Transport
for NSW

Heathcote Road Bridge

Addendum Review of Environmental Factors

April 2022

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Heathcote Road Bridge

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Transport for NSW | April 2022

Prepared by Aurecon Australasia Pty Ltd (Aurecon) and Transport for NSW

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Executive summary

The proposed modification

Transport for NSW (Transport) propose to modify the approved Heathcote Road Bridge widening project and pursue a bridge duplication option (the proposed modification) instead. Key features of the proposed modification include:

- construction of a new single lane bridge on the upstream side of the existing bridge over Woronora River to carry northbound traffic, including four new piers
- conversion of the existing bridge to a single lane with wide shoulders to carry southbound traffic
- adjustments to the bridge abutments to capture both bridge structures
- shifting the alignment of the southern bridge approach up to 10 metres west and the northern bridge approach up to eight metres west
- removal of the northbound breakdown bay (due to the relocation of the southern approach alignment on top of this location)
- upgrades to drainage infrastructure, including:
  - drainage work for the new alignment
  - scupper drainage from the new bridge
  - pavement drainage running along the alignment discharges where the road alignment meets the river valley
- provision of new road furniture, including a concrete median barrier to separate northbound and southbound vehicles along the length of both bridges.

The proposed modification would require the temporary full closure of Heathcote Road between New Illawarra Road and the Princes Highway for up to 12 weekends and 67 weeknights during construction due to the constraints of the location including the steep terrain of the surrounding area and narrow width of existing roadway. During these periods, construction is proposed to be carried out 24 hours per day to minimise the duration of full road closures required. Construction would occur offline at other times during standard working hours.

It is anticipated that construction would start in May 2022 and take up to one year to complete, subject to weather.

Background

In 2020, Transport for NSW (Transport) proposed to widen Bridge 152 over the Woronora River (referred to as the Heathcote Road bridge) and its approaches to improve road safety and network reliability (referred to as the approved project). The Heathcote Road bridge is located about halfway along Heathcote Road between New Illawarra Road in Lucas Heights and Princes Highway in Heathcote, New South Wales (NSW) within the Sutherland Shire local government area (LGA).

A review of environmental factors (REF) was prepared for the Heathcote Road bridge widening project on 4 December 2020 (referred to as the project REF). The project REF was determined on 4 December 2020.

Since exhibiting the project REF, Transport have listened to community feedback and developed an innovative and improved design with better safety outcomes and less construction impact to customers on Heathcote Road and the wider road network. This is the proposed modification.

The proposed modification generally remains within the approved project boundary of the project REF, except for minor drainage upgrades required beyond the approved boundary to the north. This area has been assessed within a modified project boundary adopted in this addendum REF.

Need for the proposed modification

The Heathcote Road bridge was built during World War II by the military to provide a basic east-west transport route over the Woronora River. The bridge was built with narrow lane widths and steep curved approaches that do not meet current road design standards and provide little room for motorist error, which increases the risk of road incidents. This risk is supported by the crash history statistics within 500 metres of the bridge, which include two fatalities and six serious injuries between 2009 and 2019. In 2018, the Minister for Roads, Maritime and Freight announced a commitment to improve the safety of the Heathcote Road bridge due to a history of community concern for motorist safety when crossing the bridge.

The section of Heathcote Road between New Illawarra Road and the Princes Highway is part of the 'A6' road corridor, which is a major arterial road that services north–south journeys for freight and general traffic in Sydney. The strategic phase of the upgrade was funded by Transport's 'Gateway to the South Pinch Point Program', which focuses on short to medium term solutions to improve reliability for road traffic, as the A6 section of Heathcote Road was identified as a key pinch point for traffic within southern Sydney. The upgrade has since secured $73 million funding for development and delivery.

The need for upgrades to the section of Heathcote Road within the A6 road corridor has been identified in several NSW and local government strategic plans and policies. This includes *Future Transport Strategy 2056* (NSW Government, 2018), which specifically lists Heathcote Road improvements as an initiative for investigation. The proposed modification would contribute to achieving the 'safety and performance' outcome of this strategy as well as form part of the 'safe roads' component of the *Road Safety Plan 2021* (a supporting plan of the *Future Transport Strategy 2056*), which is aimed at reducing fatalities on NSW roads by 30 percent by 2021 (Transport for NSW, 2018). It would align with these outcomes better than the approved project.

Proposal objectives

The proposal objectives that apply to the proposed modification are to:

- improve road safety by increasing the road and shoulder lane widths on the bridge and approaches
- improve network reliability
- deliver a design solution that has the ability to be implemented in the short-term.

Options considered

During the construction tender phase, the strategic options, being a bridge duplication with a single lane of traffic on each bridge, or bridge widening, were developed into sub-options for further assessment by Transport. The sub-options included a range of engineering solutions for each strategic option and were refined to consider only road alignment and bridge options which did not require significant additional land acquisition, environmental assessment or approvals compared to the approved project.

Following this process, two options were identified for further investigation:

- Option 1 – Proceed with the approved project as described in the project REF
- Option 2 – Proposed modification: construction of a new single lane bridge (about seven metres wide) immediately to the west of the existing bridge.

These options were assessed against development criteria which included property acquisition, environmental impacts, Commonwealth issues, value for money, constructability and whether they could meet the proposal objectives.

'Option 2' was determined to be the preferred option as it would provide greater short and long-term benefits compared to 'Option 1', whilst remaining within the approved project budget and without needing to acquire additional land or substantially increase environmental impacts. The preferred option would also result in:

- a better long-term outcome due to increased design life of the new and existing bridges and reduced maintenance costs to the public over time
- improved construction safety by reducing the need to modify the highly fractured south-east cut
- increased traffic lane and shoulder widths, allowing vehicles to stop in the widened shoulders without blocking traffic if required during an emergency.

Statutory and planning framework

The proposal is for the purpose of a road and road infrastructure facilities and is to be carried out by Transport. In accordance with Section 2.108 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP), the proposed modification can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Development consent from council is not required. 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.

An assessment of the proposed modification concluded that it would not significantly impact on the matters of national environmental significance protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or significantly affect threatened species or ecological communities and their habitats under the *Biodiversity Conservation Act 2016* (BC Act). Therefore, the proposed modification is a valid development to be taken forward under Division 5.1 of the EP&A Act and no further planning approval requirements would be triggered under the EPBC Act or BC Act.

Community and stakeholder consultation

The consultation strategy relevant to the proposed modification remains consistent with the project REF. Public display of this addendum REF was not considered necessary given that targeted consultation has occurred, and the proposed modification is in response to community feedback received during public display of the project REF.

The requirements for consultation required by the Transport and Infrastructure SEPP were met in the project REF. However, Transport carried out additional consultation with key government stakeholders during the development of this addendum REF. This included consultation with:

- National Parks and Wildlife Service via email about the key features of the proposed modification
- DPI Fisheries via phone and email in accordance with section 199 of the *Fisheries Management Act 1994* and regarding construction waterways impact management
- Heritage NSW via virtual briefing presentation about the key features of the proposed modification and changes to potential impacts to the existing Heathcote Road bridge (compared to the approved project)

- Department of Agriculture, Water and the Environment (DAWE) regarding key features of the proposed modification and Cubbitch Barta National Estate Area curtilage issues
- Water NSW via teleconference, phone and email about flood management within the modified project boundary.

Transport would continue to consult with the community and key stakeholders throughout the project in line with the Community and Stakeholder Engagement Plan (refer to Section 5.1 of the project REF) and Communication Plan (refer to safeguard SE1 in Section 5.2 of the project submissions report).

Future consultation would include notification of:

- Emergency Services, Sutherland Shire Council and the community about any road closures and the likely disruptions to access
- Transgrid to maintain access to their assets during full road closures
- DAWE of the outcome of the self-assessment against DAWE's Significant Impact Guidelines
- National Parks and Wildlife Service, Heritage NSW, Southerland Shire Council and the community when the addendum REF is published online for information.

Environmental impacts

The main environmental impacts for the proposed modification are outlined in the following sections.

Traffic and transport

During construction, the proposed modification would require the full closure of Heathcote Road between New Illawarra Road and the Princes Highway for about 67 weeknights and 12 weekends. A full road closure would be required for certain construction activities (safety-critical activities) due to the site constraints including steep terrain and the narrow width of existing roadway. The duration of closure required for the proposed modification would be less than the worst-case assessed in the project REF, which was a full six-month road closure with construction 24 hours/day, 7 days per week. As a result, there would be reduced construction traffic and transport impacts compared to the approved project.

During operation, compared to the existing scenario and project REF, the proposed modification would result in increased road safety from wider lanes and shoulders and separation of opposing traffic flows with a central concrete median between the two bridges. There would also be improved network reliability from:

- wider lanes and shoulders than the existing scenario or project REF, providing extra room for vehicles to navigate around traffic incidents (such as breakdowns) on the bridges and improved emergency services access
- the ability for temporary diversions of both lanes of traffic onto either bridge (for example, during maintenance or an emergency).

Noise and vibration

The proposed modification would require some changes to the construction methodology described in the project REF, resulting in additional construction noise scenarios (for example, the substitution of a bored piling rig with a driven piling rig). Noise modelling was carried out for these additional scenarios using Transport's Noise Estimator Tool and adopted conservative scenarios.

The predicted construction noise levels of the proposed modification would exceed the assessed noise management levels during the three additional construction scenarios.

Construction noise would be managed in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016), which specifies standard mitigation measures and the need to consider additional mitigation measures for sensitive receivers who are predicted to experience noise levels that would exceed the adopted criteria.

As the new bridge could be constructed offline, the proposed modification would result in a reduced duration of out of hours construction work. This would reduce noise impacts to sensitive receivers during out of hours construction periods. During these periods, construction may occur up to 24 hours per day between 9pm on Friday and 5am on Monday. There would be a respite period from Monday until the following Friday night for these works. Work would be required on consecutive weekends for the earthworks to minimise the length of the construction program. This is considered justified as the project requires less out of hours work compared to the approved project.

Additional construction scenarios required for the proposed modification would have vibration impacts, with pile driving causing the most vibration. A vibration assessment was undertaken which identified that expected vibration levels would be compliant with heritage vibration criteria and compliant with the maximum criteria for the ANSTO site. There would be a marginal exceedance of the preferred criterion for the ANSTO site and a marginal exceedance of the maximum continuous vibration criterion at the nearest residential receiver when the piles are being driven at refusal, and an additional mitigation measure has been proposed in this addendum. A further assessment of potential human comfort was carried out which found that impact piling could occur for up to 9 hours out of the standard 11-hour construction day and therefore would be less than or equal to the maximum daytime target of 0.4 $m/s^{1.75}$ (which would be the worst-case scenario). The vibration impacts associated with all other construction scenarios remain consistent with the assessment in Section 6.2.4 of the project REF.

The proposed modification would result in negligible changes to the operational noise levels compared to those assessed in Section 6.2.4 of the project REF.

Biodiversity

The project REF considered that up to 3.12 hectares of vegetation would require removal for widening the bridge and approaches, assuming broad vegetation clearance. During detailed design, the vegetation clearance requirements for the proposed modification have been refined to a maximum of 1.2 hectares. Less habitat bearing trees would be removed than considered in the project REF, with 8 requiring removal to construct the proposed modification.

The proposed modification would result in an additional 1800 m^2 of clearing of vegetation and bush rock at the north-western cut, however, has reduced clearing on the eastern side of the bridge (including south-east cut, north-east retaining wall and waterway). The vegetation in these areas is comparable and is not a threatened ecological community and was not found to provide habitat for koalas or *Hibbertia woronorana* during biodiversity surveys.

The proposed modification would consider wildlife corridors and support the movement of koalas below the Heathcote Road bridge, which may limit wildlife from accessing the road and result in fewer vehicle-related wildlife deaths.

There may be a potential reduction in impacts to threatened microbats as scuppers within the existing bridge structure which are known habitat for microbats would no longer be removed but would instead be capped.

Water quality and soil

Construction of the proposed modification has the potential to result in water quality and soil impacts from earthworks, which may result in soil erosion as well as sedimentation of local waterways. The risk of water quality and soil impacts during construction would be marginally greater than under the project REF due to:

- additional construction activities would be undertaken from the temporary work platform within the waterway
- earthworks and placement of fill materials and disturbance of soils and vegetation from the adjustments to the approaches to the new bridge
- construction of new piers into the valley floor requiring excavation and removal of materials.

Other construction water quality and soil impacts would be similar to those identified in the project REF. These potential impacts would be managed in accordance with a Soil and Water Management Plan (SWMP). The SWMP would include site-specific Erosion and Sedimentation Control plans, an emergency spill plan, a stabilisation plan, a surface water quality monitoring program as well as other safeguards and management measures to minimise potential water quality and soil impacts. An Environmental Work Method Statement (EWMS) would be prepared for the maintenance works on the existing bridge to ensure wastewater during the construction phase is adequately managed.

Potential impacts on water quality and soil during the operation of the proposed modification would be minor. Widening of the approaches and construction of the new bridge would result in a marginal increase in hardstand area and lead to a slight increase in dirty water runoff into the Woronora River compared to the approved project. However, the complete separation of traffic lanes on each bridge by the central median barrier and wider shoulders would result in reductions in spill risk compared to those assessed in the project REF.

Hydrology and flooding

Construction of the proposed modification would result in similar hydrology and flooding impacts to those identified in the project REF. There would be a reduction in the overtopping level of the temporary waterway crossing to minimise flooding impacts. Afflux in the waterway would also marginally increase compared to the approved project. Construction impacts would be temporary, as the waterway crossing structure would be removed and the access track and laydown area would be rehabilitated after construction to return the disturbed areas to pre-existing conditions.

The proposed modification would result in minor positive impacts on hydrology and flooding compared to those assessed in the project REF. This would be due to additional longitudinal drainage work in the northern extension of the modified project boundary, which would result in reduced sheet flow, aquaplaning and flooding issues along the road. The proposed modification is not anticipated to result in long-term impacts to scour or result in increased flood risk to private properties, motorists or key infrastructure.

Aboriginal cultural heritage

The Aboriginal cultural heritage impacts of the proposed modification would be consistent with those assessed in the project REF. The design is further away from the AHIMS site identified within the approved project boundary in the project REF.

The section of the Cubbitch Barta National Estate Area that would be impacted by the proposed modification does not contain Aboriginal objects and some evidence of previous disturbance exists within the general landscape. It is considered that the proposed

modification would result in minor impacts to the Cubbitch Barta National Estate Area, consistent with the project REF.

Non-Aboriginal heritage

Construction of the proposed modification would result in a reduction of impacts to non-Aboriginal heritage. There would negligible physical impacts to the Woronora River Bridge (compared to direct and indirect impacts of the approved project) as it would no longer require the existing bridge to be widened. The proposed modification would require minor repair and maintenance work and would cap the sandstone facing of the bridge abutments for protection. The conversion of the bridge to a single lane would also extend the bridge's design life by reducing the weight load on the bridge.

During operation, there would be minor visual impacts to the Woronora River Bridge due to the new bridge directly obstructing views towards the existing bridge from the west. There would also be minor visual impacts to the heritage significance of the Cubbitch Barta National Estate Area due to an increase to the north-west cut compared to the approved project with additional vegetation impacts along the crest of the cutting.

Further safeguards and management measures would be implemented to minimise potential non-Aboriginal heritage impacts.

Other impacts

Other notable impacts associated with the proposed modification would include:

- increased visual impacts for receivers within the river valley due to the introduction of a new bridge structure immediately next to the existing bridge
- improved socio-economic impacts during construction due to the reduced duration of full, continuous road closure, which may reduce short-term inconvenience and feelings of severance for the local community, surrounding businesses and stakeholders.

Justification and conclusion

The proposed modification would involve construction of a new single lane bridge on the western (upstream) side of the existing Heathcote Road bridge to carry northbound traffic, conversion of the existing bridge to be a single lane bridge and upgrades to its approaches.

The proposed modification would meet the proposal objectives and need to improve the safety and reliability associated with the use of the Heathcote Road bridge in the short-term. The need for the proposed modification has been driven by existing community concern for motorist safety, the poor crash history record on the Heathcote Road bridge and its approaches and community feedback received during public display of the project REF. The proposed modification is also aligned with several strategic policies and government strategies, such as Future Transport Strategy 2056 (TfNSW, 2018a) and Road Safety Plan 2021 – Towards Zero (NSW Government, 2018a). The proposed modification would better align with these objectives and outcomes than the approved project.

Several potential environmental impacts have been avoided or reduced during the detailed design development of the proposed modification compared to what was assessed in the project REF. However, the proposed modification would still result in some short-term impacts on traffic, noise and vibration, non-Aboriginal heritage, water quality, hydrology and flooding during construction as well as some longer-term minor biodiversity and visual impacts. Environmental safeguards and management measures as detailed in this addendum REF would minimise these expected impacts.

Overall, the proposed modification is justified on the basis that it best meets the proposal objectives and results in long-term benefits on safety and reliability that would outweigh the potential adverse impacts, which would mainly occur during construction. Moreover, the proposal would not result in any significant negative long-term impacts on society, the biophysical environment or the local economy.

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1 Introduction

1.1 Proposed modification overview

In 2020, Transport for NSW (Transport) proposed to widen Bridge 152 over the Woronora River (referred to as the Heathcote Road bridge) and its approaches to improve road safety and network reliability (referred to as the approved project). The Heathcote Road bridge is located about halfway along Heathcote Road between New Illawarra Road in Lucas Heights and Princes Highway in Heathcote, New South Wales (NSW) within the Sutherland Shire local government area (LGA). The existing Heathcote Road bridge is a single lane undivided bridge with approaches on a curve and sloping gradient. The narrow road lanes and shoulders do not meet current road design standards and are associated with a poor crash history and ongoing community concern for motorist safety.

A review of environmental factors (REF) was prepared for the Heathcote Road bridge widening project on 4 December 2020 (referred to as the project REF). The project REF was placed on public display for about ten weeks between Wednesday 16 December 2020 and Wednesday 24 February 2021 for community and stakeholder comment. A submissions report dated 17 June 2021 was prepared to respond to the issues raised in the 48 formal submissions received. The project REF was determined on 4 December 2020.

Since exhibiting the project REF, Transport have listened to community feedback and developed an innovative and improved design with better safety outcomes and less construction impact to customers on Heathcote Road and the wider road network.

Initial considerations during the project REF and submissions report led to predictions that a bridge duplication (single lane of unidirectional traffic flow on each bridge) may be costly, complex and result in extended construction durations. During the tender phase of the project, the construction contractor and design team were able to identify an approach which would allow a bridge duplication to be delivered in a cost efficient and timely way where more of the infrastructure could be built offline. As well as providing a competitive cost option, this would result in a better outcome for the community in terms of improved long-term traffic safety outcomes and a substantial reduction in construction road closure impacts.

Transport now propose to modify the approved project and pursue the bridge duplication option instead of the bridge widening option. The existing bridge would be converted to a single lane bridge with wide shoulders for southbound traffic. A new single lane bridge would be constructed on the western (upstream) side of the existing Heathcote Road bridge to carry northbound traffic. Upgrades to the northern and southern bridge approaches would still be required and would shift slightly west to align with the new bridge. This improved design provides a physical dividing barrier between opposing traffic lanes. The bridge duplication option is hereafter referred to as the proposed modification.

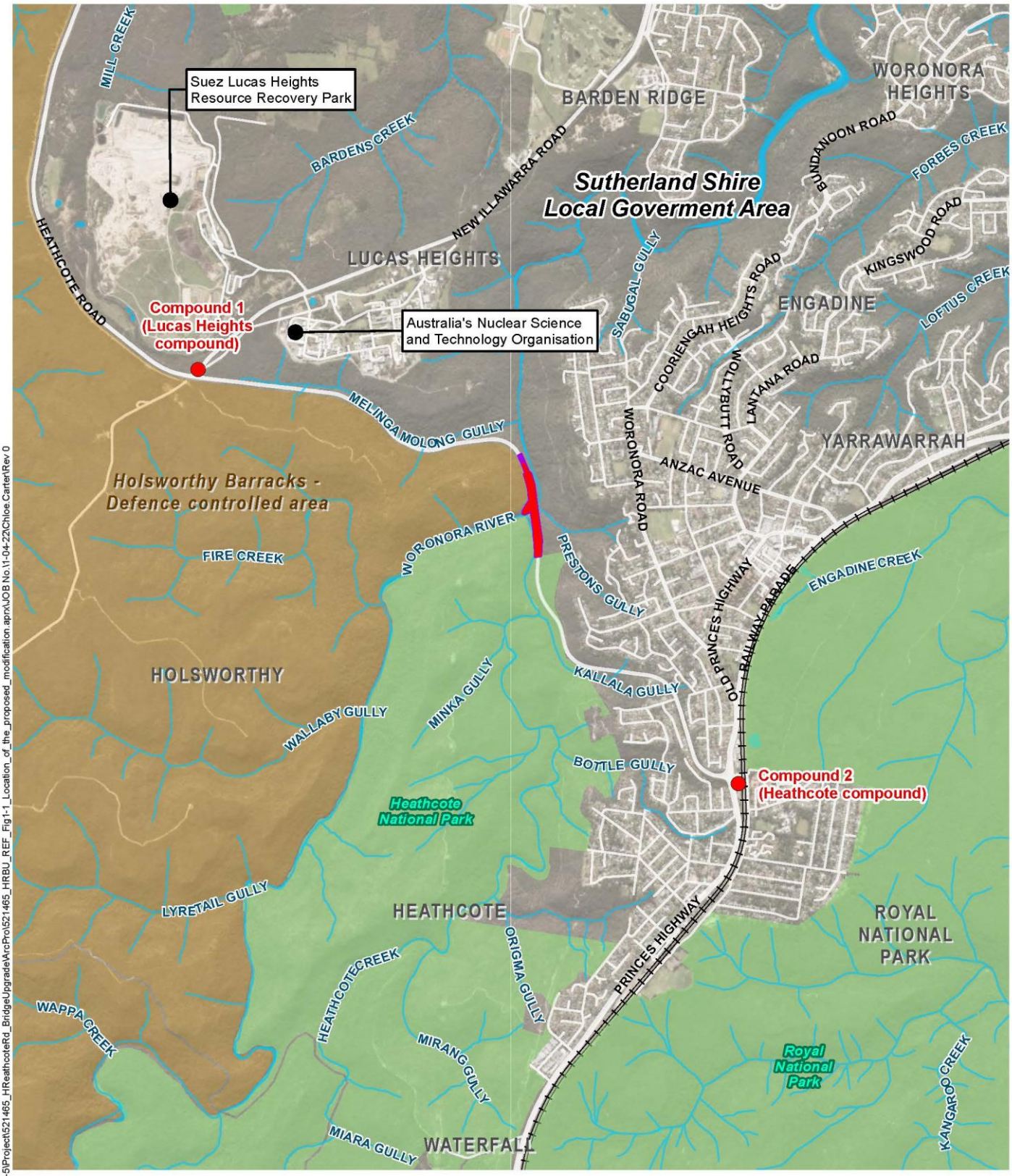
Construction and operation of the proposed modification would be able to occur mostly within the proposed area identified in the project REF. This is referred to as the approved project boundary in this addendum REF (refer to Section 1.3). Despite this, the area within the approved project boundary required for construction of the proposed modification has changed compared to the approved project. Work would also now be required to extend drainage works within the road corridor slightly to the north of the approved project boundary. As such, a modified project boundary has been adopted for the proposed modification (refer to Figure 1-2 and Section 1.3).

Key features of the proposed modification include:

- construction of a new single lane bridge on the upstream side of the existing bridge over Woronora River to carry northbound traffic, including four new piers
- conversion of the existing bridge to a single lane with wide shoulders to carry southbound traffic
- adjustments to the bridge abutments to capture both bridge structures
- shifting the alignment of the southern bridge approach up to 10 metres west and the northern bridge approach up to eight metres west
- removal of the northbound breakdown bay (due to the relocation of the southern approach alignment on top of this location)
- upgrades to drainage infrastructure, including:
  - drainage work for the new alignment
  - scupper drainage from the new bridge
  - pavement drainage running along the alignment discharges where the road alignment meets the river valley
- provision of new road furniture, including a concrete median barrier to separate northbound and southbound vehicles along the length of both bridges.

Further detail on the features of the proposed modification, including comparison to the original project scope, is provided in Section 3.1. Those features which are modified or additional to the original scope are further assessed within this addendum REF. Common scope features are captured within the project REF.

The location of the proposed modification is shown in Figure 1-1 and the proposed modification is shown in Figure 1-2. Chapter 3 describes the proposed modification in more detail.



Approved project boundary

Modified project boundary

Holsworthy Barracks - Defence controlled area

National park

Watercourses

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Source: Aurecon, TfNSW, Spatial Services, Esri

1:38,000 @ A4

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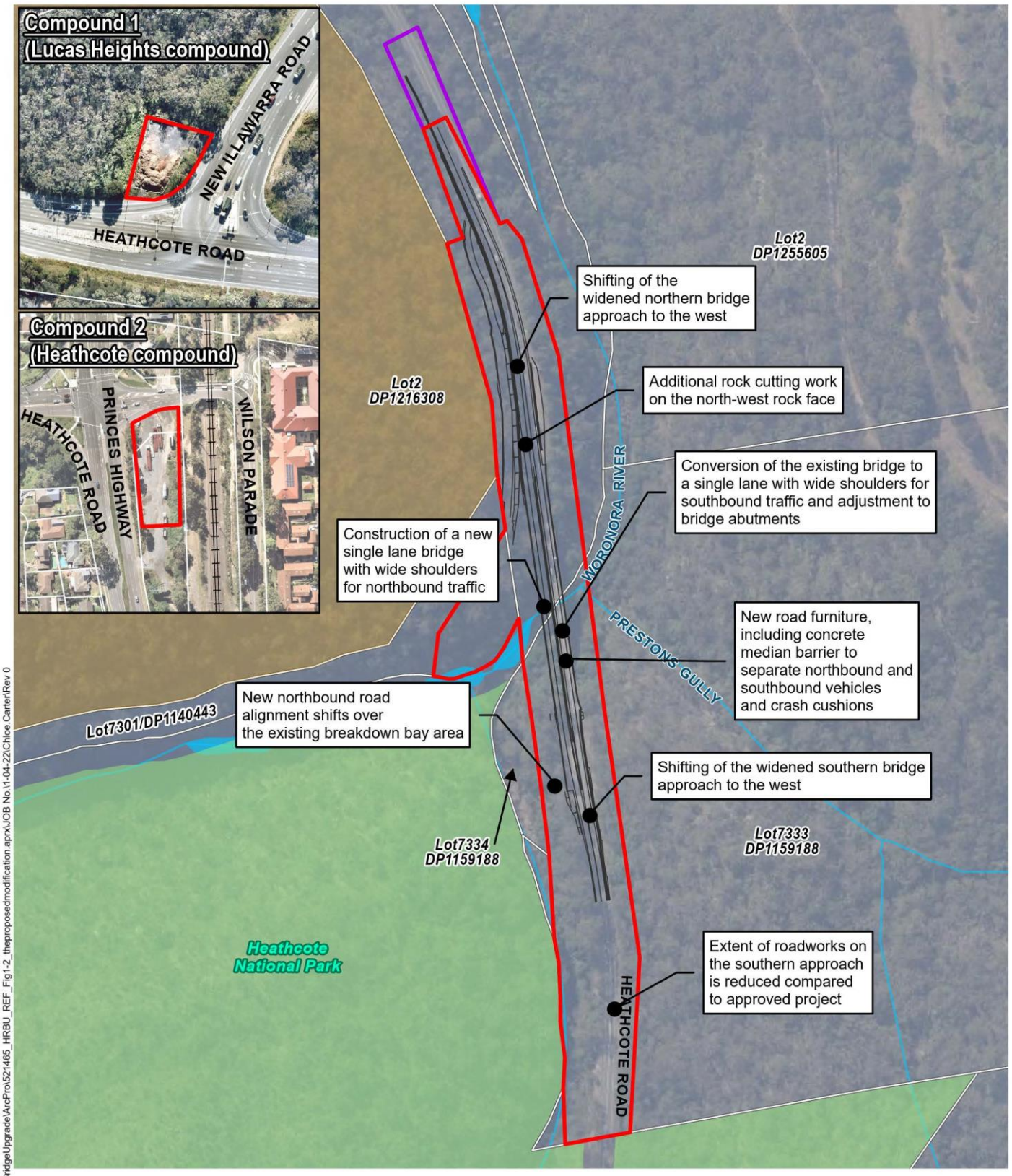
Projection: GDA 1994 MGA Zone 56

Heathcote Road Bridge **Addendum REF**

FIGURE 1-1: Location of the proposed modification



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Source: Aurecon, TfNSW, Spatial Services, Esri

1:3,500 @ A4

0 50 100m

Projection: GDA 1994 MGA Zone 56

Heathcote Road Bridge **Addendum REF**

FIGURE 1-2: The proposed modification

1.2 Purpose of the report

This addendum review of environmental factors (addendum REF) has been prepared by Aurecon Australasia Pty Ltd (Aurecon) on behalf of Transport. For the purposes of these works, Transport is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This addendum REF is to be read in conjunction with the project REF and submissions report for the project. The purpose of this addendum REF is to describe the proposed modification, to document and assess the likely impacts of the proposed modification 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 context of Section 171 of the Environmental Planning and Assessment Regulation 2021, *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS Required? guidelines) (DUAP, 1995/1996), Roads and Road 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* (EPBC Act).

In doing so, the addendum 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 addendum REF would be considered when assessing:

- whether the proposed modification is likely to result in a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act
- the significance of any impact on threatened species as defined by the BC Act and/or FM Act, in Section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- the significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured
- the potential for the proposed modification to significantly impact any other matters of national environmental significance or Commonwealth land and therefore the need to make a referral to the Australian Government Department of Agriculture, Water and the Environment for a decision by the Australian Government Minister for the Environment on whether assessment and approval is required under the EPBC Act.

1.3 Terms used in this report

The following terms have been used in this report:

- The 'approved project' is the Heathcote Road bridge widening project, to widen the existing two-lane bridge and its approaches.
- The 'project REF' is the REF prepared for the approved project.
- The 'proposed modification' is the bridge duplication proposal, to convert the existing Heathcote Road bridge to a single lane bridge for southbound traffic, and build a new single lane bridge on the western (upstream) side of the existing bridge to carry northbound traffic (refer to Section 3.1)

- This ‘addendum REF’ is the assessment and approval document for the proposed modification.
- The ‘approved project boundary’ refers to the area identified in the project REF that may be directly impacted by construction and operation of the approved project (shown in Figure 1-1 and Figure 1-2). The approved project boundary includes both the:
  - construction footprint, which is the area where construction activities would occur for the proposed modification and includes land that would be temporarily impacted for the construction compound sites, temporary access track, waterway crossing and crane pads
  - operational footprint, which includes the areas that would be permanently impacted by the proposed modification including the widened bridge and approaches and supporting infrastructure.
- The ‘modified project boundary’ refers to the total area that may be directly impacted by construction and operation of the proposed modification. It includes the ‘approved project boundary’ as well as an extension of about 1565 square metres to the north beyond the approved project boundary required for construction and operation of drainage upgrades required for the proposed modification (shown in Figure 1-1 and Figure 1-2).
- The ‘study area’ consists of land in the vicinity of, and including, the modified project boundary. The study area is the wider area surrounding the modified project boundary, including land that has the potential to be indirectly impacted by the proposed modification beyond the immediate works area (for example, as a result of any noise or traffic diversions). The scope of the study area varies depending on the environmental factor being assessed.

2 Need and options considered

2.1 Strategic need for the proposed modification

Chapter 2 of the project REF addresses the strategic need for the project, the project objectives and the options that were considered during development of the approved project. The proposed modification described and assessed in this addendum REF is consistent with the strategic need for the project.

Like the approved project, the proposed modification would support road network safety and reliability improvements to the road network, and address community concern about the safety of Heathcote Road.

The proposed modification has been developed in response to community feedback and in collaboration with industry partners, providing an innovative bridge duplication design which is substantially within the approved project boundary. As noted in Section 1.3, the proposed modification would occur within a modified project boundary, which includes an extension to the north of the approved project boundary due to drainage upgrades. The modification provides a better solution to the approved project as it would:

- achieve a superior safety outcome through full separation of opposing traffic with a physical dividing barrier
- provide improved emergency services reliability via two bridges
- reduce impacts to the heritage listed existing bridge because more of the original fabric/design integrity would be retained
- improve community outcomes for customers on the local and broader road network with a substantial reduction in the required construction road closures compared to the approved project
- provide better medium- and long-term asset outcomes related to maintenance costs and asset lifetime.

The proposed modification remains aligned with the NSW policy context documents discussed in Section 2.1.2 of the project REF.

The proposed modification would be better aligned with the 'safe roads' component of the *Road Safety Plan 2021 – Towards Zero* (NSW Government, 2018a) than the approved project. The separation of traffic across the two bridges and provision of wider lanes and shoulders would improve the safety of Heathcote Road bridge and its approaches. This would reduce the risk of serious road incidents.

These improvements to safety would also align better than the approved project with the following documents:

- *Future Transport Strategy 2056* (Transport, 2018a) – safety and performance outcome
- *Greater Sydney Services and Infrastructure Plan* (Transport, 2018b) – Customer Outcome 9: "a safe transport system for every customer with the aim for zero deaths or serious injuries on the network by 2056"
- *NSW Freight and Ports Plan 2018-2023* (NSW Government, 2018b) – Objective 4: Safety
- *Greater Sydney Region Plan: A Metropolis of Three Cities* (Greater Sydney Commission, 2018) – 'A city supported by infrastructure' and 'A city for people'
- *Sutherland Shire Local Strategic Planning Statement* – Planning Priority 2: Managing Traffic Congestion and Parking and Planning Priority 14: ANSTO Innovation Precinct

Consistent with the approved project, the proposed modification would be aligned with the:

- *State Infrastructure Strategy 2018 – 2038 – Building Momentum* (Infrastructure NSW, 2018) as it would improve an existing road asset
- *NSW Freight and Ports Plan 2018-2023* (NSW Government, 2018b) – Objective 4: Safety as it would improve the existing road network and connectivity between freight routes
- *Greater Sydney Region Plan: A Metropolis of Three Cities* (Greater Sydney Commission, 2018) due to improvements of reliability through increased the capacity of the network and the ability for traffic flows to be maintained in an emergency or if maintenance was required on one of the bridges.

2.2 Proposal objectives and development criteria

The proposal objectives that apply to the proposed modification as outlined in Section 2.3 of the project REF are to:

- improve road safety by increasing the road and shoulder lane widths on the bridge and approaches
- improve network reliability
- deliver a design solution that has the ability to be implemented in the short-term.

The development criteria identified in the project REF also apply to the proposed modification and are to:

- minimise property acquisitions
- minimise environmental impacts, including avoiding encroachment into Heathcote National Park
- avoid impact to Commonwealth issues including Defence Land and Commonwealth heritage area
- achieve value for money
- achieve constructability.

The urban design objectives outlined in the project REF also remain applicable (refer to Section 2.3.3 of the project REF).

2.3 Alternatives and options considered

This section summarises the design options that were considered for the proposed modification and explains why the preferred option was chosen.

2.3.1 Strategic options considered in the project REF

As discussed in Section 2.4.2 of the project REF, the 2018 strategic options development for the Heathcote Road bridge upgrade considered various options including the widening of the existing bridge and the duplication of the Heathcote Road bridge to provide a single lane on each bridge.

At that stage of the project's development, the bridge duplication option was determined to provide greater safety benefits than the bridge widening option due to the separation of opposing traffic flows. However, concept cost estimates sourced by Transport identified the earlier bridge duplication option as being significantly more expensive than the bridge widening option and requiring a much longer construction duration. This estimate relied on certain design assumptions such as bridge width, degree of works required on both

approaches, constructability and materials. The earlier and wider duplication design resulted in more substantial environmental and property impacts, greater risk of impacting Aboriginal cultural heritage due to the greater length of roadworks on approaches, greater risk of impacting Commonwealth Land as well as greater vegetation clearance than the bridge widening option. It was also determined to be more difficult to construct and would be associated with longer and more complex approval, land acquisition and construction durations. At that stage, the bridge widening option was the preferred option taken forward in the project REF and became the approved project.

Following the project determination, as part of construction tendering, Transport sourced detailed cost estimates from construction alliances to undertake the bridge widening project. During this process, there were several issues raised by the alliances in the constructability of the approved project which had not been considered by Transport at the concept cost estimation phase. It was identified that adding extra width to an old and existing structure had complicated construction risks and hazards that prompted reconsideration of alternative design solutions.

Non-conforming tenders were submitted to Transport which identified that a bridge duplication could be constructed for a similar cost and schedule and with better outcomes to the bridge widening option. Further investigation led to development of an improved bridge duplication option, being the proposed modification. The proposed modification was found to be only slightly more expensive to construct than the approved project design but was still within project funding estimates. It was justified by the improved safety outcomes and reduced heritage and community impacts.

Key objectives of the approved project (per Section 2.2) were to improve road safety and network reliability whilst allowing for timely delivery of the new infrastructure to road users. By building a second bridge, the proposed modification would allow for a large amount of the work to be completed offline thus reducing the need for a full continuous six-month closure of Heathcote Road. This would reduce interruptions on the traffic network while still maintaining the delivery date for the new transport asset.

The proposed modification would be constructed mostly within the approved project boundary, with a small extension of works outside this boundary to the north along Heathcote Road included within the modified project boundary. However, the area within the approved project boundary required for construction of the proposed modification has changed compared to the approved project, mainly due to the additional work required on the north-west cut and the valley floor and a reduction of work to the south-east cut. This has resulted in some changes to environmental impacts which are assessed in Chapter 6.

2.3.2 Methodology for selection of preferred option

As noted in the previous section, during the construction tender phase, a variety of options for bridge widening and bridge duplication (using different engineering solutions) were considered by Transport. The strategic options considered in Section 2.4.2 of the project REF (i.e. bridge duplication with a single lane of traffic on each bridge and bridge widening) were developed into several sub-options for further assessment. These sub-options included a range of engineering solutions for each strategic option. They were then refined to consider only road alignment and bridge options which would not trigger additional land acquisition or require extensive additional environmental assessment and approvals than the approved project.

A multi-criteria analysis of the sub-options was carried out during technical interactive workshops held by Transport. The sub-options were compared against the following criteria:

- effect on existing bridge capacity
- urban design objectives
- road user experience
- traffic impact
- maintenance outcomes
- safety and constructability
- construction program
- technical approval risk
- heritage and environmental impacts
- approval pathway risks
- cost.

Following this analysis, two options were shortlisted: a new approximately seven-metre-wide bridge on the western side of the existing bridge; and a three-metre widening of the existing bridge on the western side. These two options were then assessed against the proposal objectives and development criteria to select the preferred option for design development, being the proposed modification.

2.3.3 Identified options

Option 1 – Proceed with the approved project

This option would proceed with the approve project as described in the project REF, without any additional scope of work. This would involve widening the existing two-lane bridge by headstock widening with supports using the existing bridge piers and upgrading the bridge approaches.

Option 2 – Proposed modification

This option would involve constructing a new single lane bridge (about seven metres wide) immediately to the west of the existing bridge (the proposed modification). It would also result in conversion of the existing bridge to a single lane carriageway, shifted alignment of the northern and southern approaches to the west, upgraded drainage infrastructure and widening into the north west rock cutting. This option could be predominantly constructed offline (with intermittent weekend and weeknight road closures rather than a prolonged continuous full road closure).

2.3.4 Analysis of options

Both options are evaluated against the proposal objectives and development criteria (refer to Section 2.2) in Table 2-1.

Table 2-1 Evaluation of options

Criteria	'Option 1' (approved project)	'Option 2' (the proposed modification)
Proposal objectives		
Improve safety	This option would result in a positive safety outcome as it would increase the lane and shoulder widths on the bridge as well as the width and alignment of the northern and southern bridge approaches. However, there would not be any physical separation of the opposing traffic flows. During the upgrade, there may be additional safety benefits as a result of the opportunity to improve road drainage, the stability and safety of the adjacent rock cuttings and maintenance of the existing bridge structure.	The option would result in a much superior safety outcome compared to the approved project as it would provide full physical separation of the opposing traffic flows crossing the Heathcote Road bridge with a central concrete median barrier between the two bridges. Option 1 provided separation by line marking delineation only. Lane and shoulder widths would be compliant with current standards. These design features would reduce the risk of road incidents including head-on and rear-end collisions and out-of-control vehicles. The combination of lane separation, and the additional lane and shoulder widths would also allow safe overtaking in the event of incident or breakdown on either bridge (and improved ability for incident response). The option would provide a superior permanent rock treatment on the north-west cut and would improve the risk rating of the cut, which improves long-term road safety. The creation of a bench as part of the cut would provide safer and more efficient access for maintenance inspections. The additional drainage infrastructure to the north of the approved project boundary would reduce the potential for sheet flows across Heathcote Road, improving safety for motorists travelling across the Heathcote Road bridge.
Improve network reliability	The reduced risk of road incidents would reduce the frequency of unplanned road closures and their associated impacts on the reliability on the A6 road corridor and the surrounding road network. The wider lane widths and shoulders would also provide extra room for vehicles to navigate around incidents on the Heathcote Road bridge and its	The option would provide extra room for vehicles to navigate around traffic incidents (such as breakdowns) on the bridges and enable improved emergency services access. Both lanes of traffic would also be able to be temporarily diverted onto either bridge during maintenance activities. These design features would decrease traffic delays and improve the reliability of the A6 road corridor and surrounding road network.

Criteria	'Option 1' (approved project)	'Option 2' (the proposed modification)
	approaches, such as vehicle breakdowns, which would minimise traffic delays.	This option would provide the most network reliability improvements.
Ability to be delivered in the short-term	While it was expected that this option would take less time to deliver than a bridge duplication option, design improvements have meant both options could be delivered in the short-term. Complex engineering would be required to allow extensions to the existing bridge. As such, this option presents potential risks of delay to the construction program compared to 'Option 2'.	This option would require further environmental impact assessment; however, it aligns with the project REF safeguard TT2 for investigating alternative construction methodologies and design innovations to minimise the need for road closures and minimising the duration of continuous full road closures during construction. Due to the new bridge being separate from the existing road there would be time savings in construction as much of this can be completed offline (without impact to traffic flow on Heathcote Road). The net outcome is a similar construction timeframe as the approved project (i.e. the option would be able to be delivered in the short-term).
Minimise property acquisition	This option would require some property acquisition, including areas of Crown Land. Avoids acquisition of National Park land and Commonwealth lands.	No additional land acquisition beyond that identified in the project REF would be required.
Minimise environmental impacts including encroachment into Heathcote National Park	This option would require vegetation clearing, however avoids direct impacts to Heathcote National Park. This option would avoid impacts to a known Aboriginal cultural heritage item and limit impacts on the cultural heritage place to the edge of the item curtilage. There would be potential direct impacts to about 1200 square metres of the Cubbitch Barta National Estate Area due to this option. This option requires a major modification to the existing Heathcote Road bridge structure, which would result in irreversible heritage impacts.	This option would achieve a better heritage outcome as it would reduce direct impacts to the existing Heathcote Road bridge and preserve the heritage bridge in its current form. The improved design would allow the bridge to function for its original intended purpose and be progressed towards nomination for State Heritage Register listing in a better condition than under 'Option 1'. The proposed modification could still remain compliant with the safeguards developed in the project REF in consultation with Heritage NSW. The reduced vehicle loads from carrying only a single direction of traffic may also contribute to extending the operating life of the heritage item This option would result in minor impacts to the Cubbitch Barta National Estate Area (CBNEA) curtilage (refer to following rows in this table). It would result in additional impacts to about 1800 square metres of this heritage place (equivalent to 0.001 per cent of the estate). This option would also result in negligible changes to the potential Aboriginal cultural heritage impacts compared to Option 1. The design is further away

Criteria	'Option 1' (approved project)	'Option 2' (the proposed modification)
	This option requires a major road detour for 6 months of construction, impacting on local and through traffic. There would be visual changes from the addition of the new structural elements to the existing bridge and rock cutting, however there is possibly less visual impact than the bridge duplication option for motorists as the bulk of the structural changes would be below the bridge deck.	from the AHIMS site identified within the approved project boundary in the project REF. The ability for the new bridge to carry two lanes of traffic while the existing bridge is upgraded or maintained would allow a significant reduction in duration of road closures and associated detours. This offers a noticeably improved outcome for the community and by comparison substantially reduces the degree of traffic disruption during construction and operational maintenance. This option would also require piling works in the waterway for the new bridge piers, however these impacts would be minor with the implementation of appropriate construction methods and safeguards. This option would no longer require the piling wall on the southern approach (required for Option 1). Additional clearing of vegetation and bush rock would be required on the north-western cut for the proposed modification, although there would be reduced clearing required on the eastern side of the existing bridge compared to Option 1. While the same western temporary access track would be required for both options, there would be a reduction in the temporary access required on the eastern side of the existing bridge for this option. No new threatened species, populations or ecological communities have been identified as being impacted due to the proposed modification. Commitments to offset in accordance with the *Guideline for Biodiversity Offsets* (Transport for NSW, 2016) would still be able to be met. This option would result in a better visual outcome for the north-west cut than Option 1 as the proposed clean cut would reduce the need for treatments such as shotcrete, rock netting or rock bolts. The increased rock cutting and vegetation removal on the north-west cut would consider Transport's urban design guidelines and urban design objectives from the project REF. For other environmental aspects, the option would not substantially increase environmental impacts beyond those identified in the project REF. There would be no encroachment into Heathcote National Park.
Avoid impact to Commonwealth issues including	This option would avoid impact to Commonwealth Defence Lands and minimise impacts on the Commonwealth heritage item curtilage by limiting work to the edge of the curtilage. There would be	As with 'Option 1', this option would impact the Cubbitch Barta National Estate Area curtilage (Commonwealth heritage item). It would result in additional impacts to about 1800 square metres of this heritage place (equivalent to 0.001

Criteria	'Option 1' (approved project)	'Option 2' (the proposed modification)
Defence land and Commonwealth heritage area	potential direct impacts to about 1200 square metres of the Cubbitch Barta National Estate Area due to this option.	per cent of the estate) beyond those required for 'Option 1'. This increase in impact is not considered significant. Refer to Section 6.6.3 for further details. There would be no encroachment onto Commonwealth Holsworthy Defence Lands.
Value for money	This option was considered likely to cost substantially less than the strategic design bridge duplication option and could be delivered within the allocated funding. This option would not provide a long-term solution (new bridge) and would not provide physical separation of opposing traffic.	This option would have only a slightly greater cost compared to Option 1 and still remains within the allocated project funding. The option would provide the best long-term benefits in the form of improved road safety and network reliability. It would result in a longer design life (up to 50 years longer than Option 1) due to construction of a new bridge asset. The new infrastructure would be built to higher technical design standards and result in lesser maintenance demand in comparison to the retrofit solution on the ageing existing bridge proposed as Option 1. The repair and maintenance work on the existing bridge (which is part of the scope for both options) and the reduced bridge load demands from the reduction to single lane only in this option would reduce the maintenance demand and costs of this bridge into the future.
Constructability	This option would be simpler to construct than the bridge duplication option, however would still be challenging due to the difficult topography, the need for a six-month full continuous road closure and associated detour route, extensive scaffolding, utility relocation work, and work over the Woronora River.	The ability for the proposed modification to be predominantly completed offline would reduce construction complexity and disruption to the community and traffic. The shifted road alignment would reduce the amount of rock cutting work required on the southern approach and considerably reduces impact on the north-east road embankment. The shorter southern approach reduces the amount of earthworks required on the steep roadside embankment. This option would require increased works over the Woronora River, including construction of new piers within the waterway. A temporary rock platform would still be required in the waterway, and would need to be engineered to accommodate crane and piling rig. As noted previously, comparatively greater works in the waterway are also attributed to the reduction in available working area as a result of significant localised erosion from a recent major flood event.

2.4 Preferred option

‘Option 2’ was selected as the preferred option as it would provide greater short and long-term benefits compared to ‘Option 1’, whilst remaining within the approved project budget and without needing to acquire additional land or substantially increase environmental impacts. In particular, ‘Option 2’ would:

- provide a superior road safety outcome by introducing physical separation of the opposing traffic lanes
- provide additional network reliability benefits as it would facilitate wide shoulders for safe overtaking movements in the event of a breakdown or road incident to improve ability to maintain traffic flow and opportunity for emergency response
- result in a superior heritage outcome for the existing bridge (due to the reduced impacts to the existing heritage listed bridge)
- substantially reduce the road closure impacts from the original continuous six-month full closure of Heathcote Road between New Illawarra Road and the Princes Highway to a series of intermittent weekend and night-time road closures on an as needed basis, resulting in less disruption to wider road network and the community
- provide better medium- and long-term asset outcomes
- able to be delivered in a similar timeframe.

The proposed modification is based on the preferred option and is described in detail in Chapter 3.

3 Description of the proposed modification

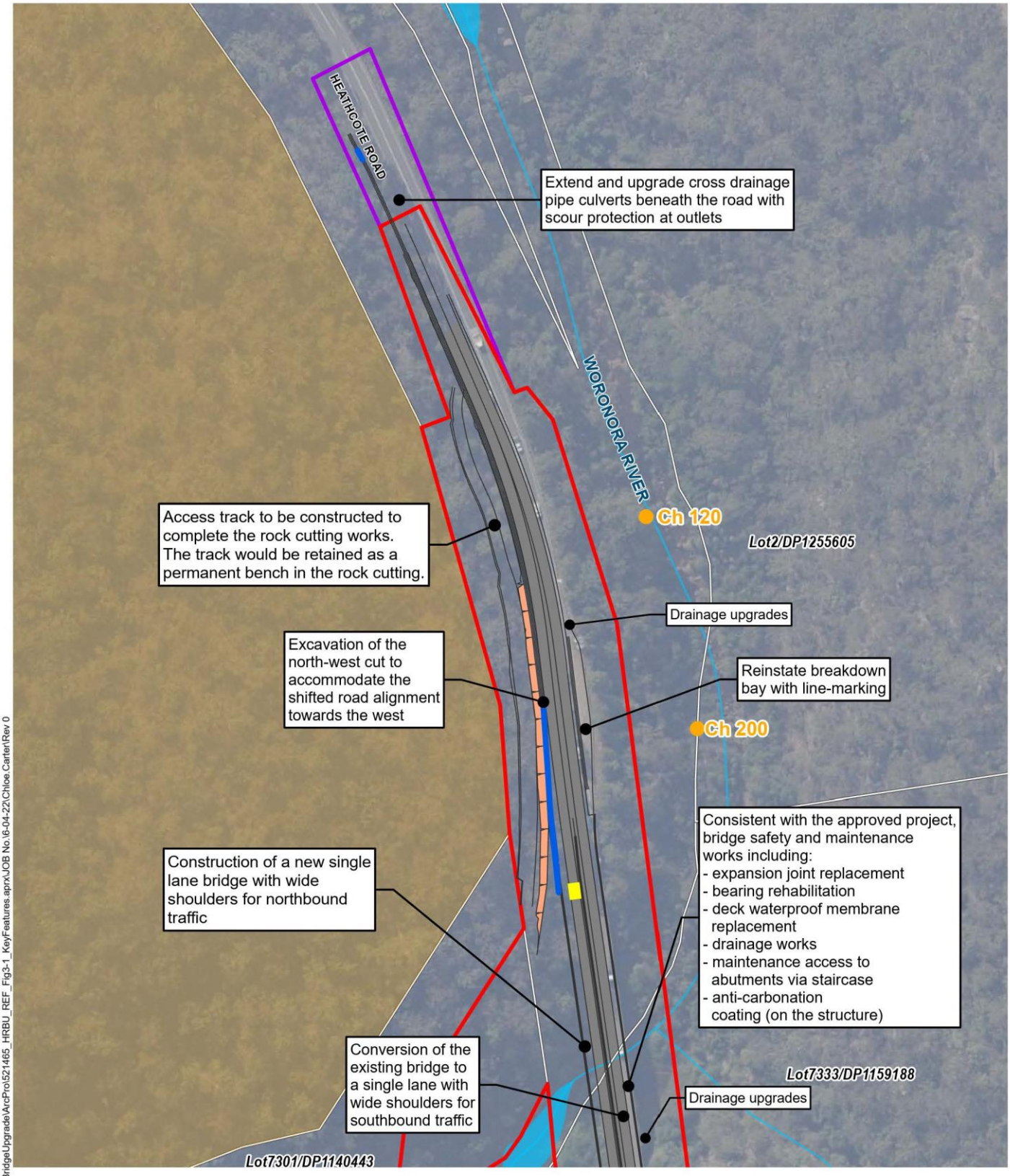
3.1 The proposed modification

Transport propose to modify the approved Heathcote Road bridge safety improvement project and pursue a bridge duplication option instead of the previous bridge widening option. The existing bridge would be converted to a single lane bridge with wide shoulders for southbound traffic. A new single lane bridge would be constructed parallel to the existing on the western (upstream) side and carry northbound traffic. Upgrades to the northern and southern bridge approaches would still be required and shift slightly west to align with the new bridge. This design would provide a superior safety outcome with the physical dividing barrier between opposing traffic lanes.

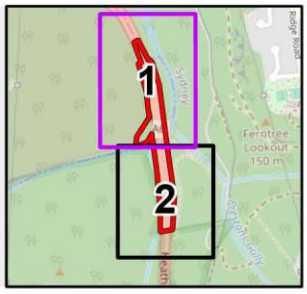
Key features of the proposed modification include:

- construction of a new single lane bridge on the upstream side of the existing bridge over Woronora River to carry northbound traffic, including four new piers
- conversion of the existing bridge to a single lane with wide shoulders to carry southbound traffic
- adjustments to the bridge abutments to capture both bridge structures
- shifting the alignment of the southern bridge approach up to 10 metres west and the northern bridge approach up to eight metres west
- removal of the northbound breakdown bay (due to the relocation of the southern approach alignment on top of this location)
- upgrades to drainage infrastructure, including:
  - drainage work for the new alignment
  - open scupper drainage from the new bridge
  - longitudinal pavement drainage running along the alignment discharges where the road alignment meets the river valley
- provision of new road furniture, including a concrete median barrier to separate northbound and southbound vehicles along the length of both bridges.

The key features of the proposed modification are shown in Figure 3-1.



Approved project boundary
Modified project boundary
Road
Shoulder
Cut
Holsworthy Barracks - Defence controlled area
New bridge abutment
Abutment access
New longitudinal drainage
Chainages
Lot
Watercourses
Water bodies



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Source: Aurecon, TfNSW, Spatial Services, Esri

1:2,000 @ A4
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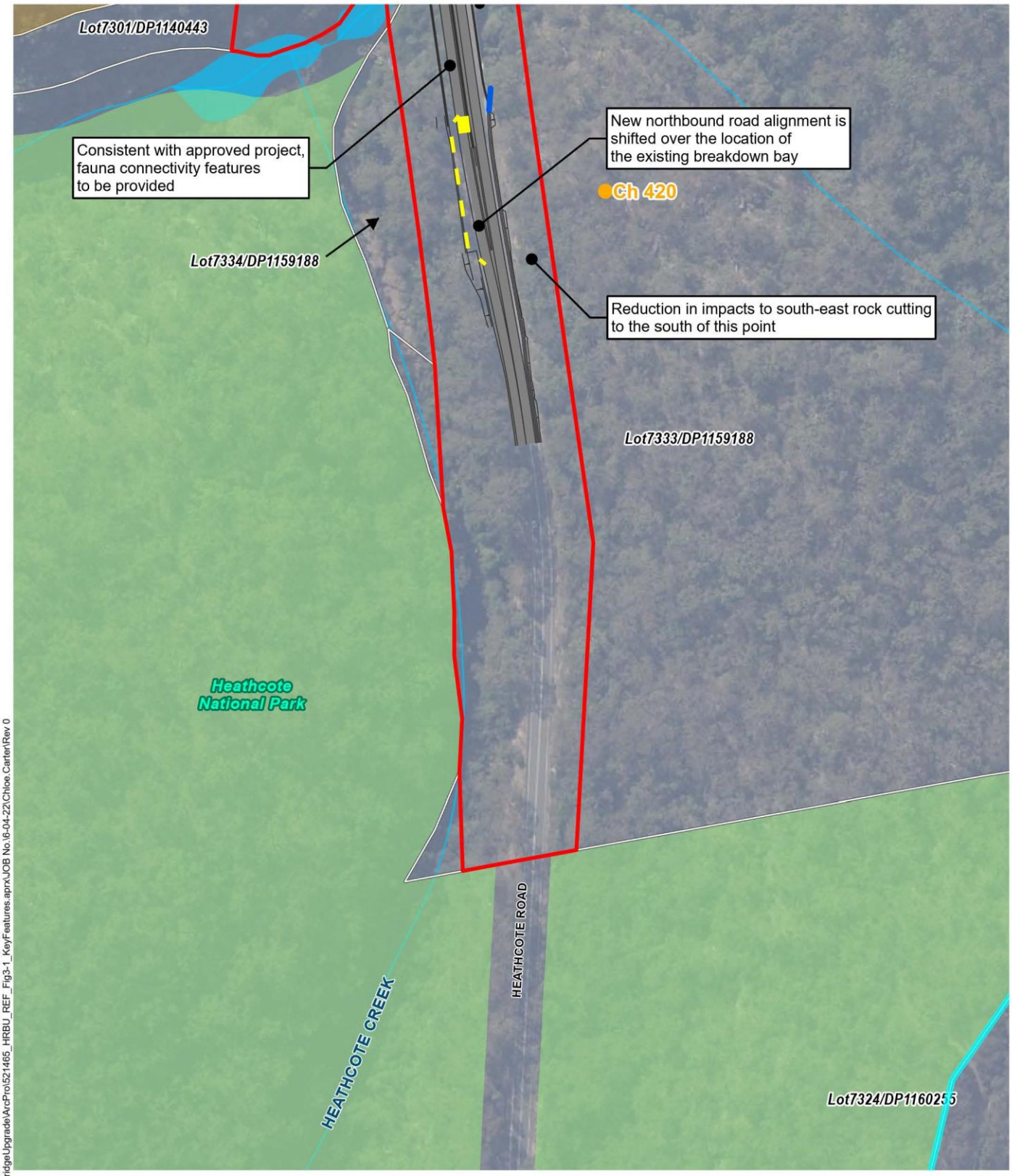
Projection: GDA 1994 MGA Zone 56

Heathcote Road Bridge **Addendum REF**

FIGURE 3-1a: Key features of the proposed modification



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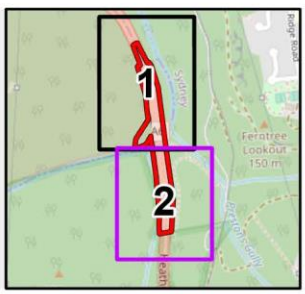
- Approved project boundary
- Modified project boundary
- Road
- Shoulder
- Cut
- Holsworthy Barracks - Defence controlled area
- National park
- New bridge abutment
- Abutment access
- New longitudinal drainage
- Chainages
- Lot
- Watercourses
- Water bodies



Source: Aurecon, TfNSW, Spatial Services, Esri

1:2,000 @ A4

0 25 50m

Projection: GDA 1994 MGA Zone 56

Heathcote Road Bridge **Addendum REF**

FIGURE 3-1b: Key features of the proposed modification

A summary table of key features of the proposed modification and comparison to the original project scope is provided in Table 3-1. Those features which are modified or additional to the original scope are further assessed within this addendum REF. Common scope features are captured within the project REF.

Table 3-1 Key features of the proposed modification and comparison to the original scope

Original REF scope – Bridge upgrade by widening	The proposed modification – Duplicate single lane bridge (subject of this addendum REF)
Widening of the existing bridge by about 1.4 metres on each side to provide one wide 3.5 metre lane in each direction with 1.2 metre shoulders	Widening the existing bridge structure is no longer proposed. The updated scope proposes to construct a new single lane bridge on the upstream side, parallel to the existing bridge. The new bridge would require: • additional work in the waterway for pier construction and construction • new bridge deck, barriers and safety rails • new bridge abutments at the northern and southern end of the proposed new bridge • adjustments to the northern and southern road alignment to connect to the new bridge • extra cutting on the north-west cut and reduced cutting on the south-east cut • new pavement drainage discharging to the Woronora River on either side of the bridge. The approved project design planned to remove sandstone at the abutments and re-use it by incorporating it elsewhere in the design however further investigation has since found the stone to be a structural stone wall. It is now proposed to cover the stone facing to preserve it and construct over it to expand the abutment to accommodate both bridges. There would be maintenance stairs provided to access each abutment during operation. Refer to Section 3.2.3 for bridge design details.
Widening and adjustments to the northern and southern bridge approaches about 250 metres either side of the bridge to improve the road alignment, increase lane and shoulder widths and reinstate the existing breakdown bays either side of the bridge	Widening of the bridge approaches is still required though the shifted alignment means there would be a reduced impact on the eastern side. The proposed modification would result in the removal of the northbound breakdown bay, however the proposed wide shoulders on the new bridge maintain the ability for a vehicle to pull over into the shoulder and allow traffic to pass.
New bored-pile retaining walls to support the slope along both bridge approaches, which would be up to two metres high and range in length up to 100 metres	The retaining wall on the northern approach (eastern side) would no longer be required due to the alignment shifting to the west. The retaining wall on the southern approach (western side) would be substantially reduced in length.
Slope stabilisation measures including rock scaling, shotcreting, rock bolting, rock netting, and vegetation removal	Slope stabilisation works remain part of the scope. Due to the alignment shifting west, the proposed modification would require greater rock cutting works on the northern approach (western side) of up to nine metres back from the existing road edge line (refer to Section 3.2.3).

Original REF scope – Bridge upgrade by widening	The proposed modification – Duplicate single lane bridge (subject of this addendum REF)
	Additionally, an access track (with variable width between 3.5 and six metres) would also be required at the top of the north-west cutting to safely excavate the new rock cut face. This access track would remain in place as a bench in the cutting which would assist with future maintenance access. On the south-east side cutting, the scope of slope stabilisation works would be reduced.
New and modified drainage infrastructure including replacement and extension of existing cross culvert pipes on the approaches for the widened road pavement, improved drainage gutter along the base of the rock cuttings, new longitudinal drainage outlet at each abutment and scour protection at all discharge points	Drainage upgrades are still required. The scope of drainage work has changed with the new alignment of the road and new bridge. This includes: • new scupper drainage on the new bridge and modified scupper drainage on the existing bridge • new alignment drainage on the northern and southern bridge approaches which would both discharge at the bridge abutments • an extra drainage line improvement at the northern extent of the modified project boundary, preventing upstream water sheet flowing over Heathcote Road • upgraded bench drainage on the north-west cut area, diverting water away from the northbound carriageway.
Adjustments to optical fibre conduits for the length of the approved project boundary	Adjustments to optical fibre conduits would no longer be required.
Repair and maintenance work to the existing bridge structure including: • repairs to cracks • replacement of all bearings • joint replacement • application of an anti-carbonation coating on the bridge structure including piers • installation of new steel maintenance staircase for side access to the bridge for bridge inspections	Repair and maintenance work on the existing bridge would still be required, consistent with original scope. This includes upgrades to the edge safety barriers. The change in scope would also require the existing bridge deck to be converted to a single lane with wide shoulders. This conversion will include resurfacing and line-marking work.
Other ancillary work required to support construction of the approved project including two off site construction compounds and establishment of a temporary access track, waterway crossing and crane pads	Consistent with original scope. The temporary waterway crossing would also contain piling pads for pier construction. While a construction waterway crossing is still required, flood events in early 2022 have altered the river morphology and a larger engineered crossing would be required to span the greater channel width.
Koala connectivity features to support north-south movement corridors at the northern and southern bridge abutments	Koala connectivity features remain part of the proposed modification scope.

3.2 Design

3.2.1 Design criteria

The proposed modification has been designed to NSW and Australian engineering, road safety, environmental and transport planning standards developed by Transport and Austroads. These standards describe the criteria that should be adopted for specific road classifications and conditions.

The key design criteria for the proposed modification is summarised in Table 3-2.

Table 3-2 Summary of design criteria for the proposed modification

Criteria	Description
Speed limit	70 kilometres per hour (posted speed) 80 kilometres per hour (design speed)
Lane and shoulder widths	• Minimum 3.5-metre-wide lanes • Minimum 1.2-metre-wide shoulders • Minimum 0.5-metre-wide verge
Grade	Same as existing
Rock cutting	1:0.5 to achieve a slope rating of ARL4
Design vehicle	Main carriageway – 26 metre B-double Maintenance bay access – 19 metre semi-trailer, with a 26 metre B-double check vehicle
Height of edge barriers	Medium performance edge barrier on bridge

The typical cross section of the proposed modification at Heathcote Road bridge is shown in Figure 3-2 and Figure 3-3.

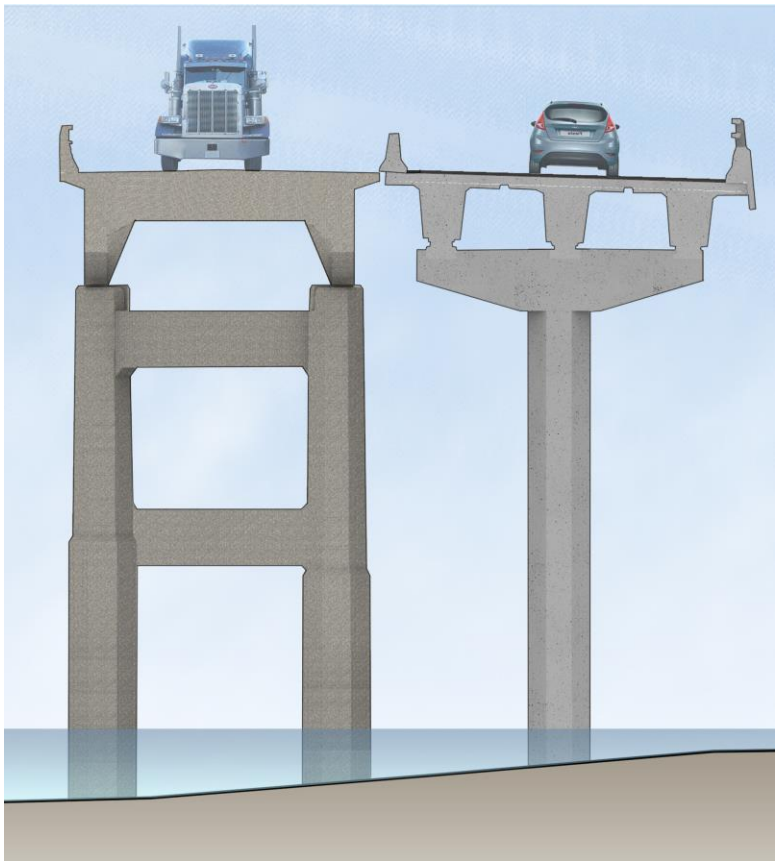


Figure 3-2 Typical cross section at Heathcote Road bridge

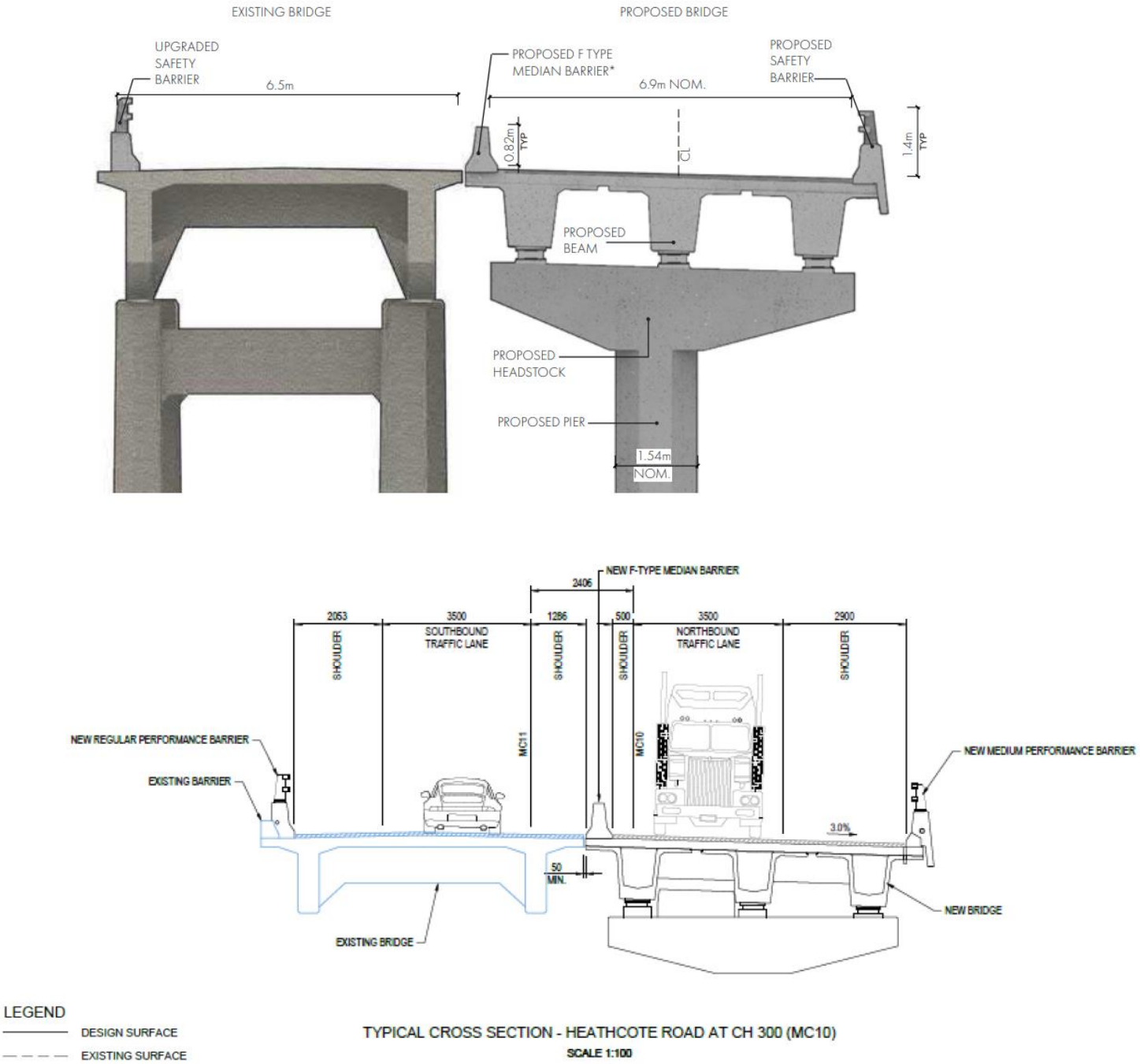


Figure 3-3 Typical cross sections of existing and proposed bridges

3.2.2 Engineering constraints

The engineering constraints for the proposed modification include:

- difficult terrain including the rock escarpments and steeply incised river valley, with restricted access
- narrow road corridor
- adjoining Heathcote National Park and Commonwealth Defence land
- AARNET optic fibre cable.

3.2.3 Main features of the modification

New bridge

The new bridge would be aligned parallel to the existing bridge, on the western, upstream side (refer to Figure 3-2 and Figure 3-3). The superstructure of the bridge would be about seven metres wide (excluding edge barriers) with super-T girders and a composite cast in-situ deck slab (refer to Figure 3-3). The proposed bridge would be comprised of five spans, about 30 metres long and would have the same height as the existing bridge.

The bridge would include a single 3.5 metre lane with wide shoulders for northbound traffic (refer to Figure 3-3). Type F safety barriers are proposed on both sides of the bridge. The bridge would be constructed primarily out of concrete, with steel elements for the barriers and asphalt for the road surface. It would be a different concrete colour to the existing bridge. The texture of the new bridge would be confirmed during later stages of detailed design.

The substructure would consist of four new piers. The bridge piers would be hexagonal matching the existing piers on the current Heathcote Road Bridge. These would align with the existing piers as shown in Figure 3-6. They are designed to match the skew and width of the existing piers. The piers have been designed to be octagonal to complement the existing bridge piers and also minimise hydraulic impacts.

New abutments would be constructed adjacent to the existing abutments and protect the sandstone cladding and minimise heritage impacts. There would be archival recording, geo-fabric wrapping and encapsulation of the existing sandstone cladding prior to adjustments to the abutments. The new abutments would:

- be clearly delineated from the existing abutments
- minimise disturbance at point of connection
- align with the existing abutments
- be about eight metres wide and encapsulate the existing structural sandstone at the wing wall
- avoid impacts to the steep batter to Heathcote Creek.

The existing sandstone walls on the north-east and south-east abutments would be retained.

During construction, the southern abutment would be accessed from the proposed new alignment via a maintenance access track running north-south to the west of the alignment which would be maintained during operation (refer to Figure 3-1). The northern abutment would be accessed via the temporary access track (refer to Figure 3-13). There would be no construction vehicle access to the abutments from the valley floor. Access to the valley floor would be by foot only. During operation, there would be staircases directly adjacent to the abutments on the western side of the new bridge which would be provided instead of the metal maintenance stairs included in the approved project. There would be sufficient space for a vehicle to pull over to access the southern abutment for maintenance via stairs adjacent to the wing wall and this access track. There would not be changes to the batter along the access track.

Figure 3-1 indicates the location of the proposed abutments and the maintenance access track compared to the rest of the bridge structure. Figure 3-4 shows a cross-section of the proposed abutment. Figure 3-5 shows a plan view of the new abutments.

The abutments would be a dark colour to provide a visually appropriate design and reduce the likelihood of vandalism. Maintenance access to the abutments would be via a new

staircase with handrails. The stairs would be dark and either masonry or steel to minimise visual impact.

New wing walls would be required on the eastern side of the new bridge. On the western side, the north-western wing wall would be adjusted to join the rock cut slope.

No additional retaining walls or sign structures are required for the proposed modification. The north-eastern retaining wall proposed in the project REF would no longer be required.

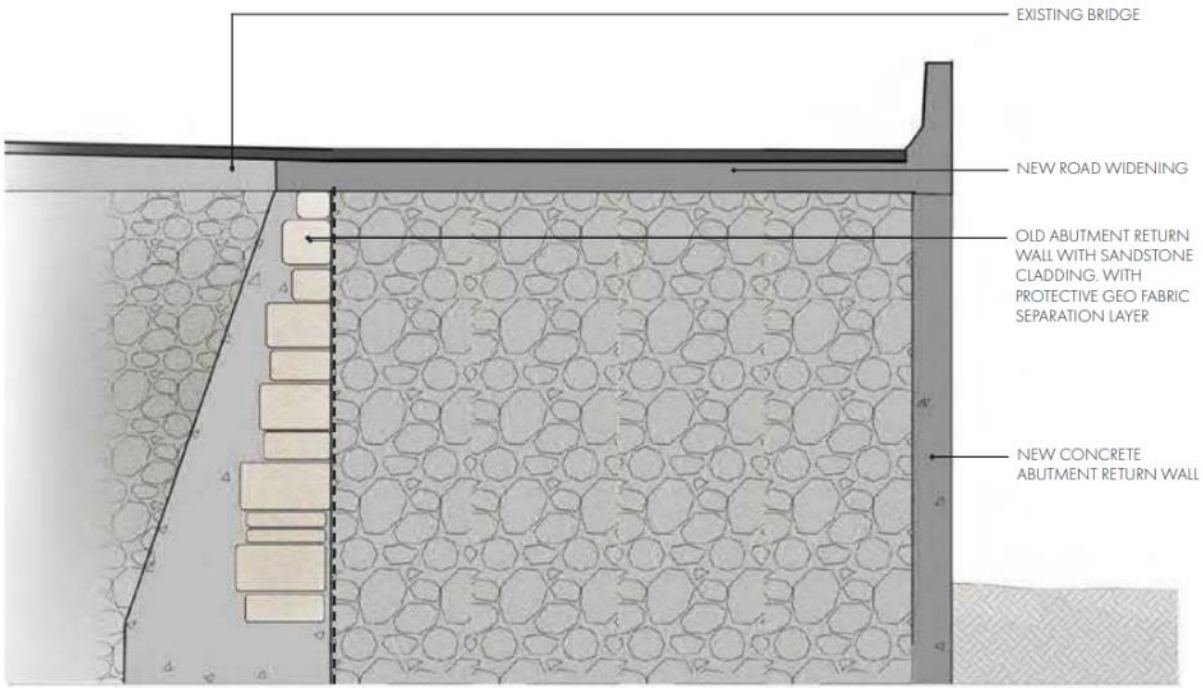


Figure 3-4 Proposed abutment treatment

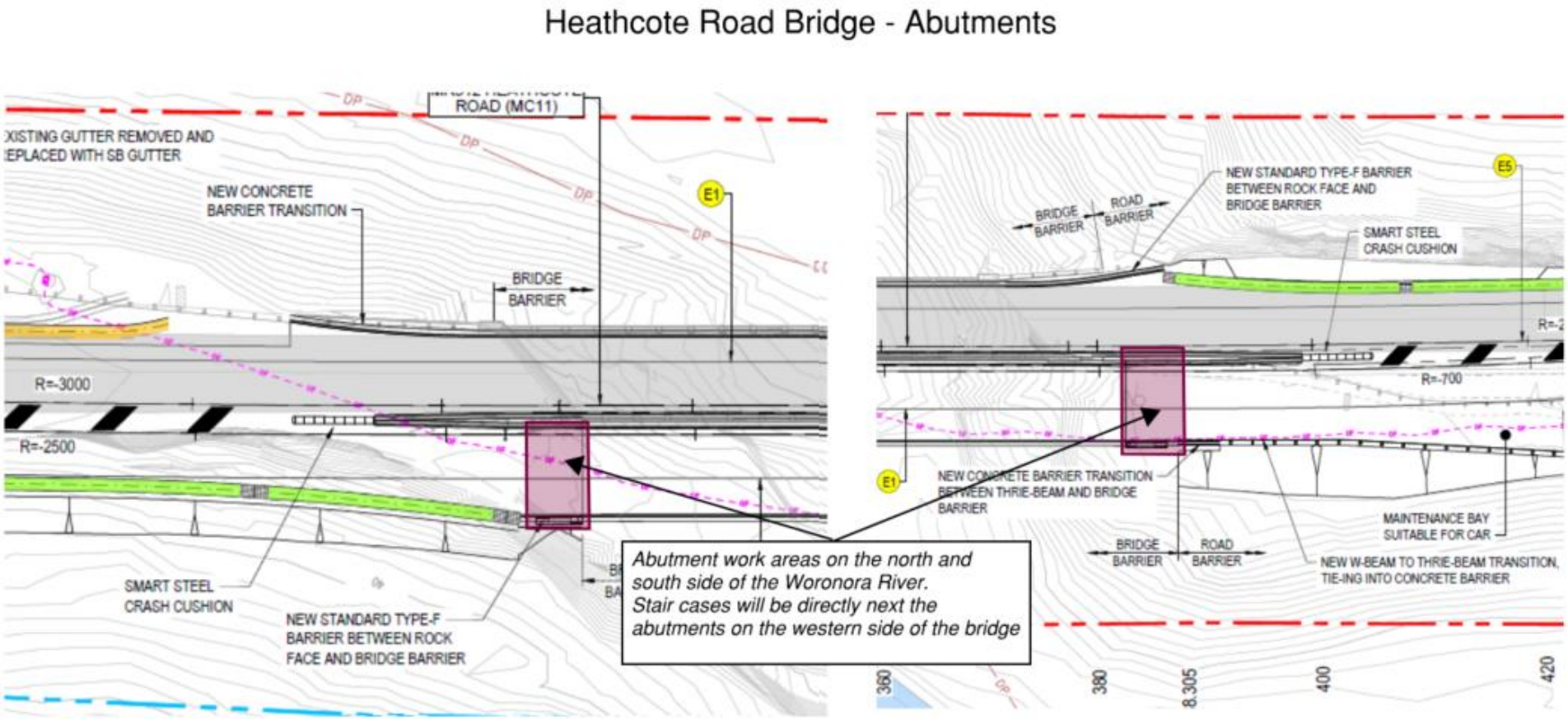


Figure 3-5 Plan view of abutments

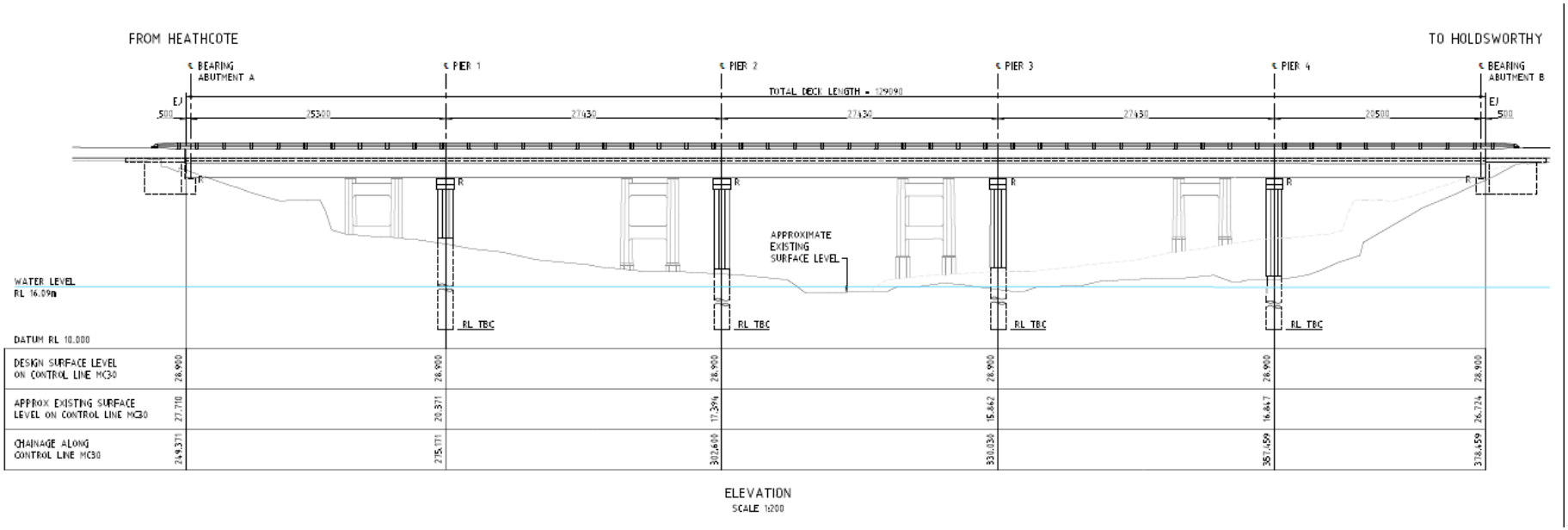


Figure 3-6 General arrangement – piers

Upgrades to existing bridge

While the existing bridge would no longer be widened as part of the proposed modification, there would be upgrades to the road surface and furniture along the bridge. The bridge deck would be resurfaced with new asphalt pavement and reconfigured to consist of a single 3.5-metre-wide lane for southbound traffic with wide shoulders (refer to Figure 3-2 and Figure 3-3). The proposed modification would not change the existing bridge's structural capacity. Though there would be changes to the road surface, the conversion from a dual lane to a single traffic lane bridge reduces the loading demand and benefits the projected lifespan of the asset.

Type F safety barriers are proposed for both sides of the existing bridge. These would be cast in-situ in front of the current edge barriers.

Consistent with the project REF, the scope for bridge maintenance and repair work would still form part of the proposed modification, including:

- expansion joint replacement
- bearing rehabilitation
- deck waterproof membrane replacement
- drainage works
- maintenance access to abutments via staircase
- anti-carbonation coating (on the substructure).

Maintenance work on the existing bridge would be carried out under a separate traffic stage with both lanes of traffic shifted onto the new bridge, to minimise disruption.

It was originally proposed to remove existing sandstone at the abutments and re-use it elsewhere in the design, however further investigation has determined the stone to be a capping layer only. As part of the proposed modification, the existing sandstone facing would be capped for protection and expanded with a new widened abutment to accommodate both bridges (refer to Figure 3-4).

Northern approach

The northern approach would have minimum 3.5-metre-wide lanes, minimum 1.2-metre-wide shoulders and a minimum 0.5-metre-wide verge. The eastern side of the northern approach would be lined with W-Beam safety barriers. The piling wall would no longer be required.

The north-east retaining wall would no longer be required due to the road alignment being shifted to the west. However, despite this shift, the proposed modification would still not encroach on Commonwealth Defence land in this location (refer to Section 3.6).

Figure 3-7 and Figure 3-8 shows cross sections of the proposed upgrades to the northern approach. Figure 3-1 indicates the chainage locations for these figures.

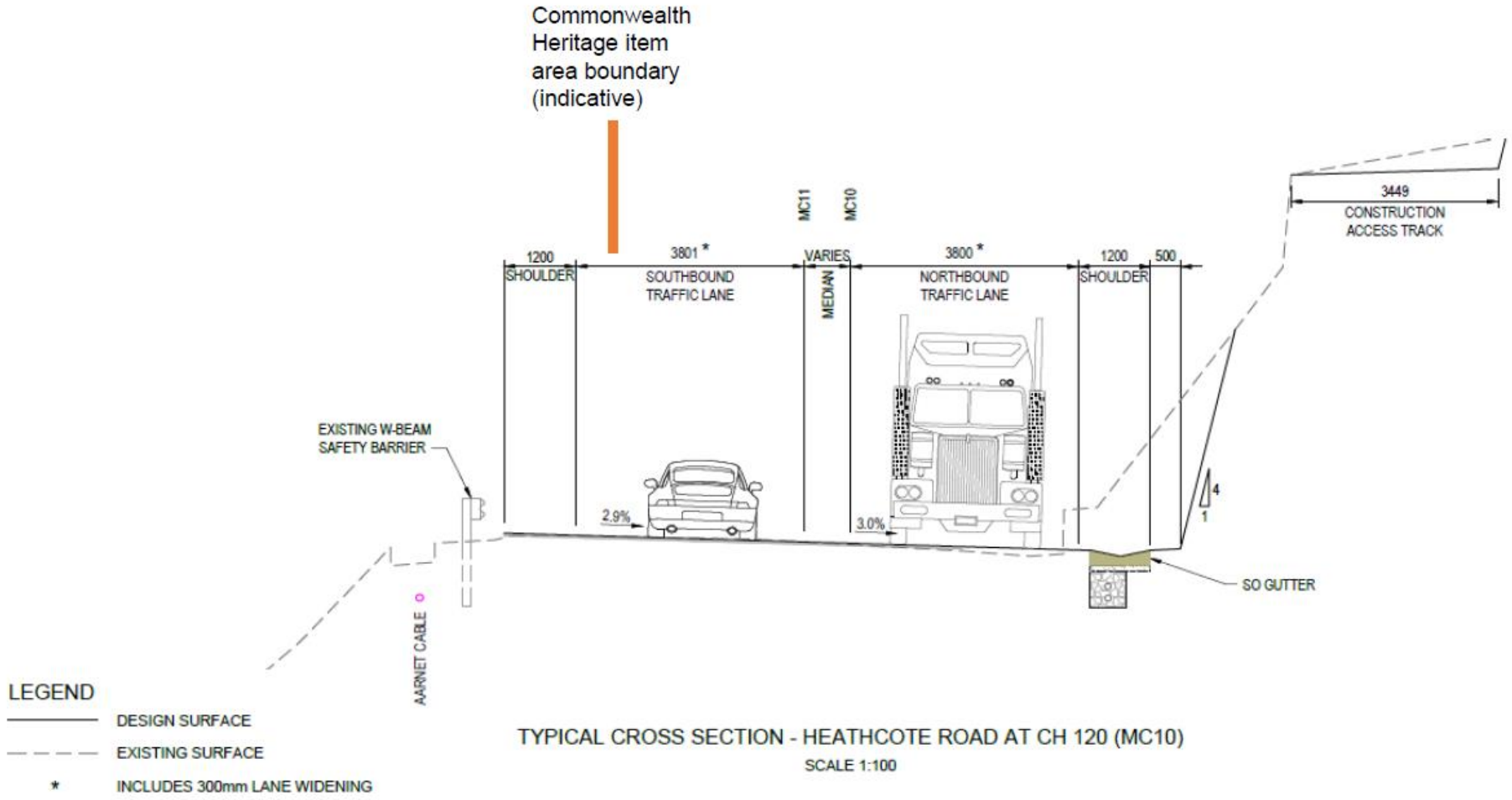


Figure 3-7 Cross section of northern approach – Ch 120

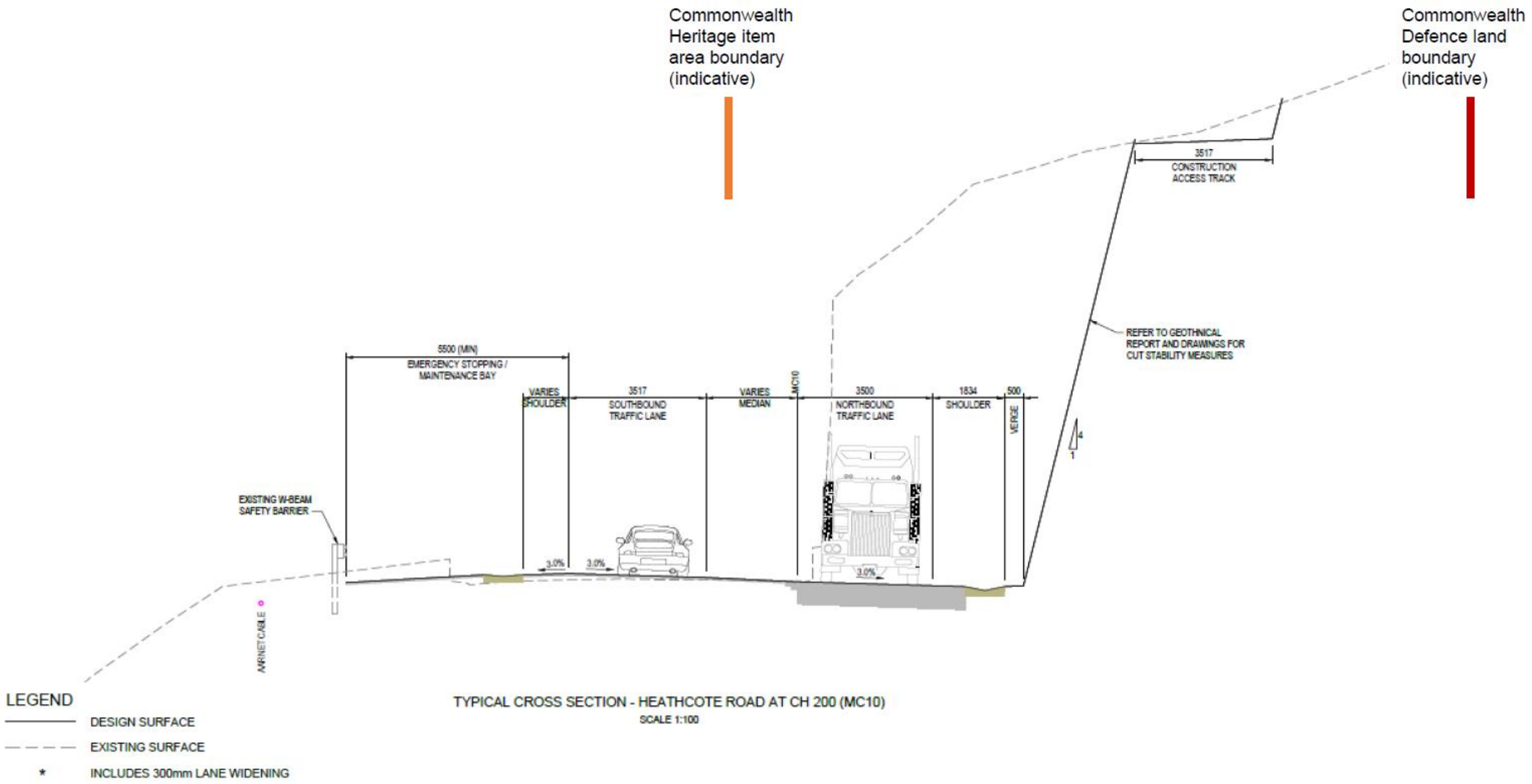


Figure 3-8 Cross section of northern approach – Ch 200

Southern approach

The southern approach would have minimum 3.5-metre-wide lanes, minimum 1.2-metre-wide shoulders and a minimum 0.5-metre-wide verge. The western side of the southern approach would be lined with W-Beam safety barriers. The piling wall would no longer be required.

While the alignment would shift to the west, the proposed modification would still not encroach on Heathcote National Park as the national park is to the west of both the approved and modified project boundaries (refer to Section 3.6). A maintenance access path would be installed to the west of the widened southern approach (refer to the purple line in Figure 3-9), which would allow access to the southern abutment via a maintenance staircase. This would be within the modified project boundary (shown as red in this figure).

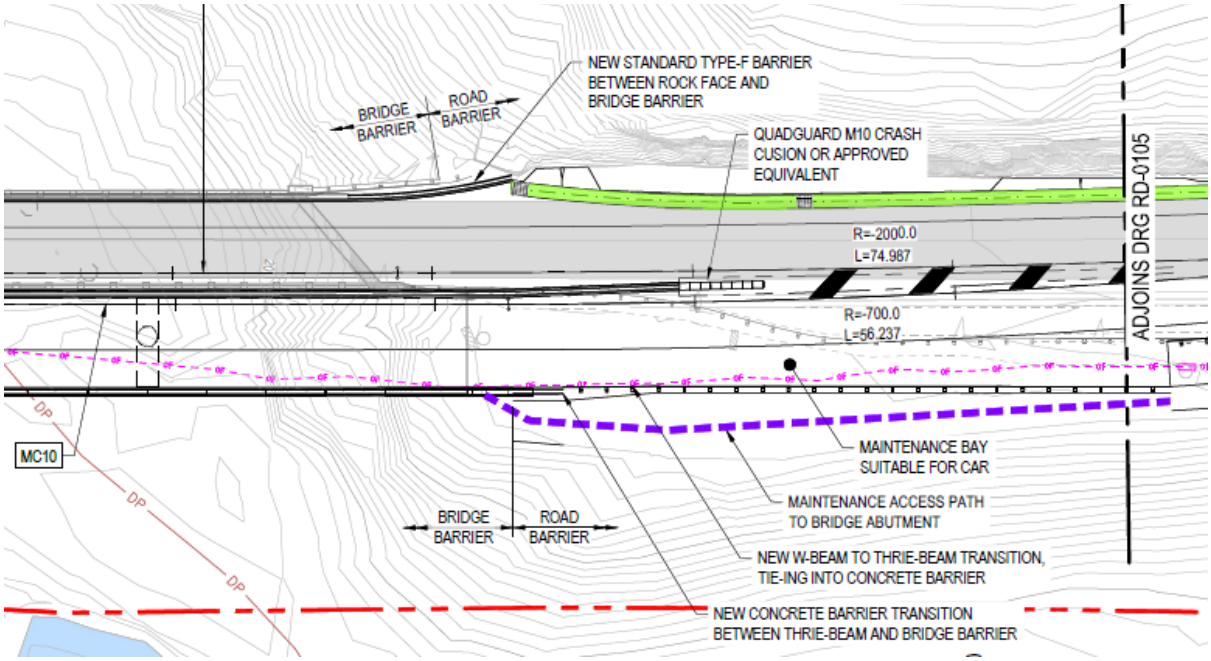


Figure 3-9 Maintenance access path to bridge abutment

The shifted road would be aligned over the existing northbound breakdown bay. A small section of road shoulder would remain though stopping would be restricted to maintenance vehicles only. This would avoid the need for major changes to earthworks in this area due to increased road cross section width and allow the design to maintain a small footprint with lower cost, construction complexity and environmental risk. However, the proposed modification provides wide shoulders on the new and existing bridges, allowing a vehicle to pull into the shoulder if broken down, with room for traffic to pass.

Figure 3-10 shows cross sections of the proposed upgrades to the southern approach. Figure 3-1 indicates the chainage location for this figure.

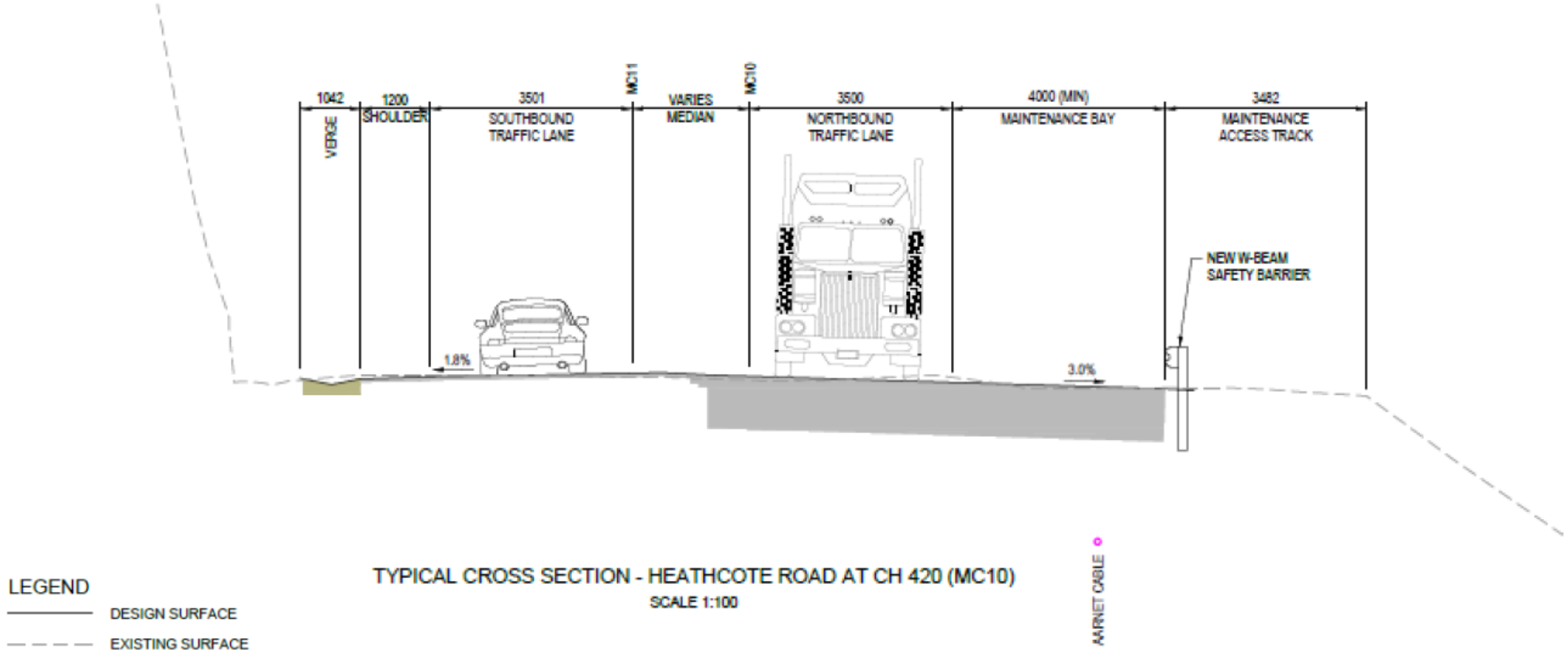


Figure 3-10 Cross section of southern approach – Ch 420

Rock cutting and stabilisation

The proposed modification would require additional excavation on the rock cutting located on the north-west side of the existing bridge (refer to Figure 3-1). This cutting would be accessed from the top to allow materials to be safely and efficiently removed. The extent of the cutting varies but is generally about nine metres at the southern end, five to seven metres in the mid-point of the cut and tapering from three to zero metres at the tie-in on the northern extent. The north-west rock cutting is about 150 metres long in total. This cut is also shown in Figure 3-7 and Figure 3-8.

The north-west cut access track would be between 3.5 and six metres wide and retained as a bench upon completion of construction (refer to Section 3.3.1). The width of the track varies to minimise environmental impacts.

During operation, the north-west cut access track would not be revegetated and instead be retained as a bench. This would improve safety as it would collect loose rockfall from above and allow maintenance inspection access.

The proposed angle of cut would vary depending on the height and width of cut required from 1:0.2 to 1:1.4 and is subject to adjustment during construction based on live conditions.

During construction, a geotechnical assessment of all rocks and boulders on the north-west extent of works would be carried out. This would inform the identification of boulders that would need to be removed, partially removed, pinned or worked around. The treatment of boulders which encroach into the construction footprint would consider the following factors:

- long term safety
- environmental impacts
- cost
- time.

The north-west cut rock face would be reviewed during and after construction of the extended cutting. While the design is likely to reduce the need for rock bolting, shotcrete and mesh treatment, these measures may be considered during construction if required to maintain the stability and safety of the cut. There would be long term road safety benefits due to traffic superior permanent rock treatment on the north-west cut which would improve the risk rating of the cut compared to the approved project.

Drainage infrastructure

The drainage infrastructure included in the approved project utilised existing features and proposed to upgrade that infrastructure where required. By comparison, the proposed modification includes new sections of road and a new bridge so new drainage lines have been proposed. These would include:

- open scuppers on the new bridge draining into the river at four metre intervals. On the existing bridge, scuppers would be blocked on one side of the bridge and crossfall adjusted so that the water drains to one side only (refer to Figure 3-11).
- new longitudinal alignment drainage discharging at the bridge abutments.
- a new longitudinal drainage line at the northern extent of the modified project boundary, preventing upstream water sheet flowing over Heathcote Road.
- upgraded bench drainage on the north-west cut, diverting water away from the northbound carriageway.

There would be scour protection at all discharge points. Localised earthworks and rock scour would need to be constructed to ensure that the outlets are stable and do not cause long term erosion.

The new longitudinal drainage is shown in Figure 3-1.

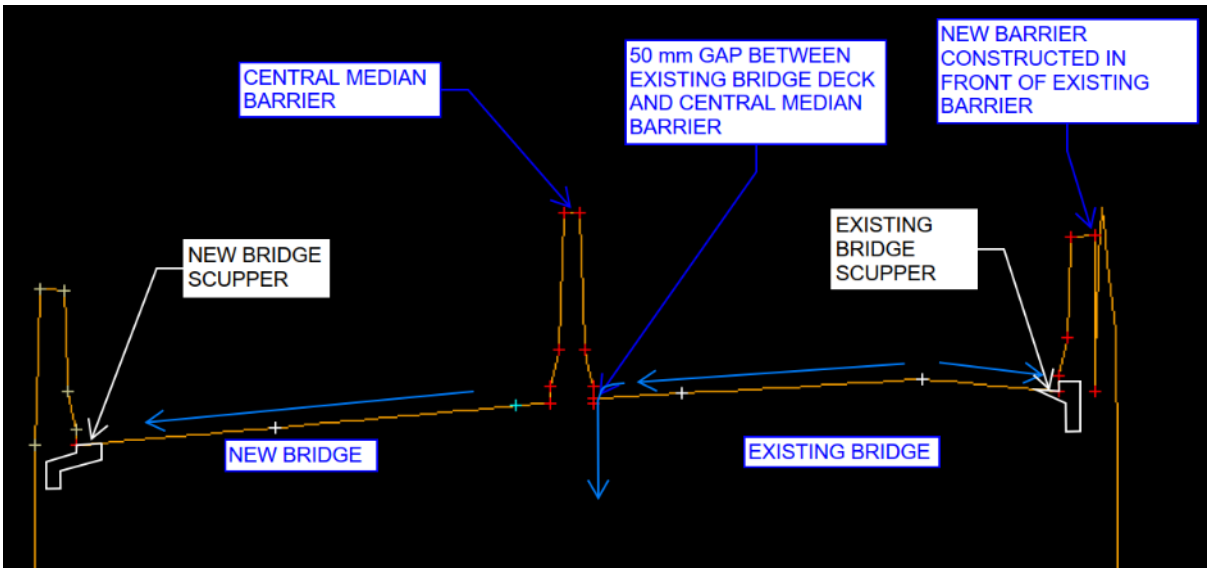


Figure 3-11 Existing and new bridge deck drainage strategy

On the northern approach, the current drainage network which takes waters flowing from the north towards the approved project boundary is insufficient to divert upstream flows. As a result, there are sheet flows towards the approved project boundary which have been known to cause water planing on the existing bridge and create a hazard to road users. To prevent this, an upgrade to a cross drainage line about 30 metres to the north of the approved project boundary would be required (refer to Figure 3-12). This proposed drainage line upgrade would divert drainage away from the proposed modification and has been included in the modified project boundary.

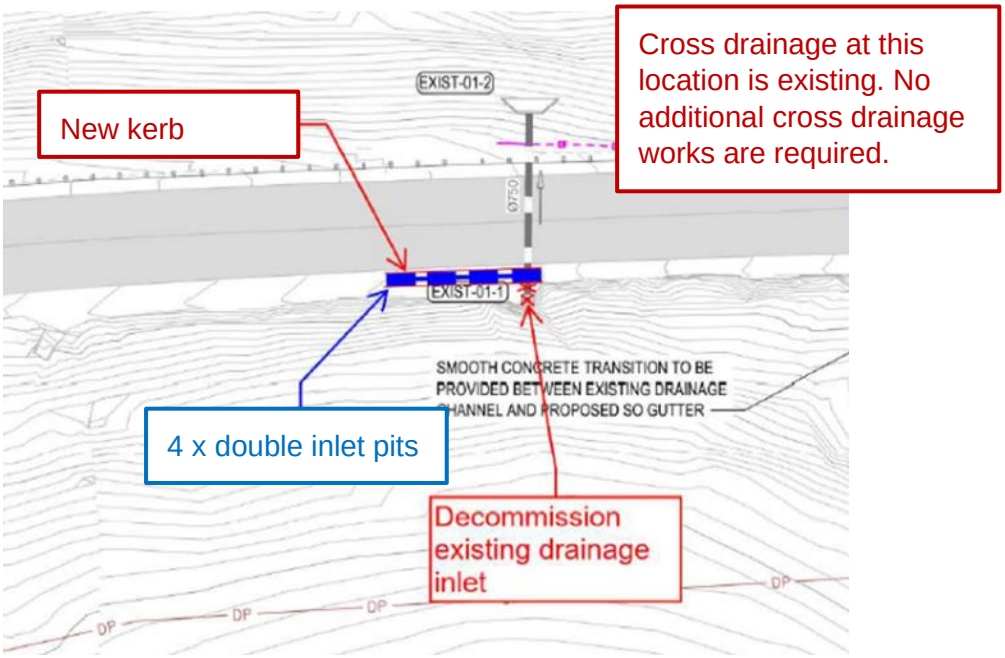


Figure 3-12 Proposed drainage line about 30 metres north of the approved REF boundary

Detailed drainage design plans are shown in Appendix A.

Additional road furniture

The design would also include additional road furniture, including:

- crash cushions on the northern and southern bridge approaches adjacent to the Type F safety barriers proposed to be installed between the northbound and southbound lanes
- a new W-BEAM safety barrier to the west of the new northbound maintenance bay.

Fauna connectivity features

The provision of fauna connectivity features is a pre-existing commitment from the project REF that remains part of the scope for the proposed modification. This includes design features for animal movement under both sides of the bridges, including fauna furniture to aid the movement of koalas who use the area as a north-south movement corridor. Transport has engaged an experienced ecologist to explore additional safety and preservation methods to continue to protect our valued koala communities. Connectivity features such as potential applications of fencing, modified abutment design, refuge poles, suitable substrate materials and complementary planting schemes are being considered as part of detailed design development.

Fauna connectivity features will continue to be refined in collaboration with the project ecologist as detailed design progresses.

3.3 Construction activities

This section summarises the likely method, work hours, plant and equipment and associated activities for construction of the proposed modification. The work method as described in this section is indicative. The construction activities and their sequencing would be finalised during the detailed design phase and described in full in the project Construction Environmental Management Plan (CEMP). Any work outside the scope of activities described in the REF or addendum REF would require additional assessments.

3.3.1 Work methodology

Construction of the proposed modification would require the following traffic stages:

1. new bridge constructed offline, with traffic on existing bridge
2. traffic switched to new bridge, enabling offline upgrades to existing bridge
3. traffic switched to outer edges of each bridge (one direction of traffic on each bridge), to allow median barrier work on both bridges
4. both bridges open to traffic in final configuration.

The expected sequencing of works and methodology for the proposed modification is provided in Table 3-3. Figure 3-13 shows the proposed work area layout including ancillary facilities. Figure 3-14 shows the access track required to construct the north-west cut.

Table 3-3 Works sequencing

Construction Activity	Associated Work
Establish ancillary facilities	Ancillary facilities are required to support construction. These are locations where the workforce would congregate and carry out support work for the proposed modification. They are required to store equipment, setup office space, provide first aid and provide meeting areas out of the weather. Key tasks include: • Setup construction compounds. • Establish ancillary facilities, including construction compounds at Heathcote and Lucas Heights.

Construction Activity	Associated Work
	• Installation of construction fencing, laydown areas and driveway access points (refer to Figure 3-13).
Site Establishment	Site establishment is the first phase of construction for the proposed modification and would enable safe working practices during later stages of construction.. Key tasks include: • Establish site access from the existing Heathcote Road through modifying existing traffic barriers. • Install traffic controls and signage. • Install project boundary fencing on the limit of works. • Undertake clearing to the required areas, remove felled vegetation from the site progressively. • Establish temporary laydown areas and access track into the Woronora River working area. • Construct crane platforms. • Setup an onsite site shed and amenities. • Setup required construction support materials including waste management and tools storage areas.
Environmental controls	Environmental controls would be used at each stage of works to prevent harm to the receiving environment, and would be detailed within work methodologies , the project CEMP documents and sub-plans (per safeguard GEN1 in the project REF). Environmental controls would be adaptive to respond to each stage of construction and weather conditions. Key tasks include: • Establish site environmental controls, including: – erosion and sediment controls – fencing and signage marking the limit of works – spill kits waste facilities – weather monitoring and environmental monitoring – containment controls.
Investigations	Investigations would be needed to inform the design team of the underlying ground conditions. These ground conditions would vary at different points across the site and the design may need to be adapted to ensure it responds to the existing conditions of the site. Key tasks include: • Undertake design investigations, services investigations, geo-tech investigations and soil sampling as required.
Traffic controls	Traffic controls would be used to manage both the through traffic of the general public on the roads but also mange construction access into and out of the site. Traffic controls would be essential to keep all road users safe and would need to be progressively updated throughout construction as part of the Traffic Management Plan (safeguard TT1 from the project REF). Key tasks include: • Establish rearranged traffic controls, barriers and line marking to facilitate safe access to the site. • Temporary signage and vehicles to stop and slow traffic.

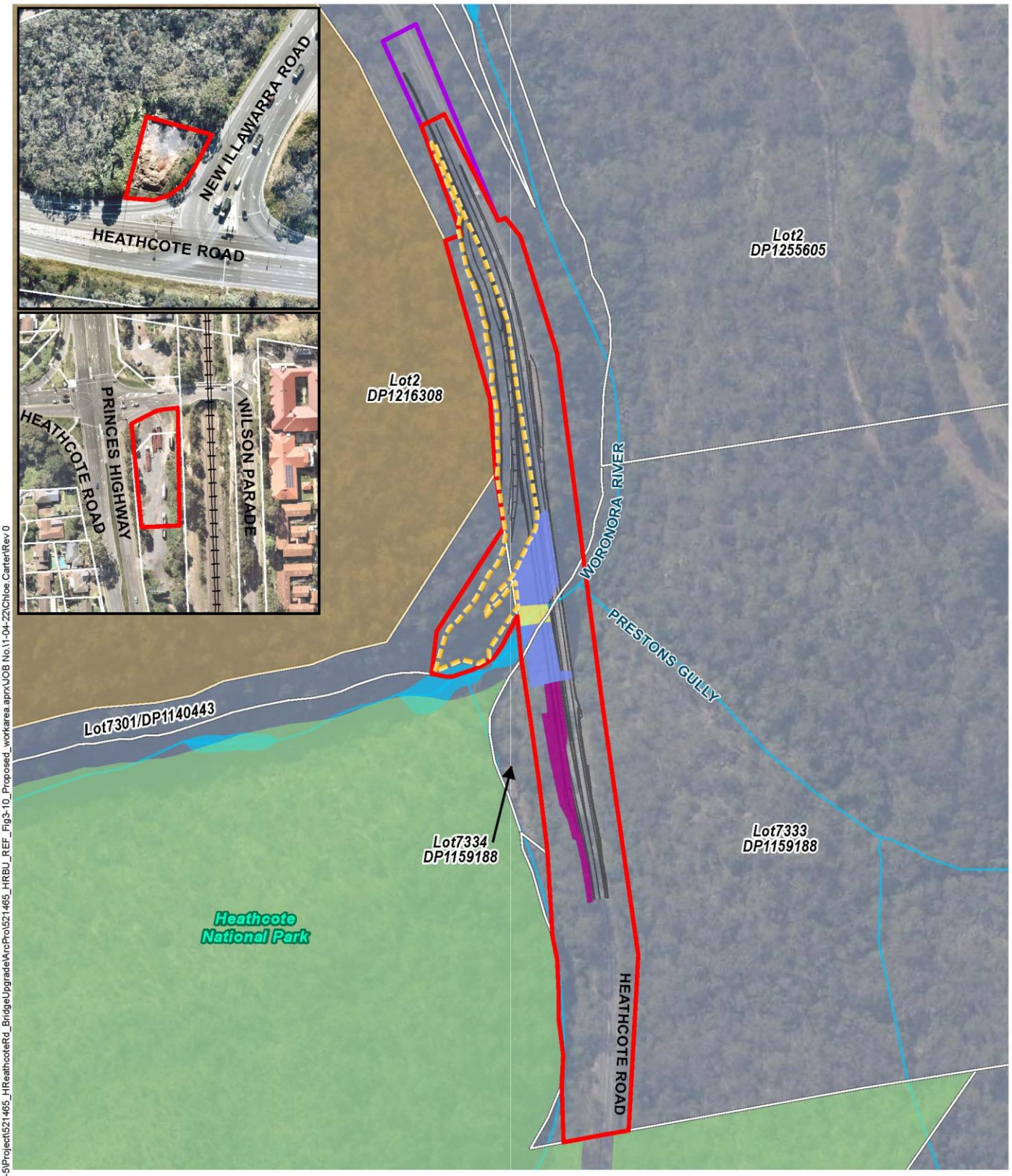
Construction Activity	Associated Work
	• Road closures and temporary work requirements.
Early construction activities – new bridge	• Utilise controlled traffic closures to enable early construction activities for the new bridge. • These works would be undertaken at night under a road occupancy licence (ROL), and include: – establishment of plant and importation of materials to form the access track and temporary piling platforms (refer to Figure 3-13) – excavation of (using various methods) the north-west section of the existing rock cutting to allow the shifted road alignment to be built – construction of the tie-ins to the existing Heathcote Road – receipt of oversize deliveries including but not limited to piling equipment.
Piling	Piling is the first phase of construction for the new bridge and involves constructing deep concrete and steel pile into bedrock to support the new structure. Piling would require a stable clean rock access pad in the Woronora River works area. This pad would need to be built out of well compacted rock. At each pile location, the rock would be removed and replaced with a sand like product so the piling rig can drill through it. The piling rig would be transported to site on oversize vehicles and would then be unloaded and assembled. The piling rig would first have a vehicle hygiene inspection to ensure it has clean tracks, a clean body and clean piling equipment to ensure no pathogens or contaminants are brought to site. Safeguard B1 has been modified in this addendum to include hygiene protocols. With the piling rig established onsite, it would slowly track into place at the piling locations. Large steel casings would be delivered to the piling rig and these would be hammered in at the pile locations. These steel casing provide a physical barrier between the excavation area inside the pile and the rest of the environment. With the casing in place, the piling rig would then bore or dig out the materials inside the casing. This material would be lifted out of the hole and the machine would slew 90 degrees and drop the spoil material into a steel bin/containment area. This bin/containment area would be removed every day so that there would be no fines or materials left in the valley floor. Boring or excavating the pile out would continue until hard rock is found at the bottom of the pile (refusal). The next stage would be to place steel cages into the pile hole. These would be tied and fixed together. A crane working on the same pad would lift the pile cages into place inside the pile. The piling rig at this stage would not be needed at the previous pile location and would move onto the next pile site and start repeating the same steps to create a new pile. The next phase of work would involve concreting around the steel cages in the pile hole. New construction plant would be required for this phase including welding equipment, concrete trucks, concrete pump and a crane. Pre-mixed concrete would be transported to site in concrete trucks. It would be tested for quality in controlled areas. Engineering specifications require a certain amount of each concrete load is wasted onto the ground for testing at an approved location away from the waterway. This waste material and concrete washout would be contained in a bunded area and regularly cleaned up. Once approved for quality, concrete would then be pumped into the pile by reversing concrete trucks into a concrete pump and discharging concrete into the pump receiving area. Concrete would then be pumped under pressure through a line to the

Construction Activity	Associated Work
	pile hole. To minimise risk of loss of concrete to the environment due to rupturing of the pressured line, the following industry standard practices would be implemented: • Review the concrete pumping equipment that comes to site to ensure it is fit for purpose, in good condition and not showing signs of fraying or wear. • Pressure test the concrete line before use. • Lay the lines in free-flowing positions and avoid angles where possible. • At joints, where there are pressure waves observed, place absorbent materials such as tires under the line to prevent the joint lying on the ground. Environmental controls for each stage of these works would be detailed in the project CEMP and sub-plan documents, or via Environmental Work Method Statements (EWMS). Note: there may water in the bottom of pile holes. If present, this water would need to be captured before going into the environment if displaced by the concrete, as it would be alkaline in nature. Specific procedures would be developed within the construction EWMS to manage wastewater treatment and disposal. Key tasks include: • Establish piling rig onsite, oversize vehicles and traffic controls. • Assemble plant. • Install environmental controls on the piling pad areas. • Install steel cases to refusal into rock. • Undertake piling activities, piling spoil removed progressively. • Received project deliveries. • Install pile cages, undertake required steel works, grinding cutting and welding. • Establish concrete pump trucks and lines onsite. • Install containment controls and pressure test lines. • Pump concrete from delivered concrete trucks, manage traffic out of hours or with road stoppages as required.
Waste removal	Waste would be generated at each stage of construction. It may come from packaging, surplus materials, construction errors or be found onsite. Waste would need to be separated into different waste streams and taken offsite for disposal. Key tasks include: • Remove construction waste and any spoil from piling and roadworks which cannot be reused onsite. • Traffic and road closures required for oversize road deliveries.
Pier construction	Pier construction is the connection from the pile to the underside of the bridge. For the new bridge, an octagonal pier has been specified to be sympathetic to the existing bridge design. Pier construction involves formwork carpentry and prefabricated forms to make the shapes of the new pier columns. To allow the forms to be built and put in place, crane and temporary working platforms would be required. These platforms would be able to support temporary mobile plant and there would also be areas of scaffolding at each pier. The form of the piers would be installed and then steel would be tied inside of the piers. This steel would be the structural support of the new bride and would be required to be welded and tied onsite. With the steel tied and in place inside the forms, the next step would be to pour concrete into the columns. Concrete would be pumped using concrete trucks and

Construction Activity	Associated Work
	concrete pumps. Concrete may be pumped across from the abutments or pumped from the existing bridge across into the pier locations. Pier construction would require temporary works such as craneage and scaffolding equivalent or less than the project REF. Controls and mitigations are considered in Section 7.2. Key tasks include: • Install temporary works required to support pier construction including scaffolding, storage and works areas. • Receive oversize deliveries required materials and tools. • Install forms and moulds for the pier. • Setup concrete pumps, concrete lines and containment for the concrete works. • Construction of piers using the temporary platforms.
Abutment construction	Abutments are the landing points of the bridge on either side of the river. The new abutments would be about eight metres wide. Both the northern and southern abutments would have an adjacent 90-degree wing wall. Abutments would be accessed from the new road alignments directly behind the abutment areas. Access from the abutments to the valley floor would be by foot only. Abutment construction would first involve excavating material out in a step down from the existing ground height. Materials would be dug free or hammered out with excavators and removed. A flat binding layer of concrete would be poured when the shape of the abutment is ready. After the concrete is poured, a form would be built around the edge of the abutment shape. This would be in filled with steel that is tied and connected to make the structural support of the abutment With the form and steel in place, concrete would then be poured into place at the abutment. Key tasks include: • Abutment construction, develop access to the site, install required traffic controls, remove existing road signage and furniture. • Carry out earthworks, remove spoil and cut the required formation for the abutment. • Install blinding concrete. • Install formwork, steel tying and steel reinforcement. • Install concrete.
North-west cutting earthworks	The north-west cutting is a steep and difficult to access environment. The access would need to be developed under traffic controls from chainage 60 at the northern end of the modified project boundary. At this point the road meets the crest of the hill and access from the road would be able to occur. The excavator and labour crews would pioneer the track by walking in and removing rock and vegetation directly in the walking line of the track. Temporary construction phase boundary fencing would be established progressively. Pioneering the track will occur from chainage 60 in the north and work south. At about chainage 130, the track would be made wider than the 3.5 metres needed for the first 100 metres. This wider section is the start of the bench and working platform area. This track is shown in Figure 3-14.

Construction Activity	Associated Work
	Crews would progressively clear and establish the track and working platform. All environmental controls will be clearly detailed on site specific documents and followed at each stage of works. With the track and bench established, minor earthworks would be needed to create a flat bench. This flat bench would become a drainage and maintenance access point over time. There are some large boulders and trees that would need to be removed. The rock cutting face would be drilled using line drilling equipment. This process is where a rock drill makes holes at the same angle and regular centres all the way along the cut face. With the cut face drilled, the next step would be to hammer away all the materials using large excavators and with hammers. Spoil would be removed progressively. Key tasks include: • Temporary construction boundary fencing installed on the edge of works at the hinge point of the access track. • Install required safety and traffic delineation controls. • Access the track from the northern end under a road closure. • Hand clearing along alignment of the track, progressively removing vegetation from the cutting as works progress. • Earthworks, cut and grade the access track (refer to Figure 3-14). Locally filling and break rock as the excavator works north to south. • Cutting track established. • Earthworks on the cutting, establish a line drilling rig, line drill the face of the cut. • Rock hammers would then break up the rock face for excavation and loading out into trucks for offsite disposal. • The majority of these works would occur during long weekend shutdowns.
Superstructure	This step is the next phase of the bridge works and would occur when the bridge deck is placed on top of the piles. The bridge deck elements would be built offsite and brought to the site on large oversize vehicles during a track shutdown. Cranes would be needed to lift the large elements into place onto the bridge. Key tasks include: • Mobilise crane to site with oversize deliveries, assemble crane onsite. • Receive bridge beams, oversize out of hours deliveries. • Landing of girders and construction of the bridge deck. • Construction of the bridge deck, setup all required form work, scaffolding and environmental controls. • Concrete pouring activities including setup of pumps and receive OOH concrete deliveries. • Bridge barrier construction including required temporary works, formwork, and concrete activities. • Expansion joint construction.
Site drainage	Drainage from the new roadway would need to be discharged at both abutments. To enable this, localised clearing of the drainage outlets would be required. An outlet would then be shaped into the ground and rock placed at the outlets of the drains to prevent scouring. Key tasks include:

Construction Activity	Associated Work
	• Drainage works required on the new road and bridge works. • Cross drainage lines, excavation, remove spoil, place bedding material, place pipes back fill. • Installation of rock scour and flow tie-in works, required installation down batters to prevent scouring. • Road drainage including sub-soils and cut off drains, remove spoil, install pipes and imported rock products for backfill. • Bridge drainage is equivalent to the existing structure with free draining scuppers from the deck of the bridge.
Pavement works	Pavement work would be built using offsite materials and placed into the road corridor. Asphalt paving would be supported using asphalt trucks and placement trucks. Key tasks include: • Pavement works on the new bridge and roadway. • Pavement works at the roadways, excavate and box out for the installation of new paving materials. • Import required paving materials. Some works would be required out of hours. • Place and compact pavements. Some works would be required out of hours.
Finishing works	• Finishing works on the new bridge. • Installation of road furniture, including signage, road fencing and new road safety features. • Prepare for the traffic switch onto the bridge. • Line marking and lighting. • Complete traffic switch onto the new alignment and bridge.
Existing bridge works	• Carry out repairs and maintenance on the existing bridge. These works will require temporary access points, scaffolding, elevated work platforms and crane lifts. • Existing bridge works would include: – guard rail works – temporary Concrete barriers – repair cracking and concrete spalling – replace as needed expansion joints and bearings. • Anti-carbonation coatings to bridge surfaces and piers.
Restoration works	• Removal of temporary environmental controls and ancillary facilities. • Removal of all construction fencing and signage. • Remove all waste bins and waste materials. • Landscaping and rehabilitation works. • Removal of the crane pads from the river area. • Removal of the temporary waterway crossing. • Rehabilitation and installation of fauna furniture in the river area.



Approved project boundary
Modified project boundary
Proposed modification design
Temporary access track
Temporary rock platform
Temporary waterway crossing
Widening of southern approach
Holsworthy Barracks - Defence controlled area
National park
Lot
Watercourses
Water bodies

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Source: Aurecon, TfNSW, Spatial Services, Esri

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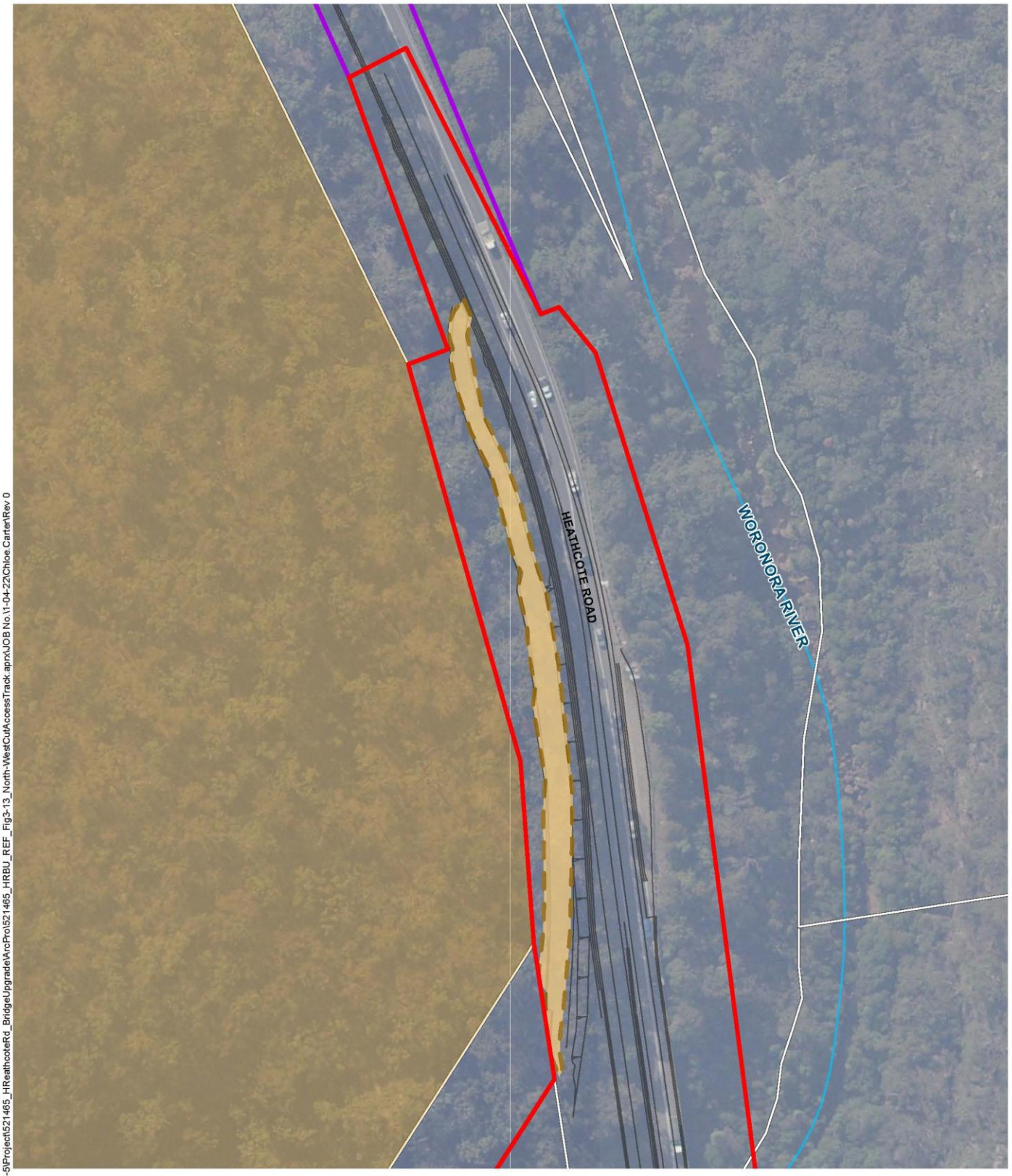
Projection: GDA 1994 MGA Zone 56

Heathcote Road Bridge **Addendum REF**

FIGURE 3-13: Proposed work area layout including ancillary facilities



Approved project boundary
Modified project boundary
Proposed modification design
North-west cut access track
Holsworthy Barracks - Defence controlled area
National park
Lot
Watercourses
Water bodies

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Heathcote Road Bridge **Addendum REF**

Projection: GDA 1994 MGA Zone 56

FIGURE 3-14: North-west cut access track

3.3.2 Construction workforce

The construction workforce is consistent with the description in the project REF.

3.3.3 Construction hours and duration

It is anticipated that construction would start in mid-2022 and take up to two years to complete, subject to weather.

Construction out of hours is required and would involve weekend shutdowns with works occurring over 60-hour continuous blocks during weekend shutdowns. Each weekend shutdown would generally commence at 9pm on Friday and continue through to 5am on Monday. There would also be a number of weeknight works required after the period of weekend shutdowns is complete.

Construction would generally otherwise be in compliance with the requirements of standard construction working hours as defined by the *Interim Construction Noise Guideline* (DECC, 2009):

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- Sundays and public holidays: no work.

However, to minimise the impact of construction on road users, the majority of works are proposed as night work and weekend work. Construction activities which would be undertaken outside standard construction hours include:

- rock cutting and excavation
- girder delivery and placement
- concrete pours
- bridge construction work near live traffic
- completion of asphalt and tie in works.

As a result of these out of hours works, the proposed modification would reduce the duration of full road closure of the section of Heathcote Road between New Illawarra Road and the Princes Highway and the associated traffic disruption to road users described in the project REF and submissions report (refer also to Section 3.3.7). There would be a reduction of about 50 per cent in out of hours works compared to the project REF.

It is anticipated that there would be about 67 weeknight closures and about 12 weekend full road closures of Heathcote Road during construction of the proposed modification. During these periods, construction may occur up to 24 hours per day between 9pm on Friday and 5am on Monday. There would be a respite period from Monday until the following Friday night for these works. Work would be required on consecutive weekends for the earthworks to minimise the length of the construction program.

3.3.4 Plant and equipment

Plant and equipment would be generally consistent with the description provided in Section 3.3.4 of the project REF.

In addition, the equipment outlined in Table 3-4 is specific to the listed construction activities.

Table 3-4 Indicative plant and equipment for the proposed modification

Construction activity	Plant/equipment
New bridge substructure	• Chain saws and hand tools • Small and large excavators • Small and large trucks • Concreting equipment including trucks and concrete pumps • Vibration rollers • Generators and lighting towers • Traffic control equipment and signage • Elevated work platforms • Pumps • Frana cranes • Mobile crane • Large piling rig • Water carts
Bridge construction	• Small hand-held tools • Excavators (up to 36 tonnes) including a long reach excavator with rock hammer attachment and an excavator with a pile boring attachment • Tipper truck • Hiab truck crane • Concreting equipment including trucks and concrete pumps • Large cranes including franna crane • Prime mover and jinker trailer • Rollers • Hydrodemolition equipment • Elevated work platforms and tele handler • Water carts
Rock cutting works	• Drill rig (sized to suit the access and noise restrictions) • Excavators (up to 36 tonnes) including a long reach excavator with rock hammer attachment • Concreting equipment including trucks and concrete pumps • Trucks
Finishing works	• Asphalt plant and machinery • Franna crane • Large and small excavators • Large and small trucks • Elevated work platform • Road line marking trucks • Hand tools and small trucks for landscaping works • Water carts

Final equipment would be outlined within the CEMP.

3.3.5 Earthworks

The modification shifts the road alignment to the west. This changes the balance of earthworks compared to the project REF. On the northern approach, the shifting of the alignment to the west as part of the

proposed modification would increase the quantity of earthworks required along the north-west cut. As outlined in Section 3.2.3, the increased cut would now be about 150 metres long in total and vary in extent, up to a maximum of about nine metres at the southern end. The proposed modification would also reduce the quantity of earthworks required along the north-east embankment. The previous 250 metre length piling wall would no longer be required.

On the southern approach, the alignment shift to the west would substantially reduce the scale of rock cutting works required on the south-east cutting. On the south-west embankment, additional earthworks are required though the increase is not substantial. This is because the approach has been aligned over the existing breakdown bay area therefore the location of the approach is similar to the approved project. The proposed modification increases the length of the pavement approach works by about 25 metres from the south and about 50 metres from the north.

Overall, the proposed modification is expected to generate around an additional 6,000 cubic metres of excavated material (spoil) compared to the project REF, as indicated in Table 3-5It should be noted that initial earthworks estimations for the project REF were very conservative, but have been maintained in the revised quantity to provide flexibility in the north-west rock cutting. Most of the rock and excavated material is expected to be classified as excavated natural material (ENM) or virgin ENM (VENM) which would meet standards required for engineering fill or in earthworks under the NSW Resource Recovery Framework. While limited amounts of this material would be able to be reused on-site for the new road pavement where possible, the proposed modification would recycle as much excavated material onsite as possible, including scour protection and piling and crane platforms.

Table 3-5 Indicative earthworks spoil generation

Item	Original quantity	Revised quantity
Rock cutting	2000 cubic metres	3100 cubic metres
Roadworks and drainage	2942 cubic metres	8272 cubic metres
Pavement milling	143 cubic metres	129 cubic metres
Retaining wall piling	445 cubic metres	N/A
Total	5530 cubic metres	11,501 cubic metres

The above volumes do not trigger the need for the project to have an ‘Environmental Protection Licence’ from the NSW EPA.

Excavated materials would be managed and stored (stockpiled) in accordance with the mitigation measures outlined in the project REF, the submissions report and this addendum REF, and subject to testing and classification in accordance with the *Waste Classification Guidelines* (EPA, 2014) prior to any offsite disposal.

3.3.6 Source and quantity of materials

The type and indicative quantities of resources and materials needed to build the proposed modification are outlined in Table 3-6.

Table 3-6 Indicative earthworks volumes

Item	Original quantity	Revised quantity
Natural material (earthworks and imported material)	2850 cubic metres	10,000 cubic metres
Steel for bridge components	500 tonnes	170 tonnes
Concrete for bridge elements	810 cubic metres	1130 cubic metres
Prefabricated drainage pipes	60 metres	240 metres
Rock for scour protection	50 tonnes	250 tonnes
Pavement base and sub-base materials	450 tonnes	1760 tonnes
Heavy duty asphalt	890 tonnes	2240 tonnes

Water required for construction would be sourced from local Sydney Water supply points and transported to site. The environmental flows in the Woronora River would not be affected by the proposed modification and there would be no construction water sourced from local waterways. All water for the project will come from the Sydney Water network.

3.3.7 Traffic management and access

Construction traffic access routes to the modified project boundary would be consistent with the description provided in Section 3.3.7 of the project REF. Construction traffic access would typically access the bridge construction site via New Illawarra Road to the north and the Princes Highway to the south. Construction workers would still generally be transported to and from the site via a shuttle bus due to the lack of parking and constrained access. The number of vehicle movements would broadly be consistent with the project REF, being about 24 heavy vehicle and 40 light vehicle movements to and from the site each day, during peak construction. There would be an increase in vehicle kilometres travelled (VKT) due to haulage of the increased spoil quantity required for the proposed modification compared to the approved design.

The proposed modification would allow the new bridge to be constructed mostly offline, allowing traffic to continue to use the existing Heathcote Road bridge with substantially less traffic network disruption by comparison.

However, some construction work would require temporary road closure of the section of Heathcote Road between New Illawarra Road and the Princes Highway on an as needed basis. This is due to the limited space within the existing road corridor to safely carry out construction work and the complexity of construction activities required. Temporary road closure and traffic control arrangements at night are anticipated to be required for the following construction work:

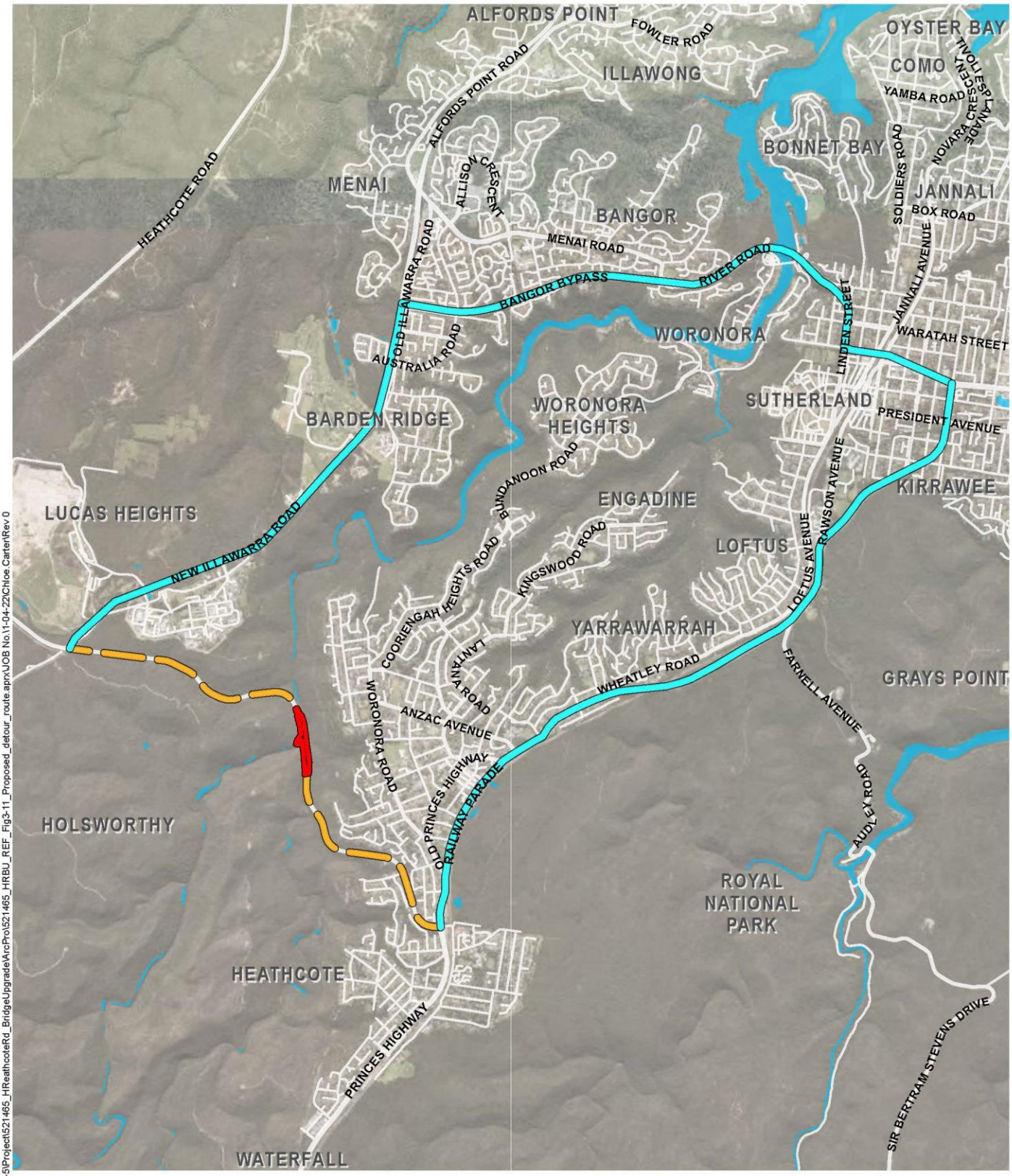
- design investigation and early work, including surveys, geotechnical investigations, establishment of site access, delivery of plant and importation of materials
- excavation and stabilisation of northern rock cutting
- landing of girders for the new bridge

- construction of the tie-in to the existing Heathcote Road
- establishment, adjustment and removal of temporary traffic barriers during construction.

It is anticipated that there would be about 67 weeknight closures and about 12 weekend shutdowns during construction of the proposed modification, which would require temporary full road closures of this section of Heathcote Road. During these periods, construction may occur up to 24 hours per day between Friday night and Monday morning. This is substantially reduced from a complete road closure (24 hours per day, 7 days per week) for about six months for the approved project, because more construction work can be completed during standard construction working hours with no traffic control measures required (other than a gawk screen) under the proposed modification. However, the majority of works are still proposed as night work and weekend work and this will be completed under either contra flow arrangements or short-term dual carriageway closures.

The temporary road closures would take place with approval from the Customer Journey Centre under the terms of a road occupancy licence. Consultation activities would also be carried out to inform the community in advance of the full road closure including updates of its expected start and end date. During the temporary road closures, traffic would be diverted to an alternative route that would be about 20 kilometres longer than the existing route via Heathcote Road. This alternative route would use New Illawarra Road, Bangor Bypass, River Road, Linden Street, The Grand Parade and the Princes Highway (refer to Figure 3-15). The potential traffic and transport impacts of this detour are discussed in Section 6.1.3. A concurrent and complementary program of works will be constructed at Linden Street in the Sutherland Shire. This road is part of the proposed detour route and would be upgraded to reduce traffic impacts on this community over the long term.

Once the new bridge is constructed, both lanes of traffic would operate on the new bridge while the upgrades to the existing bridge are carried out. Once all work is completed, the proposed modification would be opened to traffic as described in Section 3.2.3.



Existing route via Heathcote Road

Proposed detour route

Approved project boundary and Modified project boundary

\\aurecon.info\Shares\AUSYD\Projects\GIS\Project-5\Project\521465_HReathcoteRd_BridgeUpgradeArcPro\521465_HRBU_REF_Fig3-11_Proposed_detour_route.aprx\JOB No.\1-04-22\Chloe Carter\Rev 0

Source: Aurecon, TfNSW, Spatial Services, Esri Topo, Nearmap

1:54,500 @ A4

0 500 1,000 m

Projection: GDA 1994 MGA Zone 56

Heathcote Road Bridge **Addendum REF**

FIGURE 3-15: Proposed detour route during the full road closure of Heathcote Road

3.4 Ancillary facilities

Ancillary facilities would be generally consistent with Section 3.4 of the project REF, except as described in Section 3.4.1.

3.4.1 Temporary access track, laydown area and waterway crossing

The temporary access track described in Section 3.4.2 of the project REF would be extended to enable construction of the proposed modification. The track would be extended about 220 metres in length and widened about four metres to allow for access to the north-west cut (refer Figure 3-14). This is to accommodate the new carriageway at the north-west cut and provide a safe and efficient construction methodology, utilising weekend closures to remove rock from above (otherwise) live traffic lanes. This access track would be maintained as a bench for maintenance access during operation (refer to Section 3.2.3).

The temporary waterway crossing, piling and crane platforms and the steel pipes would be generally consistent with the project REF. The temporary work areas in the valley floor would have a larger work area on the western side of the existing bridge. However, the platform overtopping height would be lowered which would reduce the cross-sectional area of the platform and not extend as far downstream as proposed in the project REF, reducing impacts on aquatic habitats and flow regimes. The temporary pipes may be also be resized to optimise the platform design, while still permitting fish passage and conveying environmental low flows. These refinements may reduce the predicted impacts to the Coastal Freshwater Wetland area and reduce temporary impacts to upstream flood levels and inundation times compared to the project REF.

As part of the refinements for the proposed modification and in response to updated hydraulic and flood modelling (refer to Section 6.5), it is proposed to provide rock scour protection over the full scale of the crane pad (the top and the upstream batter would also be protected in addition to that described for the project REF).

3.5 Public utility adjustment

The proposed modification would not require public utility adjustment as the pile arrangement for the new bridge has been optimised to avoid impacts to the existing AARNet fibre optic cable (refer to Figure 3-16).

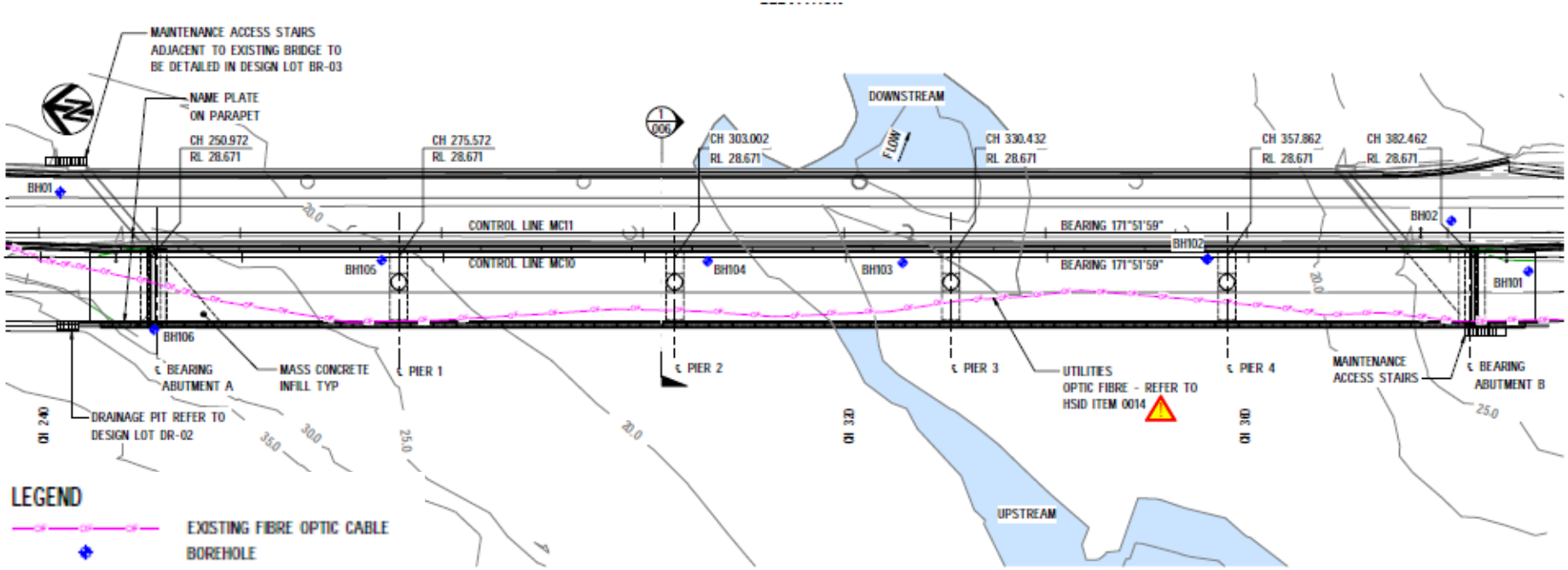


Figure 3-16 Alignment of existing fibre optic cable and bridge piers

3.6 Property acquisition

Additional property acquisition is not required for the proposed modification as the design has been optimised to so that most work would occur within the approved project boundary from the project REF.

The additional area (about 1565 square metres) included in the modified project boundary to the north of the approved project boundary required for new drainage upgrades occurs on Crown land. This land would be leased and no acquisition would be required due to the northern extension to the approved project boundary (which is included within the modified project boundary).

4 Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

In March 2022, the State Environmental Planning Policies (SEPPs) were updated. The former State Environmental Planning Policy (Infrastructure) was incorporated into the State Environmental Planning Policy (Transport and Infrastructure) 2021. Chapter two of the SEPP (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State.

Section 2.108 of the Transport and Infrastructure SEPP 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 proposed modification is for a road and a vehicle bridge and is to be carried out by Transport, it can be assessed under Division 5.1 of the EP&A Act. Development consent from council is not required.

The proposed modification is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not require development consent or approval under State Environmental Planning Policy (Resilience and Hazards) 2021, State Environmental Planning Policy (Planning Systems) 2021, or State Environmental Planning Policy (Central River City) 2021.

Part 2.2 of the Transport and Infrastructure SEPP 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 the Transport and Infrastructure SEPP (where applicable), is discussed in chapter 5 of this addendum REF.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

With the March 2022 updates to the SEPPs, the former Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment was incorporated into the State Environmental Planning Policy (Biodiversity and Conservation) 2021.

Chapter 11 of the State Environmental Planning Policy (Biodiversity and Conservation) 2021 applies to land within the Georges River Catchment and provides a series of general and specific planning principles and requirements to establish a consistent and coordinated approach to environmental planning and assessment and protect the environmental quality within the Georges River catchment.

In accordance with Part 11.2, Section 11.5(b) of the SEPP, Transport is required to take the planning principles specified in Section 11.7 of this Plan into account as the proposed modification is located within the Georges River catchment and is development without consent that may have the potential to adversely affect the water quality, river flows, floor regime or ecosystems within the Catchment.

Table 4-1 outlines how the principles from Section 11.7 of the SEPP have been considered and addressed in this addendum REF.

Table 4-1 Consideration of the Georges River Catchment planning principles

Georges River planning principle	Where considered or addressed
General planning principles	
a) the aims, objectives and planning principles of this Chapter;	As detailed in the following sections of this table, the aims, objectives and planning principles of the SEPP are considered throughout the addendum REF.
b) the likely effect of the proposed plan, development or activity on adjacent or downstream local government areas;	Chapter 6 (Environmental assessment) examines the potential impacts of the proposed modification on the environment in the immediate vicinity of the proposed modification, as well as downstream where possible. This is in addition to the environmental assessment carried out in Chapter 6 of the project REF. Safeguards and management measures have been identified to avoid, minimise or mitigate potential impacts on all receivers, where relevant (refer to Section 7.2).
c) the cumulative impact of the proposed development or activity on the Georges River or its tributaries,	Sections 6.4 and 6.5 outline the potential impacts of the proposed modification on water quality and hydrology, with a focus on the Woronora River, which is a major tributary of the Georges River. The assessment considered the impacts of the existing development and any additional cumulative impact of the proposed modification.
d) any relevant plans of management including any River and Water Management Plans approved by the Minister for Environment and the Minister for Land and Water Conservation and best practice guidelines approved by the Department of Urban Affairs and Planning (all of which are available from the respective offices of those Departments);	The plans of management considered include but are not limited to: • NSW Metropolitan Water Plan • Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (2011) • Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources (2011) Relevant legislation and guidelines are further outlined in Section 6.4.2 of the project REF.
e) the *Georges River Catchment Regional Planning Strategy* (prepared by, and available from the offices of, the Department of Urban Affairs and Planning);	The NSW Office of Water and the NSW Office of Environment and Heritage (OEH) Water Quality Objectives (WQOs) and the River Flow Objectives (RFOs) for the Georges River catchment supersede the Georges River Catchment Strategy (which is an old document). The specific WQOs and the RFOs are considered within Section 6.4 of the project REF.

Georges River planning principle	Where considered or addressed
f) all relevant State Government policies, manuals and guidelines of which the council, consent authority, public authority or person has notice; and	The assessment of water quality impacts has been based on: • NSW Water Quality and River Flow Objectives • NSW State Groundwater Policy Framework • NSW Aquifer Interference Policy • NSW Metropolitan Water Plan In addition, this Chapter outlines the relevant NSW State Government regulations applicable to the proposed modification including state environmental planning policies and other legislation. Relevant legislation and guidelines are further outlined in Section 6.4.2 of the project REF.
g) whether there are any feasible alternatives to the development or other proposal concerned.	Section 2.3 discusses the alternatives identified for the proposed modification and Section 2.4 justifies the preferred option.
Specific planning principles	
(1) Acid sulfate soils **Disturbance of acid sulfate soil areas is to be avoided or minimised and those areas are to be protected in accordance with the requirements set out in the *Acid Sulfate Soils Assessment and Management Guidelines* prepared by the Acid Sulfate Soils Management Advisory Committee. Measures to minimise that disturbance are to take into account the following—** **(a) verification of the existence, locations and extent of acid sulfate soils,** **(b) the capacity of land to sustain the proposed land uses, having regard to—** **(i) potential impacts on surface and groundwater quality and quantity, and** **(ii) potential impacts on ecosystems and on biodiversity, and** **(iii) potential impacts on agricultural, fisheries and aquaculture productivity, and** **(iv) any likely engineering constraints and impacts on infrastructure, and** **(v) cumulative environmental impacts.**	A review of the acid sulfate soil (ASS) mapping on the Australian Soil Resource Information System (ASRIS) identified that there is an extremely low probability of encountering ASS within the modified project boundary (CSIRO, 2014). As such, it is unlikely that ASS would be disturbed during construction or operation of the proposed modification.

Georges River planning principle	Where considered or addressed
(2) Bank disturbance **Disturbance of the bank or foreshore along the Georges River and its tributaries is to be avoided and those areas and any adjoining open space or vegetated buffer area must be protected from degradation.**	The construction methodology and materials for the temporary access track, waterway crossing and crane pads would be subject to design input from a soil conservation specialist and approved construction work method statements. Appropriate erosion and sediment control including progressive stabilisation plans and severe weather event plans would be implemented to mitigate risk of bank disturbance during construction. Disturbed areas would be restored on completion and design features including new pier protection, formalised drainage outlets with scour protection, and new bridge aprons would assist to alleviate risk of bank disturbance during operation. The final safeguards and mitigation measures to be implemented during construction to minimise bank disturbance would be outlined in the Soil and Water Management Plan as part of the CEMP.
(3) Flooding **The following are to be recognised—** **(a) the benefits of periodic flooding to wetland and other riverine ecosystems,** **(b) the pollution hazard posed by development on flood liable land in the event of a flood,** **(c) the cumulative environmental effect of development on the behaviour of flood water and the importance of not filling flood prone land.**	The proposed modification is generally located outside the one per cent annual exceedance probability (AEP) flood zone and does not extend into flood prone land with the exception of the temporary access track, waterway crossing and crane pad located under the bridge (refer to Section 3.3.1). As discussed in Section 6.5.3, potential impacts on flooding may result during construction from the temporary waterway crossing and crane pads that would be installed within the waterway. These potential impacts would be minimised by designing the waterway crossing to include appropriate pipe outlets to maintain flow, scour protection and flood immunity. However, impacts on flooding during operation of the proposed modification would be minimal as the new bridge elements and widened approaches would generally be located above flood prone land.
(4) Industrial discharges **The discharging of industrial waste into the Georges River or its tributaries must be avoided and the requirements of the relevant consent authority and licensing authority must be met in those instances where industrial discharges into the river and its tributaries occur.**	The proposed modification would not involve any discharging of industrial waste into the Georges River or its tributaries.
(5) Land degradation **Land degradation processes, such as—** **(a) erosion,**	Potential land degradation and contamination impacts as a result of the proposed modification are discussed in Sections 6.3.3 and 6.4.3. Where potential impacts have been identified, safeguards and mitigation measures have been

Georges River planning principle	Where considered or addressed
(b) sedimentation, **(c) deterioration of soil structure,** **(d) significant loss of native vegetation,** **(e) pollution of ground or surface water,** **(f) soil salinity and acidity, and** **(g) adverse effects on habitats and sensitive natural environments (aquatic and terrestrial) within the Catchment,** **(h) must be avoided where possible, and minimised where avoidance is not possible.**	proposed, as outlined in Sections 6.3.4 and 6.4.4, to avoid or minimise these impacts.
(6) On-site sewage management **The potential adverse environmental and health impact associated with effluent disposal is to be recognised and guarded against by meeting the criteria set out in the *Environment Health Protection Guidelines: On-site Sewage Management for single households* and the provisions of the *Local Government (Approvals) Regulation 1993*.**	The proposed modification would not involve any on-site sewage management.
(7) River-related uses **Uses located on immediate foreshore land on the Georges River and its tributaries must be water-related and public access to the foreshore of the river and its tributaries must be provided in order to enhance the environment of the Catchment.**	The proposed modification would not change the existing use of the land for the Heathcote Road bridge. The new pier locations would be placed in line with existing piers to minimise impacts to the river. No additional land uses would be permanently established on foreshore land as a result of the proposed modification.
(8) Sewer overflows **The adverse impact of sewer overflows, including exfiltration, on the environment within the Catchment, and specifically on the water quality of the river and its tributaries, is to be recognised and that issue is to be addressed through appropriate planning and management of development within the Catchment.**	The proposed modification would not involve development of or adjustment to sewage infrastructure.
(9) Urban/stormwater runoff **The impacts of stormwater runoff, including sewage contaminated runoff into or near streams within the Catchment, is to be minimised and mitigation measures that address urban stormwater runoff are to be implemented in accordance with the local council**	Potential impacts associated with stormwater runoff during construction and operation of the proposed modification are discussed in Section 6.4.3. To minimise the potential impacts, safeguards and management measures would be implemented, including implementation of a Soil and Water Management Plan, site specific Erosion

Georges River planning principle	Where considered or addressed
requirements and the Managing Urban Stormwater series of documents. **Development is also to be in accordance with the *NSW State Rivers and Estuaries Policy* available from offices of the Department of Urban Affairs and Planning. Stormwater management must be integrated so that quality, quantity and land use aspects are all encompassed.**	and Sediment Control Plans and incorporation of water sensitive urban design (WSUD) measures.
(10) Urban development areas **The environment within the Catchment is to be protected by ensuring that new or expanding urban development areas are developed in accordance with the Urban Development Program and the Metropolitan Strategy and that the requirements of the *NSW Floodplain Development Policy and Manual* (prepared by and available from the Department of Land and Water Conservation) are also satisfied. It is important to ensure that the level of nutrients entering the waterways and creeks is not increased by the development.**	The proposed modification would not involve the establishment of new or expanding urban development areas or increase the level of nutrients likely to enter the surrounding waterways.
(11) Vegetated buffer areas **Appropriate buffer widths (as identified in item 21 relating to Development in Vegetated Buffer Areas in the Planning Control Table in Part 3) must be retained as a means of improving surface runoff entering into the Georges River or its tributaries.**	The potential impacts of the proposed modification on vegetation is discussed in Section 6.3. The proposed modification would not notably reduce the existing vegetated buffer widths along the Woronora River, which is a tributary of the Georges River, with no change compared to the project REF.
(12) Water quality and river flows **Water quality and river flows within the Catchment are to be improved through the implementation of environmental objectives for water quality and river flows agreed between the Minister for Environment and the Minister for Land and Water Conservation and by the application of consistent decisions affecting the use and management of land.**	As detailed in previous rows, water quality would be protected through a variety of strategies associated with stormwater management, as well as responsible construction and operation practices (e.g. to avoid or minimise erosion and sedimentation or other forms of contamination). The environmental values and water quality guidelines specific to the Georges River, which have been used for the basis of the assessment of water quality impacts, are identified in Section 6.4.3 of the project REF.
(13) Wetlands **Wetlands must be protected through the application of consistent land use and management decisions that take into account the potential impact of surrounding land uses, incorporate**	The proposed modification does not involve any impact on wetlands.

Georges River planning principle	Where considered or addressed
measures to mitigate adverse effects and are in accordance with the *NSW Wetlands Management Policy* (prepared by and available from the Department of Land and Water Conservation). Wetlands must also be protected by requiring adequate provisions where clearing, construction of a levee, draining or landscaping is to be undertaken.	

4.1.2 Local Environmental Plans

Sutherland Shire Local Environmental Plan 2015

The proposed modification is located within the Sutherland Shire Local Government Area (LGA). Local development control and land use zoning within the Sutherland Shire LGA is managed under the *Sutherland Shire Local Environmental Plan 2015* (Sutherland Shire LEP). The operation of the Transport and Infrastructure SEPP means that the Sutherland Shire LEP does not apply where they impose controls that are inconsistent with the Transport and Infrastructure SEPP. However, the LEP is still relevant in identifying land use objectives, potential land use impacts and planning policy conflicts and as such, has still been considered.

The proposed modification is located within land zoned as SP2: Infrastructure under the Sutherland Shire LEP. The proposed modification is consistent with the objectives of this zone, which are to provide for infrastructure and related uses as well as to prevent development that is not compatible with or that may detract from the provision of infrastructure, as it is associated with road and bridge infrastructure.

On 1 December 2021 the NSW Government renamed ‘Environmental Protection Zones’ as ‘Conservation Zones’ under clause 2.1 of Standard Instrument—Principal Local Environmental Plan (2006 EPI 155a). This is an administrative change of name only, with no impact to planning requirements compared to the project REF. This related to land now zoned as ‘C1 – National Parks and Nature Reserves’ and ‘C2 – Environmental Conservation’ which was previously zoned as ‘E1 – National Parks and Nature Reserves’ and ‘E2 – Environmental Conservation’ within the approved project boundary (refer to Section 6.8.2 of the project REF).

4.2 Other relevant NSW legislation

4.2.1 Roads Act 1993

The *Roads Act 1993* establishes that consent is required from the relevant road authority for the carrying out of work in, on or over a public road. A road occupancy licence would be obtained from the Customer Journey Centre under Section 138 of the *Roads Act 1993* to build the proposed modification as it would impact the operation of Heathcote Road, which is a classified road managed by Transport.

4.2.2 Crown Lands Management Act 2016 and Crown Land Legislation Amendment Act 2017

The *Crown Lands Management Act 2016* and *Crown Land Legislation Amendment Act 2017* set out the requirements for ownership, use and management of Crown Land. They describe the permissions and authorisation needed when planning the development of activities on Crown Land. They also include provisions relating to specific controls and restrictions on the development of Crown Land for Division 5.1 activities. The Crown Lands Management Act 2016 also describes the process for the acquisition of Crown Land.

Consistent with the approved project, most of the proposed modification is located within Crown Land. As such, Transport would need to secure the required lease and/or land acquisition in accordance with these Acts before starting work and for ongoing ownership of the road corridor during operation.

4.2.3 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) is designed to protect both known heritage items (such as standing structures) and items that may not be immediately obvious (such as potential archaeological remains or 'relics'). Different parts of the Heritage Act deal with different situations and types of heritage and the Act provides a number of mechanisms by which items and places of heritage significance may be protected.

Section 57(1) of the Heritage Act lists the types of activities/works that require approval from Heritage NSW (a branch of the NSW Department of Premier and Cabinet) under Section 60 of the Heritage Act, when working on/in an item/place listed on the State Heritage Register (SHR). An application for an exemption can also be made under some circumstances. There are no items or conservation areas listed on the SHR within the modified project boundary, therefore no approvals under Section 60 of the Heritage Act would be required.

Section 139 of the Heritage Act protects archaeological 'relics' from being 'exposed, moved, damaged or destroyed' by the disturbance or excavation of land. This protection extends to the situation where a person has 'reasonable cause to suspect' that archaeological remains may be affected by the disturbance or excavation of the land. This section applies to all land in NSW that is not included on the SHR. Mitigation measures would be implemented to prevent harm to archaeological relics including implementation of the Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015), which would be followed in the event that any potential relics are encountered during construction of the proposed modification (refer to Section 6.7.4).

Section 170 of the Heritage Act requires that culturally significant items or places managed or owned by Government agencies are listed on a departmental Heritage and Conservation Register.

Section 170A(1) requires that, if a government instrumentality intends to undertake any of the following actions regarding items listed on their s170 Heritage and Conservation Register, it must give the Heritage Council a minimum of 14 days' notice:

- remove an item from the s170 register
- transfer ownership
- cease to occupy an item currently on the s170 register
- demolish an item.

The Heathcote Road bridge is listed on the Roads and Maritime Services s170 Heritage and Conservation Register as 'Woronora River Bridge, RTA Bridge No. 152'. Transport carried out consultation with Heritage NSW regarding potential impacts to the bridge structure during development of the project REF. A briefing was carried out with Heritage NSW during development of the proposed modification with regard to the reduced impacts and ability for the bridge to be progressed for nomination for SHR listing in an even better state due to the proposed modification.

4.2.4 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) aims to reduce pollution and manage the storage, treatment and disposal of waste within NSW. The POEO Act also introduces the requirement for environmental protection licences (EPLs) to be obtained for scheduled activities that are of a nature and scale that have a potential to cause environmental pollution.

The proposed modification involves rock cutting and earthworks. The volumes are outlined in Table 3-5 and Table 3-6. The volumes for the proposed modification would not exceed the trigger for extraction or processing of over 150,000 tonnes of material during construction and would not result in the existence of four or more traffic lanes for a continuous length of three kilometres, therefore an EPL is not required.

4.2.5 National Parks and Wildlife Act 1974

The National Parks and Wildlife Act 1974 (NPW Act) provides for the control and management of all national parks, historic sites, nature reserves, wetlands and other state reserves. The proposed modification is not located within land reserved under the NPW Act, however is located next to Heathcote National Park. Safeguards and management measures would be implemented (refer to Section 7.2) to prevent any direct or indirect impacts on Heathcote National Park as a result of the proposed modification.

The NPW Act also provides for the protection of 'Aboriginal objects' and 'Aboriginal places' and makes it an offence to harm Aboriginal objects, places or sites without permission.

The Heathcote Road Bridge over Woronora River, Safety Improvement Works – Aboriginal Archaeological Survey Report Stage 2 PACHCI prepared for the project REF identified one known Aboriginal site to be located within the modified project boundary (refer to Section 6.6.1). The proposed modification design does not impact on this site. Safeguards and mitigation measures would be implemented to ensure this site would be avoided during construction and operation of the proposed modification. Therefore, an Aboriginal heritage impact permit under Part 6 of this Act would not be required.

An unexpected finds procedure and other appropriate safeguards would also be implemented to address circumstances if an unexpected find occurs to prevent any damage to any Aboriginal objects, places or sites due to the proposed modification.

4.2.6 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) is directed at conserving threatened species, populations and ecological communities of animals and plants. The BC Act outlines the framework for addressing impacts on biodiversity from development and clearing. It

establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme.

A biodiversity assessment report (BAR) was prepared for the project REF in accordance with the requirements of the Biodiversity Assessment Methodology (BAM) under the BC Act. This BAR was reviewed, and a technical memorandum prepared to consider the impacts of the proposed modification on biodiversity, compared with the approved project. As part of the BAR, significant impact assessments, in accordance with the BC Act, were carried out for threatened species and endangered ecological communities with a moderate to high likelihood of occurrence within the modified project boundary and considered likely to be impacted upon. The technical memorandum has determined that there is no additional impact to these threatened species and endangered ecological communities by the proposed modification, compared to the project REF. In fact, the memorandum has identified a reduced impact on endangered ecological communities vegetation, due to the new design alignment. These assessments concluded that the proposed modification is unlikely to have a significant impact on threatened species (refer to Section 6.3.3).

4.2.7 Water Management Act 2000 and Water Act 1912

The *Water Management Act 2000* (WM Act) provides for the sustainable and integrated management of water resources. Aquifer interference approval requirements under the WM Act have not yet commenced, and regulation is managed under Part 5 of the Water Act 1912.

The WM Act includes requirements for:

- a water access licence to take water from a river, lake, dam or groundwater for irrigation, industrial or commercial purposes
- a water supply work approval to construct and use a water supply work, such as a pump, dam, channel or bore
- a water use approval to use water for a specific purpose at a particular location
- a flood work approval for works on floodplains that divert floodwaters
- a controlled activity approval to carry out work in a watercourse or within 40 metres of the bank of a river, lake or estuary, such as extracting material from a river bed, constructing a creek crossing or residential developments.

Consistent with the approved project, the proposed modification would require establishment of a watercourse crossing and work within 40 metres of Woronora River, which is considered a controlled activity. However, Transport is exempt from controlled activity approvals under Subdivision 4, Clause 41 of the *Water Management (General) Regulation 2018* as they are a public authority. The proposed modification does not involve any water take, use or supply from natural sources or flood diversion work.

The proposed modification would not be likely to intercept groundwater aquifers and require dewatering. Therefore, no approvals or licences are required for the proposed modification under the WM Act and Water Act 1912.

4.2.8 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) provides for the identification, conservation and recovery of threatened fish, aquatic invertebrates and marine vegetation. One of the key objectives of the FM Act is to conserve fish stocks and key fish habitats.

Part 7 of the FM Act establishes that a permit is generally required to dredge, reclaim, obstruct fish passage, harm marine vegetation, use explosives or electrical devices in a waterway that is classified as key fish habitat.

The proposed modification would involve construction of a watercourse crossing of Woronora River and crane pads along the banks. Woronora River and Heathcote Creek are mapped as key fish habitat. However, as no marine vegetation is likely to be harmed from the proposed modification, a Section 205 permit under Part 7 of the FM Act is not required. Under Section 219(5)(a), any work that is permitted under the FM Act turns off the requirement for a Section 219 permit to block fish passage, therefore a Section 219 permit is also not required. The new piers included in the proposed modification do not trigger any additional statutory requirements beyond the project REF.

Transport has carried out consultation with the NSW Department of Primary Industries (DPI) Fisheries during development of the proposed modification. Under Section 199, a public authority (other than a local government authority) must, before it carries out or authorises the carrying out of dredging work or reclamation work:

(a) give the Minister written notice of the proposed work, and
(b) consider any matters concerning the proposed work that are raised by the Minister within 21 days after the giving of the notice (or such other period as is agreed between the Minister and the public authority).

A Section 199 letter has been issued for the proposed modification, which was accepted by DPI Fisheries on 27 January 2022.

Transport also carried out additional consultation with DPI Fisheries on 15 February 2022 about construction work impacting waterways, including the temporary waterway crossing, piling and crane platforms and flood management.

4.2.9 Biosecurity Act 2015

The *Biosecurity Act 2015* requires Transport to control, remove and eradicate weeds on land that they own to avoid further growth and spreading. A total of five priority weed species were observed opportunistically within the biodiversity study area: African Olive, Ground Asparagus, Lantana, Primrose and Alligator Weed. A high weed incursion under the Heathcote Road bridge was observed during additional field surveys between December 2021 and March 2022. The safeguards and management measures identified in the project REF are sufficient to manage these weeds in accordance with the *Biosecurity Act 2015* during construction and operation of the proposed modification. Detailed weed management advice has been provided as part of specialist ecological engagement for assessment of the proposed modification, which in part fulfils the requirements of safeguard B7.

4.2.10 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 proposed modification would be

managed in accordance with the waste hierarchy and where required, disposed of in accordance 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 B and chapter 6 of the addendum REF.

A referral is not required for proposed road actions 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 chapter 6 of the addendum REF and Appendix B.

Findings – matters of national environmental significance (other than biodiversity matters)

The assessment of the proposed modification's impact on matters of national environmental significance and the environment of Commonwealth land found that there would be no change to the findings of the determined activity and would be unlikely to cause a significant impact on matters of national environmental significance or the environment of Commonwealth land. A referral to the Australian Government Department of Agriculture, Water and the Environment is not required.

4.3.2 Other relevant Commonwealth legislation

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 carried out in February 2022, with one Native Title claim identified within the modified project boundary, NC2017/003 – South Coast People. Accordingly, Transport would provide notice of the proposed modification to NTSCORP under section 24KA of the Act as part of the property access negotiation process.

4.4 Confirmation of statutory position

The proposed modification is categorised as development for the purpose of a road and a vehicle bridge and is being carried out by or on behalf of a public authority. Under Section

2.108 of the Transport and Infrastructure SEPP the proposed modification is permissible without consent. The proposed modification is not State significant infrastructure or State significant development. The proposed modification can be assessed under Division 5.1 of the EP&A Act. Consent from Council is not required.

Transport is the determining authority for the proposed modification. This addendum 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. Since the public display of the project REF, Transport has also taken into account the planning principles outlined in the State Environment Planning Policy (Biodiversity and Conservation) 2021, as required by Part 11.2, Section 11.5(b) of the SEPP, to minimise any potential impacts of the proposed modification on the water quality, river flows, floor regime or ecosystems within the Georges River Catchment

5 Consultation

5.1 Consultation strategy

The consultation strategy relevant to the proposed modification remains consistent with Section 5.1 of the project REF. Public display of this addendum REF was not considered necessary given that targeted consultation has occurred and the proposed modification is in response to community feedback received during public display of the project REF.

Project information, project updates, including details on the proposed modification, and media releases are regularly published on the Transport Heathcote Road bridge website (https://roads-waterways.transport.nsw.gov.au/projects/heathcote-road-bridge/index.html).

Transport also notes that there was feedback received during public display of the REF about the need to upgrade the whole length of Heathcote Road. On 9 November 2020, the NSW Government announced $35 million in additional funding for the planning of the duplication of Heathcote Road between The Avenue, Voyager Point and its intersection with the Princes Highway, Engadine. Investigation work for this upgrade is separately underway.

5.2 Consultation outcomes

Section 2.108 of the Transport and Infrastructure SEPP provides that "development on behalf of a public authority for the purpose of a road or road infrastructure facilities may be carried out without consent" providing that certain key parties are consulted and/or notified about the work.

The National Parks and Wildlife Service (NPWS) (a directorate of the DPE) was consulted during the development of the project REF as per the requirements of Section 2.15 of the Transport and Infrastructure SEPP. These requirements were met in the project REF.

Table 5-1 provides details on consultation activities carried out with key government stakeholders. Table 5-2 summarises the issues raised by these stakeholders and the proposed modification's response to these issues.

Table 5-1 Consultation activities with key government stakeholders

Agency	Date and method of consultation	Key information provided
National Parks and Wildlife Service	10 February 2022 (email) 18 February 2022 (email)	• Key features of the proposed modification • Overview of project footprint • Visualisation of proposed modification compared to the existing bridge
DPI Fisheries	20 January 2022 (phone and email) 11 February 2022 (email) 21 March 2022 (email)	• Consultation in accordance with section 199 of the FM Act (refer to Section 4.2.8) due to the proposed modification meeting the definition of 'dredging and reclamation' and potential risk of the temporary waterway crossing structure to fish passage • Construction waterways impact management, including: – Temporary waterway crossing – Piling / crane platform

Agency	Date and method of consultation	Key information provided
		– Flood management • Provision of 50% detailed design documents
Heritage NSW	19 October 2021 (virtual briefing presentation)	• Project background • Key features of the proposed modification • Existing environment of the proposed modification • Potential impacts on the Heathcote Road bridge which is listed on a s170 heritage register (refer to Section 4.2.3) • Next steps to be carried out by Transport
Department of Agriculture, Water and the Environment (DAWE)	7 March 2022 (virtual briefing presentation)	• Key features of the proposed modification • Overview of project footprint • Visualisation of proposed modification compared to the existing bridge • Cubbitch Barta National Estate Area curtilage issues
Water NSW	3 February 2022 (teleconference) Ongoing (via phone and email)	• Likely impacts of releases from the upstream Woronora Dam on the proposed modification • Flood management within the modified project boundary • Ongoing updates on status of construction work near the Woronora River

Table 5-2 Key issues raised during government agency consultation and proposed modification response

Agency	Key issues raised during consultation	Proposed modification response / where addressed in this addendum REF
National Parks and Wildlife Service	• No access to or work within the national park unless permission is granted by NPWS • Concern that the proposed modification would result in encroachments to NPWS estate	• Construction and operation of the proposed modification would not encroach on any land managed by NPWS estate (consistent with the project REF). • Refer to Section 3.6 for details on property acquisition for the proposed modification.
	• Need for park access to remain operational and unobstructed for visitors or NPWS management	• There may be some disruption to motorists using Heathcote Road to access Heathcote National Park during construction of the proposed modification (refer to Section 3.3.7). • As per safeguard TT4, access will be maintained for NPWS staff at all times, where possible (refer to Section 7.2).
	• Concern that the proposed modification would result in substantial environmental impacts	• Environmental impacts of the proposed modification are outlined in chapter 6. • The proposed modification would result in a reduction of non-Aboriginal heritage and traffic and transport impacts and

Agency	Key issues raised during consultation	Proposed modification response / where addressed in this addendum REF
		negligible changes in impacts to other environmental disciplines compared to those assessed in the project REF.
	• Need for adequate sediment and erosion controls during construction and operation of the proposed modification	• The expected water quality and soils impacts, including sediment and erosion impacts, are discussed in Section 6.4.3. • Section 7.2 outlines the safeguards and mitigation measures recommended to minimise these impacts.
	• Need for hygiene protocols for machinery, vehicle and material to be established and implemented throughout the project to limit propagule and pathogen transmission on the park interface.	• These measures would be implemented as part of the Flora and Fauna Management Plan for the proposed modification. Safeguard B1 has been modified to address this requirement (refer to Section 7.2).
	• Request for ongoing communication with NPWS, including provision of a copy of the determined REF to NPWS and at least one week's notification to NPWS when works are due to commence.	• Transport commits to ongoing communication with NPWS. • Transport will provide a copy of the determined REF to NPWS. • Transport will provide at least one week's notification to NPWS when works are due to commence.
DPI Fisheries	• Request to be consulted when 50 per cent detailed designs for the proposed modification are available to discuss in-water structures and abutment engineering to ensure they meet best practise.	• Transport notes that this consultation was carried out with DPI Fisheries via email on 21 March 2022.
	• Need for best practice erosion and sediment mitigation devices to prevent the entry of sediment into the waterway prior to any earthworks being undertaken.	• The expected water quality and soils impacts, including sediment and erosion impacts, are discussed in Section 6.4.3. • Section 7.2 outlines the safeguards and mitigation measures recommended to minimise these impacts.
	• Request for any material removed from the waterway that is to be temporarily deposited or stockpiles on land is to be located well away from the waterway and to be contained by appropriate sediment control devices.	• This request is addressed in safeguard SW8 of the project REF and submissions report (refer to Section 7.2).
	• Request for DPI Fisheries and the Environment Protection Authority to be notified immediately if any fish kills occur in the vicinity of the works.	• This request is addressed in safeguard SW15 of the project REF and submissions report (refer to Section 7.2).

Agency	Key issues raised during consultation	Proposed modification response / where addressed in this addendum REF
Heritage NSW	• Support for the proposed modification in that it has better outcomes, is much less intrusive and less fabric impact than the approved project	• Transport notes the support of Heritage NSW and acknowledges that the proposed modification would result in a superior heritage outcome than the approved project (refer to Sections 6.6 and 6.7).
Department of Agriculture, Water and the Environment	• Requirement for Transport to complete a self-assessment using DAWE's Significant Impact Guidelines to self-assess whether the proposed modification is likely to have a significant impact on a matter protected under national environment law (the *Environmental Protection and Biodiversity Act 1999*) and determine whether there is a need to make a referral to DAWE. • Request an update on the self-assessment when complete.	• Transport will complete the self-assessment using DAWE's Significant Impact Guidelines and will communicate the outcome of this assessment with DAWE.
Water NSW	• Regular notifications (including weekly catchment overviews and emergency alerts) have been and will continue to be issued by Water NSW to the construction team	• Transport thanks Water NSW for the regular updates and acknowledges the close, ongoing working relationship between Water NSW and the construction team.

Consultation has also occurred with other key stakeholders during the development of the detailed design (in line with Transport's commitments in the project REF and submissions report). This includes:

- Sutherland Shire Council – regarding design changes and updates to key issues identified by Council during the display of the project REF
- NSW Crown Lands – regarding land acquisition
- ANSTO – regarding impacts on surrounding land uses due to change in road access and the location of vibration sensitive equipment
- Cleanaway Lucas Heights Resource Recovery Park – regarding impacts on surrounding land uses due to change in road access
- directly affected residents – regarding access requirements during construction and operation of the proposed modification.

5.3 Ongoing or future consultation

Transport would continue to consult with the community and key stakeholders throughout the project in line with the Community and Stakeholder Engagement Plan (refer to Section 5.1 of the project REF) and Communication Plan (refer to safeguard SE1 in Section 5.2 of the project submissions report).

The community and stakeholder engagement carried out during construction would include community updates on the project design, planned construction activities and program. Project representatives would respond to enquiries and concerns in a timely manner, while seeking to minimise potential impacts, where possible.

Emergency Services, Sutherland Shire Council and the community would be notified in advance of any road closures and the likely disruptions to access. Transport would carry out consultation with Transgrid during construction to maintain access to their assets during full road closures.

Transport would also notify DAWE of the outcome of the self-assessment against DAWE's Significant Impact Guidelines (refer to Table 5-2).

This addendum REF will be made available on the Transport website, so that the community and stakeholders are informed about what is being proposed. Transport would notify the National Parks and Wildlife Service, Heritage NSW and Southerland Shire Council when the addendum REF is published online for information.

The Transport Heathcote Road bridge website enables individuals or organisations to subscribe for updates.

6 Environmental assessment

This section of the addendum REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposed modification of the Heathcote Bridge widening project. All aspects of the environment potentially impacted upon by the proposed modification are considered. This includes consideration of the factors specified in the guidelines *Roads and Related Facilities EIS Guideline* (DUAP, 1996) and *Is an EIS required?* (DUAP, 1999) as required under Section 171 of the Environmental Planning and Assessment Regulation 2021. The factors specified in Section 171 of the Environmental Planning and Assessment Regulation 2021 are also considered in Appendix B.

Site-specific safeguards and management measures are provided to ameliorate the identified potential impacts.

6.1 Traffic and transport

This section describes the traffic, transport and access impacts that may occur when constructing and operating the proposed modification. The assessment of the construction traffic impacts associated with the proposed road closure and detour route has been informed by a review of the assessment carried out in Section 6.1 of the project REF.

6.1.1 Methodology

The methodology adopted for this addendum traffic and transport assessment was consistent with that outlined in Section 6.1.1 of the project REF.

6.1.2 Existing environment

The existing traffic and transport environment relevant to the proposed modification is consistent with that described in Section 6.1.2 of the project REF. The proposed detour is described in Section 3.3.7 and shown in Figure 3-15.

6.1.3 Potential impacts

Construction

Traffic redistribution due to the road closure and detour route

The proposed modification still requires the full closure of Heathcote Road between New Illawarra Road and the Princes Highway, though the duration and timing of the closures are reduced in comparison to the original scope. The detour route is unchanged (Figure 3-15).

Full road closures are unable to be avoided entirely as some activities such as traffic switches between bridges, and excavation of rock cuttings above the road corridor require full closures for safety. Hereafter referred to as ‘safety-critical’ activities.

The original REF assessed that construction would require full six-month continuous road closure with construction 24 hours/day, 7 days per week. The modification has enabled much more of the construction to be completed offline which has reduced the duration of detours required. The modification would require an estimated 67 weeknight closures in total

on an intermittent as-needed basis, as well as 12 consecutive weekend closures, weather permitting.

Further, the construction program has been modified to complete safety-critical activities outside of weekday daytime period to reduce overall disruption on the road network. The construction program is predominantly during weekday nights when traffic volumes are lowest (refer to the weekday traffic distributions for Heathcote Road in Figure 6-1). Some safety-critical activities require a full weekend closure (Friday evening to Monday morning) though the program has tried to coordinate their timing outside of school holiday periods to minimise potential disruption to the road network.

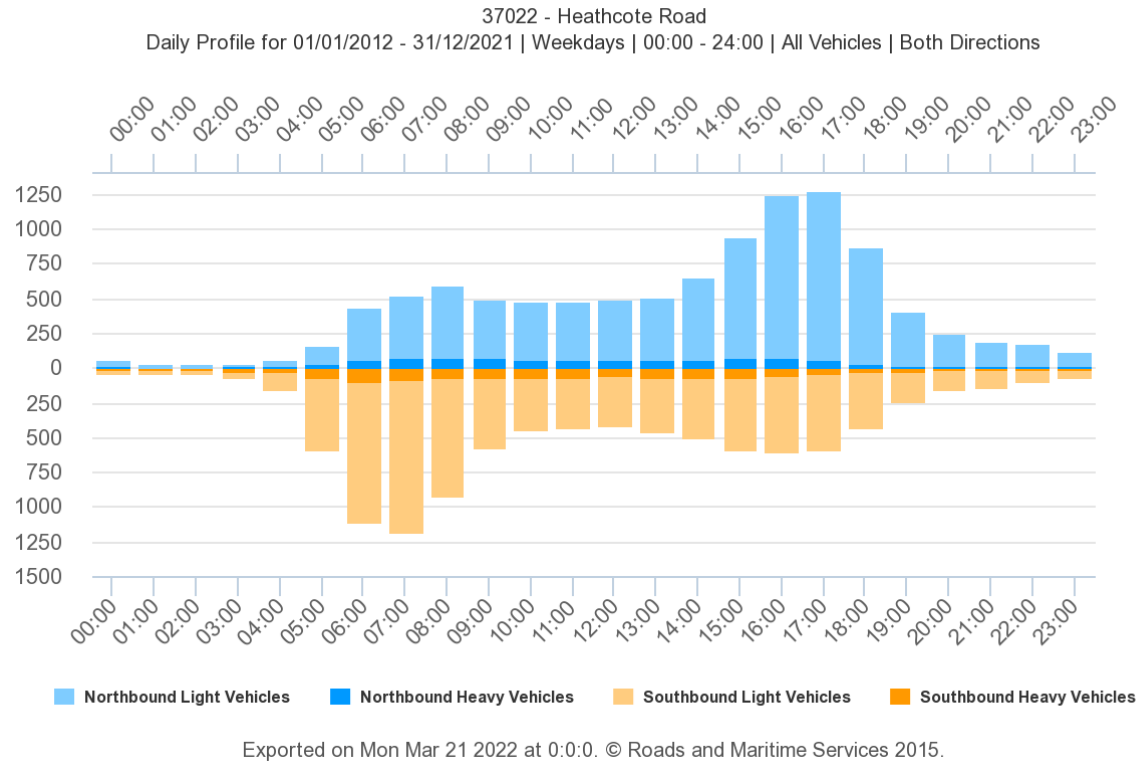


Figure 6-1 Heathcote Road 24-hour traffic distribution – weekday

The traffic detour assessment completed for the project REF also identified other potential traffic impacts on the wider road network. This included predictions of minor traffic increases on Picton Road, Appin Road, Tom Ugly's Bridge and Captain Cook Bridge during full road closure events on Heathcote Road. The altered construction program for the proposed modification avoids impact during weekday daytime travel which would reduce this impact. Further, this should also lessen the risk of traffic using rat-runs to avoid congestion on the main detour route. The proposed modification may also reduce potential impacts on school weekday bus services.

Consistent with the project REF, Transport would minimise impacts on the local road network. However, Transport would continue to consult with the Customer Journey Centre and Emergency Services to minimise potential traffic impacts associated with implementation of the proposed detour route and identify additional safeguards or management measures, as required.

Travel time impacts due to the road closure and detour route

The detour route (and length) remains consistent with the route nominated in the project REF, and would use New Illawarra Road, Bangor Bypass, River Road, Linden Street, The Grand Parade and the Princes Highway (Figure 3-15). The project REF assessed travel time impact of the detour route to add about 31 to 43 minutes during peak periods. When averaged out across time periods this reduced down to about 29 minutes. These travel time figures now represent very conservative estimates because of the shift away from weekday day time travel impacts for the proposed modification. As assessed in the project REF, proposed road closures may also impact ANSTO's ability to efficiently deliver materials and equipment (including nuclear medicine) via Heathcote Road, however this impact would also be reduced by timing road closures for off-peak periods. Consistent with the project REF, Transport would continue to directly consult with ANSTO to provide early notification of planned full road closures and investigate opportunities for collaborative efforts to mitigate impacts to critical deliveries.

Traffic generated during construction

The proposed modification would result in a temporary increase in vehicle movements on the surrounding road network due to the need to transport equipment, materials, and resources to and from the construction footprint and compound locations, as well as construction staff vehicle movements. Vehicle movements would be broadly consistent with the project REF, although overall VKT would increase due to haulage. Section 6.1.3 of the project REF estimated that there would be up to:

- 40 light vehicle and 24 heavy vehicle movements to and from the approved project boundary per day during peak construction
- 95 light vehicles associated with construction staff that would travel to and from the compound sites each day at the start and end of their shift.

Construction vehicle access to the compound sites and parking at each compound would be unchanged compared to the project REF. Construction haulage routes are also consistent.

The road network and intersections are anticipated to have capacity to temporarily accommodate the increased vehicle traffic due to construction of the proposed modification. The traffic volumes generated by construction are expected to be relatively low compared to the existing traffic volumes using Heathcote Road, New Illawarra Road, the Princes Highway or Wilson Parade.

Other impacts

Once the new bridge is constructed, both lanes of traffic would be switched to the new bridge, enabling offline upgrades to the existing bridge (refer to Section 3.3.1). There would be a similar temporary traffic arrangement to the existing scenario on the new bridge (i.e. one lane in each direction with no median) and so would not lead to in a reduction in safety for road users compared to the existing scenario. However, there may be slight delays for motorists during this stage of construction due to temporary tie-in arrangements. Temporary speed limits may also be enforced during all phases of construction.

The proposed modification does not introduce any new impacts to public transport or active transport, and may reduce impacts to weekday school bus services. The proposed modification would have no direct impacts on private property access, consistent with the impacts assessed in Section 6.1.3 of the project REF.

Operation

Operation of the proposed modification would result in superior traffic and safety benefits than those discussed in Section 6.1.3 of the project REF. Compared to the existing scenario and project REF, the proposed modification would result in:

- increased road safety from wider lanes and shoulders and physical separation of opposing traffic flows with a central concrete median between the two bridges, reducing the risk of head-on and rear-end collisions and crashes involving out-of-control vehicles
- long term road safety benefits due to traffic superior permanent rock treatment on the north-west cut which would improve the risk rating of the cut
- improved network reliability from:
  - wider lanes and shoulders than the existing scenario or project REF, providing extra room for vehicles to navigate around traffic incidents (such as breakdowns) on the bridges and improved emergency services access
  - the ability for temporary diversions of both lanes of traffic onto either bridge (for example, during maintenance).

6.1.4 Safeguards and management measures

Safeguards TT-1 to TT-10 of the project REF remain applicable and are considered adequate to address the traffic and transport impacts of the proposed modification. No additional measures are proposed.

6.2 Noise and vibration

This section describes the noise and vibration impacts that may occur when constructing and operating the proposed modification. This section summarises the addendum noise and vibration report prepared by Resonate Consultants that is attached as Appendix C.

6.2.1 Methodology

The methodology for the addendum noise and vibration assessment involved:

- reviewing and confirming the relevance of:
  - the sensitive receivers and noise catchment areas (NCA) identified in Section 6.2 of the project REF
  - existing background noise levels and relevant assessment criteria identified in Section 6.2 of the project REF
  - the assessment of construction noise and vibration scenarios identified in Section 6.2 of the project REF
  - the assessment of construction road traffic noise levels
  - the assessment of construction vibration and ground-borne noise
  - the assessment of operational traffic noise
  - the safeguards and management measures identified in the project REF and submissions report
- identifying and assessing noise impacts of an additional construction scenario – 'Construction Scenario 2B: Bridge works – Driven piles' using Transport's *Noise*

Estimator Tool and in accordance with the *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime Services, 2016)
- identifying and assessing vibration impacts of the use of a driven piling rig using source vibration levels from available data on similar vibration intensive equipment in line with *BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sies – Part 2: Vibration*
- recommending additional safeguards and management measures to be implemented, where feasible and reasonable, to minimise noise and vibration noise impacts from the proposed modification.

Consistent with the project REF, the use of the Transport Noise Estimator Tool for prediction of construction noise levels is a conservative approach as it is based on a 2D distance between a receiver and construction activity (the 'true' distance would generally be further due to the topography) and does not account for dense bushland present in the modified project boundary that may provide some screening and result in lower noise levels than predicted.

6.2.2 Existing environment

The existing noise and vibration environment relevant to the proposed modification is consistent with that described in Section 6.2.2 of the project REF.

6.2.3 Criteria

The noise and vibration criteria relevant to the proposed modification is consistent with that described in Section 6.2.3 of the project REF, including the construction noise management levels (NMLs) for the proposed modification. The minimum Rating Background Noise Level (RBL) of 30 dB(A) was selected, resulting in NMLs as follows:

- Standard hours: RBL + 10 dB(A) or 40 dB(A)
- Out of hours: RBL + 5 dB(A) or 35 dB(A).

The RBL was determined by considering the land use surrounding the modified project boundary and is likely to be conservative for work during standard hours, and may not account for the actual noise environment due to normal road traffic. Quantitative noise monitoring, which would include confirmation of the RBLs, would be carried out prior to construction and during a full road closure (in the absence of construction noise) to inform the Construction Noise and Vibration Management Plan (CNVMP).

6.2.4 Potential impacts

Construction

Construction noise

Three additional construction scenarios have been developed to assess additional construction work required for the proposed modification (compared to the project REF). They are:

- Construction scenario 1A: Access track works
- Construction scenario 1B: Rock cutting works
- Construction scenario 2B: Bridge works – Driven piles.

The plant and equipment required during these construction scenarios are generally consistent with the plant assessed in the project REF, except for the substitution of a bored piling rig with a driven piling rig.

Table 6-1 presents the predicted noise levels for residential receivers within various noise catchment areas (NCAs) at different distances from the modified project boundary for the additional construction scenarios. Construction scenario 2B would only occur during standard construction hours and so has been assessed against the standard construction hours NML of 40 dB(A). The other scenarios have been assessed against both standard construction hours and night-time out of hours NMLs.

A detailed noise contour figure for 'Construction scenario 1B: Rock cutting works' is included in Appendix C to this addendum REF.

Table 6-1 Summary of predicted construction noise levels for construction scenario 2B

Noise catchment area	Noise catchment distances (metres)[1]	NML dB(A)[4]	Predicted noise levels dB(A)	Recommended additional mitigation measures
Construction scenario 1A: Access track works				
NCA1	≤370	40 (daytime) 35 (night-time)	64	**Daytime:** Notification[2], Verification monitoring[3] **Night-time:** Notification[2], Verification monitoring[3], Individual Briefings, Phone Calls, Respite Period 2, Duration Respite, Alternative Accommodation
NCA2 (shielded)	≤575		54	**Daytime:** Notification[2], Verification monitoring[3] **Night-time:** Notification[2], Verification monitoring[3], Individual Briefings, Phone Calls, Respite Period 2, Duration Respite
NCA2	370 – 880		54	
NCA3 (shielded)	575 – 1000		44	**Daytime:** N/A **Night-time:** Notification[2], Verification monitoring[3], Respite Period 2, Duration Respite
NCA3	880 – 1000		44	
Construction scenario 1B: Rock cutting works				
NCA1	≤370	40 (daytime) 35 (night-time)	65	**Daytime:** Notification[2], Verification monitoring[3] **Night-time:** Notification[2], Verification monitoring[3], Individual Briefings, Phone Calls, Respite Period 2, Duration Respite, Alternative Accommodation
NCA2 (shielded)	≤575		55	**Daytime:** Notification[2], Verification monitoring[3]

Noise catchment area	Noise catchment distances (metres)[1]	NML dB(A)[4]	Predicted noise levels dB(A)	Recommended additional mitigation measures
NCA2	370 – 880		55	**Night-time:** Notification[2], Verification monitoring[3], Individual Briefings, Phone Calls, Respite Period 2, Duration Respite
NCA3 (shielded)	575 – 1000		45	**Daytime:** N/A **Night-time:** Notification[2], Verification monitoring[3], Respite Period 2, Duration Respite
NCA3	880 – 1000		45	
Construction scenario 2B: Bridge works – Driven piles				
NCA2	≤685	40 (daytime)	53	Notification[2], Verification monitoring[3]
NCA3 (shielded)	≤440		53	Notification[2], Verification monitoring[3]
NCA3	<1000		43	n/a
NCA4 (shielded)	440 – 685		43	n/a

1. Beyond these distances, it is likely that the RBL/NML would change due to proximity to other major roads or substantial shielding from the modified project boundary, reducing noise impacts greater than predicted levels. The NCA zones are described in the REF Noise and Vibration Impact Assessment Report.

2. Notification via letterbox drops to potentially affected noise sensitive receivers.

3. Verification monitoring at representative noise sensitive receiver locations to confirm predicted noise levels.

4. The NMLs assume minimum background noise levels

Sensitive receivers in NCAs that are denoted as 'shielded' are residential properties that do not have a direct line of sight to the modified project boundary, due to topography or residential properties in front, and therefore would experience lower noise levels than non-shielded residential receivers

These results show that the predicted noise levels generated during construction of the proposed modification would exceed the assessed NMLs during all three construction scenarios. Due to the proposed modification, the overall scenario sound power level would be:

- 4 dB higher than the previously assessed bulk earthworks scenario for construction scenario 1A: Access track works
- 5 dB higher than the previously assessed bulk earthworks scenario for construction scenario 1B: Rock cutting works
- 3 dB higher than the previously assessed bored piling scenario for construction scenario 2B: Bridge works – Driven piles.

The modelling scenario is also considered conservative in that it assumed all plant would be operating simultaneously and the distance to the noise source was assumed to be from the modified project boundary (at the closest point to the sensitive receivers). In reality, not all plant would be operating simultaneously and at the edge of the modified project boundary and so noise impacts would be lower than predicted. For example, piling work would occur at the bridge pier locations and not at the construction footprint boundary.

The construction noise impacts for all other construction scenarios are generally consistent with those assessed in Appendix C to the project REF. However, the proposed modification would result in a reduced duration of out of hours construction work. This would be due to the ability for the new bridge to be constructed offline, reducing the noise impacts to sensitive receivers during out of hours construction periods.

During these periods, construction may occur up to 24 hours per day between 9pm on Friday and 5am on Monday. There would be a respite period from Monday until the following Friday night from audible night-time construction work. Work would be required on consecutive weekends for the earthworks to minimise the length of the construction program. This is considered justified as the project requires less out of hours work compared to the approved project.

The construction noise mitigation measures identified in the project REF remain applicable to the other scenarios.

Construction road traffic noise

Construction road traffic noise would be compliant with the criteria identified in Section 6.2.3 of the project REF. Predicted noise impacts of construction traffic during implementation of the proposed road closure and detour route would be consistent with the assessment in Section 6.2.4 of the project REF. However, as the road closure would no longer be a full, continuous road closure for up to six months, these impacts would reduce to the predicted 67 weeknight and 12 weekend full road closures.

Construction vibration and ground-borne noise

The vibration impacts of the driven piling rig for the new bridge piers have been assessed for the additional construction scenario 2B. Table 6-2 outlines the predicted vibration levels (Peak Particle Velocity (PPV)) at sensitive receivers expected during driven piling both when the pile is driven to refusal and not yet driven to refusal. The predictions assume a nominal hammer energy of 85 kilojoules and a pile diameter of 1500 millimetres. The activity with the most vibration is pile driving to refusal within 150 m of the Aboriginal cultural heritage site, with an assessed vibration level of 2.2 PPV mm/s, which is below the criteria for heritage damage.

Table 6-2 Predicted vibration levels due to impact piling at sensitive receiver locations

Sensitive receiver	Distance to receiver (m)	Exposure duration	Pile not yet driven to refusal PPV (mm/s)	Pile driven to refusal PPV (mm/s)	Criteria PPV (mm/s)	Criterion category
Aboriginal cultural heritage site	150	Continuous	1.3	2.2	2.5	Heritage (damage)

Sensitive receiver	Distance to receiver (m)	Exposure duration	Pile not yet driven to refusal PPV (mm/s)	Pile driven to refusal PPV (mm/s)	Criteria PPV (mm/s)	Criterion category
ANSTO	1,100	Continuous	0.1	**0.17**	0.14	Critical Working Areas (preferred)
ANSTO	1,100	Continuous	0.1	0.17	0.28	Critical Working Areas (maximum)
Woronora-Penshurst Pipeline	200	Continuous	0.9	1.5	2.5	Heritage (damage)
Residential receivers	390	Continuous	0.4	**0.6**	0.56	Human Comfort Continuous Vibration (Day, maximum)
Additional eVDV assessment for human comfort at residential receivers (eVDVm/s$^{1.75}$)						
Residential receivers	390	9 hours out of standard 11-hour daytime construction period	0.27	0.4	0.4	Human Comfort eVDV (Day, maximum)

This assessment identifies that there would be compliance with heritage vibration criteria at the Aboriginal Heritage Site and at the Woronora – Penshurst Pipeline. There would be a marginal exceedance of the preferred criterion for the ANSTO site when the piles are being driven at refusal, however, there would be compliance with the maximum criterion during all modelled scenarios. The modelling is based on a conservative offset distance from the modified project boundary to the nearest ANSTO property boundary. As per safeguard NV-3 (refer to Section 7.2), ANSTO would be consulted with to confirm the location of any vibration sensitive equipment prior to construction.

There would be a marginal exceedance of the maximum continuous vibration criterion at the nearest residential receiver when piles are driven at refusal. A further assessment of potential human comfort was carried out by calculating an Estimated Vibration Dose Value (eVDV). The eVDV considers the absolute vibration level of the activity as well as the duration of exposure during the respective assessment period (in this case the 11-hour standard daytime construction hours). The eVDV calculation (as shown in Table 6-2) shows that impact piling could occur for up to 9 hours out of the standard 11-hour construction day and remain less than or equal to the maximum daytime VDV target of 0.4 m/s$^{1.75}$ (which would be the worst-case scenario).

Due to the predictions for minor criteria exceedances at the ANSTO site and at the nearest residential receivers during the driven piling scenario exceeding approximately 9 hours out of

the standard daytime construction period, additional mitigation measures have been proposed in Section 6.2.5.

The vibration impacts associated with all other construction scenarios remain consistent with the assessment in Section 6.2.4 of the project REF.

Operation

The proposed modification would result in negligible changes to the operational noise levels compared to those assessed in Section 6.2.4 of the project REF. This is due to the road alignment shifting slightly to the west, away from the nearest residential receivers, and there being no proposed road traffic capacity increase due to the proposed modification.

6.2.5 Safeguards and management measures

Safeguards NV-2 and NV-3 are considered adequate to address the noise and vibration impacts of the proposed modification. Safeguard NV-1 and NV-4 have been amended and additional safeguards NV-5 to NV-8 have been proposed to address the additional noise and vibration impacts due to the proposed modification (refer to Table 6-3).

Table 6-3 Amendments to noise and vibration safeguards and mitigation measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV1	Noise and vibration impacts	A Construction Noise Management Plan (CNMP) would be prepared as part of the CEMP. This plan would include but not be limited to: • a map indicating the locations of sensitive receivers including residential properties • a quantitative noise assessment based on the detailed design of the proposal in accordance with the EPA *Interim Construction Noise Guidelines* (DECC, 2009) • management measures to minimise the potential noise impacts from the quantitative noise assessment and for potential works outside of standard working hours (including implementation of EPA *Interim Construction Noise Guidelines* (DECC, 2009), including specific mitigation measures for truck movements • a risk assessment to determine potential risk for activities likely to affect receivers (for activities carried out during and outside of standard working hours) • a process for assessing the performance of the implemented mitigation measures such as a program of noise monitoring for sensitive receivers • a process for documenting and resolving issues and complaints • a construction staging program • a process for updating the plan when activities affecting construction noise and vibration change • an outline of the content for toolbox talks regarding noise management • **noise contour maps for all work scenarios.**	Contractor	Detailed design/ pre-construction	Standard safeguard Section 4.6 of QA *G36 Environment Protection*
NV4	Vibration impacts	A Ground Vibration Management Plan is to be prepared incorporating outcomes of the Vibration Risk Assessment and incorporated into the CEMP. As a minimum the plan must include: • identification of all potentially affected properties or features of the natural/built environment and show on a map	Transport/ Contractor	Pre-construction/ construction	Standard safeguard Section 4.6 of QA *G36*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• identification of all vibration generating tasks, duration and predicted vibration levels • a schedule of properties or features of the natural/built environment where condition inspections are required to be undertaken (based on the Vibration Risk Assessment) • locations and types of management measures to be implemented to reduce excessive ground vibration such as: – maximising the offset distance between high vibration plant items and nearby buildings – substitution by alternative equipment, plant and processes – screening or enclosures – restricted times when work is being carried out; – increased work setback distances – consultation with affected receivers; – orienting equipment away from vibration-sensitive areas – specific physical and managerial measures for controlling ground vibration to comply with the relevant OEH guidelines and best practice • a vibration trial to determine the dominant frequency of vibration • vibration monitoring, reporting and response procedures including a short and long term ground vibration monitoring program to assess compliance with the identified criteria **at the nearest potentially affected sensitive receivers, including the existing bridge, including upon commencement of activities requiring high vibration intensity plant items to confirm vibration predictions and appropriateness of mitigation measures** • procedures for notifying any residents or business premises about vibration-generating activities likely to affect buildings on their property • contingency plans to be implemented in the event of non-compliances and/or vibration complaints			*Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• procedures for regularly reviewing the effectiveness of the Vibration Management Plan including specific review in response to any exceedance events and when activities affecting construction vibration change • outline of the content for toolbox talks regarding vibration management			
NV5	**Vibration impacts**	**The smallest piling rig that can reasonably complete the required work will be selected.**	**Contractor**	**Pre-construction/ construction**	**Additional safeguard**
NV6	**Noise impacts**	**Quantitative noise monitoring will be carried out at representative sensitive receiver locations prior to construction commencing and during a full road closure (in the absence of construction noise) to confirm existing background noise levels and inform the Construction Noise and Vibration Management Plan (CNVMP).**	**Transport / Contractor**	**Pre-construction**	**Additional safeguard**
NV7	**Noise impacts**	**There will be a reduced respite between the 12 weekend shutdowns from Monday until the following Friday night (as opposed to the standard seven-day respite period as per the CNVG), subject to the outcomes of verification monitoring.**	**Contractor**	**Construction**	**Additional safeguard**
NV8	**Noise impacts**	**Verification monitoring will be carried out to confirm whether construction noise is audible at residential receivers and to inform development of specific mitigation measures.**	**Contractor**	**Construction**	**Additional safeguard**

6.3 Biodiversity

This section describes the biodiversity impacts that may occur when constructing and operating the proposed modification. It reviews the information presented in the project REF and summarises additional assessment by Lodge Environmental completed for the proposed modification including the Heathcote Road Bridge Widening Early Works Pre-clearance Survey Report (January 2022), and the Heathcote Road Bridge Upgrade Technical Memorandum: Biodiversity (March 2022), attached as Appendix D to this addendum.

6.3.1 Methodology

The methodology for the biodiversity assessment involved:

- review of previous ecological studies and survey data within the modified project boundary, broadscale vegetation mapping and aerial photography, and publicly available databases
- updated assessment of impacts under the modified project boundary
- targeted survey for *Hibbertia woronorana* on 15 December 2021 during the known flowering period to determine presence of absence of species using transects throughout the modified project boundary
- field survey on 18 January 2022 of early works impact areas including the access track and riverbanks where clearing would be required, considering areas of weed incursion and species present, recording habitat bearing trees, notable habitat features, and presence or absence of threatened species,
- targeted search for evidence of vertebrate fauna occupation in and around bush rock on the north-west cut
- investigation into koala movement through the local landscape
- targeted search for koala habitat and evidence of koala activity
- determining potential impacts to biodiversity values listed under the *Biodiversity Conservation Act 2016* (BC Act) that may occur during construction and operation of the proposed modification
- review of the biodiversity offset calculations in the project REF
- consideration of significance of impacts
- additional or updated Assessments of Significance for species listed as vulnerable on the BC and EPBC Act
- review of safeguards and management measures.

Study area

The biodiversity study area is unchanged from the project REF. It comprises the approved project boundary plus an additional 50 metre buffer to capture the surrounding area. It includes the additional area included in the modified project boundary to the north of the approved project boundary where clearing is required for the north-west cut. The locality for the biodiversity assessment is defined as the area within 10 kilometres of the modified project boundary.

6.3.2 Existing environment

The plant community types (PCTs) within the biodiversity study area are consistent with those identified in Section 6.3.2 of the project REF.

During development of the project REF, a literature review identified *Hibbertia woronorana* as having a high potential of occurrence within distinct areas of the approved project boundary. This was not confirmed with targeted surveys at the time. Targeted surveys carried out during the development of the proposed modification for *Hibbertia woronorana* during the known flowering period did not identify any species within the modified project boundary. One plant which resembled *Hibbertia woronorana* was identified in the northern extent of the modified project boundary, sampled, and identified to be *Hibbertia fasiculata.* There is no conservation listing for *Hibbertia fasiculata.* These targeted surveys concluded that limited potential habitat for *Hibbertia woronorana* was determined to be present and the species was not suspected to occur in the modified project boundary.

It was observed during field surveys between December 2021 and March 2022 that the condition and species composition of aquatic vegetation below the existing Heathcote Road bridge had changed since the initial biodiversity reporting was conducted for the project REF. High weed incursion and significant alteration from frequent flooding was noted in the waterway. Increased volumes of water were being released from the upstream Woronora Dam during the March surveys due to the dam reaching maximum capacity. Flooding and temporary submersion of riparian vegetation was evident, with increased sedimentation expected to be deposited downstream.

Biodiversity surveys carried out in January 2022 found areas to be impacted on the southern bank of the Woronora River to be densely vegetated with exotic species, with few mature native trees present. Key weed species identified include:

- crofton weed
- whisky grass
- small-leaved privet
- cassia
- lantana
- flaxseed fleabane
- purple top
- willow
- tickseed
- *Sporobolus sp.* (exotic grasses).

Vegetation along the access track to the waterway has been historically cleared and is characterised by regenerating vegetation, with no trees above five-centimetre diameter at breast height identified during survey. Key weed species identified along the access track included:

- crofton weed
- whisky grass
- small-leaved privet
- blackberry
- cassia.

During survey, vegetation along the proposed north-west cut was determined to be characteristic of PCT 1250 (Coastal Sandstone Gully Forest) and is not associated with a Threatened Ecological Community. Native vegetation in this area is known to have been cleared prior to construction of the existing Heathcote Road bridge and was considered to provide lower habitat potential than native vegetation adjacent to the area of impact in the

Heathcote National Park and Holsworthy Military Reserve. The area comprises steep slopes with numerous large boulders and bush rocks present. No evidence of vertebrate fauna occupation was determined in and around the bush rock to be removed during surveys, however, reptile scats and a nest were recorded in less disturbed bush rock beyond the proposed area of impact.

Previous clearing associated with construction of the existing bridge has resulted in few habitat bearing trees or suitably sized koala feed trees being present within the study area. Numerous *Eucalyptus punctata* are present within the clearing footprint, which are known to be a key feed species for the local koala population. During surveys, no koala scratch marks or scats were noted around *Eucalyptus punctata* trees within the study area.

Seventeen habitat bearing trees or feed trees were recorded within the modified project boundary. These trees contain small or medium hollows, or fissured trunks or branches. Two of the trees were identified as *Corymbia gummifera* (Red Bloodwood) and were noted to be active feed trees for Yellow-bellied Gliders (listed as vulnerable under the BC Act and EPBC Act).

Two notable habitat features were recorded along the temporary access track during survey. They were a fallen tree with habitat potential and a rock overhang with no signs of fauna occupation.

The scuppers within the existing bridge are known habitat for threatened microbats including Southern Myotis (*Myotis Macropus*).

No threatened flora species were identified in the proposed modification impact area. Due to the high levels of existing disturbance across the impact area and abundant weed incursion beneath the existing bridge, much of the area is unsuitable for threatened species.

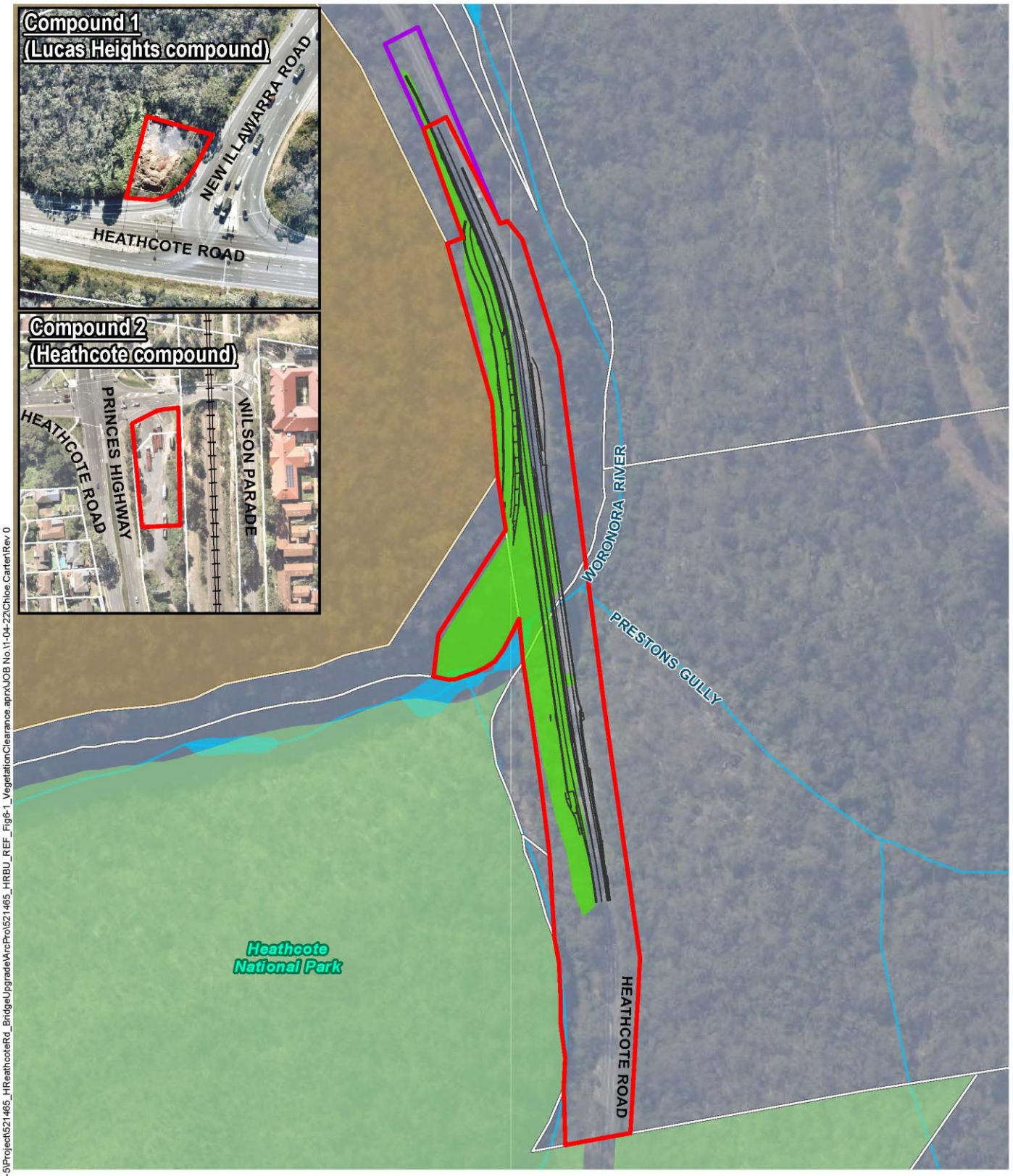
6.3.3 Potential impacts

The anticipated biodiversity impacts in Section 6.3.3 of the project REF remain relevant for the proposed modification. Additional clearing of vegetation and bush rock within the modified project boundary and works within the waterway required to construct the proposed modification would result in the following impacts to biodiversity.

Construction

The approved project considered that up to 3.12 hectares of vegetation would require removal for widening the bridge and approaches. This was calculated using the assumption of broad vegetation clearance within the approved project boundary. However, during the development of the proposed modification, a refined vegetation clearance boundary has been prepared for the proposed bridge duplication (refer to Figure 6-2). This figure is indicative and shows the area which is expected be required to be cleared during construction of the proposed modification. It lies within the modified project boundary. All other vegetation within the modified project boundary would not be impacted.

As a result of these refinements to vegetation clearance, the proposed modification would require up to 1.2 hectares of vegetation to be cleared. This would include direct impacts to 1.14 hectares of native vegetation, comprising:



\\aurecon.info\Shares\AUSYD\Projects\GIS\Project-5\Project\521465_HReathcoteRd_BridgeUpgrade\ArcPro\521465_HRBU_REF_Fig6-1_VegetationClearance.aprx\JOB No.\1-04-22\Chloe.Carter\Rev 0

- Approved project boundary
- Modified project boundary
- Proposed modification design
- Vegetation clearance boundary (indicative only)
- Holsworthy Barracks - Defence controlled area
- National park
- Lot
- Watercourses
- Water bodies

Source: Aurecon, TfNSW, Spatial Services, Esri

1:3,500 @ A4

0 50 100m

Projection: GDA 1994 MGA Zone 56

Heathcote Road Bridge **Addendum REF**

FIGURE 6-2: Vegetation clearance boundary

- 0.22 hectares of PCT 1292 – Water Gum- Coachwood Riparian Scrub Along Sandstone Streams, Sydney Basin (referred to as Coastal Sandstone Gully Forest)
- 0.92 hectares of PCT 1250 – Sydney Peppermint-Smoothbarked Apple-Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin (referred to as Coastal Sandstone Riparian Scrub).

This includes the additional area of clearing required at the north-west cut as indicated in Table 6-4. Neither of these vegetation types are associated with a Threatened Ecological Community and clearing represents a fraction of the area present in the broader study area.

A refined vegetation clearance boundary was never determined for the approved project (bridge widening), as only the proposed modification was taken to detailed design. A similar amount of clearing would have been required for the approved project; however, there are differences in the amount of clearing required at different locations within the modified project boundary. Compared to the vegetation which would have been required to be cleared to construct the approved project, the proposed modification has:

- reduced vegetation required to be cleared on the eastern side of the bridge (including south-east cut, north-east retaining wall and waterway) by about 1513 square metres
- increased the area of vegetation required to be cleared on the north-west cut by about 1800 square metres.

Key changes to vegetation clearing due to the proposed modification are summarised in Table 6-4.

Table 6-4 Changes to vegetation clearing due to the proposed modification

Location	Change in area required to be cleared (square metres)	Detail
North-west cut	+ 1800 m^2	• Access track requirements include a maximum six-metre-wide access track due to topography and access, to enable a safe construction technique • New design requires additional clearing above the north-west cut • Characteristic of PCT 1250 (Coastal Sandstone Gully Forest) and not associated with a Threatened Ecological Community • Previously cleared for construction of the existing bridge • Considered to provide lower habitat potential than adjacent native vegetation in Heathcote National Park and Holsworthy Military Reserve
South-east cut	- 780 m^2	• New design reduces need for vegetation clearing above the south-east cut • Considered comparable, if not better condition to vegetation above the north-west cut
North-east retaining wall	- 533 m^2	• New design removes need for retaining wall on the north-east extent of the project footprint

Location	Change in area required to be cleared (square metres)	Detail
Waterway	*- 200 m²*	• New temporary works design and new bridge design alignment may reduce potential for direct impacts • May retain PCT 781 (Coastal Freshwater Wetland) vegetation, which can be associated with an Endangered Ecological Community (EEC) • New piers are located upstream away from the EEC and may avoid impact

Whilst additional vegetation and bush rock removal would be required in the area of the north-west cut for the proposed modification that was not required for the approved project, the area is relatively small compared to the extent of habitat in the locality. It is therefore unlikely to impact the abundance or diversity of flora and fauna in the region in the long-term. All impacts would be contained within the modified project boundary and are included in the impact footprint assessed under the project REF.

Of the two notable habitat features recorded along the access track to the waterway, the rock overhangs which line the north-western side of the temporary access track to the valley floor would not be impacted. During early works preparation of the access track, the fallen tree with habitat potential has been relocated to lay parallel to the access track to retain its habitat potential.

Of the 17 habitat and hollow bearing trees identified within the modified project boundary during surveys for the proposed modification, nine would require removal for the proposed modification. This is a reduction from the 16 identified for removal under the project REF. All other habitat bearing trees would be retained. One of the trees identified for removal is a Red Bloodwood and an active feed tree for the Yellow-bellied Glider. This is not considered to impose a significant impact on this species as per the Assessment of Significance carried out in Appendix D, and it was noted that additional Red Bloodwood trees occur directly adjacent to the clearing footprint. Felled hollows would be retained (where possible) to minimise the impacts of the removal of habitat features.

Enhancement of wildlife corridors below the Heathcote Road bridge will likely limit wildlife from accessing the road and result in fewer vehicle-related wildlife deaths.

The Initial Biodiversity Offset Calculations for the project REF considered a larger area of vegetation clearance, and would be sufficient to cover all impacts under the final design alignment for the proposed modification as the final design arrangement requires less native vegetation clearance.

There would be potential direct and indirect impacts to roosting microbats during construction. The proposed modification may result in:

- temporary loss of access to roost sites
- potential abandonment of roost sites
- injury or death if potential roost sites are not thoroughly inspected prior to removal or other work taking place
- disturbance from increased noise and vibration during construction.

These impacts would be minimised through the implementation of safeguard B-2 (refer to Section 6.3.4). These impacts would be reduced compared to the approved project as the scuppers within the existing bridge structure which are known habitat for threatened microbats would no longer be removed. Half of the scuppers would instead be capped and would still provide habitat during operation.

Additional targeted surveys undertaken since publication of the Submissions Report did not identify *Hibbertia woronorana* or suitable habitat, and the proposed modification is not expected to impact the species.

Whilst the Woronora River including the areas below the existing bridge are a known movement corridor for koalas, no evidence of koala activity including scratch marks or scats was located in proposed clearing areas during the additional targeted surveys. Native vegetation on the northern bank of the Woronora River was considered thin, whilst the southern bank was characterised by dense stands of lantana and cassia, which is largely prohibitive to koala movement. The likelihood of koalas crossing the river and nearby creeks was noted to be tied to water levels, which are affected by rainfall in the catchment and water releases from the Woronora Dam upstream. It was considered unlikely that koalas would use the north-west cut area for feeding due to difficulty in accessing vegetation. Despite this, it was considered that there may be a short-term disruption to localised koala movement during construction. Fauna connectivity features would be further considered and incorporated in the proposed modification design to minimise impacts to koalas and enhance koala movement corridors between Heathcote National Park and suitable bushland east of the Heathcote Road bridge.

Potential impacts on aquatic ecology by the proposed modification were considered. The design of the temporary waterway crossing would ensure there is minimal disruption to water flow and no disruption to fish passage, and may reduce impact to freshwater wetland species associated with an EEC.

Operation

The proposed modification requires the construction of a new bridge with piers in the waterway. As described in Section 6.5, additional piers would be aligned with the existing bridge piers and the same effective width, so any associated reduction in waterway area would be negligible and would result in negligible impacts to the hydrological regime of the Woronora River when the bridge is operational. The hydrological assessment of the proposed modification also determined there would be no increases in water flows and flood velocity during operation of the new bridge.

Impacts to roosting microbats would be minimised during operation of the proposed modification as the existing bridge scuppers would be retained (with new scuppers included in the new bridge).

Potential impacts on aquatic ecology by the proposed modification such as new piers in the waterway were also considered in the biodiversity assessments. It was concluded that any minor alterations to water flow by the proposed modification would be negligible when compared to the impacts of water releases from the upstream Woronora Dam.

Enhancement of wildlife corridors below the Heathcote Road bridge would likely limit wildlife from accessing the road during operation of the bridges, and result in fewer vehicle-related wildlife deaths.

The proposed modification would provide new scuppers, similar to the existing scuppers that are currently used as roosting habitat by microbats. There is a possibility of a net biodiversity benefit by incorporating new elements on the bridge that could be used for roosting, such as small gaps beneath the parapet.

Conclusion on significance of impacts

The Assessments of Significance for threatened species considered likely to be impacted by the approved project included in the project REF remain relevant for the proposed modification. The Assessment of Significance for the koala was updated to reflect the presence of *Eucalyptus punctata*, which is known to be a feed tree for local koalas. An additional Assessment of Significance was carried out for Yellow-bellied Glider (*Peraurus australis*) during development of the proposed modification (refer to Appendix D). It concluded that the proposed modification is not considered likely to impose a significant impact on a local viable population of this species. A Significant Impact Criteria (SIC) assessment was conducted for the locally occurring south-eastern subspecies *Petaurus australis australis.* No significant impact on a local, viable population is expected to eventuate.

As such, the modification is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a Species Impact Statement is not required.

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

6.3.4 Safeguards and management measures

Safeguards B-3 to B-8 and B-11 are considered adequate to address the biodiversity impacts of the proposed modification.

Safeguards B-1, B-2 and B-10 have been strengthened to address the additional biodiversity impacts due to the proposed modification (refer to Table 6-5).

Safeguard B-9 has been removed as the targeted surveys have been carried out during the development of the proposed modification and no threatened species were identified (refer to Section 6.3.2).

Table 6-5 Amendments to biodiversity safeguards and mitigation measures

ID	Impact	Environmental safeguards	Responsibility	Timing	Reference
B1	Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Transport's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (Roads and Traffic Authority NSW (RTA), 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* (RTA, 2008) • pre-clearing survey requirements • requirements for supervision of vegetation clearing activities • procedures for unexpected threatened species finds and fauna handling, including entering all fauna sightings during construction into BioNet within 28 days • 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**, including hygiene protocols for machinery, vehicles and material to limit propagule and pathogen transmission on the Heathcote National Park interface**. • procedures for retention and reuse of felled timber • identification of trees to be cut to base to avoid grubbing • an outline of the content to be included in toolbox talks including exclusion zones and stop work procedures • a procedure to routinely review and update the plan	Contractor	Detailed design/ pre-construction	Section 4.8 of QA G36 Environment Protection
B2	Biodiversity	A Microbat Management Plan is to be developed by a suitably qualified microbat ecologist in consultation with Transport Biodiversity Officer. The Microbat Management Plan would be incorporated into the Flora and Fauna Management Plan. As a minimum, the plan is to include:	Transport	Detailed design/ pre-construction	Additional safeguard

ID	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• demonstrated consideration of the roosting and breeding season requirements of the target species • pre-clearing requirements for artificial habitat during pre-construction • requirements for changes to artificial habitat during each phase of bridge work • a detailed methodology for pre-clearing surveys to identify microbats within the bridge structure • a protocol for identification, capture, and relocation of microbats • a protocol for microbat exclusion and provision of alternative housing for microbats during construction • references to examples to demonstrate proven effectiveness of proposed management measures • reporting requirements including species identification, number, relocation actions, exclusion methods • a protocol to routinely review and update the plan • **installation of microbat boxes to compensate for the loss of potentially suitable habitat features which are required to be cleared** • **provision for no demolition of habitat features to occur while microbats are present.**			
~~**B9**~~	~~**Potential for impacts to *Hibbertia woronorana* and unrecorded threatened species**~~	~~**Targeted biodiversity surveys will be conducted prior to vegetation clearance within areas that were unable to be previously surveyed due to access restrictions, including within and above the high rock cuttings.**~~ ~~**These surveys will focus on confirming the presence or absence of *Hibbertia woronorana* and other threatened species within proposal area, and if present, record the number and location of individuals present.**~~	~~**Transport / Contractor**~~	~~**Detailed design / Construction**~~	~~**Additional safeguard**~~

ID	Impact	Environmental safeguards	Responsibility	Timing	Reference
		~~**If individuals are recorded within the proposal area, the design and construction methodology will be reviewed to avoid or minimise impacts, where feasible and reasonable.**~~			
B10	Opportunities to re-use felled timber	Opportunities to reuse removed hollow bearing trees or other large felled timber within the proposal area will be considered in consultation with a suitably qualified ecologist. **Where possible, hollows will be retained once felled as habitat.**	Transport / Contractor	Detailed design/ construction	Additional safeguard

6.4 Water quality and soil

This section describes the water quality and soil impacts that may occur when constructing and operating the proposed modification. It summarises the Technical Memorandum: Surface Water prepared by SMEC that is attached as Appendix E.

6.4.1 Methodology

The methodology adopted for this water quality and soil assessment was consistent with that outlined in Section 6.4.1 of the project REF.

The relevant guidelines and legislation and environmental values and guidelines applicable to this assessment are consistent with those identified in Section 6.4.2 and 6.4.3 of the project REF respectively.

6.4.2 Existing environment

The existing water quality and soil environment relevant to the proposed modification is consistent with that described in section 6.4.4 of the project REF.

6.4.3 Potential impacts

The anticipated water quality and soil impacts of the proposed modification are generally consistent with those identified in Section 6.4.3 of the project REF, except where identified in the following sections.

Construction

Surface water quality and soil impacts are often interrelated, as soil erosion can result in sedimentation of waterways and increased water runoff can erode soil.

Construction of the proposed modification has the potential to result in surface water quality and soil impacts from disturbance of waterways, soils, topography, and vegetation.

The proposed construction activities which may impact water quality are predominately associated with construction earthworks, emplacement of fill, disturbance of soils and vegetation and changes to topography. Impacts associated with the proposed modification additional to those identified in Section 6.4.3 of the project REF include:

- approaches to facilitate the new bridge, requiring additional earthworks (on the north-western cut) and placement of fill materials, and disturbance of soils and vegetation, increasing the potential for erosion of surface soils and sedimentation of local waterways
- construction of new piers into the valley floor, requiring the mobilisation of a piling rig onto a constructed rock pad, driving a steel tube to refusal into bedrock, piling excavation and removal of materials, which would increase disturbance to soils near the pier locations
- pouring concrete into the new piers which has the potential for concrete or hydrocarbon spills and accidental release of alkaline water to the environment
- an increase in vehicle movements (primarily cranes, piling rigs and concrete trucks) within the river valley and along the temporary work areas in the valley floor compared to the approved project, which would increase potential for erosion of surface soils and sedimentation of local waterways and the risk of leaks or spills of hydrocarbons, concrete or other contaminants

- the potential for concrete pumping pressure lines to rupture causing concrete to be lost and pollution of the Woronora River during pumping of concrete under pressure to the discharge location outside of the river valley.

These changes have the potential to cause degradation or loss of aquatic habitat and as such, suitable management measures would be required. The potential hydrological impacts and management measures are discussed further in Section 6.5 (Hydrology and Flooding).

The potential impacts to water quality and soil caused by concrete pumping would be minimised through industry standard management of the concrete pumping equipment and as part of the emergency spill plan (refer to Safeguard SW-5 in Section 7.2 of the project REF).

The proposed modification would result in similar impacts to the waterway through construction of the temporary access track and construction activities in the waterway compared to the approved project.

The proposed modification would result in reduced impacts from the following activities compared to those identified in Section 6.4.3 of the project REF:

- reduced works on the existing bridge, including reduced demolition work and concrete cutting above the waterway that would have required an impermeable containment structure
- there would no longer be earthworks for utility adjustments required

The proposed modification would still require maintenance work to the existing bridge, which has the potential to generate contaminated wastewater from the superstructure during the construction phase. There would also still be hydro-demolition required, consistent with the project REF, which may impact the water quality of the surrounding environment if not appropriately contained. An Environmental Work Method Statement (EWMS) would be developed for review and approval by Transport, to consider the construction methodology and wastewater management measures whist working over water. This would include consideration of any potential impacts from hydro-demolition, concrete pumping, hydrocarbon spills and leaks, and management of chemicals.

Soil erosion

The loss of topsoil from earthworks activities has the potential to result in impacts to both terrestrial and aquatic ecology through loss of/changes to habitat. The highest potential for soil erosion would be associated with the disturbance of soils from earthworks on the access track to the Woronora River as a result of the steep gradient and soil erodibility. This would be unchanged compared to the project REF.

Consistent with the project REF, there would be estimated soil loss for the access track to the Woronora River of up to 1408 tonnes per hectare per year, which is a conservative estimate. There are limited opportunities for basins to be used as sediment control areas due to the constrained construction area. Erosion control through minimising disturbed areas and progressive stabilisation will be important considerations for the development of the Soil and Water Management Plan.

A revised erosion and sediment control assessment is attached as appendix B to the surface water memo.

Operation

Widening of the approaches and construction of the new bridge would result in a marginal increase in hardstand area relative to the total size of the Woronora River catchment area draining to the bridge (124.97 square kilometres). This would lead to a slight increase in dirty water runoff into the Woronora River compared to the approved project. However, this increase would be very minor and in line with the intent of the project REF.

Similar to the approved project, the proposed modification would also minimise stormwater quality impacts. Potential scour and erosion would be limited through scour protection at pipe outlets in the form of either rock riprap (in flatter areas) or rock-lined mattress chutes (where pipes outlet onto steep embankments).

The complete separation of traffic lanes on each bridge by the central median barrier and wider shoulders would result in reductions in spill risk compared to those assessed in the project REF. If a spill were to occur on one carriageway, it would not affect the other.

The other surface water quality, soil and groundwater quality impacts of the proposed modification would remain consistent with the approved project.

6.4.4 Safeguards and management measures

Safeguards SW-1 to SW-15 are considered adequate to address the noise and vibration impacts of the proposed modification. Additional safeguards SW-16 to SW-18 have been proposed to address the additional water quality and soil impacts due to the proposed modification (refer to Table 6-6).

Table 6-6 Amendments to water quality and soil safeguards and mitigation measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW16	**Construction water quality**	**An EWMS for the management of construction wastewater from the superstructure over the waterway would be developed for review and approval by Transport.**	**Contractor**	**Construction**	**Additional safeguard**

6.5 Hydrology and flooding

This section describes the hydrology and flooding impacts that may occur when constructing and operating the proposed modification. It summarises the Technical Memorandum: Surface Water prepared by SMEC that is attached as Appendix E.

6.5.1 Methodology

The flow estimation method in the project REF used Regional Flood Frequency Estimation (RFFE), however, this method has since been deemed unsuitable for a catchment containing a flood-controlling structure, being the Woronora Dam. For this reason, a Flood Frequency Analysis (FFA) was carried out for the proposed modification. The change in flow estimation method has resulted in a change in the assessed flood levels and velocities.

The methodology for the hydrology and flooding assessment of the proposed modification was based on Australian Rainfall and Runoff 2019 guidelines (AR&R 2019) and involved:

- reviewing publicly available hydrology and flooding information relevant to the proposed modification, including information on the catchment and previous flood investigations
- calculating peak flow discharges for a range of storm events (from 0.05 per cent annual exceedance probability (AEP) to one per cent AEP events) for “The Needles” causeway using At-Site Flood Frequency Analysis (FFA) and TUFLOW FLIKE software
- assessing flood sensitivity to climate change through an AR&R 2019 risk-based climate change assessment
- predicting the existing 0.05 per cent and one per cent AEP flood levels below the Heathcote Road bridge using HEC-RAS computer software
- assessing the potential flooding impacts of the new bridge structure on the one per cent AEP flood level
- assessing the potential hydraulic impacts of the temporary waterway crossing and crane pads within the Woronora River using TUFLOW software
- providing safeguards and management measures to manage the potential impacts on hydrology and flooding.

6.5.2 Existing environment

As a result of the methodology changes outlined in Section 6.5.1, the baseline predicted flood levels and flood velocities beneath Heathcote Road bridge have been adjusted for the proposed modification (refer to Table 6-7 and Table 6-8).

It should be noted that the adjustment in flood levels and velocities is due to the change in flow estimation method from the project REF, and is not related to the new bridge in the proposed modification design (i.e., the difference is due to a change in method, and does not constitute a change in outcome). The existing bridge deck and approaches would remain outside the one per cent AEP flood event (as was the case in the project REF).

Table 6-7 Adjustments to predicted flood levels below the Heathcote Road bridge

AEP (%)	Design criteria predicted flood level (as per project REF) (m AHD)	Revised design criteria predicted flood level (m AHD)	Flood level difference (m)
1	24.02	21.90	-2.12

AEP (%)	Design criteria predicted flood level (as per project REF) (m AHD)	Revised design criteria predicted flood level (m AHD)	Flood level difference (m)
10	20.62	20.41	-0.21
20	19.76	19.77	0.01
50	18.64	18.65	0.01

Table 6-8 Adjustments to predicted flood velocities below the Heathcote Road bridge

AEP (%)	Flood velocity through existing bridge (as per project REF) (m/s)	Flood velocity through existing bridge (as per addendum REF) (m/s)	Flood velocity difference (m/S)
50	0.8	1.2	0.4
20	1.1	1.5	0.4
10	1.2	1.7	0.5
5	1.4	1.7	0.3
2	1.5	1.8	0.3
1	1.6	1.8	0.2

During a one per cent AEP flood event, there would be a 2.12 metre decrease in flood level during compared to the project REF due to adjustments to the baseline modelling methodology. Despite this, the land located beneath the Heathcote Road bridge (including the proposed location of the temporary access track and laydown area) still has the potential to flood during a range of flood events, with the temporary working platform overtopping in the 50% AEP flood event or greater (consistent with the project REF).

6.5.3 Potential impacts

Construction

Detailed design has refined the parameters for the temporary waterway crossing and rock platform for the crane pads, as well as the temporary access track. Pier construction would require temporary work such as craneage and scaffolding equivalent to or reduced compared to the project REF. The largest plant required in the waterway would be cranes, which would have been required for both the approved project and proposed modification. As such, the proposed modification would not result in a substantial increase in the temporary waterway crossing area.

The hydrology and flooding impacts during construction of the proposed modification would be generally consistent with those identified in Section 6.5.3 of the project REF. The overtopping level would be reduced to around 17.5 metres AHD as part of the proposed modification to reduce temporary impacts to the flow regime. The lower overtopping level of the modified rock platform would reduce the area of waterway obstructed by the temporary platform, minimising flooding impacts compared to the project REF. Flooding and the potential need to move plant and machinery out of the waterway would be considered and managed by the project CEMP and sub-plans. As described in the project REF, the temporary low flow pipes under the crane pad would be prone to debris blockage and

sedimentation, however, this would be managed through regular inspection and unblocking during construction.

Afflux in the waterway would marginally increase compared to the approved project to the levels shown in Table 6-9. While the overtopping level and obstruction area of the temporary working platform would be lower than the project REF, the changes to the methodology (refer to Section 6.5.1) have resulted in a marginal increase in afflux. However, no private properties situated in the one per cent AEP flood extent in the vicinity of the bridge that would experience adverse flood impacts during construction.

Table 6-9 Upstream afflux for construction flood impacts

Design Flood Event AEP (%)	Upstream Afflux (mm)
20	140
5	80
2	70
1	70

Work areas near the waterway may be impacted by releases from the upstream Woronora Dam. Impacts of these releases on these areas would be minimised through regular communication between the construction contractor and Water NSW. This communication has been established through the early work phase of construction and would continue through later phases of construction.

Temporary drainage will be managed with controls and systems that are shown on the site-specific erosion and sediment control plans, these plans will be updated for each stage of construction.

Operation

The proposed modification would result in minor changes to surface water flow patterns and runoff due to the increased impervious area from the new road pavement and altered topography from the earthworks and rock cutting. However, impacts associated with these hydrological changes would be negligible as free-draining scuppers would be installed on the new bridge (consistent with the existing bridge). Runoff would be able to flow freely through a 50-millimetre gap between the two bridge decks.

The additional longitudinal drainage work required in the northern extension of the modified project boundary would result in reduced sheet flow, aquaplaning and flooding issues along the road, resulting in a positive operational impact from the proposed modification.

Impacts on hydrology and flooding associated with the new bridge are expected to be negligible as the new bridge would be located immediately to the west of the existing bridge and in-line with the existing bridge. The additional bridge piers would be constructed in the waterway aligned with the existing bridge piers in the direction of flow with the same effective width. As a result, the reduction in waterway area associated with the construction of the new bridge would be negligible and would result in negligible impacts to the hydrological regime of the Woronora River when the bridge is operational. There would also be no increases in water flows and flood velocity during operation of the new bridge.

The new piers would cause flood afflux upstream of the bridge of up to 30 millimetres in the one per cent AEP flood event. However, this flood risk is confined to the Woronora River

floodway and would not increase flood risk to any private properties, motorists or key infrastructure.

The proposed modification is not expected to result in long-term impacts to scour in the waterway. The bases of the northern and southern bridge abutments are both outside the one per cent AEP events and so would not be susceptible to scour due to the proposed modification. It is anticipated that any scour holes which form at the bridge piers during a flood event would be refilled by upstream bedload (alluvial material) when the flood recedes. This would remove the need to carry out maintenance for manually fill in scour holes and reinstate displaced scour protection. The reduction in scour protection would also minimise disturbance within the waterway compared to the project REF.

The new bridge deck would remain outside one per cent AEP (consistent with the existing bridge) and therefore unlikely to flood.

6.5.4 Safeguards and management measures

Safeguards HF-1 to HF-6 are considered adequate to address the hydrology and flooding impacts of the proposed modification. Additional safeguard HF-7 has been proposed to address the additional hydrology and flooding impacts due to the proposed modification (refer to Table 6-10).

Table 6-10 Amendments to hydrology and flooding safeguards and mitigation measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
HF7	Hydrology and flooding impacts from waterway crossing	There will be regular clearing of vegetation debris and sedimentation blockage in temporary low flow pipes under crane pad to minimise frequency of crane pad overtopping during heavy rainfall events.	Contractor	Construction	Additional safeguard

6.6 Aboriginal cultural heritage

This section describes the Aboriginal cultural heritage impacts that may occur when constructing and operating the proposed modification. It summarises the Aboriginal Heritage consistency assessment attached as Appendix F.

6.6.1 Methodology

The approach to the assessment of potential Aboriginal heritage impacts has involved a review of the:

- Aboriginal Archaeological Survey Report prepared in accordance with Transport's Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI Stage 2) as part of the project REF
- design adjustments of the proposed modification compared to the approved project.

This review was supported by an updated Aboriginal Heritage Information Management System (AHIMS) search conducted on 11 January 2022 to identify registered (or known) Aboriginal sites or declared Aboriginal places within or near to the modified project boundary.

6.6.2 Existing environment

The modified project boundary including the additional clearing for the north-west cut was within the area assessed in the Stage 2 PACHCI. The existing environment is consistent with Section 6.6.2 of the project REF.

The updated AHIMS search carried out on 11 January 2022 returned four known Aboriginal sites within a broader search area. One of these AHIMS sites ('Scouters Mountain Engadine' (AHIMS 52-2-0742)) is within the modified project boundary. This updated search identified no additional AHIMS sites beyond those identified in the project REF.

The modified project boundary also contains a portion of the Cubbitch Barta National Estate Area (also referred to as the Holsworthy Military Training Area) which is a listed place on the Commonwealth Heritage List (Place ID 105405). It is listed on the Commonwealth Heritage List and protected under the EPBC Act for its Indigenous values. No previously recorded or registered AHIMS sites or potential archaeological deposit (PAD) areas associated with the listing were recorded within the modified project boundary.

The area of vegetation and rock proposed to be cleared at the north-west cut was assessed for Aboriginal cultural heritage potential during the project REF. The rocky steep slopes in this area were found to not provide any potential for rockshelter sites. Around and under the existing bridge, flat outcropping sandstone exposures or riverbed sandstone exposures were closely inspected for any evidence of Aboriginal sites, however, none were identified. An additional site survey to the north-western extent of the proposed modification undertaken to inform this addendum REF included an additional inspection of trees in this location for any cultural heritage potential. One tree with scarring was recorded though the tree scar was determined to not be diagnostically cultural, with evidence of branch tearing along the top of the scar and insect damage at the base. No specific cultural markers were visible within or around the scar, indicating the tree scar was a naturally formed scar without cultural heritage significance.

6.6.3 Potential impacts

Construction

There would be no change to impact to the 'Scouters Mountain Engadine' (AHIMS 52-2-0742) site compared to the project REF as it would be avoided during construction. The five-metre exclusion zone has been maintained in the proposed modification to avoid any direct impacts by the proposed modification. A Vibration Risk Assessment and a Ground Vibration Management Plan would be prepared to manage any indirect risk from vibration generating activities (refer to Section 6.2.5 of the project REF).

The Cubbitch Barta National Estate Area heritage place identified within the existing Aboriginal archaeological survey assessment (Appendix G to the project REF) would be impacted by the proposed modification. The PACHCI Stage 2 previously identified impacts to the Cubbitch Barta National Estate Area heritage place based upon the design of the approved project in the project REF. The CBNEA boundary overlaps with the road corridor therefore impacts would be unavoidable. However, the proposed modification would remain aligned with the function of the land as a safe functioning transport corridor. While there would be no change to the extent of the Cubbitch Barta National Estate heritage place within the approved project boundary, the proposed modification would extend the design up to nine metres to the west compared to the project REF. This would require additional rock cutting and up to four metres of additional vegetation clearing to the west to accommodate the new bridge and extended access track compared to the approved project. This would include additional grinding back of a localised section of the northern rock cutting to accommodate the widening of the road cross section. The proposed modification would result in additional impacts to about 1800 square metres of this heritage place (equivalent to 0.001 per cent of the estate).

The section of the Cubbitch Barta National Estate Area that would be impacted by the proposed modification does not contain Aboriginal objects and some evidence of previous disturbance exists within the general landscape. The assessment concluded that the proposed modification would result in minor impacts to the Cubbitch Barta National Estate Area (refer to Appendix F).

Overall, the proposed modification is not expected to impact any other known Aboriginal heritage items or areas where potential items may be present. Assessment as per the PACHCI requirements concluded that an AHIP would not be required for the proposed modification, consistent with Section 6.6.3 of the project REF.

Operation

No Aboriginal heritage items or places are likely to be impacted during operation.

6.6.4 Safeguards and management measures

Safeguards AH-1 to AH-3 remain appropriate to address the Aboriginal cultural heritage impacts of the proposed modification.

6.7 Non-Aboriginal heritage

This section describes the non-Aboriginal heritage impacts that may occur when constructing and operating the proposed modification. It summarises the addendum Statement of Heritage Impacts attached as Appendix G.

6.7.1 Methodology

The non-Aboriginal heritage assessment was carried out in accordance with current heritage guidelines including *Assessing Heritage Significance, Assessing Significance for Historical Archaeological Sites and 'Relics'* and the *Burra Charter*, and provides an assessment of heritage items or relics that exist within or in the vicinity of the proposal area.

The methodology included:

- reviewing and confirming the relevance of:
  - statutory advice provided in the project REF
  - literature review carried out to inform the project REF
  - the assessment of potential impacts in the project REF statement of heritage impacts
  - the safeguards and mitigation measures identified in the project REF and submissions report
- carrying out field investigations of the modified project boundary to identify known historical heritage items, unrecorded historical heritage items and assess the potential for any unrecorded historical heritage items
- undertaking a targeted inspection of a potential scarred tree at the north-western extent of the modified project boundary
- identifying and assessing additional or modified potential impacts to heritage items due to the proposed modification
- recommending additional safeguards and management measures to be implemented to avoid or mitigate any negative impacts on the heritage significance in the modified project boundary.

6.7.2 Existing environment

The existing non-Aboriginal heritage environment relevant to the proposed modification is consistent with that described in section 6.7.2 of the project REF. The study area assessed in the project REF included the northern extension in the modified project boundary.

6.7.3 Potential impacts

Construction

There are two listed heritage items within the modified project boundary that would be subject to physical impacts from construction of the proposal. These are:

- Woronora River Bridge, RTA Bridge No. 152
- Cubbitch Barta National Estate Area. (105405).

The impacts to these items are discussed in the following sections.

Woronora River Bridge

The proposed modification would result in a substantial reduction of impacts to the Woronora River Bridge compared to the approved project. It would result in minor direct impacts to the bridge (compared to moderate direct impacts in the project REF). This would allow the bridge to retain its State heritage significance.

The proposed modification would require:

- changes to pavement and line marking, which are considered exempt minor or maintenance work
- upgrades to the western barrier on the existing bridge, which would not impact heritage significance as the edge barriers were not original fabric and had been replaced in the 1990s
- repair and maintenance works are still required consistent with the project REF, which would add value as they would extend the design life of the bridge.
- the sandstone facing of the bridge abutments to be capped for protection, reducing impacts to the abutments compared to the approved project, and an expansion of the total abutment area on the northern and southern sides to capture both the old and new bridge structures.

The conversion of the bridge to a single lane would also extend the bridge's design life by reducing the weight load on the bridge.

Cubbitch Barta National Estate Area

The proposed modification would result in minor, direct impacts to the Cubbitch Barta National Estate Area. The north-west cut would remove elements of the landscape and vegetation within the estate area to allow for the construction of the new bridge and its approaches to the west of the existing road alignment. Impacts would be to less than one hectare of the 18,000 hectare estate area.

However, the proposed modification would not impact any identified items of heritage significance within the estate area and would impact land with low archaeological potential. A section of the existing Heathcote Road also already passes through the estate area.

On the assessment of the place's historical values, the proposed work would be small scale, low intensity and localised to a small area, and the overall impact to the Estate is considered to be minor. This finding is consistent with the project REF.

Impacts to other heritage items

The proposed modification is anticipated to have no physical impacts to other listed heritage items identified near the modified project boundary. There would be negligible visual impacts to the heritage significance of Kolora Weir and Woronora-Penshurst pipeline. Views of these heritage items may be temporarily obstructed during construction.

It would result in a reduction of impacts to the unlisted heritage stone features at cross culvert outlets which would no longer be extended due to a reduction in extent of roadworks.

The proposed modification would result in direct impacts to the unlisted south-west sandstone retaining wall near the bridge abutments due to the shift of the road alignment to the west. This wall would be buried under the new widened southern abutment and wing wall. Avoidance of direct impacts was not deemed possible as relocation of the sandstone blocks would destabilise the adjacent ground. The proposed modification would also avoid impact to the south-eastern unlisted sandstone retaining wall feature described in the project

REF. These features would be captured in archival recording consistent with project REF safeguards (refer to safeguard NH-6 in Section 6.7.4).

Operation

Woronora River Bridge

During operation, the new bridge directly to the west of the heritage listed existing bridge would obstruct views towards the existing bridge from the west. This would result in a minor visual impact on the heritage item (which would be greater than under the approved project). The magnitude of this adverse impact would be minimised as the surrounding environment restricts views of the bridge and public access to viewpoints along the valley floor. These impacts would also be minimised through the design of the new bridge. The design of the new bridge is intended to complement the existing bridge, including through concrete construction, similar colouring and matching pile shapes, allowing the heritage item to still be appreciated whilst providing a sympathetic visual appearance.

No operational vibration impacts to the item are anticipated as the new bridge would be constructed separate to the existing bridge.

Cubbitch Barta National Estate Area

The proposed modification would result in minor visual (indirect) impacts to the Cubbitch Barta National Estate Area. It would result in an increase to the north-west cut compared to the approved project with additional vegetation impacts along the crest of the cutting. However, the cross-sectional area of the rock cutting face would remain generally consistent with the approved project and is still proposed to be a near vertical cut (with no benching within the height of the existing cutting). The proposed slope face treatments would also be generally consistent with the approved project, including potential shotcrete treatments. As such, upon completion of the works, the impacted part of the estate area would appear similar to its current form.

There would not be impacts to heritage significant elements of the Cubbitch Barta National Estate Area. The impacted area would be a small part of the entire estate area. The proposed modification seeks to find a holistic solution which balances impacts to the existing bridge with impacts to the edge of the Cubbitch Barta National Estate Area boundary.

Impacts to other heritage items

During operation of the proposed modification, the Kolora Weir may be partially obstructed when viewed from the Woronora River Bridge. However, this is anticipated to result in negligible indirect visual impacts to the item's heritage significance.

There would also be negligible impacts to the Woronora-Penshurst pipeline, Royal National Park and Garawarra State Conservation Area and unlisted heritage items near the proposed modification during operation.

6.7.4 Safeguards and management measures

Safeguards NH-1 to NH-4 and NH-7 are considered adequate to address the non-Aboriginal heritage impacts of the proposed modification. Safeguard NH-5 and NH-6 have been amended and additional safeguard NH-8 has been proposed to address the additional non-Aboriginal heritage impacts due to the proposed modification (refer to Table 6-11).

Table 6-11 Amendments to non-Aboriginal heritage safeguards and mitigation measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NH5	Non-Aboriginal heritage – Woronora River Bridge	During the detailed design process the following will be considered to limit impacts to the Woronora River Bridge: • retain as much of the original fabric of Woronora River Bridge where possible. • ~~**use of sympathetic colour shades and textures for steel paint finishes of the box girders and headstock extensions.**~~ • **carry out sandstone capping for the abutments.** • carry out colour and material matching for repair and maintenance works. • an appropriately qualified structural engineer to carry out an assessment of structural integrity for each element to be removed and/or replaced prior to removal as part of repair and maintenance works. Only replace elements which are at risk of failing. **A conservation architect will be consulted to provide advice regarding the scope of maintenance work and appropriate management measures.** • ~~**salvage sandstone block facing from abutments and incorporate their use into the project or potential heritage precinct.**~~ • use of discrete fencing with hoarding or fabric for Woronora River Bridge during works.	Transport/ contractor	Detailed design/ operation	Additional safeguard
NH6	Non-Aboriginal heritage – Woronora River Bridge	Archival recording of the Woronora River Bridge and any associated ~~**infrastructure**~~ **heritage items to be impacted** will be carried out prior to construction **in a Photographic Archival Recording (PAR). This will create a record of the item's appearance prior to construction works and document the views to and from the item which will be affected by the proposed modification.** To ensure total	Contractor	Pre-construction/ operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		impacts are catalogued, an archival recording of the Woronora River Bridge is also recommended after the conclusion of works.			
NH8	**Other non-Aboriginal heritage items**	**To reduce direct and indirect impacts to other heritage items during work, the following will be implemented:** • **Regularly monitor vibrations levels during works.** • **Erect an exclusion zone around the survey marker tree (if located during work) until an archival recording and salvage of the item is conducted. The survey marker to be used as part of an interpretive display.**	**Contractor**	**Construction**	**Additional safeguard**

6.8 Property and land use

6.8.1 Methodology

The methodology adopted for this property and land use assessment was consistent with that outlined in Section 6.8.1 of the project REF.

6.8.2 Existing environment

The existing property and land use environment relevant to the proposed modification is consistent with that described in section 6.8.2 of the project REF. The proposed modification design and construction footprint is zoned 'SP2 Infrastructure (Classified Road)' except for the southern portion of Compound Location 2, which is zoned 'B6 Enterprise Corridor'.

On 1 December 2021 the NSW Government renamed 'Environmental Protection Zones' as 'Conservation Zones' under clause 2.1 of Standard Instrument—Principal Local Environmental Plan (2006 EPI 155a). This is an administrative change of name only, with no impact to planning requirements compared to the project REF. This related to land now zoned as 'C1 – National Parks and Nature Reserves' and 'C2 – Environmental Conservation' within the modified project boundary.

6.8.3 Potential impacts

Additional property acquisition would not be required for the proposed modification as the design has been optimised to mostly occur within the approved project boundary from the project REF. The modified project boundary includes an extension of about 1565 square metres to the north beyond the approved project boundary required for construction and operation of drainage upgrades required for the proposed modification (Figure 1-2). This additional area occurs on Crown land and no acquisition is required due to this proposed extension of the project boundary (refer to Section 3.6). As such, the anticipated property and land use impacts of the proposed modification are generally consistent with those identified in Section 6.8.3 of the project REF.

During construction, there would be temporary land use impacts during the proposed closure of a section of Heathcote Road, which would change the use of the land from an operational road to a construction site for the proposed modification. This land use change and loss of road access may impact visitors and staff of surrounding land uses such as Heathcote National Park, ANSTO and Cleanaway Lucas Heights Resource Recovery Park, who may need to use longer alternate routes to access the properties. However, the magnitude of these land use impacts would be reduced compared to those assessed in Section 6.8.3 of the project REF due to the reduced duration of road closure as part of the proposed modification.

Transport has and would continue to consult with these key stakeholders to minimise impacts on surrounding land uses associated with the change in road access. Traffic and transport impacts are discussed in Section 6.1.3, landscape character and visual impacts in Section 6.9, and socio-economic impacts in Section 6.10.

6.8.4 Safeguards and management measures

Safeguards LP-1 to LP-4 are considered adequate to address the property and land use impacts of the proposed modification. No additional measures are proposed.

6.9 Landscape character and visual impacts

This section describes the landscape character and visual impacts that may occur when constructing and operating the proposed modification. It summarises the Addendum to TfNSW Appendix I: Heathcote Road Bridge Urban Design Concept prepared by Tract that is attached as Appendix H.

6.9.1 Methodology

The assessment was carried out in accordance with the *Environmental Impact Assessment Practice Note - Guidelines for Landscape Character and Visual Impact Assessment (EIA-N04) Version 2.2* (TfNSW, 2020e) and urban design guideline *Beyond the Pavement* (TfNSW, 2020f).

The methodology for the landscape and visual impact assessment involved:

- reviewing the suitability of the visual catchment prepared for the project REF (i.e. the approximate area where it would be possible to see the proposed modification)
- reviewing the suitability of the landscape character zones (LCZs) identified in the project REF, which are areas of similar character within and surrounding the modified project boundary
- reviewing the suitability of the representative viewpoints within the visual catchment
- determining the sensitivity of each LCZ and viewpoint to changes in the landscape, through consideration of the existing quality of the views and type of visual receivers
- determining the potential magnitude of change from construction and operation of the proposed modification for each LCZ and viewpoint, by considering the scale, nature and duration of change
- assessing the potential impacts of the proposed modification for each LCZ and viewpoint, which combines the level of sensitivity and magnitude of change using a matrix (refer to Table 6-12)
- recommending mitigation measures, including urban design principles, to minimise the potential landscape character and visual impacts identified.

Table 6-12 Landscape character and visual impacts rating matrix

		Magnitude			
		High	**Moderate**	**Low**	**Negligible**
Sensitivity	High	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.9.2 Existing environment

The existing landscape character and visual impact environment relevant to the proposed modification is consistent with that described in section 6.9.2 of the project REF. The landscape character zones are unchanged from the project REF and are shown in Figure 6-3.

The visual catchment of the proposed modification is also unchanged from the project REF. The proposed modification would remain most visible along the road corridor and at the waterway near the new bridge, however there would be glimpses outside the road corridor.

As the proposed modification has a relatively similar footprint to the approved project (with only a small extension to the north in the modified project boundary), the landscape character zones and viewpoints remain unchanged from the project REF.

6.9.3 Potential impacts

Construction

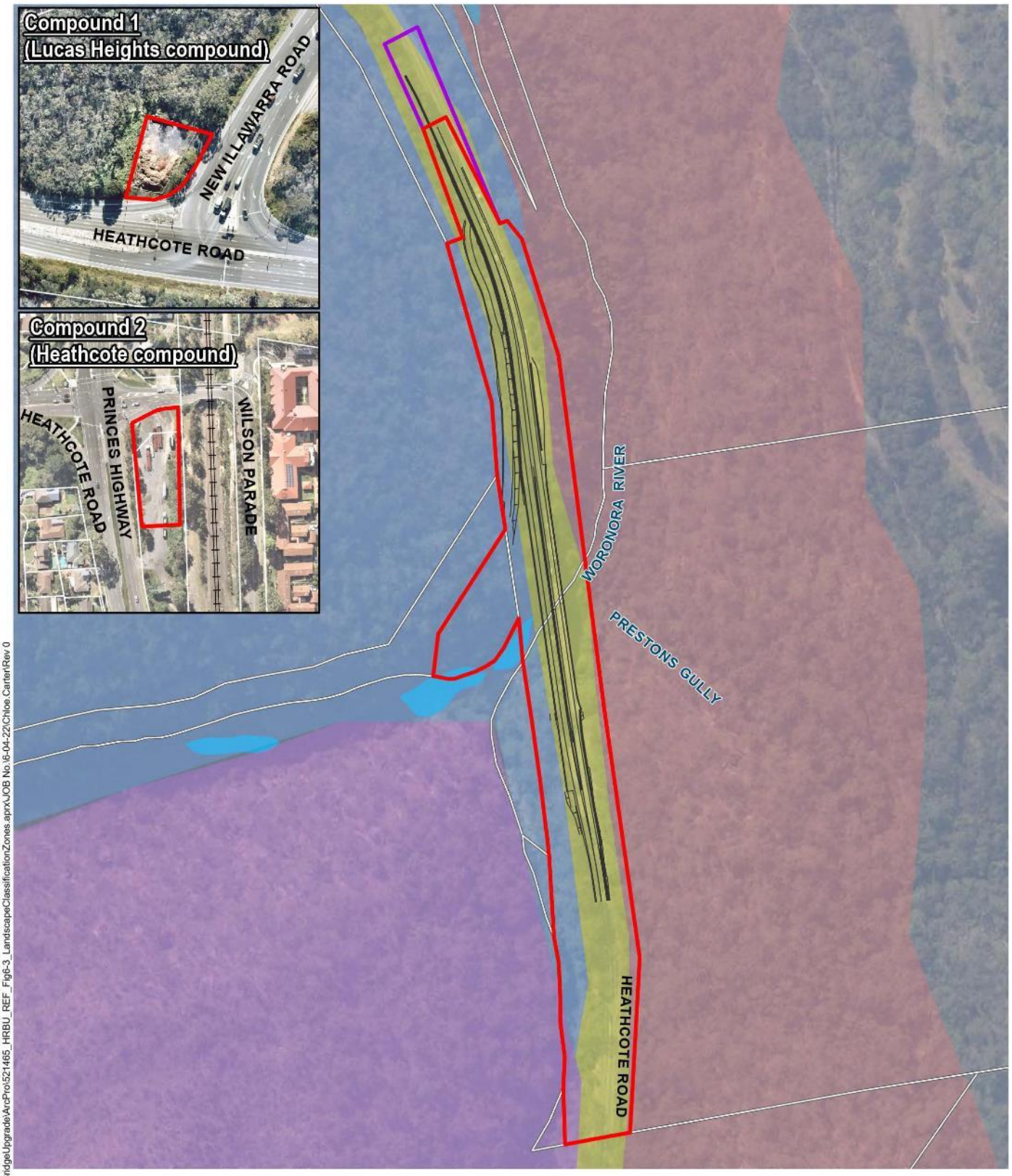
Landscape character impacts

Landscape character impacts expected during construction of the proposed modification would be consistent with those assessed in Section 6.9.3 of the project REF.

In LCZ-4 Heathcote Road, the road would no longer become a long-term construction site and would instead remain operational during the predominantly offline construction of the proposed modification. However, construction areas would be adjacent to the road and result in a similar ‘moderate to high’ impact rating for motorists passing through (as transient receivers).

Visual impacts

Although construction of the proposed modification would occur within an environment with high sensitivity and would introduce new temporary elements into the landscape, the construction activities would have limited visibility (as the majority of construction activities would occur outside the active road corridor). Motorists travelling across the Heathcote Road bridge would only be able to see glimpses of construction activities. There are limited other opportunities to view the modified project boundary. As such, given the transient nature of motorists and the limited other visual receivers, visual impacts from construction of the proposed modification are considered to be negligible. These impacts would be generally consistent with those assessed in Section 6.9.3 of the project REF.



Approved project boundary
Modified project boundary
Proposed modification design
Lot
Water bodies

Landscape character zones
LCZ-1 Engadine Bushland
LCZ-2 Holsworthy Military Reserve
LCZ-3 Heathcote National Park
LCZ-4 Heathcote Road

P:\GIS\Project-5\Project\521465_HReathcoteRd_BridgeUpgrade\ArcPro\521465_HRBU_REF_Fig6-3_LandscapeClassificationZones.aprx\JOB No.\6-04-22\Chloe.Carter\Rev 0

Source: Aurecon, TfNSW, Spatial Services, Esri

1:3,500 @ A4
0 50 100m

Projection: GDA 1994 MGA Zone 56

Heathcote Road Bridge **Addendum REF**

FIGURE 6-3: Landscape character zones

Operation

Landscape character impacts

Landscape character impacts expected during operation of the proposed modification would remain generally consistent with those assessed in Section 6.9.3 of the project REF.

The impact rating for LCZ-4 (which is the existing Heathcote Road road corridor) would remain as ‘moderate’. However, the widened lanes on the new bridge and introduction of the median would marginally enhance motorists’ experience travelling along this section of Heathcote Road.

Visual impacts

The visual impacts expected during operation of the proposed modification are outlined in Table 6-13.

Table 6-13 Visual impacts – operational

Viewpoint ID	Description of change	Sensitivity	Magnitude	Impact rating
V01 – Northern approach facing north 	Modified rock cuttings and new verge treatment would contrast with the existing viewpoint. This would reduce when the rock cutting weathers.	Moderate	Moderate	Moderate adverse impact
V02 – Northern approach facing south 	Widened road with shoulder and paved breakdown bay and minor changes to verge treatments would be visible, which contribute to the road being more dominant within the setting. Sections of shotcrete, rock bolts, rock netting and removed vegetation would be visible.	Moderate	High	Moderate to high adverse impact

Viewpoint ID	Description of change	Sensitivity	Magnitude	Impact rating
V03 – Existing bridge facing south 	The enhanced sense of safety (including through centre median) would contribute to a better visual experience and lessen the adverse nature of the impact.	High	Moderate	Moderate to high adverse impact
V04 – Southern approach facing south 	Road would be widened. New verge treatment would contrast with the existing viewpoint. This would reduce over time as vegetation establishes. Shotcrete work and use of rock mesh and bolts would be minimised to limit visual impacts.	Moderate	Moderate	Moderate adverse impact

Viewpoint ID	Description of change	Sensitivity	Magnitude	Impact rating
V05 – Woronora River facing north-west towards existing bridge 	New bridge structure, piers and girders would be visible behind the existing bridge, however, the existing bridge would remain dominant. The northern abutment wall may be visible. The visual impact would be reduced once the riverscape vegetation recovers.	Moderate	Low	Low to moderate adverse impact
V06 – Underneath the existing bridge facing north 	New bridge structure, piers and girders would be clearly visible behind the existing bridge. The northern abutment wall may be visible. Loss of vegetation would be noticeable however the visual impact would be reduced over time as vegetation matures.	Low	High	Moderate adverse impact

Viewpoint ID	Description of change	Sensitivity	Magnitude	Impact rating
V07 – Woronora River facing north-east 	New bridge structure, piers and girders would be clearly visible in front of the existing bridge. The alignment of piers and elevation of the new bridge result in the magnitude of change. The visual impact of vegetation loss (even though this area is mostly weed cover) would be reduced over time as vegetation matures.	Moderate	Low	Low to moderate adverse impact
V08 – Woronora River facing east towards existing bridge 	New bridge structure, piers and girders would be clearly visible in front of the existing bridge. The alignment of piers and elevation of the new bridge result in the magnitude of change. Loss of vegetation would be noticeable however the visual impact would be reduced as vegetation matures. The introduction of the new bridge as part of the proposed modification would increase the magnitude of visual impact compared to the approved project. However, due to the limited access of the viewpoint for potential receivers, the visual impact assessment would remain moderate.	High	Moderate	Moderate to high adverse impact

6.9.4 Safeguards and management measures

Safeguard V-1 and V-2 are considered adequate to address the landscape character and visual impacts of the proposed modification. No additional measures are proposed.

6.10 Socio-economic

6.10.1 Methodology

The methodology adopted for this socio-economic impact assessment was consistent with that outlined in Section 6.10.1 of the project REF. The socio-economic study area is the same as that adopted for the project REF.

6.10.2 Existing environment

The existing socio-economic environment relevant to the proposed modification is consistent with that described in Section 6.10.2 of the project REF.

6.10.3 Potential impacts

The anticipated socio-economic impacts of the proposed modification are generally consistent with those identified in Section 6.10.3 of the project REF, except where identified in the following sections.

Construction

Social infrastructure

Impacts to emergency service access to areas within the socio-economic study area would be greatly reduced by the proposed modification, compared to the project REF. This is due to the reduction in duration of the expected closure of Heathcote Road from about six months of continuous full road closure (24 hours per day as per the project REF) to about 67 weeknight and 12 weekend full road closures. Consultation with emergency services would still be required in advance of any partial or full road closures to ensure alternative emergency routes or services within the study area are available to respond to emergencies.

Business, industry and tourism

Construction activities would mainly be limited to the bridge and its approaches on Heathcote Road and would have minimal direct impacts on local businesses and industry.

The proposed modification would indirectly impact businesses that use Heathcote Road for travel. This includes freight operators and commuters that require north/south connectivity in the socio-economic study area. However, the proposed modification would result in reduced impacts to these businesses compared to the project REF due to a large reduction in duration of expected full road closures (refer to the previous section).

Road closures during holiday periods may impact road users travelling north-south between Sydney and the Illawarra-Shoalhaven and South Coast regions. Road closures would be subject to Traffic Management Centre approval. Where possible, the anticipated 67 weeknight and 12 weekend full road closures would be scheduled to avoid overlap with holiday periods. This would minimise impacts of the full road closures to holidaymakers. The communications strategy would include traffic alerts and an electronic signage strategy to inform road users of any planned road closures.

Transport and access

The proposed modification would restrict access for traffic travelling along Heathcote Road during periods of full road closures. The provision of an alternative detour route would result in increased travel times and potential congestion on surrounding State roads, however, as these detour periods have shifted to avoid peak hour, the impacts are considerably reduced. Increased travel times and congestion may lead to increased frustration for local road users as the proposed alternative route would be about 20 kilometres longer than the existing route via Heathcote Road. However, the impact on road users of the proposed modification would be substantially reduced compared to the project REF. There would be a reduction in duration of full road closure of Heathcote Road from about six months with a continuous full road closure (as per the project REF) to about 67 weeknight and 12 weekend full road closures.

The adjusted duration of full road closures would also reduce the expected minor impacts on cyclists who may wish to use Heathcote Road.

Community values

The community may experience feelings of severance during full road closures on Heathcote Road during construction. However, due to the reduction in proposed full road closure duration from about six months (as per the project REF) to 67 weeknight and 12 weekend full road closures, the proposed modification is expected to reduce the feelings of severance which may be experienced by the community.

During construction of the proposed modification, gawk screens would be established to shield the construction areas from motorists travelling along Heathcote Road. This would lead to minor visual impacts for passing receivers. Community concerns associated with general earthworks and the associated vegetation removal may also occur. Given Heathcote Road would remain open to traffic for most of the construction period, these impacts would be visually greater than those identified in the project REF when most construction work would have occurred during a full road closure. However, given the transient nature of motorists passing the area at speed, this impact is considered minor and acceptable.

Amenity impacts in the form of noise impacts would occur during construction of the proposed modification. The use of a driven piling rig for construction of the new bridge piers would slightly increase the amenity impacts compared to those identified in the project REF. These impacts would be minimised as the driven piling rig would be used during standard working hours only. Most surrounding receivers would be largely shielded from construction noise due to vegetation and the difference in elevation to the main works area, which would reduce the construction noise levels experienced.

The noise assessment predicts that road traffic noise levels along Heathcote Road would reduce during construction when the full road closure is implemented for out of hours work. This reduction in road traffic noise levels would only occur during the weeknight and weekend full road closures, which is a shorter period than identified in the project REF.

Operation

Business and industry

The proposed modification would improve network reliability along Heathcote Road. This would have an indirect positive impact on people using the road for access, including

commuters travelling to work and freight operators travelling north and south through Sydney.

Transport and access

The proposed modification would have a positive impact on people travelling on Heathcote Road through improved road safety and network reliability from widening the bridge and approaches.

Community values

The removal of vegetation required for the proposed modification would result in an adverse impact to community values. About 1.2 hectares of vegetation would be removed for the proposed modification. This is a substantial reduction from 3.12 hectares of vegetation removal as per the approved project. This would result in reduced visual amenity impacts and reduced impacts to community values for the local community and road users compared to the approved project.

Once operational, the proposed modification would improve safety on Heathcote Road. The separation of opposing traffic flows with a central concrete median between the two bridges would result in a safer outcome compared to that assessed in the project REF. This separation would reduce the risk of head-on and rear-end collisions and crashes involving out-of-control vehicles. This would benefit all road users and the community who value safety within the Sutherland Shire LGA.

The proposed modification would also improve network reliability by providing wider lanes and shoulders than the project REF. This means there would be extra room for vehicles to navigate around traffic incidents (such as breakdowns) on the bridges and improved emergency services access. The road network would also be more reliable because of the ability for temporary diversions of both lanes of traffic onto either bridge (for example, during maintenance). As a result, the proposed modification would benefit people living in and travelling through the study area.

6.10.4 Safeguards and management measures

Safeguard SE-1 is considered adequate to address the socio-economic impacts of the proposed modification. No additional measures are proposed.

6.11 Other impacts

6.11.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Waste and resources	Waste and resources relevant to the proposed modification is consistent with that described in Section 6.11.1 of the project REF.	Section 3.3.6 describes the resources that would be needed to build the proposed modification. The potential impacts of the proposed modification on waste and resources would be consistent with those described in Section 6.11.1 of the project REF. Additional waste quantities due to the proposed modification would be negligible in the context of the project and no additional types of waste have been identified.
Air quality	Air quality relevant to the proposed modification is consistent with that described in Section 6.11.1 of the project REF.	The potential impacts of the proposed modification on air quality would be generally consistent with those described in Section 6.11.1 of the project REF. There would be temporary, localised and minor emissions from machinery (for example, delivery vehicles, construction plant), use of the proposed detour route and dust. However, due to the proposed reduction in duration of the full road closures of this section of Heathcote Road, the anticipated air quality impacts from emissions from vehicles using the detour route may be reduced compared to those assessed in this section of the project REF.
Greenhouse gases and climate change	Greenhouse gases and climate change relevant to the proposed modification is consistent with that described in Section 6.11.1 of the project REF.	The potential impacts of the proposed modification on greenhouse gases and climate change would be generally consistent with those described in Section 6.11.1 of the project REF. Due to the proposed reduction in duration of the full road closures of this section of Heathcote Road, the anticipated greenhouse gas emissions from vehicles using the detour route may be reduced compared to those assessed in this section of the project REF, however, there would be additional truck movements due to increased earthworks for the proposed modification.
Utilities	Utilities relevant to the proposed modification is consistent with that described in Section 6.11.1 of the project REF.	The pile arrangement for the new bridge has been designed to avoid impacts to the existing AARNet fibre optic cable. As per safeguard TT4 (refer to Section 7.2), access would be maintained for utility providers at all times, where possible. Access to utilities along Heathcote Road would be maintained for utility providers during construction.

Environmental factor	Existing environment	Potential impacts
Hazards and risk management	Hazards and risk management relevant to the proposed modification is consistent with that described in Section 6.11.1 of the project REF.	The potential impacts of the proposed modification on hazards and risk management would be generally consistent with those described in Section 6.11.1 of the project REF. During construction, the reduction in duration of full road closures from about 6 months continuous full road closure to about 67 weeknights and 12 weekends would reduce the period of time during which special emergency vehicle access during road closures would need to be established and maintained. This would further minimise impacts of construction on access during emergency events (including bushfires). Once operational, the proposed modification would provide wider lane and shoulder widths compared to the design in the project REF (refer to Section 3.2.3). This would lead to improved road safety on the bridge and approaches, which would minimise the risk of road incidents. The provision of a bench during operation along the north-west cut access track would also improve safety as it would collect loose rockfall from above and allow maintenance inspection access.

6.11.2 Safeguards and management measures

Safeguards RW-1 to RW-4, AQ-1, CC-1 to CC-3, U-1, HR-1 and HR-2 are considered adequate to address the other impacts of the proposed modification. No additional measures are proposed.

6.12 Cumulative impacts

6.12.1 Potential impacts

The proposed modification would decrease the cumulative impacts of construction traffic and transport identified in Section 6.12.4 of the project REF. This is due to the substantial reduction in the duration of a full road closure of Heathcote Road between New Illawarra Road and the Princes Highway from about six months of continuous full road closure (as per the project REF) to about 67 weeknights and 12 weekends during construction of the proposed modification. This would reduce the potential for cumulative impacts associated with the upgrade of Linden Street and for the full closure of this section of Heathcote Road to impact proposed haulage routes for the construction of other nearby projects.

The proposed modification and the upgrade of Linden Street are being constructed by the same construction contractor. This would allow for scheduling of construction activities to be aligned to minimise cumulative impacts during construction of the two projects.

There would also be an improvement in the operational cumulative traffic and transport impacts, with the proposed modification expected to improve safety and reliability compared to the project REF design. This would lead to even greater cumulative benefits to traffic flow, network reliability and road safety along Heathcote Road and nearby key roads.

The proposed modification is not expected to otherwise materially change the assessment of cumulative impacts provided in Section 6.12.4 of the project REF.

6.12.2 Safeguards and management measures

Safeguards CU-1 to CU-3 are considered adequate to address the other impacts of the proposed modification. No additional measures are proposed.

7 Environmental management

7.1 Environmental management plans

A number of safeguards and management measures have been identified to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposed modification. Should the proposed modification proceed, these management measures would be addressed if required during detailed design and incorporated into the Construction Environmental Management Plan (CEMP) and applied during the construction and operation of the proposed modification.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures for the Heathcote Road Bridge Upgrade are summarised in Table 7-1. Additional safeguards and management measures identified in this addendum REF are included in bold and italicised font. The safeguards and management measures will be incorporated into the detailed design phase of the proposed modification and the CEMP and implemented during construction and operation of the proposed modification, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment.

Table 7-1 Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Transport Environment Manager 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 project manager	Pre-construction/ detailed design	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
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 project manager	Pre-construction	Core standard safeguard
GEN3	General – environmental awareness	All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular 'toolbox' style briefings. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include*:* • areas of Aboriginal and non-Aboriginal heritage sensitivity • threatened species habitat • noise and vibration management	Contractor/ Transport project manager	Pre-construction/ detailed design	Core standard safeguard
TT1	Traffic and transport impacts	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the *Traffic Control at Work Sites Manual* (Transport, 2020) and *QA Specification G10 Control of Traffic* (Roads and Maritime, 2008). The TMP will include: • confirmation of haulage routes and any Customer Journey Centre requirements • measures to maintain access to local roads and properties and minimise the potential for 'rat-runs' to form on local roads during road closures • site specific traffic control measures (including signage) to manage and regulate traffic movement	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• measures to maintain pedestrian and cyclist access • requirements and methods to consult and inform the local community of impacts on the local road network • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • a response plan for any construction traffic incident • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • monitoring, review and amendment mechanisms.			
TT2	Travel time impacts	Transport will investigate alternative construction methodologies and design innovations to minimise the need for road closures during peak traffic periods (including school drop-off and pick-up periods). Transport will also seek to minimise the duration of continuous full road closures required during construction.	Transport	Detailed design	Additional safeguard
TT3	Changed traffic conditions	Emergency Services, Sutherland Shire Council and the community will be notified in advance of any road closures and the likely disruptions to access in accordance with the Community and Stakeholder Engagement Plan. Adequate advisory and warning signage will be provided to inform motorists of the road conditions ahead including any road closure and/or detour route.	Contractor	Construction	Additional safeguard
TT4	Emergency vehicle and key	Access will be maintained for private properties, emergency response vehicles, NPWS staff and utility providers at all times, where possible. This will include maintaining access	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
	stakeholder access	to the Pipeline and Scouters Mountain fire trails, as required. If a stage of the work restricts access along Heathcote Road, alternative arrangements will be developed in consultation with the relevant stakeholders in advance.			
TT5	Road closures and detours	Temporary traffic diversions and road closures will be implemented in consultation with and in accordance with the Customer Journey Centre requirements.	Contractor	Construction	Additional safeguard
TT6	Road closures and detours	Prior to any proposed road closures Transport will consult with ANSTO to provide early notification of works and to investigate collaborative efforts to minimise impact to nuclear medicine deliveries.	Transport	Pre-construction	Additional safeguard
TT7	Enforcement of speed limits	Transport will consult with the NSW Police Force to discuss traffic management and enforcement of temporary / permanent speed limits, as required.	Transport	Construction / operation	Additional safeguard
TT8	Road closures	Transport will consider incorporating performance-based initiatives in the construction delivery contract to encourage innovation in the construction methodology and reduce the likelihood of peak traffic period road closures.	Transport	Pre-construction	Additional safeguard
TT9	Traffic impacts of road closures	In the event that a continuous long term road closure is required, Transport would undertake further traffic modelling to accurately quantify these impacts and assist in the management of traffic. This would include consideration of any increased congestion and delays on sections of the proposed detour route.	Transport	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TT10	Traffic impacts on Shire Christian School	Transport will consult with Shire Christian School prior to implementation of the proposed detour route in relation to traffic impacts and identify additional safeguards and management measures, as required.	Transport	Pre-construction / construction	Additional safeguard
NV1	Noise and vibration impacts	A Construction Noise Management Plan (CNMP) would be prepared as part of the CEMP. This plan would include but not be limited to: • a map indicating the locations of sensitive receivers including residential properties • a quantitative noise assessment based on the detailed design of the proposal in accordance with the EPA *Interim Construction Noise Guidelines* (DECC, 2009) • management measures to minimise the potential noise impacts from the quantitative noise assessment and for potential works outside of standard working hours (including implementation of EPA *Interim Construction Noise Guidelines* (DECC, 2009), including specific mitigation measures for truck movements • a risk assessment to determine potential risk for activities likely to affect receivers (for activities carried out during and outside of standard working hours) • a process for assessing the performance of the implemented mitigation measures such as a program of noise monitoring for sensitive receivers • a process for documenting and resolving issues and complaints • a construction staging program	Contractor	Detailed design/ pre-construction	Standard safeguard Section 4.6 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• a process for updating the plan when activities affecting construction noise and vibration change • an outline of the content for toolbox talks regarding noise management • **noise contour maps for all work scenarios.**			
NV2	Noise and vibration impacts	All sensitive receivers (i.e. local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: • the project • the construction period and construction hours • contact information for project management staff • complaint and incident reporting • how to obtain further information	Contractor	Detailed design / pre-construction	Noise and vibration
NV3	Vibration impacts	During detailed design and pre-construction, a Vibration Risk Assessment is to be completed and as a minimum will involve: • identifying construction ground vibration criteria, including applicable criteria for Aboriginal and Non-Aboriginal heritage features and ANSTO • identifying the ground type and topography in the vicinity of the works location (in terms of its susceptibility to ground vibration) • identifying and describing the potentially affected properties and heritage features which may be impacted by ground vibration during construction	Transport / Contractor	Detailed design/ pre-construction	Standard safeguard Section 4.6 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• consulting with ANSTO to confirm the location of any vibration sensitive equipment • identifying the types of activities to be carried out, the machinery and equipment to be used, including the predicted vibration emission levels from each plant and their corresponding buffer distances • reviewing the construction methodology and identifying discrete work activities with the potential to affect identified buildings or heritage features • assessing the potential vibration impacts on building structures and heritage features. • reviewing predicted vibration emissions against construction criteria • providing a map indicating the heritage features / buildings on adjacent properties considered likely to be impacted by ground vibration • detailing which features of the natural and built environment require condition inspections • identifying mitigation measures to be incorporated during construction to address ground vibration impacts including assessment of ‘at-source’ mitigation measures • evaluating the potential reductions that could be achieved with the application of recommended measures • evaluating the use of a fixed vibration monitoring system which would appropriately warn plant operators (i.e. flashing light, audible alarm, SMS) when vibration levels approach established criteria limits			

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV4	Vibration impacts	A Ground Vibration Management Plan is to be prepared incorporating outcomes of the Vibration Risk Assessment and incorporated into the CEMP. As a minimum the plan must include: • identification of all potentially affected properties or features of the natural/built environment and show on a map • identification of all vibration generating tasks, duration and predicted vibration levels • a schedule of properties or features of the natural/built environment where condition inspections are required to be undertaken (based on the Vibration Risk Assessment) • locations and types of management measures to be implemented to reduce excessive ground vibration such as: – maximising the offset distance between high vibration plant items and nearby buildings – substitution by alternative equipment, plant and processes – screening or enclosures – restricted times when work is being carried out; – increased work setback distances – consultation with affected receivers; – orienting equipment away from vibration-sensitive areas	Transport/ Contractor	Pre-construction/ construction	Standard safeguard Section 4.6 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		– specific physical and managerial measures for controlling ground vibration to comply with the relevant OEH guidelines and best practice • a vibration trial to determine the dominant frequency of vibration • vibration monitoring, reporting and response procedures including a short and long term ground vibration monitoring program to assess compliance with the identified criteria **at the nearest potentially affected sensitive receivers, including the existing bridge, including upon commencement of activities requiring high vibration intensity plant items to confirm vibration predictions and appropriateness of mitigation measures** • procedures for notifying any residents or business premises about vibration-generating activities likely to affect buildings on their property • contingency plans to be implemented in the event of non-compliances and/or vibration complaints • procedures for regularly reviewing the effectiveness of the Vibration Management Plan including specific review in response to any exceedance events and when activities affecting construction vibration change • outline of the content for toolbox talks regarding vibration management			

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV5	**Vibration impacts**	**The smallest piling rig that can reasonably complete the required work will be selected.**	**Contractor**	**Pre-construction/ construction**	**Additional safeguard**
NV6	**Noise impacts**	**Quantitative noise monitoring will be carried out at representative sensitive receiver locations prior to construction commencing and during a full road closure (in the absence of construction noise) to confirm existing background noise levels and inform the Construction Noise and Vibration Management Plan (CNVMP).**	**Transport / Contractor**	**Pre-construction**	**Additional safeguard**
NV7	**Noise impacts**	**There will be a reduced respite between the 12 weekend shutdowns from Monday until the following Friday night (as opposed to the standard seven-day respite period as per the CNVG), subject to the outcomes of verification monitoring.**	**Contractor**	**Construction**	**Additional safeguard**
NV8	**Noise impacts**	**Verification monitoring will be carried out to confirm whether construction noise is audible at residential receivers and to inform development of specific mitigation measures.**	**Contractor**	**Construction**	**Additional safeguard**
B1	Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Transport's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (Roads and Traffic Authority NSW (RTA), 2011) and implemented as part of the CEMP. It will include, but not be limited to:	Contractor	Detailed design/ pre-construction	Section 4.8 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• 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* (RTA, 2008) • pre-clearing survey requirements • requirements for supervision of vegetation clearing activities • procedures for unexpected threatened species finds and fauna handling, including entering all fauna sightings during construction into BioNet within 28 days • 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**, including hygiene protocols for machinery, vehicles and material to limit propagule and pathogen transmission on the Heathcote National Park interface**. • procedures for retention and reuse of felled timber • identification of trees to be cut to base to avoid grubbing • an outline of the content to be included in toolbox talks including exclusion zones and stop work procedures • a procedure to routinely review and update the plan			
B2	Biodiversity	A Microbat Management Plan is to be developed by a suitably qualified microbat ecologist in consultation with Transport Biodiversity Officer. The Microbat Management	Transport	Detailed design/ pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Plan would be incorporated into the Flora and Fauna Management Plan. As a minimum, the plan is to include: • demonstrated consideration of the roosting and breeding season requirements of the target species • pre-clearing requirements for artificial habitat during pre-construction • requirements for changes to artificial habitat during each phase of bridge work • a detailed methodology for pre-clearing surveys to identify microbats within the bridge structure • a protocol for identification, capture, and relocation of microbats • a protocol for microbat exclusion and provision of alternative housing for microbats during construction • references to examples to demonstrate proven effectiveness of proposed management measures • reporting requirements including species identification, number, relocation actions, exclusion methods • a protocol to routinely review and update the plan • **installation of microbat boxes to compensate for the loss of potentially suitable habitat features which are required to be cleared** • **provision for no demolition of habitat features to occur while microbats are present.**			
B3	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal (including	Contractor	Detailed design/ pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		design refinements to retain hollow bearing trees) will be investigated during detailed design.			
B4	Biodiversity	Transport will consult with relevant experts within DPIE to develop a site specific management plan for the newly described but as yet unlisted *Hibbertia woronorana*.	Transport	Detailed design/ pre-construction	Additional safeguard
B5	Biodiversity/ fauna connectivity	During detailed design, the design of fauna connectivity features including arboreal fauna furniture, tie-in fencing (including consideration of wing fencing, floppy-top and steel top fencing types), and landscape species selection would be further refined in consultation with suitably qualified ecologist, DPI Fisheries and Transport Biodiversity officer. Design is to include consideration of refuge areas, maximise opportunities for replanting, use of Koala feed trees in the landscape species selection and natural substrates. Transport will provide an update to key stakeholders (including NPWS, Sutherland Shire Council and relevant environmental organisations) with more detailed information on the design of the proposed fauna connectivity features, once the design has been refined.	Transport	Detailed design/ pre-construction	Additional safeguard
B6	Biodiversity	The applicability of Koala signage within the local road corridor would be subject to further review during detailed design in consultation with Transport Biodiversity Officer.	Transport	Detailed design/ pre-construction	Consultation with NPWS
B7	Weed management	A weed management plan would be prepared in accordance with *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011) and incorporated into the Flora and Fauna Management Plan and would:	Transport	Detailed design/ pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• outline the requirement for a pre-clearing inspection by an ecologist identify the weeds on site • outline weed management priorities and objectives • identify sensitive environmental areas within or adjacent to the site • identify the location of weed infested areas • provide weed control methods including machinery hygiene procedures and disposal requirements • outline a monitoring program to measure the success of weed management • requirements for communication with local Council noxious weed representative			
B8	Maintaining fish passage	Transport will consult with DPI Fisheries during the development of detailed design and notify DPI Fisheries prior to the commencement of construction of the temporary waterway crossing.	Transport / Contractor	Detailed design/ construction	Additional safeguard
~~**B9**~~	~~**Potential for impacts to *Hibbertia woronorana* and unrecorded threatened species**~~	~~**Targeted biodiversity surveys will be conducted prior to vegetation clearance within areas that were unable to be previously surveyed due to access restrictions, including within and above the high rock cuttings.**~~ ~~**These surveys will focus on confirming the presence or absence of *Hibbertia woronorana* and other threatened species within proposal area, and if present, record the number and location of individuals present.**~~ ~~**If individuals are recorded within the proposal area, the design and construction methodology will be reviewed**~~	~~**Transport / Contractor**~~	~~**Detailed design / Construction**~~	~~**Additional safeguard**~~

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		~~**to avoid or minimise impacts, where feasible and reasonable.**~~			
B10	Opportunities to re-use felled timber	Opportunities to reuse removed hollow bearing trees or other large felled timber within the proposal area will be considered in consultation with a suitably qualified ecologist. **Where possible, hollows will be retained once felled as habitat.**	Transport / Contractor	Detailed design/ construction	Additional safeguard
B11	Potential spread of weeds	Declared priority weeds (if detected) will be managed according to the requirements of the *Biosecurity Act 2015*. To fulfil this requirement all priority weeds requiring removal will need to be disposed of at a registered waste management facility.	Contractor	Construction	Additional safeguard
SW1	Construction soil and water quality impacts	A Soil and Water Management Plan (SWMP) would be prepared as part of the CEMP in accordance with the requirements of RMS QA specification G38 prior to the commencement of construction. The SWMP would also address the following: • RMS Code of Practice for Water Management, the RMS Erosion and Sedimentation Procedure • The NSW Soils and Construction – Managing Urban Stormwater Volume 1 “the Blue Book” (Landcom, 2004) and Volume 2A (DECC, 2008) • RMS Technical Guideline: Temporary Stormwater Drainage for Road Construction, 2011 • RTA Technical Guideline: Environmental Management of Construction Site Dewatering, 2011	Contractor	Detailed design/ pre-construction	Section 2.1 of QA G38 Soil and Water Management

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		The SWMP is to be developed by suitably qualified soil conservationist and would detail the following as a minimum: • identification of catchment and sub-catchment areas, high risk areas and sensitive areas • sizing of each of the above areas and catchment • the likely volume of run-off from each road sub-catchment • direction of flow of on-site and off-site water • separation of on-site and off-site water • the direction of run-off and drainage points during each stage of construction • the locations and sizing of sediment traps such as sumps as well as associated drainage • dewatering plan which includes process for monitoring, flocculating, testing and dewatering water from site (i.e. sumps) • the staging plans, location, sizing and details of creek alignment and realignment controls for scour protection and bank and bed stabilisation including those used during construction and for long-term stabilisation • progressive Erosion and Sedimentation Control Plans (ESCPs) • a process to routinely monitor the weather forecast • preparation of a wet weather (rain event) plan which includes a process for monitoring potential wet weather and identification of controls to be implemented in the event of wet weather			

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• procedure for routine visual water quality monitoring • identification of the construction water source • provision of an inspection and maintenance schedule for ongoing maintenance of temporary and permanent erosion and sedimentation controls The SWMP is to identify all activities that have the potential to generate wastewater and include an assessment of the containment needs for each activity, including minimum requirements for impermeable containment setup.			
SW2	Construction erosion and sedimentation impacts	The Construction SWMP is to include preparation of Environmental Work Method Statements for all activities it has identified as high risk. The EWMS must as a minimum include: • a description of the work activity including any plant and equipment to be used • an outline of the sequence of tasks for the activity including interfaces with other construction activities • identification of any sensitive areas or exclusion zones • identification of potential environmental risks/impacts due to the work activity • specific safeguards and environmental management measures to reduce the identified environmental risk, including assigned responsibilities to site management personnel • a process for assessing the performance of the implemented mitigation measures	Contractor	Detailed design/ pre-construction	Section 3.2.4 of QA G36

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• figures showing the work activities and proposed mitigation measures.			
SW3	Construction erosion and sedimentation impacts	An Erosion and Sedimentation Control Plan (ESCP) is to be developed by suitably qualified soil conservationist. As a minimum, the ESCP must be in accordance with the requirements of QA G38 specification, Soil and Water Management.	Contractor	Detailed design/ pre-construction	Section 2.2 of QA G38 Soil and Water Management
SW4	Construction erosion and sedimentation impacts	A Stabilisation Plan is to be prepared and included in the SWMP. 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 • Identification of areas requiring stabilisation, including stockpiles and batters, exposed for a duration of two 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. Work areas are to be stabilised progressively during the works.	Contractor	Pre-construction / construction	Additional safeguard
SW5	Construction accidental spills	A site-specific emergency spill plan will be developed and included within the SWMP. This plan would be implemented during construction and include spill management measures in accordance with the Transport *Code of Practice for Water Management: Road Development Management* (RTA, 1999) and relevant EPA guidelines. The plan will address	Contractor	Pre-construction / construction	Section 4.3 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		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).			
SW6	Construction accidental spills	All works directly above the waterway including on the bridge and scaffolding will be subject to an approved EWMS including details of minimum containment requirements, protocol to inspect and approve containment setup, and identification of activities requiring impermeable containment setup to prevent accidental spills into the river.	Contractor	Construction	Additional safeguard
SW7	Construction accidental spills	Emergency wet and dry spill kits would be kept on site at all times and all staff would be made aware of the location of the spill kit and trained in its use.	Contractor	Construction	Additional safeguard
SW8	Construction erosion and sedimentation impacts	All stockpiles would be designed, established, operated and decommissioned in accordance with the *Roads and Maritime Services Stockpile Site Management Guideline* (EMS-TG-10). Any material removed from the waterway that is to be temporarily stockpiled on land is to be located well away from the waterway and be contained by appropriate sediment control measures.	Contractor	Construction	Additional safeguard
SW9	Construction water quality impacts	A procedure for refuelling and storage of fuels, chemicals and liquids, is to be detailed within the SWMP. As a minimum this is to identify nominated storage areas, spill kit provisions including provision for aquatic spills and boom, minimum double bunding requirements, weather restrictions, flood event preparedness and visual monitoring.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW10	Construction water quality impacts	The crossing design and any potential cofferdam set up will be refined during detailed design to maintain fish passage through continued consultation with DPI Fisheries.	Contractor	Detailed design	Additional safeguard
SW11	Construction contamination impacts	In the event that indications of contamination are encountered (known and unexpected, such as odorous or visually contaminated materials), work in the area would cease until a contamination assessment can be prepared to advise on the need for remediation or other action, as deemed appropriate.	Contractor	Construction	Additional safeguard
SW12	Risk of tannins	Any mulch stockpiling is to be in accordance with Environmental Direction – Management of Tannins from Vegetation Mulch (RMS,2012)	Contractor	Construction	Additional safeguard
SW13	Operational drainage, soil and water quality impacts	Detailed design will seek to minimise water quality impacts by incorporating the following design principles: • appropriate measures to mitigate any potential impacts to soil and water quality, including but not limited to scour protection, infiltration trenches, vegetated swales, geofabrics, lined channels • appropriate energy dissipation and scour prevention measures downstream of culverts and other drainage structures to minimise soil erosion.	Contractor	Detailed design	Additional safeguard
SW14	Erosion and sediment impacts	Erosion and sediment mitigation controls are to be erected in a manner consistent with currently accepted Best Management Practice (i.e. Managing Urban Stormwater: Soils and Construction 4th Edition Landcom, 2004) to prevent the entry of sediment into the waterway prior to any earthworks being carried out. Erosion and sedimentation	Contractor	Construction	Additional safeguard – DPI Fisheries consultation response

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		controls are to be maintained for the duration of the works until the site has been stabilised and the risk of erosion and sediment movement from the site is minimal.			
SW15	Risk of impacts on fish	DPI Fisheries (1800 043 536) and the Environment Protection Authority (131 555) is to be notified immediately if any fish kills occur in the vicinity of the works. In such cases, all works other than emergency response procedures are to cease until the issue is rectified and approval is given by DPI Fisheries and/or the Environment Protection Authority for the works to proceed.	Contractor	Construction	Additional safeguard – DPI Fisheries consultation response
SW16	**Construction water quality**	**An EWMS for the management of construction wastewater from the superstructure over the waterway would be developed for review and approval by Transport.**	**Contractor**	**Construction**	**Additional safeguard**
HF1	Hydrology and flooding impacts from waterway crossing	The detailed design of the temporary waterway crossing will be developed in consultation with the Transport Senior Environmental Officer and DPI Fisheries, and include appropriate pipe outlets, scour protection and flood immunity to minimise impacts on hydrology and flooding. DPI Fisheries will be provided an opportunity to review the 50% detailed design plans for in-water structures and abutment engineering.	Transport	Detailed design	Additional safeguard
HF2	Hydrology and flooding	The final layout and detail of the drainage system including scour protection and operational WSUD features will be refined during detailed design in consultation with the Transport Senior Environmental Officer.	Transport	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
HF3	Hydrology and flooding impacts from waterway crossing	The Soil and Water Management Plan is to include but may not be limited to: • an outline of the works which are to occur in waterways including and temporary works • a profile of the waterways within which works are to occur e.g. ephemeral or permanent; creek or river • assessment of the flow regime of waterway such as flooding events • schedule and timing of works • work methodology including environmental controls • how Erosion and Sediment Control Plans would be managed and updated for the works in waterways	Contractor	Pre-construction/ construction	Additional safeguard
HF4	Hydrology and flooding impacts from waterway crossing	The temporary waterway crossing structure will be removed and the temporary access track and laydown areas will be rehabilitated as soon as practical to return the disturbed areas to pre-existing conditions.	Contractor	Construction	Additional safeguard
HF5	Flooding during construction	A flood action plan will be prepared to manage a potential flood event during construction and included as part of the CEMP. This plan will be implemented during construction and outline: • procedures to monitor rainfall and dam water releases that may influence river levels • what flood event would trigger the plan • evacuation procedures including a map indicating the area that is flood prone and the locations where to evacuate	Contractor	Pre-construction/ construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• procedures to reduce risk during a flood event including removal of all plant/equipment and stabilising exposed areas			
HF6	Flood risk	The detailed design of the proposal will include consideration of the potential risk of flooding events during construction and operation causing damage to infrastructure.	Transport and Contractor	Detailed design	Additional safeguard
HF7	**Hydrology and flooding impacts from waterway crossing**	**There will be regular clearing of vegetation debris and sedimentation blockage in temporary low flow pipes under crane pad to minimise frequency of crane pad overtopping during heavy rainfall events.**	**Contractor**	**Construction**	**Additional safeguard**
AH1	Aboriginal heritage	The Aboriginal archaeological site known as 'Scouters Mountain Engadine' (AHIMS 52-2-0742) will be clearly identified on design drawings with a five metre exclusion zone. Review of the detailed design at 80% and 100% development will be carried out in consultation with the Transport Environment Manager to confirm no encroachment within the exclusion zone.	Transport	Detailed design/ pre-construction	Additional safeguard
AH2	Aboriginal heritage	An Aboriginal Heritage Management Plan will be prepared and incorporated into the CEMP. This plan would include but not be limited to the following: • a map identifying locations of no-go areas, items or sites which are to be protected and those which are to be impacted. • identification of potential environmental risks/impacts due to the works/activities	Contractor	Detailed design/ pre-construction/ construction	Additional

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• management measures to avoid or minimise potential impacts, including any management measures identified in the Ground Vibration Management Plan. • outline of the content to be included in toolbox talks regarding management of Aboriginal heritage, including identification of no-go areas, any relevant permits and any responsibilities specified under the *National Parks and Wildlife Act 1974*. • a stop works procedure in the event of actual or suspected potential harm to a heritage feature/place. • the requirement to comply with RMS Standard Management Procedure -Unexpected Archaeological Finds, 2012.			
AH3	Aboriginal heritage	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Transport Aboriginal cultural heritage officer and regional environment manager contacted immediately. Steps in the Roads and Maritime *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime, 2015) must be followed.	Contractor	Construction	Section 4.9 of QA G36 Environment Protection
NH1	Non-Aboriginal heritage - General	A Non-Aboriginal Heritage Management Plan would be prepared and included in the CEMP. This plan would include but not be limited to the following: • a map identifying locations of no-go areas, items or sites (including curtilages) which are to be protected and those which are to be impacted • identification of potential environmental risks/impacts due to the works/activities	Contractor	Detailed design/ pre-construction/ construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• management measures to avoid or minimise potential impacts, including any management measures identified in the Ground Vibration Management Plan. • outline of the content to be included in toolbox talks regarding management of Non-Aboriginal heritage, including identification of no-go areas, any relevant permits and any responsibilities specified under the *National Parks and Wildlife Act 1974*. • a stop works procedure in the event of actual or suspected potential harm to a heritage feature/place. • the requirement to comply with RMS Standard Management Procedure -Unexpected Archaeological Finds, 2012.			
NH2	Non-Aboriginal heritage – Woronora River Bridge	Transport will continue to consult with Heritage NSW throughout the development of Heathcote Road Bridge Urban Design.	Transport	Detailed design	Additional safeguard
NH3	Non-Aboriginal heritage – Woronora River Bridge	Heritage reviews will be incorporated into the design and development process. Heritage reviews will be carried out in consultation with Transport Environment Manager at 30%, 80% and 100% detailed design stages.	Transport/ contractor	Detailed design	Additional safeguard
NH4	Non-Aboriginal heritage – Woronora River Bridge	A Conservation Management Plan (CMP) will be prepared for the Woronora River Bridge to outline how the heritage fabric of Woronora River Bridge should be managed on an ongoing basis. This CMP will also consider the establishment of an extended heritage precinct for Woronora River Bridge,	Transport/ contractor	Pre-construction/ operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Kolara Weir and former recreation area, and the extant remains of Heathcote Creek bridge as an area of local and State heritage significance.			
NH5	Non-Aboriginal heritage – Woronora River Bridge	During the detailed design process the following will be considered to limit impacts to the Woronora River Bridge: • retain as much of the original fabric of Woronora River Bridge where possible. • ~~**use of sympathetic colour shades and textures for steel paint finishes of the box girders and headstock extensions.**~~ • **carry out sandstone capping for the abutments.** • carry out colour and material matching for repair and maintenance works. • an appropriately qualified structural engineer to carry out an assessment of structural integrity for each element to be removed and/or replaced prior to removal as part of repair and maintenance works. Only replace elements which are at risk of failing. **A conservation architect will be consulted to provide advice regarding the scope of maintenance work and appropriate management measures.** • ~~**salvage sandstone block facing from abutments and incorporate their use into the project or potential heritage precinct.**~~ • use of discrete fencing with hoarding or fabric for Woronora River Bridge during works.	Transport/ contractor	Detailed design/ operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NH6	Non-Aboriginal heritage – Woronora River Bridge	Archival recording of the Woronora River Bridge and any associated **heritage items to be impacted** will be carried out prior to construction **in a Photographic Archival Recording (PAR). This will create a record of the item's appearance prior to construction works and document the views to and from the item which will be affected by the proposed modification.** To ensure total impacts are catalogued, an archival recording of the Woronora River Bridge is also recommended after the conclusion of works.	Contractor	Pre-construction/ operation	Additional safeguard
NH7	Non-Aboriginal heritage – Woronora River Bridge	If unexpected heritage item/s, archaeological remains or potential relics are uncovered during the works, all works would cease in the vicinity of the material/find and the *RMS Standard Management Procedure - Unexpected Archaeological Finds 2012* would be followed.	Contractor	Construction	Section 4.10 of QA G36 Environment Protection
NH8	**Other non-Aboriginal heritage items**	**To reduce direct and indirect impacts to other heritage items during work, the following will be implemented:** • **Regularly monitor vibrations levels during works.** • **Erect an exclusion zone around the survey marker tree (if located during work) until an archival recording and salvage of the item is conducted. The survey marker to be used as part of an interpretive display.**	**Contractor**	**Construction**	**Additional safeguard**
LP1	Property acquisition	All property acquisition will be carried out in accordance with the *Land Acquisition Information Guide* (Roads and Maritime, 2012) and the *Land Acquisition (Just Terms Compensation) Act 1991.*	Transport	Pre-construction and construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
LP2	Property acquisition or lease of Crown Land	All property acquisition or leasing of Crown Land will be carried out in accordance with the *Crown Lands Management Act 2016* and *Crown Land Legislation Amendment Act 2017*.	Transport	Pre-construction	Additional safeguard
LP3	Private property impacts	Transport will seek to consult with directly affected residents to identify their access requirements during construction and operation of the proposal.	Transport	Pre-construction and construction	Additional safeguard
LP4	Indirect impacts on Heathcote National Park	Transport will consider the *Guidelines for development adjacent to National Parks and Wildlife Service Lands* (National Parks and Wildlife Service, 2020) during preparation of the CEMP and associated sub-plans, including but not limited to the Noise and Vibration Management Plan, Flora and Fauna Management Plan and Soil and Water Management Plan.	Transport	Pre-construction	Additional safeguard
V1	Landscape character and visual impact	The landscape and urban design strategy for the proposal will be reviewed during detailed design in consideration of the design principles and objectives as described in the *Heathcote Road Bridge Urban Design Concept* report prepared for the REF. An Urban Design Plan will be prepared to support the detailed design and will implemented as part of the CEMP. The preparation of the Urban Design plan must involve as a minimum: • investigating opportunities to re-use sandstone features • integrating recommendations for fauna habitat and connectivity features and developing standard design drawings in consultation with the Transport biodiversity officer	Transport	Detailed design	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• refining scour protection designs • reviewing slope stabilisation works at 20, 80 and 100% detailed design in consultation with Transport Urban Design team to achieve a balance of safety and good design outcomes • investigating opportunities for incorporating WSUD features such as swales and considering their location, size and treatment so that they blend into the landform and landscape character • outlining the location and identification of existing vegetation and proposed landscaped areas, including species to be used • considering design treatments for built elements including retaining walls and bridges, shotcrete and other stope stabilisation measures and fixtures such as fencing and signs • refining staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage • outlining procedures for monitoring and maintaining landscaped or rehabilitated areas.			
V2	Landscape character and visual impact	The Urban Design Plan will be prepared in accordance with relevant guidelines, including: • Beyond the Pavement urban design policy, process and principles (Transport, 2020f) • Landscape Guideline (RTA, 2008) • Bridge Aesthetics (Transport, 2019)	Transport	Detailed design	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Shotcrete Design Guideline (Roads and Maritime, 2016).			
SE1	Socio-economic impact	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community and key stakeholders during construction. The CP will include (as a minimum): • mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions, including proposed detour routes • contact name and number for complaints.	Contractor	Detailed design/ pre-construction	Standard safeguard
RW1	Resource use	The following resource management hierarchy principles would be followed: • avoid unnecessary resource consumption as a priority • avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) disposal would be undertaken as a last resort (in accordance with the *Waste Avoidance and Resource Recovery Act, 2001).*	Contractor	Detailed design/ pre-construction	G36 Environment Protection
RW2	Resource use and waste	A Resource and Waste Management Plan (RWMP) would be prepared, which would include the following (as a minimum): • the type, classification and volume of all materials to be generated and used on site including identification of recyclable and non-recyclable waste in accordance with *EPA Waste Classification Guidelines 2014*	Contractor	Detailed design/ pre-construction	Section 4.2 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• quantity and classification of excavated material generated as a result of the proposal • interface strategies for cut and fill on site to ensure re-use where possible • strategies to 'avoid', 'reduce', 'reuse' and 'recycle' materials • classification and disposal strategies for each type of material • destinations for each resource/waste type either for on-site reuse or recycling, offsite reuse or recycling, or disposal at a licensed waste facility • details of how material would be stored and treated on-site • identification of available recycling facilities on and off site • identification of suitable methods and routes to transport waste, including wastewater • procedures and disposal arrangements for unsuitable excavated material or contaminated material site clean-up for each construction stage			
RW3	Waste	All waste would be managed in accordance with the *Protection of the Environment Operations Act 1997*.	Contractor	Detailed design/ pre-construction	Additional safeguard
RW4	Waste	Types of waste collected, amounts, date/time and details of disposal are to be recorded in a waste register.	Contractor	Detailed design/ pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
AQ1	Air quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: • potential sources of air pollution • air quality management objectives consistent with any relevant published EPA and/or EES/DPIE guidelines • mitigation and suppression measures to be implemented • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces.	Contractor	Detailed design/ pre-construction	Section 4.4 of QA G36 Environment Protection
CC1	Climate change effects	The potential impacts of climate change on the proposal, such as the increased potential for localised flooding and need for resilience against more severe and frequent extreme weather events, will be considered during detailed design.	Transport	Detailed design	Additional safeguard
CC2	Greenhouse gas emissions from material use and transport	Ways to reduce construction material requirements, source materials from local suppliers, re-use materials on-site and choose recycled materials or materials with low-embodied energies will be investigated during detailed design.	Transport / Contractor	Detailed design/ construction	Additional safeguard
CC3	Greenhouse gas emissions from equipment and vehicle use	Minimise equipment and vehicle idling and switch off when not in use to minimise unnecessary emissions and fuel consumption.	Constructor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
U1	Utilities	Prior to the commencement of work: • the location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners • If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be carried out.	Contractor	Detailed design/ pre-construction	Standard safeguard
HR1	Hazards and risks	A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to: • details of hazards and risks associated with the activity • measures to be implemented during construction to minimise these risks including (but not limited to): – weather restrictions for 'hot works' activities such as welding – handling and storage procedures for potentially hazardous chemicals and materials – measures to manage bushfire risk such as limitations on mulch stockpiling – procedures and adequate resources to prepare for and instantly respond to a spot fire • record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials	Contractor	Detailed design/ pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• a monitoring program to assess performance in managing the identified risks • an Emergency Preparedness Plan that outlines contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations • procedures to routinely review and update the plan The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or DPIE publications.			
HR2	Bushfire risk	The detailed design of the proposal will include consideration of bushfire resilience to minimise the risk of damage during operation.	Transport and Contractor	Detailed design	Additional safeguard
CU1	Cumulative construction impacts	Other developers will be consulted in accordance with the Community Stakeholder and Engagement Plan to: • obtain information about project timeframes and impacts • manage the interfaces of the proposal's staging and programming in combination with the other projects occurring in the area • identify and implement appropriate safeguards and management measures to minimise cumulative impacts	Transport and Contractor	Pre-construction and construction	Additional safeguard
CU2	Cumulative traffic impacts	Transport will coordinate with the project teams for nearby road upgrades including the Linden Street upgrade and Princes Highway Upgrade, Kirrawee, and the Customer Journey Centre, with regard to the proposed timing of the road and lane closures and to identify alternative routes or	Transport and Contractor	Pre-construction and construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		additional safeguards and management measures, as required. Transport will also consider opportunities for alternative delivery methods, such as using the same contractor for nearby projects, where this may increase the ability for effective coordination between projects.			
CU3	Cumulative construction impacts	The CEMP would consider potential cumulative construction impacts from known surrounding development activities (i.e. the Heathcote Road upgrade, Upgrading Linden Street, Princes Highway Upgrade, Kirrawee, New residential flat building at 5 Prestons Avenue Engadine and Refurbishment of Heathcote Hall) as well as new planned development activities near the proposal, as they become known. This would include a process to regularly review and update mitigation measures as new works are identified that may lead to cumulative impacts or if complaints are received due to cumulative impacts.	Transport and Contractor	Pre-construction and construction	Additional safeguard

7.3 Licensing and approvals

All relevant licenses, permits, notifications and approvals needed for the Heathcote Road Bridge Upgrade and when they need to be obtained are listed in Table 7-2. Additional or changed licenses and approval requirements identified in this addendum REF are indicated by underlined and/or struck out font.

Table 7-2: Summary of licensing and approval required

Instrument	Requirement	Timing
Fisheries Management Act 1994 (s199)	Notification to the Minister for Agriculture and Western NSW prior to any dredging or reclamation works. This requirement has been satisfied. Refer to Section 5.2 for ongoing consultation efforts with Fisheries.	A minimum of 28 days prior to the start of work.
Crown Land Management Act 2016 (Divisions 3.4, 5.5 and 5.6)	Lease or licence to occupy areas of Crown land.	Prior to start of the activity
Roads Act 1993 (Section 138)	A road occupancy licence would be obtained from the Customer Journey Centre	Prior to start of the activity

8 Sustainability

The Transport for NSW's environment and sustainability policy (2020) provides strategic direction to fulfil 'a duty to undertake our activities in the interest of the greater good, moving beyond compliance, and being a genuine leader in environment and sustainability performance'.

The Policy provides a clear commitment 'to delivering transport which contributes to economic prosperity and social inclusion in an environmentally responsible and sustainable manner, consistent with the Future Transport Strategy 2056'.

Supporting the policy is the Transport Sustainability Plan (Transport, 2021) that sets out sustainability objectives relevant to transport projects. Table 8-1 details the sustainability themes and objectives of the plan and describes how the proposed modification meets those objectives.

Table 8-1: Sustainability Plan 2021 focus areas and goals

Sustainability focus area	Sustainability goal	Proposed modification response
Respond to climate change	• Net zero emissions by 2050 • Consider climate change risks in all decisions	Transport's G36 Environmental Protection specifications for construction will require contractors to demonstrate energy-efficient and time-efficient methods for handling and transporting materials and operation of plant. This would typically include reducing idling time, reducing the length of haulage routes by sourcing material locally and considering using a sustainable energy alternative for temporary lighting during night-work. This may minimise energy use and reducing greenhouse gas emissions during construction of the proposed modification. The reduction in duration of full continuous road closure for general traffic would reduce general traffic vehicle kilometres travelled on the detour route (about 20 kilometres). This may result in less greenhouse gas emissions from general traffic vehicles during construction than the approved project, although the proposed modification would generate additional truck movements due to increased earthworks. Water recapture technology and systems would be considered (e.g. for hydro demolition and bridge washing) to minimise water used during construction. During operation, there would be minimal ongoing energy consumption for the proposed modification. The proposed drainage system has been developed with sufficient capacity to account for any changed in localised flood intensity caused by higher intensity of rainfall due to climate change. The wider lanes and shoulders included in the proposed modification would improve emergency services access along Heathcote Road, including during natural disasters such as bushfire.

Sustainability focus area	Sustainability goal	Proposed modification response
Protect and enhance biodiversity	• No net loss of biodiversity	The development of the design has avoided and minimised impacts on biodiversity by largely remaining within the existing road infrastructure corridor. The proposed modification has reduced the area required for vegetation clearance from about 3.12 hectares to about 1.2 hectares. The koala connectivity features of the proposed modification will act to protect and enhance biodiversity values.
Improve environmental outcomes	• Develop a circular economy for Transport by designing waste and pollution out and keeping products and materials in use • Reduce environmental impacts of projects and operations	The proposed modification would minimise the environmental impacts identified in Chapter 6 through the proposed management measures identified in Section 7.2. The environmental flows in the Woronora River would not be affected by the proposed modification and there would be no construction water sourced from local waterways. Most of the rock and excavated material is expected to be classified as excavated natural material (ENM) or virgin ENM (VENM) and could be reused as engineering fill or in earthworks under the NSW Resource Recovery Framework. While limited amounts of this material would be able to be reused on-site for the new road pavement where possible, the proposed modification would recycle as much excavated material onsite as possible, including scour protection and piling and crane platforms. Transport's detailed design process under specification PS311 Environment Design and Compliance involves the development of a Material Re-Use and Management Plan to identify strategies of 'avoid', 'reduce', 'reuse' and 'recycle' materials. By maximising reuse of these materials onsite, vehicle kilometres travelled and resulting emissions would be minimised. The proposed modification would also rehabilitate the existing pavement, where possible rather than removing it to go to landfill. Re-use of recycled materials would support the development of a circular economy. Dust generation is common during construction and dust suppression management measures will be implemented by the construction contractor so that they comply with Transport's G36 Environmental Protection specifications.
Procure responsibly	• All suppliers meet the standards in Transport Supplier Sustainability Charter • Social and environmental outcomes included in all procurement decisions • Go beyond minimum	Responsible procurement will be carried out adopting the following initiatives: • All tendered procurement would include non-price selection criteria that assesses relevant sustainability and social procurement measures. • Implementing the Aboriginal Participation in Construction Policy. • Where possible, procuring from small and medium-sized enterprises Aboriginal business and Australian Disability enterprises. • Monitoring the supply chain to identify and address issues related to poor labour practices.

Sustainability focus area	Sustainability goal	Proposed modification response
	compliance targets in Aboriginal Procurement Policy	• Supporting local suppliers to minimise haulage distances of construction material when feasible.
Partner with communities	• Always leave a positive legacy for communities as a result of projects • Enable, apply and report on community engagement	During construction, the proposed modification would improve community outcomes for customers on the local and broader road network with a substantial reduction in the required construction road closures compared to the approved project. When operational, the proposed modification would have positive impacts on road users and the broader community. It would result in a superior safety outcome compared to the approved project through full separation of opposing traffic with a physical dividing barrier. It would also improve reliability of access due to wide lanes and shoulders allowing vehicles to pull to the side during a breakdown or emergency. This would also allow emergency services to better service the surrounding community. Urban design has been integrated into the design development of the proposed modification and has considered the design of the new bridge and north-west cutting.
Respect culture and heritage	• Aboriginal culture is integrated and preserved • Acknowledging and incorporating culture through stories, examples, and best practice	The proposed modification would result in reduced impacts to the heritage listed existing bridge because more of the original fabric/design integrity would be retained compared to the approved project (refer to Section 6.7.3). It would also result in minor impacts to the Cubbitch Barta National Estate Area. The Aboriginal cultural heritage impacts of the proposed modification would be consistent with those assessed in the project REF.
Align spend and impact	• All decisions consider value created from sustainability alongside financial analysis • Reduce whole of life costs for the transport network	The proposed modification would provide better medium- and long-term asset outcomes related to maintenance costs and asset lifetime. It would result in the construction of a new bridge (with a new asset life) and reduce the traffic load carried by the existing bridge (extending its asset life). The proposed modification would improve network reliability as the provision of two bridges would allow traffic flows to be maintained in an emergency or if maintenance was required on one of the bridges.
Empower customers to make sustainable choices	• Use customer journeys to inform, engage and inspire more sustainable practices and demonstrate Transport's progress	The reduction in duration of full continuous road closure for general traffic would reduce general traffic vehicle kilometres travelled on the detour route (about 20 kilometres). This would allow motorists to continue to use Heathcote Road during the construction period, which may be a more sustainable route as it may be a shorter distance to travel and result in fewer greenhouse gas emissions from each general traffic vehicle.

9 Conclusion

9.1 Justification

9.1.1 Social factors

The proposed modification would result in positive long-term social impacts during operation through providing improved road safety and network reliability along the A6 section of Heathcote Road by duplicating the Heathcote Road bridge and its approaches to achieve compliance with current road safety standards. These safety improvements would address the existing community concern for motorist safety when crossing the Heathcote Road bridge and would provide separated carriageways when crossing the Woronora River.

Construction of the proposed modification would result in traffic disruptions during the proposed full closure of Heathcote Road between New Illawarra Road and the Princes Highway. During this period, local community, businesses and industry may experience feelings of severance or reduced access. The design of the proposed modification has allowed these impacts to be substantially reduced compared to the original project REF. A full, continuous road closure, 24 hours per day for up to six months would no longer be required, instead the road closures would be reduced to around 67 weeknights and up to 12 weekends. By restricting the road closures to weeknights and weekend periods, this avoids the impact on peak hour traffic forecast in the project REF. To minimise potential disruption, further consultation with key stakeholders and the local community would be carried out. Transport would also refine the construction methodology during the later stages of detailed design and construction to reduce the duration of the full road closure further, if possible.

Construction noise and vibration generated by the proposal may also temporarily impact the amenity of local residents, including due to the revised construction scenarios, however, these impacts would be short term and would be minimised during construction through plant selection and orientation wherever possible. These potential noise impacts would be minimised and managed in accordance with Transport's CNVG.

The design for the proposed modification would result in substantially reduced direct impacts on non-Aboriginal heritage including reduced impact to the heritage fabric (as the existing bridge is listed on the Roads and Maritime Services Section 170 Heritage and Conservation Register). However, there would be minor direct impacts to the Cubbitch Barta National Estate Area (consistent with the project REF). There would be minor indirect visual impacts to the Woronora River Bridge due to the construction of the new bridge and Cubbitch Barta National Estate Area due to the increase to the north-west cut. There would also be negligible visual impacts to the Kolora Weir, Woronora-Penshurst pipeline, Royal National Park and Garawarra State Conservation Area and unlisted heritage items during operation. These potential impacts would be minimised through urban design considerations during detailed design and continued consultation with Heritage NSW.

Overall, the social benefits of the proposed modification associated with the increased road safety and network reliability are considered to outweigh the potential adverse social impacts identified.

9.1.2 Biophysical factors

The proposed modification may result in some minor adverse biophysical impacts, which are largely limited to impacts during the construction phase of the proposed modification and are not expected to significantly impact the biophysical environment.

The proposed modification would result in an adjusted construction footprint and associated vegetation clearing due to the bridge duplication design compared to the bridge widening design of the approved project, including additional clearing at the north-west cut. However, the refined design has enabled overall clearing to be reduced to a maximum of 1.2 ha from the 3.12 ha of vegetation proposed in the approved REF. In addition, the proposed modification reduces impact to roosting habitat of Southern Myotis (*Myotis macropus*), which is listed as vulnerable under the BC Act by avoiding removal of the scuppers on the existing bridge (scuppers along one side of the bridge will be capped so that they can continue to function as potential habitat), and may avoid clearing 0.05 hectares of aquatic vegetation consistent with an EEC listed under the BC Act (Sydney Freshwater Wetlands in the Sydney Basin Bioregion), which was considered in the approved project. There remains a risk of fauna injury and mortality from construction movements and disturbance to aquatic habitat during establishment and use of the temporary waterway crossing. However, it is unlikely that any threatened fauna species would be reliant on the habitat within the modified project boundary considering the extensive high-quality habitat nearby within Heathcote National Park and Holsworthy Military Reserve.

An analysis of relevant literature and koala records indicates that the modified project boundary is used as a north-south movement corridor for koalas. The proposed modification provides an opportunity to provide fauna connectivity features under the bridge such as fauna furniture to facilitate Koala crossing beneath the bridge. The final design solution would be confirmed during detailed design in consultation with specialist ecologists.

Overall, the proposed modification is not likely to significantly impact threatened species, populations, ecological communities or their habitats.

A temporary access track, laydown area and waterway crossing are proposed to be established in an area under the bridge near the Woronora River to provide access for construction equipment and temporary storage of construction materials. Use of these ancillary facilities has the potential to result in minor impacts on soil and water quality as well as water flows and flooding patterns. However, these potential impacts would be temporary, as the waterway crossing structure would be removed and the access track and laydown area would be rehabilitated after construction to return the disturbed areas to pre-existing conditions.

9.1.3 Economic factors

The proposed modification would improve road safety and network reliability along the A6 section of Heathcote Road. This would have an indirect positive impact on the local economy in the area, as it would reduce the likelihood of traffic delays from road incidents along Heathcote Road and therefore would contribute to improved productivity and reduced costs associated with traffic delays for road users. This is expected to benefit commuters travelling to work, surrounding businesses and industry such as ANSTO and the Cleanaway Lucas Heights Resource Recovery Park as well as freight operators travelling north and south through Sydney. These positive impacts would be slightly greater than would result from the approved project due to the superior safety and reliability outcome provided by the proposed modification (refer to Section 2.3.4).

The benefits of the proposed modification for road transportation in the long-term are considered to outweigh the short-term inconvenience on the local community and businesses during the proposed full road-closure for up to 67 weeknights and up to 12 weekends for construction of the proposed modification. The reduced road closure and detour provisions for

the proposed modification compared to the approved project will also contribute to improved productivity and reduced delays for local road users during the construction of the project.

9.1.4 Public interest

The proposed modification is justified to be in the public interest on the basis that it improves the safety and network reliability of Heathcote Road to address community concern without any significant negative long-term impacts on society, the biophysical environment or the local economy. It would result in a more beneficial outcome than the approved project through improved road safety and network reliability outcomes, and by a reduced duration of full road closure compared to the approved project. These short and long-term benefits are in the public interest. The proposed modification is also aligned with several strategic policies and government strategies, such as *Future Transport Strategy* 2056 (TfNSW, 2018a) and *Road Safety Plan 2021 – Towards Zero* (NSW Government, 2018a).

9.2 Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposed modification would contribute to improved road safety and traffic flow along Heathcote Road, which would promote the social and economic welfare of the community.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	The principles of ecologically sustainable development are considered with respect to the proposed modification in Section 9.3.
1.3(c) To promote the orderly and economic use and development of land.	The proposed modification would improve an important section of road infrastructure within NSW and is aligned with several State and local policies and strategies that identify the need for upgrades to the Heathcote Road bridge to realise future transport planning goals for Greater Sydney (refer to Section 2.1 of the project REF). The proposed modification is also within an existing road corridor and consistent with the land zoning provisions of the Sutherland Shire LEP.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposed modification.
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 need to minimise impacts on the environment, including threatened and native species has been considered during development of the proposed modification. Additional vegetation clearing is required in the north-west cut area for the proposed modification, however, overall the clearing requirements for the proposed modification have been reduced compared to the approved project. Where potential impacts have been identified on native animals and plants, ecological communities and their habitats, safeguards and management measures have been proposed to avoid or

Object	Comment
	minimise the impacts (refer to Safeguards B-1 to B-11 in Section 7.2).
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The need to minimise impacts on built and cultural heritage has been considered during development of the proposed modification. Direct impacts to the heritage listed existing bridge have been avoided compared to the approved project. Where potential impacts have been identified on heritage, safeguards and management measures have been proposed to avoid or minimise the impact (refer to Sections 6.6 and 6.7).
1.3(g) To promote good design and amenity of the built environment.	Urban design objectives have been developed for the proposed modification to promote good design and amenity of the built environment (refer to Section 2.3.3 of the project REF).
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 proposed modification.
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 proposed modification.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Transport has carried out consultation as part of the Heathcote Road Bridge upgrade project, providing an opportunity for the community to participate in the environmental planning and assessment process. This includes: • community consultation during preparation of the project REF (refer to Chapter 5 of the project REF) • preparation of a submissions report, which responded to community and stakeholder submissions received during the public display of the project REF • ongoing stakeholder consultation during preparation of this addendum REF (refer to Chapter 5). This addendum REF will be made available on the Transport website, so that the community and stakeholders are informed about what is being proposed.

9.3 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 proposed modification.

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.

9.3.1 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.

The proposed modification has sought to take a precautionary approach to minimise environmental impacts, including through assessing impacts based on the 'worst-case' or conservative scenarios. This has also been applied in the development of safeguards and management measures using best available technical information, environmental standards and guidelines.

As discussed in Section 2.5.5 of the project REF, the approved project boundary and construction methodology was also refined to minimise the potential for direct and indirect damage to a known item of Aboriginal cultural heritage significance (Scouters Mountain Engadine Aboriginal heritage site) through incorporation of an exclusion zone and management measures to minimise risks associated with vibration. The proposed modification has been designed to be located mostly within the approved project boundary, with a small extension to the north which has been assessed in this addendum REF as part of the modified project boundary.

9.3.2 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 proposed modification has integrated both short and long-term economic, social and environmental considerations so that any likely impacts are not left to be addressed by future generations.

Whilst either the approved project or the proposed modification were needed in the short-term to address key safety and network reliability concerns, the options assessment for the proposed modification considered whether the design would allow for flexibility to adjust traffic arrangements in the future, and the proposed modification is considered to provide a better long-term economic, social and environmental outcomes.

Through design refinement and application of appropriate environmental safeguards and management measures, issues that have potential long-term implications were minimised or avoided, such as removal of vegetation, impacts on Aboriginal and non-Aboriginal heritage, consumption of non-renewable resources, greenhouse emissions and changes to hydrology during operation.

9.3.3 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.

As discussed in Section 6.3.3, the proposed modification has refined the initial clearing extent of 3.12 ha of vegetation to a maximum of 1.2 ha, which includes the additional vegetation

clearing at the north-west cut. This reduction has been due in part to detailed design development, however, the bridge duplication does avoid some areas of clearing required for the bridge widening in the approved project. The proposed modification may also avoid the direct impact of up to:0.05 hectares of PCT 781, which is associated with an EEC listed under the BC Act (Sydney Freshwater Wetlands in the Sydney Basin Bioregion).

The area of vegetation removal required for the proposed modification is relatively small compared to the extent of habitat in the locality and therefore is unlikely to impact the abundance or diversity of flora and fauna in the region in the long-term. It is also unlikely that any threatened fauna species would be solely reliant on the habitat within the modified project boundary considering the proximity of Heathcote Road and the extensive high-quality habitat nearby within Heathcote National Park and Holsworthy Military Reserve.

Additionally, the proposed modification may contribute to a net benefit to fauna connectivity through the provision of fauna furniture in response to the existing vehicle strike threat, particularly to koalas. Final design of the fauna connectivity features, including tie-in fencing details and landscape species selection, would be developed during detailed design in consultation with a suitably qualified ecologist and Transport biodiversity officer.

Similarly, the proposed modification may also contribute to a net biodiversity benefit by incorporating microbat roosting provisions in the design. Final design of the microbat habitat features would be developed during detailed design in consultation with a suitably qualified ecologist and Transport biodiversity officer.

9.3.4 Improved valuation, pricing and incentive mechanisms

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

Environmental issues were considered as key matters in the options selection process and in the economic and financial feasibility assessments for the proposed modification. The value of the proposed modification to the community in terms of improved safety was also recognised.

Environmental safeguards and management measures for the avoidance, reuse, recycling and management of waste during construction and operation are to be implemented.

9.4 Conclusion

This addendum 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, populations 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 identified in the project REF been avoided or reduced during the design development and options assessment undertaken for the proposed modification. The proposed modification as described in the addendum REF best meets the project objectives, but would still result in some temporary impacts on traffic, noise and vibration, water quality, hydrology and flooding during construction, as well as some longer term biodiversity, non-Aboriginal heritage, property and visual impacts. Safeguards and

management measures as detailed in this addendum REF would ameliorate or minimise these expected impacts. The proposed modification would also improve road safety and network reliability to alleviate community concern and reduce likelihood of road incidents and reduce construction traffic impacts compared to the approved project. On balance the proposed modification is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposed modification would not result in a change to the findings of the project REF and submissions report and would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposed modification 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 modified proposal would not likely cause a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the EPBC Act. A referral to the Australian Government Department of Agriculture, Water and the Environment is not required.

10 Certification

This addendum review of environmental factors provides a true and fair review of the proposed modification 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 proposed modification.

Katie Schultz

Manager, Environment & Planning

Aurecon

Date: 8 April 2022

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

Paul Leonard

Transport for NSW, Senior Project Manager, Infrastructure and Place

Date: 14/04/2022

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Terms and acronyms used in this addendum REF

Term/ Acronym	Description
A6 road corridor	A major arterial road corridor that includes the section of Heathcote Road between New Illawarra Road and the Princes Highway
AEP	annual exceedance probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
Alignment	The vertical and horizontal location of the road
ANSTO	Australian Nuclear Science and Technology Organisation
AQMP	Air Quality Management Plan
ASRIS	Australian Soil Resource Information System
ASS	acid sulfate soil
Aurecon	Aurecon Australasia Pty Ltd
approaches	The sections of road that join either side of a bridge
Approved project	Duplication of Heathcote Road bridge
Approved project boundary	The area identified in the project REF that may be directly impacted by construction and operation of the approved project
BAM	Biodiversity Assessment Methodology
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016* (NSW).
Capacity	Maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or a road in one direction during a given time period under prevailing road and traffic conditions.
CMP	Conservation Management Plan
CNMP	Construction Noise Management Plan
CNVG	*Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016)
CNVMP	Construction Noise and Vibration Management Plan
CP	Communication Plan
DAWE	Department of Agriculture, Water and the Environment
DPI	Department of Primary Industries
DPIE	NSW Department of Planning, Industry and the Environment
EEC	endangered ecological community

Term/ Acronym	Description
ENM	Excavated Natural Material
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.
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
EPA	NSW Environment Protection Authority
EPL	environmental protection licence
ESCP	Erosion and sedimentation control plan
eVDV	Estimated Vibration Dose Value
EWMS	Environmental work method statements
FFA	Flood Frequency Analysis
FM Act	*Fisheries Management Act 1994* (NSW)
Georges River Catchment REP	*Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment*
Heathcote Road bridge	Bridge No. 152 over the Woronora River
Heritage Act	*Heritage Act 1977* (NSW)
HRMP	Hazard and Risk Management Plan
LCZ	landscape character zone
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area
mAHD	Metres above the Australian Height Datum
Modified project boundary	The total area that may be directly impacted by construction and operation of the proposed modification. It includes the 'approved project boundary' as well as an extension of about 1565 square metres to the north beyond the approved project boundary required for construction and operation of drainage upgrades required for the proposed modification

Term/ Acronym	Description
NCA	Noise catchment area
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NPWS	National Parks and Wildlife Service (a directorate of the DPIE)
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PACHCI	*Procedure for Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime, 2011a)
PAD	potential archaeological deposit
PCT	plant community types
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PPV	peak particle velocity
Project REF	The review of environmental factors (REF) that was prepared for the Heathcote Road bridge widening project on 4 December 2020
Proposed modification	Construction of a new single lane bridge (about 7 meters wide) immediately to the west of the existing bridge.
RBL	Rating background levels
REF	Review of environmental factors
RFFE	Regional Flood Frequency Estimation
Roads and Maritime or RMS	NSW Roads and Maritime Services, now known as Transport for NSW
ROL	Road Occupancy Licence
RFOs	River Flow Objectives
RWMP	Resource and Waste Management Plan
s170 heritage register	Roads and Maritime Services Section 170 Heritage and Conservation Register
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SHR	State Heritage Register
SOHI	Statement of Heritage Impact
study area	The ‘study area’ consists of land in the vicinity of, and including, the modified project boundary. The study area is the wider area surrounding the modified project boundary, including land that has the potential to be indirectly impacted by the proposal beyond the immediate works area (for example, as a result of any noise or traffic

Term/ Acronym	Description
	diversions). The scope of the study area varies depending on the environmental factor being assessed.
SWMP	Soil and Water Management Plan
TMP	Traffic Management Plan
VENM	Virgin Excavated Natural Material
VKT	Vehicle Kilometres Travelled
WARR Act	*Waste Avoidance and Resource Recovery Act 2001* (NSW)
WM Act	*Water Management Act 2000* (NSW)
WQOs	Water Quality Objectives
WSUD	water sensitive urban design

Appendix A

Design drawings

Appendix B

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? (1995/1996) guideline and the Roads and Related Facilities EIS Guideline (DUAP, 1996) as detailed in the addendum 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 proposed modification on the natural and built environment.

Factor	Impact
a) Any environmental impact on a community? The proposed modification would result in the following environmental impacts on the community: • improved road safety and network reliability during operation • traffic delays and increased travel time during the proposed full road closure and detour route for construction of the proposal • potential noise and vibration impacts to surrounding sensitive receivers during construction of the proposal • decreased duration of construction traffic impacts due to a reduced duration required of the full continuous road closure compared to the approved project	Long-term moderate positive impact Short-term moderate negative impacts
b) Any transformation of a locality? The proposed modification is unlikely to result in any transformation of a locality as it would not change the current land use within the proposal footprint	Nil
c) Any environmental impact on the ecosystems of the locality? The proposed modification would involve removal of additional vegetation at the north-west cut, and may avoid impact to 0.05 hectares consistent with an EEC listed under the BC Act. The refined clearing extent would be up to 1.2 hectares of vegetation. Safeguards and mitigation measures have been proposed in Section 6.3.4, to manage and minimise these impacts where possible.	Long-term minor negative impact
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? The proposed modification may result in a temporary reduction in the aesthetic and recreational quality of the area during the construction phase in the form of noise and visual impacts. The proposal may also result in temporary reduction of environmental quality due to water quality and hydrological impacts during construction. Safeguards and mitigation measures have been proposed to manage and minimise these impacts where possible.	Short-term minor negative impact
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural,	

Factor	Impact
historical, scientific or social significance or other special value for present or future generations? The proposed modification would have a lesser impact on non-Aboriginal heritage values of the existing bridge compared to the approved project. The new bridge would be visually separate to the existing bridge that is listed on the Roads and Maritime Services Section 170 Heritage and Conservation Register. The revised design has been able to mitigate these minor impacts further as not to diminish the item's heritage significance to the extent that the works are unacceptable from a heritage perspective or to preclude it from the ability to be formally state heritage listed in future. The proposed modification area would cover a larger portion of the listed Cubbitch Barta National Estate heritage place. Natural landscapes which are tied to the cultural values of the site would be partially impacted by the proposal (through activities such as rock excavation and construction of the temporary access track).	Long-term minor negative impact Short-term minor negative impact
f) Any impact on the habitat of protected fauna (within the meaning of the Biodiversity Conservation Act 2016)? The proposed modification would involve removal of up to 1.2 hectares of vegetation. Safeguards and mitigation measures have been proposed in Section 6.3.4, to manage and minimise these impacts where possible.	Long-term minor negative impact
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 proposed modification may result in a potential for wildlife injury or mortality throughout the construction phase due to vehicle and equipment movements within the proposal area. However, this is not anticipated to endanger any species.	Short-term minor negative impact
h) Any long-term effects on the environment? The proposed modification would result in loss of vegetation due to the works, however this would not result in a significant impact to the environment.	Long-term minor negative impact
i) Any degradation of the quality of the environment? Providing the mitigation measures outlined in this REF are implemented (refer to Section 7.2), the proposed modification is not expected to result in noticeable degradation of the quality of the environment.	Nil
j) Any risk to the safety of the environment? The proposed modification would result in increased safety for road users of the Heathcote Road bridge and approaches through the separation of the two lanes of traffic and provision of increased lane and shoulder widths.	Long-term major positive impact

Factor	Impact
k) Any reduction in the range of beneficial uses of the environment? The proposed modification would not result in a reduction in the range of beneficial uses of the environment.	Nil
l) Any pollution of the environment? Providing the mitigation measures outlined in this REF are implemented (refer to Section 7.2), the proposed modification is not expected to result in any pollution of the environment.	Nil
m) Any environmental problems associated with the disposal of waste? The proposed modification is not likely to cause environmental problems associated with the disposal of waste. Standard mitigation measures have been proposed in Section 6.11.2.	Nil
n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposed modification is not likely to result in increased demands on resources which are or are likely to become in short supply.	Nil
o) Any cumulative environmental effect with other existing or likely future activities? The proposed modification may result in cumulative traffic impacts with other nearby future activities during construction, including the Linden Street upgrade. However, the proposed modification and the upgrade of Linden Street are being constructed by the same construction contractor. This would allow for scheduling of construction activities to be aligned to minimise cumulative impacts during construction of the two projects. Due to the reduced duration of the full continuous road closure, the proposed modification would also minimise any traffic delays and travel time increases caused by the detour when compared with the approved project. Mitigation measures have been proposed in Section 6.12.5, to avoid or minimise impacts, where possible. During operation, the proposed modification would result in cumulative positive traffic impacts with other future upgrades proposed to improve the reliability, safety and efficiency of the A6 road corridor such as the Heathcote Road intersection improvements project and Linden Street upgrade.	Short-term minor negative impact Long-term minor positive impact
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposed modification would not impact on coastal processes or hazards, including those under projected climate change conditions.	Nil

Factor	Impact
q) Any applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1? The Sutherland Shire Council Local Strategic Planning Statement has been addressed in Section 2.1.3 Local policy context of the project REF. The proposed modification positively aligns with two priorities outlined in the planning statement. These are Planning Priority 2: Managing Traffic Congestion and Parking, and Planning Priority 14: ANSTO Innovation Precinct.	Long-term moderate positive impact
r) Any other relevant environmental factors? The proposed modification would have reduced traffic impacts during construction compared to the approved project. There would be decreased traffic delays and travel time due to the reduced duration of full, continuous road closure. During construction, the proposed modification would result in greenhouse gas emissions through use of materials as well as use of construction equipment, as well as increased vehicle kilometres travelled for haulage.	Short-term minor positive impact Short-term minor negative impact

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 proposed modification should be referred to the Australian Government Department of Water, Agriculture and the Environment.

Under the EPBC Act strategic assessment approval a referral is not required for proposed road actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are assessed in detail as part of this addendum 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 proposed modification area.	Nil
b) Any impact on a National Heritage place? The proposed modification would involve a minor impact to a small portion of the Cubbitch Barta National Estate Area (Aboriginal and Non-Aboriginal heritage significance), which is a Commonwealth Heritage Place. This area would be slightly larger than that of the approved project area. The modified proposal is considered to	Minor direct impact on Cubbitch Barta National Estate Area

Factor	Impact
represent a more positive heritage outcome than the approved project. The closest National Heritage place is the Royal National Park, which is located about 100 metres north-east of the Heathcote compound. However, no direct or indirect impacts are expected on the Royal National Park.	
c) Any impact on a wetland of international importance? There are no wetlands of international importance within or near the proposed modification area.	Nil

d) Any impact on a listed threatened species or communities?
 	
Assessments of significance for threatened species listed under the EPBC Act were carried out as part of the project REF or this addendum REF for:
 	
• flora species:
  – Thick-leaf Star-hair *Astrotricha crassifolia* (Vulnerable)
  – Small-flower *Grevillea Grevillea parviflora subsp. parviflora* (Vulnerable)
  – Woronora Beard-heath *Leucopogon exolasius* (Vulnerable)
  – Deane's Paperbark *Melaleuca deanei* (Vulnerable)
 	
• fauna species:
  – Broad-headed Snake *Hoplocephalus bungaroides* (Vulnerable)
  – Large-eared Pied Bat *Chalinolobus dwyeri* (Vulnerable)
  – Grey-headed Flying-fox *Pteropus poliocephalus* (Vulnerable)
  – Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable)
  – Australian Bittern *Botaurus poiciloptilus* (Endangered)
 	
• Yellow-bellied Glider (south-eastern) *Petaurus australis* (Vulnerable).
 	
These assessments are provided in Appendix D of the *Biodiversity Assessment Report* provided in Appendix D of the project REF and Appendix D to this addendum. Overall, the assessments of significance concluded that a significant impact on threatened species is not considered to be likely providing safeguards and management measures are implemented (refer to Section 6.3.4).
	Minor direct and indirect impacts may occur for listed threatened species.
	
	No significant impact on threatened species would occur as a result of the proposal, provided appropriate safeguards and management measures are implemented.

e) Any impacts on listed migratory species? The biodiversity assessment for the project REF concluded two of the listed migratory species may occur within the study area on	Minor direct and indirect impacts may

Factor	Impact
occasion: Black-faced Monarch *Monarcha melanopsis* and Rufous Fantail *Rhipidura rufifrons.* The proposed modification would involve the removal of up to 1.2 hectares of vegetation, which is considered a small amount compared to other potentially suitable habitat surrounding the proposal. Overall, a significant impact is considered unlikely on these species as no important habitat will be substantially modified, destroyed, or isolated, the risk of invasive species establishment can be mitigated, and no serious disruptions to the lifecycle of these migratory species is anticipated.	occur for listed migratory species.
f) Any impact on a Commonwealth marine area? There are no Commonwealth marine areas within or near the modified project boundary.	Nil
g) Does the proposal involve a nuclear action (including uranium mining)? The proposed modification would not involve any nuclear action.	Nil
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land? The proposed modification is located near Commonwealth Land associated with the Holsworthy Military Barracks and the Australian Nuclear Science & Technology Organisation. The proposed modification has been designed to avoid additional impacts to Commonwealth land beyond those assessed as being within the approved project boundary in the project REF. However, the proposed modification may involve short-term indirect impacts on Commonwealth Land associated with noise and vibration during construction, however these impacts would be minor and minimised through safeguards and management measures.	Minor indirect impacts on Commonwealth land

Appendix C

Noise and Vibration

Appendix D

Heathcote Road Bridge Upgrade Technical Memorandum – Biodiversity

Heathcote Road Bridge Widening Early Works Pre-clearance Survey Report

Appendix E

Technical Memorandum: Surface Water

Appendix F

Aboriginal Heritage consistency assessment

Appendix G

Addendum Statement of Heritage Impact

Appendix H

Addendum urban design concept report

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