> <li>Minimise sediment moving offsite and sediment laden water entering any water course, drainage lines, or drain inlets</li> <li>Reduce water velocity and capture sediment on site</li> <li>Minimise the amount of material transported from site to surrounding pavement surfaces</li> <li>Divert clean water around the site (in line with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).</li> </ul>	Contractor	Construction
SGC10	Erosion and Sedimentation	Erosion and sedimentation controls would be installed prior to construction and would then be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.	Contractor	Construction
SGC11	Erosion and Sedimentation	Erosion and sediment control measures would not to be removed until the works are complete, and areas are stabilised.	Contractor	Construction
SGC12	Erosion and Sedimentation	The maintenance of temporary stockpile sites near the worksite is to be in line with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10).	Contractor	Construction
SGC13	Erosion and Sedimentation	Implement measures to minimise tracking of dirt and mud into public roads and other public spaces	Contractor	Construction
SGC14	Erosion and Sedimentation	Use erosion and sediment controls, such as sandbag checks, to protect drainage channels and pits, as required	Contractor	Construction
SCG15	Erosion and Sedimentation	Pre and post rainfall inspections would occur to ensure controls are adequate prior to rain events, review effectiveness of controls and make necessary environmental control repairs.	Contractor	Construction
SCG16	Erosion and Sedimentation	An Erosion and Sediment Control Plan (ESCP) would be produced prior to construction to detail controls on site.	Contractor	Construction
SCG17	Stockpiling of soil	Soil profiles are to be kept separate when stockpiling at the NPWS helipad ancillary facility	Contractor	Construction
SCG18	Concrete washout	Concrete washout locations would be located away from sensitive environments and adequately controlled with all wash downs contained within designated impervious bunding	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
SCG19	Stabilisation Plan	<p>A Stabilisation Plan is to be prepared as part of the CEMP. The stabilisation plan is to include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>• identification and methodology of techniques for stabilisation of site.</li> <li>• identification of area on site for progressive stabilisation.</li> <li>• stabilisation is to be undertaken of areas, including stockpiles and batters, exposed for a duration of 2 weeks or greater. For example covering with geotextile fabric, stabilised mulch, soil binder or spray grass</li> <li>• identification of areas on site for progressive permanent stabilisation such as implementation of landscaping.</li> </ul>	Contractor	Pre-construction Construction

## 6.3 Surface water, groundwater and flooding

### 6.3.1 Methodology

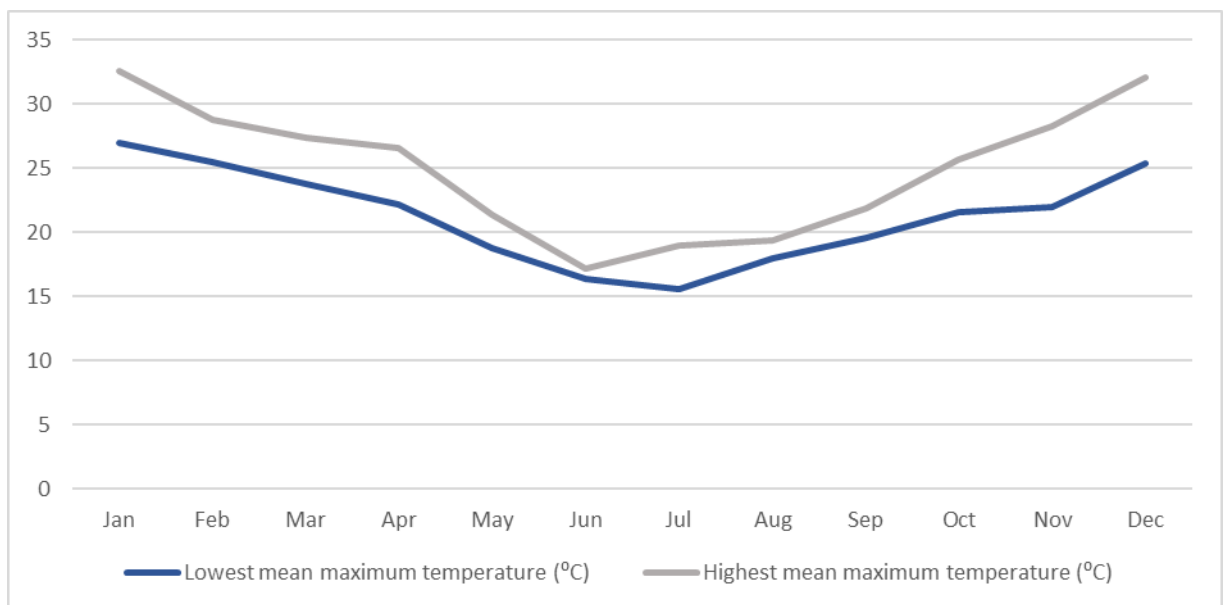
The methodology for this assessment included a desktop review of the proposal area on 27 January 2023, including a review of:

- meteorological data
- watercourses, waterbodies and wetlands (including their catchment values)
- coasts and estuaries.

### 6.3.2 Existing environment

#### Meteorological data

Climatic conditions for the Royal National Park (recorded at Holsworthy [Defence] 068263) indicate that the warmest month in terms of mean maximum temperatures between January 2018 and December 2022 is in January at 32.6 degrees Celsius. The coldest month in terms of mean minimum temperatures is July at 15.6 degrees Celsius. Refer to Figure 6-4 for a summary of the highest and lowest mean maximum temperatures between 2018 and 2022.



**Figure 6-4 Mean historical temperature data from 2018 to 2022 (source: BoM 2023)**

The mean annual rainfall for the Royal National Park (recorded at Audley [Royal National Park] 066176) between 1979 and 2022 is 1,100 millimetres, with March recording the highest rainfall at 133.2 millimetres. The lowest monthly mean in rainfall recording is in September at 55.8 millimetres. Refer to Figure 6-5 for the mean historical rainfall data between 1979 to 2022.



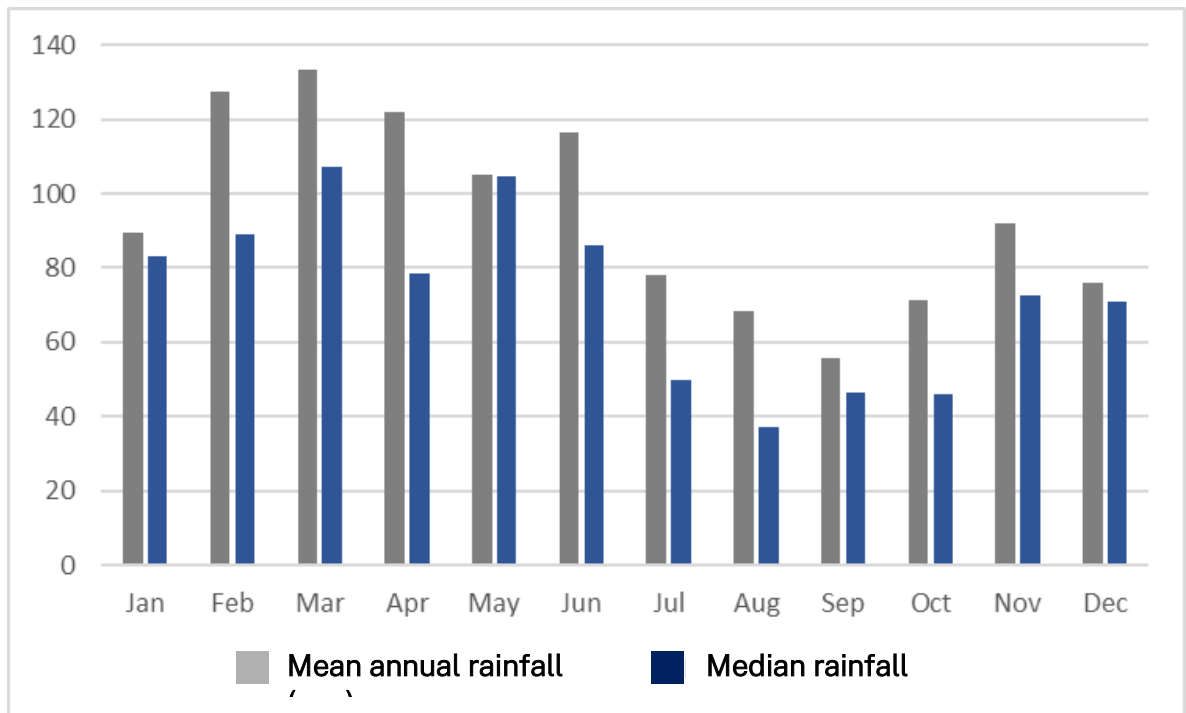


Figure 6-5 Mean historical rainfall data between 1979 to 2022 (source: BoM 2023)

**Watercourses, waterbodies and wetlands (including their catchment values)**

Watercourses, waterbodies and wetlands are outlined in Figure 6-6 below.

The Royal National Park sits within the Greater Sydney Region Local Land Services and the Sydney Metro Catchment (Hacking River sub-catchment) areas. The Sydney Metro Catchment occupies an area of around 1,860 square kilometres, extending offshore to include state waters to the three nautical mile limit.

There are numerous watercourses that drain from the top of the ridge near Sir Bertram Stevens Drive, including South Rill (16 metres from the proposal), Black Gin Gully (350 metres from the proposal) and Middle Rill (480 metres from the proposal). These waterways are in good condition as they are all located within the national park and not exposed to a high level of pollution. The largest source of water pollutant material comes from the use of nearby roads, such as Garie Road, and tracks which lead to sediment run-off during rainfall events.

Wild rivers are defined and protected under the *National Parks and Wildlife Act 1974* as rivers which are in near-pristine condition. Aboriginal objects and places associated with these rivers may also be identified and conserved. There are no declared wild or scenic rivers located within the vicinity of the proposal area.

The EPBC Act Protected Matters Search Tool report was generated in November 2022. There is one wetland (Towra Point Nature Reserve) within 10 kilometres of the proposal area.

The proposal would not be located within the Sydney Drinking Water Catchment or any other water supply catchments.

**Coasts and estuaries**

There are no marine parks or aquatic reserves within one kilometre of the proposal. The proposal is located about 650 metres from Garie Beach and its associated foredunes. The nearest estuary (South West Arm Creek) is located about nine kilometres from the proposal.

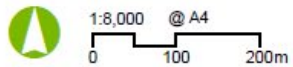


- Subject land
- Proposed ancillary facilities
- Assumed transport road corridor
- Waterways



*Subject to detailed design*

Source: Aurecon, RMS, LPI, Esri



Projection: GDA2020 MGA Zone 56

Figure 6-6 Watercourses, waterbodies, wetlands, coasts and estuaries

### 6.3.3 Potential impacts

#### Construction

The proposal would require removal of pavement and vegetation, stripping of topsoil and earthworks (removal of scarps, the creation of the access ramp and benches) and backfilling of earthworks that would expose soils and could potentially lead to erosion of soils. If unmitigated, this has the potential to move soils and sediments outside the proposal footprint and pollute nearby waterways. This could potentially lead to increased turbidity in these watercourses as well as other water quality impacts.

The movement of soils and sediments outside the proposal footprint may also impact the existing stormwater harvesting/reuse system located on the eastern side of the proposal footprint. Stormwater captured as part of this system is reused in the toilet facilities located at the Garie Beach carpark. If unmitigated, the build-up of soils and sediment may impact the operation of the stormwater harvesting/reuse system as well as the operation of the toilets.

There would be the potential for harmful substances to be released to the surface water environment at the works zone as a result of refuelling and inappropriate handling or maintenance of equipment and plant. Contamination of exposed soils or mobilisation of contaminated soils and liquids into local watercourses could result in water quality impacts and impacts to sensitive receiving environments.

While there are no works within watercourses, there would be concrete pouring works at areas of water flow paths. This includes the construction of the concrete drainage channel at the northern end of Garie Road, the installation of a rock apron and culvert outlets downslope and concrete pours for the piles. These activities have the potential for concrete to move offsite and pollute waterways as well as existing stormwater harvesting/reuse system. During drainage works and piling, adequate water quality control measures would need to be implemented to prevent concrete leaving site.

Soil and erosion control measures (as identified in Section 6.2) would be implemented would avoid sediment and contaminants leaving the site and entering nearby waterways and existing stormwater reuse infrastructure.

The proposal is anticipated to commence construction in November 2023. Data from the BoM recorded the highest mean annual rainfall event between 1979 and 2022 to be April, with high rainfall events during Autumn and through winter. Although the proposal would not occur during peak rainfall season, the proposal would still incorporate weather contingencies, and water quality controls would be implemented and maintained to minimise impacts from heavy rain.

While the site is not located in a flood prone zone, due to the level of excavation required and the position on the side of a hill, it is possible that large storm or rainfall events may result in localised flooding of the proposal area and inundation of excavated areas and mobilisation of sediment. Weather forecasts would be checked regularly to make sure that the proposal area is prepared for large rainfall events including securing materials and plant on site and where possible, covering excavated or exposed areas.

The proposal during the construction phase would not affect or be affected by coastal processes and coastal hazards.

#### Ancillary facilities

Due to the surrounding sensitive environment, refuelling of equipment and plant would, where possible, not occur onsite or at the ancillary facilities and would be refuelled at an appropriate offsite facility. If refuelling needs to occur at either ancillary facility, this is to be carried out in an appropriately bunded area as well as away from the boundary of the ancillary facility as the NPWS helipad ancillary facility is located at the top of a steep slope and the Governor Game lookout ancillary is adjacent to PCTs classified as a TEC. This would avoid spills or leaks leaving the site and travelling downslope potentially polluting Black Gin Gully waterway or reaching Little Garie or Garie Beach. Due to the small size and unsuitable topography of the Garie Road ancillary facility i.e. located on top of a steep slope, refuelling of equipment and plant would not occur at this location.

Concrete washout areas would also be required and established at the NPWS helipad ancillary facility. Concrete washout material can also increase the pH of surrounding waters including nearby drainage channels of South Rill and Black Gin Gully with the potential to harm aquatic life and cause pollution of waters. Concrete washout locations would be located away from sensitive environments i.e. surrounding vegetation and drainage channels, and adequately controlled with all wash downs contained within designated impervious bunding.

Temporary stockpiles and storage of materials at the NPWS helipad ancillary facility would be adequately managed in fenced / bunded areas to minimise the potential for sediment laden runoff to be discharged offsite.

While all ancillary facilities are not located in a flood prone zone, due to the stockpiling of soils in the NPWS helipad ancillary facility, it is possible that large storm or rainfall events may result in localised flooding of the ancillary facility and the mobilisation of sediment. Weather forecasts would be checked regularly to make sure that the ancillary facility is prepared for large rainfall events including securing materials and plant on site and where possible and covering excavated or exposed areas. The ancillary facilities during the construction phase would not affect or be affected by coastal processes and coastal hazards.

### Operation

There is not anticipated to be any ongoing adverse surface or groundwater impacts from the operation of the proposal. However, the stabilisation of the slope as well as the repair of Garie Road would improve the resilience of the existing road infrastructure by stabilising the ground and reducing the potential for similar road failure during future severe weather events.

As the ancillary facilities and 'Little Garie Cabin Community' parking area would be temporary and the area reinstated to its original condition, no operational impacts are expected within these areas.

The proposal would also include updated drainage infrastructure including the installation of a new swale drainage system, the replacement of the existing culvert, a concrete lined channel, a rock apron at the culvert outlet to reduce water velocity, sub-horizontal drainage as well as weep holes to facilitate groundwater movement.

The proposal during operation would not affect or be affected by coastal processes and coastal hazards.

## 6.3.4 Safeguards and management measures

The following section provides a list of mitigation measures that should be applied during the proposal (Table 6-11). Soil and erosion safeguards and management measures are detailed in section 6.2.4.

**Table 6-11 Surface water, groundwater and flooding safeguards and management measures**

No.	Impact	Environmental safeguards	Responsibility	Timing
SWQ1	Water Quality	There is to be no release of dirty water into drainage lines and/or waterways. Dirty water is to be removed by an appropriately licensed contractor and taken to a suitably licensed waste facility.	Contractor	Construction
SWQ2	Water Quality	Water quality control measures are to be used to prevent any materials (e.g. concrete, grout, sediment etc.) entering drain inlets or waterways.	Contractor	Construction
SWQ3	Water Quality	Refuelling of plant and machinery must be carried out off site or if on-site, in an impervious double bunded area away from drainage lines.	Contractor	Construction
SWQ4	Water Quality	Plant and equipment will be serviced and maintained in good working order to reduce unnecessary emissions from exhaust fumes, as well as accidental spills from faulty equipment.	Contractor	Construction
SWQ5	Flooding	Weather forecasts would be checked regularly to make sure that the proposal area is prepared for large rainfall events including securing materials and plant on site and where possible, covering excavated or exposed areas	Contractor	Construction



## 6.4 Traffic and transport

### 6.4.1 Methodology

A desktop review of traffic and transport impacts was carried out for the proposal to determine:

- existing environment: existing road network, road safety and transport data. Data was collated using publicly available information
- construction impacts and operational impacts to the proposed locations. Where feasible, management measures were identified to manage potential impacts.

No traffic modelling was carried out as part of this assessment as the road infrastructure would remain unchanged from the existing scenario during the operational phase.

### 6.4.2 Existing environment

Garie Road is a State classified road running from Sir Bertram Stevens Drive and Garawarra Farm Road to Garie Beach, located in the Sutherland Shire LGA. Garie Road is typically a two-way road with traffic travelling in either direction with a posted speed limit of 60 kilometres per hour. Garie Road serves as the only road access to Garie Beach. However, Garie Road is completely closed to the public due to the road failure.

There are no residential properties with direct access from Garie Road. There are, however, beach huts that are predominately accessed via the Coastal Access Walking Track (which is accessed from Garie Beach) by residents. Garie Road provides vehicular access to the beach, from where people can walk to the beach huts. There are no pedestrian footpaths located along the road. However, as the Garie Road is currently closed due to the road failure, temporary parking measures have been made to accommodate the residents of the 'Little Garie Cabin Community' at the NPWS helipad location.

The Park Connections bus connects transport hubs outside of and along the boundary of the Royal National Park to the attractions within the park. The bus has one route between Sutherland and Waterfall via Bundeena and uses Garie Road on its journey, with a bus stop at the Garie Beach carpark. Currently, due to the closure of Garie Road, the bus has temporarily ceased operations.

There is an existing helipad owned by NPWS located on National Park Estate land. The NPWS helipad is not accessible to the general public and is used by NPWS for their operations within the Royal National Park. This area can only be accessed via Garie Road (Figure 3-8).

The Governor Game lookout and parking area is a scenic lookout that provides visitors to the Royal National Park with coastal views and heathlands. This area is located on National Park Estate and is owned by the NPWS. It is typically accessible to the general public for use, however, is currently not accessible as a result of Garie Road closure (Figure 3-9).

### 6.4.3 Potential impacts

#### Construction

Garie Road would remain temporarily closed for the duration of the construction period to provide a safe environment for members of the public. This would continue to restrict public vehicle and pedestrian access via Garie Road to Garie Beach and access to the Coastal Walking Track. Advanced messaging Variable Messaging Signs (VMS) would be used to inform the public of road closures or changed traffic conditions.

Road closures would not impact the Park Connection bus as it has temporarily ceased operations.

Concrete and material deliveries would be required for Standard and OOHW periods during road closures. Access to the construction and compound sites would contribute to minor, short-term increased vehicle movements for the duration of construction including heavy vehicle traffic on the local road network. However, deliveries during construction would not put additional strain on the road network.

During construction, the proposed NPWS helipad ancillary facility would not be available for use by the 'Little Garie Cabin Community residents' due to safety reasons to mitigate potential plant and vehicle movement conflict with public vehicles and users. Temporary parking measures have subsequently been proposed to



accommodate the residents of the ‘Little Garie Cabin Community’ and which comprises the utilisation of an extension of road, adjacent and west of the Garie Beach Fare Booth. This location is approximately 75 metres north-west from the entrance of the proposed NPWS helipad ancillary facility. Minor trimming of understorey vegetation would be required to allow for parking. During construction, the proposed ancillary facility would require about 1,950 square metres of the NPWS helipad. This temporary parking arrangement would be managed in agreement with NPWS to facilitate pedestrian access to the cabins for residents of the ‘Little Garie Cabin Community’. This temporary parking measure would be required to provide access to the Cabin community which has been restricted due to the Garie Road failure.

The Governor Game lookout proposed ancillary facility would be located on existing hardstand at the Governor Game lookout carpark and is within National Park Estate land. A portion of the carpark would be fenced off in agreement with NPWS, with the remainder of the carpark providing light vehicle parking to for work personnel. This area would not be available for use by members of the public during construction, however, this is unchanged from what it is currently.

The construction of the proposal would have an overall low adverse impact on traffic and transport.

### Operation

The operational impacts of the proposal would include re-instating access to Garie Beach for both vehicles and pedestrians, improving safety for road users, as well as improving the resilience of existing road infrastructure for future extreme weather events. There would be no other operational impacts to traffic and transport from the proposal. In addition, as ancillary facilities would only be required during construction of the proposal, the entire NPWS helipad and Governor Game lookout areas would be reinstated and operational handover given back to NPWS. The Governor Game lookout area would be re-opened to the public with the Garie Road ancillary facility demobilised and reinstated to function as a grassed verge for Garie Road. During the operation of the proposal, the Park Connection bus would resume operation.

Overall, the operation of the proposal would have a beneficial impact on traffic and transport.

## 6.4.4 Safeguards and management measures

The following section provides a list of mitigation measures that should be applied during the proposal (Table 6-12)

**Table 6-12 Traffic and transport safeguards and management measures**

No.	Impact	Environmental safeguards	Responsibility	Timing
TT1	Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in line with the <i>Transport Traffic Control at Work Sites Technical Manual</i> (TfNSW, 2022) and <i>QA Specification G10 Control of Traffic</i> (TfNSW, 2020). The TMP will include:</p> <ul style="list-style-type: none"> <li>confirmation of haulage routes</li> <li>measures to maintain access to local roads</li> <li>site-specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>requirements and methods to consult and inform the local community of impacts on the local road network</li> <li>access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads</li> <li>a response plan for any construction traffic incident</li> </ul>	Contractor	Detailed design / Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> <li>consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic</li> <li>monitoring, review and amendment mechanisms.</li> </ul>		
TT2	Traffic management	The TMP would be developed in conjunction with key stakeholders, particularly NPWS and Sutherland Shire Council	Contractor	Detailed design Pre-construction Construction
TT3	Little Garie Cabin Community	The Little Garie Cabin Community would be notified in advance prior to the NPWS helipad ancillary facility being established.	Contractor	Pre-construction Construction

## 6.5 Noise and vibration

### 6.5.1 Methodology

The noise assessment applied the Transport for NSW Construction Noise Estimator tool to determine potential construction noise levels, noise impacts at the most affected sensitive receivers and, where necessary, recommend appropriate mitigation measures to reduce and manage noise and vibration impacts as a result of the proposal.

A distance based (scenario) assessment tool was selected with 'corridor clearing' selected as the scenario for the proposal. A distance based (noisiest plant) assessment in the tool was selected with the 'smooth drum roller' for the NPWS helipad ancillary facility, and the distance based (noisiest plant) assessment in the tool was selected with the 'Hand Power Tools (2-3 items)' was selected for the Governor Game lookout ancillary facility. A separate noise assessment was not undertaken for the Garie Road ancillary facility due to its close proximity to the worksite. Noise impacts have been assessed cumulatively as part of the 'corridor clearing' scenario as these works are likely to be more noise intensive and represent the 'worst-case' scenario in terms of impacts to nearby sensitive receivers.

### 6.5.2 Existing environment

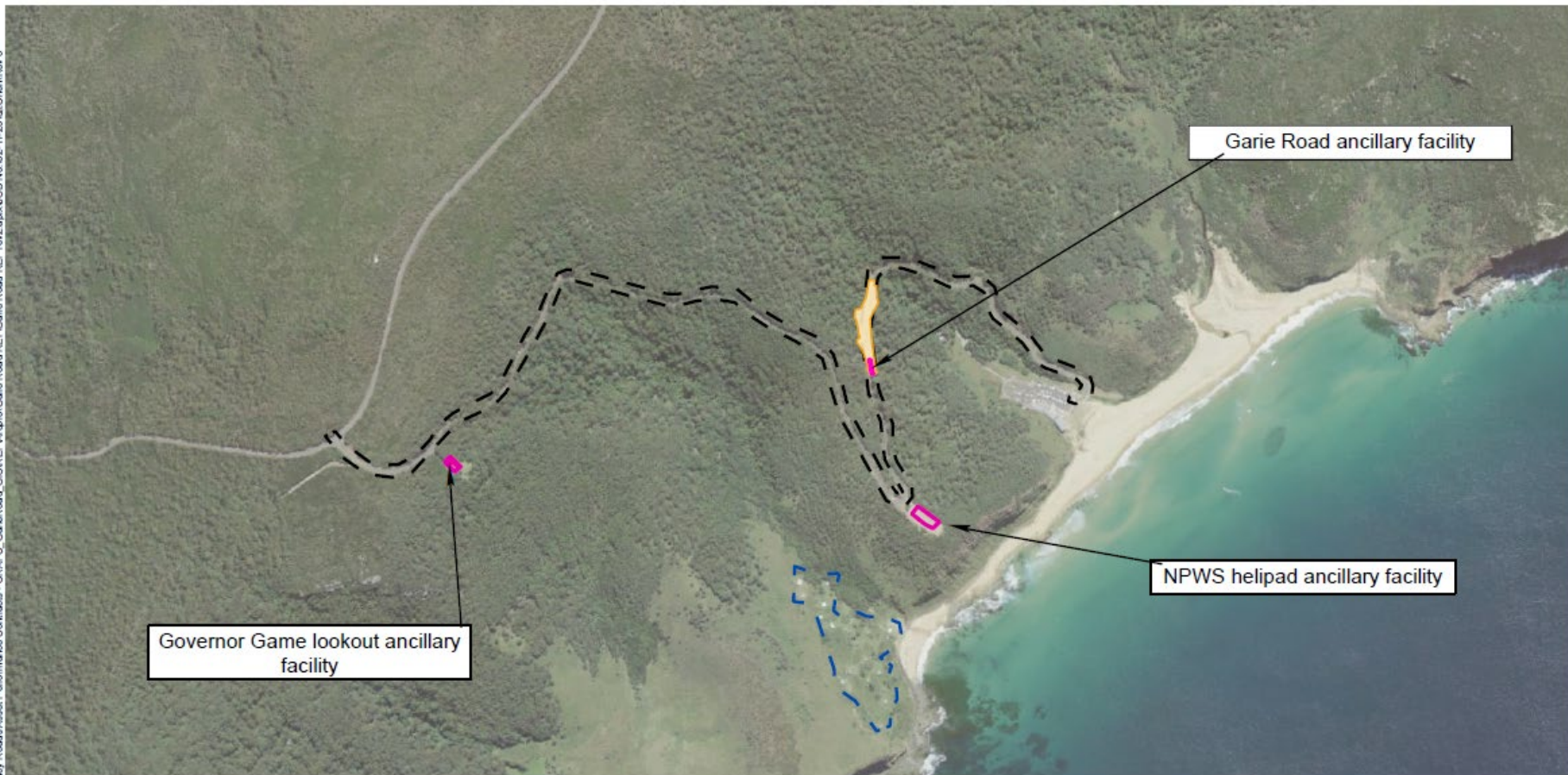
#### Background noise levels

The proposal is within the Royal National Park, over a kilometre away from the Princes Highway, any urban areas and low-density residential areas. The existing noise levels within these areas are typically dominated by ambient noise from the surrounding natural environment, with occasional noise from the road. However, noise levels are typically less during night-time periods due to reduced traffic volumes along the road.

The Transport for NSW Construction Noise Estimator Tool uses representative noise environments rather than specific RBLs as inputs into the tool. The existing noise levels are represented by the representative noise area category R0. Section 6.5.3 below outlines the inputs to the noise estimator tool.

#### National Parks

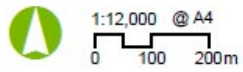
The existing noise levels are represented by the representative noise area category R0. This noise environment was selected for a portion of the proposal area and ancillary facilities, both located on Royal National Park Estate. The nearest sensitive receiver to the proposed NPWS helipad ancillary facility and the Governor Game lookout ancillary facility are the beach huts, which are about 230 metres and 730 metres away respectively (Figure 6-7). The existing noise levels within these areas are typically dominated by ambient noise from the surrounding natural environment, with occasional noise from the road. However, road noise levels are typically less during night-time periods due to reduced traffic volumes along the road



- Subject land
- Proposed ancillary facilities
- Assumed transport road corridor
- Sensitive receivers



Source: Aurecon, RMS, LPI, Esri



Projection: GDA2020 MGA Zone 56

Figure 6-7 Sensitive receivers

Review of environmental factors (for national parks)

### 6.5.3 Criteria

#### Construction

The rated background level (RBL) criteria and corresponding representative noise area category are summarised in Table 6-13.

Table 6-13 Rated-background levels (RBL)

Representative noise category area	Rated Background Level (RBL) (dBA)		
	Standard construction	Out of Hours	
	Day	Evening	Night
R0	30	30	30

During works, noise management levels are set as per Transport for NSW Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime, 2016). These levels are determined to be 10dB(A) above the background levels during standard hours and 5dB(A) above the background level for all out-of-hours works. These are summarised in Table 6-14.

Table 6-14 Noise management levels (NMLs)

Representative noise area category	Noise management levels (NMLs) (dBA)		
	Standard construction	Out of Hours	
	Day	Evening	Night
R0	40	35	35

### 6.5.4 Potential impacts

#### Construction

The construction of the proposal has the potential to generate noise from the use of plant and equipment. Predicted noise levels are dependent on the number of plant items operating at any one time and their precise location relative to a sensitive receiver. Equipment was assumed to be working at the worst-case location relative to each receiver. Where activity moves away from each receiver, or less equipment is operating, predicted levels would decrease. Predicted noise levels are summarised in Table 6-15.

Table 6-15 Predicted construction noise levels

Site	NML (dBA)	Exceedance over NML (dBA)	Receiver perception at the worst affected receiver (dbA)	Additional mitigation measures
Proposed work site and Garie road ancillary facility	35	3	38	Notification
NPWS helipad ancillary facility	35	0	35	N/A - inaudible
Governor Game lookout ancillary facility	35	-3	32	N/A - inaudible

The noise calculations for the proposal workzone and Garie Road ancillary facility indicated that the nearest sensitive receiver at the 'Little Garie Cabin Community' (i.e. 500 metres away) would experience a noticeable level of noise impacts. However, due to the short-term nature and the isolated location of the works as well as undulating topography providing substantial noise attenuation, these are anticipated to be inaudible during construction. The noise calculations for works to establish the NPWS helipad and Governor Game ancillary facilities indicated that the nearest sensitive receiver at the 'Little Garie Cabin Community' would experience inaudible noise impacts. This is due to the short-term



nature of the works as well as the undulating topography. Refer to Appendix F for the Transport for NSW Construction Noise and Vibration Estimator Tool results.

Concrete and material deliveries would be required for Standard and OOHW periods during road closures. It is anticipated that noise levels from construction traffic and heavy vehicle movements would be negligible as limited construction traffic movement would be required for the works.

As there are no buildings or built structures within close proximity of the works, vibration for the proposal was not assessed against the criteria for damage to buildings. There may be vibration impacts during construction which may impact slope stability, however these impacts would be managed in line with the CNVG.

The overall noise and vibration impact of the construction of the proposal is anticipated to be low adverse.

### Operation

The operation of the proposal would not result in an increase in traffic generation and would therefore not result in an increase in traffic noise levels. Operational impacts of the proposal on noise and vibration on NPWS land would be consistent with those identified within the road corridor.

## 6.5.5 Safeguards and management measures

The following section provides a list of mitigation measures that should be applied during the proposal (Table 6-16).

**Table 6-16 Noise and vibration safeguards and management measures**

No.	Impact	Environmental safeguards	Responsibility	Timing
NV1	Noise and vibration	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: <ul style="list-style-type: none"> <li>all project specific and relevant standard noise and vibration mitigation measures</li> <li>relevant licence and approval conditions</li> <li>permissible hours of work</li> <li>any limitations on high noise generating activities</li> <li>location of nearest sensitive receivers</li> <li>site opening/closing times (including deliveries)</li> <li>environmental incident procedures.</li> </ul>	Contractor	Pre-construction
NV2	Non-tonal reversing beepers	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	Contractor	Pre-construction /construction
NV3	Plant and equipment maintenance	All plant and equipment must be appropriately maintained to ensure optimum running conditions, with periodic monitoring.	Contractor	Construction
NV4	Plant not in use	Plant not in use for extended periods must be shut down were practicable.	Contractor	Construction

## 6.6 Socio-economic

### 6.6.1 Methodology

This socio-economic impact assessment has been prepared in line with the Roads and Maritime Environmental Impact Assessment Practice Note on Socio-economic assessment (EIA-05) as well as in line with the NPWS Guidelines for preparing a Review of Environmental Factors: How to assess the environmental impacts of activities within NSW national parks (NPWS, 2021). Under the Roads and Maritime Environmental Impact Assessment Practice Note on Socio-economic assessment (EIA-05), a basic level of assessment was carried out based on the scale and magnitude of impacts to the socio-economic environment within the study area.

The socio-economic assessment included:

- Review of statutory planning and legislative requirements, including a review of existing State and local government strategies relevant to the social and economic environment of the study area
- Description of the existing socio-economic environment of the study area to establish the baseline
- Identification and assessment of the potential socio-economic impacts of the proposal's construction and operation on community services, social infrastructure, economic value and access
- Measures to manage or mitigate potential impacts on the socio-economic environment and maximise potential benefits of the proposal.

Information used to inform the socio-economic assessment has been obtained from the following sources:

- Roads and Maritime Environmental Impact Assessment Practice Note on Socio-economic assessment (EIA-05)
- NPWS Guidelines for preparing a Review of Environmental Factors: How to assess the environmental impacts of activities within NSW national parks (NPWS, 2021)
- Australian Bureau of Statistics (ABS) 2016 Census of Population and Housing
- NSW and the City of Sydney reports and strategies
- NSW Government strategic planning reports and plans
- NSW Department of Planning and Environment population and dwelling projections.

For the purpose of the socio-economic assessment, the statistical areas of Heathcote –Waterfall and Helensburgh were selected as the 'representative study area' (socio-economic study area).

The impact assessment has been prepared in line with the methodology of assessing impacts based on sensitivity and magnitude to determine potential significance of impacts prescribed in the Transport EIA-N05 Environmental Impact Assessment Practice Note –Socio-economic assessment (2020). This includes:

- Identification and analysis of likely changes to existing socio-economic conditions of the direct study area during construction and operation
- Determination of the significance of likely impacts, based on the sensitivity and magnitude of the impacts
- Sensitivity refers to the qualities of the receptor which influence its vulnerability to change and capacity to adapt
- Magnitude refers to the scale, duration, intensity and scope of the overall proposal including how it would be constructed and operated.

The impact grading matrix utilised to assess the level of significance for potential negative impacts is shown in Table 6-17.

Table 6-17 Grading matrix to assess the level of significance

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High impact	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate- Low	Negligible
	Low	Moderate	Moderate- Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

### 6.6.2 Existing environment

The socio-economic characteristics of the broader study area can be summarised as follows:

- There were 15,808 people living in the study area in 2021
- The Aboriginal and Torres Strait Islander population within the broader study area was 2 per cent in 2021
- In 2021, vehicle ownership in the broader study area ranged between 1-2 vehicles per dwelling, with 6 per cent of dwellings having no motor vehicles.

#### Recreation values

Understanding the values of a community assists in identifying what is most important for residents for quality of life and wellbeing and provides context and insight into how the community may perceive impacts of the overall proposal.

The Sutherland Shire Council's CSP are used to inform the community values for this assessment as Strategy has been developed in consultation with the local community. The CSP highlights community importance in maintaining a beautiful, protected and healthy natural environment as well as the importance of having access to beaches, parks and trails.

There are areas such as gathering areas, lookouts and other places, that hold value and appreciated and visited by the community. The following areas of community value that are located within the direct study area:

- Garie Beach and Garie Beach Picnic area
- Little Garie Beach
- Royal National Park and various walking tracks
- Curra Moors loop track and lookout
- Governor Game lookout.

#### Scenic and visually significant areas

The proposal and surrounding national park land provides a scenic background for the local community of Lilyvale. The bushland is predominately made up of uncleared eucalypt woodland, open-forest (dry sclerophyll) and tall forest (wet sclerophyll). Due to topography, dense vegetation and the distance from the local towns and communities, the proposal area would not be visible from surrounding areas or from walking tracks.

#### Education and scientific values

There are many educational uses occurring within the Royal National Park, with NPWS providing a variety of guided tours, activities and educational talks for the general public and groups such as primary and high school students.

### Interests of external stakeholders

The proposal would be located on Garie Road. This road is used by the public to get to Garie Beach, the surf lifesaving club, as well as residents who reside the 'Little Garie Cabin Community'. The Little Garie Cabin Community includes 20 beach huts located 500 metres from the proposal. Currently, Garie Road is completely closed restricting access to these cabins via the beach.

As outlined above, Garie Road provides access to many areas identified as tourist destinations and social infrastructure within the Royal National Park. Access to these facilities and destinations within the Royal National Park is currently unavailable from Garie Road due to the complete closure of the road.

## 6.6.3 Potential impacts

### Construction

The proposal is anticipated to have a low adverse socio-economic impact. The potential construction socio-economic impacts of the proposal include continued restricted access to Garie Beach due to the complete closure of Garie Road as well as restricted access to the Governor Game lookout area. This, however, is no different to the existing environment, in which Garie Road (and as a result, Garie Beach and the Governor Game lookout area) is completely closed to protect visitors and staff. Certain walking tracks within the Royal National Park such as the Coast track would also remain closed between Garie Beach and Little Garie Beach during construction to minimise the potential risk of erosion and rockfalls on pedestrians. As such, the impacts are expected to be temporary and minor.

The temporary closure of the NPWS helipad for the 'Little Garie Cabin Community' is to address safety reasons to mitigate potential plant and vehicle movement conflict with public vehicles and users. The temporary closure would reduce the amount of parking available in the area for 'Little Garie Cabin Community'. Socio-economic characteristics of the broader study area suggests it is likely these residents do own vehicles that would require parking. Temporary parking measures have subsequently been proposed to accommodate the residents of the 'Little Garie Cabin Community' and which comprises the utilisation of an extension of road, adjacent and west of the Garie Beach Fare Booth as illustrated under Figure 3-8 NPWS helipad ancillary facility. Visual impacts may also be experienced by the residents of the 'Little Garie Cabin Community'. Given that the road is currently closed to the public, it is not anticipated that there would be any visual impacts associated with construction work of the proposal. In addition, there are no other nearby views to the site from tracks or roads. Impacts associated with the NPWS helipad ancillary facility would involve setting up perimeter fencing and the presence of temporary site sheds, amenities, spoil stockpiles as well as storage facilities. The ancillary facility is about 230 metres from the Little Garie Cabin Community and is located higher up on the slope, with dense vegetation between both locations. Therefore, there would be no view of the ancillary facility from these residents or members of the public. Visual impacts have been assessed in further detail in section 6.7. The topography would also provide noise attenuation between ancillary facility operation and the Little Garie Cabin Community.

Other socio-economic impacts that would result due to the construction of the proposal include the potential for increased traffic due to increased volume of construction vehicles within the Royal National Park, particularly along the Princes Highway through Waterfall, McKell Avenue and Sir Bertram Stevens Drive. The average vehicles per dwelling is 1.2, which suggests residents rely on their personal vehicles for transport. This has potential to cause localised delays for the community travelling on these roads. However, this potential impact would be temporary, as the completion of works would see the removal of the construction vehicles from the National Park.

### Operation

Operation of the proposal is anticipated to have a positive socio-economic impact, with impacts of the works including improved safety and reliability of Garie Road. Vehicle access to Garie Beach and the Governor Game lookout area would be re-established, which is particularly important for the surf lifesaving club, who rely on Garie Road, particularly for emergency services. Garie Beach would also be much more accessible to the community, particularly for those residing near the Royal National Park.

The re-opening of Garie Road would also have positive impacts for the 'Little Garie Cabin Community'. During the operation of the proposal the NPWS helipad ancillary facility would no longer be required and the Garie Beach parking area would be able to be accessed again.

## 6.6.4 Safeguards and management measures

The following section provides a list of mitigation measures that should be applied during the proposal (Table 6-18).

**Table 6-18 Socio-economic safeguards and management measures**

No.	Impact	Environmental safeguards	Responsibility	Timing
SE1	Communication Plan (CP)	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions contact name and number for complaints. The CP will be prepared in line with the Community Involvement and Communications Resource Manual (RTA, 2008).	Transport	Pre-construction
SE2	Consultation with 'Little Garie Cabin Community'	Transport will continue to consult with 'Little Garie Cabin Community' and land occupiers until the completion of the proposal	Transport	Pre-construction /construction
SE3	Complaints management	Complaints received are to be recorded and attended to promptly.	Transport	Pre-construction /construction



## 6.7 Other impacts

### 6.7.1 Existing environment and potential impacts

Table 6-19 summarises the existing environment and potential impacts for other environmental impacts as a result of the proposal.

Table 6-19 Other impacts - existing environment and potential impacts

Environmental factor	Existing environment	Construction and operation impacts
Landscape character and visual amenity	The proposal would be located along a 150-metre section of Garie Road. Garie Road is a state road with either side of the road containing dense vegetation.	<p>Given that the road is currently closed to the public, it is not anticipated that there would be any visual impacts associated with construction of the proposal and operation of the Garie road ancillary facility. In addition, there are no other nearby views to the site from tracks or roads.</p> <p>Impacts associated with the NPWS helipad ancillary facility would involve setting up perimeter fencing and the presence of temporary site sheds, amenities, spoil stockpiles as well as storage facilities. The ancillary facility is about 230 metres from the Little Garie Cabin Community and is located higher up on the slope, with dense vegetation between both locations. Therefore, there would be no view of the ancillary facility from these residents or members of the public.</p> <p>Operation of the proposal is not expected to impact landscape character or visual amenity.</p>
Aboriginal cultural heritage	<p>A Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) Stage 1 investigation has been prepared for the proposal and is provided in Appendix D.</p> <p>An AHIMS search was completed on 17 January 2023 for the proposal and NPWS ancillary facility using a 100-metre buffer of the general proposal area and ancillary facility. A search of the Native Title Tribunal Native Title Vision website was also carried out.</p>	<p>The proposal is considered to have no to low potential to disturb archaeological material as there are no nearby identified Aboriginal places or items identified through the PACHCI Stage 1 checklist. If unexpected items/finds are uncovered during construction activities, then the <i>Roads and Maritime Unexpected Heritage Finds Procedure</i> is to be followed.</p> <p>An Aboriginal Heritage Information Management System (AHIMS) search was undertaken for the proposal including the NPWS helipad ancillary facility. The AHIMS search showed no Aboriginal heritage sites or heritage items within the proposed work location and the ancillary facility. Site establishment for the Governor Game lookout and Garie road ancillary facilities would not include excavation or vegetation removal. It is anticipated that there would be no to low archaeological potential within these areas.</p> <p>A Stage 1 Procedure for Aboriginal Cultural Heritage Investigation (PACHCI) was conducted for the proposal area and the NPWS helipad ancillary facility and an assessment outcome letter was received on 1 June 2023. The proposal was assessed as being unlikely to</p>

Environmental factor	Existing environment	Construction and operation impacts
		<p>have an impact on Aboriginal cultural heritage based on the following considerations:</p> <ul style="list-style-type: none"> <li>• The project is unlikely to harm known Aboriginal objects or places</li> <li>• The AHIMS search did not indicate moderate to high concentrations of Aboriginal objects or places in the study area</li> <li>• The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage’s Due diligence Code of Practice for the Protection of Aboriginal objects in NSW and the Roads and Maritime Services’ procedure</li> <li>• The cultural heritage potential of the study area appears to be reduced due to past disturbance</li> <li>• There is an absence of sandstone rock outcrops likely to contain Aboriginal art.</li> </ul> <p>The Stage 1 PACHCI assessment is provided in Appendix D. The Stage 1 PACHCI did not include the Governor Game lookout and Garie Road ancillary facilities as site establishment and operation of the proposed ancillary facilities would not involve the removal of mature vegetation and excavation would not be required.</p> <p>A search of the Native Title Tribunal Native Title Vision website was carried out, with one Native Title holders identified (South Coast People NC2017/003). Transport would provide a notice of the proposal to NTSCORP under Section 24KA of the Act and would consult with NTSCORP regarding the proposal.</p> <p>The proposal is located 16 metres from South Rill. However, the proposal is not anticipated to impact waterways (refer to section 6.3.3 of this REF).</p> <p>Construction of the proposal would not impact wild resources which are used or valued by the Aboriginal community or affect access to these resources and would not restrict access to culturally important sites.</p> <p>Operation of the proposal is not expected to impact any Aboriginal cultural heritage as there would be no ground disturbance, removal of mature vegetation or excavation works during operation.</p>
Non-Aboriginal heritage	The following database searches were completed on 2 <sup>nd</sup> November 2023:	The proposal would not impact any buildings or structures of heritage significance.

Environmental factor	Existing environment	Construction and operation impacts
	<ul style="list-style-type: none"> <li>Local Heritage: Sutherland Shire Local Environmental Plan 2015</li> <li>State Heritage: NSW State Heritage Register</li> <li>National Heritage: Australian Heritage Register.</li> </ul> <p>Five National heritage items were identified near the site. These include:</p> <ul style="list-style-type: none"> <li>Burning Palms Settlement – around four kilometres from the proposal area (Place ID: 19949)</li> <li>Era Beach Settlement - around two kilometres from the proposal area (Place ID: 18795)</li> <li>Royal National Park (1977 boundary) – the proposal area is within the Royal National Park (Place ID: 1529)</li> <li>Little Garie Cabin Community – around 500 metres from the proposal area (Place ID: 19950)</li> <li>Royal National Park and Garawarra State Conservation Area- the proposal area is within the Royal National Park (Place ID: 105893).</li> </ul> <p>A copy of the heritage database searches is available in Appendix G.</p>	<p>The proposal would impact nearby places and landscapes of heritage significance including:</p> <ul style="list-style-type: none"> <li>Royal National Park (1977 boundary) – the proposal area is within the Royal National Park (Place ID: 1529)</li> <li>Royal National Park and Garawarra State Conservation Area- the proposal area is within the Royal National Park (Place ID: 105893).</li> </ul> <p>However, these impacts are anticipated to be negligible as it would only impact 504 square metres of National Park Estate.</p> <p>Operation of the proposal is not expected to impact non-Aboriginal heritage.</p>
Air quality	<p>The National Pollutant Inventory (NPI) for the Sydney area identified 17 air pollutant substances emitted across three facilities during the 2019 to 2020 period (NPI, 2021). The type of industry emissions identified included:</p> <ul style="list-style-type: none"> <li>carbon monoxide</li> <li>Total Volatile Organic Compounds</li> <li>polycyclic aromatic hydrocarbons</li> <li>oxides of nitrogen</li> <li>particulate matter 10.0 um.</li> </ul> <p>There are no facilities within 100 metres of this site.</p>	<p>The scope and extent of the proposal is limited to the 150-metre failure along Garie Road and the proposed ancillary facilities, therefore subsequent dust impacts and vehicle emissions would be temporary and minor at these locations. These impacts would be adequately managed by standard safeguards. No fumes or odours expected from works during construction.</p> <p>The proposal would not result in any air quality impacts during operation.</p>
Waste	<p>The proposal requires three temporary ancillary facilities.</p> <p>The NPWS helipad ancillary facility would be located on the helipad, south of the proposed works. This site would comprise temporary site sheds, amenities, spoil stockpiles and materials. This storage would be temporary. All waste would be taken out of storage and sent to an appropriate waste facility according to EPA guidelines.</p>	<p>Construction activities would generate waste, and if not managed correctly could potentially impact nearby land and waterways.</p> <p>Waste streams likely to be generated during construction of the proposal include:</p> <ul style="list-style-type: none"> <li>Liquid waste (non-putrescible and non-hazardous) including concrete washout/slurry</li> <li>General solid waste (non-putrescible) including any fill/spoil, mulch, bark,</li> </ul>

Environmental factor	Existing environment	Construction and operation impacts
	<p>The Governor Game lookout ancillary facility would be located at the carpark area at the Governor Game lookout. This site would contain site sheds and amenities.</p> <p>The Garie Road ancillary facility would be located just south of the workzone and adjacent to Garie Road. This site would contain site shed and offices, an ablution block, a small diesel generator, water tank and equipment storage. Septic waste, general solid waste and co-mingled recyclables would be collected on a needs basis across all ancillary facilities.</p>	<p>woodchips and soil blends, used erosion and sediment controls, weed waste and waste produced from personnel e.g. paper and cardboard</p> <ul style="list-style-type: none"> <li>• General solid waste (Putrescible) including household waste that contains putrescible organics and food waste.</li> </ul> <p>Unsuitable spoil and all other wastes would be classified in line with the <i>NSW EPA Waste Classification Guidelines</i> (NSW EPA, 2014) and disposed of at an appropriately licenced facility. Final waste classification is required once the volumes of waste requiring offsite disposal during construction are confirmed.</p> <p>There would be no anticipated impacts from waste during the operation of the proposal.</p>
Greenhouse gases and climate change	<p>Climate change is caused by increases in greenhouse gas concentrations in the atmosphere. This includes greenhouse emissions as a result of human activities. Climate change is associated with several effects including the increased severity and frequency of extreme weather events.</p> <p>Transport emissions are currently the second largest component of the greenhouse gas emissions in NSW, comprising 21 per cent of total emissions. Road transport accounts for 85 per cent of these transport emissions (AdaptNSW, 2017).</p>	<p>During construction, the proposal would result in minor increases in greenhouse gas emissions through use of materials (including the embodied emissions in the production of materials) as well as use of fuel-based construction equipment and vehicles.</p> <p>However, given the small scale of the proposal these emissions would have a negligible contribution to emissions. Opportunities to minimise emissions related to construction of the proposal would be further investigated during detailed design, including sourcing materials from local suppliers and using recycled and low embodied energy materials, where practical.</p> <p>During operation, the proposal would improve road reliability and access to the Garie Beach. The overall magnitude of any greenhouse gas emissions from vehicles travelling along the proposal are expected to be relatively negligible given the small scale of the proposal.</p>
Hazards and risk management	<p>At present, NSW Rural Fire Service Bushfire Prone Land (NSW RFS, 2015) mapping classifies Garie Road within the proposal area as a 'Vegetation Category 1', which reflects the highest bushfire risk.</p> <p>There is no existing storage or handling of hazardous and dangerous materials associated with the operation of Garie Road beyond small quantities that may be required for occasional maintenance activities. Fuel spills may occur as a result of vehicle crashes.</p>	<p>The proposal is not anticipated to have an impact on the safety of the community as the Garie Road failure as well as ancillary facilities would be fenced off and restricted from public access.</p> <p>The proposal and the ancillary facilities would be located next to dense bushland, increasing the potential risk for bushfire within these areas. Construction activities may have the potential to increase bushfire risk during construction.</p> <p>The potential risk of the proposal would be mainly due to fuel/chemical storage and plant operation within vegetated areas (i.e. exhaust fires). During construction, emergency vehicles</p>

Environmental factor	Existing environment	Construction and operation impacts
		<p>would require access to the proposed site and evacuation plans would be required in the case of an emergency e.g. fire. For these reasons a bushfire management plan would need to be put in place.</p> <p>During operation, the proposal is not expected to increase bushfire hazards. The proposal however would increase the reliability for emergency vehicle access to Garie Beach for the NSW RFS, NSW SES and other emergency services.</p>



## 6.7.2 Safeguards and management measures

Safeguards and management measures of other environmental factors are summarised in Table 6-20.

**Table 6-20 Other impacts - safeguards and management measures**

No.	Impact	Environmental safeguards	Responsibility	Timing
VA1	Visual amenity	Temporary site lighting, for security purposes or night works will be installed and operated in line with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting	Contractor	Construction
HER1	Non-Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Transport for NSW, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction
AB1	Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Transport for NSW, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Aboriginal origin are encountered.	Contractor	Construction
AIR1	Dust Emissions	Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust in the response to an air quality complaint.	Contractor	Construction
AIR2	Dust Emissions	Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.	Contractor	Construction
AIR3	Smoke emissions	Smoky emissions will be kept within the standards and regulations under the Protection of the Environment Operations Act 1997 that no vehicle shall have continuous smoky emissions for more than 10 seconds.	Contractor	Construction
AIR4	Dust Emissions	Construction plant and equipment will be suitably maintained.	Contractor	Construction
AIR5	Dust Emissions	Plant and machinery will be turned off when not in use.	Contractor	Construction
WAS1	Waste Management	Resource management hierarchy principles are to be followed: <ul style="list-style-type: none"> <li>Avoid unnecessary resource consumption as a priority</li> <li>Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery).</li> </ul> Disposal is carried out as a last resort (in line with the Waste Avoidance & Resource Recovery Act 2001).	Contractor	Construction
WAS2	Waste Management	Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.	Contractor	Construction
WAS3	Waste Management	Green waste as result of vegetation clearing would be mulched and reused on site or disposed of in the following order of priority: <ul style="list-style-type: none"> <li>Removal by a licenced waste contractor and disposal at an accredited materials recycling or waste disposal facility</li> </ul>	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		<ul style="list-style-type: none"> <li>As otherwise provided for by the relevant waste legislation.</li> </ul>		
HRM1	Hazards and risk management	During construction, a bushfire management plan (BMP) would be prepared and included as part of the CEMP. This bushfire management plan should consider risk of ancillary facilities, feasible bushfire reduction methods and the potential to incorporate asset protection zones.	Contractor	Construction

## 6.8 Cumulative impacts

### 6.8.1 Study area

The cumulative impact assessment has considered the following suburbs:

- Uloomla
- Lilyvale
- Waterfall.

### 6.8.2 Broader program of work

This proposal is part of a nine-year program of work covering the maintenance and management of classified state roads i.e. roads that are managed by Transport, within the Eastern Harbour City zone.

### 6.8.3 Other projects and development

Cumulative impacts occur when multiple projects are operating at the same time and in close proximity to one another. This is particularly important when there are similar impact types occurring at each location e.g. cumulative noise impacts. The impacts may be caused by construction and/or operational activities and may result in a greater impact to the surrounding area than would be expected if each project was carried out in isolation.

The following table summarises other projects that have been approved, are in construction or are being proposed in the vicinity of the proposal covered by this REF and outline their environmental impact assessments (Table 6-21).

**Table 6-21 Past, present and future projects**

Project	Construction impacts	Operational impacts
McKell Avenue slope stabilisation	<p>Construction impacts may include:</p> <ul style="list-style-type: none"> <li>• Biodiversity impacts as a result of removing vegetation</li> <li>• Soil impacts as the existing soil environment in the area is considered high erodibility</li> <li>• Traffic and transport impacts including the intermittent full closure of McKell Avenue.</li> </ul>	There are no operational impacts.
Sir Bertram Stevens slope stabilisation	<p>Construction impacts may include:</p> <ul style="list-style-type: none"> <li>• Soil and potential water quality impacts as the proposal would require large scale movement and stabilisation of soil</li> <li>• Traffic and transport impacts including the intermittent closure of one lane of traffic</li> </ul>	There are no operational impacts.
Audley Road slope stabilisation	<p>Construction impacts may include:</p> <ul style="list-style-type: none"> <li>• Soil impacts as the existing soil environment in the area is considered high erodibility</li> <li>• Traffic and transport impacts including the intermittent full closure of Audley Road</li> </ul>	There are no operational impacts.

### 6.8.4 Potential impacts

The potential cumulative impacts as a result of the proposal are summarised in Table 6-22.

**Table 6-22 Potential cumulative impacts**

Environmental factor	Construction impacts	Operational impacts
Traffic	<p>During construction, McKell Avenue would require full road closures from Sunday night at 8pm until Friday night at 8pm. McKell Avenue would be reopened to the public from Friday night until Sunday night i.e. over the weekend, with one lane still remaining closed near the proposal area to maintain public safety.</p> <p>The temporary closure of this road would impact construction traffic route access (particularly traffic travelling from the north-west via Heathcote road) to the Garie Road work zone as well as the ancillary facilities.</p> <p>Traffic wanting to use McKell Avenue during these times would need to either travel northbound from Heathcote Road via the Princes Highway, Farnell Avenue, Audley Road, Sir Bertrams Stevens Drive and onto Garie Road (about 23 kilometres), or southbound along Princes Highway through Heathcote and Waterfall, Lawrence Hargrave Drive (Stanwell Tops and Helensburgh), via Lady Wakehurst Drive in Lilyvale and onto Sir Bertram Stevens Drive and onto Garie Road (about 36 kilometres).</p> <p>During construction, it is also proposed to undergo the temporary full closure of Audley Road. During this time Audley Road would not be accessible by public vehicles. The temporary closure of this road would impact construction traffic route access (particularly traffic travelling from the north-east via Princes Highway) to the Garie Road work zone as well as the ancillary facilities.</p> <p>Traffic wanting to use or travel to Audley Road during this time would need to either travel further south-west along the Princes Highway through Engadine, Heathcote and Waterfall, through McKell Avenue and back onto Sir Bertram Drive (about 21 kilometres) and then onto Garie Road.</p> <p>It is also proposed to intermittently close one lane of traffic for the stabilisation of two Sir Bertram</p>	<p>There would be no cumulative adverse impacts as a result of the proposal.</p> <p>There would be cumulative benefits as a result of all proposals. The repair of McKell Avenue, Sir Bertram Stevens Drive and Audley Road would allow traffic to utilise both lanes. Vehicles travelling from the east and the west in conjunction with the opening of Garie Road would be able to easily access Garie Beach without any short-term delays as a result of temporary single lane closures.</p>

Environmental factor	Construction impacts	Operational impacts
	Stevens drive slopes. This may cause localised, short-term traffic delays due to having to having a contraflow arrangement for traffic as well as speed reductions around the work site.	

### 6.8.5 Safeguards and management measures

Table 6-23 Cumulative safeguards and management measures

#	Impact	Environmental safeguards	Responsibility	Timing	Reference
C1	Cumulative construction traffic impacts	Cumulative traffic impacts would be coordinated with the other nearby projects to minimise lengthy construction traffic detour routes.	Contractor	Construction	Additional mitigation measure



## 7. Environmental management

This chapter describes how the proposal would be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

### 7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) would be prepared to describe the safeguards and management measures identified. The CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The CEMP would be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer, SRAPC Harbour Zone, prior to the commencement of any on-site works. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in line with the specifications set out in the: QA Specification G36SRAPC – *Environmental Protection (Management System)*.

## 7.2 Summary of environmental safeguards and management measures

Environmental safeguards and management measures outlined in this REF would be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the TfNSW Senior Manager Environment &amp; Sustainability prior to commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> <li>any requirements associated with statutory approvals</li> <li>details of how the project will implement the identified safeguards outlined in the REF</li> <li>issue-specific environmental management plans</li> <li>roles and responsibilities</li> <li>communication requirements</li> <li>induction and training requirements</li> <li>procedures for monitoring and evaluating environmental performance, and for corrective action</li> <li>reporting requirements and record-keeping</li> <li>procedures for emergency and incident management</li> <li>procedures for audit and review.</li> </ul> <p>The endorsed CEMP will be implemented during the carrying out of the activity.</p>	Contractor / TfNSW project manager	Pre-construction / detailed design	QA Specification G36SRAPC Environmental Protection (Management System)
GEN2	General - notification	All businesses, residential properties and other key stakeholders (e.g. schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / TfNSW project manager	Pre-construction	Standard safeguard
GEN3	General – environmental awareness	All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular toolbox-style briefings.	Contractor / TfNSW project manager	Pre-construction / detailed design	QA Specification G36SRAPC Environmental Protection

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
		<p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> <li>• areas of Aboriginal heritage sensitivity</li> <li>• threatened species habitat</li> <li>• adjoining residential areas requiring particular noise management measures.</li> </ul>			(Management System)
GEN4	General –proposal area	If any proposed works are to be carried out outside the proposal area, then further environmental assessment would be required prior to works commencing in those areas	Contractor	Pre-construction / detailed design / construction	Standard safeguard
B1	Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in line with Transport for NSW's Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas</li> <li>• requirements set out in the Landscape Guideline (RMS, 2008)</li> <li>• pre-clearing survey requirements</li> <li>• procedures for unexpected threatened species finds and fauna handling</li> <li>• procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013)</li> <li>• protocols to manage weeds and pathogens.</li> </ul>	Transport / contractor	Detailed design / pre-construction	Biodiversity Assessment Report (Aurecon 2023)
B2	Biodiversity	Measures to further avoid and minimise native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Transport / contractor	Detailed design / pre-construction	Biodiversity Assessment Report (Aurecon 2023)
B3	Removal of native vegetation	<p>Pre-clearing surveys will be carried out in line with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). An ecologist and/or fauna handler would be required to be on site. The location of any hollow-bearing trees (HBTs) is to be re-confirmed prior to construction.</p>	Contractor	Pre-construction	Biodiversity Assessment Report (Aurecon 2023)

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
B4	Removal of native vegetation	Vegetation removal will be carried out in line with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Trees assessed for removal will be marked with spray paint. However, where possible, trees would only be removed if necessary for operational reasons. Trees not marked are not permitted to be removed.	Contractor	Construction	Biodiversity Assessment Report (Aurecon 2023)
B5	Removal of native vegetation	Native vegetation will be re-established in line with <i>Guide 3: Re-establishment of native vegetation</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Transport / contractor	Post construction	Biodiversity Assessment Report (Aurecon 2023)
B6	Removal of native vegetation	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	Biodiversity Assessment Report (Aurecon 2023)
B7	Removal of native vegetation	If trimming is required at the Governor Game Lookout ancillary facility, this must be conducted in accordance with Australian Standard AS 4373-2007. Trimming is to be limited to small outer branches of trees that do not contain fauna habitat features (i.e. hollows and/or nests). If trimming is expected to impact the structural integrity of the tree further impact assessment would be required.	Transport Contractor	Construction	
B8	Removal of native vegetation	Vegetation surrounding the Governor Game Lookout ancillary facility is to be marked out with exclusion fencing. No plant, equipment, personnel etc are to go beyond the exclusion fencing and onto any vegetation, with the exception of minor tree trimming (see above mitigation measure), without further ecological surveys and assessment. Consequences of damage and impact to the plant community assumed to be a TEC will be discussed during toolbox talks and non-conformances to be reported to Transport.	Contractor	Prior to construction Construction	
B9	Removal of threatened fauna habitat	In accordance with the TfNSW Tree and hollow replacement guidelines, tree and hollows that require replacement will be identified prior to the commencement of works and: <ul style="list-style-type: none"> <li>• A Tree and Hollow Replacement Plan will be prepared to address the impacts prior to the commencement of works; OR</li> </ul>	Transport / contractor	Detailed design	Biodiversity Assessment Report (Aurecon 2023)

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>Payment will be made to a Conservation</li> </ul>			
B10	Removal of threatened fauna habitat	If fauna is encountered, they will be managed in line with <i>Guide 9: Fauna handling</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	Biodiversity Assessment Report (Aurecon 2023)
B11	Removal of threatened fauna habitat	Habitat will be replaced or reinstated in line with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Already fallen or cutdown logs, trees or stags should not be mulched and/or taken offsite. Instead, they should be placed around site particularly closer to flattened areas. They should not be reinstated in environmentally sensitive areas including areas along and directly next to South Rill.	Transport / contractor	Construction	Biodiversity Assessment Report (Aurecon 2023)
B12	Removal of threatened fauna habitat	No hollow bearing trees would be impacted by the proposal. If the hollow bearing tree located within the proposal area or any other hollow bearing tree is to be impacted, further survey and impact assessment would be recommended to determine impacts to hollow dwelling and hollow dependent threatened fauna. Where assessed hollow bearing trees are to be removed, they are to be replaced as per the <i>Tree and Hollow Replacement Guidelines</i> (Transport 2022b).	Transport / contractor	Pre-construction / construction	Biodiversity Assessment Report (Aurecon 2023)
B13	Removal of threatened flora	An environmental exclusion zone will be placed around identified threatened flora (scrub turpentine) within which a minimum 3.5 metre buffer around each individual is also to be established. Consequences of damage and impact to listed threatened species will be discussed during toolbox talks with all non-conformances to be reported to Transport.	Transport / contractor	Pre-construction / construction	Biodiversity Assessment Report (Aurecon 2023)
B14	Aquatic impacts	Potential impacts to aquatic habitat will be minimised through detailed design to limit the potential for erosion. Mitigation measures to control sedimentation and drainage impacts will be implemented prior to the commencement of construction and would be maintained during construction in line with the NSW 'Blue Book' <i>Managing Urban Stormwater: Soils and construction - Volumes 1 and 2C</i> (NSW Government, March 2004; DECC, 2008).	Transport / contractor	Detailed design / construction	Biodiversity Assessment Report (Aurecon 2023)
B15	Aquatic impacts	Aquatic habitat will be protected in line with <i>Guide 10: Aquatic habitats and riparian zones</i> of the <i>Biodiversity Guidelines: Protecting</i>	Contractor	Construction	Biodiversity Assessment



No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
		<i>and managing biodiversity on RTA projects</i> (RTA 2011) and Section 3.3.2 <i>Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (DPI (Fisheries NSW) 2013).			Report (Aurecon 2023)
B16	Changes to hydrology and groundwater dependent ecosystems	Changes to existing surface water flows and interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design to limit the potential for erosion.	Transport / contractor	Detailed design / construction	Biodiversity Assessment Report (Aurecon 2023)
B17	Edge effects on nearby native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in line with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Transport / contractor	Detailed design / construction	Biodiversity Assessment Report (Aurecon 2023)
B18	Edge effects on adjacent native vegetation and habitat	<p>Tree Protection Zones (TPZs) will be placed around all hollow bearing trees.</p> <p>The two hollow bearing trees adjoining /within the proposal (one <i>Eucalyptus botryoides</i> and one <i>Eucalyptus saligna</i> x <i>Eucalyptus botryoides</i>) require a TPZ. All protective measures for the TPZ around hollow bearing trees must be in accordance with the Australian Standard for the protection of trees on development sites (AS 4970-2009). Fencing around trees should be installed in accordance with the Tree Protection Zone prior to site establishment (before any machinery or materials are brought on site) and should remain until the completion of works. The fencing erected should be approved by the project arborist/ecologist.</p> <p>Tree protection fencing should comply with the following requirements:</p> <ul style="list-style-type: none"> <li>• Fence post supports (e.g. star pickets) should have a diameter greater than 20 mm and should not impact surface tree roots</li> <li>• Fencing height minimum of 1.8 m</li> <li>• Shade cloth, paraweb, wire mesh panels or similar should be attached to the fencing posts</li> <li>• Signage should be installed stating “Vegetation Protection Zone - No Entry”</li> </ul>	Transport / contractor	Detailed design / construction	Biodiversity Assessment Report (Aurecon 2023)

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>The tree protection fencing must remain in place until construction is completed</li> <li>No vehicular or pedestrian access, trenching or soil excavation is to occur within the Tree Protection Zone</li> </ul> <p>No storage or dumping of tools, equipment or waste is to occur within the Tree Protection Zone.</p>			
B19	Invasion and spread of weeds	Weed species will be managed in line with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	Biodiversity Assessment Report (Aurecon 2023)
B20	Invasion and spread of weeds	The grass swale on the upslope of the design would be revegetated with native vegetation only with no exotic grass species. Low lying shrubs native to PCT 3155 could be included in the design such as <i>Lomandra filiformis</i> , <i>L. confertifolia</i> , and <i>L. longifolia</i> .	Contractor	Detailed design	Biodiversity Assessment Report (Aurecon 2023)
B21	Invasion and spread of pests	Pest species will be managed within the proposal site.	Contractor	Construction	Biodiversity Assessment Report (Aurecon 2023)
B22	Invasion and spread of pathogens and disease	Pathogens will be managed in line with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Daily biosecurity controls, as detailed in the contractors Construction Environmental Management Plan, are to implemented for vehicles and equipment entering the site.	Contractor	Construction	Biodiversity Assessment Report (Aurecon 2023)
B23	Noise, light, dust and vibration	Shading and artificial light impacts will be minimised through detailed design.	Transport	Detailed design	Biodiversity Assessment Report (Aurecon 2023)
B24	Biodiversity Policy	The proposal will be undertaken in accordance with the TfNSW Biodiversity Policy, 2022.	Contractor	Pre-construction Construction	Biodiversity Assessment Report

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
					(Aurecon 2023)
SGC1	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Environment Manager	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>  QA Specification G38 – <i>Soil and Water Management (Soil and Water Plan)</i>
SCG2	Contaminated land	The NPWS Asbestos Risk Assessment and Management Plan (Getex 2023) would be implemented at the NPWS helipad ancillary facility to manage the risk of asbestos	Contractor	Construction	
SGC3	Accidental spill	Site-specific emergency spill-management measures will be developed in line with the Transport Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport EPA officers).	Contractor	Construction	
SGC4	Spill control	Spill Kits are located close to the works and maintained to ensure they are fully stocked.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
SGC5	Spill control – ancillary facilities	Ancillary facilities would minimise storage of fuel, oil, chemicals or other dangerous goods on site, through efficient and timely ordering	Contractor	Construction	QA Specification G36 <i>Environmental Protection</i>

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
					(Management System)
SGC6	Spill control – ancillary facilities	Chemicals fuels, oils and chemicals to be stored inside impervious bunds of sufficient capacity to contain 110% of the stored volume. Bunded areas must have sufficient cover to prevent ingress of rain and must have appropriate signage	Contractor	Construction	QA Specification G36 Environmental Protection (Management System)
SGC7	Spill control – ancillary facilities	Materials removed from the bunded storage area for use are to be returned to the bund at the end of each shift	Contractor	Construction	QA Specification G36 Environmental Protection (Management System)
SGC8	Spill control – ancillary facilities	No contaminated water to be discharged from bunded areas into site drainage system. Contaminated water to be removed by appropriately licensed contractor & taken to a suitably licensed waste facility.	Contractor	Construction	QA Specification G36 Environmental Protection (Management System)
SGC9	Erosion and Sedimentation	Erosion and sediment control measures, such as sediment fencing, would be implemented and maintained to: <ul style="list-style-type: none"> <li>Minimise sediment moving offsite and sediment laden water entering any water course, drainage lines, or drain inlets</li> <li>Reduce water velocity and capture sediment on site</li> <li>Minimise the amount of material transported from site to surrounding pavement surfaces</li> </ul> Divert clean water around the site (in line with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SGC10	Erosion and Sedimentation	<ul style="list-style-type: none"> <li>Erosion and sedimentation controls would be installed prior to construction and would then be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.</li> </ul>	Contractor	Construction	QA Specification G38 – Soil and Water

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
					<i>Management (Soil and Water Plan)</i>
SGC11	Erosion and Sedimentation	Erosion and sediment control measures would not to be removed until the works are complete, and areas are stabilised.	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SGC12	Erosion and Sedimentation	The maintenance of temporary stockpile sites near the worksite is to be in line with the Roads and Maritime Services Stockpile Site Management Guideline (EMS-TG-10).	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SGC13	Erosion and Sedimentation	Implement measures to minimise tracking of dirt and mud into public roads and other public spaces	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SGC14	Erosion and Sedimentation	Use erosion and sediment controls, such as sandbag checks, to protect drainage channels and pits, as required	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SCG15	Erosion and Sedimentation	Pre and post rainfall inspections would occur to ensure controls are adequate prior to rain events, review effectiveness of controls and make necessary environmental control repairs.	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)



No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
SCG16	Erosion and Sedimentation	An Erosion and Sediment Control Plan (ESCP) would be produced prior to construction to detail controls on site.	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SCG17	Stockpiling of soil	Soil profiles are to be kept separate when stockpiling at the NPWS helipad ancillary facility	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SCG18	Concrete washout	Concrete washout locations would be located away from sensitive environments and adequately controlled with all wash downs contained within designated impervious bunding	Contractor	Construction	Transport Concrete Washout Guideline 3TP-SD-112/2.0
SCG19	Stabilisation Plan	A Stabilisation Plan is to be prepared as part of the CEMP. The stabilisation plan is to include but not be limited to the following: <ul style="list-style-type: none"> <li>• identification and methodology of techniques for stabilisation of site.</li> <li>• identification of area on site for progressive stabilisation.</li> <li>• stabilisation is to be undertaken of areas, including stockpiles and batters, exposed for a duration of 2 weeks or greater. For example covering with geotextile fabric, stabilised mulch, soil binder or spray grass</li> <li>• identification of areas on site for progressive permanent stabilisation such as implementation of landscaping.</li> </ul>	Contractor	Pre-construction Construction	N/A
SWQ1	Water Quality	There is to be no release of dirty water into drainage lines and/or waterways. Dirty water is to be removed by an appropriately licensed contractor and taken to a suitably licensed waste facility.	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
SWQ2	Water Quality	Water quality control measures are to be used to prevent any materials (e.g. concrete, grout, sediment etc.) entering drain inlets or waterways.	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SWQ3	Water Quality	Refuelling of plant and machinery must be carried out off site or if on-site, in an impervious double bunded area away from drainage lines.	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SWQ4	Water Quality	Plant and equipment will be serviced and maintained in good working order to reduce unnecessary emissions from exhaust fumes, as well as accidental spills from faulty equipment.	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
SWQ5	Flooding	Weather forecasts would be checked regularly to make sure that the proposal area is prepared for large rainfall events including securing materials and plant on site and where possible, covering excavated or exposed areas	Contractor	Construction	QA Specification G38 – Soil and Water Management (Soil and Water Plan)
TT1	Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in line with the Transport <i>Traffic Control at Work Sites Technical Manual</i> (TfNSW, 2022) and <i>QA Specification G10 Control of Traffic</i> (TfNSW, 2020). The TMP will include:</p> <ul style="list-style-type: none"> <li>• confirmation of haulage routes</li> <li>• measures to maintain access to local roads</li> <li>• site-specific traffic control measures (including signage) to manage and regulate traffic movement</li> </ul>	Contractor	Detailed design / Pre-construction	QA Specification G10 Control of Traffic

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>requirements and methods to consult and inform the local community of impacts on the local road network</li> <li>access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads</li> <li>a response plan for any construction traffic incident</li> <li>consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic</li> <li>monitoring, review and amendment mechanisms.</li> </ul>			
TT2	Traffic management	The TMP would be developed in conjunction with key stakeholders, particularly NPWS and Sutherland Shire Council	Contractor	Detailed design Pre-construction Construction	QA Specification G10 Control of Traffic
TT3	Little Garie Cabin Community	The Little Garie Cabin Community would be notified in advance prior to the NPWS helipad ancillary facility being established.	Contractor	Pre-construction Construction	QA Specification G10 Control of Traffic
NV1	Noise and vibration	<p>All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include:</p> <ul style="list-style-type: none"> <li>all project specific and relevant standard noise and vibration mitigation measures</li> <li>relevant licence and approval conditions</li> <li>permissible hours of work</li> <li>any limitations on high noise generating activities</li> <li>location of nearest sensitive receivers</li> <li>site opening/closing times (including deliveries)</li> <li>environmental incident procedures.</li> </ul>	Contractor	Pre-construction	<p>EPA Interim Construction Noise Guideline (NSW EPA 2009)</p> <p>QA Specification G36 Environmental Protection (Management System)</p> <p>TfNSW Construction Noise and Vibration Strategy</p>

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
					(Transport 2020)
NV2	Non-tonal reversing beepers	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	Contractor	Pre-construction /construction	EPA Interim Construction Noise Guideline (NSW EPA 2009)  QA Specification G36 <i>Environmental Protection (Management System)</i>  TfNSW Construction Noise and Vibration Strategy (Transport 2020)
NV3	Plant and equipment maintenance	All plant and equipment must be appropriately maintained to ensure optimum running conditions, with periodic monitoring.	Contractor	Construction	EPA Interim Construction Noise Guideline (NSW EPA 2009)  QA Specification G36 <i>Environmental Protection (Management System)</i>  TfNSW Construction Noise and

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
					Vibration Strategy (Transport 2020)
NV4	Plant not in use	Plant not in use for extended periods must be shut down were practicable.	Contractor	Construction	EPA Interim Construction Noise Guideline (NSW EPA 2009)  QA Specification G36 <i>Environmental Protection (Management System)</i>  TfNSW Construction Noise and Vibration Strategy (Transport 2020)
SE1	Communication Plan (CP)	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions contact name and number for complaints. The CP will be prepared in line with the Community Involvement and Communications Resource Manual (RTA, 2008).	Transport	Pre-construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
SE2	Consultation with 'Little Garie Cabin Community'	Transport will continue to consult with 'Little Garie Cabin Community' and land occupiers until the completion of the proposal	Transport	Pre-construction /construction	QA Specification G36 <i>Environmental Protection (Management System)</i>



No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
SE3	Complaints management	Complaints received are to be recorded and attended to promptly.	Transport	Pre-construction /construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
VA1	Visual amenity	Temporary site lighting, for security purposes or night works will be installed and operated in line with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
HER1	Non-Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Transport for NSW, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
AB1	Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Transport for NSW, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Aboriginal origin are encountered.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
AIR1	Dust Emissions	Measures (including watering or covering exposed areas) are to be used to minimise or prevent air pollution and dust in the response to an air quality complaint.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
AIR2	Dust Emissions	Vehicles transporting waste or other materials that may produce odours or dust are to be covered during transportation.	Contractor	Construction	QA Specification G36 <i>Environmental</i>

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
					<i>Protection (Management System)</i>
AIR3	Smoke emissions	Smoky emissions will be kept within the standards and regulations under the Protection of the Environment Operations Act 1997 that no vehicle shall have continuous smoky emissions for more than 10 seconds.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
AIR4	Dust Emissions	Construction plant and equipment will be suitably maintained.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
AIR5	Dust Emissions	Plant and machinery will be turned off when not in use.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
WAS1	Waste Management	Resource management hierarchy principles are to be followed: <ul style="list-style-type: none"> <li>• Avoid unnecessary resource consumption as a priority</li> <li>• Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery).</li> </ul> Disposal is carried out as a last resort (in line with the Waste Avoidance & Resource Recovery Act 2001).	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
WAS2	Waste Management	Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>

No.	Impact	Environmental safeguards and management measures	Responsibility	Timing	Reference
WAS3	Waste Management	Green waste as result of vegetation clearing would be mulched and reused on site or disposed of in the following order of priority: <ul style="list-style-type: none"> <li>• Removal by a licenced waste contractor and disposal at an accredited materials recycling or waste disposal facility.</li> <li>• As otherwise provided for by the relevant waste legislation.</li> </ul>	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
HRM1	Hazards and risk management	During construction, a bushfire management plan (BMP) would be prepared and included as part of the CEMP. This bushfire management plan should consider risk of ancillary facilities, feasible bushfire reduction methods and the potential to incorporate asset protection zones.	Contractor	Construction	QA Specification G36 <i>Environmental Protection (Management System)</i>
C1	Cumulative construction traffic impacts	Cumulative traffic impacts would be coordinated with the other nearby projects to minimise lengthy construction traffic detour routes.	Contractor	Construction	Additional mitigation measure

## 7.3 Licensing and approvals

The following table summarises the required licenses and approvals required for the proposal (Table 7-2).

**Table 7-2: Summary of licensing and approval required**

Instrument	Requirement	Timing
<b>Roads Act 1993</b>	Road Occupancy Licence (ROL)	Licence takes up to 10 days to be approved so must apply at least 10 days before works are to commence

## 8. Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Section 193 of the Environmental Planning and Assessment Regulation 2021.

### 8.1 Justification

The proposal is required to reinstate Garie Road, preserve the life of existing infrastructure as well as improve the resilience of existing road infrastructure by reducing the potential for road failure from similar weather events.

#### 8.1.1 Social factors

There would be positive social implications via the operation of the proposal as it would increase the stability of the slope along Garie Road, this would improve the safety of road users and re-establish reliable access to Garie Beach as well as movement and connectivity through the Royal National Park.

#### 8.1.2 Biophysical factors

The proposal would not have a significant impact on any TECs. A total of 72 trees across 0.296 hectares of native vegetation would be removed as part of the proposal. This includes 0.164 hectares of PCT 3155 and 0.132 hectares of PCT 3153. Neither PCTs within the proposal boundary are associated with any TECs. Additionally, no thresholds under the No Net Loss Guidelines would be triggered as part of the proposal, meaning offsets would not be required. A tree and hollow replacement plan would be prepared.

#### 8.1.3 Economic factors

By carrying out this proposal, Transport would also reduce the ongoing maintenance costs associated with repairing of or re-instating Garie Road. The proposal would also result in the stabilisation of the slope along Garie Road, increasing reliability of the road and potentially minimising the need and cost for ongoing repairs.

The proposal would also reinstate Garie Road access to Garie Beach and surrounds. This would also reinstate the NPWS fee that visitors would need to pay upon entry to the park.

#### 8.1.4 Public interest

The proposal would be of public interest due to the safety benefits it would provide, as well as the connection it provides to Garie Beach, the Surf Life Saving Club, Little Garie Beach as well as the Little Garie Cabin Community. The proposal would increase the stability of the slope along Garie Road and the resilience of the existing infrastructure, subsequently improving the safety for road users and maintain reliability of road connection.

### 8.2 Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	By re-instating the road and improving it through design, this would improve road resilience to future extreme weather events and similar slope failures. This would mean less maintenance activities i.e. potholing, as well as providing certainty and reliability of access for the community, particularly the Surf Life Saving Club, residents at the Little Garie Cabin Community as well as beach and Royal National Park visitors.



Object	Comment
<p>1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.</p>	<p>Ecologically sustainable development has been considered throughout the proposal, with the legislative context of ecological sustainable development considered in section 4 and the impact of the proposal is considered in detail in section 6. An options process was also carried out for the proposal that has considered a range of constraints (refer section 2.4). Mitigation measures are proposed to be implemented to avoid or minimise direct and indirect impacts of the proposal.</p>
<p>1.3(c) To promote the orderly and economic use and development of land.</p>	<p>Reinstating and reopening Garie Road would support the primary use of the road i.e. to provide access to Garie Beach and surrounds. The proposal would also improve safety for road users as well as reduce the ongoing maintenance costs as road has been designed to be more resilient to extreme weather events and slope failures. The improved resilience of the road and the decreased likelihood of the road failing from similar climatic events, would encourage visitors to the Royal National Park and Garie Beach as well.</p>
<p>1.3(d) To promote the delivery and maintenance of affordable housing.</p>	<p>Not relevant to the proposal.</p>
<p>1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.</p>	<p>Construction of the proposal would require the removal of 0.296 hectares of native vegetation and would not impact any endangered or threatened ecological communities. The impacts to vegetation have been minimised where possible. The safeguards and mitigation measures included in the environmental assessment (refer to section 7.2) would further minimise these risks.</p>
<p>1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).</p>	<p>The proposal is considered to have negligible heritage impacts. Stage 1 PACHCI consultation was undertaken, with an assessment outcome letter issued on the 1st June 2023 (Appendix D). The AHIMS search showed no Aboriginal heritage sites or heritage items within the proposed work location and the NPWS helipad ancillary facility. The assessment outcome letter identified that the proposal was unlikely to impact on Aboriginal cultural heritage. The Governor Game lookout and Garie Road ancillary facilities would not require the removal of mature vegetation or any excavation, therefore an AHIMS search or PACHCI Stage 1 checklist was not undertaken as site establishment and operational activities of this ancillary facility would unlikely impact any Aboriginal heritage.</p>
<p>1.3(g) To promote good design and amenity of the built environment.</p>	<p>The proposal has been developed with the aim to minimise the overall impact of the proposal on existing landscape character of Garie Road. However, construction of the proposal would result in minor unavoidable visual impacts. Visual impacts would be temporary in nature and as the road would be closed during construction, the impacts are considered negligible.</p>
<p>1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.</p>	<p>Not relevant to the proposal.</p>
<p>1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.</p>	<p>Not relevant to the proposal.</p>

Object	Comment
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Section 5 outlines the community and stakeholder consultation that would be carried out during various stages of the proposal. This REF will be placed on the Transport website for community notification.

## 8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

### The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

This principle was considered during options development (refer to section 2). The precautionary principle has guided the assessment of environmental impacts for this REF and the development of mitigation measures.

Issues that may cause serious or irreversible environmental damage from the proposal and where there is scientific uncertainty as to the nature of the damage have been identified. The proposal is designed in line with up-to-date and valid guidelines and Standards. Mitigation measures have been used to minimise environmental impacts.

### Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Intergenerational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The proposal would maintain safe road usage along Garie Road for use by future generations. The proposal would also protect the safety of future generations by improving the resilience of existing road infrastructure and ensuring another road failure from similar climatic conditions would not be experienced.

### Conservation of biological diversity and ecological integrity

The environment in which the proposal would be carried out is a roadside slope which has been subject to slope failure. A thorough assessment of existing biodiversity was carried out to identify and manage any potential impacts of the proposal on local biodiversity and ecological integrity.

The proposal would not have a significant impact on biological diversity or ecological integrity. 0.296 hectares of native vegetation would be removed as part of the proposal, however this would not include any threatened ecological communities. A full assessment of the biodiversity impacts and safeguards is provided in Appendix E. An assessment of Section 171 of the EP&A Regulation factors that broadly consider biological diversity and ecological integrity of the proposal area has been included in Appendix A.

### Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

Valuation of environmental resources has shaped the proposal and mitigation measures. The proposal demonstrates value to the community in regard to improved safety. The design of the proposal has considered all environmental impacts and have tried to reduce impacts to the greatest extent practicable.

## 8.3 Conclusion

Transport for NSW is the determining authority for the proposal outside of the Royal National Park and National Parks and Wildlife Service are the determining authority for the works within the National Park. This REF fulfils Transport for NSW's obligation under Section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. This REF would be issued to NPWS to determine the portion of the proposal located on national park land as per Section 2.109 of the SEPP (Transport and Infrastructure).

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on traffic and transport, biodiversity and noise and vibration. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also minimise safety risks on Garie Road, as well as improve the resilience of existing road infrastructure. On balance the proposal is considered justified and the following conclusions are made.

### **Significance of impact under NSW legislation**

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

### **Significance of impact under Australian legislation**


The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the Environment Protection and Biodiversity Conservation Act 1999. A referral to the Australian Department of Climate Change, Energy, the Environment and Water is not required.


## 9. Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Laura Atencio  
Senior Consultant, Environment and Planning  
Aurecon Australasia Pty Ltd  
07 November 2023

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.

Name: Larry Melnick  
Position: Environmental Management Representative, Assurance Network, ConnectSydney  
Transport  
region/program: Sydney Roads Asset Performance Contract – Harbour Zone  
Date: 09 November 2023 

Name: Sam Singh  
Position: Project Manager, Special Projects, Connect Sydney  
Transport  
region/program: Sydney Roads Asset Performance Contract – Harbour Zone  
Date: 09 November 2023 

## 10. EP&A Regulation publication requirement

The following table summarises the requirement for publication under Section 171(4) of the EP&A Regulation (Table 10-1).

Table 10-1: EP&A Regulation publication requirement

Respondent	Yes/No
Does this REF and its determination need to be published under Section 171(4) of the EP&A Regulation?	Yes



## 11. Terms and acronyms used in this REF

Term /acronym	Description
AHIP	Aboriginal heritage impact permit
ARL	Assessed risk level
AusLink	Mechanism to facilitate cooperative transport planning and funding by Commonwealth and state and territory jurisdictions
BAM	Biodiversity assessment methodology
BAR	Biodiversity Assessment Report
BC Act	<i>Biodiversity Conservation Act 2016 (NSW).</i>
BMP	Bushfire management plan
CEMP	Construction / Contractor's environmental management plan
CNVG	Construction Noise and Vibration Guideline
CP	Communication plan
DBH	Diameter at breast height
EIA	Environmental impact assessment
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW).</i> Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).</i> Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EPL	Environment protection licence
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
GDE	Groundwater dependent ecosystem
Heritage Act	<i>Heritage Act 1977 (NSW)</i>
ICNG	Interim construction noise guideline
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
MNES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999.</i>
NML	Noise management level
NPWS	National Parks and Wildlife Service

Term /acronym	Description
NPW Act	<i>National Parks and Wildlife Act 1974 (NSW)</i>
OOHW	Out-of-hours-work
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PCT	Plant Community Type
RBL	Rated background level
REF	Review of environmental factors
Roads and Maritime	NSW Roads and Maritime- dissolved by the Transport Administration Amendment Bill in August 2019. All functions now managed by Transport for NSW.
ROL	Road occupancy licence
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SEPP (Biodiversity and Conservation)	State Environmental Planning Policy (Biodiversity and Conservation) 2021
SEPP (Planning Systems)	State Environmental Planning Policy (Planning Systems) 2021
SEPP (Precincts – Central River City)	State Environmental Planning Policy (Precincts – Central River City) 2021
SEPP (Precincts – Eastern Harbour City)	State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021
SEPP (Precincts – Regional)	State Environmental Planning Policy (Precincts – Regional) 2021
SEPP (Precincts – Western Parkland City)	State Environmental Planning Policy (Precincts – Western Parkland City) 2021
SEPP (Resilience and Hazards)	State Environmental Planning Policy (Resilience and Hazards) 2021
SEPP (Transport and Infrastructure)	State Environmental Planning Policy (Transport and Infrastructure) 2021
SIS	Species impact statement
SRAPC	Sydney Roads Asset Performance Contract
TAMP	Tactical asset management plan
TBDC	Threatened biodiversity data collection
TCP	Traffic control plan
TEC	Threatened ecological community
TMP	Traffic management plan
Transport	Transport for NSW
VMS	Variable messaging sign

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# Appendix A Consideration of Section 171(2) factors and matters of national environmental significance and Commonwealth land



## Section 171(2) checklist

In addition to the requirements of the Guideline for Division 5.1 assessments, DPE 2022 and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in Section 171(2) of the Environmental Planning and Assessment Regulation 2021, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
<p><b>a) Any environmental impact on a community?</b></p> <p>There would be some temporary minor impacts to the community during construction, particularly in relation to traffic, parking and access to Garie Beach.</p> <p>However, the proposal would have a long-term positive benefit to the community and Royal National Park tourists by improving overall road safety, the resilience of existing road infrastructure from extreme weather events and reinstating access to Garie Beach.</p>	<p>Short-term negative impact during construction</p> <p>Long-term positive impact during operation</p>
<p><b>b) Any transformation of a locality?</b></p> <p>Garie Road would remain temporarily closed for the duration of the construction period to provide a safe environment for members of the public. This would continue to restrict public vehicle and pedestrian access via Garie Road to Garie Beach, the Governor Game lookout and access to the Coastal Walking Track. This would continue to temporarily transform the locality until the completion of the proposal.</p> <p>The operation of the proposal would improve road safety for road users through strategic risk identification and action, as well as improve the resilience of existing road infrastructure through design.</p>	<p>Short-term minor negative impact</p> <p>Long-term positive impact</p>
<p><b>c) Any environmental impact on the ecosystems of the locality?</b></p> <p>The proposal would result in the removal of 0.296 hectares of native vegetation. This has been assessed as being unlikely to impact nearby ecosystems.</p>	<p>Short-term minor negative impact</p>
<p><b>d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</b></p> <p>The proposal would have a long-term positive benefit to the Royal National Park tourists through improving the overall road safety and the resilience of existing road infrastructure against extreme weather events.</p>	<p>Long-term positive impact during operation</p>
<p><b>e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?</b></p> <p>The proposal would not impact on the locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations.</p>	<p>Nil</p>
<p><b>f) Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)?</b></p> <p>The proposal would result in the removal of 0.296 hectares of native vegetation. This has been assessed as being unlikely to impact the habitat of protected fauna.</p>	<p>Short term minor negative impact</p>
<p><b>g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</b></p> <p>The proposal is not likely to endanger any species of animal, plant or other form of life. Around 16 scrub turpentines were recorded within the BAR study area. The design of the proposal has been amended to avoid removing these plants. An exclusion zone has been placed around the area where they were identified with a minimum 2.5 metre buffer zone at</p>	<p>Short term minor negative impact</p>

Factor	Impact
<p>its closest point within a larger fixed environmental exclusion zone. The condition of the scrub turpentine habitat may potentially reduce in quality as a result of nearby construction work, however the habitat would not be cleared as part of the proposal.</p>	
<p><b>h) Any long-term effects on the environment?</b></p> <p>The proposal would result in long-term positive impacts on:</p> <ul style="list-style-type: none"> <li>• traffic by increasing the safety of existing road infrastructure as well as improving the resilience road infrastructure to extreme weather events</li> </ul> <p>See section 6.4 for more information on the long-term environmental impacts. See section 7.2 for proposed mitigation measures to minimise environmental impacts.</p>	<p>Long-term minor positive impact</p>
<p><b>i) Any degradation of the quality of the environment?</b></p> <p>During construction, if environmental mitigation measures are not implemented or maintained, the proposal has the potential to temporarily degrade the quality of the environment during construction through erosion, sedimentation, dust and vegetation removal. Proposed environmental safeguards are detailed in section 6.2 and 0. During operation, the design has incorporated measures to minimise impact to the environment through urban design. As a result, the quality of the environment is not likely to be degraded.</p>	<p>Short-term minor negative impact Long-term neutral impact</p>
<p><b>j) Any risk to the safety of the environment?</b></p> <p>The proposal is unlikely to cause any pollution or safety risks to the environment provided the recommended mitigation measures are implemented.</p>	<p>Nil</p>
<p><b>k) Any reduction in the range of beneficial uses of the environment?</b></p> <p>The proposal would not reduce the range of beneficial uses of the environment during construction. During operation, Garie Road would be reinstated allowing for greater movement and connectivity of visitors to the Royal National Park to Garie Beach, Little Garie Beach, the Little Garie Cabin Community as well as surrounding walking tracks. The proposal would reinstate the range of beneficial uses that the community and visitors would be able to experience of the environment.</p>	<p>Long-term minor positive impact</p>
<p><b>l) Any pollution of the environment?</b></p> <p>Providing the mitigation measures outlined in this REF are implemented (refer to section 7.2), the operation of the proposal is not expected to result in any pollution of the environment.</p>	<p>Nil</p>
<p><b>m) Any environmental problems associated with the disposal of waste?</b></p> <p>Provided that the mitigation measures in section 7.2 are implemented, the proposal is unlikely to cause any environmental problems associated with the disposal of waste.</p>	<p>Nil</p>
<p><b>n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</b></p> <p>The proposal is unlikely to increase demands on resources that are or are likely to become in short supply.</p>	<p>Nil</p>
<p><b>o) Any cumulative environmental effect with other existing or likely future activities?</b></p> <p>There are no expected positive or negative cumulative impacts from other existing or likely future activities.</p>	<p>Nil</p>

Factor	Impact
<p>p) <b>Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</b></p> <p>The proposal would not affect or be affected by any coastal processes or hazards.</p>	<p>Nil</p>
<p>q) <b>Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1.</b></p> <p>The proposal would align with:</p> <ul style="list-style-type: none"> <li>• Our Shire Towards 2032</li> <li>• Sutherland Shire Local Strategic Planning Statement 2020</li> <li>• Sutherland Shire Environment and Sustainability Strategy 2012</li> <li>• Safer Communities Strategy 2022-2032.</li> </ul> <p>See section 2 of this REF for further information on the local context of the area and section 4 for further information on statutory and planning framework.</p>	<p>Nil</p>
<p>r) <b>Other relevant environmental factors</b></p>	<p>In considering the potential impacts of this proposal all relevant environmental factors have been considered, refer to section 6 of this REF.</p>

## Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act 1999, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of Climate Change, Energy, the Environment and Water.

A referral is not required for proposed actions that may affect nationally listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in line with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
<p><b>a) Any impact on a World Heritage property?</b></p> <p>There are no World Heritage Properties within or near the proposal.</p>	Nil
<p><b>b) Any impact on a National Heritage place?</b></p> <p>There is one National Heritage place i.e. Royal National Park that would be impacted as part of the proposal. About 504 square metres and the two temporary ancillary facilities ie. NPWS helipad and Governor Game lookout, would be located on National Park Estate. The proposal area would directly impact vegetation, however no vegetation removal would be required for the ancillary facilities. However, the impact would be considered negligible as it forms a small part of the Royal National Park and would not impact the National Heritage listing.</p>	Negligible
<p><b>c) Any impact on a wetland of international importance?</b></p> <p>There are no wetlands of international importance within or near the proposal.</p>	Nil
<p><b>d) Any impact on a listed threatened species or communities?</b></p> <p>No threatened ecological communities are contained within the proposal area. One TEC was identified that is associated with PCT 3134: Littoral Rainforest and Coastal Vine Thickets of Eastern Australia. However, this TEC would not be directly affected by the proposal. Therefore, the impact would be nil.</p> <p>The scrub turpentine (Critically Endangered TEC under the EPBC Act) was found within the proposal area, however the design of the proposal was amended to avoid impacts to this threatened species. Further targeted surveys were conducted for the Bauer's Midge Orchid and for the red-crowned toadlet, however neither of these species were found to occur within the proposal area.</p>	Nil
<p><b>e) Any impacts on listed migratory species?</b></p> <p>Migratory species are unlikely to use vegetation in the study area due to an abundance of adjacent habitat which would typically be preferred by migratory species as there is less interaction with traffic and traffic noise. Therefore, the impact would be considered low.</p>	Nil
<p><b>f) Any impact on a Commonwealth marine area?</b></p> <p>The proposed works would not have any impacts on Commonwealth marine areas.</p>	Nil
<p><b>g) Does the proposed modification involve a nuclear action (including uranium mining)?</b></p> <p>The proposal does not involve any nuclear action.</p>	Nil
<p><b>h) Additionally, any impact (direct or indirect) on Commonwealth land?</b></p>	Nil

Factor	Impact
The proposal does not involve any direct or indirect impacts to the environment of Commonwealth land.	



# Appendix B - Statutory consultation checklists

## SEPP (Transport and Infrastructure)

### Certain development types

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) section
Car park	Does the project include a car park intended for the use by commuters using regular bus services?	No	Sutherland Shire Council	Section 2.110
Bus depots	Does the project propose a bus depot?	No	Sutherland Shire Council	Section 2.110
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	Sutherland Shire Council	Section 2.110

### Development within the Coastal Zone

Issue	Description	Yes / No / N/A	If 'yes' consult with	SEPP (Transport and Infrastructure) section
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	Sutherland Shire Council	Section 2.14

Note: See interactive map [Coastal management-\(nsw.gov.au\)](http://Coastal%20management-(nsw.gov.au)). Note the coastal vulnerability area has not yet been mapped.

Note: a certified coastal zone management plan is taken to be a certified coastal management program.

Council-related infrastructure or services

Development type	Potential impact	Yes / No	If 'yes' consult with the relevant local council(s).	SEPP (Transport and Infrastructure) section
Stormwater	Are the works likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?	No	Sutherland Shire Council	Section 2.10
Traffic	Are the works likely to generate traffic to an extent that will strain the capacity of the existing road system in a local government area?	No	Sutherland Shire Council	Section 2.10
Sewerage system	Will the works involve connection to a council-owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?	No	Sutherland Shire Council	Section 2.10
Water usage	Will the works involve connection to a council-owned water supply system? If so, will this require the use of a <i>substantial</i> volume of water?	No	Sutherland Shire Council	Section 2.10
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?	No	Sutherland Shire Council	Section 2.10
Road and footpath excavation	Will the works involve more than minor or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	Sutherland Shire Council	Section 2.10

Local heritage items

Development type	Potential impact	Yes / No	If 'yes' consult with the relevant local council(s).	SEPP (Transport and Infrastructure) section
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works?  If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than <i>minor</i> or <i>inconsequential</i> ?	No	Sutherland Shire Council	Section 2.11

Flood liable land

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) section
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a <i>minor</i> extent?	No	Sutherland Shire Council	Section 2.12
Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance?	No	State Emergency Services Email: erm@ses.nsw.gov.au	Section 2.13

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in line 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.

Public authorities other than councils

Development type	Potential impact	Yes / No	If 'yes' consult with the relevant local council(s).	SEPP (Transport and Infrastructure) section
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> , or on land acquired under that Act?	Yes	Environment, Energy and Science, DPE	Section 2.15
National parks and reserves	Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	Yes	Environment, Energy and Science, DPE	Section 2.15
Aquatic reserves and marine parks	Are the works adjacent to an aquatic reserve or a marine park declared under the <i>Marine Estate Management Act 2014</i> ?	No	Department of Planning and Environment	Section 2.15
Sydney Harbour foreshore	Are the works in the Sydney Harbour Foreshore Area as defined by the <i>Sydney Harbour Foreshore Authority Act 1998</i> ?	No	Property NSW	Section 2.15
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service [Refer to the NSW Rural Fire Service publication <i>Planning for Bush Fire Protection</i> (2006)]	Section 2.15
Artificial light	Would the works 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? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	Section 2.15
Defence communications buffer land	Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in Section 5.15 of Lockhart	No	Secretary of the Commonwealth Department of Defence	Section 2.15

Development type	Potential impact	Yes / No	If 'yes' consult with the relevant local council(s).	SEPP (Transport and Infrastructure) section
	LEP 2012, Narrandera LEP 2013 and Urana LEP 2011).			
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the <i>Mine Subsidence Compensation Act 1961</i> ?	No	Mine Subsidence Board	Section 2.15
Willandra Lakes Region World Heritage Property	Are the works on land or reasonably likely to have an impact on, a part of the Willandra Lakes Region World Heritage Property?	No	World Heritage Advisory Committee Heritage NSW	Section 2.15
Western City operational area	Are the works within a Western City operational area specified in the <i>Western Parkland City Authority Act 2018</i> , Schedule 2 with a capital investment value of \$30 million or more?	No	Western Parkland City Authority	Section 2.15

# Appendix C – Detailed design and Staging Diagrams





THE INDICATIVE CONSTRUCTION SEQUENCE SHOWN IS FOR THE PURPOSES OF THE ENVIRONMENTAL ASSESSMENT ONLY. THE PROVIDED CONSTRUCTION SEQUENCE IS BASED ON THE GEOTECHNICAL SITE CONSTRAINTS RESULTING FROM THE LANDSLIDE TO ALLOW A CONSTRUCTION SEQUENCE THAT MITIGATES STABILITY RISK TO THE CONSTRUCTION PLANT AND PERSONNEL.

NOTE THE ACTUAL CONSTRUCTION METHODOLOGY MAY CHANGE DEPENDENT ON THE CONTRACTORS CHOSEN CONSTRUCTION METHODOLOGY IN CONSULTATION WITH THEIR TEMPORARY WORKS DESIGNER.

INDICATIVE CONSTRUCTION SEQUENCE TO BE READ IN ASSOCIATION WITH DESIGN DRAWINGS 520212TP-AURC-80232-GE-DRG-000001-000080.

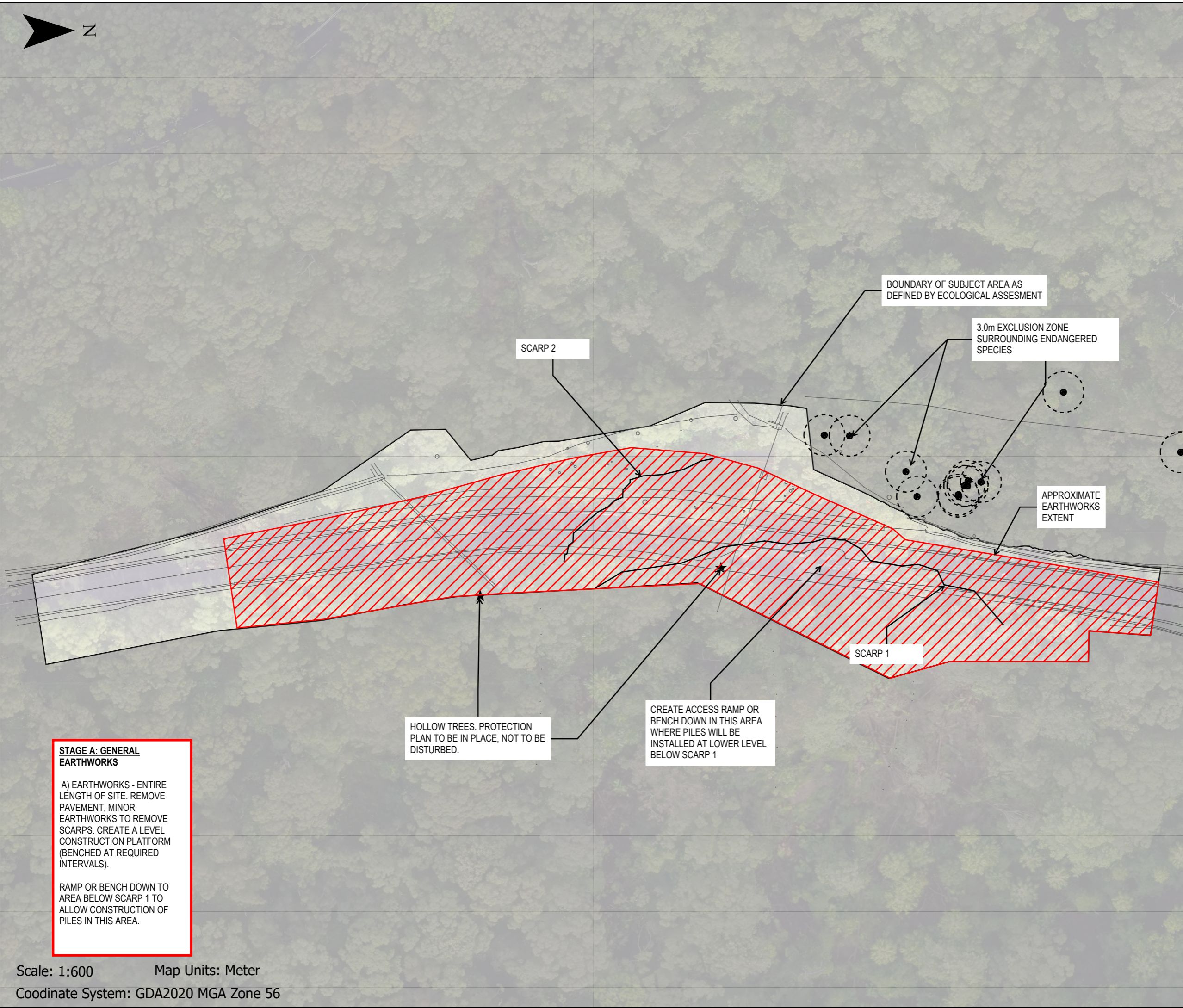
CONSTRUCTION SEQUENCE BASED ON THE IFC DESIGN ALIGNMENT MAY CHANGE SLIGHTLY.

HATCHED AREAS INDICATIVE CONSTRUCTION FOOTPRINTS ONLY.

SKETCH NOT TO SCALE

DRAFTED: LJ  
APPROVED: TD

DATE: 07/11/2023



**STAGE A: GENERAL EARTHWORKS**

A) EARTHWORKS - ENTIRE LENGTH OF SITE. REMOVE PAVEMENT, MINOR EARTHWORKS TO REMOVE SCARPS. CREATE A LEVEL CONSTRUCTION PLATFORM (BENCHED AT REQUIRED INTERVALS).

RAMP OR BENCH DOWN TO AREA BELOW SCARP 1 TO ALLOW CONSTRUCTION OF PILES IN THIS AREA.





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NOTE THE ACTUAL CONSTRUCTION METHODOLOGY MAY CHANGE DEPENDENT ON THE CONTRACTORS CHOSEN CONSTRUCTION METHODOLOGY IN CONSULTATION WITH THEIR TEMPORARY WORKS DESIGNER.

INDICATIVE CONSTRUCTION SEQUENCE TO BE READ IN ASSOCIATION WITH DESIGN DRAWINGS 520212TP-AURC-80232-GE-DRG-000001-000080.

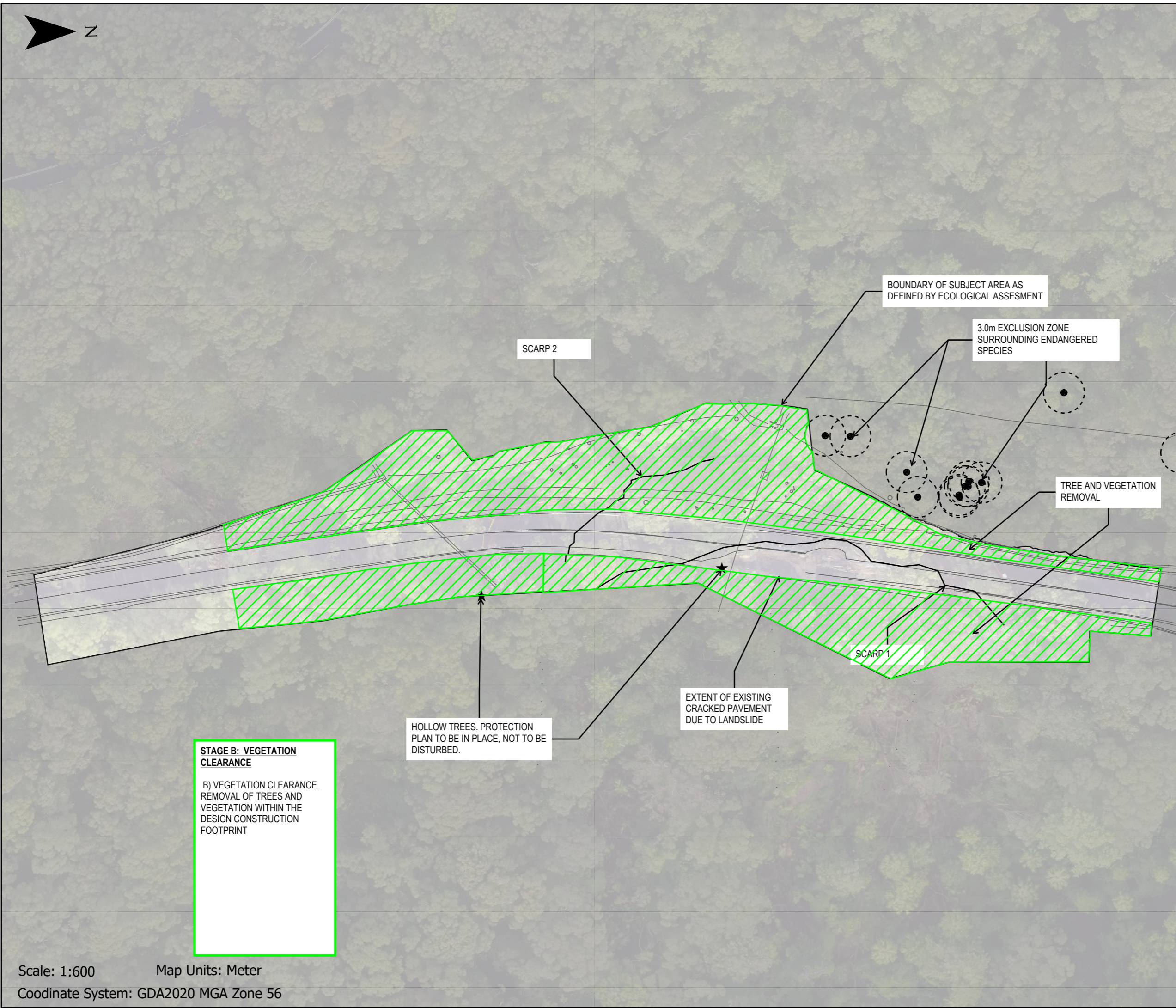
CONSTRUCTION SEQUENCE BASED ON THE IFC DESIGN ALIGNMENT MAY CHANGE SLIGHTLY.

HATCHED AREAS INDICATIVE CONSTRUCTION FOOTPRINTS ONLY.

SKETCH NOT TO SCALE

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DATE: 07/11/2023



**STAGE B: VEGETATION CLEARANCE**  
B) VEGETATION CLEARANCE. REMOVAL OF TREES AND VEGETATION WITHIN THE DESIGN CONSTRUCTION FOOTPRINT

HOLLOW TREES. PROTECTION PLAN TO BE IN PLACE, NOT TO BE DISTURBED.

EXTENT OF EXISTING CRACKED PAVEMENT DUE TO LANDSLIDE

BOUNDARY OF SUBJECT AREA AS DEFINED BY ECOLOGICAL ASSESSMENT

3.0m EXCLUSION ZONE SURROUNDING ENDANGERED SPECIES

TREE AND VEGETATION REMOVAL

SCARP 2

SCARP 1





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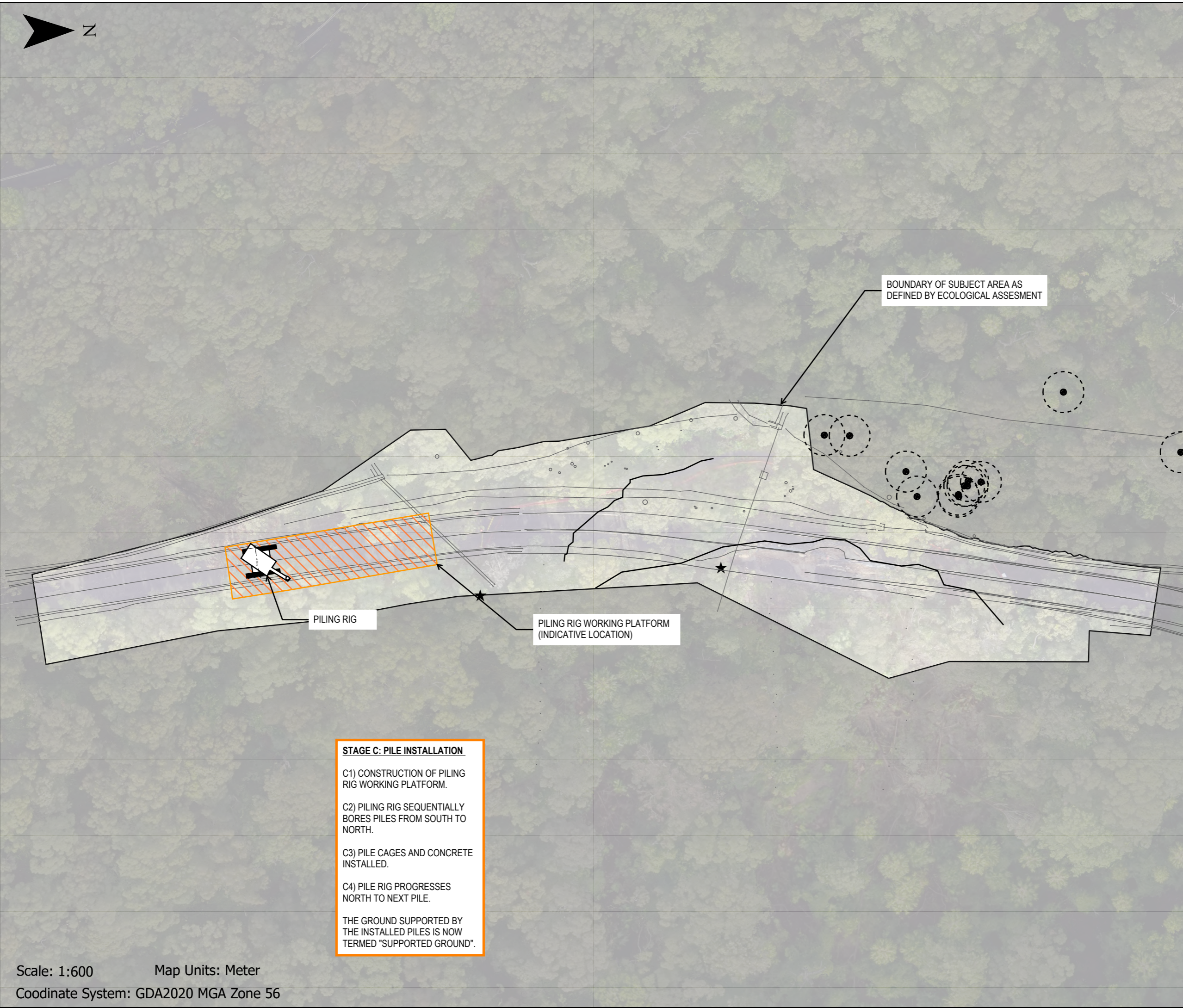
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Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Esri, Geoscience Australia, NASA, NGA, USGS



BOUNDARY OF SUBJECT AREA AS DEFINED BY ECOLOGICAL ASSESSMENT

PILING RIG

PILING RIG WORKING PLATFORM (INDICATIVE LOCATION)

**STAGE C: PILE INSTALLATION**  
C1) CONSTRUCTION OF PILING RIG WORKING PLATFORM.  
C2) PILING RIG SEQUENTIALLY BORES PILES FROM SOUTH TO NORTH.  
C3) PILE CAGES AND CONCRETE INSTALLED.  
C4) PILE RIG PROGRESSES NORTH TO NEXT PILE.  
THE GROUND SUPPORTED BY THE INSTALLED PILES IS NOW TERMED "SUPPORTED GROUND".





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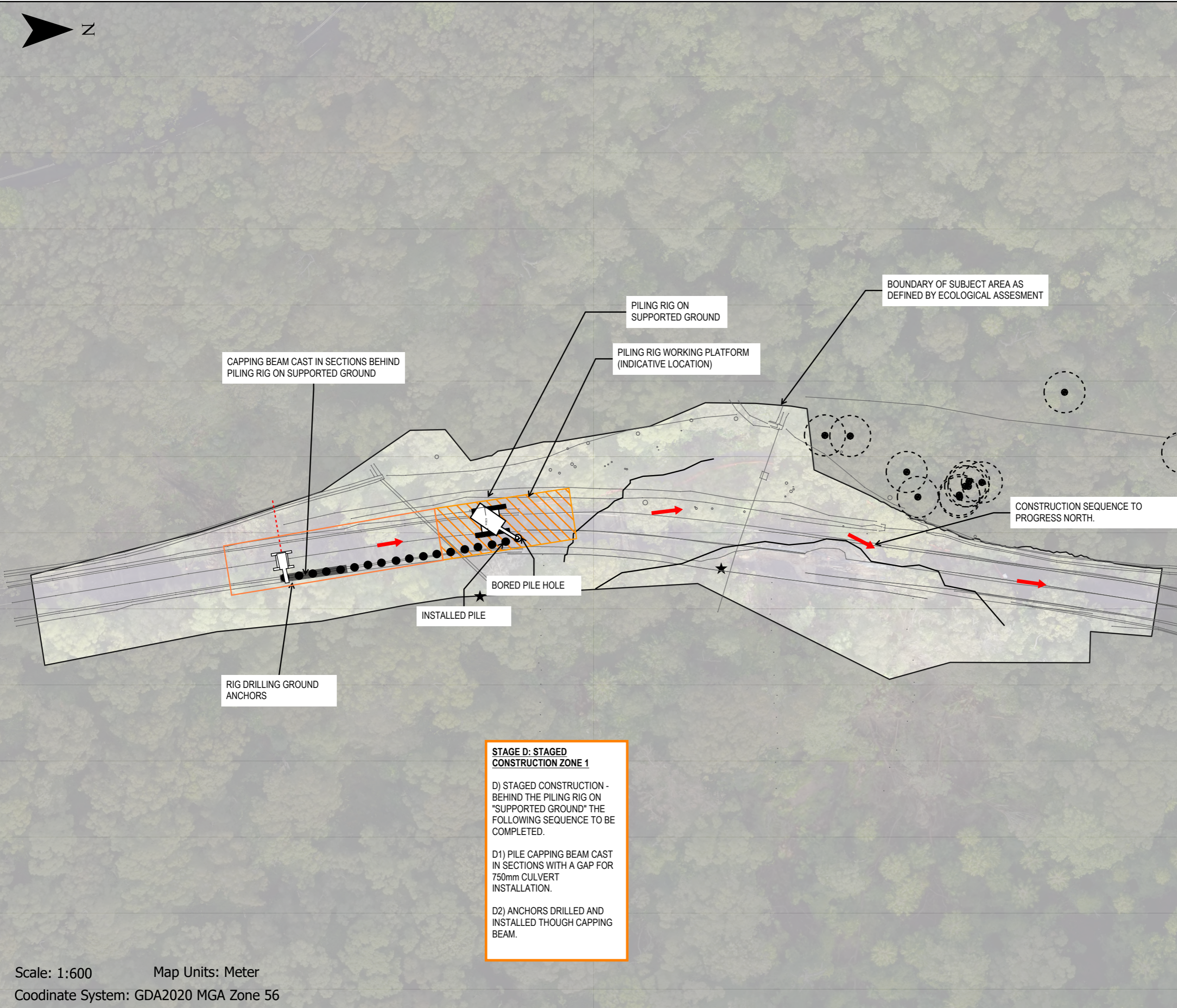
SKETCH NOT TO SCALE

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Esri, HERE, Garmin, Foursquare, METI/NASA, USGS, Esri, Geoscience Australia, NASA, NGA, USGS



**STAGE D: STAGED CONSTRUCTION ZONE 1**

D) STAGED CONSTRUCTION - BEHIND THE PILING RIG ON "SUPPORTED GROUND" THE FOLLOWING SEQUENCE TO BE COMPLETED.

D1) PILE CAPPING BEAM CAST IN SECTIONS WITH A GAP FOR 750mm CULVERT INSTALLATION.

D2) ANCHORS DRILLED AND INSTALLED THROUGH CAPPING BEAM.





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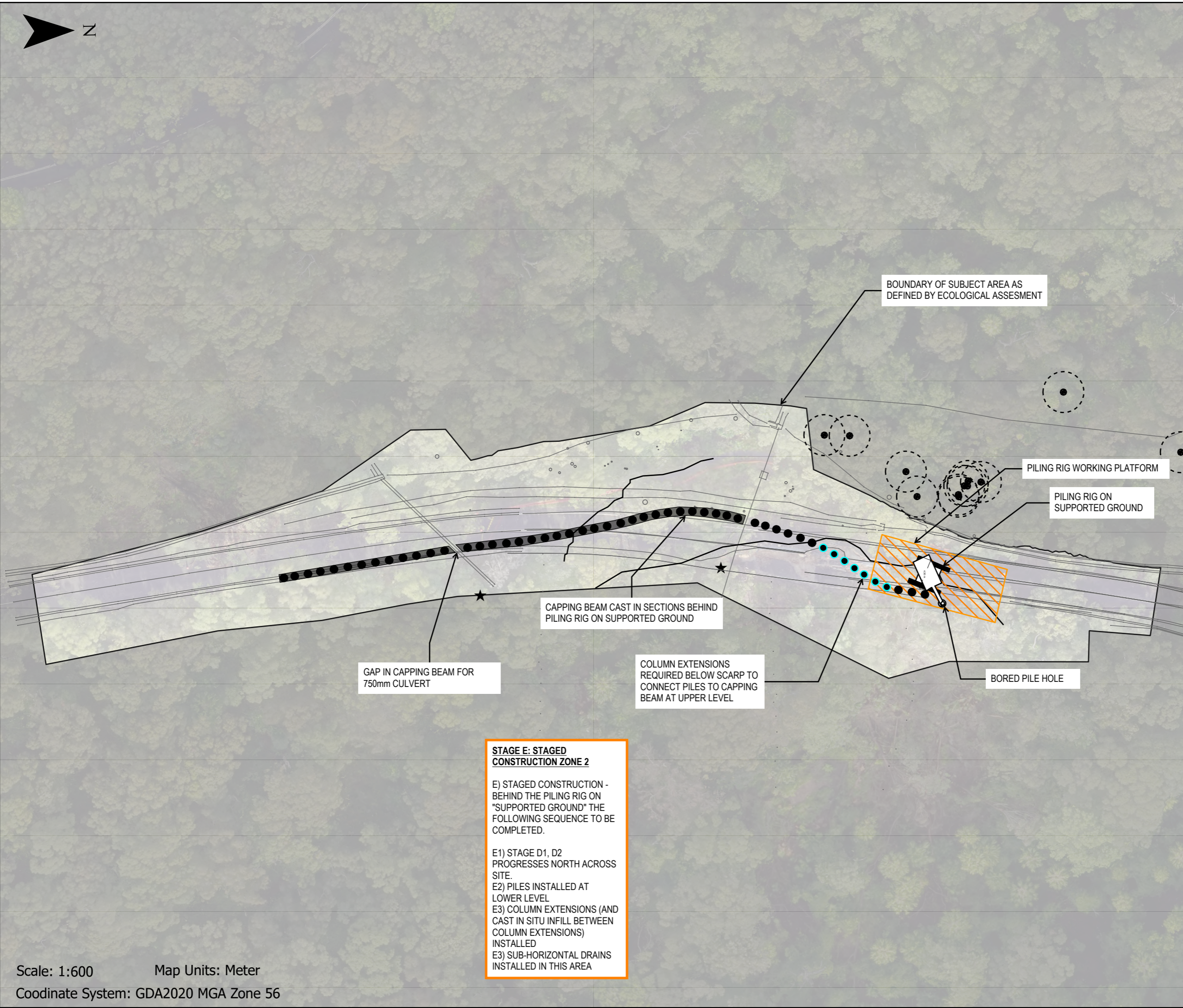
CONSTRUCTION SEQUENCE BASED ON THE IFC DESIGN ALIGNMENT MAY CHANGE SLIGHTLY.

HATCHED AREAS INDICATIVE CONSTRUCTION FOOTPRINTS ONLY.

SKETCH NOT TO SCALE

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APPROVED: TD

DATE: 07/11/2023



BOUNDARY OF SUBJECT AREA AS  
DEFINED BY ECOLOGICAL ASSESSMENT

PILING RIG WORKING PLATFORM

PILING RIG ON  
SUPPORTED GROUND

CAPPING BEAM CAST IN SECTIONS BEHIND  
PILING RIG ON SUPPORTED GROUND

GAP IN CAPPING BEAM FOR  
750mm CULVERT

COLUMN EXTENSIONS  
REQUIRED BELOW SCARP TO  
CONNECT PILES TO CAPPING  
BEAM AT UPPER LEVEL

BORED PILE HOLE

**STAGE E: STAGED  
CONSTRUCTION ZONE 2**

E) STAGED CONSTRUCTION -  
BEHIND THE PILING RIG ON  
"SUPPORTED GROUND" THE  
FOLLOWING SEQUENCE TO BE  
COMPLETED.

E1) STAGE D1, D2  
PROGRESSES NORTH ACROSS  
SITE.  
E2) PILES INSTALLED AT  
LOWER LEVEL  
E3) COLUMN EXTENSIONS (AND  
CAST IN SITU INFILL BETWEEN  
COLUMN EXTENSIONS)  
INSTALLED  
E3) SUB-HORIZONTAL DRAINS  
INSTALLED IN THIS AREA





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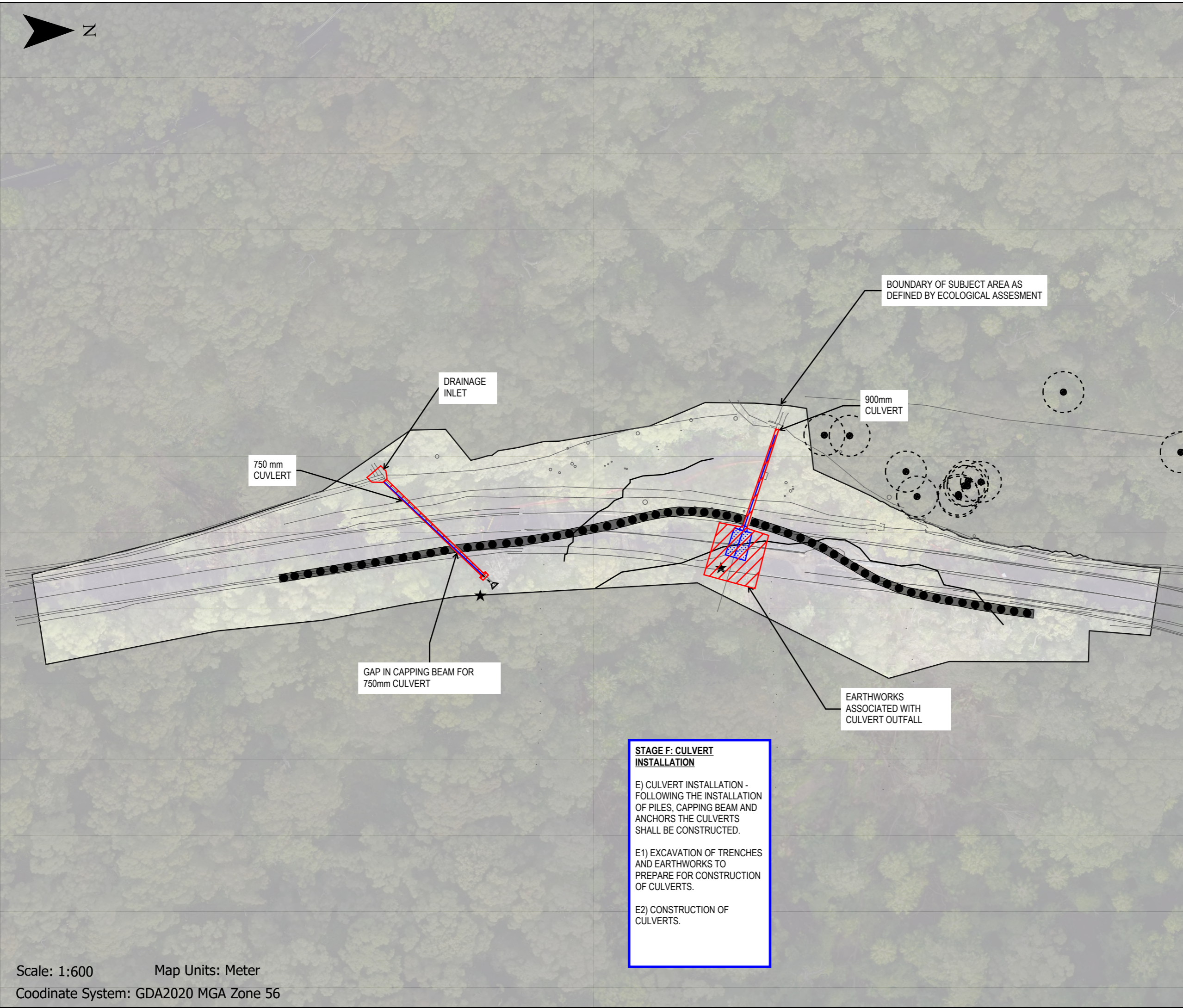
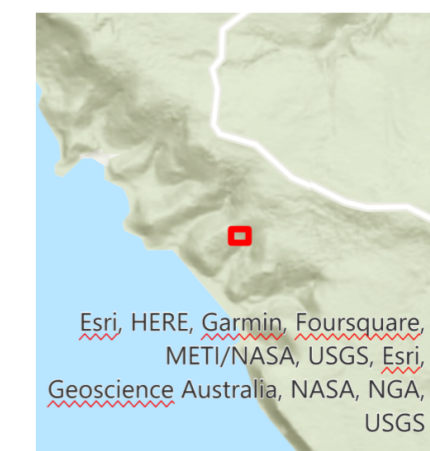
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BOUNDARY OF SUBJECT AREA AS  
DEFINED BY ECOLOGICAL ASSESSMENT

DRAINAGE  
INLET

750 mm  
CUVLERT

900mm  
CULVERT

GAP IN CAPPING BEAM FOR  
750mm CULVERT

EARTHWORKS  
ASSOCIATED WITH  
CULVERT OUTFALL

**STAGE F: CULVERT  
INSTALLATION**

E) CULVERT INSTALLATION -  
FOLLOWING THE INSTALLATION  
OF PILES, CAPPING BEAM AND  
ANCHORS THE CULVERTS  
SHALL BE CONSTRUCTED.

E1) EXCAVATION OF TRENCHES  
AND EARTHWORKS TO  
PREPARE FOR CONSTRUCTION  
OF CULVERTS.

E2) CONSTRUCTION OF  
CULVERTS.





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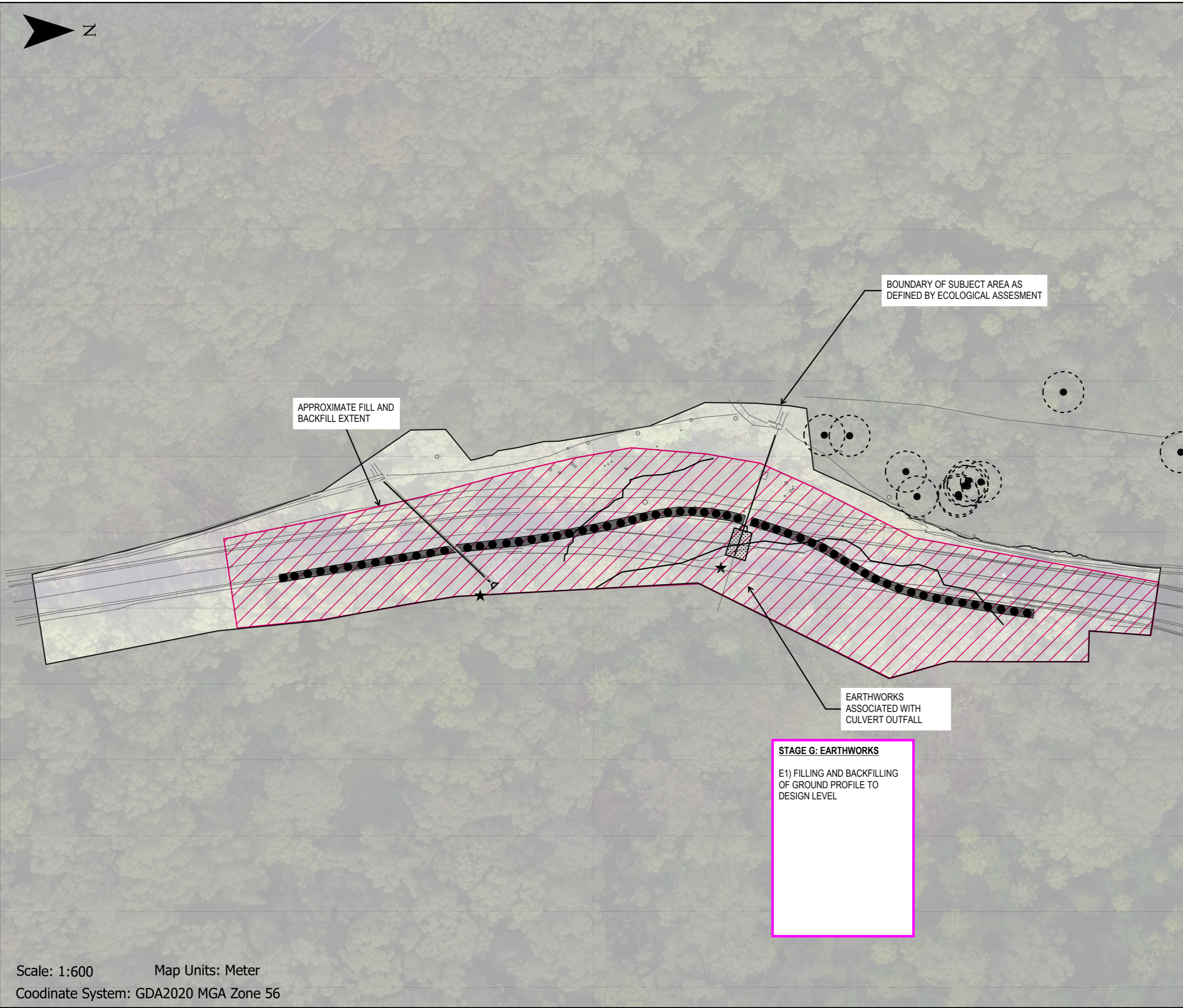
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APPROXIMATE FILL AND BACKFILL EXTENT

BOUNDARY OF SUBJECT AREA AS DEFINED BY ECOLOGICAL ASSESSMENT

EARTHWORKS ASSOCIATED WITH CULVERT OUTFALL

**STAGE G: EARTHWORKS**  
E1) FILLING AND BACKFILLING OF GROUND PROFILE TO DESIGN LEVEL





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BOUNDARY OF SUBJECT AREA AS  
DEFINED BY ECOLOGICAL ASSESMENT

SWALE DRAIN

PAVEMENT

CRASH  
BARRIER

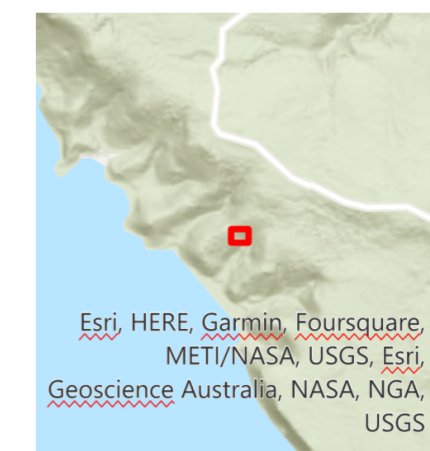
**STAGE H:ROAD  
CONSTRUCTION**

F) ROAD AND ASSOCIATED  
FEATURES CONSTRUCTION.

F1) CONSTRUCTION OF  
CULVERT INLETS AND SWALE  
DRAINS.

F2) PAVEMENT LAYERS AND  
ASPHALT CONSTRUCTED

F3) CRASH BARRIER  
CONSTRUCTED.







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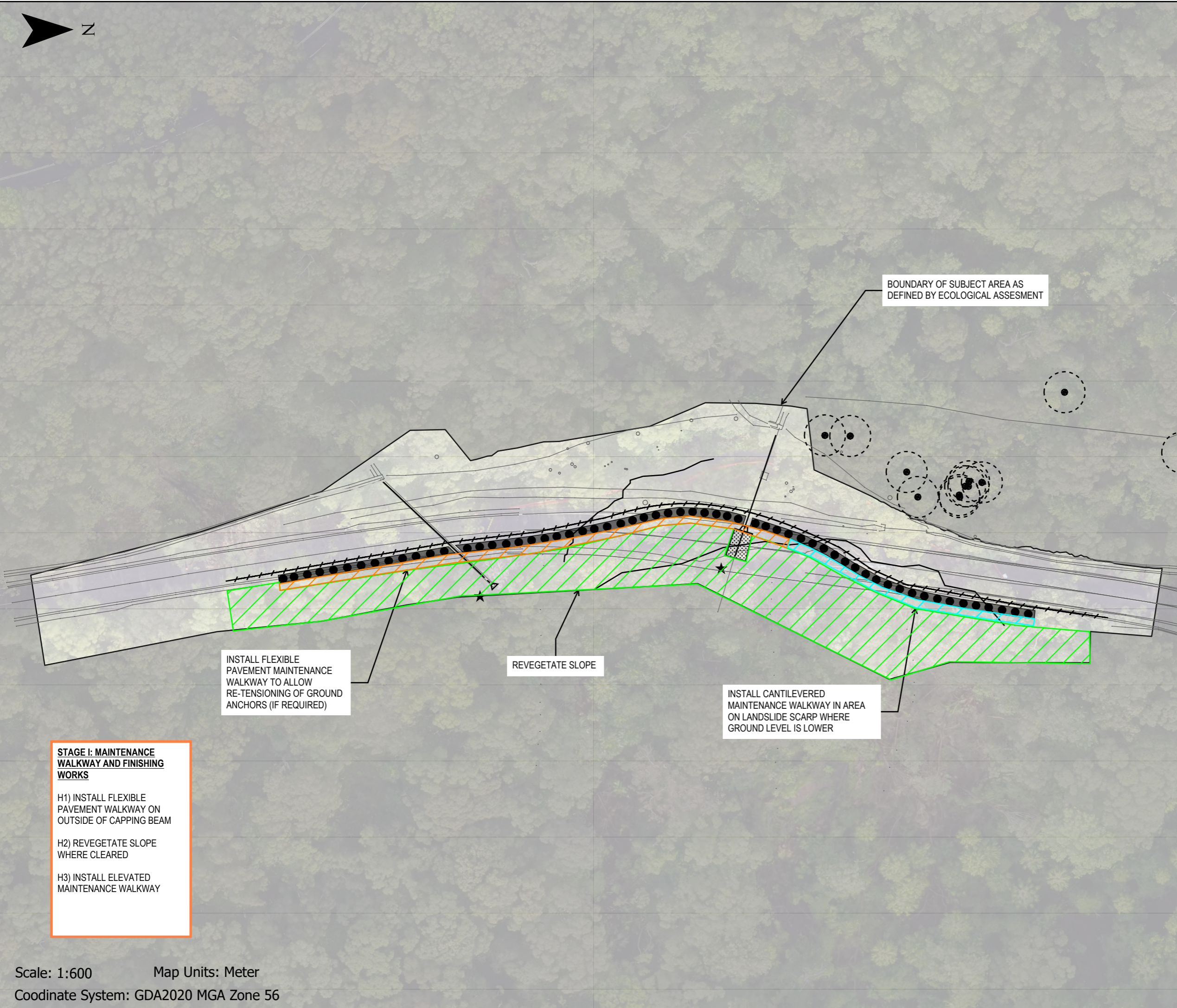
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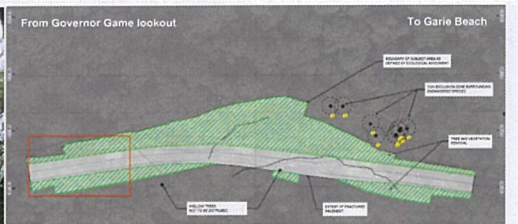
**STAGE I: MAINTENANCE WALKWAY AND FINISHING WORKS**

H1) INSTALL FLEXIBLE PAVEMENT WALKWAY ON OUTSIDE OF CAPPING BEAM

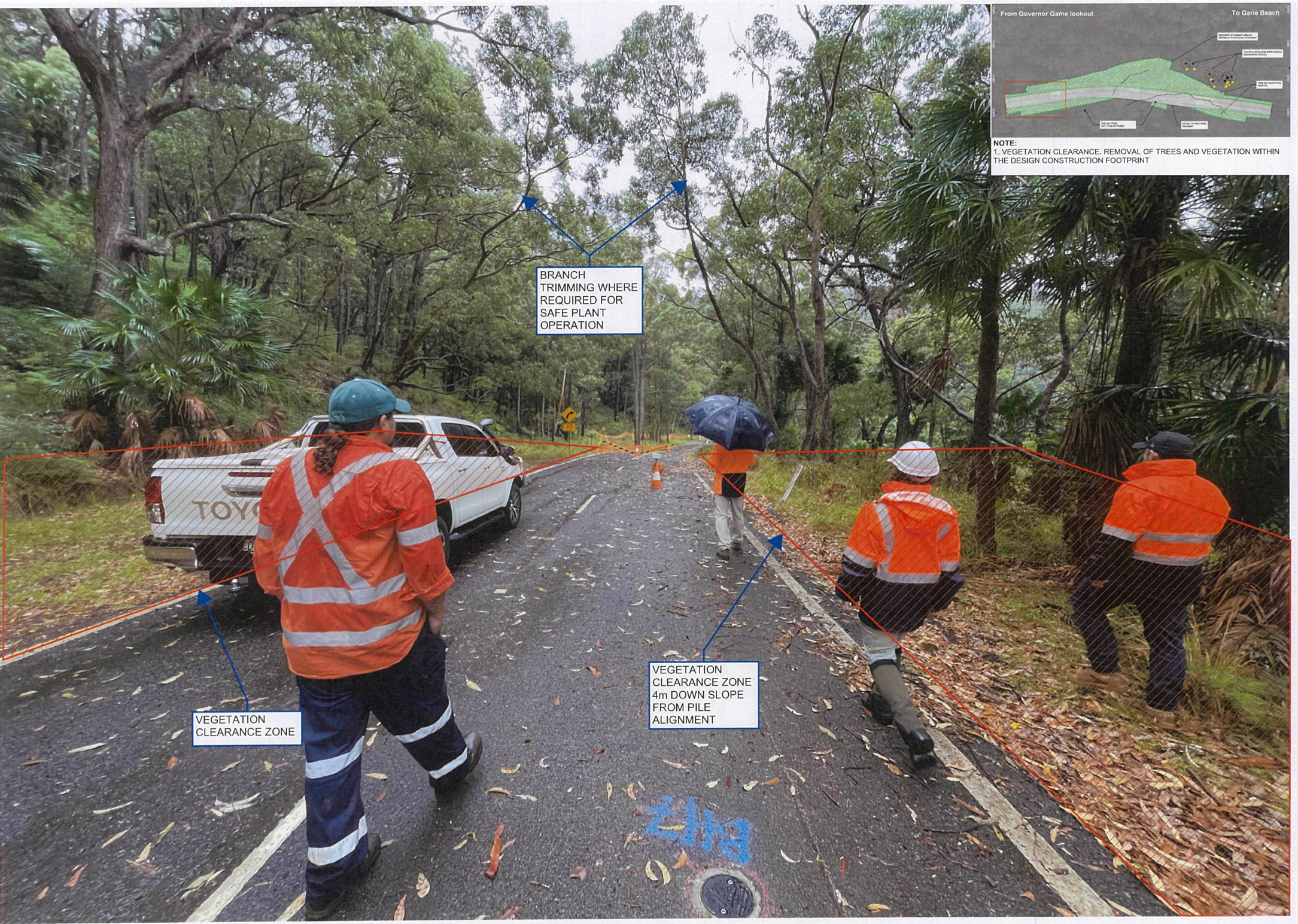
H2) REVEGETATE SLOPE WHERE CLEARED

H3) INSTALL ELEVATED MAINTENANCE WALKWAY





**NOTE:**  
 1. VEGETATION CLEARANCE, REMOVAL OF TREES AND VEGETATION WITHIN THE DESIGN CONSTRUCTION FOOTPRINT



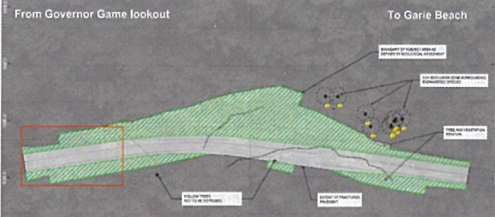
BRANCH TRIMMING WHERE REQUIRED FOR SAFE PLANT OPERATION

VEGETATION CLEARANCE ZONE

VEGETATION CLEARANCE ZONE  
 4m DOWN SLOPE FROM PILE ALIGNMENT



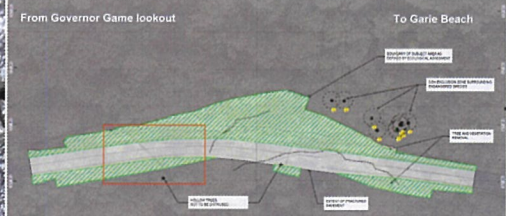




**NOTE:**  
1. VEGETATION CLEARANCE. REMOVAL OF TREES AND VEGETATION WITHIN THE DESIGN CONSTRUCTION FOOTPRINT

VEGETATION  
CLEARANCE ZONE  
4M DOWNSLOPE  
FROM PILE  
ALIGNMENT





**NOTE:**  
1. VEGETATION CLEARANCE. REMOVAL OF TREES AND VEGETATION WITHIN THE DESIGN CONSTRUCTION FOOTPRINT

DEFINE BY NEW V DRAIN AND TOE OF UPSLOPE BATTER

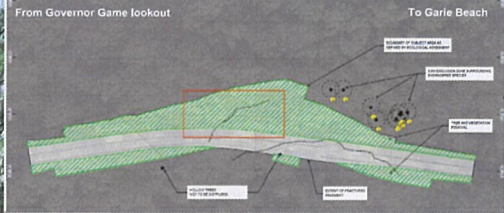
VEGETATION CLEARANCE ZONE

VEGETATION CLEARANCE ZONE 4M DOWN SLOPE FROM PILE ALIGNMENT









**NOTE:**  
1. VEGETATION CLEARANCE. REMOVAL OF TREES AND VEGETATION WITHIN THE DESIGN CONSTRUCTION FOOTPRINT

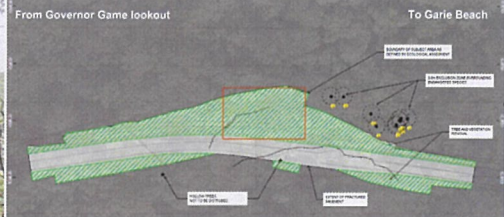
VEGETATION CLEARANCE ZONE

AREA FOR NEW ROAD ALIGNMENT & V DRAIN





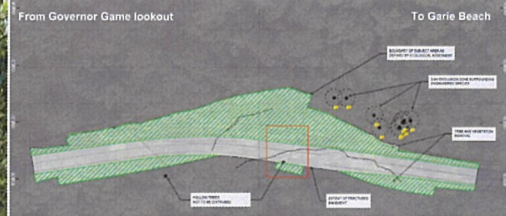
VEGETATION  
CLEARANCE ZONE



**NOTE:**  
1. VEGETATION CLEARANCE. REMOVAL OF TREES AND VEGETATION WITHIN THE DESIGN CONSTRUCTION FOOTPRINT







**NOTE:**  
 1. VEGETATION CLEARANCE. REMOVAL OF TREES AND VEGETATION WITHIN THE DESIGN CONSTRUCTION FOOTPRINT



DEAD TREES TO BE REMOVED

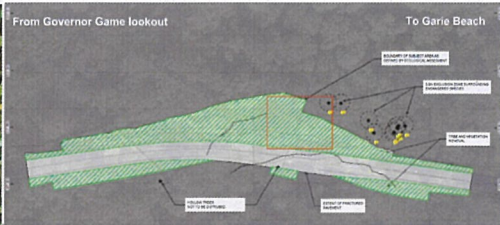
VEGETATION CLEARANCE ZONE .

AREA FOR DRAINAGE CROSSING OUTLET





VEGETATION  
CLEARANCE ZONE

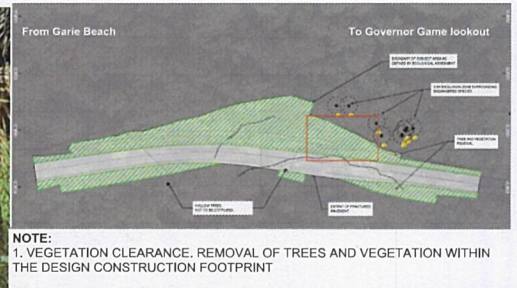


**NOTE:**  
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VEGETATION  
CLEARANCE ZONE

DEFINED BY TOE OF  
BATTER



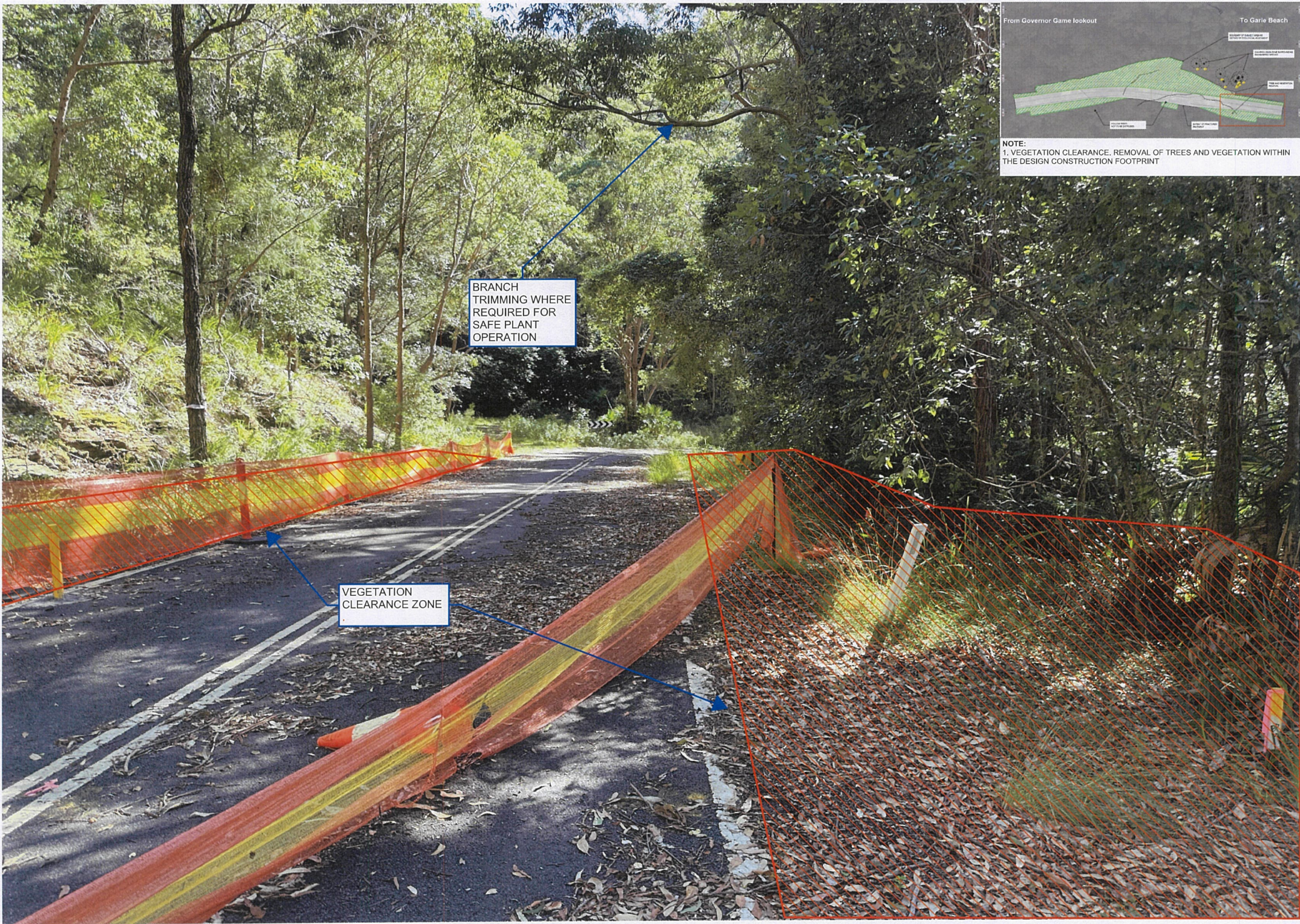






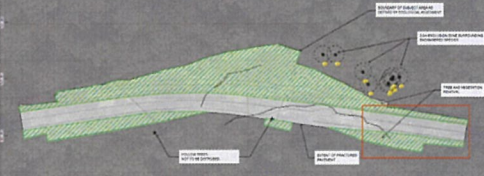






From Governor Game lookout

To Garie Beach



**NOTE:**  
1. VEGETATION CLEARANCE. REMOVAL OF TREES AND VEGETATION WITHIN THE DESIGN CONSTRUCTION FOOTPRINT





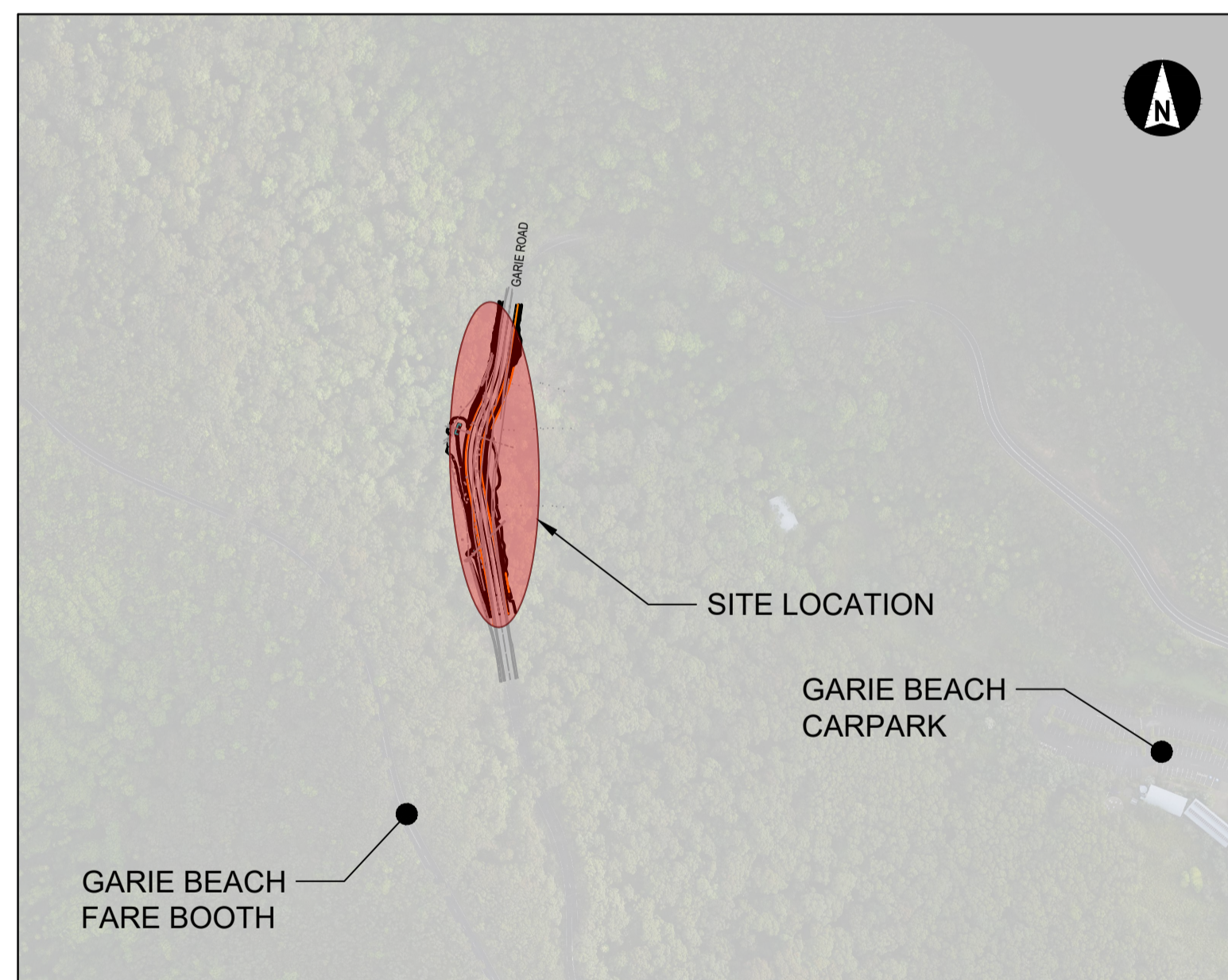
ROAD No. 4025  
SITE No. SL80232  
GARIE ROAD

SYDNEY ROAD ASSETS  
PERFORMANCE CONTRACT  
HARBOUR ZONE

# ANCHORED BORED PILE WALL SLOPE STABILISATION

## 100% DETAILED DESIGN

### GEOTECHNICAL AND STRUCTURAL DRAWING SET



LOCALITY PLAN  
NTS

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- IN ELECTRONIC FORM WITHOUT REQUESTING AND CHECKING THEM FOR ACCURACY AGAINST THE ORIGINAL HARD COPY VERSIONS.
- FOR ANY PURPOSES NOT AGREED TO IN WRITING BY AURECON.

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SCHEDULE OF DRAWINGS		
DRAWING NUMBER	DRAWING DESCRIPTION	REV
520212TP-AURC-80232-GE-DRG-000001	COVER SHEET AND DRAWING LIST	C
520212TP-AURC-80232-GE-DRG-000002	GENERAL NOTES	C
520212TP-AURC-80232-GE-DRG-000003	INDICATIVE CONSTRUCTION SEQUENCE	C
520212TP-AURC-80232-GE-DRG-000010	GENERAL ARRANGEMENT	C
520212TP-AURC-80232-GE-DRG-000015	GEOTECHNICAL POST CONSTRUCTION MONITORING PLAN	C
520212TP-AURC-80232-GE-DRG-000020	ANCHORED BORED PILE WALL ARRANGEMENT PLAN	C
520212TP-AURC-80232-GE-DRG-000021	PILE AND GROUND ANCHOR SCHEDULE TABLE AND NOTES	C
520212TP-AURC-80232-GE-DRG-000022	PILE STRUCTURAL DETAILS	C
520212TP-AURC-80232-GE-DRG-000023	PILE EXTENSION AND RETAINING WALL STRUCTURAL DETAILS	C
520212TP-AURC-80232-GE-DRG-000024	CAPPING BEAM STRUCTURAL DETAILS	C
520212TP-AURC-80232-GE-DRG-000025	TYPICAL PILE AND GROUND ANCHOR DETAIL	C
520212TP-AURC-80232-GE-DRG-000026	MAINTENANCE WALKWAY DETAILS - SHEET 1	C
520212TP-AURC-80232-GE-DRG-000027	MAINTENANCE WALKWAY DETAILS - SHEET 2	C
520212TP-AURC-80232-GE-DRG-000040	GEOLOGICAL CROSS SECTION - SHEET 1	C
520212TP-AURC-80232-GE-DRG-000041	GEOLOGICAL CROSS SECTION - SHEET 2	C
520212TP-AURC-80232-GE-DRG-000042	GEOLOGICAL CROSS SECTION - SHEET 3	C
520212TP-AURC-80232-GE-DRG-000070	SID REGISTER - SHEET 1	C
520212TP-AURC-80232-GE-DRG-000071	SID REGISTER - SHEET 2	C
520212TP-AURC-80232-GE-DRG-000080	BAR SHAPES DIAGRAM	C

FOR REVIEW

<p>REFERENCES:</p> <table border="1"> <thead> <tr> <th>REV</th> <th>DESCRIPTION</th> <th>DESIGNER INITIAL/DATE</th> <th>VERIFIED INITIAL/DATE</th> <th>APPROVED INITIAL/DATE</th> </tr> </thead> <tbody> <tr><td>C</td><td>100% DETAILED DESIGN</td><td>H.Z. 28/04/2023</td><td>W.D. 28/04/2023</td><td>M.A. 28/04/2023</td></tr> <tr><td>B</td><td>100% DETAILED DESIGN</td><td>H.Z. 13/04/2023</td><td>W.D. 13/04/2023</td><td>M.A. 13/04/2023</td></tr> <tr><td>A01.01</td><td>80% DETAILED DESIGN</td><td>H.Z. 30/01/2023</td><td>W.D. 30/01/2023</td><td>C.G. 30/01/2023</td></tr> </tbody> </table>	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023	B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023	A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p>SCALE:</p>	<p>CLIENT:</p>	<p><i>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</i></p>	<p>HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232 ANCHORED BORED PILE WALL SLOPE STABILISATION COVER SHEET AND DRAWING LIST</p>
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**GENERAL**

- THE INFORMATION CONTAINED IN THESE DRAWINGS PRODUCED BY AURECON IS SOLELY FOR THE USE OF CONNECT SYDNEY FOR THE PURPOSE FOR WHICH IT HAS BEEN PREPARED. AURECON AUSTRALIA PTY LTD UNDERTAKES NO DUTY TO OR ACCEPTS NO RESPONSIBILITY TO ANY THIRD PARTY WHO MAY RELY UPON THIS DOCUMENT.
- ALL WORKS SHALL BE PERFORMED IN ACCORDANCE WITH TNSW STANDARD DRAWINGS AND SPECIFICATIONS UNLESS OTHERWISE SHOWN.
- ANY DISCREPANCIES OR OMISSIONS FROM THESE DOCUMENTS SHALL BE REFERRED TO AURECON FOR CLARIFICATION AND APPROVED BY TNSW.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL CHAINAGES AND LEVELS ARE IN METRES UNLESS NOTED OTHERWISE. THE LEVEL DATUM REFERRED TO IN THESE DRAWINGS IS AUSTRALIAN HEIGHT DATUM (AHD), GDA2020 (GEOCENTRIC DATUM OF AUSTRALIA 2020) / MGA (MAP GRID OF AUSTRALIA) ZONE 56.
- ALL DIMENSIONS RELEVANT TO SETTING OUT OR OFF-SITE WORK SHALL BE VERIFIED BY THE CONTRACTOR BEFORE CONSTRUCTION AND FABRICATION HAS COMMENCED.
- DO NOT SCALE FROM DRAWINGS.
- WHERE A PROPRIETARY ITEM (OR EQUIVALENT) IS SPECIFIED, AND AN EQUIVALENT ITEM IS PROPOSED, THE CONTRACTOR SHALL PROVIDE MANUFACTURERS SPECIFICATIONS FOR BOTH PRODUCTS TO CONNECT SYDNEY FOR APPROVAL AND DEMONSTRATE THAT THE PRODUCT PERFORMANCE IS EQUIVALENT OR BETTER, PRIOR TO USE.
- ALL PROPRIETARY PRODUCTS ARE TO BE INSTALLED FIXED AND TESTED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
- SPECIFIC CONSTRUCTION DETAILS SHALL BE TAKEN FROM DETAIL DRAWINGS. GENERAL ARRANGEMENT PLANS AND SECTIONS SHALL BE USED ONLY TO SHOW SET OUT AND THE RELATIONSHIP BETWEEN ITEMS IN THE CONSTRUCTION.

**SITWORKS**

- THE CONTRACTOR IS TO MAKE SMOOTH CONNECTION TO ANY EXISTING WORKS.
- ON COMPLETION OF THE WORKS, THE CONTRACTOR MUST RESTORE OR REINSTATE ANY AREAS, STRUCTURES, PAVEMENTS OR UTILITY SERVICES DAMAGED OR DIRTIED DURING THE CONSTRUCTION, TO THE SATISFACTION OF THE DESIGNER. ALL TRENCH BACKFILL MATERIAL SHALL BE COMPACTED TO THE SAME DENSITY AS THE ADJACENT MATERIAL.
- ALL SERVICE TRENCHES UNDER VEHICULAR PAVEMENTS SHALL BE BACKFILLED IN ACCORDANCE WITH TNSW STANDARDS.
- ASPHALTIC CONCRETE SHALL CONFORM TO RMS QA SPECIFICATION R116
- THE USE OF RECYCLED MATERIALS IS ENCOURAGED. IF THE CONTRACTOR INTENDS TO USE RECYCLED MATERIALS, A RECYCLED MATERIAL COMPLYING WITH RMS QA SPECIFICATION 3051 - GRANULAR BASE AND SUBBASE MATERIALS FOR SURFACED ROAD PAVEMENTS WILL BE CONSIDERED, SUBJECT TO MATERIAL SAMPLES AND APPROPRIATE CERTIFICATIONS BEING PROVIDED TO THE SATISFACTION OF THE DESIGNER.
- THE CONTRACTOR IS TO CONTINUE TO PROVIDE CERTIFICATION FOR ALL RECYCLED MATERIALS DURING THE COURSE OF CONSTRUCTION, AND WHERE MATERIAL THAT DOES NOT COMPLY, THE CONTRACTOR WILL BE RESPONSIBLE FOR REMOVAL AND REPLACEMENT WITH A SUITABLY COMPLIANT MATERIAL AT THEIR OWN COST.
- SHOULD THE CONTRACTOR WISH TO USE A RECYCLED PRODUCT, THE INTENT SHALL BE CLEARLY INDICATED IN THEIR TENDER AND THE PRICE DIFFERENCE BETWEEN AN IGNEOUS PRODUCT AND A RECYCLED PRODUCT SHALL BE CLEARLY NOTED.
- ANY EXCAVATION OR SAW CUTTING OF THE ROAD SURFACE SHALL BE REINSTATED WITH APPROPRIATE WATERPROOFING BY THE CONTRACTOR.
- UNO DENOTES "UNLESS NOTED OTHERWISE"  
SLS DENOTES "SERVICE LIMIT STATE"  
ULS DENOTES "ULTIMATE LIMIT STATE"  
THK DENOTES "THICKNESS"  
TYP DENOTES "TYPICAL"

**SAFETY**

- THE CONTRACTOR IS RESPONSIBLE FOR SAFETY ONSITE.
- DURING CONSTRUCTION, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT THE STRUCTURES AND EXCAVATIONS ARE MAINTAINED IN A SAFE AND STABLE CONDITION AT ALL TIME AND NO PART IS TO BE OVERSTRESSED. THE CONTRACTOR SHALL DEVELOP WORK METHOD STATEMENTS FOR ALL ERECTION OF STRUCTURAL STEEL/FORMWORK/ DEMOLITION/EXCAVATION/TILT PANELS ETC. AND PROVIDE TEMPORARY WORKS SUCH AS BRACING, PROPPING AND SHORING ETC. TO KEEP THE WORKS AND EXCAVATIONS STABLE AND FREE FROM WATER AT ALL TIMES. THE CONTRACTOR IS TO ENGAGE A STRUCTURAL ENGINEER TO DESIGN AND CERTIFY THE TEMPORARY WORKS.
- THE CONTRACTOR MUST MAKE PROVISION FOR THE SAFETY OF NORMAL VEHICULAR TRAFFIC AND PEDESTRIANS, AND OTHERS INCLUDING UNAUTHORISED INTRUDERS.
- ALL PITS, MANHOLES, PUMPSTATIONS AND OTHER CONFINED SPACES SHOULD BE FITTED WITH A CONFINED SPACE WARNING SIGN.

**OTHER ENVIRONMENTAL NOTES**

- ACCEPTABLE RECEPTORS WILL BE PROVIDED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHING, LIGHT WEIGHT MATERIALS AND LITTER.
- ENDANGERED PLANT SPECIES ARE PRESENT ON SITE, CONTRACTOR IS TO FOLLOW THE DIRECTION OF THE ENVIRONMENTAL SPECIALISTS - NO ACTIVITIES ARE TO BE UNDERTAKEN NEAR THE PLANT SPECIES.

**UTILITY SERVICES**

- THESE DRAWINGS SHALL TO BE READ IN CONJUNCTION WITH ALL PUBLIC OR PRIVATE SERVICE PROVIDER DRAWINGS.
- EXISTING UTILITIES SHOWN ON DRAWINGS ARE INDICATIVE ONLY AND MAY NOT INCLUDE ALL SERVICES PRESENT. AURECON TAKES NO RESPONSIBILITY FOR THE UTILITY INFORMATION AS SHOWN ON THESE DRAWINGS.
- IT IS THE CONTRACTORS RESPONSIBILITY TO LIAISE WITH EACH UTILITY SERVICE PROVIDER ON SITE, TO LOCATE AND IDENTIFY THE SIZE, POSITION, LINE AND LEVEL OF ALL UTILITY SERVICES IN BOTH PUBLIC AND PRIVATE LAND, PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.
- THE CONTRACTOR MUST TAKE EVERY PRECAUTION TO PROTECT EXISTING AND NEW UTILITY SERVICES THROUGH THE COURSE OF THE CONTRACT.

**SURVEY NOTES**

- THE SURVEY INFORMATION IS SHOWN TO PROVIDE A BASIS FOR DESIGN. AURECON DOES NOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THE SURVEY BASE OR ITS SUITABILITY AS A BASIS FOR CONSTRUCTION DRAWINGS. SHOULD DISCREPANCIES BE ENCOUNTERED DURING CONSTRUCTION BETWEEN THE SURVEY DATA AND ACTUAL FIELD DATA, CONTACT THE PRINCIPAL'S REPRESENTATIVE.
- CONTRACTOR TO VERIFY SURVEY AND SETOUT INFORMATION PRIOR TO CONSTRUCTION.

**DESIGN CRITERIA**

- BORED PILE WALL DESIGN LOAD COMBINATIONS HAVE BEEN CONSIDERED IN ACCORDANCE WITH AS5100.2-2017.
- A DESIGN SLS LIVE LOAD OF 20kPa HAS BEEN ADOPTED FOR THE ROAD CARRIAGEWAY.
- EARTHQUAKE LOADING IN ACCORDANCE WITH AS1170.4 BASED ON THE FOLLOWING PARAMETERS:  
ANNUAL RECURRENCE INTERVAL: 1-in-500 YEARS  
ACCELERATION COEFFICIENT: 0.09g
- THE BORED PILE WALL HAS NOT BEEN DESIGNED FOR TRAFFIC BARRIER LOADING AS THE BARRIER IS STRUCTURALLY SEPARATE FROM THE WALL.
- GLOBAL SLOPE STABILITY: MINIMUM FOS FOR SHORT TERM = 1.2, FOR LONG TERM = 1.5.

**TEMPORARY WORKS**

- TEMPORARY WORKS IS THE RESPONSIBILITY OF THE CONTRACTOR.
- THE CONTRACTOR MUST COMPLETE THEIR OWN TEMPORARY WORKS ASSESSMENT AND DESIGN FOR THE METHODOLOGY AND PLANT PROPOSED TO BE USED INCLUDING BEARING CAPACITY AND STABILITY ASSESSMENT BEHIND THE BORED PILE WALL.

**REFERENCES**

TNSW SPECIFICATION B114: GROUND ANCHORS  
TNSW SPECIFICATION B59: BORED CAST-IN-PLACE REINFORCED CONCRETE PILES (WITHOUT PERMANENT CASING)  
TNSW QA SPECIFICATION R44: EARTHWORKS  
TNSW QA SPECIFICATION R63: GEOTEXTILES  
TNSW QA SPECIFICATION R106: SPRAYED BITUMINOUS SURFACING (WITH CUTBACK BITUMEN)  
TNSW QA SPECIFICATION 3152: AGGREGATES FOR ASPHALT  
TNSW QA SPECIFICATION 3201: CONCRETE SUPPLY FOR PAVEMENT MAINTENANCE  
TNSW QA SPECIFICATION 3222: NO FINES CONCRETE (FOR SUBSURFACE DRAINAGE)  
TNSW QA SPECIFICATION B82: SHOTCRETE WORKS  
TNSW QA SPECIFICATION B80: CONCRETE WORK FOR BRIDGES  
AS5100-2017 BRIDGE DESIGN  
AS2159-2009 PILE DESIGN AND INSTALLATION  
AS1657-2018 FIXED PLATFORMS, WALKWAYS, STAIRWAYS AND LADDERS - DESIGN, CONSTRUCTION AND INSTALLATION

**CONSTRUCTION HOLD POINTS**

CONSTRUCTION HOLD POINTS WILL BE REQUIRED TO BE IN ACCORDANCE WITH THE ABOVE TNSW SPECIFICATIONS.

**OTHER RELEVANT DESIGN PACKAGES**

GARIE ROAD CIVIL DESIGN

**PILES**

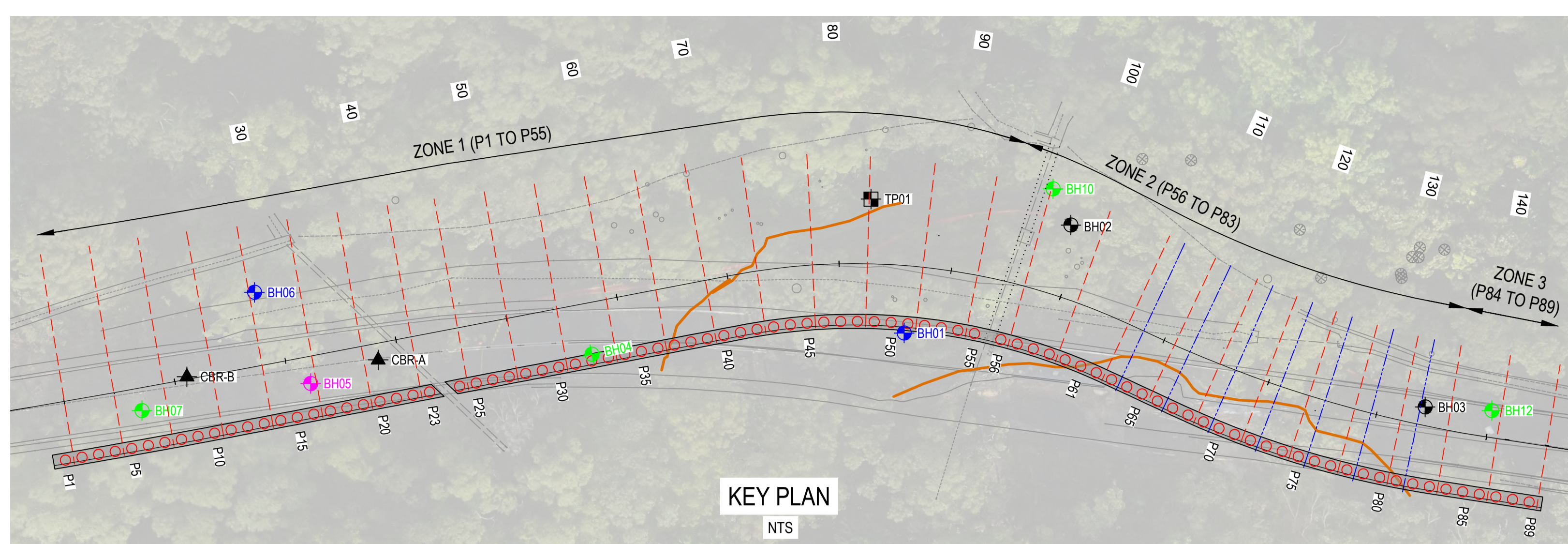
- ALL PILES SHALL BE INSTALLED IN ACCORDANCE WITH THE DRAWING AND AS2159-2009.
- TOLERANCE OF PILE INSTALLATION SHALL BE AS BELOW:

PARAMETER	REQUIRED TOLERANCE (mm)
LOCATION OF PILE AT PILE CONSTRUCTION PLATFORM	+/- 50
VERTICALITY WITHIN THE PLANE OF THE WALL	1%
VERTICALITY AT RIGHT ANGLES TO THE PLANE OF THE WALL	1%
COUPLER BARS - INSTALLED ELEVATION	+/- 75

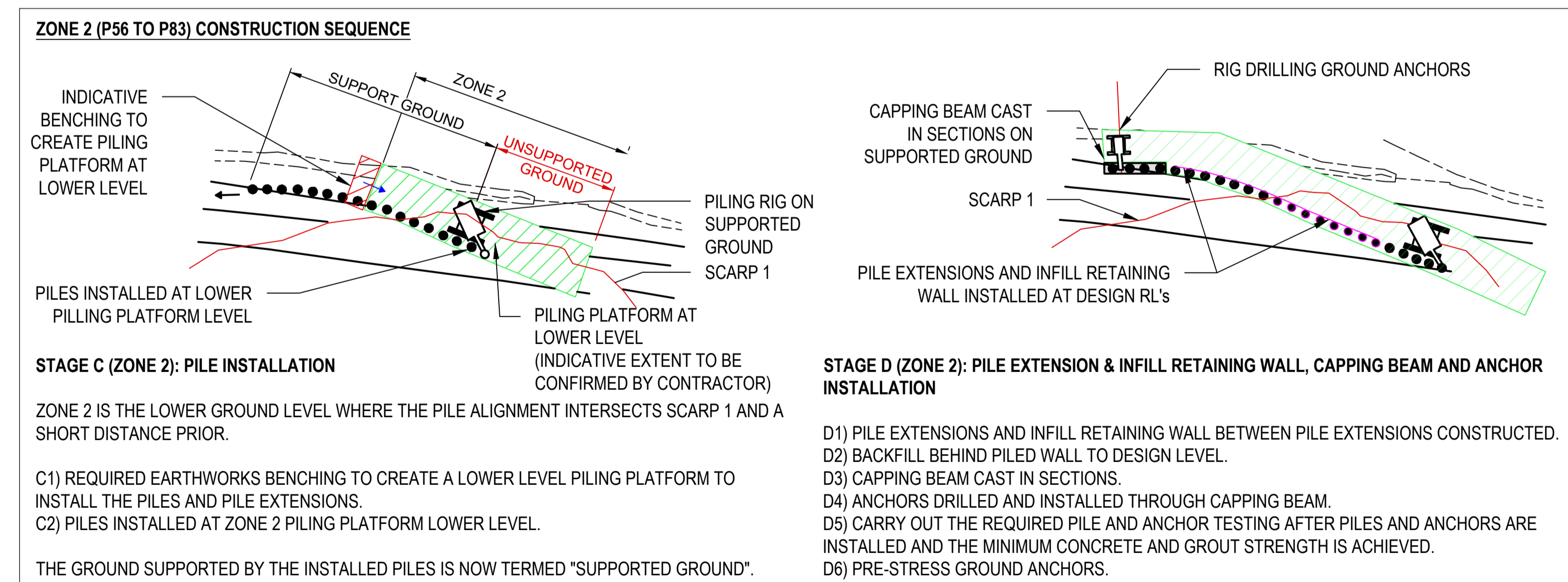
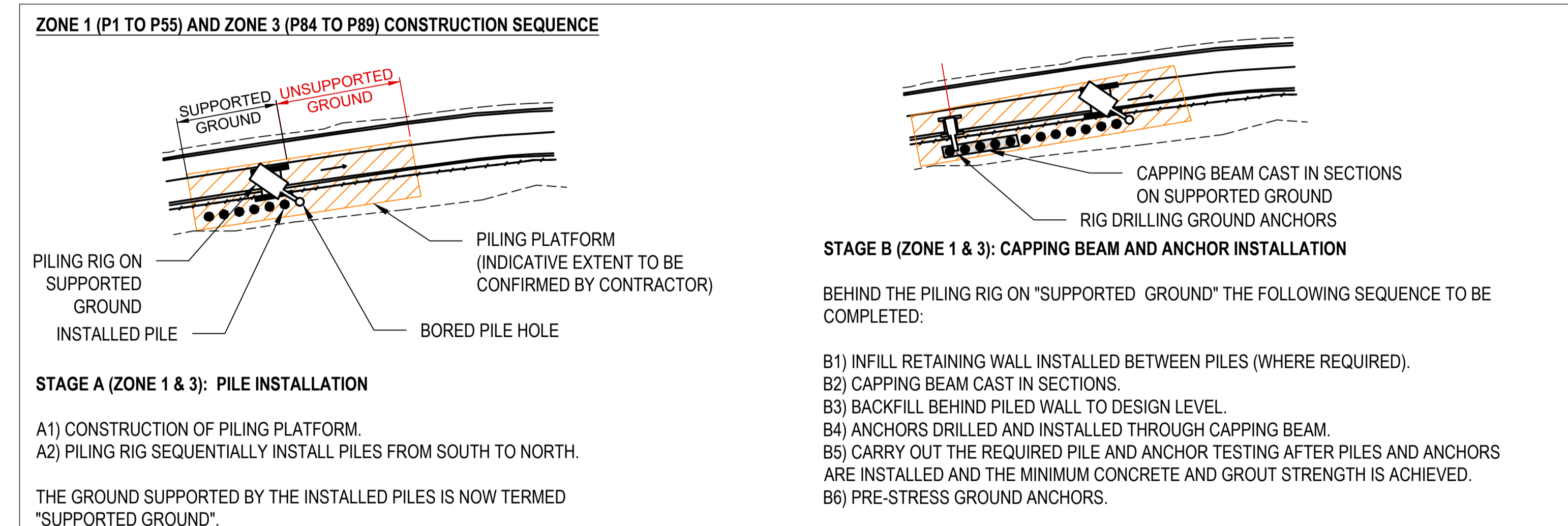
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THE BELOW IMAGES SHOW THE KEY CONSTRUCTION STAGES RELEVANT TO PROVIDING A CONSTRUCTION SEQUENCE THAT MITIGATES SLOPE INSTABILITY. OTHER CONSTRUCTION STAGES SUCH AS DRAINAGE AND ROAD PAVEMENT AND ASSOCIATED FEATURES ARE NOT SHOWN. 'SUPPORTED GROUND' IS DEFINED AS THE AREA OF GROUND UPLOPE OF THE CONSTRUCTED PILES (PILES AT 1.5m C/C SPACING), WHERE THE PILES HAVE REACHED 20MPa CONCRETE STRENGTH.



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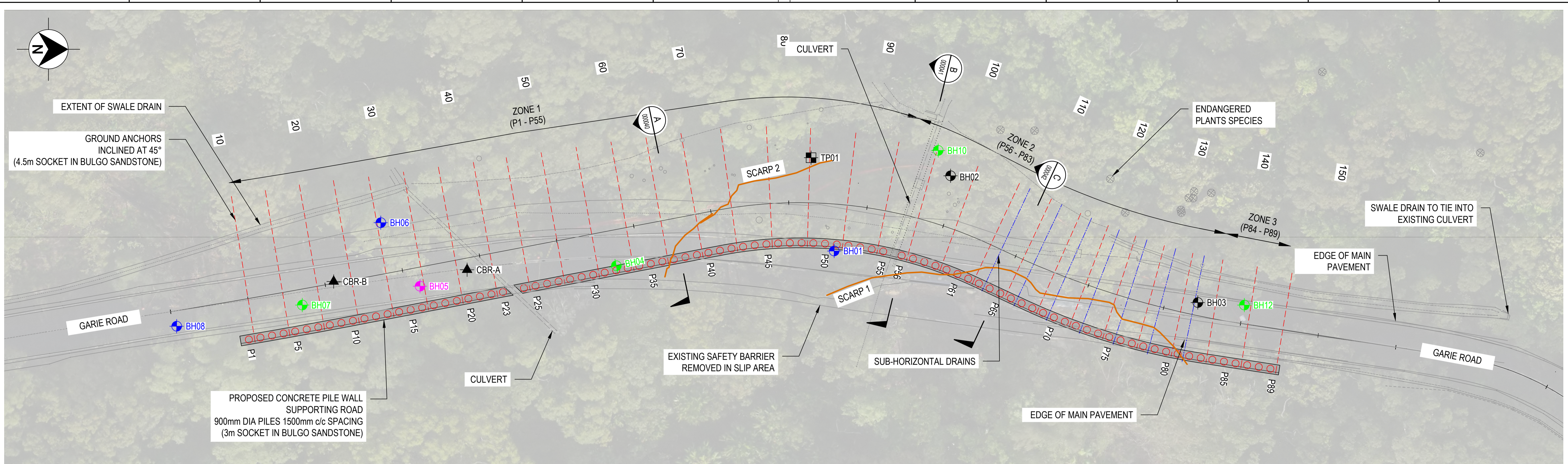
**CONSTRUCTION SEQUENCE GENERAL**

1. THE PROVIDED INDICATIVE CONSTRUCTION SEQUENCE IS BASED ON THE GEOTECHNICAL SITE CONSTRAINTS RESULTING FROM THE LANDSLIDE TO ALLOW A CONSTRUCTION SEQUENCE THAT MITIGATES STABILITY RISK TO THE CONSTRUCTION PLANT AND PERSONNEL. THE PROVIDED CONSTRUCTION SEQUENCE IS INDICATIVE ONLY AND THE TEMPORARY WORKS WILL BE THE RESPONSIBILITY OF THE CONTRACTORS TEMPORARY WORKS DESIGNER.
2. THE SITE HAS BEEN DIVIDED INTO THREE ZONES FOR THE PURPOSES OF THE CONSTRUCTION METHODOLOGY, REFER TO KEY PLAN.
3. DUE TO THE LOCATION OF THE UNSTABLE LANDSLIDE MATERIAL AND ASSOCIATED TENSION CRACKS, PLANT ACCESS TO CONSTRUCT THE ANCHORED PILE WALL IS TO BE FROM THE SOUTHERN SIDE OF THE SITE ONLY.
4. PILES ARE TO BE INSTALLED FROM PILE P1 SEQUENTIALLY ALONG THE PROPOSED LINE OF PILES MOVING FROM SOUTH TO NORTH. CONSTRUCTION IS TO PROGRESS CONTINUOUSLY IN A NORTHERLY DIRECTION SUCH THAT CAPPING BEAM/ANCHORS ARE CONSTRUCTED/ INSTALLED ON PREVIOUSLY COMPLETED PILES TO THE SOUTH AS NEW PILES TO THE NORTH ARE INSTALLED.
5. THE PILING RIG AND ALL OTHER HEAVY PLANT IS TO BE PLACED BEHIND THE LINE OF NEWLY CONSTRUCTED PILES ONLY WITHIN "SUPPORTED GROUND" AT ALL TIMES, THE ONLY EXCEPTION BEING AT THE SOUTHERN END OF THE SITE DURING THE INSTALLATION OF THE THE FIRST FEW PILES. THE TIMEFRAME FOR CURING OF THE CONCRETE SHALL BE TAKEN INTO ACCOUNT TO ENSURE ADEQUATE CAPACITY TO SUPPORT THE RIG FOR THE INSTALLATION OF PILES TO THE NORTH. (PILE CONCRETE STRENGTH TO HAVE REACHED AT LEAST 20MPa WITH THE EXCEPTION OF PILES P1 TO P5).
6. AN AUTOMATED GROUND MOVEMENT MONITORING SYSTEM WILL BE INSTALLED ON SITE BY THE PRINCIPAL PRIOR TO THE CONSTRUCTION WORKS THAT MUST FORM PART OF THE SAFE WORK METHOD STATEMENT FOR THE CONSTRUCTION ACTIVITIES.
7. CREEP MOVEMENT OF THE LANDSLIDE OCCURS WHEN HEAVY RAINFALL INFILTRATES INTO THE GROUND RESULTING IN ELEVATED SOIL PORE PRESSURES THAT DRIVES THE CREEP MOVEMENT. CAREFUL ATTENTION TO THE RAIN FORECAST IS CRITICAL TO THE CONSTRUCTION WORKS PLANNING. WORKS MAY BE SUSPENDED ACCORDINGLY WHEN IN EXCESS OF 30 mm OF RAIN IS FORECAST OR FALLS WITHIN A 24 HR PERIOD OR >50 mm IN A 48 HOUR PERIOD. WORKS CAN RE-COMMENCE ONCE THE MONITORING REQUIREMENTS ARE SATISFIED AS PER THE CONSTRUCTION MONITORING PLAN (TO BE ISSUED AT AFC).
8. GIVEN NOTE 7, THE CONTRACTOR IS TO DEVELOP CONTINGENCY PLANS FOR ADVERSE WEATHER.

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FILE NAME: 520212TP-AURC-80232-GE-DRG-000003.dwg  
PLOT DATE & TIME: 28/04/2023 3:02:18 PM





PLAN  
SCALE 1:250

LEGEND:

- ROAD CONTROL LINE
- LANDSLIDE HEADSCARP AND OBSERVED SURFACE CRACKS (APPROX.)
- GROUND ANCHORS
- SUB-HORIZONTAL DRAINS

GEOTECHNICAL INVESTIGATION PREVIOUSLY UNDERTAKEN

- BOREHOLES
- VIBRATING WIRE PIEZOMETER (INSTALLATION IN BOREHOLE)
- STANDPIPE (INSTALLATION IN BOREHOLE)
- INCLINOMETER (INSTALLATION IN BOREHOLE)
- TESTPIT
- CBR TEST LOCATION

NOTES:

1. AERIAL IMAGE SHOWN IS FROM MARINE EARTH SCIENCE SURVEY 19 OCTOBER 2022.
2. LOCATION OF ENDANGERED PLNAT SPECIES LOCATED ON SITE BY PAUL GADSBY (INDEPENDENT ECOLOGIST) AND SURVEYED BY AURECON.

FOR REVIEW

REFERENCES:

C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023
B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023
AD1.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023
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COORDINATE SYSTEM: MGA_ZONE_56/GDA20		HEIGHT DATUM: AHD	
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SCALE:

SCALE 1:250

DESIGN LOT CODE:

CLIENT:

Transport for NSW

PREPARED FOR:

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CONNECT SYDNEY

DRAWN	D.GASGAS	28.04.2023
DESIGNED	H.ZHANG	28.04.2023
DRG CHECK	T.DONOVAN	28.04.2023
DESIGN CHECK	W.DENG	28.04.2023
PROJ/DES MNGR	V.TIET	28.04.2023
APPROVED	M.ABERLINE	28.04.2023

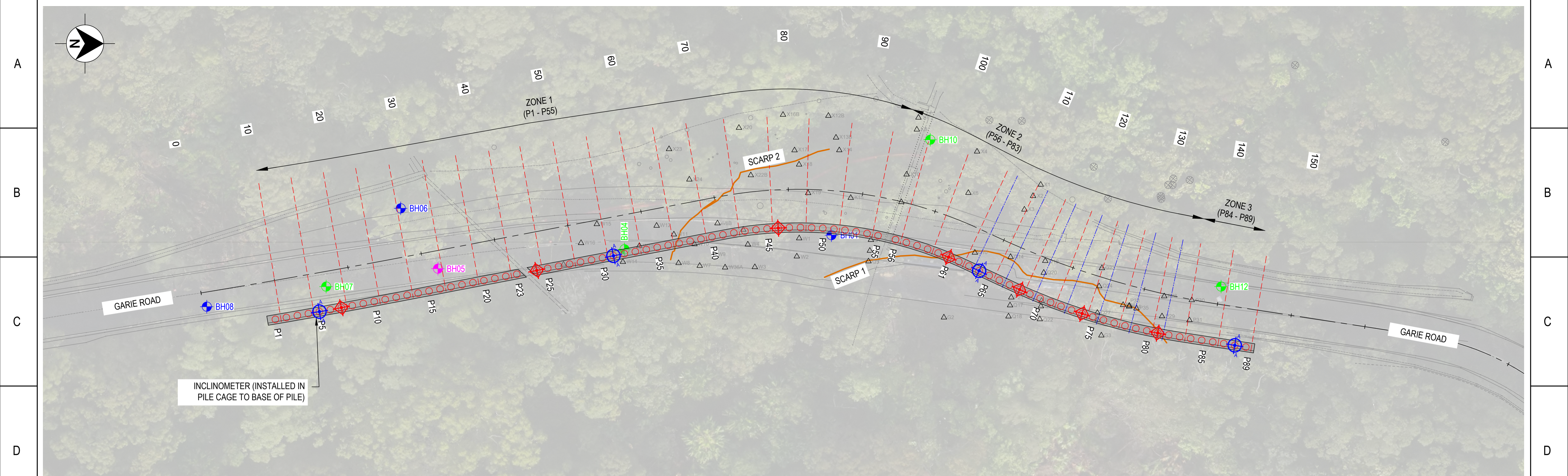
HARBOUR ZONE  
SRAPC SPECIAL PROJECTS  
GARIE ROAD  
SL80232

ANCHORED BORED PILE WALL SLOPE STABILISATION  
GENERAL ARRANGEMENT

DRAWING SET No: SL80232	PART: SHEET: 4 OF 19	A1
STATUS: FOR REVIEW	BRIDGE No:	©
DRG No: 520212TP-AURC-80232-GE-DRG-000010	REV C	EDMS No. AMD No.

FILE NAME: 520212TP-AURC-80232-GE-DRG-000010.dwg  
PLOT DATE & TIME: 28/04/2023 3:01:27 PM





PLAN  
SCALE 1:250

NOTES:

- THE MONITORING EQUIPMENT AND LOCATIONS SHOWN ARE FOR THE PURPOSE OF SAFETY AND PERFORMANCE MONITORING OF THE PILE WALL IN THE PERMANENT CONDITION (I.E. NOT FOR MONITORING EFFECTS OF TEMPORARY WORKS ON EXISTING ROAD AND PILES). TEMPORARY WORKS MONITORING IS CRITICAL TO THE CONSTRUCTION WORKS AND THE TEMPORARY WORKS MONITORING REGIME MUST BE INCLUDED IN THE CONTRACTOR'S WORKS METHOD STATEMENT.
- INCLINOMETER A0 DIRECTION IS AS SHOWN ON THIS PLAN, IN LINE WITH A-A ON THE INCLINOMETER DIRECTION. INCLINOMETER PREDOMINANT AXIS TO BE INSTALLED PERPENDICULAR TO THE RETAINING WALL.
- INCLINOMETERS SHALL BE MANUAL AND SHALL BE INSTALLED BY A SUITABLY QUALIFIED AND EXPERIENCED SPECIALIST CONTRACTOR.
- FOUR NO. INCLINOMETERS TO BE INSTALLED IN PILES P5, P31, P64, P88. INCLINOMETERS SHALL BE INSTALLED IN THE PILE CAGE AND TO THE BASE OF THE PILE CAGE (REFER TO 520212TP-AURC-80232-GE-DRG-000021 FOR PILE CUT-OFF LEVELS).
- SURVEY PINS ATTACHED TO PILES SHALL BE SURVEY PRISMS. SURVEY PRISMS SHALL BE LOCATED ON THE PILE, JUST BELOW THE CAPPING BEAM AND BE POSITIONED SUCH THAT THEY ARE CLEAR OF WORKS AND ABLE TO BE MONITORED REMOTELY.
- ALL MONITORING INSTRUMENTS MUST BE PROTECTED AND DEMARCATED. THE CONTRACTOR SHALL PROPOSE PROTECTION AND DEMARCATION FOR DESIGNER APPROVAL.
- THE CONTRACTOR SHALL ENSURE THAT ANY REQUIRED MONITORING OR MAINTENANCE OF THE INCLINOMETERS IS NOT RESTRICTED BY SAFETY BARRIER OR FENCES.
- ALL MONITORING INSTRUMENTS MUST BE INSTALLED AND BASE LINED AS SOON AS PRACTICABLY POSSIBLE. FOLLOWING SUCCESSFUL INSTALLATION AND BASELINE READINGS, MONITORING SHALL BE UNDERTAKEN MONTHLY FOLLOWING CONSTRUCTION UNLESS AN ALTERNATIVE FREQUENCY IS SPECIFIED OR AGREED BY THE DESIGNER.
- UNLESS OTHERWISE SPECIFIED AND AGREED BY THE INCLINOMETER SUPPLIER/INSTALLER AND THE DESIGNER, INCLINOMETERS TO BE FILLED WITH WATER DURING INSTALLATION TO ENSURE THEY AVOID FLOATING WHILE CONCRETE IS POURED.

LEGEND: (EXISTING GROUND INVESTIGATION INSTRUMENTATION)

- VIBRATING WIRE PIEZOMETER (INSTALLATION IN BOREHOLE)
- STANDPIPE (INSTALLATION IN BOREHOLE)
- INCLINOMETER (INSTALLATION IN BOREHOLE)
- MONITORING PIN AS OF (28/04/2023)  
(MONITORING PINS WILL LIKELY BE DISTURBED BY CONSTRUCTION ACTIVITIES)

LEGEND: (PROPOSED POST CONSTRUCTION MONITORING AND INSTRUMENTATION)

- INCLINOMETER TO BE INSTALLED  
(A-A PERPENDICULAR TO WALL AND A+ POINTS TO DOWNHILL DIRECTION)
- SURVEY PIN

MONITORING INSTRUMENT LOCATION TABLE

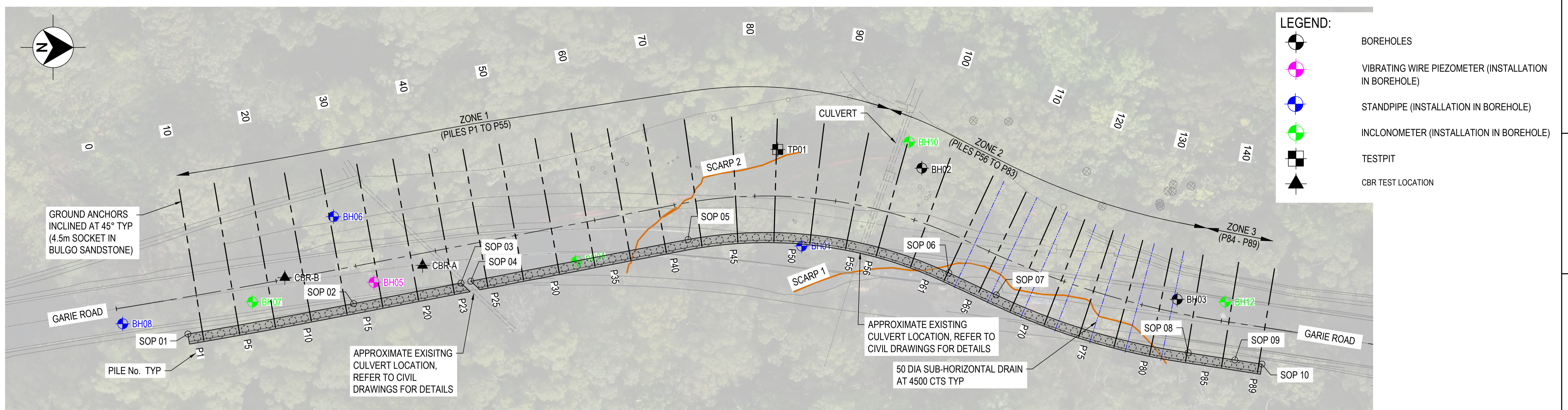
INSTRUMENT I.D.	INSTRUMENT TYPE	PILE NUMBER
INCL_P5	INCLINOMETER	P5
INCL_P31	INCLINOMETER	P31
INCL_P64	INCLINOMETER	P64
INCL_P88	INCLINOMETER	P88
PIN_1	PRISM	P7
PIN_2	PRISM	P24
PIN_3	PRISM	P46
PIN_4	PRISM	P61
PIN_5	PRISM	P68
PIN_6	PRISM	P74
PIN_7	PRISM	P81

FOR REVIEW

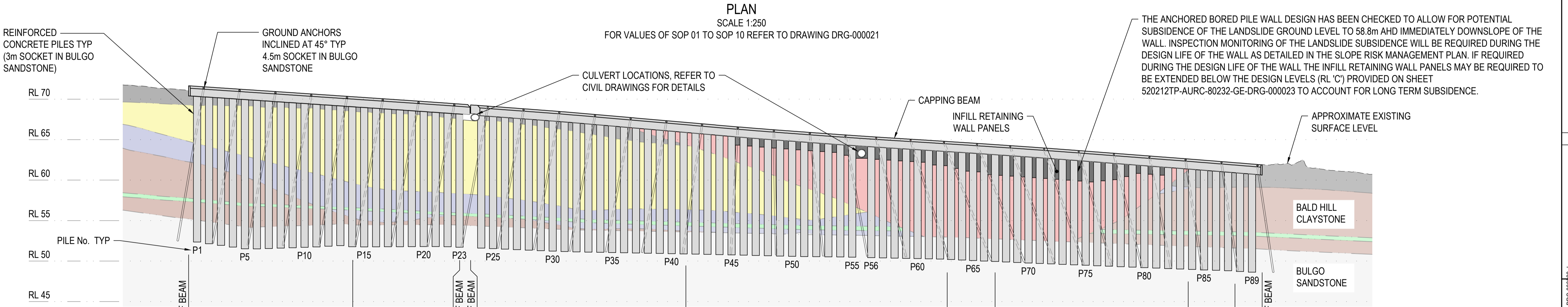
<p>REFERENCES:</p> <p>C 100% DETAILED DESIGN H.Z. 28/04/2023 W.D. 28/04/2023 M.A. 28/04/2023</p> <p>B 100% DETAILED DESIGN H.Z. 13/04/2023 W.D. 13/04/2023 M.A. 13/04/2023</p> <p>A01.01 80% DETAILED DESIGN H.Z. 30/01/2023 W.D. 30/01/2023 C.G. 30/01/2023</p> <p>REV DESCRIPTION DESIGNER INITIAL/DATE VERIFIED INITIAL/DATE APPROVED INITIAL/DATE</p> <p>COORDINATE SYSTEM: MGA_ZONE_56/GDA20 HEIGHT DATUM: AHD DESIGN LOT CODE:</p>	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p>SCALE:</p> <p>SCALE 1:250</p>	<p>CLIENT:</p> <p>Transport for NSW</p> <p>PREPARED FOR:</p>	<p><i>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.</i></p> <p>Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</p> <p> DRAWN <u>D.GASGAS</u> 28.04.2023</p> <p>DESIGNED <u>H.ZHANG</u> 28.04.2023</p> <p>DRG CHECK <u>T.DONOVAN</u> 28.04.2023</p> <p>DESIGN CHECK <u>W.DENG</u> 28.04.2023</p> <p>PROJ/DES MNGR <u>Y.TIET</u> 28.04.2023</p> <p>APPROVED <u>M.ABERLINE</u> 28.04.2023</p> <p></p>	<p>HARBOUR ZONE</p> <p>SRAPC SPECIAL PROJECTS</p> <p>GARIE ROAD</p> <p>SL80232</p> <p>ANCHORED BORED PILE WALL SLOPE STABILISATION</p> <p>GEOTECHNICAL POST CONSTRUCTION MONITORING PLAN</p> <p>DRAWING SET No: SL80232 PART: SHEET: 5 OF 19 A1</p> <p>STATUS: FOR REVIEW BRIDGE No: ©</p> <p>DRG No: 520212TP-AURC-80232-GE-DRG-000015 REV C VER EDMS No. AMD No.</p>
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FILE NAME: 520212TP-AURC-80232-GE-DRG-000015.dwg  
PLOT DATE & TIME: 28/04/2023 3:00:43 PM





- LEGEND:**
- BOREHOLES
  - VIBRATING WIRE PIEZOMETER (INSTALLATION IN BOREHOLE)
  - STANDPIPE (INSTALLATION IN BOREHOLE)
  - INCLINOMETER (INSTALLATION IN BOREHOLE)
  - TESTPIT
  - CBR TEST LOCATION



THE ANCHORED BORED PILE WALL DESIGN HAS BEEN CHECKED TO ALLOW FOR POTENTIAL SUBSIDENCE OF THE LANDSLIDE GROUND LEVEL TO 58.8m AHD IMMEDIATELY DOWNSLOPE OF THE WALL. INSPECTION MONITORING OF THE LANDSLIDE SUBSIDENCE WILL BE REQUIRED DURING THE DESIGN LIFE OF THE WALL AS DETAILED IN THE SLOPE RISK MANAGEMENT PLAN. IF REQUIRED DURING THE DESIGN LIFE OF THE WALL THE INFILL RETAINING WALL PANELS MAY BE REQUIRED TO BE EXTENDED BELOW THE DESIGN LEVELS (RL 'C') PROVIDED ON SHEET 520212TP-AURC-80232-GE-DRG-000023 TO ACCOUNT FOR LONG TERM SUBSIDENCE.

	END OF BEAM SOP 01	SOP 02	SOP 03	END OF BEAM SOP 04	SOP 05	SOP 06	SOP 07	SOP 08	SOP 09	END OF BEAM SOP 10
DATUM RL 40										
TOP OF CAPPING BEAM RL (m)	71.647	70.282	69.732	69.282	67.081	64.743	64.362	62.603	62.415	61.871
APPROXIMATE EXISTING SURFACE LEVEL RL (m)	71.07	69.63	68.67	68.56	66.32	63.21	62.23	62.22	61.86	62.08
CHAINAGE (m)	0.000	20.787	34.629	35.865	63.152	90.085	102.539	127.359	133.179	136.563

- LEGEND - GEOLOGICAL UNITS**
- LANDSLIDE MATERIAL (COLLUVIUM AND WEATHERED ROCK)
  - FILL
  - COLLUVIUM
  - RESIDUAL SOIL/EXTREMELY WEATHERED ROCK
  - WEAK ZONE
  - BALD HILL CLAYSTONE
  - BULGO SANDSTONE
  - INFERRED GEOLOGICAL BOUNDARY

LONGITUDINAL SECTION ALONG PILE WALL  
SCALE 1:250

**FOR REVIEW**

<p><b>REFERENCES:</b></p> <p>C 100% DETAILED DESIGN H.Z. 28/04/2023 W.D. 28/04/2023 M.A. 28/04/2023</p> <p>B 100% DETAILED DESIGN H.Z. 13/04/2023 W.D. 13/04/2023 M.A. 13/04/2023</p> <p>A01.01 80% DETAILED DESIGN H.Z. 30/01/2023 W.D. 30/01/2023 C.G. 30/01/2023</p> <p>REV DESCRIPTION DESIGNER INITIAL/DATE VERIFIED INITIAL/DATE APPROVED INITIAL/DATE</p>	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p>SCALE:</p> <p>SCALE 1:250</p>	<p>CLIENT:</p> <p>Transport for NSW</p>	<p><i>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.</i></p> <p><i>Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</i></p>	<p>HARBOUR ZONE</p> <p>SRAPC SPECIAL PROJECTS</p> <p>GARIE ROAD</p> <p>SL80232</p> <p>ANCHORED BORED PILE WALL SLOPE STABILISATION</p> <p>ANCHORED BORED PILE WALL ARRANGEMENT PLAN</p>	
	<p>COORDINATE SYSTEM: MGA_ZONE_56/GDA20</p>	<p>HEIGHT DATUM: AHD</p>	<p>DESIGN LOT CODE:</p>	<p>PREPARED FOR:</p> <p>CONNECT SYDNEY</p>	<p>DRAWN <u>D.GASGAS</u> 28.04.2023</p> <p>DESIGNED <u>H.ZHANG</u> 28.04.2023</p> <p>DRG CHECK <u>T.DONOVAN</u> 28.04.2023</p> <p>DESIGN CHECK <u>W.DENG</u> 28.04.2023</p> <p>PROJ/DES MNGR <u>V.TIET</u> 28.04.2023</p> <p>APPROVED <u>M.ABERLINE</u> 28.04.2023</p>	<p>DRAWING SET No: SL80232</p> <p>STATUS: FOR REVIEW</p> <p>DRG No: 520212TP-AURC-80232-GE-DRG-000020</p>
	<p>PART: SHEET: 6 OF 19 A1</p>	<p>BRIDGE No:</p>	<p>REV C</p>	<p>EDMS No.</p>	<p>AMD No.</p>	<p>©</p>
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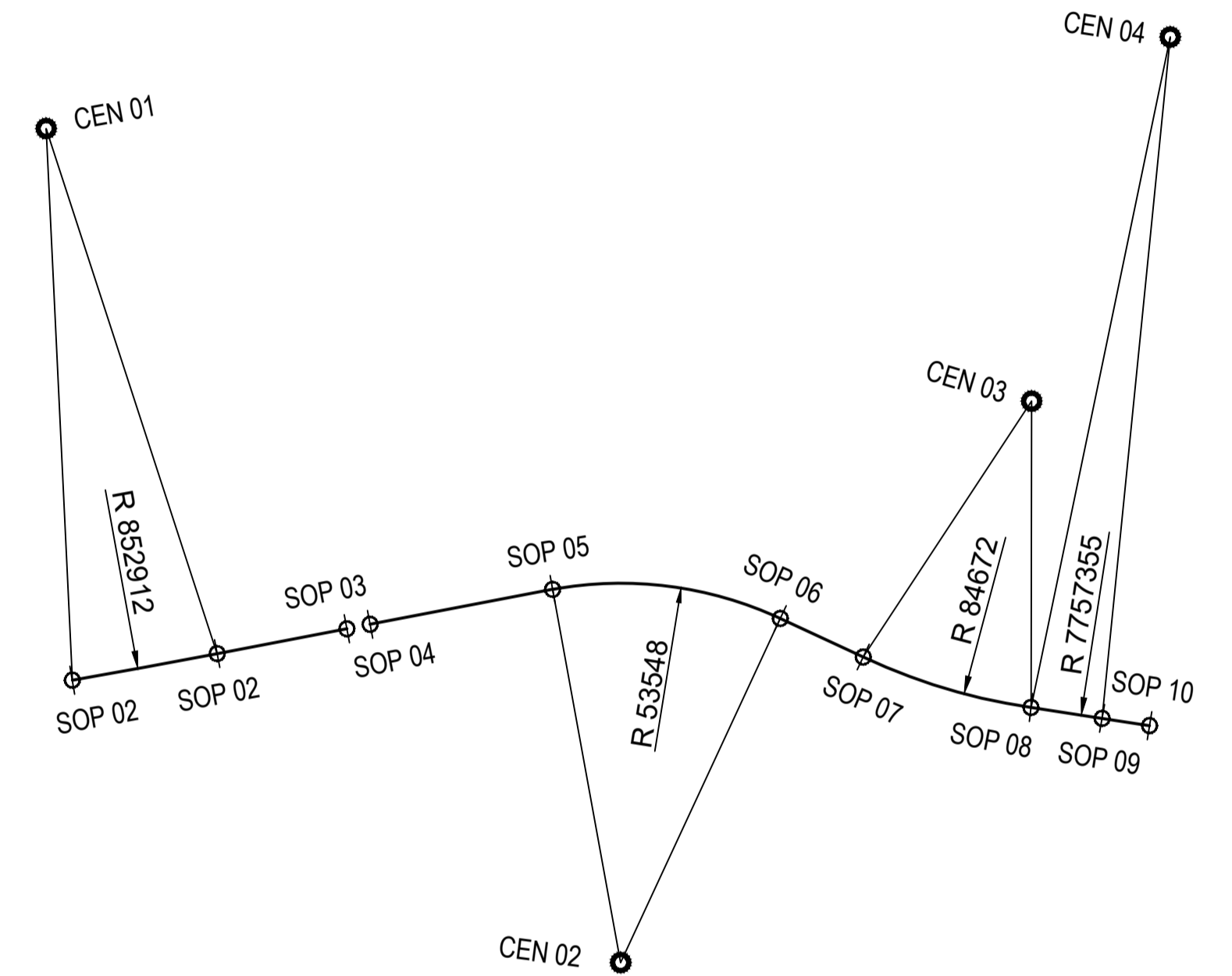


PILE SCHEDULE						
PILE No.	COORDINATES		PILE CUT-OFF LEVEL 'RL' 'A' (m)	MINIMUM PILE TOE LEVEL 'RL' 'B' (m)	EXISTING GROUND LEVEL (m)	MINIMUM PILE LENGTHS 'L' (m)
	EASTING	NORTHING				
P1	321378.10	6217404.20	70.38	52.35	71.01	18.03
P2	321377.84	6217405.67	70.28	52.14	70.94	18.13
P3	321377.58	6217407.15	70.18	51.94	70.87	18.24
P4	321377.33	6217408.62	70.08	51.72	70.74	18.36
P5	321377.06	6217410.10	69.98	51.51	70.63	18.47
P6	321376.80	6217411.57	69.89	51.50	70.44	18.38
P7	321376.53	6217413.04	69.79	51.55	70.49	18.24
P8	321376.26	6217414.51	69.69	51.60	70.31	18.09
P9	321375.98	6217415.99	69.59	51.65	70.20	17.95
P10	321375.71	6217417.46	69.49	51.70	70.09	17.80
P11	321375.43	6217418.93	69.40	51.75	70.02	17.65
P12	321375.14	6217420.40	69.30	51.83	69.94	17.47
P13	321374.86	6217421.87	69.20	51.90	69.76	17.29
P14	321374.58	6217423.34	69.10	51.77	69.65	17.33
P15	321374.30	6217424.81	69.00	51.75	69.62	17.25
P16	321374.02	6217426.28	68.90	51.76	69.53	17.14
P17	321373.74	6217427.75	68.80	51.76	69.38	17.04
P18	321373.46	6217429.22	68.70	51.77	69.35	16.93
P19	321373.17	6217430.69	68.60	51.78	69.20	16.82
P20	321372.89	6217432.16	68.50	51.79	69.10	16.72
P21	321372.61	6217433.63	68.40	51.79	68.97	16.61
P22	321372.33	6217435.10	68.30	51.77	68.87	16.53
P23	321372.05	6217436.57	68.19	51.71	68.77	16.48
P24	321371.54	6217439.24	67.99	51.60	68.55	16.40
P25	321371.25	6217440.71	67.88	51.53	68.50	16.35
P26	321370.97	6217442.18	67.78	51.47	68.39	16.30
P27	321370.69	6217443.65	67.67	51.41	68.23	16.26
P28	321370.41	6217445.12	67.56	51.35	68.15	16.21
P29	321370.13	6217446.59	67.45	51.29	67.99	16.16
P30	321369.85	6217448.06	67.34	51.23	67.89	16.11
P31	321369.57	6217449.53	67.22	51.17	67.78	16.05
P32	321369.28	6217450.99	67.10	51.13	67.66	15.97
P33	321369.00	6217452.46	66.97	51.10	67.60	15.87
P34	321368.72	6217453.93	66.84	51.08	67.49	15.76
P35	321368.44	6217455.40	66.71	51.05	67.33	15.66
P36	321368.16	6217456.87	66.59	51.02	67.27	15.56
P37	321367.88	6217458.33	66.46	51.00	67.11	15.46
P38	321367.60	6217459.80	66.33	50.97	66.91	15.36
P39	321367.32	6217461.27	66.20	50.94	66.69	15.26
P40	321367.04	6217462.74	66.08	50.91	66.54	15.16
P41	321366.76	6217464.20	65.95	50.88	66.43	15.06
P42	321366.49	6217465.68	65.82	50.85	66.29	14.96
P43	321366.22	6217467.15	65.69	50.82	66.26	14.87
P44	321366.08	6217468.64	65.56	50.79	66.19	14.77
P45	321365.94	6217470.12	65.43	50.76	66.10	14.67
P46	321365.84	6217471.62	65.31	50.73	65.98	14.58
P47	321365.79	6217473.11	65.19	50.69	65.90	14.49
P48	321365.77	6217474.61	65.07	50.66	65.90	14.41
P49	321365.80	6217476.10	64.96	50.62	65.84	14.34
P50	321365.87	6217477.59	64.85	50.59	65.76	14.26
P51	321365.99	6217479.09	64.74	50.55	65.68	14.18
P52	321366.14	6217480.57	64.63	50.54	65.66	14.09
P53	321366.34	6217482.06	64.52	50.52	65.49	14.00
P54	321366.58	6217483.53	64.42	50.51	65.44	13.91
P55	321366.86	6217485.00	64.31	50.48	65.32	13.84

PILE SCHEDULE (CONTINUED)						
PILE No.	COORDINATES		PILE CUT-OFF LEVEL 'RL' 'A' (m)	MINIMUM PILE TOE LEVEL 'RL' 'B' (m)	EXISTING GROUND LEVEL (m)	MINIMUM PILE LENGTHS 'L' (m)
	EASTING	NORTHING				
P56	321367.40	6217487.36	64.16	50.42	65.22	13.73
P57	321367.79	6217488.80	64.06	50.39	65.16	13.67
P58	321368.22	6217490.24	63.97	50.36	64.98	13.61
P59	321368.68	6217491.66	63.88	50.33	64.90	13.55
P60	321369.20	6217493.07	63.79	50.30	64.82	13.49
P61	321369.74	6217494.46	63.71	50.27	64.65	13.44
P62	321370.33	6217495.83	63.62	50.24	64.57	13.38
P63	321370.96	6217497.20	63.53	50.19	63.31	13.35
P64	321371.59	6217498.56	63.45	50.13	62.82	13.32
P65	321372.22	6217499.91	63.36	50.07	62.37	13.29
P66	321372.85	6217501.27	63.27	50.01	62.35	13.26
P67	321373.48	6217502.63	63.18	49.94	62.30	13.23
P68	321374.10	6217503.99	63.09	49.88	62.17	13.20
P69	321374.70	6217505.36	62.99	49.82	61.87	13.17
P70	321375.27	6217506.75	62.90	49.76	61.62	13.14
P71	321375.82	6217508.14	62.80	49.70	61.51	13.10
P72	321376.35	6217509.54	62.70	49.65	61.40	13.05
P73	321376.85	6217510.95	62.59	49.59	61.58	13.00
P74	321377.32	6217512.37	62.49	49.54	61.46	12.95
P75	321377.77	6217513.80	62.38	49.48	61.26	12.89
P76	321378.19	6217515.23	62.27	49.42	61.08	12.84
P77	321378.59	6217516.67	62.16	49.36	61.15	12.79
P78	321378.97	6217518.12	62.04	49.30	61.19	12.74
P79	321379.32	6217519.58	61.93	49.25	61.41	12.69
P80	321379.64	6217521.04	61.82	49.19	61.60	12.63
P81	321379.94	6217522.50	61.71	49.13	62.01	12.58
P82	321380.21	6217523.97	61.60	49.07	62.18	12.53
P83	321380.45	6217525.45	61.49	49.02	62.26	12.47
P84	321380.68	6217526.93	61.37	48.96	62.21	12.41
P85	321380.91	6217528.41	61.25	48.91	62.03	12.35
P86	321381.13	6217529.88	61.14	48.86	62.04	12.28
P87	321381.36	6217531.36	61.02	48.80	61.81	12.22
P88	321381.59	6217532.84	60.90	48.71	61.87	12.19
P89	321381.81	6217534.32	60.78	48.62	61.94	12.16

ANCHOR SCHEDULE		
ANCHOR No.	MINIMUM ANCHOR LENGTHS 'L' (m)	LOCATION BETWEEN PILES
A1	26.64	P1/P2
A2	26.63	P4/P5
A3	26.55	P7/P8
A4	26.19	P10/P11
A5	25.64	P13/P14
A6	25.32	P16/P17
A7	25.00	P19/P20
A8	24.68	P22/P23
A9	24.39	P24/P25
A10	24.09	P27/P28
A11	23.87	P30/P31
A12	23.61	P33/P34
A13	23.18	P36/P37
A14	22.76	P39/P40
A15	22.31	P42/P43
A16	21.84	P45/P46
A17	21.39	P48/P49
A18	21.06	P51/P52
A19	20.60	P54/P55
A20	20.27	P56/P57
A21	20.15	P59/P60
A22	20.13	P62/P63
A23	20.02	P65/P66
A24	19.87	P68/P69
A25	19.67	P71/P72
A26	19.46	P74/P75
A27	19.25	P77/P78
A28	19.03	P80/P81
A29	18.79	P83/P84
A30	18.50	P86/P87
A31	18.34	P89 +

HORIZONTAL ALIGNMENT DATA					
POINT	LOCATION	COORDIANATES		BEARING IN	BEARING OUT
		EASTING	NORTHING		
SOP 01	CH 0.000	321377.659	6217403.041		
CEN 01	CENTRE OF CIRCLE	320536.885	6217259.663		
SOP 02	CH 20.878	321373.916	6217423.487		349° 09' 43"
SOP 03	CH 34.629	321371.381	6217436.729	349° 09' 43"	
SOP 04	CH 35.865	321371.148	6217437.942		
SOP 05	CH 63.152	321366.017	6217464.742		
CEN 02	CENTRE OF CIRCLE	321418.697	6217474.348		
SOP 06	CH 90.085	321370.128	6217496.897		24° 54' 55"
SOP 07	CH 102.532	321372.847	6217502.751	24° 54' 55"	
CEN 03	CENTRE OF CIRCLE	321296.195	6217538.720		
SOP 08	CH 127.359	321379.971	6217526.434		
CEN 04	CENTRE OF CIRCLE	313713.175	6218708.290		
SOP 09	CH 133.179	321380.855	6217532.186		8° 43' 39"
SOP 10	CH 136.536	321381.369	6217535.531		



HORIZONTAL ALIGNMENT DIAGRAM

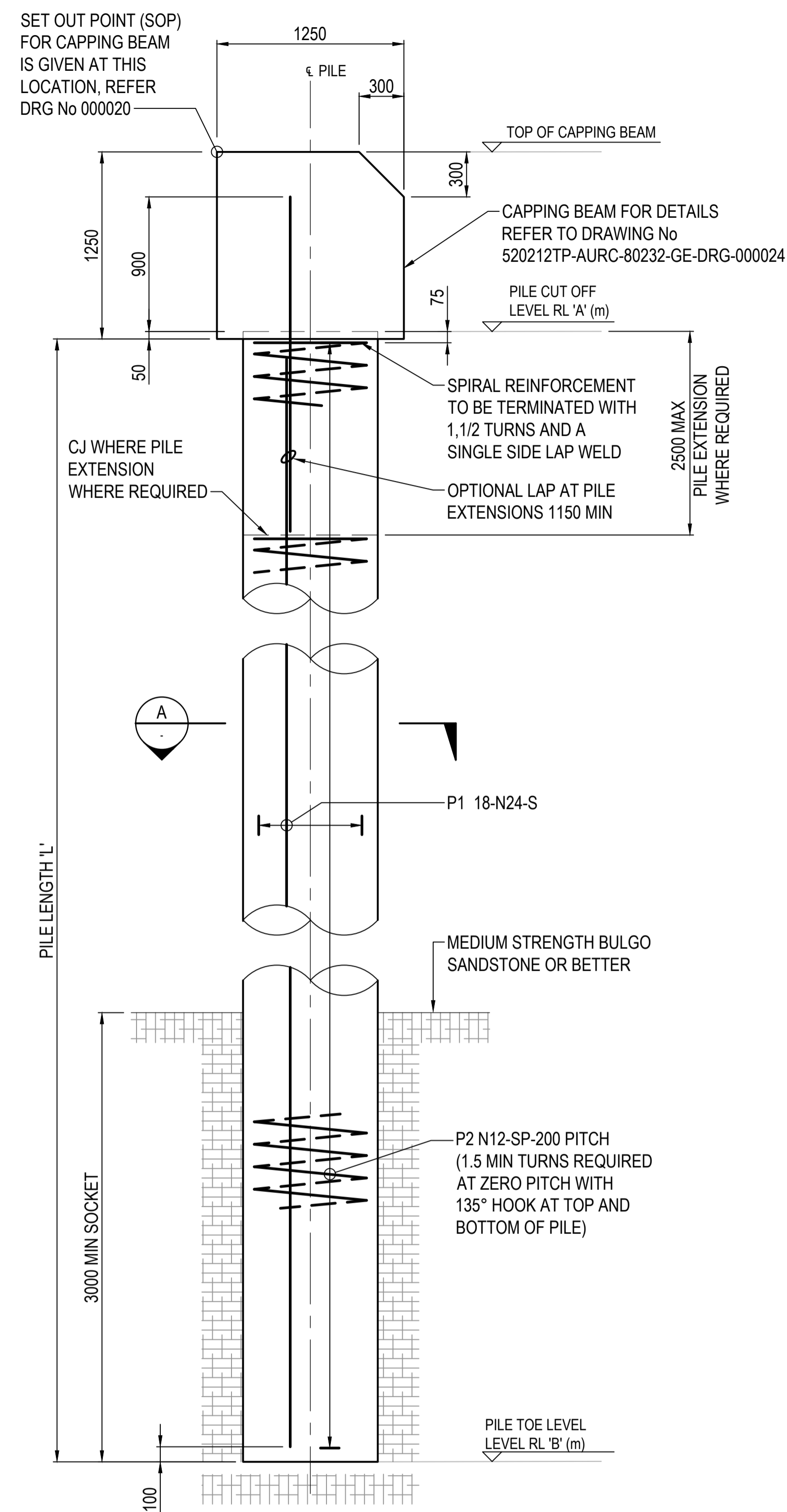
PILING

- PILES MUST BE CONSTRUCTED IN ACCORDANCE WITH TNSW SPECIFICATION B59.
- CONCRETE EXPOSURE CLASSIFICATION.
- B1 NOMINAL COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE, UNLESS SPECIFIED OTHERWISE, SHALL BE 75mm.
- THE SUBSURFACE GEOLOGICAL STRATIGRAPHY SHOWN ON THE DRAWINGS IS INDICATIVE ONLY AND IS INFERRRED BASED ON AVAILABLE GROUND INFORMATION. ACTUAL GROUND CONDITION MAY VARY.
- CONCRETE MUST BE PLACED BY THE TREMIE METHOD IN ACCORDANCE WITH TNSW SPECIFICATION B59.
- PILE TOE LEVELS ARE INDICATIVE ONLY (BASED ON INTERPRETATION OF AVAILABLE GROUND INVESTIGATION DATA).
- THE ACTUAL PILE TOE LEVEL MAY VARY ON SITE.
- THE PRINCIPAL'S REPRESENTATIVE SHALL REVIEW THE ACTUAL PROFILE OF THE ROCK SOCKET AND ADJUST THE FOUNDING LEVEL IF REQUIRED TO ACHIEVE THE DESIGN REQUIREMENTS.
- PILE TOE LEVEL TO BE GOVERNED BY WHICHEVER IS THE LOWEST OF EITHER THE PILE TOE LEVEL OR THE MINIMUM SOCKET LENGTH REQUIRED, AS GIVEN BY THE PILE SET OUT TABLE.
- RISK OF COLLAPSE OF THE PILE HOLE TO BE MANAGED BY THE PILING CONTRACTOR. METHOD STATEMENT TO BE SUBMITTED TO THE PRINCIPAL FOR APPROVAL PRIOR TO THE COMMENCEMENT OF PILING WORKS.
- PILE P1 IS TO COMMENCE AT CH9 AS PER THE PILE SET OUT TABLE, UNLESS THE LANDSLIDE EXTENT CONDITIONS CHANGE AT THE SITE AT THE COMMENCEMENT OF CONSTRUCTION WORKS. IF THE LATTER IS THE CASE PILE P1 MAY HAVE TO COMMENCE SOME DISTANCE TO THE SOUTH (TO BE CONFIRMED BY THE DESIGNER).
- 20% OF THE PILES WILL BE TESTED FOR INTEGRITY USING PE OR IR METHOD.
- PILES STRUCTURAL DETAILS REFER TO DRG No. 520212TP-AURC-80232-GE-DRG-000022.
- ANCHOR STRUCTURAL DETAILS REFER TO DRG No. 520212TP-AURC-80232-GE-DRG-000025.
- HIGH STRAIN DYNAMIC TESTING IS NOT REQUIRED.

FOR REVIEW

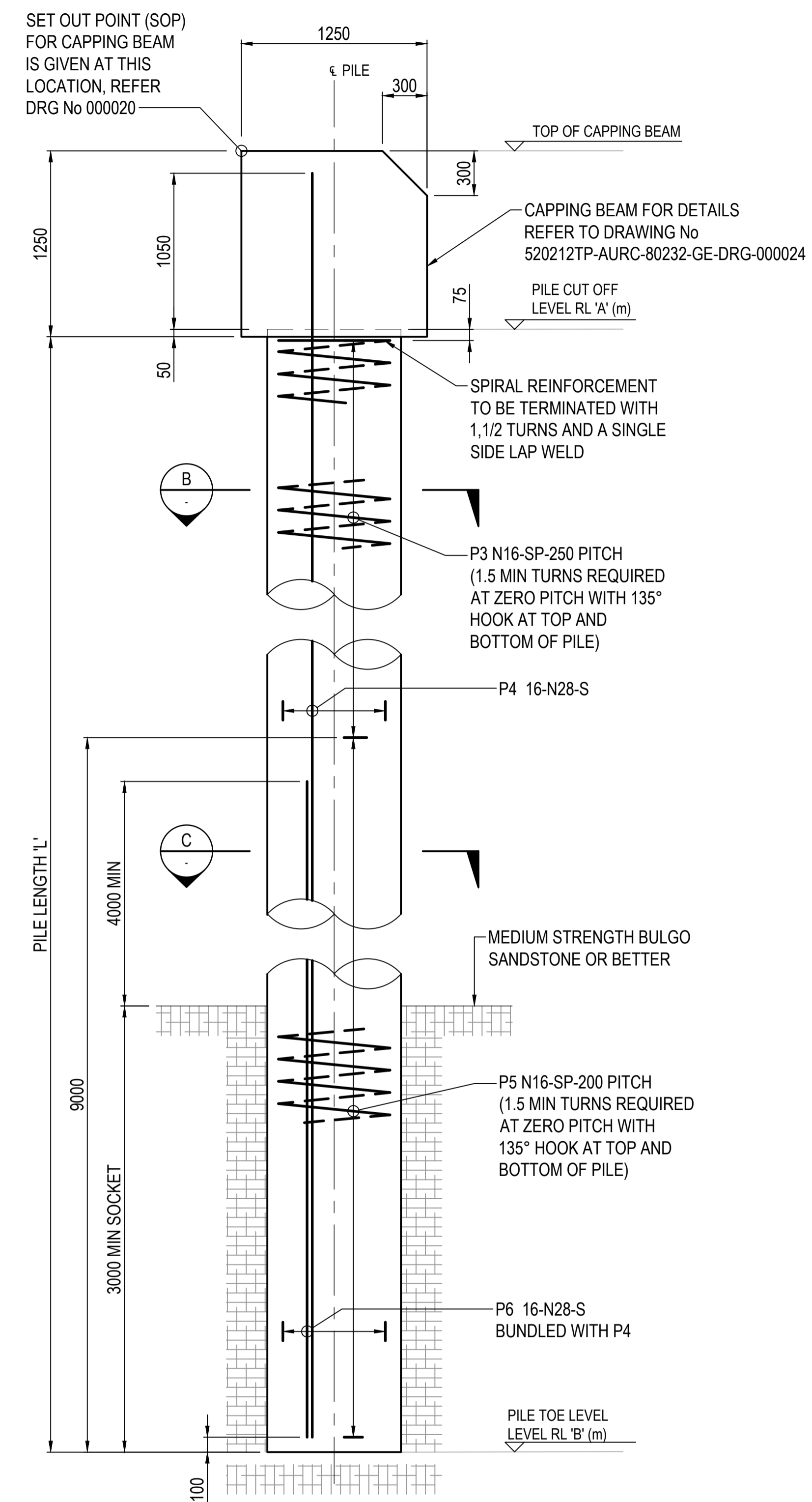
REFERENCES:	THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.	SCALE:	CLIENT:	<small>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.</small> <small>Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</small> 	HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232 ANCHORED BORED PILE WALL SLOPE STABILISATION PILE AND ANCHOR SCHEDULE TABLE AND NOTES																					
<table border="1"> <tr><td>C</td><td>100% DETAILED DESIGN</td><td>H.Z. 28/04/2023</td><td>W.D. 28/04/2023</td><td>M.A. 28/04/2023</td></tr> <tr><td>B</td><td>100% DETAILED DESIGN</td><td>H.Z. 13/04/2023</td><td>W.D. 13/04/2023</td><td>M.A. 13/04/2023</td></tr> <tr><td>A01.01</td><td>80% DETAILED DESIGN</td><td>H.Z. 30/01/2023</td><td>W.D. 30/01/2023</td><td>C.G. 30/01/2023</td></tr> <tr><td>REV</td><td>DESCRIPTION</td><td>DESIGNER INITIAL/DATE</td><td>VERIFIED INITIAL/DATE</td><td>APPROVED INITIAL/DATE</td></tr> </table>	C	100% DETAILED DESIGN	H.Z. 28/04/2023			W.D. 28/04/2023	M.A. 28/04/2023	B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023	A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	COORDINATE SYSTEM: MGA_ZONE_56/GDA20 HEIGHT DATUM: AHD	DESIGN LOT CODE:		DRAWN _____ D.GASGAS _____ 28.04.2023 DESIGNED _____ H.ZHANG _____ 28.04.2023 DRG CHECK _____ T.DONOVAN _____ 28.04.2023 DESIGN CHECK _____ W.DENG _____ 28.04.2023 PROJ/DES MNGR _____ V.TIET _____ 28.04.2023 APPROVED _____ M.ABERLINE _____ 28.04.2023
C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023																						
B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023																						
A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023																						
REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE																						



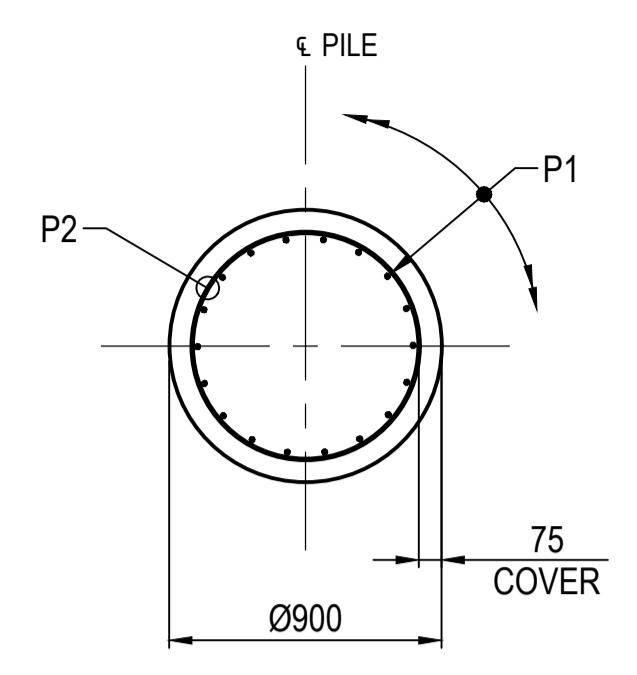


**TYPICAL PILE ELEVATION FOR PILES P60 TO P84**  
1:25

FOR VALUES OF 'L', 'RL 'A' AND 'RL 'B'  
REFER TO DRAWING 520212TP-AURC-80232-GE-DRG-000021

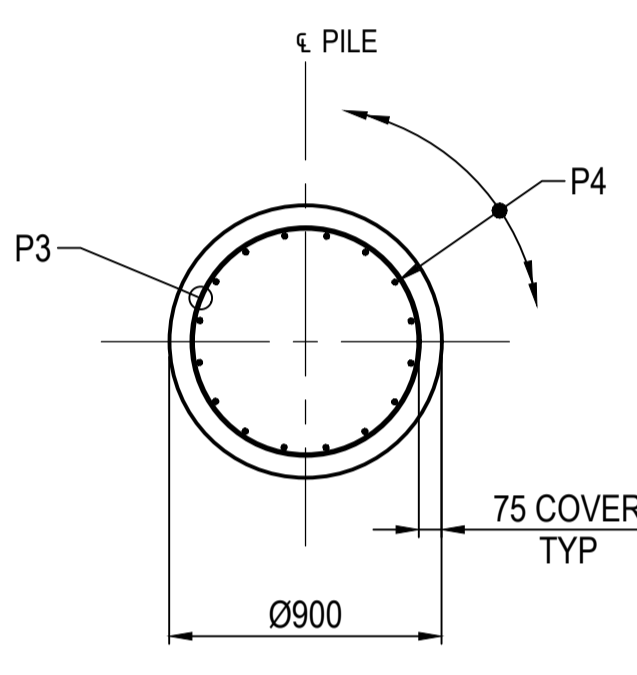


**TYPICAL PILE ELEVATION FOR PILES P1 TO P59 AND P85 TO P89**  
1:25



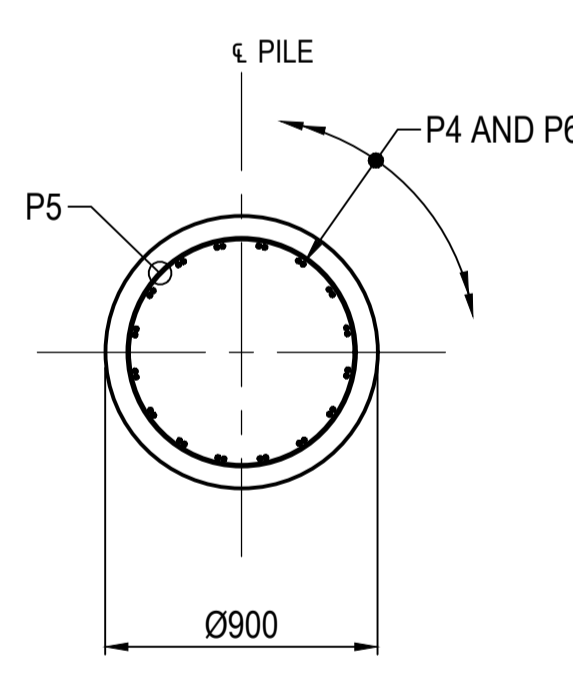
**SECTION A**  
1:25

**PILES P60 TO P84**  
1:25



**SECTION B**  
1:25

**PILES P1 TO P59 AND P85 TO P89**  
1:25



**SECTION C**  
1:25

**PILES P1 TO P59 AND P85 TO P89**  
1:25

**NOTES**

- CONCRETE EXPOSURE CLASSIFICATION: B1.
- MINIMUM 28 DAY COMPRESSIVE STRENGTH OF ALL CONCRETE SHALL BE 40 MPa, UNLESS NOTED OTHERWISE.
- REQUIRED COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE SHALL BE 75mm, UNLESS SPECIFIED OTHERWISE.
- ALL REINFORCEMENT SHALL BE GRADE 500 MPa TO AS/NZS 4671 UNLESS SPECIFIED OTHERWISE.
- EDGES TO BE CHAMFERED 20 x 20mm UNLESS SPECIFIED OTHERWISE.
- HELIX SHALL BE ANCHORED AT EACH END WITH 1.5 TURNS ADJUSTED TO ZERO PITCH AND ANCHORED BY A STANDARD HOOK AROUND A MAIN BAR. ALTERNATIVELY HELIX ANCHORAGE MAY CONSIST OF A SINGLE SPLICE WELD WITH BARS SUPERIMPOSED IN ACCORDANCE WITH JOINT IDENTIFICATION L-d TO AS1554.3 WELD SIZE TO HELIX:  
N12 - 3mm x 120 LONG  
N16 - 4mm x 160 LONG
- FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE DRAWING No's 520212TP-AURC-80232-GE-DRG-000002 AND 520212TP-AURC-80232-GE-DRG-000021.
- THE MINIMUM DEVELOPMENT LENGTHS TO BE AS FOLLOWS, UNLESS SPECIFIED OTHERWISE:

BAR SIZE	N24	N28
VERTICAL BARS	900	1050

CLEAR DISTANCE BETWEEN LAPPED BARS SHALL NOT EXCEED 3 x BAR DIAMETER.  
LAP LENGTH SHALL BE 25% GREATER THAN DEVELOPMENT LENGTH.

**FOR REVIEW**

REFERENCES:

C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023
B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023
A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023
REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE

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COORDINATE SYSTEM: MGA\_ZONE\_56/GDA20

HEIGHT DATUM: AHD

SCALE:

SCALE 1:25

DESIGN LOT CODE:

CLIENT:

PREPARED FOR:

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**CONNECT SYDNEY**

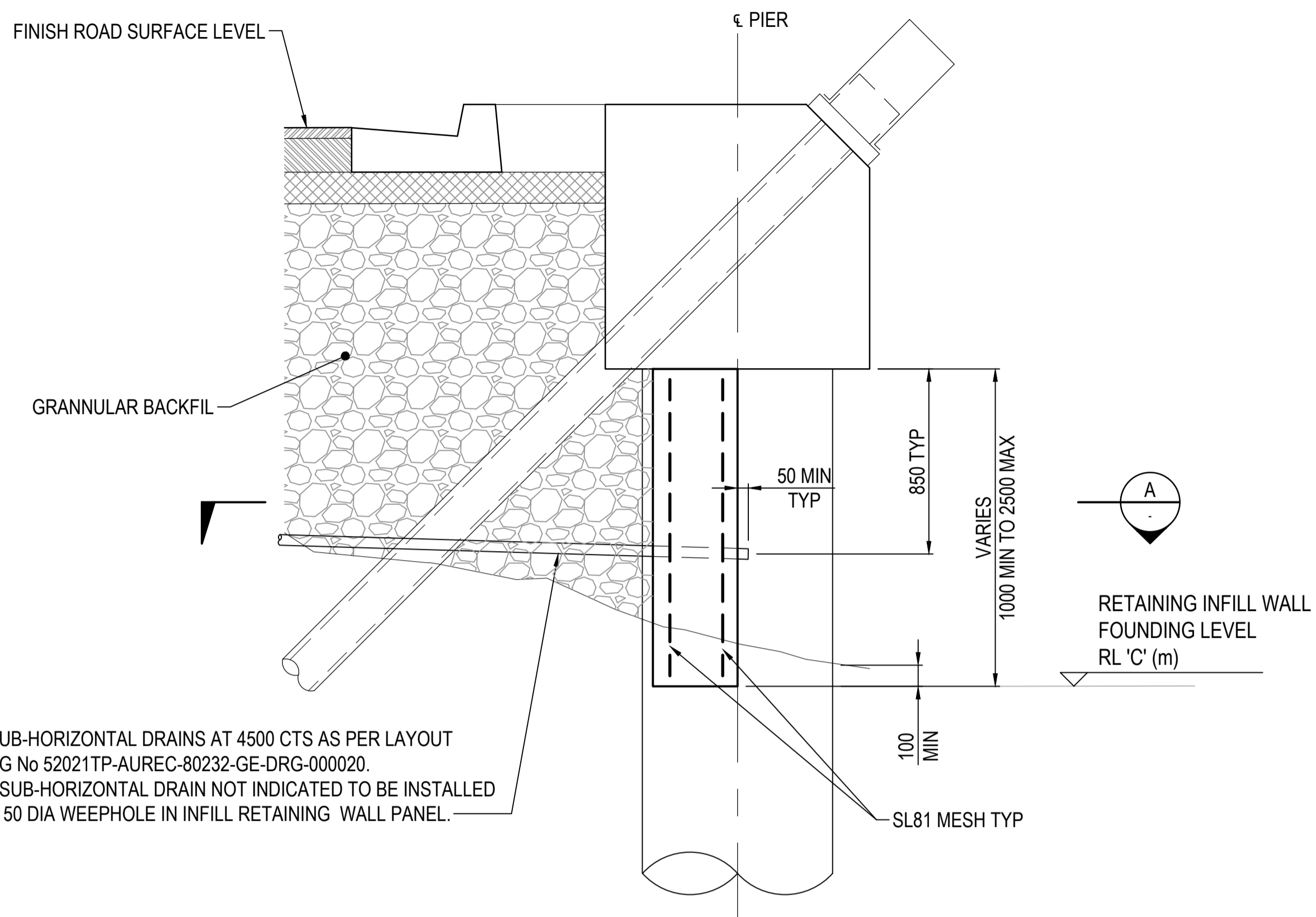
DRAWN	D.GASGAS	28.04.2023
DESIGNED	H.ZHANG	28.04.2023
DRG CHECK	T.DONOVAN	28.04.2023
DESIGN CHECK	W.DENG	28.04.2023
PROJ/DES MNGR	V.TIET	28.04.2023
APPROVED	M.ABERLINE	28.04.2023

HARBOUR ZONE  
SRAPC SPECIAL PROJECTS  
GARIE ROAD  
SL80232  
ANCHORED BORED PILE WALL SLOPE STABILISATION  
PILE STRUCTURAL DETAILS

DRAWING SET No:	SL80232	PART:	SHEET: 8	OF 19	A1
STATUS:	FOR REVIEW	BRIDGE No:			
DRG No:	520212TP-AURC-80232-GE-DRG-000022	REV	VER	EDMS No.	AMD No.

FILE NAME: 520212TP-AURC-80232-GE-DRG-000022.dwg  
PLOT DATE & TIME: 28/04/2023 11:28:54 AM

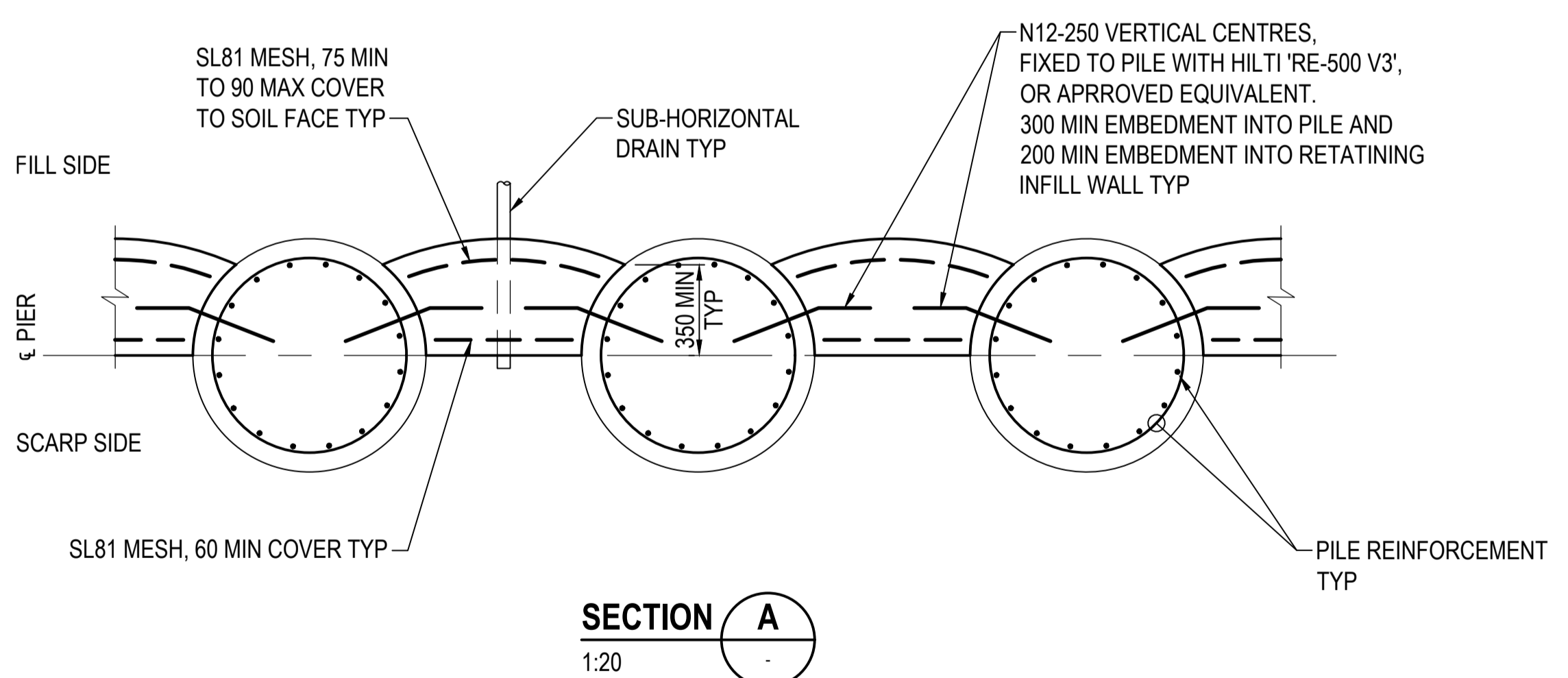




50 DIA SUB-HORIZONTAL DRAINS AT 4500 CTS AS PER LAYOUT  
DRAWING No 52021TP-AUREC-80232-GE-DRG-000020.  
WHERE SUB-HORIZONTAL DRAIN NOT INDICATED TO BE INSTALLED  
INSTALL 50 DIA WEEPHOLE IN INFILL RETAINING WALL PANEL.

**TYPICAL RETAINING INFILL WALL SECTION**  
1:20  
SIDE FOR VALUES OF RL 'C' SEE ADJACENT TABLE

INFILL RETAINING WALL LOCATION	BASE LEVEL ON INFILL RETAINING WALL RL 'C' m
P45 TO P46	64.32
P46 TO P47	64.20
P47 TO P48	64.08
P48 TO P49	63.96
P49 TO P50	63.85
P50 TO P51	63.74
P51 TO P52	63.63
P52 TO P53	63.52
P53 TO P54	63.42
P54 TO P55	63.06
P55 TO P56	62.69
P56 TO P57	62.56
P57 TO P58	62.47
P58 TO P59	62.38
P59 TO P60	62.29
P60 TO P61	62.20
P61 TO P62	61.86
P62 TO P63	61.78
P63 TO P64	61.44
P64 TO P65	61.11
P65 TO P66	61.02
P66 TO P67	60.67
P67 TO P68	60.58
P68 TO P69	60.49
P69 TO P70	60.40
P70 TO P71	60.30
P71 TO P72	60.20
P72 TO P73	60.10
P73 TO P74	59.99
P74 TO P75	59.88
P75 TO P76	59.77
P76 TO P77	59.91
P77 TO P78	60.05
P78 TO P79	60.44
P79 TO P80	60.83
P80 TO P81	60.72
P81 TO P82	60.60



- NOTES**
- CONCRETE EXPOSURE CLASSIFICATION: B2.
  - MINIMUM 28 DAY COMPRESSIVE STRENGTH OF ALL CONCRETE SHALL BE 40 MPa, UNLESS NOTED OTHERWISE.
  - REQUIRED COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE SHALL BE 60mm, UNLESS SPECIFIED OTHERWISE.
  - ALL REINFORCEMENT SHALL BE GRADE 500 MPa TO AS/NZS 4671 UNLESS SPECIFIED OTHERWISE.
  - EDGES TO BE CHAMFERED 20 x 20mm UNLESS SPECIFIED OTHERWISE.
  - FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE DRAWING No's 520212TP-AURC-80232-GE-DRG-000002 AND 520212TP-AURC-80232-GE-DRG-000021.
  - AS STATED ON SHEET 520212TP-AURC-80232-GE-DRG-000020, INSPECTION MONITORING OF THE LANDSLIDE SUBSIDENCE WILL BE REQUIRED DURING THE DESIGN LIFE OF THE PILE WALL. IF REQUIRED, THE DESIGN BASE LEVEL (RL 'C') OF THE INFILL RETAINING WALL PANELS MAY BE REQUIRED TO BE EXTENDED BELOW THE DESIGN LEVELS DURING THE DESIGN LIFE OF THE WALL TO ACCOUNT FOR LONG TERM SUBSIDENCE.

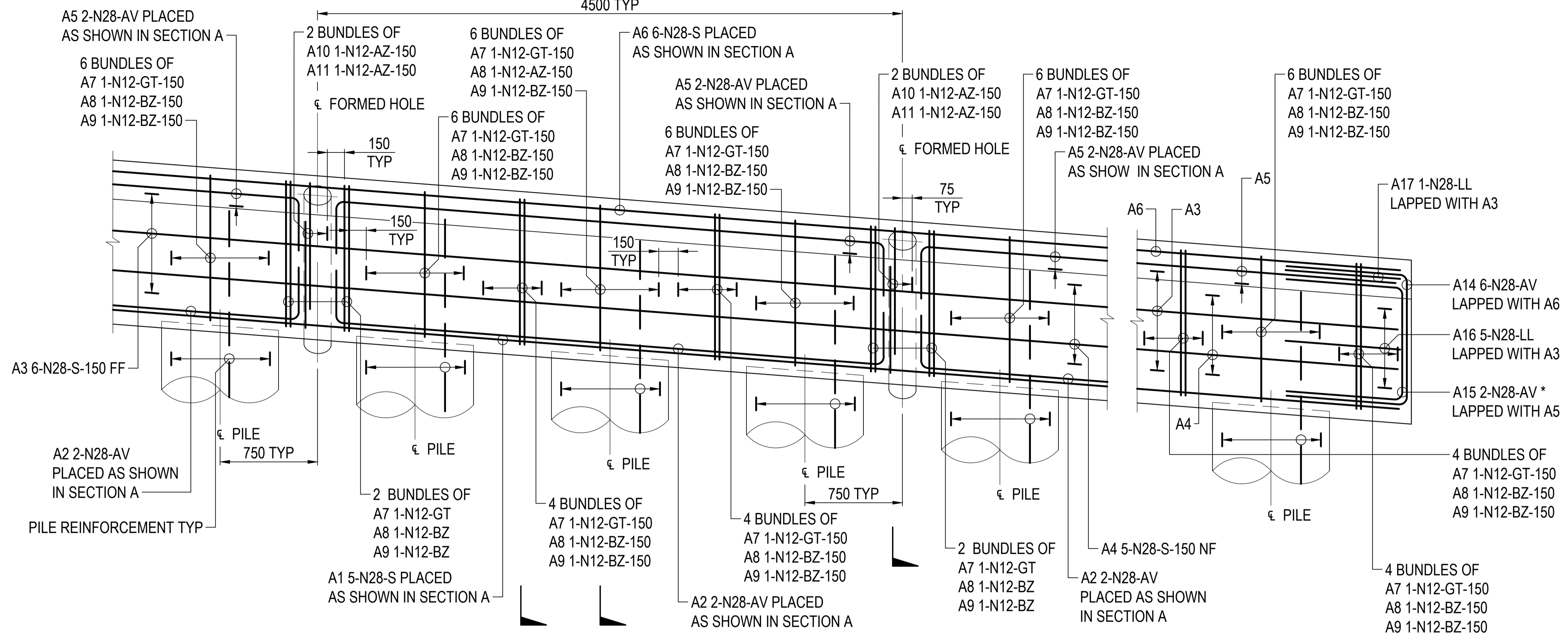
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	<table border="1"> <tr><td>C</td><td>100% DETAILED DESIGN</td><td>H.Z. 28/04/2023</td><td>W.D. 28/04/2023</td><td>M.A. 28/04/2023</td></tr> <tr><td>B</td><td>100% DETAILED DESIGN</td><td>H.Z. 13/04/2023</td><td>W.D. 13/04/2023</td><td>M.A. 13/04/2023</td></tr> <tr><td>A01.01</td><td>80% DETAILED DESIGN</td><td>H.Z. 30/01/2023</td><td>W.D. 30/01/2023</td><td>C.G. 30/01/2023</td></tr> </table>			C				100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023	B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023	A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023	 SCALE 1:20	DRAWING SET No: SL80232 STATUS: FOR REVIEW DRG No: 520212TP-AURC-80232-GE-DRG-000023	PART: SHEET: 9 OF 19 A1 BRIDGE No: _____ REV C VER EDMS No. _____ AMD No. _____
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A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023																				
COORDINATE SYSTEM: MGA_ZONE_56/GDA20 HEIGHT DATUM: AHD			DESIGN LOT CODE:																					
PREPARED FOR:																								
REFERENCES:																								

FILE NAME: 520212TP-AURC-80232-GE-DRG-000023.dwg  
PLOT DATE & TIME: 28/04/2023 11:28:17 AM





**TYPICAL CAPPING BEAM ELEVATION**  
1:20

**NOTES**

- CONCRETE EXPOSURE CLASSIFICATION: B2.
  - MINIMUM 28 DAY COMPRESSIVE STRENGTH OF ALL CONCRETE SHALL BE 40 MPa, UNLESS NOTED OTHERWISE.
  - REQUIRED COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE SHALL BE 60mm, UNLESS SPECIFIED OTHERWISE.
  - ALL REINFORCEMENT SHALL BE GRADE 500 MPa TO AS/NZS 4671 UNLESS SPECIFIED OTHERWISE.
  - EDGES TO BE CHAMFERED 20 x 20mm UNLESS SPECIFIED OTHERWISE.
  - UNLESS SPECIFIED OTHERWISE THE MINIMUM DEVELOPMENT LENGTH SHALL BE AS FOLLOWS, UNLESS OTHERWISE NOTED:
- | BAR SIZE  | N12 | N16 | N20 | N24 | N28  |
|---|-----|-----|-----|-----|------|
| a) HORIZONTAL BARS WITH >300mm OF CONCRETE CAST BELOW THE BAR | 500 | 650 | 750 | 950 | 1200 |
| b) OTHER BARS   | 350 | 500 | 600 | 700 | 900  |
- CLEAR DISTANCE BETWEEN LAPPED BARS SHALL NOT EXCEED 3 x THE BAR DIAMETER.
- LAP LENGTH SHALL BE 25% GREATER THAN DEVELOPMENT LENGTH.
  - REINFORCEMENT MAY DISPLACED SLIGHTLY WHERE NECESSARY TO CLEAR FORMED HOLES, HOLD DOWN BOLTS ASSEMBLIES AND PILE STARTER BARS.
  - TOP AND BOTTOM REINFORCEMENT MATS SHALL BE ALIGNED.

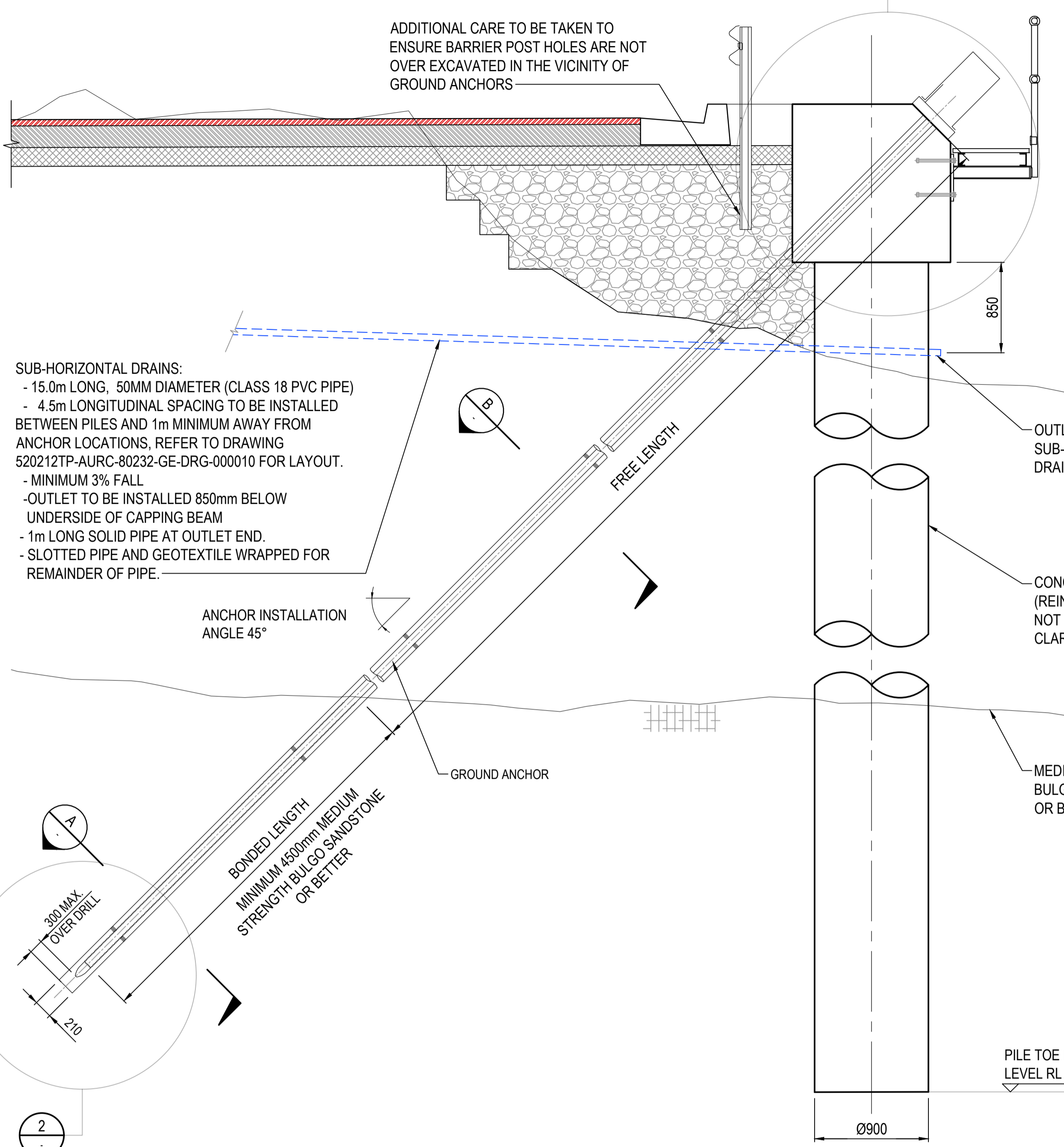
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	C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023					M.A. 28/04/2023	DRAWN	D.GASGAS	28.04.2023
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A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023	DRG CHECK	T.DONOVAN	28.04.2023	DESIGN CHECK	W.DENG	28.04.2023		
REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	PROJ/DES MNGR	V.TIET	28.04.2023	APPROVED	M.ABERLINE	28.04.2023		
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						STATUS: FOR REVIEW		BRIDGE No:		©		
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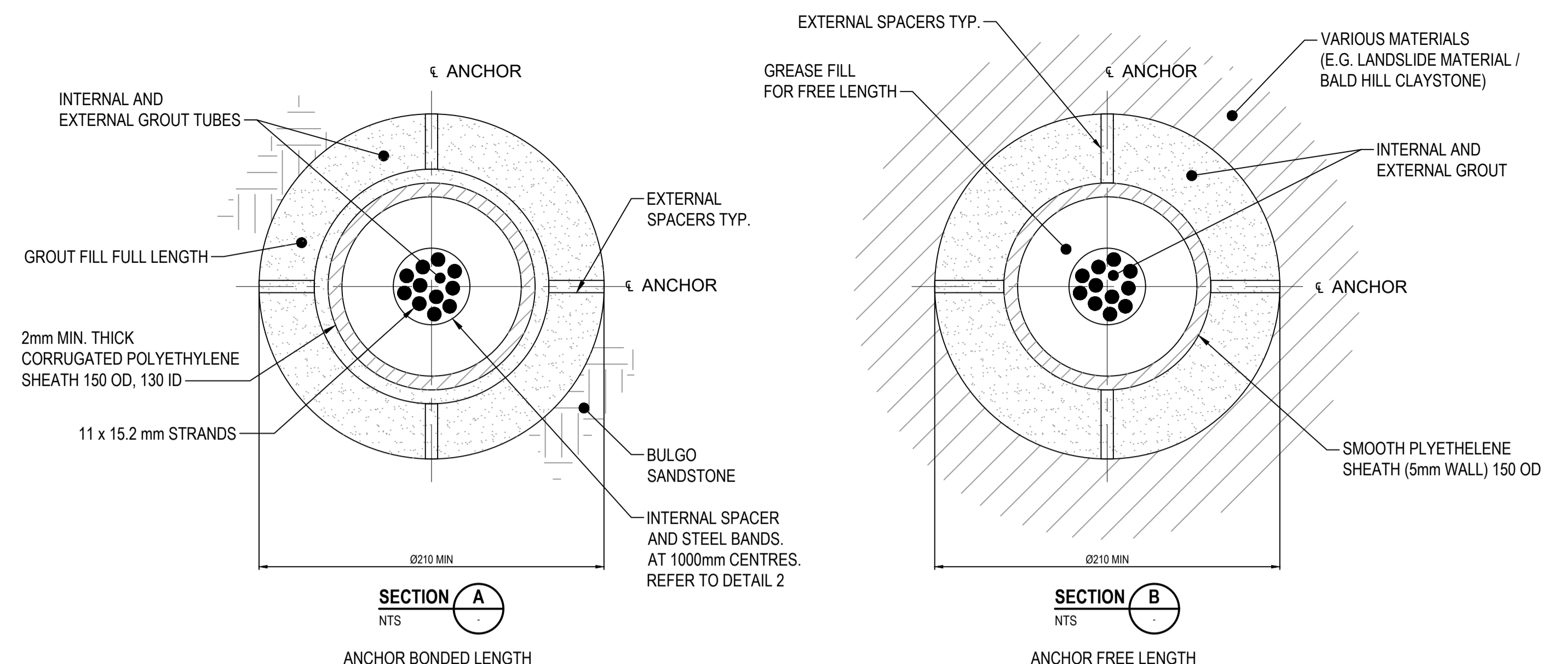
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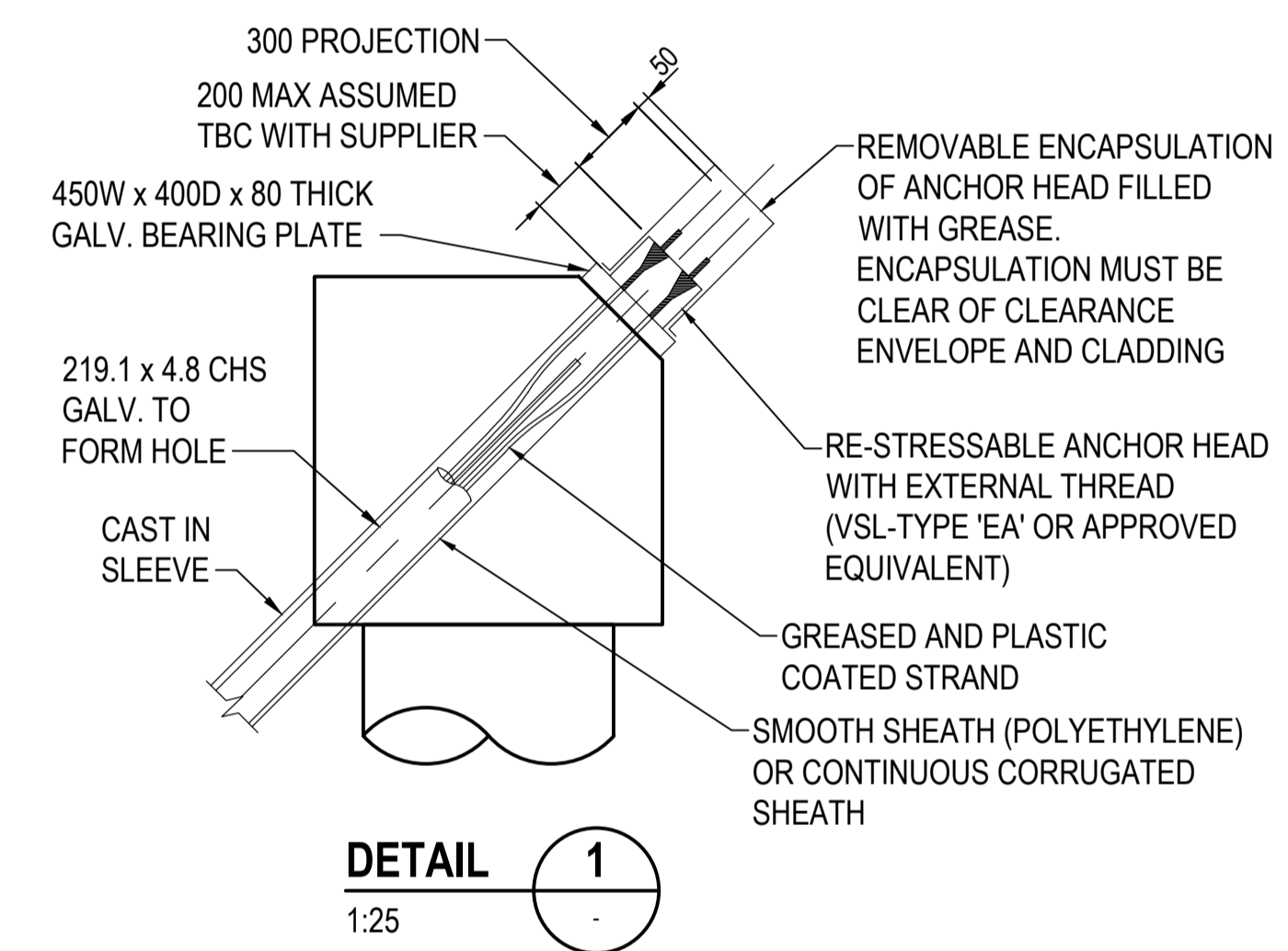




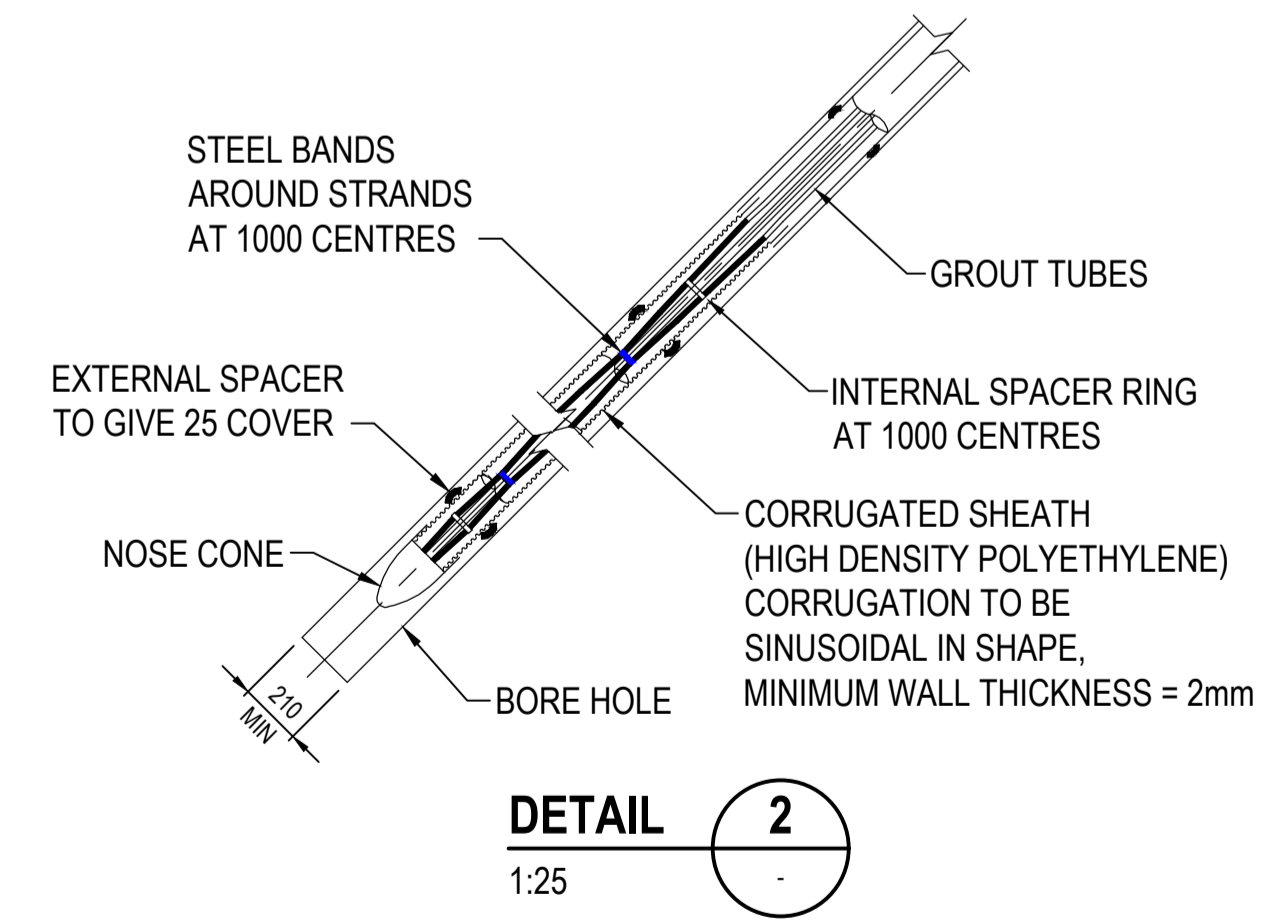
TYPICAL SECTION - BORED PILE WALL  
SCALE 1:25



TYPICAL SECTION THROUGH STRAND ANCHOR  
SCALE NTS



DETAIL 1  
SCALE 1:25



DETAIL 2  
SCALE 1:25

**GROUND ANCHOR NOTES**

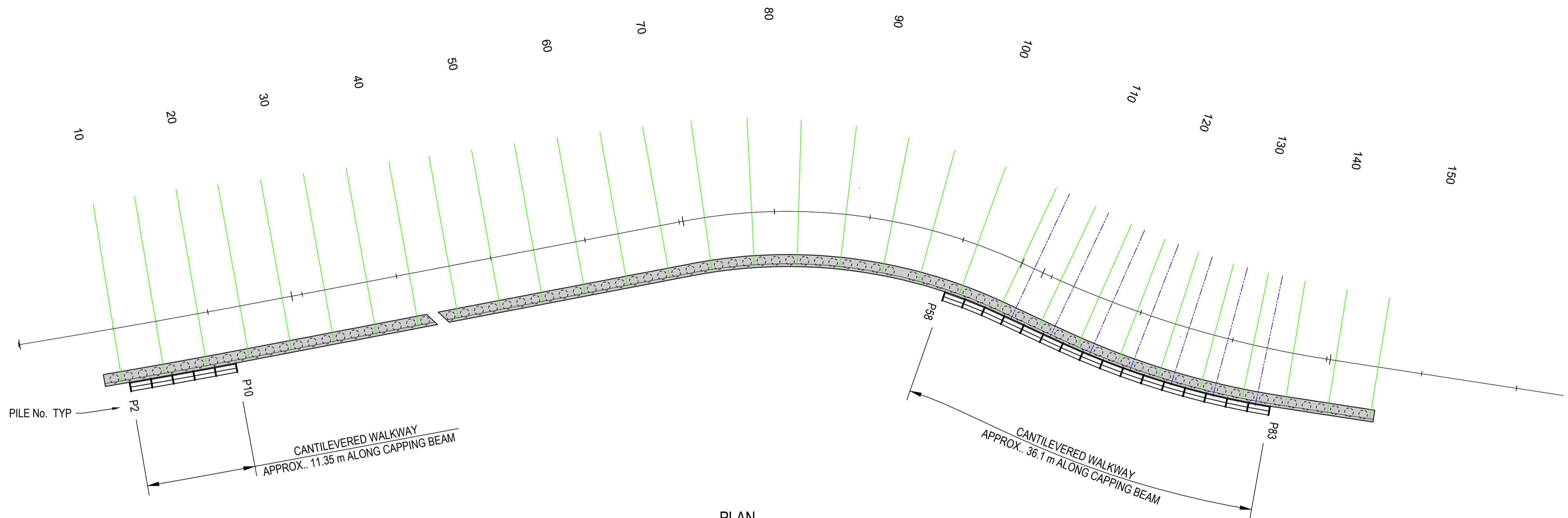
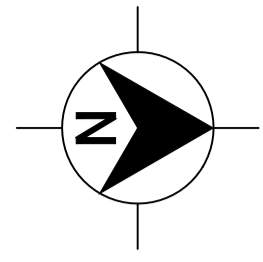
1. THE GROUND ANCHORS SHALL BE PERMANENT ANCHORS WITH A DOUBLE CORROSION PROTECTION SYSTEM AND A MINIMUM DESIGN LIFE OF COMPONENTS OF 100 YEARS. GROUND ANCHORS SHALL CONFORM TO TNSW SPECIFICATION B114.
2. EACH GROUND ANCHOR COMPRISES AN 11/15.2mm DIAMETER 7-WIRE, ORDINARY, RELAX 2 PRESTRESSING STRANDS TO AS/NZS 4672.1 WITH A MINIMUM BREAKING LOAD OF 261 kN PER STRAND.
3. THE ANCHORS SHALL BE RE-STRESSABLE TO ALLOW MONITORING AND ADJUSTMENT OF THE ANCHOR LOAD OVER THE LIFE OF THE ANCHOR. THE STRANDS SHALL BE DOUBLE SHEATHED WITH THE INNER SHEATH GREASE FILLED AND THE ANCHORAGES PROTECTED FROM CORROSION IN ACCORDANCE WITH TNSW B114.
4. MINIMUM COMPRESSIVE STRENGTH OF CAPPING BEAM CONCRETE PRIOR TO STRESSING ANCHOR SHALL BE 32 MPa.
5. MINIMUM 28 DAY CUBE STRENGTH OF GROUT SHALL BE 50 MPa
6. THE SLS LOAD ON EACH GROUND ANCHOR IS 505 kN. THE ULS LOAD ON EACH GROUND ANCHOR IS 1265 kN. THE BOND LENGTH SHALL BE LOCATED IN MEDIUM STRENGTH OR BETTER BULGO SANDSTONE.
7. PRIOR TO THE CONSTRUCTION OF ANCHORS A1 TO A15, A PROOF TEST SHALL BE CARRIED OUT ON A TRIAL ANCHOR NEAR ANCHOR A6 TO CONFIRM THAT A GROUT/ ROCK BOND STRESS IN THE BULGO SANDSTONE IS AT LEAST 1500 kPa. THE TRIAL ANCHOR SHALL HAVE THE SAME DETAILS AS THE PERMANENT ANCHORS BUT THE BOND LENGTH MAY BE REDUCED. THE CONTRACTOR SHALL SUBMIT DETAILS OF THE PROOF LOAD TESTING TO THE DESIGN REPRESENTATIVE AT LEAST 2 WEEKS BEFORE INSTALLING THE ANCHOR. AFTER TESTING, THE FORCE IN THE TRIAL ANCHOR SHALL BE REDUCED TO 50 kN AND THE ANCHORAGE PROTECTED FROM CORROSION IN THE SAME MANNER AS THE PERMANENT ANCHORS.
8. BEFORE CONSTRUCTING ANCHORS A16 TO A31 A PROOF TEST SHALL BE CARRIED OUT ON A SECOND TRIAL ANCHOR NEAR ANCHOR A20 FOLLOWING THE PROCEDURE IN 7 ABOVE.
9. SUITABILITY TESTS SHALL BE CARRIED ON GROUND ANCHORS A1 AND A15 BEFORE INSTALLING THE FOLLOWING ANCHORS. THE TEST LOAD FOR SUITABILITY TESTS IS 1265 kN.
10. THE REMAINING ANCHORS SHALL BE ACCEPTANCE TESTED. THE TEST LOAD FOR ACCEPTANCE TESTS SHALL BE 1265 kN.
11. THE LOCK-OFF FORCE IN THE GROUND ANCHORS IMMEDIATELY AFTER STRESSING SHALL BE 600 kN.

**FOR REVIEW**

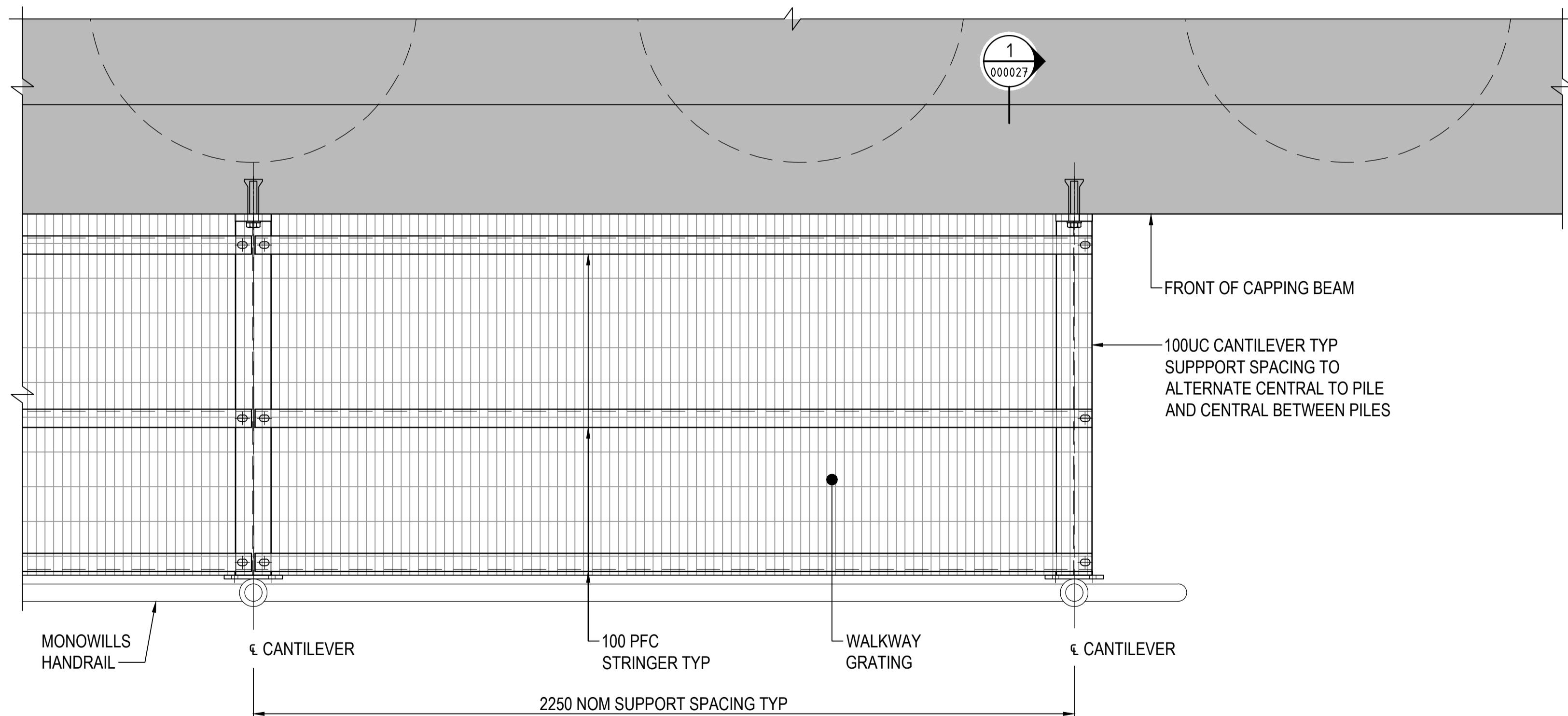
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	<table border="1"> <tr> <td>C</td> <td>100% DETAILED DESIGN</td> <td>H.Z. 28/04/2023</td> <td>W.D. 28/04/2023</td> <td>M.A. 28/04/2023</td> </tr> <tr> <td>B</td> <td>100% DETAILED DESIGN</td> <td>H.Z. 13/04/2023</td> <td>W.D. 13/04/2023</td> <td>M.A. 13/04/2023</td> </tr> <tr> <td>A01.01</td> <td>80% DETAILED DESIGN</td> <td>H.Z. 30/01/2023</td> <td>W.D. 30/01/2023</td> <td>C.G. 30/01/2023</td> </tr> </table>			C				100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023	B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023	A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023	0.25 0 0.5 1m SCALE 1:25	DRAWN _____ D.GASGAS _____ 28.04.2023 DESIGNED _____ H.ZHANG _____ 28.04.2023 DRG CHECK _____ T.DONOVAN _____ 28.04.2023 DESIGN CHECK _____ W.DENG _____ 28.04.2023 PROJ/DES MNGR _____ V.TIET _____ 28.04.2023 APPROVED _____ M.ABERLINE _____ 28.04.2023	DRAWING SET No: SL80232 STATUS: FOR REVIEW DRG No: 520212TP-AURC-80232-GE-DRG-000025
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PLAN  
SCALE 1:250



TYPICAL DETAIL PLAN OF  
CANTILEVERED WALKWAY MAINTENANCE PLATFORM  
1:10

NOTES

- DIMENSIONS ARE NOT TO BE SCALED FROM THIS DRAWING.
- DIMENSIONS ARE IN MILLIMETRES
- CONSTRUCTION AND INSTALLATION OF HANDRAILS TO BE IN ACCORDANCE WITH AS1657
- WALKWAY HAS BEEN DESIGNED FOR 2.5 kPa MAINTENANCE LIVE LOAD

STEELWORK

- ALL STRUCTURAL STEELWORK TO COMPLY WITH AS4100
- ALL ROLLED STEEL SECTIONS TO COMPLY WITH AS 3679 GRADE 300 PLUS
- ALL STEEL PLATES TO COMPLY WITH AS3678 GRADE 250

PROTECTIVE COATING

- ALL STEELWORK TO BE HOT DIP GALVANISED AND ANY DAMAGED/UNCOATED AREA TO BE REPAIRED IN ACCORDANCE WITH AS/NZS 4680
- ALL NUTS, BOLTS AND WASHERS ARE TO BE GALVANISED TO AS1214.

BOLTING

- ALL STRUCTURAL BOLTS TO BE GRADE 8.8/TB WITH NUTS IN ACCORDANCE WITH AS1252 AND AS1214.

WELDING

- ALL WELDS COMPLY WITH AS 1554 PART 1, CATEGORY SP.
- EXTENT OF WELD INSPECTION:  
100% VISUAL EXAMINATION  
10% NON-DESTRUCTIVE TESTING
- ALL FILLET WELDS 6mm CONTINUOUS UNLESS NOTED OTHERWISE.
- ALL BUTT WELDS COMPLETE PENETRATION.

HANDRAILS, KICKPLATE AND GRATING

- ALL HANDRAILS, FIXTURES, FITTINGS, CONNECTIONS AND STEEL GRATING TO BE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
- GRATING SECURELY CLAMPED DOWN WITH GALVANISED FASTENERS TO MANUFACTURER'S SPECIFICATIONS.

FOR REVIEW

REFERENCES:

C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023
B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023
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SCALE:

SCALE 1:10  
SCALE 1:250

DESIGN LOT CODE:

CLIENT:

PREPARED FOR:

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DESIGNED: H.ZHANG 28.04.2023  
DRG CHECK: T.DONOVAN 28.04.2023  
DESIGN CHECK: W.DENG 28.04.2023  
PROJ/DES MNGR: V.TIET 28.04.2023  
APPROVED: M.ABERLINE 28.04.2023

HARBOUR ZONE  
SRAPC SPECIAL PROJECTS  
GARIE ROAD  
SL80232  
ANCHORED BORED PILE WALL SLOPE STABILISATION  
MAINTENANCE WALKWAY DETAILS - SHEET 1

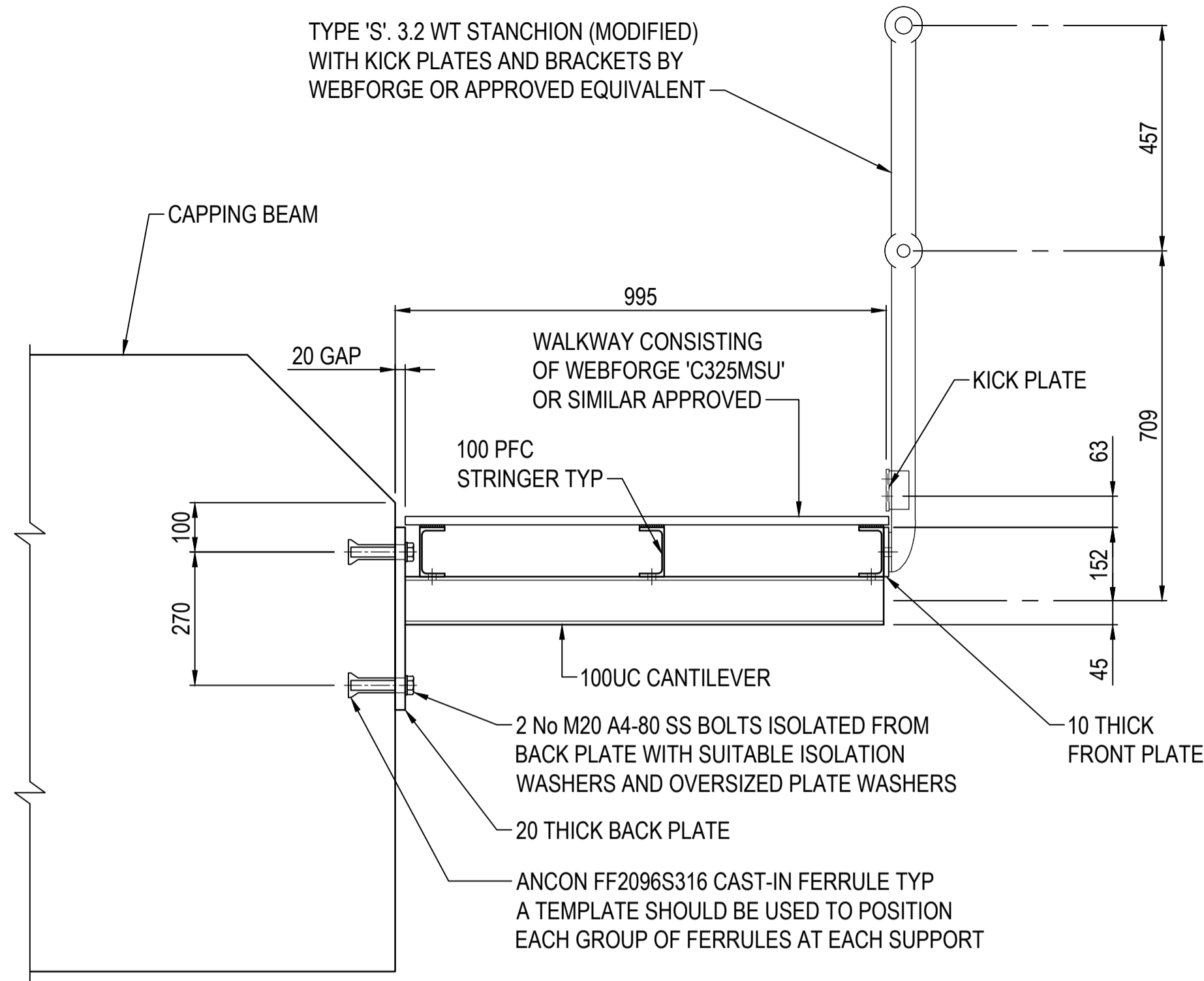
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DRG No: 520212TP-AURC-80232-GE-DRG-000026	REV C	EDMS No.	AMD No.

PROJECT: SRAPC GARIE ROAD SLOPE STABILISATION - SHEET 12 OF 19  
DRAWN: D.GASGAS  
DESIGNED: H.ZHANG  
DRG CHECK: T.DONOVAN  
DESIGN CHECK: W.DENG  
PROJ/DES MNGR: V.TIET  
APPROVED: M.ABERLINE

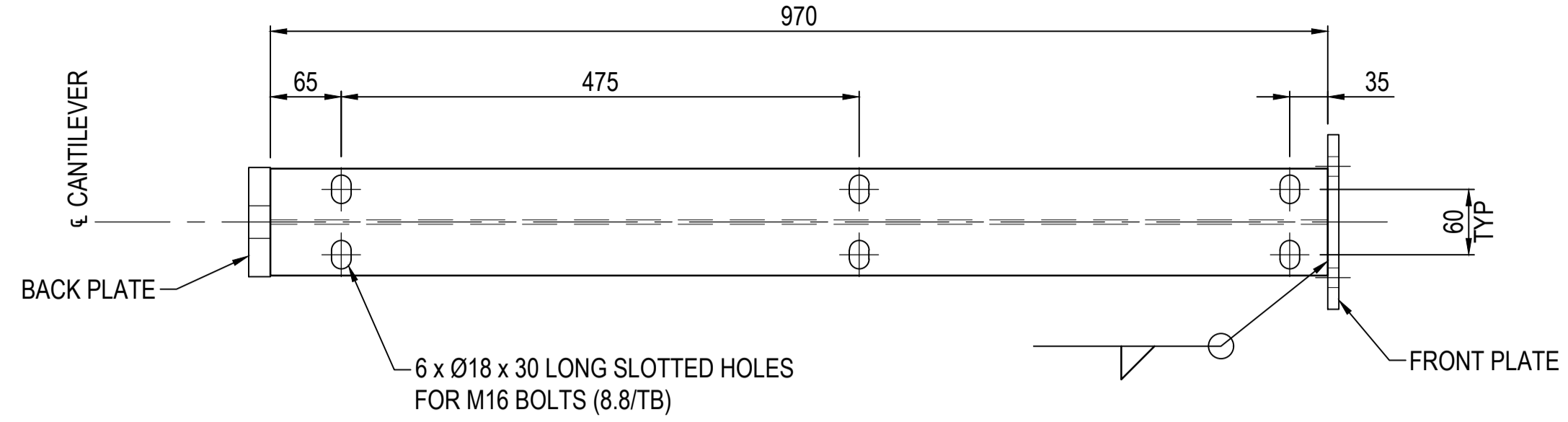
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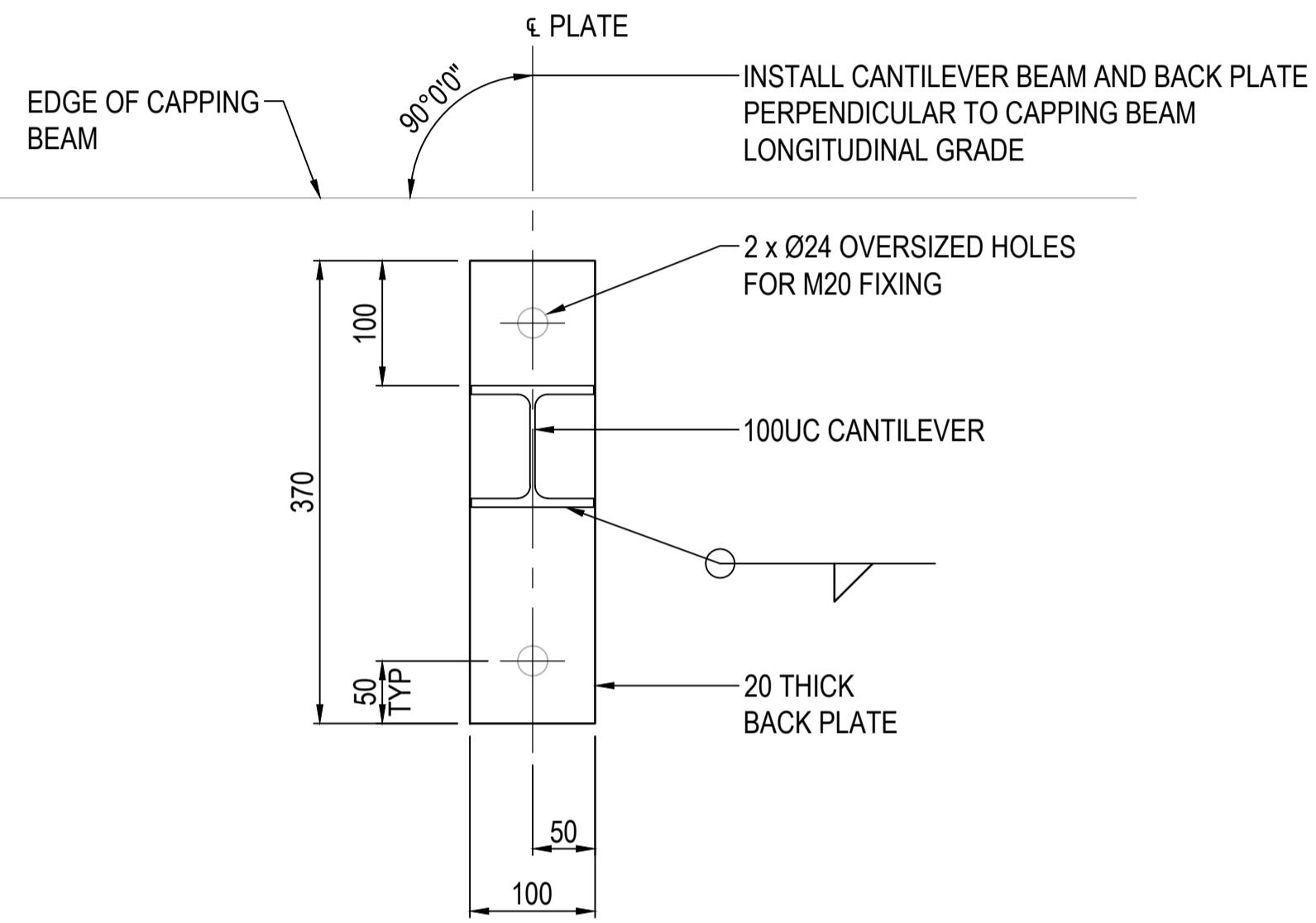




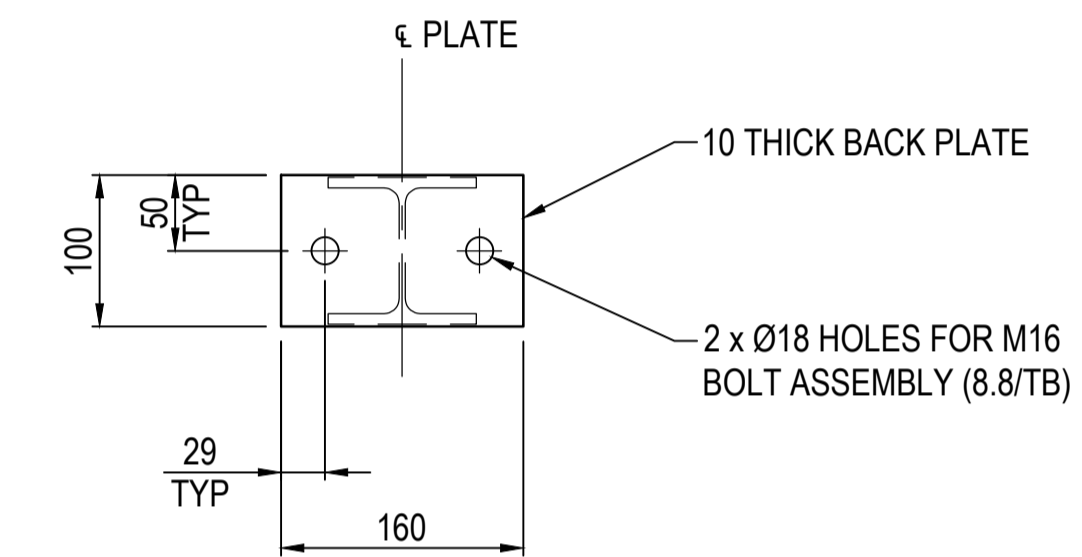
**SECTION 1**  
1:10  
**TYPICAL CROSS SECTION OF CANTILEVERED WALKWAY MAINTENANCE PLATFORM**



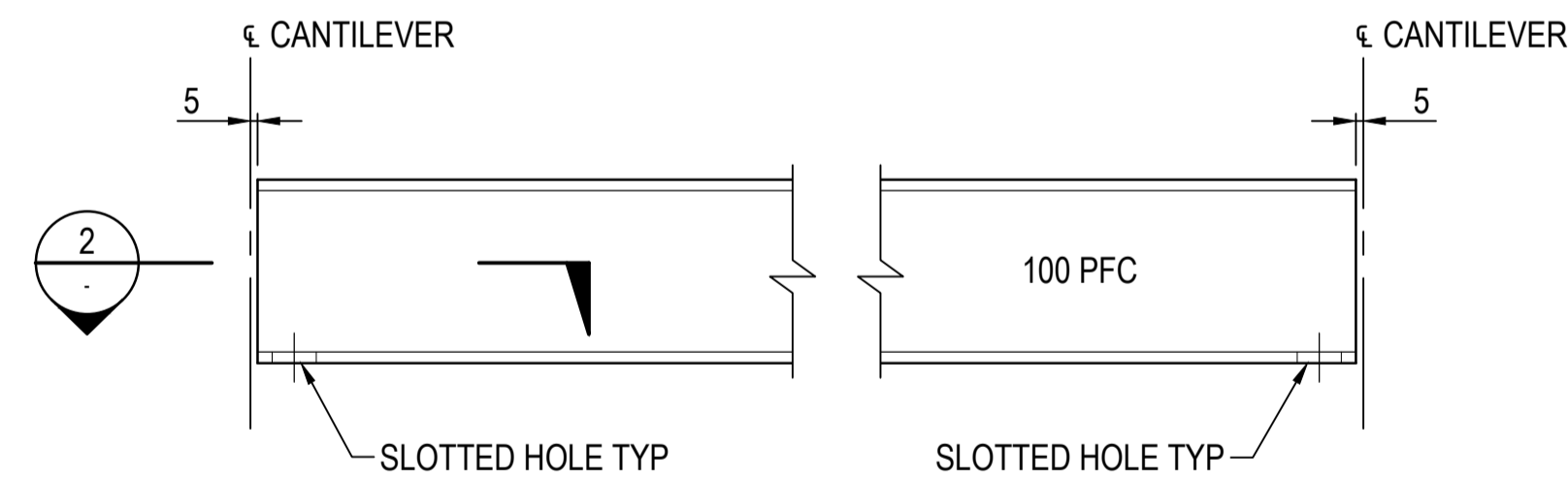
**CANTILEVER DETAIL - PLAN**  
1:5



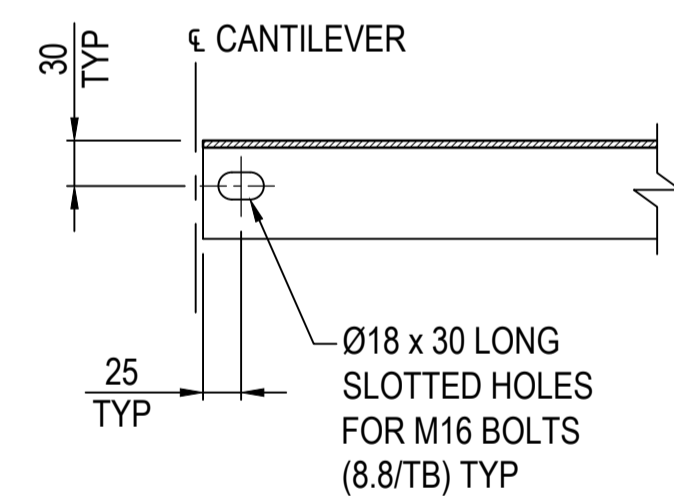
**BACK PLATE DETAIL - ELEVATION**  
1:5



**FRONT PLATE DETAIL - ELEVATION**  
1:5



**STRINGER DETAIL - ELEVATION**  
1:5



**SECTION 2**  
1:5

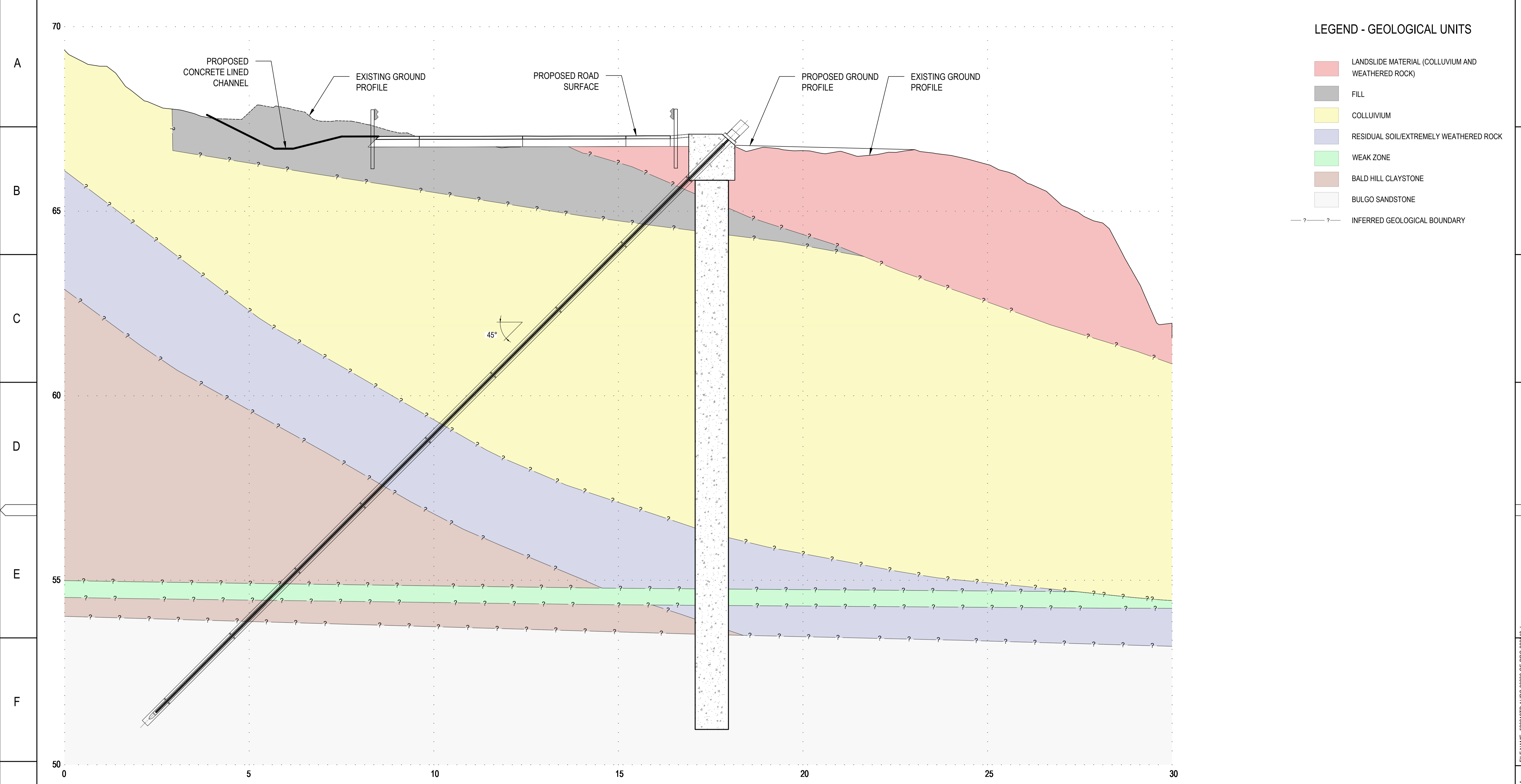
- NOTES**
1. SCALES AS SHOWN
  2. FOR NOTES RELATING TO THIS SHEET SEE DRAWING 520212TP-AURC-GE-DRG-000026

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	C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023					M.A. 28/04/2023
	B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023					M.A. 13/04/2023
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FILE NAME: 520212TP-AURC-80232-GE-DRG-000027.dwg

PLOT DATE & TIME: 28/04/2023 4:28:53 PM



- LEGEND - GEOLOGICAL UNITS**
- LANDSLIDE MATERIAL (COLLUVIUM AND WEATHERED ROCK)
  - FILL
  - COLLUVIUM
  - RESIDUAL SOIL/EXTREMELY WEATHERED ROCK
  - WEAK ZONE
  - BALD HILL CLAYSTONE
  - BULGO SANDSTONE
  - INFERRED GEOLOGICAL BOUNDARY

**SECTION A**  
1:50  
**TYPICAL SECTION AT CHAINAGE 65**

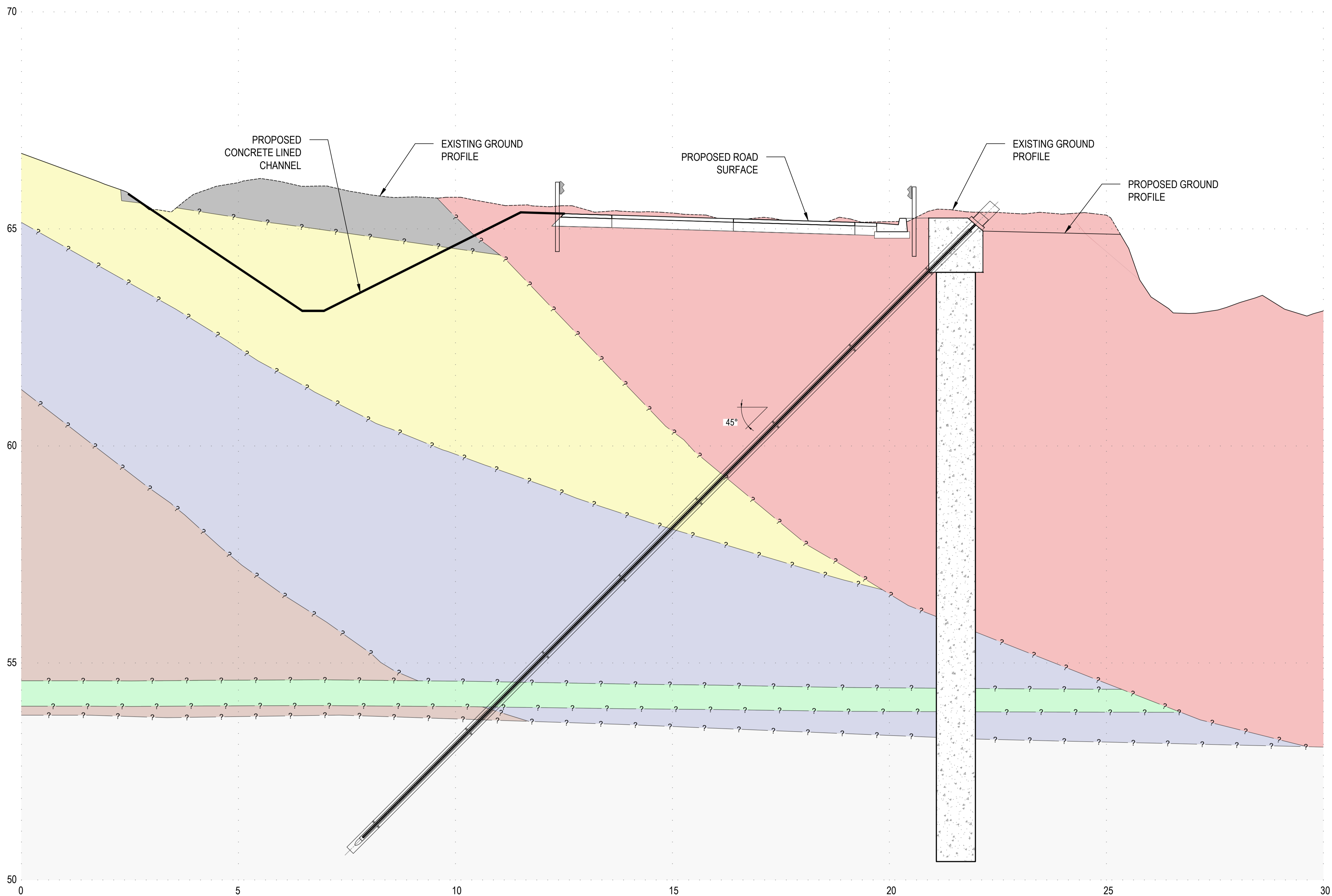
FOR REVIEW

<p><b>REFERENCES:</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">C</td> <td style="width: 20%;">100% DETAILED DESIGN</td> <td style="width: 10%;">H.Z. 28/04/2023</td> <td style="width: 10%;">W.D. 28/04/2023</td> <td style="width: 10%;">M.A. 28/04/2023</td> </tr> <tr> <td>B</td> <td>100% DETAILED DESIGN</td> <td>H.Z. 13/04/2023</td> <td>W.D. 13/04/2023</td> <td>M.A. 13/04/2023</td> </tr> <tr> <td>A01.01</td> <td>80% DETAILED DESIGN</td> <td>H.Z. 30/01/2023</td> <td>W.D. 30/01/2023</td> <td>C.G. 30/01/2023</td> </tr> <tr> <td>REV</td> <td>DESCRIPTION</td> <td>DESIGNER INITIAL/DATE</td> <td>VERIFIED INITIAL/DATE</td> <td>APPROVED INITIAL/DATE</td> </tr> </table>	C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023	B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023	A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p><b>SCALE:</b></p> <div style="text-align: center;"> <p>SCALE 1:50</p> </div>	<p><b>CLIENT:</b></p> <p><b>PREPARED FOR:</b></p>	<p><small>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</small></p> <p><b>aurecon</b> www.aurecongroup.com</p> <p><b>CONNECT SYDNEY</b></p>	<p><b>HARBOUR ZONE</b> <b>SRAPC SPECIAL PROJECTS</b> <b>GARIE ROAD</b> <b>SL80232</b> ANCHORED BORED PILE WALL SLOPE STABILISATION GEOLOGICAL CROSS SECTION - SHEET 1</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>DRAWN</td> <td>D.GASGAS</td> <td>28.04.2023</td> </tr> <tr> <td>DESIGNED</td> <td>H.ZHANG</td> <td>28.04.2023</td> </tr> <tr> <td>DRG CHECK</td> <td>T.DONOVAN</td> <td>28.04.2023</td> </tr> <tr> <td>DESIGN CHECK</td> <td>W.DENG</td> <td>28.04.2023</td> </tr> <tr> <td>PROJ/DES MNGR</td> <td>V.TIET</td> <td>28.04.2023</td> </tr> <tr> <td>APPROVED</td> <td>M.ABERLINE</td> <td>28.04.2023</td> </tr> </table>	DRAWN	D.GASGAS	28.04.2023	DESIGNED	H.ZHANG	28.04.2023	DRG CHECK	T.DONOVAN	28.04.2023	DESIGN CHECK	W.DENG	28.04.2023	PROJ/DES MNGR	V.TIET	28.04.2023	APPROVED	M.ABERLINE	28.04.2023
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LEGEND - GEOLOGICAL UNITS

- LANDSLIDE MATERIAL (COLLUVIUM AND WEATHERED ROCK)
- FILL
- COLLUVIUM
- RESIDUAL SOIL/EXTREMELY WEATHERED ROCK
- WEAK ZONE
- BALD HILL CLAYSTONE
- BULGO SANDSTONE
- INFERRED GEOLOGICAL BOUNDARY

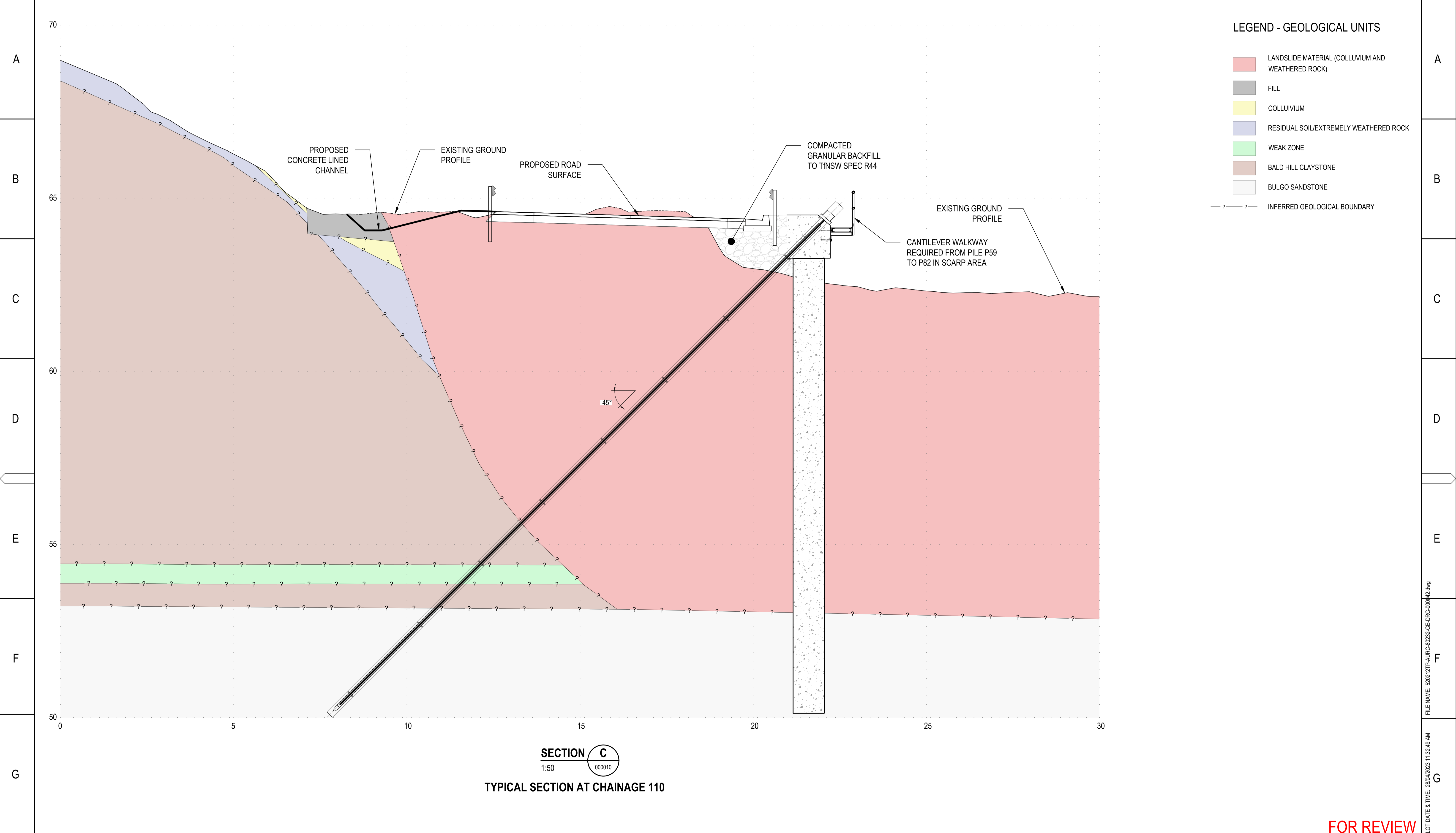


SECTION B  
1:50  
000010  
TYPICAL SECTION AT CHAINAGE 96

FOR REVIEW

<p>REFERENCES:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">C</td> <td style="width: 75%;">100% DETAILED DESIGN</td> <td style="width: 10%;">H.Z. 28/04/2023</td> <td style="width: 10%;">W.D. 28/04/2023</td> <td style="width: 10%;">M.A. 28/04/2023</td> </tr> <tr> <td>B</td> <td>100% DETAILED DESIGN</td> <td>H.Z. 13/04/2023</td> <td>W.D. 13/04/2023</td> <td>M.A. 13/04/2023</td> </tr> <tr> <td>A01.01</td> <td>80% DETAILED DESIGN</td> <td>H.Z. 30/01/2023</td> <td>W.D. 30/01/2023</td> <td>C.G. 30/01/2023</td> </tr> <tr> <td>REV</td> <td>DESCRIPTION</td> <td>DESIGNER INITIAL/DATE</td> <td>VERIFIED INITIAL/DATE</td> <td>APPROVED INITIAL/DATE</td> </tr> </table> <p>COORDINATE SYSTEM: MGA_ZONE_56/GDA20      HEIGHT DATUM: AHD</p>	C	100% DETAILED DESIGN	H.Z. 28/04/2023	W.D. 28/04/2023	M.A. 28/04/2023	B	100% DETAILED DESIGN	H.Z. 13/04/2023	W.D. 13/04/2023	M.A. 13/04/2023	A01.01	80% DETAILED DESIGN	H.Z. 30/01/2023	W.D. 30/01/2023	C.G. 30/01/2023	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p>SCALE:</p> <p>SCALE 1:50</p>	<p>CLIENT:</p> <p>PREPARED FOR:</p>	<p><small>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</small></p> <p>DRAWN _____ D.GASGAS _____ 28.04.2023          DESIGNED _____ H.ZHANG _____ 28.04.2023          DRG CHECK _____ T.DONOVAN _____ 28.04.2023          DESIGN CHECK _____ W.DENG _____ 28.04.2023          PROJ/DES MNGR _____ V.TIET _____ 28.04.2023          APPROVED _____ M.ABERLINE _____ 28.04.2023</p>	<p>HARBOUR ZONE              SRAPC SPECIAL PROJECTS              GARIE ROAD              SL80232              ANCHORED BORED PILE WALL SLOPE STABILISATION              GEOLOGICAL CROSS SECTION - SHEET 2</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>DRAWING SET No: SL80232</td> <td>PART:</td> <td>SHEET: 15 OF 19</td> <td>A1</td> </tr> <tr> <td colspan="2">STATUS: FOR REVIEW</td> <td colspan="2">BRIDGE No: _____</td> </tr> <tr> <td>DRG No: 520212TP-AURC-80232-GE-DRG-000041</td> <td>REV C</td> <td>VER</td> <td>EDMS No. _____</td> </tr> <tr> <td></td> <td></td> <td></td> <td>AMD No. _____</td> </tr> </table>	DRAWING SET No: SL80232	PART:	SHEET: 15 OF 19	A1	STATUS: FOR REVIEW		BRIDGE No: _____		DRG No: 520212TP-AURC-80232-GE-DRG-000041	REV C	VER	EDMS No. _____				AMD No. _____
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REFERENCES:	THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.			SCALE: 0.5 0 1 2m SCALE 1:50		CLIENT: <b>NSW GOVERNMENT</b>   <b>Transport for NSW</b>	<small>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.</small> <small>Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</small>	DRAWN _____ D.GASGAS _____ 28.04.2023 DESIGNED _____ H.ZHANG _____ 28.04.2023 DRG CHECK _____ T.DONOVAN _____ 28.04.2023 DESIGN CHECK _____ W.DENG _____ 28.04.2023 PROJ/DES MNGR _____ V.TIET _____ 28.04.2023 APPROVED _____ M.ABERLINE _____ 28.04.2023	HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232 ANCHORED BORED PILE WALL SLOPE STABILISATION GEOLOGICAL CROSS SECTION - SHEET 3
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FILE NAME: 520212TP-AURC-80232-GE-DRG-000042.dwg  
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**Safe Design Risk Register – SL80232 Garie Road Landslide Remediation**

IDENTIFY SAFE DESIGN RISK				ANALYSE SAFE DESIGN RISK - CURRENT EXPOSURE				IMPLEMENT SAFE DESIGN RISK TREATMENT			
ID	Risk Title	Event / Cause / Consequence	Persons Affected	Inherent Consequence	(Risk Treatment) Current Control Measures	Consequence	Likelihood	Risk Level	Risk Owner	Evaluation	(Risk Treatment) Action Summary
<b>Design and Pre-construction Phase</b>											
1.1	Below and above ground services	Clashes and/or damage due to incorrectly identified services leading to loss of service, injury or death.	Contractor Workers Client	A - Catastrophic	There are no known live services in the vicinity of the Works, based on Dial Before you Dig desktop information, other than the culverts shown on the Drawings.	A - Catastrophic	1 - Rare	High	Designer / Contractor / Client	Tolerable	Contractor must complete their own due diligence on buried and overhead services and service clearance during the Works. Standover from utility owners as necessary. Any in ground services in the Works area will need to be removed or protected prior to commencing.
1.2	Retgression / extension of landslide prior to construction phase	Large rain event results in retrogression of landslide which may change the conditions at the site where the design may have to be amended to suit the changed conditions (e.g. development of the scarps change the existing ground RL).	Designers Contractor Workers	C - Moderate	Current weekly manual monitoring of the site (and the automated monitoring system to be installed in preparation for the construction phase) allows any change to the site conditions to be monitored and changes to the design made if required.	C - Moderate	3 - Possible	High	Designer / Contractor / Client	Tolerable	If the site conditions change (e.g. the area of Zone 2 grows in size due to further instability) the design has tools in place to account for the change in ground level such as the pile extensions to allow piling to take place at the lower ground level. The design can be amended to suit the changed conditions if required.
<b>Construction Phase</b>											
2.1	Ground instability from plant loading	Machinery or plant become unstable due to landslide movement, particularly piling activities as Garie Road is an active, slow creeping landslide. Movement typically increases in association with heavy rainfall and movement to date has been slow (creep movement).	Contractor Workers	A - Catastrophic	The design has carefully considered possible construction sequencing and design components, to limit the requirement for workers to be near unsupported parts of the landslide scarps. Strict monitoring program and controls will be in place to minimise risk as owned by the Contractors temporary works designer. Restrictions for construction sequencing are specified on the design drawings and a monitoring plan will be developed and actioned by the Contractor.	A - Catastrophic	2 - Unlikely	Critical	Contractor	Tolerable	The Contractor should complete site specific risk assessments and a detailed works methodology statement. The contractor will appoint their temporary works designer to sign off on the proposed construction sequencing and be responsible for the required temporary works to maintain safety during construction. The contractors proposed construction sequence should be provided to the designer for review. Practical plant should be considered, such as ~40T piling rigs that are capable of drilling the pile depths and socket material but not impose excessive construction loads (e.g. 70T piling rig). Detailed monitoring plans must be agreed between the contractor(s), designers and client before works commence with regular review. Precautionary site shutdowns are to be expected following heavy rain, emergency procedures must be in place to cover expected scenarios.
2.2	Rockfall and landsliding	Workers and/or plant being hit by rockfall from up slope to Garie Road or landslide scarps infilling from above Garie Road level, the works area, or below the works area.	Workers Contractor Traffic	A - Catastrophic	Works should be undertaken during dry weather only and the automated monitoring system will be in place to monitor ground movements with the appropriate trigger and resultant actions detailed in the construction monitoring plan.	A - Catastrophic	2 - Unlikely	Critical	Contractor	Tolerable	The Contractor should complete site specific risk assessments and establish mitigations further to the generic mitigations summarised to the left, as necessary. This should include stop works level(s) for rainfall and ground movements monitored by the automated monitoring system, the trigger limits and the resultant actions will be detailed in the construction monitoring plan).
2.3	Rock level deeper than expected	The rock level encountered by the piles is deeper than expected, causing piles / anchors to be deeper / longer than expected.	Designers Contractor Client	C - Moderate	Detailed construction records will be recorded for the piles and anchors and construction records provided regularly to the designer.	C - Moderate	2 - Unlikely	Medium	Client	Acceptable	Geotech Designer to monitor depth to rock in all piles and anchors, to check compliance of the geology model to allow early warning of any unexpected conditions.
2.4	Vibration	Vibration caused from the Works adversely affecting existing infrastructure and/or causing ground instability e.g. large vibration could reactivate the landslip.	Contractor Traffic	B - Major	Contractor to prepare vibration management plan within the Works Methodology Statement prior to Works commencing. Vibration monitoring to be undertaken if deemed necessary.	B - Major	2 - Unlikely	High	Contractor	Tolerable	• Identify areas where vibration monitoring is required as necessary. • Use construction methods and plant that minimise vibration.
2.5	Stormwater contamination	Contamination of stormwater system during the Works.	Contractor	B - Major	Contractor to prepare an environmental management plan.	B - Major	2 - Unlikely	High	Contractor	Tolerable	Contractor to establish runoff controls on site during the Works.
2.6	Damage endangered plant (Rhodamnia Rubescens)	Damage to the critically endangered plant, Rhodamnia Rubescens, near the site works, will result in criminal charges to person(s) responsible and impact to environment.	Workers Contractor Traffic	B - Major	Contractor to prepare and enforce exclusion zone to area where plant is present to ensure no access and sufficient exclusion to prevent accident damage from plant or equipment.	B - Major	1 - Rare	High	Contractor	Acceptable	Contractor to prepare and enforce exclusion zone to area where plant is present to ensure no access and sufficient exclusion to prevent accident damage from plant or equipment.
2.7	Inability of emergency vehicles to attend site or travel through construction zone	Emergency vehicles unable to attend incidents promptly during construction due to road closures or further road failures	Workers	B - Major	Traffic control is to be implemented during construction to coordinate emergency services egress. Coordination with TMC to re-direct emergency vehicles during closures required	B - Major	3 - Possible	Critical	Contractor	Acceptable	Traffic control is to be implemented during construction to coordinate emergency services egress. Coordination with TMC to re-direct emergency vehicles during closures required
2.8	Construction lifting	Falling objects/Failure of lifting systems, dangerous environmental conditions (strong winds), high winds may catch the transported element, causing it to be dislodged or fall over from its temporary position	Constructors	A - Major	Lifting to be done in favourable weather conditions. Temporary works to be designed with consideration of most adverse loading conditions.	B - Major	2 - Unlikely	High	Contractor	Tolerable	Contractor to consider a weather condition and adopt safety measures. Works to be rescheduled if there will be tough conditions. Lift and transport plans shall be developed within the SWMS.
2.9	Uncontained bushfire within and around project site	Bushfire spreading from adjacent area. Fire starting on site due to equipment failure or ignition of fuels on site.	Contractor	A - Major	* Follow correct safety procedures during equipment usage on site - Ensure bushfire protocols/plan is supplied - Monitor weather conditions	B - Major	2 - Unlikely	High	Contractor	Tolerable	To be transferred to Contractor through safe work practices in lieu of elimination via design.
<b>Operations and Maintenance Phases</b>											
3.1	Maintenance inspections	Routine inspections will be required to assess performance of the design, check the loads in the anchors during the design life of the structure and geotechnical inspections will be required to monitor the subsidence of the landside on the immediate downslope of the pile wall. The landslide long term creep subsidence is an unknown that will be assessed through inspections during the design life of the structure.	Maintainers	D - Minor	The Slope Risk Management Plan and the Maintenance Plan will detail the required geotechnical inspections to monitor the landslide subsidence and to monitor the required structural aspects such as the anchor loads. A structural maintenance walkway has been provided in the design to allow safe maintenance and checking of the anchor loads during the design life of the structure.	D - Minor	3 - Possible	Medium	Client / TNSW	Acceptable	Inspections to be undertaken by the Designer and/or Client as part of the SRAP Contract as per the Slope Risk Management Plan and the Maintenance Plan. If required as per the notes on the design drawings, the in-fill retaining wall panels may need to be extended down below the design depths to mitigate against potential long term landslide subsidence and consequent (potential) material loss between the piles. The pile wall design has been checked for potential subsidence scenario to a ground level of 58.8 m AHD. A structural maintenance walkway has been provided in the design to allow safe maintenance and checking of the anchor loads during the design life of the structure.
3.2	Compromised wall drainage	Pile wall sub-horizontal drains and weepholes could clog up with fines and hinder its drainage capability, resulting in water pressure build up behind the wall and adverse effects on the pile wall performance.	Maintainers	C - Moderate	Routine slope and maintenance inspections should check the drainage elements for signs of clogging and seepage (e.g. staining) and flush the drains as required.	C - Moderate	2 - Unlikely	Medium	Client / TNSW	Acceptable	Routine slope and maintenance inspections should check the drainage elements for signs of clogging and seepage (e.g. staining) and flush the drains as required.
3.3	Errant Vehicle	Errant vehicle goes off verge when traversing road	Operators	A - Catastrophic	Shoulder is provided on outside with barrier and sufficient dynamic deflection to retain errant vehicles from going off the road in the instance of a collision.	A - Catastrophic	1 - Rare	High	Client / TNSW	Tolerable	Risk has been considered and reduced in design with engineering controls. Barriers selected are appropriate for the road width and posted speed.
3.4	Flooding during inclement Weather	Road is flooded during a significant storm event.	Operators	C - Moderate	Drainage has been designed to the improved standard of the existing drainage network taking into consideration of the location of the project. Adequate drainage has been provided to prevent water ponding in roadway during minor storm events.	C - Moderate	1 - Rare	Medium	Client / TNSW	Acceptable	Flooding of road has been appropriately mitigated with engineering controls based on existing drainage on site and expected rainfall during minor storm events.
<b>Modification, Demolition and Dismantling Phases</b>											
4.1	Modification/Demolition/ Dismantling	At some point in the future, upgrade or dismantling and reinstatement of the Works will be required to maintain its performance.	Client Maintainers	D - Minor	Keep accurate as built records and design reports secure for future reference.	D - Minor	1 - Rare	Low	Client / TNSW	Acceptable	Client / TNSW should continue routine inspections and hold an asset management database to inform and trigger the requirement for further works in future.

**NOTES**

- THIS RISK REGISTER HAS BEEN PREPARED TO DOCUMENT HAZARDS AND RISK TREATMENTS ASSOCIATED WITH PROJECT ELEMENTS DESIGNED BY AURECON, INCLUDING SUBCONSULTANTS WHERE APPLICABLE.
- THE FULL LIFE CYCLE OF THE PROJECT HAS BEEN CONSIDERED INCLUDING DESIGN, CONSTRUCTION (AND COMMISSIONING) OPERATION, MAINTENANCE, MODIFICATION AND DEMOLITION PHASES.
- THE RISK REGISTER IS FOCUSED ON HAZARDS RESULTING FROM ATYPICAL FEATURES SPECIFIC TO THE DESIGN. IT IS EXPECTED THAT RISKS ASSOCIATED WITH GENERIC HAZARDS (WORKING AT HEIGHTS, EXCAVATIONS, ETC) WILL BE ADDRESSED BY OTHER STAKEHOLDERS USING APPROPRIATE RISK MANAGEMENT TECHNIQUES DURING SUBSEQUENT PHASES OF THE PROJECT.
- RESIDUAL RISKS WHICH CANNOT REASONABLY BE ACTIONED BY AURECON DURING THE DESIGN PHASE HAVE BEEN IDENTIFIED AND REQUIRE ACTION BY OTHER STAKEHOLDERS DURING SUBSEQUENT PHASES OF THE PROJECT (EG CONSTRUCTION, OPERATIONS, MAINTENANCE, MODIFICATION OR DEMOLITION.)
- THE RISK REGISTER DOES NOT REPLACE THE NEED FOR OTHER STAKEHOLDERS TO COMPLETE THEIR OWN HAZARD IDENTIFICATION AND RISK ASSESSMENT FOR THE PROJECT (INCLUDING THE DEVELOPMENT OF SAFE WORK PROCEDURES FOR SPECIFIC ACTIVITIES) IN DUE COURSE.

**FOR REVIEW**

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COORDINATE SYSTEM: MGA_ZONE_56/GDA20		HEIGHT DATUM: AHD	DESIGN LOT CODE:																							

FILE NAME: 520212TP-AURC-80232-GE-DRG-000070.dwg

PLOT DATE & TIME: 28/04/2023 4:23:10 PM

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A

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Risk Level Matrix						
Likelihood						
	0 - Eliminated	1 - Rare	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain
Consequence	A - Catastrophic	High	Critical	Critical	Critical	Critical
	B - Major	High	High	Critical	Critical	Critical
	C - Moderate	Medium	Medium	High	High	Critical
	D - Minor	Low	Low	Medium	High	High
	E - Incidental	Low	Low	Low	Medium	Medium





Consequence Analysis Descriptions				
	People	Property	Environment	Community
A - Catastrophic	Single or multiple fatality	Virtual complete loss of plant or system	Permanent / irreversible widespread ecological damage not able to be remediated	Outrage by a sizeable community or many communities. Riots.
B - Major	Disabling injury or illness i.e. amputation and/or permanent loss of bodily function, or any kind of permanent health impact	Extensive damage to plant or system	Extensive ecological damage, lengthy remediation process	Community/NGO legal actions. Pickets, demonstrations.
C - Moderate	Any Lost Time Incident (LTI), i.e. an illness or injury resulting in one or more consecutive days or shifts off work	Significant damage to plant or system	Substantial ecological damage but able to be remediated	Persistent formal community complaints. Formal complaints to politicians or comparable representatives.
D - Minor	A medical treatment case (MTC) / or restricted work case (RWC)	Damages impact on budget and program	Localised ecological damage, easily remediated	Formal complaints from local Community complaints locally
E - Incidental	First Aid Case, or an injury or illness not requiring treatment	Minor damage to plant or system	Negligible ecological damage, may not require remediation	No Informal community complaints &/or negative comments / views.

Likelihood Analysis Descriptions			
	Descriptor	Likelihood (i.e. % chance of realisation during applicable period: construction phase, operating cycle or decommissioning)	Industry Incidences (only applicable to common systems/assets)
Category	5 - Almost Certain	The threat is expected to be realised	90% < Likelihood ≤ 100% Common incident
	4 - Likely	The threat is likely to be realised.	5% < Likelihood ≤ 90% Several incidents nationally
	3 - Possible	The threat may be realised.	1% < Likelihood ≤ 5% One or a few incidents nationally
	2 - Unlikely	The threat is not expected to be realised.	0.1% < Likelihood ≤ 1% No known national incidents. One or a few incidents in comparable international operating regimes.
	1 - Rare	The threat may be realised in reasonably foreseeable but exceptional circumstances.	0% < Likelihood ≤ 0.1% No known incidents in comparable international operating regimes.

**NOTES**

- THIS RISK REGISTER HAS BEEN PREPARED TO DOCUMENT HAZARDS AND RISK TREATMENTS ASSOCIATED WITH PROJECT ELEMENTS DESIGNED BY AURECON, INCLUDING SUBCONSULTANTS WHERE APPLICABLE.
- THE FULL LIFE CYCLE OF THE PROJECT HAS BEEN CONSIDERED INCLUDING DESIGN, CONSTRUCTION (AND COMMISSIONING) OPERATION, MAINTENANCE, MODIFICATION AND DEMOLITION PHASES.
- THE RISK REGISTER IS FOCUSED ON HAZARDS RESULTING FROM ATYPICAL FEATURES SPECIFIC TO THE DESIGN. IT IS EXPECTED THAT RISKS ASSOCIATED WITH GENERIC HAZARDS (WORKING AT HEIGHTS, EXCAVATIONS, ETC) WILL BE ADDRESSED BY OTHER STAKEHOLDERS USING APPROPRIATE RISK MANAGEMENT TECHNIQUES DURING SUBSEQUENT PHASES OF THE PROJECT.
- RESIDUAL RISKS WHICH CANNOT REASONABLY BE ACTIONED BY AURECON DURING THE DESIGN PHASE HAVE BEEN IDENTIFIED AND REQUIRE ACTION BY OTHER STAKEHOLDERS DURING SUBSEQUENT PHASES OF THE PROJECT (EG CONSTRUCTION, OPERATIONS, MAINTENANCE, MODIFICATION OR DEMOLITION.)
- THE RISK REGISTER DOES NOT REPLACE THE NEED FOR OTHER STAKEHOLDERS TO COMPLETE THEIR OWN HAZARD IDENTIFICATION AND RISK ASSESSMENT FOR THE PROJECT (INCLUDING THE DEVELOPMENT OF SAFE WORK PROCEDURES FOR SPECIFIC ACTIVITIES) IN DUE COURSE.

**FOR REVIEW**

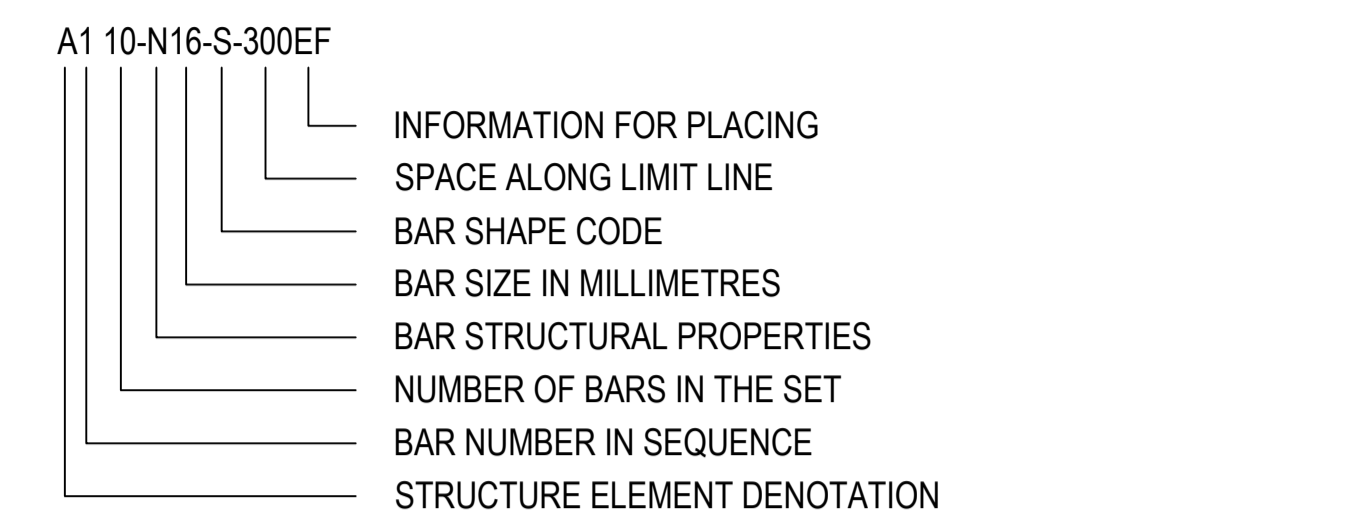
REFERENCES:	THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.	SCALE:	CLIENT:	<small>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</small>	HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232 ANCHORED BORED PILE WALL SLOPE STABILISATION SID REGISTER - SHEET 2																				
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FILE NAME: 520212TP-AURC-80232-GE-DRG-000071.dwg  
PLOT DATE & TIME: 28/04/2023 11:38:43 AM



SHAPE CODE	TfNSW STANDARD SHAPE	SHAPE CODE	TfNSW STANDARD SHAPE	SHAPE CODE	TfNSW STANDARD SHAPE	SHAPE CODE	TfNSW STANDARD SHAPE
S		LL		VL		H	
SH		XT		HH		VV	
CT		V		J		HT	
L		JJ		R		LH	
SP		RC		U		F	
T		A		CC			

**BAR MARKING LEGEND**  
THE METHOD USED TO LABEL REINFORCEMENT ON THE DRAWING IS AS FOLLOWS:



STRUCTURE ELEMENT DENOTATIONS COMMONLY USED ARE:  
A DENOTES RETAINING WALL  
P DENOTES PILES

**REINFORCEMENT NOTES**

- AUSTRALIAN STANDARD BAR SHAPES ARE IN ACCORDANCE WITH AS 1100.501.
- BAR SIZE IS THE NOMINAL DIAMETER IN MILLIMETRES, OR THE AS/NZS 4671 FABRIC NUMBER.
- THE GRADE OF REINFORCEMENT, IF NOT STATED ON THE DRAWINGS, SHALL BE D500N TO AS/NZS 4671.
- WHERE SHOWN ON THE DRAWINGS, "W" SHALL DENOTE PLAIN ROUND REINFORCING BARS EQUIVALENT TO GRADE R500L TO AS/NZS 4671.
- WHERE SHOWN ON THE DRAWINGS, RL AND SL SHALL DENOTE WELDED REINFORCING BAR (RECTANGULAR AND SQUARE), RESPECTIVELY.
- DIMENSIONS SHOWN ON BAR SHAPES DIAGRAM ARE MEASURED FROM THE OUTSIDE FACES OF THE BARS AND ARE IN MILLIMETRES.
- THE INCLUDED ANGLE OF ANY BEND SHALL BE RIGHT ANGLE IF NO DIMENSIONS SHOWN.
- BAR SIZE OF DIAMETER GREATER THAN 24mm SHALL NOT BE REBENT.
- BAR BENDING AND HOOK DETAILS SHALL BE IN ACCORDANCE WITH SECTION 5.13 OF AS 5100-BRIDGE DESIGN.

INFORMATION FOR PLACING:  
NF FOR NEAR FACE  
FF FOR FAR FACE  
EF FOR EACH FACE  
\* FOR VARIABLE LENGTH BAR  
NSOP FOR NOT SHOWN ON PLAN FOR CLARITY

SHAPE CODE	TfNSW STANDARD SHAPE	SHAPE CODE	TfNSW STANDARD SHAPE	SHAPE CODE	TfNSW STANDARD SHAPE	SHAPE CODE	TfNSW STANDARD SHAPE
LF		AV		TT		XH	
LA		LG		PT		Y	
AA		KH		QT		VF	
KL		GT		KF		AF	

SHAPE CODE	NON STANDARD SHAPE
AZ	
BZ	

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PLOT DATE & TIME: 28/04/2023 11:34:05 AM



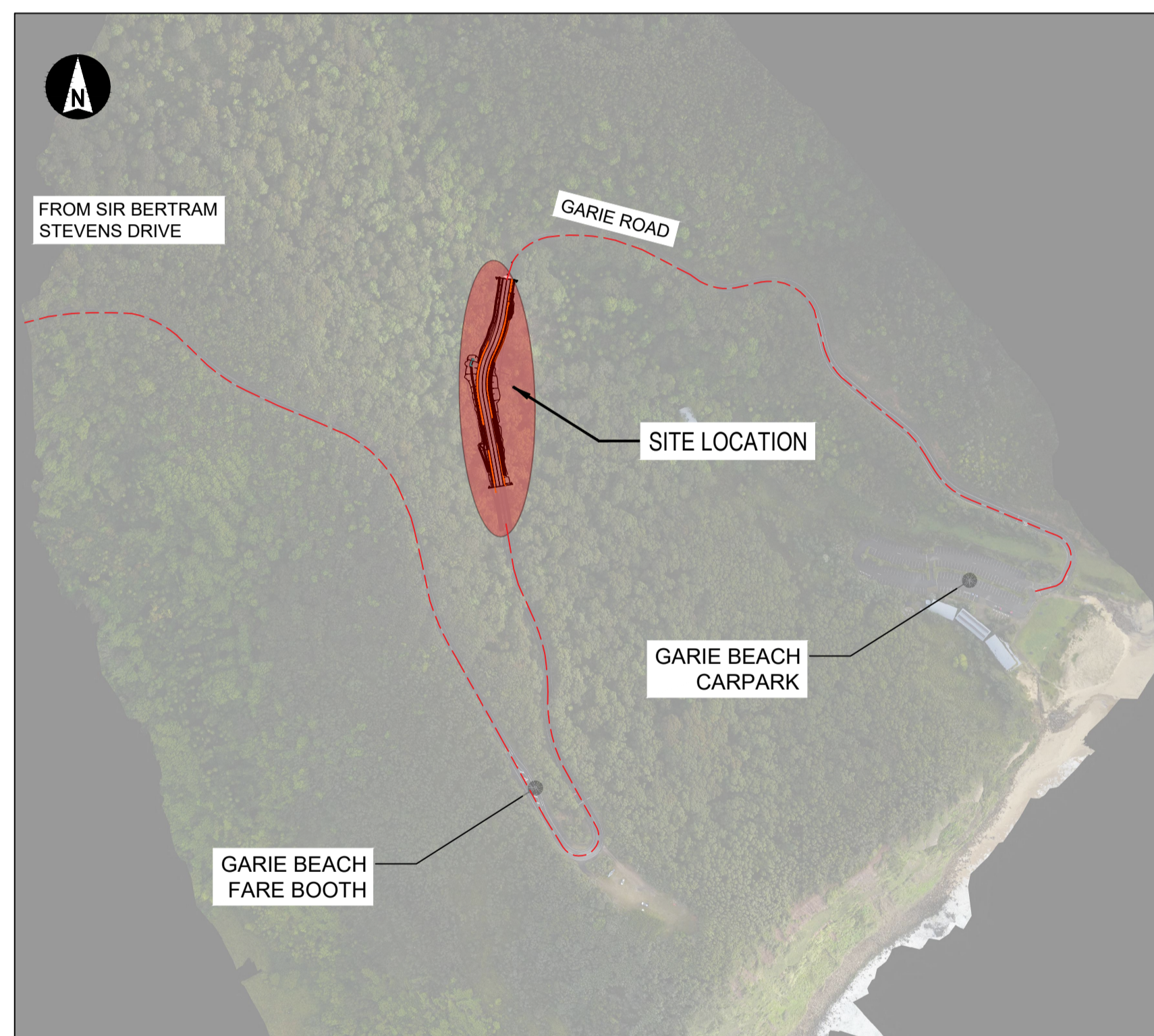


ROAD No. 4025  
SITE No. SL80232  
GARIE ROAD

SYDNEY ROAD ASSETS  
PERFORMANCE CONTRACT  
HARBOUR ZONE

# ANCHORED BORED PILE WALL SLOPE STABILISATION

## 100% DETAILED DESIGN CIVIL DRAWING SET



LOCALITY PLAN  
NTS

DRAWING NUMBER	DRAWING TITLE
520212TP-AURC-80232-RW-DRG-000001	COVER SHEET AND DRAWING LIST
520212TP-AURC-80232-RW-DRG-000002	GENERAL NOTES
520212TP-AURC-80232-RW-DRG-000010	GENERAL ARRANGEMENT AND ALIGNMENT PLAN
520212TP-AURC-80232-RW-DRG-000011	TYPICAL SECTIONS - SHEET 1
520212TP-AURC-80232-RW-DRG-000020	LONGITUDINAL SECTION
520212TP-AURC-80232-RW-DRG-000030	CROSS SECTIONS - SHEET 1
520212TP-AURC-80232-RW-DRG-000031	CROSS SECTIONS - SHEET 2
520212TP-AURC-80232-RW-DRG-000032	CROSS SECTIONS - SHEET 3
520212TP-AURC-80232-RW-DRG-000033	CROSS SECTIONS - SHEET 4
520212TP-AURC-80232-RW-DRG-000040	STORMWATER DRAINAGE PLAN
520212TP-AURC-80232-RW-DRG-000041	DRAINAGE LONGITUDINAL SECTION AND DETAILS
520212TP-AURC-80232-RW-DRG-000042	DRAINAGE DETAILS - SHEET 1
520212TP-AURC-80232-RW-DRG-000043	DRAINAGE DETAILS - SHEET 2
520212TP-AURC-80232-RW-DRG-000044	DRAINAGE DETAILS - SHEET 3
520212TP-AURC-80232-RW-DRG-000050	PAVEMENT PLAN
520212TP-AURC-80232-RW-DRG-000051	PAVEMENT DETAILS
520212TP-AURC-80232-RW-DRG-000070	LINEMARKINGS AND SIGNS PLAN
520212TP-AURC-80232-RW-DRG-000080	SAFETY IN DESIGN REGISTER - SHEET 1
520212TP-AURC-80232-RW-DRG-000081	SAFETY IN DESIGN REGISTER - SHEET 2
520212TP-AURC-80232-RW-DRG-000100	ORTHO MOSAIC AERIAL LAYOUT

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<p>REV C</p>			<p>BRIDGE No: _____</p>		<p>PART: SHEET: 1 OF 1 A1</p>																				
<p>EDMS No. 80232</p>			<p>AMD No. _____</p>		<p>©</p>																				

FILE NAME: 520212TP-AURC-80232-RW-DRG-000001.dwg

PLOT DATE & TIME: 27/4/2023 3:20:58 am



**GENERAL**

1. THE INFORMATION CONTAINED IN THESE DRAWINGS PRODUCED BY AURECON IS SOLELY FOR THE USE OF TNSW FOR THE PURPOSE FOR WHICH IT HAS BEEN PREPARED. AURECON AUSTRALIA PTY LTD UNDERTAKES NO DUTY TO OR ACCEPTS NO RESPONSIBILITY TO ANY THIRD PARTY WHO MAY RELY UPON THIS DOCUMENT.
2. ALL WORKS SHALL BE PERFORMED IN ACCORDANCE WITH TNSW STANDARD DRAWINGS AND SPECIFICATIONS UNLESS OTHERWISE SHOWN.
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5. ALL DIMENSIONS RELEVANT TO SETTING OUT OR OFF-SITE WORK SHALL BE VERIFIED BY THE CONTRACTOR BEFORE CONSTRUCTION AND FABRICATION HAS COMMENCED.
6. DO NOT SCALE FROM DRAWINGS.
7. ORIGIN OF LEVELS - AHD COORDINATES TO MGA20 - MAP GRID AUSTRALIA 2020.
8. WHERE A PROPRIETARY ITEM (OR EQUIVALENT) IS SPECIFIED, AND AN EQUIVALENT ITEM IS PROPOSED, THE CONTRACTOR SHALL PROVIDE MANUFACTURERS SPECIFICATIONS FOR BOTH PRODUCTS TO TNSW FOR APPROVAL AND DEMONSTRATE THAT THE PRODUCT PERFORMANCE IS EQUIVALENT OR BETTER, PRIOR TO USE.
9. ALL PROPRIETARY PRODUCTS ARE TO BE INSTALLED FIXED AND TESTED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
10. DURING CONSTRUCTION, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT THE STRUCTURES AND EXCAVATIONS ARE MAINTAINED IN A SAFE AND STABLE CONDITION AT ALL TIME AND NO PART IS TO BE OVERSTRESSED. THE CONTRACTOR SHALL DEVELOP WORK METHOD STATEMENTS FOR ALL ERECTION OF STRUCTURAL STEEL/FORMWORK/ DEMOLITION/EXCAVATION/TILT PANELS ETC. AND PROVIDE TEMPORARY WORKS SUCH AS BRACING, PROPPING AND SHORING ETC. TO KEEP THE WORKS AND EXCAVATIONS STABLE AND FREE FROM WATER AT ALL TIMES. THE CONTRACTOR IS TO ENGAGE A STRUCTURAL ENGINEER TO DESIGN AND CERTIFY THE TEMPORARY WORKS.

**SITWORKS**

1. THE CONTRACTOR TO MAKE SMOOTH CONNECTION TO ANY EXISTING WORKS.
2. ON COMPLETION OF THE WORKS, THE CONTRACTOR MUST RESTORE OR REINSTATE ANY AREAS, STRUCTURES, PAVEMENTS OR UTILITY SERVICES DAMAGED OR DIRTIED DURING THE CONSTRUCTION, TO THE SATISFACTION OF TNSW. ALL TRENCH BACKFILL MATERIAL SHALL BE COMPACTED TO THE SAME DENSITY AS THE ADJACENT MATERIAL.
3. ALL SERVICE TRENCHES UNDER VEHICULAR PAVEMENTS SHALL BE BACKFILLED IN ACCORDANCE WITH TNSW STANDARD DRAWINGS.
4. ASPHALTIC CONCRETE SHALL CONFORM TO RMS QA SPECIFICATION R116
5. ALL BASECOURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH RMS QA SPECIFICATION 3051 - GRANULAR BASE AND SUBBASE MATERIALS FOR SURFACED ROAD PAVEMENTS, COMPACTED TO 98% MODIFIED DENSITY IN ACCORDANCE WITH AS 1289 5.2.1. FREQUENCY OF COMPACTION TESTING TO BE NO LESS THAN 1 TEST PER 50m<sup>2</sup> OF BASECOURSE MATERIAL PLACED.
6. ALL SUBBASECOURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH RMS QA SPECIFICATION 3051 - GRANULAR BASE AND SUBBASE MATERIALS FOR SURFACED ROAD PAVEMENTS, COMPACTED TO 95% MODIFIED DENSITY IN ACCORDANCE WITH AS 1289 5.2.1. FREQUENCY OF COMPACTION TESTING TO BE NO LESS THAN 1 TEST PER 50m<sup>2</sup> OF BASECOURSE MATERIAL PLACED.
7. THE USE OF RECYCLED MATERIALS IS ENCOURAGED BY TNSW. IF THE CONTRACTOR INTENDS TO USE RECYCLED MATERIALS, A RECYCLED MATERIAL COMPLYING WITH RMS QA SPECIFICATION 3051 - GRANULAR BASE AND SUBBASE MATERIALS FOR SURFACED ROAD PAVEMENTS WILL BE CONSIDERED, SUBJECT TO MATERIAL SAMPLES AND APPROPRIATE CERTIFICATIONS BEING PROVIDED TO THE SATISFACTION OF TNSW.
8. THE CONTRACTOR IS TO CONTINUE TO PROVIDE CERTIFICATION FOR ALL RECYCLED MATERIALS DURING THE COURSE OF CONSTRUCTION, AND WHERE MATERIAL THAT DOES NOT COMPLY, THE CONTRACTOR WILL BE RESPONSIBLE FOR REMOVAL AND REPLACEMENT WITH A SUITABLY COMPLIANT MATERIAL AT THEIR OWN TNSW.
9. SHOULD THE CONTRACTOR WISH TO USE A RECYCLED PRODUCT, THE INTENT SHALL BE CLEARLY INDICATED IN THEIR TENDER AND THE PRICE DIFFERENCE BETWEEN AN IGNEOUS PRODUCT AND A RECYCLED PRODUCT SHALL BE CLEARLY NOTED.
10. ANY EXCAVATION OR SAW CUTTING OF THE ROAD SURFACE SHALL BE REINSTATED WITH APPROPRIATE WATERPROOFING BY THE CONTRACTOR.

**SAFETY**

1. THE CONTRACTOR IS RESPONSIBLE FOR SAFETY ON SITE.
2. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ALL EXCAVATION WORKS IN A STABLE CONDITION, AND ENSURING NO PART SHALL BE OVERSTRESSED DURING CONSTRUCTION ACTIVITIES. PROVISION OF TEMPORARY BRACING, SHORING AND BATTERING IS BY THE CONTRACTOR AS REQUIRED TO PROVIDE A SAFE WORKING ENVIRONMENT.
3. THE CONTRACTOR MUST MAKE PROVISION FOR THE SAFETY OF NORMAL VEHICULAR TRAFFIC AND PEDESTRIANS, AND OTHERS INCLUDING UNAUTHORISED INTRUDERS.
4. ALL PITS, MANHOLES, PUMPSTATIONS AND OTHER CONFINED SPACES SHOULD BE FITTED WITH A CONFINED SPACE WARNING SIGN.

**OTHER ENVIRONMENTAL NOTES**

1. ACCEPTABLE RECEPTORS WILL BE PROVIDED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHING, LIGHT WEIGHT MATERIALS AND LITTER.

**UTILITY SERVICES**

1. THESE DRAWINGS SHALL TO BE READ IN CONJUNCTION WITH ALL PUBLIC OR PRIVATE SERVICE PROVIDER DRAWINGS, INCLUDING BUT NOT LIMITED TO:
  - JEMENA DRAWINGS
  - AUSGRID DRAWINGS
  - NBN DRAWINGS
  - SYDNEY WATER DRAWINGS
  - TNSW SIGNAL PLAN DRAWINGS
  - TELSTRA, OPTUS, AND TPG DRAWINGS
  - SYDNEY TRAINS DRAWINGS
2. EXISTING UTILITIES SHOWN ON DRAWINGS ARE INDICATIVE ONLY AND MAY NOT INCLUDE ALL SERVICES PRESENT. AURECON TAKES NO RESPONSIBILITY FOR THE UTILITY INFORMATION AS SHOWN ON THESE DRAWINGS.
3. IT IS THE CONTRACTORS RESPONSIBILITY TO LIAISE WITH EACH UTILITY SERVICE PROVIDER ON SITE, TO LOCATE AND IDENTIFY THE SIZE, POSITION, LINE AND LEVEL OF ALL UTILITY SERVICES IN BOTH PUBLIC AND PRIVATE LAND, PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.
4. THE CONTRACTOR MUST TAKE EVERY PRECAUTION TO PROTECT EXISTING AND NEW UTILITY SERVICES THROUGH THE COURSE OF THE CONTRACT.
5. ALL WORKS INVOLVING UTILITY SERVICES TO BE UNDERTAKEN TO THE SATISFACTION OF THE UTILITY SERVICE PROVIDER. THE CONTRACTOR WILL BE RESPONSIBLE FOR ENGAGING WITH THE UTILITY SERVICE PROVIDER, THE EXECUTION OF THE WORK TO THEIR REQUIREMENTS AND PROCUREMENT OF APPROVALS FOR WORKS UNDERTAKEN.
6. ALL WORKS INVOLVING UTILITY SERVICES MUST ONLY BE UNDERTAKEN USING PLANS APPROVED BY THE UTILITY SERVICE PROVIDER.
7. ALL SERVICE PIT COVERS AND MARKERS ARE TO BE PLACED IN ACCORDANCE WITH THE LOCATIONS AS SHOWN ON THE PUBLIC DOMAIN DRAWINGS, AND IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATION.
8. ALL SERVICE PIT COVERS TO BE PLACED AT FINISHED SURFACE LEVELS TO MATCH THE PROPOSED LONGITUDINAL AND CROSS FALL GRADES OF THE FOOTPATH OR ROADWAY IT IS CONTAINED WITHIN.
9. NO PIPE OR TRENCH SHALL BE LOCATED WITHIN THE ZONE OF INFLUENCE (1V:2H) OF A FOOTING.
10. "WORKS AS CONSTRUCTED" SURVEY ON ALL UTILITY WORK SHALL BE RECORDED PRIOR TO ANY BACKFILLING.

**KERB NOTES**

1. FOR STANDARDS KERB DRAWING DETAILS TO THE RMS R0300-01 STANDARDS DRAWING SO-KERB.
2. ALL KERB AND GUTTER SHALL BE CONSTRUCTED IN ACCORDANCE WITH R15.

**STORMWATER DRAINAGE**

1. PIPES TO BE REINFORCED CONCRETE CLASS '4', APPROVED SPIGOT AND SOCKET WITH RUBBER RING JOINTS TO AS/NZS 4058 ALL PIPEWORK IS TO BE LAID WITH THE SOCKET FACING UPSTREAM. ALL WORKS ARE TO COMMENCE AT THE OULET END OF EACH LINE.
2. PIPES TO BE INSTALLED TO TYPE H3 SUPPORT IN ACCORDANCE WITH CLSM BACKFILL.
3. PITS TO BE CONSTRUCTED IN ACCORDANCE WITH TNSW STANDARDS.
4. CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES SHOWN ARE NOT TO BE REDUCED WITHOUT APPROVAL.
5. GRATES AND COVERS SHALL CONFORM TO TNSW STANDARDS.
6. AT ALL TIMES DURING CONSTRUCTION, ADEQUATE SAFETY PROCEDURES SHALL BE TAKEN TO PREVENT PERSONNEL FROM FALLING INTO PITS AND OPEN TRENCHES.
7. ALL EXISTING STORMWATER DRAINAGE LINES AND PITS THAT ARE TO REMAIN, AND ANY PART OF THAT SYSTEM IDENTIFIED AS WARRANTING REPAIR SHALL BE REPORTED TO THE DESIGNER FOR FURTHER DIRECTION.
8. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT PIPES FROM DAMAGE DUE TO HEAVY CONSTRUCTION LOADING. CONTRACTOR TO UNDERTAKE PRE AND POST CONSTRUCTION CCTV INSPECTIONS FOR ALL PIPE LINES IMPACTED BY THE WORKS, AND TO BE PROVIDED TO CONNECT SYDNEY FOR ACCEPTANCE PRIOR TO HAND-OVER.
9. THE CONTRACTOR IS TO MANAGE AND STAGE CONSTRUCTION WORKS, INCLUDING PROVIDING TEMPORARY DIVERSION WORKS IF NECESSARY, TO ENSURE ANY EXISTING DRAINAGE SYSTEM IS ABLE TO PERFORM TO ITS CURRENT STANDARD.
10. THE CONTRACTOR SHALL PROTECT THE WORKS IN PROGRESS. ANY DAMAGE TO THE WORKS IN PROGRESS, INCLUDING FROM STORMWATER FLOWS OR FLOODING, IS AT THE CONTRACTOR'S RISK.
11. SUBSOIL DRAINAGE PIPES TO BE TYPE 1 CLASS S8 CONFORMING TO AS 2439.1
12. ALL DRAINAGE STRUCTURES (EXCEPT PRECAST PIPES AND PITS) SHALL BE PLACED ON MINIMUM 50mm THICK CONCRETE BUILDING SLAB. FOR PRECAST STRUCTURES THEY SHALL BE PLACED ON A BEDDING MATERIAL IN ACCORDANCE WITH TNSW SPECIFICATION D&C R11.
13. THE FOUNDATION FOR THE DRAINAGE LINES THAT WILL BE FOUNDED ON IN-SITU MATERIAL ARE TO BE INSPECTED BY THE GEOTECHNICAL ENGINEER'S REPRESENTATIVE. THIS WILL BE ADMINISTERED THROUGH HOLD POINTS IN TNSW D&C SPECIFICATION R11.
14. INADEQUATE FOUNDATION MATERIAL FOR PIPES AND STRUCTURES SHALL BE REMOVED OR IMPROVED IN ACCORDANCE WITH TNSW D&C SPECIFICATION R11.

**SURVEY NOTES**

1. THE FOLLOWING SURVEY DATA HAS BEEN ADOPTED FOR THE PURPOSE OF DESIGN.
2. THE SURVEY INFORMATION IS SHOWN TO PROVIDE A BASIS FOR DESIGN. AURECON DOES NOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THE SURVEY BASE OR ITS SUITABILITY AS A BASIS FOR CONSTRUCTION DRAWINGS. SHOULD DISCREPANCIES BE ENCOUNTERED DURING CONSTRUCTION BETWEEN THE SURVEY DATA AND ACTUAL FIELD DATA, CONTACT THE PRINCIPAL'S REPRESENTATIVE.
3. CONTRACTOR TO VERIFY SURVEY AND SETOUT INFORMATION PRIOR TO CONSTRUCTION.

**PAVEMENT**

**GENERAL**

1. A DEFINITION OF THE TERMS AND ABBREVIATIONS IS CONTAINED IN THE RMS PAVEMENT STANDARD DRAWINGS - ASPHALT NEW CONSTRUCTION, SHEET 2.
2. THESE DRAWINGS PROVIDE STANDARD DETAILS FOR USE BY CONSTRUCTORS.
3. DIMENSIONS:
  - 3.1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE;
  - 3.2. ALL ASPHALT PAVEMENT DIMENSIONS RELATE TO COMPACTED ASPHALT.

**ASPHALT**

4. THE MINIMUM PAVING WIDTH IS 1.2 M UNLESS OTHERWISE AGREED WITH THE PRINCIPAL.
5. ALL LOOSE, CRACKED AND /OR BONEY MATERIAL AT THE EDGE OF REMOVED PRIOR TO PLACING THE ADJACENT MAT.
6. EACH JOINT MUST BE FINISHED WITH A SMOOTH, PLANAR SURFACE COINCIDING WITH THE SURFACE OF THE REST OF THE MAT AND SATISFYING THE SURFACE SHAPE REQUIREMENTS SPECIFIED IN TNSW SPECIFICATION R116.

**PRIMESEALS AND SEALS**

7. ALL PRIMERSEALS AND SEALS MUST BE APPLIED IN ACCORDANCE WITH TNSW QA SPECIFICATION
8. SEALS MUST NOT BE PLACED OVER THE TOP OF SUBSURFACE TRENCH DRAINS.

**SUBSURFACE DRAINAGE**

9. ALL TRENCH AND INTERFACE DRAINS TO BE INSTALLED WITH A MINIMUM 0.5% GRADE.

**EARTHWORKS**

10. ALL EARTHWORKS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH TNSW QA SPECIFICATION R44.

**NO FINES CONCRETE**

11. NO FINES CONCRETE TO BE CONSTRUCTED IN ACCORDANCE WITH TNSW QA SPECIFICATION 3222.

**GEOTEXTILE**

12. GEOTEXTILES TO BE IN ACCORDANCE WITH TNSW QA SPECIFICATION R63.

**REFERENCES**

TNSW QA SPECIFICATION R11: STORMWATER DRAINAGE  
 TNSW QA SPECIFICATION R15: KERBS AND GUTTERS  
 TNSW QA SPECIFICATION R33: TRENCH DRAINS  
 TNSW QA SPECIFICATION R44: EARTHWORKS  
 TNSW QA SPECIFICATION R63: GEOTEXTILES  
 TNSW QA SPECIFICATION R106: SPRAYED BITUMINOUS SURFACING (WITH CUTBACK BITUMEN)  
 TNSW QA SPECIFICATION 3152: AGGREGATES FOR ASPHALT  
 TNSW QA SPECIFICATION 3201: CONCRETE SUPPLY FOR PAVEMENT MAINTENANCE  
 TNSW QA SPECIFICATION 3222: NO FINES CONCRETE (FOR SUBSURFACE DRAINAGE)  
 TNSW QA SPECIFICATION 3552: SUBSURFACE DRAINAGE PIPE (CORRUGATED AND NON-PERFORATED (PLASTIC))  
 TNSW D&C R53 - CONCRETE FOR GENERAL WORKS  
 TNSW D&C B02 - SHOTCRETE WORK  
 TNSW D&C R178 - VEGETATION  
 TNSW QA SPECIFICATION R56 - GROUND ANCHORS  
 TNSW QA SPECIFICATION B59 - BORED CAST-IN-PLACE REINFORCED CONCRETE PILES (WITHOUT PERIMETER CASING)  
 AS 1379 - SPECIFICATION AND SUPPLY OF CONCRETE

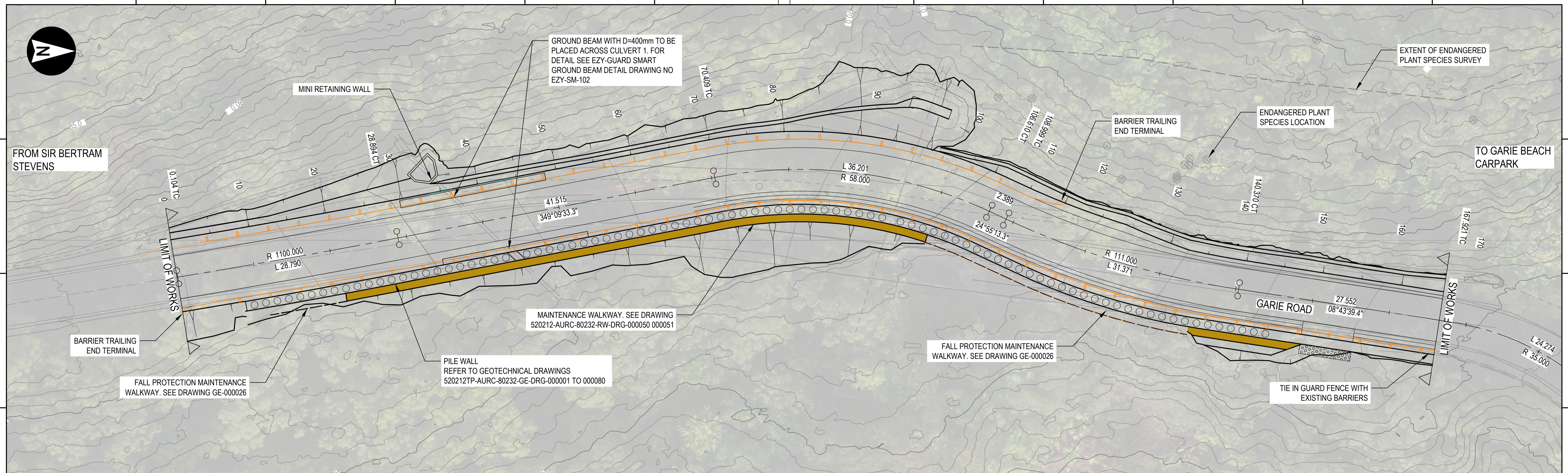
**SCOUR PROTECTION**

1. ROCK IS TO BE HARD, DENSE, DURABLE, RESISTANT TO WEATHERING AND ANGULAR IN SHAPE. IT MUST BE FREE FROM OVERBURDEN, SPOIL, SHALE AND ORGANIC MATTER. ROCK THAT IS LAMINATED, FRACTURED, POROUS OR OTHERWISE PHYSICALLY WEAK IS UNACCEPTABLE.
2. GEOTEXTILE UNDER ROCK MATTRESS AND DUMPED RIP RAP TO BE IN ACCORDANCE WITH TNSW R63.
3. ALL ROCK MATTRESSES MUST COMPLY WITH TNSW R55.
4. ALL ROCK MATTRESSES MUST BE PROVIDED WITH GALVANIZED AND GRAY PVC COATINGS.

FOR REVIEW

H	REFERENCES:	THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.			SCALE: NOT TO SCALE	CLIENT:	This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.  DRAWN _____ K.GREWAR _____ 27.04.2023 DESIGNED _____ B.WEIMANN _____ 27.04.2023 DRG CHECK _____ J.VAN DER MERWE _____ 27.04.2023 DESIGN CHECK _____ J.VAN DER MERWE _____ 27.04.2023 PROJ/DES MNGR _____ V.TIET _____ 27.04.2023 APPROVED _____ M.ABERLINE _____ 27.04.2023	HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232 ROAD REALIGNMENT GENERAL NOTES DRAWING SET No: 80232 STATUS: FOR REVIEW DRG No: 520212TP-AURC-80232-RW-DRG-000002																				
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**LEGEND**

	ROAD CONTROL LINE
	PROPOSED ROAD DESIGN
	EXISTING ROAD
	TL-3 FLEXIBLE GF (EZY-GUARD SMART OR APPROVED EQUIVALENT) AT 2.0m POST SPACING, UNLESS NOTED OTHERWISE
	GREAT TERMINAL (ET-SS OR APPROVED EQUIVALENT)
	PILE WALL
	MAINTENANCE WALKWAY
	FALL PROTECTION MAINTENANCE WALKWAY

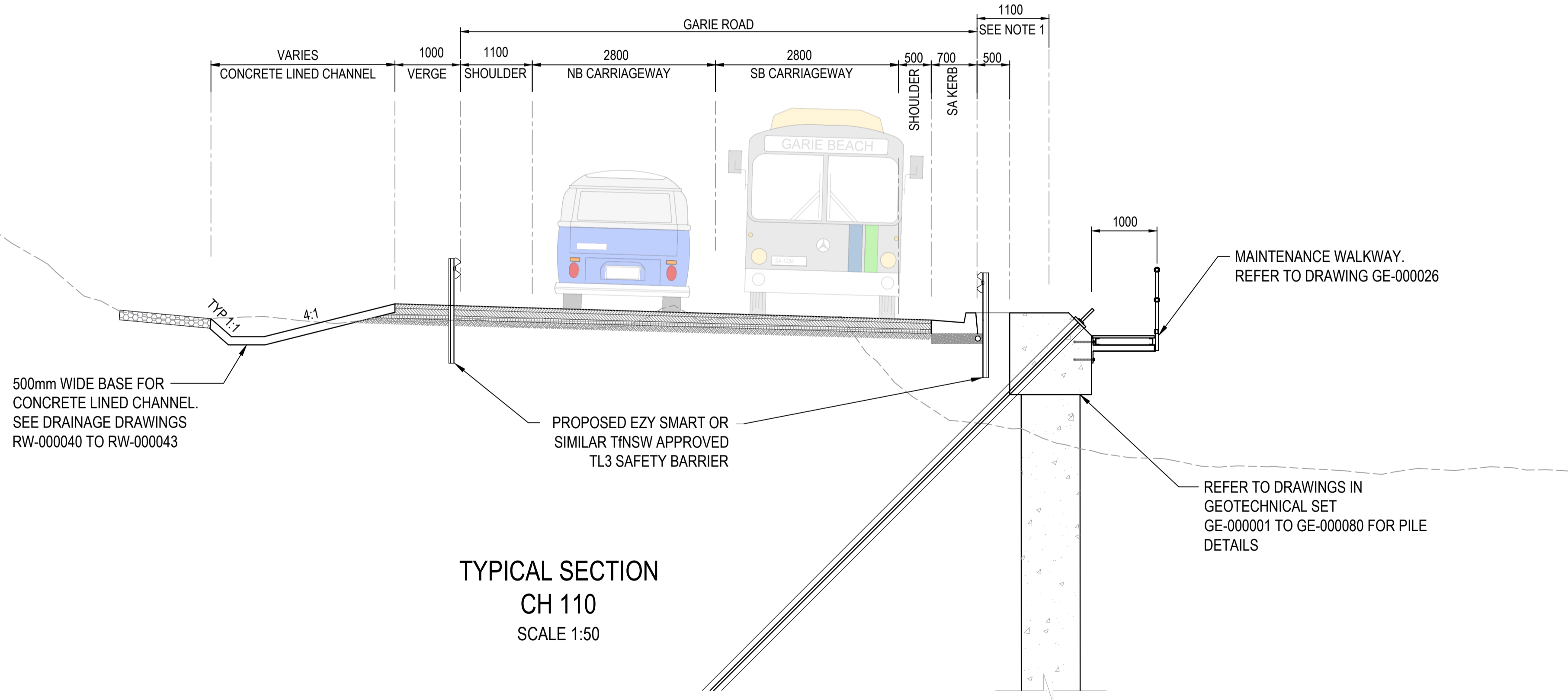
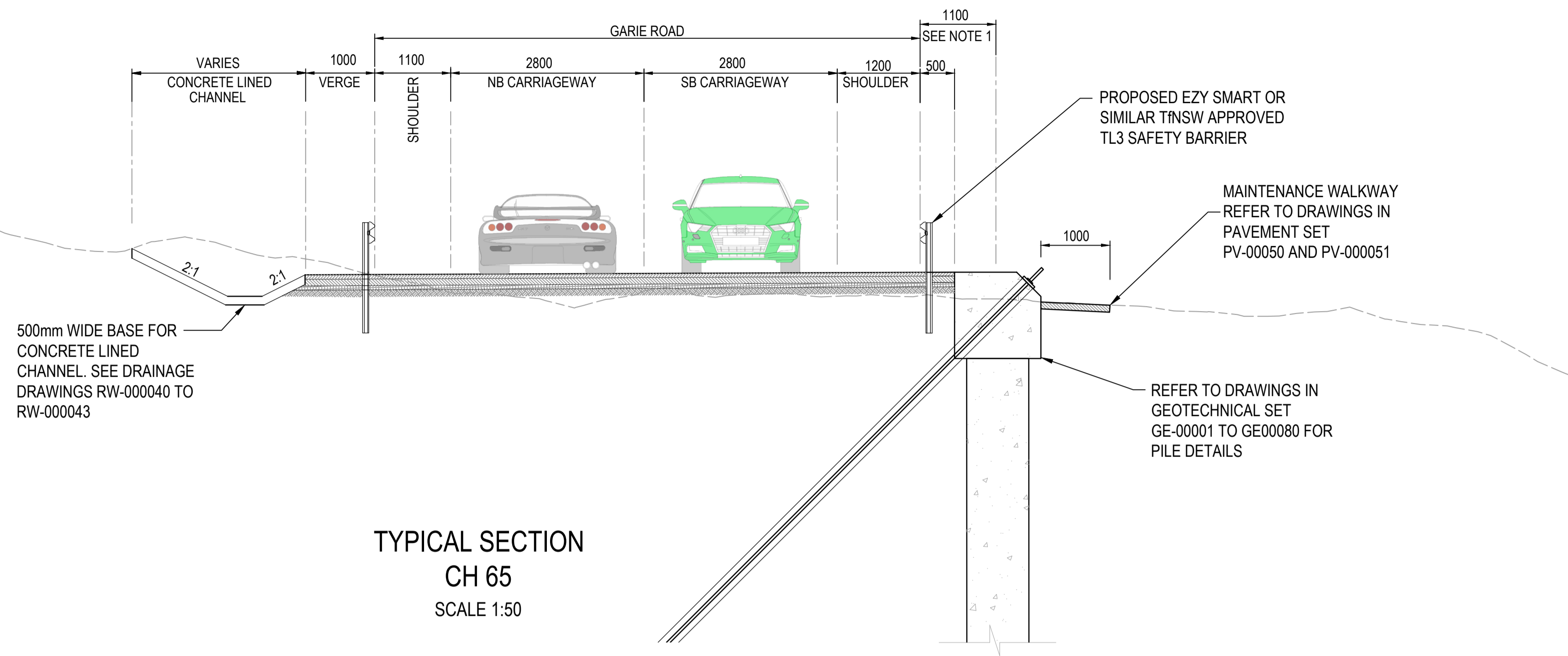
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**NOTE:**  
 1. THE DYNAMIC DEFLECTION DEPICTED FOR THE BARRIER IS FOR A 2270kg PICK-UP TRAVELLING AT 80km/h IMPACTING THE BARRIER WITH 2.0m POST SPACING AT A 25° ANGLE.



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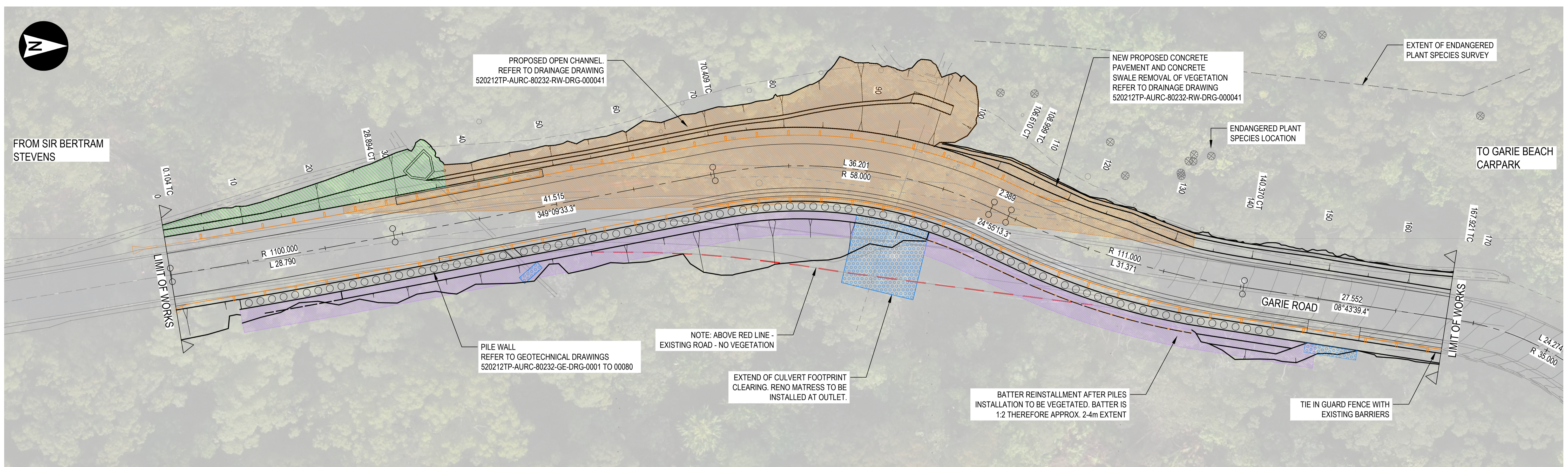
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FROM SIR BERTRAM STEVENS

TO GARIE BEACH CARPARK



**LEGEND**

- ROAD CONTROL LINE
- PROPOSED ROAD DESIGN
- EXISTING ROAD
- TL-3 FLEXIBLE GF (EZY-GUARD SMART OR APPROVED EQUIVALENT) AT 1.0M POST SPACING, UNLESS NOTED OTHERWISE
- GREAT TERMINAL (ET-SS OR APPROVED EQUIVALENT)
- REVEGETATION - GRASSED SWALE
- DEVEGETATION - PAVEMENT AREA
- DEVEGETATION/CLEARANCE - DRAINAGE OUTLET AREA
- BATTER REINSTATEMENT AFTER PILE INSTALLATION

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR REVIEW

<p>REFERENCES:</p> <table border="1"> <tr><td>C</td><td>100% DETAIL DESIGN</td><td>B.W 27.04.23</td><td>J.VDM 27.04.23</td><td>V.T 27.04.23</td></tr> <tr><td>B</td><td>100% DETAIL DESIGN</td><td>B.W 13.04.23</td><td>J.VDM 13.04.23</td><td>V.T 13.04.23</td></tr> <tr><td>A</td><td>80% DETAIL DESIGN</td><td>V.H 01.02.23</td><td>M.T 01.02.23</td><td>M.H 01.02.23</td></tr> <tr> <th>REV</th> <th>DESCRIPTION</th> <th>DESIGNER INITIAL/DATE</th> <th>VERIFIED INITIAL/DATE</th> <th>APPROVED INITIAL/DATE</th> </tr> </table>	C	100% DETAIL DESIGN	B.W 27.04.23	J.VDM 27.04.23	V.T 27.04.23	B	100% DETAIL DESIGN	B.W 13.04.23	J.VDM 13.04.23	V.T 13.04.23	A	80% DETAIL DESIGN	V.H 01.02.23	M.T 01.02.23	M.H 01.02.23	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>			<p>SCALE: 1:250</p> <p>SCALE 1:250</p>	<p>CLIENT:</p> <p>Transport for NSW</p>	<p><i>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.</i></p> <p><i>Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</i></p>	<p>HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232</p>
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<p>DRAWING SET No: 80232</p>					<p>PART: SHEET: 1 OF 1 A1</p>		<p>STATUS: FOR REVIEW</p>	<p>BRIDGE No:</p>																			
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A

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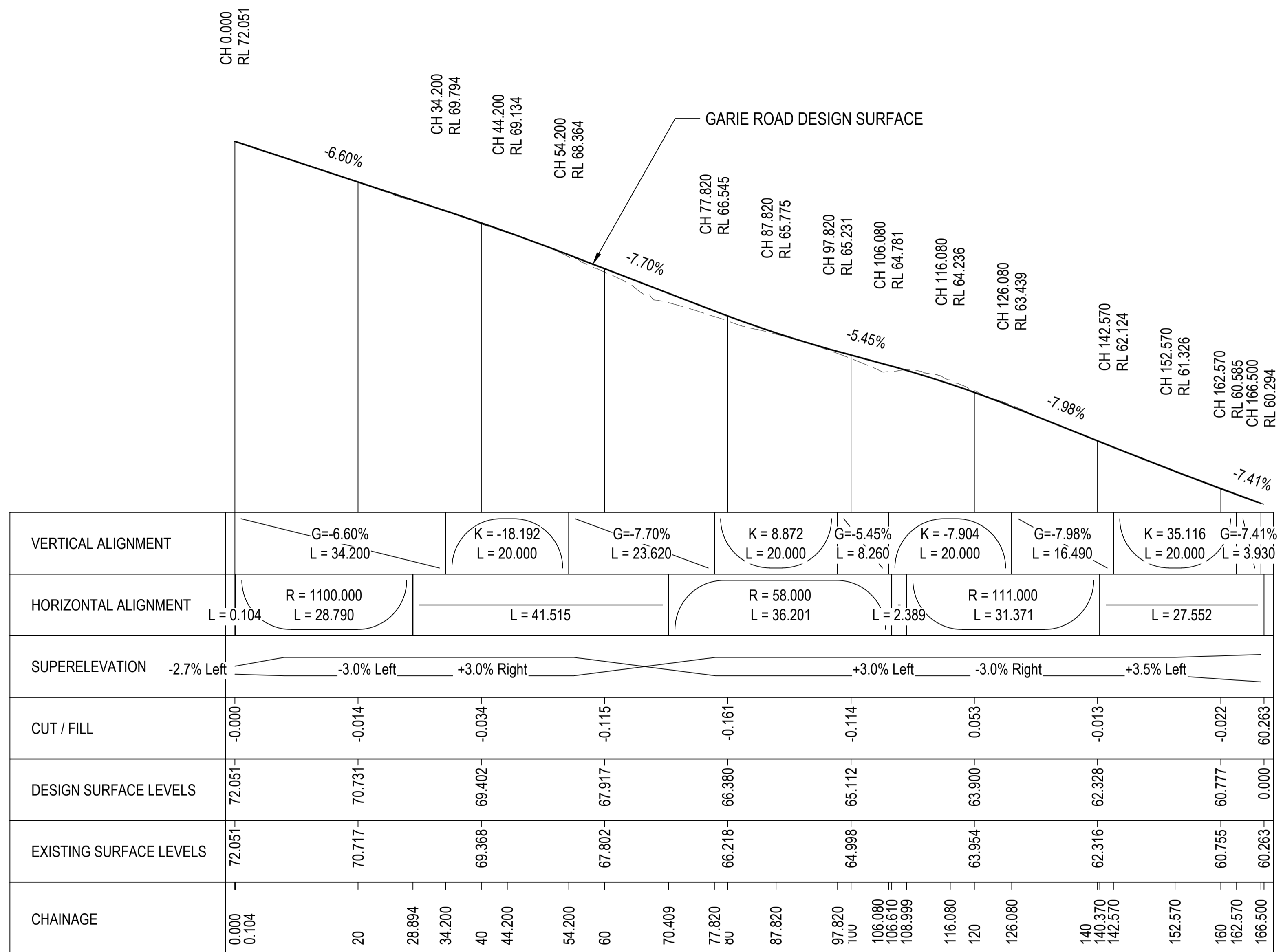
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GARIE ROAD LONGITUDINAL SECTION

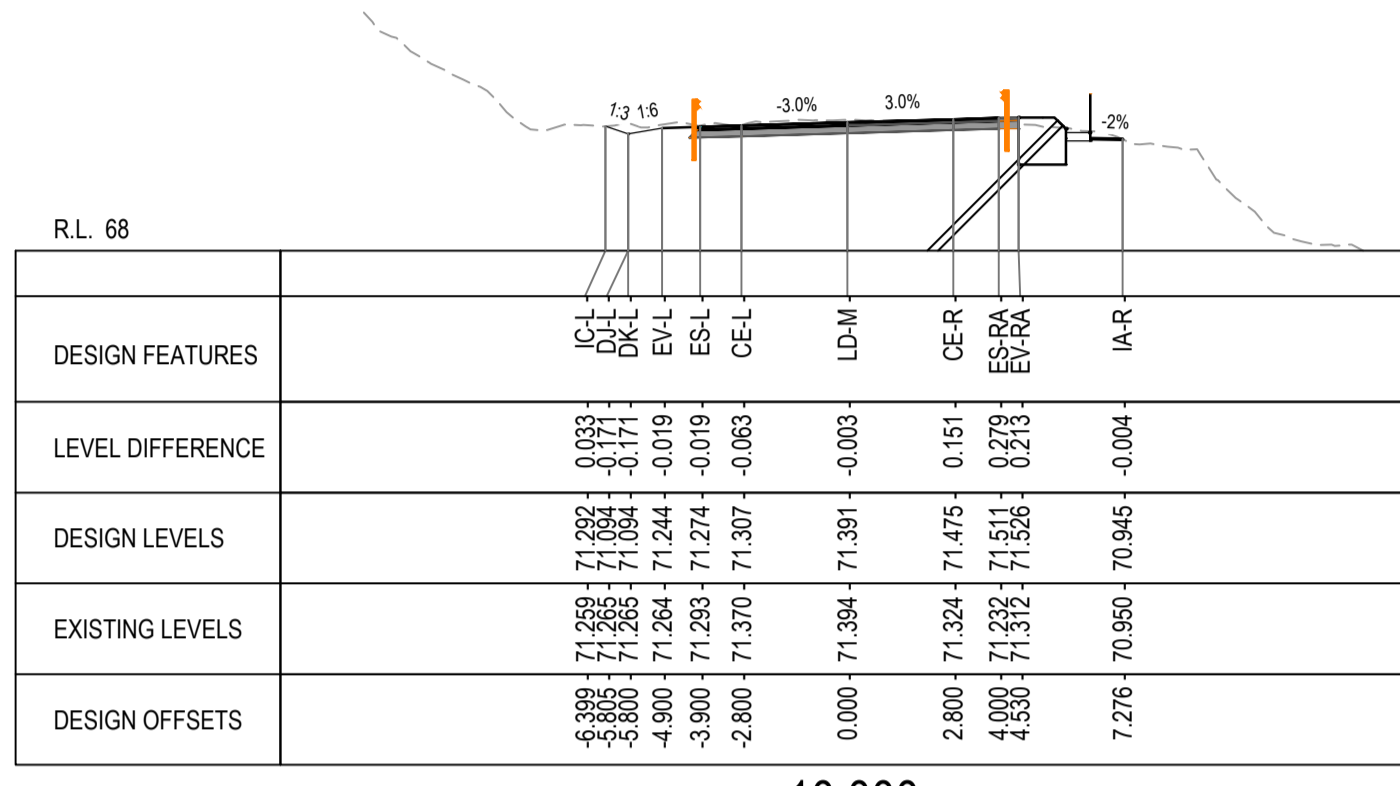
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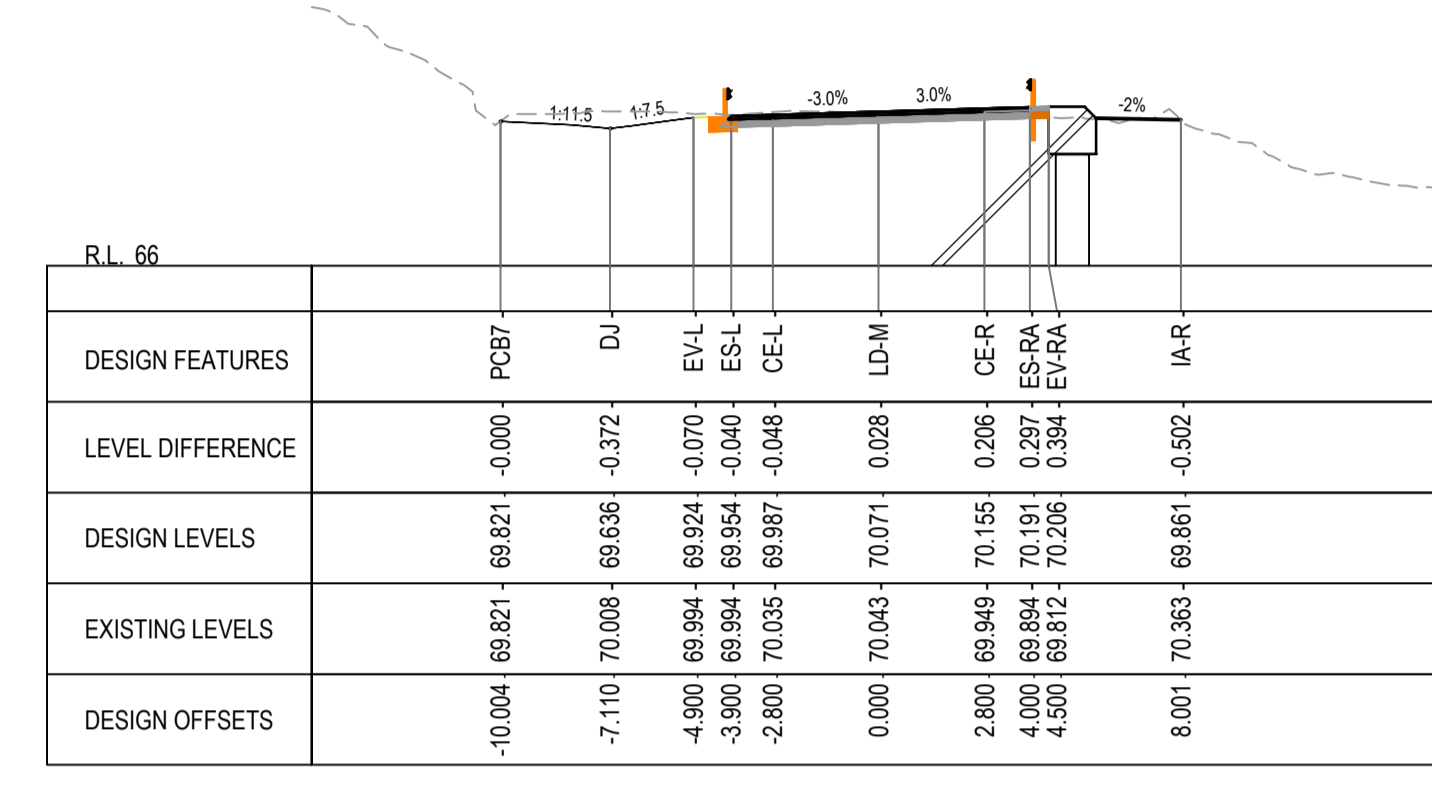
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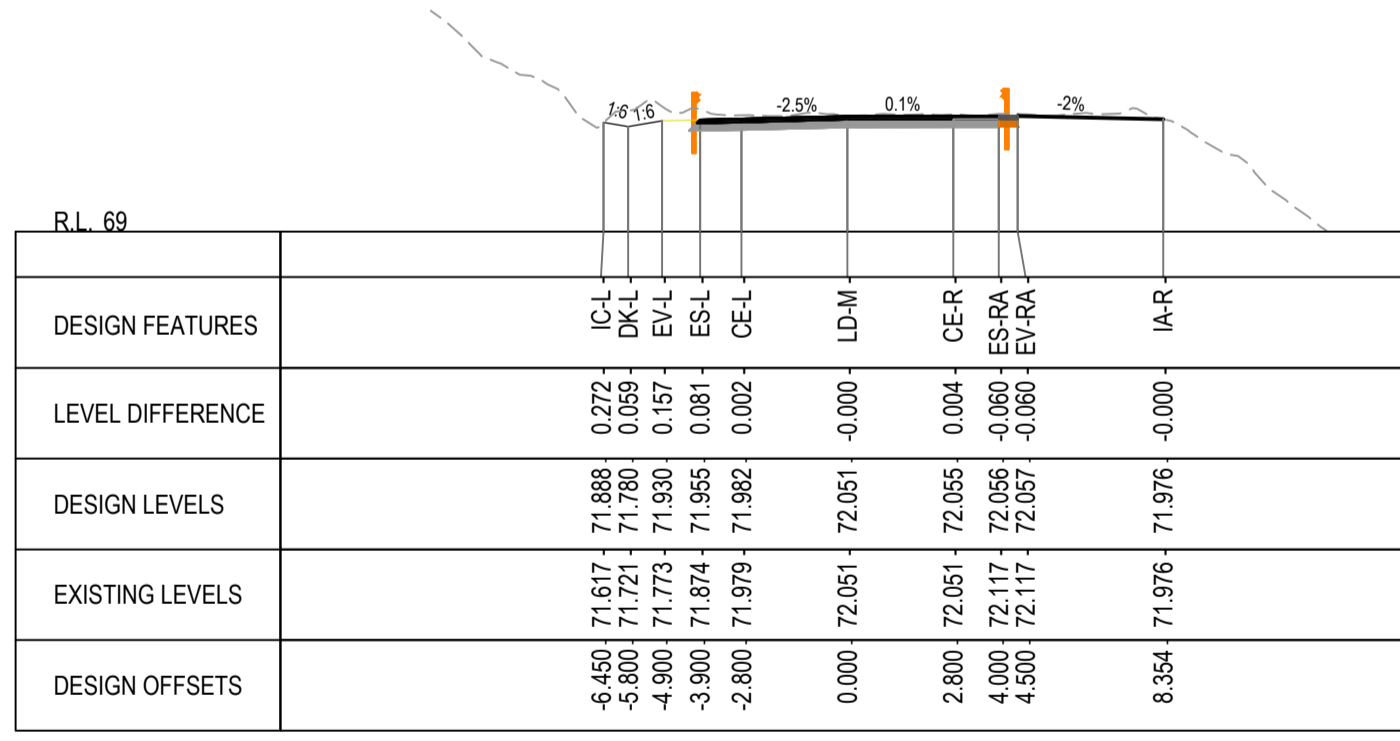
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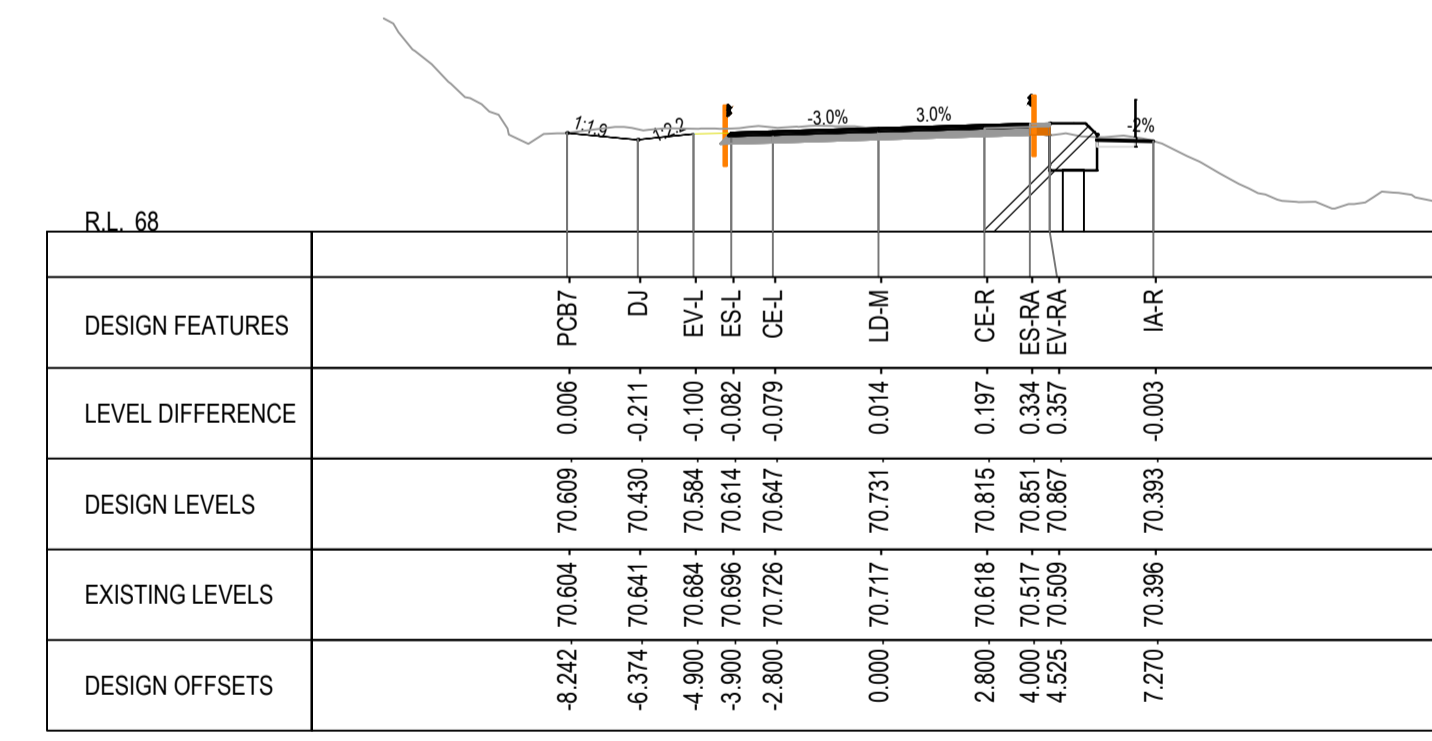
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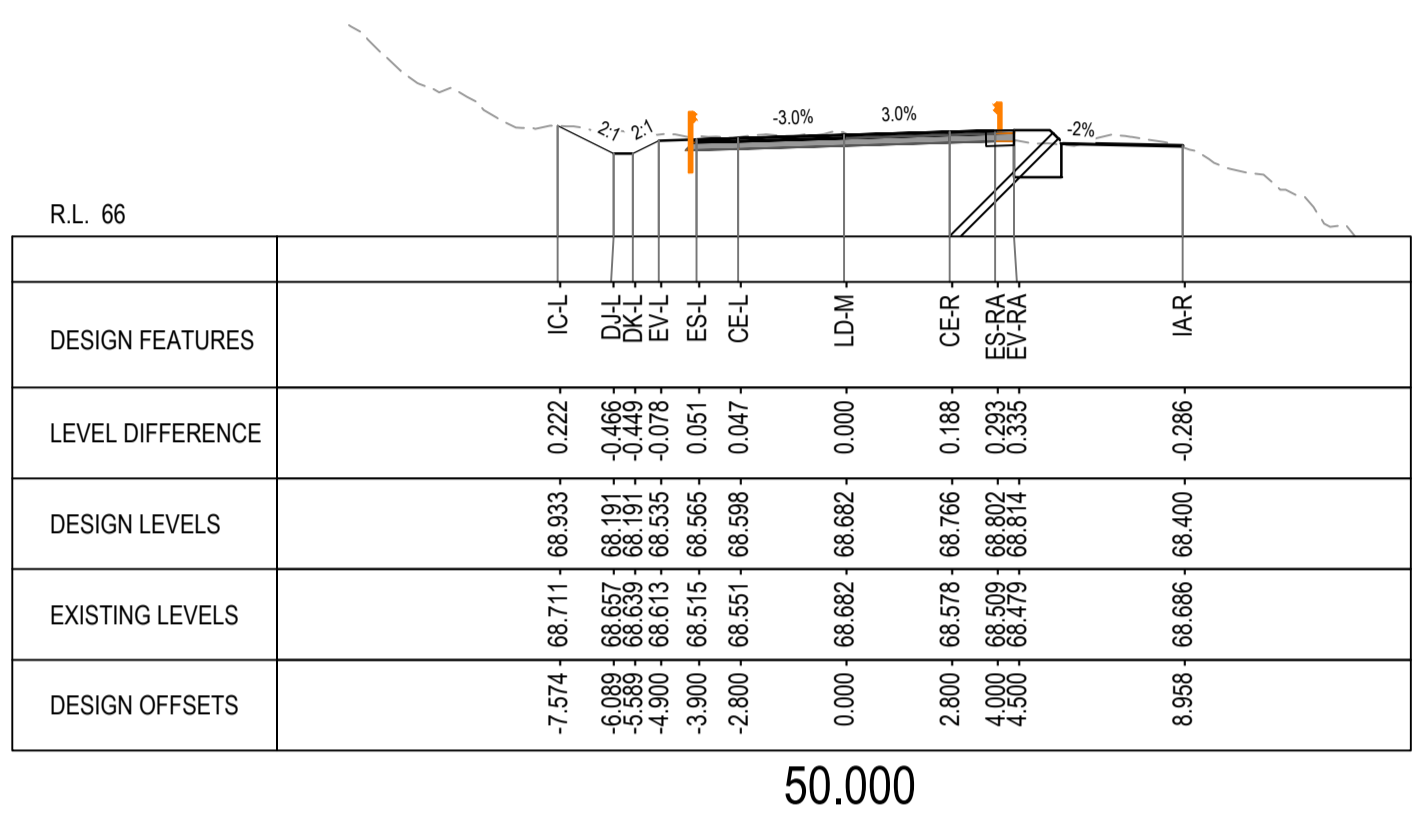
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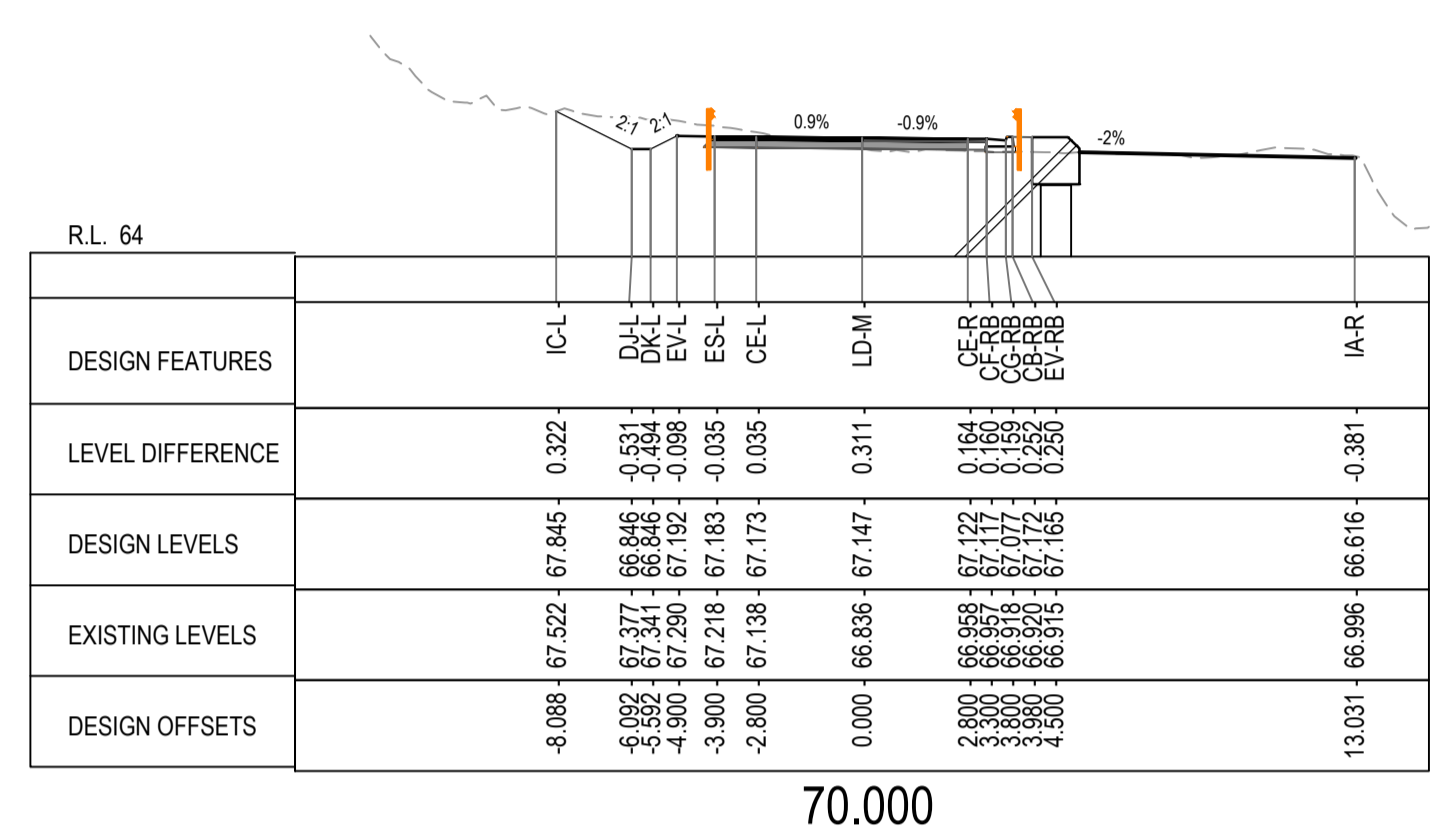
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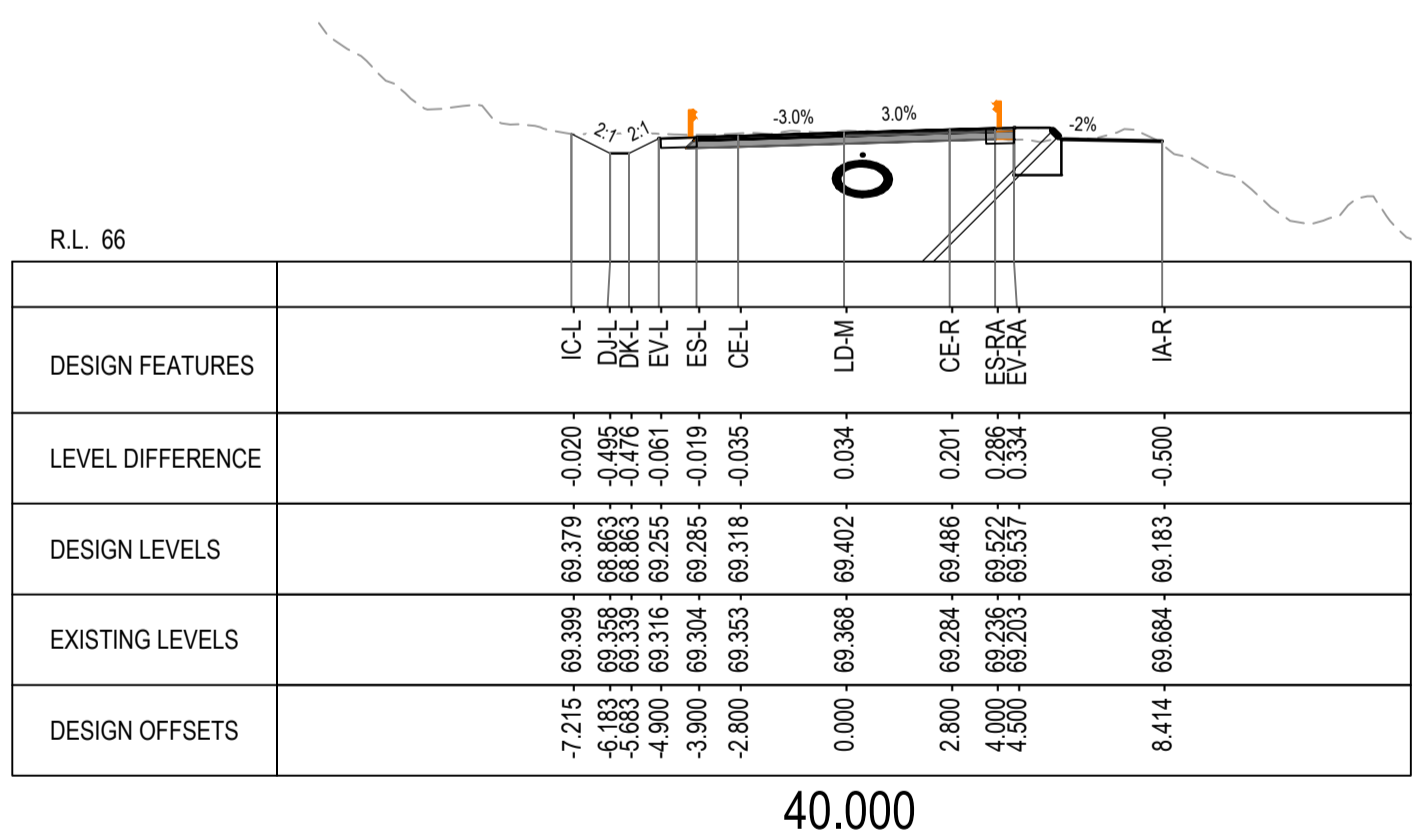




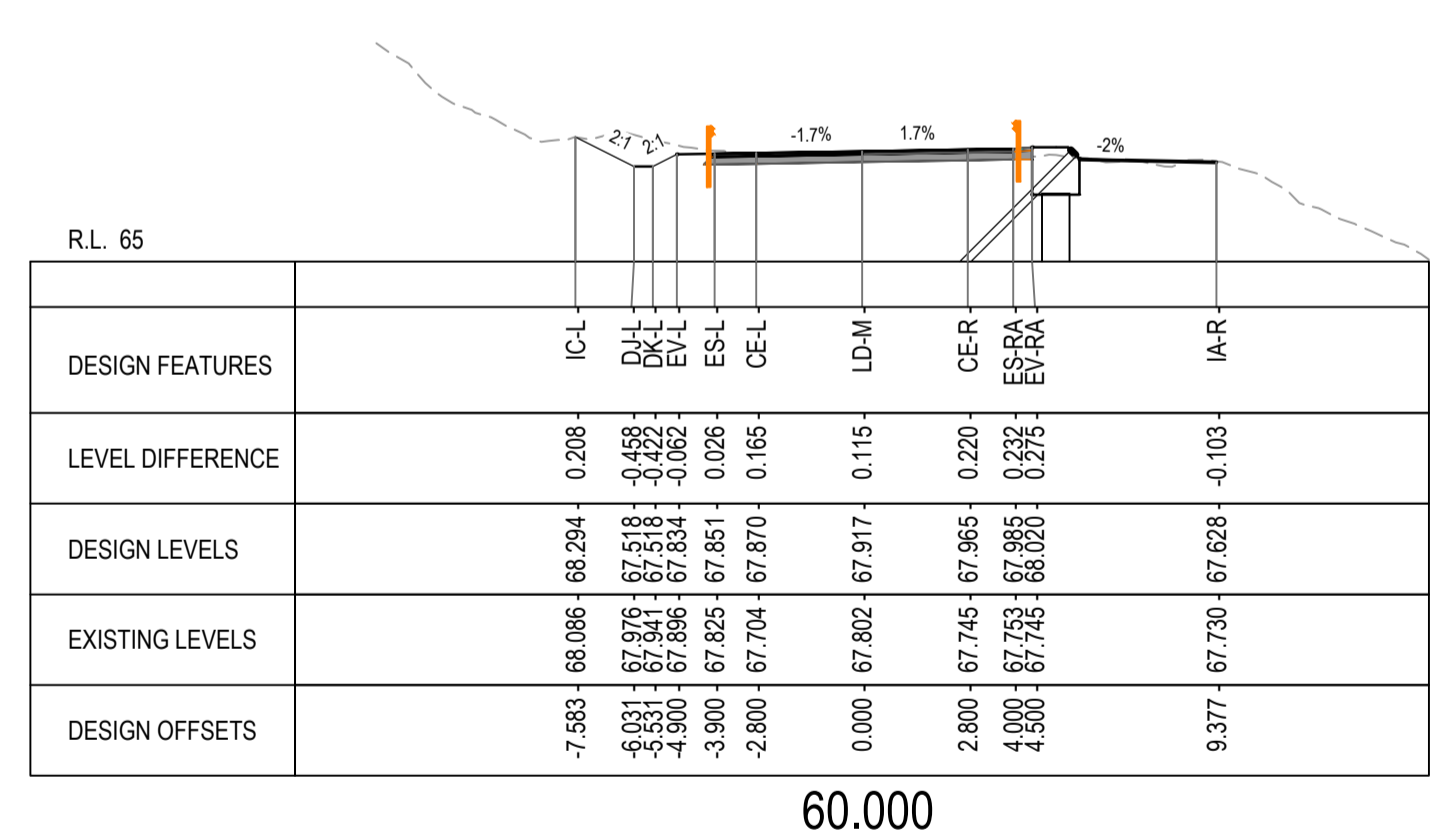
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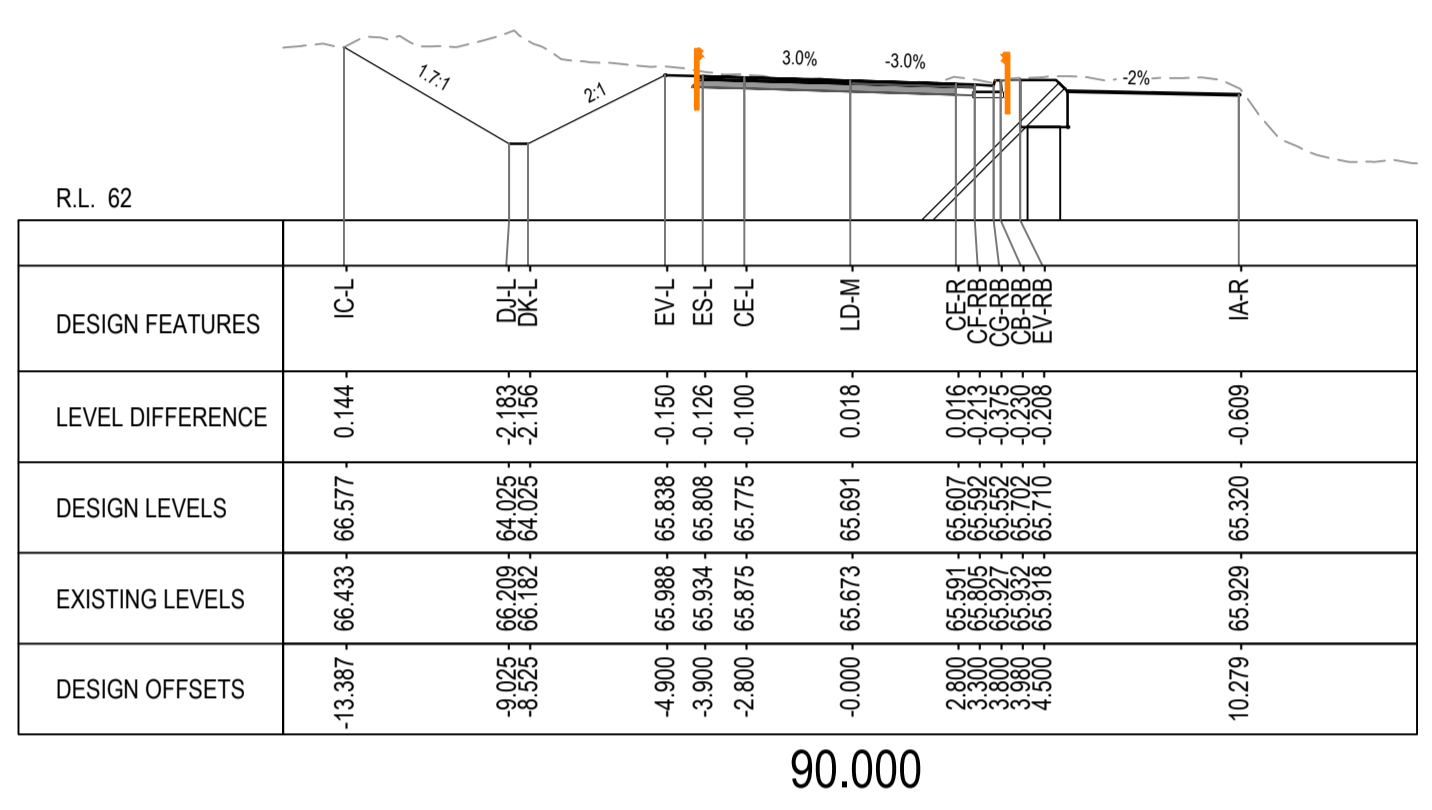


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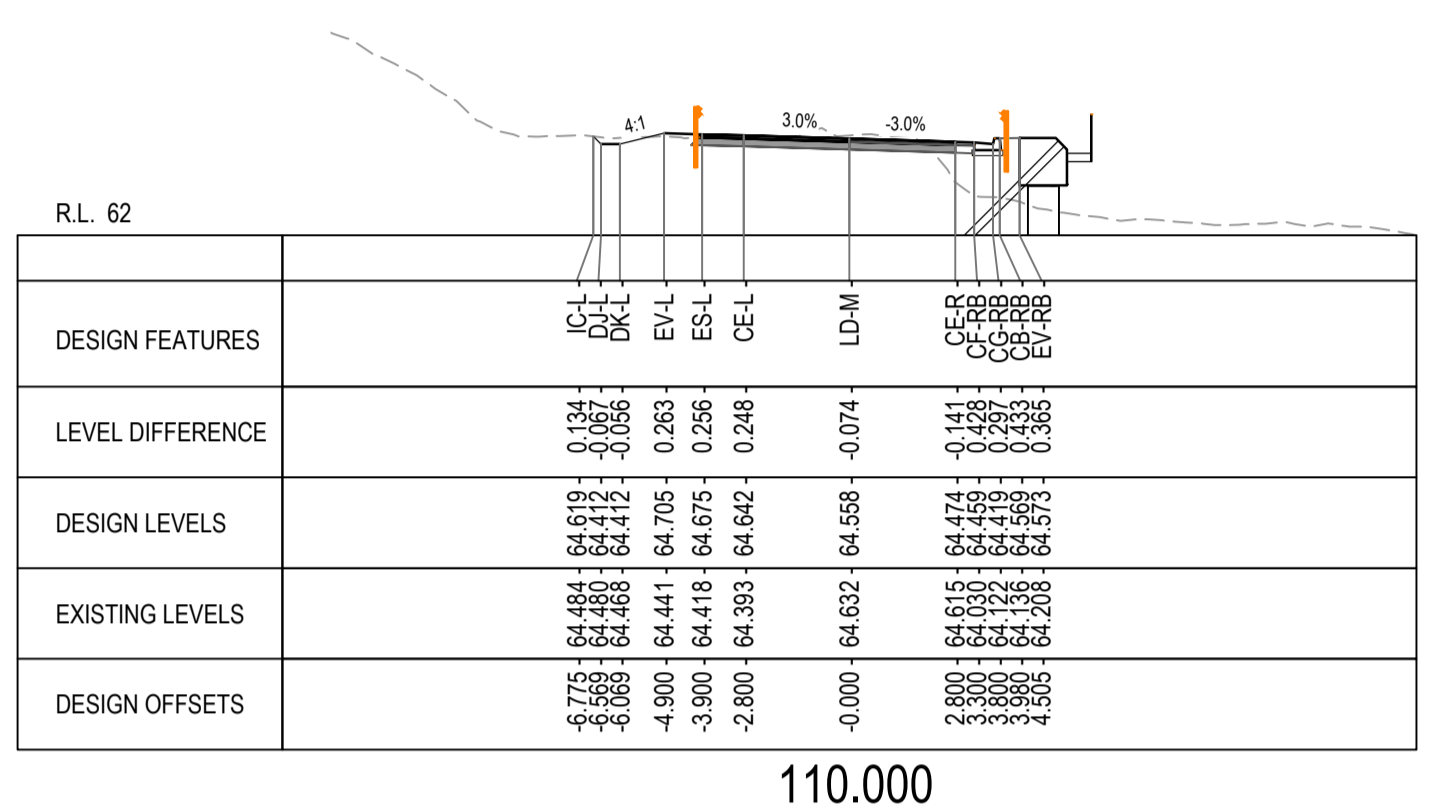
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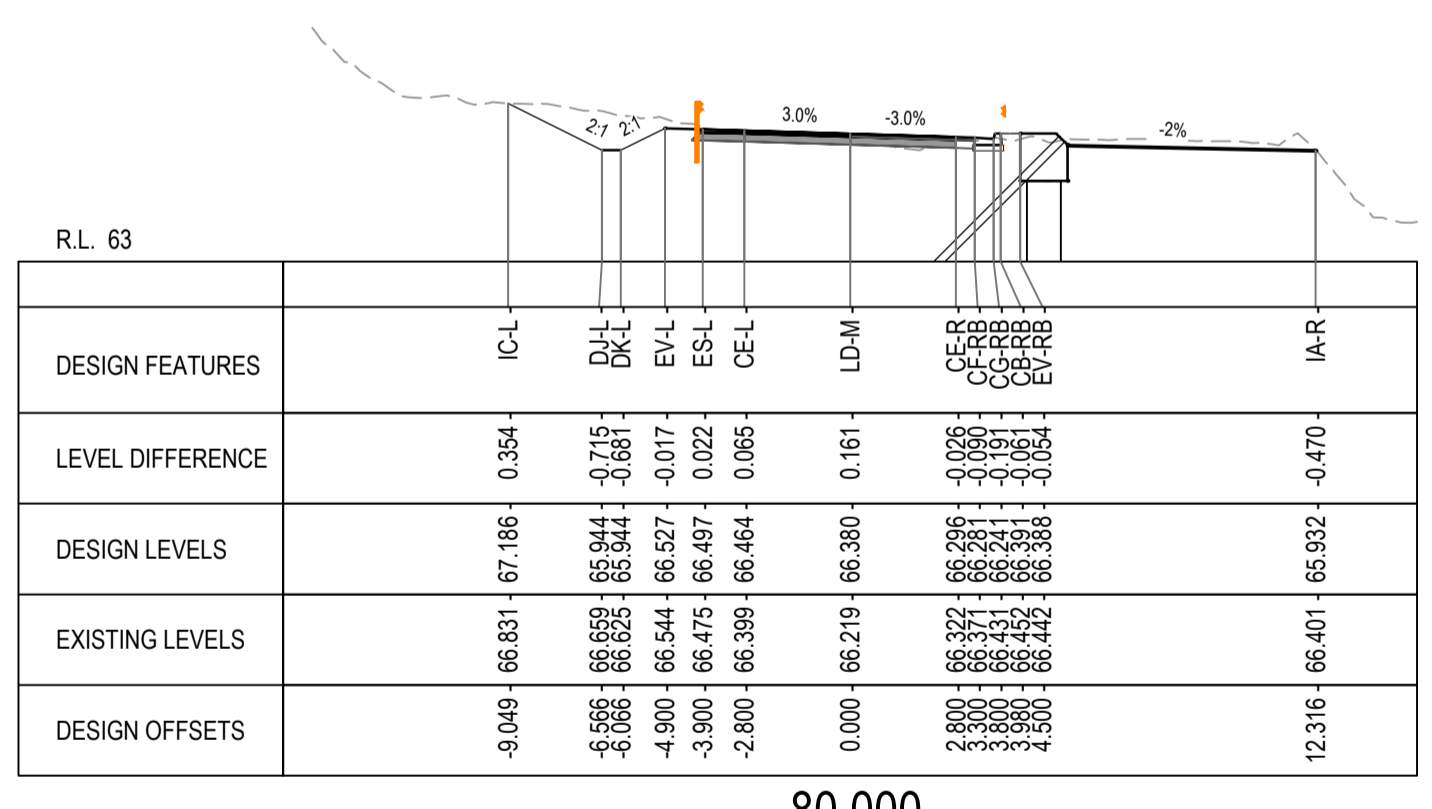
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	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE																				
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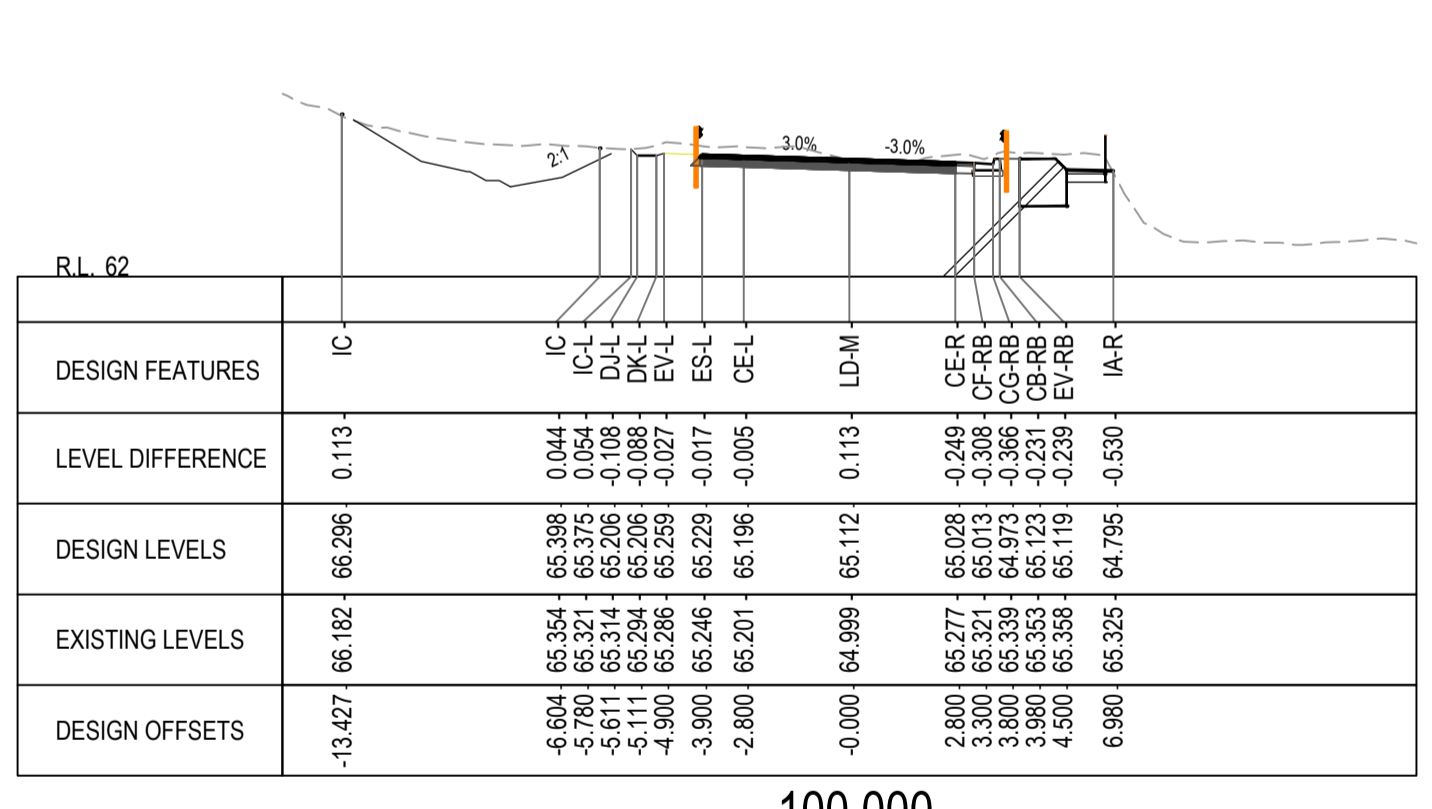
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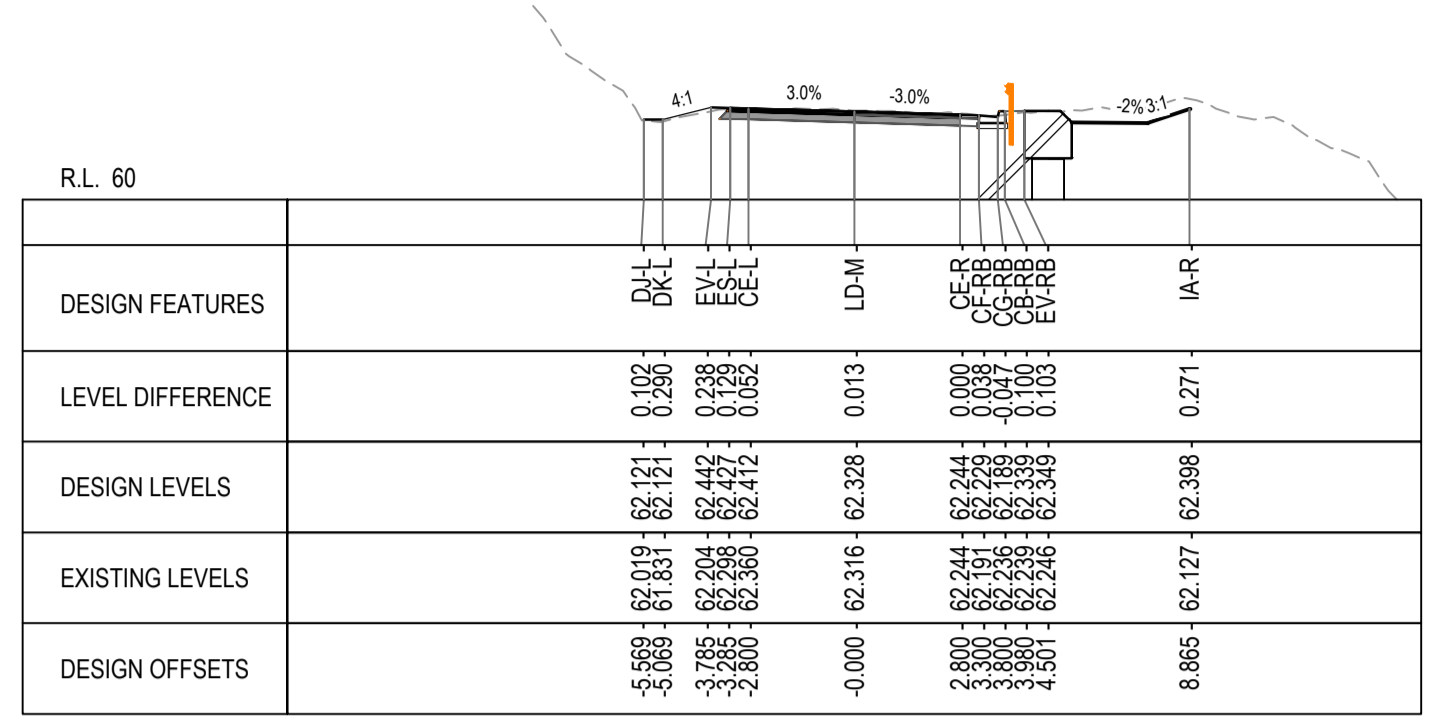
FOR REVIEW

<p>REFERENCES:</p> <table border="1"> <tr> <th>REV</th> <th>DESCRIPTION</th> <th>DESIGNER INITIAL/DATE</th> <th>VERIFIED INITIAL/DATE</th> <th>APPROVED INITIAL/DATE</th> </tr> <tr> <td>C</td> <td>100% DETAIL DESIGN</td> <td>B.W 27.04.23</td> <td>J.VDM 27.04.23</td> <td>V.T 27.04.23</td> </tr> <tr> <td>B</td> <td>100% DETAIL DESIGN</td> <td>B.W 13.04.23</td> <td>J.VDM 13.04.23</td> <td>V.T 13.04.23</td> </tr> <tr> <td>A</td> <td>80% DETAIL DESIGN</td> <td>V.H 01.02.23</td> <td>M.T 01.02.23</td> <td>M.H 01.02.23</td> </tr> </table>	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	C	100% DETAIL DESIGN	B.W 27.04.23	J.VDM 27.04.23	V.T 27.04.23	B	100% DETAIL DESIGN	B.W 13.04.23	J.VDM 13.04.23	V.T 13.04.23	A	80% DETAIL DESIGN	V.H 01.02.23	M.T 01.02.23	M.H 01.02.23	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p>SCALE: 1:200</p>	<p>CLIENT:</p>	<p><i>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.</i></p> <p>Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</p>	<p>HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232 ROAD REALIGNMENT CROSS SECTIONS - SHEET 3</p>
	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE																				
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<p>COORDINATE SYSTEM: MGA_ZONE_56/GDA20</p>	<p>HEIGHT DATUM: AHD</p>	<p>DESIGN LOT CODE:</p>	<p>PREPARED FOR:</p>	<p>DRAWN _____ K.GREWAR _____ 27.04.2023 DESIGNED _____ B.WEIMANN _____ 27.04.2023 DRG CHECK _____ J.VAN DER MERWE _____ 27.04.2023 DESIGN CHECK _____ J.VAN DER MERWE _____ 27.04.2023 PROJ/DES MNGR _____ V.TIET _____ 27.04.2023 APPROVED _____ M.ABERLINE _____ 27.04.2023</p>	<p>DRAWING SET No: 80232 STATUS: FOR REVIEW</p>																				
<p>REV C</p>			<p>BRIDGE No:</p>	<p>PART: SHEET: 3 OF 4 A1</p>																					
<p>EDMS No. 80232</p>			<p>AMD No.</p>	<p>©</p>																					

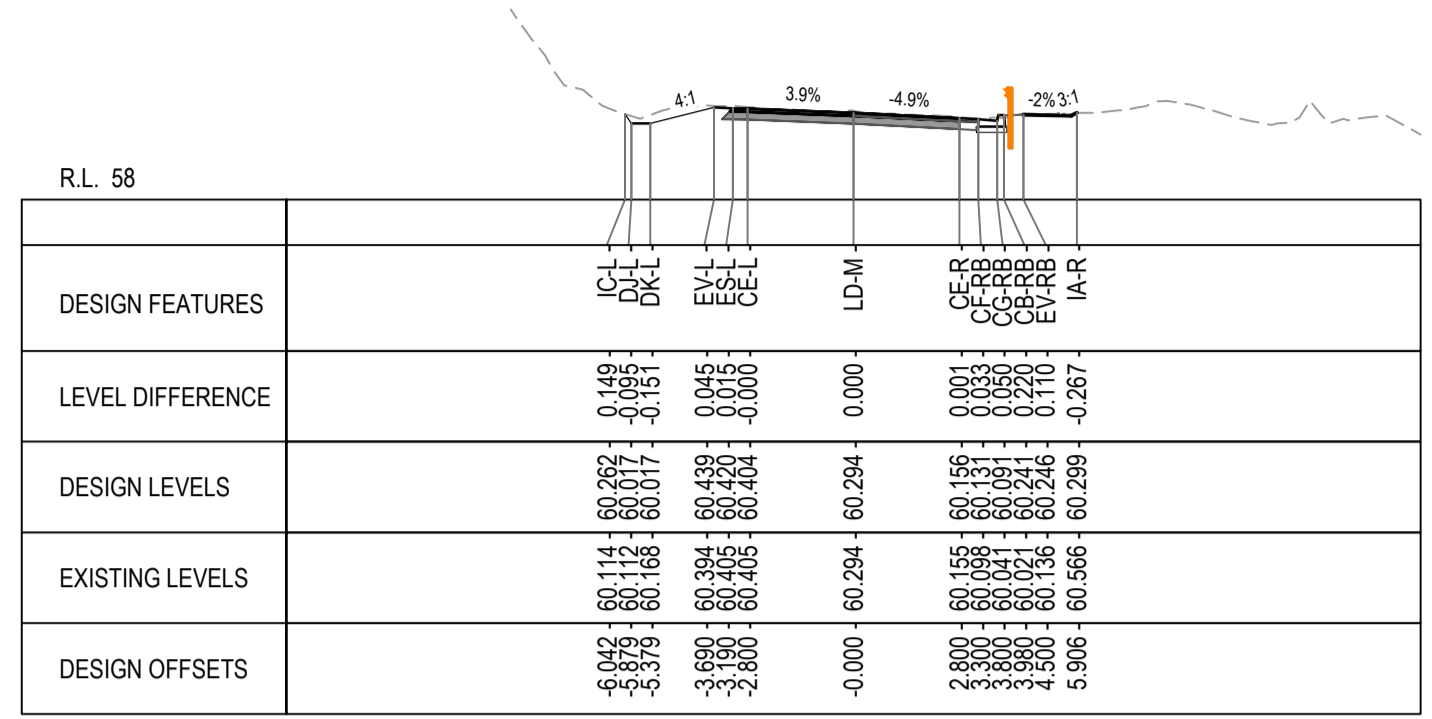


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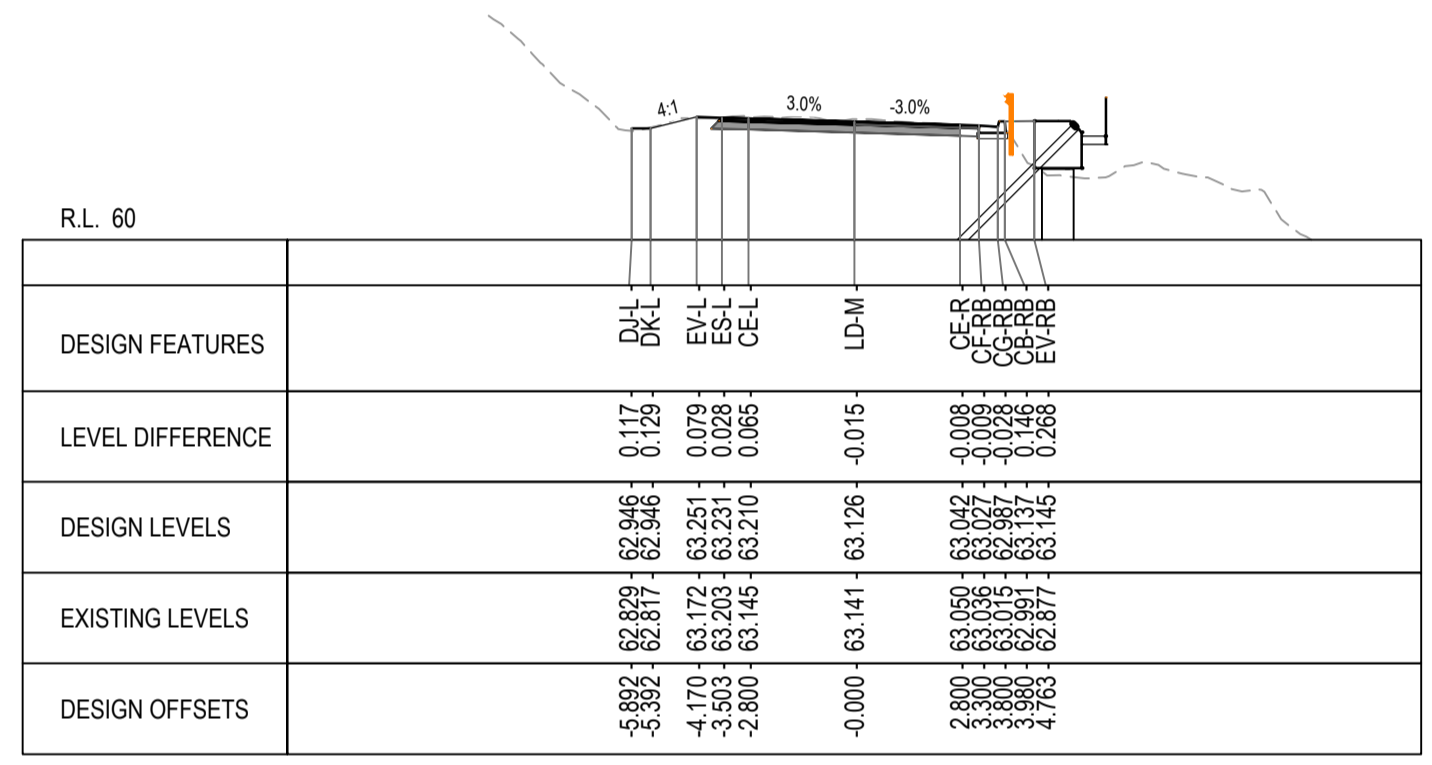
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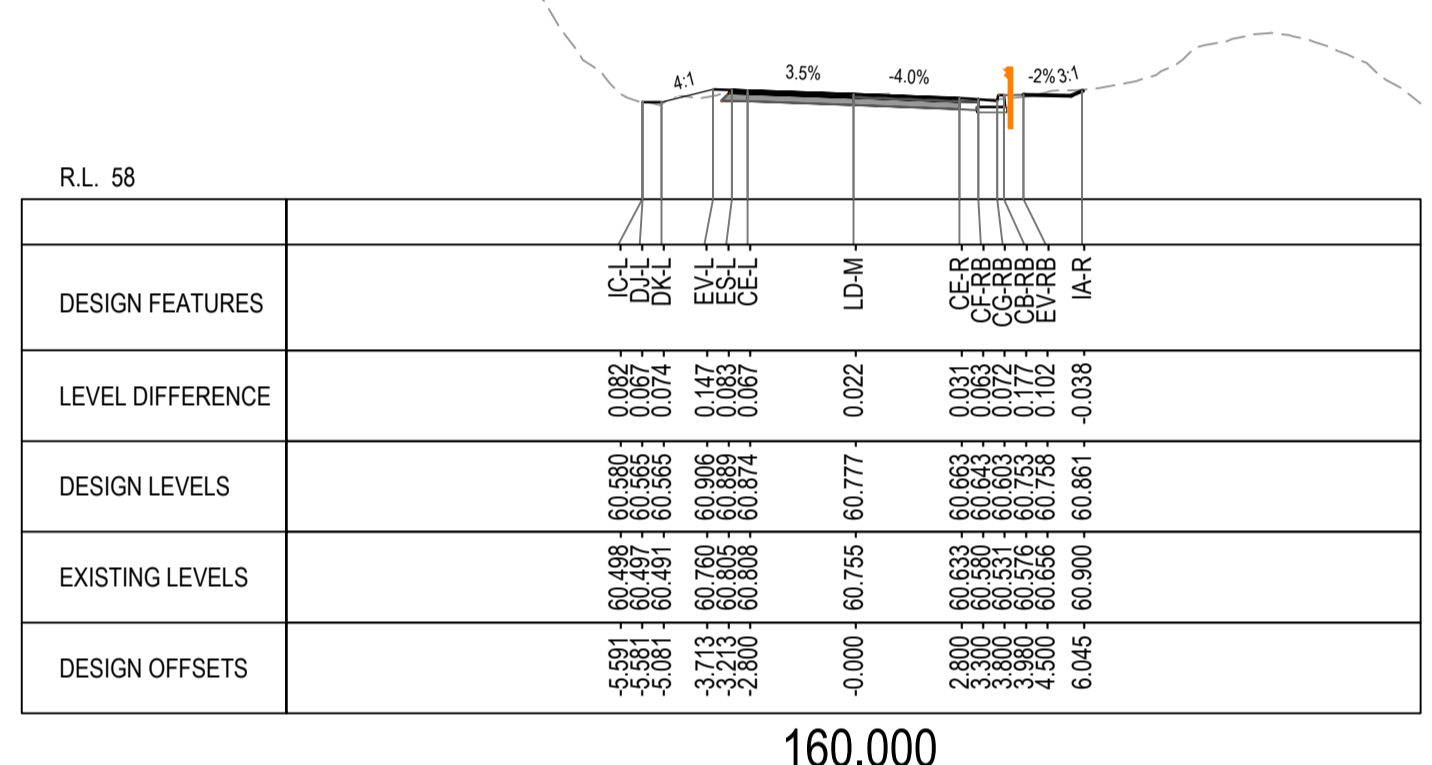
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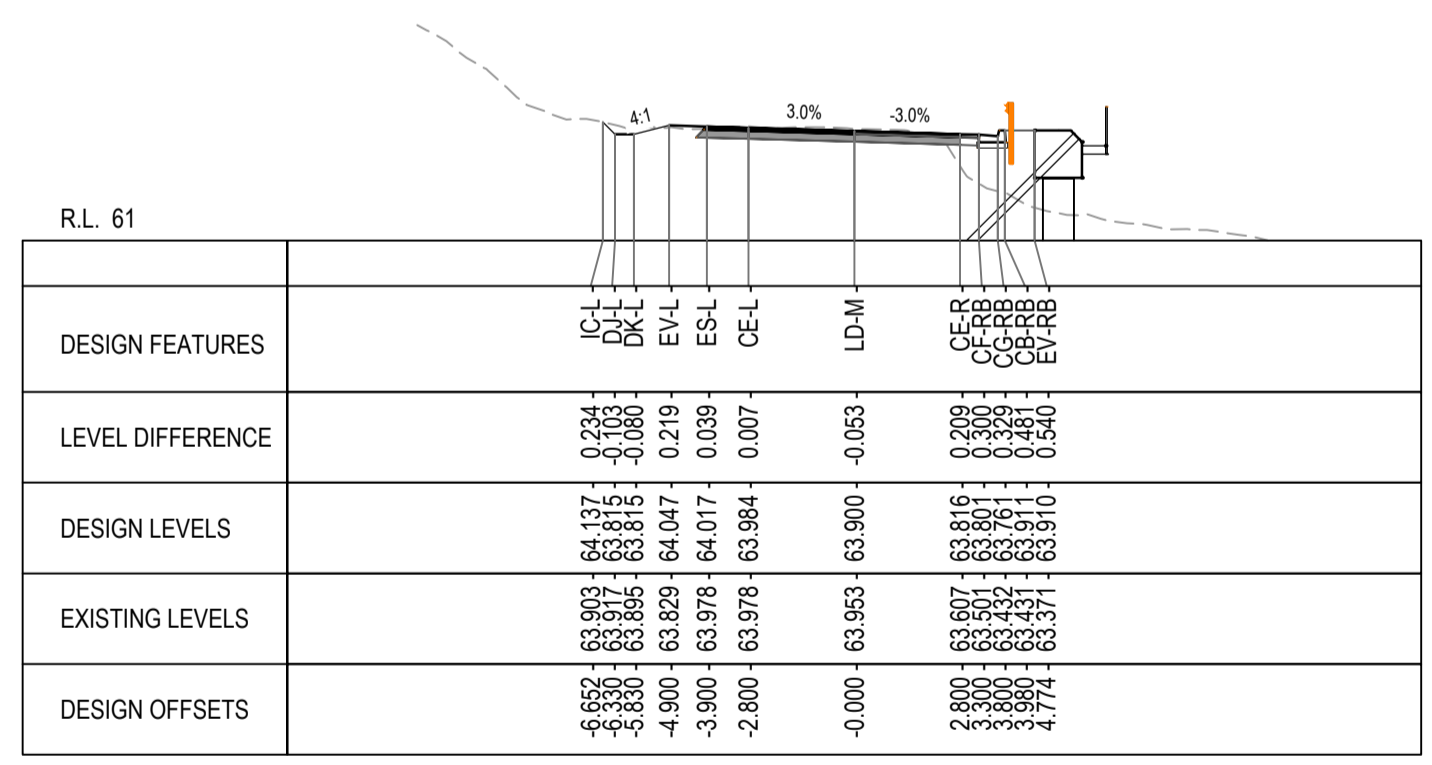
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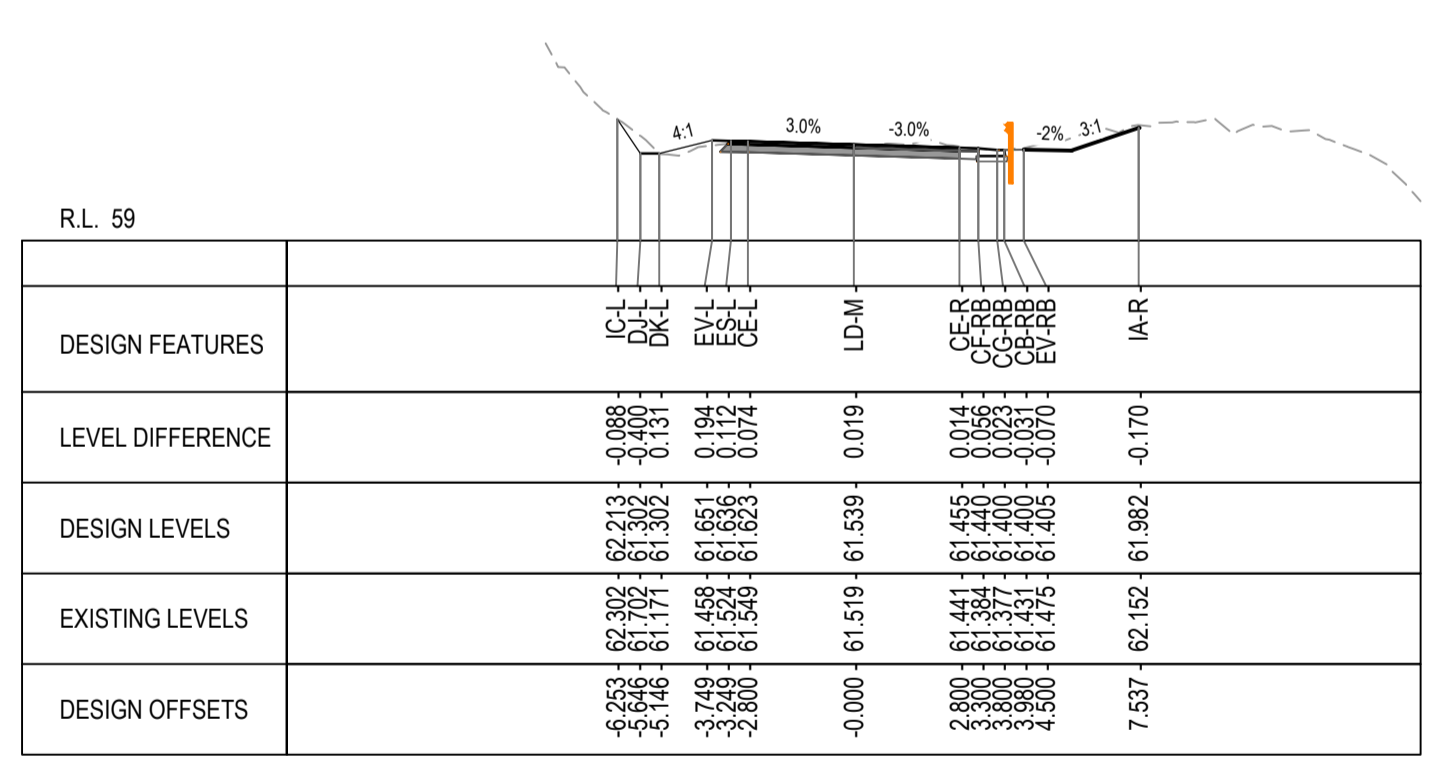
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E

E



120.000



150.000

G

G

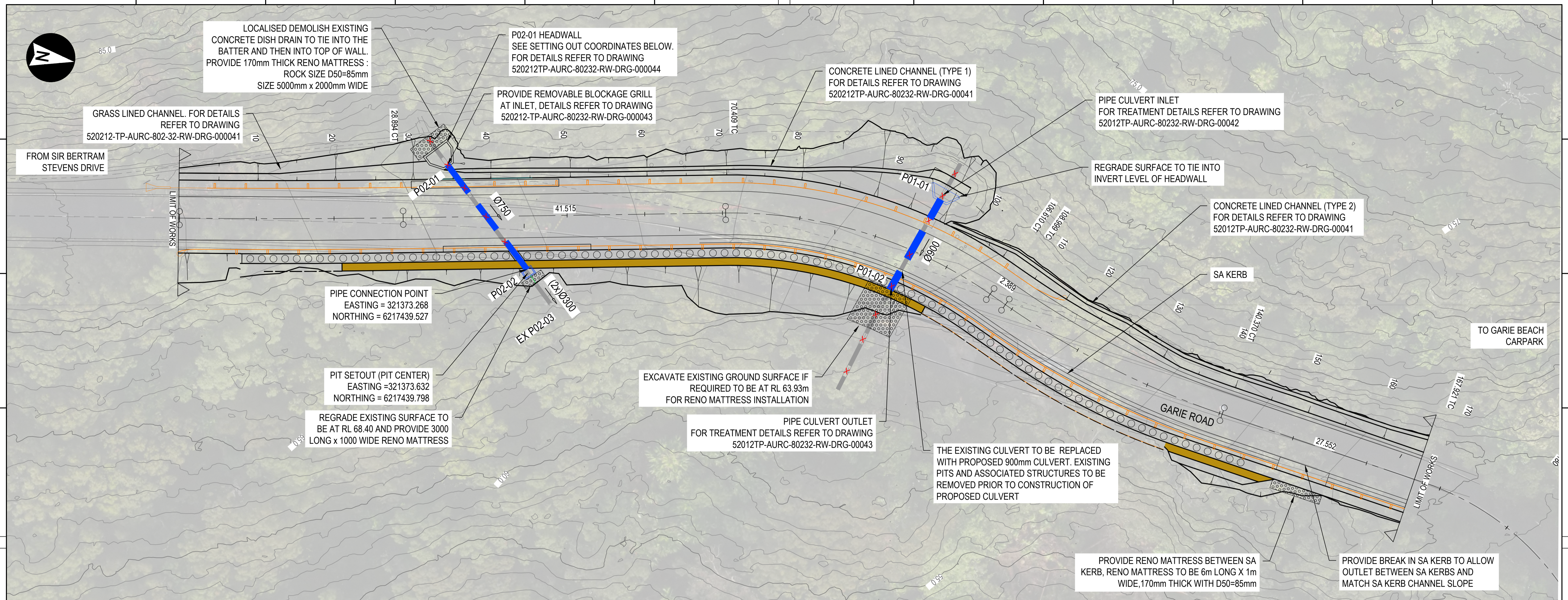
DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR REVIEW

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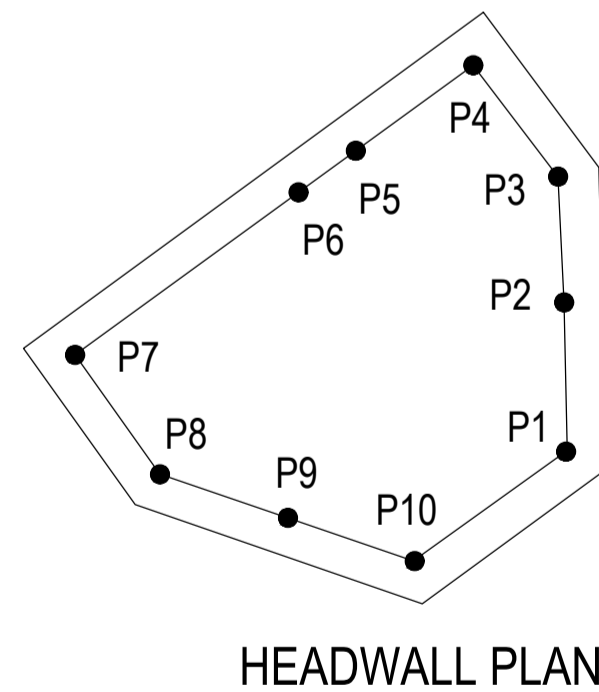
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PLOT DATE & TIME: 27/4/2023 3:22:26 am





**CULVERT DRAINAGE SCHEDULE**

STRUCTURE ID	STRUCTURE TYPE	EASTING	NORTHING	DRAWING REFERENCE
P01-01	HW	321355.163	6217490.411	RW-DRG-00042
P01-02	HW	321367.754	6217485.959	RW-DRG-00042
P02-01	HW	321361.796	6217427.104	R0210-01
P02-02	RSG 900x1200	321373.632	6217439.798	RW-DRG-00044
EX P02-03	EXISTING OUTLET	-	-	-



HEADWALL PLAN

**P02-01 HEADWALL SETTING OUT TABLE**

POINT ID	EASTING	NORTHING	TOP OF WALL RL (m)	WALL HEIGHT (m) #
P1	321361.330	6217427.540	69.200	1.20
P2	321360.472	6217427.359	69.200	1.20
P3	321359.579	6217427.169	69.700	1.70
P4	321358.916	6217426.461	69.700	1.70
P5	321359.719	6217425.710	69.700	1.70
P6	321359.902	6217425.539	69.450	1.45
P7	321361.321	6217424.212	69.450	1.45
P8	321361.984	6217424.921	69.450	1.45
P9	321362.118	6217425.863	69.200	1.20
P10	321362.237	6217426.692	69.200	1.20

# WALL HEIGHT BASED ON INLET CONCRETE APRON LEVEL OF 68.0m RL

**LEGEND:**

- EXISTING CULVERT TO BE ABANDONED OR CAPPED
- EXISTING STORMWATER
- NEW STORMWATER PIPE
- EXISTING PIT
- EXISTING PIT
- NEW INLET/OUTLET STRUCTURE
- NEW DRAIN / SWALE

**NOTES:**

- FOR NOTES REFER TO DRAWING 520212TP\_AURC\_80232\_RW\_DRG\_00002.
- PIPES TO BE CONSTRUCTED IN ACCORDANCE WITH TNSW STANDARD DETAILS.
- EXISTING UTILITIES INFORMATION IS BASED ON A COMPILATION OF SURVEY DATA AND DBYD INFORMATION. ACTUAL LOCATION OF SERVICES AND IDENTITY OF PIT COVERS ARE TO BE CONFIRMED ON SITE.

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR REVIEW

<p>REFERENCES:</p> <table border="1"> <thead> <tr> <th>REV</th> <th>DESCRIPTION</th> <th>DESIGNER INITIAL/DATE</th> <th>VERIFIED INITIAL/DATE</th> <th>APPROVED INITIAL/DATE</th> </tr> </thead> <tbody> <tr> <td>C</td> <td>100% DETAIL DESIGN</td> <td>Y.C 27.04.23</td> <td>N.P 27.04.23</td> <td>M.A 27.04.23</td> </tr> <tr> <td>B</td> <td>100% DETAIL DESIGN</td> <td>Y.C 13.04.23</td> <td>N.P 13.04.23</td> <td>M.A 13.04.23</td> </tr> <tr> <td>A</td> <td>80% DETAIL DESIGN</td> <td>Y.C 01.02.23</td> <td>N.P 01.02.23</td> <td>M.A 01.02.23</td> </tr> </tbody> </table>	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	C	100% DETAIL DESIGN	Y.C 27.04.23	N.P 27.04.23	M.A 27.04.23	B	100% DETAIL DESIGN	Y.C 13.04.23	N.P 13.04.23	M.A 13.04.23	A	80% DETAIL DESIGN	Y.C 01.02.23	N.P 01.02.23	M.A 01.02.23	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p>SCALE: 1:250</p>	<p>CLIENT:</p> <p>Transport for NSW</p>	<p><i>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</i></p> <p>www.aurecongroup.com</p>	<p>HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232 ROAD REALIGNMENT STORMWATER DRAINAGE PLAN</p>
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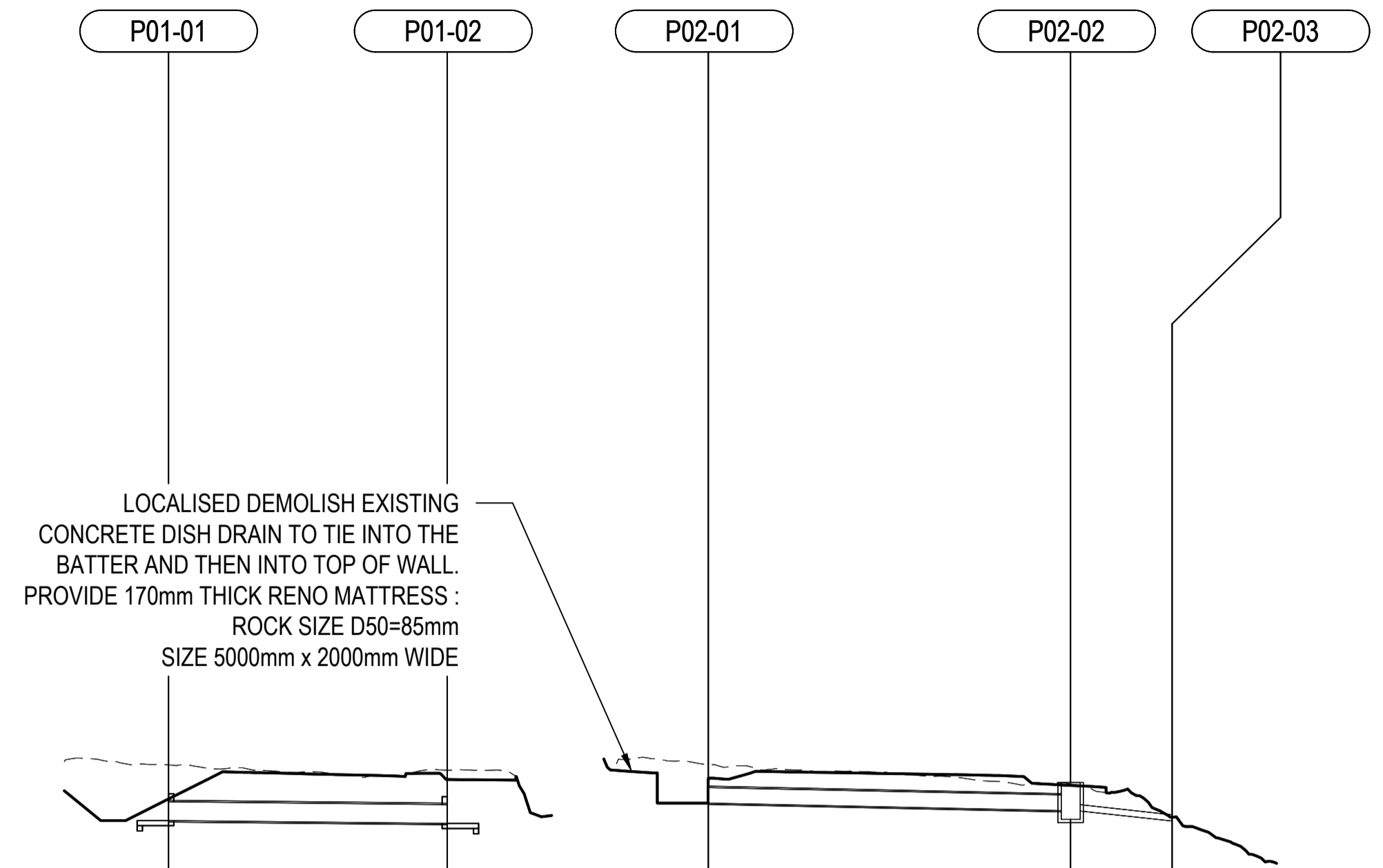
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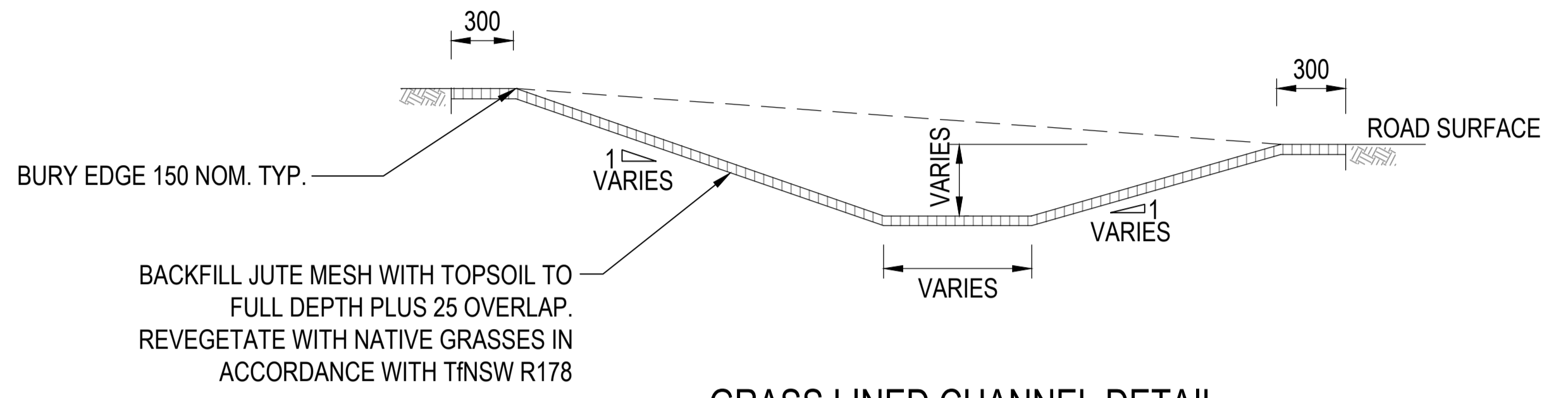


- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING 520212TP-AURC-80232-RW-DRG-000002.
  - CONCRETE SHALL BE IN ACCORDANCE WITH TNSW SPECIFICATION D&C D80 UNO. MINOR CONCRETE WORKS AND TNSW APPROVED PRECAST PITS MAY BE CONSTRUCTED IN ACCORDANCE WITH TNSW SPECIFICATION D&C R53 UNO.
  - CONCRETE WORKS FOR CHANNELS TO 40MPa MINIMUM. THE MINIMUM STRENGTH OF BUILDING OR MASS CONCRETE TO BE 20MPa.

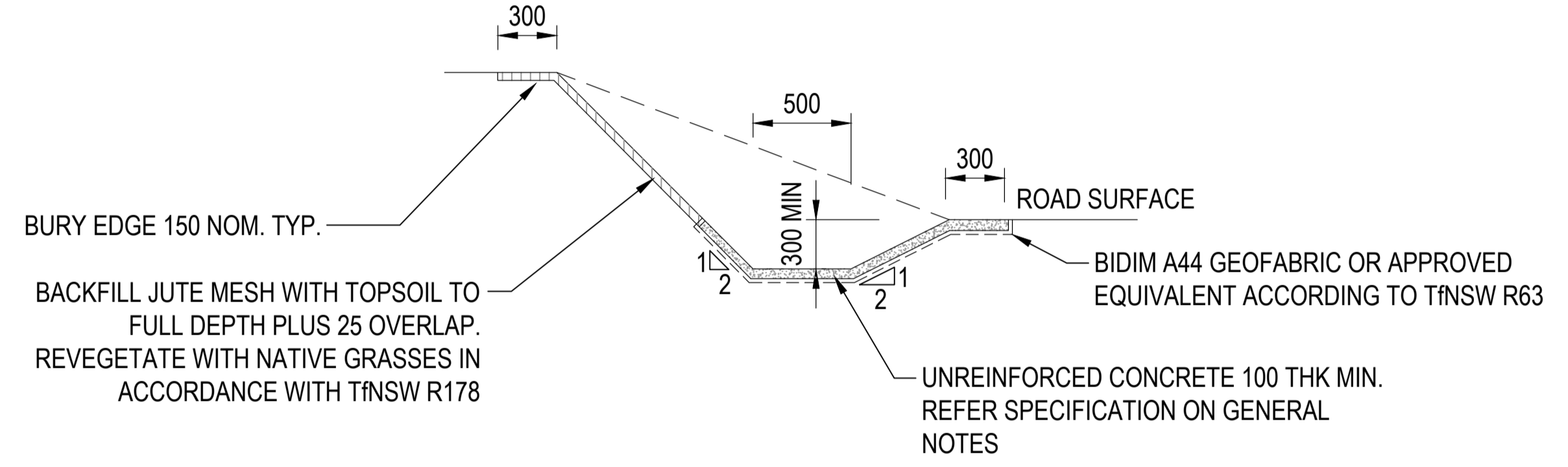


PIPE SIZE & CLASS	900 RCP CLASS 4	750 RCP CLASS 4	(2x)300 EXISTING
GRADE (%)	1.0%	2.1%	9.9%
DATUM R.L.	13.00	17.00	
DEPTH TO INVERT	0.900	0.750	0.300
INVERT LEVEL	63.170	67.642 67.226 67.626	1.358 1.774 1.374
FINISHED SURFACE	64.070	69.000	67.626 67.142
NATURAL SURFACE	65.836	68.921	67.329 67.442
CHAINAGE	0.00	17.36	22.23

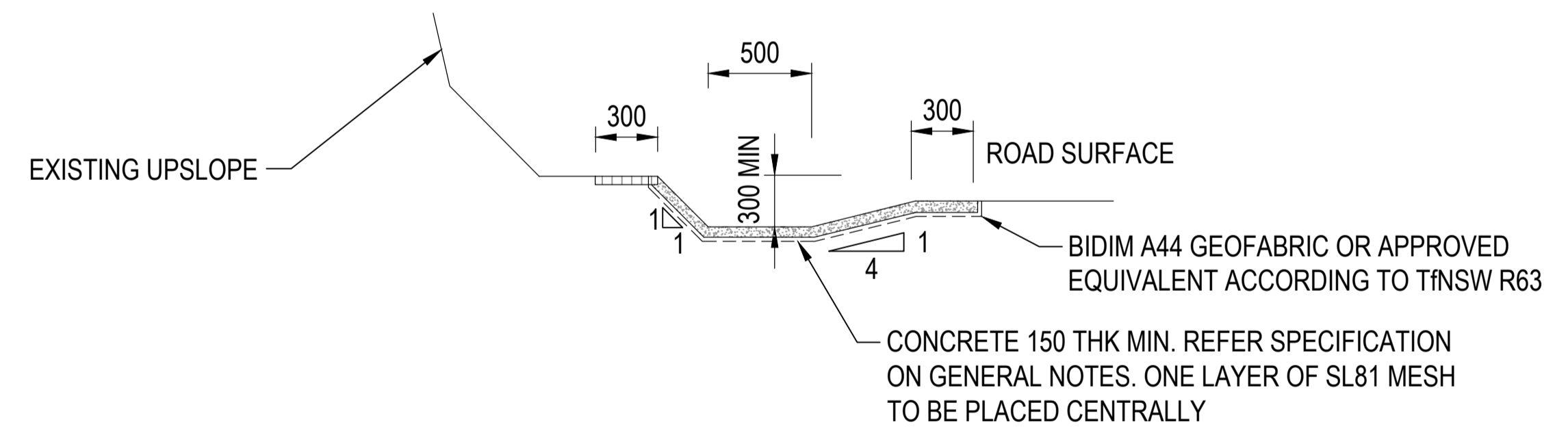
P01 P02



GRASS LINED CHANNEL DETAIL  
1:25



CONCRETE LINED CHANNEL DETAIL - TYPE 1  
1:25



CONCRETE LINED CHANNEL DETAIL - TYPE 2  
1:25

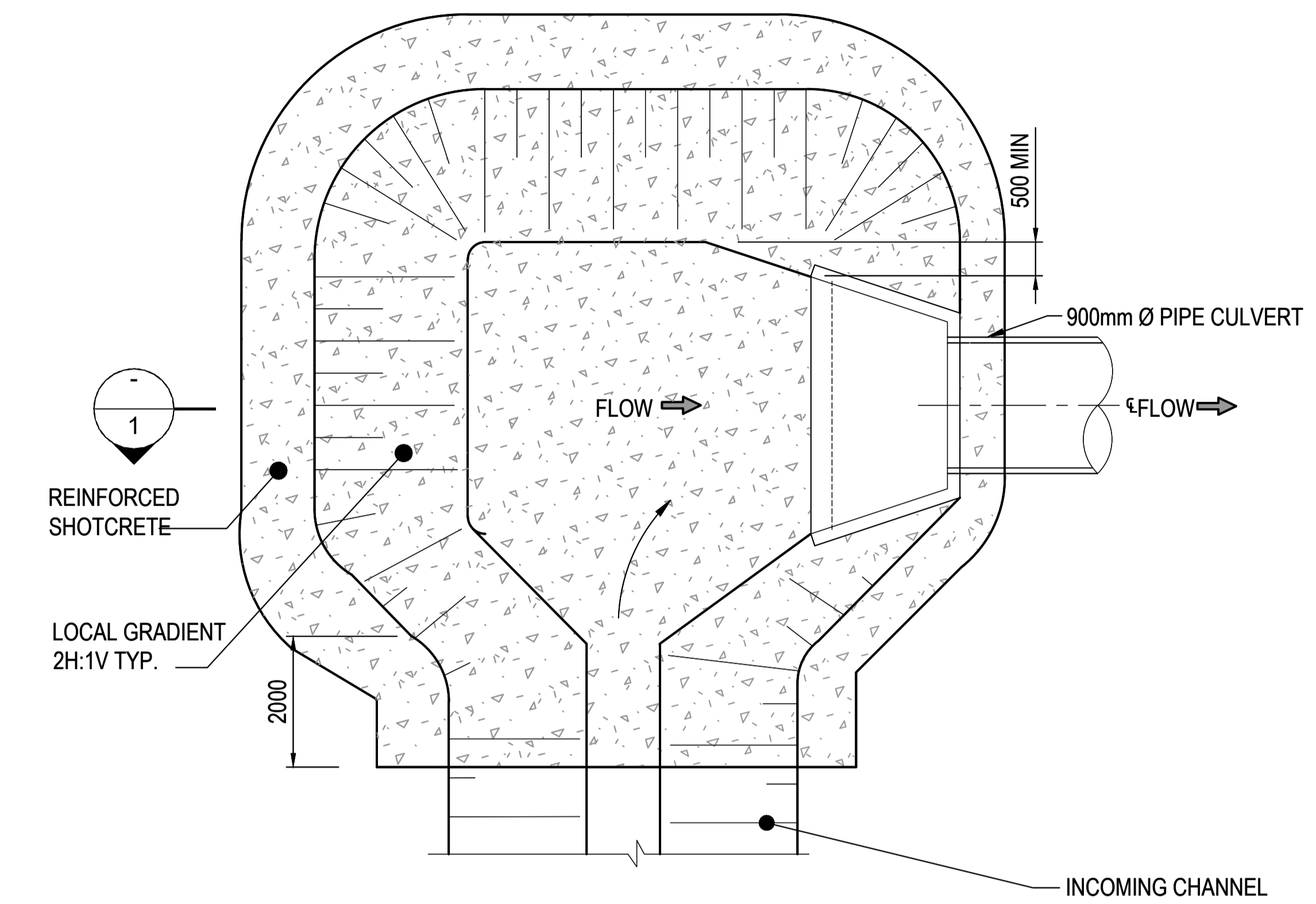
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FOR REVIEW

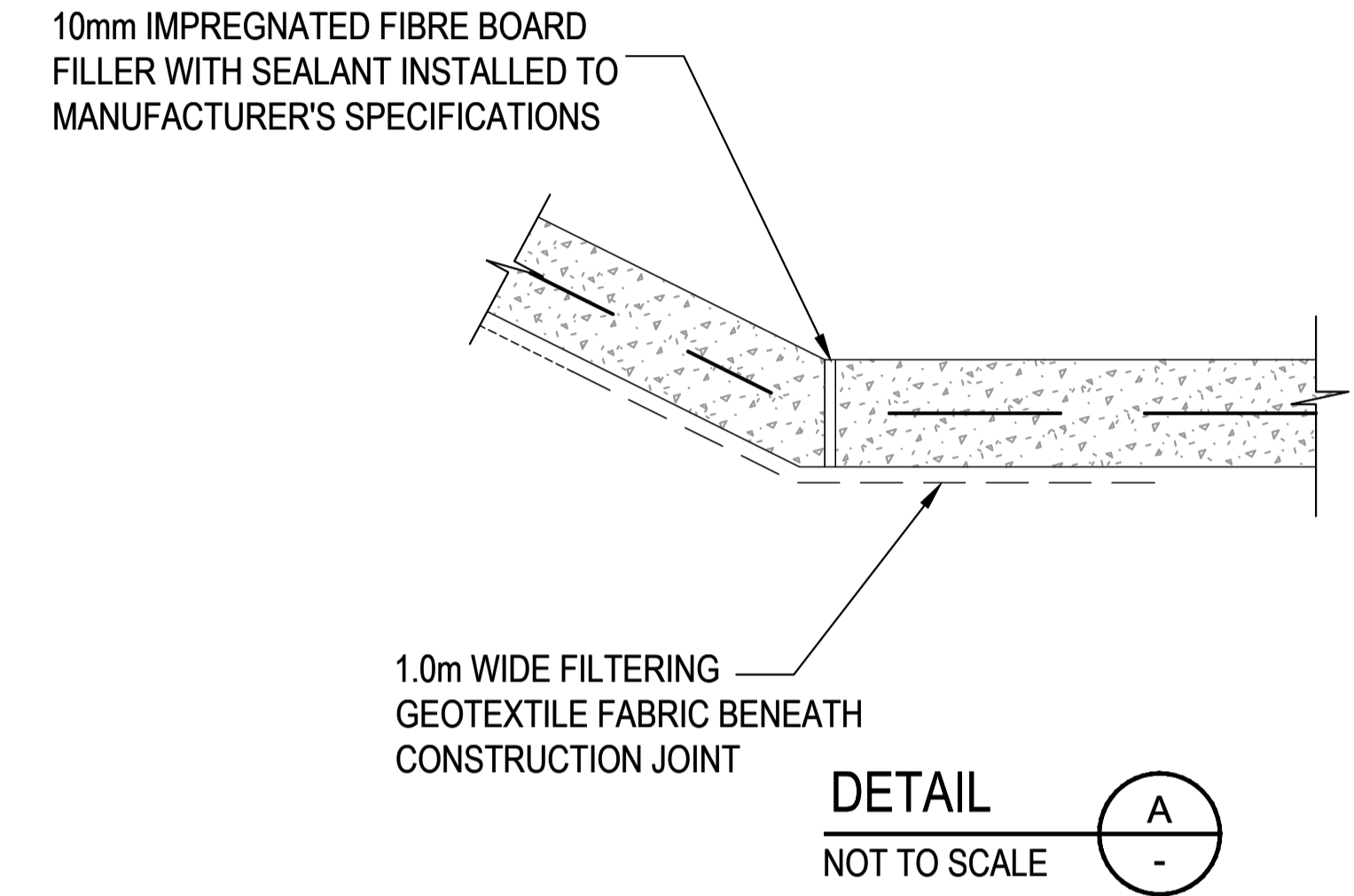
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<p>DRAWING SET No: 80232</p>		<p>PART: SHEET: 2 OF 5 A1</p>		<p>STATUS: FOR REVIEW</p>																					
<p>BRIDGE No:</p>		<p>REV C</p>		<p>EDMS No. 80232</p>																					
<p>AMD No.</p>		<p>520212TP-AURC-80232-RW-DRG-000041</p>		<p>©</p>																					

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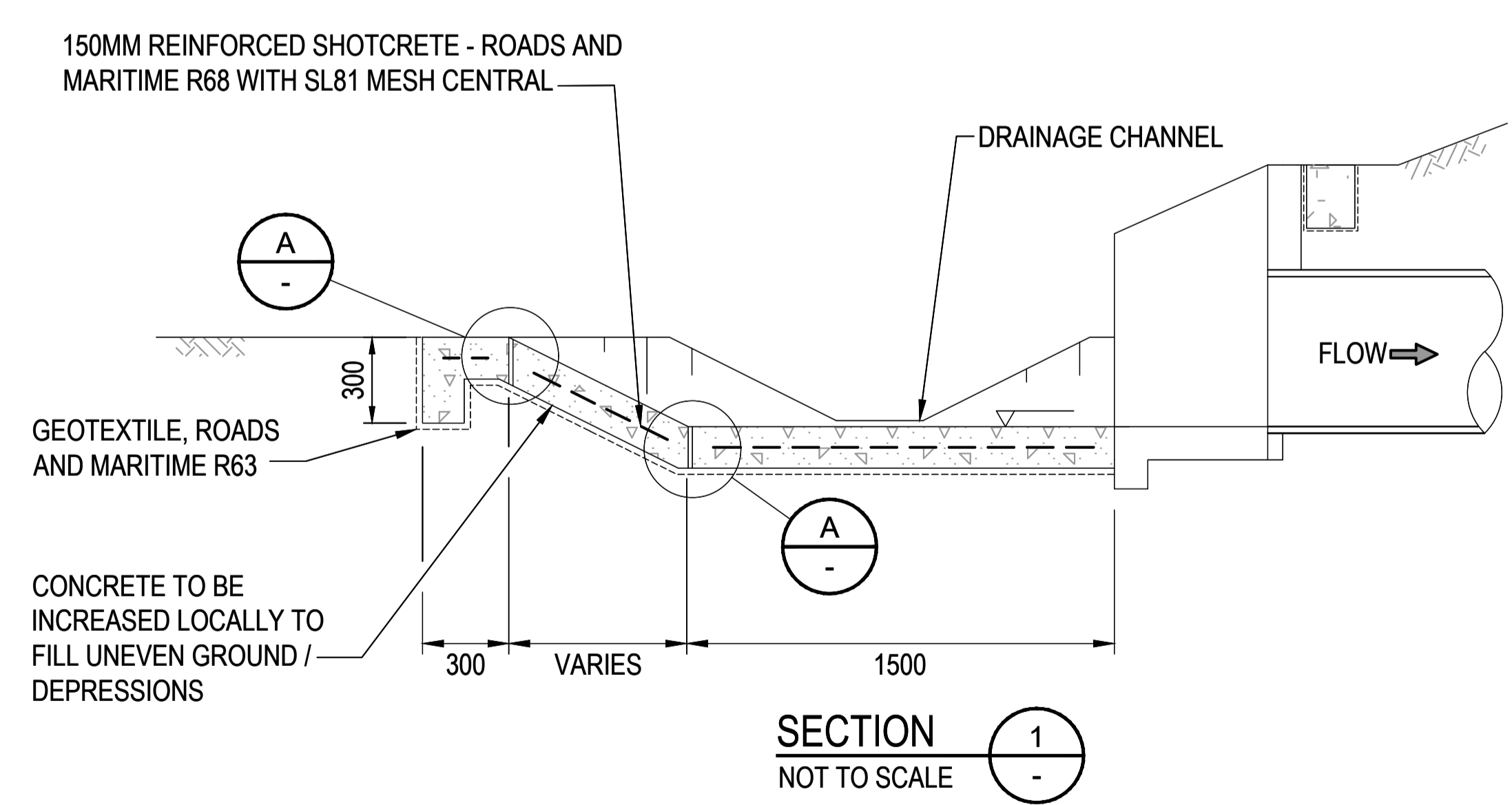
- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING 520212TP-AURC-80232-RW-DRG-000002.
  - EXTENT AND SLOPE OF APRON AND BENCHING TO BE ADJUSTED ON SITE TO SUIT CHANNEL DIMENSIONS AND LOCATION.
  - CONCRETE SHALL BE IN ACCORDANCE WITH TNSW SPECIFICATION D&C D80 UNO. MINOR CONCRETE WORKS AND TNSW APPROVED PRECAST PITS MAY BE CONSTRUCTED IN ACCORDANCE WITH TNSW SPECIFICATION D&C R53 UNO.
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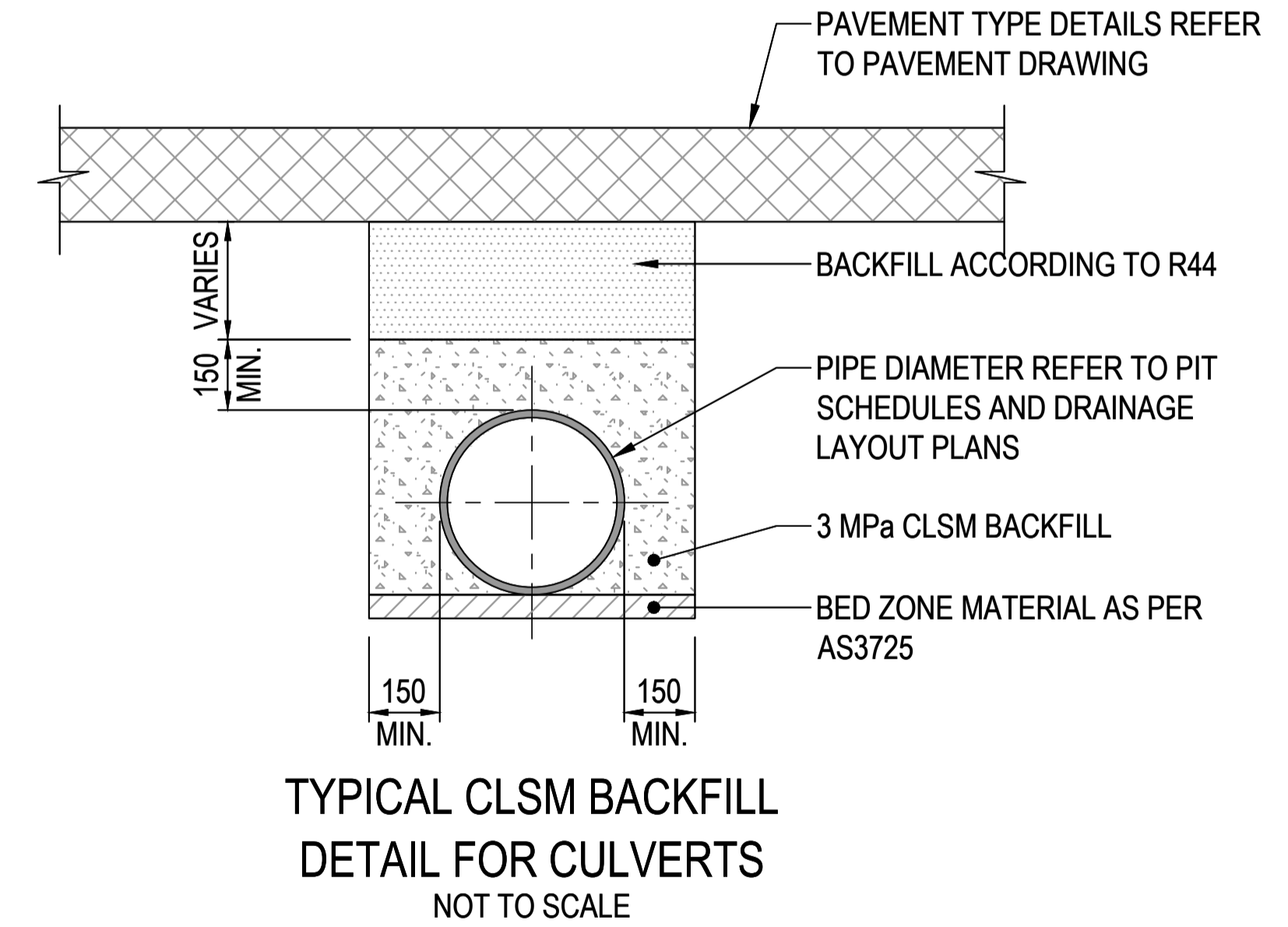
**900mm DIAMETER PIPE CULVERT  
INLET TREATMENT DETAIL  
PLAN  
NOT TO SCALE**



**DETAIL A  
NOT TO SCALE**







**SECTION 1  
NOT TO SCALE**



**TYPICAL CLSM BACKFILL  
DETAIL FOR CULVERTS  
NOT TO SCALE**

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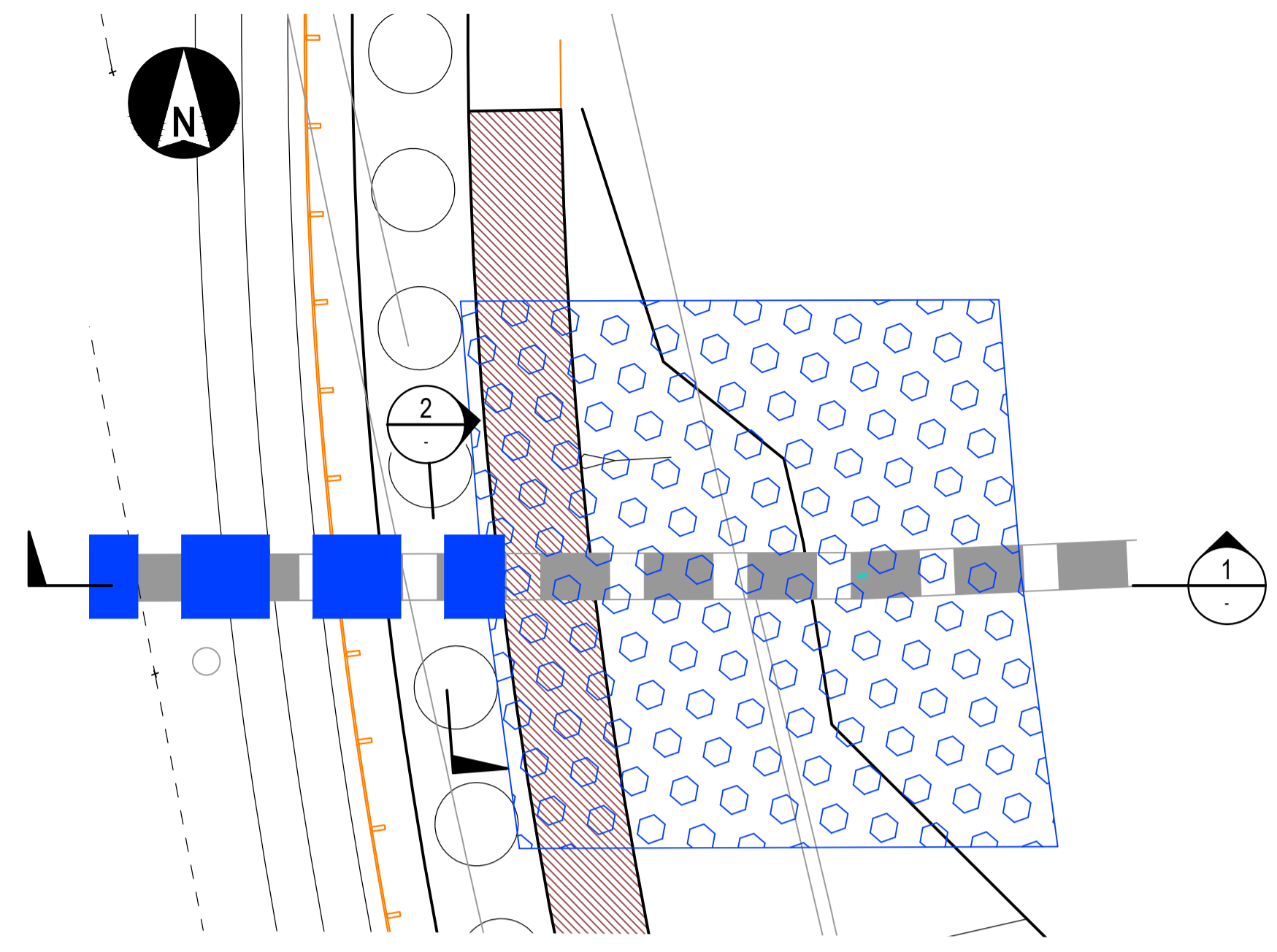
**FOR REVIEW**

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	<table border="1"> <tr> <th>REV</th> <th>DESCRIPTION</th> <th>DESIGNER INITIAL/DATE</th> <th>VERIFIED INITIAL/DATE</th> <th>APPROVED INITIAL/DATE</th> </tr> <tr> <td>C</td> <td>100% DETAIL DESIGN</td> <td>Y.C 27.04.23</td> <td>N.P 27.04.23</td> <td>M.A 27.04.23</td> </tr> <tr> <td>B</td> <td>100% DETAIL DESIGN</td> <td>Y.C 13.04.23</td> <td>N.P 13.04.23</td> <td>M.A 13.04.23</td> </tr> <tr> <td>A</td> <td>80% DETAIL DESIGN</td> <td>Y.C 01.02.23</td> <td>N.P 01.02.23</td> <td>M.A 01.02.23</td> </tr> </table>			REV	DESCRIPTION			DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	C	100% DETAIL DESIGN	Y.C 27.04.23	N.P 27.04.23	M.A 27.04.23	B	100% DETAIL DESIGN	Y.C 13.04.23	N.P 13.04.23	M.A 13.04.23	A	80% DETAIL DESIGN	Y.C 01.02.23	N.P 01.02.23	M.A 01.02.23	DRAWN _____ K.GREWAR _____ 27.04.2023 DESIGNED _____ A.CHEN _____ 27.04.2023 DRG CHECK _____ J.VD MERWE _____ 27.04.2023 DESIGN CHECK _____ Y.CHEN _____ 27.04.2023 PROJ/DES MNGR _____ V.TIET _____ 27.04.2023 APPROVED _____ M.ABERLINE _____ 27.04.2023			STATUS: FOR REVIEW			BRIDGE No: _____		
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COORDINATE SYSTEM: MGA_ZONE_56/GDA20			HEIGHT DATUM: AHD			DESIGN LOT CODE:			DRG No: 520212TP-AURC-80232-RW-DRG-000042																									
									REV C VER EDMS No. 80232 AMD No. _____																									

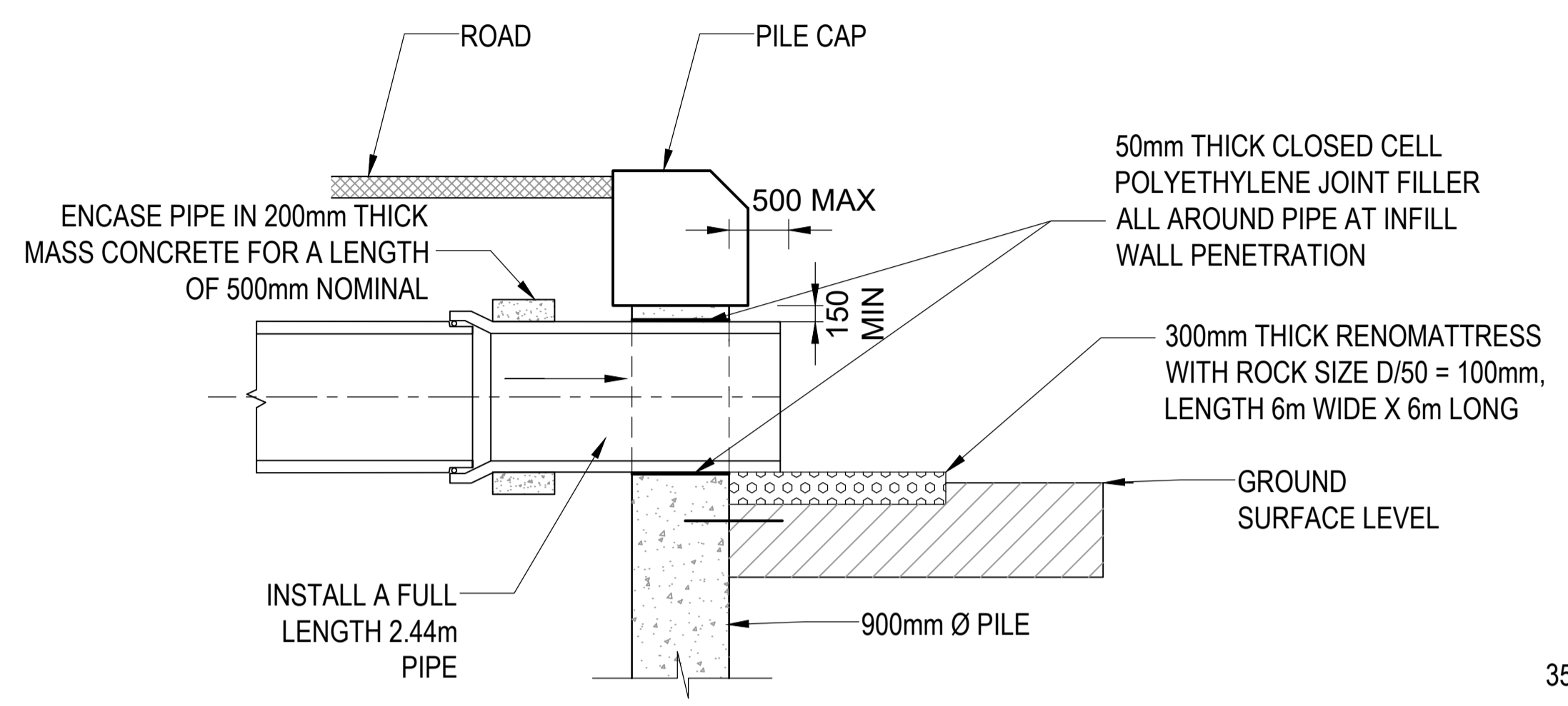
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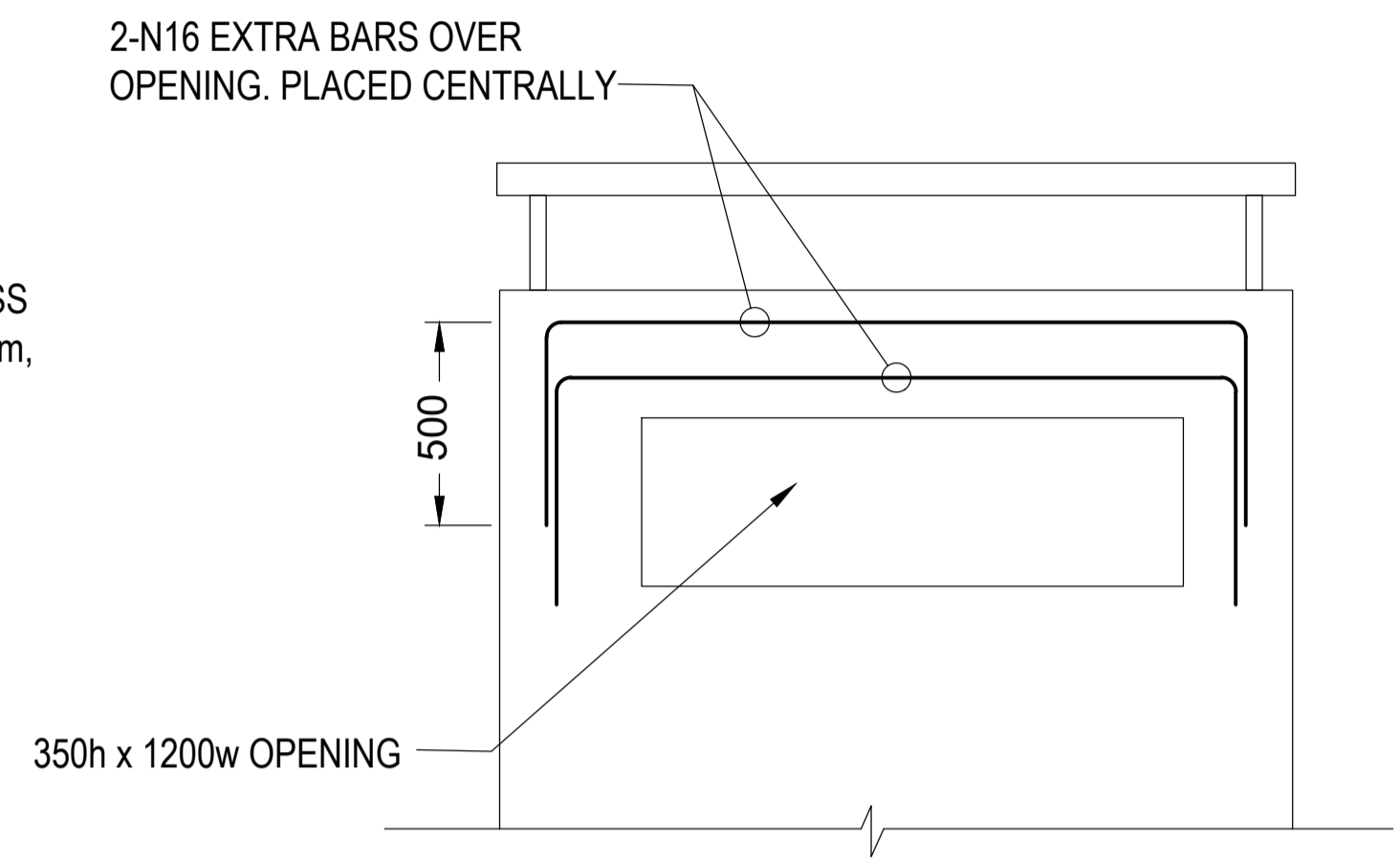
- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING 520212TP-AURC-80232-RW-DRG-000002.
  - EXTENT AND SLOPE OF APRON AND BENCHING TO BE ADJUSTED ON SITE TO SUIT CHANNEL DIMENSIONS AND LOCATION.
  - CONCRETE SHALL BE IN ACCORDANCE WITH TNSW SPECIFICATION D&C D80 UNO. MINOR CONCRETE WORKS AND TNSW APPROVED PRECAST PITS MAY BE CONSTRUCTED IN ACCORDANCE WITH TNSW SPECIFICATION D&C R53 UNO.
  - CONCRETE WORKS FOR CHANNELS TO 40MPa MINIMUM. THE MINIMUM STRENGTH OF BUILDING OR MASS CONCRETE TO BE 20MPa.



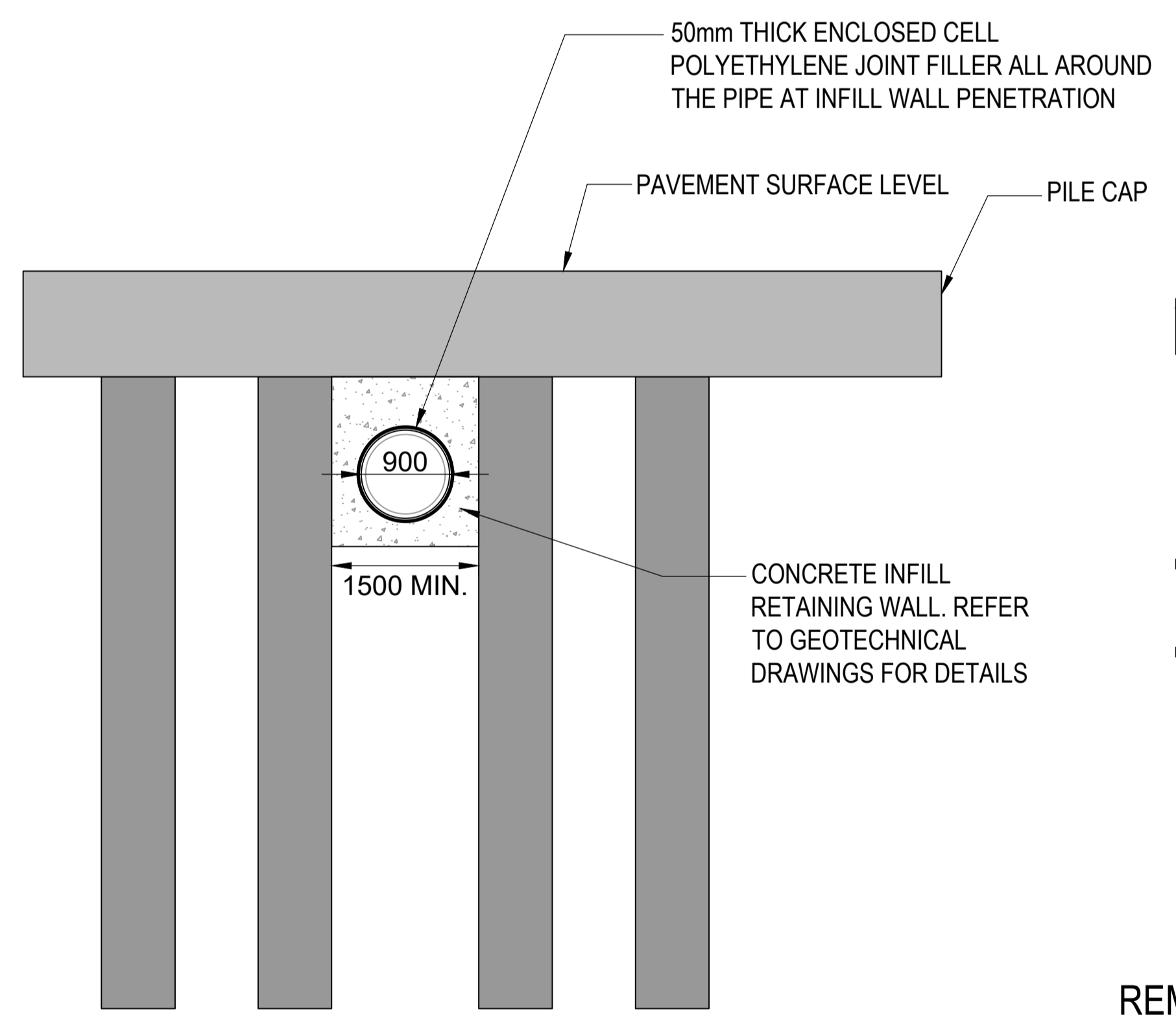
**TYPICAL PLAN  
ROCK APRON TO NATURAL CHANNEL**  
NOT TO SCALE



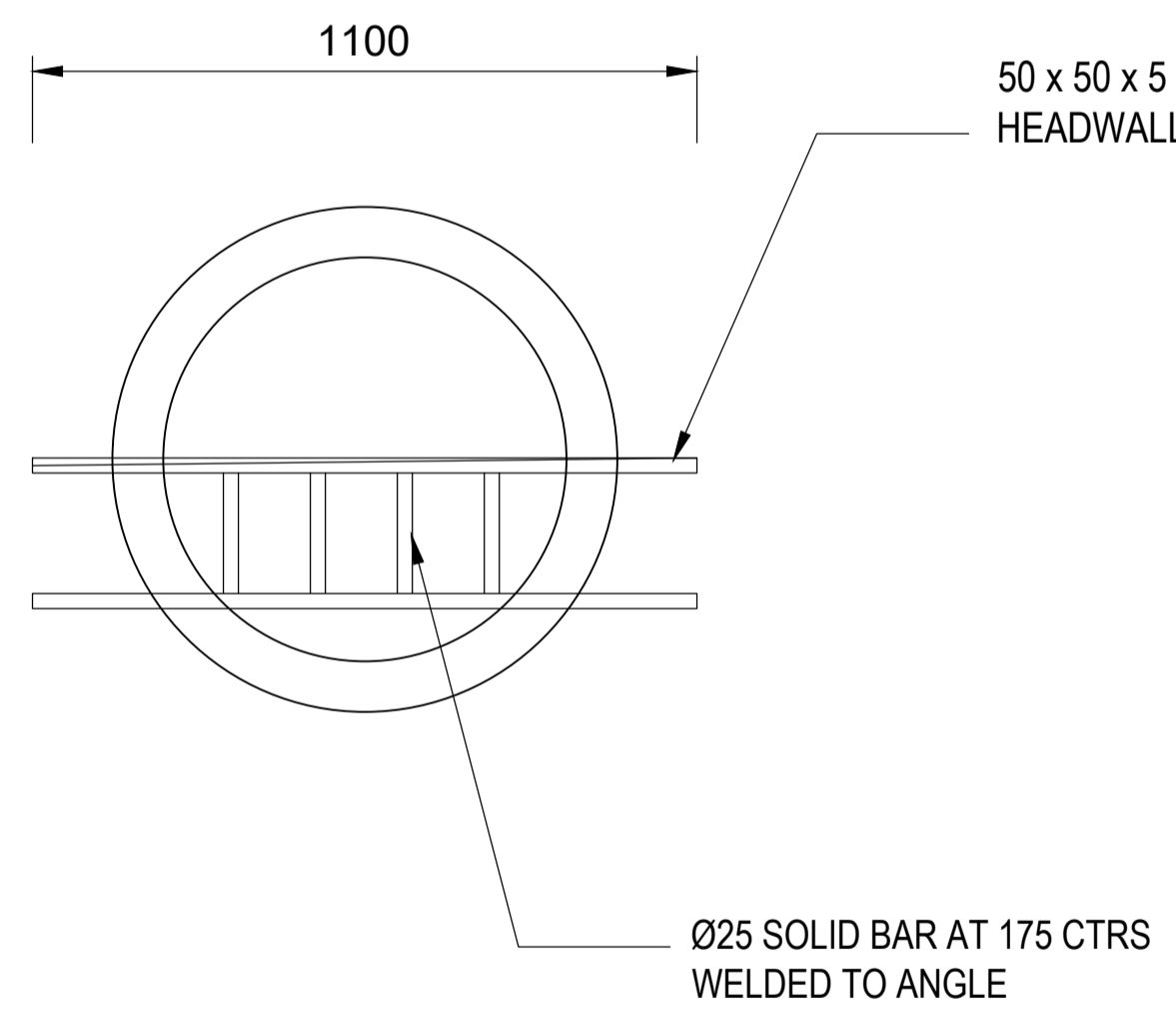
**SECTION 1**  
NOT TO SCALE



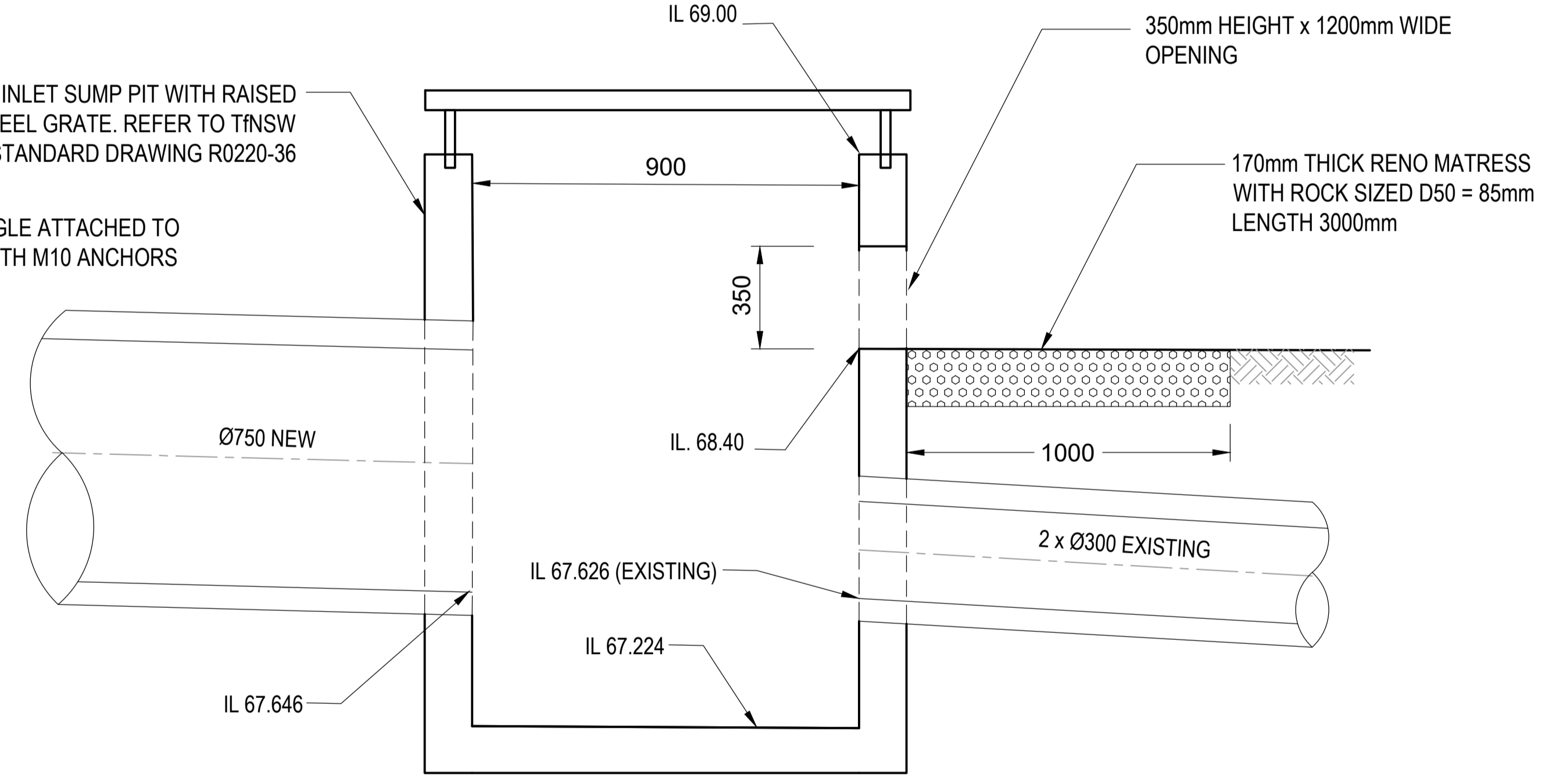
**VIEW 3**  
NOT TO SCALE



**SECTION 2**  
NOT TO SCALE



**REMOVABLE BLOCKAGE GRILL OVER PIPE (Ø750 PIPE)**  
1:50



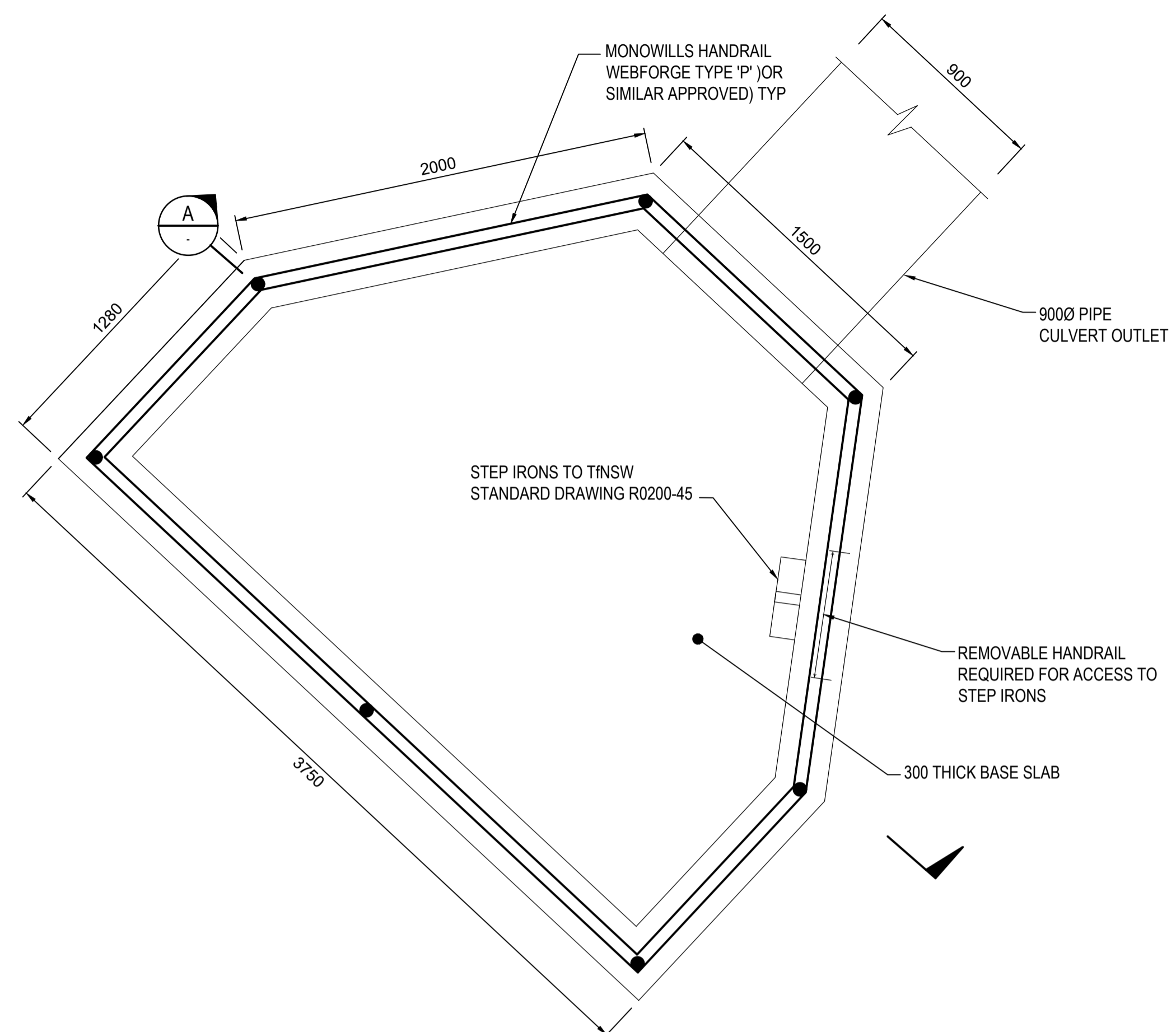
**1200mm x 900mm RAISED STEEL GRATE PIT WITH SIDE OPENING - PIT P02-02**  
1:50

**DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR**

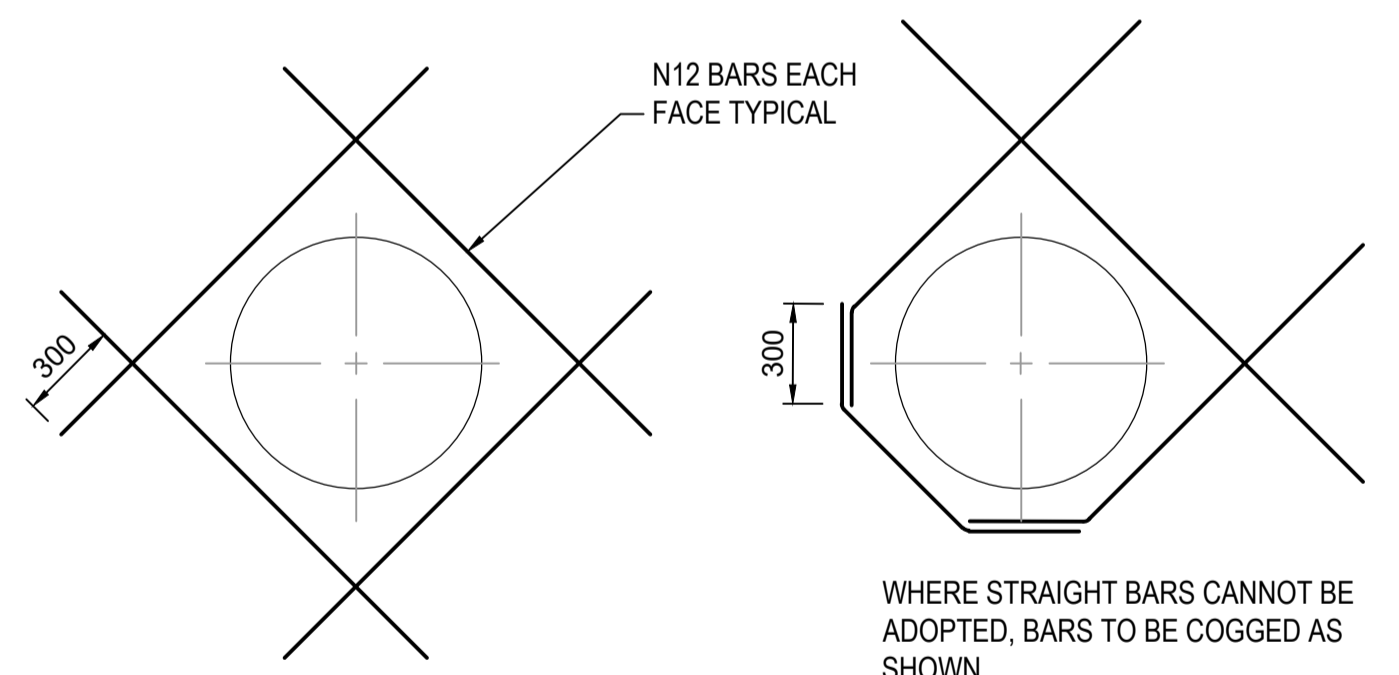
**FOR REVIEW**

<p><b>REFERENCES:</b></p> <table border="1"> <tr> <td>C</td> <td>100% DETAIL DESIGN</td> <td>Y.C 27.04.23</td> <td>N.P 27.04.23</td> <td>M.A 27.04.23</td> </tr> <tr> <td>B</td> <td>100% DETAIL DESIGN</td> <td>Y.C 13.04.23</td> <td>N.P 13.04.23</td> <td>M.A 13.04.23</td> </tr> <tr> <td>A</td> <td>80% DETAIL DESIGN</td> <td>Y.C 01.02.23</td> <td>N.P 01.02.23</td> <td>M.A 01.02.23</td> </tr> <tr> <th>REV</th> <th>DESCRIPTION</th> <th>DESIGNER INITIAL/DATE</th> <th>VERIFIED INITIAL/DATE</th> <th>APPROVED INITIAL/DATE</th> </tr> </table>	C	100% DETAIL DESIGN	Y.C 27.04.23	N.P 27.04.23	M.A 27.04.23	B	100% DETAIL DESIGN	Y.C 13.04.23	N.P 13.04.23	M.A 13.04.23	A	80% DETAIL DESIGN	Y.C 01.02.23	N.P 01.02.23	M.A 01.02.23	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p>SCALE: AS SHOWN</p>	<p>CLIENT:</p> <p>Transport for NSW</p>	<p><i>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.</i></p> <p><i>Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.</i></p>	<p>HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232 ROAD REALIGNMENT DRAINAGE DETAILS - SHEET 2</p>
	C	100% DETAIL DESIGN	Y.C 27.04.23	N.P 27.04.23	M.A 27.04.23																				
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<p>REV C</p>	<p>VER</p>	<p>EDMS No. 80232</p>	<p>AMD No.</p>	<p>PART: SHEET: 4 OF 5 A1 BRIDGE No: ©</p>																					
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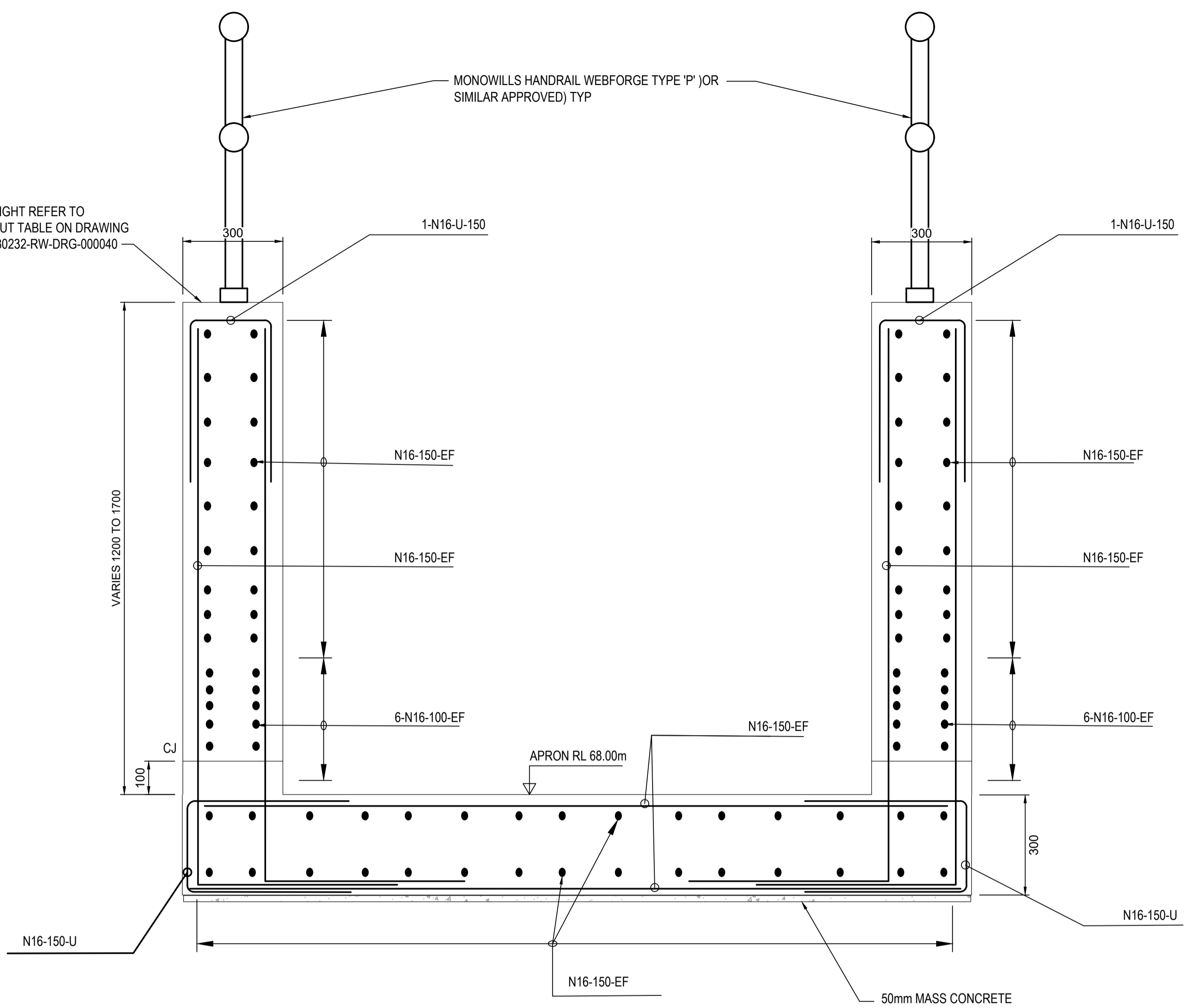




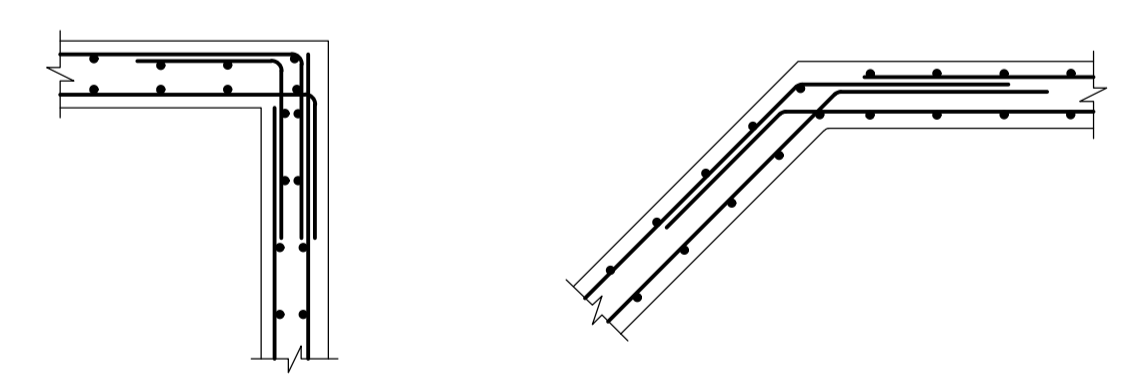
P02-01 HEADWALL DETAILS PLAN  
SCALE 1:10



TYPICAL PIPE PENETRATION DETAILS  
SCALE 1:10



SECTION A  
SCALE 1:25



PLAN - CORNER BAR TYPICAL DETAILS  
REINFORCEMENT SIZE AND SPACING TO BE AS SHOWN IN SECTION A

- NOTES:**
1. CONCRETE EXPOSURE CLASSIFICATION: B2.
  2. MINIMUM 28 DAY COMPRESSIVE STRENGTH OF ALL CONCRETE SHALL BE 40 MPa, UNLESS NOTED OTHERWISE.
  3. REQUIRED COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE SHALL BE 60mm, UNLESS SPECIFIED OTHERWISE.
  4. ALL REINFORCEMENT SHALL BE GRADE 500 MPa TO AS/NZS 4671 UNLESS SPECIFIED OTHERWISE.
  5. EDGES TO BE CHAMFERED 20 x 20 mm UNLESS SPECIFIED OTHERWISE.
  6. UNLESS SPECIFIED OTHERWISE THE MINIMUM DEVELOPMENT LENGTH SHALL BE AS FOLLOWS:

BAR SIZE	N12	N16
a) HORIZONTAL BARS WITH >300mm OF CONCRETE CAST BELOW BAR	450	600
b) OTHER BARS	350	500

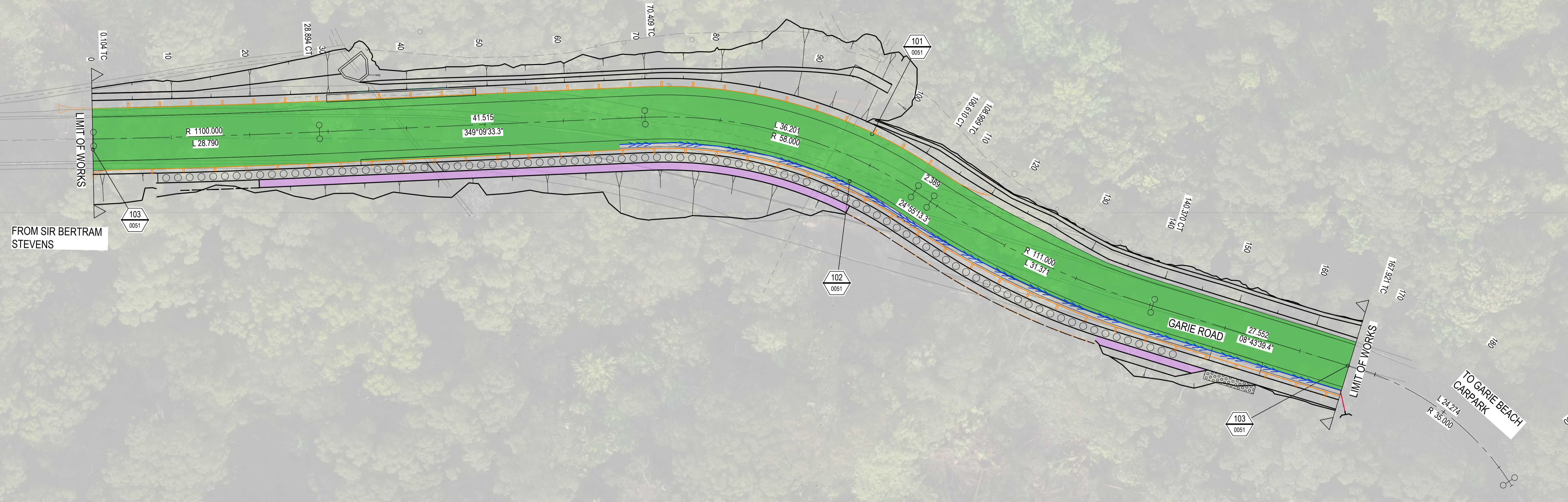
- CLEAR DISTANCE BETWEEN LAPPED BARS SHALL NOT EXCEED 3 x THE BAR DIAMETER.  
LENGTH OF LAP SPLICES SHALL BE 25% GREATER THAN DEVELOPMENT LENGTH.
7. REINFORCEMENT MAY DISPLACED SLIGHTLY WHERE NECESSARY TO CLEAR FORMED HOLES, HOLD DOWN BOLTS ASSEMBLIES AND STARTER BARS.
  8. TOP AND BOTTOM REINFORCEMENT MATS SHALL BE ALIGNED.
  9. MINIMUM COMPRESSIVE STRENGTH OF MASS CONCRETE SHALL BE 20MPa.

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FOR REVIEW

<p>REFERENCES:</p> <p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p> <p>SCALE: AS SHOWN</p> <p>CLIENT:</p> <p>PREPARED FOR:</p> <p>CONNECT SYDNEY</p>	<p>100% DETAIL DESIGN</p> <p>100% DETAIL DESIGN</p> <p>80% DETAIL DESIGN</p>	<p>Y.C 27.04.23</p> <p>Y.C 13.04.23</p> <p>Y.C 01.02.23</p>	<p>N.P 27.04.23</p> <p>N.P 13.04.23</p> <p>N.P 01.02.23</p>	<p>M.A 27.04.23</p> <p>M.A 13.04.23</p> <p>M.A 01.02.23</p>	<p>DESIGNER INITIAL/DATE</p> <p>VERIFIED INITIAL/DATE</p> <p>APPROVED INITIAL/DATE</p>	<p>DESIGN LOT CODE:</p>	<p>HARBOUR ZONE</p> <p>SRAPC SPECIAL PROJECTS</p> <p>GARIE ROAD</p> <p>SL80232</p> <p>ROAD REALIGNMENT</p> <p>DRAINAGE DETAILS - SHEET 3</p>	<p>DRAWING SET No: 80232</p> <p>STATUS: FOR REVIEW</p> <p>DRG No: 520212TP-AURC-80232-RW-DRG-000044</p>	<p>PART: SHEET: 5 OF 5</p> <p>BRIDGE No: 520212TP-AURC-80232-RW-DRG-000044</p> <p>EDMS No: 80232</p>	<p>A1</p> <p>©</p> <p>AMD No.</p>																							
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	<p>REVISIONS:</p> <table border="1"> <thead> <tr> <th>REV</th> <th>DESCRIPTION</th> <th>DESIGNER</th> <th>VERIFIED</th> <th>APPROVED</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>C</td> <td>100% DETAIL DESIGN</td> <td>Y.C</td> <td>N.P</td> <td>M.A</td> <td>27.04.23</td> </tr> <tr> <td>B</td> <td>100% DETAIL DESIGN</td> <td>Y.C</td> <td>N.P</td> <td>M.A</td> <td>13.04.23</td> </tr> <tr> <td>A</td> <td>80% DETAIL DESIGN</td> <td>Y.C</td> <td>N.P</td> <td>M.A</td> <td>01.02.23</td> </tr> </tbody> </table>										REV	DESCRIPTION	DESIGNER	VERIFIED	APPROVED	DATE	C	100% DETAIL DESIGN	Y.C	N.P	M.A	27.04.23	B	100% DETAIL DESIGN	Y.C	N.P	M.A	13.04.23	A	80% DETAIL DESIGN	Y.C	N.P	M.A
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A	80% DETAIL DESIGN	Y.C	N.P	M.A	01.02.23																												





**LEGEND**

- ROAD DESIGN
- EXISTING SURVEY
- PAVEMENT TYPE 1
- PAVEMENT TYPE 2
- CARRIER PIPE
- NO FINES CONCRETE PAD
- HEADWALL

**NOTES:**

1. FOR PAVEMENT TYPE DETAILS REFER TO DRAWING PV-0051.

**DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR**

**FOR REVIEW**

<p>REFERENCES:</p> <table border="1"> <tr> <th>REV</th> <th>DESCRIPTION</th> <th>DESIGNER INITIAL/DATE</th> <th>VERIFIED INITIAL/DATE</th> <th>APPROVED INITIAL/DATE</th> </tr> <tr> <td>C</td> <td>100% DETAIL DESIGN</td> <td>S.N 27.04.23</td> <td>J.VDM 27.04.23</td> <td>V.T 27.04.23</td> </tr> <tr> <td>B</td> <td>100% DETAIL DESIGN</td> <td>S.N 13.04.23</td> <td>J.VDM 13.04.23</td> <td>V.T 13.04.23</td> </tr> <tr> <td>A</td> <td>80% DETAIL DESIGN</td> <td>V.H 01.02.23</td> <td>M.T 01.02.23</td> <td>M.H 01.02.23</td> </tr> </table>	REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE	C	100% DETAIL DESIGN	S.N 27.04.23	J.VDM 27.04.23	V.T 27.04.23	B	100% DETAIL DESIGN	S.N 13.04.23	J.VDM 13.04.23	V.T 13.04.23	A	80% DETAIL DESIGN	V.H 01.02.23	M.T 01.02.23	M.H 01.02.23	<p>THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.</p>	<p>SCALE: 1:250</p>	<p>CLIENT:</p>	<p><i>This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.</i></p>	<p>HARBOUR ZONE SRAPC SPECIAL PROJECTS GARIE ROAD SL80232</p>
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<p>COORDINATE SYSTEM: MGA_ZONE_56/GDA20</p>	<p>HEIGHT DATUM: AHD</p>	<p>DESIGN LOT CODE:</p>	<p>PREPARED FOR:</p>	<p>www.aurecongroup.com</p>	<p>ROAD REALIGNMENT PAVEMENT PLAN</p>																				
<p>DRAWN _____ K.GREWAR _____ 27.04.2023</p> <p>DESIGNED _____ S.KENTHESWARAN _____ 27.04.2023</p> <p>DRG CHECK _____ S.NGUYEN _____ 27.04.2023</p> <p>DESIGN CHECK _____ M.HENAWAY _____ 27.04.2023</p> <p>PROJ/DES MNGR _____ V.TIET _____ 27.04.2023</p> <p>APPROVED _____ M.ABERLINE _____ 27.04.2023</p>	<p>DRAWING SET No: 80232</p>	<p>STATUS: FOR REVIEW</p>	<p>DRG No: 520212TP-AURC-80232-RW-DRG-000050</p>	<p>PART: SHEET: 1 OF 2 A1</p>	<p>BRIDGE No: _____</p>																				
<p>EDMS No. 80232</p>	<p>REV C</p>	<p>VER</p>	<p>AMD No.</p>	<p>©</p>	<p>FILE NAME: 520212TP-AURC-80232-RW-DRG-000050.dwg</p>																				

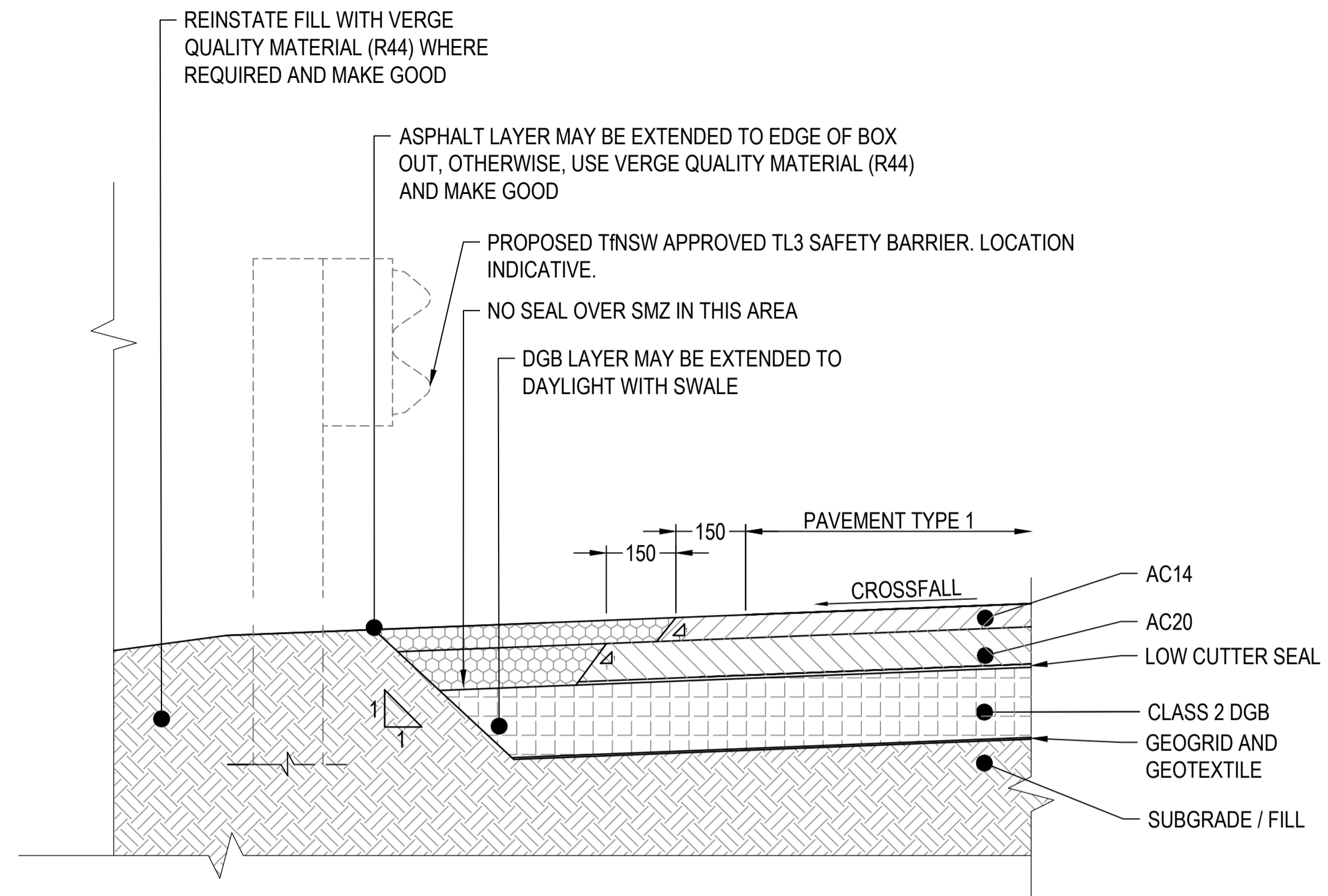
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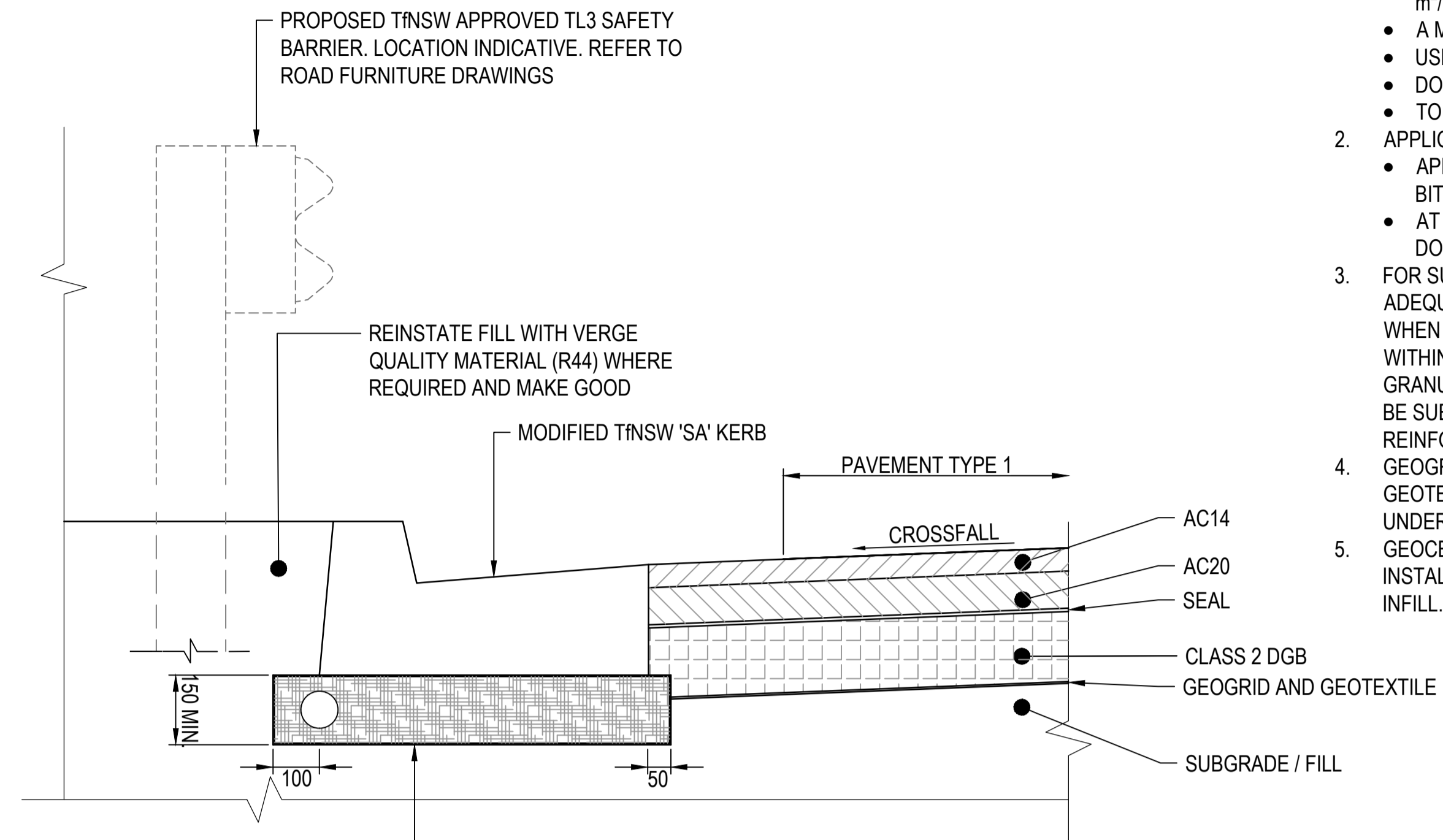


**NOTES**

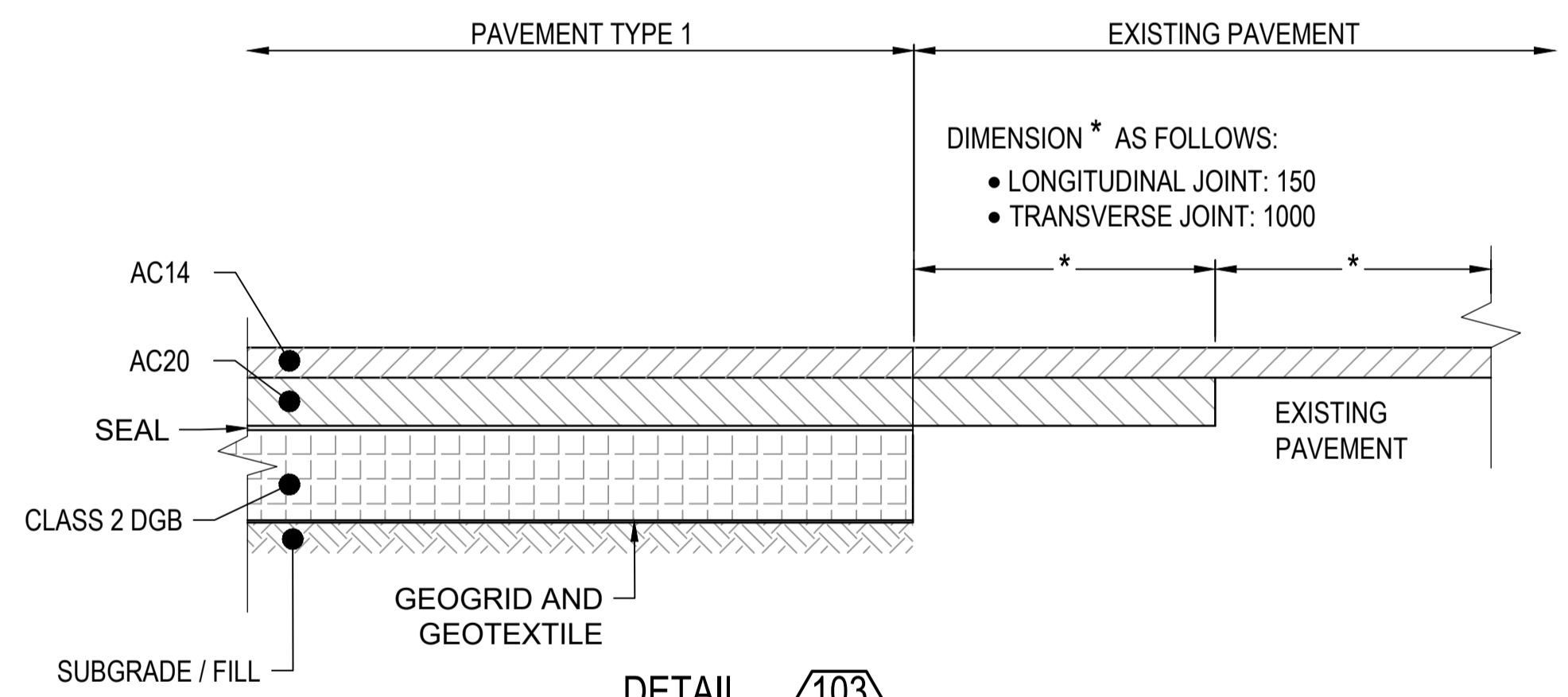
- THE APPLICATIONS OF A LOW CUTTER SEAL IS AS FOLLOWS:
  - AGGREGATE SPREAD RATE FOR 7mm AGGREGATE IS BETWEEN 200 - 230 m<sup>2</sup>/m<sup>3</sup>.
  - A MAXIMUM OF 2% CUTTER OIL MAY BE USED.
  - USE 1% ADHESION AGENT.
  - DOUBLE THE AMOUNT OF ROLLING FOR A SPRAYED SEAL.
  - TO BE PLACED IN ACCORDANCE WITH TNSW R106.
- APPLICATION OF TACKCOAT IS AS FOLLOWS
  - APPLICATION RATE OF BETWEEN 0.15L/m<sup>2</sup> AND 0.30L/m<sup>2</sup> OF RESIDUAL BITUMEN.
  - AT VERTICAL FACES AT JOINTS, THE APPLICATION RATES MUST BE DOUBLED THE ABOVE POINT.
- FOR SUBGRADE, COMPACT WITH STATIC ROLLER (8 TONNE MIN.) TO ACHIEVE ADEQUATE COMPACTION TO PERFORMANCE CRITERIA OF NO DEFORMATION WHEN PROOF ROLLED. PROOF ROLL MUST BE UNDERTAKEN AT A SPEED WITHIN THE RANGE OF 3-10KM/H OVER THE FULL AREA OF EXPOSED GRANULAR SUBGRADE. THE RECOMMENDED COMPACTION EQUIPMENT WILL BE SUBJECT TO CHANGE PENDING FINAL CONFIRMATION OF SIZE/CLASS OF REINFORCED CONCRETE PIPES.
- GEOGRID (TENSAR TX160 OR SIMILAR APPROVED) LAMINATED WITH GEOTEXTILE, SHALL BE PLACED IN ACCORDANCE WITH TNSW R63 AT THE UNDERSIDE OF CLASS 2 DGB LAYER.
- GEOCELL TO BE FILLED WITH CLASS 2 DGB. REFER TO MANUFACTURER'S INSTALLATION MANUAL FOR PLACEMENT AND COMPACTION OF GEOCELL INFILL.



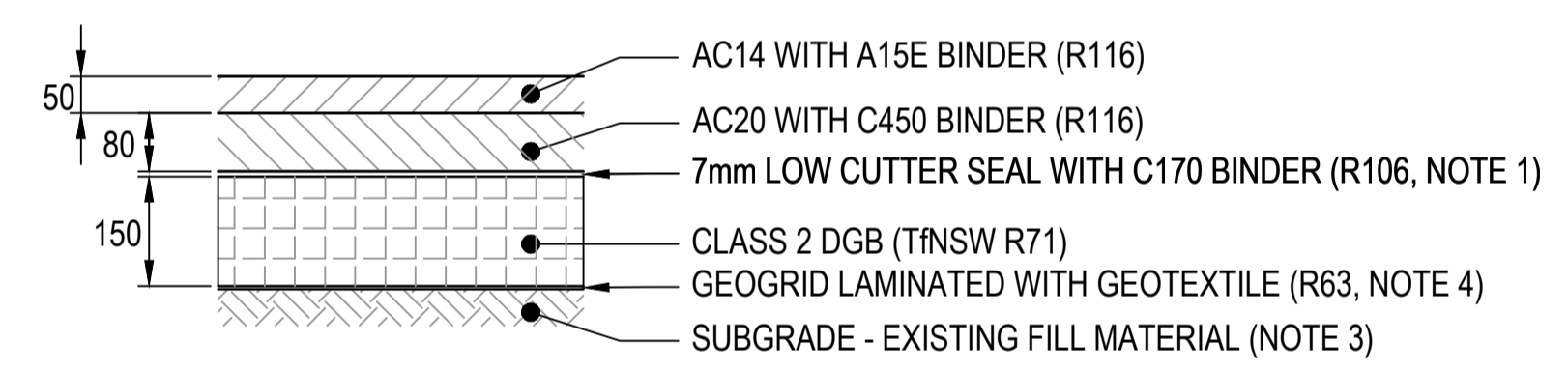
**DETAIL 101**  
PAVEMENT EDGE DETAIL WITH W-BEAM  
SCALE 1:10



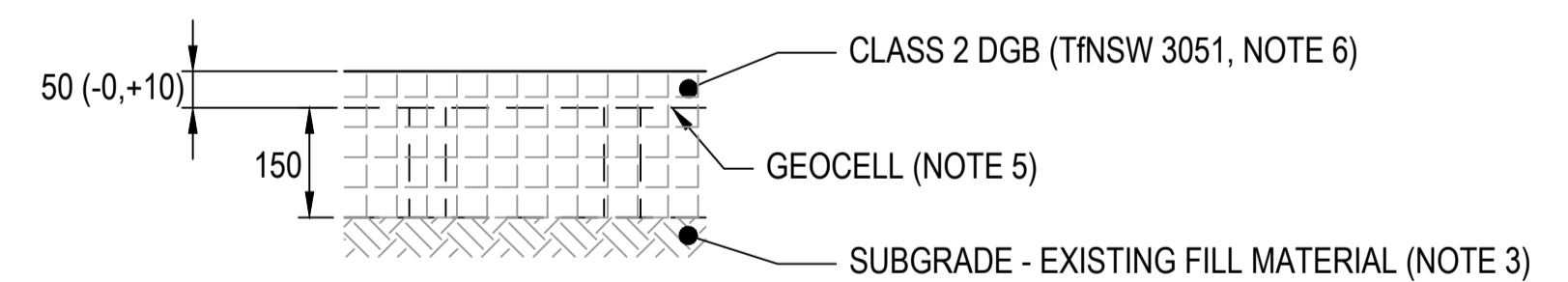
**DETAIL 102**  
PAVEMENT EDGE DETAIL WITH SO KERB AND W-BEAM  
SCALE 1:10



**DETAIL 103**  
PAVEMENT INTERFACE DETAIL EXISTING PAVEMENT TO PAVEMENT TYPE 1  
SCALE 1:10



**PAVEMENT TYPE 1**  
ASPHALT ON GRANULAR BASE



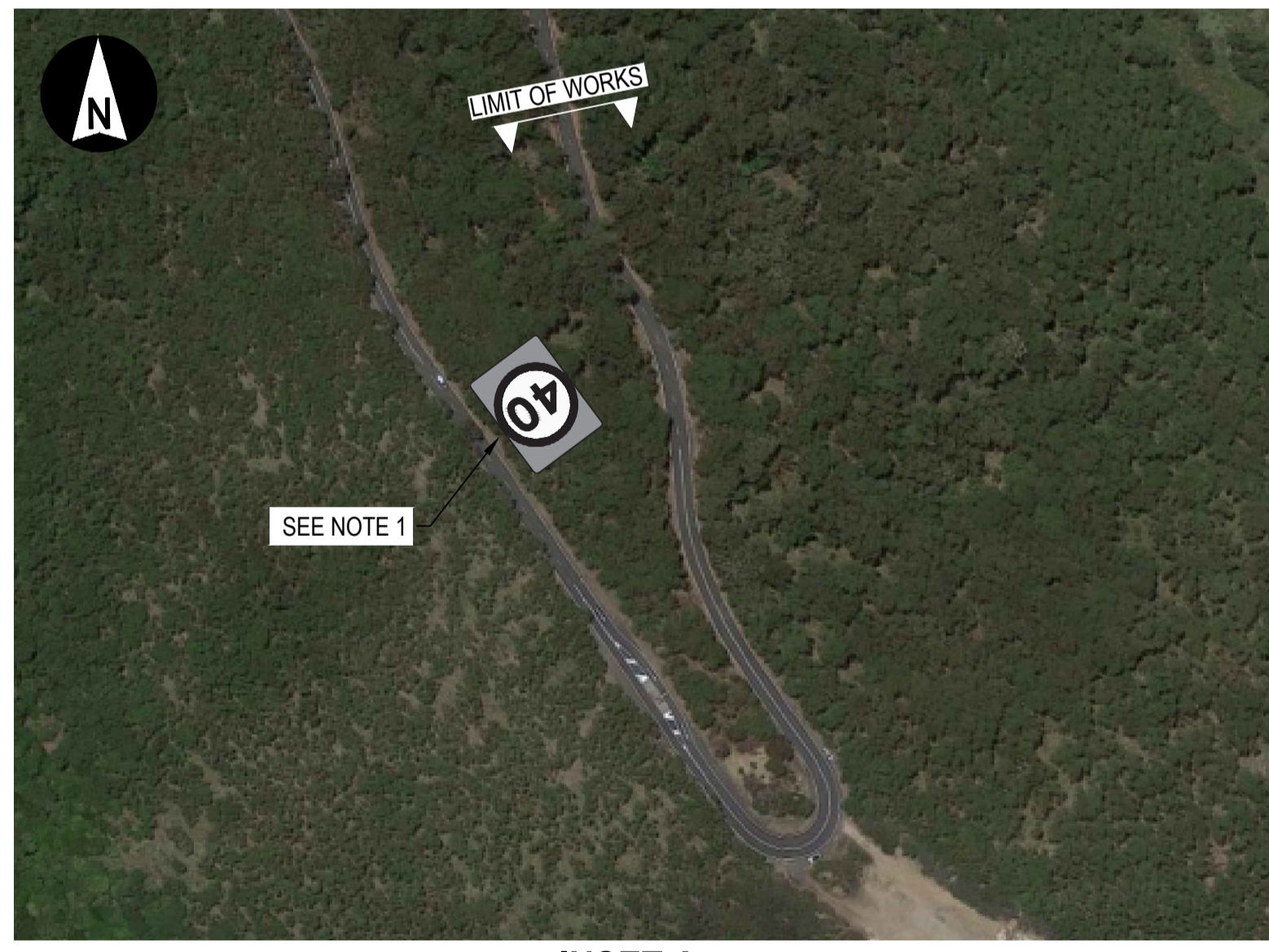
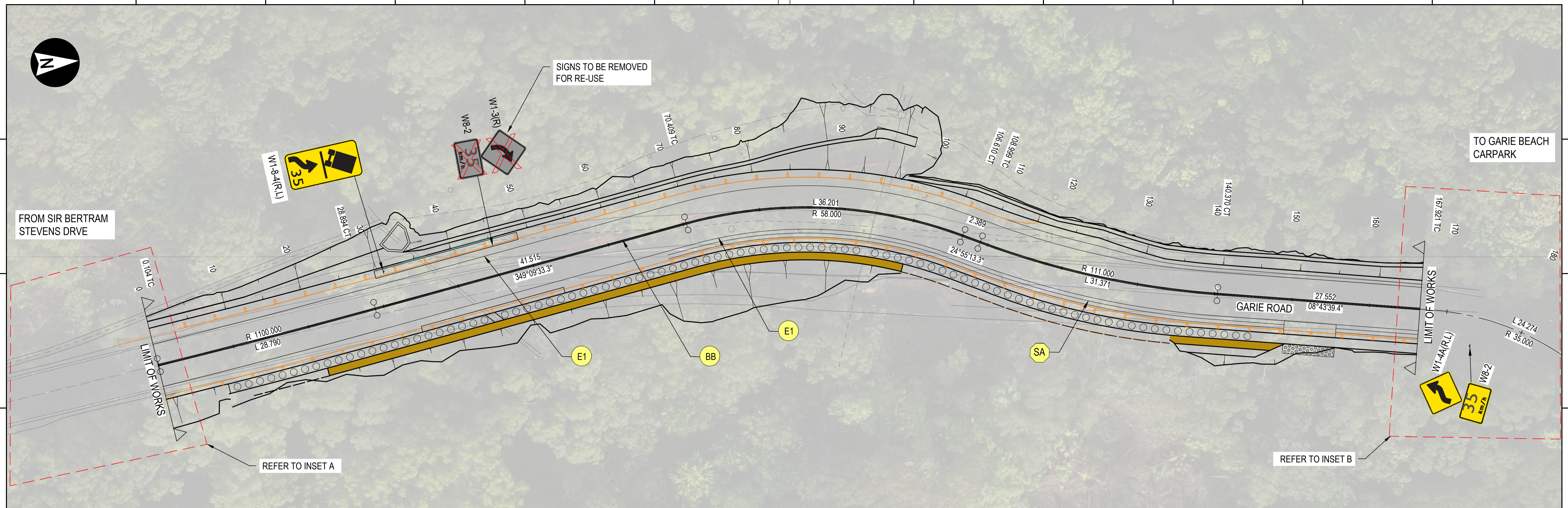
**PAVEMENT TYPE 2**  
MAINTENANCE FOOTPATH WITH GEOCELL

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	<table border="1"> <tr> <td>C</td> <td>100% DETAIL DESIGN</td> <td>S.N 27.04.23</td> <td>J.VDM 27.04.23</td> <td>V.T 27.04.23</td> </tr> <tr> <td>B</td> <td>100% DETAIL DESIGN</td> <td>S.N 13.04.23</td> <td>J.VDM 13.04.23</td> <td>V.T 13.04.23</td> </tr> <tr> <td>A</td> <td>80% DETAIL DESIGN</td> <td>V.H 01.02.23</td> <td>M.T 01.02.23</td> <td>M.H 01.02.23</td> </tr> </table>			C				100% DETAIL DESIGN	S.N 27.04.23	J.VDM 27.04.23	V.T 27.04.23	B	100% DETAIL DESIGN	S.N 13.04.23	J.VDM 13.04.23	V.T 13.04.23	A	80% DETAIL DESIGN	V.H 01.02.23	M.T 01.02.23	M.H 01.02.23		DRAWN _____ K.GREWAR _____ 27.04.2023 DESIGNED _____ S.KENTHESWARAN _____ 27.04.2023 DRG CHECK _____ S.NGUYEN _____ 27.04.2023 DESIGN CHECK _____ M.HENAWAY _____ 27.04.2023 PROJ/DES MNGR _____ V.TIET _____ 27.04.2023 APPROVED _____ M.ABERLINE _____ 27.04.2023	DRAWING SET No: 80232 STATUS: FOR REVIEW DRG No: 520212TP-AURC-80232-RW-DRG-000051
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COORDINATE SYSTEM: MGA_ZONE_56/GDA20 HEIGHT DATUM: AHD			DESIGN LOT CODE:	PART: SHEET: 2 OF 2 A1 BRIDGE No: _____ REV C VER EDMS No. 80232 AMD No. _____																				





**INSET A**  
NTS



**INSET B**  
NTS

**LEGEND**

- NEW SIGN POST
- E1 LINE MARKING TYPE
- SA KERB TYPE
- PROPOSED SIGN
- EXISTING SIGNAGE ( TO BE RETAINED)
- EXISTING SIGNAGE ( TO BE REMOVED)

**NOTES:**

1. EXISTING R4-1A 40km/h SPEED LIMIT SIGN APPROXIMATELY 500m FROM LIMIT OF WORKS.
2. REPLACE EXISTING R4-1A 60km/h SPEED LIMIT SIGN WITH NEW R4-1A 40km/h SPEED LIMIT SIGN APPROXIMATELY 550m FROM LIMIT OF WORKS.

**FOR REVIEW**

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Safe Design Risk Register – SL80232 Garie Road Landslide Remediation

NOTES  
REFER NOTES ON DRAWING RW-000081

IDENTIFY SAFE DESIGN RISK				ANALYSE SAFE DESIGN RISK - CURRENT EXPOSURE					IMPLEMENT SAFE DESIGN RISK TREATMENT		
ID	Risk Title	Event / Cause / Consequence	Persons Affected	Consequence Inherent	(Risk Treatment) Current Control Measures	Consequence	Likelihood	Risk Level	Risk Owner	Evaluation	(Risk Treatment) Action Summary
<b>Design and Pre-construction Phase</b>											
1.1	Below and above ground services	Clashes and/or damage due to incorrectly identified services leading to loss of service, injury or death.	Contractor Workers Client	Catastrophic A - C	There are no known services in the vicinity of the Works, based on Dial Before you Dig desktop information, other than the culverts shown on the Drawings.	A - Catastrophic	1 - Rare	High	Contractor / Designer / Client	Tolerable	Contractor must complete their own due diligence on buried and overhead services and service clearance during the Works. Standover from utility owners as necessary. Any in ground services in the Works area will need to be removed or protected prior to commencing.
<b>Construction Phase</b>											
2.1	Work in or near an active road corridor.	Workers and/or plant being hit by traffic leading to loss of service, injury or death. Conversely traffic being hit by plant or equipment associated with the Works.	Workers Contractor Traffic Pedestrians	Catastrophic A - C	Garie Rd is currently closed due to the embankment slip so no active road corridor traffic will be expected during the Works.  In the event that the road is reopened during partial completion of the Works, the selected Contractor should have experience working under such conditions and shall have the appropriate safety protocols in place	A - Catastrophic	2 - Unlikely	Critical	Contractor	Tolerable	Traffic management to be implemented as required if the road is reopened during partial completion of the Works.
2.2	Vibration	Vibration caused from the Works adversely affecting existing infrastructure and/or causing ground instability e.g. large vibration could reactivate the landslide.	Contractor Traffic	Moderate C - G	Contractor to prepare vibration management plan within the Works Methodology Statement prior to Works commencing. Vibration monitoring to be undertaken if deemed necessary.	D - Minor	2 - Unlikely	Low	Contractor	Tolerable	No existing infrastructure that is sensitive to vibration is expected, however the Contractor shall undertake their own assessment and confirm prior to the commencement of the Works.
2.3	Rockfall, ground instability	Machinery or plant become unstable due to landslide movement, particularly piling activities as Garie Road is an active, slow creeping landslide. Movement typically increases in association with heavy rainfall and movement to date has been relatively slow.	Contractor Workers	Catastrophic A - C	Particularly hazardous areas to be identified in the Design Documentation. Scaling and rockface excavation Works sequencing should be undertaken starting from the top of the slope and working downwards. Works should be undertaken during dry weather only.  Contractor to confirm suitability of the work area to facilitate necessary equipment to construct the Works.  A survey monitoring network of existing slip scarp shall be established and monitored both prior to reinstatement of the slip, and reinstated and monitored thereafter.	A - Catastrophic	2 - Unlikely	Critical	Contractor	Tolerable	The Contractor should complete site specific risk assessment and detailed works methodology statement. Feedback should be provided to the designer on construction sequencing and design, to explore possible design improvements for safety. Practical plant should be considered, such as long reach equipment to avoid having to work in close proximity to the landslide head scarp. Detailed monitoring plans must be agreed between the contractor(s), designers and client before works commence with regular review. Precautionary site shutdowns are to be expected following heavy rain, emergency procedures must be in place to cover expected scenarios.
2.4	Tree felling	Workers and/or plant being hit by falling trees leading to loss of service, injury or death.	Workers Contractor Traffic Pedestrians	Catastrophic A - C	Skilled arborist should undertake tree felling and vegetation clearance work necessary to construct the Works.	A - Catastrophic	2 - Unlikely	Critical	Contractor	Tolerable	The Contractor should complete site specific risk assessments and establish mitigations further to the generic mitigations summarised to the left, as necessary.
2.5	Stormwater contamination	Contamination of stormwater system during the Works.	Contractor	Minor D - M	Contractor to prepare an environmental management plan.	E - Incidental	2 - Unlikely	Low	Contractor	Acceptable	Contractor to establish runoff controls on site during the Works.
2.6	Working at heights	Injury to workers above or below construction activities.	Contractor	Minor D - M	Workers to have formal safety inductions, training and appropriate PPE. Work shall be carried out and supervised by experienced personnel.	E - Incidental	2 - Unlikely	Low	Contractor	Acceptable	The Contractor should complete site specific risk assessments and establish mitigations further to the generic mitigations summarised to the left, as necessary.
2.7	Working with cranes	Injury to workers below materials being offloaded or placed utilizing cranes.	Contractor	Minor D - M	Contractor shall ensure that only certified crane operators assisted by experienced supervision staff shall carry out the work. Fall zones shall be clearly demarcated during crane operations.	C - Moderate	2 - Unlikely	Medium	Contractor	Tolerable	The Contractor should complete site specific risk assessments and establish mitigations further to the generic mitigations summarised to the left, as necessary.
2.8	Damage Endangered Plant	Damage to the critically endangered plant, Rhodamnia Rubescens, near the site works, will result in criminal charges to person(s) responsible and impact to environment.	Workers Contractor Traffic	Moderate C - G	Contractor to prepare and enforce exclusion zone to area where plant is present to ensure no access and sufficient exclusion to prevent accident damage from plant or equipment.	C - Moderate	1 - Rare	Medium	Contractor	Acceptable	Contractor to prepare and enforce exclusion zone to area where plant is present to ensure no access and sufficient exclusion to prevent accident damage from plant or equipment.
<b>Operations and Maintenance Phases</b>											
3.1	Maintenance inspections	Routine inspections will be required to assess performance of the design AND any new developing slope risks, particularly following heavy rainfall.	Maintainers	Minor D - M	The Works components have been designed based on an intended material durability of 100 years for resilience and to limit maintenance actions.	D - Minor	1 - Rare	Low	TNSW Client /	Tolerable	Inspections to be undertaken by the Designer and/or Client as part of the SRAP Contract.
3.2	Compromised wall drainage	wall drains could clog up with fines and hinder its drainage capability, resulting in water pressure build up behind the wall and adverse effects on wall stability.	Maintainers	Moderate C - G	Routine slope and maintenance inspections should check the drainage elements for signs of clogging and seepage (e.g. staining)	C - Moderate	2 - Unlikely	Medium	TNSW Client /	Acceptable	If there is concern about the drainage functionality horizontal drains and/or weep holes could be installed through the wall as a maintenance measure, whilst considering the anchors and other buried elements of the design.
3.3	Repair	Repairs may be required if the landslide below the proposed wall reactivates. For example if potentially unstable material is exposed, that is the founding material for the wall in the central part of the design.	Maintainers	Moderate C - G	The overall design has been completed assuming the slope in front will fail in the future to mitigate the need for repairs	D - Minor	3 - Possible	Medium	TNSW Client /	Tolerable	Should unstable wall founding rock be exposed, actions could include reinforced shotcrete and/or rock bolting to add support to the wall.
3.4	Errant Vehicle	Errant vehicle goes off verge when traversing road	Operators	Catastrophic A - C	Shoulder is provided on outside with barrier and sufficient dynamic deflection to retain errant vehicles from going off the road in the instance of a collision.	A - Catastrophic	1 - Rare	Medium	TNSW Client /	Acceptable	Risk has been considered and reduced in design with engineering controls. Barriers selected are appropriate for the road width and posted speed.
3.5	Flooding during Inclement Weather	Road is flooded during a significant storm event.	Operators	Moderate C - G	Drainage has been designed to the standard of the existing drainage network taking into consideration of the location of the project. Adequate drainage has been provided to prevent water ponding in roadway during minor storm events.	C - Moderate	1 - Rare	Medium	TNSW Client /	Acceptable	Flooding of road has been appropriately mitigated with engineering controls based on existing drainage on site and expected rainfall during minor storm events.
<b>Modification, Demolition and Dismantling Phases</b>											
4.1	Modification/Demolition/Dismantling	At some point in the future, upgrade or dismantling and reinstatement of the Works will be required to maintain its performance.	Client Maintainers	Minor D - M	Keep accurate as built records and design reports secure for future reference.	E - Incidental	1 - Rare	Low	TNSW Client /	Acceptable	Client / TNSW should continue routine inspections and hold an asset management database to inform and trigger the requirement for further works in future.

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COORDINATE SYSTEM: MGA_ZONE_56/GDA20		HEIGHT DATUM: AHD	DESIGN LOT CODE:															

FILE NAME: 520212TP-AURC-80232-RV-DRG-000080.dwg  
PLOT DATE & TIME: 27/4/2023 3:27:53 am





- NOTES**
1. THIS RISK REGISTER HAS BEEN PREPARED TO DOCUMENT HAZARDS AND RISK TREATMENTS ASSOCIATED WITH PROJECT ELEMENTS DESIGNED BY AURECON, INCLUDING SUBCONSULTANTS WHERE APPLICABLE.
  2. THE FULL LIFE CYCLE OF THE PROJECT HAS BEEN CONSIDERED INCLUDING DESIGN, CONSTRUCTION (AND COMMISSIONING) OPERATION, MAINTENANCE, MODIFICATION AND DEMOLITION PHASES.
  3. THE RISK REGISTER IS FOCUSED ON HAZARDS RESULTING FROM ATYPICAL FEATURES SPECIFIC TO THE DESIGN. IT IS EXPECTED THAT RISKS ASSOCIATED WITH GENERIC HAZARDS (WORKING AT HEIGHTS, EXCAVATIONS, ETC) WILL BE ADDRESSED BY OTHER STAKEHOLDERS USING APPROPRIATE RISK MANAGEMENT TECHNIQUES DURING SUBSEQUENT PHASES OF THE PROJECT.
  4. RESIDUAL RISKS WHICH CANNOT REASONABLY BE ACTIONED BY AURECON DURING THE DESIGN PHASE HAVE BEEN IDENTIFIED AND REQUIRE ACTION BY OTHER STAKEHOLDERS DURING SUBSEQUENT PHASES OF THE PROJECT (EG CONSTRUCTION, OPERATIONS, MAINTENANCE, MODIFICATION OR DEMOLITION.)
  5. THE RISK REGISTER DOES NOT REPLACE THE NEED FOR OTHER STAKEHOLDERS TO COMPLETE THEIR OWN HAZARD IDENTIFICATION AND RISK ASSESSMENT FOR THE PROJECT (INCLUDING THE DEVELOPMENT OF SAFE WORK PROCEDURES FOR SPECIFIC ACTIVITIES) IN DUE COURSE.

Risk Level Matrix						
Likelihood						
	0 - Eliminated	1 - Rare	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain
Consequence	A - Catastrophic	High	Critical	Critical	Critical	Critical
	B - Major	High	High	Critical	Critical	Critical
	C - Moderate	Medium	Medium	High	High	Critical
	D - Minor	Low	Low	Medium	High	High
	E - Incidental	Low	Low	Low	Medium	Medium

Consequence Analysis Descriptions				
	People	Property	Environment	Community
A - Catastrophic	Single or multiple fatality	Virtual complete loss of plant or system	Permanent / irreversible widespread ecological damage not able to be remediated	Outrage by a sizeable community or many communities. Riots.
B - Major	Disabling injury or illness i.e. amputation and/or permanent loss of bodily function, or any kind of permanent health impact	Extensive damage to plant or system	Extensive ecological damage, lengthy remediation process	Community/NGO legal actions. Pickets, demonstrations.
C - Moderate	Any Lost Time Incident (LTI), i.e. an illness or injury resulting in one or more consecutive days or shifts off work	Significant damage to plant or system	Substantial ecological damage but able to be remediated	Persistent formal community complaints. Formal complaints to politicians or comparable representatives.
D - Minor	A medical treatment case (MTC) / or restricted work case (RWC)	Damages impact on budget and program	Localised ecological damage, easily remediated	Formal complaints from local Community complaints locally
E - Incidental	First Aid Case, or an injury or illness not requiring treatment	Minor damage to plant or system	Negligible ecological damage, may not require remediation	No Informal community complaints &/or negative comments / views.

Likelihood Analysis Descriptions			
	Descriptor	Likelihood (i.e. % chance of realisation during applicable period: construction phase, operating cycle or decommissioning)	Industry Incidences (only applicable to common systems/assets)
Category	5 - Almost Certain	The threat is expected to be realised	90% < Likelihood ≤ 100% Common incident
	4 - Likely	The threat is likely to be realised.	5% < Likelihood ≤ 90% Several incidents nationally
	3 - Possible	The threat may be realised.	1% < Likelihood ≤ 5% One or a few incidents nationally
	2 - Unlikely	The threat is not expected to be realised.	0.1% < Likelihood ≤ 1% No known national incidents. One or a few incidents in comparable international operating regimes.
	1 - Rare	The threat may be realised in reasonably foreseeable but exceptional circumstances.	0% < Likelihood ≤ 0.1% No known incidents in comparable international operating regimes.

FOR REVIEW

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## Appendix D - Stage 1 PACHCI clearance letter



1<sup>st</sup> of June 2023

**Paula Camarero**

Senior Environment & Sustainability Officer  
Environment and Sustainability Branch (Assets and Operations)  
Safety, Environment and Regulation Division  
**Transport for NSW**

Dear Paula,

**Preliminary assessment results for Remediation of Garie Road on Stage 1 of the *Procedure for Aboriginal cultural heritage consultation and investigation* (the procedure).**

---

The project, as described in the Stage 1 assessment checklist, was assessed as being unlikely to have an impact on Aboriginal cultural heritage.

The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate moderate to high concentrations of Aboriginal objects or places in the study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Roads and Maritime Services' procedure.
- The cultural heritage potential of the study area appears to be reduced due to past disturbance.
- There is an absence of sandstone rock outcrops likely to contain Aboriginal art.

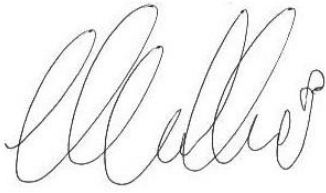
Your project may proceed in accordance with the environmental impact assessment process, as relevant, and all other relevant approvals.

If the scope of your project changes, you must contact The Aboriginal Engagement Section, Greater Sydney Region, and your regional environmental staff to reassess any potential impacts on Aboriginal cultural heritage.

If any potential Aboriginal objects (including skeletal remains) are discovered during the course of the project, all works in the vicinity of the find must cease. Follow the steps outlined in the Roads and Maritime Services' *Unexpected Heritage Finds Procedure*.

For further assistance in this matter do not hesitate to contact me.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Corrine Quinlan', written in a cursive style.

Corrine Quinlan  
Aboriginal Cultural Heritage Advisor – Greater Sydney Region

---



# Appendix E - Biodiversity Assessment Report (November 2023)

# Biodiversity assessment report for REF

SRAPC Garie Road rehabilitation

November 2023





## Document control

Document Title	Biodiversity assessment report for REF SRAPC Garie Road rehabilitation
Author	MC (Aurecon) and PG (subconsultant)
Reviewer	DA (Aurecon)

## Versions

0.0	Feb 2023	First draft BAR
1.0	April 2023	Revision based on Transport comments and review
2.0	June 2023	Revision based on Transport comments and review
3.0	July 2023	Revision based on design change, Transport comments and review
4.0	September 2023	Minor revision based on Transport comments
5.0	October 2023	Minor revision based on Transport comments
6.0	November 2023	Revision based on design change
7.0	November 2023	Minor revision based on Transport comments

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## Executive summary

The Sydney Roads Asset Performance Contract (SRAPC) Garie Road rehabilitation (the proposal) is required due to extensive damage to the existing road due to extreme weather events in early 2022. The proposal is in the Royal National Park and the route provides the only access road to Garie Beach. This Biodiversity Assessment Report forms part of the Review of Environmental Factors being prepared to satisfy Transport's duties under the *Environmental Planning and Assessment Act 1979*.

The proposal is located within the Sydney Cataract Interim Biogeographic Regionalisation for Australia sub-region of the Sydney Basin Bioregion. It is at the junction of three soil landscape groups. The vegetation either side of the existing road corridor is native and relatively undisturbed. Up to 0.296 hectares of native vegetation would be cleared for the proposal noting that 0.016 hectares of this is within tree protection zones (and therefore may have residual impacts). Vegetation removal includes 72 native trees. This clearing occurs within both Plant Community Type 3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest and Plant Community Type 3155 Illawarra North-Pittwater Bangalay Moist Forest. One Threatened Ecological Community associated with Plant Community Type 3134 Illawarra Seacliffs Littoral Rainforest is adjacent to the proposal although would not be directly impacted. Three vegetation integrity plots were conducted to determine impacts to vegetation and the condition of the vegetation zones, all of which were found to be high.

Targeted surveys for several threatened flora species were conducted, including the Bauer's Midge Orchid (*Genoplesium baueri*) during its flowering season in March. One species, Scrub Turpentine (*Rhodamnia rubescens*), listed as Critically Endangered under both the *Biodiversity Conservation Act 2016* and the *Environmental Protection and Biodiversity Conservation Act 1999* was identified adjacent to the slope failure (upslope). The design has been amended and an environmental exclusion zone established to avoid direct impact to the known location of 16 individuals of this species. Fauna species identified were noted.

Targeted surveys were conducted for the Red-Crowned Toadlet (*Pseudophryne australis*) on four separate occasions. However, the species was not recorded.

Hollow bearing trees would not be directly impacted by the proposal. If any hollow bearing trees would be impacted, further surveys, impact assessments and offsets would likely be required as several other threatened fauna species would likely be using and or dependent on hollows. The mitigation chapter of this BAR discusses necessary protection requirements (tree protection zones) to be placed around the two hollow bearing trees within/adjoining the proposal subject land.

Assessments of significance were conducted for species that were considered to have a moderate, high or recorded likelihood of presence within the area. Results were assessed under Section 7.2 of the BC Act and EPBC Act Significant Impact Guidelines 1.1.

Safeguards and mitigation measures have been developed to reduce the potential impacts on biodiversity values from the proposal. These include but are not limited to:

- Avoid clearing all hollow bearing trees identified with the subject land and placing tree protection zones around the two closest hollow bearing trees within/adjoining the proposal subject land
- Avoid identified threatened vegetation species (Scrub Turpentine) within an environmental exclusion zone
- Including a coir log for stabilisation at perimeter of the environmental exclusion zone to prevent further erosion or impact the stability of the bank and therefore impact the threatened Scrub Turpentine individuals
- Avoiding and minimising vegetation removal
- Avoiding impact to threatened ecological communities by installing exclusion fencing around an ancillary facility adjacent to the assumed community. Only trimming of small branches without habitat features encroaching on the existing hardstand would be permitted.
- Completing pre-clearing surveys and having fauna spotter/catchers present during tree felling
- Implementing soil erosion and sediment control measures continuously during construction
- Rehabilitating grass-swale with only native and local vegetation. (ie native to the PCTs present)
- Where possible, of the trees which are approved for removal, clearing only those necessary for operational reasons.

Clearing of threatened species habitat does not exceed one hectare, therefore the threshold relating to threatened flora and species credit fauna species has not been reached. Provided safeguards and mitigation measures are adhered to, the proposal is likely to not have a significant impact on biodiversity.



# 1. Introduction

## 1.1 Proposal background

The Sydney Roads Asset Performance Contract (SRAPC) Garie Road rehabilitation (the proposal) is required to rehabilitate a single lane two-way road within the Royal National Park (RNP). Garie Road provides access to Garie Beach which is currently inaccessible due to a slope failure. The location of the proposal is shown in Figure 1-1. Aurecon has been engaged by Connect Sydney to prepare this Biodiversity Assessment Report (BAR).

## 1.2 The proposal

Transport proposes to rehabilitate Garie Road (the proposal) in the Sutherland Shire local government area (LGA). This section of road has experienced damage due to extreme weather events in early 2022, which has left the road unuseable for staff and visitors of the Royal National Park. Typically, Garie Road is a two lane road with one lane in each direction and provides the only vehicular route to Garie Beach.

The works have been identified as part of flood recovery program of works for the continual maintenance and management of roads which comprise of the SRAPC. The SRAPC is a 9-year operational contract covering the maintenance and management of classified State roads within the Eastern Harbour City zone.

Key features of the proposal would include:

- New anchored bored pile wall comprising 89 reinforced bored capped piles (about 900 millimetre in diameter) spaced at 1.5 metres apart. The rock anchors (about 150 millimetres in diameter) would be installed into the existing bedrock at 45 degrees
- New flexible guard fence along the edge of the road to tie into existing fence at one metre spacing
- Realignment of the existing road surface away from slip area including excavation works and tree clearing
- Installation of at-ground and elevated walkways attached to capping beam to allow maintenance crew access
- Installation of a new swale drainage system including the replacement of two existing culverts. A grass lined channel would be installed along Garie Road to the south of the replaced culvert, and a concrete lined channel to the north. Swale drains would be connected to a PVC piped system to carry water away from slope.

The proposal would be located mostly within the road corridor, with a portion located on National Parks and Wildlife Service (NPWS) Land (about 0.098 hectares and the two temporary ancillary facilities outside the subject land: NPWS helipad and Governor Game Lookout). NPWS Land is assumed to be from ten metres either side from the centre of the existing road corridor. Key features of the proposal that are located on Royal National Park Estate include:

- Rock anchors at 45 degrees (about 150 millimetres in diameter). The rock anchors would be installed into the existing bedrock
- Realignment of the existing road surface away from slip area including excavation works and tree clearing
- Installation of a new swale drainage system including the replacement two existing culverts. A grass lined channel would be installed to the south of the slip area, and a concrete lined channel to the north
- Minor trimming of understorey vegetation along the road shoulder on Garie Road (about 70 metres from the NPWS helipad ancillary facility) to provide additional temporary parking for 'Little Garie Cabin Community'.
- Minor trimming of the canopy around the subject land to facilitate required construction works within work zones including larger plant and equipment and their movement.

The proposal would involve the follow temporary structures and facilities:

- Establishment of a temporary ancillary facility on previously cleared land currently used as the NPWS helipad, including the installation of temporary fencing and plant and equipment storage. Includes minor trimming of established trees around the perimeter to facilitate movement of larger plant and equipment.
- Establishment of a secondary temporary ancillary facility (Governor Game Lookout) on the existing hardstand, including minor trimming of some established trees.

- Establishment of the following facilities to the south within the Garie Road subject land (known as Garie Road Ancillary Facilities):
  - The following buildings, which are 6m x 3m each, to be powered by an onsite generator:
    - Two offices
    - Meeting room
    - Lunch room
    - Ablution Block
  - Water tank immediately uphill from site sheds and water fed to lunch room and ablution block

The location of the proposal with the wider assessment area is shown in Figure 1-1. The proposal REF provides figures with a more detailed visual representation of the design of the proposal.

### 1.2.1 Assessment areas

The proposal runs along about 150 metres of Garie Road and would be located mostly within the existing road corridor, partially encroaching on NPWS land (about 0.098 hectares). It also incorporates two temporary ancillary facilities on cleared land currently specified as the NPWS helipad and Governor Game Lookout. The Garie Road Ancillary Facility is located on disturbed land (existing road shoulder) within the subject land. Construction of the proposal is expected to commence in November 2023 and would be completed within six months, subject to funding, weather, access considerations and issuance of construction contracts. The assessment area context, which incorporates a 1500 metre buffer (broader assessment area), is shown in Figure 1-1. The subject land is the identified project area and incorporates the construction and operation footprint (0.455 hectares). The study area incorporates the subject land and a 20 metre buffer (refer to Figure 1-2). Parts of the study area were not able to be traversed due to safety limitations.



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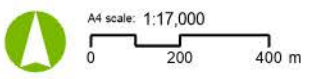


- Subject Land
- Study Area
- Broader Assessment Area
- Ancillary Facilities
- Watercourses
- NPWS Land
- Biodiversity Values
- Landscapes**
- Sydney - Newcastle Barriers and Beaches
- Woronora Plateau

- IBRA Subregions**
- Sydney Basin
- Surveyed Scrub Turpentine (*Rhodamnia rubescens*)
- NSW BioNet Atlas Previously Recorded Threatened Species**
- Fauna**
- Black-winged Petrel (1)
- Broad-billed Sandpiper (1)
- Eastern Ground Parrot (1)

- Eastern Pygmy-possum (11)
- Giant Burrowing Frog (5)
- Grey-headed Flying-fox (1)
- Koala (2)
- Large-eared Pied Bat (1)
- New Holland Mouse (11)
- New Zealand Fur-seal (1)
- Powerful Owl (1)
- Red-crowned Toadlet (18)
- Rosenberg's Goanna (3)

- Shy Albatross (1)
- Sooty Oystercatcher (1)
- Swift Parrot (1)
- White-bellied Sea-Eagle (6)
- Flora**
- Scrub Turpentine



Date: 1/11/2023 Version:1 Job No: 520212  
Coordinate System: GDA2020 MGA Zone 56

**SRAPC Garie Road Biodiversity Assessment Report**

Figure 1-1: Assessment Area Context



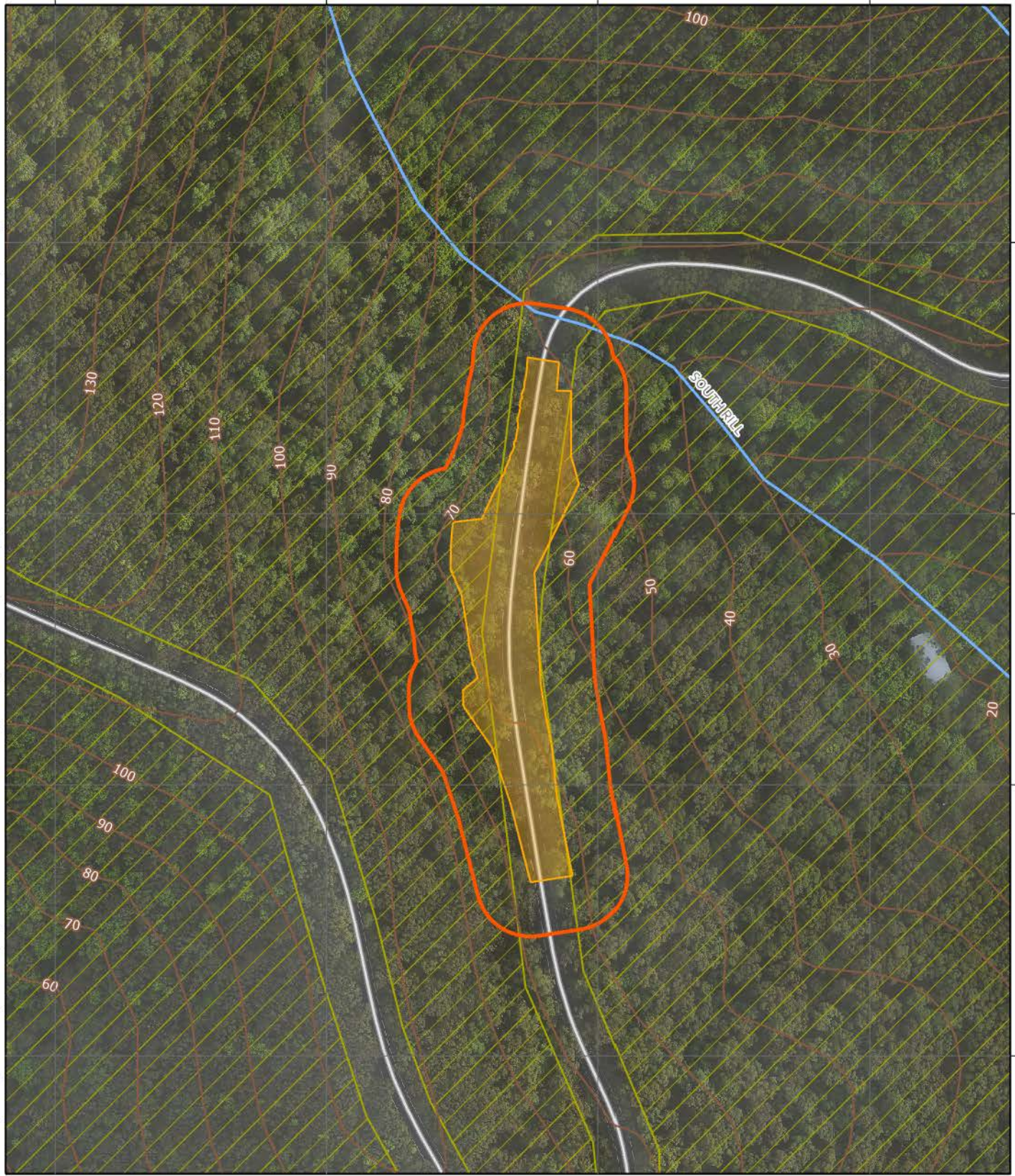
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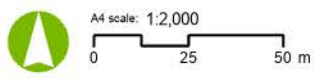
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6217500  
6217400  
6217300

-  Subject Land
-  Study Area
-  NPWS Land
-  Watercourses
-  Contours (10m)
-  Road



Date: 1/11/2023 Version:1 Job No: 520212  
Coordinate System: GDA2020 MGA Zone 56

**SRAPC Garie Road Biodiversity Assessment Report**

Figure 1-2: The proposal



## 1.3 Legislative context

A Review of Environmental Factors (REF) is prepared to satisfy Transport for NSW (Transport) duties under s.5.5 of the *Environment Planning and Assessment Act 1979* (NSW) (EP&A Act) to “examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity”. This biodiversity impact assessment forms part of the REF being prepared for SRAPC Garie Road rehabilitation and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

The *Biodiversity Conservation Act 2016* (BC Act) requires that the significance of the impact on threatened species, populations and threatened ecological communities is assessed using the test listed in s.7.3 of the BC Act. Similarly, Part 7A of the *Fisheries Management Act 1994* (FM Act) requires that significance assessments are undertaken in accordance with Division 12 of the FM Act. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Environment Agency Head’s requirements, or a biodiversity development assessment report (BDAR) must be prepared by an accredited assessor in accordance with the biodiversity assessment method (BAM) (DPIE 2020a).

In September 2015, a ‘strategic assessment’ approval was granted by the Federal Minister in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The approval applies to Transport road activities being assessed under Division 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Transport road proposals assessed via an REF:

- Must address and consider potential impacts on EPBC Act listed threatened species, populations, ecological communities and migratory species, including application of the “avoid, minimise, mitigate and offset” hierarchy
- Do not require referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for these matters, even if the activity is likely to have a significant impact
- Must use the Biodiversity Assessment Method (BAM) to calculate credits that would offset significant impacts on EPBC Act listed threatened species, populations, ecological communities and migratory species.

Assessments of impact significance are required for all relevant biodiversity values in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

### 1.3.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as Matters of National Environmental Significance (MNES). Any action that may have a significant impact on a MNES or Commonwealth land, triggers the Act. An action with the potential for a significant impact on MNES is to be referred to the DCCEEW for determination as to whether or not it is a controlled action. The Commonwealth Minister for DCCEEW must have approved the action before it is undertaken. A controlled action is any action that has, will have or is likely to have a significant impact on an MNES.

The nine MNES categories under the EPBC Act are:

- World Heritage
- National Heritage
- Wetlands of international importance (RAMSAR)
- Listed threatened species and communities
- Listed migratory species
- Protection of the environment from nuclear actions
- Marine environment
- Great Barrier Reef Marine Park
- Protection of water resources from coal seam gas development and large coal mining

The proposal is not expected to have a significant impact on MNES and is therefore not required to be referred to DCCEEW.

### 1.3.2 Environmental Planning and Assessment Act 1979

The EP&A Act provides a statutory basis for planning and environmental assessment in NSW. The EP&A Act provides a framework for environmental planning and development approvals and includes provisions to ensure that the potential environmental impacts of a development are assessed and considered in the proposal approval process. The proposal is subject to assessment under Division 5.1 of the EP&A Act.

### 1.3.3 Biodiversity Conservation Act 2016

The BC Act became operational in August 2017 replacing the *Threatened Species Conservation Act 1995*. The BC Act seeks to

- Conserve biological diversity
- Promote ecologically sustainable development
- Prevent extinction
- Promote the recovery of threatened species, populations and ecological communities
- Protect areas of outstanding biodiversity value.

The BC Act applies to the proposal through the requirement to avoid, minimise and offset the impacts of proposed development and land use changes on biodiversity.

### 1.3.4 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) aims to conserve nature, habitat ecosystems, ecosystem processes and biological diversity at the community, species and genetic levels. All native fauna is protected, threatened or otherwise under this act. Schedule 13 lists protected plants which shall not be harmed or picked on any land either on or off National Park estate. The NPW Act provides legislative protection for Aboriginal heritage in NSW which is discussed in the REF.

The proposal is partially located on land contained within the RNP under the NPW Act. However, the proposal is permissible in accordance with section 30E as it is directly related to the purpose and management principles for the reserve. The proposal is subject to authorization under the NPW Act.

Under Section 81(4) of the NPW Act, all operations undertaken on park have to be in accordance with any plan of management adopted for that park. In accordance with Section 81, the proposal is consistent with the RNP, Heathcote National Park and Garawarra State Conservation Area Plan of Management (PoM) which establishes its permissibility given the PoM.

NPWS have a variety of policies that are designed to protect native plants, animals and ecosystems while meeting the needs of business operators and visitors. The policies typically cover how visitors should conduct themselves within national parks and reserves in order to protect native plants, animals and ecosystems, as well as dictate how NPWS operate within reserves and responsibilities, businesses operating in reserves as well as the responsibilities of neighbours and visitors.

The following policies are relevant to the proposal:

- Developments adjacent to National Parks and Wildlife Service lands Policy (NPWS 2020)
- Landslides and Rockfalls Policy (NPWS 2021)
- Revocation, recategorisation and road adjustment Policy (NPWS 2017)
- People and wildlife Policy (NPWS 2022)
- Vehicle access Policy (NPWS 2021)
- Visitor safety Policy (NPWS 2017)
- Walking tracks Policy (NPWS 2017).

The NPWS area branch that the proposal is partially located on is the Royal Area Park, Greater Sydney Branch.



### 1.3.5 Fisheries Management Act 1994

The FM Act aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. Part 7A Division 4 of the FM Act prohibits, without a licence or permit, activities that damage habitats or harm threatened species, populations or ecological communities.

### 1.3.6 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) repeals the *Noxious Weeds Act 1993* and covers all biosecurity risks, including pest animals, plant diseases and weeds and introduces the legally enforceable concept of a general biosecurity duty. The Biosecurity Act divides NSW into regions based on combined LGAs and priority weeds for a region. Some weeds are managed at a State level as they form part of a broader containment strategy. The legislation also complements the listed of Weeds of National Significance (WoNS).

All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise potential biosecurity risks. Weeds that were identified on the proposal site would be managed in accordance with the Biosecurity Act. Further information is provided in section 5.2.4.

## 2. Methods

### 2.1 Personnel

This assessment has been conducted by suitably qualified and experience ecologists. Their roles and qualifications are detailed in Table 2-1.

Table 2-1: Personnel

Name	Role	Qualifications
Paul Gadsby	Field surveys and biodiversity assessment methodology content	Masters of Conservation Biology Bachelor of Environmental Science BAM accredited assessor # BAAS20010
Miranda Crossley	Field surveys and biodiversity assessment content	Bachelor of Environmental Science, Bachelor of Creative Intelligence and Innovation (Honours)
Dominic Adshead	Quality assurance review	Bachelor of Science (Forestry)

### 2.2 Background research

Background research was undertaken to collect and review information relevant to the presence and likelihood of occurrence of threatened ecological communities, terrestrial and aquatic threatened species and their habitat, important habitat for migratory species and areas of outstanding biodiversity value. Searches were undertaken in November 2022 using NSW and Federal databases and are detailed in table Table 2-2.

Table 2-2 Background research

Database/tool	Search Area	Date
Atlas of NSW Wildlife (BioNet)	Locality	25.11.2022
Threatened Biodiversity Data Collection (TBDC)	Locality	Ongoing during BAR preparation
BioNet Vegetation Classification database	Sydney Cataract IBRA sub-region	Ongoing during BAR preparation
Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool	Locality	25.11.2022
Department of Climate Change, Energy, the Environment and Water (DCCEEW) Species Profile and Threats Database (SPRAT)	Locality	Ongoing during BAR preparation
BAM calculator (BAM-C)	Locality/PCTs	Ongoing during BAR preparation
NSW DPI Fisheries Spatial Data Portal	Study area	preparation
Seed Layer Intersection tool	Study area	Ongoing during BAR preparation
Commonwealth Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE)	Locality	25.11.2022
DCCEEW National Flying-fox monitoring viewer	Locality	25.11.2022
State Environmental Planning Policy (SEPP) Resilience and Hazards 2021 Chapter 2 (Coastal Management)	Locality	25.01.2023
Core Koala Habitat identified by the Biodiversity and Conservation SEPP 2022	Locality	25.01.2023



The preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act were viewed on the NSW Threatened Species Scientific Committee website on 25<sup>th</sup> November 2022.

The annual Final Priority Assessment List of nominated species and ecological communities that have been approved for assessment by the Minister responsible for the EPBC Act were viewed on the Commonwealth DCCEEW website on 25<sup>th</sup> November 2022.

## 2.3 Vegetation assessment

### 2.3.1 Vegetation mapping

For the purposes of this BAR, native vegetation is defined in accordance with section 1.6 of the BC Act and Part 5A 60B of the *Local Land Services Act 2013*, repeated here:

1. *For the purposes of this Part, native vegetation means any of the following types of plants native to New South Wales:*
  - a. *trees (including any sapling or shrub or any scrub),*
  - b. *understorey plants,*
  - c. *groundcover (being any type of herbaceous vegetation),*
  - d. *plants occurring in a wetland.*
2. *A plant is native to New South Wales if it was established in New South Wales before European settlement. The regulations may authorise conclusive presumptions to be made of the species of plants native to New South Wales by adopting any relevant classification in an official database of plants that is publicly accessible.*
3. *For the purposes of this Part, native vegetation extends to a plant that is dead or that is not native to New South Wales if:*
  - a. *the plant is situated on land that is shown on the native vegetation regulatory map as category 2-vulnerable regulated land, and*
  - b. *it would be native vegetation for the purposes of this Part if it were native to New South Wales.*
4. *For the purposes of this Part, native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). A declaration under Section 14.7 of the BC Act that specified vegetation is or is not marine vegetation also has effect for the purposes of this Part.*

Native vegetation within this BAR has been mapped and classified in accordance with the Plant Community Type (PCT) classification system which is described in the BioNet Vegetation Classification (Veg-C). Vegetation mapping of the study area was ground-truthed by collecting Rapid Data Points (RDPs) and BAM plot floristic data. RDPs collected the dominant flora and cover across each strata. PCT boundaries were recorded while undertaking RDPs. A PCT was allocated to each RDP based on species composition, dominance, soil, aspect, and landscape position. Plot based data was collected across 25 to 30 November 2022, analysed and used to further refine vegetation mapping within this BAR.

The vegetation has not been assessed during site investigations where minor tree trimming would occur outside the subject land at the two ancillary facilities and on the road shoulder (about 70 metres from the NPWS helipad ancillary facility). However, vegetation has been assessed at the Garie Road Ancillary Facility (located on disturbed vegetation and existing road shoulder within the subject land).

### 2.3.2 Vegetation survey and classification

The three mapped PCTs within the study area were assigned a condition class. The vegetation within the study area was intact and shows very little variation, therefore, each PCT was assigned into a single zone. Adjacent the lower slope of the Garie Road a minor change in vegetation was observed but it does not lower the condition class of the zone. Exotic flora was limited to minor incursions of herbaceous windblown annuals and perennials.

Vegetation integrity scores from plot data, past disturbances to vegetation and the presence of exotic vegetation were used to assign vegetation zones to each PCT and are detailed in Table 3-1. No areas of non-native vegetation were found to occur within the study area.

#### **Plot-based vegetation survey**

A plot-based full floristic survey was completed in accordance with subsection 4.3.4 of the BAM. Table 2-3 lists the minimum number of plots required per hectare for each vegetation zone. Table 2-4 summarises the plots completed per PCT.

Table 2-3: Minimum number of plots required per zone area

Vegetation zone area (ha)	Minimum number of plots/midlines
<2	1 plot/midlines
>2-5	2 plots/midlines
>5-20	3 plots/midlines
>20-50	4 plots/midlines
> 50–100	5 plots/midlines
> 100–250	6 plots/midlines
> 250–1000	7 plots/midlines; more plots may be needed if the condition of the vegetation is variable across the zone.
> 1000	8 plots/midlines; more plots may be needed if the condition of the vegetation is variable across the zone.

Table 2-4: Minimum number of plots required and completed per vegetation zone

Veg zone	PCT	Condition	Area (ha)	No. plots required	No. plots completed (plot IDs)
Zone 2	PCT 3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	High	0.4	1	BAM Plot 2
Zone 1	PCT 3155 Illawarra North-Pittwater Bangalay Moist Forest	High	0.4	1	BAM Plot 1
Zone 3	PCT 3134 Illawarra Seacliffs Littoral Rainforest	High	0.5	1	BAM Plot 3

### 2.3.3 Patch size

In accordance with section 3.3.3 of the BAM the study area and all vegetation zones have been allocated a patch size of > 101 ha in the BAM calculator as the bushland is well connected with continuous vegetation within the Royal National Park.

### 2.3.4 Native vegetation cover

Native vegetation within and adjacent to the study area consists of relatively undisturbed old growth bushland as it lies within the RNP. Therefore, the high condition bushland has been classified as ‘intact’ as it has a native vegetation cover of >70% (section 2.3 of BAM) (refer Table 2-5).

Table 2-5: Native vegetation cover in the assessment area

Assessment area (ha)	20.0 ha
Total area of native vegetation cover (ha)	19.9 ha



Transport  
for NSW

Percentage of native vegetation cover (%)	99%
Class (0-10, >10-30, >30-70 or >70%)	>70%

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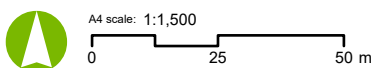
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- Study Area
- Subject Land
- Biodiversity Values
- ◆ Survey Plot Location
- ~ Watercourses
- ~ Contours (10m)
- Road



Date: 1/11/2023 Version:1 Job No: 520212  
 Coordinate System: GDA2020 MGA Zone 56

**SRAPC Garie Road Biodiversity Assessment Report**

Figure 2-1: Vegetation Plot Based Survey Location



## 2.4 Threatened species assessment

### 2.4.1 Habitat suitability assessment

A habitat assessment was undertaken as part of this BAR and is included in Appendix B Habitat Assessment Table. The likelihood of occurrence ratings for each threatened species were allocated to reflect desktop and on-ground findings. BioNet, PMST and species credit species list (generated from BAM-C associated PCTs) were used to generate a list of potential threatened species that utilise the study area. Where background information, sightings records or targeted survey is lacking, the precautionary principle has been applied and a 'moderate' rating assigned. As the study area is within 1 km of the coastline but consists entirely of bushland vegetation, threatened marine entities have been excluded from this assessment.

The location of targeted flora and fauna surveys is shown in Figure 2-2.

### 2.4.2 Targeted flora surveys

Targeted surveys were undertaken for all threatened flora (considered as having a moderate or higher likelihood of occurrence). Targeted surveys were conducted in November 2022 for all species except the Bauer's Midge Orchid (*Genoplesium baueri*) which was surveyed during its February to March survey period, in March 2023. Surveys were conducted across several days on 28 November 2022, 1 December 2022, 8 December 2022, 9 February 2023, 10 March, and 17 March and comprised a total of 74 person hours. Survey findings are summarised in Table 2-6. Conditions were suitable for detection of threatened flora with temperatures averaging between 19°C and 25°C, and winds were light to moderate. There was no rainfall on most of survey days, however rainfall became heavy in the afternoon of the February 2023 site visit.

Survey efforts consisted of parallel field traverses of 5 metre separation or less (surveying threatened plants and their habitats – NSW survey guide for the Biodiversity Assessment Method (DPIE 2020a)). All vegetation zones were searched except for the lower slope of the landslide that was unstable at the time of survey. Further limitations of the targeted flora surveys are discussed in Section 2.6.

Table 2-6: Targeted threatened flora survey details

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements <sup>1</sup>	Survey completed
<i>Astrotricha crassifolia</i>	Thick-Leaf Star-Hair	July to December	None	5 m wide parallel traverses in suitable habitat (DPIE 2020c)	Survey undertaken in November 2022. Suitable habitat present in study area despite no associated PCTs. Surveyed via 5-10 m wide parallel traverses. 10 person hours total.
<i>Prostanthera densa</i>	Villous Mint-Bush	All year round	None	10 m wide parallel traverses in suitable habitat (DPIE 2020c)	Survey undertaken in November 2022. Suitable habitat present in study area despite no associated PCTs. Surveyed via 5-10 m wide parallel traverses. 10 person hours total.
<i>Callistemon linearifolius</i>	Netted Bottle Brush	October to January	PCT 3155	10 m wide parallel traverses in suitable habitat (DPIE 2020)	Survey undertaken in November 2022. Suitable habitat in associated PCTs surveyed via 5-10 m wide parallel traverses. 10 person hours total.
<i>Rhodamnia rubescens</i>	Scrub Turpentine	All year round	PCT 3134 PCT 3153 PCT 3155	20 m wide parallel traverses in suitable habitat (DPIE 2020)	Survey undertaken in November 2022. Suitable habitat in associated PCTs surveyed via 5-10 m wide

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements <sup>1</sup>	Survey completed
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	April to June	PCT 3134 PCT 3153	20 m wide parallel traverses in suitable habitat (DPIE 2020)	parallel traverses. 10 person hours total.  Survey undertaken in November 2022. Suitable habitat in associated PCTs surveyed via 5-10 m wide parallel traverses. 10 person hours total.
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	February to March	None	5 m wide parallel traverses in suitable habitat (DPIE 2020)	Survey undertaken in March 2023 (during flowering season). Suitable habitat in study area surveyed via 5 m wide parallel traverses. 10 person hours total.

### 2.4.3 Targeted fauna surveys

Targeted fauna surveys were only undertaken for the Red-Crowned Toadlet (*Pseudophryne australis*) to rule out presence. As there is no breeding habitat to be impacted for birds and mammals and many of the species are ecosystem credit species under the BAM and do not strictly require survey.

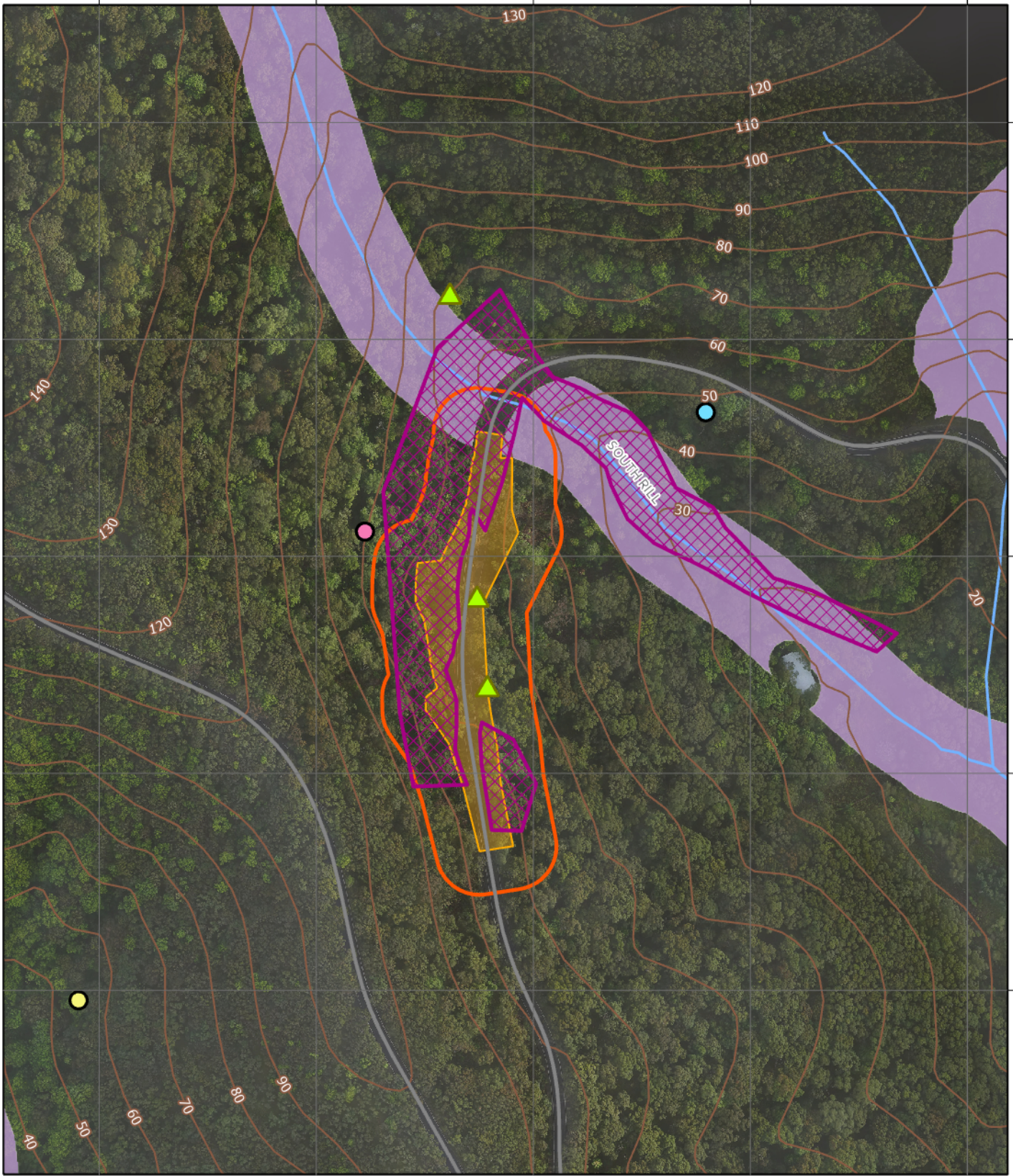
Document details of fauna survey methods in Table 2-7.

Table 2-7: Targeted threatened fauna survey details

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements <sup>1</sup>	Survey completed
<i>Pseudophryne australis</i>	Red-Crowned Toadlet	All year round	3134, 3153, 3155	Target preferred habitat including wet seeps. Call playback surveys.  Aural-visual survey. 4 repeats of surveys.	Survey completed across four separate afternoons: 10 March, 17 March, 20 March and 22 March 2023. Toadlet calls were played from small speakers at various locations across the study area and around South Rill.

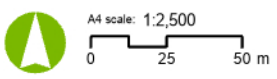


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- Study Area
  - Subject Land
  - Targeted Survey Location
  - ▲ Hollow Bearing Trees - To be retained
  - Biodiversity Values
- NSW BioNet Atlas Previously Recorded Threatened Species**
- Flora
- Scrub Turpentine (*Rhodamnia rubescens*) (1)

- Fauna
- Koala (*Phascolarctos cinereus*) (1)
  - Powerful Owl (*Ninox strenua*) (1)
  - ~ Watercourses
  - ~ Contours (10m)
  - Road



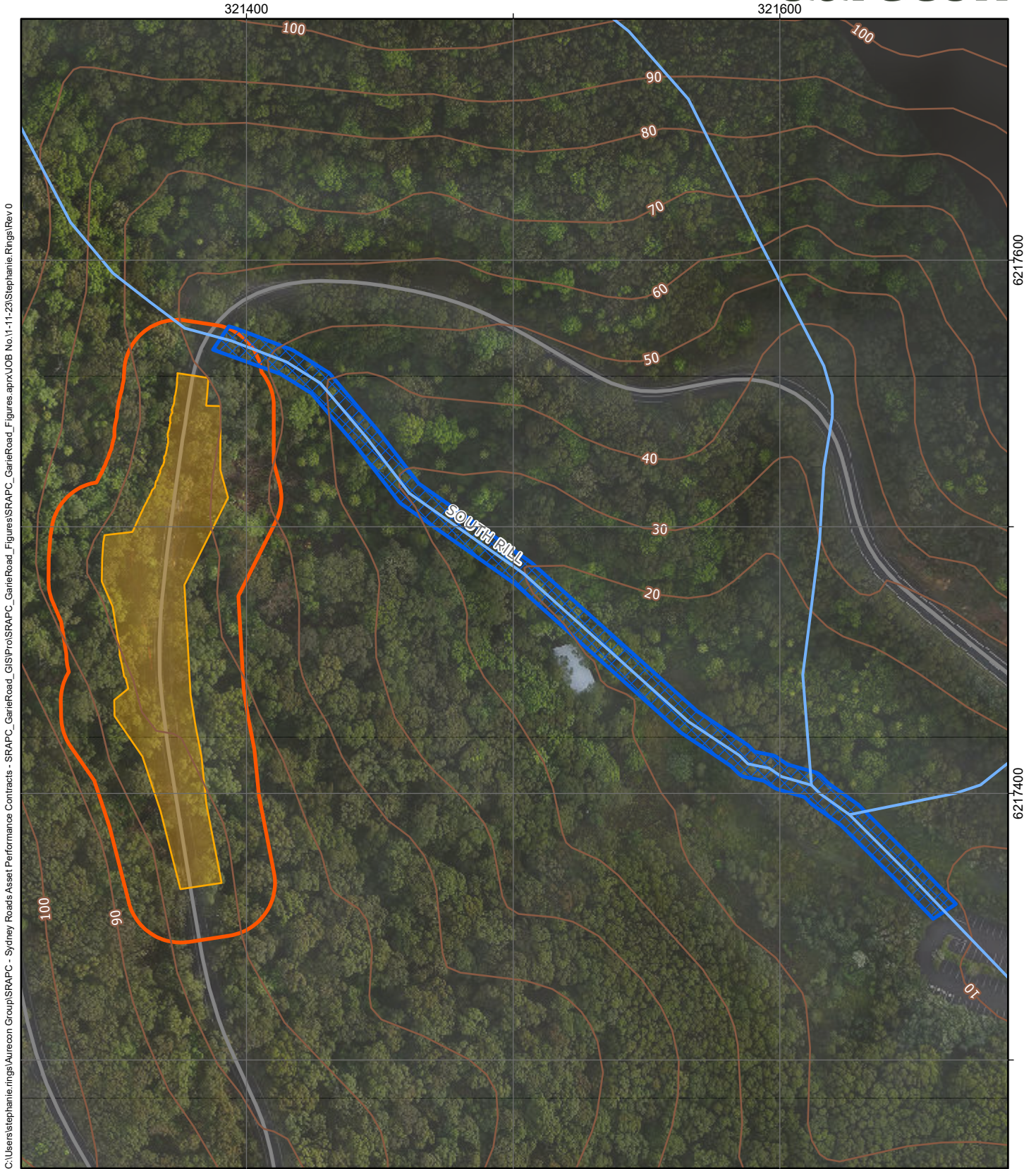


## 2.5 Aquatic surveys






One creekline (South Rill) occurs within the study area and was assessed for habitat features in accordance with the NSW DPI (Fisheries) *Policy and Guidelines for fish habitat conservation and management* (update 2013). Waterway habitat assessment was undertaken on 28 November 2022. The location shown in Figure 2-3 and included confirmation of:

- The ecosystem type (e.g. wetlands, floodplains, streams, estuaries, lakes).
- Dimensions of waterway and depth of water.
- Flow characteristics and hydrological features of aquatic habitat, including changes to drainage and filtration and flow regime.
- Bed substrate (e.g. rocks, coral, gravel, sand, mud).
- Habitat features (e.g. pools, riffles, billabongs, reefs).
- Existing infrastructure and barriers to fish movement (natural or artificial).
- Width and species composition of riparian vegetation including the type of vegetation present (e.g. macrophytes, snags, seaweeds, seagrasses, mangroves, saltmarsh) and condition.
- Water quality (i.e. a snapshot using basic water quality indicators at the time of sampling including dissolved oxygen, pH, turbidity, temperature, nutrients and salinity).





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-  Subject Land
-  Study Area
-  Watercourses
-  Contours (10m)
-  Road
-  Aquatic Survey Location



A4 scale: 1:2,000  
 0 25 50 m

Date: 1/11/2023 Version:1 Job No: 520212  
 Coordinate System: GDA2020 MGA Zone 56

## 2.6 Limitations

The random meander and plot-based survey undertaken has provided a list of flora species present within the study area (28 November 2022 to 9 February 2023). Targeted surveys for the Bauer's Midge Orchid (*Genoplesium baueri*) were later conducted during its flowering period in March 2023. To comprehensively detect all native flora species that may be present within the study area would require repeated survey throughout all seasonal periods with a range variation in rainfall and fire regimes. This level of comprehensive survey is not feasible for this BAR.

Vegetation and fauna habitat east of the road alignment within the study area was unable to be surveyed due to slope instability and is therefore not shown as part of the survey location on Figure 2-1.

Magenta Lilly Pilly (*Syzygium paniculatum*) was surveyed for outside of the timing stipulated within the TBDC. However, all potential individuals were checked against Lilly Pilly (*Acmena smithii*), Brush Cherry (*Syzygium austral*) and Blue Lilly Pilly (*Syzygium oleosum*). Only Lilly Pilly (*Acmena smithii*) was found to occur onsite. All leaf material was examined to rule out the presence of Magenta Lilly Pilly.

Not all fauna species that utilise the study area will be detected due to movement patterns, weather and seasonal conditions and the cryptic nature of some fauna. Therefore, a precautionary habitat-based assessment has been undertaken.

The additional Governor Game lookout ancillary facility was included in the design following desktop and field investigations. Initial desktop investigations indicate that the vegetation surrounding this ancillary facility may likely be a Threatened Ecological Community (TEC). Mitigation measures are included precautionarily to surpass the need for further investigations and assessments into the surrounding vegetation community. This vegetation has been assumed as a TEC.

The habitat has not been assessed during on site inspections where minor tree trimming would occur outside the subject land at the two ancillary facilities and on the road shoulder (about 70 metres from the NPWS helipad ancillary facility).



### 3. Existing environment

The proposal is located within the Sydney Cataract IBRA sub-region of the Sydney Basin Bioregion. The geology beneath the study area contains Hawkesbury Sandstone, Narrabeen Group and Quaternary (Holocene) geologies. The Hawkesbury Sandstone and Narrabeen group influence vegetation, fauna and threatened species within the study area, with the Narrabeen group the broadest influence upon vegetation and hydrology. It is noted the study area is located at the junction of three soil landscape groups (and associated geology): Watagan (Narrabeen), Wollongong (Quaternary) and Bundeena (Hawkesbury). The local topography consists of steep colluvial sideslopes (>25%) with occasional boulders and benches. Elevation is between 70 and 90 m, with local relief between 50-150 m. Two waterways intersect with Garie Road at the aquatic study site, South Rill and an unnamed ephemeral waterway.

One NSW (Mitchell) Landscape occurs within the study area with the following characteristics (DECC, 2002):

- **Woronora Plateau:** Extensive plateau occurring on Triassic quartz sandstone. Locally steep valleys are present with a general elevation of 50 to 150 m and local relief of 80 m. Soils on slopes consist of gradational soils. Rocky outcrops are absent to rare on slopes.

The vegetation within the study area consists of high condition native vegetation in a near pristine state. The Narrabeen Group geology in the study area and surrounds supports a mix of dry and wet sclerophyll forest on the slopes and rainforest in sheltered gully areas. Evidence of recent fire (<2 years) was observed on the north-eastern side of Garie Road. Native shrub and ground layer recruitment is strong. Outside of recently burnt areas, the fire interval exceeds 20 years, and the vegetation supports a strong component of mesic species as opposed to sclerophyllous shrubs. Weed incursion throughout the study area is minor and limited to the interface between Garie Road and the bushland edge. It predominately consists of herbaceous wind dispersed Asteraceae species such as Crofton Weed (*Ageratina adenophora*) and Spear Thistle (*Cirsium vulgare*).

The locations of the ancillary facilities and road shoulder outside the subject land where there would be minor trimming, have not been assessed during site visits. These areas are largely cleared at present.

#### 3.1 Plant community types and vegetation zones

Three PCTs were observed within the assessment area and are outlined in Table 3-1 and Figure 3-1 below.

Table 3-1: Plant community types and vegetation zones including patch size and vegetation integrity (VI) score

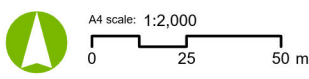
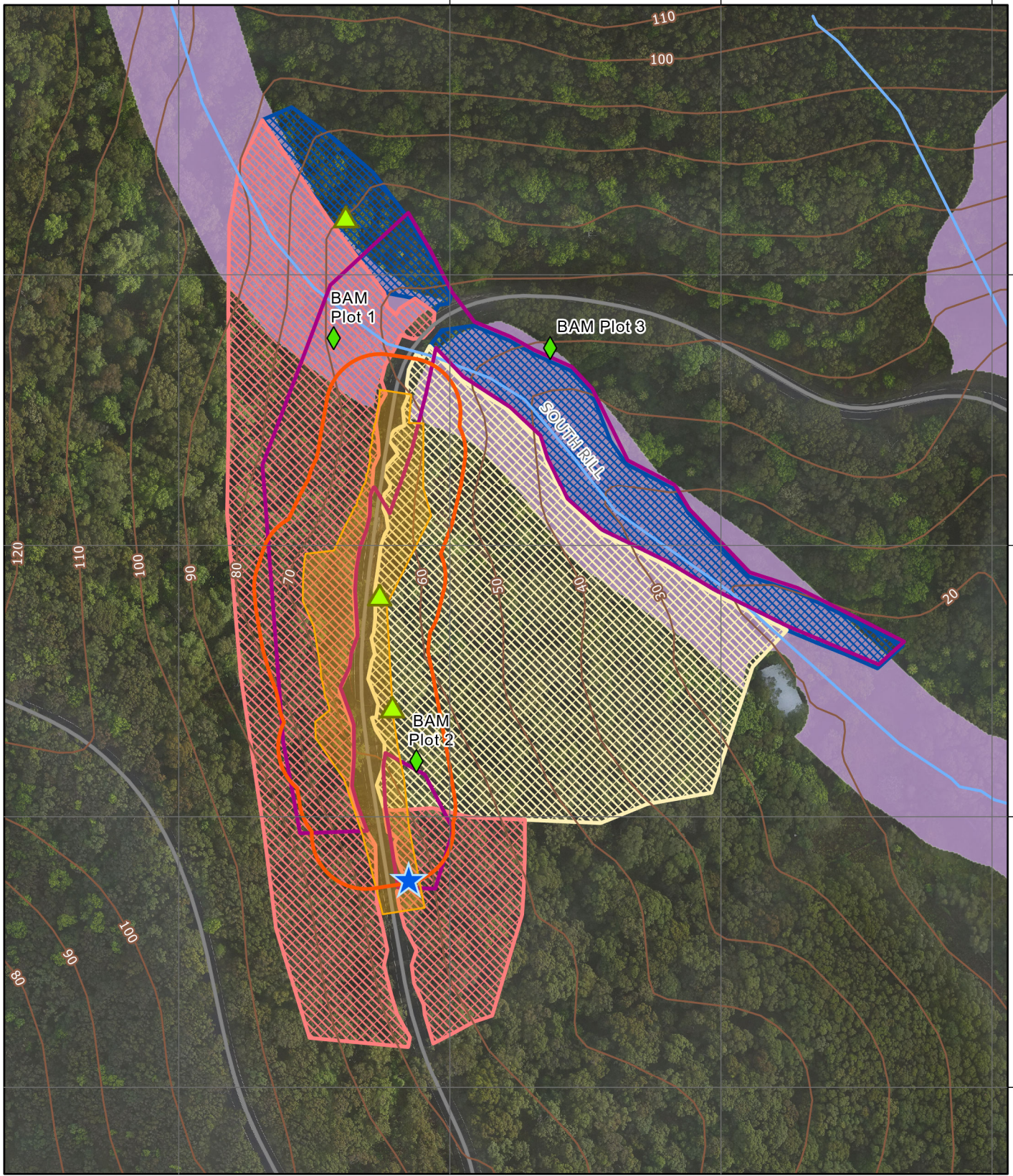
Veg. zone	Plant community type (PCT)	Threatened ecological community	Area (ha)		Area (ha) within RNP only (as a subsection of previous column)		Patch size class	VI score
			Subject land	Study area	Subject land	Study area		
Zone 2	PCT 3153: Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Not a TEC	0.132 ha	0.478ha	0.018 ha	0.334ha	> 100 ha	57.5
Zone 1	PCT 3155: Illawarra North-Pittwater Bangalay Moist Forest	Not a TEC	0.164 ha	0.776 ha	0.080 ha	0.624ha	> 100 ha	93.7
Zone 3	PCT 3134: Illawarra Seacliffs Littoral Rainforest	BC Act, Endangered: Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South-	0 ha	0.004 ha	0 ha	0.002 ha	>100 ha	N/A

		<p>East Corner Bioregions.</p> <p>EPBC Act, Critically Endangered: Littoral Rainforest and Coastal Vine Thickets of Eastern Australia.</p>						
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In the context of plant community type classification, trees and shrubs have been classed as per BioNet Vegetation Classification. However, for the purpose of offsetting (refer to Chapter 7), trees have been defined in line with the Transport Tree and Hollow Replacement Guidelines (July 2022) and as per Australian Standard 4970-2209. A tree is considered a “Long lived woody perennial plant greater than (or usually greater than) 3m in height with one or relatively few main stems or trunks (or as defined by the determining authority)”. Therefore, some species are defined in this chapter as shrubs whereas they are defined as trees in Chapter 7 (such as *Acacia implexa* and *Livistona australis*)



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Date: 21/11/2023 Version:1 Job No: 520212  
 Coordinate System: GDA2020 MGA Zone 56



### 3.1.1 PCT 3134: Illawarra Seacliffs Littoral Rainforest.

**Description:**

A rainforest or tall open wet sclerophyll forest with a dense, closed mid-story of rainforest shrubs and palms. PCT 3134 occurs on east-facing slopes and gullies within coastal areas that are influenced by salt laden winds (typically within 2 km of the ocean). The PCT is found in high rainfall areas at elevations of 8 to 170 m and is distributed between Burning Palms and Wombarra. Floristically, the PCT may consist of two to four strata. The canopy is commonly comprised of *Acmena smithii*, *Guioa semiglauca*, *Pittosporum undulatum*, *Elaeodendron australe* and *Livistona australis*. Occasional eucalypt emergent may occur, most commonly *E. botryoides* due to its affinity with coastal areas. Vines are common and may include *Geitonoplesium cymosum*, *Eustrephus latifolius* and *Smilax australis*. Graminoids and herbs are sparse with ferns comprising much of the ground layer. Refer to Table 3-2.

Table 3-2 PCT 3134 details

PCT ID	3134
PCT name	Illawarra Seacliffs Littoral Rainforest
Vegetation class	Littoral Rainforests
Vegetation formation	Rainforests
Estimate of per cent cleared	36.46 %
Area in subject land	0 ha
Conservation status	Listed BC Act, Endangered: Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South-East Corner Bioregions. Listed EPBC Act, Critically Endangered: Littoral Rainforest and Coastal Vine Thickets of Eastern Australia.
Vegetation zones (condition) and plots	High condition, Bam plot 3

**Justification for PCT selection:**

PCT 3134 occurs in the Sydney Cataract IBRA sub-region, meets the abiotic descriptions of easterly facing slopes with a maritime influence, rainforest formation and dominant species throughout the three strata. The floristic structure of the PCT within the area is summarised in Table 3-3.

The vegetation contains the characteristic species within the canopy, shrub and ground layers (refer to Table 3-3). Canopy dominants include *A. smithii*, *E. botryoides*, *Doryphora sassafrass*, *Livistona australis* and *Pittosporum undulatum*. Shrub layer species include *Guioa semiglauca*, *Elaeodendron australe* and *Eupomatia laurina*. Vines present included *Cissus antarctica*, *Geitonoplesium cymosum* and *Eustrephus latifolius*. Ferns are common and include *Microsorium scandens* and *Doodia aspera*. Adjacent to the water course the rainforest vegetation intergrades into PCT 3153 a wet sclerophyll forest (shrubby formation) that shares a number of species with PCT 3134. While PCT 3153 is floristically similar it is ecologically driven by fire and always has a strong eucalypt component with a variable mesic component in the mid storey that is tightly correlated to fire interval and moisture availability.

Table 3-3 Floristic and structural summary of PCT 3134 within the study area

Growth form	Typical species
Trees	<i>Acmena smithii</i> , <i>Pittosporum undulatum</i> , <i>Eucalyptus botryoides</i>
Shrubs	<i>Elaeodendron australe</i> , <i>Eupomatia laurina</i>
Grass and grass-like	n/a
Forb	<i>Pseuderanthemum variabile</i>



Growth form	Typical species
Fern	<i>Microsorium scandens</i> , <i>Pellaea falcata</i> ,
Other	<i>Cissus antarctica</i> , <i>Geitonoplesium cymosum</i> and <i>Eustrephus latifolius</i>
Exotic	n/a
High Threat Exotic	n/a

**Condition states:**

The vegetation is in high condition and uniform throughout the zone. The extent (and surrounding vegetation), absence of threats, and continued fire management (avoidance of fire) have allowed landscape scale ecological processes to continue to function uninterrupted. Past disturbances associated with road construction were minor and resulted in little soil disturbance, weed invasion and a highly resilient vegetation community.



Photo 3-1: BAM Plot 3 showing vegetation zone 3 (PCT 3134 – high condition)

### 3.1.2 PCT 3153: Illawarra Escarpment Bangalay x Blue Gum Wet Forest

**Description:**

A tall open, wet sclerophyll forest with a mid-story of rainforest shrubs and palms. PCT 3153 occurs on escarpment benches and slopes in the Illawarra Escarpment area in high rainfall areas with a preference for soils of moderate fertility. The tree canopy is dominated by *Eucalyptus saligna x botryoides* or *E. botryoides*, and occasionally with *Syncarpia glomulifera*. The mid-stratum contains characteristic rainforest species such as *Acmena smithii*, *Livistona australis*, *Pittosporum undulatum*. Other shrub and small tree species very frequently include *Synoum glandulosum* subsp. *Glandulosum*. Mesic vines are common and include *Gynochthodes jasminoides*, *Smilax australis* and *Pandorea pandorana* subsp. *Pandorana*. The ground layer is comprised of a dense layer of ferns, grasses and graminoids when rainforest shrubs cover is low to moderate. Ground covers include *Doodia aspera*, *Oplismenus imbecillis* and *Gymnostachys anceps*. Refer to Table 3-4.

Table 3-4 PCT 3153 details

PCT ID	3153
PCT name	Illawarra Escarpment Bangalay x Blue Gum Wet Forest
Vegetation class	North Coast Wet Sclerophyll Forests
Vegetation formation	Wet Sclerophyll Forests (Shrubby sub-formation)
Estimate of per cent cleared	33.86 %
Area in subject land	0.132ha
Conservation status	Not a TEC
Vegetation zones (condition) and plots	High condition

**Justification for PCT selection:**

PCT 3153 occurs in the Sydney Cataract IBRA sub-region, meets the abiotic descriptions of sheltered landscape position, soils derived from Narrabeen Group geology, wet sclerophyll formation and dominant species throughout the three strata. The floristic structure of the PCT within the area is summarised in Table 3-5.

The vegetation contains the characteristic species within the canopy, shrub and ground layers. Canopy dominants include *E. botryoides*, *E. botryoides x saligna* and the occasional *A. costata* subsp. *Costata*. Closely allied PCTs occur in the area but can be excluded on canopy and shrub layer composition. PCT 3154 is mapped in the locality, however *E. pilularis*, a characteristic species of the canopy is absent, and the shrub layer contains a dense rather than sparse layer of mesic species, including palms.

Table 3-5 Floristic and structural summary of PCT 3153 within the study area

Growth form	Typical species
Trees	<i>E. botryoides</i> , <i>E. saligna x botryoides</i>
Shrubs	<i>Livistona australis</i> , <i>Pittosporum undulatum</i> , <i>Acacia implexa</i> , <i>Breynia oblongifolia</i> , <i>Myrsine varibilis</i>
Grass and grass-like	<i>Gahnia melanocarpa</i> , <i>Poa affinis</i> , <i>Carex appressa</i> , <i>Imperata cylindrica</i>
Forb	<i>Geranium homeanum</i> , <i>Glycine clandestine</i> , <i>Hydrocotyle</i> sp.
Fern	<i>Pteridium esculentum</i> , <i>Pellaea falcata</i>
Other	n/a
Exotic	n/a
High Threat Exotic	n/a

**Condition states:**

The vegetation is in high condition and uniform throughout the zone. The extent (and surrounding vegetation), absence of threats, and continued fire management have allowed landscape scale ecological processes to continue to function uninterrupted. Past disturbances associated with road construction were minor and resulted in little soil disturbance, weed invasion and a highly resilient vegetation community.





Photo 3-2: BAM Plot 2 showing vegetation zone 2 (PCT 3153 – high condition)

### 3.1.3 PCT 3155: Illawarra North-Pittwater Bangalay Moist Forest

**Description:**

A tall open, wet sclerophyll forest with a mid-stratum of mesic shrubs and palms and a ground layer commonly dominated by ferns. PCT 3155 has a tree canopy of that includes a number of eucalypts, most frequently *Eucalyptus botryoides* and *Syncarpia glomulifera*, and occasionally *Eucalyptus paniculata* and *Angophora costata*. Small trees and shrubs include a dominance of *Livistona australis*, and an assemblage of various other mesic species such as *Synoum glandulosum* subsp. *Glandulosum*, *Breynia oblongifolia*, *Myrsine variabilis*, *Notelaea longifolia*, and *Acacia* species. The ground layer contains a dense cover of ferns, such as *Calochlaena dubia*, *Pteridium esculentum* and *Blechnum cartilagineum*.

This PCT is common on sheltered escarpment slopes with a coastal salt spray influence, predominately on Narrabeen sediments from Newport to Mt Keira. Occurring at altitudes from 6 to 360 m. Refer to Table 3-6.

Table 3-6 PCT 3155 Details

PCT ID	3155
PCT name	Illawarra North-Pittwater Bangalay Moist Forest
Vegetation class	Northern Hinterland Wet Sclerophyll Forests
Vegetation formation	Wet Sclerophyll Forests (Grassy sub-formation)
Estimate of per cent cleared	38.71 %
Area in subject land	0.164 ha
Conservation status	Not a TEC

Vegetation zones (condition) and plots

High condition

**Justification for PCT selection:**

PCT 3155 occurs in the Sydney Cataract sub-region, meets the abiotic descriptions of sheltered landscape position, soils derived from Narrabeen Group geology, wet sclerophyll formation and dominant species throughout the three strata. The floristic structure of the PCT within the area is summarised in Table 3-7.

The vegetation contains characteristic species within the canopy, shrub and ground layers. Canopy dominants include *E. botryoides*, *A. costata* subsp. *Costata*, *Syncarpia glommulifera* and *E. paniculata*. In sheltered areas on incised gullies *Syncarpia glommulifera* and *E. paniculata* become increasingly dominant to the detriment of *A. costata* subsp. *Costata*. Conversely, as exposure increases, and conditions become drier, *A. costata* subsp. *Costata* and sclerophyllous shrubs begin to dominate. Closely allied PCTs occur in the area but can be excluded on canopy and shrub layer composition. PCT 3154 is mapped in the locality, however *E. pilularis*, a characteristic species of the canopy is absent.

Floristic and structural summary of PCT 3155 within the study area

Table 3-7 Floristic and structural summary of PCT 3155 within the study area

Growth form	Typical species
Trees	<i>E. paniculata</i> , <i>A. costata</i> subsp. <i>Costata</i> , <i>Syncarpia glommulifera</i>
Shrubs	<i>Elaeodendron australe</i> , <i>Guioa semiglauca</i> , <i>Livistona australis</i> , <i>Indigofera australis</i>
Grass and grass-like	<i>Macrozamia communis</i> , <i>Gahnia melanocarpa</i>
Forb	<i>Dichondra repens</i> , <i>Pseuderanthemum variabile</i>
Fern	<i>Lastreopsis decomposita</i> , <i>Adiantum formosum</i>
Other	n/a
Exotic	<i>Conyza</i> sp.
High Threat Exotic	<i>Ageratina adenophora</i>

**Condition states:**

The vegetation is in high condition and uniform throughout the zone. The extent (and surrounding vegetation), absence of threats, and continued fire management have allowed landscape scale ecological processes to continue to function uninterrupted. Past disturbances associated with road construction were minor and resulted in little soil disturbance, weed invasion and a highly resilient vegetation community.





Photo 3-3: BAM Plot 1 showing vegetation zone 1 (PCT 3155-high condition)

### 3.2 Threatened ecological communities

One Threatened Ecological Community occurs within the assessment area but outside the subject land. PCT 3134 Illawarra Seacliffs Littoral Rainforest is listed under NSW State and Commonwealth legislation. Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South-East Corner Bioregions is listed as Endangered under the BC Act and as Littoral Rainforest and Coastal Vine Thickets of Eastern Australia which is listed as Critically Endangered under the EPBC Act. The TEC matches the listing in the BioNet Vegetation Classification for PCT 3134. The commonwealth TEC relates where it occurs within two kilometres of a coastline. This was confirmed during site visit conducted in November 2022. This TEC identified is shown in Figure 3-2. The vegetation within the study area consists of the defined structure and characteristic species as identified by the NSW Scientific Committee final determinations and includes at least 18 species. The community occurs on a range of substrates and is predominantly driven by the salt laden winds (as nutrient rich) and the absence of fire.

The Governor Game Lookout ancillary facility was included in the design after a thorough desktop analysis and field investigations were undertaken. Based on an initial desktop survey, PCT 3591 Southern Sydney Sheltered Forest is located directly adjacent to the ancillary facility. PCT 3591 relates to NSW Southern Sydney Sheltered Forest TEC which is listed under the BC Act as an Endangered Ecological Community. For the purpose of this assessment, the area outside of this ancillary facility is assumed to be the PCT 3591 TEC.

The NPWS Helipad ancillary facility (and the section where clearing would occur on the road shoulder about 70 metres from the ancillary facility) have not been assessed during site inspections. These areas are associated with PCT 3407 Central Headland Grassland and PCT3125 Illawarra Seacliff Banksia-Bangalay Forest. The former of which is associated with BC Act listed TEC (Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions). However, this TEC is a grassland which is therefore unlikely to be associated with the surrounding vegetation (which is dense and taller).

The Garie Road Ancillary Facility (within the subject land) occurs within PCT 3155: Illawarra North-Pittwater Bangalay Moist Forest which is not identified as a TEC.

Key threatening processes that are involved with the proposal that have the potential to impact upon the TECs are listed below. None of these would occur directly within either of the TECs as they are all contained to the subject land (which does not directly incorporate the TEC associated with PCT 3134 nor PCT 3591.

- BC Act:

## Transport for NSW

- Clearing of native vegetation
- Bushrock removal
- Removal of dead wood and dead trees
- EPBC Act
  - Land clearance



321400

90

6217600

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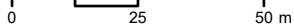


6217400

-  Study Area
-  Subject Land
-  Watercourses
-  Contours (10m)
-  Road
-  Validated TEC Associated with PCT 3134



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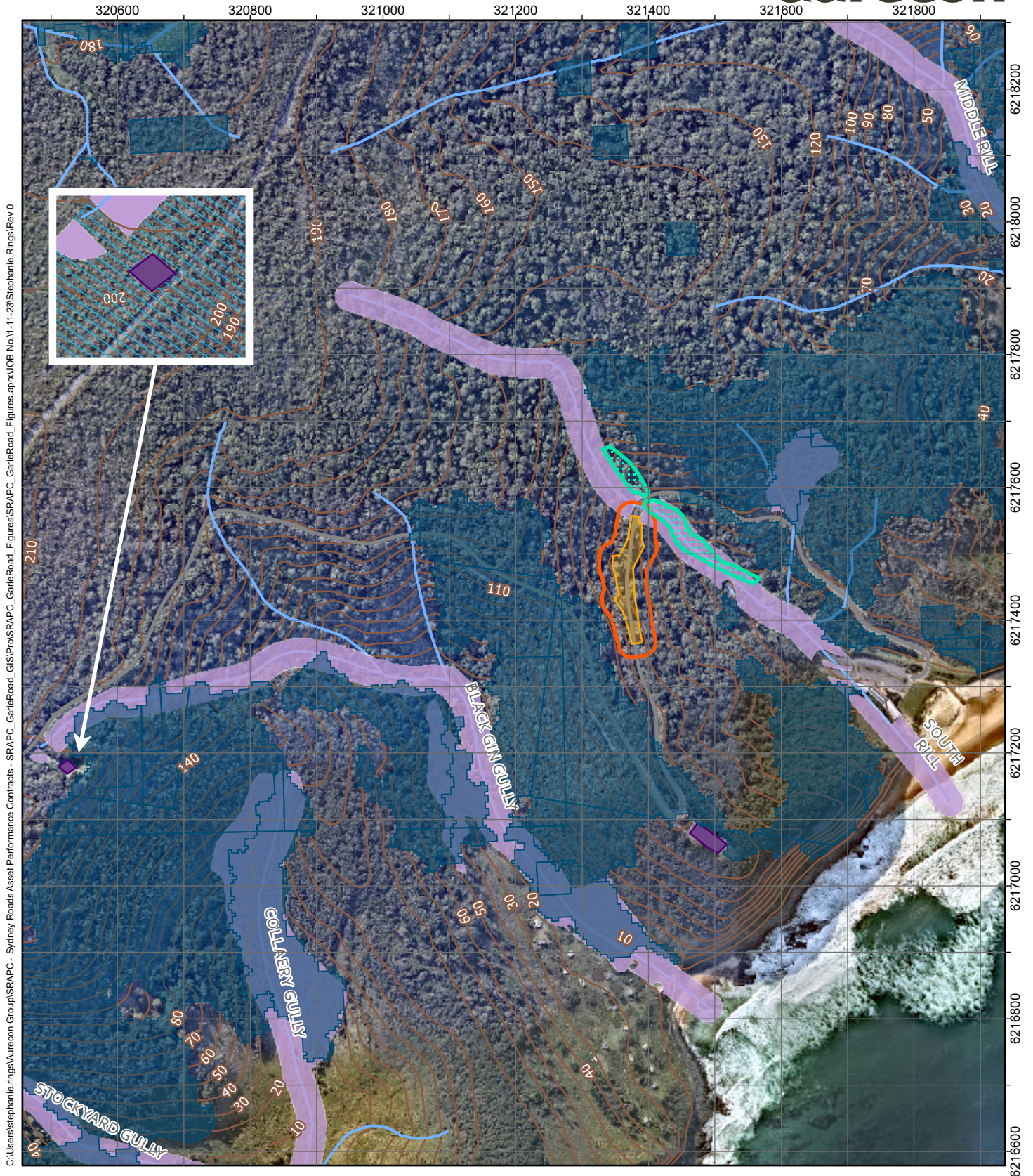
Date: 1/11/2023 Version:1 Job No: 520212

Coordinate System: GDA2020 MGA Zone 56

### 3.3 Groundwater dependent ecosystems

No groundwater dependent ecosystems (GDEs) occur within the assessment area. Four patches containing GDEs are mapped outside of the assessment area and are unlikely to be impacted by the proposal.





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- Study Area
- Subject Land
- Ancillary Facilities
- Watercourses
- Contours (10m)
- Road
- Validated TEC Associated with PCT 3134
- Biodiversity Values
- Groundwater Dependent Ecosystems



A4 scale: 1:8,000  
0 25 50 m

Date: 1/11/2023 Version:1 Job No: 520212  
Coordinate System: GDA2020 MGA Zone 56

**SRAPC Garie Road Biodiversity Assessment Report**

Figure 3-3: Groundwater Dependent Ecosystems



### 3.4 Threatened species

There is potential for up to 140 threatened species to occur (Appendix B) within the study area.

#### 3.4.1 Threatened flora

Targeted surveys were conducted for all species that were considered to have a moderate or higher likelihood of occurring (Table 3-8). Targeted surveys revealed one threatened species within the study area, Scrub Turpentine (*Rhodamnia rubescens*) which is listed as critically endangered under the BC Act and the EPBC Act. A total of 16 individuals were observed on the north-eastern side of Garie Road (see Figure 3-4).

Separate surveys for the Bauer’s Midge Orchid were conducted during its flowering season in March. The species was not found within the area.

Table 3-8: Threatened species surveys results

Species name	EPBC Act	BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? <sup>1</sup>	Results
<i>Astrotricha crassifolia</i>	V	V	Not recorded	Yes, on upper slopes. Not surveyed for on lower slopes due to slip hazard.	Marginal habitat present but species not recorded after adequate survey.
<i>Prostanthera densa</i>	V	V	Not recorded	Yes, on upper slopes. Not surveyed for on lower slopes due to slip hazard.	Marginal habitat present but species not recorded after adequate survey.
<i>Callistemon linearifolius</i>	Not listed	V	Not recorded	Yes, on upper slopes. Not surveyed for on lower slopes due to slip hazard.	Habitat present but species not recorded after adequate survey.
<i>Rhodamnia rubescens</i>	CE	CE	Recorded	Yes, on upper slopes. Not surveyed for on lower slopes due to slip hazard.	A total of 16 individuals were recorded within the study area. They are located on the slope above Garie Rd in PCT 3155. Habitat for Scrub Turpentine occurs on the lower slopes beneath Garie Road. As the slope is considered unstable and prone to landside the area was not surveyed.
<i>Syzygium paniculatum</i>	V	E	Not recorded	Yes, on upper slopes. Not surveyed for on lower slopes due to slip hazard.	Habitat present but species not recorded after adequate survey.
<i>Genoplesium baueri</i>	E	E	Not recorded	Yes, on upper slopes. Not surveyed for on lower slopes due to slip hazard.	Marginal habitat present but species not recorded after adequate survey during flowering time (February to March).

Note: 1. As identified in Section 2.4 of this BAR.



### 3.4.2 Threatened fauna

Habitat assessment and incidental surveys were undertaken on 28 November 2022 to determine the likelihood of presence of threatened mammals, avifauna and amphibians. Mapping of hollows was undertaken and is recorded on Figure 3-4.

Several fauna species were considered to have a moderate or high likelihood of occurrence within the study area. As no hollow bearing trees would be removed for the proposal, target surveys were not deemed necessary for avifauna, bats, or gliders. Fauna species where targeted surveys were not required and the justification for the exclusion of targeted surveys, are shown in Table 3-9. If hollow bearing trees are to be impacted by the proposal, further targeted surveys for these fauna groups and impact assessments would be required.

Table 3-9 Fauna habitat assessment results

Scientific name	Common name	BC Act status	EPBC Act status	Potential occurrence (Moderate or high)	Justification for no targeted surveys
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	Moderate	Only potential foraging habitat is within subject land as no hollow bearing trees to be removed for the project.
<i>Lathamus discolor</i>	Swift Parrot	E	CE	Moderate	Subject land does not occur within important habitat map. Only potential foraging habitat is within subject land as no hollow bearing trees to be removed for the project.
<i>Ninox strenua</i>	Powerful Owl	V	-	Moderate	Only potential hunting habitat is within subject land as no hollow bearing trees to be removed for the project.
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Moderate	Only potential hunting habitat is within subject land as no hollow bearing trees to be removed for the project.
<i>Tyto tenebricosa</i>	Sooty Owl	V	-	Moderate	Only potential hunting habitat is within subject land as no hollow bearing trees to be removed for the project.
<i>Anthochaera Phrygia</i>	Regent Honeyeater	CE	CE	Moderate	Subject land does not occur within important habitat map. Only potential foraging habitat is within subject land.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-Fox	V	V	Moderate	Only potential foraging habitat is within subject land and no roosting habitat would be impacted by the project.
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	-	Moderate	Potential foraging habitat is within subject land. No hollow bearing trees or human-made structures (roosting habitat) to be removed for the project. Unlikely to impact roosting under loose bark.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Moderate	Only potential foraging habitat within the subject land. No caves

					(roosting habitat) present in the area.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Moderate	Limited foraging habitat within the subject land. Unlikely to impact roosting habitat (loose bark on trees or hollows).
<i>Myotis Macropus</i>	Southern Myotis	V	-	Moderate	Limited foraging habitat within the subject land. Project would not remove roosting habitat (hollows, caves, human-made structures). Small pond that may be used for fishing by Southern Myotis is outside of the subject land.
<i>Scoteanax rueppellii</i>	Greater Broad-Nosed Bat	V	-	Moderate	Only potential foraging habitat within the subject land. No hollows (roosting habitat) would be removed by the project.
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Moderate	While there is suitable habitat present at South Rill, the subject area would not contain breeding habitat.

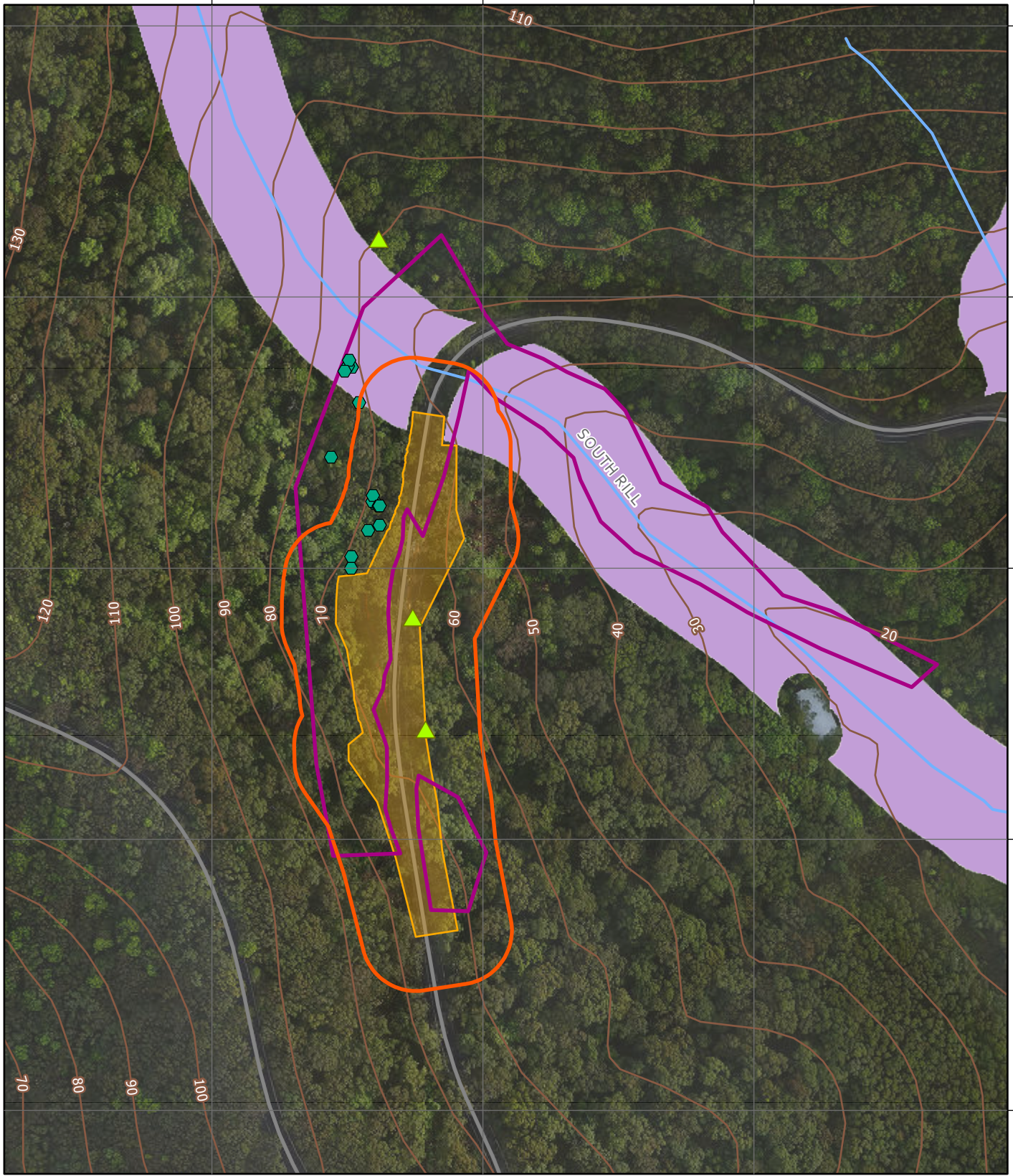
The Red-crowned Toadlet was considered to have a moderate likelihood of occurrence. Targeted aural-visual surveys were conducted across four dates in March 2023 (10 March, 17 March, 20 March and 22 March 2023). Weather for these surveys were mostly dry. However had followed some rain events. Target preferred habitat including wet seeps. Toadlet calls were played from speakers at various locations across the study area and around South Rill. No evidence (visual or aural) of the Red-crowned Toadlet was identified any of the four afternoons. This is summarised in Table 3-10.

Table 3-10 Targeted fauna assessment results

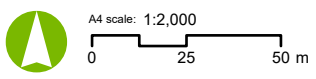
Scientific name	Species name	EPBC Act	BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? <sup>1</sup>	Results
<i>Pseudophryne australis</i>	Red-Crowned Toadlet	-	V	Not recorded	Yes	Species not present. No species credit required.
<i>Note: 1. As identified in Section 2.4 of this BAR.</i>						



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- Study Area
- Subject Land
- Watercourses
- Contours (10m)
- Road
- Biodiversity Values
- Targeted Survey Location
- Hollow Bearing Tree Locations - To be retained
- Surveyed Scrub Turpentine (*Rhodamnia rubescens*)



### 3.5 Aquatic results

The study area is located within the South Rill catchment, which is intersected by Garie Road. The vegetation surrounding the creekline is in high condition. The creekline has had several modifications including a small weir to dam water, pipes to supply water to infrastructure at Garie beach and a culvert that lies beneath Garie Road. South Rill is located about 16 metres from the subject land at its closest point. South Rill is a 1<sup>st</sup> order stream based on the Strahler method of stream ordering (NSW DPI 2018). The creek does not meet the threshold for key fish habitat under the Policy and guidelines for fish habitat conservation and management (DPI, 2013). It may likely provide habitat for amphibians on the steep rocky sections and potentially fish within the flat, low-lying sections of the reach.

South Rill is 2 to 4 metres across, with a bank height of 1 to 2 m. The reach contained no aquatic vegetation as the steep creekline was rocky and well shaded. Water was flowing within the creekline at the time of the survey and varied from 5 cm to 20 cm deep. The creek bed consisted of boulders, gravels and sand. Garie Road intersects the watercourse and a culvert transports water beneath the road. On the lower side of Garie Road, natural and artificial barriers to fish passage are present. Large boulders and sandstone benches are present. Rock gabions have been installed to minimise erosion and enhance the stability of the creek bank and surrounding slope. Refer to Photo montage 3-1.

South Rill is mapped on the Biodiversity Values Map and classified as biodiverse land. The high quality creekline is not to be directly impacted by the proposal, however, works associated with construction may indirectly impact the quality and function of the waterway, if mitigation measures are not applied and maintained. There is a low, but natural level of sands and gravels within the creek bed. Additional sedimentation associated with construction and vegetation removal is likely to adversely impact the habitat value of this sensitive aquatic habitat if mitigation measures are not put in place. Additionally, the steep slopes >18° are highly erodible. Any earthworks or vegetation clearing has the potential to indirectly impact the creekline and the riparian vegetation – classified as TEC - littoral rainforest under NSW and Commonwealth legislation. Provided mitigation measures are adhered to, it is not expected that South Rill would be impacted by the proposal.





Photo montage 3-1 Photo montage of South Rill creekline and rock gabions.

### 3.6 Areas of outstanding biodiversity value

No areas of outstanding biodiversity value occur within the study area.

### 3.7 Wildlife connectivity corridors

The study area is located within the RNP which contains about 15 000 hectares of near continuous vegetation. A series of national parks and special areas (water catchments) link the study area to millions of hectares of bushland with minimal interruptions from barriers such as roads. The existing road alignment separates two large areas of the RNP. However, the existing road is unlikely to prevent fauna from traversing between the gap in bushland nor is it likely to impede the dispersal of flora. Similarly, the proposal follows closely to the existing road alignment.

### 3.8 SEPPs

State Environmental Planning Policies (SEPPs) outline policy objectives relevant to issues on a state level.

#### 3.8.1 State Environmental Planning Policy (Biodiversity and Conservation) 2021

Koala Habitat Protection falls under the Biodiversity and Conservation SEPP (2021). The Koala Habitat Protection SEPPs aim to help reverse the decline of the population of *Phascolarctos cinereus* (Koala) by having koala habitat properly considered during the development assessment process. The Koala Habitat Protection SEPP (2020) is contained in Chapter 3 of the Biodiversity and Conservation SEPP. The SEPP does not apply to the proposal as it is not located in any of the listed LGAs. The Koala Habitat Protection SEPP (2021) is contained in Chapter 4 of the Biodiversity and Conservation SEPP. The SEPP does not apply to the proposal as it is not located on one of the listed LGAs in Schedule 2 as well as being on land dedicated or reserved under the NPW Act 1974.

#### 3.8.2 State Environmental Planning Policy (Resilience and Hazards) 2021

The Resilience and Hazards SEPP commenced on 1 March 2022 superseding several previous SEPPs. Chapter 2 - Coastal Management of the Resilience and Hazards SEPP considers coastal planning provisions which replaced three repealed policies including SEPP 26 (Littoral Rainforests).

A search of the ePlanning Spatial Viewer indicates that the project is adjacent to an area mapped as 'Littoral Rainforest' on the Coastal Wetlands and Littoral Rainforests Map, and the NSW Helipad ancillary facility is less than 50 metres from the 'Proximity area for Littoral Rainforest' (while the Governor Game Lookout ancillary facility is over 100 metres away). Section 2.7 (1) (a) states that development consent is required for the clearing of native vegetation and for carrying out earthworks. However, as the proposal would not fall on land that is mapped as 'Littoral Rainforest' or 'Proximity area for Littoral Rainforest', then Section 2.7 would not apply.

The proposal is also adjacent to areas mapped as 'Coastal Environment Area Map'. The proposal is a minimum of 100 metres from these areas. However, the NSW Helipad ancillary facility overlaps with the 'Coastal Environment Area Map'. Section 2.10 states where development consent on land within the coastal environment area cannot be granted. As the proposal is not expected to have an adverse impact on marine vegetation, native vegetation and fauna and their habitats, Clause 2.10 (1) (d) would not prevent development consent.

### 3.9 Matters of national environmental significance

The Protected Matters Search Tool identified the following Matters of National Environmental Significance (MNES) as outlined in Table 3-11. The location of the MNES is shown in Figure 3-5.

Table 3-11 Matters of National Environmental Significance

Category	Number present	Matter within the 10 kilometres of the area	Impact
World Heritage Properties	0	None within search area	-
National Heritage Places	1	Royal National Park and Garawarra State Conservation Area. The Royal National Park and Garawarra State Conservation Area constitute a major area of plant biodiversity. The Royal	The RNP is located within the study area. Vegetation clearance would include the removal of 72 trees in a total



Category	Number present	Matter within the 10 kilometres of the area	Impact
		National Park was the first National Park to be established in Australia (1879), regarded as beginning of non-Indigenous Australian conservation.	up to 0.296 hectares. Therefore, the impact would be low.
<b>Wetlands of International Importance</b>	1	Towra Point Nature Reserve. Towra Point supports three EPBC Act threatened species and it is an important area for maintaining the biodiversity of the Sydney region. It contains significant food sources for over 60 species of fish as well as containing high numbers of fish dependent on the mangrove habitat within stages of juvenile development	Towra Point Nature Reserve is located outside the study area. The study area is located adjoining a watercourse, but not near waterbodies or wetlands. The adjoining watercourses are unlikely to affect Ramsar wetlands, given that the initial drainage of the site flows to South Rill which drains to the ocean. Therefore, the impact would be low.
<b>Great Barrier Reef Marine Park</b>	0	None within search area	-
<b>Commonwealth Marine Area</b>	0	None within search area	-
<b>Listed Threatened Ecological Communities</b>	8	The eight TECs that are likely or may occur within the area are <ul style="list-style-type: none"> <li>Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of NSW and South East Queensland ecological community</li> <li>Coastal Swamp Sclerophyll Forest of NSW and South East Queensland</li> <li>Coastal Upland Swamps in the Sydney Basin Bioregion</li> <li>Eastern Suburbs Banksia Scrub of the Sydney Region</li> <li>Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion</li> <li>Littoral Rainforest and Coastal Vine Thickets of Eastern Australia</li> <li>Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion</li> <li>Southern Sydney Sheltered Forest</li> </ul>	One TEC was identified that is associated with PCT 3134: Littoral Rainforest and Coastal Vine Thickets of Eastern Australia. A further TEC associated with PCT: 3591 Southern Sydney Sheltered Forest, was assumed present adjacent to the Governor Game Lookout ancillary facility. However, this TEC is outside the Subject land. Therefore, the impact would be low.
<b>Listed Threatened Species</b>	102	A total of 102 threatened species were identified as may, likely, or known to occur, or to have habitat occurring, within a 10-kilometre radius of the study area.	One threatened species was identified outside the Subject land but within the Study area. Many species were considered not likely to occur within the study area. Assessments of significance were undertaken for several species that were considered moderately or highly likely within the study area.
<b>Listed Migratory Species</b>	59	A total of 59 migratory species were identified within a 10-kilometre radius of the study area.	Migratory species are unlikely to use vegetation in the study area due to an abundance of adjacent habitat. Therefore, the impact would be considered low.

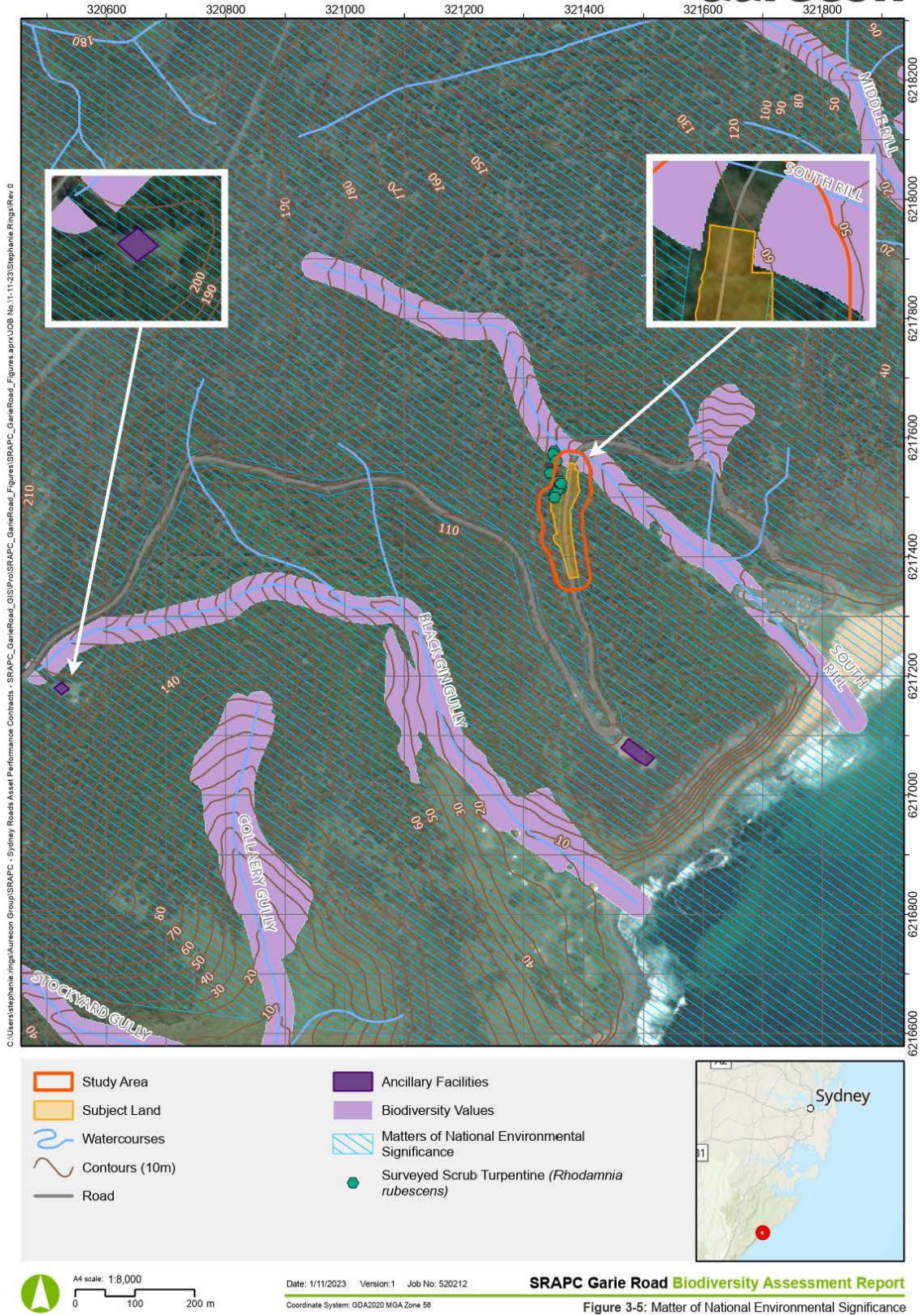


Figure 3-5: Matters of national environmental significance recorded



## 4. Avoidance and minimisation

This chapter of the BAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values. Construction and operation of roads can lead to and exacerbate the decline of biodiversity if appropriate mitigation measures are not implemented. The Transport *Biodiversity Guidelines* (2011) outline ways in which these potential impacts could be avoided as far as practicable throughout the stages of a project. A key part of Transport's management of biodiversity for this proposal is the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

1. Avoid and minimise impacts.
2. Mitigate impacts.
3. Offset impacts in accordance with TfNSW guidelines.

Direct impacts on native vegetation, threatened species and habitat have been avoided and minimised by:

- Locating the proposal in areas where there are no significant biodiversity values.
- Locating the proposal in areas that avoid habitat for threatened species that may be at risk of a significant impact or native vegetation that is part of a critically endangered ecological community (CEEC) or an endangered ecological community (EEC).
- Amending the proposal design and location to avoid clearing known threatened flora species (Scrub Turpentine) including the establishment of environmental exclusion areas.
- Developing a new road design which does not include unnecessary vegetation and habitat clearing. This includes the retention of all hollow bearing trees and placing a Tree Protection Zone (TPZ) around each of the two closest hollow bearing trees within/adjoining the proposal.
- Locating the proposal such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained.
- Locating the temporary ancillary facilities within areas previously cleared therefore reducing the potential clearing footprint of the proposal (impact to vegetation limited to minor trimming of tree branches). Minor trimming of understorey vegetation along the road shoulder on Garie Road (about 70 metres from the NPWS helipad ancillary facility).

In addition, several mitigation measures would be applied to avoid and minimise biodiversity impacts. These mitigation measures are discussed in Chapter 6 and include:

- Establishing a formal exclusion zone during the design phase to avoid clearing and reduce impacts to the known threatened flora species (Scrub Turpentine).
- Pre-clearance surveys, including the preparation of a Wildlife Management Plan, by accredited ecologist and/or fauna handler
- An ecologist and/or fauna handler is present during vegetation clearing works
- Avoid clearing hollow bearing trees (and placing TPZs around two hollow bearing trees)
- Reuse of woody debris where practicable to enhance habitat and only using locally endemic native species for revegetation work (consistent with the PCTs present)
- Locating ancillary facilities in areas where there would not require any vegetation clearing (trimming of trees)
- Avoiding impact to threatened ecological communities by installing exclusion fencing around the Governor Game Lookout ancillary facility adjacent to the assumed community. Only trimming of small branches without habitat features encroaching on the existing hardstand would be permitted.
- Where possible, clearing only trees that are necessary for operational reasons.

## 5. Impact assessment

### 5.1 Construction direct impacts

During construction, the proposal could potentially diminish biodiversity values within the footprint. Further indirect impacts may occur extending beyond the proposal boundary. This section details the construction impacts from the proposal including clearing threatened species habitat.

#### 5.1.1 Removal of native vegetation

Clearing of native vegetation is listed as a Key Threatening Process under the BC Act as is Land clearance under the EPBC Act. The proposal would involve clearing of up to 0.296 hectares of native vegetation noting that part of this clearing footprint value includes tree protection zones (in which clearing and works are restricted but residual impacts may be generated). The subject land includes 0.164 hectares of PCT 3155 and up to 0.132 hectares of PCT 3153 (Table 5-1). Neither PCTs within the proposal boundary are associated with any TECs.

The vegetation surrounding the Governor Game Lookout ancillary facility is assumed to be a TEC (NSW Southern Sydney Sheltered Forest). Direct and indirect impacts can occur with associated facilities. Minor tree trimming is also likely to be necessary at the NPWS helipad ancillary facility and at the road shoulder on Garie Road about 70 metres from this ancillary facility to provide additional parking for the 'Little Garie Cabin Community'. These areas have not been assessed during site investigations. However, apart from trimming of small outer branches of trees, no removal of vegetation is expected for the use of the facilities reducing the likelihood of direct impacts. Trimming is to be restricted to smaller branches and no hollow bearing limbs. Indirect impacts such as the movement of pathogens, weeds and trampling of TEC may occur. At the road shoulder about 70 metres from the NPWS Helipad ancillary facility, impact would be limited to minor trimming of understory vegetation to allow for additional temporary parking. The Garie Road Ancillary Facility would sit within the subject land to the south of the proposed works. It is located on land already disturbed and may involve minor tree trimming and clearing of smaller non-woody plants (such as grasses, sedges, forbs). Mitigation measures such as exclusion fencing to avoid the threat of these impacts to the TECs are discussed in Chapter 6.

Within the workzones (at the subject land) for the project, minor trimming of the canopy would be necessary to facilitate required construction works including larger plant and equipment and their movements.

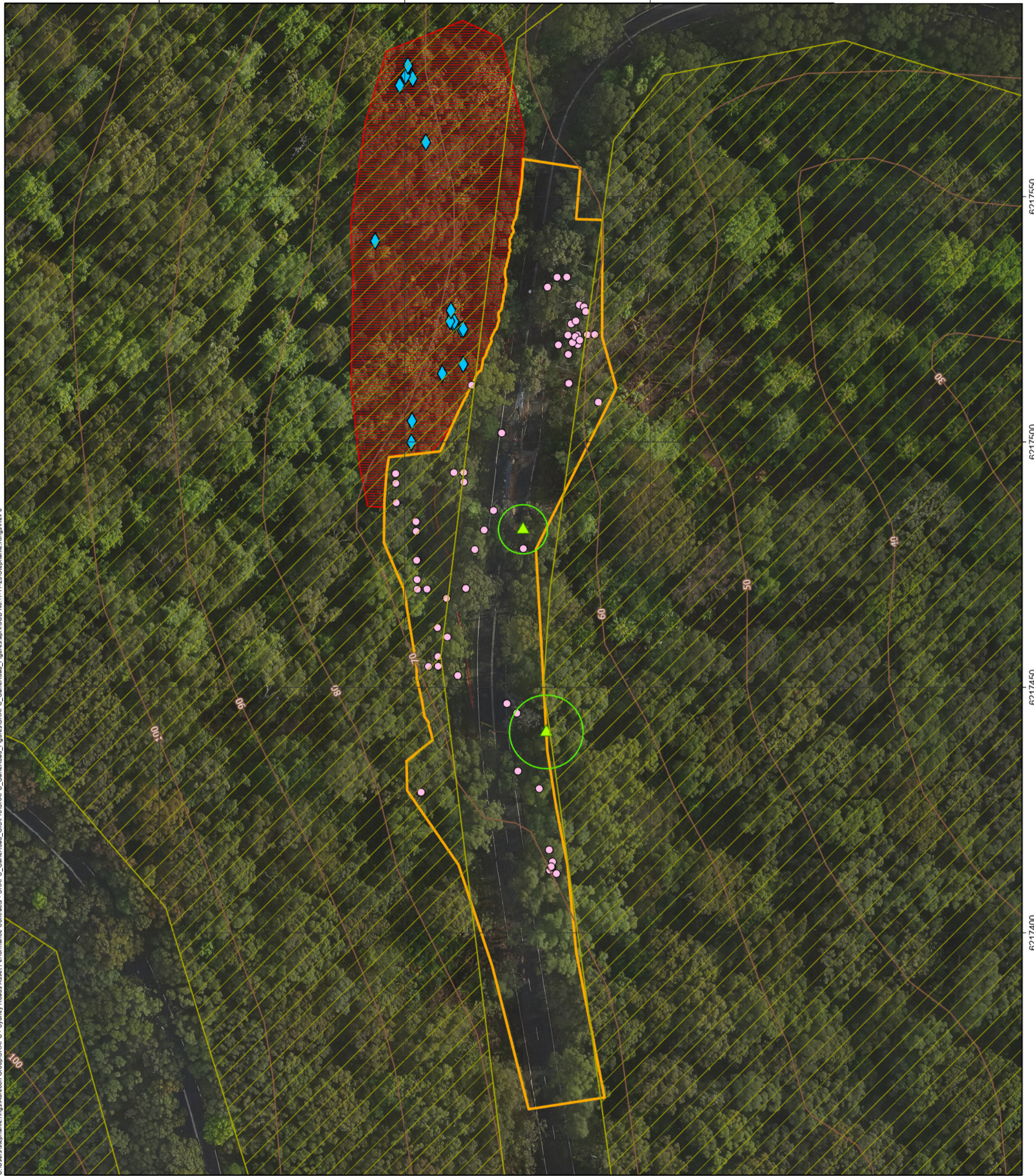
The location of the trees that have been assessed and approved for removal in the BAR are shown in Figure 5-1 and trees within the proposal subject land that have not been identified for removal must be retained. Tree locations shown are indicative only with up to about five metres of inaccuracy.

Table 5-1: Summary of direct impacts on native vegetation

Veg. zone	Plant community type (PCT)	Broad condition class	TEC	Area to be impacted (ha)	Area to be impacted (ha) within RNP only (as a sub section of total area)
Zone 2	PCT 3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	High	No associated TECs	0.132 ha	0.018 ha
Zone 1	PCT 3155 Illawarra North-Pittwater Bangalay Moist Forest	High	No associated TECs	0.164 ha	0.080ha






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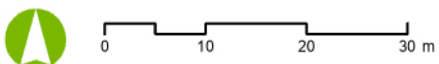


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-  Subject Land
-  Hollow Bearing Tree Protection Zone
-  Environmental Exclusion Zone
-  Contours (10m)
-  NPWS Land

-  Trees assessed for removal
-  Hollow Bearing Tree - TO BE RETAINED
-  Surveyed Scrub Turpentine (*Rhodamnia rubescens*) - TO BE RETAINED

Please note this figure is for reference only. Tree locations are indicative only (~5m accuracy) and a formal site survey of tree locations can provide greater accuracy if required. Trees which are approved for removal (only if required for operational reasons) have been physically marked and tagged. Operational works are excluded from tree protection zones and any access is not permitted within the environmental exclusion zone.



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### 5.1.2 Removal of threatened fauna habitat

The proposal would need to avoid removing any hollow bearing trees. If the hollow bearing trees within the subject land (or anywhere else) are to be directly impacted by the proposal, further surveys and impact assessments would be required prior to any further works to confirm presence or absence of several threatened hollow dwelling and dependent species. Mitigation measures including placing TPZs around the two hollow bearing trees within/adjoining the proposal are summarised in Table 6-1. While one hollow bearing tree (*Eucalyptus botryoides*) has been impacted by the slope failure, its habitat value remains due to the presence of a hollow. The second hollow bearing tree (*Eucalyptus saligna x botryoides*) is larger with potential habitat for larger fauna. The TPZs are shown in Figure 5-1. The size of the TPZ is determined by the DBH times by 12, therefore reflecting the variation in size of the two TPZs visible.

Up to 72 trees across up to 0.296 hectares of vegetation are approved for removal which may provide habitat for several threatened species identified with a moderate or high likelihood of occurrence in Appendix B (Habitat Suitability Assessment). Assessments of significance were conducted for these species (Appendix D: Tests of Significance (BC Act)). Noting that 0.016 hectares of vegetation assessed for removal is within TPZs (and therefore may have residual impacts).

No evidence of the Red-Crowned Toadlet was found during targeted surveys.

Where tree trimming is required to trees and woody plants that have not been assessed for removal (ie at the ancillary facilities and on the road shoulder for additional parking), trimming is to be restricted to smaller branches and no hollow bearing limbs. Mitigation measures to minimise construction impacts to threatened species are discussed in chapter 6.

The direct impacts for threatened fauna species with a moderate or higher likelihood of occurrence are described in Table 5-2.

Table 5-2: Summary of direct impacts on threatened fauna and habitat

Scientific name	Species name	BC Act	EPBC Act	Credit type <sup>1</sup>	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	-	Species	Moderate	The subject land contains 0.296 ha of potential foraging habitat (PCT 3153, 3155). However, targeted surveys revealed no evidence of the toadlet in study area.	0 ha
<i>Glossopsitta pusilla</i>	Little Lorikeet	-	V	Ecosystem	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296ha
<i>Lathamus discolor</i>	Swift Parrot	CE	E	Ecosystem	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant impact on the	0.296 ha



Scientific name	Species name	BC Act	EPBC Act	Credit type <sup>1</sup>	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)
						livelihood of the species.	
<i>Ninox strenua</i>	Powerful Owl	-	V	Ecosystem	Moderate	The subject land contains 0.296 ha of potential hunting habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296 ha
<i>Tyto novaehollandiae</i>	Masked Owl	-	V	Ecosystem	Moderate	The subject land contains 0.296 ha of potential hunting habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296 ha
<i>Tyto tenebricosa</i>	Sooty Owl	-	V	Ecosystem	Moderate	The subject land contains 0.296 ha of potential hunting habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296 ha
<i>Anthochaera Phrygia</i>	Regent Honeyeater	CE	CE	Ecosystem	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have an impact on the livelihood of the species.	0.296 ha
<i>Pteropus poliocephalus</i>	Grey-Headed Flying-Fox	V	V	Ecosystem	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant impact on the	0.296 ha

Scientific name	Species name	BC Act	EPBC Act	Credit type <sup>1</sup>	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)
						livelihood of the species.	
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-Tailed Bat	-	V	Ecosystem	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296 ha
<i>Chalinolobus dwyeri</i>	Large-Eared Pied Bat	V	V	Species	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296 ha
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	V	Ecosystem	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296 ha
<i>Myotis Macropus</i>	Southern Myotis	-	V	Species	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296 ha
<i>Scoteanax rueppellii</i>	Greater Broad-Nosed Bat	-	V	Ecosystem	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant	0.296 ha



Scientific name	Species name	BC Act	EPBC Act	Credit type <sup>1</sup>	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Species	Moderate	The subject land contains 0.296 ha of potential foraging habitat. However, the proposal is not expected to have a significant impact on the livelihood of the species.	0.296 ha

As discussed in section 3.8, the Koala SEPPs do not apply to the proposal. Transport’s management of biodiversity applies the ‘avoid, minimise, mitigate and offset’ hierarchy. Therefore, Transport aims to avoid impacts to Koalas and Koala habitat where possible. One ancillary habitat tree species and one assumed locally important Koala tree (hybrid species) were identified during site visits (see Table 5-3). The overall habitat value for the species is considered low. Six locally important and 23 ancillary habitat trees would be impacted by the proposal. Mitigation measures to avoid impacts to koalas and other threatened fauna species are outlined in Chapter 6.

Table 5-3 Locally important and ancillary habitat, koala trees in the NSW South Coast (A review of koala habitat assessment criteria and methods (Youngentob, Marsh & Skewes, 2021)).

Scientific Name	Common Name	Ancillary or Locally Important	Identified on site
<i>Eucalyptus bosistoana</i>	Coast Grey Box	Locally important	No
<i>E. cypellocarpa</i>	Monkey Gum	Locally important	No
<i>E. eugenioides</i>	Thin-Leaved Stringybark	Locally important	No
<i>E. globoidea</i>	White Stringybark	Locally important	No
<i>E. longifolia</i>	Woollybutt	Locally important	No
<i>E. maidenii</i>	Maiden’s Gum	Locally important	No
<i>E. meulleriana</i>	Yellow Stringybark	Locally important	No
<i>E. obliqua</i>	Messmate Stringybark	Locally important	No
<i>E. punctata</i>	Grey Gum	Locally important	No
<i>E. saligna</i>	Sydney Blue Gum	Locally important	Hybrid <i>E. saligna</i> x <i>E. botryoides</i> identified on site
<i>E. tereticornis</i>	Forest Red Gum	Locally important	No
<i>E. viminalis</i>	Red Ironbark	Locally important	No
<i>Allocasuarina littoralis</i>	Black She-Oak	Ancillary habitat	Yes, identified within the study area (outside of subject land)
<i>Angophora floribunda</i>	Rough-Barked Apple	Ancillary habitat	No
<i>Corymbia gummifera</i>	Red Bloodwood	Ancillary habitat	No
<i>Corymbia maculata</i>	Spotted Gum	Ancillary habitat	No
<i>E. agglomerata</i>	Blue-Leaved Stringybark	Ancillary habitat	No
<i>E. baueriana</i>	Blue Box	Ancillary habitat	No
<i>E. consideniiana</i>	Yertchuk	Ancillary habitat	No
<i>E. elata</i>	River Peppermint	Ancillary habitat	No
<i>E. fastigata</i>	Brown Barrel	Ancillary habitat	No
<i>E. paniculata</i>	Grey Ironbark	Ancillary habitat	Yes, identified on site
<i>E. pilularis</i>	Blackbutt	Ancillary habitat	No
<i>E. piperita</i>	Sydney Peppermint	Ancillary habitat	No

Scientific Name	Common Name	Ancillary or Locally Important	Identified on site
<i>E. sclerophylla</i>	Hard-Leaved Scribbly Gum	Ancillary habitat	No
<i>E. sieberi</i>	Silvertop Ash	Ancillary habitat	No

### 5.1.3 Removal of threatened flora

Targeted surveys were conducted in areas shown in Figure 2-2 for the species listed in Table 3-8. Sixteen Scrub Turpentines were identified in the targeted survey location. Three to six Scrub Turpentines were originally within the design footprint. However, following identification of these plants, the design of the proposal was amended to avoid removing any Scrub Turpentines. An exclusion zone has been placed around the area where they were identified with a minimum 2.5 metre buffer zone at its closest point within a larger fixed environmental exclusion zone. The condition of the Scrub Turpentine habitat may potentially reduce in quality as a result of construction work adjacent. Up to 0.296 hectares of PCT 3153 and PCT 3155 would be cleared noting that 0.016 hectares of this is within tree protection zones (and therefore may have residual impacts). However, no Scrub Turpentines were identified within the area that would be cleared. A BC Act test of significance and EPBC Act assessment of significance were conducted indicating that there would not be a significant impact, despite potential direct impact to the closest Scrub Turpentines to the subject land.

Bauer’s Midge Orchid flowers between February and March. Targeted surveys for the orchid were conducted in March 2023 to confirm that the species was absent from the study area. Therefore, no known habitat for the Bauer’s Midge Orchid would be directly impacted by the proposal.

No further threatened flora were identified. Therefore, minimal impact is expected to threatened flora. No mortality, removal or relocation is necessary or expected to threatened flora as a result of the proposal.

Minor tree trimming may be required for the Governor Game Lookout and NPWS helipad ancillary facilities, as well as at the subject land and on the road shoulder about 70 metres from the NPWS ancillary facility, with no further impact to flora.

There is not expected to be impacts on threatened flora species as none were identified during site surveys within the subject land, with a summary provided in Table 5-4.

Table 5-4: Summary of direct impacts on threatened flora

Species name	EPBC Act	BC Act	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha or individuals)
<i>Astrotricha crassifolia</i>	V	V	Moderate	None	No impacts as species not detected
<i>Prostanthera densa</i>	V	V	Moderate	None	No impacts as species not detected
<i>Callistemon linearifolius</i>	Not listed	V	High	PCT 3155	No impacts as species not detected
<i>Rhodamnia rubescens</i>	CE	CE	Recorded	PCT 3155, PCT 3153,	No impacts as species design modified to avoid individuals detected
<i>Syzygium paniculatum</i>	V	E	High	PCT 3153	No impacts as species not detected
<i>Genoplesium baueri</i>	E	E	Moderate	None	No impacts as species not detected



#### 5.1.4 Aquatic impacts

Drainage channels are located around 16 metres to the north (South Rill) of the proposal and 350 metres to the south (Black Gin Gully) of the proposal. Due to the distance of the works to these channels, and the implementation of soil erosion and sediment control measures from the commencement of construction, the risk of erosion and sedimentation impacting the efficiency of the drainage channels is low.

Construction activities may generate liquid and/solid waste that, if not managed correctly, could potentially impact nearby water.

The current culvert does not provide fish passage. Therefore, removing the culvert during construction is not expected to impact aquatic dependent fauna. The provision of the new culvert follows a similar drainage course and would not be expected to substantially change hydrology.

The proposal is not expected to have any construction impacts and changes to flooding regimes, shading regime and temperature. Acid Sulphate Soils are not expected to be encountered in the proposal area (including the nominated ancillary facilities).

No earthworks are required for the ancillary facilities. Potential spills and leaks may occur from plant and equipment on site that if not appropriately prevented and managed could lead to aquatic impacts downstream.

#### 5.1.5 Injury and mortality

The proposal footprint is located largely within and directly adjacent to the existing road corridor that travels through the RNP. However, clearing of up to 0.296 hectares of land is required to meet the goals of the proposal noting that 0.016 hectares of this is within tree protection zones (and therefore may have residual impacts). When Garie Road was operational (ie prior to slope failure) it was not often susceptible to heavy disturbance (as contrast to a road in a highly urbanised area for example). Injury and mortality would have occurred on occasion from road vehicles. It is possible that disturbance sensitive species are present in the area. In its current operation, Garie Road segments dense wet sclerophyll forests where fauna are highly likely to inhabit and therefore attempt to traverse.

It is likely that the highest risk of injury and mortality to fauna would occur during vegetation clearing where multiple trees, shrubs and other natural habitat would be impacted and cleared. However, no hollow bearing trees would be impacted by the clearing. Fauna species such as birds, bats, terrestrial and arboreal mammals are sufficiently mobile and able to relocate to adjacent areas of habitat to avoid injury.

The culvert that would be removed is unlikely to contain vertebrates due to its size and a build-up of debris.

Further, machinery and plant are also a source of fauna injury and mortality during construction. When Garie Road was operational, there would have likely been more injury and mortality impacts from road vehicles than is expected during construction.

Mitigation measures to reduce these impacts are outlined in Chapter 6.

#### 5.1.6 Groundwater dependent ecosystems

There are no GDEs within or directly adjoining the proposal footprint.

To further manage and mitigate potential impacts to GDEs in the broader landscape, standard sedimentation and erosion control measures would be put in place as discussed in Section 6. In addition, no non-native grasses would be planted as part of the grass swale.

### 5.2 Indirect and operational impacts

#### 5.2.1 Edge effects on adjacent native vegetation and habitat

The removal of up to 0.296 hectares of native vegetation would increase the edge to core ratio. However, the proposal is within the RNP, in a largely undisturbed area of dense native vegetation, and parallel to the existing roadway. Increasing the edge to core ratio can encourage more weed growth and decrease foraging habitat. Linear infrastructure developments are known to cause negative impacts associated with edge effects and habitat fragmentation. However, design of the proposal has

meant that the road would largely follow the footprint of the existing road with minimal additional clearing. Therefore, this impact is expected to be minimal. Mitigation measures are outlined in Chapter 6.

### 5.2.2 Wildlife connectivity and habitat fragmentation

The proposed works would not create new fragments within the RNP. The distance between fragments either side of the existing road would increase as a result of up to 0.296 hectares of clearing (necessary to meet the goals of the proposal). While the proposal is a linear infrastructure development, it follows a similar footprint to the existing road, therefore not fragmenting vegetation and wildlife connectivity further.

RNP is known to a range of wildlife. The existing culvert is unlikely to provide habitat or passage for wildlife due to its small size and a build-up of debris, however new culvert design should consider the potential for fauna movement. Mobile species such as birds would unlikely be impacted by the minor increase in gap between areas of bushland and slight road realignment. Less mobile fauna species would still be able to traverse the gap. The proposal is not expected to prevent the dispersal of flora. Reinstating access to Garie Beach is expected to return road use to pre slope failure levels. Therefore, there is not expected to be an increase in operational traffic therefore there would not be an expected increase in roadkill.

In summary, the proposal is not expected to cause a substantial change to wildlife connectivity and habitat fragmentation from the existing environment.

### 5.2.3 Injury and mortality

Garie Road is a two-way road that, when operational, may lead to injury and mortality of fauna do to motor vehicles. However, the proposal in operation is not expected to encourage more traffic to the area and the route was in use prior to the landslip. Therefore, the proposal would not have a negative change from the existing environment (prior to the slope failure).

Fauna fencing is not included in the current design and is therefore not considered necessary to be implemented.

### 5.2.4 Invasion and spread of weeds

Clearing vegetation and soil disturbance, including machine work, may result in an increase in the invasion and further spread of exotic flora throughout the native vegetation patches. Machinery may colonise weed propagules therefore exacerbating weed growth. This could lead to lowering the native vegetation condition.

Several annual, biannual and perennial weeds were identified along the existing road edge such as Crofton weed and Spear thistle. However, the proposal area is largely undisturbed and less weeds were located further from the road edge.

Mitigation and weed control measures, during and following construction, would reduce this potential.

### 5.2.5 Invasion and spread of pests

Proposal activities have the potential to disperse pests out of the proposal area. Machinery that enters the site should be subject to biosecurity controls including cleaning of equipment to remove potential pest species to limit any that may be transported into the proposal and surrounding area. The impact is likely to be low and mitigation measures are likely to be effective.

### 5.2.6 Invasion and spread of pathogens and disease

Myrtle rust is known to have infected all Scrub turpentines within the vicinity of the proposal. These individuals would not be cleared for the proposal.

As well as Myrtle Rust, *Phytophthora* (*Phytophthora cinnamomi*) and Chytrid Fungus (*Batrachochytrium dendrobatidis*) are also known in NSW to impact biodiversity as a result of transferal and infection through construction. All these pathogens should be treated as a potential risk during construction. Pathogen dispersal will most commonly occur through earthworks, movement of soil, and plant matter attaching to vehicles and equipment during construction and operation.

As Myrtle rust is known to be detrimental to the health of Scrub Turpentines, it is also important to ensure that this fungus and other potential pathogens are not spread *from* the proposal site. Other populations of Scrub Turpentines are within the RNP. Myrtle Rust is infecting the Scrub Turpentines adjacent to the project area. Therefore, Transport must ensure mitigation measures are in place to prevent the spread of Myrtle Rust to these populations or any other populations of plants in the family *Myrtaceae* that might be susceptible to the fungus.



Spread of pathogens and disease would be managed in accordance with the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011). The main mitigation measure to minimise the spread of pathogens would be ensuring there is no access within the Scrub Turpentine exclusion zone prior to or during construction. Mitigation measures are discussed in Chapter 6.

### 5.2.7 Changes to hydrology

The proposal design does not result in any major direct changes to hydrology. Given the proposal is located on a steep incline, no indirect impacts to hydrology are expected upslope. However, construction of the proposal would likely impact downslope from plant and equipment. Sedimentation and erosion from construction may cause substantial changes in flow rates in South Rill, in turn negatively impacting ecosystem functioning.

Sedimentation and erosion impacts would be minimised through mitigation measures outlined in chapter 6.

### 5.2.8 Noise, light, dust and vibration

The existing environment is relatively undisturbed meaning there is little artificial light, dust, noise and vibration with exception of the road vehicles that pass through. During construction, there would be an increase in vehicles, machinery and equipment on site. During the day, there would be an increase in dust, noise and vibration, particularly relative to the existing environment. This may result in sensitive species relocating (such as birds and mammals). These impacts would be short-term and temporary.

Night works are not expected for the proposal as Garie Road is not operational at present (due to slope failure). Therefore, little to no artificial light is expected from construction. Further, there would be no noise and vibration impacts expected during construction overnight. Mitigation measures are discussed in Chapter 6.

Operation of the proposal would not increase traffic generation when compared to the pre-slope failure existing environment. Therefore, there is not expected to be an increase in operational noise, light, dust and vibration.

More details on the noise and vibration impacts of the proposal are provided in the REF.

## 5.3 Cumulative impacts

There are other projects within the RNP that also may impact upon threatened species, ecological communities, habitats and key threatening processes. Cumulative impacts occur when multiple projects are operating at the same time close to each other. The suburbs of Uloomla, Lilyvale and Waterfall were considered for cumulative impact (refer to Table 5-5).

Table 5-5: Present and future project/proposals

Project/proposal	Biodiversity value impacted	Construction impacts	Operational impacts
McKell Avenue slope stabilisation	Clearing of native vegetation PCTs 3230, 3595, 3028, 3924, 3591	Clearing of remnant native vegetation in National Park Removal of threatened species and habitat Increase in heavy vehicle movements Changes to natural drainage	None expected

The proposal is part of a nine-year program of work covering the maintenance and management of roads managed by Transport within the Eastern Harbour City Zone. One project which is also part of the SRAPC program is the remediation of McKell Avenue. Clearing for this proposal as well as the McKell Avenue slope stabilisation are limited in extent but both are located within the RNP. Preserving the RNP is of high importance. Both proposals may impact upon threatened native vegetation, flora, fauna and their habitat. The McKell Avenue project is located over 4.5 kilometres away from the Garie Road proposal. As mentioned in Table 5-5 the project would involve clearing of native vegetation and potential threatened species habitat. However, this is limited in extent and, combined with the impacts of the Garie Road proposal, potential impacts are expected to be minimal. The cumulative clearance of the two projects is not expected to have a significant impact on threatened and other native species, particularly considering the distance between the two project locations and the National

Park in-between. Potential impacts from the changes to natural drainage and heavy vehicle movement would be considered in the respective projects' REFs.

## 5.4 Assessments of significance

Assessments of significance have been undertaken for TECs and for threatened species with a moderate or above likelihood of occurrence. A total of 21 assessments were conducted for entities listed under Schedule 1 and 2 of the BC Act and six under the EPBC Act. Copies of these are located in Appendix D and Appendix E. The results of the significance assessments are shown in Table 5-6 (BC Act) and Table 5-7 (EPBC Act).

Table 5-6: Summary of BC Act significance assessments findings

Significance assessment question <i>(per Section 7.3 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018b))</i>						
Threatened species, or communities	a	b	c	d	e	Likely significant impact?
Scrub Turpentine	N	X	N	N	N	N
Powerful Owl	N	X	N	N	N	N
Australian Masked Owl	N	X	N	N	N	N
Greater Sooty Owl	N	X	N	N	N	N
Grey-Headed Flying-Fox	N	X	N	N	N	N
Large Eared Pied Bat	N	X	N	N	N	N
Eastern Coastal Free-Tailed Bat	N	X	N	N	N	N
Eastern False Pipistrelle	N	X	N	N	N	N
Southern Myotis	N	X	N	N	N	N
Greater Broad-Nosed Bat	N	X	N	N	N	N
Little Lorikeet	N	X	N	N	N	N
Swift Parrot	N	X	N	N	N	N
Varied Sittella	N	X	N	N	N	N
Dusky Woodswallow	N	X	N	N	N	N
Scarlet Robin	N	X	N	N	N	N
Regent Honeyeater	N	X	N	N	N	N
Giant Burrowing Frog	N	X	N	N	N	N

*Y = Yes (negative impact), N = No (no or positive impact), X = Yes/No answer not applicable, ? = unknown impact.*

Table 5-7: Summary of EPBC Act significance assessments findings

Threatened species, or communities	Important population <i>(per Significant Impact Guidelines 1.1 (DoE 2013))</i>	Likely significant impact?
Scrub Turpentine	N	N



Swift Parrot	N	N
Regent Honeyeater	N	N
Grey-Headed Flying-Fox	N	N
Giant Burrowing Frog	N	N
<p><i>Y = Yes (negative impact), N = No (no or positive impact), X = Yes/No answer not applicable, ? = unknown impact.</i></p>		

## 6. Mitigation

Mitigation measures to avoid and minimise impacts that may result from the proposal are detailed below in Table 6-1. These measures are designed to cover impacts from preworks design, pre-works construction, construction and the maintenance.



Table 6-1: Mitigation measures

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B01	Removal of native vegetation	Native vegetation removal will be minimised through detailed design.	Detailed design	Effective	Removal of up to 0.296 hectares of native vegetation	Transport Contractor
B02		Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). An ecologist and/or fauna handler would be required to be on site.	Prior to construction	Effective	None	Contractor
B03		Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Trees assessed for removal have been marked with spray paint. However, where possible, trees would only be removed if necessary for operational reasons. Trees not marked are not permitted to be removed.	During construction	Effective	Removal of up to 0.296 hectares of native vegetation	Contractor
B04		Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Post construction	Effective	Positive	Transport Contractor
B05		The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	Temporary	Contractor
B06		A Tree and Hollow Replacement Plan should be prepared to option replacing the cleared trees in the RNP.	Detailed design	Effective	Positive	Transport Contractor
B07		If trimming is required, this must be conducted in accordance with Australian Standard AS 4373-2007. Trimming is to be limited to small outer branches of trees that do not contain fauna habitat features (ie hollows and/or nests). If trimming is expected to impact the structural integrity of the tree further impact assessment would be required. Trimming is to be limited to the below locations: <ul style="list-style-type: none"> <li>Governor Game Lookout ancillary facility</li> <li>NPWS Helipad ancillary facility</li> </ul>	During construction	Effective	None	Transport Contractor

		<ul style="list-style-type: none"> <li>Understorey vegetation removal at road shoulder on Garie Road 70 metres from the NPWS Helipad ancillary facility to provide additional temporary parking for the 'Little Garie Cabin Community'</li> <li>Subject land.</li> </ul>				
B08		Vegetation surrounding the Governor Game Lookout ancillary facility is to be marked out with exclusion fencing. No plant, equipment, personnel etc are to go beyond the exclusion fencing and onto any vegetation, with the exception of minor tree trimming (see above mitigation measure), without further ecological surveys and assessment. Consequences of damage and impact to the plant community assumed to be a TEC will be discussed during toolbox talks and non-conformances to be reported to Transport.	Prior to construction During construction	Effective	None	Contractor
B09	Removal of threatened and non-threatened fauna habitat	Threatened fauna habitat removal, including hollow-bearing trees, will be minimised through detailed design.	Detailed design	Effective	No removal of hollow bearing trees	Transport
B10		If fauna is encountered, they will be managed in accordance with <i>Guide 9: Fauna handling</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	Yes, potential impacts during clearing	Contractor
B11		Habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). This includes having a licensed wildlife carers and/or ecologist (fauna spotter/catcher) present for all habitat removal. This includes for trimming of branches if necessary at the ancillary facilities, around the subject land, and on the road shoulder about 70 metres from the NPWS Helipad ancillary facility.	During construction	Effective	No removal of hollow bearing trees Removal of up to 0.296 hectares of native vegetation.	Contractor
B12		Habitat will be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Already fallen or cutdown logs, trees, stags should not be mulched and/or taken offsite. Instead, they should be placed around site particularly closer to flattened areas. They should not be reinstated in environmentally sensitive areas including areas along and directly adjacent to South Rill.	During construction	Proven	No removal of hollow bearing trees Removal of up to 0.296 hectares of native vegetation.	Contractor Transport
B13		The unexpected species find procedure is to be followed under <i>Guide 1: Pre-clearing process</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	Positive	Contractor



B14		Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Proven	None	Contractor
B15		No hollow bearing trees would be impacted by the proposal. If the hollow bearing tree located within the subject land or any other hollow bearing tree are to be directly impacted, further survey and impact assessment would be recommended to determine impact to hollow dwelling and hollow depending threatened fauna. Where assessed hollow bearing trees are to be removed, they are to be replaced as per the <i>Tree and Hollow Replacement Guidelines (Transport 2022b)</i> .	Detailed design During Construction	Effective	No removal of hollow bearing trees	Transport Contractor
B16	Removal of threatened flora	An environmental exclusion zone will be placed around identified threatened flora (Scrub turpentine) within which a minimum of 2.5 metre buffer around each individual is also to be established. Consequences of damage and impact to listed threatened species will be discussed during toolbox talks with all non-conformances to be reported to Transport.	Prior to construction During construction	Effective	Positive	Transport Contractor
B17		The slope where the Scrub turpentines are located needs to be sufficiently stabilised with coir logs to prevent further erosion or impact the stability of the bank and therefore impact threatened species. Detailed design needs to maintain the integrity of the surrounds by anchoring coir logs to the toe of the slope, at the perimeter of the Environmental Exclusion Zone.	Detailed design During construction	Effective	Positive	Transport Contractor
B18		Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Proven	None	Contractor
B19		The unexpected species find procedure is to be followed under <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	Temporary	Contractor
B20	Aquatic impacts	Potential impacts to aquatic habitat will be minimised through detailed design to limit the potential for erosion. Mitigation measures to control sedimentation and drainage impacts will be implemented prior to the commencement of construction and maintained during construction in accordance with the NSW 'Blue Book' <i>Managing Urban Stormwater: Soils and construction - Volumes 1 and 2C</i> (NSW Government, March 2004; DECC, 2008).	Detailed design During Construction	Effective	None	Transport Contractor
B21		Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and</i>	During construction	Effective	Potential for indirect impacts	Contractor

		<i>managing biodiversity on RTA projects (RTA 2011) and Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013 (DPI (Fisheries NSW) 2013).</i>				
B22	Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design to limit the potential for erosion. Mitigation measures to control sedimentation and drainage impacts will be implemented from the commencement of construction and maintained during construction in accordance with the NSW 'Blue Book' Managing Urban Stormwater: Soils and construction - Volumes 1 and 2C (NSW Government, March 2004; DECC, 2008).	Detailed design During construction	Effective	None	Transport Contractor
B23	Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design to limit the potential for erosion. Mitigation measures to control sedimentation and drainage impacts will be implemented from the commencement of construction and maintained during construction in accordance with the NSW 'Blue Book' Managing Urban Stormwater: Soils and construction - Volumes 1 and 2C (NSW Government, March 2004; DECC, 2008).	Detailed design During construction	Effective	None	Transport Contractor
B24	Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).</i>	Detailed design During construction	Effective	Yes, there will be increased edge effects on native vegetation and habitat.	Transport Contractor
B25		Tree Protection Zones (TPZs) will be placed around all hollow bearing trees. The two hollow bearing trees adjoining /within the proposal (one Eucalyptus botryoides and one Eucalyptus saligna x Eucalyptus botryoides) require a TPZ. All protective measures for the TPZ around hollow bearing trees must be in accordance with the Australian Standard for the protection of trees on development sites (AS 4970-2009). Fencing around trees should be installed in accordance with the Tree Protection Zone prior to site establishment (before any machinery or materials are brought on site) and should remain until the completion of works. The fencing erected should be approved by the project arborist/ecologist.  Tree protection fencing should comply with the following requirements: <ul style="list-style-type: none"> <li>• Fence post supports (e.g. star pickets) should have a diameter greater than 20 mm and should not impact surface tree roots</li> <li>• Fencing height minimum of 1.8 m</li> </ul>	Detailed design During construction	Effective	Yes, there will be increased edge effects on native vegetation and habitat.	Transport Contractor



		<ul style="list-style-type: none"> <li>Shade cloth, paraweb, wire mesh panels or similar should be attached to the fencing posts</li> <li>Signage should be installed stating "Vegetation Protection Zone - No Entry"</li> <li>The tree protection fencing must remain in place until construction is completed</li> <li>No vehicular or pedestrian access, trenching or soil excavation is to occur within the Tree Protection Zone</li> <li>No storage or dumping of tools, equipment or waste is to occur within the Tree Protection Zone.</li> </ul>				
B26	Injury and mortality of fauna	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	Yes, potential impacts during clearing.	Transport Contractor
B27	Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	Positive	Contractor
B28		The grass swale on the upslope of the design would be revegetated with native vegetation only with no exotic grass species. Low lying species native to PCT 3155 could be included in the design such as <i>Lomandra filiformis</i> , <i>L. confertifolia</i> , and <i>L. longifolia</i> .	Detailed Design During Construction	Effective	Positive	Contractor
B29	Invasion and spread of pests	Pest species will be managed within the proposal site.	During construction	Effective	Positive	Contractor
B30	Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011). Daily biosecurity controls, as detailed in the contractors Construction Environmental Management Plan, are to implemented for vehicles and equipment entering the site.	During construction	Effective	Temporary, during construction only	Contractor
B30	Noise, light, dust and vibration	Shading and artificial light impacts will be minimised through detailed design.	Detailed design	Effective	Yes, increased (temporary) impacts in the construction phase of increased noise, dust and vibration.	Transport

## 7. Offsets and other measures

### 7.1 Thresholds

Offset thresholds set out by the No Net Loss Guidelines (Transport 2022a) are detailed in Table 7-1.

Table 7-1: Offset thresholds (TfNSW No Net Loss Guidelines)

Impact	Threshold
Works involving clearing of a <u>CEEC</u>	Where there is any clearing of an <u>CEEC</u> in 'moderate to good' condition
Works involving clearing of an <u>EEC</u>	Where clearing of a <u>EEC</u> $\geq$ 2 ha in 'moderate to good' condition
Works involving clearing of <u>VEC</u>	Where clearing of <u>VEC</u> $\geq$ 5 ha in 'moderate to good' condition
Works involving clearing of any habitat for a known species credit fauna species or clearing of breeding habitat (as defined by the TBDC) for dual-credit fauna species (excluding exotic and planted vegetation that cannot be assigned to a plant community type)	Where clearing $\geq$ 1 ha in 'moderate to good' condition
Works involving removal of known threatened flora species and their habitat	Where loss of individuals is $\geq$ 10 or where clearing of habitat is $\geq$ 1 ha
Type 1 or Type 2 key fish habitats	Where there is a net loss of habitat
<b>Any residual biodiversity impact that doesn't require offsets in accordance with the No Net Loss Guideline is to be assessed against the requirements of the Tree and Hollow Replacement Guideline.</b>	<b>Any clearing of hollows and/or trees <math>\geq</math>5cm DBH</b>

Table 7-2 details the assessment of direct impacts on native vegetation and threatened species habitat against the threshold set out above and in Table 7-1.

Species polygons have been prepared for Scrub Turpentine, the significant majority of which fall outside the subject land, although the fixed species buffers do extend across the project area. It should be noted the Scrub Turpentine recorded are within an environmental exclusion area established to exclude works. To accurately assess biodiversity impacts of the proposal under the BAM, surveys were undertaken that found the critically endangered Scrub Turpentine. As per the BAM a species polygon must be prepared where the field survey confirms the presence of a threatened species and/or the species is assumed present. The proposal would intersect with 0.241 hectares of Scrub Turpentine habitat (ie where vegetation would be cleared/impacted within the Scrub Turpentine species polygon). However, as clearing is limited to 0.241 hectares of threatened species habitat, the 'one-hectare' threshold for threatened species habitat is not triggered. Refer to Figure 7-1.

Table 7-2: Assessment of vegetation impacts against thresholds

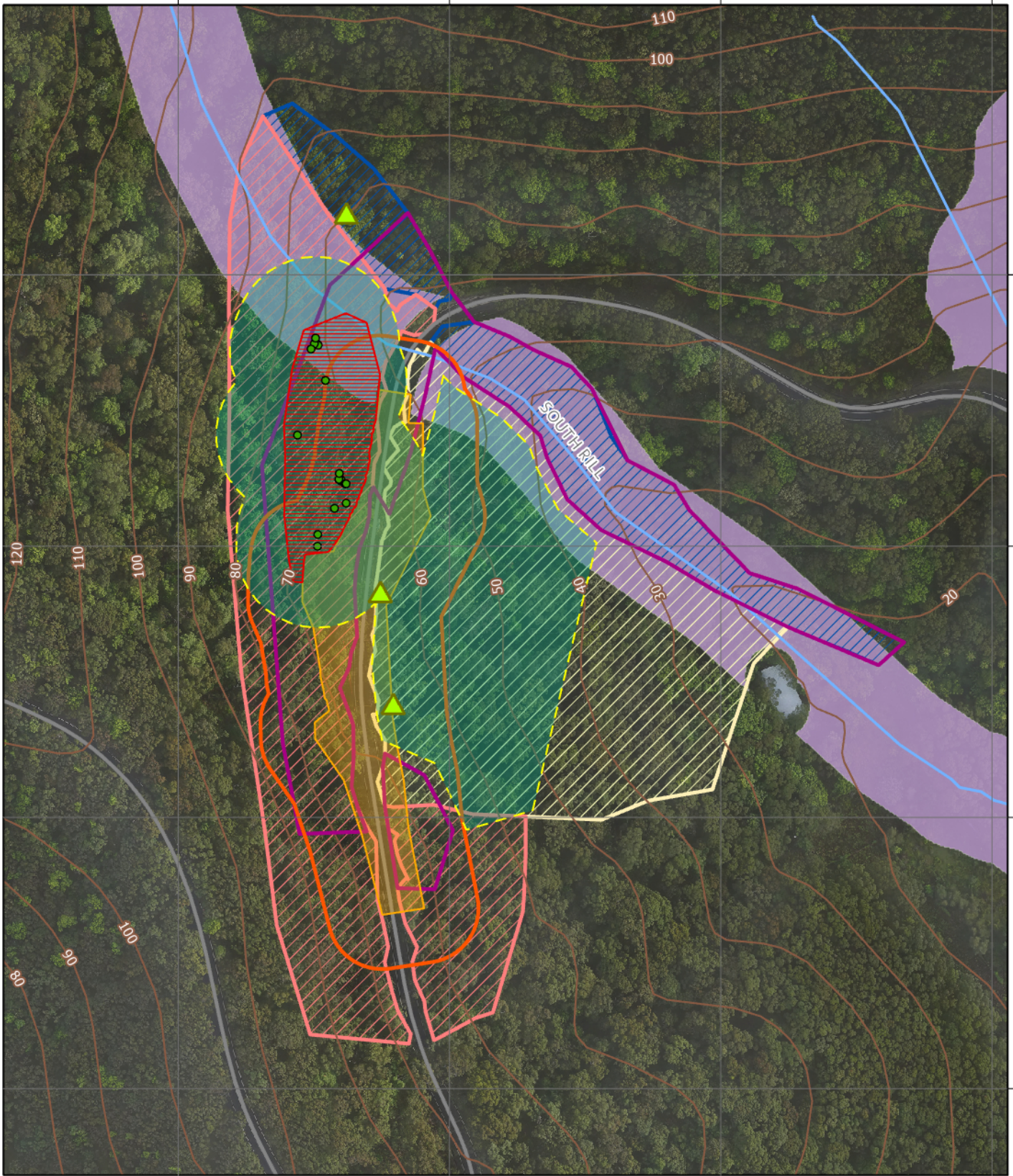
Veg. zone	Plant community type (PCT)	Condition	TEC	Impact area (ha or m <sup>2</sup> ) <sup>1</sup>	Threshold triggered?
Zone 2	PCT 3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	High	Not a TEC	0.132 ha	No. Tree replacement required.
Zone 1	PCT 3155 Illawarra North-Pittwater Bangalay Moist Forest	High	Not a TEC	0.164 ha	No. Tree replacement required.



Veg. zone	Plant community type (PCT)	Condition	TEC	Impact area (ha or m <sup>2</sup> ) <sup>1</sup>	Threshold triggered?
Zone 3	PCT 3134 Illawarra Seacliffs Littoral Rainforest	High	Endangered BC Act, critically endangered EPBC Act.	0 ha	No. No offsets required, provided mitigation measures are followed.



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- Subject Land
- Study Area
- Watercourses
- Contours (10m)
- Road
- Targeted Survey Location
- Hollow Bearing Trees - To be retained
- Surveyed Scrub Turpentine (*Rhodamnia rubescens*)
- Biodiversity Values
- Scrub Turpentine Species Polygon
- Environmental Exclusion Zone
- PCT - Validated**
- 3134 Illawarra Seacliffs Littoral Rainforest
- 3153 Illawarra Escarpment Bangalay x Blue Gum Wet
- 3155 Illawarra North-Pittwater Bangalay Moist Forest





## 7.2 Preliminary offset calculations

As no offset scheme threshold triggers have been met for threatened communities or threatened species habitat. Residual impacts to trees are outlined in Table 7-3 For the purpose of offsetting, this assessment has defined trees in line with the *Transport Tree and Hollow Replacement Guidelines* (2022b) and as per Australian Standard 4970-2209. A tree is considered a “Long lived woody perennial plant greater than (or usually greater than) 3m in height with one or relatively few main stems or trunks (or as defined by the determining authority)”. Some species identified for removal can be defined as a ‘shrub or small tree’ as per the description provided in NSW Flora Online (PlantNet, n.d.). However, all species listed in Table 7-3 are known to grow above three metres with few main stems and/or one trunk, and therefore are considered trees. The *Tree and Hollow Replacement Guidelines* (Transport, 2022b) and the *Biodiversity Policy* (Transport, 2022c) discuss the impacts of clearing and where offsets are required.

Table 7-3: Preliminary calculations for impacts to native trees and hollows

Category	Estimated No. impacted		Replacement requirement per tree/hollow removed <sup>1</sup>		Estimates number to be replaced <sup>2</sup>		Estimated equivalent payment to Transport conservation fund <sup>2</sup>
	Native trees	Amenity trees	Planting required	Contribution required	Native trees	Amenity trees	
Very large tree (DBH ≥100cm)	0	0	Plant minimum 16 trees	\$2,500	0	0	\$0
Large tree (DBH ≥50 to <100cm)	7	0	Plant minimum 8 trees	\$1,000	56	0	\$7,000
Medium tree (DBH ≥20 to <50 cm)	37	0	Plant minimum 4 trees	\$500	148	0	\$18,500
Small tree (DBH ≥ 5cm to <20 cm)	28	0	Plant minimum 2 trees	\$125	56	0	\$3,500
Hollow	0		Provide 3 artificial hollows for every occupied hollow removed*	\$500	0		\$0
Totals	72				260		\$29,000

NOTE 1: As per the *Transport Tree and Hollow Replacement Guidelines*

NOTE 2: An equivalent payment to the Transport Conservation Fund can be used where replanting is not feasible or fully achievable within the project boundary or adjacent land.

If hollow bearing trees are to be impacted by the proposal, further offsets may need to be calculated (following further survey and impact assessment). Details of TPZ requirements for the two closest hollow bearing trees to the proposal are discussed Table 6-1.

A breakdown of the species of trees expected to be removed for the proposal are shown in Table 7-4.

Table 7-4 Sizes of trees to be removed

Common name	Scientific Name	Very large tree (DBH ≥100cm)	Large tree (DBH ≥50 to <100cm)	Medium tree (DBH ≥20 to <50 cm)	Small tree (DBH ≥ 5cm to <20 cm)
Hickory wattle	<i>Acacia implexa</i>	0	0	0	1
Bangalay	<i>Eucalyptus botryoides</i>	0	4	10	4

Grey ironbark	<i>Eucalyptus paniculata</i>	0	3	9	10
N/a	<i>Eucalyptus saligna x botryoides</i>	0	0	4	2
Cabbage tree palm	<i>Livistona australis</i>	0	0	6	3
Turpentine tree	<i>Syncarpia glomulifera</i>	0	0	7	8
Sydney red gum	<i>Angophora costata</i> subsp. <i>costata</i>	0	0	1	0
<b>Total</b>		<b>0</b>	<b>7</b>	<b>37</b>	<b>28</b>

### 7.3 Biodiversity offset strategy/tree and hollow replacement plan

Provided mitigation measures are followed, the proposal is unlikely to impact TECs, thereby the offsetting thresholds will not be triggered under the No Net Loss Guidelines (refer Table 7-1). Clearing of threatened species habitat does not exceed one hectare, therefore the threshold relating to threatened flora and species credit fauna species has not been reached.

As biodiversity offsetting scheme thresholds have not been triggered under the No Net Loss Guidelines a biodiversity offset strategy is not required. A Tree and Hollow Replacement Plan should be prepared or alternatively a contribution to Transport conservation fund is required.



## 8. Conclusion

Survey over a period of eight days found a range of biodiversity values within the study area, including:

- Three PCTs of high condition bushland.
- One TEC listed as endangered under the BC Act (Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions) and as critically endangered (Littoral Rainforest and Coastal Vine Thickets of Eastern Australia) under the EPBC Act.
- 16 individuals of Scrub Turpentine (*Rhodamnia rubescens*) listed as critically endangered under both the BC and EPBC Acts.
- Three hollow bearing trees with a range of small to large hollows.
- One water way, South Rill, that may likely provide habitat for amphibians on the steep rocky sections and potentially fish within the flat, low-lying sections of the reach.
- Up to 0.296 hectares of habitat for threatened fauna considered to have a moderate or higher likelihood of occurring within the subject land. Including, frogs, microbats, owls and woodland birds.

Measures to avoid and minimise impacts would reduce impacts on native biodiversity; however, the following impacts would still occur due to constraints on the alignment of the road.

- The removal of up to 0.296 hectares of native bushland noting that 0.016 hectares of this is within tree protection zones (and therefore may still experience residual impacts).
- Removal of up to 0.296 hectares of vegetation and suitable habitat for Scrub Turpentine (*Rhodamnia rubescens*). Known individuals would not be cleared due to changes in design and the establishment of an environmental exclusion zone. Due to safety concerns, there was 0.1165 ha of vegetation that was not surveyed and may provide potential habitat for Scrub Turpentine (*Rhodamnia rubescens*) and other threatened flora species. No known Scrub Turpentine would be removed. Residual impacts to habitat suitable for Scrub Turpentine is a possible risk. There is not expected to be a significant impact to the species.

Due to limited clearing of native vegetation and habitat, environmental exclusion zone for Scrub Turpentine, retention of all hollow bearing trees, implementation of mitigation measures and change in design to avoid important biodiversity values, the proposal is not likely to significantly impact upon any threatened species, populations and communities.

In accordance with Transport's *No Net Loss Guidelines* (Transport 2022a), the proposal does not trigger the Transport threshold to enter the Biodiversity Offset Scheme. A Tree and Hollow Replacement Plan or a payment to the Transport Conservation Fund will therefore be required to replace the 72 individual trees that are to be removed. Inclusion of hollows would be required if there are expected to be any impacts to hollows (as well as additional targeted fauna surveys for a range of fauna groups).

Significant impact assessments were undertaken for threatened species and communities that were either recorded within the study area or assessed as having a moderate or higher likelihood of occurrence. Through undertaking these assessments, it was concluded that the proposal is unlikely to have a significant impact upon any NSW or nationally listed threatened species or community. As the proposal will result in a relatively small impact with the removal of up to 0.296 hectares of native vegetation noting that 0.016 hectares of this is within tree protection zones (and therefore may have residual impacts). With the installation of mitigation measures, the resulting impacts are likely to be negligible. Therefore, Transport is not required to prepare a Species Impact Statement (SIS) or a Biodiversity Development Assessment Report (BDAR).

Provided mitigation measures, safeguards and recommended actions outlined in this report are followed, impacts to biodiversity is likely to be low.

## 9. Glossary

Term	Definition
Accredited person or assessor	Means as person accredited under section 6.10 (of the BC Act) to prepare reports in accordance with the BAM.
Biodiversity Assessment Method	The Biodiversity Assessment Method is established under section 6.7 of the BC Act. The BAM is established for the purpose of assessing certain impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values.
Biodiversity Assessment Method Calculator	Biodiversity Assessment Method Calculator (BAM-C) – the online computer program that provides decision support to assessors and proponents by applying the BAM and referred to as the BAM-C.  The BAM-C contains biodiversity data from the BioNet Vegetation Classification and the Threatened Biodiversity Data Collection that the assessor is required to use in a BAM assessment. The BAM-C applies the equations used in the BAM, including those to determine the number and class of biodiversity credits required to offset the impacts of a development, or created at a biodiversity stewardship site. It is published by the Department (DPIE 2020a).
Biodiversity credit report	The report produced by the BAM-C that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (DPIE 2020a).
Biodiversity offsets	The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (DPIE 2020a).
Biodiversity Offsets and Agreement Management System	The online system used to administer the Biodiversity Offsets Scheme. The BOAMS is used by accredited assessors (to carry out specific BAM-related tasks involving access to the BAM-C to perform assessments, submit data, generate credits and calculate a credit price), by landholders (to apply for a Biodiversity Stewardship Agreement and manage ongoing reporting obligations for their agreement) and by proponents of developments (to view their credit obligation or the payment required to the Biodiversity Conservation Fund).
Biodiversity risk weighting	A factor of the formulas used by the BAM to calculate credits. The biodiversity risk weighting (BRW) is a score given to each vegetation zone and species based on the ‘sensitivity to loss’ versus the ‘sensitivity to gain’. The value is set for threatened species and listed in the TBDC. The BRW for vegetation is calculated for each vegetation zone by the BAM-C using a factor of the ‘sensitivity to loss’ of the PCT or TEC (located in the BioNet vegetation classification) and the ‘sensitivity to gain’ of the ecosystem credit species (in the TBDC) that are predicted to occur.
Biodiversity Stewardship site	Refers to land which is the subject to a Biodiversity Stewardship Agreement under the BC Act.
BioNet Atlas	The DPIE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish (DPIE 2020a).
BioNet Vegetation classification	Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. Refer <a href="#">About BioNet Vegetation Classification   NSW Environment and Heritage</a> (DPE 2020a).
Construction footprint	The area to be directly impacted by the proposal during construction activities. See also definition for subject land.



Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020a).
Ecosystem credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for ecosystem credits. This is analogous with the definition of ‘predicted species’.
Ecosystem credits	A measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development, activity, clearing or biodiversity certification site and the gain in biodiversity values at a biodiversity stewardship site (DPIE 2020a).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (DPIE 2020a).
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (DPIE 2020a).
Landscape assessment area	The area which includes the subject land and a 1500 m buffer surrounding the outside edge of the boundary of the subject land or 500 m along each side of the centre line of a linear-shaped proposal
Local population	The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions: <ul style="list-style-type: none"> <li>• <i>The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.</i></li> <li>• <i>The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.</i></li> <li>• <i>The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time or return year to year (OEH 2018).</i></li> </ul>
Matter of national environmental significance	A matter of national environmental significance (MNES) is any of the nine defined components protected by a provision of Part 3 of the EPBC Act (Commonwealth).
Mitigation	Action to reduce the severity of an impact.
Native vegetation	Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary, <ol style="list-style-type: none"> <li>trees (including any sapling or shrub or any scrub)</li> <li>understorey <u>plants</u></li> <li>groundcover (being any type of herbaceous vegetation)</li> </ol>

	<p>d) <u>plants</u> occurring in a wetland.</p> <p>A <u>plant</u> is native to New South Wales if it was established in New South Wales before European settlement (BC Act).</p> <p>Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act.</p>
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020a).
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Patch size	<p>An area of native vegetation that:</p> <ul style="list-style-type: none"> <li>• <i>occurs on the development site or biodiversity stewardship site</i></li> <li>• <i>includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems).</i></li> </ul> <p>Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a).</p>
PlantNET	An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020a).
Spatial datasets	<p>Spatial databases required to prepare a BAR</p> <ul style="list-style-type: none"> <li>• <i>BioNet NSW (Mitchell) Landscapes – Version 3.1</i></li> <li>• <i>NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7</i></li> <li>• <i>NSW soil profiles</i></li> <li>• <i>hydrogeological landscapes</i></li> <li>• <i>acid sulfate soils risk</i></li> <li>• <i>digital cadastral database</i></li> <li>• <i>Vegetation Information Systems maps</i></li> <li>• <i>Geological sites of NSW.</i></li> </ul>
Species credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (DPIE 2020a). This is analogous with the definition of ‘candidate species’.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (DPIE 2020a).
Species polygon	An area of land identified in Chapter 5 (of the BAM) that contains habitat or is occupied by a threatened species (DPIE 2020a).
Study area	The area directly affected by the proposal (subject land or construction footprint) and any additional areas likely to be affected by the proposal, either directly or indirectly.
Subject land	Land subject to a development, activity, clearing, biodiversity certification or a biodiversity stewardship proposal. It excludes the landscape assessment area which surrounds the subject land (i.e., the area of land in the 1500 m buffer zone around the subject land or 500m buffer zone for linear proposals). In the case of a biodiversity certification proposal, subject land includes the biodiversity certification assessment area (DPIE 2020a). See also definition for construction footprint.



Threatened Biodiversity Data Collection	A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (DPIE 2020a). Part of the BioNet database, published by the EHG and accessible from the BioNet website at <a href="http://www.bionet.nsw.gov.au">www.bionet.nsw.gov.au</a> .
Vegetation integrity (score)	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT. The vegetation integrity score is the quantitative measure of vegetation condition calculated by the BAM-C (DPIE 2020a).
Vegetation zone	A relatively homogeneous area of native vegetation on a development site, clearing site, land to be biodiversity certified or biodiversity stewardship site that is the same PCT and has the same broad condition state (DPIE 2020a).

## 10. Abbreviations

Term	Definition
AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method calculator
BC Act	Biodiversity Conservation Act 2016 (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offset Scheme
BRW	Biodiversity risk weighting
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DIWA	Directory of Important Wetlands in Australia
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EHG	NSW Environment and Heritage Group within the Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A Act	<i>Environment Planning and Assessment Act 1979</i> (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
Fisheries NSW Policy and guidelines	Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013)
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of national environmental significance
PCT	Plant community type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
RNP	The Royal National Park
SAIL	Serious and Irreversible Impacts
SEARS	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SRAPC	Sydney Roads Asset Performance Contract
SSD	State Significant Development
SSI	State Significant Infrastructure
TBDC	Threatened Biodiversity Data Collection
TECs	Threatened ecological communities (VECs, EECs and CEECs)



Transport  
for NSW

TfNSW/Transport	Transport for NSW
TPZ	Tree Protection Zone
VEC	Vulnerable Ecological Community

# 11. References

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## Appendix A: Species recorded



## Appendix A: Species recorded

## Garie Road Plot 1

Family name	Scientific name	Cover	Abundance	Growth form	N, E, HTE
Myrtaceae	<i>Eucalyptus paniculata</i>		35	11 Tree	N
Myrtaceae	<i>Syncarpia glommulifera</i>		10	5 Tree	N
Fabaceae	<i>Acacia implexa</i>		5	3 Shrub	N
Celastraceae	<i>Elaeodendron australe</i> var. <i>australe</i>		10	10 Shrub	N
Sapindaceae	<i>Guioa semiglauca</i>		5	5 Tree	N
Oleaceae	<i>Notelaea longifolia</i>		2	5 Shrub	N
Primulaceae	<i>Myrsine variabilis</i>		2	5 Shrub	N
Arecaceae	<i>Livistona australis</i>		20	20 Palm & palmlike	N
Phyllanthaceae	<i>Breynia oblongifolia</i>		0.7	5 Shrub	N
Pittosporaceae	<i>Pittosporum multiflorum</i>		0.2	1 Shrub	N
Myrtaceae	<i>Rhodamnia rubescens</i>		0.5	5 Shrub	N
Lamiaceae	<i>Clerodendrum tomentosum</i>		0.1	1 Shrub	N
Primulaceae	<i>Myrsine howittiana</i>		0.5	1 Shrub	N
Cannabaceae	<i>Trema tomentosa</i> var. <i>aspera</i>		0.1	1 Shrub	N
Zamiaceae	<i>Macrozamia communis</i>		2	10 Cycad	N
Cyperaceae	<i>Carex appressa</i>		5	50 Grass & grasslike (t	N
Rutaceae	<i>Zieria smithii</i>		0.3	10 Shrub	N
Violaceae	<i>Viola hederacea</i>		0.5	10 Forb (FG)	N
Dryopteridaceae	<i>Lastreopsis decomposita</i>		1	5 Fern (EG)	N
Asphodelaceae	<i>Geitonoplesium cymosum</i>		0.1	10 Vine	N
Cyperaceae	<i>Gahnia melanocarpa</i>		4	30 Grass & grasslike (t	N
Aspleniaceae	<i>Asplenium flabellifolium</i>		0.2	10 Fern (EG)	N
Pteridaceae	<i>Pellaea falcata</i>		0.5	10 Fern (EG)	N
Acanthaceae	<i>Pseuderanthemum variabile</i>		2	50 Forb (FG)	N
Poaceae	<i>Oplismenus imbecillis</i>		1	10 Grass & grasslike (t	N
Pteridaceae	<i>Adiantum formosum</i>		2	1 Fern (EG)	N
Smilacaceae	<i>Smilax australis</i>		0.1	5 vine	N
Menispermaceae	<i>Stephania japonica</i> var. <i>discolor</i>		0.2	5 vine	N
Oxalidaceae	<i>Oxalis</i> sp.		0.5	10 Forb (FG)	N
Convolvulaceae	<i>Dichondra repens</i>		3	50 Forb (FG)	N
Blechnaceae	<i>Doodia aspera</i>		0.5	50 Fern (EG)	N
Fabaceae	<i>Desmodium</i> sp.		0.3	20 vine	N
Pteridaceae	<i>Adiantum hispidulum</i> var. <i>hispidulum</i>		0.1	10 Fern (EG)	N
Cyperaceae	<i>Cyperus</i> sp.		0.1	10 Grass & grasslike (t	N
Vitaceae	<i>Cayratia clematidea</i>		0.2	5 Vine	N
Cyperaceae	<i>Cyperus tetraphyllus</i>		0.2	20 Grass & grasslike (t	N

Appendix A: Species recorded

Asphodelaceae	<i>Dianella caerulea</i> var. <i>producta</i>	0.1	5 Forb (FG)	N
Phyllanthaceae	<i>Phyllanthus</i> sp.	0.1	5 Shrub	N
Araliaceae	<i>Hydrocotyle</i> sp.	0.2	10 Forb (FG)	N
Solanaceae	<i>Solanum</i>	0.1	1 Forb (FG)	N
Pteridaceae	<i>Pteris tremula</i>	0.1	1 Fern (EG)	N
Geraniaceae	<i>Geranium homeanum</i>	0.5	20 Forb (FG)	N
Plantaginaceae	<i>Plantago debilis</i>	2	50 Forb (FG)	N
Asparagaceae	<i>Lomandra longifolia</i>	5	50 Grass & grasslike (t	N
Araceae	<i>Gymnostachys anceps</i>	2	30 Forb (FG)	N
Dilleniaceae	<i>Hibbertia scandens</i>	0.1	20 Vine	N
Pteridaceae	<i>Pteridium esculentum</i>	0.5	1 Fern (EG)	N
Poaceae	<i>Entolasia stricta</i>	0.2	10 Grass & grasslike (t	N
Fabaceae	<i>Glycine</i> sp.	0.5	30 vine	N
Cyperaceae	<i>Cyperus</i> sp.	0.1	20 Grass & grasslike (t	N
Poaceae	<i>Poa affinis</i>	5	50 grass & grasslike (C	N
Asparagaceae	<i>Eustrephus latifolius</i>	0.5	5 vine	N
Poaceae	<i>Echinopogon ovatus</i>	0.5	20 Grass & grasslike (t	N
Ranunculaceae	<i>Clematis aristata</i>	0.2	2 Vine	N
Vitaceae	<i>Cissus antarctica</i>	0.5	1 Vine	N
Vitaceae	<i>Cissus hypoglauca</i>	0.1	1 Vine	N
Asteraceae	<i>Sigesbeckia orientalis</i>	0.1	1 Forb (FG)	N
Euphorbaceae	<i>Bertya</i> sp.	0.1	1 Shrub	N
Asteraceae	<i>Ageratina adenophora</i>	2	20 Forb (FG)	HTE
Asteraceae	<i>Conyza</i> sp.	1	20 Forb (FG)	E
Moraceae	<i>Ficus coronata</i>	0.2	10 Shrub	N
Lamiaceae	<i>Plectranthus parviflorus</i>	0.2	5 Forb (FG)	N
Cyperaceae	<i>Carex inversa</i>	0.1	1 Grass & grasslike (t	N
Polygonaceae	<i>Rumex brownii</i>	0.1	5 Forb (FG)	N



## Appendix A Species recorded

## Garie Road Plot 2

Family name	Scientific name	Cover	Abundance	Growth form	N, E, HTE
Myrtaceae	<i>Eucalyptus botryoides</i>		20	5 Tree	N
Myrtaceae	<i>Eucalyptus saligna</i> x <i>botyroides</i>		10	1 Tree	N
Myrtaceae	<i>Eucalyptus paniculata</i>		3	2 Tree	N
Myrtaceae	<i>Angophora costata</i> subsp. <i>Costata</i>		5	1 Tree	N
Fabaceae	<i>Acacia implexa</i>		4	2 Shrub	N
Oleaceae	<i>Notelaea longifolia</i>		2	5 Shrub	N
Primulaceae	<i>Myrsine variabilis</i>		1	5 Shrub	N
Arecaceae	<i>Livistona australis</i>		20	7 Palm	N
Phyllanthaceae	<i>Breynia oblongifolia</i>		0.5	1 Shrub	N
Lamiaceae	<i>Clerodendrum tomentosum</i>		0.1	1 Shrub	N
Cyperaceae	<i>Carex appressa</i>		10	100 Grass and Grass lik	N
Campanulaceae	<i>Lobelia purpurascens</i>		0.5	1 Forb	N
Violaceae	<i>Viola hederacea</i>		2	50 Forb	N
Poaceae	<i>Imperata cylindrica</i>		0.2	1 Grass and Grass lik	N
Asphodelaceae	<i>Geitonoplesium cymosum</i>		0.1	5 Vine	N
Cyperaceae	<i>Gahnia melanocarpa</i>		10	50 Grass and Grass lik	N
Apocynaceae	<i>Gomphocarpus fruticosus</i>		0.3	10	E
Pteridaceae	<i>Pellaea falcata</i>		1	5 Fern	N
Acanthaceae	<i>Pseuderanthemum variabile</i>		1	30 Forb	N
Poaceae	<i>Oplismenus imbecillis</i>		3	50 Grass and Grass lik	N
Apocynaceae	<i>Araujia sericifera</i>		0.1	1	HTE
Smilacaceae	<i>Smilax australis</i>		0.3	5 Vine	N
Menispermaceae	<i>Stephania japonica</i> var. <i>discolor</i>		2	10 Vine	N
Oxalidaceae	<i>Oxalis</i> sp.		0.5	10 Forb	N
Convolvulaceae	<i>Dichondra repens</i>		1	20 Forb	N
plantaginaceae	<i>Veronica plebeia</i>		0.1	1 Forb	N
Fabaceae	<i>Desmodium</i> sp.		0.2	20 Forb	N
Commelinaceae	<i>Commelina cyanea</i>		1	20 Forb	N
Apocynaceae	<i>Tylophora barbata</i>		2	5 Vine	N
Vitaceae	<i>Cayratia clematidea</i>		0.5	5 Vine	N
Menispermaceae	<i>Sarcopetalum harveyanum</i>		0.5	3 Vine	N
Araliaceae	<i>Hydrocotyle</i> sp.		1	5 Forb	N
Pteridaceae	<i>Pteris tremula</i>		0.5	10 Fern	N
Geraniaceae	<i>Geranium homeanum</i>		1	30 Forb	N
Dilleniaceae	<i>Hibbertia scandens</i>		0.5	20 Vine	N
Pteridaceae	<i>Pteridium esculentum</i>		1	1 Fern	N
Poaceae	<i>Entolasia stricta</i>		0.7	30 Grass and Grass lik	N
Fabaceae	<i>Glycine</i> sp.		0.5	20 Vine	N

Appendix A Species recorded

Cyperaceae	<i>Cyperus</i> sp.	0.1	10 Grass and Grass lik N
Poaceae	<i>Poa affinis</i>	30	100 Grass and Grass lik N
Poaceae	<i>Echinopogon ovatus</i>	1	20 Grass and Grass lik N
Ranunculaceae	<i>Clematis aristata</i>	0.1	1 vine N
Asteraceae	<i>Ageratina adenophora</i>	0.5	20
Asteraceae	<i>Conyza</i> sp.		



## Appendix A Species recorded

## Garie Road Plot 3

Family name	Scientific name	Cover	Abundance	Growth form	N, E, HTE
Arecaceae	<i>Livistona australis</i>		20	20 Palm	N
Lamiaceae	<i>Clerodendrum tomentosum</i>			Shrub	N
Asphodelaceae	<i>Geitonoplesium cymosum</i>		0.2	1 Vine	N
Smilacaceae	<i>Smilax australis</i>		2	10 Vine	N
Menispermaceae	<i>Stephania japonica var. discolor</i>			Vine	N
Moraceae	<i>Ficus coronata</i>			Shrub	N
Celastraceae	<i>Elaeodendron australe</i>		2	Shrub	N
Eupomatiaceae	<i>Eupomatia laurina</i>		1	0.1 Shrub	N
Myrtaceae	<i>acmena smithii</i>		5	5 Tree	N
Atherospermataceae	<i>Doryphora sassafras</i>		20	0.5 Tree	N
Cuoniaceae	<i>Callicoma</i>			Shrub	N
Ebenaceae	<i>Diospyros pentamera</i>		10	5 Shrub	N
Rousseaceae	<i>Abrophyllum</i>			Shrub	
Phyllanthaceae	<i>glochidion</i>		0.1	Tree	
Sapindaceae	<i>Guioa semiglauca</i>			Tree	N
Oleaceae	<i>Notelaea longifolia</i>		5	Tree	N
Monimiaceae	<i>Hedycarya angustifolia</i>			Shrub	
Pittosporaceae	<i>Pittosporum undulatum</i>		2	1 Tree	N
Primulaceae	<i>Myrsine howittiana</i>			Shrub	N
Myrtaceae	<i>Backhousia</i>			Tree	
Cyatheaceae	<i>Cyathea australis</i>			Tree	
Cunoniaceae	<i>Ceratopetalum apetalum</i>			Tree	
Polypodiaceae	<i>Microsorium scandens</i>		5	1 Fern	
Vitaceae	<i>Cissus hypoglauca</i>		25	2 Vine	N
Blechnaceae	<i>Doodia aspera</i>		5	1 Fern	N
Vitaceae	<i>Cissus antarctica</i>		5	Vine	N
Asteraceae	<i>Pseuderanthemum</i>		1	Forb	N
Apocynaceae	<i>Marsdenia flavescens</i>			Other	N
Asparagaceae	<i>Eustrephus</i>			Other	N
Dryopteridaceae	<i>Lastreopsis decomposita</i>		5	2 Fern	N
Blechnaceae	<i>Blechnum cartilagenium</i>		0.1	1 Fern	N

Appendix A Species recorded

Arecaceae	<i>Gymnostachys anceps</i>	0.5	3 Forb	N
Pteridaceae	<i>Adiantum hispidulum var. hispidulum</i>		Fern	N
Dryopteridaceae	<i>Polystichum australiense</i>	2	20 Fern	N
Aspleniaceae	<i>Asplenium flabellifolium</i>	1	Fern	N
Pteridaceae	<i>Pellaea</i>		Fern	N
Pteridaceae	<i>Adiantum formosum</i>	10	1 Fen	N
Myrtaceae	<i>Syncarpia glomulifera</i>	10	5 Tree	N
Pittosporaceae	<i>Pittosporum multiflorum</i>	10.5	5 Shrub	N



Appendix A Species recorded

Fauna species identified			Status	
Taxa	Scientific name	Common name	BC Act	EPBC act
Ambphibia	<i>Crinia signifera</i>	Common eastern froglet	-	-
Aves	<i>Cacomantis flabelliformis</i>	Fan-tailed cuckoo	-	-
Aves	<i>Philemon corniculatus</i>	Noisy friarbird	-	-
Aves	<i>Ptilonorhynchus violaceus</i>	Satin Bowerbird	-	-
Aves	<i>Meliphaga lewinii</i>	Lewin's honeyeater	-	-
Aves	<i>Eopsaltria australis</i>	Eastern yellow robin	-	-
Aves	<i>Alisterus scapularis</i>	Australian king parrot	-	-
Aves	<i>Todiramphus sanctus</i>	Sacred kingfisher	-	-
Aves	<i>Psophodes olivaceus</i>	Eastern whipbird	-	-
Aves	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-Cockatoo	-	-
Aves	<i>Monarcha melanopsis</i>	Black-faced Monarch	-	-
Aves	<i>Pardalotus punctatus</i>	Spotted pardalote	-	-

## Appendix B: Habitat suitability assessment

As the subject land is within 10 kilometres of the ocean, several marine and shorebird species are noted within the proximity of the proposal. However, as the proposal is located in vegetated area set back from the shore, all marine and shorebird species have been excluded as they would be unlikely to occur within the study area.

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey or has been recorded within the past five years (known from a reputable source).
High	<p>A species is considered highly likely to occur in the study area if:</p> <ul style="list-style-type: none"> <li>• <i>There are previous credible records on BioNet within the study area from the last 10 years and suitable habitat is present.</i></li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• <i>The species is highly mobile, is dependent on identified suitable habitat within the study area (i.e., for breeding or important life cycle periods such as winter flowering resources) and has been recorded recently (within five years) on BioNet in the locality. This also includes species known or likely to visit the study area during regular seasonal movements or migration.</i></li> </ul>
Moderate	<p>A species is considered moderately likely to occur in the study area if:</p> <ul style="list-style-type: none"> <li>• <i>Any suitable habitat (e.g., foraging) is present in the study area, the species is highly mobile and has been recorded in the locality in the last 10 years on BioNet. The species may be unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area.</i></li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• <i>The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has been recorded in the locality in the last 10 years on BioNet.</i></li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• <i>For flora species that are associated with PCTs in the study area (see TBDC) or have been recorded in the locality in the last 10 years on BioNet – the associated PCT/habitat present in the study area is not degraded and the species was not targeted by surveys in accordance with the BAM and relevant survey guidelines. In addition, for flora species known to occur in disturbed areas (e.g., orchids), records from any time within the locality may warrant inclusion in this category.</i></li> </ul>
Low	<p>A species is considered to have a low likelihood of occurring in the study area if:</p> <ul style="list-style-type: none"> <li>• <i>For highly mobile species, the species may be an occasional visitor, but habitat similar to the study area is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the study area and the species has not been recorded in the locality in the last 10 years on BioNet.</i></li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• <i>The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has not been recorded in the locality in the last 10 years on BioNet.</i></li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• <i>For flora species that are associated with PCTs in the study area (see TBDC) and the species was not identified following targeted surveys in accordance with the BAM and relevant survey guidelines. Flora species that have been recorded in the locality on BioNet at any time, associated suitable habitat (see the TBDC) is not present in the study area, though similar habitats of the same vegetation formation is present in the study area.</i></li> </ul>
Unlikely	Suitable habitat for the species is absent from the study area.



### Habitat suitability assessment table

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
Plants							
<i>Astrotricha crassifolia</i>	V	V	Species	PCT 3591	The Thick-Leaf Star-Hair is known in the RNP and will occur in dry sclerophyll woodland on sandstone landscapes. Flowers during spring. Little known about seed storage, dispersal and germination.	1 – BioNet	Moderate – marginally suitable habitat present. Species was not recorded during field investigations.
<i>Prostanthera densa</i>	V	V	Species	PCT 3591	The Villous Mint-Bush is a mint-smelling shrub to 2 metres tall flowering mostly in spring. Has been recording in the RNP and mostly grows in sclerophyll forests and on coastal headlands. Will mostly grow on sandstone and rocky slopes near coastal ranges.	95 – BioNet	Moderate – marginally suitable habitat present Species was not recorded during field investigations.
<i>Callistemon linearifolius</i>	V	-	Species	PCT 3155 PCT 3789	The Netted Bottle Brush grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers in spring/summer	1 – BioNet	Moderate – marginally suitable habitat present. Species was not recorded during field investigations.
<i>Eucalyptus camfieldii</i>	V	V	Species	No PCTs associated	The Camfield's Stringy Bark occurs on poor coastal country in shallow sandy soils. Habitat is coastal heath and is associated with <i>Eucalyptus oblonga</i> , <i>Eucalyptus capitellata</i> and <i>Eucalyptus haemastoma</i> . Usually on Hawkesbury sandstone on exposed sandy ridges.	12 – BioNet	Low – ridgetop species on Hawkesbury sandstone whereas Narrabeen group is present within the study area.
<i>Melaleuca deanei</i>	V	V	Species	-	Deane's Paper Bark populations located in the RNP. Occurs mostly in ridgetop woodland. Flowering in summer.	1 – BioNet	Low – ridgetop species on Hawkesbury sandstone whereas Narrabeen group is present within the study area.
<i>Rhodamnia rubescens</i>	CE	CE	Species	3023, 3153, 3155, 3789, 3134	The Scrub Turpentine is found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forests, usually on volcanic and sedimentary soils. Typically occur in coastal regions.	11 – BioNet	Recorded – suitable habitat present and was identified on site.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Syzygium paniculatum</i>	E	V	Species	3028, 3153, 3134	The Magenta Lilly Pilly is found only on the coast of NSW. Occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities on the central coast.	2 – BioNet	High – suitable habitat present Species was not recorded during field investigations.
<i>Diuris aequalis</i>	E	V	Species	No PCTs associated	The Buttercup Doubletail has records in forest, low open woodland with grassy understorey and secondary grassland. Occurs on the higher parts of the Southern and Central Tablelands.	1 – BioNet	Low – grassland species, unfavourable habitat
<i>Genoplesium baueri</i>	E	E	Species	3789	Bauer’s Midge Orchid occurs in dry sclerophyll forests and moss gardens over sandstone. Flowers from February to March. Species is recorded at locations according to OEH likely within the Royal National Park	1 – BioNet	Moderate – suitable habitat present Species was not recorded during field investigations.
<i>Acacia bynoeana</i>	E	V	Species	-	The Bynoe’s Wattle occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	-	Low – unfavourable habitat
<i>Acacia terminalis</i> subsp. <i>terminalis</i>	E	E	Species	-	The Sunshine Wattle occurs in sparse and scattered habitat in coastal scrub and dry sclerophyll woodland on sandy soils. It is mostly found in areas of high modification and isolation.	-	Low – unfavourable habitat
<i>Allocasuarina glareicola</i>	E	E	Species	-	The <i>Allocasuarina glareicola</i> is mostly restricted to the north-western portion of the Cumberland Plain. Found in open woodlands with <i>Eucalyptus parramattensis</i> , <i>Eucalyptus fibrosa</i> , <i>Angophora bakeri</i> , <i>Eucalyptus sclerophylla</i> and <i>Melaleuca decora</i> . Associated species include <i>Melaleuca nodosa</i> , <i>Hakea dactyloides</i> , <i>Hakea sericea</i> , <i>Dillwynia tenuifolia</i> , <i>Micromyrtus minutiflora</i> , <i>Acacia</i>	-	Low – unfavourable habitat and no associated species identified.



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					<i>85anicula</i> , <i>Acacia 85anicul</i> , <i>Themeda australis</i> and <i>Xanthorrhoea minor</i> .		
<i>Caladenia tessellata</i>	E	V	Species	3407, 3789	The Thick-Lipped Spider-Orchid is generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	-	Low – unfavourable habitat
<i>Calochilus pulchellus</i>	E	-	Species	-	The Pretty Beard Orchid is endemic to NSW. It is known to occur at the southern end of Sydney Sandstone and the northern end of the South coast. Flowers between October to late November with only one or two flowers present at a time for only a few days.	-	Low – unfavourable habitat
<i>Cryptostylis hunteriana</i>	V	V	Species	3407	The Leafless Tongue-Orchid occurs in a range of vegetation communities including swamp-heath and woodland. Mostly occur in woodland with <i>Eucalyptus sclerophylla</i> , <i>E. sieberi</i> , <i>Corymbia gummifera</i> and <i>Allocasuarina littoralis</i> . Often found in association with <i>Cryptostylis subulate</i> and <i>C. erecta</i> . Prefers open areas in understorey.	-	Low – unfavourable habitat
<i>Cynanchum elegans</i>	E	E	Species	3028, 3134, 3153	The White-Flowered Wax Plant is known on rainforest gullies in scrub and scree slopes between Gloucester district to Wollongong around Mt Dangar. Flowering occurs between August and May.	-	Low – unfavourable habitat
<i>Melaleuca biconvexa</i>	V	V	Species	3153, 3789	The Biconvex Paperbark is a shrub/small tree found only in NSW. It grows in damp places near streams or low-lying areas. Found on alluvial soils of low slopes or sheltered aspects and resprouts following fire.	-	Low – unfavourable habitat

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Persoonia hirsuta</i>	E	E	Species	-	The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	-	Low – unfavourable habitat
<i>Persoonia nutans</i>	E	E	Species	-	The Nodding Geebung is found only within the Cumberland Plain in western Sydney, between Richmond and Macquarie Fields. Core distribution within the Penrith LGA.  Associated with sclerophyll forest and woodland vegetation communities. Can also occupy tertiary alluvium or shale sandstone transition communities.	-	Low – unfavourable habitat
<i>Pterostylis saxicola</i>	E	E	Species	-	The Sydney Plains Greenhood is most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where <i>Pterostylis saxicola</i> occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. All species of <i>Pterostylis</i> are deciduous and die back to fleshy, rounded underground tuberoids. The time of emergence and withering has not been recorded for this species, however flowering occurs from October to December and may vary due to climatic conditions. The above ground parts of the plant wither and die following seed dispersal and the plant persists as a tuberoid until the next year.	-	Low – unfavourable habitat
<i>Rhizanthella slateri</i>	V	E	Species	3028, 3591	The Eastern Underground Orchid is known to occur in sclerophyll forest, however no particular vegetation type has been associated with species. Located when soil is disturbed as most of the plant, except the flower, grows below the soil surface.	-	Low – unfavourable habitat
<i>Rhodomyrtus psidioides</i>	CE	CE	Species	3134, 3153	The Native Guava is found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest. Commonly near creeks and	-	Low – unfavourable habitat



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					drainage lines. It is extremely susceptible to Myrtle Rust infection		
<i>Thelymitra kangaloonica</i>	CE	CE	Species	-	The Kangaloon Sun Orchid is found in swamps in sedgelands over grey silty grey loam soils. It is only known to occur on the southern tablelands of NSW.	-	Low- unfavourable habitat
<i>Thesium australe</i>	V	V	Species	3407, 3789	The Austral Toadflax can occur within un-treed native grassland or heterogeneous native/exotic grassland if host flora for parasitisation are present. Usually associated with Kangaroo Grass.	-	Low – unfavourable habitat
Birds							
<i>Ptilinopus regina</i>	V	-	Ecosystem	3028, 3153, 3134	The Rose-Crowned Fruit Dove is found on coast and ranges of Eastern NSW. Occurs mainly in sub-tropical and dry rainforest. Will sometimes occur in moist eucalypt forest and swamp forest. Feeds on fruits from vines, shrubs, trees and palms.	1 – BioNet	Low – marginally suitable habitat present
<i>Hirundapus caudacutus</i>	-	V	Ecosystem	3023, 3153, 3155, 3591, 3789, 3134 Migratory terrestrial	The White-Throated Needletail is migratory and is usually seen in eastern Australia from October to April before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. The species is more commonly found in coastal areas. They are most commonly recorded above wooded areas, such as open forest and rainforest. In coastal areas they have been seen flying over sandy beaches or mudflats, near coastal cliffs.	6 – BioNet	Low – mostly aerial, marginally suitable habitat present
<i>Thalassarche cauta</i>	V	V	EEC/Marine	No PCTs associated	The Shy Albatross is an ocean-going species that inhabits subantarctic and subtropical marine waters. Will spend most of its time at sea. Breeding is endemic to Australia on three islands off Tasmania. Less pelagic than other albatross species. Take prey from the surface, surface plunges or shallow dives. Fish and cephalopods make up a majority of their diet	1 – BioNet	Low – marine species

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Thalassarche melanophris</i>	V	V	EEC/Marine	No PCTs associated	The Black-Browed Albatross is mostly confined to subantarctic and Antarctic waters surrounding these islands. Breeds within Australian jurisdiction on several islands. Diet consists of fish, molluscs and crustaceans	1 – BioNet	Low – marine species
<i>Pterodroma nigripennis</i>	V	-	EEC/Marine	No PCTs associated	The Black-Winged Petrel is a marine petrel that nests at numerous sites in burrows up to a metre long in sandy soil. The burrows are located on higher ground, usually hidden in bushes. Ranges throughout the Tasman Sea and Central Pacific Ocean.	1 – BioNet	Low – marine species
<i>Circus assimilis</i>	V	-	Ecosystem	3407, 3789	The Spotted Harrier is found throughout mainland Australia excluding densely forested or wooded habitats of the coast, escarpment and ranges. Usually found in grassy open woodlands, inland riparian woodland, grassland and shrub steppe.	1 – BioNet	Low – suitable habitat not present
<i>Haliaeetus leucogaster</i>	V	-	Species/ecosystem	3153, 3155, 3407, 3591, 3789, 3134	The White-bellied Sea Eagle is widespread along the east coast of NSW. Habitats characterised by large areas of open water. Occurs at sites near the sea and terrestrially at coastal dunes, tidal flats, grassland, heathland, woodland and forest.	13 – BioNet	Low – suitable habitat not present
<i>Hieraaetus morphnoides</i>	V	-	Species/ecosystem	3028, 3153, 3155, 3407, 3591, 3789, 3134	The Little Eagle Is Found throughout the Australian mainland. The main habitat is open eucalypt forest, woodland or open woodland.	1 – BioNet	Low – suitable habitat not present
<i>Lophoictinia isura</i>	V	-	Species/ecosystem	3028, 3153, 3155, 3407, 3591, 3789, 3134	The Square-Tailed Kite is found in a variety of timbered habitats including dry woodlands and open forests. Prefers timbered watercourses. Appears to occupy large hunting ranges of more than 100 km <sup>2</sup> . Nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	1 – BioNet	Low – suitable habitat not present
<i>Haematopus fuliginosus</i>	V	-	Species	No associated PCTs	The Sooty Oystercatcher is found around the entire Australian coast preferring rocky headlands, rocky	4 – BioNet	Low – suitable habitat not present



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					shelves, exposed reefs with rock pools, beaches and muddy estuaries.		
<i>Limicola falcinellus</i>	V	-	Species/ ecosystem	No associated PCTs	Broad-Billed Sandpiper prefers sheltered parts of the coast including estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs for both feeding and roosting. The main site in NSW for the species is the Hunter River estuary.	1 – BioNet	Low – suitable habitat not present
<i>Callocephalon fimbriatum</i>	V	E	Species/ ecosystem	3028, 3153, 3155, 3591, 3789, 3134	The Gang-Gang Cockatoo requires eucalypt tree species with hollows greater than 9 cm diameter. During warmer months, they found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. During autumn and winter, they will move to lower altitudes in drier and more open eucalypt forests and woodlands.	3 – BioNet	Low – may roost and nest in hollows in eucalypt trees however no hollow trees are identified for removal
<i>Glossopsitta pusilla</i>	V	-	Ecosystem	3028, 3153, 3155, 3591, 3789, 3134	NSW provides a large portion of the Little Lorikeet’s habitat. They forage primarily in the canopy of open <i>Eucalyptus</i> forest and woodland. Riparian habitats are particularly used. They roost in treetops often far from feeding areas.	3 – BioNet	Moderate – marginally suitable habitat present
<i>Lathamus discolor</i>	E	CE	Species/ ecosystem	No associated PCTs	The Swift Parrot migrates to south-east mainland Australian between February and October. Occur in areas where eucalypts flower profusely or where there are abundant lerp infestations.	7 – BioNet	Moderate – suitable habitat present
<i>Pezoporus wallicus wallicus</i>	V	-	Species	No associated PCTs	The Eastern Ground Parrot occurs in high rainfall coastal and near coastal low heathlands and sedgeland, generally one metre in height and very dense.	1 – BioNet	Low – suitable habitat not present
<i>Ninox strenua</i>	V	-	Species/ ecosystem	3028, 3153, 3155, 3591, 3134	The Powerful Owl is endemic to eastern and south-eastern Australia. They inhabit many vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large	32 – BioNet	Moderate – limited foraging and roosting habitat is present on site.

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine ( <i>Syncarpia glomulifera</i> ), Black She-oak ( <i>Allocasuarina littoralis</i> ), Blackwood ( <i>Acacia melanoxylon</i> ), Rough-barked Apple ( <i>Angophora floribunda</i> ), Cherry Ballart ( <i>Exocarpus cupressiformis</i> ) and a number of eucalypt species. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense “grove” of trees that provide concealment from other birds.		
<i>Tyto novaehollandiae</i>	V	-	Species/ ecosystem	3028, 3153, 3155, 407, 3591	The Masked Owl lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	22 – BioNet	Moderate – limited foraging habitat only is present on site.
<i>Tyto tenebricosa</i>	V	-	Species/ ecosystem	3028, 3153, 3155, 3591, 3134	The Sooty Owl inhabits rainforests and moist eucalypt forests along the coast. During the day, this species roosts in hollows of tall forest trees or in heavy vegetation. Nests are also found in very large tree-hollows.	72 – BioNet	Moderate – limited foraging habitat only is present on site.
<i>Pycnoptilus floccosus</i>	-	V	Not listed	Not listed	Pilotbird is endemic to South east Australia from Melbourne to north of Newcastle. Critical habitat includes wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth as well as dry sclerophyll forests and woodlands occupying dry slopes and ridges.	14 – BioNet	Low – only marginally suitable habitat present



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Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Epthianura albifrons</i>	V	-	Ecosystem	3407	The White-Fronted Chat is found mostly in temperate to arid climates. They breed from late July to early March in 'open-cut' nests built in low vegetation. In coastal areas it is found mostly in damp open habitats (saltmarsh, open grasslands and wetland verges).	1 – BioNet	Low – suitable habitat not present
<i>Daphoenositta chrysoptera</i>	V	-	Ecosystem	3028, 3153, 3155, 3591, 3789, 3134	The Varied Sittella inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	3- BioNet	Moderate – potential habitat adjacent
<i>Artamus cyanopterus cyanopterus</i>	V	-	Ecosystem	3028, 3153, 3155, 3407, 3591, 3789, 3134	The Dusky Woodswallow primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris.	1 – BioNet	Moderate – can be migratory with suitable habitat potentially present adjacent
<i>Petroica boodang</i>	V	-	Ecosystem	3028, 3591	The Scarlet Robin breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgeland at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains). Often occurs in recently burnt areas; however, habitat becomes unsuitable as vegetation closes up following regeneration. In winter lives in dry forests, open	1 – BioNet	Moderate – potential suitable habitat present adjacent

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					woodlands and in pastures and native grasslands, with or without scattered trees.		
<i>Anthochaera phrygia</i>	CE	CE	Species/ ecosystem	3591	The Regent Honeyeater inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests. The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany, Lower Hunter Spotted Gum, Thin-leaved Stringybark, Eucalyptus eugenioides and other Stringybark species, and Broad-leaved Ironbark can also contribute important nectar flows at times. Nectar and fruit from the mistletoes <i>Amyema miquelii</i> , <i>A. pendula</i> and <i>A. cambagei</i> are also utilised. When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings. There are three known key breeding areas, two of them in NSW – Capertee Valley and Bundarra-Barraba regions. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in mistletoe haustoria.	-	Moderate – favourable habitat adjacent
<i>Botaurus poiciloptilus</i>	E	E	Ecosystem	3407	The Australasian Bittern is found in brackish or freshwater wetlands. Favours permanent freshwater	-	Low – unfavourable habitat



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					wetlands with tall, dense vegetation, particularly bullrushes ( <i>Typha</i> spp.) and spike rushes ( <i>Eleocharis</i> spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains.		
<i>Calidris canutus</i>	-	E	Species/ ecosystem	- Migratory wetland	The Red Knot breeds mostly in North America, Russia, Greenland and Alaska and is a non-breeding visitor to most continents. In Australasia, it inhabits intertidal mudflats, sandflats, sandy beaches, estuaries, bays, inlets, lagoons and harbours. Rarely uses inland lakes or swamps. Usually forages in soft substrate near the edge of water on intertidal mudflats or sandflats exposed by low tide. Roosts on sandy beaches, spits and islets, and mudflats. Omnivorous, mostly eating invertebrates	-	Low – unfavourable habitat
<i>Calidris ferruginea</i>	E	CE	Species/ ecosystem	3134, 3789 Migratory wetland	The Curlew Sandpiper generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on shingle, shell or sand beaches; spits or islets on the coast or in wetlands; or sometimes in salt marsh, among beach-cast seaweed, or on rocky shores	-	Low – unfavourable habitat
<i>Calyptorhynchus lathami lathami</i>	V	V	Species/ ecosystem	3028, 3134, 3153, 3155, 3407, 3591, 3789	The South-Eastern Glossy Black-Cockatoo inhabits forest and woodlands of coastal areas. They are associated with a wide range of sheoaks. Dependent on large hollow-bearing eucalypts for nest sites.	-	Low – favourable food trees not present

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Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Charadrius leschenaultii</i>	V	V	Species/ ecosystem	Migratory wetland	The Greater Sand Plover occurs mostly on sheltered sandy, shelly or muddy beaches or estuaries roosting on sandy beaches and rocky shores during high tides	-	Low – unfavourable habitat
<i>Dasyornis brachypterus</i>	E	E	Species	3153, 3028, 3789	The Eastern Bristlebird inhabits central and southern populations characterised by dense, low vegetation. Mostly in heath and open woodlands with a heathy understorey.	-	Low – unfavourable habitat
<i>Diomedea antipodensis</i>	V	V	Not listed	-	The Antipodean Albatross is marine and nests in open patchy vegetation, such as among tussock grassland or shrubs on ridges, slopes and plateaus	-	Low – unfavourable habitat
<i>Diomedea antipodensis gisboni</i>	V	V	EEC/Marine	-	The Gibson's Albatross forages in NSW waters during the winter.	-	Low – unfavourable habitat
<i>Diomedea exulans</i>	E	V	EEC/Marine	-	The Wandering Albatross has a circumpolar range in the Southern Ocean.	-	Low – unfavourable habitat
<i>Diomedea sanfordi</i>	-	E	Not listed	-	The Northern Royal Albatross feeds in waters in Tasmania, South Australia, and less frequently in NSW	-	Low – unfavourable habitat
<i>Erythrotriorchis radiatus</i>	CE	V	Species	3028, 3134, 3407, 3591	The Red Goshawk inhabits open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. Mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers. Breeding is likely to be in spring and summer in southern Queensland and NSW	-	Low – unfavourable habitat
<i>Falco hypoleucos</i>	V	V	Ecosystem	-	The Grey Falcon is usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in	-	Low – unfavourable habitat



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					open woodlands near the coast. It also occurs near wetlands where surface water attracts prey		
<i>Fregetta grallaria grallaria</i>	V	V	EEC/Marine	-	The White-Bellied Storm-Petrel is marine and only breeds in offshore islands in Australia. It occurs in Coastal NSW waters.	-	Low – unfavourable habitat
<i>Grantiella picta</i>	V	V	Ecosystem	3134, 3153, 3155, 3591	The Painted Honeyeater inhabits the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. Inhabits Boree/ Weeping Myall ( <i>Acacia pendula</i> ), Brigalow ( <i>A. harpophylla</i> ) and Box-Gum Woodlands and Box-Ironbark Forests. Feeds on the fruits of mistletoes in woodland eucalypts and acacias. Prefers <i>Amyema</i> mistletoes of the genus. Nests spring to autumn, hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe.	-	Low – unfavourable foraging habitat and at the margins of known range
<i>Limosa lapponica baueri</i>	-	V	Species/ ecosystem		The Nunivak Bar-Tailed Godwit is mostly found in coastal habitats. Forages at low to mid tide in shallow water or along the water's edge. Feeds on worms, molluscs, crustaceans, insects and some plants. Rarely found on inland wetlands or in areas of short grass such as farmland, paddocks and airstrips.	-	Low – unfavourable habitat
<i>Macronectes giganteus</i>	E	E	EEC/ marine		The Southern Giant-Petrel nests in small colonies amongst open vegetation over summer in Antarctic and subantarctic islands. Single chick is raised and breeding occurs annually (although only 30% of the potential breeding population does not nest). Opportunistic scavenger and predator and sometimes an active predator	-	Low – unfavourable habitat
<i>Neophema chrysogaster</i>	CE	CE	Species	3407, 3789	The Orange-Bellied Parrot is found in sedges and salt-tolerant coastal salt marsh plants. Habitat will vary throughout the year as it is migratory. It will be found in salt marshes, coastal dunes, pastures, shrub lands,	-	Low – unfavourable habitat

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Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					estuaries, islands, beaches and moorlands. Uses <i>Eucalyptus nitida</i> and <i>Eucalyptus ovata</i> hollows.		
<i>Numenius madagascariensis</i>	-	CE	Species/ ecosystem	- Migratory wetland	The Eastern Curlew is an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on crabs and molluscs in intertidal mudflat.	-	Low – unfavourable habitat
<i>Pachyptila turtur subantarctica</i>	-	V	Not listed		The Fairy Prion breeds on Macquarie Island and a number of other subantarctic islands outside of Australia. The species digs burrows among rocks or low vegetation to nest. Often will occur in larger flocks out at sea.	-	Low – unfavourable habitat
<i>Phoebastria fusca</i>	V	V	EEC/marine		The Sooty Albatross occurs in South Atlantic and southern Indian Oceans. Pelagic or oceangoing species spends the majority of time at sea.	-	Low – unfavourable habitat
<i>Pterodroma leucoptera leucoptera</i>	V	E	EEC/marine	3134, 3407, 3789	The Gould's Petrel principal nesting habitat is located within two gullies and in rock crevices. Breed colonially and nests are clumped and often less than one metre apart.	-	Low – unfavourable habitat
<i>Pterodroma neglecta neglecta</i>	V	V	EEC/marine	-	The Kermadec Petrel is a marine bird that ranges over subtropical and tropical waters of the South Pacific. It nests in a crevice amongst rocks	-	Low – unfavourable habitat
<i>Rostratula australis</i>	E	E	Ecosystem	-	The Australian Painted Snipe is restricted to Australia, particularly south east and Murray Darling Basin, scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW there are many records are from the Murray-Darling Basin, wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the	-	Low – unfavourable habitat



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					ground amongst tall vegetation, such as grasses, tussocks or reeds.		
<i>Sternula nereis nereis</i>	-	V	Species	-	The Australian Fairy Tern is a small bird with bulky and round body. It occurs along the coasts of Victoria, Tasmania, SA and WA and has not been known in NSW recently. Nests on sheltered sandy beaches, spits and banks. Feeding involves hovering and diving into shallow waters to catch fish.	-	Low – unfavourable habitat
<i>Thalassarche bulleri</i>	-	V	Not listed	-	The Buller's Albatross is a non breeding visitor to Australia seen over inshore, offshore and pelagic waters.	-	Low – unfavourable habitat.
<i>Thalassarche carteri</i>	-	E	Not listed	-	The Indian Yellow-Nosed Albatross occurs in the Southern Indian Ocean. It is a marine bird, located in subtropical and warmer subantarctic waters.	-	Low – unfavourable habitat
<i>Thalassarche eremita</i>	-	E	Not listed	-	The Chatham Albatross is a marine species occurring in subantarctic and subtropical waters. Breeding occurs between September and December. Fish and cephalopods make up a majority of their diet.	-	Low – unfavourable habitat
<i>Thalassarche impavida</i>	-	V	Campbell albatross	-	The Campbell Albatross is a non-breeding visitor to Australian waters. Seen foraging on oceanic continental slopes off Tasmania, Victoria and NSW. Feeds mostly on -krill and fish	-	Low – unfavourable habitat
<i>Thalassarche melanophris</i>	-	V	EEC/marine	-	The Black-Browed Albatross is mostly confined to subantarctic and Antarctic waters surrounding these islands. It breeds on several islands within Australian jurisdiction.	-	Low – unfavourable habitat
<i>Thalassarche salvini</i>	-	V	Not listed	-	The Salvin's Albatross is a non-breeding visitor to Australian waters taking inshore cephalopods and fish.	-	Low – unfavourable habitat.

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Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Thalassarche steadi</i>	-	V	Not listed	-	The White-Capped Albatross is a marine species in subantarctic and subtropical waters. It likely feeds on inshore cephalopods and fish. Common on south-east coast of Australia throughout the year.	-	Low – unfavourable habitat
<i>Actitis hypoleucos</i>	-	-	Not listed	- Migratory wetland	The Common Noddy is protected by the EPBC Act. It occurs mainly in ocean off the Queensland coast. During the breeding season it usually occurs on or near islands, cays, shoals etc.	-	Low – unfavourable habitat
<i>Ardenna carneipes</i> as <i>Puffinus carneipes</i>	V	-	EEC/marine	-	The Flesh-Footed Shearwater is protected by the EPBC Act. It nests on Lord Howe Island in forest on sandy soils.	-	Low – unfavourable habitat
<i>Ardenna grisea</i> as <i>Puffinus griseus</i>	-	-	Not listed	-	The Sooty Shearwater is protected by the EPBC Act. It is pelagic and migrates and forages in the North Pacific and Atlantic Oceans. It may forage inshore during rough weather.	-	Low – unfavourable habitat
<i>Bubulcus ibis</i> as <i>Ardea ibis</i>	-	-	Not listed	-	The Cattle Egret is protected by the EPBC Act. Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands.	-	Low – unfavourable habitat
<i>Calidris melanotos</i>	-	-	Not listed	-	The Pectoral Sandpiper is protected by the EPBC Act. It prefers shallow fresh to saline wetlands.	-	Low – unfavourable habitat
<i>Calonectris leucomelas</i>	-	-	Not listed	-	The Streaked Shearwater is protected by the EPBC Act. It forages in both shelf and pelagic waters.	-	Low – unfavourable habitat
<i>Diomedea epomophora</i>	-	V	Not listed	-	The Southern Royal Albatross is protected by the EPBC Act. It is a large marine migratory bird that does not breed in Australia.	-	Low – unfavourable habitat
<i>Fregata ariel</i>	-	-	Not listed	-	The Lesser Frigatebird is protected by the EPBC Act and is a marine species occurring over tropical and subtropical waters.	-	Low – unfavourable habitat



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Fregata minor</i>	-	-	Not listed	-	The Great Frigatebird is protected by the EPBC Act. It is a large seabird that nests in the tropical Pacific and Indian Oceans.		Low – unfavourable habitat
<i>Macronectes halli</i>	V	V	EEC/marine	-	The Northern Giant Petrel is protected by the EPBC Act. It has circumpolar pelagic distribution. Breeding in Australia is limited to Macquarie Island. Adults remain near the breeding colonies where immature birds take further movements (hence most birds on NSW coast are immature).		Low – unfavourable habitat
<i>Merops ornatus</i>	-	-	Not listed	-	The Rainbow Bee-Eater is protected by the EPBC Act. It is most commonly found in open forests and woodlands, shrublands and in various cleared or semi-cleared habitats.		Low – unfavourable habitat
<i>Motacilla flava</i>	-	-	Not listed	-	The Yellow Wagtail is protected by the EPBC Act. It is ground dwelling in grassy and waterside habitats.		Low -unfavourable habitat
<i>Neophema chrysostoma</i>	-	-	Not listed	-	The Blue-Winged Parrot is protected by the EPBC Act and is partly migratory.		Low – unfavourable habitat
<i>Phaethon lepturus</i>	-	-	Not listed	-	The White-Tailed Tropicbird is protected by the EPBC Act. It is a seabird found in tropical Atlantic, western Pacific and Indian oceans.		Low – unfavourable habitat
<i>Rhipidura rufifrons</i>	-	-	Not listed	- Migratory terrestrial	The Rufous Fantail is protected by the EPBC Act. It inhabits wet sclerophyll forests often in eucalypt dominated gullies.		Low – only marginally favourable habitat present
<i>Stercorarius skua</i>	-	-	Not listed	-	The Great Skua is protected by the EPBC Act and is a large seabird catching fish caught at sea.		Low – unfavourable habitat
<i>Sternula albifrons</i> as <i>Sterna albifrons</i>	E	-	Species/ ecosystem	-	The Little Tern Is protected by the EPBC Act. It migrates from Eastern Asia and is almost exclusively coastal, preferring sheltered environments. It nests in small colonies in a scrape in the sand.		Low – unfavourable habitat

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Symposiachrus trivirgatus</i>	-	-	Not listed	-	The Spectacled Monarch is protected by the EPBC Act. It inhabits thicker understories in rainforests as well as rainforests, wet gullies and waterside vegetation.		Low – unfavourable habitat
Mammals							
<i>Phascolarctos cinereus</i>	E	E	Species	3153, 3155, 3591	The Koala inhabits eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Can live in many different eucalypt forests including dense, wet coastal forests.	10 – BioNet	Low – one ancillary habitat tree species and one locally important tree identified on site. Marginally suitable habitat present.
<i>Cercartetus nanus</i>	V	-	Species	3028, 3153, 3155, 3407, 3591, 3789, 3134	The Eastern Pygmy-Possum is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum ( <i>Pseudocheirus peregrinus</i> ) dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.	51 – BioNet	Low – Suitable habitat not present
<i>Petauroides volans</i>	E	E	Species	3028, 3153, 3155, 3591, 3134	The Greater Glider occurs most commonly in tall, moist eucalypt forests and woodlands with old trees	11 – BioNet	Low – marginally suitable habitat present and no hollowing bearing trees are identified for removal



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					and abundant hollows. They are loyal to their territory.		
<i>Pteropus poliocephalus</i>	V	V	Species/ ecosystem	3028, 3153, 3155, 3407, 3591, 3789, 3134	The Grey-Headed FlyingFox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.	42 – BioNet	Moderate – suitable foraging habitat present (unlikely for roosting habitat)
<i>Micronomus norfolkensis</i>	V	-	Ecosystem	3028, 3153, 3591	The Eastern Coastal Free-tailed Bat occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	1 – BioNet	Moderate – may be present in hollows or under bark or man-made structure.
<i>Chalinolobus dwyeri</i>	V	V	Species	3028, 3153, 3155, 3591	The Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin ( <i>Petrochelidon ariel</i> ), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to	24 – BioNet	Moderate – no caves present in area, suitable foraging habitat present

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					the same cave over many years. Found in well timbered areas containing gullies. he relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. They will likely hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.		
<i>Falsistrellus tasmaniensis</i>	V	-	Ecosystem	3028, 3153, 3155, 3591	The Eastern False Pipistrelle prefers moist habitats, with trees taller than 20m. They will generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. They hibernate in winter. Females are pregnant in late spring to early summer.	3 – BioNet	Moderate – limited roosting and foraging habitat present
<i>Myotis macropus</i>	V	-	Species	3028, 3153, 3155, 3591, 3134	The Southern Myotis generally roost in groups of 10 – 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.	20 – BioNet	Moderate – limited roosting and foraging habitat present
<i>Scoteanax rueppellii</i>	V	-	Ecosystem	3153, 3155, 3591	The Greater Broad-Nosed Bat utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. The species forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 – 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its	6 – BioNet	Moderate – likely to use hollows.



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.		
<i>Miniopterus orianae oceanensis</i>	V	-	Species/ ecosystem	3028, 3153, 3155, 3591, 3789	Large Bent-Winged Bats use caves as the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Hunt in forested areas, catching moths and other flying insects above the tree tops.	15 – BioNet	Low – no caves in area, limited foraging habitat present
<i>Pseudomys novaehollandiae</i>	-	V	Ecosystem	3407	The New Holland Mouse inhabits coastal areas and up to 100 km inland on sandstone country. They are known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Floristic diversity, especially leguminous perennials	57 – BioNet	Low – suitable habitat potentially present
<i>Dasyurus maculatus maculatus</i>	V	E	Ecosystem	3028, 3134, 3153, 3155, 3407, 3591, 3789	The Spot-Tailed Quoll is recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. Will spend most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by	-	Low – unfavourable habitat

Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
					multiple individuals and can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creeklines.		
<i>Isoodon obesulus obesulus</i>	E	E	Species	3134, 3153, 3155, 3407, 3591, 3789	The Southern Brown Bandicoot is largely crepuscular. It's found in heath and open forests with heathy understorey. They nest during the day in shallow depressions in ground covered by plant material.	-	Low
<i>Petaurus australis australis</i>	V	V	Ecosystem	3153	The Yellow-Bellied Glider occurs in tall, mature eucalypt forests with high rainfall and nutrient rich soils.	-	Low
<i>Petrogale penicillata</i>	E	V	Species	3028, 3153, 3155, 3591	The Brush-Tailed Rock-Wallaby is found in a variety of habitats in rocky area. Usually on northerly aspects.	-	Low
<i>Potorous tridactylus tisulcatus</i>	V	V	Species	3153, 3789	The Long-Nosed Potoroo is found on coastal heaths and dry and wet sclerophyll forests, particularly with dense understorey. Occasional open areas are essential part of habitat. Sandy loam soil is also a common feature. They are mainly nocturnal.	-	Low
Amphibians							
<i>Pseudophryne australis</i>	V	-	Species	3028, 3155, 3591	The Red-Crowned Toadlet occurs in open forests, periodically in wet drainage lines below sandstone ridges. Shelters under rocks and amongst dense vegetation or thick piles of leaf litter. Not recorded to breed in waters that are even mildly polluted or with pH outside the range of 5.5 to 6.5. Eggs are laid in moist leaf litter, from where they are washed by heavy rain.	74 – BioNet	Moderate – marginally suitable habitat present



Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Heleioporus australiacus</i>	V	V	Species	3028, 3153, 3155, 3591	The Giant Burrowing Frog inhabits heath, woodland and open dry sclerophyll forest. The home ranges of the species are approximately 0.04 hectares. Breeding habitat of this species is generally soaks or pools within first or second order streams. They will burrow below the soil surface or in leaf litter.	41 – BioNet	Moderate – suitable habitat present (South Rill) although Project area will not impact breeding
<i>Litoria aurea</i>	E	V	Species	3134, 3153, 3155, 3407, 3591, 3789	The Green And Golden Bell Frog are found within 1 km of ephemeral wet areas, swamps and waterbodies. Optimum habitat includes water-bodies that are unshaded.	-	Low – unfavourable habitat.
<i>Mixophyes balbus</i>	E	V	Species	3028, 3134, 3153, 3155, 3591	The Stuttering Frog is found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Feed on insects and smaller frogs. Breed in streams during summer after heavy rain.	-	Low – unfavourable habitat
Reptiles							
<i>Caretta caretta</i>	-	E	Species	No associated PCTs	Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months.	1 – BioNet	Low – suitable habitat not present
<i>Chelonia mydas</i>	V	V	Species	3407	Green Turtles are ocean-dwellers, with most of their life in the sea. They lay eggs in holes dug in beaches throughout their range.	2 – BioNet	Low – suitable habitat not present
<i>Eretmochelys imbricata</i>	-	V	EEC/marine	No associated PCTs	The Hawksbill Turtles are ocean-dwellers, with most of their life in the sea. Eggs laid in holes dug in beaches throughout their range.	1 – BioNet	Low – suitable habitat not present

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Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Dermochelys coriacea</i>	E	E	Species	No associated PCTs	The Leatherback Turtle occurs in inshore and offshore marine waters and rarely breeds in Australia.	1 – BioNet	Low – suitable habitat not present
<i>Varanus rosenbergi</i>	V	-	Ecosystem	3028, 3407, 3591, 3789, 3134	The Rosenberg’s Goanna is found in heath, open forest and woodlands. They are associated with termites, and therefore termite mounds are a critical habitat component. They will take shelter in hollow logs, rock crevices and in burrows.	7 – BioNet	Low – they are dependent on termite nest of which none were on or near the proposal area
<i>Hoplocephalus bungaroides</i>	E	V	Species/ ecosystem	3028	Broad-Headed Snakes shelter in sandstone rock crevices and under flat rocks on exposed cliff edges during autumn, winter and spring. In summer, this species moves to crevices or hollows in large trees within 500m of escarpments.	49 – BioNet	Low – marginally suitable habitat present.
<i>Natator depressus</i>	-	V	Not listed	No associated PCTs	Flatback Turtles are found in soft bottom habitats. They do not have wide dispersal phase in the oceanic environment. They nest on sandy beaches in the tropics and subtropics.	-	Low – unfavourable habitat
Invertebrates							
<i>Meridolum maryae</i>	-	E	Species	3407, 3591	Maroubra Woodland Snail is found in leaf litter of coastal vegetation communities. Usually they are found in heathland on foredunes.	-	Low – unfavourable habitat
Migratory species							
<i>Monarcha melanopsis</i>	-	-	Not listed	- Migratory terrestrial	The Black-Faced Monarch is most commonly found in rainforest ecosystems. This includes semideciduous vines, notophyll vine-forest, tropical rainforest, subtropical rainforest, mesophyll thicket/shrubland, warm temperate rainforest, dry rainforest and occasionally cool temperate rainforest. They are often in gullies.	-	Recorded – suitable habitat present



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Scientific name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act					
<i>Myiagra cyanoleuca</i>	-	-	Not listed	- Migratory terrestrial	The Satin flycatcher is found in very vegetated gullies in eucalypt-dominated forests/ woodlands. Found often near wetlands and watercourses.	-	Low – unfavourable habitat
<i>Calidris acuminata</i>	-	-	Not listed	- Migratory wetland	The Sharp-Tailed Sandpiper is found in muddy edges of shallow fresh or brackish wetlands.	-	Low – unfavourable habitat
<i>Gallinago hardwickii</i>	-	-	Not listed	- Migratory wetland	Latham's Snipe is a non-breeding visitor to south-eastern Australia. It inhabits permanent and ephemeral wetlands up to 2000m above sea level.	-	Low – unfavourable habitat
<i>Limosa lapponica</i>	-	-	Species/ ecosystem	- Migratory wetland	The Bar-Tailed Godwit is typically found in coastal habitats such as large intertidal sandflats, mudflats, banks, inlets, estuaries, coastal lagoons and bays.	-	Low – unfavourable habitat
<i>Pandion haliaetus</i>	-	-	Not listed	- Migratory wetland	The Osprey favour coastal areas, especially the mouths of large rivers, lagoons and lakes. It feeds on fish over clear, open water.	-	Low – no suitable nesting habitat
<i>Tringa nebularia</i>	-	-	Not listed	- Migratory wetland	The Common Greenshank is found in inland wetlands and sheltered coastal habitats of varying salinity. It forages at edges of wetlands.	-	Low – unfavourable habitat

## Appendix C: Plot-based field data sheets



		<b>Survey Name</b>	<b>Zone ID: 56 H</b>	<b>Recorders</b>			
<b>Date</b>	01/12/22			Paul Gadsby, Miranda Crossley			
56 H <sup>Zone</sup>	Datum	<b>Plot ID</b>	1	<b>Plot dimensions</b>	20 x 50	<b>Photo #</b>	
Easting	Northing	<b>IBRA region</b>	In m	<b>Midline bearing from 0 m</b>	190 degrees	Magnetic °	
151.061870	-34.167480						
<b>Vegetation Class</b>	Rainforest Formation Littoral					Confidence: H M L	
<b>Plant Community Type</b>						<b>EEC:</b> tick	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m <sup>2</sup> plot)	Sum values	
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
<b>High Threat Weed cover</b>		

BAM Attribute (1000 m <sup>2</sup> plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1	N/a
50 – 79 cm	12	N/a
30 – 49 cm	yes	N/a
20 – 29 cm	yes	N/a
10 – 19 cm	yes	N/a
5 – 9 cm	yes	N/a
< 5 cm	yes	n/a
<b>Length of logs (m)</b> (≥10 cm diameter, >50 cm in length)	72m Tally space	

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
<b>Subplot score (% in each)</b>	55	70	85	70	∅	25	15	10	20	5	0	0	0	0	10	0	15	5	10	5
<b>Average of the 5 subplots</b>	60					15					2					7				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

**Physiography + site features that may help in determining PCT and Management Zone**

Morphological Type	Valley	Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour	dark brown	Soil Depth	
Slope	17 degrees	Aspect	North east	Site Drainage	good	Distance to nearest water and type	20 m stream

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	0		
Cultivation (inc. pasture)	0		
Soil erosion	0		
Firewood / CWD removal	0		
Grazing (identify native/stock)	0		
Fire damage	1		
Storm damage	0		
Weediness	1		
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

		<b>Survey Name</b>	<b>Zone ID: 56 H</b>	<b>Recorders</b>			
<b>Date</b>	1/12/22			Paul Gadsby, Miranda Crossley			
56 H <sup>Zone</sup>	Datum	<b>Plot ID</b>	2	<b>Plot dimensions</b>		<b>Photo #</b>	
Easting	Northing	<b>IBRA region</b>	In m	<b>Midline bearing from 0 m</b>	167 degrees <span style="float: right;">Magnetic °</span>		
<b>Vegetation Class</b>		Rainforest Formation Littoral				Confidence: H M L	
<b>Plant Community Type</b>						Confidence: H M L	
						EEC: tick	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m <sup>2</sup> plot)	Sum values	
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
<b>High Threat Weed cover</b>		

BAM Attribute (1000 m <sup>2</sup> plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1	1
50 – 79 cm	8	3
30 – 49 cm	yes	N/a
20 – 29 cm	yes	N/a
10 – 19 cm		N/a
5 – 9 cm		N/a
< 5 cm		n/a
<b>Length of logs (m)</b> (≥10 cm diameter, >50 cm in length)	94m	Tally space

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
<b>Subplot score (% in each)</b>	80	95	85	80	70	20	5	15	20	30	0	0	0	0	0	0	0	0	0	0
<b>Average of the 5 subplots</b>	82					18					0					0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

### Physiography + site features that may help in determining PCT and Management Zone

Morphological Type	Valley	Landform Element		Landform Pattern		Microrelief	
Lithology	Narrabeen group	Soil Surface Texture		Soil Colour	dark brown	Soil Depth	
Slope	18 degrees	Aspect	north	Site Drainage	good	Distance to nearest water and type	80 m stream

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)	0		x
Cultivation (inc. pasture)	0		x
Soil erosion	0		x
Firewood / CWD removal	0		x
Grazing (identify native/stock)	0		x
Fire damage	0		x
Storm damage	0		x
Weediness	1=		x
Other			occasional wind dispersal Asteraceae

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)



		<b>Survey Name</b>	<b>Zone ID: 56 H</b>	<b>Recorders</b>			
<b>Date</b>	09/02/2023			Paul Gadsby, Naomi Mansell			
56 H <sup>Zone</sup>	Datum	<b>Plot ID</b>	3	<b>Plot dimensions</b>		<b>Photo #</b>	
Easting	Northing	<b>IBRA region</b>	In m	<b>Midline bearing from 0 m</b>	133 degrees SE <sup>magnetic</sup> °		
<b>Vegetation Class</b>		Rainforest Formation Littoral				Confidence: H M L	
<b>Plant Community Type</b>						<b>EEC:</b> tick	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m <sup>2</sup> plot)	Sum values	
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
<b>High Threat Weed cover</b>		

BAM Attribute (1000 m <sup>2</sup> plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	3	N/a
50 – 79 cm	3	N/a
30 – 49 cm	yes	N/a
20 – 29 cm	yes	N/a
10 – 19 cm	yes	N/a
5 – 9 cm	yes	N/a
< 5 cm	yes	n/a
<b>Length of logs (m)</b> (≥10 cm diameter, >50 cm in length)	35m	Tally space

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	80	70	90	60	90	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
<b>Average of the 5 subplots</b>	78																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

### Physiography + site features that may help in determining PCT and Management Zone

Morphological Type	Valley	Landform Element		Landform Pattern		Microrelief	
Lithology	Narrabeen group	Soil Surface Texture	more clay	Soil Colour	brown	Soil Depth	
Slope	17 degrees	Aspect	north	Site Drainage	good	Distance to nearest water and type	stream 1 metre

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			x
Cultivation (inc. pasture)			x
Soil erosion			x
Firewood / CWD removal			x
Grazing (identify native/stock)			x
Fire damage			x
Storm damage			x
Weediness			x
Other			x

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

# Appendix D: Tests of Significance (BC Act)

As per Section 7.3 of the BC Act and Threatened Species Test of Significance Guidelines

## Scrub Turpentine

<b>Test of Significance: Scrub Turpentine</b>	
<b>(a) 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,</b>	The proposal would result in clearing of up to 0.241 hectares of Scrub Turpentine habitat (Scrub Turpentine habitat is where vegetation would be cleared/impacted within the Scrub Turpentine species polygon). However, the proposal would not result in any clearing of known Scrub Turpentine habitat (known individuals are protected within an environmental exclusion zone). The proposal may reduce the potential area that the species may reproduce. However, this habitat is already segmented due to the existing road and there is further available habitat upslope of the proposal. The proposal has been amended to avoid clearing the known Scrub Turpentines. However, as Scrub Turpentines have extensive root systems the proposal may directly impact individuals closest to the subject land. This habitat is connected to large expanses of high quality potential habitat within the RNP. The potential habitat that the proposal would impact is considered less favourable to the known Scrub Turpentine habitat that the proposal has been designed to avoid as it is directly roadside succumbing to the impacts of the edge effect. Given how small the individuals are, their root zones are limited in extent no works are permitted within 2.5 metres (at the closest point) of the Scrub Turpentines and more broadly known individuals are within a broad environmental exclusion result. As a result, negative impacts to root zones of the known Scrub Turpentines are not expected. Given construction would occur downslope of the known Scrub Turpentine habitat, there is not expected to be run off impacts associated with plant and equipment for example from potential spills. As such, the proposal is unlikely to have an adverse impact upon the lifecycle of the Scrub Turpentine.
<b>(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</b>	
<b>(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</b>	Not applicable
<b>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</b>	Not applicable
<b>€ in relation to the habitat of a threatened species or ecological community:</b>	
<b>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</b>	Targeted surveys indicated that all Scrub turpentine specimens are outside the proposal footprint and therefore there would be no clearing to known Scrub Turpentines. However, there would be clearing of 0.241 hectares of Scrub Turpentine habitat. Mitigation measures such as exclusion zones would be in place to minimise impact to the known Scrub Turpentine habitat. Construction may decrease the condition of the known Scrub turpentine habitat directly adjacent to the road. The proposal may potentially directly impact some individuals closest to the subject land by impacting their root systems.
<b>(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</b>	The potential and known Scrub Turpentine habitat is within the RNP in high condition. With exception of the existing road, the vegetation is not fragmented. There may be a minor increase in edge effect impacts due to the construction and operation footprint being slightly different to the existing road. Seed dispersal across the gap in vegetation would not be impacted by the proposal (as seeds are dispersed by birds). The proposal would not further fragment or isolate habitat.
<b>(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</b>	The proposal would not create additional fragments to the habitat and no known Scrub turpentine individuals would be directly cleared. Direct impacts to the three to six known Scrub Turpentines directly adjacent to the proposal footprint may occur due to the construction works being adjacent (although outside the exclusion zones). Up to 0.296 hectares of vegetation where the species may potentially reproduce is being removed although this habitat is less favourable than the known habitat that is being retained (due to the impacts of the edge effect being directly roadside).
<b>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</b>	The proposal is not likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).
<b>(e) 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 threatening process</b>	



Clearing of native vegetation is a listed key threatening process. The proposal would involve clearing of up to 0.296 hectares of native vegetation which incrementally reduces native vegetation cover.
<b>Conclusion</b>
The proposal would not be expected to substantially reduce the extent or connectivity of important habitat for the Scrub Turpentine within the RNP. The lifecycle of the species would not likely be adversely impacted. Potential direct impacts to the Scrub Turpentine individuals most adjacent to the subject land may be directly impacted (as construction could encroach on root zones). No Scrub Turpentines would be cleared for the proposal. Assuming mitigation measures such as exclusion zones are adhered to, there is not expected to be a significant impact on the species from the proposal.

## Owls: Powerful Owl, Australian Masked Owl and Greater Sooty Owl

Test of Significance: Powerful Owl, Australian Masked Owl, Greater Sooty Owl
<b>(a) 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,</b>
The proposal would remove up to 0.296 hectares of native vegetation. Three hollow bearing trees were identified within the study area. However, these owls use hollows with a minimum of 40cm (usually larger) diameter. None of the hollows identified in the study area would be large enough to support the listed threatened owl species. No hollows would be removed for the proposal. The study area and vegetation to be cleared would support foraging habitat, which is connected to a large expanse of alternative high quality habitat in RNP. These three owls have large home ranges, the removal of up to 0.296 hectares of native vegetation is not likely to put the population in the region at risk of extinction.
<b>(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</b>
<b>(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</b>
N/a
<b>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</b>
<b>€(c) in relation to the habitat of a threatened species or ecological community:</b>
<b>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</b>
Up to 0.296 hectares of potential foraging habitat would be removed for the proposal. Potential roosting habitat would occur in the broader assessment area in the RNP. Roosts were not identified during site investigations.
<b>(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</b>
The RNP is a densely forested area only separated by the road corridor. However, as these listed owl species are aerial, the foraging habitat is considered well connected. The proposed road largely follows the existing road corridor. The proposal is unlikely to prevent these species from utilising habitat on both sides of Garie Road.
<b>(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</b>
The proposal would remove up to 0.296 hectares of habitat which is part of the RNP with extensive potential habitat present. No evidence of the three owl species was detected. No potential breeding habitat for the species would be removed. As only a marginal amount of potential habitat is being removed, it is not likely to have a significant impact on the long-term survival of the species in the locality.
<b>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</b>
The Proposal is not likely to have an adverse effect on any declared area of outstanding biodiversity values.
<b>(e) 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 threatening process</b>
Clearing of native vegetation is a listed key threatening process. The proposal would involve clearing of up to 0.296 hectares of native vegetation which incrementally reduces native vegetation cover.
<b>Conclusion</b>
The proposal would unlikely substantially reduce the extent of habitat connectivity for the Powerful Owl, Australian Masked Owl or Greater Sooty Owl within the local area. No potential breeding habitat would be removed and a large expanse of high quality alternative habitat is present adjacent to the proposal in RNP. Specific mitigation measures are not considered necessary for these species. However, limiting the removal of vegetation as addressed in the safeguards and mitigation measures (Chapter 6) would reduce impacts to the species by maintaining potential foraging, hunting and/or roosting habitat. The lifecycle of the local populations would not likely be adversely impacted by the proposal. Therefore, the proposal is not considered to have a significant impact on these three owl species.

## Grey-headed Flying-fox

<b>Test of Significance: Grey-headed Flying-fox</b>	
<b>(a) 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,</b>	The proposal would reduce the extent of potential habitat for the Grey-headed Flying-fox. The proposal would remove up to 0.296 hectares of habitat that may be utilised and/or occupied by the species. This habitat is comprised of dense native vegetation with little invasive species. There are no camps present within the broader assessment area and the closest camp is over 14 kilometres from the proposal. Therefore, the proposal would not remove breeding habitat for the species and is unlikely to have an adverse impact upon the lifecycle of the Grey-headed flying-fox.
<b>(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</b>	
<b>(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</b>	N/a
<b>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</b>	N/a
<b>(c) in relation to the habitat of a threatened species or ecological community:</b>	
<b>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</b>	The proposal will result in a reduction of up to 0.296 hectares of potential foraging habitat. Several nectar, fruit and diet plant/tree species were identified within the study area include: <i>Eucalyptus paniculata</i> , <i>Livistona australis</i> , <i>Cissus hypoglauca</i> , <i>Angophora costata</i> , <i>Eucalyptus saligna x botryoides</i> , <i>Eucalyptus botryoides</i> , <i>Syncarpia glomulifera</i> , <i>Ficus coronata</i> (Department of Environment and Climate Change, 2008). 72 of these trees would be removed. Extensive foraging habitat including the listed diet trees are known within the broader assessment area that would not be impacted by the proposal. The proposal would not remove any known breeding habitat of the species. The impact on the extent of this species habitat is considered negligible.
<b>(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</b>	The proposal would largely follow the existing road corridor and therefore no further habitat fragmentation would occur. The RNP is a densely forested area only separated by the road corridor. The proposal is unlikely to prevent these species from utilising habitat on both sides of Garie Road.
<b>(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</b>	The species has potential to occupy habitat within the study area, although it has not been detected. Grey-headed flying-foxes are highly mobile and have large home ranges. Therefore, the removal of up to 0.296 hectares of foraging habitat would not likely impact the long-term survival of the species. No known breeding habitat would be impacted by the proposal.
<b>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</b>	The Proposal is not likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
<b>(e) 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 threatening process</b>	Clearing of native vegetation is a listed key threatening process. The proposal would involve clearing of up to 0.296 hectares of native vegetation which incrementally reduces native vegetation cover.
<b>Conclusion</b>	The proposal is unlikely to substantially reduce the extent or connectivity of habitat for the Grey-headed Flying-fox within the study area. No known breeding habitat would be removed and a large expanse of high quality alternative habitat is present adjacent to the proposal in RNP. Specific mitigation measures to this species have not been considered necessary to include. However, limiting the removal of vegetation as addressed in the safeguards and mitigation measures (Chapter 6) would reduce impacts to the species by maintaining potential foraging, hunting and/or roosting habitat. The lifecycle of the species is not likely to be adversely impacted to an extent that would threaten a viable local population of the species. Therefore, the proposal is not likely to have a significant impact on the species.

## Large-eared Pied Bat

<b>Test of Significance: Large eared Pied Bat</b>	
<b>(a) 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,</b>	



Test of Significance: Large eared Pied Bat
The study area does not contain potential roosting habitat as no caves or human made structures are present. However, there is potential foraging habitat within the study area, of which up to 0.296 hectares would be removed. Large extents of native vegetation occur within the broader assessment area and the RNP with high quality foraging habitat. Therefore, the project is unlikely to cause significant impacts upon these species due to the marginal removal of foraging habitat and no roosting habitat features within subject land or identified with the study area.
<b>(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</b>
<b>(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</b>
N/a
<b>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</b>
N/a
<b>(c) in relation to the habitat of a threatened species or ecological community:</b>
<b>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</b>
The proposal would remove up to 0.296 hectares of potential foraging habitat adjacent to the existing road corridor. No caves or human made structures likely to provide roosting habitat are within the study area.
<b>(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</b>
The removal of up to 0.296 hectares of native vegetation along parts of the linear proposal area is unlikely to significantly fragment the local extent of foraging habitat for the cave-dependent bats given the species are highly mobile and the large extent of vegetation within 5 km of the study area. Impacts will be limited to the vegetation either side of the existing road corridor, which the species is capable of traversing.
<b>(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</b>
The foraging habitat within the proposal area to be impacted is relatively small (0.296 hectares) and there is no potential important roosting habitat for the species. Therefore, it is unlikely that the proposal would significantly impact the long-term survival of the species.
<b>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</b>
The Proposal is not likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
<b>(e) 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 threatening process</b>
Clearing of native vegetation is a listed key threatening process. The proposal would involve clearing of up to 0.296 hectares of native vegetation which incrementally reduces native vegetation cover.
<b>Conclusion</b>
The proposal would not likely substantially reduce the extent nor connectivity of habitat important for the Large-eared Pied Bat within the local area, nor would it adversely affect the lifecycle of the species to an extent that would threaten a viable local population of the species. Therefore, the proposal is not likely to have a significant impact on Large-eared Pied Bat.

### Hollow dwelling bats: Eastern Coastal Free-Tailed Bat, Eastern False Pipistrelle, Southern Myotis, Greater Broad-Nosed Bat,

Test of Significance: Hollow dwelling bats: Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle, Southern Myotis, Greater Broad-nosed Bat,
<b>(a) 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,</b>
The proposal would remove up to 0.296 hectares of potential habitat for the Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle, Southern Myotis and the Greater Broad-nosed Bat. These species are either dependent on or likely roost in hollows. Three hollow bearing trees were identified during site investigations which may be used for roosting. However, none would be impacted by the proposal. Further targeted surveys and assessments would be required if impact to these trees are expected. The study area is connected to larger areas of vegetation which represent higher quality foraging and roosting habitat. Given the small-scale impacts from proposal it is unlikely that these actions will result in a significant impact on the local hollow-dependent bats.
<b>(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</b>

<b>(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</b>
N/a
<b>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</b>
N/a
<b>I in relation to the habitat of a threatened species or ecological community:</b>
<b>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</b>
About up to 0.296 hectares of exotic and native vegetation would be removed by the proposal. No hollow bearing trees would be removed. Much larger extents of native vegetation are present within the broader assessment area.
<b>(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</b>
The vegetation in the study area is well connected. The removal of up to 0.296 hectares of remnant native vegetation is unlikely to significantly fragment the local extent of habitat for the hollow-dependent bats. Impacts will be limited to the edges of remnant vegetation. The proposal follows closely to the existing road corridor, which the species is capable of traversing. Therefore, the proposal would not fragment or isolate the habitat of this species.
<b>(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</b>
The vegetation to be removed by the proposal is within a native and largely undisturbed wet sclerophyll forest. The vegetation in the study area is in high condition with up to 0.296 ha to be removed. No potential breeding habitat for the species would be removed. There are large and intact stands of native vegetation within the broader study area and the rest of the RNP. Therefore, it is unlikely that the proposal would significantly impact the long-term survival of the species.
<b>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</b>
<b>The proposal is not likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</b>
<b>(e) 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 threatening process</b>
Clearing of native vegetation is a listed key threatening process. The proposal would involve clearing of up to 0.296 hectares of native vegetation which incrementally reduces native vegetation cover.
<b>Conclusion</b>
The proposal is not likely to substantially reduce the extent nor connectivity of important habitat for the Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle, Southern Myotis and Greater Broad-nosed Bat. The proposal would not likely adversely impact on the lifecycle of the species. Therefore, the proposal is not considered likely to have a significant impact on microbats that use and are dependent on hollows.

## Nectar feeders: Little Lorikeet, Swift Parrot, Regent Honeyeater

<b>Test of Significance: Little Lorikeet, Swift Parrot, Regent Honeyeater</b>
<b>(a) 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,</b>
The proposal would remove up to 0.296 hectares of potential foraging habitat for nectar feeding species with a potential to be present such as Little Lorikeet ( <i>Glossopsitta pusilla</i> ), Swift Parrot ( <i>Lathamus discolor</i> ), and Regent Honeyeater ( <i>Anthochaera phrygia</i> ). However the proposal would not impact any key breeding areas, noting Swift Parrot breeds in Tasmania, Regent Honey-eater in Capertee Valley and Bundarra-Barraba west of the Great Dividing Range and Little Lorikeet nests in hollow trees (no hollow trees are proposed for removal). The limited extent of vegetation clearing, the sporadic nature of flowering for the species present (annually/inter-annually) and the abundance of nectar resources locally in the Royal NP, the proposal is not likely to place local population of nectar feeding birds at risk of extinction.
<b>(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</b>
<b>(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</b>
N/A
<b>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</b>
N/A
<b>(c) in relation to the habitat of a threatened species or ecological community:</b>
<b>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</b>



The proposal would remove of up to 0.296 hectares of potential foraging habitat for nectar feeding birds, directly parallel to Garie Road, within the wider uncleared landscape of the vegetated Royal NP.
<b>(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</b>
There is a presently a gap in native vegetation adjoining the study area with the existing Garie Road corridor. The proposal is not likely to significantly impact the fragmentation or isolation of habitat for nectar feeding bird species. These species are all highly mobile and capable of traversing the additional gap in habitat along the proposal site.
<b>(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</b>
The native vegetation adjoining the study area is fragmented by the Garie Road corridor with vegetation to be removed for remediation works running parallel to this existing cleared area. Several plant/tree species were identified within the study area: <i>Eucalyptus paniculata</i> , <i>Angophora costata</i> , <i>Eucalyptus saligna x botryoides</i> , <i>Eucalyptus botryoides</i> and <i>Syncarpia glomulifera</i> . a subset of the 72 trees which would be removed. Extensive nectar resources including the listed diet trees are known within the broader assessment area would not be impacted by the proposal. This removal of vegetation parallel to the road is unlikely to have a significant impact upon the long-term survival of these species, including their nectar resources.
<b>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</b>
There are AOBV within the study area.
<b>(e) 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 threatening process</b>
In relation to the threatened nectar feeding bird species, the proposal is likely to include or exacerbate the following Key Threatening Processes: <ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> <li>• Removal of dead wood and dead trees</li> </ul> The proposal would remove up to 0.296 hectares and would not contribute significantly to these threatening processes
<b>Conclusion</b>
The proposal is not expected to substantially reduce the connectivity, feeding resources or important habitat for listed nectar feeding birds, nor would it adversely affect the lifecycle of these species. Therefore, the proposal is not considered to have a likely impact on these species.

## Woodland birds: Varied sittella, Dusky Woodswallow, Scarlet Robin

<b>Test of Significance: Varied sittella, Dusky Woodswallow, Scarlet Robin</b>
<b>(a) 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,</b>
The proposal would remove of up to 0.296 hectares of potential foraging habitat for woodland birds. While woodland bird species such as Varied Sittella ( <i>Daphoenositta chrysoptera</i> ), Dusky Woodswallow ( <i>Artamus cyanopterus cyanopterus</i> ) and Scarlet Robin ( <i>Petroica boodang</i> ) have the potential to be present none of the key foraging species were identified on site and the proposal would not impact breeding or foraging opportunities for these species. The proposal is not likely to place local population of woodland birds at risk of extinction.
<b>(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</b>
<b>(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</b>
N/a
<b>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</b>
N/a
<b>I in relation to the habitat of a threatened species or ecological community:</b>
<b>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</b>
The proposal would remove of up to 0.296 hectares of potential foraging and breeding habitat for woodland birds, directly parallel to Garie Road, within the wider uncleared landscape of the vegetated Royal NP.
<b>(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</b>
The native vegetation adjoining the study area is fragmented by the Garie Road corridor with vegetation to be removed for remediation works running parallel to this existing cleared area. The proposal is not likely to have an impact on the fragmentation or isolation of habitat for woodland bird species. These species are all sufficiently mobile and capable of traversing the additional gap in habitat along the proposal site.

<b>(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</b>
The native vegetation adjoining the study area is only fragmented by the Garie Road corridor with the relatively small amount of vegetation to be removed for remediation works running parallel to this existing cleared area, within the broader landscape of the heavily vegetated RNP. The majority of the shrub, woody debris and mid and overstorey of vegetation is to be retained adjoining the project area. The removal of vegetation parallel to the road is unlikely to influence breeding or foraging opportunities for these species, or significantly modify, fragment or isolate potential habitat. Therefore, the proposal is not likely to have a significant impact upon the long-term survival of these species.
<b>(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)</b>
There is no AOBV within the study area.
<b>(e) 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 threatening process</b>
<b>In relation to the threatened woodland species, the proposal is likely to include or exacerbate the following Key Threatening Processes:</b>
<ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> <li>• Removal of dead wood and dead trees</li> </ul>
The proposal would remove up to 0.2960.296 hectares of native vegetation and will not contribute significantly to these threatening processes
<b>Conclusion</b>
The proposal is not expected to substantially reduce the connectivity or important habitat for listed Woodland Birds, nor would it adversely affect the lifecycle of these species. Therefore, the proposal is not considered to have a likely impact on these species.

## Giant burrowing frog

<b>Test of Significance: Giant burrowing frog</b>
<b>(a) 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,</b>
The proposal would remove up to 0.296 hectares of native vegetation either side of the existing road corridor. The Giant Burrowing Frog ( <i>Heleioporus australiacusis</i> ) is listed as Vulnerable under the BC and EPBC Act. The species occupies heath, woodland and open dry sclerophyll forest generally adjoining breeding habitat (soaks and pools within first or second order streams). The proposal has the potential to impact non-breeding habitat, but if potential breeding habitat is protected with standard mitigation measures designed to reduce erosion, sediment dispersal and protect water quality and stream-side habitat, the activity is not likely to place the local population at risk. The subject land is about 16 metres from South Rill at the closest point.
<b>(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</b>
<b>(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</b>
N/a
<b>(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</b>
N/a
<b>I in relation to the habitat of a threatened species or ecological community:</b>
<b>(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</b>
The proposal would remove up to 0.296 hectares of native vegetation which provides potential movement and foraging habitat and connects to potential breeding habitat (soaks and pools within first or second order streams). Potential breeding habitat would not be impacted by the proposal.
<b>(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</b>
The habitat within the broader assessment area is relatively well connected. It is separated by the existing road corridor, where the proposal would largely follow. The removal of up to 0.296 hectares of potential habitat either side of the road is unlikely to significantly impact the habitat within the proposal area. Potential breeding habitat for the species would not be impacted and it is unlikely the proposal would sever or isolate any areas of habitat.
<b>(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</b>
The proposal would remove up to 0.296 hectares of native vegetation that provides potential foraging and movement habitat for the species parallel to the existing Garie Road corridor. This vegetation generally adjoins potential breeding



habitat (soaks and pools within first or second order streams) however none will not be removed by the proposal. Standard mitigation measures during construction work and the project design including elements to reduce erosion, sediment dispersal and protect water quality and stream-side habitat, will mitigate potential impacts. The project is not likely to place the local population at risk.

**(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)**

The proposal is not likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

**(e) 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 threatening process**

In relation to this species, the proposal is likely to include or exacerbate the following Key Threatening Processes:

- Clearing of native vegetation
- Removal of dead wood and dead trees

The proposal would remove up to 0.296 hectares of native vegetation and will not contribute significantly to these threatening processes

**Conclusion**

The proposal would remove up to 0.296 hectares of native vegetation that provides potential foraging and movement habitat parallel to the existing Garie Road corridor. Potential breeding habitat (soaks and pools within first or second order streams) would not be removed by the proposal. Standard mitigation measures to reduce erosion, sediment dispersal and protect water quality and stream-side habitat, will be incorporated into the design and construction requirements. The project is not expected to significantly impact this species.

# Appendix E: Assessments of significance (EPBC Act)

*As per EPBC Act Significant Impact Guidelines 1.1*

## Critically Endangered and Endangered species

### Scrub Turpentine (CE)

***An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:***

*Lead to a long-term decrease in the size of a population*

There is expected to be a large number of distinct populations of the Scrub Turpentine. However, this number is not known (TSSC, 2020). Field investigations identified a population of Scrub Turpentines previously not known within the RNP. Sixteen individuals were identified upslope of the proposal boundary. However, no specimens were identified during targeted field surveys within the subject land. As the 16 individuals are outside and upslope of the proposal boundary, no specimens are expected to be cleared. There may be direct impacts given the proximity of the some of the individuals and their root zones to construction works and operation of a two-way road. Several individuals identified are growing in close proximity to the existing road corridor. An exclusion zone would be implemented prior to construction to protect all identified individuals. However, given how small the individuals are, their root zones are limited in extent no works are permitted within 2.5 metres (at the closest point) of the Scrub Turpentines, with all known locations within a broader environmental exclusion zone. As a result, negative impacts to root zones of the known Scrub Turpentines are not anticipated. Therefore, the proposal is not expected to lead to a long-term decrease in the size of a population.

*Reduce the area of occupancy of the species.*

The proposal would not remove any known habitat for the species. Targeted surveys were conducted and indicated that clearing would not occur within 2.5 metres of the individuals identified. Up to 0.296 hectares of native bushland adjacent to the known threatened individuals would be removed which may potentially reduce the area that the species could reproduce. Of the 0.296 hectares of native bushland to be cleared that may be cleared, 0.241 hectares is considered Scrub Turpentine habitat (ie where vegetation would be cleared/impacted within the Scrub Turpentine species polygon). The vegetation that is being cleared is in high condition. The Area of Occupancy for the Scrub Turpentine is estimated in the Conservation Advice to be 3,360 km<sup>2</sup> (TSSC, 2020). The proposal is not expected to notably reduce the area of occupancy.

*Fragment an existing population into two or more populations*

The proposal would not fragment an existing population. The proposal is entirely downslope of the population identified. The boundary of the existing population's habitat may be impacted by the proximity to the construction and operation of a road (ie the edge effect). However, the existing population was already adjacent to the existing road with an exclusion zone to be implemented prior to construction to protect the area of identified habitat. The proposal is not expected to fragment an existing population.

*Adversely affect habitat critical to the survival of a species*

No critical habitat has been declared for this species.

*Disrupt the breeding cycle of a population*

The Scrub Turpentine usually flowers from late winter to spring peaking in October (PlantNET, n.d.). Myrtle Rust is known to be a key threat. Myrtle Rust contributes to declining plant health, a loss in the number of mature plants and therefore a lack of seed-based recruitment (OEH, 2022). The individuals identified adjacent to the proposal footprint were not mature and were infected with Myrtle Rust and therefore not expected to reproduce during construction.

The proposal would clear up to 0.296 hectares of native bushland that may prevent the reproduction of new species. However, the proposal is within a well-connected area within the RNP that provides an extensive area of alternative potential habitat. The proposal is not expected to disrupt the breeding cycle given standard mitigation measures are adhered to.

*Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*



The proposal would remove up to 0.296 hectares of native bushland adjacent to the known threatened individuals. The proposal has been designed to avoid areas where the species is known with a 2.5 metre buffer minimum within a broader environmental protection exclusion zone. The construction and operation footprint would be marginally closer to the known population than the existing road is which may have indirect impacts (i.e. from the edge effect). The habitat closest to the proposal would be more susceptible to a decrease in quality via edge effects including introduction and spread of weed species. Given mitigation measures are adhered to, the quality of the habitat should not impact the Scrub Turpentine to the extent that the species would likely decline.

*Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

Myrtle Rust is a fungus that is known as a key threat to the health, livelihood and reproduction of Scrub Turpentines. All 16 Scrub turpentines identified adjacent to the proposal footprint were noted to have been infected with Myrtle Rust. Infection with the Myrtle Rust was identified prior to the commencement of construction. Translocation is not an option for the individuals identified as this would likely spread the fungus to other Scrub Turpentine populations or to other species in the family Myrtaceae which are also susceptible to the fungus.

Currently, there is not understood to be an effective or practical chemical, biological or management control to protection Scrub Turpentines from Myrtle rust (TSSC, 2020).

Given mitigation measures are adhered to it is unlikely that further invasive species would be spread to the potential habitat in the area and to the known population. As the known population of Scrub Turpentine is upslope of the project, there is less likely to be impacts from runoff during construction and operation of the proposal.

*Introduce disease that may cause the species to decline, or*

As discussed above, the Myrtle Rust is a harmful fungus already noted on the individuals near the proposal footprint. As the proposal is downslope of the identified Scrub Turpentines and providing mitigation measures are adhered to, it is unlikely that the proposal would introduce disease that may cause the species to decline.

*Interfere with the recovery of the species*

Under the EPBC Act, there is not currently a recovery plan recommended. The NSW OEH Saving Our Species strategy for the Scrub Turpentine is maintained under the BC Act. Provided that mitigation measures such as hygiene controls are in place to minimising the spread of Myrtle Rust, the proposal is not expected to interfere with the Saving Our Species Strategy or the actions identified in the Conservation Advice.

## Swift Parrot (CE)

***An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:***

*Lead to a long-term decrease in the size of a population*

Swift Parrots breed in Tasmania, therefore habitat within the study area is limited to foraging and movement. The proposal would remove up to 0.296 hectares of potential foraging habitat that is within the RNP (providing plenty (which provides a large area of adjacent optimal habitat). Given there are no recent records of the Swift Parrot within ten kilometres of the proposal and the presence of higher quality habitat within the RNP, the proposal is unlikely to lead to or influence any long-term decrease in population size.

*Reduce the area of occupancy of the species.*

The proposal would remove up to 0.296 hectares of potential foraging habitat. This potential foraging habitat is not listed as Swift Parrot habitat within mainland Australia under the National Recovery Plan (Saunders and Tzaros 2011). Given that the small area of vegetation within the study area proposed for removal is not considered to provide a significant source of winter nectar it is unlikely that the loss of habitat will have a significant impact upon the species.

*Fragment an existing population into two or more populations*

The proposal is unlikely to fragment a population as the Swift Parrot is highly mobile species and sub-optimal foraging habitat occurs within the study area. The proposal would remove up to 0.296 hectares of this habitat.

*Adversely affect habitat critical to the survival of a species*

No critical habitat has been declared for this species

*Disrupt the breeding cycle of a population*

The proposal is unlikely to disrupt the breeding of this species as the Swift Parrot is known to only breed in Tasmania.

*Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The proposal would remove up to 0.296 hectares of potential foraging habitat. However, it is not listed under the National Recovery Plan. Given this is a small area adjacent to Garie Road proposed for removal, it is unlikely that the proposal will cause a decline of the Swift Parrot.

*Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The proposal occurs adjacent to largely undisturbed native vegetation. Some Invasive species of flora are noted within the environment, however, given the species forages exclusively within the canopy it is unlikely this would impact on the Swift Parrot. Given mitigation measures are adhered to, it is unlikely that the works associated with the proposal would further result in establishment of an invasive species in the habitat of the Swift Parrot.

*Introduce disease that may cause the species to decline, or*

No, it is unlikely that the proposal would introduce a disease. Myrtle Rust is assumed to be established within the local environment.

*Interfere with the recovery of the species*

The proposal is unlikely to interfere with the recovery of the Swift Parrot given that the species breeds in Tasmania and that low numbers of the species have been recorded within 10 kilometres within recent years.

## Regent Honeyeater (CE)

***An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:***

*Lead to a long-term decrease in the size of a population*

No key breeding areas occur within the study area as this species is known in NSW to breed in only two areas west of the Great Dividing Range, and habitat present is likely to be foraging and movement only. The proposal would remove up to 0.296 hectares of potential foraging habitat of native vegetation either side of the existing road corridor. Given there were no recent records in the locality and the presence of higher quality habitat within the RNP, the proposal is unlikely to lead to a long-term decrease in population size.

*Reduce the area of occupancy of the species.*

Potential foraging habitat would be removed by up to 0.296 hectares, which comprises a small fraction of habitat within the broader assessment area. Therefore, it is unlikely that the proposal would substantially reduce the area of occupancy of the species

*Fragment an existing population into two or more populations*

No key breeding areas occur within the broader assessment area, as this species is known in NSW to breed in only two areas west of the Great Dividing Range. The proposal would see a minor reduction of potential foraging habitat for the species. Given the Regent Honeyeater is highly nomadic and the broader assessment area would likely support patches of high-quality foraging habitat, the removal of up to 0.296 hectares of vegetation for the proposal is unlikely to fragment the population into two or more.

*Adversely affect habitat critical to the survival of a species*

No critical habitat occurs within the study area.

*Disrupt the breeding cycle of a population*



The Regent Honeyeater breeds in three main areas north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region in the NSW Central Tablelands and North-west Plains. Given that the species is not known to breed east of the Great Divide, it is unlikely to disrupt the breeding cycle of the population.

*Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The proposal would remove up to 0.296 hectares of potential foraging habitat. As large areas of quality habitat occur in the locality it is unlikely that the proposal will destroy, remove, isolate or cause a decline in the species due to the small extent of vegetation clearing proposed adjacent to the existing roadway.

*Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The proposal occurs adjacent to largely undisturbed native vegetation though within an existing road corridor. Some Invasive species of flora are noted within the environment, however, given the species forages exclusively within the canopy it is unlikely this would impact on the Regent Honeyeater. Given mitigation measures are adhered to, it is unlikely that the works associated with the proposal would further result in establishment of an invasive species in the habitat of the Regent Honeyeater.

*Introduce disease that may cause the species to decline, or*

No, it is unlikely that the proposal would introduce a disease and Myrtle Rust is assumed as present.

*Interfere with the recovery of the species*

The proposal is unlikely to interfere with the recovery of the Regent Honeyeater given that no key breeding areas occur within the broader assessment area (or east of the Great Dividing Range) and the species has not been recorded in the last ten years within ten kilometres of the proposal.

## Vulnerable species

### Grey-Headed Flying-Fox (V)

***An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:***

*Lead to a long-term decrease in the size of an important population of a species*

No Grey-Headed Flying-Fox camps occur within the broader assessment area and the closest one is over 14 kilometres from the proposal. The proposal would remove up to 0.296 hectares of potential foraging habitat. It is unlikely that the removal of vegetation would lead to a long-term decrease in the size of the population.

*Reduce the area of occupancy of an important population*

The proposal would remove up to 0.296 hectares of foraging habitat. As the species is highly mobile and have large home ranges, the surrounding landscape supports plentiful potential foraging habitat. The removal of up to 0.296 hectares of habitat is not likely to have a significant impact on the area of occupancy of the species.

*Fragment an existing important population into two or more populations*

The species is highly mobile with several camps within 25 kilometres of the proposal including one Nationally Important Flying-fox camp. However, none are within 14 kilometres of the proposal. The removal of up to 0.296 hectares of foraging habitat would not fragment the population into two or more populations.

*Adversely affect habitat critical to the survival of a species*

No camps occur within the study area. The study area contains foraging habitat that is considered critical to the survival of the species. Several nectar, fruit and diet trees were identified within the study area (*Eucalyptus paniculata*, *Livistona australis*, *Cissus hypoglauca*, *Angophora costata*, *Eucalyptus saligna x botryoides*, *Eucalyptus botryoides*, *Syncarpia glomulifera* and *Ficus coronata*). Foraging habitat is considered critical to the survival of the species. However, removal of up to 0.296 hectares of foraging habitat is not considered to be an adverse effect given it is an extremely small fraction of the potential foraging habitat available in the connected RNP.

*Disrupt the breeding cycle of a population*

No Grey-Headed Flying-Fox camps occur within the broader assessment area. While the study area does contain foraging habitat, the small amount of vegetation to be removed and the large home range of the species, it is therefore unlikely to adversely disrupt the breeding success of the local populations.

*Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The proposal would remove up to 0.296 hectares of foraging habitat. However, given the species is highly mobile and there is an extensive area of foraging habitat adjacent in the RNP, it is unlikely that the proposal would result in the decline of the species.

*Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The proposal occurs within the RNP which has limited modification and disturbance compared to urban flying-fox habitats. The proposal is not expected to result in additional invasive species that are harmful to the Grey-headed flying-fox.

*Introduce disease that may cause the species to decline, or*

The proposal is unlikely to spread any disease that may cause the Grey-Headed Flying-Fox to decline.

*Interfere with the recovery of the species*

The marginal vegetation to be cleared could likely be used for foraging. The broader assessment area contains no camps and therefore it is unlikely that the proposal would interfere with the recovery of the species. Limiting the removal of vegetation as addressed in the safeguards and mitigation measures (Chapter 6) would reduce impacts to the species by maintaining potential foraging, hunting and/or roosting habitat.

## Giant Burrowing Frog (V)

***An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:***

*Lead to a long-term decrease in the size of a population*

The proposal would remove up to 0.296 hectares of native vegetation either side of the existing road corridor. The species occupies heath, woodland and open dry sclerophyll forest generally adjoining breeding habitat (soaks and pools within first or second order streams). The proposed development has the potential to impact non-breeding habitat if standard mitigation measures are not adhered to. However, given the species has not previously been identified within the study area and the implementation of mitigation measures would be applied, the proposal would not likely lead to a long-term decrease in the size of a population.

*Reduce the area of occupancy of the species.*

The proposal would remove up to 0.296 hectares of native vegetation that provides potential foraging and movement habitat and connects to potential breeding habitat (soaks and pools within first or second order streams). Potential breeding habitat would not be impacted by the proposal. This is not expected to have a substantial impact on the species' area of occupancy.

*Fragment an existing population into two or more populations*

The habitat within the broader assessment area is relatively well connected. It is separated by the existing road corridor, where the proposal would largely follow. The removal of up to 0.296 hectares of potential habitat either side of the road is unlikely to significantly impact the habitat within the proposal area. Potential breeding habitat for the species would not be impacted and it is unlikely the proposal would sever or isolate any areas of habitat.

*Adversely affect habitat critical to the survival of a species*

No critical habitat has been declared for this species.

*Disrupt the breeding cycle of a population*

The proposal would remove up to 0.296 hectares of native vegetation that provides potential foraging and movement habitat and connects to potential breeding habitat (soaks and pools within first or second order streams). The proposal has the



potential to impact non-breeding habitat, but if potential breeding habitat is protected with standard mitigation measures designed to reduce erosion, sediment dispersal and protect water quality and stream-side habitat, the activity is not likely to place the local population at risk. The subject land is about 16 metres from South Rill at the closest point. The removal of potential habitat in the context of the alternative habitat available along the creekline is not expected to disrupt the breeding cycle of a population.

*Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The proposal would remove up to 0.296 hectares of native vegetation of potential habitat parallel to the existing Garie Road corridor. This vegetation generally adjoins potential breeding habitat (soaks and pools within first or second order streams) however none will not be removed by the proposal. Standard mitigation measures during construction work and the project design including elements to reduce erosion, sediment dispersal and protect water quality and stream-side habitat, will mitigate potential impacts. The project is not likely to place the local population at risk.

*Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The proposal occurs within the RNP which has limited modification and disturbance. Provided standard mitigation measures during construction work and the project design are adhered to, the proposal is not expected to result in additional invasive species that are harmful to the Giant Burrowing Frog.

*Introduce disease that may cause the species to decline, or*

The proposal is unlikely to spread any disease that may cause the Giant burrowing frog to decline. Mitigation measures have been included to prevent the spread of diseases and pathogens (such as Chytrid fungus) that may lead to a decline in species.

*Interfere with the recovery of the species*

The proposal is unlikely to interfere with the recovery of the species provided standard mitigation measures during construction work and the project design are adhered to.



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# Appendix F - Transport for NSW Construction Noise and Vibration Estimator Tool Results







## Distanced Based Assessment (Noisiest Plant)

### Steps for Assessment:

- Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
- Select the representative noise area category. The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
- Select the noisiest plant. If not found in drop-down list, refer to 'Source List' and select a representative plant with equivalent sound power level.
- Is there line of sight to receiver? Select the appropriate scenario from the drop down list.

Identify and implement standard mitigation measures where feasible and reasonable. Include any shielding implemented as part of the standard mitigation measures by changing the selection in the 'Is there line of sight to receiver?' drop-down list. Solid barriers can be in the form of road cutting, timber lapped and capped fence, shipping container, site office, etc. Substantial solid barriers are barriers greater than 5 metres in height or multiple rows of houses or a sound barrier specifically designed to mitigate construction noise. Please note that vegetation and trees are not considered to be a form of solid barrier and any gaps would compromise the acoustic integrity of the solid barrier.

- Determine if there are any receivers (both residential and non-residential receivers) within the affected distance for each relevant time period. Consider background LA90 noise measurements to check assumption in Step #2 if:
  - there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or
  - there are a few affected receivers and the impact duration at any one receiver is more than 6 weeks.

Note that consideration need to be given to the construction staging plan when determining impact duration.

- Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver.

- Where night works are involved, identify sleep disturbance affected distance.

- Document the outcomes of these steps.

(Note that suitable noise management levels for other noise-sensitive businesses not identified in the Construction Noise Estimator should be investigated on a project-by-project basis. Please contact a Roads and Maritime noise specialist for more information)

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Note that spot check verification of noise levels and individual briefings are not required for projects with less than 3 weeks impact duration

Please pick from drop-down list in orange cells

Noise area category	R0
RBL or LA90	30
Background level (dB(A))	30
Day	30
Evening	30
Night	30
LAeq(15minute)	40
Day	40
Day (OOHW)	35
Evening	35
Night	35
Noisiest plant	Hand Power Tools (2-3 items)
Is there line of sight to receiver?	No (behind substantial solid barrier)

Residential receiver		LAeq(15minute) noise level above background (LA90)											LAeq(15minute) 75 dB(A) or greater (Highly affected)			Sleep disturbance LAmax 65 dB(A)		
		5 to 10 dB(A) Noticeable			10 to 20 dB(A) Clearly audible			20 to 30 dB(A) Moderately intrusive			> 30 dB(A) Highly intrusive						Affected distance (m)	
		Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Measures	Within distance (m)	Mitigation level (dB(A))	Affected distance (m)	
Undeveloped green fields, rural areas with isolated dwellings	Day	185																
	Day (OOHW)	270																
	Evening	270																
	Night	270																
	Highly Affected	N	270	35	N, R2, DR	185	40	N, PC, SN, R2, DR	85	50	AA, N, PC, SN, R2, DR	30	60	N, PC, RO	10	75	25	
Developed settlements (urban and suburban)	Day	220																
	Day (OOHW)	335																
	Evening	335																
	Night	335																
	Highly Affected	N	335	35	N, R2, DR	220	40	N, PC, SN, R2, DR	95	50	AA, N, PC, SN, R2, DR	35	60	N, PC, RO	10	75	30	
Propagation across a valley / over water	Day	280																
	Day (OOHW)	445																
	Evening	445																
	Night	445																
	Highly Affected	N	445	35	N, R2, DR	280	40	N, PC, SN, R2, DR	105	50	AA, N, PC, SN, R2, DR	40	60	N, PC, RO	10	75	35	

Non-residential receiver		LAeq(15minute) noise level above NML											LAeq(15minute) 75 dB(A) or greater (Highly affected)			
Undeveloped green fields, rural areas with isolated dwellings		Standard hours			<10 dB(A)			10 to 20 dB(A)			> 25 dB(A)					
		Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions		Day	55	50	N	25	65	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75
Hospital wards and operating theatres		Day	65	25	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Place of worship		Day	55	50	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Active recreation		Day	65	25	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Passive recreation		Day	60	30	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Industrial premise		Day	75	10	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Offices, retail outlets		Day	70	15	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75

Non-residential receiver		LAeq(15minute) noise level above NML											LAeq(15minute) 75 dB(A) or greater (Highly affected)			
Developed settlements (urban and suburban)		OOHW			< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
		Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres		Evening	65	25	N	25	65	N, R1, DR	15	70	N, R1, DR	6	80	N, R1, DR, PC, SN	2	90
Place of worship		Evening	55	50	N	50	55	N, R2, NR	15	70	N, PC, SN, R2, DR	6	80	AA, N, PC, SN, R2, DR	2	90
Active recreation		Evening	65	25	N	15	70	N, R1, DR	15	70	N, R1, DR	15	70	N, R1, DR, PC, SN	6	80
Passive recreation		Evening	60	30	N	15	70	N, R2, NR	30	60	N, PC, SN, R2, DR	15	70	AA, N, PC, SN, R2, DR	6	80
Industrial premise		Evening	75	10	N	10	75	N, R1, DR	15	70	N, R1, DR	6	80	N, R1, DR, PC, SN	2	90
Offices, retail outlets		Evening	70	15	N	10	75	N, R1, DR	25	65	N, R1, DR	10	75	N, R1, DR, PC, SN	3	85
		Night	75	10	N	10	75	N, R2, NR	6	80	N, PC, SN, R2, DR	2	90	AA, N, PC, SN, R2, DR	1	100
		Night	70	15	N	15	70	N, R1, DR	6	80	N, R1, DR	2	90	AA, N, PC, SN, R2, DR	1	100
		Night	70	15	N	15	70	N, R2, NR	10	75	N, PC, SN, R2, DR	3	85	N, R1, DR, PC, SN	1	95
		Night	70	15	N	15	70	N, R2, NR	10	75	N, PC, SN, R2, DR	3	85	AA, N, PC, SN, R2, DR	1	95

Non-residential receiver		LAeq(15minute) noise level above NML											LAeq(15minute) 75 dB(A) or greater (Highly affected)			
Developed settlements (urban and suburban)		Standard hours			<10 dB(A)			10 to 20 dB(A)			> 25 dB(A)					
		Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions		Day	55	55	N	25	65	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75
Hospital wards and operating theatres		Day	65	25	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Place of worship		Day	55	55	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Active recreation		Day	65	25	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Passive recreation		Day	60	35	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Industrial premise		Day	75	10	N	10	75	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Offices, retail outlets		Day	70	15	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75

Non-residential receiver		LAeq(15minute) noise level above NML											LAeq(15minute) 75 dB(A) or greater (Highly affected)			
Propagation across a valley / over water		OOHW			< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
		Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres		Evening	65	25	N	25	65	N, R1, DR	15	70	N, R1, DR	6	80	N, R1, DR, PC, SN	2	90
Place of worship		Evening	55	55	N	55	55	N, R2, NR	15	70	N, PC, SN, R2, DR	6	80	AA, N, PC, SN, R2, DR	2	90
Active recreation		Evening	65	25	N	15	70	N, R1, DR	35	60	N, R1, DR	15	70	N, R1, DR, PC, SN	6	80
Passive recreation		Evening	60	35	N	15	70	N, R2, NR	35	60	N, PC, SN, R2, DR	15	70	AA, N, PC, SN, R2, DR	6	80
Industrial premise		Evening	75	10	N	10	75	N, R1, DR	15	70	N, R1, DR	6	80	N, R1, DR, PC, SN	2	90
Offices, retail outlets		Evening	70	15	N	10	75	N, R1, DR	25	65	N, R1, DR	10	75	N, R1, DR, PC, SN	3	85
		Night	75	10	N	10	75	N, R1, DR	6	80	N, R1, DR	2	90	N, R1, DR, PC, SN	1	100
		Night	70	15	N	10	75	N, R2, NR	6	80	N, PC, SN, R2, DR	2	90	AA, N, PC, SN, R2, DR	1	100
		Night	70	15	N	15	70	N, R1, DR	10	75	N, R1, DR	3	85	N, R1, DR, PC, SN	1	95
		Night	70	15	N	15	70	N, R2, NR	10	75	N, PC, SN, R2, DR	3	85	AA, N, PC, SN, R2, DR	1	95

Non-residential receiver		LAeq(15minute) noise level above NML											LAeq(15minute) 75 dB(A) or greater (Highly affected)			
Propagation across a valley / over water		Standard hours			<10 dB(A)			10 to 20 dB(A)			> 25 dB(A)					
		Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions		Day	55	55	N	25	65	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75
Hospital wards and operating theatres		Day	65	25	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Place of worship		Day	55	55	N	25	65	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Active recreation		Day	65	25	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Passive recreation		Day	60	35	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Industrial premise		Day	75	10	N	10	75	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75
Offices, retail outlets		Day	70	15	N	15	70	N, PC, RO	10	75	N, PC, RO	10	75	N, PC, RO	10	75



	Period	NML	Affected distance (m)	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Classroom at schools and other educational institutions	Day	55	65				N	25	65	N, PC, RO	10	75
Hospital wards and operating theatres	Day	65	25				N	25	65	N, PC, RO	10	75
Place of worship	Day	55	65				N	25	65	N, PC, RO	10	75
Active recreation	Day	65	25				N	15	70	N, PC, RO	10	75
Passive recreation	Day	60	40							N, PC, RO	10	75
Industrial premise	Day	75	10							N, PC, RO	10	75
Offices, retail outlets	Day	70	15							N, PC, RO	10	75

	Period	OOHW	NML	Affected distance (m)	L <sub>req(15minute)</sub> noise level above NML											
					< 5 dB(A)			5 to 15 dB(A)			15 to 25 dB(A)			> 25 dB(A)		
					Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))	Measure	Within distance (m)	Mitigation level (dB(A))
Hospital wards and operating theatres	Evening	65	25					N, R1, DR	15	70	N, R1, DR	5	80	N, R1, DR, PC, SN	2	90
	Night	65	25	N	25	65		N, R2, NR	15	70	N, PC, SN, R2, DR	5	80	AA, N, PC, SN, R2, DR	2	90
Place of worship	Evening	55	65					N, R1, DR	40	60	N, R1, DR	15	70	N, R1, DR, PC, SN	5	80
	Night	55	65	N	65	55		N, R2, NR	40	60	N, PC, SN, R2, DR	15	70	AA, N, PC, SN, R2, DR	5	80
Active recreation	Evening	65	25					N, R1, DR	15	70	N, R1, DR	5	80	N, R1, DR, PC, SN	2	90
	Night	60	40					N, R1, DR	25	65	N, R1, DR	10	75	N, R1, DR, PC, SN	5	85
Passive recreation	Evening	60	40					N, R1, DR	5	80	N, R1, DR	2	90	N, R1, DR, PC, SN	1	100
	Night	75	10	N	10	75		N, R2, NR	5	80	N, PC, SN, R2, DR	2	90	AA, N, PC, SN, R2, DR	1	100
Industrial premise	Evening	75	10					N, R1, DR	10	75	N, R1, DR	5	85	N, R1, DR, PC, SN	1	95
	Night	70	15	N	15	70		N, R2, NR	10	75	N, PC, SN, R2, DR	5	85	AA, N, PC, SN, R2, DR	1	95
Offices, retail outlets	Evening	70	15					N, R1, DR	10	75	N, R1, DR	5	85	N, R1, DR, PC, SN	1	95
	Night	70	15	N	15	70		N, R2, NR	10	75	N, PC, SN, R2, DR	5	85	AA, N, PC, SN, R2, DR	1	95

**Distance Based Assessment Summary for Night Works**

Please add form information to this table  
Please input information into yellow cells

Distanced Base (Noisiest Plant)	
Noise area category	80
Night time RBL (dB(A))	70
Night time NBL (dB(A))	35
Propagation Type	Rural Underserved Areas
Noise plant	Hand Power Tools (2-3 items)
Is there line of sight to receiver?	No (behind substantial solid barrier)
Shortest distance to the worst affected receiver (m)	730
Least-noise noise level at the worst affected receiver (dB(A)) (stationary source)	22
Level above RBL at the worst affected receiver (stationary source)	-8
Rate of production (m/min) (moving source)	6
Least-noise noise level at the worst affected receiver (dB(A)) (moving source)	27
Level above RBL at the worst affected receiver (moving source)	-3
Have all standard mitigation measures been implemented where feasible and reasonable?	Yes

Please proceed with consideration given to the following additional mitigation measures

Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within mitigation distance (m)
5-10 dB(A) over RBL	5	100
10-20 dB(A) over RBL	N, R2, DR	195 (195)
20-30 dB(A) over RBL	N, R1, DR, R2, DR	30
>30 dB(A) over RBL	AA, N, R1, R2, DR	30

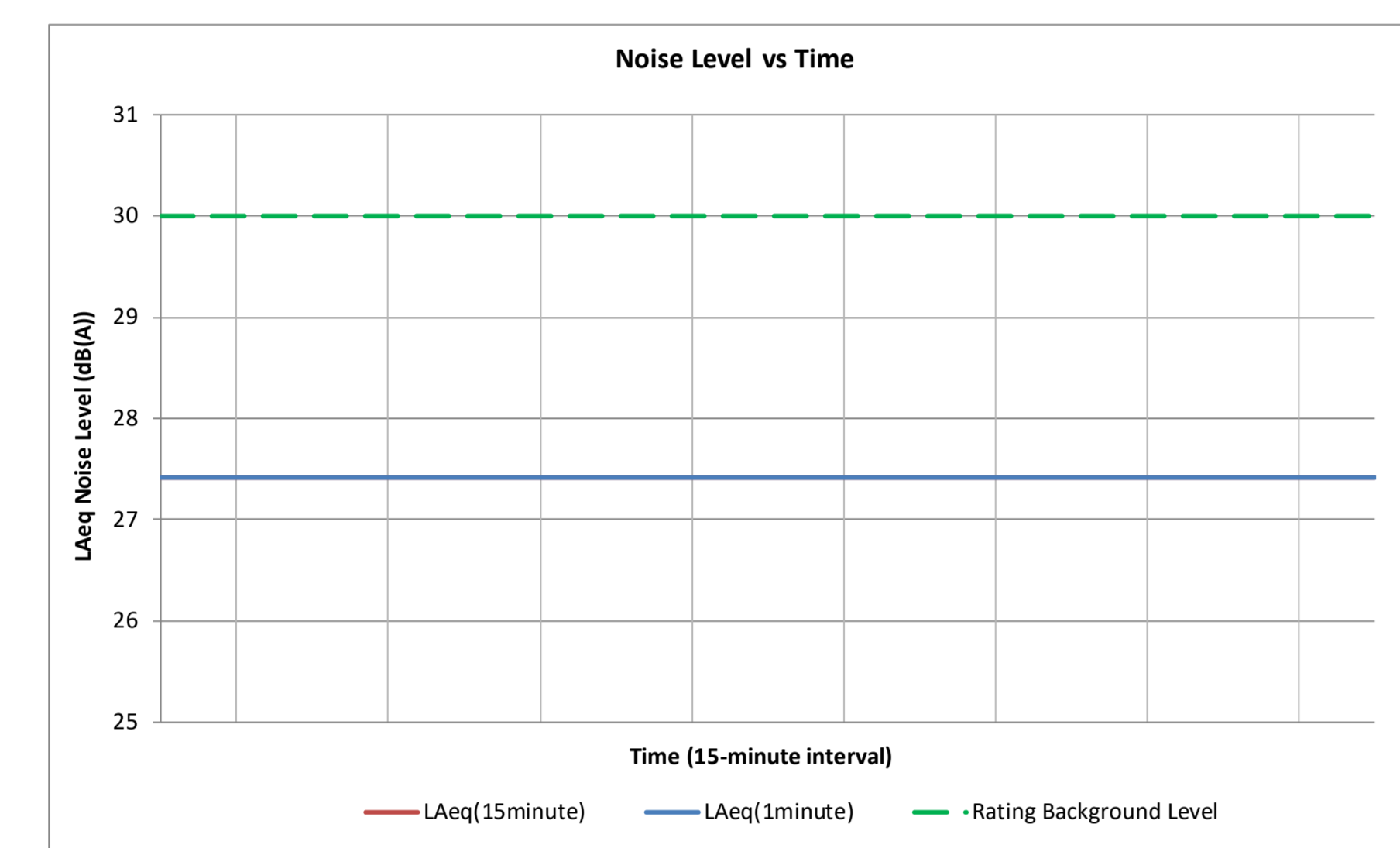
Note:  
(1) Notification (N) in the 5-10 dB(A) band is not considered reasonable if receivers are shielded by at least three rows of double storey houses or a row of multi-storey buildings or a sound barrier specifically design to mitigate construction noise  
(2) Notification (N) in the form of letterbox drop at mitigation distance where level is less than 15 dB(A) above the RBL is not considered reasonable where Respite Period 2 (RP2) is implemented. See alternate mitigation level and mitigation distance in (1) for letterbox drop.

Distanced Based (Scenario)	
Noise area category	80
Night time RBL (dB(A))	30
Night time NBL (dB(A))	35
Propagation Type	Rural Underserved Areas
Scenario	Corridor clearing
Is there line of sight to receiver?	No (behind substantial solid barrier)
Distance to the worst affected receiver (m) (greater than 5m)	500
Least-noise noise level at the worst affected receiver (dB(A))	38
Level above RBL at the worst affected receiver	8
Have all standard mitigation measures been implemented where feasible and reasonable?	Yes

Please proceed with consideration given to the following additional mitigation measures

Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within mitigation distance (m)
5-10 dB(A) over RBL	5	100
10-20 dB(A) over RBL	N, R2, DR	40 (100)
20-30 dB(A) over RBL	N, R1, DR, R2, DR	50
>30 dB(A) over RBL	AA, N, R1, R2, DR	60

Note:  
(1) Notification (N) in the 5-10 dB(A) band is not considered reasonable if receivers are shielded by at least three rows of double storey houses or a row of multi-storey buildings or a sound barrier specifically design to mitigate construction noise  
(2) Notification (N) in the form of letterbox drop at mitigation distance where level is less than 15 dB(A) above the RBL is not considered reasonable where Respite Period 2 (RP2) is implemented. See alternate mitigation level and mitigation distance in (1) for letterbox drop.



**Populate summary table**

Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within Mitigation Distance (m)	
		RP1 (100m)	This cell (behind substantial solid barrier)
5-10 dB(A) over RBL	5	40	-
10-20 dB(A) over RBL	N, R2, DR	41 (100)	200 (150)
20-30 dB(A) over RBL	N, R1, DR, R2, DR	55	35
>30 dB(A) over RBL	AA, N, R1, R2, DR	65	30





**Distance Based Assessment Summary for Night Works**

Please add form information in blue cells  
Please input information only yellow cells

Distanced Base (Noisiest Plant)	
Noise area category	50
Night time dB(A) (dB(A))	70
Night time WdL (dB(A))	35
Propagation Type	Rural Undeveloped Areas
Noisiest plant	13.57 Excavator With Hammer
In there line of sight to receiver?	No (behind substantial solid barrier)
Shortest distance to the worst affected receiver (m)	2500
Least/most noise level at the worst affected receiver (dB(A)) (stationary source)	2
Level above RBL at the worst affected receiver (stationary source)	-28
Rate of production (m/min) (moving source)	0
Least/most noise level at the worst affected receiver (dB(A)) (moving source)	26
Level above RBL at the worst affected receiver (moving source)	-4
Have all standard mitigation measures been implemented where feasible and reasonable?	Yes

Please proceed with consideration given to the following additional mitigation measures

Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within mitigation distance (m)
5-10 dB(A) over RBL	0	35
10-20 dB(A) over RBL	40 (40)	455 (455)
20-30 dB(A) over RBL	N, PC, SA, R2, DR	50
>30 dB(A) over RBL	AA, N, PC, SA, R2, DR	60

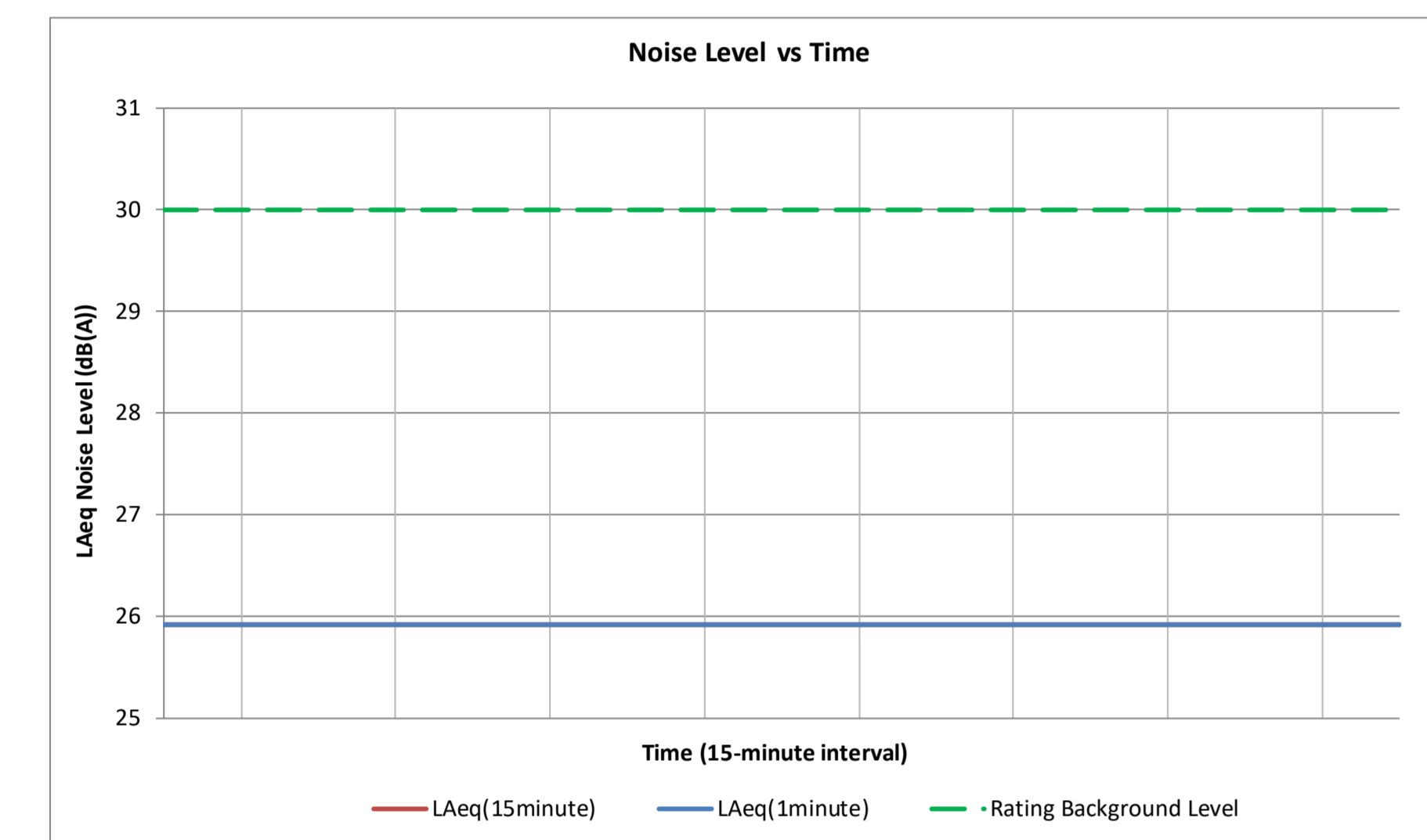
Note:  
(1) Notification (N) in the 5-10 dB(A) band is not considered reasonable if receivers are shielded by at least three rows of double storey houses or a row of multi-storey buildings or a sound barrier specifically design to mitigate construction noise  
(2) Notification (N) in the form of letterbox drop at mitigation distances where level is less than 15 dB(A) above the RBL is not considered reasonable where Regulate Period 2 (RP2) is implemented. See alternate mitigation level and mitigation distance in (1) for letterbox drop.

Distanced Based (Scenario)	
Noise area category	50
Night time dB(A) (dB(A))	30
Night time WdL (dB(A))	35
Propagation Type	Rural Undeveloped Areas
Scenario	Corridor Clearing
In there line of sight to receiver?	No (behind substantial solid barrier)
Distance to the worst affected receiver (m) (greater than 5m)	500
Least/most noise level at the worst affected receiver (dB(A))	38
Level above RBL at the worst affected receiver	8
Have all standard mitigation measures been implemented where feasible and reasonable?	Yes

Please proceed with consideration given to the following additional mitigation measures

Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within mitigation distance (m)
5-10 dB(A) over RBL	0	35
10-20 dB(A) over RBL	N, R2, DR	40 (40)
20-30 dB(A) over RBL	N, PC, SA, R2, DR	50
>30 dB(A) over RBL	AA, N, PC, SA, R2, DR	60

Note:  
(1) Notification (N) in the 5-10 dB(A) band is not considered reasonable if receivers are shielded by at least three rows of double storey houses or a row of multi-storey buildings or a sound barrier specifically design to mitigate construction noise  
(2) Notification (N) in the form of letterbox drop at mitigation distances where level is less than 15 dB(A) above the RBL is not considered reasonable where Regulate Period 2 (RP2) is implemented. See alternate mitigation level and mitigation distance in (1) for letterbox drop.



**Populate summary table**

Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within Mitigation Distance (m)		
		L5	No L5 (behind substantial barrier)	No L5 (behind substantial barrier)
5-10 dB(A) over RBL	0	40	-	-
10-20 dB(A) over RBL	N, R2, DR	41 (35)	-	200 (131)
20-30 dB(A) over RBL	N, PC, SA, R2, DR	55	-	85
>30 dB(A) over RBL	AA, N, PC, SA, R2, DR	69	-	95



# Appendix G - Non-Aboriginal heritage search results

## Search Results

6 results found.

<a href="#">Bonnie Vale Cabin Community</a> Simpson Rd	Bonnie Vale via Bundeena, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
<a href="#">Burning Palms Settlement</a> Sir Bertram Stevens Dr	Waterfall, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
<a href="#">Era Beach Settlement</a> Sir Bertram Stevens Dr	Waterfall, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
<a href="#">Little Garie Cabin Community</a> Garie Rd	Waterfall, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
<a href="#">Royal National Park (1927 boundary)</a> Farnell Av	Audley, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
<a href="#">Royal National Park and Garawarra State Conservation Area</a> Sir Bertram Stevens Dr	Audley, NSW, Australia	(Listed place) National Heritage List

Report Produced: Thu Nov 2 12:01:56 2023