Transport for NSW

McKell Avenue lane reinstatement: Review of Environmental Factors

October 2023

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Acknowledgement of Country

Transport for NSW acknowledges the Tharawal people, the traditional custodians of the land on which the project is proposed.

We pay our respects to their 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 McKell Avenue Lane 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:	11 October 2023

Document review tracking

Draft No.	Date	Comments
00	25 November 2023	Submission to TfNSW for Review
01	01 March 2023	Revision to address TfNSW comments
02	12 April 2023	Revision to address TfNSW comments
03	07 June 2023	Revision to address TfNSW comments
04	02 August 2023	Revision to address TfNSW comments
05	21 September 2023	Revision to address TfNSW comments
Final	11 October 2023	Submission to TfNSW for Final Determination

Executive summary

The proposal

The proposal has been identified as part of 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.

ConnectSydney, on behalf of Transport for NSW (Transport) proposes to reinstate about 74 metres of McKell Avenue (the proposal) which has experienced failure due to extreme weather events.

Key features of the proposal include:

- installation of a new cantilever pile retaining wall and a 74 metre traffic barrier. The retaining wall would be comprised of 41 bored reinforced concrete piles (about 750 millimetres in diameter) spaced 1.8 metres apart with a capping beam
- installation of general fill behind the piles with a concrete downturn on the slope side of the capping beam. This downturn would retain soil behind the piles
- installation of new (dynamic deflection 1.1 metres) safety barrier independent of the proposed piles in which collision loads are to be absorbed by the new barrier system
- installation of a new gutter (the gutter is proposed on top of the capping beam to minimise ingress of water into the retaining wall) which would tie into the existing stormwater system
- replacement of the existing concrete lining at the culvert outlet with 100 millimetre thick concrete
- mill and resheet of road pavement with asphalt to the depth of the existing asphalt

Construction is expected to commence in October 2023 and would take around five months to complete (March 2024).

Need for the proposal

McKell Avenue serves as the main vehicular connection between Waterfall and the wider Royal National Park. The proposal would reopen the closed lane and stabilise the slope as well as improve 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 the proposal tie into the overarching SRAPC proposed outcomes of Safety and Performance. These include:

- reopen Mckell Avenue
- stabilise existing slope hazard and reduce the risk level
- improve safety for road users
- minimise the environmental impact of the works

Options considered

Five options were identified for the proposal, including: a 'do nothing' option (Option 1); the installation of new anchored piles (Option 2); the installation of cantilevered piles (Option 3); shifting the road alignment (Option 4) and anchoring of the existing piles (Option 5). These options were investigated and assessed against the proposal objectives, which included reopening McKell Avenue, stabilising the existing slope hazard and reducing risk level, improving safety for road users, improving the existing infrastructure resilience, and minimising the environmental impact of the works.

The installation of new cantilever piles was selected as the preferred option for McKell Avenue as it included installing new cantilevered piles into the sandstone rock bed, providing the most stable, long-term solution our of all the options. Option 3 was selected as the preferred option in consultation with ConnectSydney and Transport as this option would reduce the ARL risk level to ARL 3 or greater, improve overall road safety by reinstating the closed lane and create a more resilient road i.e. 100 year design life. Construction of the new support structure would avoid the likelihood of another similar road failure event occurring due to extreme climate events.

Option 1 was not progressed as it did not meet any of the proposal objectives. Option 2 was not considered a feasible option as it would result in a longer construction timeframe i.e. the option would not result in the lane being reinstated quickly. Option 4 would require more vegetation removal than Options 2, 3 and 5 and reduced road resilience compared to Options 2 and 3. Option 5 was not progressed as it would require further investigation to determine if it is a feasible option and as such, may result in the project objectives not being able to be met or would not result in the lane being reinstated quickly.

Statutory and planning framework

The proposal is for the purpose of 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 (NSW)*. Development consent from council is not required. 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 not located on land reserved under the National Parks and Wildlife Act 1974 and would not require development consent or approval under State Environmental Planning Policy (Coastal Management) 2018, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (State Significant Precincts) 2005.

The proposal is not likely to significantly impact threatened species 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* or Biodiversity Development Assessment Report is not required.

The proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act.

A referral is not required for proposed road activities that may affect nationally listed threatened species, endangered ecological communities and migratory species as the requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted by the Australian Government in September 2015. This REF has been prepared to meet the requirements of the EPBC Act strategic assessment approval for Transport Division 5.1 road activities.

The proposal is not likely to have a significant impact on other matters of national environmental significance or the environment of Commonwealth land within the meaning of the EPBC Act. A referral to the Australian Department of Agriculture, Water and the Environment is not required.

A search of the Native Title Tribunal Native Title Vision website was undertaken, with one Native Title holders/claimants 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.

Community and stakeholder consultation

Transport has engaged with various government agencies, key stakeholders and the community regarding the proposal. Engagement activities for the proposal to date include:

- Live Traffic updates in March 2022, particularly around the changes to traffic condition after the landslip
- Social media updates in March 2022 on the Live Traffic Facebook page
- TISEPP consultation with National Parks and Wildlife Service due to the potential impacts on the Royal National Park
- Project briefings in March 2022 with the Minister's Office and the Electoral Office.

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 (refer to Chapter 5). Some of the key issues raised included:

- Access to local townships
- Condition of local roads and possibility of additional slips
- Foraging habitat of Powerful Owls
- Timing of construction / cumulative impacts of construction
- Trimming required at the Waterfall Flat picnic area and National Falls ancillary facilities
- Planting/replanting of native species adjacent to National Park Estate.

Transport will continue to seek feedback as the proposal progresses.

Environmental impacts

The main environmental impacts of the proposal are:

Biodiversity

The proposal has been designed to follow the existing road alignment to minimise the removal of any additional vegetation. The proposal would involve the removal of up to 71 (70 native) trees greater than five centimetres at diameter at breast height (dbh) (including up to 29 trees more than 20 centimetres dbh), two tree stumps, general vegetation including sapling and juvenile trees less than five centimetres diameter at breast height, as well as minor trimming (i.e.. less than 10 per cent of the canopy) of vegetation on the downslope batter to facilitate required construction works within work-zones including larger plant and equipment and their movement and minor trimming at both ancillary facilities. Trimming of trees at the National Falls and Waterfall Flats ancillary facility would require approval from National Parks and Wildlife Services (NPWS) prior to tree trimming works. Of the trees being removed, two trees have been identified as Hollow Bearing Trees (HBTs).

The trimming of vegetation may constitute potential opportunistic foraging habitat for the Powerful Owl. In addition, the trimming may result in potential dust, erosion and sedimentation impacts upslope of Waterfall Creek (identified as biodiverse riparian land under the NSW Biodiversity Values Map threshold).

The Biodiversity Memorandum (2023) (Appendix E) prepared for the proposal concluded that the proposal would not involve the removal of potential general habitat or winter foraging habitat of threatened flora/fauna species,

or potential direct mortality to unrecorded populations of threatened flora/fauna species. Field assessment identified that were no potential Powerful Owl nesting habitat and foraging habitat to be removed.

The proposal is not anticipated to have any ongoing impacts in relation to biodiversity. The proposal would have long-term positive benefits to the environment from the improved stability of the slope. The impacts of the proposal were regarded as negligible with the exception of impacts to threatened fauna species (Powerful Owl) which is considered low.

The proposal is not likely to significantly impact threatened species 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* or Biodiversity Development Assessment Report is not required. The outcomes of the Five Part Test of Significance concluded that the proposal would directly impact about 0.0128 hectares of the TEC Southern Sydney sheltered forest on transitional sandstone soils. The extent of the community within the Royal National Park is unknown, however there is a continuous patch of vegetation of the associated PCT to this TEC (PCT 3591) comprising around 11 hectares. Removal of the vegetation for the proposal would constitute about 0.116 per cent of this vegetation patch.

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.

Vegetation removal would not modify the composition of the community, as vegetation removal would not target one species or a group of species within the community. Vegetation removal is proposed at the understory, midstory, and canopy level.

Traffic and transport

During construction, full road closure of McKell Avenue would occur during the week 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. The road would also be opened during public holidays. The full road closure of McKell Avenue is required due to the size of machinery which would take up two lanes to operate. The road closure would restrict access to the Royal National Park from Waterfall during the weekdays.

Road closures would impact the Park Connection bus as well as the general public. In consultation with the bus operator either a detour route would be established (i.e. via Lady Wakehurst Drive in Lilyvale and Otford, as well as Lawrence Hargrave Drive, in Stanwell Tops and Helensburgh, then onto the Princes Motorway) or a truncated service would be provided to the public. This may impact travel times of road users wanting to access the Royal National Park using McKell Avenue.

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.

The proposal would restrict pedestrian access to the Waterfall Flat picnic area and National Falls lookout for visitors of the Royal National Park due to the road closures and set up of ancillary facilities. Access to some hiking trails would also be restricted during the construction period.

During operation, the proposal would stabilise the existing slope hazards and reduce the risk level to a minimum of ARL3. The proposal would improve safety for all road users. There would be no other operational impacts to traffic and transport as a result of the proposal.

Soils and contamination

The proposal has the potential for soil impacts during construction related to excavation activities within the proposal area. Work activities related to the proposal that pose a risk of soil erosion and could impact surface water quality include:

- Removal of trees and vegetation on the downslope batter
- Topsoil stripping
- Piling activities including establishing a level pad around each pile
- Concrete works including the pouring of the new gutter on top of the piling cap as well as replacing the existing concrete slab at the culvert outlet
- Excavation of the landslip material
- Temporary soil stockpiling at the worksite and associated transportation of spoil
- Mud tracking of exposed/dirt covered work areas
- Accidental spills or leaks from vehicles, plant and machinery used, stored or re-fuelled on site.

If construction activities are not managed correctly, this may increase the risk of erosion and sedimentation as well as the mobilisation of sediment/concrete to nearby waterways. This could potentially lead to increased turbidity and other water quality impacts in Waterfall Creek (classed as high biodiversity value and sensitive to impacts from development and clearing). There may also be the potential for harmful substances to be released into the surface water environment as well as contamination of soils as a results of concrete activities, refuelling and inappropriate handling of plant/machinery.

The establishment of the National Falls ancillary facility would require the installation of a temporary site shed placed on a densely graded base hardstand. The densely graded hardstand would be removed upon completion, and as such, geofabrics would be used to minimise disturbance to the ground level and to make sure all material is removed from site. It is proposed to temporarily stockpile excavated spoil at the Waterfall flat picnic area ancillary facility and the National Falls ancillary facility. If stockpiles are not managed correctly, this may increase the risk of erosion and sedimentation as well as the mobilisation of sediment/concrete to nearby waterways and nearby vegetated areas.

The storage of plant and equipment within the ancillary facilities also poses a potential impact to soil, through the risk of accidental spills and leaks. All ancillary facilities would be appropriately bunded to avoid any spills leaving the site. Concrete washout areas would also be required and established at the Waterfall flat picnic area ancillary facility. Concrete wash water is alkaline (pH of around 12) and contains high levels of chromium, with the potential to pollute surrounding land within the ancillary facility. Concrete washout material can also increase the pH of surrounding waters and has the potential to harm aquatic life and cause pollution of waters. Spill kits at each of the sites, as well as detailed emergency spill management measures specific to each site would be implemented in the case of accidental spill and leakages. Proper storage of procedures of equipment and fuels, oils and chemicals would also be implemented to minimise the risk of soil contamination. Concrete washout locations would be located away from sensitive environments i.e. surrounding vegetation and Waterfall Creek, and adequately controlled with all wash downs contained within designated impervious bunding.

Mitigation measures would be implemented to reduce the impact of soil erosion and sedimentation within the work site and ancillary facilities and well as reduce the potential risk of soil entering the nearby waterway.

The proposal is not anticipated to have any ongoing impacts in relation to soils, surface water and groundwater during operation. 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 due to the reduction in likelihood for a similar slope failure event.

Noise and vibration

The assessment of construction noise impacts using the Transport for NSW Construction Noise 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 will decrease.

During construction, noise calculation results indicate that impact to the nearest sensitive receiver during out-of-hours is inaudible i.e. less than 1 dBA and cannot be heard by any sensitive receivers across all locations.

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

Justification and conclusion

The proposal is required to reinstate the closed lane along McKell Avenue. By undertaking the proposal it would meet the proposal objectives of reopening Mckell Avenue, stabilise existing slope hazard, reduce the risk level, improve safety for road users and minimise the environmental impact of the works.

Table of contents

Tables

Figures

1. Introduction

This section introduces the proposal and provides context for 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

ConnectSydney, on behalf of Transport for NSW (Transport) proposes to reinstate about 74 metres of McKell Avenue (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 in which a portion of the road pavement failed. Typically, McKell Avenue is a two lane road with one lane in each direction providing passage through the Royal National Park. The proposal is required to reopen the lane that is currently closed to traffic which would improve road safety and movement along the corridor.

Part of the proposal involves the stabilisation of the slope adjacent to the road by installing a 74 metre long concrete pile wall to facilitate the road reinstatement over the landslide headscarp. The piled wall would be installed about 1.5 metres away from the original road edge/piles.

The proposal has been identified as part of flood recovery which forms part 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:

- installation of a new cantilever pile retaining wall and a 74 metre traffic barrier. The retaining wall would be comprised of 41 bored reinforced concrete piles (about 750 millimetres in diameter) spaced 1.8 metres apart with a capping beam
- installation of general fill behind the piles with a concrete downturn on the slope side of the capping beam. This downturn would retain soil behind the piles
- installation of new (dynamic deflection 1.1 metres) safety barrier independent of the proposed piles in which collision loads are to be absorbed by the new barrier system
- installation of a new gutter (the gutter is proposed on top of the capping beam to minimise ingress of water into the retaining wall) which would tie into the existing stormwater system
- replacement of the existing concrete lining at the culvert outlet with 100 millimetre thick concrete
- mill and resheet of road pavement with asphalt to the depth of the existing asphalt

The location of the proposal is shown in Figure 1-1. Section 3 and Appendix C describes the proposal in more detail.

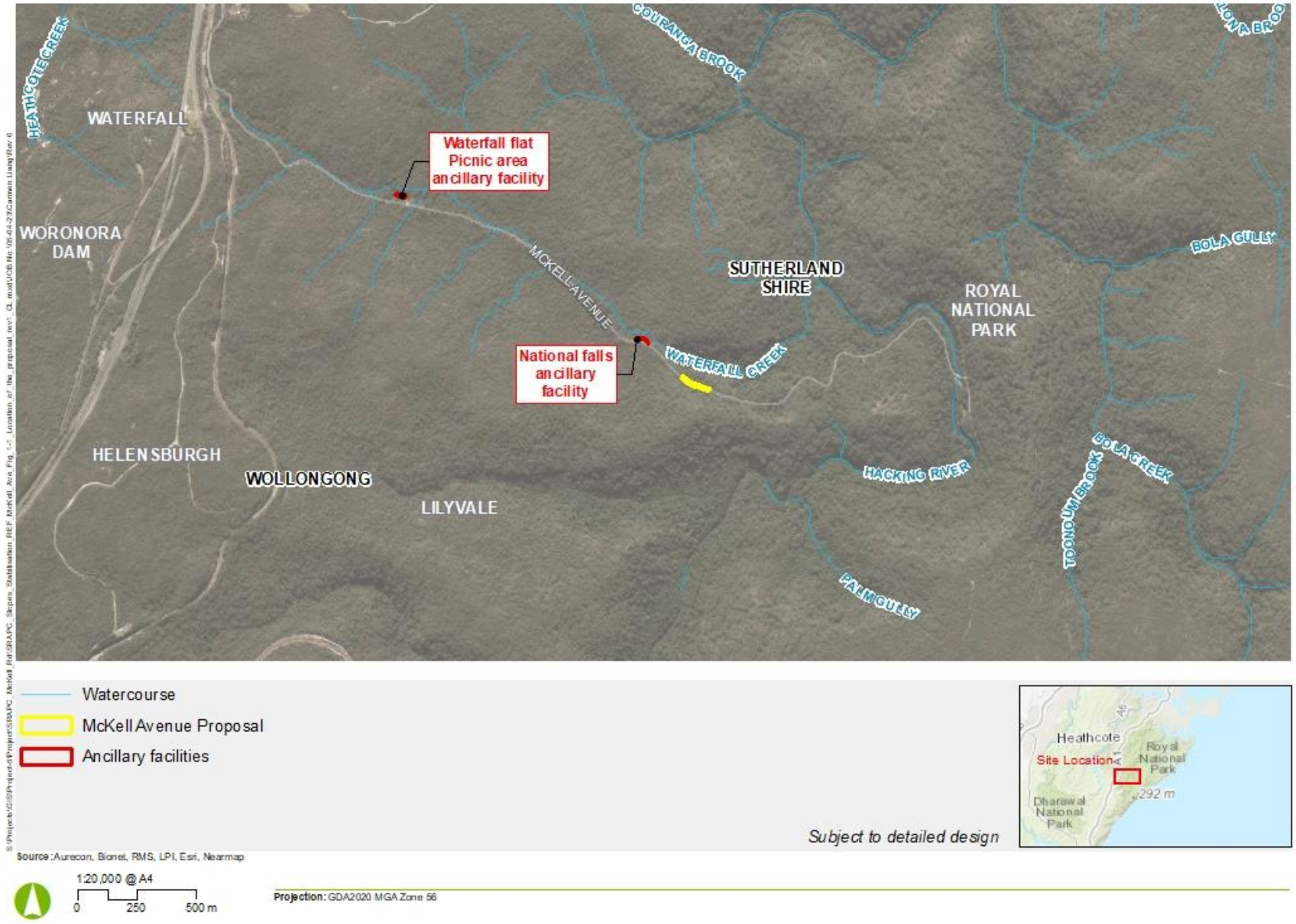


Figure 1-1: Location of the proposal

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by ConnectSydney on behalf of Transport Infrastructure and Place. For the purposes of these works, Transport is the proponent and determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979 (NSW)* (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 undertaken in the context of Section 171 of the Environmental Planning and Assessment Regulation 2021, the factors in *Guidelines for Division 5.1 assessments, DPE 2022), Roads and Related Facilities EIS Guideline* (DUAP 1996),, 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 (Commonwealth)* (EPBC Act).

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

- Section 5.5 of the EP&A Act including that Transport 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 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 https://www.awe.gov.au/environment/epbc EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and if 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 Agriculture, Water and the Environment 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 section 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

McKell Avenue serves as the main vehicular connection between the suburb of Waterfall and the Royal National Park. Due to extreme weather events, part of the road has failed leading to the temporary closure of one lane of traffic.

The proposal would stabilise the existing slope failure, reinstate the use of the closed lane and reduce the safety risk to road patrons. In addition, the proposal would improve the resilience of existing road infrastructure by reducing the potential for future road failures from similar climatic events.

These works form part of the SRAPC Maintenance Programme. The Transport outcomes for the programme are:

- 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 2056 Strategy* and the *State Infrastructure Strategy 2018-2038*, to align land use, transport and infrastructure outcomes for 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 works proposed are the outcomes of the continual maintenance and management of roads as part of SRAPC, including emergency and flood recovery works.

Future Transport Strategy 2056

The *NSW Government's Future Transport Strategy 2056* (2018) promotes the government's plans to manage rapid technological changes throughout the transport industry. In particular, it forms an overarching strategy for the Greater Sydney Services and Infrastructure Plan and the Regional NSW Services and Infrastructure Plan. These plans shift the focus away from individual functioning modes of transport to more customer-focused solutions and an integrated transport network.

The Future Transport Strategy 2056 recognises the importance of transport and the role it plays in a social and economic context. From this, the vision for the Future Transport Strategy 2056 is developed on six outcomes:

- customer focused
- successful places
- a strong economy
- safety and performance
- accessible services
- sustainability.

The strategy promotes the need to optimise and grow networks as well as increase the use of existing infrastructure and transport services. The proposal would reopen the closed lane of McKell Avenue, primarily addressing the safety and performance outcome. Improved resilience of roads against extreme weather events would also address the performance aspect of the strategy as the road would less likely need partial or full closures and potentially minimise the need of regular maintenance after these occurrences.

State Infrastructure Strategy 2018-2038

The *State Infrastructure Strategy 2018 – 2038 – Building Momentum (2018) (SIS)* is a 20-year strategy that makes recommendations on policies and projects for NSW's key infrastructure sectors to provide a positive impact on the future of the State. It recognises the importance of careful management of State-owned existing assets and ensuring appropriate maintenance, repurposing and upgrading.

The proposal closely aligns with this Strategy as it aims to optimise the management, performance and use of already existing assets via addressing safety risks, as well as aiming to improve the resilience of existing road infrastructure through design. By increasing the resilience of existing road infrastructure, this would aid in reducing regular maintenance or repair activities.

NSW 2021: A plan to make NSW number one

The *NSW Government's NSW 2021: A plan to make NSW number one* (NSW Department of Premier and Cabinet 2011) sets goals and identifies actions in five key areas:

- rebuild the economy
- return quality services
- renovate infrastructure
- strengthen our local environment and communities
- restore accountability to the government.

The plan aims to deliver strategic infrastructure projects and better coordinate different transport modes to provide clean, reliable, safe, efficient and integrated transport services.

Goal 10: Improve Road Safety aims to improve road safety by identifying and upgrading black spots, promoting safety features in cars, enforcing speed limits and road rules as well as encouraging road users to drive responsibly. One key action as part of this Strategy is carrying out road development, upgrading, maintenance and safety works.

An objective of this proposal is to improve road safety for road users by addressing identified risks i.e. reopening the closed lane and stabilising the adjacent slope, as well as improving the resilience of existing road infrastructure through design.

Road Safety Plan 2021 – Towards Zero

The *Road Safety Plan 2021 – Towards Zero* (2017) is a supporting plan of the Future Transport Strategy 2056. The Plan sets out a framework with six priority targets to achieve the NSW Government's State Priority Targets: to reduce fatalities by 30 percent by 2021 and to achieve zero harm by 2056.

The six priority areas are:

- saving lives on country roads
- liveable and safe urban communities
- using the roads safely
- building a safer community culture
- new and proven vehicle technology
- building a safe future.

The Plan has identified the need to encourage safe use of NSW roads. Road safety is one of the priority areas that the proposal would address as it would reopen the closed lane and stabilise the adjacent slope, therefore addressing existing risks on McKell Avenue.

2.1.2 Local policy context

Our Shire Towards 2032

The *Our Shire Towards 2032* (Sutherland Shire Council, 2022) is a community strategic plan that outlines the vison 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 i.e. through reinstating the closed lane, as well as preserving the life of the existing infrastructure. These objectives align with the outcomes of the community strategic plan by promoting safe, accessible and healthy spaces to improve the resilience of the community.

Sutherland Shire Local Strategic Planning Statement 2020

The Sutherland Shire Local Strategic Planning Statement (Sutherland Shire Council 2020) provides 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 and mitigation to reduce risk to life and property, as well as investing in existing infrastructure to support existing tourism spots. The proposal would reopen the closed lane of McKell Avenue and stabilise the adjacent slope to provide safe and continued access to the Royal National Park.

Sutherland Shire Environment and Sustainability Strategy 2012

The Sutherland Shire Environment and Sustainability Strategy (Sutherland Shire Council, 2012) documents the councils 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 strategy- look after our people, the council prioritises an annual road safety action plan. Road safety through the reinstatement of a lane of McKell Avenue and the stabilisation of adjacent slope, would be addressed through the works.

Safer Communities Strategy 2022-2032

The Safer Communities Strategy 2022-2032 (Sutherland Shire Council, 2022) 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 Sutherland Shire LGA. 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 in this strategy. The proposal would address road safety as well as existing road infrastructure resilience and improving safety for present and future road users within the Royal National Park.

2.2 Limitations of existing infrastructure

As part of the SRAPC, flood recovery has been implemented to identify and action risks as a result of extreme weather events.

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 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

McKell Avenue has been given a high-risk classification of ARL1 due to the collapse of part of the road pavement leading to the temporary closure of one lane of McKell Avenue. The ARL1 rating means that the road does not meet current safety standards i.e., the Roads and Maritime Guide to Slope Risk Analysis (Roads and Maritime 2014). The aim of the proposal is to undertake work to minimise the risk from ARL1 classification to a ARL3, 4 or 5 classification and reopen the closed lane to traffic as well as stabilise the adjacent slope.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

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

- reopen the closed lane of Mckell Avenue
- stabilise existing slope hazard and reduce the risk level
- improve safety for road users
- minimise the environmental impact of the works.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

The options considered for the proposal 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 options assessment considered the following five options (these are also displayed in Figure 2-1):

- *Option 1:* Do nothing (monitor only). This would involve monitoring the slope hazard and the degradation of the slope. No remedial works would occur as part of this option however one lane would remain closed to traffic.
- *Option 2*: Install new anchored piles. This would involve installing new reinforced concrete piles downslope of the existing piles up to eight metres in length. The piles would be anchored in the sandstone bedrock (with supporting rock nails angled at 45 degrees) and capped with a barrier installed to the pile caps. The gap between the existing and new piles would be filled and compacted with the road milled and asphalted. The cleared slip area would be landscaped.
- *Option 3*: Install new cantilevered piles. This would involve installing new reinforced concrete piles downslope of the existing piles up to 10 metres in length. The piles would be capped with a barrier installed to the pile caps. The gap between the existing and new piles would be filled and compacted with the road milled and asphalted. The cleared slip area would be landscaped.
- *Option 4*: Shift road alignment. This would involve cutting into the upslope side of the road and installing rock bolts and shotcrete with strip drains and reinforced mesh to shift the road alignment away from the downslope. A barrier would also be installed on the downslope side of the road. The cleared slip area would be landscaped.
- *Option 5*: Anchor existing piles. This would involve capping the existing piles as well as installing a barrier to the pile caps. The cleared slip area would be landscaped.

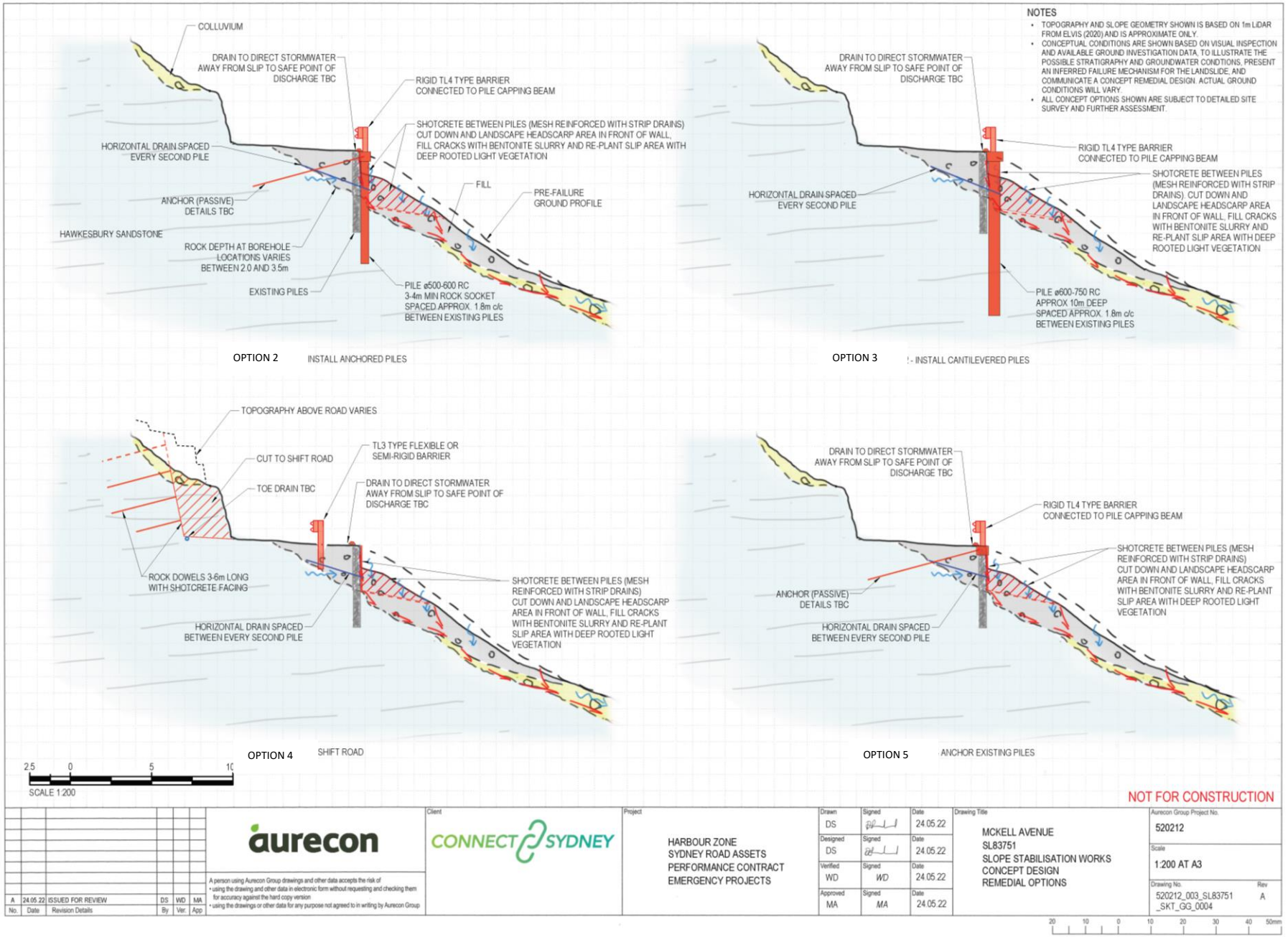


Figure 2-1 Cross section of identified option

2.4.3 Analysis of options

Table 2-2 presents a qualitative analysis of the options considered for the reinstatement of McKell Avenue and the adjacent stabilisation of the failed slope against the proposal objectives.

Table 2-2: Analysis of options

Objective	Option 1- Do nothing (observe only)	Option 2- Install new anchored piles	Option 3- Install new cantilevered piles	Option 4- Shift road alignment	Option 5- Anchor existing piles
Reopen the closed lane of McKell Avenue	• The partial road failure would remain as is and the lane would not reopen.	• The adjacent slope would be stabilised and the lane would reopen.	• The adjacent slope would be stabilised and the lane would reopen.	• The adjacent slope would be stabilised and the lane would reopen.	• The adjacent slope would be stabilised and the lane would reopen.
Stabilise existing slope hazard and reduce the risk level	• No slope stabilisation works are proposed and the risk level would remain as is	• Slope stabilisation works are proposed that would improve the ARL risk level to a minimum of ARL3 or better	• Slope stabilisation works are proposed that would improve the ARL risk level to a minimum of ARL3 or better	• Slope stabilisation works are proposed that would improve the ARL risk level to a minimum of ARL3 or better	• Slope stabilisation works are proposed that would improve the ARL risk level to a minimum of ARL3 or better
Improve safety for road users	• Traffic and safety would not improve for road users • One lane would not be open and usable	• Road safety hazards would be reduced due to pro-active remediation measures, slope stabilisation, landscaping, installation of new anchored piles, protection barriers, drains and bund • Proposal would take about six months to reopen the road lane for improved safety.	• Safety would improve as the ARL would improve • Identified safety hazards to road users would be reduced as a result of pro-active remediation measures, slope stabilisation, landscaping, installation of new cantilevered piles, protection barriers, drains and bund • Proposal would take about five months to reopen the road lane for improved safety.	• Safety would improve as the ARL would improve • Upslope hazards such as soil instability and rockfall may be exposed and require additional remediation. Identified safety hazards would not be able to be addressed as efficiently as Option 2 or Option 3 • Proposal would take about five months to reopen the road lane for improved safety.	• Road width may not be sufficient to re-instate the lane therefore safety and traffic would not improve i.e. traffic having to maintain a contraflow arrangement using one lane • Proposal would take about three months to reopen the road lane for improved safety.
Minimise environmental impact of the works.	• No environmental impact	• Vegetation removal required. This would be greater than Option 3 and 5, but less than Option 4 • Around 40m^3 of spoil would be produced	• Vegetation removal required. This would be greater than Option 5, less than Option 2 and 4. • About 100m^3 of spoil would be produced	• Vegetation removal required. This would be greater than Option 2 and Option 3 • Greater than 100m^3 of waste or spoil would be produced	• Some vegetation removal required. This would be less than Options 2, 3 and 4 as works would require anchoring the existing piles

2.5 Preferred option

Option 3- install new cantilever piles was selected as the preferred option for McKell Avenue as it included installing new cantilevered piles into the sandstone rock bed, providing the most stable, long-term solution out of all of the options. Option 3 was selected as the preferred option in consultation with ConnectSydney and Transport as this option would reduce the ARL risk level to ARL 3 or greater, improve overall road safety by reinstating the closed lane and create a more resilient road i.e. 100 year design life. Construction of the new support structure would avoid the likelihood of another similar road failure event occurring due to extreme climate events.

Option 1 was not progressed as it did not meet any of the proposal objectives. Option 2 was not considered a feasible option as it would result in a longer construction timeframe i.e. the option would not result in the lane being reinstated quickly. Option 4 would require more vegetation removal than Options 2, 3 and 5 and reduced road resilience compared to Options 2 and 3. Option 5 was not progressed as it would require further investigation to determine if it is a feasible option and as such, may result in the project objectives not being able to be met or would not result in the lane being reinstated quickly.

2.6 Design refinements

The outcomes of the constructability workshop (held on the 23rd January 2023) prompted several design refinements. These design refinements and the reason behind the refinement are summarised in Table 2-3.

Table 2-3 Design refinements

Refinement	Reason
Proposed cantilever pile alignment shifted from 2.5 metres to 1.5 metres from existing piled wall	The proposed cantilever pile alignment would now be located closer to the existing piled wall. This design refinement is driven by the narrow road corridor limiting the size of piling rig as well as providing a safer option in terms of piling rig stability i.e. if the piling rig is closer to the existing piled wall, then it is less likely for the piling rig to tip over.
Refinement of backfilling material between the proposed piles and the existing piles	The proposed design refinement changed the material for backfilling between the proposed piled wall and the existing piled wall from a foam concrete to general fill. This change has identified that adequate soil retention can still be achieved by installing general fill in association with a concrete downturn on the slope side of the capping beam.
Refinement of stormwater system upgrades	Site investigations identified that the existing stormwater system already contained a sandstone headwall, concrete lining at the outlet and adequate rip rap protection, therefore this scope has been removed as part of the proposal. The stormwater system scope has been refined to include the installation of a new gutter (the gutter is proposed on top of the capping beam to minimise ingress of water into the retaining wall). This would tie into the existing stormwater system. It is also proposed to replace the concrete lining.
Installation of a new fall protection barrier removed from scope	The proposed fall protection barrier has been removed from the scope as it was determined as not being required. A fall protection fence is typically required to create a safe environment for maintenance workers through the area on the upslope side and to protect them from falling over the piled wall. However, as maintenance workers would undertake works from the road pavement, this protective fence would no longer be required.

3. Description of the proposal

This section 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

ConnectSydney, on behalf of Transport for NSW (Transport) proposes to reinstate about 74 metres of McKell Avenue (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 in which a portion of the road pavement has failed. Typically, McKell Avenue is a two lane road with one lane in each direction providing passage through the Royal National Park. The proposal is required to reopen the lane that is currently closed to traffic and would improve road safety and movement along the corridor.

Part of the proposal involves the stabilisation of the slope adjacent to the road by installing a 74 metre long concrete pile wall to facilitate the road reinstatement over the landslide headscarp. The piled wall would be installed about 1.5 metres away from the original road edge/piles.

Key features of the proposal would include:

- installation of a new cantilever pile retaining wall separate from the 74 metre traffic barrier comprised of 41 bored reinforced concrete piles (about 750 millimetres in diameter) spaced 1.8 metres apart with a capping beam
- installation of general fill behind the piles with a concrete downturn on the slope side of the capping beam. This downturn would retain soil behind the piles
- installation of new (dynamic deflection 1.1 metre) safety barrier independent of the proposed piles in which collision loads are to be absorbed by the new barrier system
- installation of a new gutter (the gutter is proposed in top of the capping beam to minimise ingress of water into the retaining wall) which would tie into the existing stormwater system
- replacement of the existing concrete lining at the culvert outlet with 100 millimetre thick concrete
- mill and resheet of road pavement with asphalt to the depth of the existing asphalt

Construction is expected to commence in October and occur over five months (completed by March 2024).

The proposal area / construction footprint is shown in Figure 3-1 **Error! Reference source not found.**and Figure 3-2 and the design drawings are provided in Appendix C. Proposal footprint has been established earlier in the design as the maximum extent of works for drainage works. Tree and vegetation clearing and trimming would be limited to only what has been identified for removal in this REF.

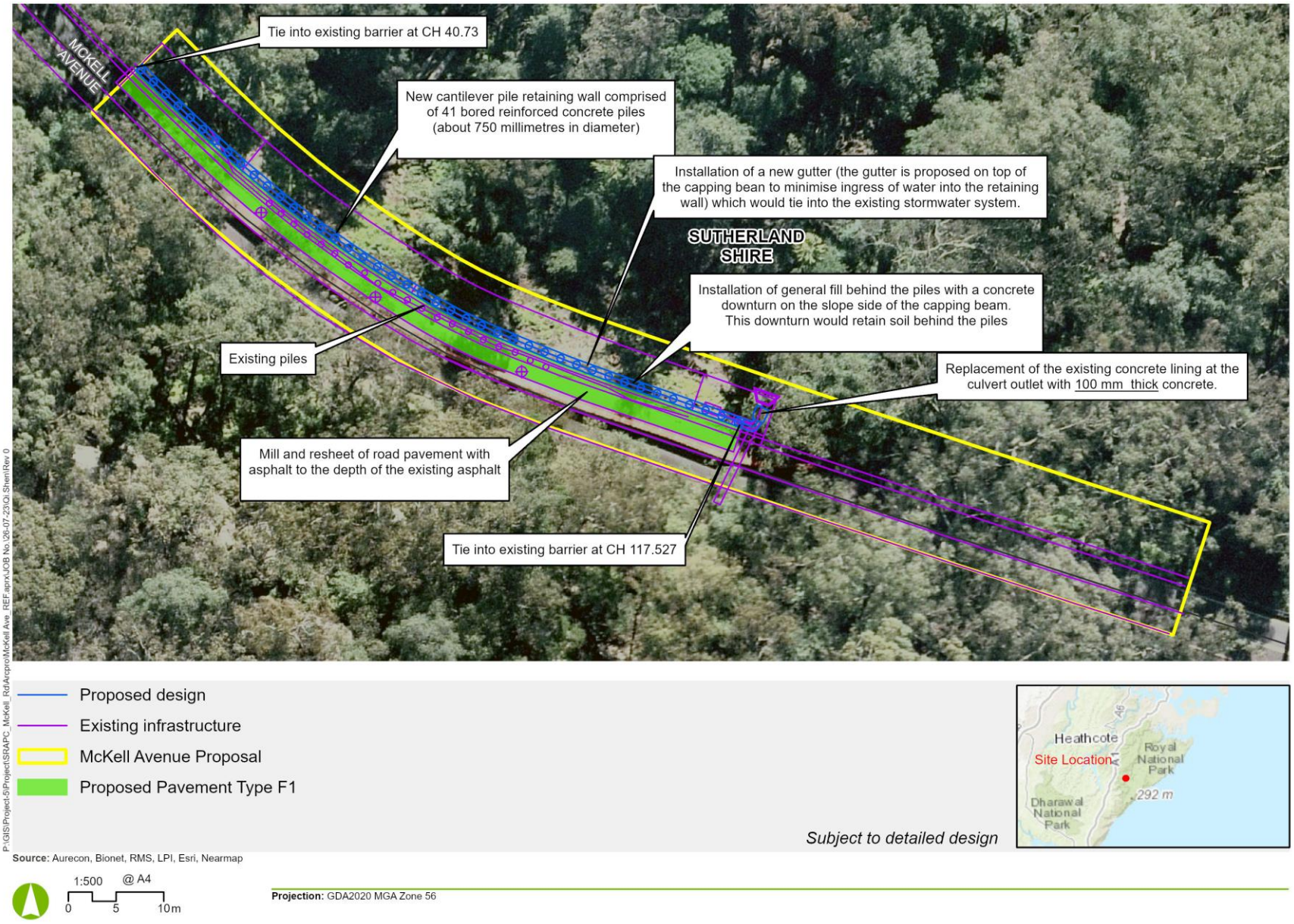


Figure 3-1: Key features of the proposal (aerial)

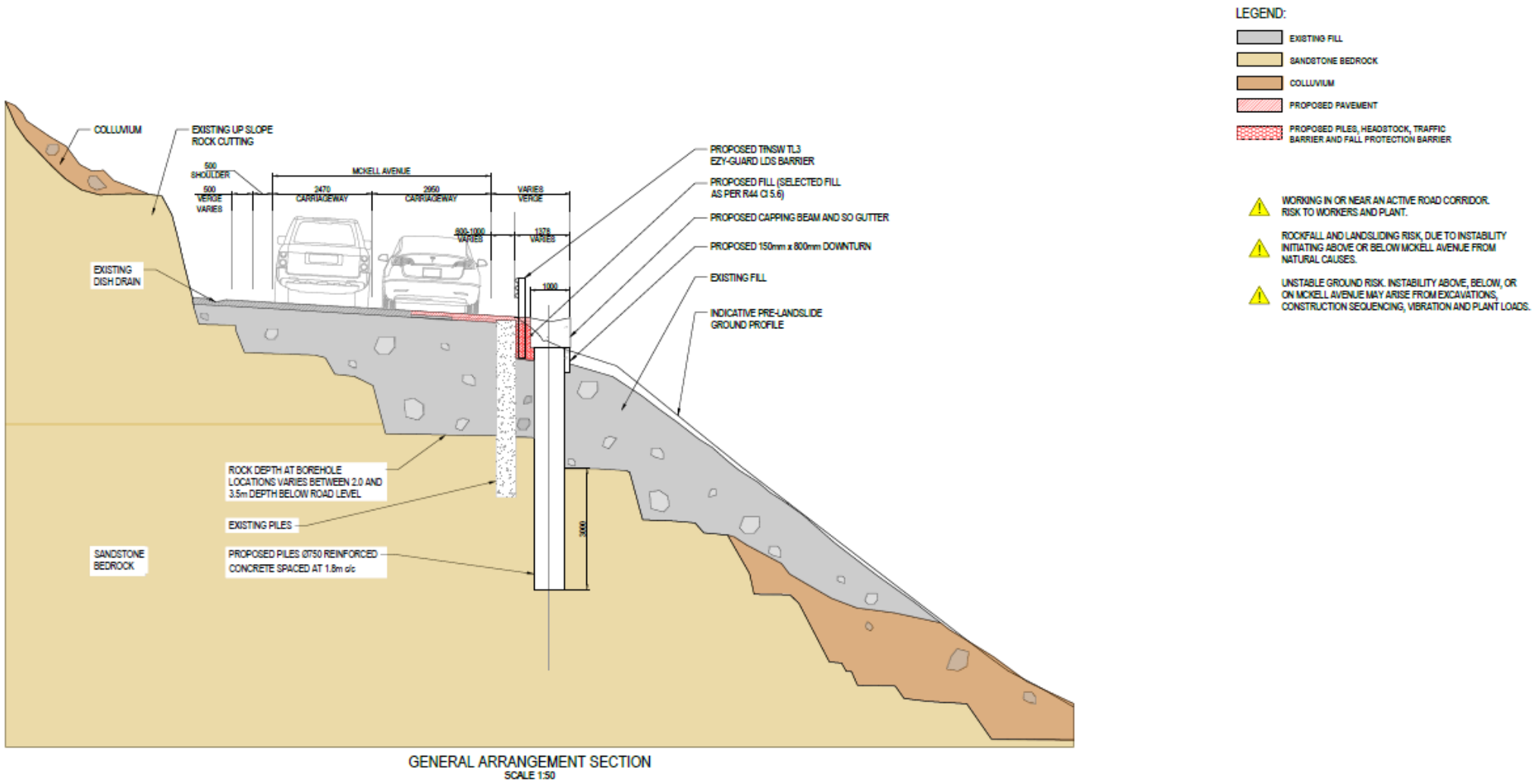


Figure 3-2 Key features of the proposal (cross-section)

3.2 Design

3.2.1 Design criteria

The design criteria includes reinstating the road along McKell Avenue as well as stabilising the adjacent slope. The road would be reinstated in accordance with Transport specifications and Austroads Guide to Road Design Part 3 as well as the following guidelines and standards would also be adopted:

- Roads and Maritime Guide to Slope Risk Analysis (Roads and Maritime, 2014)
- Slope Asset Management Policy PN 292
- SRAPC Tactical Asset Management Plan (TAMP)
- 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.

3.2.2 Engineering constraints

Table 3-1 lists the main engineering constraints and how they have been addressed as part of the detailed design.

Table 3-1 Engineering constraints for the proposal

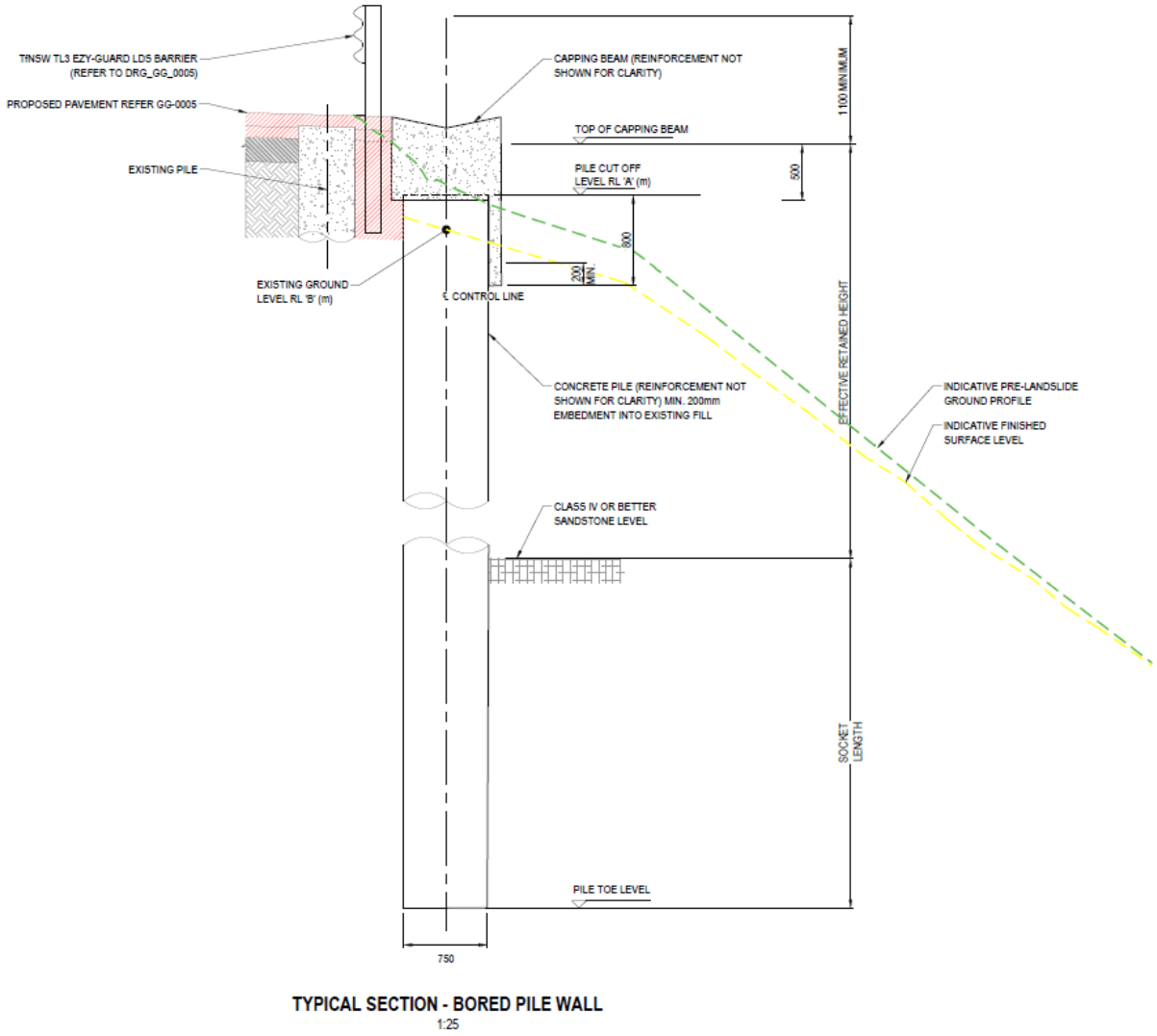
Constraint	How it has been addressed in the detailed design

Located adjacent to the Royal National Park with narrow roads making it difficult to get to and from the site	The design has considered the physical constraints e.g. narrow road of the location. The sizing of piles in the ground and other structural elements have been considered with the selection of smaller piles which would require smaller plant. The delivery of materials and plant to site would require smaller heavy vehicles which would facilitate navigating narrow roads to and from the proposed site.
The existing rock profile dictates the limits of the geotechnical design	Site investigations have been conducted to inform the geotechnical design.
Design must tie into McKell Ave existing alignment	The design of the road alignment considers and ties into the existing McKell Avenue alignment. The design and proposed works would also be limited to the existing road corridor and would not encroach onto the Royal National Park.

3.2.3 Major design features

Cantilever pile retaining wall and dynamic safety barrier

It is proposed to install a 74 metre cantilever piled retaining wall. The piled wall would be comprised of 41 bored reinforced concrete piles (about 750 millimetres in diameter) spaced 1.8 metres apart with a capping beam. There would be a concrete downturn on the slope side of the capping beam which would retain the soil behind the piles. The new cantilevered piled wall would be located adjacent to the existing piled wall (about 1.5 metres from existing piled wall). The piles would extend into the sandstone at various depths. Refer to



TYPICAL SECTION - BORED PILE WALL
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Figure 3-3 for a cross-section of the proposed cantilever piled wall.

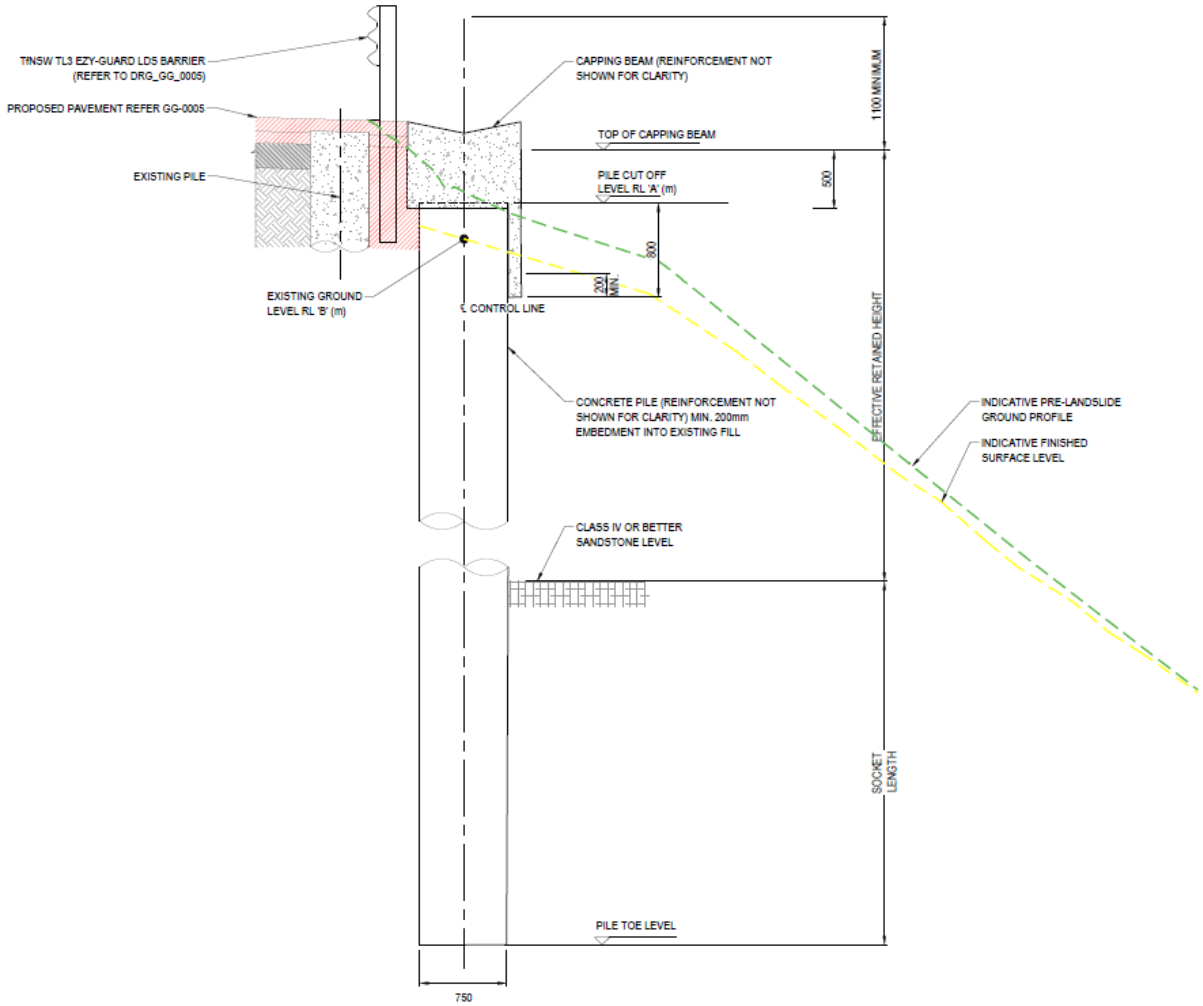

Figure 3-3 Cantilever piled retaining wall

Road pavement and safety barrier

The existing road pavement asphalt would require re-sheeting and milling prior to the new asphalt being laid. The proposed new road asphalt would be laid over existing road pavement and the lane new alignment within the proposal area over 74 metres. Part of the new asphalt would be laid over general fill in order to create a level road surface as a portion of the McKell Avenue pavement and supporting ground has fallen away.

The proposed safety barrier would would be installed between the existing and proposed piles and backfilled with general fill. The barrier would have dynamic deflection of 1.1 metres. Refer to Figure 3-4 for a cross-section of the proposed road pavement and safety barrier.

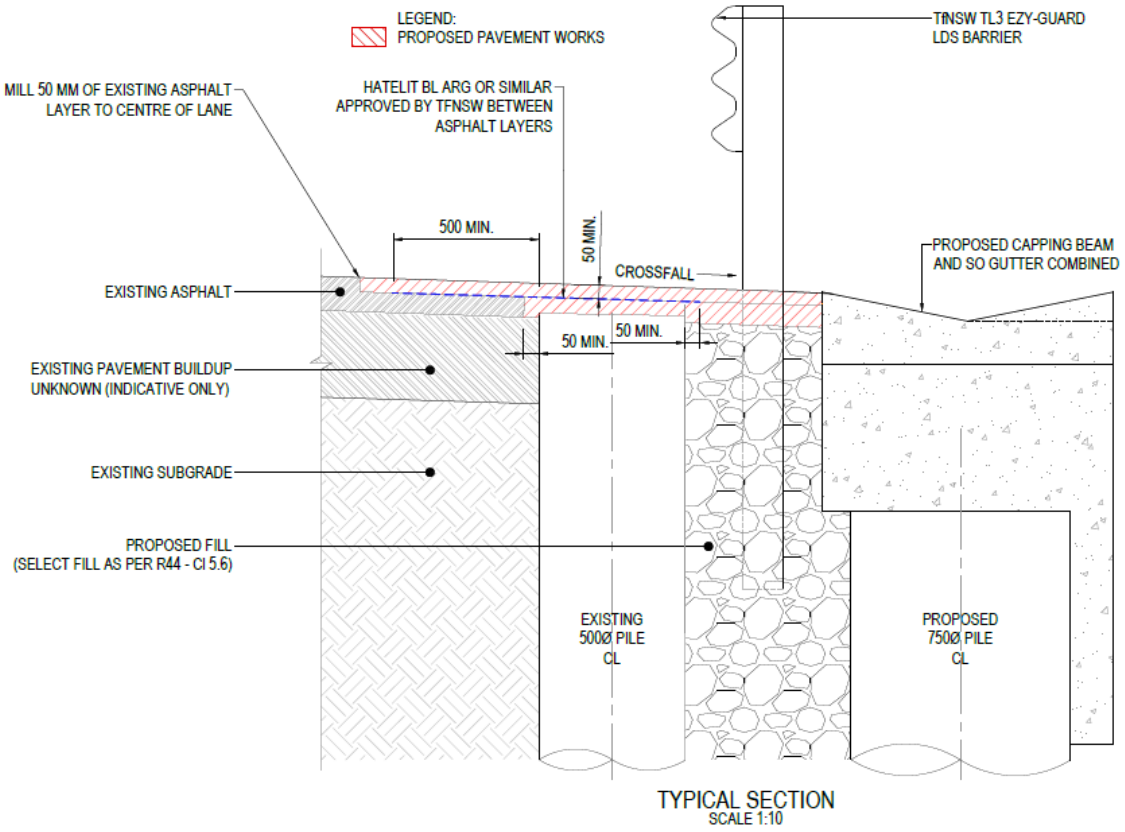

Figure 3-4 Road pavement and safety barrier

Stormwater system

As part of the proposal, the stormwater for the proposal area would also be upgraded to improve the road resilience. A new gutter would be installed along the length of the piled wall (i.e. 74 metres) which would tie into the existing stormwater system. The gutter is proposed on top of the capping beam to minimise ingress of water into the retaining wall.

The existing culvert outlet at chainage 120 would be rehabilitated with the replacement of a 100 millimetre thick concrete apron. The existing concrete apron shows signs of cracking and erosion. The new concrete apron would ensure water discharged from the culvert would not cause ongoing erosion to the downhill side of the slope. The new concrete apron extents would be shaped on site to have minimal disturbance to existing surface, trees and rocks and would be installed as not to impact the existing sandstone retaining wall (Figure 3-5).Drainage upgrades would not encroach into National Park Estate (Figure 3-6).

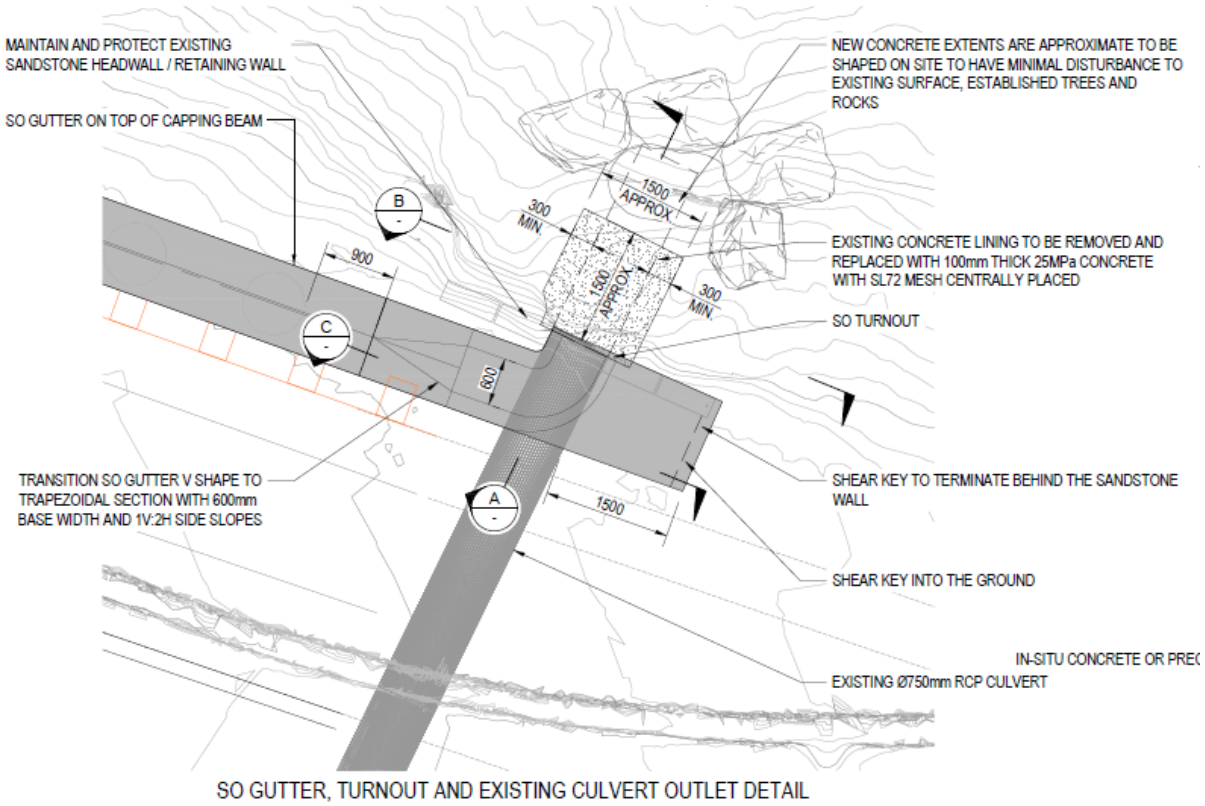

Figure 3-5 Culvert upgrades

Figure 3-6 Culvert upgrades in relation to National Park Estate

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 accordance with Transport construction specifications and would follow the SPRAC 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 limitation.

3.3.1 Work methodology

The proposed construction activities are summarised in Table 3-2 and are also detailed in Appendix C Staging diagrams.

Table 3-2: Construction activities for the proposal

Activity	Associated work
Site establishment including ancillary facilities	• Implementation of the Traffic Management Plan (TMP) including full road closure of McKell Avenue, prepared by TMC prior to works commencing and Traffic Control Plans (TCPs) • Establish environmental controls in the and around the work area including but not limited to demarcating the works area, establishing Go and No-Go zones to mark any environmentally sensitive areas including any trees in the area that do not require removal, sediment and erosion controls up to 4 metres on the downslope • Notify the community and relevant stakeholders of upcoming work **Ancillary facilities** • Establish environmental controls in and around the proposed ancillary facilities including but not limited to dilapidation report, tree protection where required and erosion and sedimentation controls in place. • Establish temporary spoil stockpile areas at both ancillary facilities • Establish concrete washout areas at the Waterfall Flats Picnic ancillary facility • Establish waste bins and plant/equipment storage locations at the National Falls ancillary facility • Establish imported fill hardstand and install site shed on top at National Falls ancillary facility • Set up temporary fencing around the ancillary facility • Set up environmental controls, including tree protection fencing
Vegetation removal	• Removal of 71 trees (70 native trees including up to 29 trees more than 20 centimetres dbh, two tree stumps, general vegetation including sapling and juvenile trees less than five centimetres diameter at breast height, as well as minor trimming (i.e. less than 10 per cent of the canopy) of vegetation on the downslope batter at the scarp failure location. This is to allow for the construction of the new piles as well as the stormwater system upgrades (refer to Section 6.1 for more detail on vegetation removal) • Minor tree trimming (i.e. less than 10 per cent of the canopy) of vegetation at the National Falls ancillary facility and the Waterfall Flat picnic area ancillary facility in order to allow for the safe movement of plant and vehicles within this ancillary facility. Trimming of trees at both ancillary facilities would require approval from National Parks and Wildlife Services (NPWS) prior to tree trimming works.

Activity	Associated work
Concrete deliveries	• Concrete deliveries to occur during standard hours in addition to Out of Hours Work (OOHW) • 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.
Concrete pours	• Concrete pours to occur during standard hours in addition to OOHW • Concrete pours required to be undertaken within tight timeframes when concrete agitator trucks arrive at site locations in satisfying the B80 concrete bridge specification.
Other vehicle movements – Oversize Overmass Load Carrying Vehicles	• 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) • Floating of heavy plant e.g., piling rigs; excavators and movement of large plant.
Other vehicle movements – waste materials for disposal/recycling	• Other vehicles movements – waste materials for disposal/recycling to occur during standard hours in addition to OOHW.
Piling	• Grubbing and the establishment of a level pad (around 100 cubic metres of excavation required to achieve this) around each pile to provide a safe working platform downslope. This is to be established from the road pavement • For areas where there have been no existing piles identified, the existing safety barrier is required to be removed to allow access to install proposed piles • A temporary piling pad (steel plate) would be established to spread point loading of the piling rig on Mckell Avenue across both lanes (full road closure would be required during piling activities). This would ensure piling rig is evenly supported and stable. The piling pad would be supported by the road pavement surface. This applies to the section where there have been no existing piles identified • Piling rig to sit on piling pad and would carry out work from the existing road asphalt level, therefore no access tracks would be required • The piling rig would progressively install piles starting from the eastern side of the road and moving west • Remove piling pad and mobilise piling rig from worksite • Remove landslide material using an excavator to the level of downturn beam. Excavator would work from the road pavement • Install the formwork through manual labour around each pile, utilising the working platform established. The proposed downturn will be braced back into the piling pad. A z-bar fastening system would be implemented to build the 1 metre capping beam. • 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 • Pour the concrete for the capping beam and downturn beam progressively moving from the eastern side of the road and moving west • Stripping of formwork after concrete curing
Stormwater system	• Remove the top sandstone block from the existing sandstone retaining wall (if required) • Install formwork for kerb. This is to be undertaken in conjunction with the formwork for the capping beams and downturn beam

Activity	Associated work
	• Pour the concrete for the kerb (in stages). This is to be undertaken in conjunction with the formwork for the capping beams and downturn beam • The new concrete extent for new transitional gutter and trapezoidal section to be using handheld plant/equipment • Removal of existing concrete lining i.e. apron, and replacing with 100 millimetre concrete slab
Backfilling	• Backfill between new and existing piles with general fill and compact • Backfill downslope material and revegetate with native species in accordance with the Transport for NSW QA Specification R178: Vegetation
Pavement / asphalt	• Mill and re-sheet asphalt for new road pavement up to capping beam • Undertake line-marking of road
Installation of safety barriers	• Install safety barrier posts into general fill • Install safety barriers and tie into existing barriers at the western and eastern ends, including existing safety barriers that were removed during construction that require reinstatement.
Site clean-up / demobilisation	• Rehabilitate disturbed areas • Restore ancillary facilities to previous existing condition • Remove temporary environmental, safety and traffic controls • Clean up the site and dispose of waste materials

3.3.2 Construction workforce

It is anticipated that the proposal would commence in October 2023 and be completed within five months (March 2024). Construction of the proposal is likely to require up to 10 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 Out of Hours Work (OOHW as defined by the Interim Construction Noise Guideline (ICNG; DECC, 2009) and summarised in Table 3-3. This is a result of the road closure between Sunday night and re-opened from Friday night, this would make sure of the safety of construction personnel and the travelling public. The road would be open during public holidays.

Concrete and material deliveries would be required for Standard and OOHW periods. 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 McKell Avenue worksite.

Table 3-3: Construction hours

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

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 proposal are summarised in Table 3-4.

Table 3-4: Types of plant and equipment

Activity	Plant, vehicle and equipment types	
Ancillary facility establishment	• Light and heavy vehicles • Day makers • Excavator (8 tonne) • Chainsaw	• Hand tools • Generator • Smooth drum roller • EWP
Ancillary facility operation	• Light and heavy vehicles • Day makers	• Hand tools • Generator
Work site establishment	• Light and heavy vehicles • Day makers	• Hand tools
Vegetation removal	• Mulcher • EWP	• Chainsaw
Piling	• Excavator (3 tonne) • Excavator (12 tonne) • Piling rig (15 tonne) • Concrete agitator (18 tonne) • Pavement laying machine • Day makers • Agitator • Reinforcement	• Excavator with hammer attachment • Pavement profiler • Smooth drum roller • Asphalt truck and sprayer • Vibrator • Formwork
Stormwater system	• Excavator (12 tonne) • Day makers	• Hand tools • Light and heavy vehicles
Backfilling	• Excavator (8 tonne)	
Pavement / asphalt	• CC10 Roller • Excavator • Watercart	• Profiler • Paver
Installation of safety barriers	• Bobcat • Day makers	• Hand tools • Light and heavy vehicles

3.3.5 Earthworks

The proposal would include piling of soil for the installation of new concrete piles. It is anticipated that any excavated material would be unsuitable for re-use on site. Any unsuitable or contaminated material would be temporarily stockpiled and bunded at the ancillary facilities and removed from site to a licensed premises or facility that is legally able to accept that type of waste. It is anticipated that the proposal would generate between 400 to 800 cubic metres of spoil from all earthwork activities.

As there is expected to be additional fill material needed during construction of the proposal, additional suitable material would need to be imported to site from beyond the proposal area. These are detailed in Section 3.3.6.

3.3.6 Source and quantity of materials

The proposal would require the following materials:

- Between 170 to 230 metres squared of reinforced concrete
- Between 27 to 37 tonnes of steel within the reinforced concrete
- Between 220 to 450 cubic metres of general fill

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 will be implemented for the duration of the proposal.

Estimated construction traffic numbers

It is estimated across the proposal area during each shift for construction there will be around:

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

Road closures

Work associated with the proposal would result in the temporary closure of McKell Avenue due to the size of the machinery required for piling and pavement activities. Full road closures would occur 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. The road would be open during public holidays. This would occur over five months for the full length of construction. A Road Occupancy Licence (ROL) would be obtained prior to any road or lane closures and construction traffic managed through a Traffic Management Plan. Traffic management would be dependent on ROL approvals from the Traffic Management Centre.

Concrete and material deliveries would be required for Standard and OOHW 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 McKell Avenue worksite.

Transport and traffic impacts including lane closures, are discussed further in Section 6.

Access management

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.

Access to the workzone would occur from the road. No new access roads or paths would be required.

Public traffic is to be managed by the TMP in place in accordance with the approved Traffic Guidance Scheme and Road Occupancy License.

3.4 Ancillary facilities

The proposal would require two ancillary facilities. These are summarised in Table 3-5. Ancillary facilities would be used to place amenities such as portable toilets, a site shed, storage of plant and equipment, temporary stockpiling of spoil, parking of personnel vehicles and a waste bin. These areas would use already cleared locations, however, the need for minor tree trimming (i.e. less than 10 per cent of the canopy) of vegetation at the both ancillary facilities would be required.

Table 3-5: Ancillary facilities

Ancillary facility	Location/description	Nearest sensitive receiver (m)
Waterfall flat picnic area ancillary facility	Waterfall flat picnic area is currently used as a recreational picnic area available to the public. The proposed ancillary facility would use the grassed area within the Waterfall Flat picnic area (about 30 x 60 metres) located within the Royal National Park. Temporary fencing would be established around the ancillary facility for security purposes and to protect surrounding vegetation. Minor tree trimming (i.e. less than 10 per cent of the canopy) of vegetation at the Waterfall Flat picnic area ancillary facility would be required. Access and egress would occur directly from McKell Avenue. This ancillary facility would be used for portable toilets, a site shed, storage of plant and equipment, parking of personnel vehicles and a waste bin. A designated temporary concrete clean-out area will also be established at this ancillary facility. This ancillary facility would be used for temporary stockpiling of spoil (up to 800 cubic metres). The use of this area for an ancillary facility would restrict visitors to the Royal National Park being able to access and use a portion of the Waterfall flat picnic area.	The nearest sensitive receiver is Waterfall Public school located about one kilometre from the ancillary facility.
National Falls ancillary facility	This area is currently used as a car park for visitors wanting to visit National Falls within the Royal National Park. The proposed ancillary facility would use the small, designated dirt carpark adjacent to the National Falls lookout on McKell Avenue (about 20 x 55 metres) located within the Royal National Park. This area is currently owned by the National Parks and Wildlife Service. The ancillary facility would require the establishment of an imported Densely Graded Base (DGB) hardstand for the installation of a temporary site shed. This area is currently owned by the National Parks and Wildlife Service. Temporary fencing would be established around the ancillary facility for security issues and to protect construction activity interaction with surrounding vegetation. Minor tree trimming (i.e. less than 10 per cent of the canopy) of vegetation at the National Falls ancillary facility would be required.. Access and egress would occur directly from McKell Avenue. This ancillary facility would be used for temporary stockpiling of spoil (up to 800 cubic metres). This ancillary facility would also contain portable toilets, storage of plant and equipment, parking of personnel vehicles, materials such as steel reinforcement and cages and a waste bin. The use of this area for an ancillary facility would restrict visitors to the Royal National Park being able to access the lookout for the during of construction. This public access to this area would be reopened after construction.	The nearest sensitive receiver is Waterfall Public school located about 2.2 kilometres from the ancillary facility.

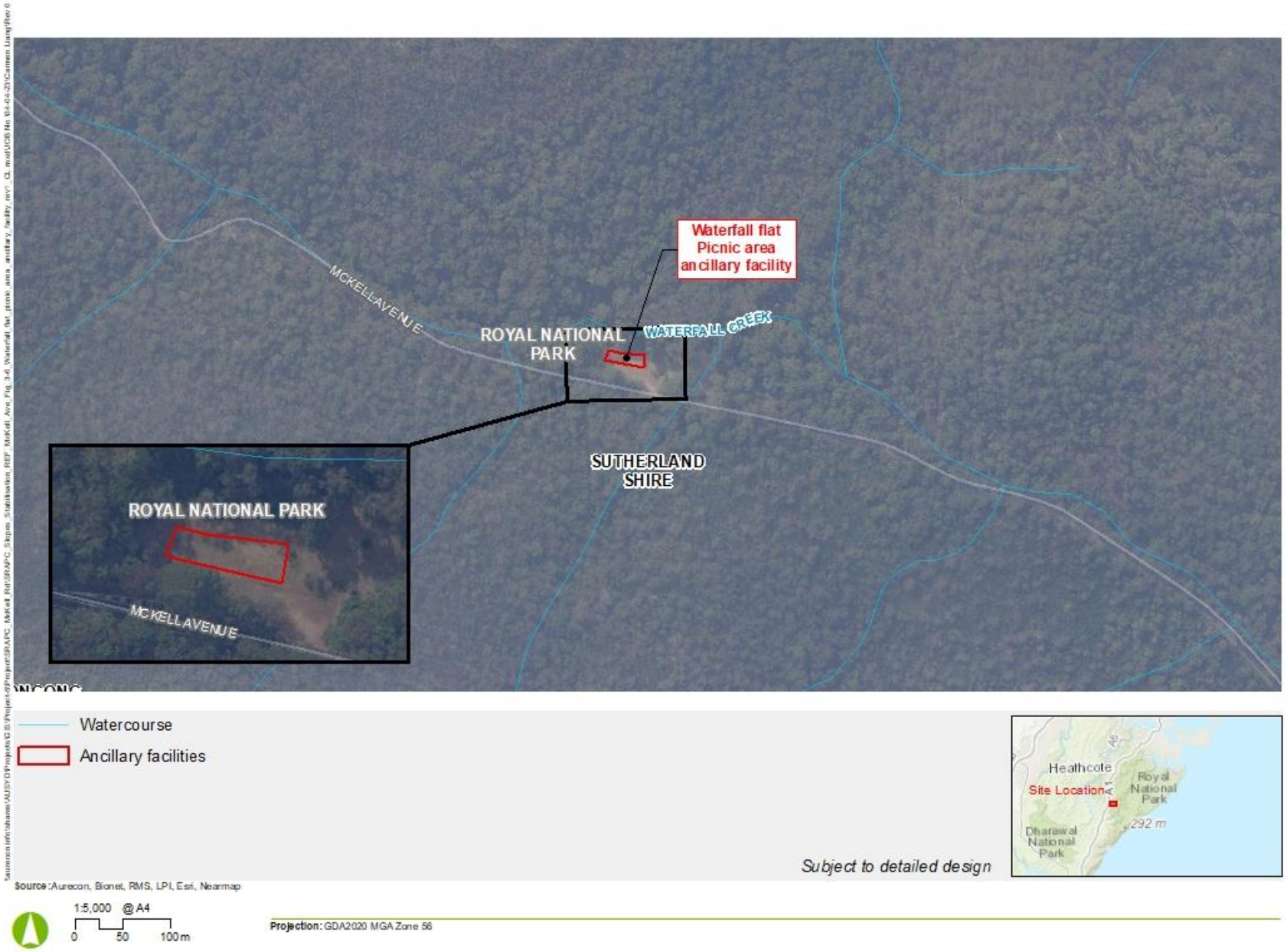

Figure 3-7 Waterfall flat picnic area ancillary facility

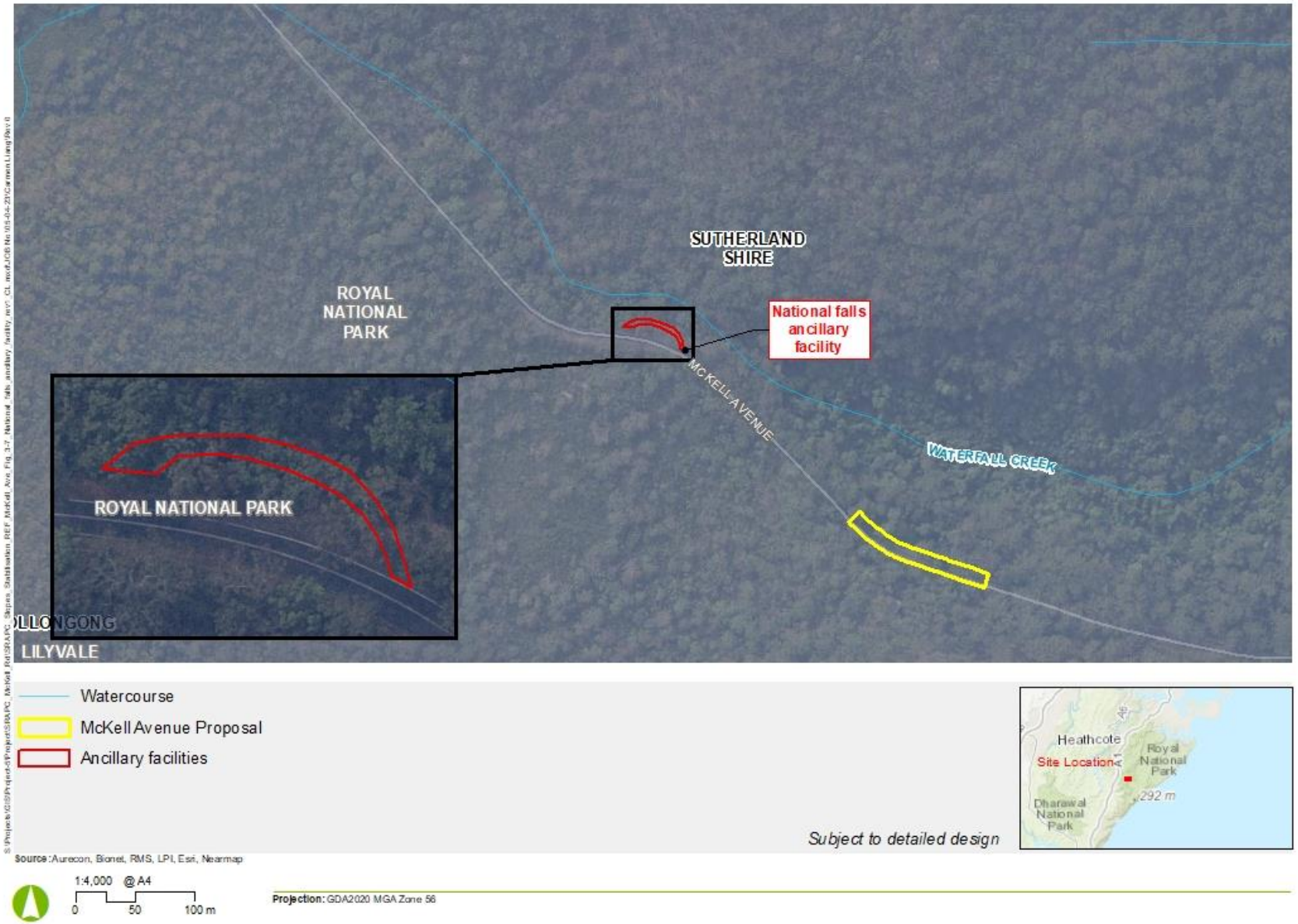

Figure 3-8 National Falls ancillary facility

3.5 Public utility adjustment

No public utility adjustments would be required for the proposal.

3.6 Property acquisition

No property acquisition would be required for the proposal.

4. Statutory and planning framework

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 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides a statuary 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.

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP (Transport and Infrastructure)) aims to facilitate the effective delivery of infrastructure across the State.

Section 2.108 of SEPP (Transport and Infrastructure) 2021 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 it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW). Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1947* and does not require development consent or approval under:

- State Environmental Planning Policy (Resilience and Hazards) 2021
- 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 City) 2021
- State Environmental Planning Policy (Precincts – Western Parkland City) 2021

However, as the temporary ancillary facilities required to support the proposal are on National Park Estate, these would need to be agreed to by the National Parks and Wildlife Service (NPWS).

Section 2.10 to 2.15 of the TISEPP 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 TISEPP (where applicable), is discussed in section 5 of this REF.

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 LEP. The proposed slope works are located on land zoned SP2 – Classified Road, and the ancillary facilities 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. The proposal would however be broadly consistent with the objectives for SP2 – Infrastructure.

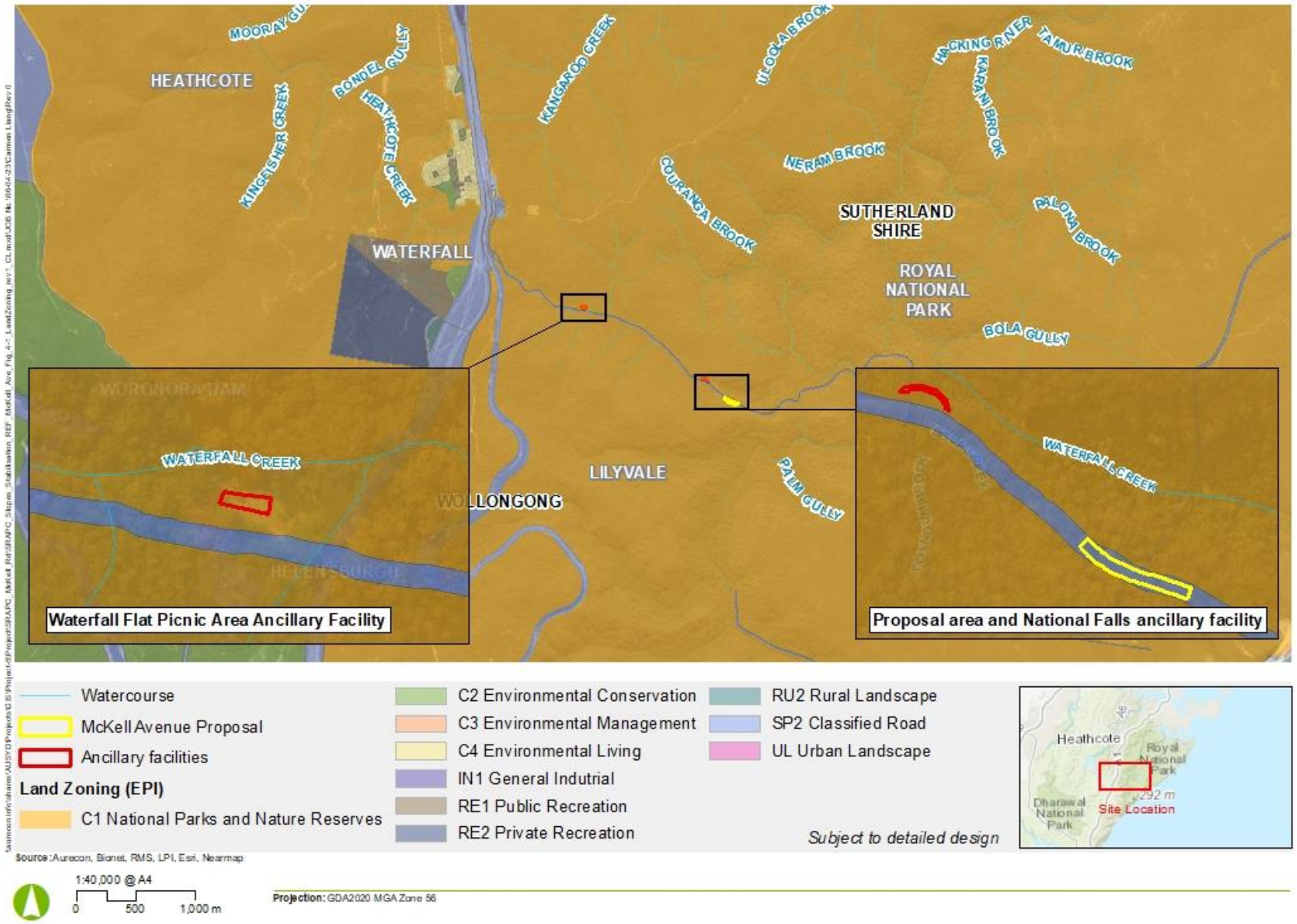

Figure 4-1 Land zoning

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 undertaking the works, then consent is required.

The proposal is located on roads that are managed by Transport. An 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 trigger criteria for an EPL. Therefore, an EPL would not be required for the proposal.

4.2.3 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. The proposal is consistent with the objects of the Act and is needed to protect existing infrastructure.

Under this Act, all native fauna is protected, threatened or otherwise. Schedule 13 of the Act lists protected plants which shall not be harmed or picked on any land either on or off National Park estate.

The proposal is not located within the Royal National Park Estate with the proposal occurring within the existing road corridor (see Figure 4-2). The proposed ancillary facilities are located on National Park Estate, however, due to the temporary nature of the ancillary facilities, ongoing consultation and leasing negotiations with NPWS would occur. The activity is consistent with the Objects of the Act (s.2A) and Reserve management principles (s.30E–30K) in relation to the Royal National Park.

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 undertaken in section 6..

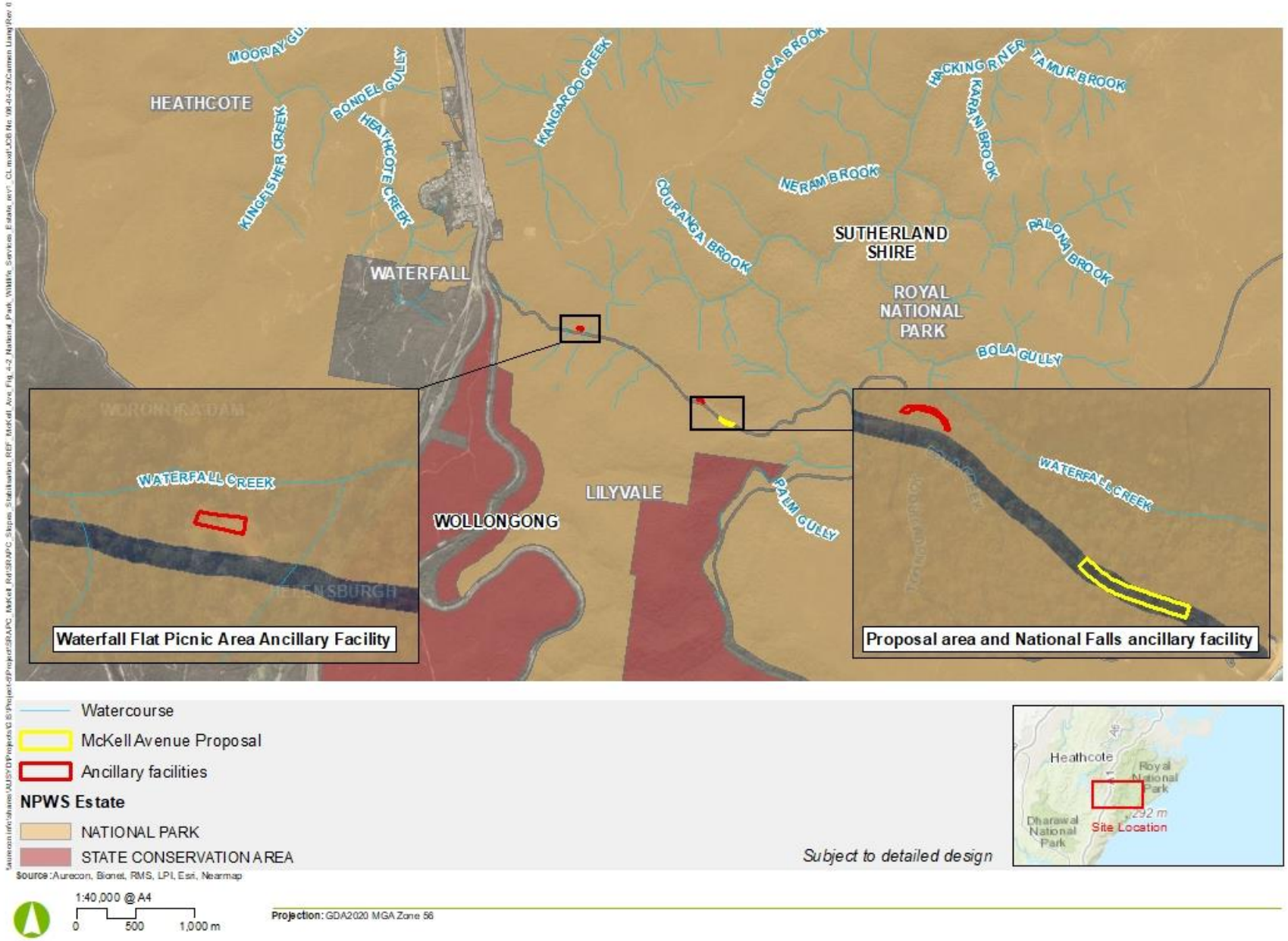

Figure 4-2 National Park Wildlife Service Estate

4.2.4 Biodiversity Conservation Act 2016

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 accordance with the Biodiversity Assessment Method (BAM).

The proposal would involve the removal of up to 71 (70 native) trees greater than five centimetres at diameter at breast height (dbh) (including up to 29 trees more than 20 centimetres dbh), two tree stumps, general vegetation including sapling and juvenile trees less than five centimetres diameter at breast height, as well as minor trimming (i.e. less than 10 per cent of the canopy) of vegetation on the downslope batter and at both ancillary facilities. As no threatened species or threatened species habitat have been identified in the vegetation proposed for removal and/or trimming is minor, the proposal is not likely to significantly impact threatened species 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 or Biodiversity Development Assessment Report is not required.

As there are no trees proposed to be removed as part of the proposal that have the potential to be Powerful Owl (listed under the BC Act as Vulnerable) associated habitat and foraging habitat, this species is unlikely to be impacted. The impacts of the proposal were regarded as negligible with the exception of impacts to threatened fauna species (Powerful Owl) which is considered low.

4.2.5 Water Management Act 2000 and Water Act 1912

The *Water Management Act 2000* (WM Act) aims to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. The WM Act is based on the principles of ESD, aiming to ensure the fundamental health of rivers and groundwater systems and associated wetlands, floodplains, estuaries are protected. A controlled activity approval is required from the DPE (Water) for certain types of developments and activities that are carried out in or near a river, lake or estuary.

The proposal would involve work within 40 metres of Waterfall Creek, which is considered a controlled activity and as such the *Water Management Act 2000* applies. A controlled activity is defined as actions carried out on waterfront land, with waterfront land any river, lake or estuary, and the land on each side within 40 metres of the river bank, lake shore or estuary's mean high water mark. However, Transport as a public authority, is exempt from the requirements to obtain a controlled activity approval under Clause 41 of the Water Management (General) Regulation 2018.

The proposal does not involve any water take, use or supply from natural sources or flood diversion work.

4.2.6 Waste Avoidance and Resource Recovery Act 2001

The *NSW Waste Avoidance and Resource Recovery Act 2001* (WARR Act) 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 of in accordance with specific waste management provisions. Waste generated during construction and operation of the proposal would be managed in accordance with the waste hierarchy and where required, disposed of in accordance with its waste classification and relevant legislation and guidelines.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the 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 A and section 6 of the 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 of the REF.

Findings - matters of national environmental significance

The assessment of the proposed modification'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 matter 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 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. Chapter 6 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 affective 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 undertaken, with one Native Title claimants identified (South Coast People NC2017/003) (Appendix D).

Transport would provide a notice of the proposal to NTSCORP under section 24KA of the Act and would consult with NTSCORP regarding the proposal.

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. Under clause 2.109 of SEPP (Transport and Infrastructure) the proposal is permissible without consent. 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.

Transport for NSW is the determining authority for the proposal. This REF fulfils Transport'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.

5. Consultation

This section discusses the consultation undertaken to date for the proposal and the consultation proposed for the future.

5.1 Community involvement

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

- Live Traffic updates in March 2022, particularly around the changes to traffic condition after the landslip
- Social media updates in March 2022 on the Live Traffic Facebook page in response to the road closure and land slip
- Key issues raised by residents and local businesses are summarised in Table 5-1.

Table 5-1: Summary of issues raised by the community

Group	Issue raised	Response / where addressed in REF
Residents	• Access to local townships • Condition of local roads and possibility of additional slips	• Due to the slope failure, there is currently a partial road closure of McKell Avenue, with contraflow put in place (one lane functioning for two-way traffic). This provides continual use of the road, therefore providing access between local town centres • The objective of this proposal is to reinstate the road along McKell Avenue and stabilise the slope adjacent to the road and improve the condition of the road.
Local business	• Access to local townships • Condition of local roads and possibility of additional slips	• Due to the slope failure, there is currently a partial road closure of McKell Avenue, with contraflow put in place (one lane functioning for two-way traffic). This provides continual use of the road, therefore providing access between local town centres • The objective of this proposal is to reinstate the road along McKell Avenue and stabilise the slope adjacent to the road and improve the condition of the road.

5.2 Aboriginal community involvement

The potential Aboriginal heritage impacts of the proposal have been considered in accordance with the requirements of Transport's Procedure for Cultural Heritage Consultation and Investigation (PACHCI) (Roads and Maritime Services, 2011). Table 5-2: Summary of Transport's Procedure for Aboriginal Cultural Heritage Consultation and Investigation summarises the stages of the PACHCI.

Table 5-2: Summary of Transport's Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial assessment by Transport.
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 initiated on 20th October 2022, with a clearance letter issued on the 1st November 2022 (Appendix D). The AHIMS searches showed no

heritage items within the proposed work location and ancillary facilities. The AHIMS search however identified one Aboriginal heritage site located within 100 metres of the Waterfall flat picnic area ancillary facility (Site ID #52-3-0878). Site establishment for the Waterfall flat picnic area ancillary facility would not include any excavation or vegetation removal (only minor vegetation trimming) and it is anticipated that there would be no to low archaeological potential. The clearance letter identified that the proposal was unlikely to impact on Aboriginal cultural heritage (refer to Section 6.5 for more detail on Aboriginal cultural heritage).

5.3 SEPP (Transport and Infrastructure) consultation

National Parks and Wildlife Service (NPWS) have been consulted about the proposal as per the requirements of section 2.15(2)(a) of SEPP (Transport and Infrastructure). Appendix B contains a SEPP (Transport and Infrastructure) consultation checklist that documents how SEPP (Transport and Infrastructure) consultation requirements have been considered as well as a copy of the SEPP letter issued to NPWS.

Issues raised from this consultation are outlined in Table 5 4 below.

Table 5-4: Issues raised through SEPP consultation

Group	Issue raised	Response / where addressed in REF
NPWS	Foraging habitat of Powerful Owls	A survey and supporting Biodiversity Memo (Aurecon 2022) has been developed to confirm the presence and foraging habitat of the Powerful Owl. Impacts to the Powerful Owl are also discussed in Section 6.1 of this REF.
	Timing of construction / cumulative impacts of construction	Construction programme is set to commence after January 2023, as per NPWS request/preference, due to the volume of visitors to Royal National Park over the summer holidays.
	Trimming required at the Waterfall Flat picnic area and National Falls ancillary facilities	Trimming of trees at the Waterfall Flat picnic area and National Falls ancillary facilities would require approval from NPWS prior to tree trimming works
	Planting/replanting of native species adjacent to National Park Estate	During construction, ConnectSydney would review the option to replant native species on the cleared slope area in consultation with and endorsement from National Parks and Wildlife Service (NPWS). NPWS prefers the payment into a conservation fund rather than replanting of trees.

5.4 Government agency and stakeholder involvement

Further consultation with government agencies and stakeholder involvement would not be undertaken or required as part of this proposal.

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 Is an EIS required? (DUAP 1995/1996) and as required under section 171 of the Environmental Planning and Assessment Regulation 2021 and the Roads and Related Facilities EIS Guideline (DUAP 1996). The factors specified in section 171 of the Environmental Planning and Assessment Regulation 2021 are also considered in Appendix A.
- Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Biodiversity

This section describes the biodiversity impacts that may occur when constructing and operating the proposal. It summarises the Biodiversity Memorandum that has been prepared for the proposal by Aurecon Australasia Pty Ltd and is provided in Appendix E.

6.1.1 Methodology

The Biodiversity Memorandum consisted of a desktop study and field survey. The following activities were undertaken to complete the Biodiversity Memorandum:

- Reviewing relevant legislation and guidelines in relation to biodiversity
- Desk-based searches of relevant databases to understand the existing environment and obtain records of threatened species, populations and ecological communities known or predicted to occur in the locality within the proposal
- Aerial imagery analysis
- Field assessments on the 29th September, 13th October 2022 and the 9th February 2023

Assessment of the potential impacts to flora, fauna, migratory and aquatic species including assessments of significance.

6.1.2 Existing environment

Landscape

The landscape context of the study area (which includes the proposal area and adjacent area) is described in Table 6-1.

Table 6-1 Landscape features

Landscape feature	Description
IBRA bioregions and subregions	Sydney Basin Bioregion and also within the Sydney Cataract subregion
Cleared areas	The majority of vegetation in the surrounding landscape has not been cleared
Rivers and streams	The proposal is adjacent to areas of Biodiverse riparian land, along Waterfall Creek and the Hacking River. This area is classed as high biodiversity value and sensitive to impacts from development and clearing.

Landscape feature	Description
Wetlands	There is one Ramsar wetland within 10 kilometres of the proposal area. Towra Point supports three EPBC Act threatened species, is an important area for maintaining the biodiversity of the Sydney region, and contains significant food source for over 60 species of fish, and high numbers of fish dependent on the mangrove habitat within stages of juvenile development.
Connectivity features	The proposal is located within road corridor adjacent to the Royal National Park, a relatively undisturbed and highly connected natural environment. The forest habitat is considered likely to be suitable for mobile species such as birds and bats as well as other native fauna.
Areas of geological significance	The proposal area is about 25 metres from a rocky overhang feature and National Falls waterfall
Areas of outstanding biodiversity value	There are no areas identified as having outstanding biodiversity value within or adjoining the proposal.

Native vegetation

Five NSW PCTs were found during field investigations and are outlined in Table 6-2. The following table identifies the relevant Plant Community Type as well as the associated threatened ecological community under the BC Act and EPBC Act.

Table 6-2 Plant community types

Plant Community Type	Associated threatened ecological community
3230 (Central Coast Escarpment Moist Forest)	No associated TEC
3595 (Sydney Coastal Sandstone Gully Forest)	No associated TEC
PCT3028 (Illawarra Escarpment Warm Temperate Rainforest)	No associated TEC
PCT 3924: Sydney Coastal Upland Swamp Heath	Coastal Upland Swamps in the Sydney Basin Bioregion Endangered (BC Act) Endangered (EPBC Act)
PCT 3591: Southern Sydney Sheltered Forest	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion Endangered (BC Act)

Threatened species

A search of the BioNet database was conducted on 15th February 2023, encompassing a 10 kilometre radius around the proposal, identified 50 species (excluding marine mammal and sea turtle species). This included 10 plants, 20 birds, 11 mammals, three amphibians and six reptiles.

During the field assessments, 21 flora species were identified of which no threatened species habitat or HBTs showing signs of use by fauna, including the Powerful Owl (*Ninox strenua*) (BC Act- Vulnerable), were identified. HBTs identified within the study area are not identified as suitable Powerful Owl habitat. Mature native trees identified downslope may constitute potential opportunistic foraging habitat for the Powerful Owl. Refer to Appendix E Biodiversity Memorandum (Aurecon 2023) for more information.

Groundwater dependent ecosystems

A review of the Bureau of Meteorology's Groundwater Dependent Ecosystem (GDE) Atlas (BOM 2021) was used to determine the presence of GDEs within or near the proposal area. No aquatic or terrestrial GDEs are mapped within or near the proposal area.

Matters of national environmental significance (MNES)

A search of the Protected Matters Search Tool (PMST) was conducted on 15th February 2023, encompassing a 10 kilometre radius around the proposal area. The search results identified the presence of a number of threatened flora and fauna, migratory species, Commonwealth land, heritage places and threatened ecological communities within the 10-kilometres of the proposal area as well as within the proposal area. The search results are summarised in Table 6-3.

Table 6-3 MNES surrounding the proposal area

Category	Matter within 10-kilometres of the study area	Matter within the study area
MNES		
Wetlands of international importance	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 proposal area.
Commonwealth marine area	The Commonwealth Marine Area - Exclusive Economic Zone and Territorial Sea is located off the east coast of Australia.	The Commonwealth Marine Area - EEZ and Territorial Sea is located outside the proposal area.
Listed threatened ecological communities	There are 11 TECs considered may or likely to be within 10-kilometres of the study area. These include: • Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion (Endangered) • Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered) • Eastern Suburbs Banksia Scrub of the Sydney Region (Critically Endangered) • Turpentine-Ironbark Forest of the Sydney Basin Bioregion (Critically Endangered) • Shale Sandstone Transition Forest of the Sydney Basin Bioregion (Critically Endangered) • River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (Critically Endangered) • Coastal Swamp Oak (Casuarina glauca) Forest of New South	One TEC has been found based on searches and confirmed during the field assessment: • PCT 3591: Southern Sydney Sheltered Forest (BC Act Endangered TEC: Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion)

Category	Matter within 10-kilometres of the study area	Matter within the study area
	Wales and South East Queensland ecological community (Endangered) • Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (Critically Endangered) • Coastal Upland Swamps in the Sydney Basin Bioregion (Endangered) • Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (Critically Endangered) • Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered)	
Listed threatened species	A total of 112 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. These include 40 birds, 11 fish, 6 reptiles, 15 mammals, 33 plants, 5 frogs, and 2 insect species.	Excluding marine mammal and sea turtle species, 36 threated species have been identified within the proposal area.
Listed migratory species	A total of 62 migratory species were identified as may, likely, or known to occur, or to have habitat occurring within a 10-kilometre radius of the study area.	Migratory species are unlikely to use vegetation within the proposal area. This due to an abundance of adjacent habitat with the proposal sitting adjacent to the Royal National Park. Migratory species would more likely select vegetation that is less fragmented, as well as vegetation further away from the road corridor i.e. noise from vehicles, etc.
Other Matters Protected by the EPBC Act		
Commonwealth land	There is unnamed Commonwealth Land, Australian Nuclear Science & Technology Organisation, Defence Service Homes Corporation, Australian Telecommunications Commission, and Australian Postal Commission land within a 10-kilometre radius of the study area.	Not relevant within the proposal area.
Listed marine species	A total of 81 marine species were identified as may, likely, or known to occur, or to have habitat within 10-kilometres of the study area.	Marine bird species may use the proposal area for foraging or roosting habitat.
Whales and other cetaceans	A total of 14 whales and other cetaceans are listed within 10-kilometres of the study area.	Not relevant within the study area.

Field assessment

A field assessment was carried out on the 29th September, 13th October 2022, and 9th February 2023. The field assessment confirmed that the proposal area contains two BC Act listed TECs and one EPBC Act listed TEC. There were no threatened species or threatened species habitat identified as part of the field assessment. Two trees were identified as Hollow Bearing Trees (HBTs) within five metres downslope of the road (Figure 6-1).

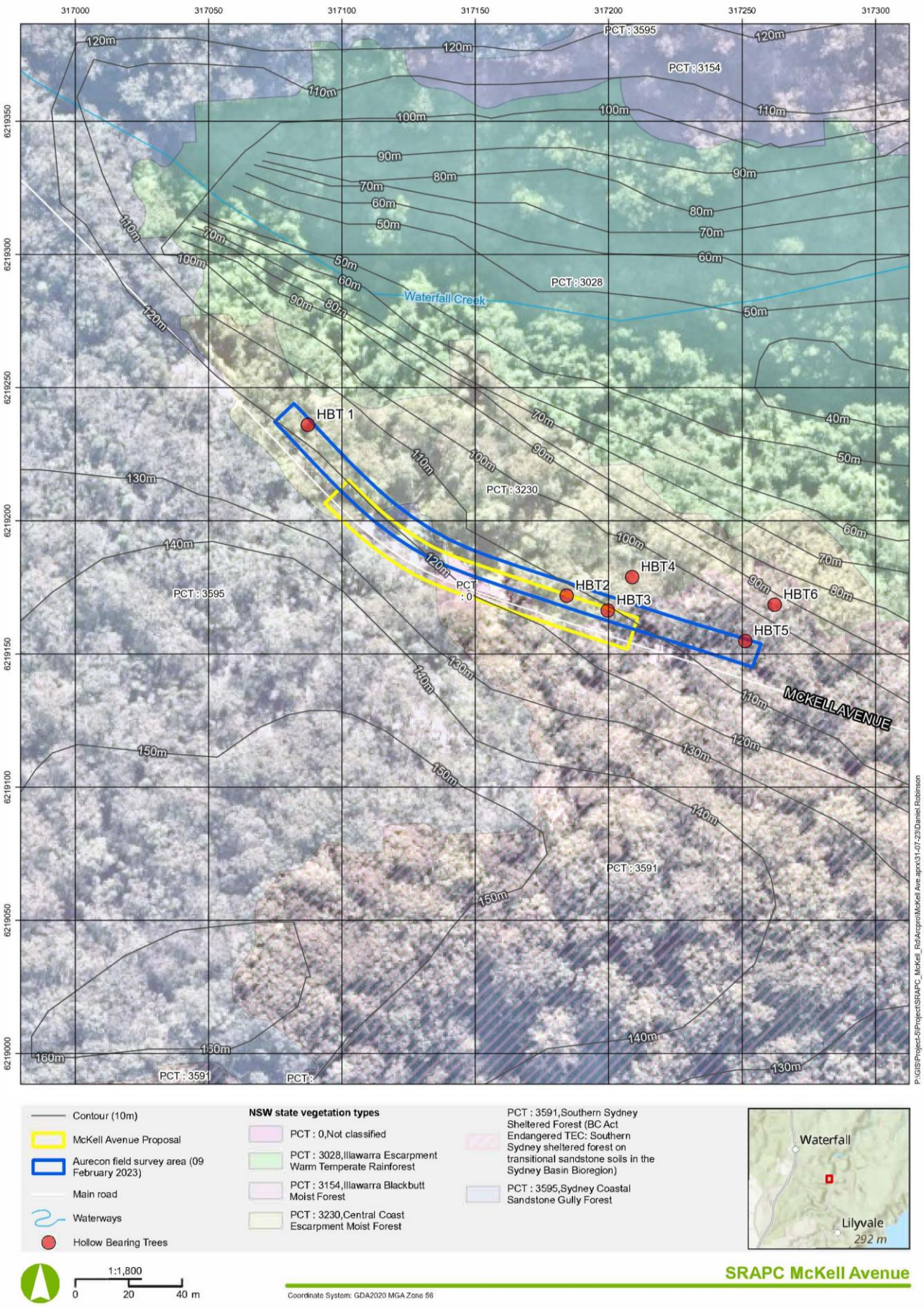

Figure 6-1 Field survey location

6.1.3 Potential impacts

Construction

The proposed activities were found to have the following impacts during construction (Figure 6-2). These include:

- Removal of 320 square metres of vegetation including:
    - up to 71 trees (70 native) greater than five centimetres diameter at breast height (dbh) within four metres downslope of the disturbed roadside environment
    - two tree stumps on the downslope batter
    - general vegetation including sapling and juvenile trees less than five centimetres dbh within four metres downslope of the disturbed roadside environment.
- Minor trimming of mature native trees (i.e. less than 10 per cent of the canopy) vegetation within five metres downslope of the disturbed roadside environment may be required to facilitate construction. This may constitute potential opportunistic foraging habitat for the Powerful Owl
- Minor trimming of mature native trees (i.e. less than 10 per cent of the canopy) of vegetation at the Waterfall Flat picnic area ancillary facility and the National Falls ancillary facility
- Removal of two HBT that would be directly impacted by the works. These HBTS are all *Eucalyptus saligna / Eucalyptus botryoides* classified species and form part of the 71 trees marked for removal.

Up to 71 trees (70 native) may be required for removal, including up to 29 trees more than 20 centimetres dbh, and 42 trees between 5 and 20 cm dbh. There are up to 29 trees more than 20 centimetres dbh that will be directly impacted by the works, as well as general vegetation and shrubs, such as Blakely's Bush-pea (Pultenaea blakelyi). Table 6 4 summarises the quantity, type and species of tree proposed for removal.

The Biodiversity Memorandum has defined trees 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)”. Some species identified for removal can be defined as a ‘shrub or small tree’ as per the description provided in NSW Flora Online (PlantNet). However, all species identified in Table 6-4 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, July 2022) and the Biodiversity Policy (Transport, August 2022) discuss the impacts of clearing and where offsets are required.

Table 6-4 Trees that require removal

Species name Common name	Scientific name	Native or exotic	Number of trees >20cm dbh	Number of trees (5 - 20 cm dbh)	HBTs and diameter at breast heigh (dbh)
Two-veined hickory	*Acacia binervata*	Native	-	6	-
Blueskin	*Acacia irrorata*	Native	-	3	-
Smooth barked apple	*Angophora costata*	Native	1	2	-
Cinnamon myrtle	*Backhousia myrtifolia*	Native	1	11	None. One 20 cm dbh
Downy chance	*Clerodendrum tomentosum*	Native	-	1	-
Murrogun	*Cryptocarya microneura*	Native	-	1	-
Jackwood	*Cryptocarya glaucescens*	Native		1	-
Sydney gum/ Woollybutt	*Eucalyptus saligna/ Eucalyptus botryoides*	Native	10	1	HBT 2: 15-30 cm HBT 3: 10-15 cm, 15-30 cm, 15-30 cm

Species name Common name	Scientific name	Native or exotic	Number of trees >20cm dbh	Number of trees (5 - 20 cm dbh)	HBTs and diameter at breast heigh (dbh)
Grey ironbark	*Eucalyptus paniculata*	Native	2	-	None. Two 20-50 cm dbh
Sydney peppermint	*Eucalyptus piperita*	Native	1		-
Native guava	*Eupomatia laurina*	Native	-	1	-
Rusty fig	*Ficus rubiginosa*	Native	-	1	-
Wild quince	*Guioa semiglauca*	Native	-	1	-
Cheese tree	*Glochidion ferdinandi*	Native	1	7	None. 20 cm dbh
Crab apple	*Malus sp.*	Exotic	1	-	None. 25 cm dbh
Turpentine	*Syncarpia glomulifera*	Native	12	4	None. 11 trees 20-40 cm dbh, four >40cm dbh
Tree heath	*Trochocarpa laurina*	Native	-	2	-
Total	**71 trees**				

Vegetation that would require removal includes two PCTS and one unclassified PCT (Table 6-1). The PCTS for removal include PCT 3591: Southern Sydney Sheltered Forest as well as PCT 3595 Sydney Coastal Sandstone Gully Forest. The removal of vegetation is in PCT 3591: Southern Sydney Sheltered Forest which is also associated with listed BC Act Endangered TEC: *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion.*

The proposal would not involve the removal of potential general habitat, winter foraging habitat, or potential direct mortality to unrecorded populations of threatened flora/fauna species. The proposal area contains potential Powerful Owl (*Ninox strenua*) (BC Act- Vulnerable) foraging habitat- open or closed sclerophyll forest or woodlands- however no threatened species, threatened species habitat, or Hollow Bearing Trees (HBTs) showing signs of use by fauna were identified during the field assessment.

The proposal would not impact the any wetlands of international importance as the nature and scope of the works would remain within the existing road corridor. The temporary ancillary facilities would be located on Royal National Park land but would not require the removal of vegetation (minor trimming only) or any excavation works.

Migratory species are unlikely to use the proposal area due to an abundance of adjacent habitat, therefore impacts to migratory species are unlikely to occur during construction.

The biodiversity impacts can be minimised and managed by applying a range of mitigation measures.

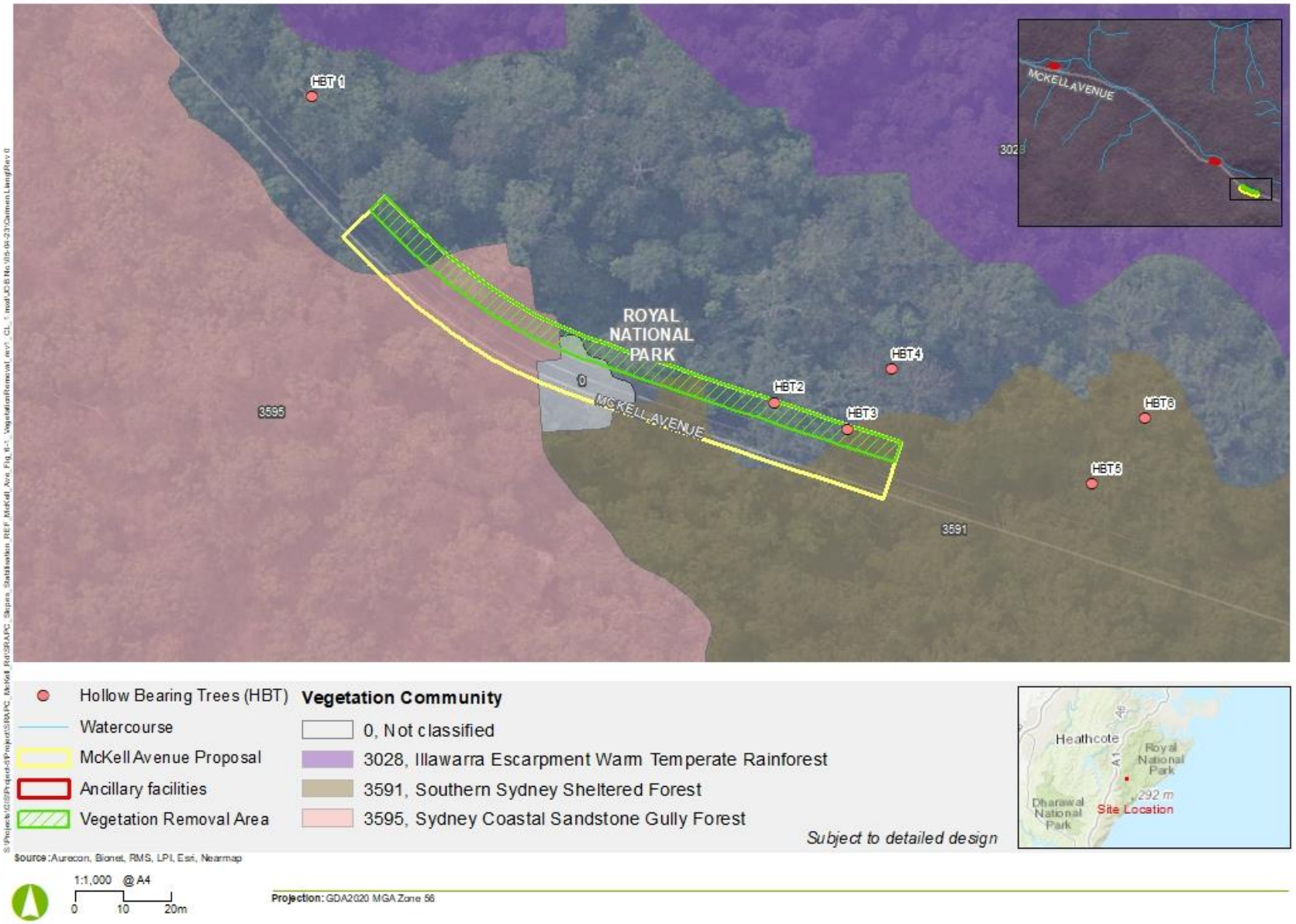

Figure 6-2 Vegetation removal and trimming

Operation

The proposal is not anticipated to have any ongoing impacts in relation to biodiversity. 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.

Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species 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* or Biodiversity Development Assessment Report is not required.

The proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act. The Five Part Test of Significance concluded that the proposal would directly impact about 0.0128 hectares of the TEC Southern Sydney sheltered forest on transitional sandstone soils. Based on these occupation estimates, vegetation removal would constitute between 0.00032 per cent to 0.0032 per cent of the existing community. The extent of the community within the Royal National Park is unknown, however the associated PCT 3591 encompasses approximately 11 hectares contiguous with the patch within the scope of works. Removal of the vegetation at McKell Avenue would constitute approximately 0.116 per cent of this vegetation patch.

The impacts of the proposal were regarded as negligible with the exception of impacts to threatened fauna species which is considered low. This assessment took into account the receiving environment and proposed mitigation measures which would limit the impact provided. See Appendix E for more detail.

The proposal would not endanger, displace or disturb terrestrial or aquatic fauna. The proposal would not create a barrier to movement, as the trees and tree stumps to be removed are in a disturbed roadside environment There are no trees to be removed with potential Powerful Owl associated nesting habitat and foraging habitat. Powerful Owl habitat occurs in larger, less disturbed landscapes i.e. wider Royal National Park. Nesting habitat would typically require large tree hollows (minimum 50 centimetres deep) in large eucalypts trees (diameter approximately 80 - 240 centimetres). It is unlikely the proposed activity would impact the species of conservation significance or create a barrier to movement.

6.1.4 Safeguards and management measures

The following section provides a list of mitigation measures that should be applied during the proposal (Table 6-5).

Table 6-5: Biodiversity safeguards and mitigation measures

No.	Impact	Environmental safeguards	Responsibility	Timing
B1	Vegetation management	Modification or removal of vegetation is not permitted outside the proposal footprint, including removal of dead timber or any other forest materials. During construction, vegetation removal would be reviewed to reduce tree and vegetation removal as far as practicable.	Contactor	Preconstruction Construction
B2	Vegetation management	Vegetation removal would be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Transport 2011*), and there would be restrictions of removal of dead vegetation outside the proposal footprint	Contactor	Preconstruction Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
B3	Vegetation management	Each tree that would be impacted by the works would be marked/identified prior to the commencement of works	Contractor	Preconstruction Construction
B4	Vegetation management	Tree removal is to be carried out by an arborist with a minimum AQF Level 5 qualification in Arboriculture and must be assessed prior to removal for the presence of fauna habitat values (such as hollows, nests or roosts).	Contactor	Preconstruction Construction
B5	Vegetation management	Trees removed for the proposal would be offset in line with the TfNSW Biodiversity Offset Policy (2022)	TfNSW Contactor	Preconstruction Construction
B6	Vegetation management	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: • A Tree and Hollow Replacement Plan will be prepared to address the impacts prior to the commencement of works; OR • Payment will be made to a Conservation Fund	Contactor	Preconstruction Construction
B7	Vegetation management	The vegetation removal area would be set up and clearly delineated using fencing or similar and sign posted. Exclusion zones would be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS 2011)	Contactor	Construction
B8	Vegetation management	Pre-clearance survey conducted to assess vegetation for habitat features including hollows and signs of fauna use if additional trees are identified for trimming or removal.	Contractor	Preconstruction Construction
B9	Vegetation management	An experienced fauna spotter-catcher must be present prior to and during clearance work working in accordance with a pre-prepared wildlife management plan to relocate any fauna encountered during clearance activities.	Contractor	Preconstruction Construction
B10	Vegetation management	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS 2011) if threatened ecological communities not assessed in the biodiversity assessment, are identified at either proposal site.	Contactor	Construction
B11	Vegetation management	Biosecurity risks (i.e. weeds and feral animals) must be managed in accordance with the *Biosecurity Act 2015* and detailed in the CEMP and FCNSW occupation permit conditions: • Disposal of double bagged weeds to a licenced waste disposal facility • Regular monitoring for weeds and pests	Contactor	Pre-construction Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		• Washdown procedure adhered to when traveling between sites and prior to entering the proposed activity area A biosecurity kit should be kept in all vehicles		
B12	Vegetation management	Trimming of trees at the Waterfall Flat picnic area and National Falls ancillary facilities would require approval from NPWS prior to tree trimming works	Contactor	Pre-construction Construction
B13	Vegetation planting / replanting	Consultation with and endorsement from National Parks and Wildlife Service (NPWS) needs to occur for any proposed vegetation planting.	Contactor	Pre-construction Construction
B14	Flora and fauna management plan	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: • plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • requirements set out in the Landscape Guideline (RMS, 2008) • pre-clearing survey requirements • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013) • protocols to manage weeds and pathogens	Contactor	Pre-construction Construction

6.1.5 Biodiversity offsets

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

PCT	Condition	TEC	Impact area	Threshold triggered?
PCT 3230: Central Coast Escarpment Moist Forest	Not assessed.	No associated TEC	Not assessed.	No. Tree and hollow replacement required.

PCT	Condition	TEC	Impact area	Threshold triggered?
PCT 3591: Southern Sydney Sheltered Forest	Not assessed.	BC Act Endangered TEC *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*	0.0128 hectares (assessed as 32 metres of impacted vegetation along McKell Avenue, extending 4 metres downslope)	No. Tree and hollow replacement required.
PCT 3595: Sydney Coastal Sandstone Gully Forest	Not assessed.	No associated TEC	Not assessed.	No. Tree replacement required.

Part of the proposal area is PCT 3591: Southern Sydney Sheltered Forest, which is associated with listed BC Act Endangered TEC*: Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*. As clearing is limited to approximately 0.0128 hectares hectares of TEC, the '≥ 2 hectares' condition threshold is not triggered. 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 prepared in accordance with the Transport for NSW Tree and hollow replacement guidelines (Transport 2022b).

6.2 Traffic and transport

6.2.1 Methodology

A desktop review of traffic and transport impacts was undertaken 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 undertaken as part of this assessment as the road infrastructure would remain unchanged during the operational phase.

6.2.2 Existing environment

McKell Avenue is the main road connecting the suburb of Waterfall with the Royal National Park, located in the Sutherland Shire LGA. Typically, the road is a two-way road with a single lane of traffic in either direction. The posted speed limit of the road is 60 kilometres per hour. However, due to the road failure there is currently a partial road closure of McKell Avenue with contraflow put in place (one lane functioning for two-way traffic).

Within the study area, there are no residential properties that require direct access from McKell Avenue. However, McKell Avenue provides public access to the Waterfall Flat picnic area and the National Falls lookout.

There are no pedestrian footpaths located along the road, however hikers may utilise the road and surrounds to access walking tracks within the Royal National Park.

The Park Connections bus travels through the study area connecting transport hubs on the outside and edge of the park with the attractions within. The bus has one route between Sutherland and Waterfall via Bundeena and uses McKell Avenue on its journey.

6.2.3 Potential impacts

Construction

Full road closure of McKell Avenue would occur 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. The road would be open during public holidays. The full road closure of McKell Avenue is required due to the size of machinery which would take up two lanes to operate. The road closure would restrict access to the Royal National Park from Waterfall during the weekdays. Advanced messaging Variable Messaging Signs (VMS) would be used to inform the public of road closures.

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.

Road closures would impact the Park Connection bus as well as the general public. In consultation with the bus operator either a detour route would be established (i.e. via Lady Wakehurst Drive in Lilyvale and Otford, as well as Lawrence Hargrave Drive, in Stanwell Tops and Helensburgh, then onto the Princes Motorway) or a truncated service would be provided to the public. For the general public, a detour route during weekdays would need to be established (i.e. via Lady Wakehurst Drive in Lilyvale and Otford, as well as Lawrence Hargrave Drive, in Stanwell Tops and Helensburgh, then onto the Princes Motorway) for a period of five months. This detour route would be about 25 kilometres, an additional 20 kilometres more than the usual route of travelling between Waterfall and Sir Bertram Drive using McKell Avenue (five kilometres). This would impact travel times of road users wanting to access the Royal National Park and surrounds during the week.

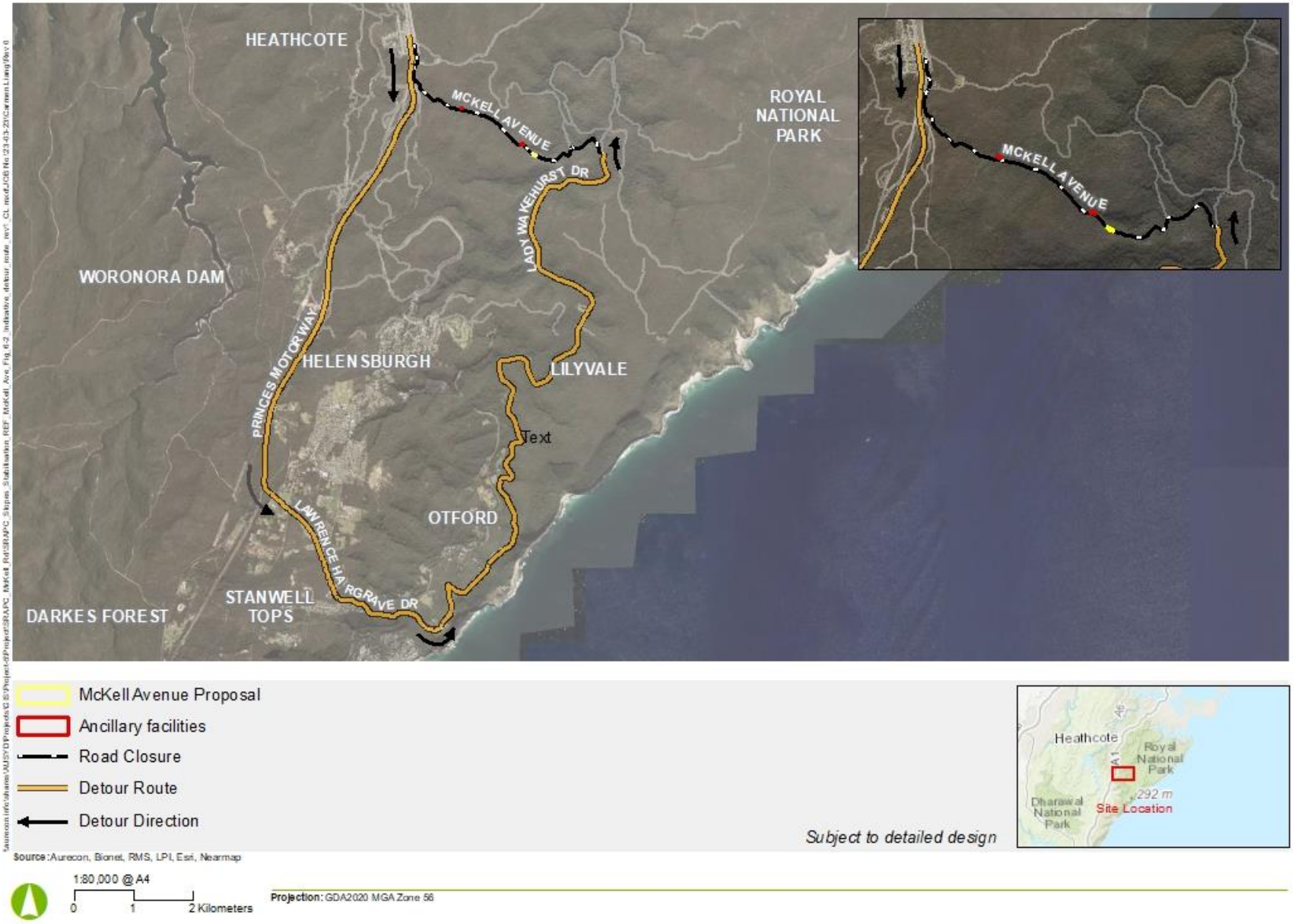

Figure 6-3 Indicative detour route

The proposal would restrict vehicle and pedestrian access to the Waterfall Flat picnic area, Gunjulla Flat picnic area and National Falls lookout for visitors of the Royal National Park due to road closures and set up of ancillary facilities within these areas. Use of the picnic areas would still be permitted during construction on the weekends, however, the use of the National Falls Lookout would not be able to be accessed or used during construction as the entire area would be used for the ancillary facility. Access to some hiking trails would also be restricted intermittently over the five months of construction.

Emergency vehicles would not be able to use McKell Avenue during weekdays during the road closure and would need to be notified of changed road conditions i.e. closures during the week and single lane operation on weekends.

A Road Occupancy Licence (ROL) would be obtained prior to road or lane closures and construction traffic managed through a Traffic Management Plan. Traffic management would be dependent the ROL approvals from the Traffic Management Centre.

Operation

The operation of the proposal would provide an improved pavement area and improved safety for all road users. There would be no other operational impacts to traffic and transport as a result of the proposal.

6.2.4 Safeguards and management measures

The following section provides a list of mitigation measures that should be applied during the proposal (Table 6-2).

Table 6-7 Safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing
TT1	Traffic management	A Traffic Management Plan (TMP) would be prepared prior to works commencing. The TMP would be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual (Roads and Maritime Services 2018) and QA Specification G10 Control of Traffic (Roads and Maritime 2008). The TMP would include: • site specific traffic control measures (including signage) to manage and regulate traffic movement • requirements and methods to consult and inform the local community of impacts on the local road network • a Traffic Movement Plan (VMP) showing the travel paths and locations of access and egress points to construction sites. This needs to include measures to prevent construction vehicles queueing on public roads • a response plan for any construction traffic incidents • monitoring, review and amendment measures	Contractor	Detailed design Pre-construction Construction
TT2	Traffic management	The TMP would be developed in conjunction with key stakeholders, particularly NPWS and	Contractor	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
		Sutherland Shire Council, where property and/or user access is impacted		Pre-construction Construction
TT3	Bus routes	The Park Connection bus operator would be consulted in advance of the proposal and timing of works and temporary impacts to bus routes.	Contractor	Pre-construction Construction
TT4	Emergency services	Emergency services would be notified of changed road conditions prior to construction	Contractor	Pre-construction
TT5	Community notification	Community would be notified of commencement of the proposal prior to construction. Notifications would include road closures and detour routes	Contractor	Pre-construction

6.3 Soils, surface water and groundwater

6.3.1 Methodology

The methodology for this assessment included a desktop review of the proposal area on 20 February 2023, 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
- local hydrology.

6.3.2 Existing environment

The desktop review of the workzone and ancillary facilities identified the soil and geological landscapes is predominantly comprised of the following:

- Watagan (9029wn) – Landscape is moderately inclined rolling low hills to very steep hills on fine-grained Narrabeen Group sediments. Local relief 50 – 150 m; slopes >25%. Narrow convex crests and ridges, steep colluvial side slopes, occasional sandstone boulders and benches. Tall open-forest with closed-forest (rainforest) in sheltered positions.
- Hawkesbury (9029ha)- landscape is rugged, rolling to very steep hills on Hawkesbury Sandstone. Local relief 100–200 m; slopes >25%. Surface rock >50%. Narrow crests and ridges, narrow incised valleys, steep side-slopes with narrow rocky benches, broken scarps and boulders. Mostly uncleared eucalypt woodland, open-forest (dry sclerophyll forest) and tall open forest (wet sclerophyll forest).

The desktop review identified that it is unlikely to encounter Acid Sulfate Soils (ASS) in the proposal area. A search of the EPA's List of Contaminated Sites Notified to the EPA was undertaken for the proposal and ancillary facilities. The search indicated there are no contaminated sites within 100 metres of the proposal and ancillary facilities. No further searches are required.

The proposal is around 25 metres from Waterfall Creek. The location of the proposal adjacent to the Royal National Park is susceptible to heavy rainfall events, however, is not located within an identified flood prone area. There are no identified groundwater bores near the proposal and supporting ancillary facilities.

Figure 6-4 Soil landscape of the proposal

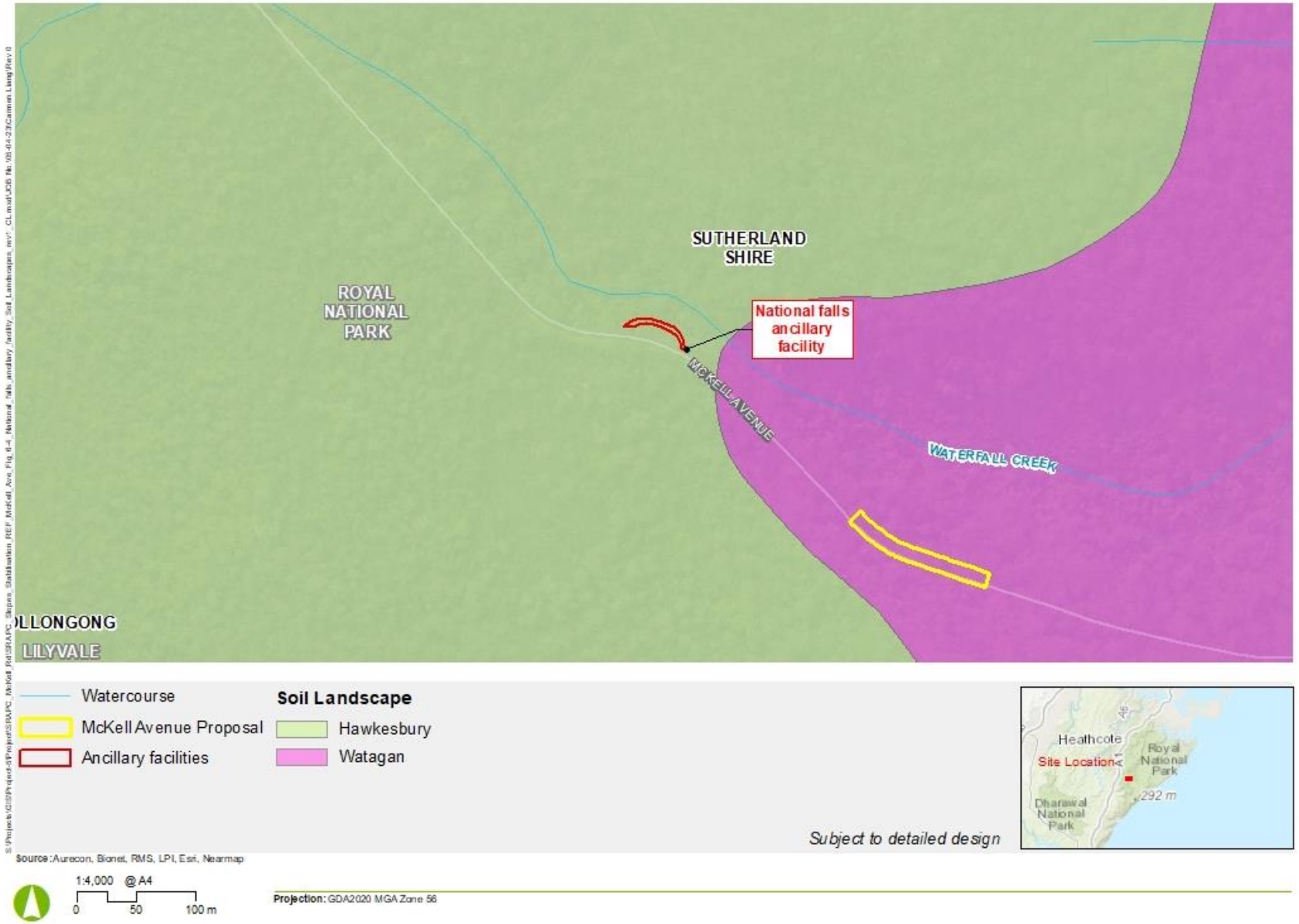

Figure 6-5 Soil landscape of the proposal

6.3.3 Potential impacts

Construction

The geological landscape of the proposal and the two ancillary facilities have an increased potential for soil erosion. Work activities related to the proposal that pose a risk of soil erosion and could impact surface water quality include:

- Removal of trees and vegetation on the downslope batter
- Topsoil stripping
- Piling activities including establishing a level pad around each pile
- Concrete works including the pouring of the new gutter on top of the piling cap as well as replacing the existing concrete slab at the culvert outlet
- Concrete washout activities at the Waterfall flat picnic ancillary facility
- Excavation of the landslip material
- Temporary soil stockpiling at the worksite and ancillary facilities as well as associated transportation of spoil
- Mud tracking of exposed/dirt covered work areas
- Accidental spills or leaks from vehicles, plant and machinery used, stored or re-fuelled on site.

If construction activities are not managed correctly, this may increase the risk of erosion and sedimentation as well as the mobilisation of sediment/concrete to nearby waterways. This could potentially lead to increased turbidity and other water quality impacts in Waterfall Creek (classed as high biodiversity value and sensitive to impacts from development and clearing). Erosion, sediment and water quality controls would be implemented and regularly maintained during the construction period, to reduce the potential for soil erosion and sedimentation.

There would be the potential for harmful substances to be released to the surface water environment at the works zone as a result of concrete activities, refuelling and inappropriate handling of plant/machinery. 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. Measures to minimise the impacts of accidental spills and leaks are summarised in Section 6.3.4.

A drainage channel is also located alongside McKell Avenue, adjacent to the proposed work site. If work activities are not managed correctly, this my increase the risk of erosion and sedimentation that may impact the efficiency of the drainage channel as well as carry sediments elsewhere. The implementation of mitigation measures such as the use of sandbag check dams, where required along the existing drainage system would be installed to reduce the potential impact of soil erosion and sedimentation. Temporary stockpiles at the worksite would be adequately managed to minimise the potential for sediment laden runoff to be discharged offsite and lead to sedimentation into receiving waters.

Ancillary facilities

As the identified ancillary facilities are existing designated car parks within the Royal National Park, no soil would be excavated to establish the Waterfall flat picnic area ancillary facility or the National Falls ancillary facility. Key functions of both the ancillary facilities include the storage of plant and equipment, as well as parking of personnel vehicles. 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 Waterfall flat picnic area ancillary facility. Concrete wash water is alkaline (pH of around 12) and contains high levels of chromium, with the potential to pollute surrounding land within the ancillary facility. Concrete washout material can also increase the pH of surrounding waters and has the potential to harm aquatic life and cause pollution of waters. 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 locations would be located away from sensitive environments i.e.. surrounding vegetation and Waterfall Creek, and adequately controlled with all wash downs contained within designated impervious bunding (refer to Transport Concrete Washout Guideline 3TP-SD-112/2.0 for concrete washout environment measures).

The installation of a temporary site shed within the National Falls ancillary facility would require the establishment of imported DGB hardstand to support the structure. As the site shed is temporary, measures such as the use of geofabric to separate the existing ground with the imported DGB would be installed. The National Falls area would be returned back to existing state on completion of construction.

It is proposed to temporarily stockpile excavated spoil at both the Waterfall Flat picnic area ancillary facility and the National Falls ancillary facility. If stockpiles are not managed correctly, this may increase the risk of erosion and sedimentation as well as the mobilisation of sediment/concrete to nearby waterways. This could potentially lead to increased turbidity and other water quality impacts in Waterfall Creek, as well as pollution of nearby vegetated areas. Separate stockpile sites would be established to segregate material of different waste classifications and prevent cross-contamination, where required. Stockpile sites would be established and managed in accordance with QA Specification R44 - Earthworks and the Stockpile Site Management Guideline (RMS, 2015d). Erosion and sediment control measures would be implemented, including requirements to cover and stabilise any long-term stockpiles, to minimise risk of mobilisation of materials off-site during high wind or storm events.

Operation

The proposal is not anticipated to have any ongoing impacts in relation to soils, surface water and groundwater. 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.

6.3.4 Safeguards and management measures

The following section provides a list of mitigation measures that should be applied during the proposal (

Table 6-8Table 6-12).

Table 6-8 Soil and contaminated land safeguards and mitigation 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 In the event that potential or actual acid sulphate soils are encountered during the works, potential or actual acid sulphate soils are to be managed in accordance with the Roads and Maritime	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		Guidelines for the Management of Acid Sulphate Materials 2005 and the SRAPC Acid Sulfate Soils Management Plan.		
SGC2	Accidental spill	Site-specific emergency spill-management measures will be developed in accordance 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 and EPA officers).	Contractor	Construction
SGC3	Spill control	Spill Kits are located close to the piling works and maintained to ensure they are fully stocked	Contractor	Construction
SGC4	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
SGC5	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
SGC6	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
SGC7	Spill control – ancillary facilities	No 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
SGC8	Erosion and Sedimentation	A site-specific Erosion and Sediment Control Plan will be prepared and implemented as part of the CEMP. The plan is to include:	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		• Erosion and sedimentation mitigation measures to stabilise site • Erosion and sedimentation mitigation measures to minimise sediment moving offsite and sediment laden water entering any water course, drainage lines or drain inlets. Some example of mitigation measures could include sand bags near inlets • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).		
SGC9	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
SGC10	Erosion and Sedimentation	Erosion and sediment control measures would not to be removed until the works are complete, and areas are stabilised.	Contractor	Construction
SGC11	Erosion and Sedimentation - stockpiles	Stockpile sites would be established and managed in accordance with QA Specification R44 - Earthworks and the Stockpile Site Management Guideline (RMS, 2015d)	Contractor	Construction
SGC12	Erosion and Sedimentation - stockpiles	Separate stockpile sites would be established to segregate material of different waste classifications and prevent cross-contamination, where required.	Contractor	Construction
SGC13	Erosion and Sedimentation - stockpiles	Erosion and sediment control measures would be implemented for stockpiles, including requirements to cover and stabilise stockpiles, to minimise risk of	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		mobilisation of materials off-site during high wind or storm events.		
SGC14	Erosion and Sedimentation	Implement measures to minimise tracking of dirt and mud into public roads and other public spaces	Contractor	Construction
SGC15	Erosion and Sedimentation	Use sandbag check dams to protect drainage channels and pits, as required	Contractor	Construction
SGC16	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
SGC17	Ancillary facility plan	An ancillary facility plan would be prepared and implemented prior to construction The plan would contain details on ancillary facility layout as well as the proposed controls.	Contractor	Construction
SGC18	Erosion and sedimentation – National Falls ancillary facility	The proposed hardstand for the site shed at the National Falls ancillary facility would be lined/separated with geofabric	Contractor	Construction
SGC19	Concrete washout	Concrete washout locations would be located away from sensitive environments i.e. surrounding vegetation and Waterfall Creek, and adequately controlled with all wash downs contained within designated impervious bunding	Contractor	Construction
SGC20	Water quality	There is to be no release of dirty water into drainage lines and/or waterways.	Contractor	Contractor
SGC21	Water quality	Water quality control measures would be used to prevent any materials (e.g. concrete, grout, sediment etc.) entering drain inlets or waterways.	Contractor	Contractor
SCG22	Water quality	Excess debris from cleaning and washing is removed using hand tools.	Contractor	Contractor
SCG23	Water quality	Refuelling of plant and machinery must be undertaken off site or in an impervious double bunded area away from drainage lines.	Contractor	Contractor
SCG24	Stabilisation Plan	A Stabilisation Plan is to be prepared as part of the CEMP.	Contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		The stabilisation plan is to include but not be limited to the following: • identification and methodology of techniques for stabilisation of site. • identification of area on site for progressive stabilisation. • 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 • identification of areas on site for progressive permanent stabilisation such as implementation of landscaping.		Construction

6.4 Noise and vibration

6.4.1 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.

As construction would be carried out in 24 hour periods over five days, both Standard hours as well as Out of Hours Work (OOHW) would be used. Therefore for the noise assessment, worst case scenario noise assessments were conducted for OOHW. This is due to the OOHW assessment providing more conservative noise management levels (NMLs) compared to those observed in standard hours.

A distance based (noisiest plant) assessment in the tool was selected with:

- the '13.5T Excavator With Hammer' selected as the noisiest plant being used at the proposal area
- the '2.5T Smoothdrum Roller' was selected as the noisiest plant used at both ancillary facilities.

6.4.2 Existing environment

Background noise levels

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 in the study area are typically dominated by natural noise i.e.. birds, wind through the trees, etc. The existing noise levels are represented by the representative noise area category R0. This noise environment was selected as the study area is surround by the Royal National Park, over a kilometre away from the closest highway- the Princes Highway, as well as any sensitive receivers.

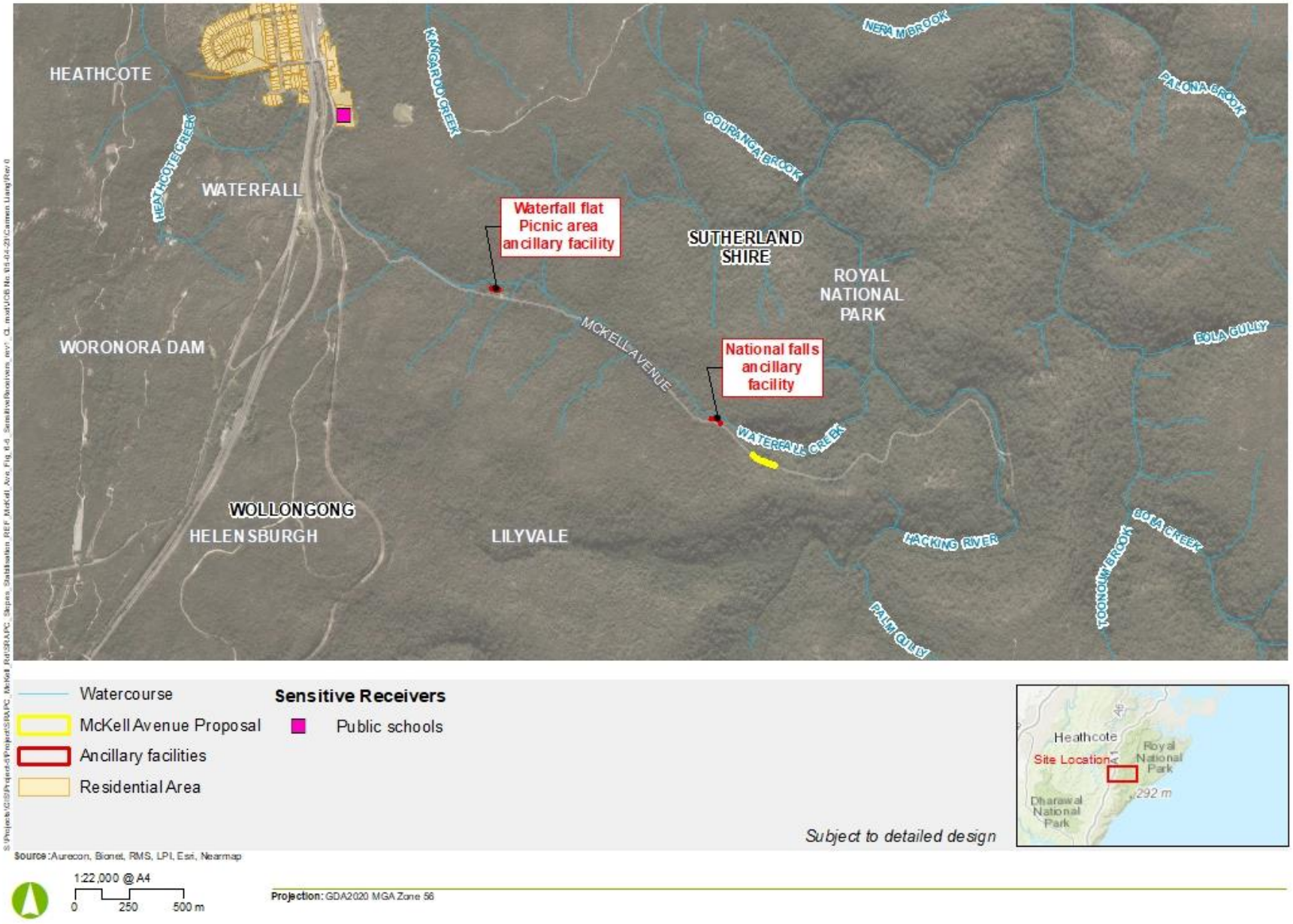

Figure 6-6 Sensitive receivers

6.4.3 Criteria

The rated background level (RBL) criteria and corresponding representative noise area category for the proposal is summarised in Table 6-9.

Table 6-9 Rated background level (RBL)

Representative noise area category	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 CNVG (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 6-10.

Table 6-10 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

Given that the works are proposed to be undertaken during out of hours night-time periods, sleep disturbance levels were estimated to be LAmax 65dB(A) in accordance with the Noise Estimator tool and the *Transport for NSW Construction Noise and Vibration Guideline* (Roads and Maritime 2016).

6.4.4 Potential impacts

Construction

The assessment of construction noise impacts using the Transport for NSW Construction Noise Estimator tool are summarised in the following sections.

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 typically be less than predicted.

Table 6-11 provides a summary of the predicted construction noise exceedances per site during out of hours works night-time. Impacts for night-time work hours have been rated as:

- Noticeable: between 1 and 5dBA increase
- Clearly audible NML exceedance of between 6 and 15dBA
- Moderately intrusive: NML exceedance of between 16 and 25dBA
- Highly intrusive: NML exceedance of over 25dBA

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 traffic movements would be required for the works.

Due to the isolated location of the works as well as undulating topography providing substantial noise attenuation, noise impacts would be inaudible to the nearest sensitive receiver. The noise calculation results indicate that impact to the nearest sensitive receiver (about one kilometre from the proposal) during out-of-hours work would be inaudible i.e., less than 1 dBA and cannot be heard by any sensitive receivers across all locations. Due to the proximity of the works to any buildings or built structures, vibration for the proposal was not assessed, and no impacts are expected.

Table 6-11 Predicted construction noise exceedances per activity – residential receivers

Site	NML	Exceedance over NML (dBA)	Receiver perception at the worst affected receiver	Additional mitigation measures
Proposed work site	35	-33	Inaudible	N/A
Waterfall flat picnic area ancillary facility	35	-26	Inaudible	N/A
National Falls ancillary facility	35	-50	Inaudible	N/A

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.

6.4.5 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 Noise and vibration safeguards and mitigation measures

No.	Impact	Environmental safeguards	Responsibility	Timing
NV1	Noise and vibration inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • site opening/closing times (including deliveries) • environmental incident procedures.	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	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		conditions, with periodic monitoring.		
NV4	Plant not in use	Plant not in use for extended periods must be shut down where practicable.	Contractor	Construction

6.5 Other impacts

This section details any additional potential impacts that may contribute to the proposal. However, these impacts have been considered as negligible to minor in nature.

6.5.1 Existing environment and potential impacts

The existing environment and potential impacts are summarised in Table 6-13.

Table 6-13: Other impacts

Environmental factor	Existing environment	Potential impacts
Landscape character and visual amenity	The proposal are located along a 74 metre section of McKell Avenue, on the border of Uloola and Lilyvale. McKell Avenue is a regional road in the Royal National Park. Either side of the road is densely vegetated.	**Construction** There would be temporary visual impacts associated with construction work of the proposal for road users and hikers. For the proposed work site, these impacts would mainly involve the set-up of the worksite such as barriers and the presence of plant and machinery within the worksite. These impacts would be short-term during construction and would be returned back to their existing state upon completion. Impacts associated with the Waterfall Flat picnic area ancillary facility would involve the fencing set up around the facility and the presence of, plant and equipment, portable toilets, spoil stockpiles, concrete washout areas, parking of personnel vehicles and a waste bin. These visual impacts are expected to be more visible as this area is used by patrons of the Royal National Park for picnicking and leisure activities. These impacts however would be mitigated by installing a shade cloth around the fencing and the ancillary facility would only be temporary during construction with the area returned back to existing state on completion. Impacts associated with the National Falls ancillary facility would involve the presence of the site shed, portable toilets, plant and equipment, parking of personnel vehicles, materials, spoil stockpiles and a waste bin. The visual impacts of the ancillary facilities would be clearly visible to road users and hikers. These impacts however would be mitigated by installing a shade cloth around the fencing and the ancillary facility would only be temporary during construction with the area returned back to existing state on completion. **Operation** The proposal would not materially alter the character of the area. This impact was considered negligible. The visual impact is considered negligible as the extent and nature of the works is minor and cannot easily be viewed by members of the public i.e., obscured by vegetation and located downslope.

Environmental factor	Existing environment	Potential impacts
Aboriginal cultural heritage	A Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) Stage 1 investigation has been prepared for the proposal and is provided in Appendix E. An AHIMS search was completed on 20th October 2022 for the proposal using a 100 metre buffer of the general proposal area and supporting ancillary facilities. The AHIMS searches showed no heritage items within the proposed work location and also at the ancillary facility National Falls ancillary facility. The closest Aboriginal site was located around 100 metres from the Waterfall flat picnic area ancillary facility (Site ID #52-3-0878), however, the site establishment and operation of this ancillary facility would not impact the site due to the minor scale and nature of the works. A search of the Native Title Tribunal Native Title Vision website was undertaken, with one Native Title holders/claimants identified (South Coast People NC2017/003).	**Construction** An Aboriginal Heritage Information Management System (AHIMS) search was undertaken for the proposal including ancillary facilities . The AHIMS search indicated there was one Aboriginal site located within 100 metres of the Waterfall flat picnic area ancillary facility (Site ID #52-3-0878). However the site establishment and operation of this ancillary facility would not impact the site due to the minor scale and nature of the works. Use of the ancillary facility would not include any excavation or vegetation removal (only minor vegetation trimming proposed). The proposal is considered to have no to low potential to disturb archaeological material. A Procedure for Aboriginal Cultural Heritage Investigation (PACHCI) was conducted in October 2022. The proposal was assessed as being unlikely to have an impact on Aboriginal cultural heritage based on the following 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. The Stage 1 PACHCI assessment is provided in Appendix D. If unexpected items/finds are uncovered during construction activities, the *Roads and Maritime Unexpected Heritage Fine Procedure* is to be followed. The proposal would require consultation with the identified Native Title claimants- South Coast People under the *Native Title Act 1993*.

Environmental factor	Existing environment	Potential impacts
		Operation Operation of the proposal is not expected to impact Aboriginal cultural heritage.
Non-Aboriginal Heritage	The following database searches were completed on 25th of July 2022: • Local Heritage: Sutherland Shire Local Environmental Plan 2015 • State Heritage: NSW State Heritage Register • National Heritage: Australian Heritage Register A search of the MNEs database found that the proposal would be adjacent to the Royal National Park and Garawarra State Conservation Area. The Royal National Park was the first National Park to be established in Australia (1879), regarded as beginning of non-Aboriginal Australian conservation. Of all the registers, the closest heritage item (Fosters Flat saw pit), listed on the Australian Heritage Register is in 740 metres from the proposal. A copy of the heritage database searches is available in Appendix H.	**Construction** The proposal is considered to have no impact to non-Aboriginal heritage items as the identified sites would be avoided during construction. **Operation** Operation of the proposal is not expected to impact non-Aboriginal heritage.
Air quality	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: • carbon monoxide • Total Volatile Organic Compounds • polycyclic aromatic hydrocarbons • oxides of nitrogen • particulate matter 10.0 um. There are no facilities within 100 metres of this site. The local road network and associating arterial roads across the proposed sites are main contributing sources of local air pollution	**Construction** The scope of the proposal is small and so subsequent dust impacts and vehicle emissions would be temporary and minor. They would be adequately managed by standard safeguards. No fumes or odours expected from works. **Operation** The proposal would not result in any air quality impacts during operation.
Waste	The proposed work requires up to two temporary ancillary facilities. These sites would hold site sheds, work vehicle parking, workshops and storage areas for the delivery and storage of viaduct structural elements, and waste.	**Construction**

Environmental factor	Existing environment	Potential impacts
	The two proposed ancillary facilities are currently owned by NPWS with land use classified under E1 National Parks and Nature Reserves.	Construction activities associated with the proposal would generate waste, and if not managed correctly could potentially impact nearby land and water. Waste streams likely to be generated during construction of the overall proposal include: • Concrete and steel • Excess spoil would be removed from site • Green waste as a result of vegetation removal. Green waste would be sent to a composting facility • Packaging and general waste from staff (e.g. lunch packaging, portable toilets) • Chemicals and oils • Waste water from wash-down and bunded areas • Redundant erosion and sediment controls. Unsuitable spoil and all other wastes would be classified in accordance with the *NSW EPA Waste Classification Guidelines* (2014) and disposed of at an appropriately licensed facility. Final waste classification is required once the volumes of waste requiring offsite disposal during construction are confirmed. **Operation** There are no anticipated impacts from waste during the operation of the proposal.
Socio-economic	McKell Avenue is a regional road. This road is used by motorists, transport businesses, tourists to the Royal National Park and emergency services.	**Construction** The following socio-economic impacts have been assessed in previous sections: • Noise and vibration (Section6.4). Noise and vibration impacts would be inaudible due to the distance of the proposal area and ancillary facilities to the nearest sensitive receivers. • Visual impacts (Section 6.5). There would be temporary visual impacts associated with construction work of the proposal for road users, hikers and visitors to the Royal National Park. Temporary visual impacts as a result of barriers, plant/equipment, fencing for ancillary facilities, waste bins and a site shed.

Environmental factor	Existing environment	Potential impacts
		• Traffic and transport (Section 6.2). Full road closure would occur during weekdays over five months of construction. McKell Avenue would be reopened again on the weekends, with one lane still closed near the proposal area to maintain public safety. Detours during weekdays would need to be established between Waterfall and Sir Bertram Stevens Drive (25 kilometres) which would require road users to travel an additional 20-kilometres. This would cause delays in travel times for road users and users of the bus service, particularly during public holidays and/or school holidays where visitors to the National Park would likely increase. During full road closure, public spaces and recreational areas would not be able to be accessed e.g. Waterfall Flat picnic area, Gunjulla Flat picnic area and National Falls lookout. However, use of these picnic areas would still be permitted on weekends. **Operation** Socio-economic impacts may include improved safety for road users during the operation of the proposal.
Greenhouse gases and climate change	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. Transport emissions are currently the second largest component of the greenhouse gas emissions in NSW, comprising of 21 per cent of total emissions. Road transport accounts for 85 per cent of these transport emissions (AdaptNSW, 2017).	**Construction** During construction, the proposal would result in minor greenhouse gas emissions through use of materials (including the embodied emissions in the production of materials) as well as use of construction equipment and vehicles. However, given the small scale of the proposal these emissions would have a negligible contribution to NSW's emissions. Opportunities to minimise emissions related to construction of the proposal would be further investigated during detailed design, including optimising the construction schedule to reduce the duration of full road closures, sourcing materials from local suppliers and using recycled and low embodied energy materials, where practical. **Operation** During operation, the proposal would improve network reliability and access through the Royal National Park via McKell Avenue. This may reduce the amount of greenhouse gas emissions from vehicles. However, the overall magnitude of any reductions in greenhouse gas emissions from vehicles travelling along the

Environmental factor	Existing environment	Potential impacts
		proposal are expected to be relatively negligible given the small scale of the proposal.
Hazards and risk management	At present, NSW Rural Fire Service Bushfire Prone Land (NSW RFS, 2015) mapping classifies McKell Avenue within the proposal area as a 'Vegetation Category 1', which reflects the highest bushfire risk. There is no existing storage or handling of hazardous and dangerous materials associated with operation of McKell Avenue beyond small quantities that may be required for occasional maintenance activities. Fuel spills may occur as a result of vehicle crashes.	**Construction** The proposal work site and ancillary facilities are adjacent to dense bushland, increasing the potential risk for bushfire within these areas. Construction activities may have the potential to increase bushfire risk during construction. This potential risk at the proposed work site would be mainly due to fuel/chemical storage and plant operation within vegetated areas (i.e. exhaust fires). As road closures are expected during shifts of construction, emergency vehicles would require access to the proposed site and evacuation plans would be required in the case of an emergency. Thereafter stop / slow traffic control signage with a contraflow operation, in which emergency vehicles could experience difficulty accessing area. For these reasons a bushfire management plan would need to be put in place (refer to section 6.4.2). **Operation** During operation, the proposal is not expected to increase bushfire hazards. The proposal however would improve emergency access into the Royal National Park for the NSW RFS, NSW SES and other emergency services.

6.5.2 Safeguards and management measures

Safeguards and management measures are summarised in Table 6-14.

Table 6-14: Safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing
VA1	Visual amenity	The installation and maintenance of outward facing elements of site fencing with a shade cloth (or similar material), to minimise visual impacts at ancillary facilities during construction	Contractor	Construction
VA2	Visual amenity	Temporary site lighting, for security purposes or night works will be installed and operated in accordance with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting	Contractor	Construction
VA3	Visual amenity	Graffiti would need to be removed or painted over promptly in line with the following timeframes: - Offensive graffiti must be cleaned or covered within 24 hours - Highly visible yet non-offensive graffiti must be cleaned or covered within one week - Graffiti that is neither offensive nor highly visible must be cleared or covered during normal operations within	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 would only re-commence once the requirements of that Procedure have been satisfied	Contractor	Construction
ABO1	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.	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 199*7 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:	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		• Avoid unnecessary resource consumption as a priority • Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) • Disposal is undertaken as a last resort (in accordance with the Waste Avoidance & Resource Recovery Act 2001).		
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
WA3	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: • Removal by a licenced waste contractor and disposal at an accredited materials recycling or waste disposal facility. As otherwise provided for by the relevant waste legislation.	Contractor	Construction
SOC1	Socio-economic	Complaints received are to be recorded and attended to promptly.	Contractor	Construction
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 construction compounds, feasible bushfire reduction methods and the potential to incorporate asset protection zones.	Contractor	Construction

6.6 Cumulative impacts

6.6.1 Study area

The cumulative impact assessment has considered the following suburbs:

- Uloola
- Lilyvale
- Waterfall

6.6.2 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.

6.6.3 Other projects and developments

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 undertaken in isolation.

A search of the NSW Government Major Projects website (NSW Government 2022) found no other major projects or developments were identified within 100 metres of the proposed site. However, although not currently on the major projects website, other nearby proposals as part of SRAPC have been considered. These are summarised in Table 6-15.

Table 6-15 Past, present and future projects

Project	Construction impacts	Operational impacts
Garie Road slope stabilisation	Construction impacts may include: • Biodiversity impacts as a result of encroaching into National Park and removing vegetation • Soil impacts as the existing soil environment in the area is considered highly erodible.	There are no operational impacts

6.6.4 Potential impacts

There are no additional impacts associated with cumulative impacts as the Garie Road slope stabilisation works are located over five kilometres from the proposal. This coupled with Garie Road is currently closed to the public.

6.6.5 Safeguards and management measures

There are no additional safeguards and management measures proposed.

7. Environmental management

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

7.1 Environmental management plans (or system)

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) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will 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 will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the *QA Specification G36 - Environmental Protection (Management System)*, *QA Specification G38 - Soil and Water Management (Soil and Water Plan)*, *QA Specification G40 - Clearing and Grubbing* and *QA Specification G10 - Traffic Management*.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will 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 will minimise any potential adverse impacts arising from the proposal 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	Responsibility	Timing
GEN1	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Environment Manager as well as the NPWS, prior to commencement of the activity. As a minimum, the CEMP will address the following: • any requirements associated with statutory approvals • details of how the project will implement the identified safeguards outlined in the REF • issue-specific environmental management plans • roles and responsibilities • communication requirements • induction and training requirements • procedures for monitoring and evaluating environmental performance, and for corrective action • reporting requirements and record-keeping • procedures for emergency and incident management • procedures for audit and review. The endorsed CEMP will be implemented during the undertaking of the activity.	Contractor / Transport for NSW project manager	Pre-construction Detailed design
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 / Transport for NSW project manager	Pre-construction
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. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include • sensitive area locations incident response and reporting procedures	Contractor / Transport for NSW project manager	Pre-construction Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
B1	Vegetation management	Modification or removal of vegetation is not permitted outside the proposal footprint, including removal of dead timber or any other forest materials. During construction, vegetation removal would be reviewed to reduce tree and vegetation removal as far as practicable.	Contactor	Preconstruction Construction
B2	Vegetation management	Vegetation removal would be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Transport 2011*), and there would be restrictions of removal of dead vegetation outside the proposal footprint	Contactor	Preconstruction Construction
B3	Vegetation management	Each tree that would be impacted by the works would be marked/identified prior to the commencement of works	Contractor	Preconstruction Construction
B4	Vegetation management	Tree removal is to be carried out by an arborist with a minimum AQF Level 5 qualification in Arboriculture and must be assessed prior to removal for the presence of fauna habitat values (such as hollows, nests or roosts).	Contactor	Preconstruction Construction
B5	Vegetation management	Trees removed for the proposal would be offset in line with the TfNSW Biodiversity Offset Policy (2022)	TfNSW Contactor	Preconstruction Construction
B6	Vegetation management	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: • A Tree and Hollow Replacement Plan will be prepared to address the impacts prior to the commencement of works; OR • Payment will be made to a Conservation Fund	Contactor	Preconstruction Construction
B7	Vegetation management	The vegetation removal area would be set up and clearly delineated using fencing or similar and sign posted. Exclusion zones would be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS 2011)	Contactor	Construction
B8	Vegetation management	Pre-clearance survey conducted to assess vegetation for habitat features including hollows and signs of fauna use if additional trees are identified for trimming or removal.	Contractor	Preconstruction Construction
B9	Vegetation management	An experienced fauna spotter-catcher must be present prior to and during clearance work working in accordance with a pre-prepared wildlife management plan to relocate any fauna encountered during clearance activities.	Contractor	Preconstruction Construction
B10	Vegetation management	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS 2011) if threatened ecological communities not assessed in the biodiversity assessment, are identified at either proposal site.	Contactor	Construction
B11	Vegetation management	Biosecurity risks (i.e. weeds and feral animals) must be managed in accordance with the *Biosecurity Act 2015* and detailed in the CEMP and FCNSW occupation permit conditions: • Disposal of double bagged weeds to a licenced waste disposal facility • Regular monitoring for weeds and pests • Washdown procedure adhered to when traveling between sites and prior to entering the proposed activity area A biosecurity kit should be kept in all vehicles	Contactor	Pre-construction Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
B12	Vegetation management	Trimming of trees at the Waterfall Flat picnic area and National Falls ancillary facilities would require approval from NPWS prior to tree trimming works	Contactor	Pre-construction Construction
B13	Vegetation planting / replanting	Consultation with and endorsement from National Parks and Wildlife Service (NPWS) needs to occur for any proposed vegetation planting.	Contactor	Pre-construction Construction
B14	Flora and fauna management plan	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: • plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • requirements set out in the Landscape Guideline (RMS, 2008) • pre-clearing survey requirements • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013) protocols to manage weeds and pathogens	Contactor	Pre-construction Construction
TT1	Traffic management	A Traffic Management Plan (TMP) would be prepared prior to works commencing. The TMP would be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual (Roads and Maritime Services 2018) and QA Specification G10 Control of Traffic (Roads and Maritime 2008). The TMP would include: • site specific traffic control measures (including signage) to manage and regulate traffic movement • requirements and methods to consult and inform the local community of impacts on the local road network • a Vehicle Movement Plan (VMP) showing the travel paths and locations of access and egress points to construction sites. This needs to include measures to prevent construction vehicles queueing on public roads • a response plan for any construction traffic incidents monitoring, review and amendment measures	Contractor	Detailed design Pre-construction Construction
TT2	Traffic management	The TMP would be developed in conjunction with key stakeholders, particularly NPWS and Sutherland Shire Council, where property and/or user access is impacted	Contractor	Detailed design Pre-construction Construction
TT3	Bus routes	The Park Connection bus operator would be consulted in advance of the proposal and timing of works and temporary impacts to bus routes.	Contractor	Pre-construction Construction
TT4	Emergency services	Emergency services would be notified of changed road conditions prior to construction	Contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
TT5	Community notification	Community would be notified of commencement of the proposal prior to construction. Notifications would include road closures and detour routes	Contractor	Pre-construction
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 In the event that potential or actual acid sulphate soils are encountered during the works, potential or actual acid sulphate soils are to be managed in accordance with the Roads and Maritime Guidelines for the Management of Acid Sulphate Materials 2005 and the SRAPC Acid Sulfate Soils Management Plan.	Contractor	Construction
SGC2	Accidental spill	Site-specific emergency spill-management measures will be developed in accordance 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 and EPA officers).	Contractor	Construction
SGC3	Spill control	Spill Kits are located close to the piling works and maintained to ensure they are fully stocked	Contractor	Construction
SGC4	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
SGC5	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
SGC6	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
SGC7	Spill control – ancillary facilities	No 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
SGC8	Erosion and Sedimentation	A site-specific Erosion and Sediment Control Plan will be prepared and implemented as part of the CEMP. The plan is to include: • Erosion and sedimentation mitigation measures to stabilise site • Erosion and sedimentation mitigation measures to minimise sediment moving offsite and sediment laden water entering any water course, drainage lines or drain inlets. Some example of mitigation measures could include sand bags near inlets • Reduce water velocity and capture sediment on site • Minimise the amount of material transported from site to surrounding pavement surfaces • Divert clean water around the site (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
SGC9	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
SGC10	Erosion and Sedimentation	Erosion and sediment control measures would not to be removed until the works are complete, and areas are stabilised.	Contractor	Construction
SGC11	Erosion and Sedimentation - stockpiles	Stockpile sites would be established and managed in accordance with QA Specification R44 - Earthworks and the Stockpile Site Management Guideline (RMS, 2015d)	Contractor	Construction
SGC12	Erosion and Sedimentation - stockpiles	Separate stockpile sites would be established to segregate material of different waste classifications and prevent cross-contamination, where required.	Contractor	Construction
SGC13	Erosion and Sedimentation - stockpiles	Erosion and sediment control measures would be implemented for stockpiles, including requirements to cover and stabilise stockpiles, to minimise risk of mobilisation of materials off-site during high wind or storm events.	Contractor	Construction
SGC14	Erosion and Sedimentation	Implement measures to minimise tracking of dirt and mud into public roads and other public spaces	Contractor	Construction
SGC15	Erosion and Sedimentation	Use sandbag check dams to protect drainage channels and pits, as required	Contractor	Construction
SGC16	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
SGC17	Ancillary facility plan	An ancillary facility plan would be prepared and implemented prior to construction The plan would contain details on ancillary facility layout as well as the proposed controls.	Contractor	Construction
SGC18	Erosion and sedimentation – National Falls ancillary facility	The proposed hardstand for the site shed at the National Falls ancillary facility would be lined/separated with geofabric	Contractor	Construction
SGC19	Concrete washout	Concrete washout locations would be located away from sensitive environments i.e. surrounding vegetation and Waterfall Creek, and adequately controlled with all wash downs contained within designated impervious bunding	Contractor	Construction
SGC20	Water quality	There is to be no release of dirty water into drainage lines and/or waterways.	Contractor	Contractor
SGC21	Water quality	Water quality control measures would be used to prevent any materials (e.g. concrete, grout, sediment etc.) entering drain inlets or waterways.	Contractor	Contractor
SCG22	Water quality	Excess debris from cleaning and washing is removed using hand tools.	Contractor	Contractor
SCG23	Water quality	Refuelling of plant and machinery must be undertaken off site or in an impervious double bunded area away from drainage lines.	Contractor	Contractor

No.	Impact	Environmental safeguards	Responsibility	Timing
SCG24	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: • identification and methodology of techniques for stabilisation of site. • identification of area on site for progressive stabilisation. • 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 identification of areas on site for progressive permanent stabilisation such as implementation of landscaping.	Contractor	Pre-construction Construction
NV1	Noise and vibration inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • site opening/closing times (including deliveries) environmental incident procedures.	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 where practicable.	Contractor	Construction
VA1	Visual amenity	The installation and maintenance of outward facing elements of site fencing with a shade cloth (or similar material), to minimise visual impacts at ancillary facilities during construction	Contractor	Construction
VA2	Visual amenity	Temporary site lighting, for security purposes or night works will be installed and operated in accordance with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting	Contractor	Construction
VA3	Visual amenity	Graffiti would need to be removed or painted over promptly in line with the following timeframes: - Offensive graffiti must be cleaned or covered within 24 hours - Highly visible yet non-offensive graffiti must be cleaned or covered within one week - Graffiti that is neither offensive nor highly visible must be cleared or covered during normal operations within	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
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 would only re-commence once the requirements of that Procedure have been satisfied	Contractor	Construction
ABO1	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.	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 199*7 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: • Avoid unnecessary resource consumption as a priority • Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) Disposal is undertaken as a last resort (in accordance 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
WA3	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: • Removal by a licenced waste contractor and disposal at an accredited materials recycling or waste disposal facility. As otherwise provided for by the relevant waste legislation.	Contractor	Construction
SOC1	Socio-economic	Complaints received are to be recorded and attended to promptly.	Contractor	Construction
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 construction compounds, feasible bushfire reduction methods and the potential to incorporate asset protection zones.	Contractor	Construction

7.3 Licensing and approvals

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Roads Act 1993	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.

The proposed reopening of the closed lane along McKell Avenue is subject to assessment under Division 5.1 of the EP&A Act. The REF has fully examined and considered all possible matters affecting or likely to affect the environment by reason of the proposed activity.

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 access, biodiversity, and landscape character. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also increase stability of the adjacent slope along McKell Avenue, improving road safety and resilience of existing infrastructure. On balance the proposal is considered justified and the following conclusions are made.

8.1 Justification

The proposal is required to reinstate the failed road pavement and reopen the closed lane along McKell Avenue which as occurred as a result of extreme weather events and adjacent slope failure. The identified site poses a potential safety risk to traffic accessing and moving through the Royal National Park from Waterfall.

8.1.1 Social factors

The proposal would have some social implications. It is recognised that the proposal would have some impacts to road users during construction as a result of temporary road closures. The safeguards and mitigation measures included in the environmental assessment (refer to section 6) would minimise impacts during construction.

There would also be positive social implications by undertaking the proposal. Reopening the closed lane of McKell Avenue as well as improving the stability of the adjacent slope would improve the safety of road users and reinstate access into and through the Royal National Park from Waterfall.

8.1.2 Biophysical factors

The proposal would involve the removal of up to 71 trees (70 native) greater than five centimetres at diameter at breast height (dbh) (including up to 29 trees more than 20 centimetres dbh), two tree stumps, general vegetation including sapling and juvenile trees less than five centimetres diameter at breast height, as well as minor trimming (i.e. less than 10 per cent of the canopy) of vegetation on the downslope batter and at the Waterfall Flat picnic area ancillary facility and the National Falls ancillary facility. Trimming of trees at both ancillary facilities would require approval from National Parks and Wildlife Services (NPWS) prior to tree trimming works (refer to Section 6.1). The removal and trimming of vegetation would include those part of a threatened ecological community. The outcomes Five Part Test of Significance concluded that the proposal would not modify the composition of the community, as vegetation removal would not target one species or a group of species within the community. Vegetation removal is proposed at the understory, midstory, and canopy level. The safeguards and mitigation measures included in the environmental assessment would further minimise these risks.

8.1.3 Economic factors

By undertaking this proposal, Transport would reduce ongoing costs and potential risks to road users associated with the existing maintenance regime of McKell Avenue. The proposal would result in reopening of the closed lane of McKell Avenue as well as the stabilisation of the adjacent slope, potentially minimising the need and cost for ongoing repairs.

8.1.4 Public interest

The proposal would be of public interest due to the safety benefits it would provide. The proposal would increase the stability of the slope adjacent to McKell Avenue and the resilience of the existing infrastructure, subsequently improving the safety of road users.

8.2 Objects of the EP&A Act

Table 8-1 Objects of the Environmental Planning and Assessment Act 1979

Instrument	Requirement
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.	The proposal improves road safety for users of McKell Avenue.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	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 overall proposal and the REF proposal is considered in detail in section 6. An options process was also undertaken 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.
1.3(c) To promote the orderly and economic use and development of land.	Reopening the closed lane of McKell Avenue as well as improving the stability of the adjacent slope would support the use of the road. The proposal would also improve safety and reduce the ongoing costs and risks to road users. This would also promote the use of the land and facilities within the National Park.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
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.	The proposal would involve the removal of up to 71 trees (70 native trees) greater than five centimetres at diameter at breast height (dbh) (including up to 29 trees more than 20 centimetres dbh), two tree stumps, general vegetation including sapling and juvenile trees less than five centimetres diameter at breast height, as well as minor trimming (i.e. less than 10 per cent of the canopy) of vegetation on the downslope batter and at the Waterfall Flat picnic area ancillary facility and the National Falls ancillary facility. Works would impact a threatened ecological community identified as PCT 3591: Southern Sydney Sheltered Forest however the impacts are not expected to the significantly reduce or alter the threatened ecological community in the regional area. 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

1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal is considered to have negligible heritage impacts. An AHIMS search was undertaken and returned no Aboriginal heritage sites within 100 metres of the proposal. An Aboriginal heritage site was identified within 100 metres of the Waterfall flat picnic area ancillary facility however, due to the minor scale and nature of the works it is not expected to impact the site. Ancillary facility establishment would not include any excavation or vegetation removal for the Waterfall flat picnic area.
1.3(g) To promote good design and amenity of the built environment.	The proposal has been developed with the aim to minimise the overall impact of the proposal on existing landscape character of McKell Avenue. 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.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Section 5 outlines the community and stakeholder consultation carried out during various stages of the proposal. This REF will not be placed on display however further notification will be carried out to the community if the proposal is determined to proceed.

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 Chapter 2) of the proposal. 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 as a result of the proposal and where there is scientific uncertainty as to the nature of the damage have been identified. The proposal design is in accordance with the best-available technical information and environmental standards. Mitigation measures have been used to minimise environmental risks. These risks were based on conservative 'worst case' scenarios.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational 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 McKell Avenue for use for 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. The proposed scope of the works would be minor would not impact on biological diversity or ecological integrity.

Conservation of biological diversity and ecological integrity

Preserving biological diversity and ecological integrity requires that ecosystems, species, and biological diversity are maintained to ensure their survival. The proposal has been designed to follow the existing road alignment to avoid encroaching into the National Park Estate. The existing road alignment and road infrastructure is located on previously disturbed land, including land disturbed by the slope failure, and by containing the proposal to the existing road alignment, this minimises vegetation removal where possible. The proposal would involve the removal of up to 71 trees (70 native trees) greater than five centimetres at diameter at breast height (dbh) (including up to 29 trees more than 20 centimetres dbh), two tree stumps, general vegetation including sapling and juvenile trees less than five centimetres diameter at breast height, as well as minor trimming (i.e. less than 10 per cent of the canopy) of vegetation on the downslope batter and at the Waterfall Flat picnic area ancillary facility and the National Falls ancillary facility. In addition, the outcomes of the Five Part Test of Significance concluded that vegetation removal would not modify the composition of the community, as vegetation removal is indiscriminate and would not target one species or a group of species within the community. Vegetation removal is proposed at the understory, midstory, and canopy level.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources that 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

The proposed reopening of the closed lane McKell Avenue is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

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 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 Biodiversity and traffic and transport. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also minimise identified safety risks for road users, as well as improve the resilience of existing road infrastructure. Improved resilience of roads against extreme weather events would less likely need partial or full closures and potentially minimise the need of regular maintenance e.g. repairing potholes, after these occurrences. 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 nor 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 nor the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*. A referral to the Australian Department of Agriculture, Water and the Environment 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

10 October 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:	11 October 2023

Name:	Sam Singh
Position:	Project Manager, Special Projects, Connect Sydney
Transport region/program:	Sydney Roads Asset Performance Contract – Harbour Zo
Date:	11 October 2023

10. EP&A Regulation publication requirement

Table 10-1 EP&A Regulation publication requirement

Requirement	Yes/No
Does this REF need to be published under section 171(4) of the EP&A Regulation?	Yes

11. References

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12. Terms and acronyms used in this REF

Term / Acronym	Description
ADT	Average Daily Traffic
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ASS	Acid sulfate soil
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
BC Act	Biodiversity Conservation Act 2016 (NSW)
Biosecurity Act	NSW Biosecurity Act 2015
CEMP	Construction environmental management plan
CNVG	Construction Noise and Vibration Guideline
DPE	Department of Planning and Environment
EIA	Environmental impact assessment
EIS	Environmental impact statement
ENMM	Environmental Noise Management Manual
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EPL	Environmental 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	Fisheries Management Act 1994 (NSW)
Heritage Act	Heritage Act 1977 (NSW)
IACA	Institute of Australian Consulting Arborists
ICNG	Interim Construction Noise Guideline
Transport and Infrastructure SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021
KFH	Key Fish Habitat
LALC	Local Aboriginal Land Council
LCVIA	Landscape Character and Visual Impact Assessment
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act
LGA	Local Government Area
LSPS	Local Strategic Planning Strategy

Term / Acronym	Description
MNES	Matters of national environmental significance under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999
NCG	Noise Criteria Guideline
NMG	Noise Mitigation Guideline
NML	Noise Management Level
NPI	National Pollutant Inventory
NPW Act	National Parks and Wildlife Act 1974 (NSW)
NSW	New South Wales
OOHW	Out-of-hours-work
PACHCI	Procedure for Aboriginal Cultural Heritage Assessment Consultation and Investigation
POEO Act	Protection of the Environment Operations Act 1997
REF	Review of Environmental Factors
RNP	Road Noise Policy
ROL	Road Occupancy Licence
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SHR	State Heritage Register
TECs	Threatened Ecological Communities
Transport	Transport for New South Wales
TMP	Traffic Management Plan
VDV(s)	Vibration Dose Value(s)
VMS	Variable Message Signage
WM ACT	Water Management Act 2000
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.

Appendix A - Consideration of section 171 factors and matters of national environmental significance and Commonwealth land

Section 171 Checklist

In addition to the requirements of the Is an EIS required? guideline (DUAP 1995/1996) and the Roads and Related Facilities EIS Guideline (DUAP 1996) as detailed in the REF, the following factors, listed in section 171 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
a	Any environmental impact on a community? There would be some temporary minor impacts to the community during construction, particularly in relation to traffic and walking track access and parking use access of National Falls parking area. Access restrictions would be temporary and reopened after construction. However, the proposal would have a long-term positive benefit to the community and Royal National Park tourists by improving overall road safety as well as the resilience of existing road infrastructure from extreme weather events e.g. flooding.	Short-term negative impact during construction Long-term positive impact during operation
b	Any transformation of a locality? The proposal would result in minor, short-term disruptions to traffic along McKell Avenue. Construction activities would lead to temporary changes to locality including traffic barriers as well as traffic detours. 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.	Short-term minor negative impact Long-term positive impact
c	Any environmental impact on the ecosystems of the locality? The proposal would involve the removal of up to 71 trees (70 native trees) greater than five centimetres at diameter at breast height (dbh) (including up to 29 trees more than 20 centimetres dbh), two tree stumps, general vegetation including sapling and juvenile trees less than five centimetres diameter at breast height, as well as minor trimming (i.e. less than 10 per cent of the canopy) of vegetation on the downslope batter and at the Waterfall Flat picnic area ancillary facility and the National Falls ancillary facility. The works are within a listed TEC, identified as PCT 3591: Southern Sydney Sheltered Forest. Impacts from works within this area are not expected to alter or significantly reduce the TEC in the regional area. See Section 6.1 for more information on impacts to biodiversity. See Section 7.2 for proposed mitigation measures to minimise impacts.	Short-term negative impact during construction.
d	Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? During construction, there would be temporary impacts to traffic. Work associated with the proposal would result in the temporary full closure of McKell Avenue due to the size of the machinery for piling activities (refer to section 6.2 of this REF). The proposal would have a long-term positive benefit to the local community of Waterfall as well as Royal National Park tourists through improving the overall road safety and the resilience of existing road infrastructure against extreme weather events.	Short-term negative impact during construction Long-term positive impact during operation

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? The proposal is adjacent to the Royal National Park and Garawarra State Conservation Area curtilage (National Heritage item), with the extent of the permanent works of the proposal remains within the existing road corridor boundary. The two proposed ancillary facilities would be located on NPWS Estate land, however, site establishment works and ancillary facility operation would have negligible impacts to the Royal National Park as they would be using existing hardstand. Some minor tree trimming (i.e. less than 10 per cent of the canopy) of vegetation at the Waterfall Flat picnic area ancillary facility and the National Falls ancillary facility would be required. As such, the proposal would not directly or indirectly impact these areas or items.	Short-term negative impact during construction. Long-term positive impact during operation
f	Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? The proposal would not impact the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974). The works do not involve the removal of potential general habitat, winter foraging habitat. No unrecorded populations were identified onsite, therefore direct mortality is considered unlikely. There are no trees to be removed with potential Powerful Owl associated habitat and foraging habitat. See Section 6.1 for more information on impacts to biodiversity. See Section 7.2 for proposed mitigation measures to minimise impacts.	Nil
g	Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal would not endanger, displace or disturb terrestrial or aquatic fauna. The proposal would not create a barrier to movement, as the trees, vegetation and tree stumps to be removed are in a fragmentated roadside environment. It is unlikely the proposed activity will impact species of conservation significance or create a barrier to movement. See Section 6.1 for more information on impacts to biodiversity. See Section 7.2 for proposed mitigation measures to minimise impacts.	Short-term minor negative impact Long-term negligible negative impact
h	Any long-term effects on the environment? The proposal would result in long-term impacts on: • traffic by increasing the safety of existing road infrastructure as well as improving the resilience road infrastructure to extreme weather events See Section 6.1 and 6.2 for more information on the long-term environmental impacts. See Section 7.2 for proposed mitigation measures to minimise environmental impacts.	Long-term minor positive impact
i	Any degradation of the quality of the environment? 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 7.2. During operation, the design has incorporated mitigation measures to minimise impact to the environment through urban design. As a result, the quality of the environment is not likely to be degraded.	Short-term minor negative impact Long-term neutral impact

j	Any risk to the safety of the environment? The proposal is unlikely to cause any pollution or safety risks to the environment provided the recommended mitigation measures are implemented.	Nil
k	Any reduction in the range of beneficial uses of the environment? The proposal would result in the short-term restriction of the number of vehicles able to use the two ancillary facility locations for parking. This would be limited to the construction period i.e. over five months	Short-term negative impact during construction
l	Any pollution of the environment? 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.	Nil
m	Any environmental problems associated with the disposal of waste? 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.	Nil
n	Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal is unlikely to increase demands on resources that are or are likely to become in short supply.	Nil
o	Any cumulative environmental effect with other existing or likely future activities? There are no expected positive or negative cumulative impacts from other existing or likely future activities.	Nil
p	Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal would not affect or be affected by any coastal processes or hazards.	Nil
q	Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1 The proposal would align with: • Our Shire Towards 2032 • Sutherland Shire Local Strategic Planning Statement 2020 • Sutherland Shire Environment and Sustainability Strategy 2012 • Safer Communities Strategy 2022-2032 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.	Nil
r	Other relevant environmental factors.	In considering the potential impacts of this proposal all relevant environmental factors have been considered, refer to Section 6 of this assessment.

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, 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 Agriculture, Water and the Environment.

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 accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor		Impact
a	Any impact on a World Heritage property? There are no World Heritage Properties within or near the proposal.	Nil
b	Any impact on a National Heritage place? The proposal would be within the existing road corridor adjacent to the Royal National Park and Garawarra State Conservation Area, a National Heritage listed place (#10589). The Royal National Park and Garawarra State Conservation Area constitute a major area of plant biodiversity. The Royal National Park was the first National Park to be established in Australia (1879), regarded as beginning of non-Indigenous Australian conservation. The proposal wouldn't impact the National Heritage listed place as the nature and scope of the works would remain within the existing road corridor. The temporary ancillary facilities would be located on Royal National Park land and would require the need for minor tree trimming (i.e.. less than 10 per cent of the canopy) of vegetation at the Waterfall Flat picnic area ancillary facility and the National Falls ancillary facility.	Minor
c	Any impact on a wetland of international importance? There are no wetlands of international importance within or near the proposal.	Nil
d	Any impact on a listed threatened species or communities? While listed threatened species have been recorded within 10 kilometres of the project site, there were no threatened species, threatened species habitat, or HBTs showing signs of use by fauna, identified during the field assessment. Further details on impacts to biodiversity including impacts to threatened species or communities are included in Section 6.1.	Nil
e	Any impacts on listed migratory species? Migratory species are unlikely to use vegetation within the proposal area. This due to an abundance of adjacent habitat with the proposal sitting adjacent to the Royal National Park. Migratory species would more likely select vegetation that is less fragmented, as well as vegetation further away from the road corridor i.e.. noise from vehicles, etc. Further details on impacts to biodiversity including impacts to threatened species or communities are included in Section 6.1.	Nil
f	Any impact on a Commonwealth marine area? The proposal would not have any impacts on Commonwealth marine areas.	Nil
g	Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve any nuclear action.	Nil
h	Additionally, any impact (direct or indirect) on the environment of Commonwealth land? The proposal does not involve any direct or indirect impacts to the environment of Commonwealth land.	Nil

Appendix B - Statutory consultation checklists and SEPP (Transport and Infrastructure) letter

Transport and Infrastructure SEPP

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	Clause 2.110
Bus Depots	Does the project propose a bus depot?	No	Sutherland Shire Council	Clause 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	Clause 2.110

Development within the Coastal Zone

Development type	Description	Yes / No	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	Clause 2.14

Note: See interactive map at ***Planning Portal NSW spatial viewer - find a property***. 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	SEPP (Transport and Infrastructure) Section
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	No	Sutherland Shire Council	Clause 2.10 (1)(a)
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	Clause 2.10 (1)(b)
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No	Sutherland Shire Council	Clause 2.10 (1)(c)

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No	Sutherland Shire Council	Clause 2.10 (1)(d)
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 *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	No	Sutherland Shire Council	Clause 2.10 (1)(e)
Road & footpath excavation	Will the works involve more than *minor* or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	Sutherland Shire Council	Clause 2.10 (1)(f)

Local heritage items

Development type	Potential impact	Yes / No	If 'yes' consult with	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 minor or inconsequential?	No	Sutherland Shire Council	Clause 2.11

Flood liable land

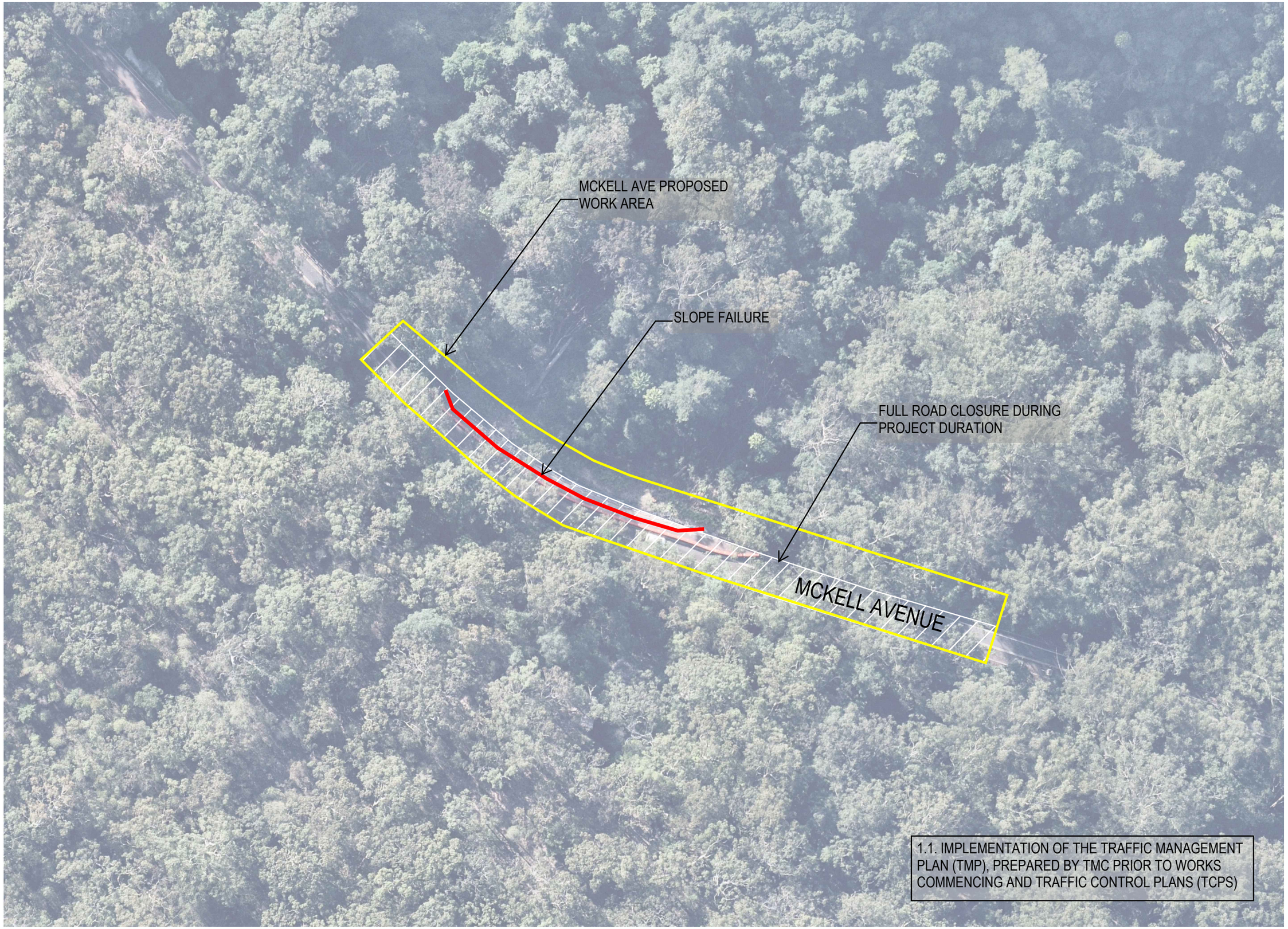
Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP Transport and Infrastructure Section
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a *minor* extent?	No	Sutherland Shire Council	Clause 2.12
Flood liable land	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	Clause 2.13

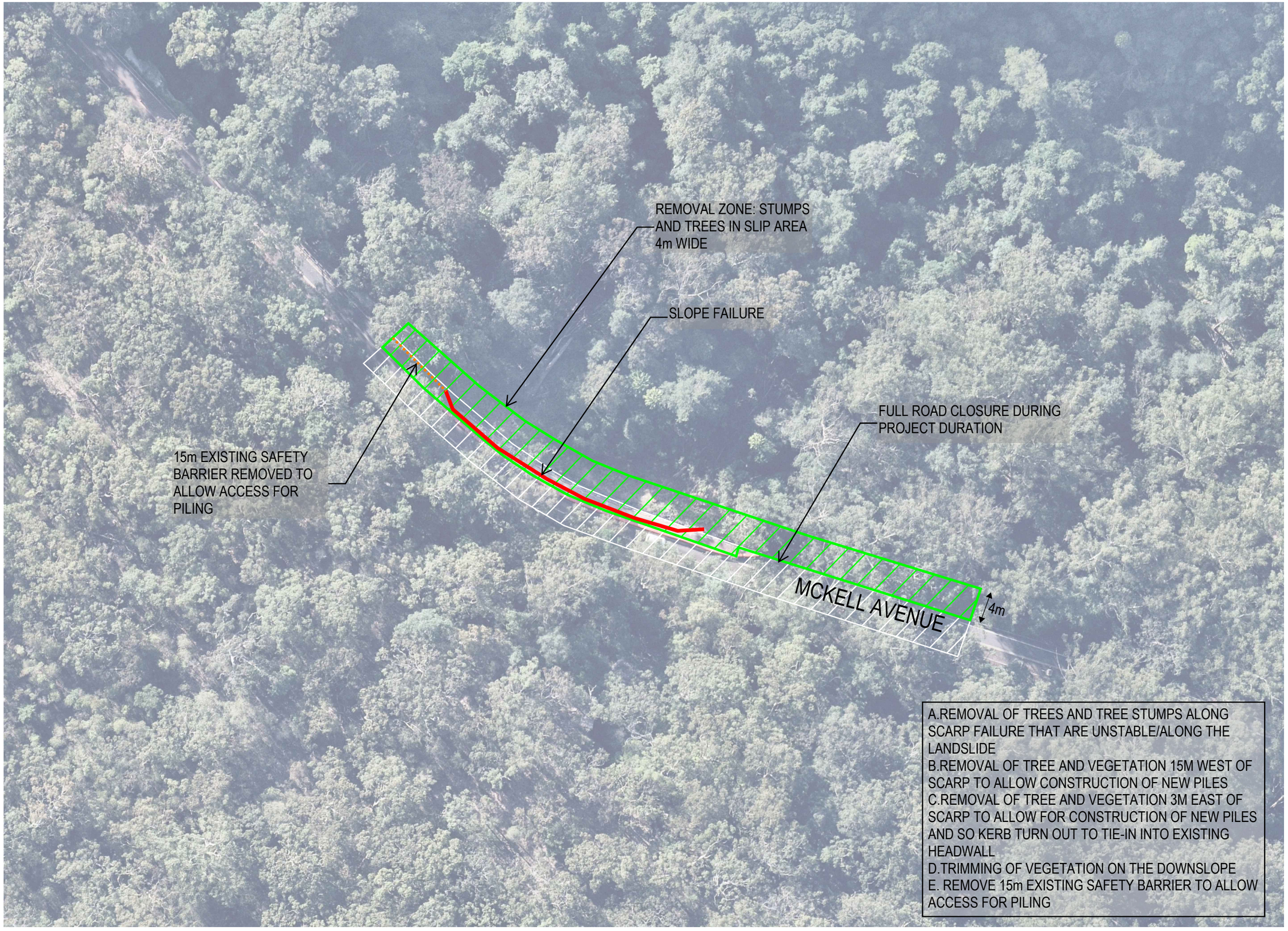
Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled Floodplain Development Manual: the management of flood liable land published by the New South Wales Government.

Public authorities other than councils

Development type	Potential impact	Yes / No	If 'yes' consult with	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 *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	Yes	Environment, Energy and Science, DPE	Clause 2.15(2)(a)
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?	No	Environment, Energy and Science, DPE	Clause 2.15 (2)(b)
Aquatic reserves	Are the works adjacent to an aquatic reserve or a marine park declared under the *Marine Estate Management Act 2014*?	No	Department of Planning and Environment	Clause 2.15 (2)(c)
Sydney Harbour foreshore	Are the works in the Sydney Harbour Foreshore Area as defined by the *Sydney Harbour Foreshore Authority Act 1998*?	No	Property NSW	Clause 2.15 (2)(d)
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 (RFS)	Clause 2.15 (2)(e)
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	Clause 2.15 (2)(f)
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 clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Secretary of the Commonwealth Department of Defence	Clause 2.15(2)(a)
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	Mine Subsidence Board	Clause 2.15 (2)(b)

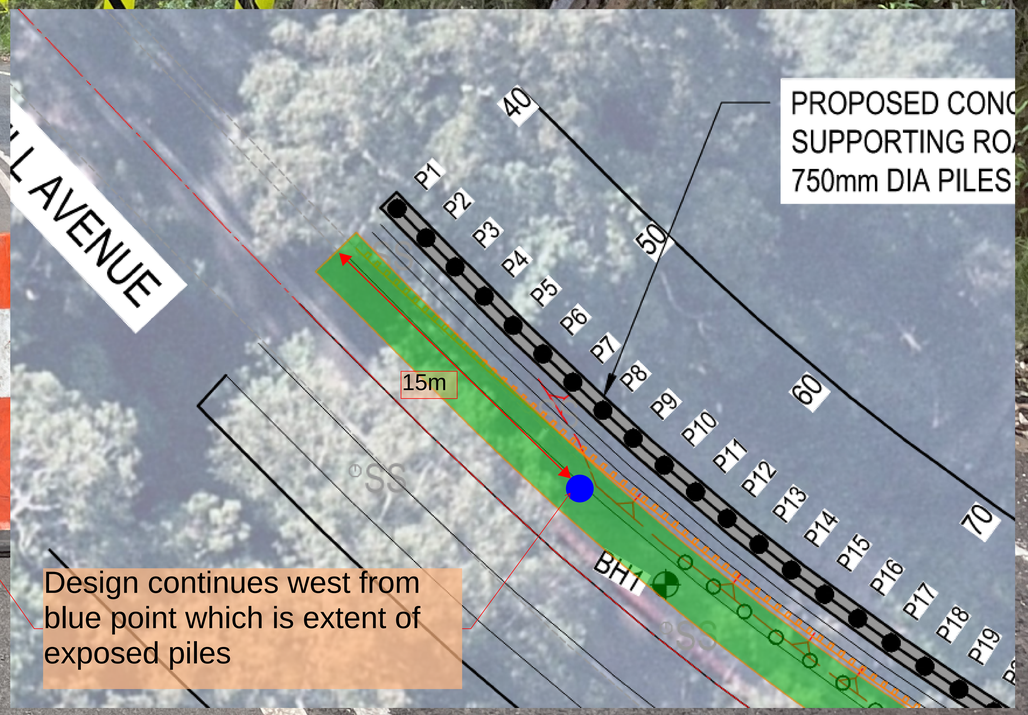
Appendix C – Detailed design drawings and staging diagrams


MCKELL AVE PROPOSED
WORK AREA
SLOPE FAILURE
FULL ROAD CLOSURE DURING
PROJECT DURATION
MCKELL AVENUE
1.1. IMPLEMENTATION OF THE TRAFFIC MANAGEMENT PLAN (TMP), PREPARED BY TMC PRIOR TO WORKS COMMENCING AND TRAFFIC CONTROL PLANS (TCPS)


REMOVAL ZONE: STUMPS AND TREES IN SLIP AREA 4m WIDE
SLOPE FAILURE
FULL ROAD CLOSURE DURING PROJECT DURATION
15m EXISTING SAFETY BARRIER REMOVED TO ALLOW ACCESS FOR PILING
MCKELL AVENUE
4m
A.REMOVAL OF TREES AND TREE STUMPS ALONG SCARP FAILURE THAT ARE UNSTABLE/ALONG THE LANDSLIDE
B.REMOVAL OF TREE AND VEGETATION 15M WEST OF SCARP TO ALLOW CONSTRUCTION OF NEW PILES
C.REMOVAL OF TREE AND VEGETATION 3M EAST OF SCARP TO ALLOW FOR CONSTRUCTION OF NEW PILES AND SO KERB TURN OUT TO TIE-IN INTO EXISTING HEADWALL
D.TRIMMING OF VEGETATION ON THE DOWNSLOPE
E. REMOVE 15m EXISTING SAFETY BARRIER TO ALLOW ACCESS FOR PILING


4m from edge of existing piles
Middle portion

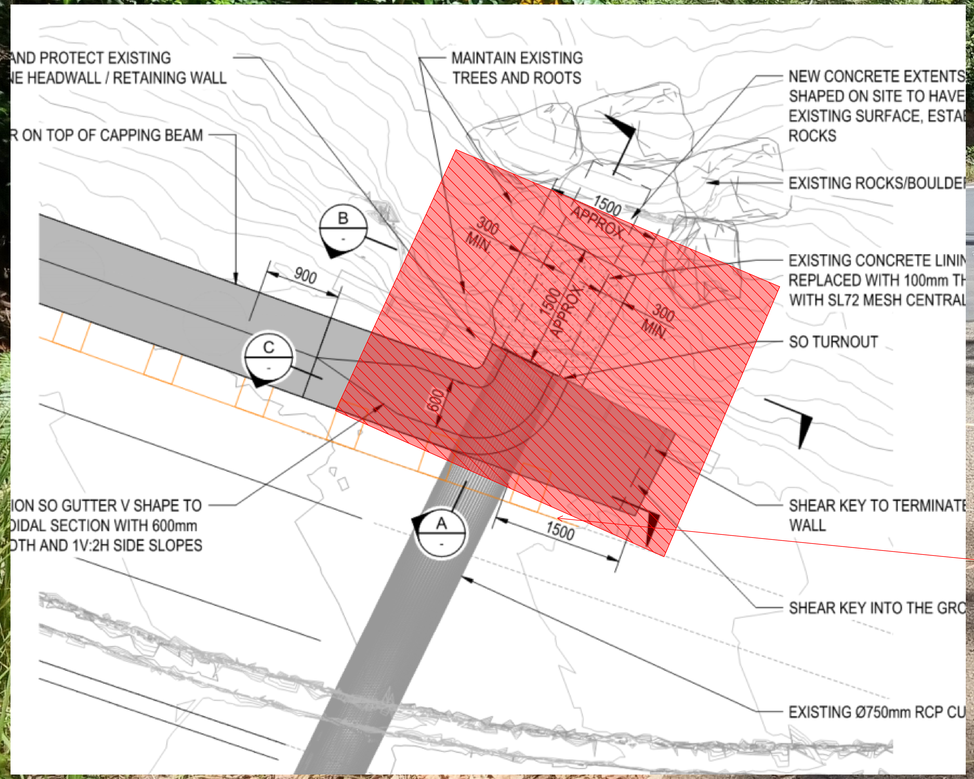
4m from edge of existing piles.



Design continues west from blue point which is extent of exposed piles

Western extent

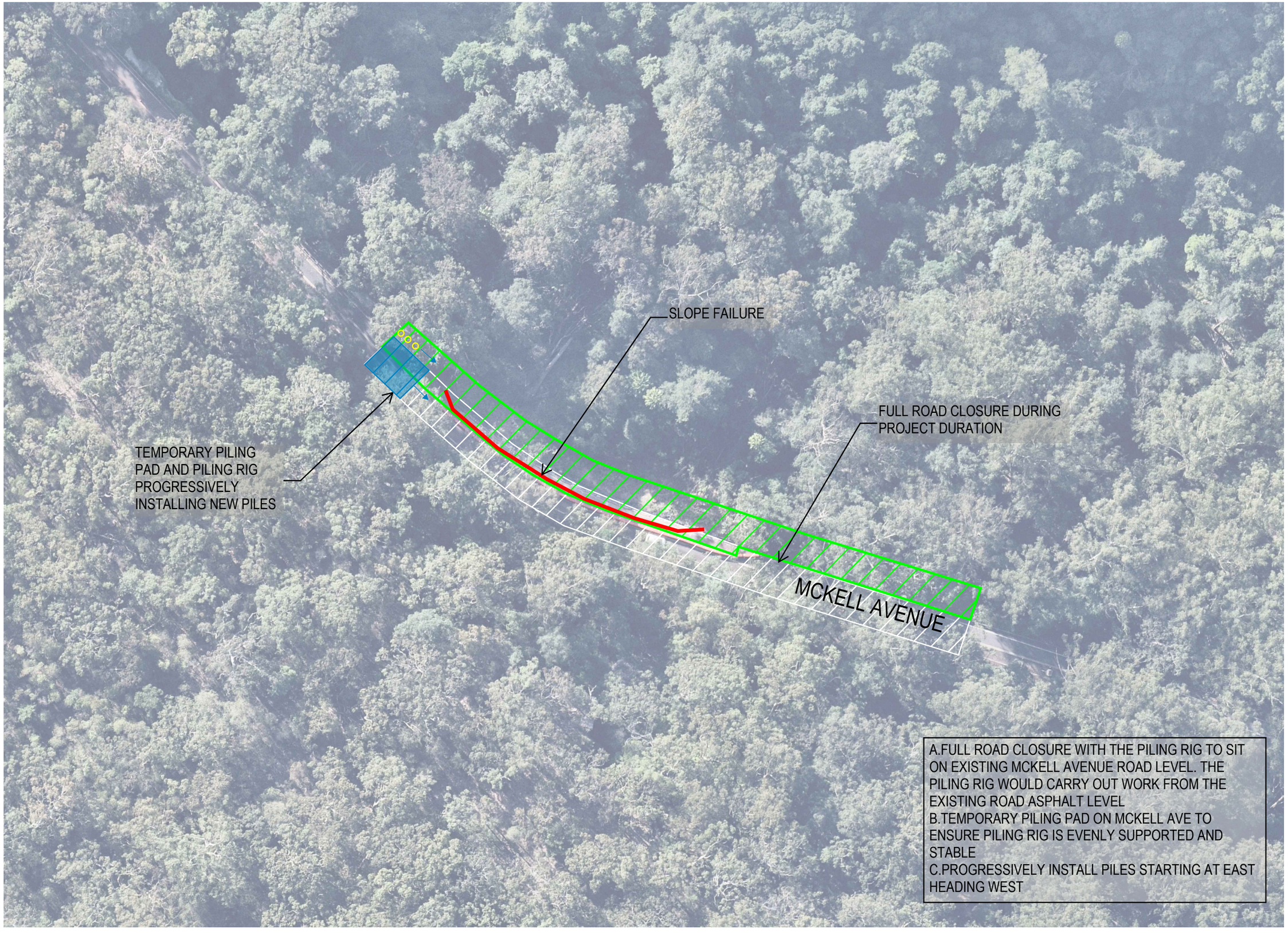

McKell Ave
4m from edge of existing piles
Western Extent pt2
Google

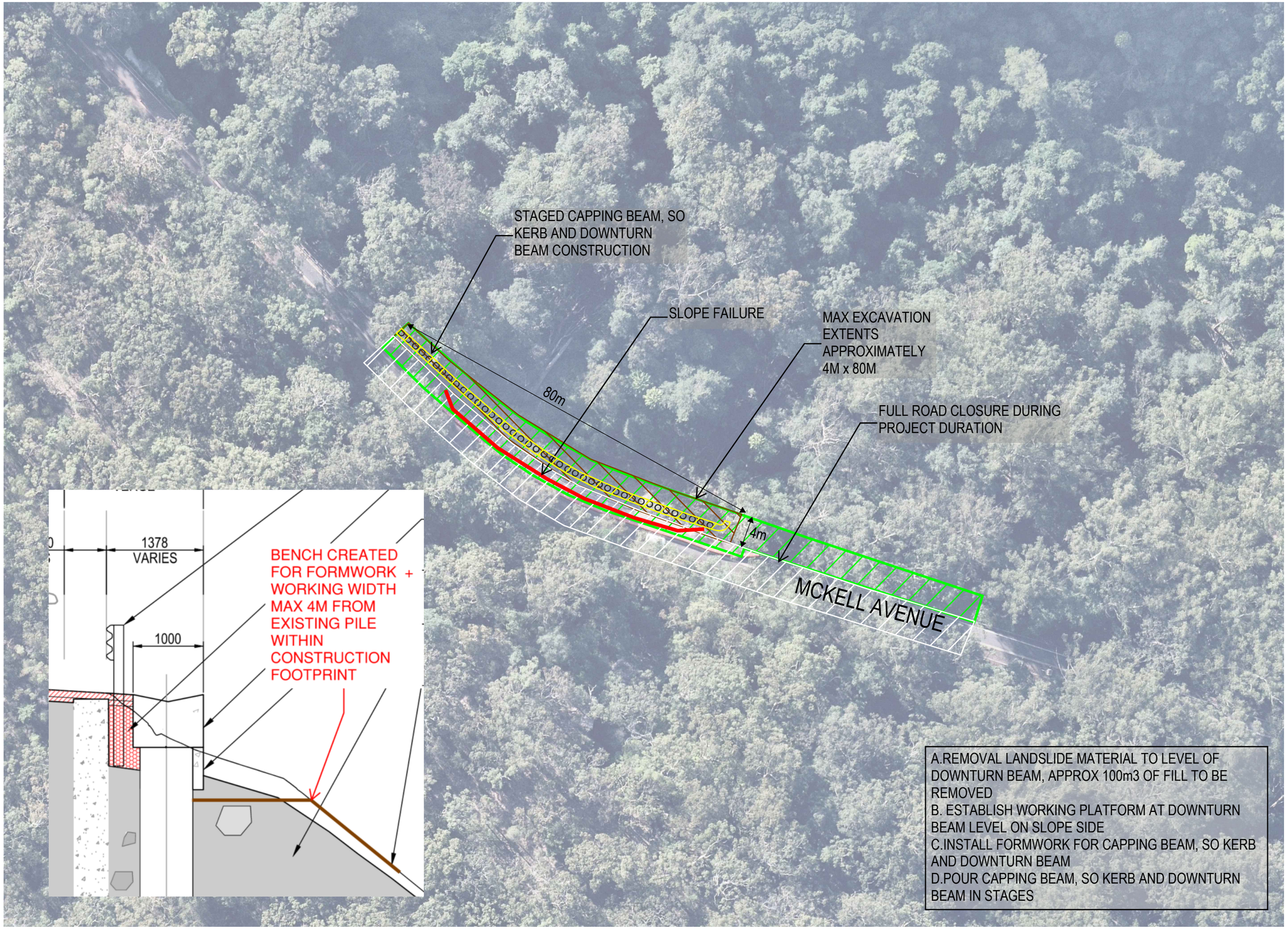


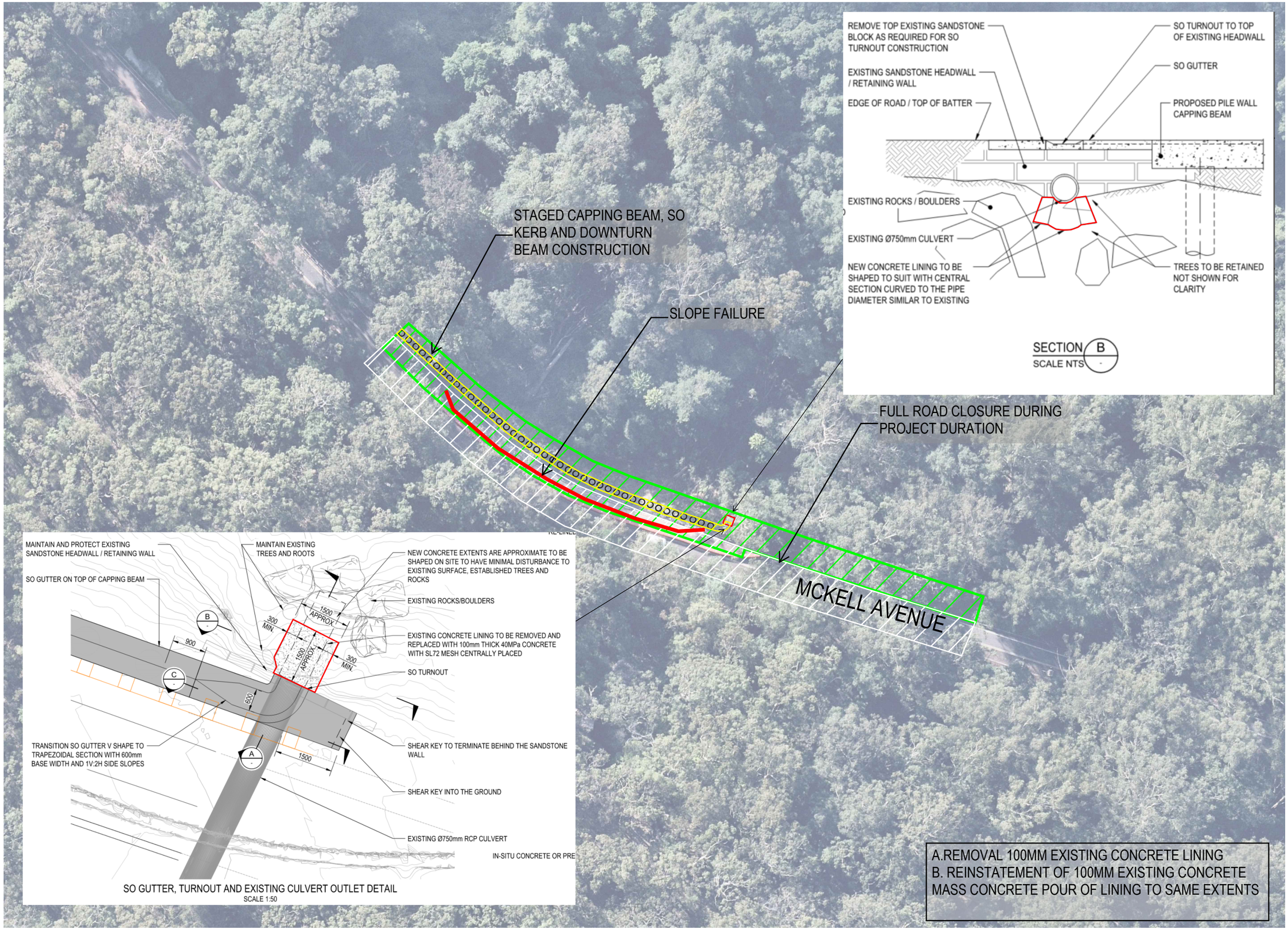
Reference pint is barrier tie in point

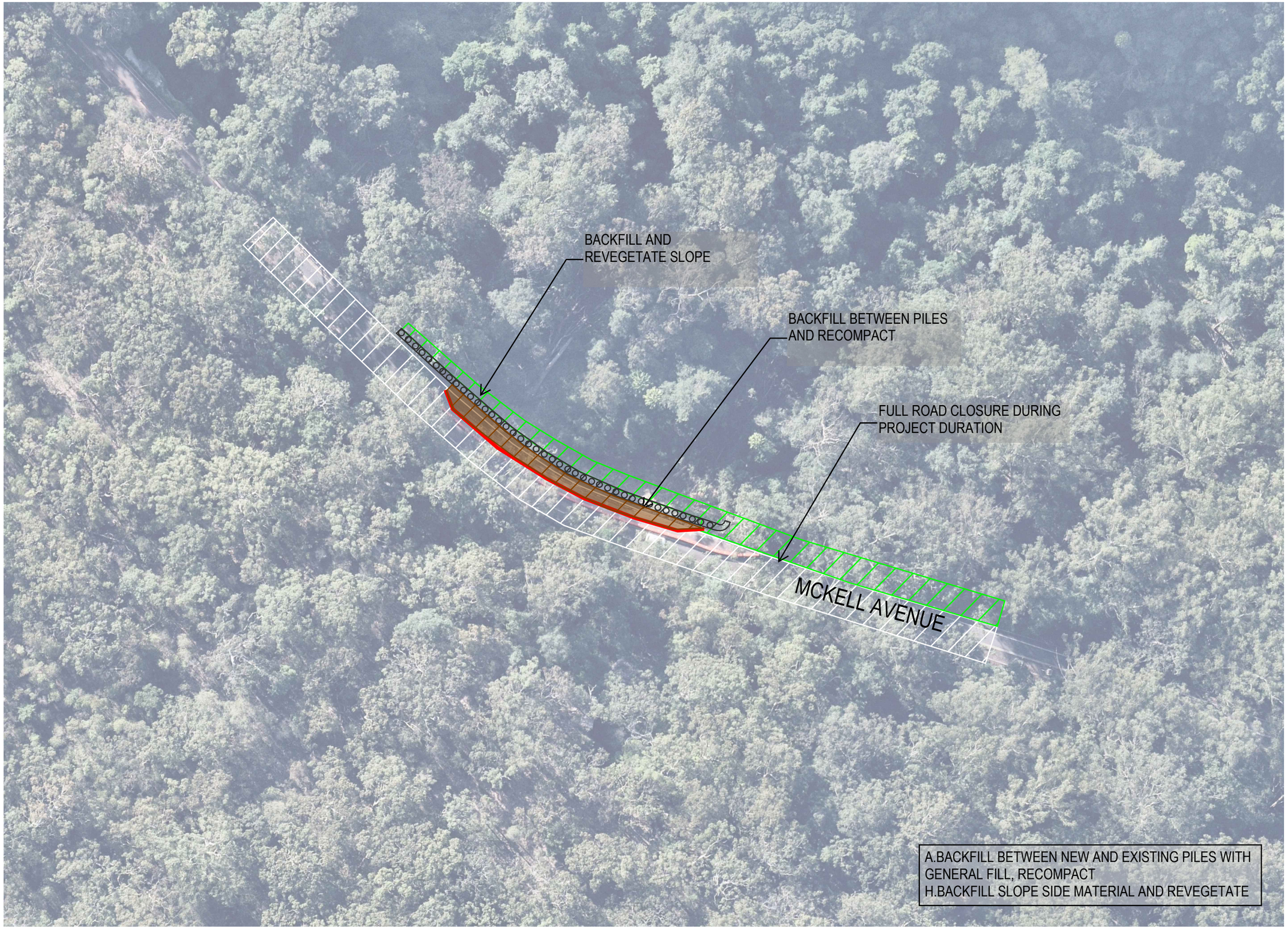
4m x 8m area removal to create room to build drainage outlet

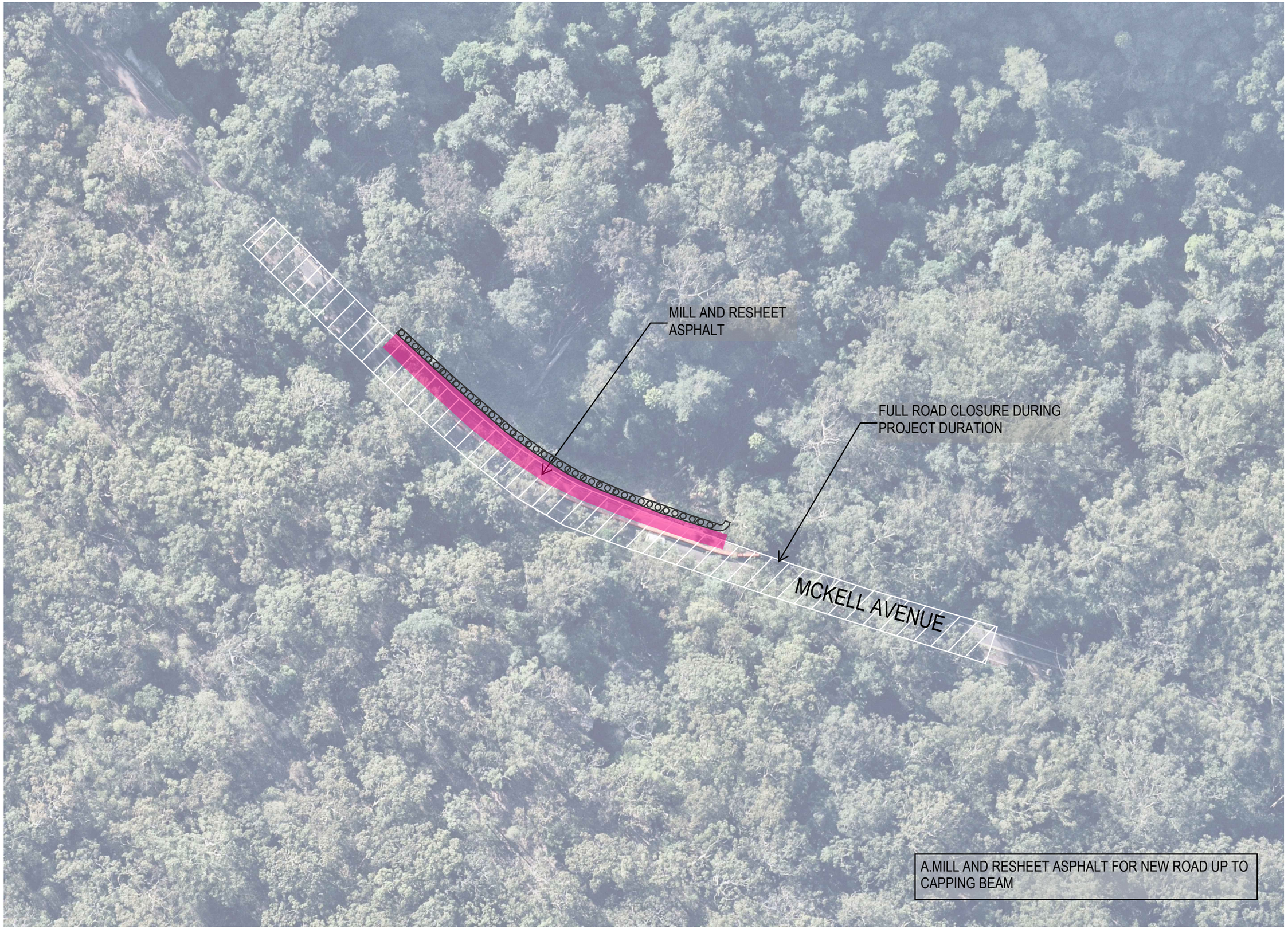
Eastern extent

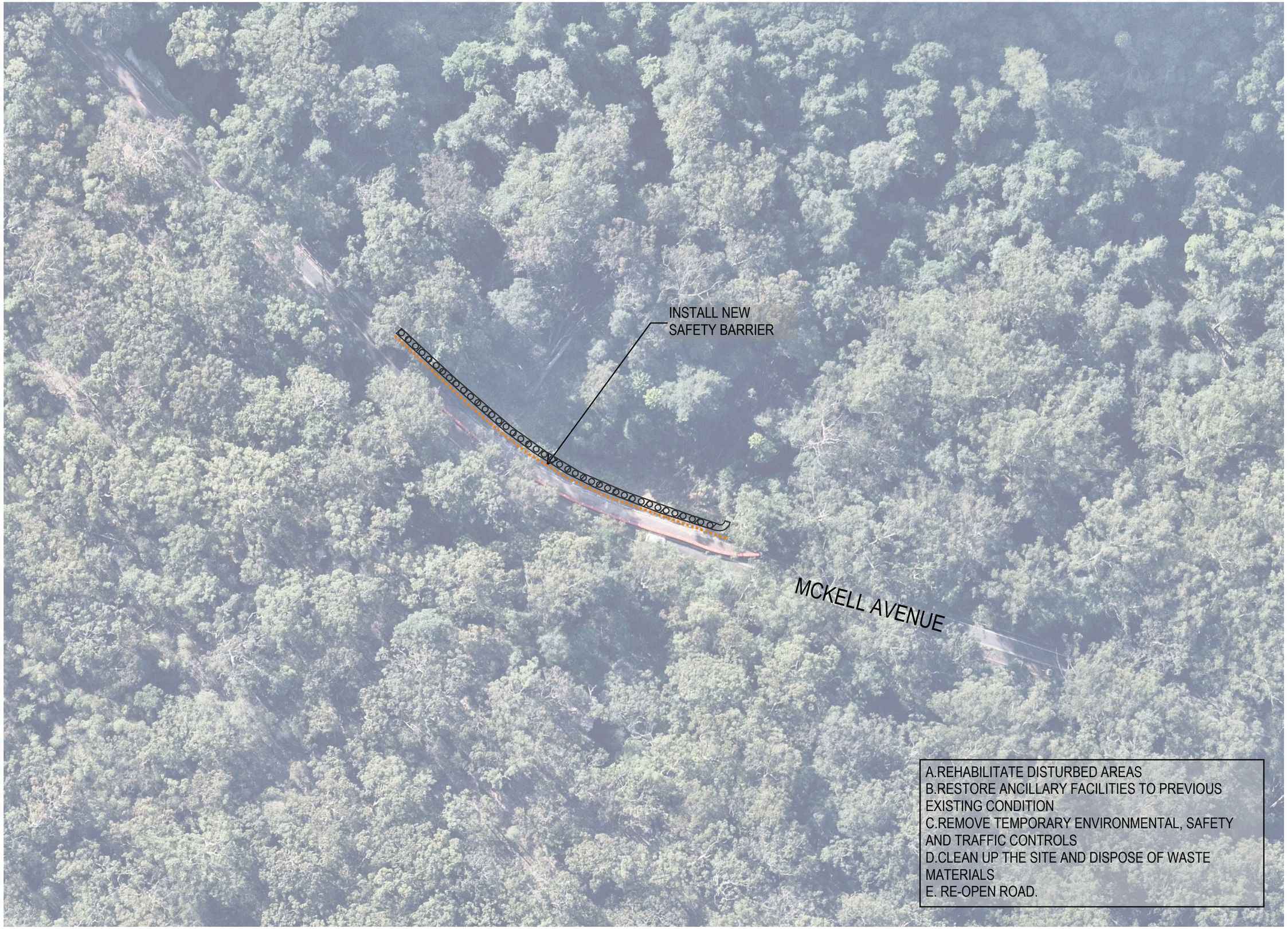

SLOPE FAILURE
FULL ROAD CLOSURE DURING
PROJECT DURATION
TEMPORARY PILING
PAD AND PILING RIG
PROGRESSIVELY
INSTALLING NEW PILES
MCKELL AVENUE
A.FULL ROAD CLOSURE WITH THE PILING RIG TO SIT ON EXISTING MCKELL AVENUE ROAD LEVEL. THE PILING RIG WOULD CARRY OUT WORK FROM THE EXISTING ROAD ASPHALT LEVEL
B.TEMPORARY PILING PAD ON MCKELL AVE TO ENSURE PILING RIG IS EVENLY SUPPORTED AND STABLE
C.PROGRESSIVELY INSTALL PILES STARTING AT EAST HEADING WEST


STAGED CAPPING BEAM, SO KERB AND DOWNTURN BEAM CONSTRUCTION
SLOPE FAILURE
MAX EXCAVATION EXTENTS APPROXIMATELY 4M x 80M
FULL ROAD CLOSURE DURING PROJECT DURATION
80m
4m
MCKELL AVENUE
1378
VARIES
1000
BENCH CREATED FOR FORMWORK + WORKING WIDTH MAX 4M FROM EXISTING PILE WITHIN CONSTRUCTION FOOTPRINT
A.REMOVAL LANDSLIDE MATERIAL TO LEVEL OF DOWNTURN BEAM, APPROX 100m3 OF FILL TO BE REMOVED
B. ESTABLISH WORKING PLATFORM AT DOWNTURN BEAM LEVEL ON SLOPE SIDE
C.INSTALL FORMWORK FOR CAPPING BEAM, SO KERB AND DOWNTURN BEAM
D.POUR CAPPING BEAM, SO KERB AND DOWNTURN BEAM IN STAGES


STAGED CAPPING BEAM, SO KERB AND DOWNTURN BEAM CONSTRUCTION
SLOPE FAILURE
FULL ROAD CLOSURE DURING PROJECT DURATION
MCKELL AVENUE
REMOVE TOP EXISTING SANDSTONE BLOCK AS REQUIRED FOR SO TURNOUT CONSTRUCTION
SO TURNOUT TO TOP OF EXISTING HEADWALL
SO GUTTER
EXISTING SANDSTONE HEADWALL / RETAINING WALL
EDGE OF ROAD / TOP OF BATTER
PROPOSED PILE WALL CAPPING BEAM
EXISTING ROCKS / BOULDERS
EXISTING Ø750mm CULVERT
NEW CONCRETE LINING TO BE SHAPED TO SUIT WITH CENTRAL SECTION CURVED TO THE PIPE DIAMETER SIMILAR TO EXISTING
TREES TO BE RETAINED NOT SHOWN FOR CLARITY
SECTION B
SCALE NTS
MAINTAIN AND PROTECT EXISTING SANDSTONE HEADWALL / RETAINING WALL
MAINTAIN EXISTING TREES AND ROOTS
NEW CONCRETE EXTENTS ARE APPROXIMATE TO BE SHAPED ON SITE TO HAVE MINIMAL DISTURBANCE TO EXISTING SURFACE, ESTABLISHED TREES AND ROCKS
SO GUTTER ON TOP OF CAPPING BEAM
EXISTING ROCKS/BOULDERS
1500 APPROX
300 MIN
EXISTING CONCRETE LINING TO BE REMOVED AND REPLACED WITH 100mm THICK 40MPa CONCRETE WITH SL72 MESH CENTRALLY PLACED
900
SO TURNOUT
600
TRANSITION SO GUTTER V SHAPE TO TRAPEZOIDAL SECTION WITH 600mm BASE WIDTH AND 1V:2H SIDE SLOPES
SHEAR KEY TO TERMINATE BEHIND THE SANDSTONE WALL
1500
SHEAR KEY INTO THE GROUND
EXISTING Ø750mm RCP CULVERT
IN-SITU CONCRETE OR PRE
SO GUTTER, TURNOUT AND EXISTING CULVERT OUTLET DETAIL
SCALE 1:50
A.REMOVAL 100MM EXISTING CONCRETE LINING
B. REINSTATEMENT OF 100MM EXISTING CONCRETE MASS CONCRETE POUR OF LINING TO SAME EXTENTS


BACKFILL AND
REVEGETATE SLOPE
BACKFILL BETWEEN PILES
AND RECOMPACT
FULL ROAD CLOSURE DURING
PROJECT DURATION
MCKELL AVENUE
A.BACKFILL BETWEEN NEW AND EXISTING PILES WITH
GENERAL FILL, RECOMPACT
H.BACKFILL SLOPE SIDE MATERIAL AND REVEGETATE


MILL AND RESHEET
ASPHALT
FULL ROAD CLOSURE DURING
PROJECT DURATION
MCKELL AVENUE
A.MILL AND RESHEET ASPHALT FOR NEW ROAD UP TO
CAPPING BEAM


INSTALL NEW
SAFETY BARRIER
MCKELL AVENUE
A.REHABILITATE DISTURBED AREAS
B.RESTORE ANCILLARY FACILITIES TO PREVIOUS EXISTING CONDITION
C.REMOVE TEMPORARY ENVIRONMENTAL, SAFETY AND TRAFFIC CONTROLS
D.CLEAN UP THE SITE AND DISPOSE OF WASTE MATERIALS
E. RE-OPEN ROAD.

CONNECT SYDNEY

ROAD No. 393
SITE No. SL83751
MCKELL AVENUE

SYDNEY ROAD ASSETS
PERFORMANCE CONTRACT
HARBOUR ZONE

BORED PILE WALL SLOPE STABILISATION

100% DESIGN

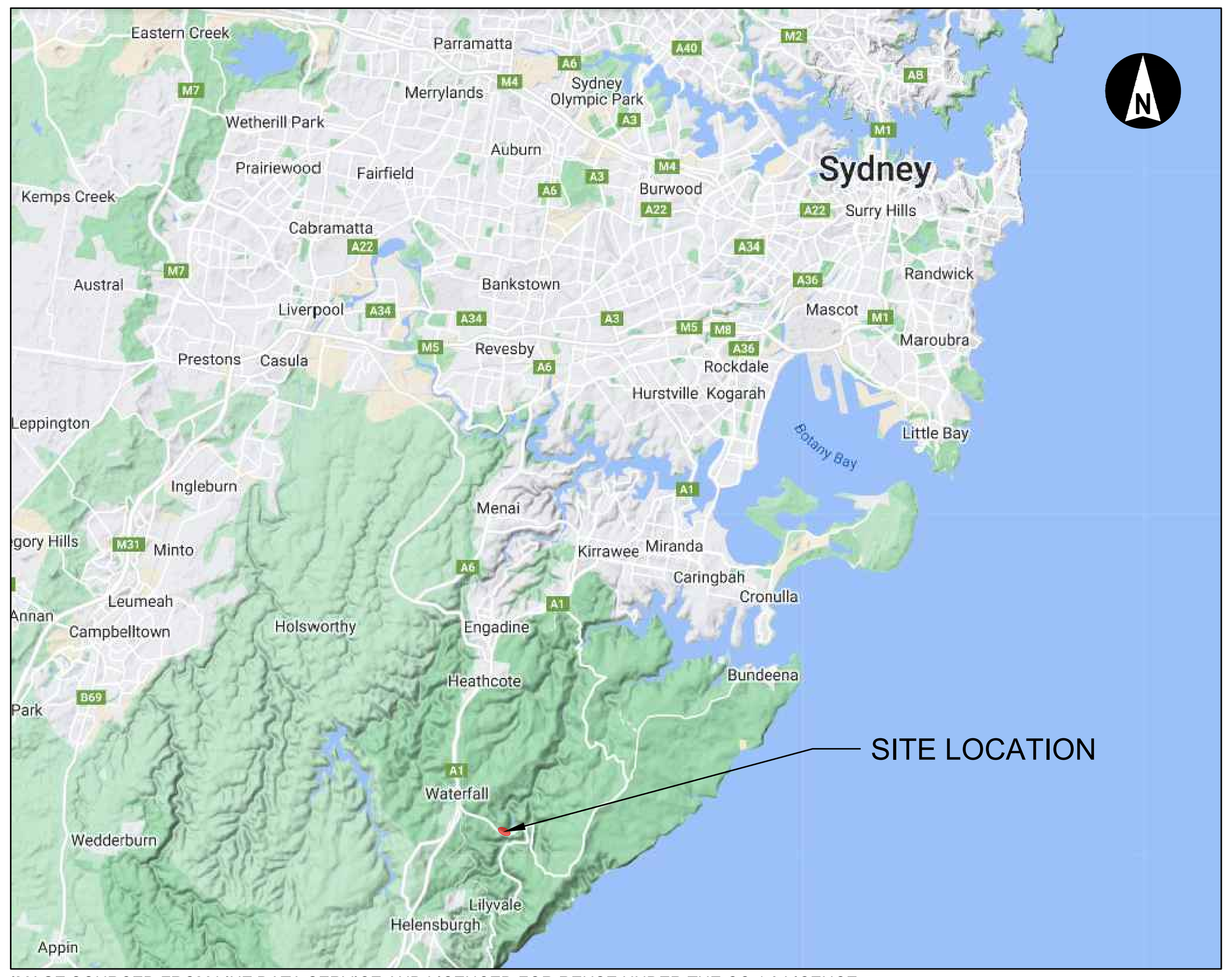


IMAGE SOURCED FROM LINZ DATA SERVICE AND LICENCED FOR REUSE UNDER THE CC 4.0 LICENCE

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SCHEDULE OF DRAWINGS

DRAWING NUMBER	DRAWING DESCRIPTION	REV
520212TP-AURC-83751-GE-DRG-000001	COVER SHEET AND DRAWING LIST	C
520212TP-AURC-83751-GE-DRG-000002	GENERAL NOTES	C
520212TP-AURC-83751-GE-DRG-000003	DRAINAGE NOTES	C
520212TP-AURC-83751-GE-DRG-000004	GENERAL ARRANGEMENT - PLAN	C
520212TP-AURC-83751-GE-DRG-000005	GENERAL ARRANGEMENT - SECTION	C
520212TP-AURC-83751-GE-DRG-000006	STORMWATER DRAINAGE GENERAL ARRANGEMENT	C
520212TP-AURC-83751-GE-DRG-000007	DRAINAGE DETAILS	C
520212TP-AURC-83751-GE-DRG-000008	PAVEMENT AND BARRIER DETAILS	C
520212TP-AURC-83751-GE-DRG-000009	CROSS SECTIONS	B
520212TP-AURC-83751-GE-DRG-000010	BORED PILE WALL ARRANGEMENT PLAN	C
520212TP-AURC-83751-GE-DRG-000011	TYPICAL WALL DETAILS	C
520212TP-AURC-83751-GE-DRG-000012	PILE DETAILS	C
~~520212TP-AURC-83751-GE-DRG-000013~~	~~INDICATIVE CONSTRUCTION SEQUENCE~~	
520212TP-AURC-83751-GE-DRG-000014	INDICATIVE CONSTRUCTION SEQUENCE	C
520212TP-AURC-83751-GE-DRG-000021	CONTINGENCY Ø900mm PILE OPTION	C
520212TP-AURC-83751-GE-DRG-000030	SAFETY IN DESIGN REGISTER - SHEET 1	C
520212TP-AURC-83751-GE-DRG-000031	SAFETY IN DESIGN REGISTER - SHEET 2	C

FOR REVIEW

NOT FOR CONSTRUCTION

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

SCALE: NOT TO SCALE

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	D.P 16/03/2023	W.D 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20

HEIGHT DATUM: AHD71

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

aurecon www.aurecongroup.com

CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D.PERERA	16.03.2023
DRG CHECK	D.PERERA	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
COVER SHEET AND DRAWING LIST

DRAWING SET No:
PART:
SHEET: 1 OF 16
STATUS:
BRIDGE No: ©
DRG No. 520212TP-AURC-83751-GE-DRG-000001
REV C
VER
EDMS No.
AMD No.

TfNSW-DE-Titleblock-A1-H-R19_BridgeRoadRail_Design.dwg

FILE NAME: 520212TP-AURC-83751-GE-DRG-000001.dwg

PLOT DATE & TIME: 16/03/2023 2:46:45 PM

GENERAL

G1 THE INFORMATION CONTAINED IN THESE DRAWINGS PRODUCED BY AURECON IS SOLELY FOR THE USE OF TRANSPORT FOR NSW FOR THE PURPOSE FOR WHICH IT HAS BEEN PREPARED. AURECON AUSTRALASIA PTY LTD UNDERTAKES NO DUTY TO OR ACCEPTS NO RESPONSIBILITY TO ANY THIRD PARTY WHO MAY RELY UPON THIS DOCUMENT.

G2 ALL WORKS SHALL BE PERFORMED IN ACCORDANCE WITH TfNSW STANDARD DRAWINGS AND SPECIFICATIONS UNLESS OTHERWISE SHOWN.

G3 ANY DISCREPANCIES OR OMISSIONS FROM THESE DOCUMENTS SHALL BE REFERRED TO AURECON FOR CLARIFICATION AND APPROVED BY TfNSW.

G4 THESE NOTES APPLY TO ALL DRAWINGS.

G5 ANY DISCREPANCIES OR VARIATIONS BETWEEN DRAWINGS SHALL BE REFERRED TO THE PRINCIPAL FOR DECISION BEFORE PROCEEDING WITH THE WORK.

G6 ALL DIMENSIONS RELEVANT TO SETTING OUT AND OFF-SITE WORK SHALL BE VERIFIED BY THE PRINCIPAL PRIOR TO CONSTRUCTION. THE DRAWINGS SHALL NOT BE SCALED UNLESS OTHERWISE INSTRUCTED IN THE NOTES ON THE DRAWINGS.

G7 ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL CHAINAGES AND REDUCED LEVELS ARE IN METRES. ALL CO-ORDINATES ARE IN METRES.

G8 THE LEVEL DATUM REFERRED TO IN THESE DRAWINGS IS AUSTRALIAN HEIGHT DATUM (AHD).

G9 ORIGIN OF LEVELS - AHD COORDINATES TO MGA20 - MAP GRID AUSTRALIA 2020.

G10 ACRONYMS: FOR ACRONYMS ASSOCIATED WITH REINFORCEMENT PLACEMENT REFER REINFORCEMENT NOTES.
UNO DENOTES "UNLESS NOTED OTHERWISE"
SLS DENOTES "SERVICE LIMIT STATE"
ULS DENOTES "ULTIMATE LIMIT STATE"
THK DENOTES "THICKNESS"
TYP DENOTES "TYPICAL"

G11 VENDOR DETAILS SHALL NOT APPLY UNLESS ABSOLUTE EQUIVALENCY CAN BE PROVED, EQUAL OR BETTER IN EVERY ASPECT.

G12 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.

G13 EXISTING UTILITIES MAY NOT BE SHOWN OR COMPLETE ON THESE DRAWINGS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT ALL EXISTING UTILITIES ARE ACCURATELY LOCATED, IDENTIFIED AND CHECKED AGAINST THESE DESIGN DRAWINGS AND PROTECTED OR RELOCATED, AS REQUIRED, PRIOR TO CONSTRUCTION WORKS.

G14 THE CONSTRUCTION METHODOLOGY AND PLANT USED MUST AVOID ADVERSE IMPACTS ON THE DESIGN ELEMENTS, SUCH AS LOAD OVER STRESSES, VIBRATION, COMPACTION AND CONSTRUCTION ASSOCIATED DAMAGE. ANY DAMAGE MUST BE RECTIFIED

DESIGN CRITERIA

D1 BORED PILE WALL DESIGN LOAD COMBINATIONS HAVE BEEN CONSIDERED IN ACCORDANCE WITH RMS GTD AS5100.2.

D2 A DESIGN SLS LIVE LOAD OF 20kPa HAS BEEN ADOPTED FOR THE ROAD CARRIAGEWAY.

D3 EARTHQUAKE LOADING IN ACCORDANCE WITH AS1170.4 BASED ON THE FOLLOWING PARAMETERS:
ANNUAL RECURRENCE INTERVAL: 1-in-500 YEARS
ACCELERATION COEFFICIENT: 0.09g

D4 TfNSW TL3 EZY-GUARD LDS BARRIER IS ADOPTED TO MATCH THE EXISTING ADJOINING TL3 BARRIER. THE BORED PILE WALL HAS NOT BEEN DESIGNED FOR TRAFFIC BARRIER LOADING AS THE BARRIER IS STRUCTURALLY SEPARATE FROM THE WALL.

CONSTRUCTION MONITORING HOLD POINTS

HOLD POINT	DESCRIPTION	REQUIRED NOTICE
1A	THE CONTRACTOR MUST PROVIDE A WORKS METHODOLOGY STATEMENT FOR REVIEW BY THE PRINCIPAL. THE WORKS MAY ONLY COMMENCE WITH A WRITTEN APPROVAL FROM THE PRINCIPAL	TWO WEEKS PRIOR TO THE WORKS
2	MEETING ON SITE BETWEEN THE CONTRACTOR, PRINCIPAL AND PRINCIPAL'S REPRESENTATIVE PRIOR TO WORKS COMMENCING TO DISCUSS ANY CLARIFICATIONS	FIVE DAYS PRIOR TO THE WORKS
3	OBSERVATION OF PILE WALL SETOUT PRIOR TO PILE EXCAVATION BY THE PRINCIPAL'S REPRESENTATIVE	FIVE DAYS PRIOR TO THE WORKS
4	GEOTECHNICAL OBSERVATIONS OF PILE EXCAVATION BY THE PRINCIPAL'S REPRESENTATIVE	48 HOURS
5	STRUCTURAL OBSERVATIONS OF PILE AND CAPPING BEAM REINFORCING BY THE PRINCIPAL'S REPRESENTATIVE	48 HOURS
6	GEOTECHNICAL OBSERVATIONS OF THE EXCAVATION SUBGRADE PRIOR TO BACKFILL WITH PROPOSED FILL	48 HOURS
7	PRIOR TO PAVEMENT CONSTRUCTION, OBSERVATIONS REQUIRED OF THE FINISHED PROPOSED FILL SURFACE LEVEL, NEW PILE CAP FACE AND MILLED EXISTING PAVEMENT SURFACE	48 HOURS
8	STORMWATER OUTLET PIPE CONSTRUCTION OBSERVATIONS	48 HOURS
9	COMPLETED WORKS AND FALL PROTECTION BARRIER PRIOR TO CONTRACTOR DEMOBILISING	48 HOURS

- THE PRINCIPAL MAY SPECIFY ADDITIONAL MONITORING OBSERVATIONS AND/OR HOLD POINTS AT THEIR DISCRETION.
- ENGINEERING MONITORING OBSERVATIONS MAY BE UNDERTAKEN IN PARALLEL WHERE POSSIBLE.

PILING

GT1 PILES MUST BE CONSTRUCTED IN ACCORDANCE WITH TfNSW SPECIFICATION B59.

GT2 CONCRETE EXPOSURE CLASSIFICATION : B2 NOMINAL COVER TO REINFORCEMENT NEAREST TO THE CONCRETE SURFACE, UNLESS SPECIFIED OTHERWISE, SHALL BE 90mm. MINIMUM 28 DAYS COMPRESSIVE STRENGTH OF CONCRETE SHALL BE : f'c 40MPa

GT3 THE SUBSURFACE GEOLOGICAL STRATIGRAPHY SHOWN ON THE DRAWINGS IS INDICATIVE ONLY AND IS INFERRED BASED ON AVAILABLE GROUND INFORMATION.

GT4 ALL EXISTING CUT FACES MUST BE INSPECTED DURING CONSTRUCTION BY THE PRINCIPAL'S REPRESENTATIVE TO CONFIRM THAT THE SUBSURFACE CONDITIONS ARE CONSISTENT WITH THE DESIGN ASSUMPTIONS AND TO ASSESS WHETHER ANY ADDITIONAL STABILISATION IS REQUIRED.

GT5 CONCRETE MUST BE PLACED BY THE TREMIE METHOD IN ACCORDANCE WITH TfNSW SPECIFICATION B59.

GT6 PILE TOE LEVELS ARE INDICATIVE ONLY (BASED ON INTERPRETATION OF AVAILABLE GROUND INVESTIGATION DATA).

GT7 THE ACTUAL PILE TOE LEVEL MAY VARY ON SITE.

GT8 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.

GT9 PILE TOE LEVEL TO BE GOVERNED BY THE MINIMUM SOCKET LENGTH REQUIRED, ONLY ASSUMED TOP OF ROCK LEVELS ARE GIVEN

GT10 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.

TEMPORARY WORKS

T1 TEMPORARY WORKS IS THE RESPONSIBILITY OF THE CONTRACTOR.

T2 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.

T3 TEMPORARY WORKS MONITORING IS THE RESPONSIBILITY OF THE CONTRACTOR AND THE TEMPORARY WORKS MONITORING REGIME MUST BE INCLUDED IN THE CONTRACTORS WORKS METHOD STATEMENT.

PAVEMENT

P1 ALL MATERIALS AND CONSTRUCTION WORKS MUST ADHERE TO THE RELEVANT TfNSW QA SPECIFICATIONS, INCLUDING:
- ASPHALT - R116
- CLASS 2 DGB - R71
- PRIME AND LOW CUTTER SEAL - R106

P2 REFER TO DRAWING GE-DRG-000005 FOR ADDITIONAL PAVEMENT NOTES.

CONCRETE

C1 ALL WORKMANSHIP, MATERIALS AND FORMWORK SHALL BE IN ACCORDANCE WITH TfNSW QA SPECIFICATION B80.

C2 CONSTRUCTION JOINTS SHALL BE LOCATED AND DETAILED AS SHOWN ON THE DRAWINGS OR SHALL BE LOCATED AND FORMED TO THE APPROVAL OF THE PRINCIPAL. CONCRETE AGAINST WHICH NEW CONCRETE IS TO BE PLACED SHALL BE INTENTIONALLY ROUGHENED TO EXPOSE THE INBOUND COARSE AGGREGATE.
TO ENSURE SATISFACTORY BOND BETWEEN ADJACENT CONCRETE SURFACES U.N.O. ALL CONCRETE SURFACES SHALL BE CLEAN AND FREE OF LAITANCE. THOROUGHLY MOISTEN THE ROUGHENED SURFACE IMMEDIATELY PRIOR TO PLACING CONCRETE.

C3 MINIMUM 28 DAY COMPRESSIVE STRENGTH OF MASS CONCRETE SHALL BE f'_c 20 MPa.

C4 EXPOSURE CLASSIFICATION, CONCRETE GRADE AND COVER (EXCLUDING PILES) ARE AS SPECIFIED BELOW:

ELEMENT	EXPOSURE CLASS	MINIMUM CONCRETE GRADE (MPa)	NOMINAL CONCRETE COVER (mm)
CAST IN SITU	B2	N50	50
	B2	N40	60
PILES	B2	N40	90

C5 NO PENETRATIONS, RECESSES OR CHASES OTHER THAN THOSE SHOWN ON THE DRAWINGS SHALL BE MADE IN THE CONCRETE MEMBERS WITHOUT PRIOR APPROVAL OF THE PRINCIPAL.

C6 ALL FORMED EXPOSED EDGES AND RE-ENTRANT CORNERS SHALL BE CHAMFERED OR FILLETED 20 x 20mm U.N.O. ON THE DRAWINGS.

C7 MINIMUM AGGREGATE SIZE TO BE 10mm, MAXIMUM AGGREGATE SIZE SHALL BE 20mm U.N.O.

C8 FREE DROPPING OF CONCRETE FROM A HEIGHT GREATER THAN 1000mm IS NOT PERMITTED.

STEEL REINFORCEMENT

R1 UNLESS OTHERWISE SPECIFIED, REINFORCEMENT SHALL BE GRADE D500N IN ACCORDANCE WITH AS/NZS4671.

R2 ALL REINFORCEMENT SHALL BE SECURELY TIED WITH WIRE TIES AND ALL TIE ENDS SHALL BE TURNED INTO THE MEMBER CLEAR OF THE COVER ZONE.

R3 ALL RE-ENTRANT CORNERS OF PENETRATIONS THROUGH WALLS AND SLABS SHALL BE TRIMMED USING MINIMUM 2N16 DIAGONAL CORNER BARS 1500mm LONG U.N.O.

R4 REINFORCEMENT SHALL NOT BE CUT OR BENT ON SITE WITHOUT THE PRIOR APPROVAL OF THE PRINCIPAL (UNLESS SHOWN IN DRAWINGS).

R5 AT PENETRATIONS WITH DIMENSIONS LESS THAN 400mm DO NOT CUT REINFORCEMENT. RATHER PLACE REINFORCEMENT TO EACH SIDE OF PENETRATION U.N.O. ON THE PLANS. AT PENETRATIONS WITH DIMENSIONS LESS THAN 600mm LAY REINFORCEMENT IN REQUIRED POSITION AND CUT OUT TO SUIT PENETRATION. PROVIDE ADDITIONAL BARS TO MATCH THE SIZE LENGTH AND NUMBER OF BARS CUT, AND PLACE EQUALLY ON EACH SIDE OF THE PENETRATION U.N.O. ON PLANS. PROVIDE 2N12 BARS ACROSS PENETRATION CORNERS.

R6 SPACING OF REINFORCEMENT SHALL BE TAKEN AS EQUAL U.N.O .

R7 REINFORCING BAR COUPLERS SHALL DEVELOP AT LEAST THE FULL STRENGTH OF THE JOINED BARS AS PER AS 5100.

R8 EMBEDDED FIXTURES (INSERTS, THREADED SOCKETS, FERRULES, BOLTS, AND STAINLESS REINFORCING ETC.) WITHIN COVER CONCRETE OR EXPOSED TO AIR MUST NOT BE IN CONTACT WITH REINFORCING STEEL.

R9 REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY AND IS NOT NECESSARILY SHOWN IN TRUE PROJECTION.

R10 REINFORCEMENT MAY BE DISPLACED SLIGHTLY WHERE NECESSARY TO CLEAR STEEL DOWELS, ANCHOR BOLTS, DRAINAGE PIPES, FORMED HOLES AND RECESSES. REINFORCEMENT IN PILECAPS AND MAY BE DISPLACED SLIGHTLY TO AVOID PILE REINFORCEMENT

R11 ALL STRUCTURAL CONCRETE OTHER THAN LABELLED AS MASS CONCRETE OR BLINDING SHALL BE REINFORCED.

R12 SPLICING OF BARS SHALL BE AT THE POSITIONS SHOWN ON THE DRAWINGS OR AS APPROVED BY THE PRINCIPAL.

R13 UNLESS SPECIFIED OTHERWISE, THE MINIMUM DEVELOPMENT LENGTH AND LENGTHS OF LAPS SHALL BE :

BAR SIZE	N12	N16	N20	N24	N28	N32
a) HORIZONTAL BARS WITH >300mm OF CONCRETE CAST BELOW THE BAR	500	650	850	1150	1450	1750
b) OTHER BARS	350	500	650	900	1100	1350

R15 CLEAR DISTANCE BETWEEN LAPPED BAR SHALL NOT EXCEED 3 x THE BAR DIAMETER

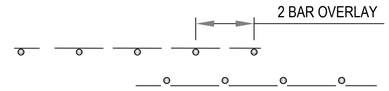
R16 HELICAL REINFORCEMENT SHALL BE SPLICED WITHIN IS LENGTH EITHER BY WELDING OR MECHANICAL MEANS

R17 ALL MESH IS TO BE LAPPED BY 2 TRANSVERSE BARS PLUS 25mm MIN.

R18 LAPS NOT SHOWN ON THE DRAWINGS SHALL BE STAGGERED SO THAT NOT MORE THAN 50% OF THE BARS ARE LAPPED IN ANY ONE CROSS SECTION.

R19 ALL DOWEL BARS ARE TO BE GRADE 304 STAINLESS STEEL UNO. ALL DOWEL BARS TO BE ELECTRICALLY ISOLATED FROM STANDARD REINFORCING BARS WITH AN INSULATING SLEEVE UNO.

R20 REINFORCEMENT FABRIC LAPPED SPLICE SHALL BE AS FOLLOWS:



FOR REVIEW

NOT FOR CONSTRUCTION

FILE NAME: 520212TP-AURC-83751-GE-DRG-000002.dwg

PLOT DATE & TIME: 16/03/2023 2:46:55 PM

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	D.P 16/03/2023	W.D 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20 | HEIGHT DATUM: AHD71

SCALE: NOT TO SCALE

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

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CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D. PERERA	16.03.2023
DRG CHECK	D. PERERA	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
GENERAL NOTES

DRAWING SET No:	PART:	SHEET: 2	OF 16	
STATUS:	BRIDGE No:			©
DRG No. 520212TP-AURC-83751-GE-DRG-000002	REV C	VER	EDMS No.	AMD No.

SITEWORKS

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 THE DESIGNER. 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 TfNSW STANDARDS.
4. ASPHALTIC CONCRETE SHALL CONFORM TO TfNSW QA SPECIFICATION R116
5. ALL BASECOURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH TfNSW QA SPECIFICATION 3051 - GRANULAR BASE AND SUBBASE MATERIALS FOR SURFACED ROAD PAVEMENTS, COMPACTED TO 98% MODIFIED DENSITY IN ACCORDANCE WITHAS1289 5.2.1. FREQUENCY OF COMPACTION TESTING TO BE NO LESS THAN 1 TEST PER 50m2 OF BASECOURSE MATERIAL PLACED.
6. ALL SUBBASECOURSE MATERIAL SHALL BE IGNEOUS ROCK QUARRIED MATERIAL TO COMPLY WITH TfNSW QA SPECIFICATION 3051 - GRANULAR BASE AND SUBBASE MATERIALS FOR SURFACED ROAD PAVEMENTS, COMPACTED TO 95% MODIFIED DENSITY IN ACCORDANCE WITHAS1289 5.2.1. FREQUENCY OF COMPACTION TESTING TO BE NO LESS THAN 1 TEST PER 50m2 OF BASECOURSE MATERIAL PLACED.
7. THE USE OF RECYCLED MATERIALS IS ENCOURAGED. IF THE CONTRACTOR INTENDS TO USE RECYCLED MATERIALS, A RECYCLED MATERIAL COMPLYING WITH TfNSW 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.
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 COST.
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 ONSITE.
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, PUMP STATIONS 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.

STORMWATER DRAINAGE

1. CARE IS TO BE TAKEN WITH LEVELS OF STORMWATER LINES. GRADES SHOWN ARE NOT TO BE REDUCED WITHOUT APPROVAL.
2. AT ALL TIMES DURING CONSTRUCTION, ADEQUATE SAFETY PROCEDURES SHALL BE TAKEN TO PREVENT PERSONNEL FROM FALLING INTO PITS AND OPEN TRENCHES.
3. 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.
4. 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.
5. 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.
6. 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.

SURVEY NOTES

1. THE FOLLOWING SURVEY DATA HAS BEEN ADOPTED FOR THE PURPOSE OF DESIGN: - PROVIDED BY CONNECT SYDNEY
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.

FOR REVIEW

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REFERENCES:

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	D.S 16/03/2023	W.D 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20 | HEIGHT DATUM: AHD71

SCALE: NOT TO SCALE

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

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CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D.PERERA	16.03.2023
DRG CHECK	D.PERERA	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
DRAINAGE NOTES

DRAWING SET No: | PART: | SHEET: 3 OF 16

STATUS: | BRIDGE No: ©

DRG No. 520212TP-AURC-83751-GE-DRG-000003 | REV C | VER | EDMS No. | AMD No.

FILE NAME: 520212TP-AURC-83751-GE-DRG-000003.dwg

PLOT DATE & TIME: 16/03/2023 2:47:00 PM

TfNSW-DE-Titleblock-A1-H-R19_BridgeRoadRail_Design.dwg

FOR REVIEW

NOT FOR CONSTRUCTION

REFERENCES:

TNSW-DE-Titleblock-A1-H-R19_BridgeRoadRail_Design.dwg
520212TP-AURC-83751-SU-M2D-SURVEY.dwg
520212TP-AURC-83751-CV-M2D-CONTROL LINE.dwg
520212TP-AURC-83751-CV-M2D-DESIGN PLAN.dwg

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	O.D 16/03/2023	M.H 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	O.D 22/12/2022	M.H 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20

HEIGHT DATUM: AHD71

SCALE: 1:250

DESIGN LOT CODE:

CLIENT: Transport for NSW

PREPARED FOR:

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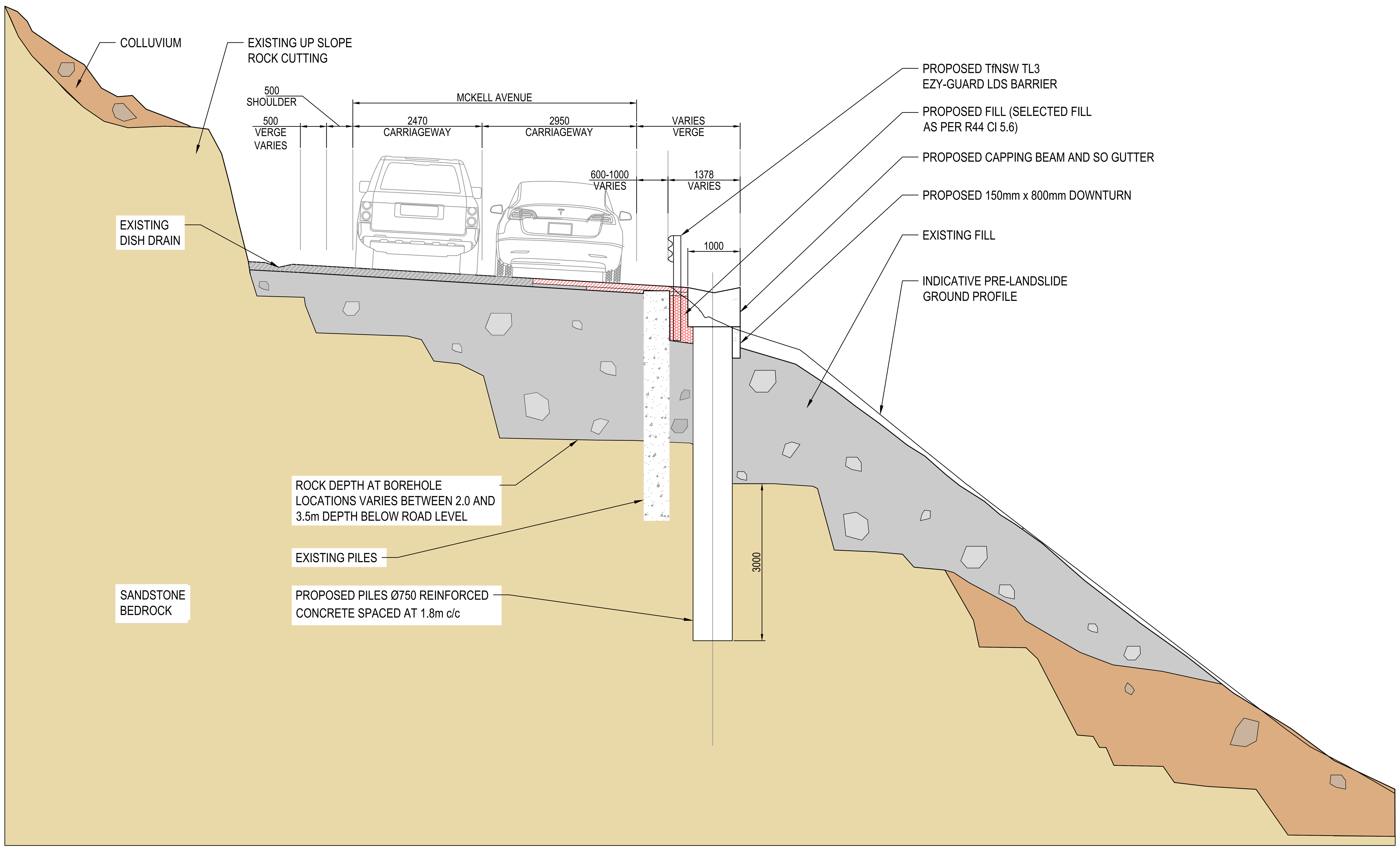
CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D.PERERA	16.03.2023
DRG CHECK	D.PERERA	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
GENERAL ARRANGEMENT - PLAN

DRAWING SET No:
PART:
SHEET: 4 OF 16
STATUS:
BRIDGE No:
©
DRG No. 520212TP-AURC-83751-GE-DRG-000004
REV C
VER
EDMS No.
AMD No.

FILE NAME: 520212TP-AURC-83751-GE-DRG-000004.dwg
PLOT DATE & TIME: 16/03/2023 2:47:09 PM



GENERAL ARRANGEMENT SECTION
SCALE 1:50

NOTES:

1. LAYOUT SHOWN IS A TYPICAL SECTION AND IS NOT TO BE SCALED FROM.
2. SUBSURFACE GEOLOGICAL STRATIGRAPHY IS INDICATIVE ONLY AND HAS BEEN INFERRED BASED ON AVAILABLE GROUND INFORMATION. ACTUAL CONDITIONS WILL VARY.

LEGEND:

- EXISTING FILL
- SANDSTONE BEDROCK
- COLLUVIUM
- PROPOSED PAVEMENT
- PROPOSED PILES, HEADSTOCK, TRAFFIC BARRIER AND FALL PROTECTION BARRIER

⚠ WORKING IN OR NEAR AN ACTIVE ROAD CORRIDOR. RISK TO WORKERS AND PLANT.

⚠ ROCKFALL AND LANDSLIDING RISK, DUE TO INSTABILITY INITIATING ABOVE OR BELOW MCKELL AVENUE FROM NATURAL CAUSES.

⚠ UNSTABLE GROUND RISK. INSTABILITY ABOVE, BELOW, OR ON MCKELL AVENUE MAY ARISE FROM EXCAVATIONS, CONSTRUCTION SEQUENCING, VIBRATION AND PLANT LOADS.

FOR REVIEW

NOT FOR CONSTRUCTION

FILE NAME: 520212TP-AURC-83751-GE-DRG-000005.dwg

PLOT DATE & TIME: 16/03/2023 2:50:41 PM

REFERENCES:

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SCALE: AS SHOWN

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	D.P 16/03/2023	W.D 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20 | HEIGHT DATUM: AHD71 | DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

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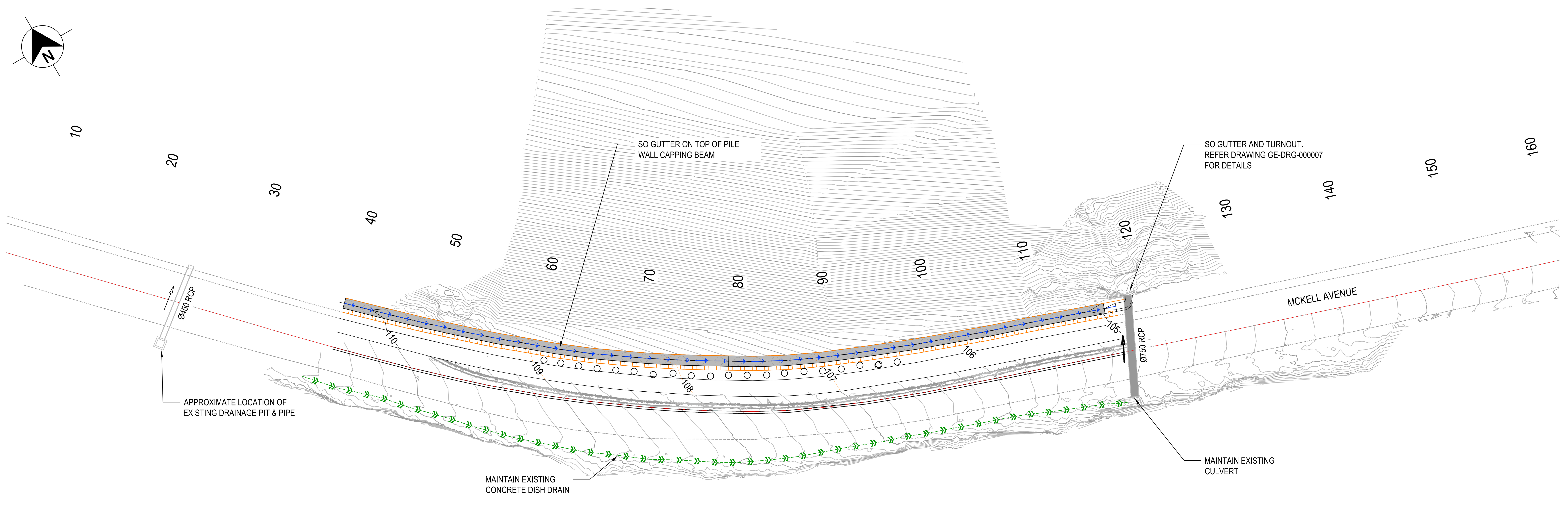
CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D. PERERA	16.03.2023
DRG CHECK	D. PERERA	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
GENERAL ARRANGEMENT SECTION

DRAWING SET No: | PART: | SHEET: 5 OF 16
STATUS: | BRIDGE No:

DRG No. 520212TP-AURC-83751-GE-DRG-000005 | REV C | VER | EDMS No. | AMD No.



PLAN
1:200

LEGEND:

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED STORMWATER CHANNEL
- EXISTING STORMWATER CHANNEL
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER PIT
- EXISTING HEADWALL

NOTES:

1. FOR GENERAL NOTES REFER TO DRG GE-DRG-000002 AND GE-DRG-000003.
2. ALL DRAINAGE PIPES SHALL BE CLASS 4 OR EQUIVALENT UNLESS NOTED OTHERWISE AND IN ACCORDANCE WITH RMS R11.
3. CONNECTION BETWEEN PITS AND STRUCTURE TO BE UNDERTAKEN IN ACCORDANCE WITH TFNSW MODEL DRAWING R0220-43 UNLESS NOTED OTHERWISE.
4. ALL PIPES ARE TO BE SPIGOT AND SOCKET OR SPIGOT AND COUPLING WITH RUBBER RING JOINTS UNLESS OTHERWISE INDICATED.
5. ALL PROPOSED DRAINAGE PIT GRATINGS SHALL BE HEAVY DUTY CLASS D.
6. EXISTING STORMWATER DRAINAGE PIPE AND PIT LAYOUTS SHOWN ON THE DRAWINGS ARE INDICATIVE ONLY. ALL LOCATIONS ORIENTATION AND LEVELS OF EXISTING SHALL BE VERIFIED ON SITE BEFORE COMMENCING ANY WORK.

FILE NAME: 520212TP-AURC-83751-GE-DRG-000006.dwg
PLOT DATE & TIME: 16/03/2023 2:47:23 PM

FOR REVIEW

NOT FOR CONSTRUCTION

REFERENCES:

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	A.M 16/03/2023	M.H 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	A.M 22/12/2022	M.H 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20
HEIGHT DATUM: AHD71
SCALE: AS SHOWN
DESIGN LOT CODE:

CLIENT: Transport for NSW
PREPARED FOR:

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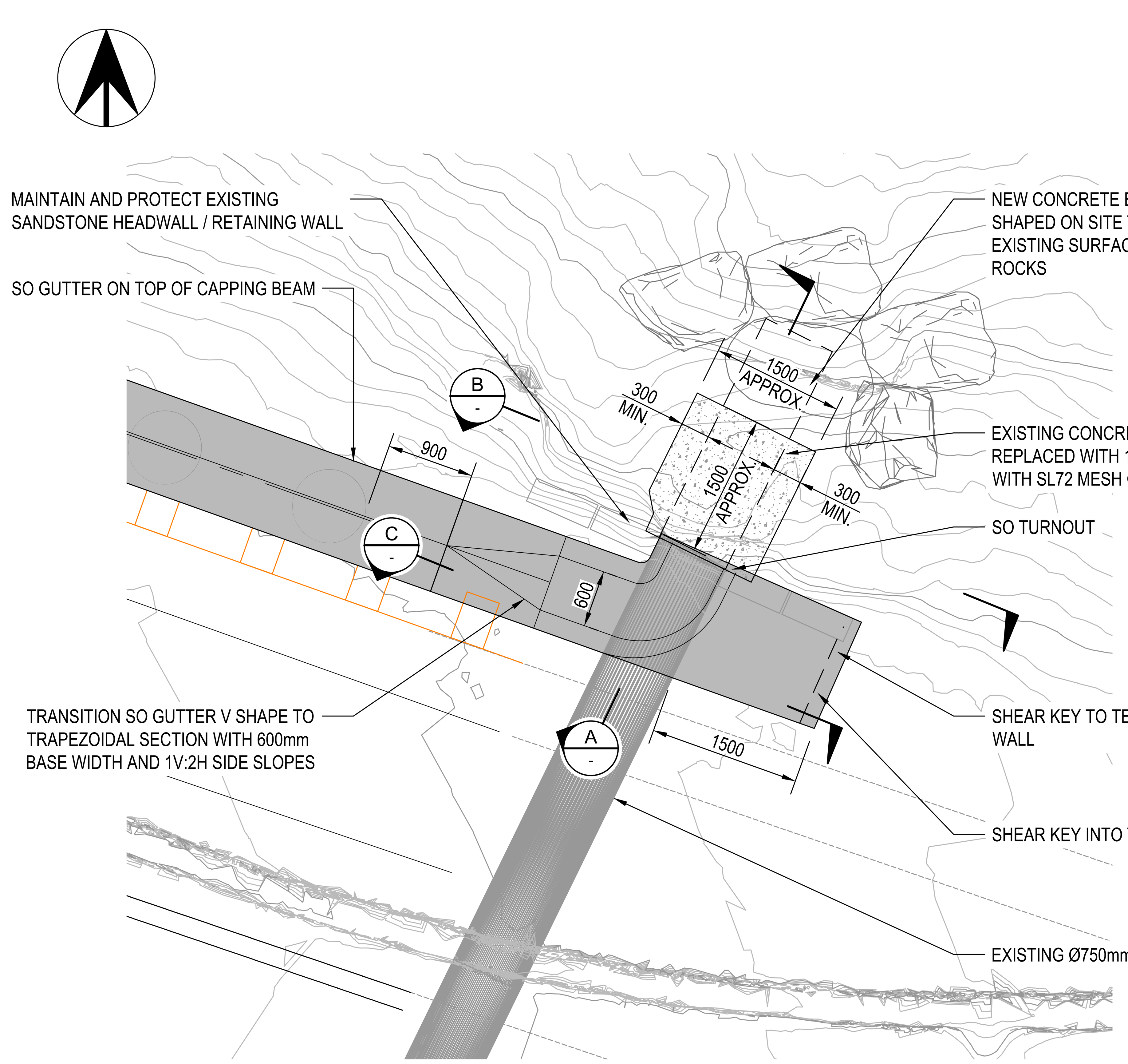
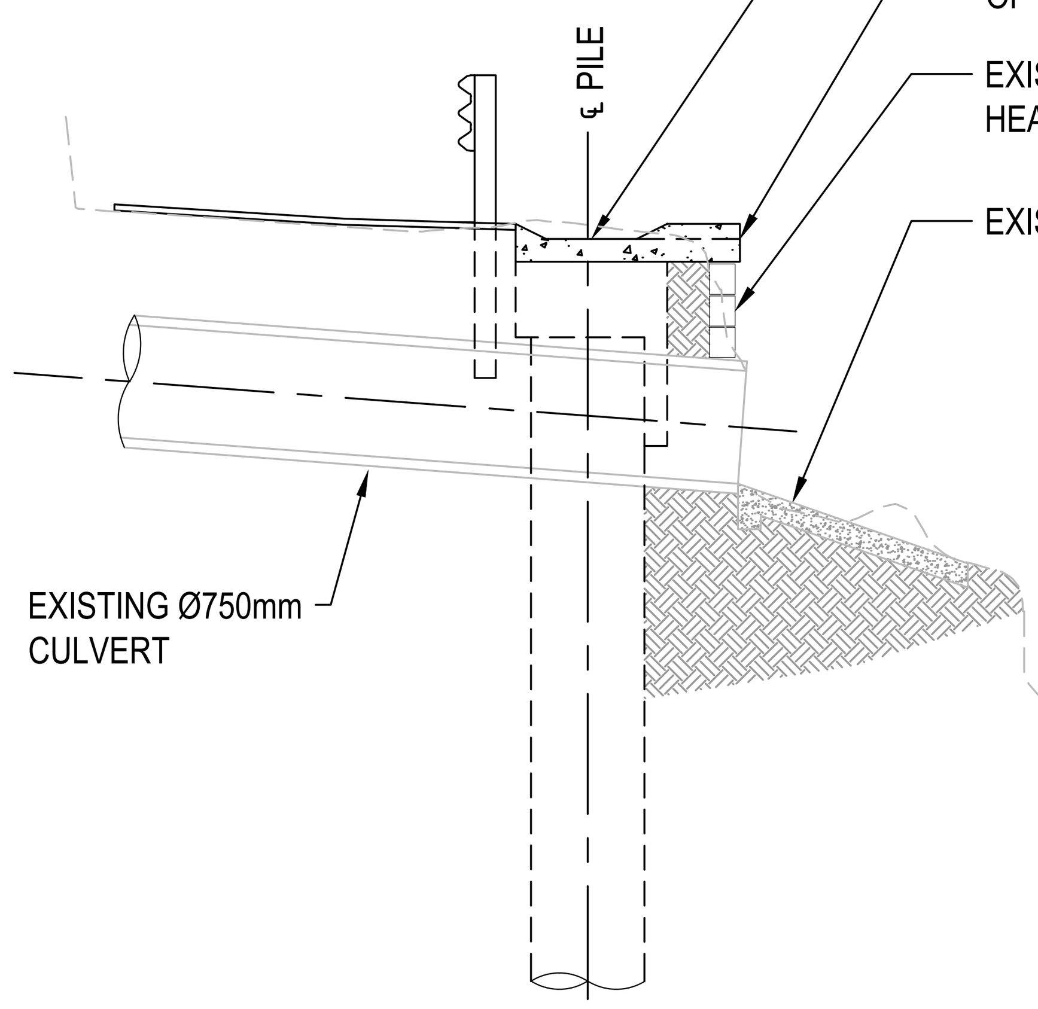
DRAWN	J.NICOLLE	16.03.2023
DESIGNED	T.FELIX	16.03.2023
DRG CHECK	V.TIET	16.03.2023
DESIGN CHECK	D.WHYTE	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
STORMWATER DRAINAGE GENERAL ARRANGEMENT

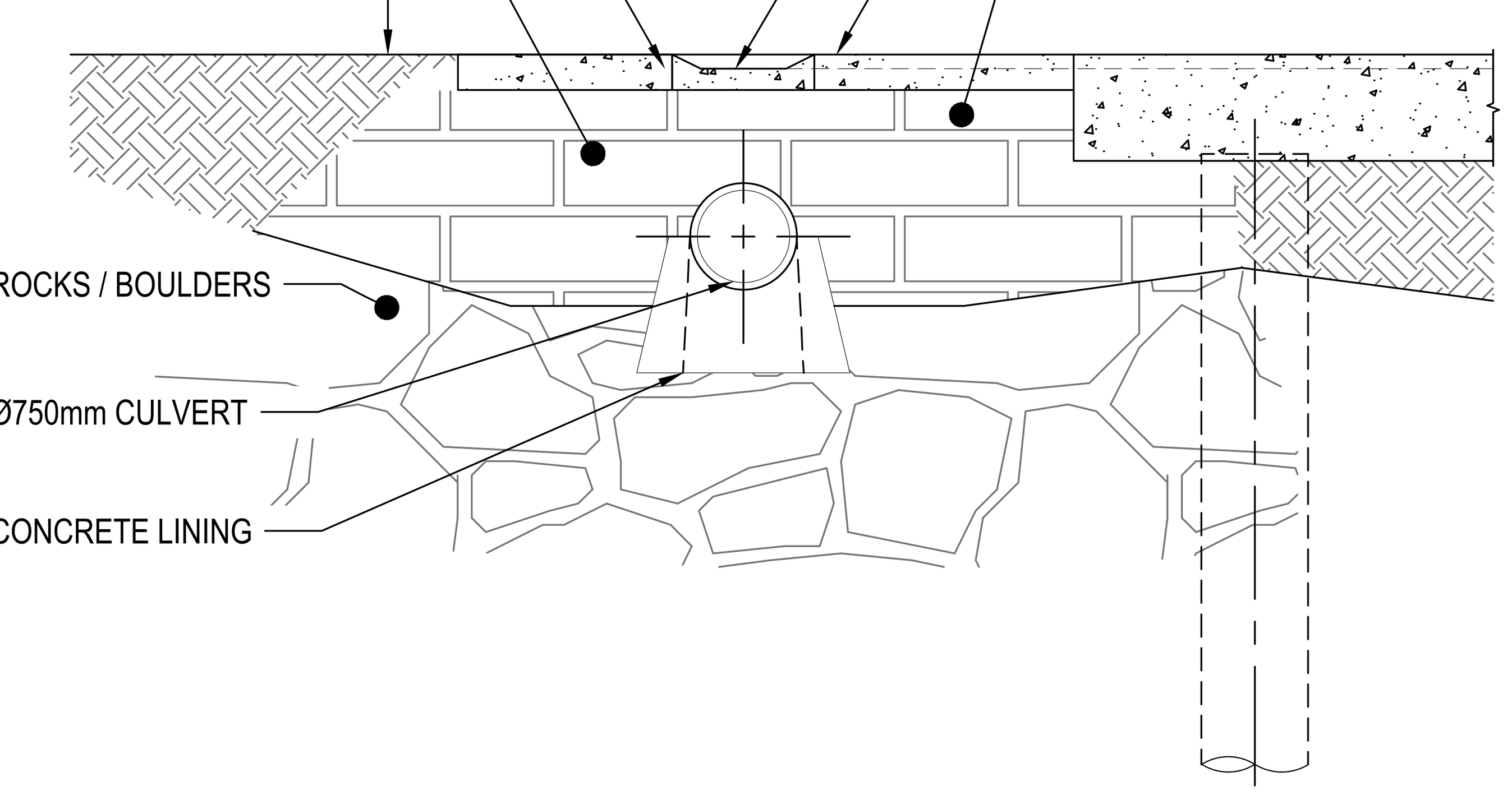
DRAWING SET No:
PART:
SHEET: 6 OF 16
STATUS:
BRIDGE No:
DRG No. 520212TP-AURC-83751-GE-DRG-000006
REV C
VER
EDMS No.
AMD No.



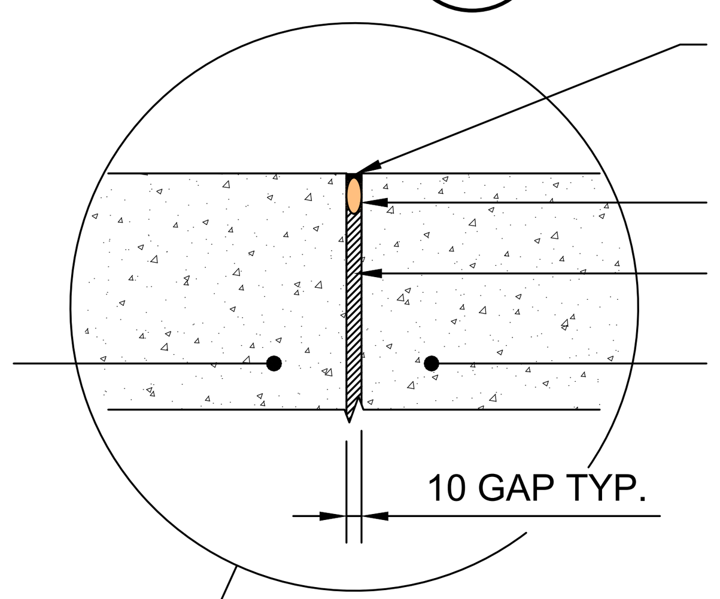
SO GUTTER, TURNOUT AND EXISTING CULVERT OUTLET DETAIL
SCALE 1:50



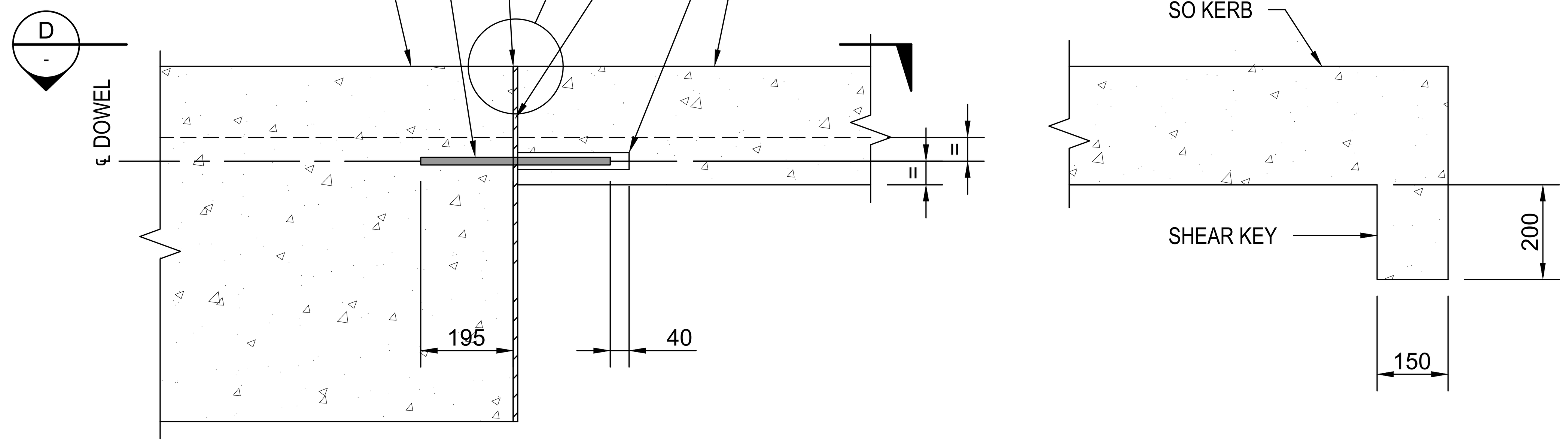
SECTION A
SCALE NTS



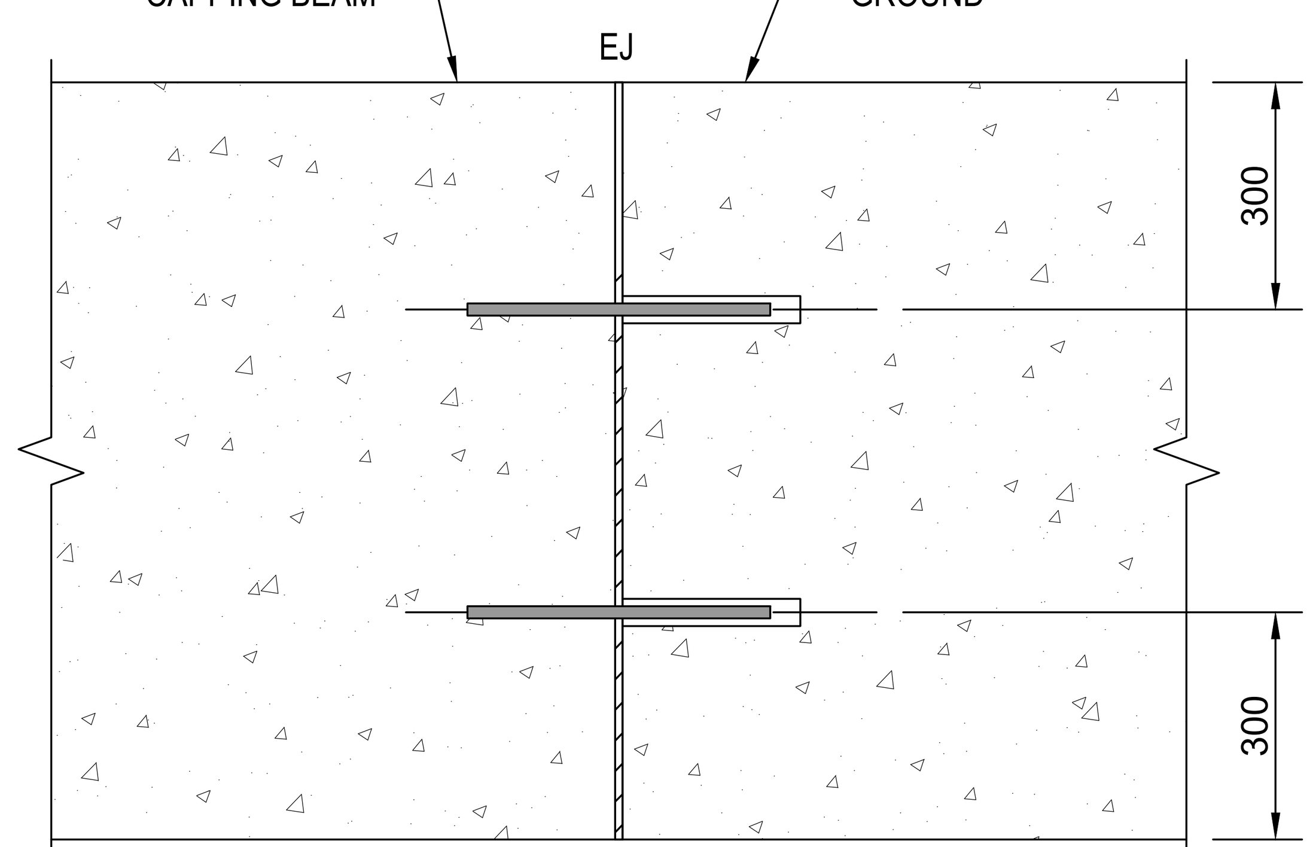
SECTION B
SCALE NTS



EXPANSION JOINT DETAIL TYPE 'B' (EJB)
SCALE 1:5



SECTION C
SCALE 1:10



SECTION D
SCALE 1:10

NOTES:
1. FOR GENERAL NOTES REFER TO DRAWING GE-DRG-000002 AND GE-DRG-000003.
2. GEOTEXTILE (BIDIM A36 OR EQUIVALENT ACCEPTED BY THE DESIGNER) TO BE LAID IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND RMS SPECIFICATION R63.
3. FLEXIBLE SEAL TO BE PROVIDED BETWEEN CULVERT AND HEADWALL AS PER MANUFACTURER'S DETAILS.

FOR REVIEW

NOT FOR CONSTRUCTION

FILE NAME: 520212TP-AURC-83751-GE-DRG-000007.dwg

PLOT DATE & TIME: 16/03/2023 2:47:30 PM

REFERENCES:
TfNSW-DE-Titleblock-A1-H-R19_BridgeRoadRail_Design.dwg
520212TP-AURC-83751-CV-M2D-DESIGN CONTOURS.dwg
520212TP-AURC-83751-CV-M2D-DESIGN PLAN.dwg
520212TP-AURC-83751-SU-M2D-EXISTING CONTOURS.dwg
520212TP-AURC-83751-SU-M2D-SURVEY.dwg
520212TP-AURC-83751-SD-M2D-SW_DETAILS.dwg

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	A.M 16/03/2023	M.H 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	A.M 22/12/2022	M.H 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20

HEIGHT DATUM: AHD71

SCALE: AS SHOWN

DESIGN LOT CODE:

CLIENT: Transport for NSW

PREPARED FOR:

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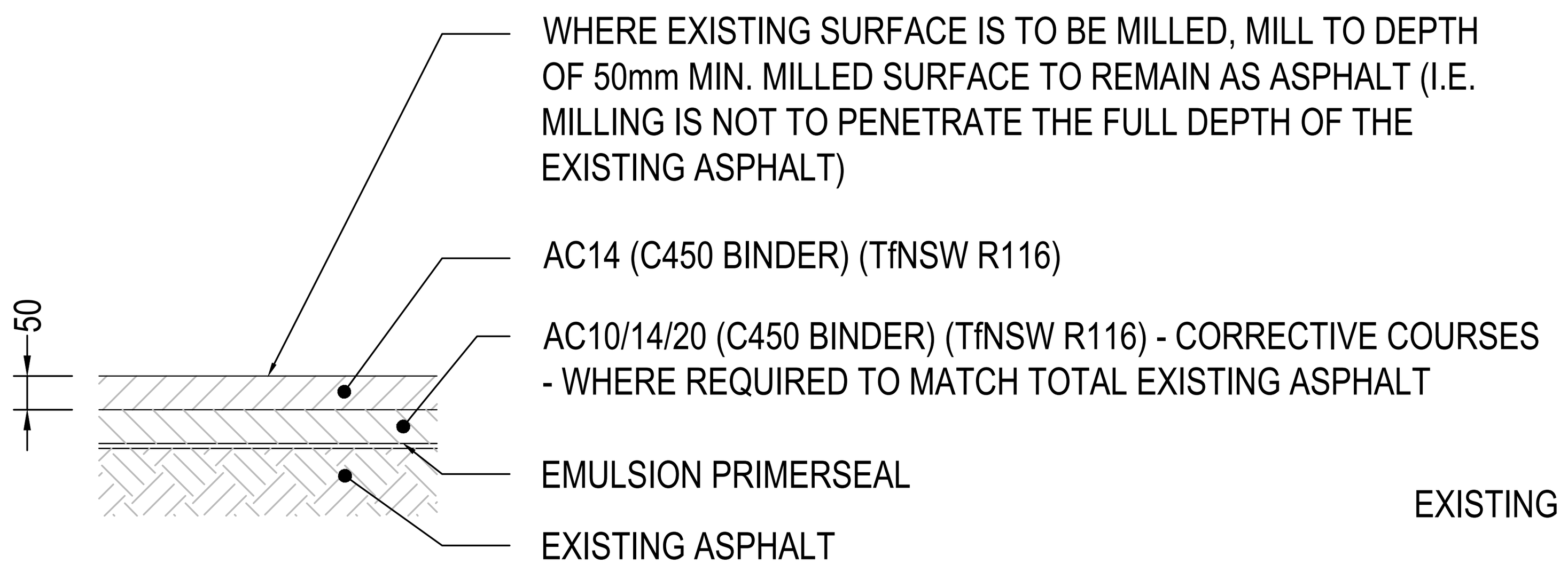
CONNECT SYDNEY

DRAWN	J.NICOLLE	16.03.2023
DESIGNED	T.FELIX	16.03.2023
DRG CHECK	W.DENG	16.03.2023
DESIGN CHECK	D.WHYTE	16.03.2023
PROJ/DES MNGR	V.TIET	16.03.2023
APPROVED	K.TIWARI	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
DRAINAGE DETAILS

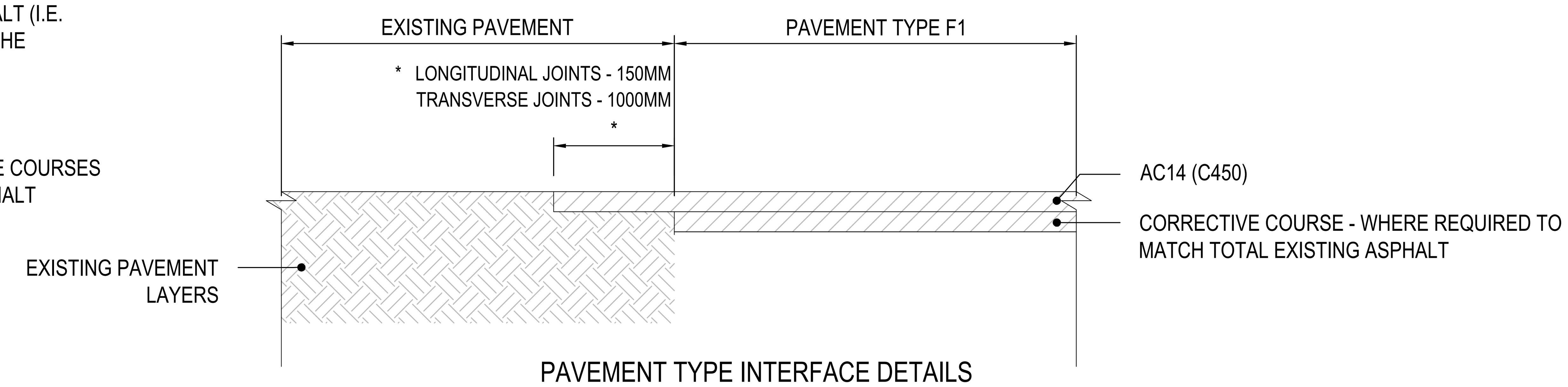
DRAWING SET No:
STATUS:
PART:
SHEET: 7 OF 16
BRIDGE No:
©

DRG No. 520212TP-AURC-83751-GE-DRG-000007
REV C
VER
EDMS No.
AMD No.



PAVEMENT TYPE F1

MILL AND RESHEET



PAVEMENT TYPE INTERFACE DETAILS

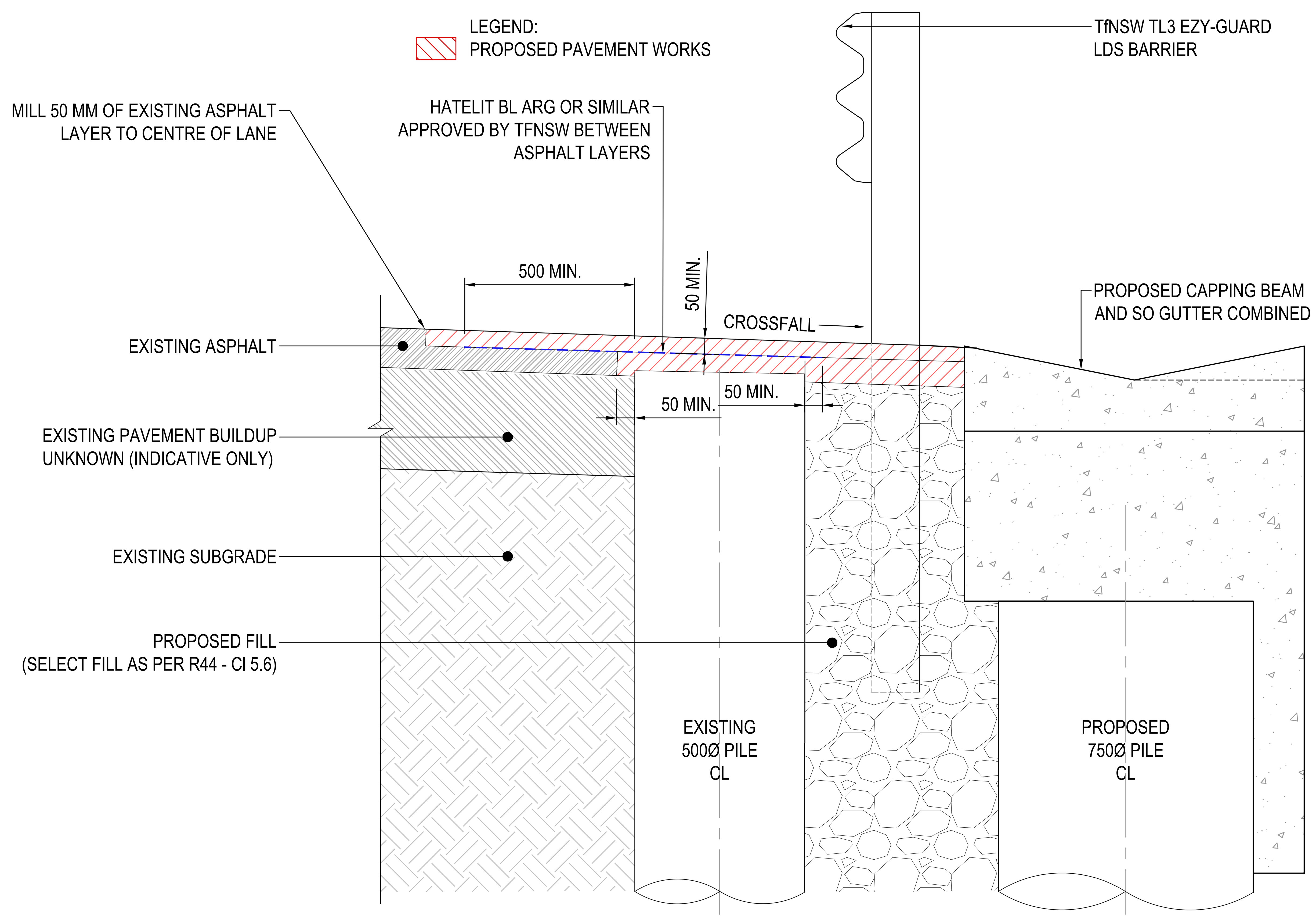
PAVEMENT TYPE F1 AND EXISTING PAVEMENT

NOTES:

1. PAVEMENT DESIGNS ARE BASED ON THE ASSUMED SUBGRADE SUPPORT CONDITIONS NOTED IN PROFILES.
2. PAVEMENT SHALL BE CONSTRUCTED ACCORDING TO TfNSW SPECIFICATIONS OR SIMILAR.
3. WIDTH OF MILLING OF EXISTING BASE MATERIAL MAY BE INCREASED TO SUIT CONTRACTIBILITY CONSTRAINTS I.E. AVAILABLE MILLING HEAD UP TO MAXIMUM OF 1.2m FROM THE EDGE OF EXISTING PILE.
4. ALL MILLING TO BE PERFORMED WITH FINE TOOTH DRUM MILLING HEAD.
5. REFER TO EZY-GUARD 4 / SMART GROUND BEAM DETAIL FOR BARRIER AND FOOTING DETAILS

KEY TO ABBREVIATION

ARG - ASPHALT REINFORCING GRID



TYPICAL SECTION

SCALE 1:10

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REFERENCES:

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	S.K 16/03/2023	J.F 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	S.K 22/12/2022	J.F 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20

HEIGHT DATUM: AHD71

SCALE: AS SHOWN

DESIGN LOT CODE:

CLIENT: Transport for NSW

PREPARED FOR:

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CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	S.KENTHEESWARAN	16.03.2023
DRG CHECK	S.CAVENS	16.03.2023
DESIGN CHECK	J.FIGUEROA	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE

SRAPC EMERGENCY PROJECTS

MCKELL AVENUE

SL83751

SLOPE STABILISATION WORKS

PAVEMENT AND BARRIER DETAILS

DRAWING SET No: | PART: | SHEET: 8 OF 16

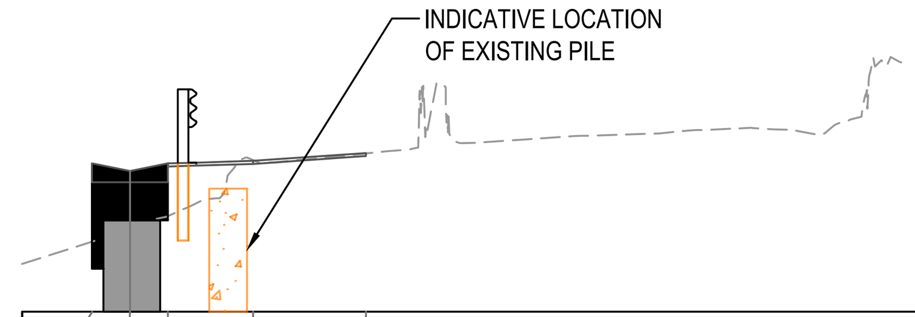
STATUS: | BRIDGE No:

DRG No. 520212TP-AURC-83751-GE-DRG-000008 | REV C | VER | EDMS No. | AMD No.

FILE NAME: 520212TP-AURC-83751-GE-DRG-000008.dwg

PLOT DATE & TIME: 16/03/2023 2:47:35 PM

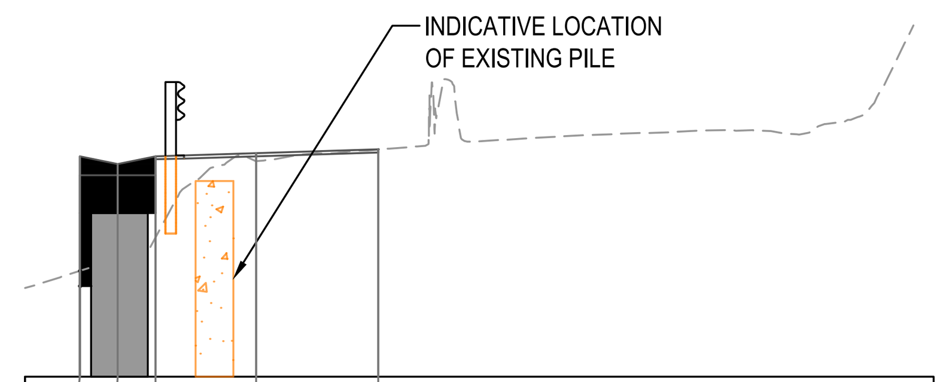
R.L. 107



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	1.033	0.774	0.694	-0.012	0.006
DESIGN LEVELS	108.957	108.857	108.957	108.991	109.095
EXISTING LEVELS	107.924	108.083	108.263	109.003	109.089
DESIGN OFFSETS	-5.077	-4.577	-4.077	-2.950	-1.461

60.000

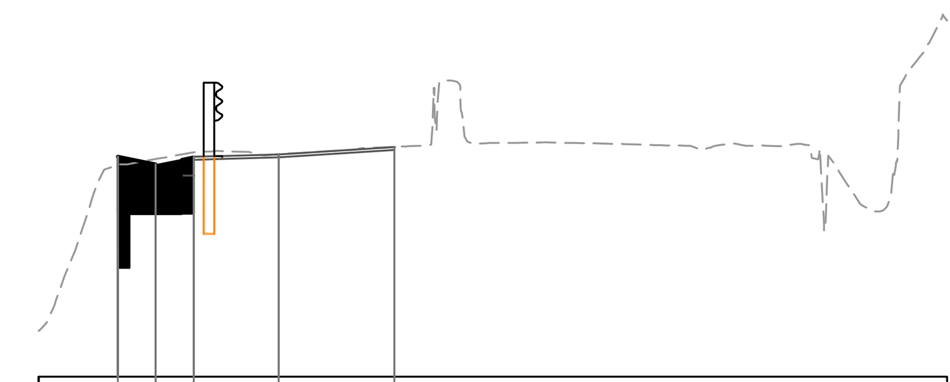
R.L. 104



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	1.514	1.264	1.077	0.104	0.004
DESIGN LEVELS	106.912	106.812	106.912	106.952	107.004
EXISTING LEVELS	105.398	105.548	105.835	106.848	107.000
DESIGN OFFSETS	-5.278	-4.777	-4.277	-2.950	-1.338

90.000

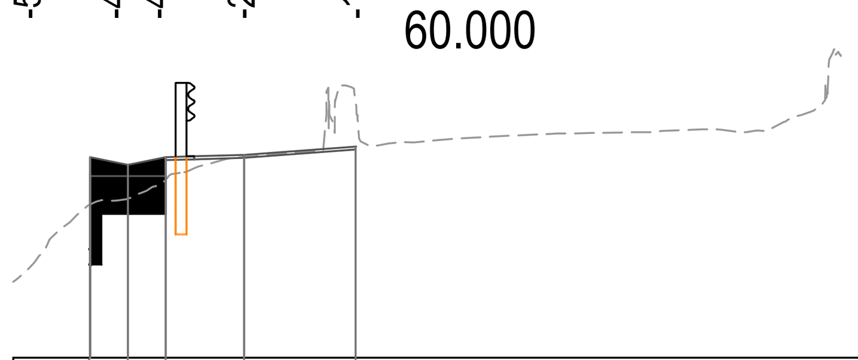
R.L. 102



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	0.107	-0.071	-0.057	-0.000	0.000
DESIGN LEVELS	104.906	104.806	104.906	104.939	105.035
EXISTING LEVELS	104.798	104.876	104.963	104.939	105.035
DESIGN OFFSETS	-4.953	-4.453	-3.953	-2.831	-1.302

117.527

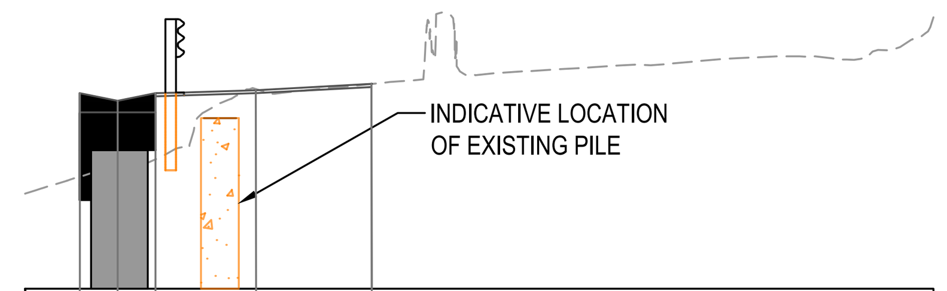
R.L. 107



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	0.625	0.447	0.298	0.028	-0.588
DESIGN LEVELS	109.648	109.548	109.648	109.680	109.789
EXISTING LEVELS	109.024	109.101	109.350	109.652	110.378
DESIGN OFFSETS	-4.984	-4.484	-3.984	-2.950	-1.474

50.000

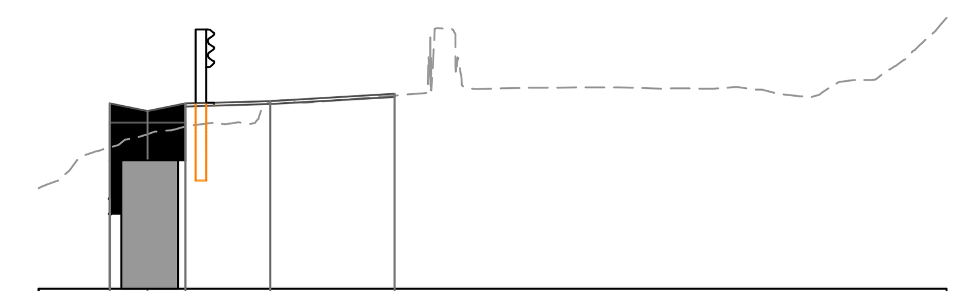
R.L. 105



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	1.103	0.902	0.873	-0.015	-0.001
DESIGN LEVELS	107.583	107.483	107.583	107.623	107.706
EXISTING LEVELS	106.480	106.581	106.710	107.638	107.707
DESIGN OFFSETS	-5.277	-4.777	-4.277	-2.950	-1.421

80.000

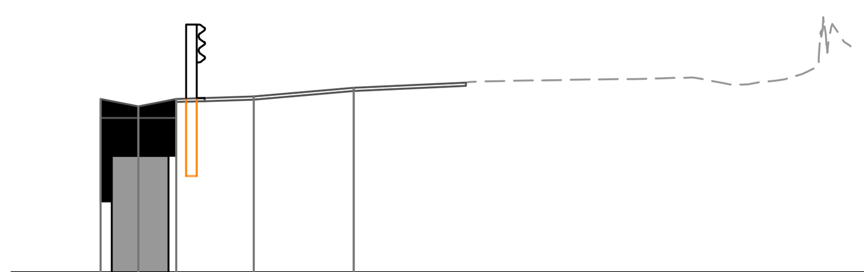
R.L. 103



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	0.576	0.306	0.305	0.008	0.022
DESIGN LEVELS	105.447	105.347	105.447	105.480	105.575
EXISTING LEVELS	104.871	105.041	105.143	105.472	105.553
DESIGN OFFSETS	-5.058	-4.558	-4.058	-2.936	-1.295

110.000

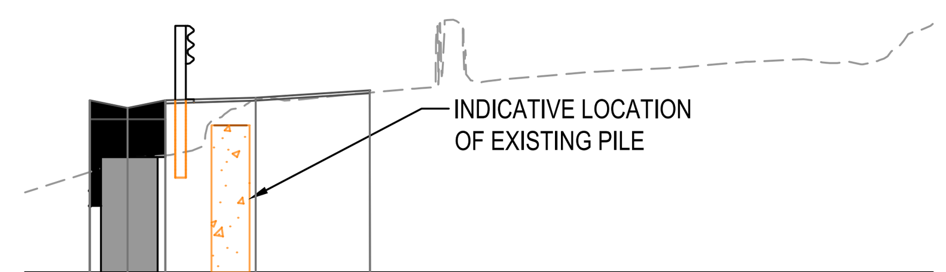
R.L. 108



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	110.288	110.188	110.288	110.320	110.434
DESIGN LEVELS	110.288	110.188	110.288	110.320	110.434
EXISTING LEVELS	0.000	0.000	0.000	0.000	0.000
DESIGN OFFSETS	-4.826	-4.326	-3.826	-2.803	-1.482

40.730

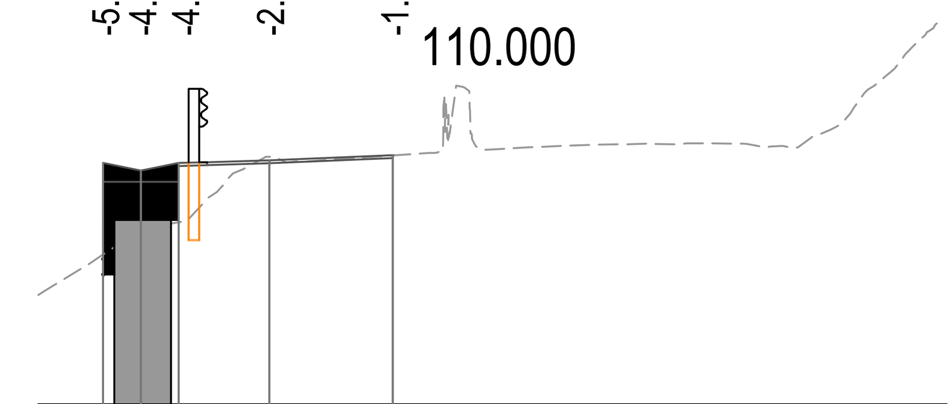
R.L. 106



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	0.946	0.686	0.727	0.034	0.030
DESIGN LEVELS	108.270	108.170	108.270	108.306	108.402
EXISTING LEVELS	107.324	107.484	107.543	108.272	108.372
DESIGN OFFSETS	-5.144	-4.644	-4.144	-2.950	-1.440

70.000

R.L. 103



	CB	CF	ES_L	CE_L	NL
DESIGN FEATURES	CB	CF	ES_L	CE_L	NL
LEVEL DIFFERENCE	1.211	0.778	0.781	-0.047	0.005
DESIGN LEVELS	106.187	106.087	106.187	106.223	106.293
EXISTING LEVELS	104.977	105.310	105.407	106.270	106.288
DESIGN OFFSETS	-5.149	-4.649	-4.149	-2.950	-1.321

100.000

FOR REVIEW

NOT FOR CONSTRUCTION

FILE NAME: 520212TP-AURC-83751-GE-DRG-000009.dwg

PLOT DATE & TIME: 16/03/2023 2:47:40 PM

REFERENCES:

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
B	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	D.S 16/03/2023	W.D 16/03/2023	C.G 16/03/2023
A	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022

COORDINATE SYSTEM: MGA_ZONE_56/GDA20

HEIGHT DATUM: AHD71

SCALE: AS SHOWN

1:100 @ A1 0 1 2 3 4 5 m

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

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AURECON CONNECT SYDNEY

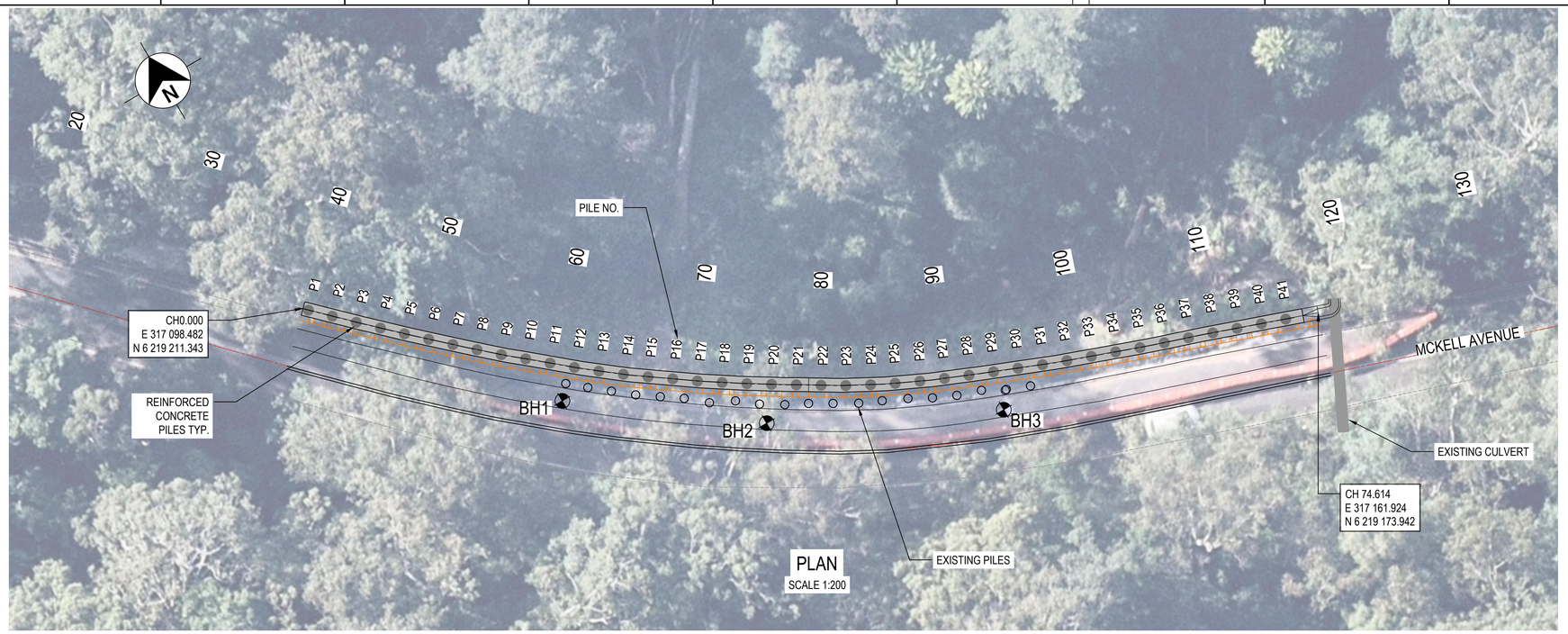
DRAWN	K.GREWAR	16.03.2023
DESIGNED	S.KENTHEESWARAN	16.03.2023
DRG CHECK	S.CAVENS	16.03.2023
DESIGN CHECK	J.FIGUEROA	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
CROSS SECTIONS

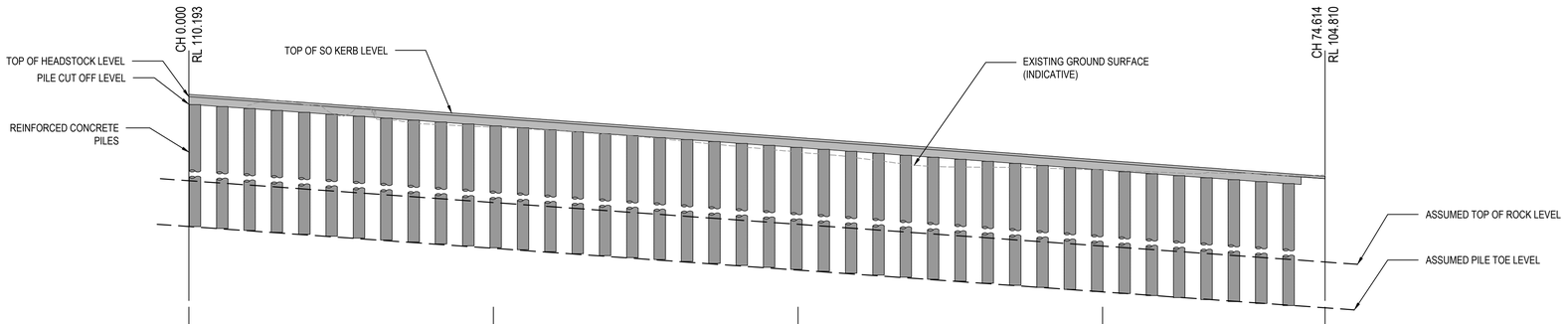
DRAWING SET No: PART: SHEET: 9 OF 16

STATUS: BRIDGE No:

DRG No. 520212TP-AURC-83751-GE-DRG-000009 REV B VER EDMS No. AMD No.



PLAN
SCALE 1:200



TOP OF SO KERB LEVEL	110.193	108.780	107.363	105.874	104.810
PILE CUT OFF LEVEL	109.538	108.125	106.698	105.219	104.155
EXISTING SURFACE LEVELS	0.000	108.039	106.402	105.217	104.880
ASSUMED TOP OF ROCK LEVEL	104.519	103.089	101.658	100.227	99.182
ASSUMED PILE TOE LEVEL	101.512	100.081	98.650	97.220	96.174
CHAINAGE	0	20	40	60	74.614

NOTES:

1. FOR GENERAL NOTES REFER TO DRG-GG-0002
2. PILE LENGTH VARIES DEPENDING ON THE ENCOUNTERED ROCK LEVEL. REFER TO DRG-GG-0011 FOR PILE LENGTH AND FOUNDING DETAILS.
3. REFER TO THE DESIGN REPORT FOR BOREHOLE LOGS.
4. EXISTING GROUND LEVEL IS BASED ON SURVEY UNDERTAKEN BY AURECON ON 30/05/2022 AND IS INDICATIVE ONLY.
5. PILE COORDINATES ARE IN TERMS OF MGA2020 AND RLS ARE IN TERMS OF AHD.

PILE No.	COORDINATES		PILE CUT OFF LEVEL
	EASTING	NORTHING	
P1	317098.767	6219211.064	109.510
P2	317100.050	6219209.807	109.384
P3	317101.332	6219208.550	109.258
P4	317102.627	6219207.306	109.131
P5	317103.925	6219206.065	109.005
P6	317105.241	6219204.844	108.878
P7	317106.561	6219203.627	108.752
P8	317107.888	6219202.417	108.625
P9	317109.226	6219201.220	108.498
P10	317110.600	6219200.065	108.367
P11	317111.973	6219198.908	108.241
P12	317113.343	6219197.748	108.115
P13	317114.743	6219196.624	107.987
P14	317116.157	6219195.517	107.859
P15	317117.612	6219194.466	107.730
P16	317119.079	6219193.432	107.603
P17	317120.546	6219192.397	107.476
P18	317122.041	6219191.403	107.347
P19	317123.546	6219190.424	107.218
P20	317125.068	6219189.471	107.091
P21	317126.603	6219188.540	106.961
P22	317128.136	6219187.606	106.835
P23	317129.677	6219186.685	106.706
P24	317131.257	6219185.832	106.577
P25	317132.855	6219185.015	106.447
P26	317134.477	6219184.247	106.319
P27	317136.118	6219183.519	106.186
P28	317137.774	6219182.825	106.055
P29	317139.434	6219182.143	105.923
P30	317141.098	6219181.471	105.790
P31	317142.763	6219180.798	105.656
P32	317144.436	6219180.151	105.518
P33	317146.122	6219179.536	105.382
P34	317147.808	6219178.918	105.246
P35	317149.493	6219178.300	105.111
P36	317151.189	6219177.713	104.977
P37	317152.891	6219177.141	104.845
P38	317154.588	6219176.556	104.716
P39	317156.279	6219175.953	104.587
P40	317157.970	6219175.351	104.458
P41	317159.662	6219174.748	104.329

FOR REVIEW

NOT FOR CONSTRUCTION

REFERENCES:

520212TP-AURC-83751-SU-ADD-SURVEY.dwg
520212TP-AURC-83751-CV-ADD-CONTROL LINE.dwg
520212TP-AURC-83751-CV-ADD-CONTROL LINE.dwg
520212TP-AURC-83751-CV-ADD-LONG SECTION.dwg
520212TP-AURC-83751-CV-ADD-LONG SECTION.dwg
520212TP-AURC-83751-SU-ADD-AERIAL IMAGE.dwg

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	D.P 16/03/2023	W.D 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20

HEIGHT DATUM: AHD71

SCALE: AS SHOWN

DESIGN LOT CODE:

CLIENT:

NSW GOVERNMENT Transport for NSW

PREPARED FOR:

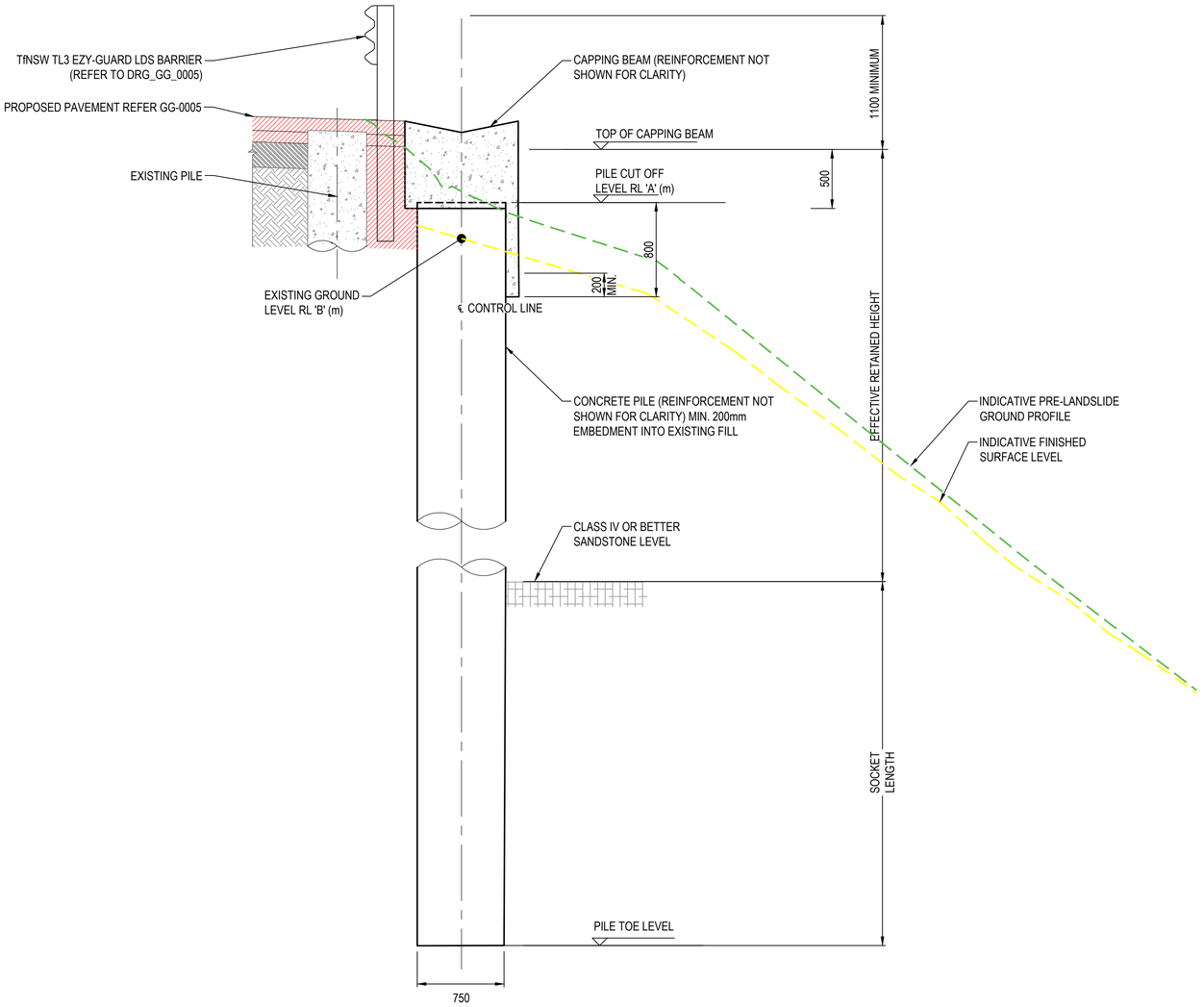
aurecon
www.aurecongroup.com
CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D. PERERA	16.03.2023
DRG CHECK	D. PERERA	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
BORED PILE WALL ARRANGEMENT PLAN

DRAWING SET No:	PART:	SHEET: 10	OF 16	
STATUS:	BRIDGE No:			©
DRG No. 520212TP-AURC-83751-GE-DRG-000010	REV C	VER	EDMS No.	AMD No.

FILE NAME: 520212TP-AURC-83751-GE-DRG-000010.dwg
PLOT DATE & TIME: 16/03/2023 2:47:49 PM



TYPICAL SECTION - BORED PILE WALL
1:25

NOTES

1. FOR GENERAL NOTES REFER TO DRG-GG-0002.
2. EFFECTIVE RETAINED HEIGHT IS DEFINED AS THE LENGTH OF PILE PLUS THE CAPPING BEAM HEIGHT (500mm), ABOVE THE TOP OF PILE SOCKET MATERIAL.
3. PILE SOCKET MATERIAL MUST BE CLASS IV OR BETTER SANDSTONE AS DEFINED BY PELLS 1998, 2019). PILE SOCKET MATERIAL AND LEVEL MUST BE CONFIRMED BY THE PRINCIPAL'S REPRESENTATIVE.
4. EXISTING GROUND LEVEL POINTS (RL 'B') ARE TAKEN AT THE TIME OF SURVEY AND MAY DIFFER FROM THE TABLED VALUES. THEREFORE RL 'B' IS INDICATIVE ONLY.
5. IN THE CASE OF THE MAX. EFFECTIVE RETAINED HEIGHT BEING EXCEEDED, REFER TO DRAWING GG-0021 FOR A CONTINGENCY PLAN DETAIL, WITH Ø900mm PILE OPTION

⚠ PILE SOCKET LEVEL MAY VARY AND/OR BE DEEPER THAN EXPECTED. REFER TO DRAWING GG-0021 FOR A CONTINGENCY DETAIL WITH A DEEPER PILE SOCKET LEVEL AND INCREASED EFFECTIVE RETAINED HEIGHT.

SCHEDULE OF BORED PILE WALL

MAX EFFECTIVE RETAINED HEIGHT (mm)	PILE DETAILS			CAPPING BEAM SIZE (W) x (D) (mm) x (mm)
	DIAMETER (mm)	SPACING C/C (mm)	MIN. SOCKET LENGTH (mm)	
5000	750	1800	3000	1000 x 500

FOR REVIEW

NOT FOR CONSTRUCTION

REFERENCES:

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
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B	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20 | HEIGHT DATUM: AHD71

SCALE: AS SHOWN

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

aurecon www.aurecongroup.com

CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D. PERERA	16.03.2023
DRG CHECK	D. PERERA	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
TYPICAL WALL DETAILS

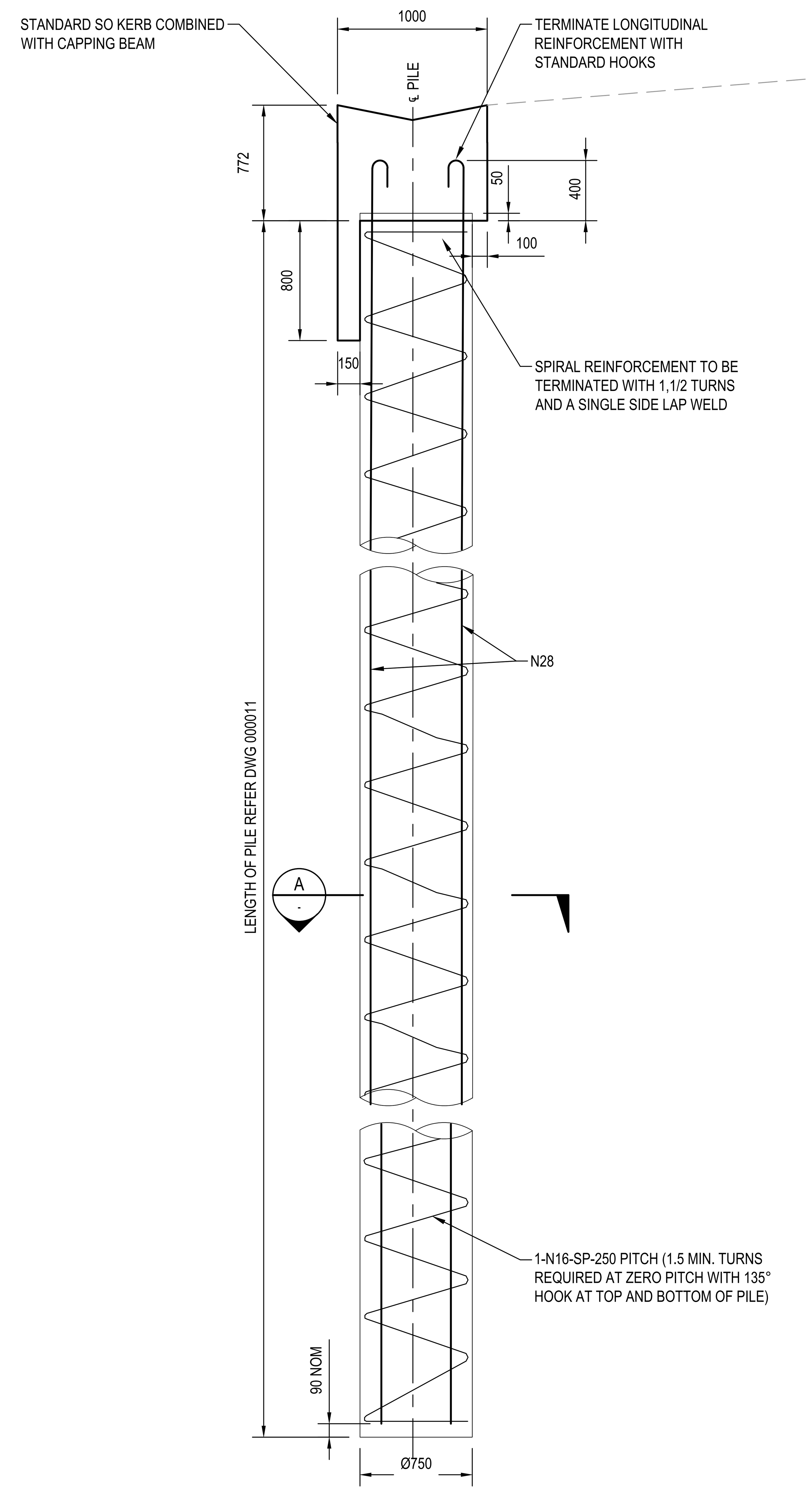
DRAWING SET No:	PART:	SHEET: 11	OF 16
STATUS:	BRIDGE No:		©

DRG No.	REV	VER	EDMS No.	AMD No.
520212TP-AURC-83751-GE-DRG-000011	C			

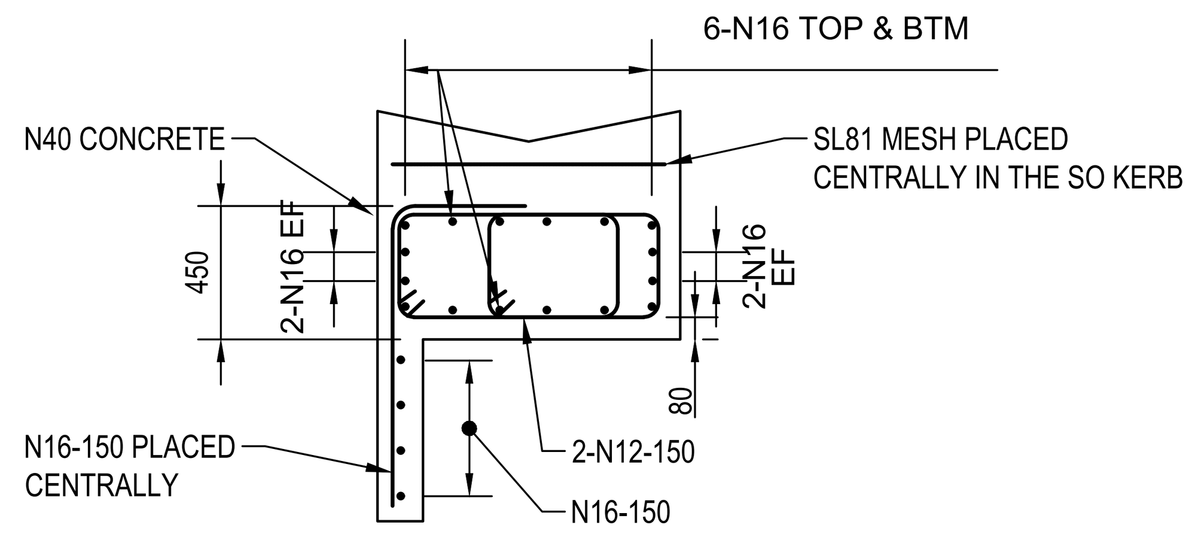
FILE NAME: 520212TP-AURC-83751-GE-DRG-000111.dwg
PLOT DATE & TIME: 16/03/2023 2:47:54 PM

NOTES

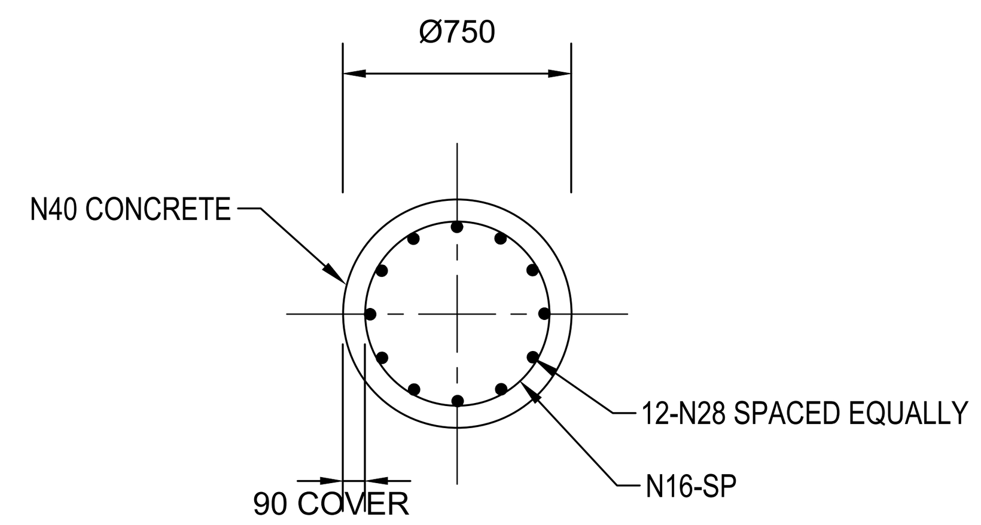
1. FOR GENERAL NOTES REFER TO DRG-GG-0002.
2. TERMINATE SPIRAL REINFORCEMENT WITH WELDING TO PREVIOUS TURN. WELD LENGTH IS TO CONFORM WITH TABLE 3.2 OF AS/NZS 1554.3:2008 FOR MANUAL METAL ARC WELDING (MMAF) FOR SINGLE LAP SPLICE WELDS.
3. MONITORING POSITIONS AND FREQUENCY DETAILS ARE SHOWN ON INSTRUMENT DETAILS DRAWING. REFER TO DRG. GG-0020 FOR DETAILS.
4. ALL LONGITUDINAL BARS SHALL BE EQUALLY SPACED AROUND THE CIRCUMFERENCE OF THE PILE REINFORCEMENT CAGE.



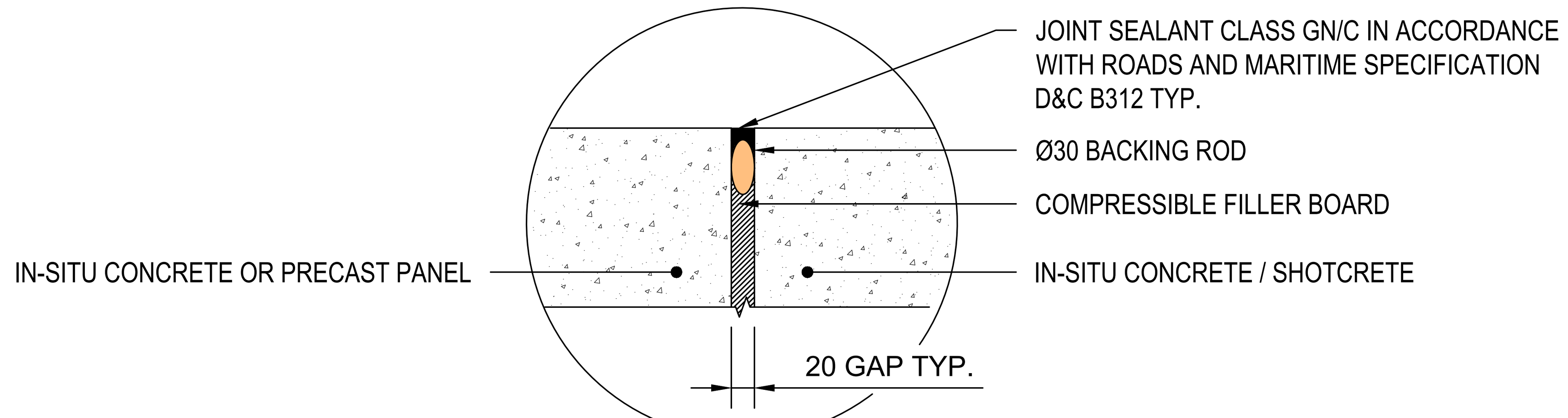
Ø750 PILE - ELEVATION
1:25
PILE CAP REINFORCEMENT NOT SHOWN FOR CLARITY



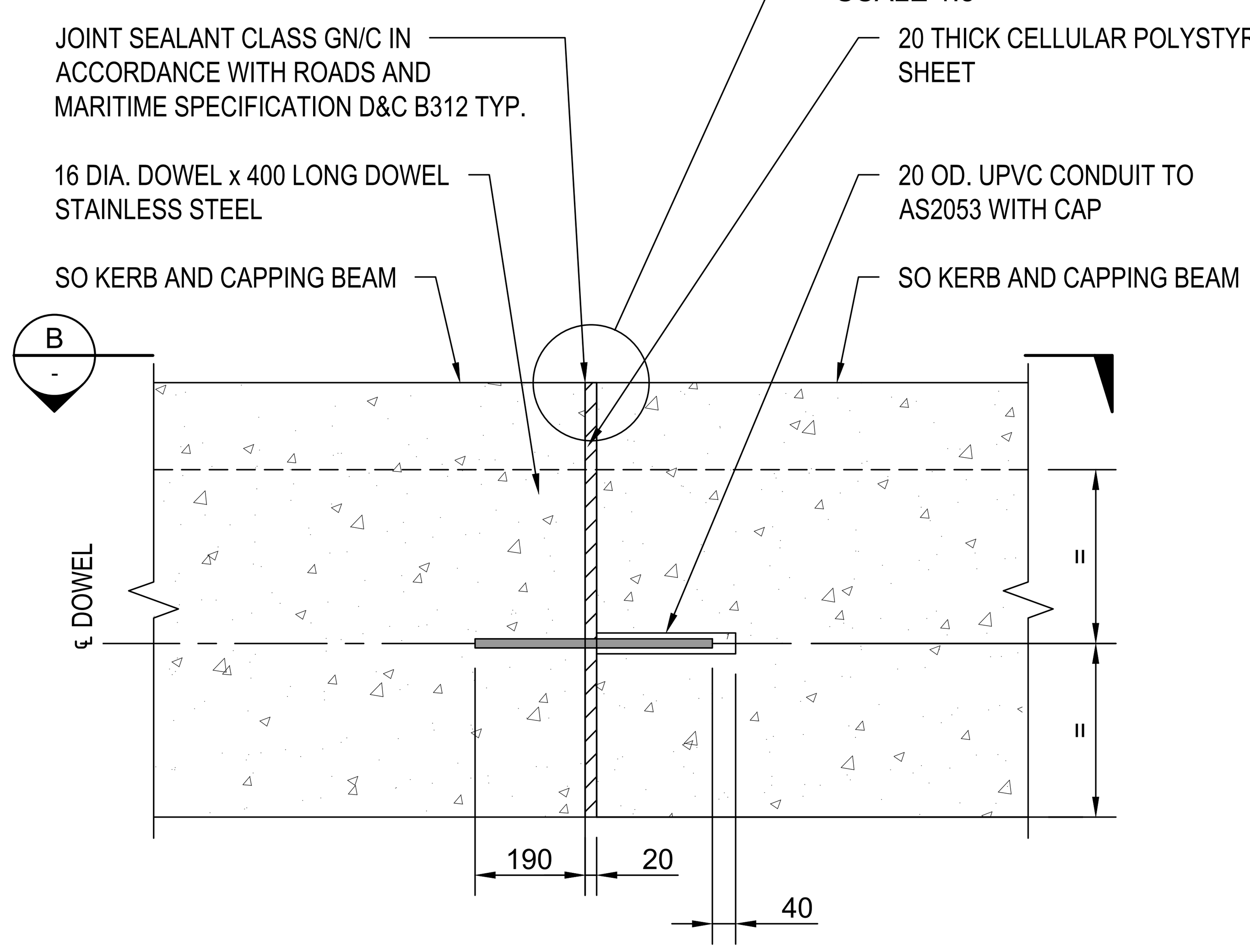
PILE CAP TYPICAL DETAIL
1:25



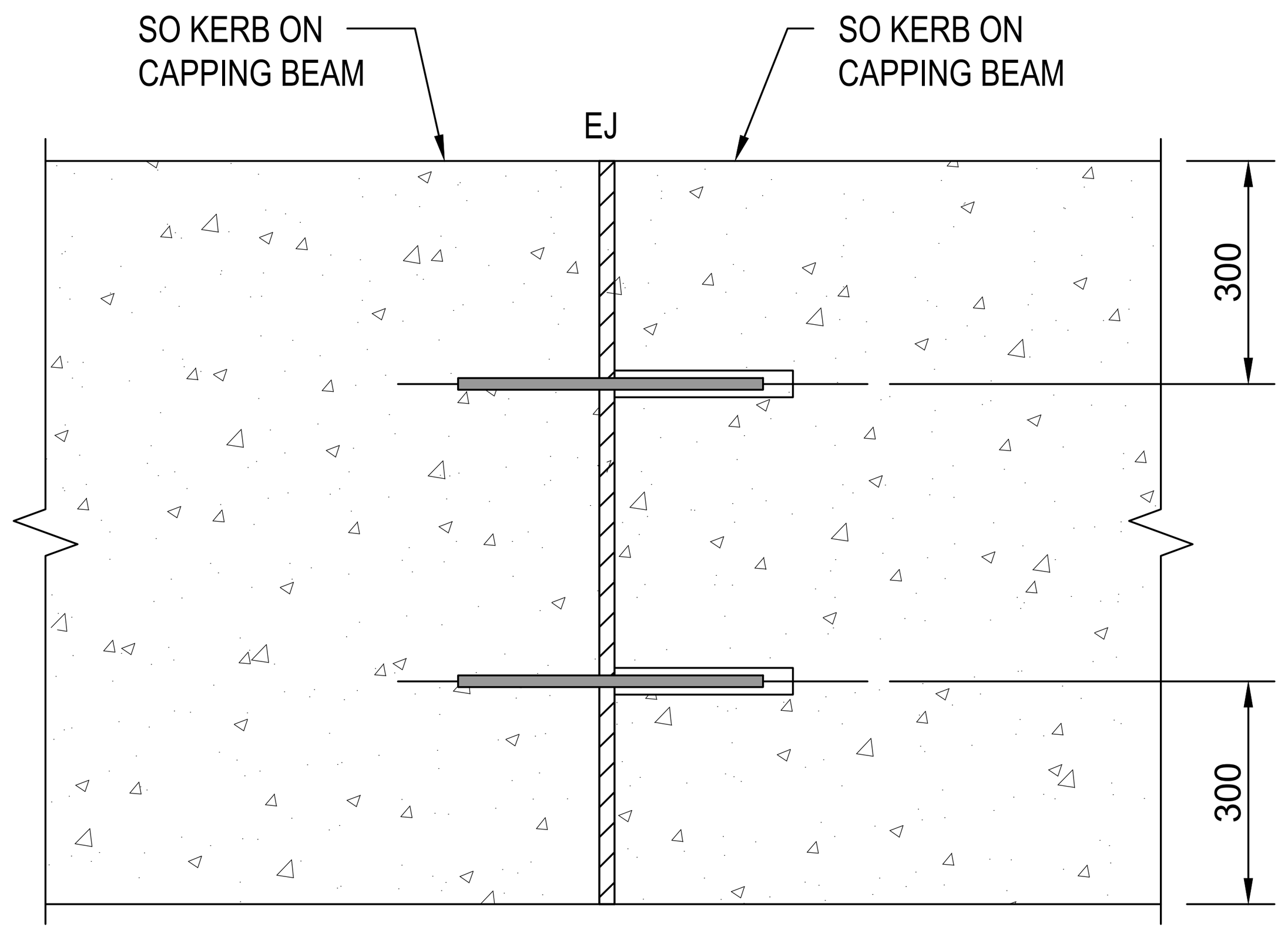
SECTION A
1:25



EXPANSION JOINT DETAIL - TYPE 'B' (EJB)
SCALE 1:5



CAPPING BEAM EXPANSION JOINT DETAIL
SCALE 1:10



SECTION B
SCALE 1:10

FOR REVIEW

NOT FOR CONSTRUCTION

FILE NAME: 520212TP-AURC-83751-GE-DRG-000012.dwg

PLOT DATE & TIME: 16/03/2023 2:48:00 PM

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

SCALE: AS SHOWN

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	A.C 16/03/2023	C.B 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	A.C 22/12/2022	C.B 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20 | HEIGHT DATUM: AHD71 | DESIGN LOT CODE:

CLIENT: Transport for NSW

PREPARED FOR:

aurecon www.aurecongroup.com

CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	A.CHAMBERLAIN	16.03.2023
DRG CHECK	A.CHAMBERLAIN	16.03.2023
DESIGN CHECK	C.BEALL	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
PILE DETAILS

DRAWING SET No: | PART: | SHEET: 12 OF 16
STATUS: | BRIDGE No: | ©
DRG No. 520212TP-AURC-83751-GE-DRG-000012 | REV C | VER | EDMS No. | AMD No.

LEGEND:

- EXISTING FILL
- SANDSTONE BEDROCK
- COLLUVIUM
- WORK STAGE
- COMPLETED WORKS

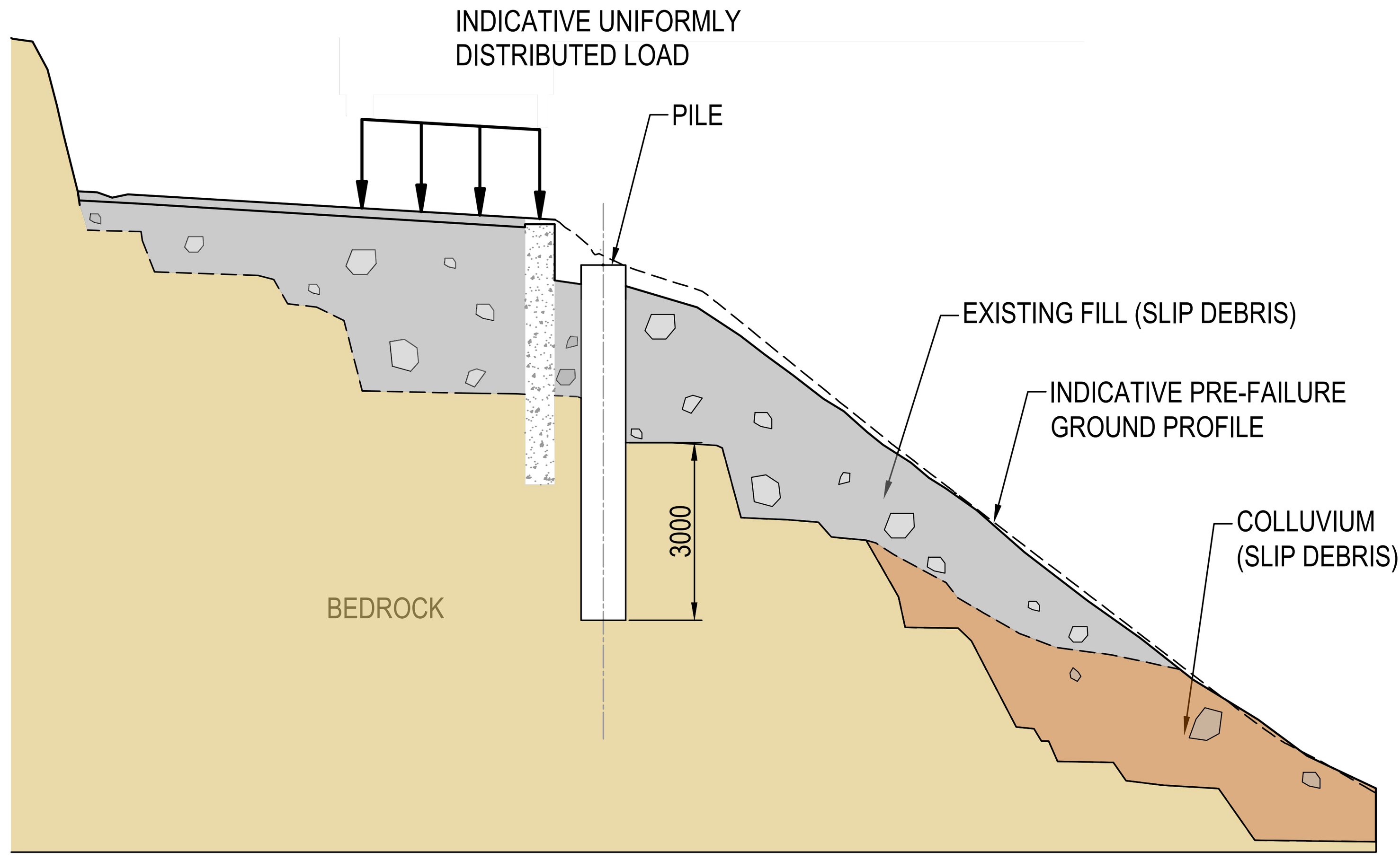
NOTES:

1. NOT TO SCALE.
2. THE CONSTRUCTION METHODOLOGY SHOWN IS INDICATIVE ONLY, TO SHOW A POTENTIAL CONSTRUCTION SEQUENCE THAT MAY NOT REQUIRE FULL CLOSURE OF MCKELL AVENUE, FOR CONSIDERATION BY THE CONTRACTOR AND PRINCIPAL.
3. ALTERNATIVE CONSTRUCTION SEQUENCES ARE POSSIBLE, WHICH COULD INCLUDE CLOSURE OF MCKELL AVENUE AND INSTALLING ALL PILES PRIOR TO BACKFILL EARTHWORKS, AND/OR ANCHORING/PROPPING AND MONITORING OF THE EXISTING PILES TO SUPPORT ADJACENT CONSTRUCTION PLANT.
4. THE CONTRACTOR MUST PROVIDE A WORKS METHODOLOGY STATEMENT FOR REVIEW BY THE PRINCIPAL. THE WORKS MAY ONLY COMMENCE WITH A WRITTEN APPROVAL FORM THE PRINCIPAL.
5. THE CONTRACTOR MUST ENSURE THE WORKS COMPLY WITH HEATH AND SAFETY GUIDELINES AND REGULATIONS.
6. APPLIED LOAD FROM PILING RIG IS INDICATIVE ONLY. PILING CONTRACTOR SHOULD CONDUCT THEIR OWN ASSESSMENT BASED ON THE TYPE OF PILING RIG TO BE USED. TEMPORARY WORKS MAY BE REQUIRED TO HAVE STABLE PLATFORM DURING PILING.

⚠ VARYING THE CONSTRUCTION SEQUENCE FROM THAT SHOWN MAY RESULT IN HIGHER INSTABILITY RISK TO WORKERS AND PLANT.

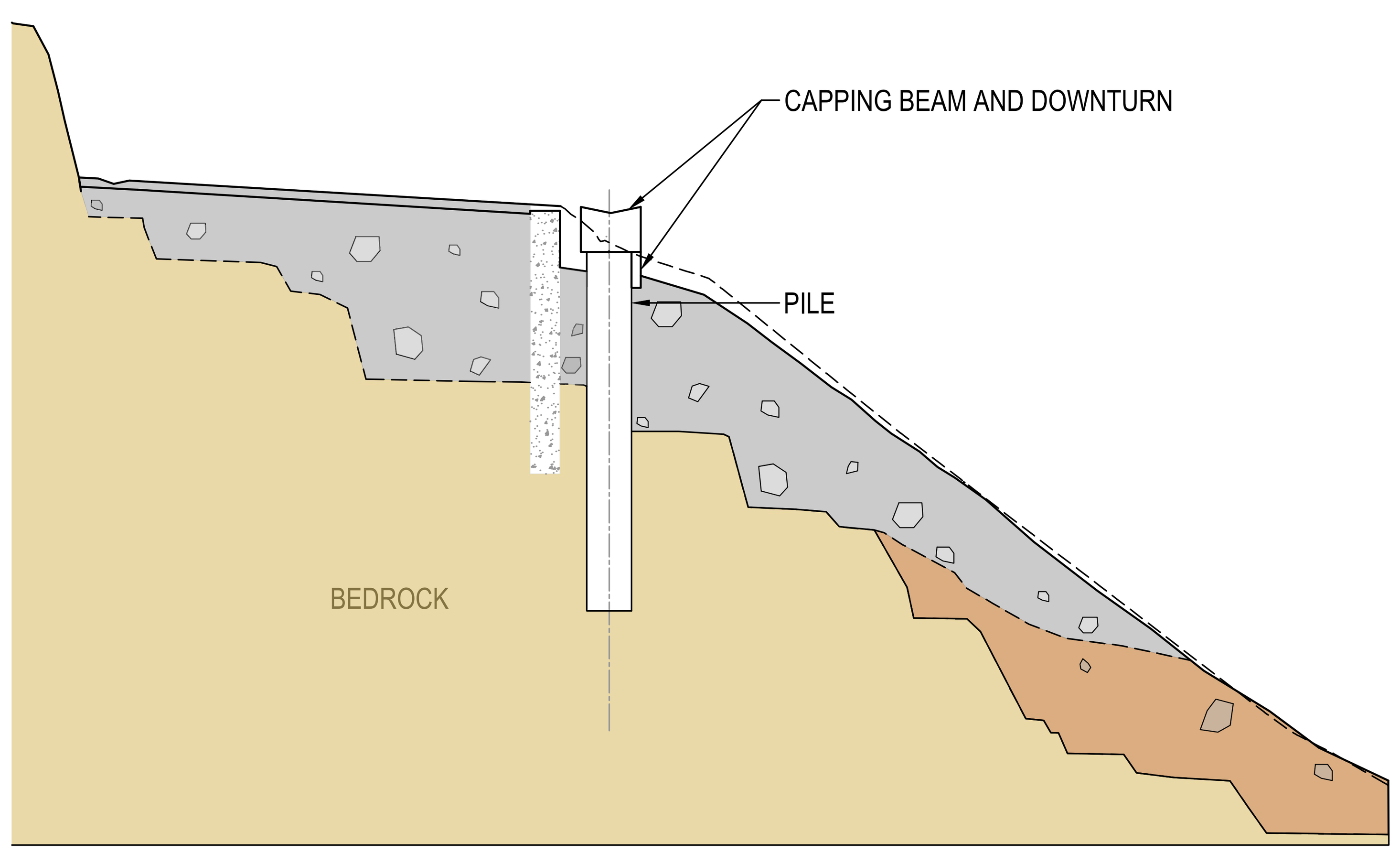
STAGE 1

INSTALL PILES



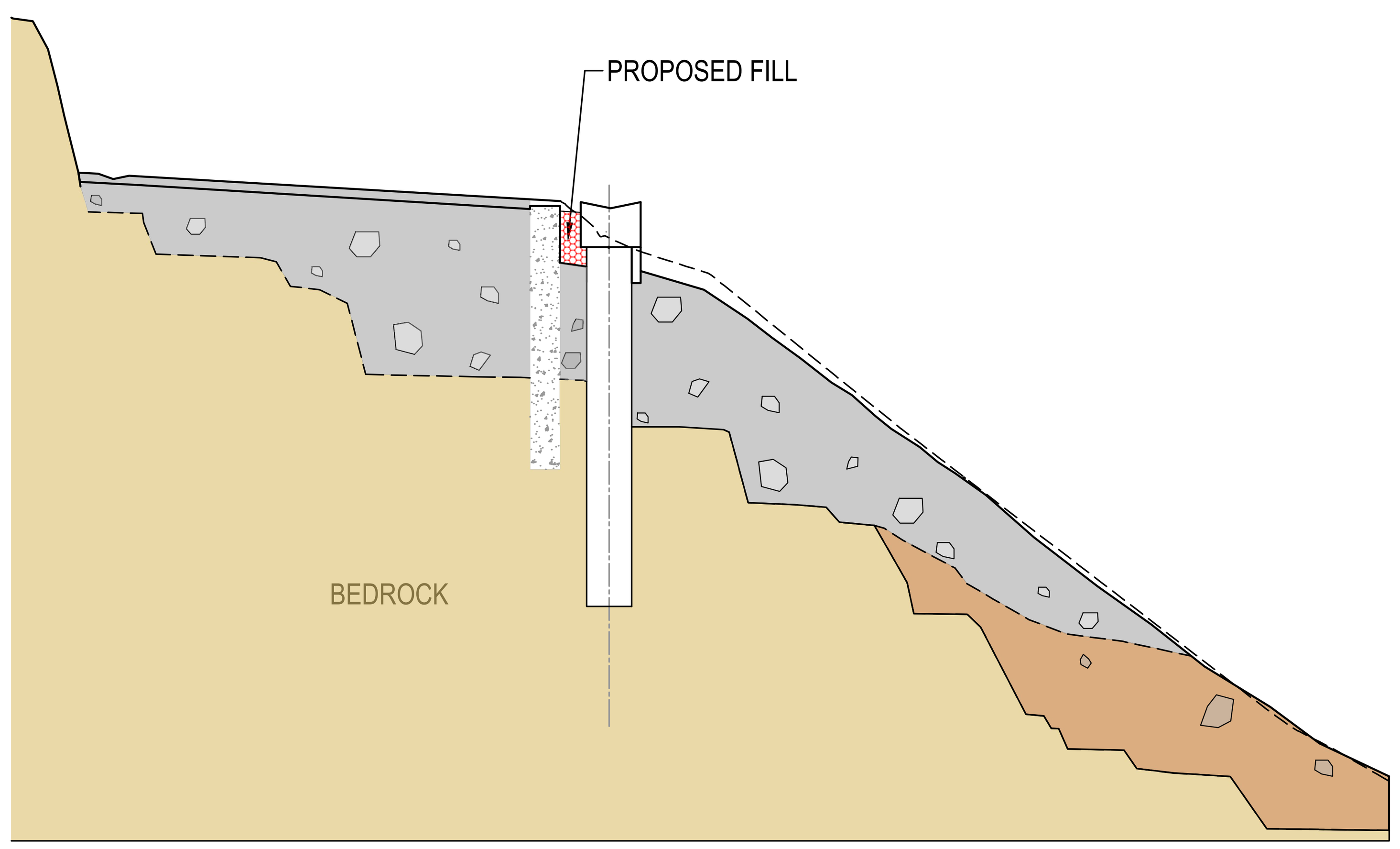
STAGE 2

INSTALL CAPPING BEAM AND DOWNTURN



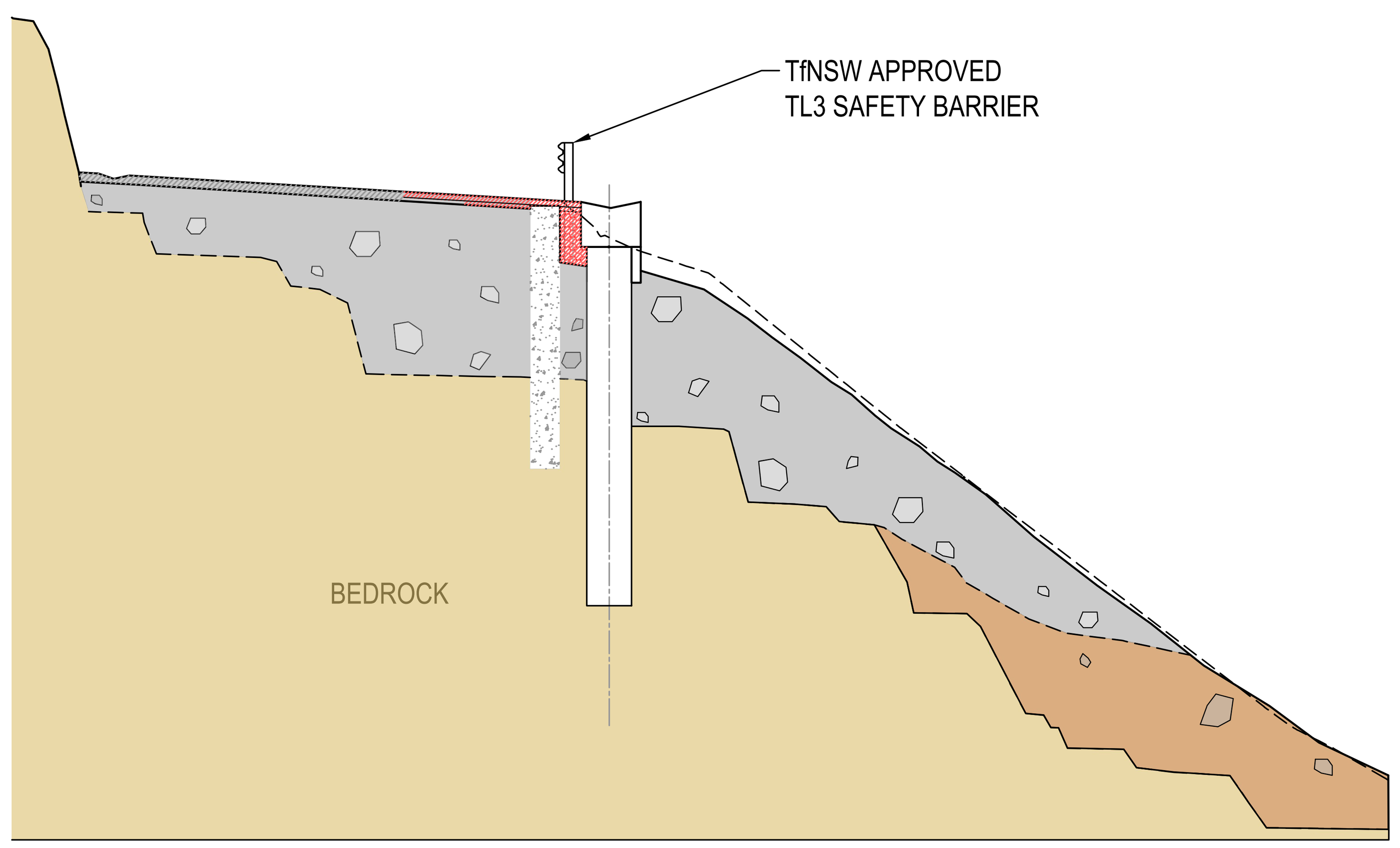
STAGE 3

BACKFILL WITH VERGE QUALITY MATERIAL



STAGE 4

INSTALL PERMANENT PAVEMENT AND TRAFFIC BARRIER



FOR REVIEW

NOT FOR CONSTRUCTION

REFERENCES:

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	D.P 16/03/2023	W.D 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20

HEIGHT DATUM: AHD71

SCALE: NOT TO SCALE

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

aurecon www.aurecongroup.com

CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D. PERERA	16.03.2023
DRG CHECK	D. PERERA	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE

SRAPC EMERGENCY PROJECTS

MCKELL AVENUE

SL83751

SLOPE STABILISATION WORKS

INDICATIVE CONSTRUCTION SEQUENCE

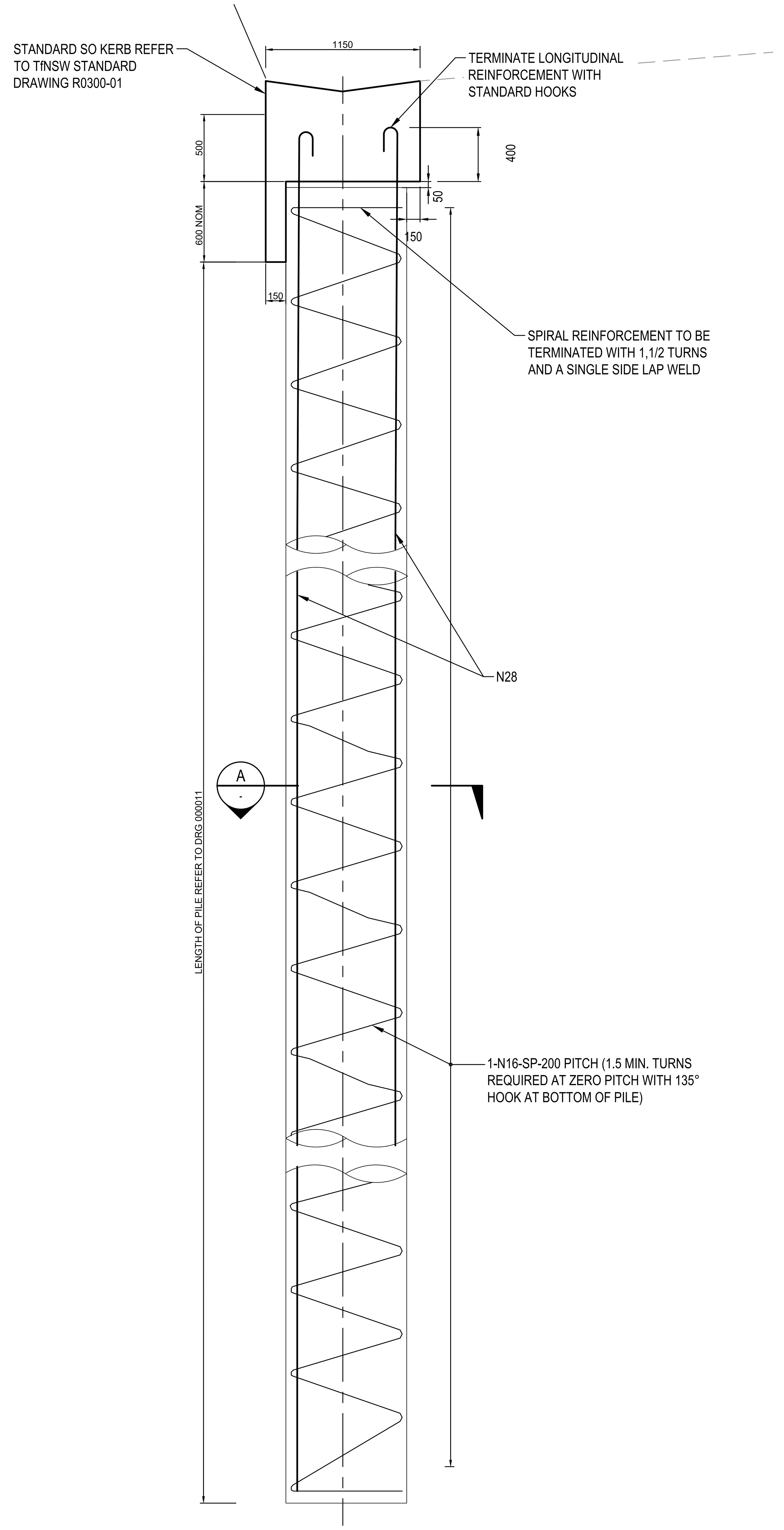
DRAWING SET No: PART: SHEET: 13 OF 16

STATUS: BRIDGE No: ©

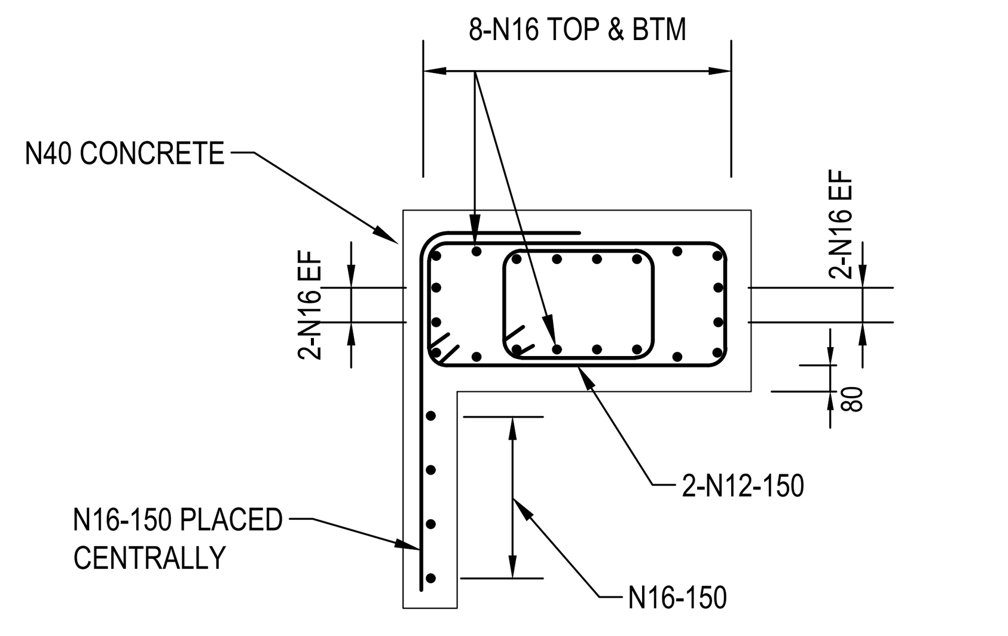
DRG No. 520212TP-AURC-83751-GE-DRG-000014 REV C VER EDMS No. AMD No.

FILE NAME: 520212TP-AURC-83751-GE-DRG-000014.dwg

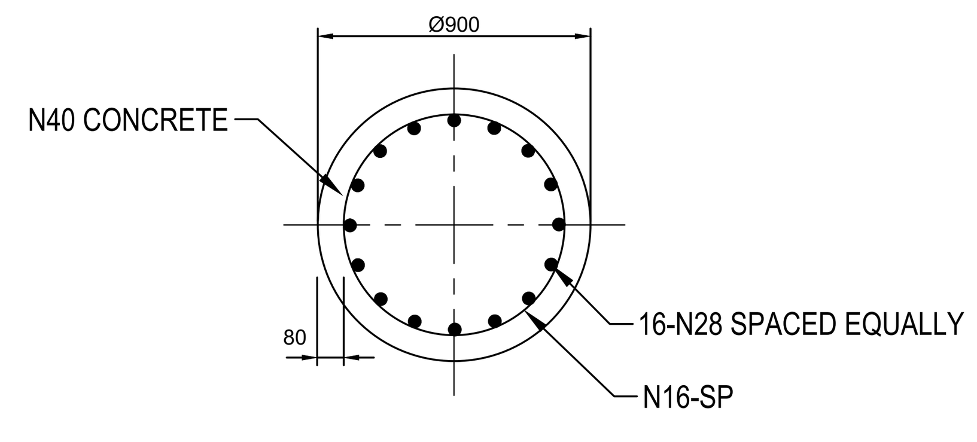
PLOT DATE & TIME: 16/03/2023 2:48:06 PM



Ø900 PILE - ELEVATION
1:25



PILE CAP TYPICAL DETAIL
1:25



SECTION A
1:25

INSTRUCTION TO PROCEED

THIS DETAIL IS ONLY TO BE CONSTRUCTED IF INSTRUCTED BY THE PRINCIPAL. IT IS A CONTINGENCY OPTION WHICH MAY BE IMPLEMENTED IF UNEXPECTED CONDITIONS ARISE, SUCH AS:

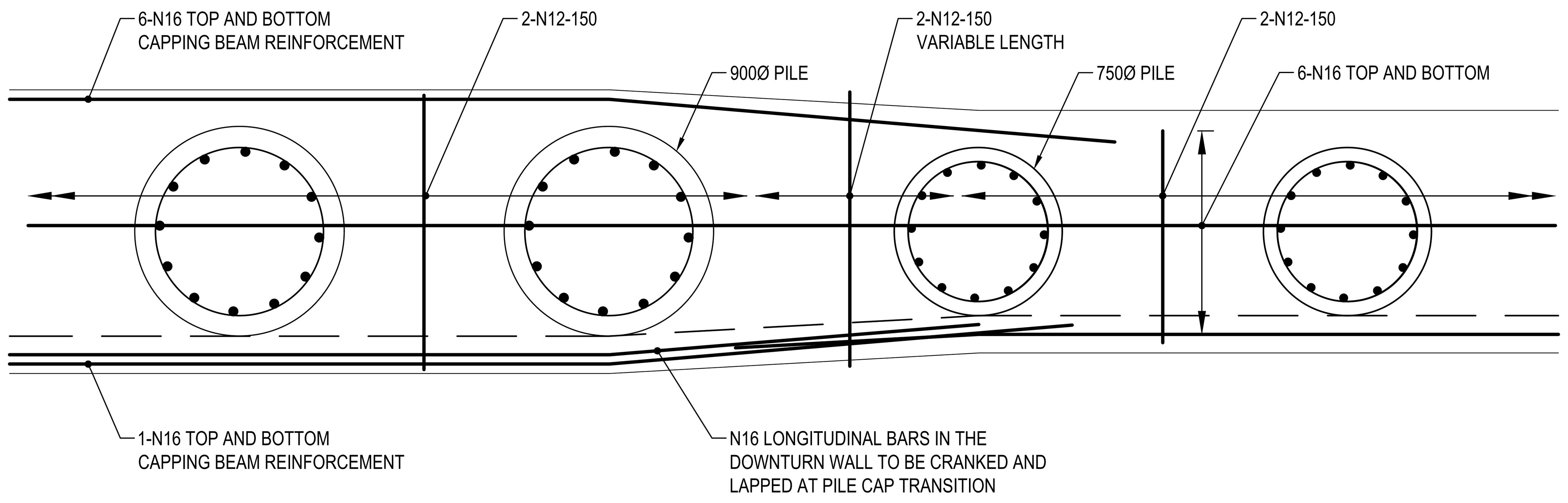
- MAXIMUM EFFECTIVE RETAINED HEIGHT ON DRAWING GG-0011 IS EXCEEDED, DUE TO DEEP ROCK LEVEL.

GENERAL NOTES

1. EFFECTIVE RETAINED HEIGHT IS DEFINED AS THE LENGTH OF PILE PLUS THE CAPPING BEAM HEIGHT (500mm), ABOVE THE TOP OF PILE SOCKET MATERIAL.
2. PILE SOCKET MATERIAL MUST BE CLASS IV OR BETTER SANDSTONE AS DEFINED BY PELLS (1998, 2019). PILE SOCKET MATERIAL AND LEVEL MUST BE CONFIRMED BY THE PRINCIPAL'S REPRESENTATIVE.
3. EXISTING GROUND LEVEL POINTS (RL 'B') ARE TAKEN AT THE TIME OF SURVEY AND MAY DIFFER FROM THE TABLED VALUES. THEREFORE RL 'B' IS INDICATIVE ONLY.
4. PLEASE REFER TO GENERAL NOTES IN SHEET 11 AND 12
5. IF DEPTH TO THE CLASS IV OR BETTER ROCK IS BETWEEN 5m AND 7m THIS OPTION SHOULD BE USED.

SCHEDULE OF BORED PILE WALL

MAX EFFECTIVE RETAINED HEIGHT (mm)	PILE DETAILS			CAPPING BEAM SIZE (W) x (D) (mm) x (mm)
	DIAMETER (mm)	SPACING C/C (mm)	MIN. SOCKET LENGTH (mm)	
7000	900	1800	3000	1150 x 500



CAPPING BEAM PLAN VIEW AT INTERFACE BETWEEN 900Ø AND 750Ø PILES
1:25

FOR REVIEW

NOT FOR CONSTRUCTION

FILE NAME: 520212TP-AURC-83751-GE-DRG-000021.dwg

PLOT DATE & TIME: 16/03/2023 2:48:11 PM

REFERENCES:

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SCALE: NOT TO SCALE

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
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A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20 | HEIGHT DATUM: AHD71 | DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

aurecon www.aurecongroup.com

CONNECT SYDNEY

DRAWN K.GREWAR 16.03.2023
DESIGNED D. PERERA 16.03.2023
DRG CHECK D. PERERA 16.03.2023
DESIGN CHECK W.DENG 16.03.2023
PROJ/DES MNGR C.GIBBONS 16.03.2023
APPROVED M.ABERLINE 16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
CONTINGENCY Ø900mm PILE OPTION

DRAWING SET No: | PART: | SHEET: 14 OF 16
STATUS: | BRIDGE No: ©
DRG No. 520212TP-AURC-83751-GE-DRG-000021 | REV C | VER | EDMS No. | AMD No.

Safe Design Risk Register – SL83751 McKell Avenue landslip repair

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
Design and Pre-construction Phase											
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 services in the vincinity of the Works, based on Dial Before you Dig desktop information, other than the culvert 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	Rock level deeper than expected	The rock level encountered by the piles is deeper than expected, causing the max effective retained height of 5m to be exceeded rendering the design unsafe.	Designers Contractor Client	D - Minor	Contingency design has been prepared, involving anchors through the pile capping beam to facilitate a larger effective retained height for the pile wall.	D - Minor	3 - Possible	Medium	Client	Acceptable	Principal to instruct Contract to implement contingency detail, if required.
Construction Phase											
2.1	Working 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	A - Catastrophic	Selected Contractor should have experience working in the road corridor, and must have the appropriate training and certifications, Works methodology statement, PPE and equipment.	A - Catastrophic	2 - Unlikely	Critical	Contractor	Tolerable	Traffic management to be implemented.
2.2	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	D - Minor	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	TBC - Contractor	Acceptable	• Identify areas where vibration monitoring is required as necessary. • Use construction methods and plant that minimise vibration.
2.3	Rockfall and landsliding	Workers and/or plant being hit by rockfall or landsliding initiating from above McKell Avenue, or landsliding inititating from the McKell Avenue level, the works area, or below the works area.	Workers Contractor Traffic	A - Catastrophic	Works should be undertaken during dry weather only.	A - Catastrophic	2 - Unlikely	Critical	TBC - 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 inspection of the slope above McKell Avenue.
2.4	Ground instability	Instability arising from excavations, construction sequencing, vibration and plant loading. For example instability of the existing pile wall following excavation of the trench in front of it, to construct the proposed wall lagging.	Workers Contractor Pedestrians	A - Catastrophic	The design has carefully considered possible construction sequencing and design components, to limit the requirement for workers to be near excavations and the landslide headscarp. A trench filled with foam concrete is specified to eliminate the need for workers to access the excavation. Restrictions for construction plan are specified on the general notes drawing and a monitoring plan has also been designed.	A - Catastrophic	2 - Unlikely	Critical	TBC - 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. Contingency for propping of the existing piles against the proposed piles should be made, and/or anchoring of the existing piles and other shoring methods. Excavation should be completed in short sections and/or hit and miss panels. Practical plant should be considered, such as long reach equipment to avoid having to work in close proximity to the excavations and landslip headscarp.
2.5	Stormwater contamination	Contamination of stormwater system during the Works.	Contractor	D - Minor	Contractor to prepare an environmental management plan.	E - Incidental	2 - Unlikely	Low	Contractor	Acceptable	Contractor to establish runoff controls on site during the Works.
Operations and Maintenance Phases											
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	D - Minor	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	Client / TfNSW	Acceptable	Inspections to be undertaken by the Designer and/or Client as part of the SRAP Contract.
3.2	Compromised wall drainage	Foam concrete could clog up with fines to hinder its drainage capability, resulting in water pressure build up behind the wall and adverse effects on wall stability.	Maintainers	C - Moderate	Routine slope and maintenance inspections should check the foam concrete lagging face for signs of clogging and seepage (e.g. staining)	C - Moderate	2 - Unlikely	Medium	Client / TfNSW	Tolerable	If there is concern about the drainage functionalility horizontal drains and/or weep holes could be installed through the foam concrete as a maintenance measure.
3.3	Repair	Repairs may be required if the landslip below the proposed wall reactivates. For example if: - The pile lagging is damaged. - Potentially unstable, or unstable rock is exposed, that is the founding material for the piles.	Maintainers	C - Moderate	Pile lagging and effective pile wall height has been designed to extend down to rock level, to mitigate need for repairs.	D - Minor	3 - Possible	Medium	Client / TfNSW	Tolerable	Should lagging be damaged, or unstable pile founding rock be exposed, actions could include reinforced shotcrete and/or rock bolting to add support to the pile wall.
3.4	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	Medium	Client / TfNSW	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 signficant storm event.	Operators	C - Moderate	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	Client / TfNSW	Acceptable	Flooding of road has been appropriately mitigated with engineering controls based on existing drainage on site and expected rainfall during minor storm events.
Modification, Demolition and Dismantling Phases											
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.	E - Incidental	1 - Rare	Low	Client / TfNSW	Acceptable	Client / TfNSW should continue routine inspections and hold an asset management database to inform and trigger the requirement for further works in future.

NOTES

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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.)
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FILE NAME: 520212TP-AURC-83751-GE-DRG-000030.dwg

PLOT DATE & TIME: 16/03/2023 2:48:16 PM

REFERENCES:

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REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
C	ISSUED FOR 100% DETAILED DESIGN - REVISION 1	D.S 16/03/2023	W.D 16/03/2023	C.G 16/03/2023
B	ISSUED FOR 100% DETAILED DESIGN	D.S 22/12/2022	W.D 22/12/2022	C.G 22/12/2022
A	80% DETAILED DESIGN	D.S 30/06/22	W.D 30/06/22	C.G 30/06/22

COORDINATE SYSTEM: MGA_ZONE_56/GDA20 | HEIGHT DATUM: AHD71 | DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

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CONNECT SYDNEY

DRAWN	K.GREWAR	16.03.2023
DESIGNED	D.SANDILANDS	16.03.2023
DRG CHECK	W.DENG	16.03.2023
DESIGN CHECK	W.DENG	16.03.2023
PROJ/DES MNGR	C.GIBBONS	16.03.2023
APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
SAFETY IN DESIGN REGISTER - SHEET 1

DRAWING SET No: | PART: | SHEET: 15 OF 16
STATUS: | BRIDGE No:
DRG No. 520212TP-AURC-83751-GE-DRG-000030 | REV C | VER | EDMS No. | AMD No.

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

Category		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), ie. 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

Category		Descriptor	Likelihood (i.e. % chance of realisation during applicable period: construction phase, operating cycle or decommissioning)	Industry Incidences (only applicable to common systems/assets)
	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.

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APPROVED	M.ABERLINE	16.03.2023

HARBOUR ZONE
SRAPC EMERGENCY PROJECTS
MCKELL AVENUE
SL83751
SLOPE STABILISATION WORKS
SAFETY IN DESIGN REGISTER - SHEET 2

DRAWING SET No: PART: SHEET: 16 OF 16
STATUS: BRIDGE No: ©
DRG No. 520212TP-AURC-83751-GE-DRG-000031 REV C VER EDMS No. AMD No.

TfNSW-DE-Titleblock-A1-H-R19_BridgeRoadRail_Design.dwg
FILE NAME: 520212TP-AURC-83751-GE-DRG-000031.dwg
PLOT DATE & TIME: 16/03/2023 2:48:22 PM

Appendix D – Stage 1 PACHCI Clearance Letter

1st November 2022

WBS P.0070449.01.001

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 McKell Avenue, Waterfall based 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 / faithfully

Corrine Quinlan
Aboriginal Cultural Heritage Advisor – Greater Sydney Region

Appendix E – Biodiversity Memorandum (Aurecon 2023)

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Memorandum

To	**Laura Atencio**	From	**Miranda Crossley / Dominic Adshead**
Copy	**N/A**	Reference	**P520212-003 - SL83751**
Date	**2023-10-10**	Pages (including this page)	**29**
Subject	**McKell Avenue Royal NP Slope Remediation - Biodiversity Memo**		

Document control						
Report title		**McKell Avenue Royal NP Slope Remediation - Biodiversity Memo**				
Document code		N/A	**Project number**		P520212-003 - SL83751	
File path		Https://aurecongroup.sharepoint.com/sites/SRAPC/3_Develop/For Delivery/004 - Environment/003 - McKell Avenue/11 Final draft 3/Appendix E - Biodiversity Memorandum (Aurecon 2023)/Appendix E - McKell Ave Royal NP Biodiversity Memo Rev5.docx				
Client		Connect Sydney				
Client contact		Sam Singh	**Client reference**		N/A	
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
0	2023-02-20	Draft for issue	NM	DM/ LA		
1	2023-04-03	Revision based on TfNSW comments	NM	DM/LA		
2	2023-05-15	Revision based on Connect Sydney comments	NM	LA		
3	2023-07-05	Revision based on Connect Sydney comments	NM	LA		
4	2023-09-13	Minor revision based on Connect Sydney comments	MC	DM		
5	2023-10-10	Minor revision based on Connect Sydney comments	MC	DM		
Current revision		**5**				

Table of Contents

1 Introduction

1.1 Proposal overview

Connect Sydney, on behalf of Transport for NSW (Transport) proposes to remediate reinstate and stabilise about 74 metres of McKell Avenue (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 in which a portion of the road pavement failed. Typically, McKell Avenue is a two lane road with one lane in each direction providing passage through the Royal National Park. The proposal is required to reopen the lane that is currently closed to traffic which would improve road safety and movement along the corridor.

Part of the works considered the removal of trees and underlying vegetation. Connect Sydney (in consultation with National Parks and Wildlife Service (NPWS) have indicated that vegetation to be removed is potential Powerful Owl (*Ninox strenua*) (BC Act- Vulnerable) foraging habitat. Refer to the McKell Avenue REF for further detail.

1.2 Purpose of document

This biodiversity memo identifies information for incorporation within the Review of Environmental Factors (REF). The biodiversity memo includes identifying and assessing the flora to be removed as part of the proposal. The assessment also evaluates the potential impacts on the Powerful Owl and other species through assessments of significance (where appropriate) and provides mitigation measures.

1.3 Legislative Context

The table below (Table 1-1) identifies the relevant legislation for consideration and applicability to the approval pathway.

Table 1-1 State and Commonwealth legislation and guidelines relevant to the proposal.

Legislation	Description	Applicability
State Legislation		
Environmental Planning and Assessment Act 1979 (EP&A Act)	Identifies the assessment and approvals pathway for development on NSW lands	The proposal is located on Transport for NSW within the road corridor. It is not located within National Parks estate and therefore is assessed under Part 5 of the EP&A Act

Legislation	Description	Applicability
National Parks and Wildlife Act 1974	Provides for the dedication, management, and use of National Parks land	The proposal is not located on land dedicated as National Park under the *National Parks and Wildlife Act 1974*. The activity is consistent with the Objects of the Act (s.2A) and Reserve management principles (s.30E–30K) in relation to Royal National Park
Biodiversity Conservation Act 2016 (BC Act)	Legislation for environmental protection, focusing on threatened species and ecological communities, and identifying threatening processes.	This REF provides consideration of potential impacts on listed species and communities (see Section 4)
Commonwealth Legislation		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) ■ *Significant impact guidelines 1.1: Matters of National Environmental Significance* ■ *Significant impact guidelines 1.2: Actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies*	Commonwealth legislation and guidelines for environmental protection, focusing on protecting Commonwealth Land and Matters of National Environmental Significance (MNES). Actions which affect the MNES must be assessed for significance of impact, and if found to be significant, referred to the Minister for approval.	A search of the Protected Matters Search Tool (PMST) was conducted to identify MNES and other protected matters that may occur within a 10 kilometre radius of the proposal (see Section 3.3)

2 Methodology

An assessment was carried out to determine and assess the impact of the potential biodiversity issues and constraints that may influence the design and construction of the proposal. This involved:

- reviewing relevant legislation and guidelines in relation to biodiversity
- defining the study area. With reference to PMST and BioNet database searches, the study area has been defined to include an area of 10 kilometre buffer around the proposal (McKell Avenue between the Princes Highway and Sir Bertram Stevens Drive
- undertaking database searches. This included:
  - DPE's Biodiversity Values map on the 15th February 2023. This was to identify areas of Biodiversity values within the study area

- NSW State Vegetation Type map on the 15th February 2023. This was to assess vegetation within the study area, including the presence of BC or EPBC Act Threatened Ecological Communities (TECs)
- Department of Climate Change, Energy, the Environment and Water PMST on 15th February 2023. This was to identify protected matters under the EPBC Act, including Matters of National Environmental Significance (MNES) within a 10-kilometre radius of the study area
- DPE's BioNet Atlas of NSW Wildlife database on the 15th February 2023. This was to identify details of listed flora and fauna sightings within a 10-kilometre radius of the study area.

- undertake a field assessment to verify the desktop review and database searches on the 29th September, 13th October 2022 and the 9th February 2023
- assessing the impacts of the proposal on biodiversity, both construction and operation
- identifying mitigation measures to reduce the identified impacts.

3 Existing Environment

3.1 DPE's Biodiversity Values Map

A review of the DPE's Biodiversity Values map indicates that the study area is adjacent to areas of Biodiverse riparian land i.e. Waterfall Creek and the Hacking River. This area is classed as high biodiversity value and sensitive to impacts from development and clearing.

3.2 NSW State Vegetation Type map

A review of the NSW State Vegetation Type map indicates that the study area is a conglomerate of several Plant Community Types (PCTs) including:

- PCT3028: Illawarra Escarpment Warm Temperate Rainforest (No associated TEC)- located downslope of the study area adjoining Waterfall Creek
- PCT 3230: Central Coast Escarpment Moist Forest (No associated TEC)- predominant vegetation bordering McKell Avenue from the Princes Highway to the National Falls
- PCT 3591: Southern Sydney Sheltered Forest (*BC Act Endangered TEC: Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*) - located partially within the eastern side of the study area, and is the predominant vegetation south-west of McKell Avenue and upslope of the study area.
- PCT 3595: Sydney Coastal Sandstone Gully Forest (No associated TEC)- predominant vegetation bordering McKell Avenue from the National Falls to Sir Bertram Stevens Drive

3.3 Department of Climate Change, Energy, the Environment and Water PMST

The PMST is used to identify potential MNES and other protected matters under the EPBC Act which has the potential to occur a 10-kilometre radius of the study area. The PMST results are detailed in Table 3-1.

Table 3-1. PMST Search Results: Protected matters under the EPBC Act.

Category	Matter within 10-kilometres of the study area	Matter within the study area
MNES		
National Heritage	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 National Park was the first National Park to be established in Australia (1879), regarded as beginning of non-Indigenous Australian conservation.	The Royal National Park heritage curtilage is located adjacent to the study area.
Wetlands of International Importance	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.
Commonwealth Marine Area	The Commonwealth Marine Area - Exclusive Economic Zone and Territorial Sea is located off the east coast of Australia.	The Commonwealth Marine Area - EEZ and Territorial Sea is located outside the study area.
Listed Threatened Ecological Communities	There are 11 TECs considered may or likely to be within 10-kilometres of the study area. These include: ■ Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion (Endangered) ■ Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Endangered) ■ Eastern Suburbs Banksia Scrub of the Sydney Region (Critically Endangered) ■ Turpentine-Ironbark Forest of the Sydney Basin Bioregion (Critically Endangered)	One TEC are mapped as occurring within the study area: ■ PCT 3591: Southern Sydney Sheltered Forest (*BC Act Endangered TEC: Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*) - located partially within the eastern side of the study area, and is the predominant vegetation south-west of McKell Avenue and upslope of the study area.

Category	Matter within 10-kilometres of the study area	Matter within the study area
	■ Shale Sandstone Transition Forest of the Sydney Basin Bioregion (Critically Endangered) ■ River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (Critically Endangered) ■ Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community (Endangered) ■ Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (Critically Endangered) ■ Coastal Upland Swamps in the Sydney Basin Bioregion (Endangered) ■ Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (Critically Endangered) ■ Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered)	
Listed Threatened Species	A total of 112 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. These include 40 birds, 11 fish, 6 reptiles, 15 mammals, 33 plants, 5 frogs, and 2 insect species.	Excluding marine mammal and sea turtle species, 36 threated species have been identified in proximity to McKell Ave.
Listed Migratory Species	A total of 62 migratory species were identified as may, likely, or known to occur, or to have habitat occurring 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.
Other Matters Protected by the EPBC Act		
Commonwealth Land	There is unnamed Commonwealth Land, Australian Nuclear Science & Technology Organisation, Defence Service Homes Corporation, Australian Telecommunications Commission, and Australian Postal Commission land within a 10-kilometre radius of the study area.	Not relevant within the study area.
Commonwealth Heritage Places	Cubbitch Barta National Estate Area is a large 18,000 ha bushland area. Undeveloped land within this area is	Not relevant within the study area

Category	Matter within 10-kilometres of the study area	Matter within the study area
	expected to contain hundreds if not thousands of Aboriginal sites and artefacts (Place ID: 105405).	
Listed Marine Species	A total of 81 marine species were identified as may, likely, or known to occur, or to have habitat within 10-kilometres of the study area.	Marine bird species may use the study area around McKell Avenue for foraging or roosting habitat.
Whales and Other Cetaceans	A total of 14 whales and other cetaceans are listed within 10-kilometres of the study area.	Not relevant within the study area.
Extra Information		
State and Territory Reserves	There are four State and Territory reserves identified within 10-kilometres of the study area: ■ Heathcote National Park ■ Royal National Park ■ Garawarra State Conservation Area ■ Illawarra Escarpment State Conservation Area	The study area captures McKell Ave, located within the Royal National Park.
Nationally Important Wetlands	One nationally important wetland is located in proximity to the study area: ■ O'Hares Creek Catchment	O'Hares Creek Catchment is located outside the study area.
Biologically Important Areas	There are three marine listed biologically important areas listed within 10-kilometres of the study area, including: ■ Indo-Pacific/Spotted Bottlenose Dolphin breeding area ■ Flesh-footed Shearwater foraging area ■ Antipodean Albatross foraging area ■ Grey Nurse Shark foraging area ■ White Shark distribution area ■ Humpback Whale foraging area	Not relevant within the study area.
Bioregional Assessments	Sydney Basin Bioregional Assessment. Bioregional assessments identify the potential impacts and likelihood of coal seam gas and coal mining development on water resources and water dependent assets.	Not relevant within the study area.

3.4 DPE's BioNet Atlas of NSW Wildlife database

A review of DPEs Bionet Atlas of NSW Wildlife database within a 10-kilometre radius of the study area is detailed in Table 3-2.

Table 3-2 BioNet threatened species search results (2013 - 2023)

Scientific name	Common name	Conservation listing[1]	
		BC Act	EPBC Act
Fauna			
Pseudophryne australis	Red-crowned Toadlet	V,P	-
Heleioporus australiacus	Giant Burrowing Frog	V,P	V
Litoria littlejohni	Littlejohn's Tree Frog	E1,P	E
Caretta caretta	Loggerhead Turtle	E1,P	E
Chelonia mydas	Green Turtle	V,P	V
Eretmochelys imbricata	Hawksbill Turtle	P	V
Dermochelys coriacea	Leatherback Turtle	E1,P	E
Varanus rosenbergi	Rosenberg's Goanna	V,P	-
Hoplocephalus bungaroides	Broad-headed Snake	E1,P	V
Hirundapus caudacutus	White-throated Needletail	P	V,C,J,K
Thalassarche cauta	Shy Albatross	V,P	V
Thalassarche melanophris	Black-browed Albatross	V,P	V
Ardenna pacifica	Wedge-tailed Shearwater	P	J
Circus assimilis	Spotted Harrier	V,P	-
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	-
Hieraaetus morphnoides	Little Eagle	V,P	-
Lophoictinia isura	Square-tailed Kite	V,P	-
Thalasseus bergii	Crested Tern	P	J
Callocephalon fimbriatum	Gang-gang Cockatoo	V,P	E
Calyptorhynchus lathami	Glossy Black-Cockatoo	V,P	-
Glossopsitta pusilla	Little Lorikeet	V,P	-
Lathamus discolor	Swift Parrot	E1,P	CE
Ninox strenua	Powerful Owl	V,P	-
Tyto tenebricosa	Sooty Owl	V,P	-

[1] **E1** = Endangered, **E2** = Endangered population, **CE** = Critically Endangered, **V** = Vulnerable, **P** = Protected under National Parks & Wildlife Act 1974, **C** = Listed on China Australia Migratory Bird Agreement, **J** = Listed on Japan Australia Migratory Bird Agreement, **K** = Listed on Republic of Korea Australia Migratory Bird Agreement

Scientific name	Common name	Conservation listing[1]	
		BC Act	EPBC Act
Dasyornis brachypterus	Eastern Bristlebird	E1,P	E
Pycnoptilus floccosus	Pilotbird	P	V
Anthochaera phrygia	Regent Honeyeater	CE,P	CE
Daphoenositta chrysoptera	Varied Sittella	V,P	-
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P	-
Phascolarctos cinereus	Koala	E1,P	E
Cercartetus nanus	Eastern Pygmy-possum	V,P	-
Petauroides volans	Greater Glider	P	E
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V,P	-
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P	-
Myotis macropus	Southern Myotis	V,P	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P	-
Miniopterus australis	Little Bent-winged Bat	V,P	-
Miniopterus orianae oceanensis	Large Bent-winged Bat	V,P	-
Arctocephalus forsteri	New Zealand Fur-seal	V,P	-
Physeter macrocephalus	Sperm Whale	V,P	-
Megaptera novaeangliae	Humpback Whale	V,P	V
Flora			
Astrotricha crassifolia	Thick-leaf Star-hair	V	V
Allocasuarina diminuta subsp. *mimica*	*Allocasuarina diminuta* subsp. *mimica* population in the Sutherland Shire and Liverpool City local government areas	E2	-
Leucopogon exolasius	Woronora Beard-heath	V	V
Pultenaea aristata	Prickly Bush-pea	V	V
Prostanthera densa	Villous Mint-bush	V	V
Callistemon linearifolius	Netted Bottle Brush	V,3	-
Melaleuca deanei	Deane's Paperbark	V	V
Rhodamnia rubescens	Scrub Turpentine	CE	CE
Syzygium paniculatum	Magenta Lilly Pilly	E1	V
Cryptostylis hunteriana	Leafless Tongue Orchid	V,P,2	V

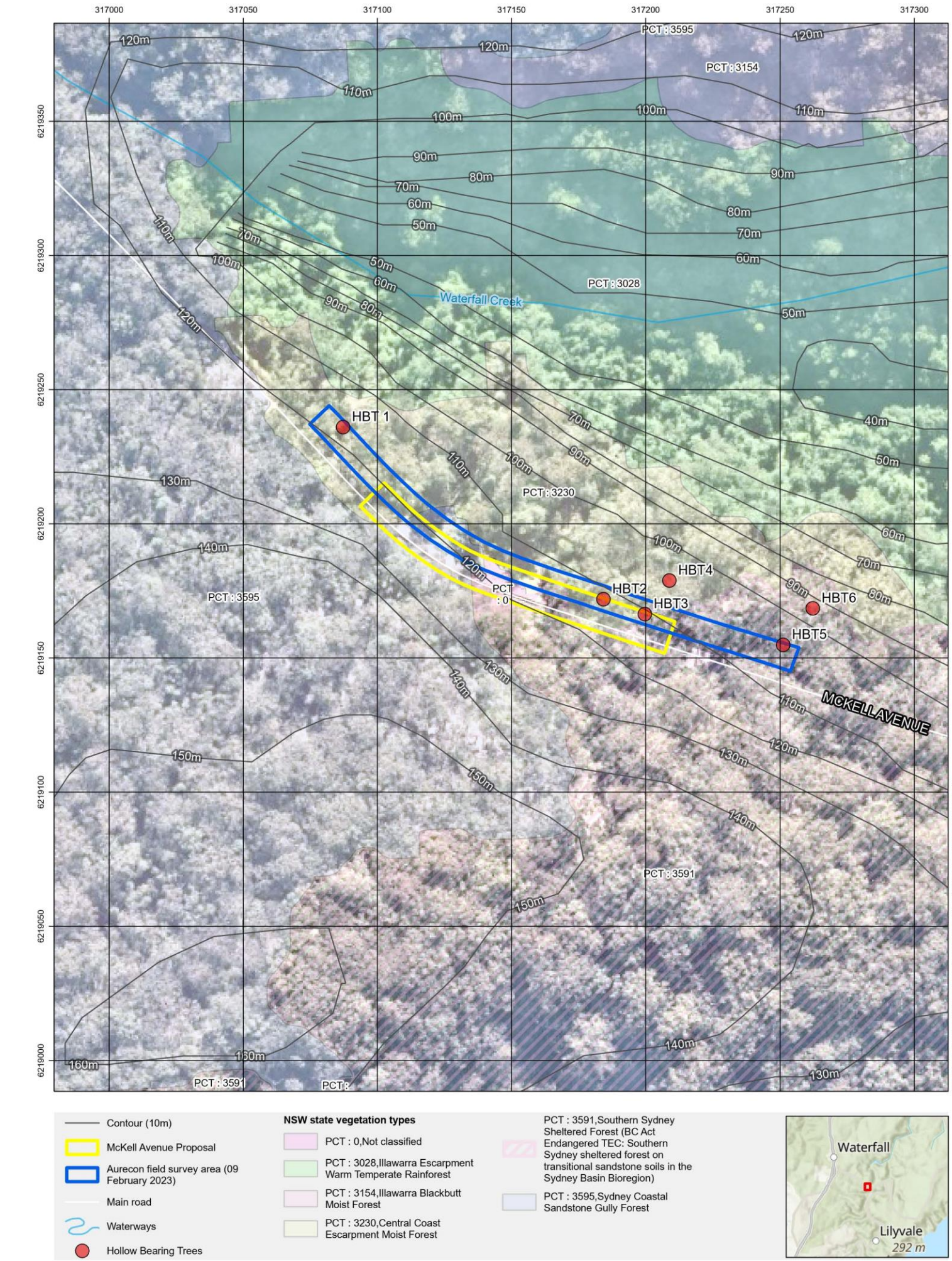
3.5 Field assessment

A field assessment was carried out on 29th September, 13th October 2022, and 9th February 2023. The field survey (9th February 2023) captured vegetation within the immediate vicinity of the McKell Avenue slope failure (Figure 3-1), locations west and east of the proposal area as well as 10 metres downslope. There was also one HBT west of the project and one HBT east of the project that were captured as part of the February 2023 survey. There were two more HBTs greater than 10 metres downslope and were only noted and not captured as part of the survey as the scope of works were considered unlikely to encroach beyond this point (Figure 3-2).

The field assessments between September 2022 and February 2023 noted that two tree stumps are present within the study area with one pre-dating the slope failure and the second removed sometime after the slope failure to maintain worker and public safety. The field assessment conducted in February 2023 confirmed that additional tree removal would be required for the proposal. Up to 71 trees may be required for removal, including up to 29 trees more than 20 centimetres diameter at breast height (dbh), and 42 trees between 5 and 20 cm dbh. These are located within five metres downslope of the road. Two of these trees have been identified as Hollow Bearing Trees (HBTs) (

Figure 3-2). Only one of the 71 trees identified is exotic (Crab Apple *Malus* sp). It is not considered to have amenity value nor to provide fauna habitat).

Figure 3-1 Road slumping on McKell Avenue



SRAPC McKell Avenue

FIGURE 3-2: Hollow Bearing Tree locations

Species identified during the field assessment on 13th October 2022 and on 9th February 2023 within the study area included:

- Two-veined hickory *Acacia binervata*
- Forest Oak *Allocasuarina torulosa*
- Smooth-barked Apple *Angophora costata*
- Rough-barked Apple *Angophora floribunda*
- Coffee Bush *Breynia oblongifolia*
- Coachwood *Ceratopetalum apetalum*
- Bloodwood *Corymbia gummifera*
- Blue flax lily *Dianella caerulea*
- Grey Ironbark *Eucalyptus paniculata*
- Sydney Peppermint *Eucalyptus piperita*
- Grey Gum *Eucalyptus punctata*
- Cheese tree *Glochidion ferdinandi*
- Spiny-headed mat-rush *Lomandra longifolia*
- Shrubby Platysace *Platysace lanceolata*
- Common Bracken *Pteridium esculentum*
- Graceful Bush-pea *Pultenaea flexilis*
- Turpentine *Syncarpia glomulifera*
- Scentless Rosewood *Synoum glandulosum*
- Water Gum *Tristaniopsis collina*

The field assessment confirmed:

- that the study area is also located within both PCT 3230: Central Coast Escarpment Moist Forest (No associated TEC), PCT 3595: Sydney Coastal Sandstone Gully Forest (No associated TEC), and PCT 3591 Southern Sydney Sheltered Forest (*BC Act Endangered TEC: Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*)
- no threatened species, threatened species habitat, or HBTs showing signs of use by fauna, including the Powerful Owl (*Ninox strenua*) (BC Act- Vulnerable), were identified. HBTs identified within the study area are not identified as suitable Powerful Owl habitat.

4 Biodiversity impact assessment

A Biodiversity Impact assessment was conducted to assess the impacts of the proposal on native vegetation and habitat, threatened flora including fungi, threatened fauna including terrestrial and aquatic impacts, Areas of Outstanding Biodiversity Value, and MNES.

The Biodiversity Impact assessment considered the vegetation removal required within the project scope. This assessment has defined trees 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)". Some species identified for removal can be defined as a 'shrub or small tree' as per the description provided in NSW Flora Online (PlantNet). However, all species identified in Table 4-1 are known to grow above three metres with few main stems and/or one trunk, and therefore are considered trees. Up to 71 trees may be required for removal, including up to 29 trees more than 20 centimetres dbh, and 42 trees between 5 and 20 cm dbh, that will be directly impacted by the works, as well as general vegetation and shrubs, such as Blakely's Bush-pea (*Pultenaea blakelyi*). Trees that require removal are summarised in Table 4-1. The *Tree and Hollow Replacement Guidelines* (Transport, July 2022) and the *Biodiversity Policy* (Transport, August 2022) discuss the impacts of clearing and where offsets are required.

Table 4-1 Trees that require removal

Species name		Native or exotic	Number of trees >20cm dbh	Number of trees (5 – 20 cm dbh)	HBTs and diameter at breast heigh (dbh)
Common name	Scientific name				
Two-veined hickory	*Acacia binervata*	Native	-	6	-
Blueskin	*Acacia irrorata*	Native	-	3	-
Smooth barked apple	*Angophora costata*	Native	1	2	-
Cinnamon myrtle	*Backhousia myrtifolia*	Native	1	11	None. One 20 cm dbh
Downy chance	*Clerodendrum tomentosum*	Native	-	1	-
Murrogun	*Cryptocarya microneura*	Native	-	1	-
Jackwood	*Cryptocarya glaucescens*	Native		1	-
Sydney gum/ Woollybutt	*Eucalyptus saligna/ Eucalyptus botryoides*	Native	10	1	**HBT 2**: 15-30 cm **HBT 3**: 10-15 cm, 15-30 cm, 15-30 cm
Grey ironbark	*Eucalyptus paniculata*	Native	2	-	None. Two 20-50 cm dbh
Sydney peppermint	*Eucalyptus piperita*	Native	1		-
Native guava	*Eupomatia laurina*	Native	-	1	-

Species name		Native or exotic	Number of trees >20cm dbh	Number of trees (5 – 20 cm dbh)	HBTs and diameter at breast heigh (dbh)
Common name	**Scientific name**				
Rusty fig	*Ficus rubiginosa*	Native	-	1	-
Wild quince	*Guioa semiglauca*	Native	-	1	-
Cheese tree	*Glochidion ferdinandi*	Native	1	7	None. 20 cm dbh
Crab apple	*Malus* sp.	Exotic	1	-	None. 25 cm dbh
Turpentine	*Syncarpia glomulifera*	Native	12	4	None. 11 trees 20-40 cm dbh, four >40cm dbh
Tree heath	*Trochocarpa laurina*	Native	-	2	-
Total	**-**	**-**	**71 (70 native)**		**-**

Of these trees, there were two HBTs within four metre downslope of the road and would be directly impacted by the works. The two HBTs that would be directly impacted as a result of the works includes:

- *Eucalyptus saligna/ Eucalyptus botryoides*
  - **HBT 2** (56 H 317184 6219172) (0-2 metres from the road): one hollow 15-30 centimetre diameter
  - **HBT 3** (56 H 317200 6219166) (0-2 metres from the road): three hollows (1) 10-15 centimetre diameter, (2) 15-30 centimetre diameter, and (3) 15-30 centimetre diameter.

There were two more HBTs greater than 10 metres downslope, one HBT west of the project, and one HBT east of the project, all outside the area of impact. The HBTs outside of the area of impact includes:

- *Eucalyptus saligna/ Eucalyptus botryoides*
  - **HBT 1** (56 H 317056 6219234) (2-5 metres from the road): two hollows, (1) 15-30 centimetre diameter, and (2) 10-15 centimetre diameter
- *Eucalyptus piperita*
  - **HBT 4** (56 H 317217 6219191) (greater than 10 metres from the road): two hollows (1)15-30 centimetre diameter, and (2) >30 centimetre diameter
- *Angophora costata*
  - **HBT 5** (56 H 317251 6219155) (2-5 metres from the road): one hollow 4-10 centimetres diameter

- **HBT 6** (56 H 317267 6219174) (greater than 10 metres from the road): one hollow 4-10 centimetres diameter.

Minor trimming of trees may be required at Waterfall Flats Picnic area and National Falls ancillary facilities, as well as within the McKell Avenue work-zone footprint. Trimming would be limited to smaller branches (where possible) without habitat features therefore reducing impact to fauna. Trimming is to facilitate storage of plant and equipment and vehicle movement at the ancillary facilities, and to allow for larger plant and equipment to move within the work-zone.

The following sections includes a description of the type, nature and extent of the impact on native vegetation and habitat, threatened flora including fungi, threatened fauna including terrestrial and aquatic impacts, Areas of Outstanding Biodiversity Value, and MNES. This assessment takes into account the receiving environment and proposed safeguards which will limit the impact. Proposed mitigation measures and safeguards are identified in Section 5.

4.1 Areas of Outstanding Biodiversity Value

Issue: Is the proposed activity likely to affect any declared area of outstanding biodiversity value or critical habitat or environmental asset of intergenerational significance?

Impact: None

Reasoning: Areas of Outstanding Biodiversity Value are areas with irreplaceable biodiversity value that hold importance to the State, Australia and/or globally. There are no Areas of Outstanding Biodiversity Value present within or adjoining the study area.

4.2 Impacts on native vegetation and habitat

Issue: Is the proposed activity likely to result in the clearing or modification of vegetation, including ecological communities and plant community types of conservation significance?

Impact: Low

Reasoning: Up to 71 trees may be required for removal (of which 70 are native). There are up to 29 trees with more than 20 centimetres dbh within five metres downslope of the road, including two HBTs. There are up to 42 trees between 5 and 20 cm dbh within five metres downslope of the road, considered to be subject to natural attrition given the size and density of the vegetation. Two tree stumps are present within the study area with one pre-dating the slope failure and the second removed sometime after the slope failure. No threatened species, threatened species habitat, or HBTs showing signs of use by fauna were identified. HBTs identified within the study area are not identified as suitable Powerful Owl (*Ninox strenua*) (BC Act- Vulnerable) habitat.

Part of the study area is PCT 3591: Southern Sydney Sheltered Forest, which is associated with listed BC Act Endangered TEC*: Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*. The project will impact this TEC through the removal of vegetation. Given the TEC occurs across an already fragmented landscape bordering the slope failure at McKell Avenue, the required vegetation clearance is not expected to alter or significantly reduce the TEC. A 5-Part Assessment of significance is included in Section 5, in accordance with the BC Act.

4.3 Threatened fauna

Issue: Is the proposed activity likely to endanger, displace or disturb terrestrial or aquatic fauna, including fauna of conservation significance, or create a barrier to their movement?

Impact: Low

Reasoning: The proposal would not endanger, displace or disturb terrestrial or aquatic fauna. The proposal would not create a barrier to movement, as the trees and tree stumps to be removed are in a disturbed roadside environment and occurs across an already fragmented landscape bordering the slope failure at McKell Avenue. There are no trees to be removed with potential Powerful Owl associated nesting habitat and foraging habitat. Powerful Owl habitat occurs in a larger, less disturbed landscapes i.e. wider Royal National Park. Nesting habitat would typically require large tree hollows (minimum 50 centimetres deep) in large eucalypts trees (diameter approximately 80 - 240 centimetres). While there are two large eucalyptus trees within five meters downslope of the road (80 centimetres dbh), all hollows identified within the proposal area are between 4 – 30 centimetres in diameter, and therefore do not meet the requirements for nesting habitat. It is unlikely the proposed activity would impact species of conservation significance or create a barrier to movement.

4.4 Threatened flora

Issue: Is the proposed activity likely to result in the removal of protected flora or plants or fungi of conservation significance?

Impact: Negligible

Reasoning: No threatened species were identified during the field assessment. Therefore, it is unlikely the proposed activity would impact species of conservation significance.

4.5 Key threatening processes

Issue: Is the proposed activity likely to contribute to a key threatening process to biodiversity or ecological integrity

Impact: Low

Reasoning: The study area is not located within an area of outstanding biodiversity value. The proposal would influence the key threatening process of clearing of native vegetation. The proposal would require the removal of trees, including two trees with hollows, tree stumps, trimming of vegetation and the removal of understorey vegetation which has regrown on the failed slope. All vegetation removal would occur within five metres downslope of disturbed roadside environment and across an already fragmented landscape bordering the road and slope failure at McKell Avenue. The area outside of 5 metres of the downslope would be retained. Minor trimming is also likely required at the Waterfall Flat picnic area and National Falls ancillary facilities. The proposal would provide a low increase to the key threatening process of native vegetation clearance.

4.6 Invasive species

Issue: Is the proposed activity likely to introduce weeds, pathogens, pest animals or genetically modified organisms into an area?

Impact: Negligible

Reasoning: There is a potential for weeds and pest animals to establish particularly with the proposal being located within the road corridor and adjacent to the Royal National Park. Mitigation measures would need to be implemented to reduce the potential for weeds and feral animals establishing and spreading.

4.7 Matters of National Environmental Significance

4.7.1 EPBC Act TECs

Issue: Is the project likely to affect listed threatened species or ecological communities?

Impact: Low

Reasoning: While listed threatened species have been recorded within 10 kilometres of the study area, there were no threatened species, and no threatened species habitat showing signs of use by fauna, identified during the field assessment. EPBC Act listed TECs are not present within the study area, and the proposed activity is not likely to impact MNES listed species.

4.7.2 EPBC Act Listed migratory species

Issue: Is the project likely to affect listed migratory species?

Impact: Negligible

Reasoning: While migratory species have been recorded within 10 kilometres of the site, migratory species are unlikely to use vegetation present within the study area due to an abundance of adjacent habitat i.e. Royal National Park

4.7.3 EPBC Act Ramsar wetlands

Issue: Is the project likely to affect the ecology of Ramsar wetlands?

Impact: Negligible

Reasoning: The study area is located adjoining a watercourses, but not near waterbodies or wetlands. The adjoining watercourses are unlikely to affect Ramsar wetlands, given that the initial drainage of the site flows gently north to Waterfall Creek, and the overall the landscape drainage is eastwards along the Waterfall Creek to Hacking River, which runs northwards to Port Hacking.

4.7.4 EPBC Act World Heritage properties

Issue: Is the project likely to affect world heritage values of World Heritage properties?

Impact: None

Reasoning: Not present within the study area

4.7.5 EPBC Act National Heritage Places

Issue: Is the project likely to affect the national heritage values of national heritage places

Impact: Low

Reasoning: The study area is adjacent to the Royal National Park. Vegetation clearance will include tree removal, including two HBTs, which occur within five metres downslope of the road.

5 Five-Part Test of Significance

The 5-Part Test of Significance is designed to determine if a development or activity will significantly affect threatened species or ecological communities, or their habitats. A 5-Part Test of Significance has been undertaken below for the BC Act Endangered TEC *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion* in accordance with the NSW BC Act (2016).

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

N/A

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

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

The NSW PCT 3591 Southern Sydney Sheltered Forest is associated with BC Act Endangered TEC *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*. This vegetation community is located partially within the eastern side of the study area, and is the predominant vegetation south-west of McKell Avenue and upslope of the study area.

The vegetation removal is unlikely to place the local extent of the community at risk of extinction. Up to 71 trees may be required for removal, including up to 29 trees more than 20 centimetres dbh, and 42 trees between 5 and 20 cm dbh, will be directly impacted by the works. About 10 – 15 trees more than 20 centimetres dbh are likely to be impacted are within the TEC. Conservative estimates indicate that the impact to the TEC encompasses approximately 0.0128 hectares (assessed as 32 metres of impacted vegetation along McKell Avenue, extending 4 metres downslope). *Southern Sydney sheltered forest on transitional sandstone soils* has an estimated total extent of occurrence of less than 45 000 hectares, and is estimated to currently occupy between 400 and 4000 hectares. Based on these occupation estimates, vegetation removal would constitute between 0.00032 per cent to 0.0032 per cent of the existing community. The extent of the community within the Royal National Park is unknown, however the associated PCT 3591 encompasses approximately 11 hectares contiguous with the patch within the scope of works. Removal of the vegetation at McKell Avenue would constitute approximately 0.116 per cent of this vegetation patch.

Vegetation removal would not modify the composition of the community, as vegetation removal is indiscriminate and would not target one species or a group of species within the community. Vegetation removal is proposed at the understory, midstory, and canopy level. Minor trimming of tree

branches without habitat features is expected around the Waterfall Flat picnic area and National Falls ancillary facilities.

c) in relation to the habitat of a threatened species or ecological community:

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

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

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

The proposal will directly impact approximately 0.0128 hectares of the TEC *Southern Sydney sheltered forest on transitional sandstone soils*, encompassing between approximately 10 and 15 trees with a dbh of more than 20 centimetres.

The vegetation within the area is already fragmented by McKell Avenue, and impacted by the current slope failure. The proposal will not further fragment or isolate patches of the habitat, as all proposed vegetation clearance immediately borders the road at McKell Avenue.

The habitat to be removed is not considered important to the long term survival of the TEC, as the community at McKell Avenue is already fragmented, bordering the existing road and in parts degraded by the current slope failure.

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)

N/A.

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

Key threatening processes that have the potential to increase due to the activity at McKell Avenue are as follows:

- Clearing of native vegetation
- Infection of native plants by *Phytophthora cinnamomi*
- Introduction and establishment of Exotic Rust Fungi of the order *Pucciniales* pathogenic on plants of the family *Myrtaceae*
- Invasion of native plant communities by *Chrysanthemoides monilifera*
- Invasion and establishment of Scotch Broom (*Cytisus scoparius*)
- Invasion and establishment of exotic vines and scramblers
- Invasion, establishment and spread of Lantana
- Invasion of native plant communities by African Olive (*Olea europaea* sp. *cuspidata*)
- Invasion of native plant communities by exotic perennial grasses
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees

The project involves the clearing of native vegetation downslope of McKell Avenue, encompassing up to 71 trees (70 native), including up to 29 trees more than 20 centimetres dbh, and 42 trees between 5

and 20 centimetres dbh. Loss of hollows will be mitigated in accordance with an approved Transport Tree and Hollow Replacement Plan, and in accordance with the EMF-BD-GD-0129 Tree and hollow replacement guidelines, EMF-BD-GD-001 No net loss guidelines, and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS 2011). Modification or removal of vegetation is not permitted outside the proposal footprint, including removal of dead timber or any other forest materials.

Weed invasion will be mitigation through biosecurity procedures, including but not limited to disposal of sealed bagged weeds to a licenced waste disposal facility, and washdown procedure adhered to when traveling between sites and prior to entering the proposed activity area. A biosecurity kit should be kept in all vehicles (as per DPI 2012).

6 Offsets and other measures

6.1 Direct offset thresholds

Offset thresholds set out by the Transport *No Net Loss Guidelines* are detailed in Table 6-1. The assessment of direct impacts on native vegetation and threatened species habitat against these offset thresholds is detailed in Table 6-2. Part of the study area is PCT 3591: Southern Sydney Sheltered Forest, which is associated with listed BC Act Endangered TEC*: Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*. As clearing is limited to approximately 0.0128 hectares hectares of TEC, the '≥ 2 hectares' condition threshold is not triggered.

Table 6-1. Offset thresholds (extracted from Transport *No Net Loss Guidelines*).

Impact	Threshold
Works involving clearing of a CEEC	Where there is any clearing of an CEEC in 'moderate to good' condition
Works involving clearing of an EEC	Where clearing of a EEC ≥ 2 ha in 'moderate to good' condition
Works involving clearing of VEC	Where clearing of VEC ≥ 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 ≥ 1 ha in 'moderate to good' condition
Works involving removal of known threatened flora species and their habitat	Where loss of individuals is ≥10 or where clearing of habitat is ≥ 1 ha
Type 1 or Type 2 key fish habitats	Where there is a net loss of habitat

Impact	Threshold
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.	Any clearing of hollows and/or trees ≥5cm DBH

Table 6-2. Assessment of vegetation impacts against thresholds.

PCT	Condition	TEC	Impact area	Threshold triggered?
PCT 3230: Central Coast Escarpment Moist Forest	Not assessed.	No associated TEC	Not assessed.	No. Tree and hollow replacement required.
PCT 3591: Southern Sydney Sheltered Forest	Not assessed.	BC Act Endangered TEC *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*	0.0128 hectares (assessed as 32 metres of impacted vegetation along McKell Avenue, extending 4 metres downslope)	No. Tree and hollow replacement required.
PCT 3595: Sydney Coastal Sandstone Gully Forest	Not assessed.	No associated TEC	Not assessed.	No. Tree replacement required.

6.2 Residual offset requirements

There are no direct impacts to threatened communities or threatened species habitat which require offsetting under the Transport *No Net Loss Guidelines*. Residual impacts that do not exceed offset thresholds are considered against the requirements of the Transport *Tree and Hollow Replacement Guidelines* (refer to Table 6-3). While 71 trees have been considered for removal, one tree has not been considered for offsetting. One Crab Apple (*Malus* sp) has been excluded as it is not native nor considered to be an amenity tree. As per the Transport *Tree and Hollow Replacement Guidelines* (2022) and the Transport *Biodiversity Policy* (2022), native trees, habitat and amenity trees are to be offset. However, the one Crab Apple tree is considered a non-native tree without amenity value (nor is it a fauna habitat tree) therefore is not required to be offset.

Preliminary tree and hollow replacement estimates are outlined in

Table 6-4.

Table 6-3.Tree and hollow replacement requirements (extracted from Transport *Tree and Hollow Replacement Guidelines*).

Tree size	Tree replacement requirement
Very large tree (DBH2 greater than 100cm)	Plant minimum 16 trees
Large tree (DBH between 50cm and 100cm)	Plant minimum eight trees
Medium tree (DBH greater than 20 cm, but less than 50cm)	Plant minimum four trees
Small tree (DBH greater than 5cm, but less than 20cm	Plant minimum two trees
Hollow replacement requirement	Provide three artificial hollows for every occupied hollow removed

Table 6-4. Preliminary tree and hollow replacement estimates.

Category	Estimated No. impacted		Replacement requirement per tree/hollow removed[1]		Estimates number to be replaced[2]		Estimated equivalent payment to Transport conservation fund[2]
	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)	11	0	Plant minimum 8 trees	$1,000	88	0	$11,000
Medium tree (DBH ≥20 to <50 cm)	17	0	Plant minimum 4 trees	$500	68	0	$8,500
Small tree (DBH ≥ 5cm to <20 cm)	42	0	Plant minimum 2 trees	$125	84	0	$5,250

Category	Estimated No. impacted		Replacement requirement per tree/hollow removed[1]		Estimates number to be replaced[2]		Estimated equivalent payment to Transport conservation fund[2]
	Native trees	Amenity trees	Planting required	Contribution required	Native trees	Amenity trees	
Hollow	Four hollows: ▪ One hollow approximately 10-15 centimetre diameter ▪ Three hollows approximately 15-30 centimetre diameter		Provide 3 artificial hollows for every occupied hollow removed*	$500	12 hollows		$2,000
Totals					240 trees 12 hollows		$26,750

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. Must occur prior to commencement of works.

6.2.1 Tree and hollow replacement plan

The project will impact the BC Act Endangered TEC *Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion* through the removal of vegetation. However, provided mitigation measures are followed the required vegetation clearance is not expected to alter or significantly reduce the TEC. Clearing is limited to approximately 0.0128 hectares hectares of TEC, and the '≥ 2 hectares' condition threshold is not triggered under the Transport *No Net Loss Guidelines* (refer to Table 7-1). As biodiversity offsetting scheme thresholds have not been triggered, a biodiversity offset strategy is not required. However, a Tree and Hollow Replacement Plan should be prepared in order to manage offsets.

7 Conclusion and recommendation

This biodiversity memo assessed potential impacts of the proposal on the environment, in accordance with the EPBC Act and BC Act, and associated guidelines. Assessment of potential impacts was undertaken for the following environmental values (Refer to Section 4): Areas of Outstanding Biodiversity Value, native vegetation and habitat, threatened flora, threatened fauna, key threatening processes, invasive species, and MNES. MNES includes TECs, migratory species, Ramsar wetlands, and world and national heritage properties.

This biodiversity memo concludes that, providing the required mitigation measures are applied the proposal is not likely to have a significant impact on the biodiversity within the study area. The

proposal is not likely to significantly impact MNES or the environment of Commonwealth land and a referral to the Australian Government is therefore not required under the Commonwealth EPBC Act. A 5-Part Assessment of significance is included in Section 5, in accordance with the BC Act.

Mitigation measures to minimise impacts to biodiversity are summarised in Table 7-1.

Table 7-1. Summary of safeguards and mitigation measures.

No.	Impact	Environmental safeguards	Responsibility	Timing
B1	Impacts on native vegetation and habitat	Vegetation removal would be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (Transport 2011), and there must be restrictions of removal of dead vegetation outside the project area	Contractor	Preconstruction Construction
B2	Impacts on native vegetation and habitat	Modification or removal of vegetation is not permitted outside the proposal area, including removal of dead timber or any other forest materials. During construction, vegetation removal would be reviewed to reduce tree and vegetation removal as far as practicable.	Contractor	Preconstruction Construction
B3	Impacts on native vegetation and habitat	Each tree that would be impacted by the works would be marked/identified prior to the commencement of works	Contractor	Preconstruction Construction
B4	Impacts on native vegetation and habitat	Tree removal is to be carried out by an arborist with a minimum AQF Level 5 qualification in Arboriculture and must be assessed prior to removal for the presence of fauna habitat values (such as hollows, nests or roosts).	Contractor	Preconstruction Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
B5	Impacts on native vegetation and habitat	In accordance with the *Transport Tree and hollow replacement guidelines*, tree and hollows that require replacement will be identified prior to the commencement of works and: ■ A Tree and Hollow Replacement Plan will be prepared to address the impacts prior to the commencement of works; OR ■ Payment will be made to a Conservation Fund	Contractor	Preconstruction Construction
B6	Impacts on native vegetation and habitat	Offsetting in accordance with Transport Vegetation Management (Protection and Removal) Guideline (Transport, 2016) and Vegetation Offset Guide – 9TP-ST-149.	Contractor	Preconstruction Construction
B7	Impacts on TECs	The vegetation removal area would be set up and clearly delineated using fencing or similar and sign posted. Exclusion zones would be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS 2011)	Contractor	Preconstruction Construction
B8	Impacts on threatened fauna	Pre-clearance survey conducted to assess vegetation for habitat features including hollows and signs of fauna use if additional trees are identified for trimming or removal.	Contractor	Preconstruction Construction
B9	Impacts on threatened fauna	An experienced fauna spotter-catcher must be present prior to and during clearance work working in accordance with a pre-prepared wildlife management plan to relocate any fauna encountered during clearance activities.	Contractor	Preconstruction Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
B10	Impacts on threatened flora and fauna	An unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS 2011) if threatened ecological communities, or threatened flora and fauna species, are not assessed in the biodiversity assessment, are identified at either proposal site.	Contractor	Preconstruction Construction
B11	Impacts to waterways	Control of sedimentation: all the proposed activities in accordance with the 'Blue Book' Volumes 1 and 2c (NSW Government 2004, DECC 2008) requirements.	Contractor	Preconstruction Construction
B12	Weeds and invasive species	The CEMP must include biosecurity controls to limit weed and feral animal establishment and must be managed in accordance with the *Biosecurity Act 2015*: ▪ Disposal of sealed bagged weeds to a licenced waste disposal facility ▪ Annual monitoring for weeds and pests ▪ Washdown procedure adhered to when traveling between sites and prior to entering the proposed activity area ▪ A biosecurity kit should be kept in all vehicles (as per DPI 2012)	Contractor	Preconstruction Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
B13	CEMP development	A CEMP should be developed for the proposed activity which would include, but not be limited to: ■ Sediment and erosion controls continuously during construction and operation in accordance with the Blue Book (NSW Government) ■ Ignition prevention/ hotworks controls to limit bushfire ignitions ■ Dust mitigation measures ■ Exclusion areas ■ Stop work measures Procedure for new finds of potential threatened species, Aboriginal Cultural Heritage items or historic heritage items ■ Disposal areas and methods in accordance with EPA guidelines	Contractor	Preconstruction Construction
B14	Vegetation management	Trimming of trees at the Waterfall Flat picnic area and National Falls ancillary facilities would require approval from NPWS prior to tree trimming works	Contactor	Pre-construction Construction
B15	Vegetation planting / replanting	Consultation with and endorsement from National Parks and Wildlife Service (NPWS) needs to occur for any proposed vegetation planting.	Contractor	Pre-construction Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
B16	Flora and fauna management plan	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: ■ Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas ■ requirements set out in the Landscape Guideline (RMS, 2008) ■ pre-clearing survey requirements ■ procedures for unexpected threatened species finds and fauna handling ■ procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013) ■ protocols to manage weeds and pathogens.	Contractor	Pre-construction Construction

Appendix F – Transport for NSW Construction Noise Estimator Results Tool

Distanced Based Assessment (Noisiest Plant) — McKell Avenue - Work-Zone

Please pick from drop-down list in orange cells

Noise area category		R0
RBL or L_{A90} Background level (dB(A))	Day	30
	Evening	30
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	Day	40
	Day (OOHW)	35
	Evening	35
	Night	35
Noisiest plant		13.5T Excavator With Hammer
Is there line of sight to receiver?		No (behind substantial solid barrier)

Steps for Assessment:

1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
3. 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.
4. 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/saw 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.

5. 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:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) 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.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver.
8. Where night works are involved, identify sleep disturbance affected distance.
9. 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 specilaist 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

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})											$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A)			10 to 20 dB(A)			20 to 30 dB(A)			> 30 dB(A)					
			Noticeable			Clearly audible			Moderately intrusive			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	455							N	215	50	N	105	60	N, PC, RO	25	75	
	Day (OOHW)	655				N, R1, DR	455	40	N, R1, DR	215	50	N, R1, DR, PC, SN	105	60	N, PC, RO	25	75	
	Evening	655				N, R1, DR	455	40	N, R1, DR	215	50	N, R1, DR, PC, SN	105	60	N, PC, RO	25	75	
	Night	655	N	655	35	N, R2, DR	455	40	N, PC, SN, R2, DR	215	50	AA, N, PC, SN, R2, DR	105	60	N, PC, RO	25	75	150
	Highly Affected	25													N, PC, RO	25	75	
Developed settlements (urban and suburban)	Day	590							N	260	50	N	110	60	N, PC, RO	25	75	
	Day (OOHW)	870				N, R1, DR	590	40	N, R1, DR	260	50	N, R1, DR, PC, SN	110	60	N, PC, RO	25	75	
	Evening	870				N, R1, DR	590	40	N, R1, DR	260	50	N, R1, DR, PC, SN	110	60	N, PC, RO	25	75	
	Night	870	N	870	35	N, R2, DR	590	40	N, PC, SN, R2, DR	260	50	AA, N, PC, SN, R2, DR	110	60	N, PC, RO	25	75	170
	Highly Affected	25													N, PC, RO	25	75	
Propagation across a valley / over water	Day	815							N	340	50	N	130	60	N, PC, RO	30	75	
	Day (OOHW)	1215				N, R1, DR	815	40	N, R1, DR	340	50	N, R1, DR, PC, SN	130	60	N, PC, RO	30	75	
	Evening	1215				N, R1, DR	815	40	N, R1, DR	340	50	N, R1, DR, PC, SN	130	60	N, PC, RO	30	75	
	Night	1215	N	1215	35	N, R2, DR	815	40	N, PC, SN, R2, DR	340	50	AA, N, PC, SN, R2, DR	130	60	N, PC, RO	30	75	210
	Highly Affected	30													N, PC, RO	30	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
	Standard hours			<10 dB(A)			10 to 20 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))
Classroom at schools and other educational institutions	Day	55	150				N	60	65	N, PC, RO	25	75
Hospital wards and operating theatres	Day	65	60							N, PC, RO	25	75
Place of worship	Day	55	150				N	60	65	N, PC, RO	25	75
Active recreation	Day	65	60							N, PC, RO	25	75
Passive recreation	Day	60	105				N	35	70	N, PC, RO	25	75
Industrial premise	Day	75	25							N, PC, RO	25	75
Offices, retail outlets	Day	70	35							N, PC, RO	25	75

				$L_{Aeq(15minute)}$ noise level above NML											
	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	60				N, R1, DR	35	70	N, R1, DR	14	80	N, R1, DR, PC, SN	4	90
	Night	65	60	N	60	65	N, R2, NR	35	70	N, PC, SN, R2, DR	14	80	AA, N, PC, SN, R2, DR	4	90
Place of worship	Evening	55	150				N, R1, DR	105	60	N, R1, DR	35	70	N, R1, DR, PC, SN	14	80
	Night	55	150	N	150	55	N, R2, NR	105	60	N, PC, SN, R2, DR	35	70	AA, N, PC, SN, R2, DR	14	80
Active recreation	Evening	65	60				N, R1, DR	35	70	N, R1, DR	14	80	N, R1, DR, PC, SN	4	90
Passive recreation	Evening	60	105				N, R1, DR	60	65	N, R1, DR	25	75	N, R1, DR, PC, SN	8	85
Industrial premise	Evening	75	25				N, R1, DR	14	80	N, R1, DR	4	90	N, R1, DR, PC, SN	1	100
	Night	75	25	N	25	75	N, R2, NR	14	80	N, PC, SN, R2, DR	4	90	AA, N, PC, SN, R2, DR	1	100
Offices, retail outlets	Evening	70	35				N, R1, DR	25	75	N, R1, DR	8	85	N, R1, DR, PC, SN	3	95
	Night	70	35	N	35	70	N, R2, NR	25	75	N, PC, SN, R2, DR	8	85	AA, N, PC, SN, R2, DR	3	95

Non-residential receiver
Developed settlements (urban and suburban)

			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
	Standard hours			<10 dB(A)			10 to 20 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))
Classroom at schools and other educational institutions	Day	55	170				N	70	65	N, PC, RO	25	75
Hospital wards and operating theatres	Day	65	70							N, PC, RO	25	75
Place of worship	Day	55	170				N	70	65	N, PC, RO	25	75
Active recreation	Day	65	70							N, PC, RO	25	75
Passive recreation	Day	60	110				N	40	70	N, PC, RO	25	75
Industrial premise	Day	75	25							N, PC, RO	25	75
Offices, retail outlets	Day	70	40							N, PC, RO	25	75

				$L_{Aeq(15minute)}$ noise level above NML											
	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	70				N, R1, DR	40	70	N, R1, DR	14	80	N, R1, DR, PC, SN	4	90
	Night	65	70	N	70	65	N, R2, NR	40	70	N, PC, SN, R2, DR	14	80	AA, N, PC, SN, R2, DR	4	90
Place of worship	Evening	55	170				N, R1, DR	110	60	N, R1, DR	40	70	N, R1, DR, PC, SN	14	80
	Night	55	170	N	170	55	N, R2, NR	110	60	N, PC, SN, R2, DR	40	70	AA, N, PC, SN, R2, DR	14	80
Active recreation	Evening	65	70				N, R1, DR	40	70	N, R1, DR	14	80	N, R1, DR, PC, SN	4	90
Passive recreation	Evening	60	110				N, R1, DR	70	65	N, R1, DR	25	75	N, R1, DR, PC, SN	8	85
Industrial premise	Evening	75	25				N, R1, DR	14	80	N, R1, DR	4	90	N, R1, DR, PC, SN	1	100
	Night	75	25	N	25	75	N, R2, NR	14	80	N, PC, SN, R2, DR	4	90	AA, N, PC, SN, R2, DR	1	100
Offices, retail outlets	Evening	70	40				N, R1, DR	25	75	N, R1, DR	8	85	N, R1, DR, PC, SN	3	95
	Night	70	40	N	40	70	N, R2, NR	25	75	N, PC, SN, R2, DR	8	85	AA, N, PC, SN, R2, DR	3	95

Non-residential receiver
Propagation across a valley / over water

			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
	Standard hours			<10 dB(A)			10 to 20 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))

Classroom at schools and other educational institutions	Day	55	210				N	80	65	N, PC, RO	30	75
Hospital wards and operating theatres	Day	65	80							N, PC, RO	30	75
Place of worship	Day	55	210				N	80	65	N, PC, RO	30	75
Active recreation	Day	65	80							N, PC, RO	30	75
Passive recreation	Day	60	130				N	45	70	N, PC, RO	30	75
Industrial premise	Day	75	30							N, PC, RO	30	75
Offices, retail outlets	Day	70	45							N, PC, RO	30	75

				$L_{Aeq(15minute)}$ noise level above NML											
	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	80				N, R1, DR	45	70	N, R1, DR	15	80	N, R1, DR, PC, SN	4	90
	Night	65	80	N	80	65	N, R2, NR	45	70	N, PC, SN, R2, DR	15	80	AA, N, PC, SN, R2, DR	4	90
Place of worship	Evening	55	210				N, R1, DR	130	60	N, R1, DR	45	70	N, R1, DR, PC, SN	15	80
	Night	55	210	N	210	55	N, R2, NR	130	60	N, PC, SN, R2, DR	45	70	AA, N, PC, SN, R2, DR	15	80
Active recreation	Evening	65	80				N, R1, DR	45	70	N, R1, DR	15	80	N, R1, DR, PC, SN	4	90
Passive recreation	Evening	60	130				N, R1, DR	80	65	N, R1, DR	30	75	N, R1, DR, PC, SN	10	85
Industrial premise	Evening	75	30				N, R1, DR	15	80	N, R1, DR	4	90	N, R1, DR, PC, SN	1	100
	Night	75	30	N	30	75	N, R2, NR	15	80	N, PC, SN, R2, DR	4	90	AA, N, PC, SN, R2, DR	1	100
Offices, retail outlets	Evening	70	45				N, R1, DR	30	75	N, R1, DR	10	85	N, R1, DR, PC, SN	3	95
	Night	70	45	N	45	70	N, R2, NR	30	75	N, PC, SN, R2, DR	10	85	AA, N, PC, SN, R2, DR	3	95

Distance Based Assessment Summary for Night Works

Please pick from drop-down list in orange cells
Please input information into yellow cells

Distanced Base (Noisiest Plant)

Noise area category	R0
Night time RBL (dB(A))	30
Night time NML (dB(A))	35
Propagation Type	Rural Undeveloped Areas
Noisiest plant	13.5T Excavator With Hammer
Is there line of sight to receiver?	No (behind substantial solid barrier)
Shortest distance to the worst affected receiver (m)	2530
$L_{Aeq(15minute)}$ 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
$L_{Aeq(15minute)}$ 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

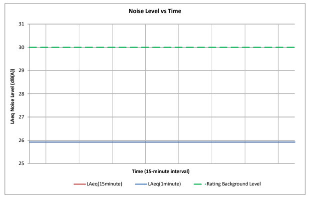
Please proceed with consideration given to the following additional mitigation measures

	Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within mitigation distance (m)
5-10 dB(A) over RBL	N	35	655
10-20 dB(A) over RBL	N, R2, DR	40 (40)	455 (455)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	50	215
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	60	105

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 Respite Period 2 (R2) is implemented. See alternate mitigation level and mitigation distance in () for letterbox drop.



Distanced Based (Scenario)

Noise area category	R2
Night time RBL (dB(A))	35
Night time NML (dB(A))	40
Propagation Type	Developed Settlements
Scenario	Road furniture installation
Is there line of sight to receiver?	No (behind solid barrier)
Distance to the worst affected receiver (m) [greater than 5m]	15
$L_{Aeq(15minute)}$ noise level at the worst affected receiver (dB(A))	69
Level above RBL at the worst affected receiver	34
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	N	40	330
10-20 dB(A) over RBL	N, R2, DR	45 (50)	215 (140)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	55	85
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	65	25

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 Respite Period 2 (R2) is implemented. See alternate mitigation level and mitigation distance in () for letterbox drop.

Populate summary table

	Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within Mitigation Distance (m)		
			LoS	No LoS (behind solid barrier)	No LoS (behind substantial solid barrier)
5-10 dB(A) over RBL	N	40	-	-	-
10-20 dB(A) over RBL	N, R2, DR	45 (50)	-	-	200 (135)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	55	-	-	85
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	65	-	-	30

Transport Roads & Maritime Services

Distanced Based Assessment (Noisiest Plant)

Waterfall Flats Picnic Area - Ancillary Facility no:01

Please pick from drop-down list in orange cells

Noise area category		R0
RBL or L_{A90} Background level (dB(A))	Day	30
	Evening	30
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	Day	40
	Day (OOHW)	35
	Evening	35
	Night	35
Noisiest plant		2.5T Smoothdrum Roller
Is there line of sight to receiver?		No (behind substantial solid barrier)

Steps for Assessment:

1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
3. 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.
4. 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 sightdraw 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.

5. 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:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) 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.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver.
8. Where night works are involved, identify sleep disturbance affected distance.
9. 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 specilast 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

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})												$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A)			10 to 20 dB(A)			20 to 30 dB(A)			> 30 dB(A)						
			Noticeable			Clearly audible			Moderately intrusive			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	130							N	50	50	N	25	60	N, PC, RO	5	75	
	Day (OOHW)	185				N, R1, DR	130	40	N, R1, DR	50	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Evening	185				N, R1, DR	130	40	N, R1, DR	50	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Night	185	N	185	35	N, R2, DR	130	40	N, PC, SN, R2, DR	50	50	AA, N, PC, SN, R2, DR	25	60	N, PC, RO	5	75	20
	Highly Affected	5													N, PC, RO	5	75	
Developed settlements (urban and suburban)	Day	145							N	55	50	N	25	60	N, PC, RO	5	75	
	Day (OOHW)	220				N, R1, DR	145	40	N, R1, DR	55	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Evening	220				N, R1, DR	145	40	N, R1, DR	55	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Night	220	N	220	35	N, R2, DR	145	40	N, PC, SN, R2, DR	55	50	AA, N, PC, SN, R2, DR	25	60	N, PC, RO	5	75	20
	Highly Affected	5													N, PC, RO	5	75	
Propagation across a valley / over water	Day	175							N	65	50	N	25	60	N, PC, RO	5	75	
	Day (OOHW)	280				N, R1, DR	175	40	N, R1, DR	65	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Evening	280				N, R1, DR	175	40	N, R1, DR	65	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Night	280	N	280	35	N, R2, DR	175	40	N, PC, SN, R2, DR	65	50	AA, N, PC, SN, R2, DR	25	60	N, PC, RO	5	75	20
	Highly Affected	5													N, PC, RO	5	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

		Standard hours			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
					<10 dB(A)			10 to 20 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))
Classroom at schools and other educational institutions	Day	55	30				N	15	65	N, PC, RO	5	75
Hospital wards and operating theatres	Day	65	15							N, PC, RO	5	75
Place of worship	Day	55	30				N	15	65	N, PC, RO	5	75
Active recreation	Day	65	15							N, PC, RO	5	75
Passive recreation	Day	60	25				N	10	70	N, PC, RO	5	75
Industrial premise	Day	75	5							N, PC, RO	5	75
Offices, retail outlets	Day	70	10							N, PC, RO	5	75

		OOHW		$L_{Aeq(15minute)}$ noise level above NML											
				< 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	15				N, R1, DR	10	70	N, R1, DR	3	80	N, R1, DR, PC, SN	1	90
	Night	65	15	N	15	65	N, R2, NR	10	70	N, PC, SN, R2, DR	3	80	AA, N, PC, SN, R2, DR	1	90
Place of worship	Evening	55	30				N, R1, DR	25	60	N, R1, DR	10	70	N, R1, DR, PC, SN	3	80
	Night	55	30	N	30	55	N, R2, NR	25	60	N, PC, SN, R2, DR	10	70	AA, N, PC, SN, R2, DR	3	80
Active recreation	Evening	65	15				N, R1, DR	10	70	N, R1, DR	3	80	N, R1, DR, PC, SN	1	90
Passive recreation	Evening	60	25				N, R1, DR	15	65	N, R1, DR	5	75	N, R1, DR, PC, SN	2	85
Industrial premise	Evening	75	5				N, R1, DR	3	80	N, R1, DR	1	90	N, R1, DR, PC, SN	0	100
	Night	75	5	N	5	75	N, R2, NR	3	80	N, PC, SN, R2, DR	1	90	AA, N, PC, SN, R2, DR	0	100
Offices, retail outlets	Evening	70	10				N, R1, DR	5	75	N, R1, DR	2	85	N, R1, DR, PC, SN	1	95
	Night	70	10	N	10	70	N, R2, NR	5	75	N, PC, SN, R2, DR	2	85	AA, N, PC, SN, R2, DR	1	95

Non-residential receiver
Developed settlements (urban and suburban)

		Standard hours			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
					<10 dB(A)			10 to 20 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))
Classroom at schools and other educational institutions	Day	55	35				N	15	65	N, PC, RO	5	75
Hospital wards and operating theatres	Day	65	15							N, PC, RO	5	75
Place of worship	Day	55	35				N	15	65	N, PC, RO	5	75
Active recreation	Day	65	15							N, PC, RO	5	75
Passive recreation	Day	60	25				N	10	70	N, PC, RO	5	75
Industrial premise	Day	75	5							N, PC, RO	5	75
Offices, retail outlets	Day	70	10							N, PC, RO	5	75

		OOHW		$L_{Aeq(15minute)}$ noise level above NML											
				< 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	15				N, R1, DR	10	70	N, R1, DR	3	80	N, R1, DR, PC, SN	1	90
	Night	65	15	N	15	65	N, R2, NR	10	70	N, PC, SN, R2, DR	3	80	AA, N, PC, SN, R2, DR	1	90
Place of worship	Evening	55	35				N, R1, DR	25	60	N, R1, DR	10	70	N, R1, DR, PC, SN	3	80
	Night	55	35	N	35	55	N, R2, NR	25	60	N, PC, SN, R2, DR	10	70	AA, N, PC, SN, R2, DR	3	80
Active recreation	Evening	65	15				N, R1, DR	10	70	N, R1, DR	3	80	N, R1, DR, PC, SN	1	90
Passive recreation	Evening	60	25				N, R1, DR	15	65	N, R1, DR	5	75	N, R1, DR, PC, SN	2	85
Industrial premise	Evening	75	5				N, R1, DR	3	80	N, R1, DR	1	90	N, R1, DR, PC, SN	0	100
	Night	75	5	N	5	75	N, R2, NR	3	80	N, PC, SN, R2, DR	1	90	AA, N, PC, SN, R2, DR	0	100
Offices, retail outlets	Evening	70	10				N, R1, DR	5	75	N, R1, DR	2	85	N, R1, DR, PC, SN	1	95
	Night	70	10	N	10	70	N, R2, NR	5	75	N, PC, SN, R2, DR	2	85	AA, N, PC, SN, R2, DR	1	95

Non-residential receiver
Propagation across a valley / over water

		Standard hours			$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
					<10 dB(A)			10 to 20 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))
Classroom at schools and other educational institutions	Day	55	40				N	15	65	N, PC, RO	5	75
Hospital wards and operating theatres	Day	65	15							N, PC, RO	5	75
Place of worship	Day	55	40				N	15	65	N, PC, RO	5	75
Active recreation	Day	65	15							N, PC, RO	5	75
Passive recreation	Day	60	25				N	10	70	N, PC, RO	5	75
Industrial premise	Day	75	5							N, PC, RO	5	75
Offices, retail outlets	Day	70	10							N, PC, RO	5	75

		OOHW		$L_{Aeq(15minute)}$ noise level above NML											
				< 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	15				N, R1, DR	10	70	N, R1, DR	5	80	N, R1, DR, PC, SN	1	90
	Night	65	15	N	15	65	N, R2, NR	10	70	N, PC, SN, R2, DR	5	80	AA, N, PC, SN, R2, DR	1	90
Place of worship	Evening	55	40				N, R1, DR	25	60	N, R1, DR	10	70	N, R1, DR, PC, SN	5	80
	Night	55	40	N	40	55	N, R2, NR	25	60	N, PC, SN, R2, DR	10	70	AA, N, PC, SN, R2, DR	5	80
Active recreation	Evening	65	15				N, R1, DR	10	70	N, R1, DR	5	80	N, R1, DR, PC, SN	1	90
Passive recreation	Evening	60	25				N, R1, DR	15	65	N, R1, DR	5	75	N, R1, DR, PC, SN	5	85
Industrial premise	Evening	75	5				N, R1, DR	5	80	N, R1, DR	1	90	N, R1, DR, PC, SN	0	100
	Night	75	5	N	5	75	N, R2, NR	5	80	N, PC, SN, R2, DR	1	90	AA, N, PC, SN, R2, DR	0	100
Offices, retail outlets	Evening	70	10				N, R1, DR	5	75	N, R1, DR	5	85	N, R1, DR, PC, SN	1	95
	Night	70	10	N	10	70	N, R2, NR	5	75	N, PC, SN, R2, DR	5	85	AA, N, PC, SN, R2, DR	1	95

Distance Based Assessment Summary for Night Works

Please pick from drop-down list in orange cells
Please input information into yellow cells

Distanced Base (Noisiest Plant)

Noise area category	R0
Night time RBL (dB(A))	30
Night time NML (dB(A))	35
Propagation Type	Rural Undeveloped Areas
Noisiest plant	2.5T Smoothdrum Roller
Is there line of sight to receiver?	No (behind substantial solid barrier)
Shortest distance to the worst affected receiver (m)	1240
$L_{Aeq(15minute)}$ noise level at the worst affected receiver (dB(A)) [stationary source]	10
Level above RBL at the worst affected receiver [stationary source]	-21
Rate of production (m/min) [moving source]	0
$L_{Aeq(15minute)}$ noise level at the worst affected receiver (dB(A)) [moving source]	17
Level above RBL at the worst affected receiver [moving source]	-13
Have all standard mitigation measures been implemented where feasible and reasonable?	Yes

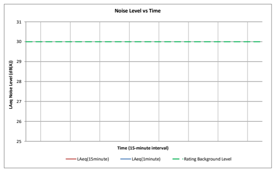
Please proceed with consideration given to the following additional mitigation measures

	Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within mitigation distance (m)
5-10 dB(A) over RBL	N	35	185
10-20 dB(A) over RBL	N, R2, DR	40 (40)	130 (130)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	50	50
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	60	25

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 Respite Period 2 (R2) is implemented. See alternate mitigation level and mitigation distance in () for letterbox drop.



Distanced Based (Scenario)

Noise area category	R2
Night time RBL (dB(A))	35
Night time NML (dB(A))	40
Propagation Type	Developed Settlements
Scenario	Road furniture installation
Is there line of sight to receiver?	No (behind solid barrier)
Distance to the worst affected receiver (m) [greater than 5m]	15
$L_{Aeq(15minute)}$ noise level at the worst affected receiver (dB(A))	69
Level above RBL at the worst affected receiver	34
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	N	40	330
10-20 dB(A) over RBL	N, R2, DR	45 (50)	215 (140)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	55	85
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	65	25

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 Respite Period 2 (R2) is implemented. See alternate mitigation level and mitigation distance in () for letterbox drop.

Populate summary table

	Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within Mitigation Distance (m)		
			LoS	No LoS (behind solid barrier)	No LoS (behind substantial solid barrier)
5-10 dB(A) over RBL	N	40	-	-	-
10-20 dB(A) over RBL	N, R2, DR	45 (50)	-	-	200 (135)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	55	-	-	85
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	65	-	-	30

Transport for NSW | Roads & Maritime Services

Distanced Based Assessment (Noisiest Plant)

National Falls - McKell Ancillary Facility no:02

Please pick from drop-down list in orange cells

Noise area category		R0
RBL or L_{A90} Background level (dB(A))	Day	30
	Evening	30
	Night	30
$L_{Aeq(15minute)}$ Noise Mangement Level (dB(A))	Day	40
	Day (OOHW)	35
	Evening	35
	Night	35
Noisiest plant		2.5T Smoothdrum Roller
Is there line of sight to receiver?		No (behind substantial solid barrier)

Steps for Assessment:

1. Schedule noisy works to occur in standard hours where possible or before 11pm and implement Standard Measures.
2. Select the representative noise area category. The worksheet titled 'Representative Noise Environ.' provides a number of examples to help select the noise area category.
3. 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.
4. 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 sightolaw 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.

5. 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:

(a) there are many affected receivers and the impact duration at any one receiver is more than 3 weeks; or

(b) 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.

7. Identify if there are any receivers within the additional mitigation measures distances and identify feasible and reasonable measures at each receiver.
8. Where night works are involved, identify sleep disturbance affected distance.
9. 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 specilast 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

Residential receiver

			$L_{Aeq(15minute)}$ noise level above background (L_{A90})												$L_{Aeq(15minute)}$ 75 dB(A) or greater (Highly affected)			Sleep disutrbance L_{Amax} 65 dB(A)
			5 to 10 dB(A)			10 to 20 dB(A)			20 to 30 dB(A)			> 30 dB(A)						
			Noticeable			Clearly audible			Moderately intrusive			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	130							N	50	50	N	25	60	N, PC, RO	5	75	
	Day (OOHW)	185				N, R1, DR	130	40	N, R1, DR	50	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Evening	185				N, R1, DR	130	40	N, R1, DR	50	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Night	185	N	185	35	N, R2, DR	130	40	N, PC, SN, R2, DR	50	50	AA, N, PC, SN, R2, DR	25	60	N, PC, RO	5	75	20
	Highly Affected	5													N, PC, RO	5	75	
Developed settlements (urban and suburban)	Day	145							N	55	50	N	25	60	N, PC, RO	5	75	
	Day (OOHW)	220				N, R1, DR	145	40	N, R1, DR	55	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Evening	220				N, R1, DR	145	40	N, R1, DR	55	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Night	220	N	220	35	N, R2, DR	145	40	N, PC, SN, R2, DR	55	50	AA, N, PC, SN, R2, DR	25	60	N, PC, RO	5	75	20
	Highly Affected	5													N, PC, RO	5	75	
Propagation across a valley / over water	Day	175							N	65	50	N	25	60	N, PC, RO	5	75	
	Day (OOHW)	280				N, R1, DR	175	40	N, R1, DR	65	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Evening	280				N, R1, DR	175	40	N, R1, DR	65	50	N, R1, DR, PC, SN	25	60	N, PC, RO	5	75	
	Night	280	N	280	35	N, R2, DR	175	40	N, PC, SN, R2, DR	65	50	AA, N, PC, SN, R2, DR	25	60	N, PC, RO	5	75	20
	Highly Affected	5													N, PC, RO	5	75	

Non-residential receiver
Undeveloped green fields, rural areas with isolated dwellings

		Standard hours		$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 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))
Classroom at schools and other educational institutions	Day	55	30				N	15	65	N, PC, RO	5	75
Hospital wards and operating theatres	Day	65	15							N, PC, RO	5	75
Place of worship	Day	55	30				N	15	65	N, PC, RO	5	75
Active recreation	Day	65	15							N, PC, RO	5	75
Passive recreation	Day	60	25				N	10	70	N, PC, RO	5	75
Industrial premise	Day	75	5							N, PC, RO	5	75
Offices, retail outlets	Day	70	10							N, PC, RO	5	75

		OOHW		$L_{Aeq(15minute)}$ noise level above NML											
				< 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	15				N, R1, DR	10	70	N, R1, DR	3	80	N, R1, DR, PC, SN	1	90
	Night	65	15	N	15	65	N, R2, NR	10	70	N, PC, SN, R2, DR	3	80	AA, N, PC, SN, R2, DR	1	90
Place of worship	Evening	55	30				N, R1, DR	25	60	N, R1, DR	10	70	N, R1, DR, PC, SN	3	80
	Night	55	30	N	30	55	N, R2, NR	25	60	N, PC, SN, R2, DR	10	70	AA, N, PC, SN, R2, DR	3	80
Active recreation	Evening	65	15				N, R1, DR	10	70	N, R1, DR	3	80	N, R1, DR, PC, SN	1	90
Passive recreation	Evening	60	25				N, R1, DR	15	65	N, R1, DR	5	75	N, R1, DR, PC, SN	2	85
Industrial premise	Evening	75	5				N, R1, DR	3	80	N, R1, DR	1	90	N, R1, DR, PC, SN	0	100
	Night	75	5	N	5	75	N, R2, NR	3	80	N, PC, SN, R2, DR	1	90	AA, N, PC, SN, R2, DR	0	100
Offices, retail outlets	Evening	70	10				N, R1, DR	5	75	N, R1, DR	2	85	N, R1, DR, PC, SN	1	95
	Night	70	10	N	10	70	N, R2, NR	5	75	N, PC, SN, R2, DR	2	85	AA, N, PC, SN, R2, DR	1	95

Non-residential receiver
Developed settlements (urban and suburban)

		Standard hours		$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 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))
Classroom at schools and other educational institutions	Day	55	35				N	15	65	N, PC, RO	5	75
Hospital wards and operating theatres	Day	65	15							N, PC, RO	5	75
Place of worship	Day	55	35				N	15	65	N, PC, RO	5	75
Active recreation	Day	65	15							N, PC, RO	5	75
Passive recreation	Day	60	25				N	10	70	N, PC, RO	5	75
Industrial premise	Day	75	5							N, PC, RO	5	75
Offices, retail outlets	Day	70	10							N, PC, RO	5	75

		OOHW		$L_{Aeq(15minute)}$ noise level above NML											
				< 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	15				N, R1, DR	10	70	N, R1, DR	3	80	N, R1, DR, PC, SN	1	90
	Night	65	15	N	15	65	N, R2, NR	10	70	N, PC, SN, R2, DR	3	80	AA, N, PC, SN, R2, DR	1	90
Place of worship	Evening	55	35				N, R1, DR	25	60	N, R1, DR	10	70	N, R1, DR, PC, SN	3	80
	Night	55	35	N	35	55	N, R2, NR	25	60	N, PC, SN, R2, DR	10	70	AA, N, PC, SN, R2, DR	3	80
Active recreation	Evening	65	15				N, R1, DR	10	70	N, R1, DR	3	80	N, R1, DR, PC, SN	1	90
Passive recreation	Evening	60	25				N, R1, DR	15	65	N, R1, DR	5	75	N, R1, DR, PC, SN	2	85
Industrial premise	Evening	75	5				N, R1, DR	3	80	N, R1, DR	1	90	N, R1, DR, PC, SN	0	100
	Night	75	5	N	5	75	N, R2, NR	3	80	N, PC, SN, R2, DR	1	90	AA, N, PC, SN, R2, DR	0	100
Offices, retail outlets	Evening	70	10				N, R1, DR	5	75	N, R1, DR	2	85	N, R1, DR, PC, SN	1	95
	Night	70	10	N	10	70	N, R2, NR	5	75	N, PC, SN, R2, DR	2	85	AA, N, PC, SN, R2, DR	1	95

Non-residential receiver
Propagation across a valley / over water

		Standard hours		$L_{Aeq(15minute)}$ noise level above NML						LAeq(15minute) 75 dB(A) or greater (Highly affected)		
				<10 dB(A)			10 to 20 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))
Classroom at schools and other educational institutions	Day	55	40				N	15	65	N, PC, RO	5	75
Hospital wards and operating theatres	Day	65	15							N, PC, RO	5	75
Place of worship	Day	55	40				N	15	65	N, PC, RO	5	75
Active recreation	Day	65	15							N, PC, RO	5	75
Passive recreation	Day	60	25				N	10	70	N, PC, RO	5	75
Industrial premise	Day	75	5							N, PC, RO	5	75
Offices, retail outlets	Day	70	10							N, PC, RO	5	75

		OOHW		$L_{Aeq(15minute)}$ noise level above NML											
				< 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	15				N, R1, DR	10	70	N, R1, DR	5	80	N, R1, DR, PC, SN	1	90
	Night	65	15	N	15	65	N, R2, NR	10	70	N, PC, SN, R2, DR	5	80	AA, N, PC, SN, R2, DR	1	90
Place of worship	Evening	55	40				N, R1, DR	25	60	N, R1, DR	10	70	N, R1, DR, PC, SN	5	80
	Night	55	40	N	40	55	N, R2, NR	25	60	N, PC, SN, R2, DR	10	70	AA, N, PC, SN, R2, DR	5	80
Active recreation	Evening	65	15				N, R1, DR	10	70	N, R1, DR	5	80	N, R1, DR, PC, SN	1	90
Passive recreation	Evening	60	25				N, R1, DR	15	65	N, R1, DR	5	75	N, R1, DR, PC, SN	5	85
Industrial premise	Evening	75	5				N, R1, DR	5	80	N, R1, DR	1	90	N, R1, DR, PC, SN	0	100
	Night	75	5	N	5	75	N, R2, NR	5	80	N, PC, SN, R2, DR	1	90	AA, N, PC, SN, R2, DR	0	100
Offices, retail outlets	Evening	70	10				N, R1, DR	5	75	N, R1, DR	5	85	N, R1, DR, PC, SN	1	95
	Night	70	10	N	10	70	N, R2, NR	5	75	N, PC, SN, R2, DR	5	85	AA, N, PC, SN, R2, DR	1	95

Distance Based Assessment Summary for Night Works

Please pick from drop-down list in orange cells
Please input information into yellow cells

Distanced Base (Noisiest Plant)

Noise area category	R0
Night time RBL (dB(A))	30
Night time NML (dB(A))	35
Propagation Type	Rural Undeveloped Areas
Noisiest plant	2.5T Smoothdrum Roller
Is there line of sight to receiver?	No (behind substantial solid barrier)
Shortest distance to the worst affected receiver (m)	2200
$L_{Aeq(15minute)}$ noise level at the worst affected receiver (dB(A)) [stationary source]	-15
Level above RBL at the worst affected receiver [stationary source]	-45
Rate of production (m/min) [moving source]	0
$L_{Aeq(15minute)}$ noise level at the worst affected receiver (dB(A)) [moving source]	10
Level above RBL at the worst affected receiver [moving source]	-20
Have all standard mitigation measures been implemented where feasible and reasonable?	Yes

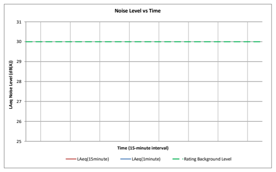
Please proceed with consideration given to the following additional mitigation measures

	Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within mitigation distance (m)
5-10 dB(A) over RBL	N	35	185
10-20 dB(A) over RBL	N, R2, DR	40 (40)	130 (130)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	50	50
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	60	25

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 Respite Period 2 (R2) is implemented. See alternate mitigation level and mitigation distance in () for letterbox drop.



Distanced Based (Scenario)

Noise area category	R2
Night time RBL (dB(A))	35
Night time NML (dB(A))	40
Propagation Type	Developed Settlements
Scenario	Road furniture installation
Is there line of sight to receiver?	No (behind solid barrier)
Distance to the worst affected receiver (m) [greater than 5m]	15
$L_{Aeq(15minute)}$ noise level at the worst affected receiver (dB(A))	69
Level above RBL at the worst affected receiver	34
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	N	40	330
10-20 dB(A) over RBL	N, R2, DR	45 (50)	215 (140)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	55	85
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	65	25

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 Respite Period 2 (R2) is implemented. See alternate mitigation level and mitigation distance in () for letterbox drop.

Populate summary table

	Additional mitigation measures for consideration where feasible and reasonable	Mitigation level (dB(A))	Within Mitigation Distance (m)		
			LoS	No LoS (behind solid barrier)	No LoS (behind substantial solid barrier)
5-10 dB(A) over RBL	N	40	-	-	-
10-20 dB(A) over RBL	N, R2, DR	45 (50)	-	-	200 (135)
20-30 dB(A) over RBL	N, PC, SN, R2, DR	55	-	-	85
>30 dB(A) over RBL	AA, N, PC, SN, R2, DR	65	-	-	30

Appendix G - Non-Aboriginal heritage search results

Search Results

47 results found.

Bonnie Vale Cabin Community Simpson Rd	Bonnie Vale via Bundeena, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Botany Bay Foreshore Rd	Botany, NSW, Australia	(Nomination now ineligible for PPAL) National Heritage List
Botany Bay Entrance Anzac Pde	La Perouse, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Bundeena Headland Loftus St	Bundeena, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Cape Baily Lighthouse Sir Joseph Banks Dr	Kurnell, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Cape Baily Lighthouse Sir Joseph Banks Dr	Kurnell, NSW, Australia	(Listed place) Commonwealth Heritage List
Captain Cooks Landing Place Historic Site Cape Solander Dr	Kurnell, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Como Hotel 15-17 Cremona Rd	Como, NSW, Australia	(Removed from Register or IL) Register of the National Estate (Non-statutory archive)
Como Pleasure Grounds Cremona Rd	Como, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Como Rail Bridge	Como, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Como Tidal Pool Cremona Rd	Como, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)

Cronulla Beach Pool McDonald St	Cronulla, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Cronulla Main Ocean Pool Ozone St	Cronulla, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Cronulla Post Office 41 Cronulla St	Cronulla, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Cronulla Post Office 41 Cronulla St	Cronulla, NSW, Australia	(Listed place) Commonwealth Heritage List
Cronulla Rock Pool McDonald St	Cronulla, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Cubbitch Barta National Estate Area Old Illawarra Rd	Holsworthy, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Cubbitch Barta National Estate Area Old Illawarra Rd	Holsworthy, NSW, Australia	(Listed place) Commonwealth Heritage List
Georges River Wetlands Henry Lawson Dr	Padstow Heights, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Gunnamatta Park Baths Nicholson Pde	Cronulla, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Heathcote National Park Princes Hwy	Waterfall, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Heathcote Railway Residences Princes Hwy	Heathcote, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
High Flux Australian Reactor Becquerel Pl	Lucas Heights, NSW, Australia	(Place not included in CHL) Commonwealth Heritage List

Illawarra Aerial Telegraph Line Princes Hwy	Heathcote, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Indigenous Place	Curracurrang via Bundeena, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Indigenous Place	Waterfall, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Indigenous Place	Woronora, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Indigenous Place	Yowie Bay, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Kamay Botany Bay: botanical collection sites Captain Cook Dr	Kurnell, NSW, Australia	(Listed place) National Heritage List
Kurnell Peninsula Captain Cook Dr	Kurnell, NSW, Australia	(Place removed in part from NHL) National Heritage List
Kurnell Peninsula Headland Cape Solander Dr	Kurnell, NSW, Australia	(Listed place) National Heritage List
Kurnell Peninsula Towra Point Area Captain Cook Dr	Kurnell, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Kurnell Sand Dune Lot 113 Captain Cook Dr	Kurnell, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Lilli Pilli Baths Koala Rd	Lilli Pilli, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Lyons House 733 Port Hacking Rd	Dolans Bay, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)

Marley Lagoon Basin	Bundeena Dr	Bundeena, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Old St Marks Church	Princes Hwy	Sylvania, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Prince Edward Park	Prince Edward Park Rd	Sutherland, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Royal National Park (1977 boundary)	Farnell Av	Audley, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Royal National Park and Garawarra State Conservation Area	Sir Bertram Stevens Dr	Audley, NSW, Australia	(Listed place) National Heritage List
Shiprock Aquatic Reserve	Shiprock Rd	Port Hacking, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Towra Point Aquatic Reserve	Captain Cook Dr	Kurnell, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)
Wara-n'hayara Plateau Area - part	Mount Kiera Rd	Wollongong, NSW, Australia	(Place not included in NHL) National Heritage List
Waterfall Railway Station Group	McKell Av	Waterfall, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Woronora Crematorium	Linden St	Sutherland, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Woronora Dam	Woronora Dam Rd	Waterfall, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)
Woronora General Cemetery	Linden St	Woronora, NSW, Australia	(Indicative Place) Register of the National Estate (Non-statutory archive)

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