Heathcote Road Upgrade, Infantry Parade to The Avenue

Addendum review of environmental factors

Roads and Maritime Services | September 2019

NSW GOVERNMENT

BLANK PAGE

Heathcote Road Upgrade, Infantry Parade to The Avenue

Addendum review of environmental factors

Roads and Maritime Services | September 2019

Prepared by Hills Environmental and Roads and Maritime Services

Document controls

Approval and authorisation

Title	Heathcote Road Upgrade, Infantry Parade to The Avenue, Addendum review of environmental factors
Accepted on behalf of NSW Roads and Maritime Services by:	Ken Vo Project Manager / Engineer Project Delivery | Infrastructure Development
Signed:	
Dated:	5/09/2019

Document status

Document status	Date	Prepared by	Reviewed by
Revision 1	29.8.2019	S. Hill	Roads and Maritime
Revision 2	1.9.2019	S. Hill	Roads and Maritime
Revision 3	5.9.2019	S. Hill	

Executive summary

The proposed modification

Roads and Maritime Services (Roads and Maritime) proposes to modify the Heathcote Road Upgrade, Infantry Parade to The Avenue. Key features of the proposed modification would include:

- Changes to the project boundary to accommodate all elements of the detailed design and additional vegetation clearing
- Provision of a shared path connection and additional traffic lane to Holsworthy Railway Station
- Extension of eastbound dual right turn lane into Macarthur Drive
- Provision of a third lane on Heathcote Road between Macarthur Drive and the rail bridge
- Provision of an additional right-turn lane from Heathcote Road (eastbound) to Macarthur Drive
- Provision of an additional right-turn lane from Macarthur Drive to Heathcote Road (eastbound)
- Provision of an additional right-turn lane from The Avenue to Heathcote Road
- Retention of the abutments and rolled steel joists of the State Heritage Register nominated Harris Creek Pedestrian Bridge
- Inclusion of additional construction compounds
- Changes to noise walls
- Inclusion of an emergency stopping bay on the southern side of Heathcote Road, west of Harris Creek
- Changes to the Harris Creek Bridge and channel widening in Harris Creek to address upstream flooding
- Sewer, water, power and communications adjustments and connections including within the rail corridor
- Additional kerb, gutter and pathway works
- Provision/extension of maintenance access tracks
- Implementation of a detour for pedestrians and cyclists during construction
- Temporary relocation of bus stops during construction
- Speed zone adjustment near The Avenue intersection
- Relocation/removal of roadside tributes.

Background

A review of environmental factors (REF) was prepared for the Heathcote Road Upgrade in October 2016 (referred to in this addendum REF as the project REF). The project REF was placed on public display between Monday 24 October 2016 and Monday 14 November 2016 for community and stakeholder comment. A submissions report dated January 2017 was prepared to respond to issues raised.

Since the project determination, several supplementary environmental assessment documents have been prepared to address project changes. An addendum REF has now been prepared to address changes arising from the detailed design process.

Need for the proposed modification

The proposed modification is the result of further design development and stakeholder consultation and is needed to:

- Provide enough construction compounds and works areas to allow the construction of the project

- Minimise impacts on the heritage listed Harris Creek Pedestrian Bridge
- Minimise flooding impacts
- Minimise operational noise impacts
- Provide an area for emergency stopping
- Include necessary utility adjustments identified during the detailed design process
- Improve the operation of the Heathcote Road / Macarthur Drive and the Heathcote Road / The Avenue intersections
- Provide shared path connectivity for pedestrians and cyclists to the Holsworthy Station
- Provide alternative pedestrian and cyclists access to Holsworthy Station with the temporary closure of access along Heathcote Road from Infantry Parade to Macarthur Drive
- Provide new (northern) access track to the existing pump station north of Heathcote Road via Kokoda Oval Access Road as the upgrade will result in the loss of the current access from Heathcote Road
- Manage traffic during construction.

Proposal objectives and development criteria

Section 2.3 of the project REF identifies the proposal objectives and development criteria that apply to the proposed modification. There are no additional criteria specific to the proposed modification.

Options considered

For the proposed modification as a whole, Roads and Maritime investigated the 'do nothing' option and the option of proceeding with the proposed modification (Option 1).

Option 1 was selected as the preferred option primarily because it would:

- Address construction requirements by allowing additional areas for compounds and utility adjustments, including necessary relocation of Sydney Trains signalling and wiring assets within the rail corridor
- Minimise impacts on the heritage listed Harris Creek Pedestrian Bridge by allowing for retention of significant heritage fabric
- Minimise flooding impacts (associated with the retention significant Harris Creek Pedestrian Bridge elements) by providing a longer bridge span and undertaking additional Harris Creek channel works
- Improve traffic efficiency through the provision of additional and extended turning lanes at the Heathcote Road intersections with Macarthur Drive and The Avenue
- Provide a better shared-path connection for pedestrians and cyclists to Holsworthy Station.

While Option 1 would involve an increase in the clearing of native vegetation (by about two hectares), the impacts of this clearing were not found to be significant and would be addressed through additional offsets.

Following a consideration of traffic and transport options it was decided to include a 175-metre-long northbound through lane at the Macarthur Drive / Heathcote Road intersection and extended double right turn from Heathcote Road into Macarthur Drive as part of the proposed modification.

Following a consideration of options to reduce impacts on the heritage listed Harris Creek Pedestrian Bridge it was decided to include five span 80 metre bridges with additional channel works at Harris Creek. This would allow retention of important heritage fabric (abutments and Rolled Steel Joists) while ensuring acceptable outcomes in terms of upstream flood extents.

Statutory and planning framework

The proposed modification is categorised as development for the purpose of a road and/or road infrastructure facilities and is being carried out by or on behalf of a public authority. Under clause 94 of ISEPP 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.

A referral to the Australian Government Department of the Environment and Energy under the EPBC Act is not required.

Community and stakeholder consultation

The consultation strategy for the project remains consistent with that described in Section 5.1 of the project REF. Public display of this Addendum REF was not considered necessary given that targeted consultation has occurred and is proposed.

Consultation with the following stakeholders occurred during the development of the detailed design (including the elements of the proposed modification)

- Liverpool City Council – regarding road design changes, shared paths, flooding, temporary construction compounds and heritage issues.
- Department of Defence – regarding property adjustments
- Sydney Trains – regarding utility works within the rail corridor
- Utility providers – regarding required adjustments
- Office of Environment and Heritage – regarding heritage issues associated with the Harris Creek Pedestrian Bridge
- Moorebank Heritage Group – regarding heritage issues associated with the Harris Creek Pedestrian Bridge
- National Trust (including via Roads and Maritime Heritage Committee)
- Residences and other stakeholders affected by noise walls

Environmental impacts

The proposed modification as described in the addendum REF would result in some additional environmental impacts and would have some benefits. These additional potential impacts and benefits are discussed below.

Biodiversity

The proposed modification would increase the native vegetation to be cleared by 2.08 hectares, including a small increase in impacts on the following threatened ecological communities:

- Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion
- Castlereagh Swamp Woodland Community
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion
- Shale Gravel Transition Forest in the Sydney Basin Bioregion.

The proposed modification has been assessed not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation Act 2016* (BC Act) or *Fisheries Management Act 194* (FM Act) and therefore a Species Impact Statement is not required. The proposed modification is also not likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Other identified biodiversity impacts include:

- Removal of riparian vegetation beneath the bridges at Harris Creek and Williams Creek and disturbance of Key Fish Habitat. However, there would be no blocking of fish passage and no threatened aquatic species are known to occur in either creek
- Small increase in the fragmentation of the wildlife corridor along the Harris Creek due to additional clearing
- New edge effects which could facilitate the recruitment of weed species
- Risk of spreading the plant diseases caused by P*hytophthora cinnamomi* and Myrtle Rust, along with frog disease Chytridiomycosis caused by chytrid fungus.

Safeguards and management measures have been proposed to address the above impacts.

Surface water and flooding

During construction, the proposed channel widening downstream of Harris Creek poses an elevated risk erosion and sedimentation requiring management.

Bioswales and check dams at the stormwater outlets at Harris and Williams Creek are included as part of the proposed modification and would improve operational water quality.

There is expected to be flood level reductions upstream of Harris Creek and Williams Creek bridges as a result of larger bridge openings with higher soffit levels. Major floodwater velocity reductions are also expected near the Harris Creek bridge due to proposed channel widening.

Soils and geology

The proposed channel widening within Harris Creek would disturb additional soils with acid sulfate potential and therefore specific management measures would need to be implemented in that area.

In the additional areas affected by the proposed modification there is a risk of asbestos within dumped materials. Bonded asbestos was also identified within the proposed ancillary site on Department of Defence land. The presence of asbestos containing materials poses a potential risk to human health during construction and requires management.

Traffic and transport

The proposed modification is expected to have a minimal impact on the number of required construction vehicles and any additional trips would be scheduled to arrive outside peak traffic flow periods to minimise any delay for road users. All additional construction compounds have direct access to Heathcote Road and would not require construction vehicles to use local streets.

The proposed pedestrian/cyclist detour has the potential to increase access distances and travel time for some people, depending on their location and destination. The maximum additional distance would be about 775 metres for people travelling from south of Harris Creek to Holsworthy Public School.

Noise and vibration

The proposed modification would involve some works outside the project REF boundary and closer to residential receivers, but these works are not expected to substantially change previously predicted impacts or the required construction noise mitigation. The proposed modification is not expected to result in a major change to the quantity of night works or the types of activities that would need to occur at night.

The project (including the proposed modification) is not predicted to increase noise levels by more than 2 dB(A), however exceedances of the cumulative limit (when the total noise level in the design build year is 5 dB(A) or more above the criterion) are predicted at numerous locations. Residences to be considered for noise treatment have been identified as part of the Heathcote Road Upgrade – Operational Road Traffic Noise Assessment Report (Resonate, 2019).

Aboriginal heritage

Survey of the additional areas that would be affected by the proposed modification occurred in December 2018 and included representatives from Tharawal Local Aboriginal Land Council and the South Coast People Native Title Claimants group.

The proposed modification is not expected to impact on Aboriginal archaeological objects, sites or potential archaeological deposits.

Non-Aboriginal heritage

The proposed modification would enable retention of elements of the Harris Creek Pedestrian Bridge in situ, which are considered to be significant; namely the rolled steel joists (RSJs), piers, the plaque and the abutments.

Views to and from the Harris Creek Pedestrian Bridge would be altered with the removal of the Bailey Bridge. However, the retention of the RSJs, piers and the north and south abutments would help retain elements that indicate the presence of the former bridge.

Landscape character and visual impacts

Proposed modification would result in some impacts on both landscape character and identified viewpoints. These increases in impact would occur primarily where the project area would expand closer to residences or public open space areas. The biggest visual impacts would be associated with further loss of screening vegetation, construction of a new retaining wall and changes to noise walls.

Changes to landscape character impacts were identified as follows:

- Landscape Character Zone 2 (Remnant Bushland): increase from Moderate to Moderate/High impact
- Landscape Character Zone 4 (Public Open space): increase from Moderate to Moderate/High impact.

Changes to visual impacts were identified as follows:

- Viewpoint 2 (Residential properties off Heathcote Road, Holsworthy): increase from Moderate to Moderate/High impact
- Viewpoint 3 (Harris Creek Reserve): increase from Moderate to Moderate/High impact
- Viewpoint 4 (Residential properties off Heathcote Road, Mornington): increase from Moderate to Moderate/High impact
- Viewpoint 9 (Macarthur Drive looking north-east towards the intersection at Heathcote Road): Moderate/Low impact (new viewpoint)
- Viewpoint 10 (Turning left into The Avenue from Heathcote Road): Moderate/High impact (new viewpoint).

Justification and conclusion

The proposed modification is needed to address the requirements of the detailed design, improve functionality, reduce environmental impacts, manage impacts on utilities and assist construction.

While there would be some additional environmental impacts as a consequence of the proposed modification including additional vegetation clearing and visual impacts, they have been avoided or minimised wherever possible through design and site-specific safeguards. It is noted that the proposed modification reduces impacts on the heritage listed Harris Creek Pedestrian Bridge and improves the operation of two key intersections.

The benefits of the proposed modification are considered to outweigh the adverse impacts and risks.

Contents

Tables

Figures

Appendices

1. Introduction

1.1 Proposed modification overview

Roads and Maritime Services (Roads and Maritime) proposes to modify the Heathcote Road Upgrade, Infantry Parade to The Avenue, to address the requirements of the detailed design, improve functionality, reduce environmental impacts, manage impacts on utilities and assist construction (proposed modification). Key features of the proposed modification would include:

- Changes to the project boundary to accommodate all elements of the detailed design and additional vegetation clearing
- Provision of a shared path connection and additional traffic lane to Holsworthy Railway Station
- Extension of eastbound dual right turn lane into Macarthur Drive
- Provision of a third lane on Heathcote Road between Macarthur Drive and the rail bridge
- Provision of an additional right-turn lane from Heathcote Road (eastbound) to Macarthur Drive
- Provision of an additional right-turn lane from Macarthur Drive to Heathcote Road (eastbound)
- Provision of an additional right-turn lane from The Avenue to Heathcote Road
- Retention of the abutments and rolled steel joists of the State Heritage Register nominated Harris Creek Pedestrian Bridge
- Inclusion of additional construction compounds
- Changes to noise walls
- Inclusion of an emergency stopping bay on the southern side of Heathcote Road, west of Harris Creek
- Changes to the Harris Creek Bridge and channel widening in Harris Creek to address upstream flooding
- Sewer, water, power and communications adjustments and connections including within the rail corridor
- Additional kerb, gutter and pathway works
- Provision/extension of maintenance access tracks
- Implementation of a detour for pedestrians and cyclists during construction
- Temporary relocation of bus stops during construction
- Speed zone adjustment near The Avenue intersection
- Relocation/removal of roadside tributes.

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.

A review of environmental factors (REF) was prepared for the Heathcote Road Upgrade in October 2016 (referred to in this addendum REF as the project REF). The project REF was placed on public display between Monday 24 October 2016 and Monday 14 November 2016 for community and stakeholder comment. A submissions report dated January 2017 was prepared to respond to issues raised.

Since the project determination, several supplementary environmental assessment documents have been prepared to address project changes, namely:

- Heathcote Road Upgrade Infantry Parade to The Avenue - Review of environmental factors consistency review – geotechnical investigations within the rail corridor (determined 15 February 2018)

- Heathcote Road Upgrade Infantry Parade to The Avenue - Review of environmental factors consistency review – geotechnical investigations outside the rail corridor (determined 23 March 2018)
- Heathcote Road Upgrade Infantry Parade to The Avenue - Review of environmental factors consistency review – changes to noise walls and clearing for utility adjustments (determined 17 January 2019).

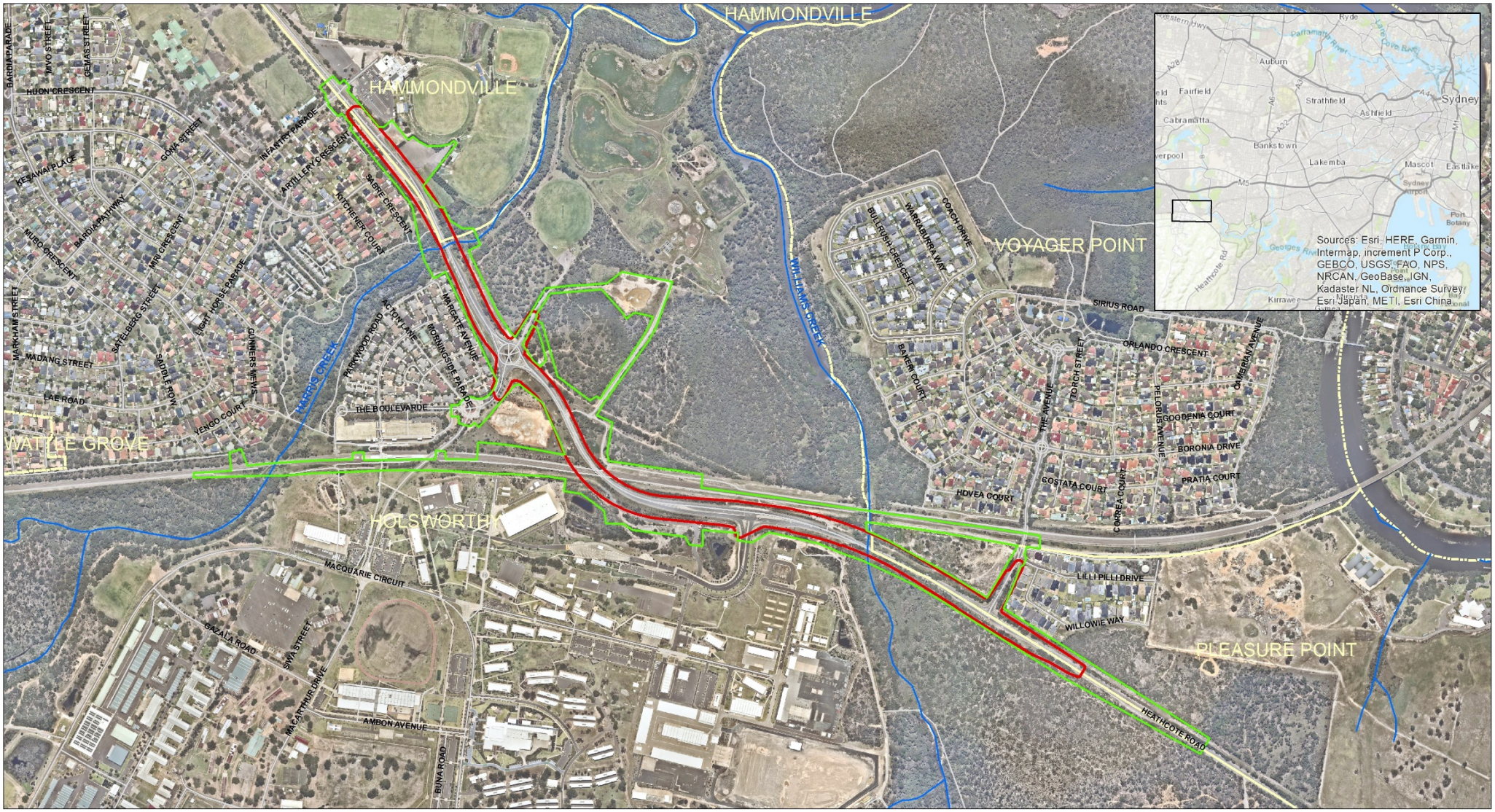

Figure 1-1: Location of the proposed modification

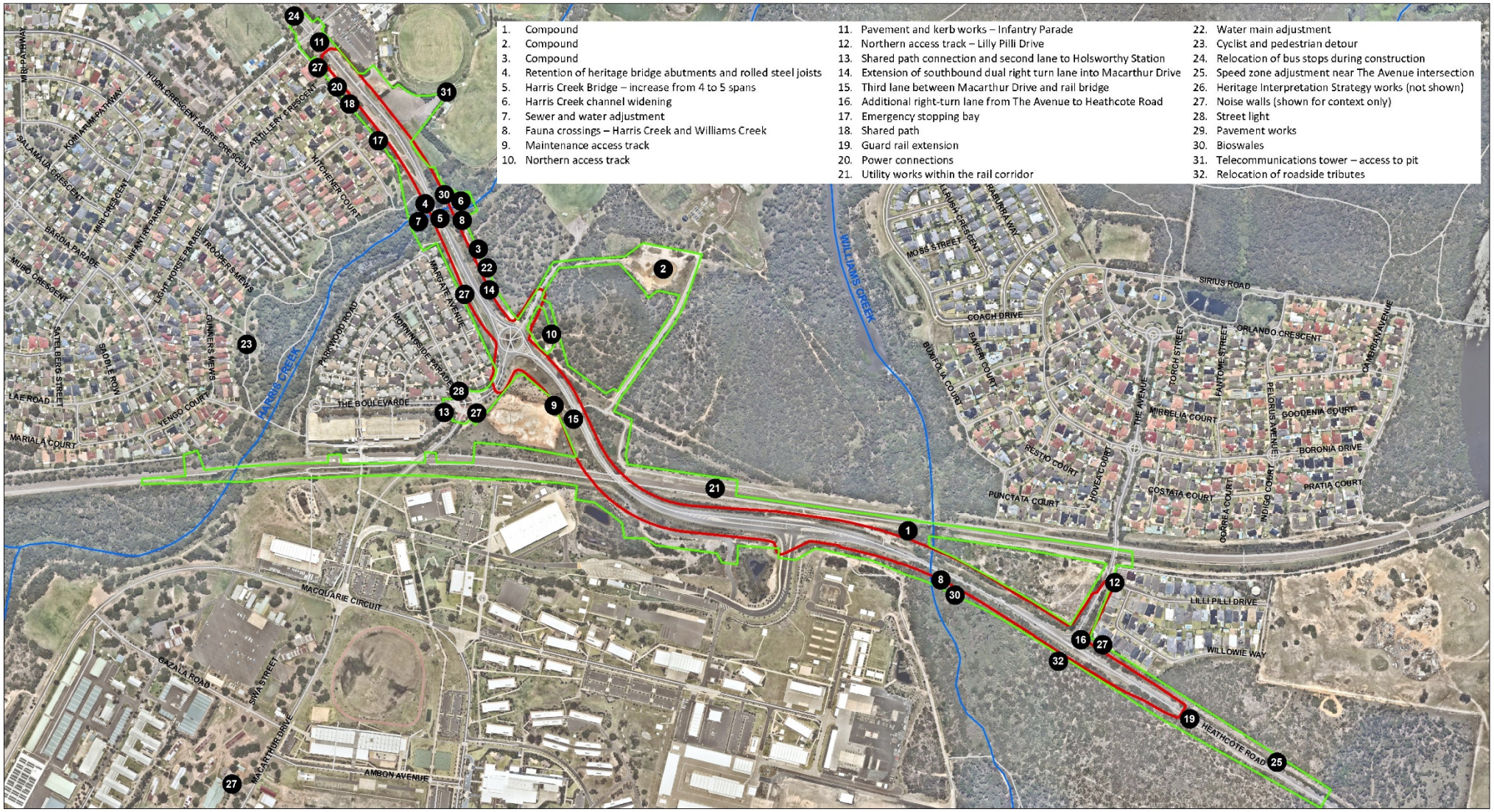

Figure 1-2: The proposed modification

1.2 Purpose of the report

This addendum review of environmental factors (REF) has been prepared by Hills Environmental on behalf of Roads and Maritime, Project Delivery – Infrastructure Development. For the purposes of these works, Roads and Maritime 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 clause 228 of the Environmental Planning and Assessment Regulation 2000, *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (*Is an EIS Required?* guidelines) (Department of Planning, 1995), *Roads and Road Related Facilities EIS Guideline* (Department of Urban Affairs and Planning, 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Commonwealth *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 Roads and Maritime 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 strategic assessment approval granted by the Australian Government under the EPBC Act in September 2015, with respect to the impacts of Roads and Maritime's road activities on nationally listed threatened species, ecological communities and migratory species.

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 the Environment and Energy for a decision by the Australian Government Minister for the Environment on whether assessment and approval is required under the EPBC Act.

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. The proposed modification described and assessed in this addendum REF is consistent with the strategic need for the project.

The proposed modification is needed to:

- Provide enough construction compounds and works areas to allow the construction of the project
- Minimise impacts on the heritage listed Harris Creek Pedestrian Bridge
- Minimise flooding impacts
- Minimise operational noise impacts
- Provide an area for emergency stopping
- Include necessary utility adjustments identified during the detailed design process
- Improve the operation of the Heathcote Road / Macarthur Drive and the Heathcote Road / The Avenue intersections
- Provide shared path connectivity for pedestrians and cyclists to the Holsworthy Station
- Provide alternative pedestrian and cyclists access to Holsworthy Station with the temporary closure of access along Heathcote Road from Infantry Parade to Macarthur Drive
- Provide new (northern) access track to the existing pump station north of Heathcote Road via Kokoda Oval Access Road as the upgrade will result in the loss of the current access from Heathcote Road
- Manage traffic during construction.

2.2 Proposal objectives and development criteria

Section 2.3 of the project REF identifies the proposal objectives and development criteria that apply to the proposed modification. There are no additional criteria specific to the proposed modification.

2.3 Alternatives and options considered

2.3.1 Methodology for selection of preferred option

The proposed modification involves a range of design and construction related changes that have arisen during detailed design which mostly did not require consideration of other options.

In this context, the process of option evaluation had two broad stages:

- A consideration of whether the proposal in any configuration could be justified. This is an evaluation of the ‘do nothing’ option.
- An evaluation of the project (inclusive of the proposed modification) (Option 1) with reference to the respective impacts and benefits.

Specific options where however considered in relation to changed lane configurations/extensions, cycle path connectivity and the retention of significant Harris Creek Pedestrian Bridge elements. These options are described in section 2.3.2 and assessed in section 2.3.3.

2.3.2 Identified options

Project wide modification options

As noted above, for the proposed modification as a whole, Roads and Maritime investigated the 'do nothing' option and one other option:

- 'Do nothing' option – This option involves carrying out the project as described in the project REF, without the changes summarised in section 1.1 and described in detail in chapter 3.
- Option 1 – This option involves implementing the various changes that form part of the proposed modification including the changes summarised in section 1.1 and described in detail in chapter 3.

Traffic and transport options

In relation to traffic and transport the following specific options (not mutually exclusive) were considered:

- Option T1 – Extension of Dual Lane Connectivity to Holsworthy Train Station
- Option T2 – Cycle path connection to Holsworthy Railway Station
- Option T3 – Additional right-turn lane from Macarthur Drive to Heathcote Road (eastbound)
- Option T4 – Changed lane configurations on Heathcote Road:
  - Scenario 1. Add a 150 metre long northbound through lane at the Macarthur Drive / Heathcote Road intersection
  - Scenario 2. Extend the northbound through lane in Scenario 1 further to the south and through The Barracks/Heathcote Road intersection
  - Scenario 3. Extend the double right turn from Heathcote Road into Macarthur Drive by 70 metres
  - Scenario 4. Scenarios 1 and 3 together.

Heritage options

With the aim of maximising the retention of significant Harris Creek Pedestrian Bridge elements, the four bridge configuration options for the crossing of Harris Creek were considered:

- Four span 64 metre bridge without additional channel works
- Five span 80 metre bridge without additional channel works
- Four span 64 metre bridge with additional channel works
- Five span 80 metre bridge with additional channel works.

2.3.3 Analysis of options

Project wide modification options

The do nothing option does not address the identified need (refer to section 2.1) and would therefore only be preferred in circumstances where the costs and environmental impacts of proceeding were assessed as outweighing identified benefits. That was not the case and therefore the 'do nothing' option was not pursued further.

Option 1 was selected as the preferred option primarily because it would:

- Address construction requirements by allowing additional areas for compounds and utility adjustments, including necessary relocation of Sydney Trains signalling and wiring assets within the rail corridor
- Minimise impacts on the heritage listed Harris Creek Pedestrian Bridge by allowing for retention of significant heritage fabric
- Minimise flooding impacts (associated with the retention significant Harris Creek Pedestrian Bridge elements) by providing a longer bridge spans and additional Harris Creek channel works
- Improve traffic efficiency through the provision of additional and extended turning lanes at the Heathcote Road intersections with Macarthur Drive and The Avenue
- Provide a better shared-path connection for pedestrians and cyclists to Holsworthy Station.

While Option 1 would involve an increase in the clearing of native vegetation (by about two hectares), the impacts of this clearing were not found to be significant and would be addressed through additional biodiversity offsets. The impacts of the proposed modification are considered in detail in Chapter 6 (Environmental assessment).

Traffic and transport options

Options T1 and T3 were identified early as essential to efficient functioning of the Heathcote Road / Macarthur Drive intersection and were therefore adopted as part of the proposed modification.

Option T2 was identified as addressing a missing link in the shared path access to Holsworthy Station from the south and was therefore adopted as part of the proposed modification.

In relation to Option T4, traffic modelling results are summarised in Table 2-1. Traffic modelling assumed the inclusion of Options T1 and T3.

Table 2-1 Traffic modelling outcomes – Option T4

Scenario	Modelling results[#]	Comment
1	2026 AM peak period satisfactory 2026 PM peak period Level of Service F	Incorporated into modification.
2	2026 AM peak period satisfactory 2026 PM peak period Level of Service F	Discarded due to increased project risks, costs and inability to provide adequate level of service in the PM peak.
3	2026 AM peak period Level of Service E 2026 PM peak period Level of Service F	Incorporated into modification.
4	2026 AM & PM peak period unsatisfactory	Satisfactory Level of Service and queue lengths for 2026 AM and PM peak periods can be achieved if the following is provided: • 75 metre extension of the left turn lane from Macarthur Drive (southwestern corner), and • An additional 175 (i.e. 150 metres as per Scenario 1 plus 25 metres) metre northbound through lane on Heathcote Road.

[#] The Level of Service is the standard measure used to assess the operational performance of the network and intersections. Level of Service is ranked from A to F, with Level of Service A representing the best performance and Level of Services F the worst.

Based on the traffic modelling results, Option T4 Scenario 4 was selected as the preferred approach and the 175 metre long northbound through lane and extended double right turn from Heathcote Road into Macarthur Drive were included in the proposed modification.

Heritage options

Options for retaining components of the Harris Creek Pedestrian Bridge (all of which achieve the minimum required flood immunity) were reviewed with reference to flood modelling of the 100 year annual recurrence interval flood event. Table 2-2 provides the results.

Table 2-2 Retained heritage pedestrian bridge components – options review

	Piers only	Piers and southern abutment	Piers, southern abutment, and northern abutment	Retained substructure and super-structure (rolled steel joist only)	Fully retained substructure and super-structure (rolled steel joist and bailey)
Four span 64 metre plank bridge without additional channel works	No	No	No	No	No
Five span 80 metre plank bridge without additional channel works	Yes	No	No	No	No
Four span 64 metre plank bridge with additional channel works	Yes	No	No	No	No
Five span 80 metre plank bridge with additional channel works	Yes	Yes	Yes	Yes	No

The above evaluation shows that adopting the five span 80-metre-long bridge option and extending channel works beyond the current project boundary would be an effective design strategy for retention of additional heritage bridge components. On balance the impacts of the changes to the bridge and additional channel works were considered to be outweighed by the retention of heritage fabric. The 80-metre-long bridge option and channel works were therefore incorporated into the proposed modification.

2.4 Preferred option

The options analysis in section 2.3.2 has identified that project wide Option 1 (the project inclusive of the proposed modification) is preferred when compared to the ‘do nothing’ option.

Option T4 Scenario 4 (175-metre-long northbound through lane and extended double right turn from Heathcote Road into Macarthur Drive) was selected as the preferred option for improving the Heathcote Road / Macarthur Drive intersection. A five span 80-metre-long bridge option (with extended channel works) was identified as the preferred option for retaining significant fabric of the Harris Creek Pedestrian Bridge.

The preferred option is therefore to implement all the elements of the proposed modification as summarised in section 1.1 and described in detail in chapter 3.

3. Description of the proposed modification

3.1 The proposed modification

Roads and Maritime proposes to modify the Heathcote Road Upgrade, Infantry Parade to The Avenue, to address the requirements of the detailed design, improve functionality, reduce environmental impacts, manage impacts on utilities and assist construction. The proposed modification is shown in Figure 1-2 with further detail provided by Figure 3-1 to Figure 3-7.

Key features of the proposed modification would include:

- Changes to the project boundary to accommodate all elements of the detailed design and additional vegetation clearing
- Provision of a shared path connection and additional traffic lane to Holsworthy Railway Station
- Extension of eastbound dual right turn lane into Macarthur Drive
- Provision of a third lane on Heathcote Road between Macarthur Drive and the rail bridge
- Provision of an additional right-turn lane from Heathcote Road (eastbound) to Macarthur Drive
- Provision of an additional right-turn lane from Macarthur Drive to Heathcote Road (eastbound)
- Provision of an additional right-turn lane from The Avenue to Heathcote Road
- Retention of the abutments and rolled steel joists of the State Heritage Register nominated Harris Creek Pedestrian Bridge
- Inclusion of additional construction compounds
- Extension of the existing 2.75 metre high (above existing ground surface) noise wall to address an approximate 37 metre gap outside the Child Care Centre at 3A Artillery Crescent.
- Changes to the proposed noise wall at The Avenue to provide a 3.5 to 3.6 metre high (above existing ground surface)
- Inclusion of an emergency stopping bay on the southern side of Heathcote Road, west of Harris Creek
- Changes to the Harris Creek Bridge and channel widening in Harris Creek to address upstream flooding
- Sewer, water, power and communications adjustments and connections
- Additional kerb, gutter and pathway works
- Provision/extension of maintenance access tracks
- Implementation of a detour for pedestrians and cyclists during construction
- Temporary relocation of bus stops during construction
- Speed zone adjustment near The Avenue intersection
- Increase in the height of the retaining wall at The Avenue from 2.5 metres to 4.5 metres
- Relocation/removal of roadside tributes.

Figure 3-1: Key features of the proposed modification – map 1

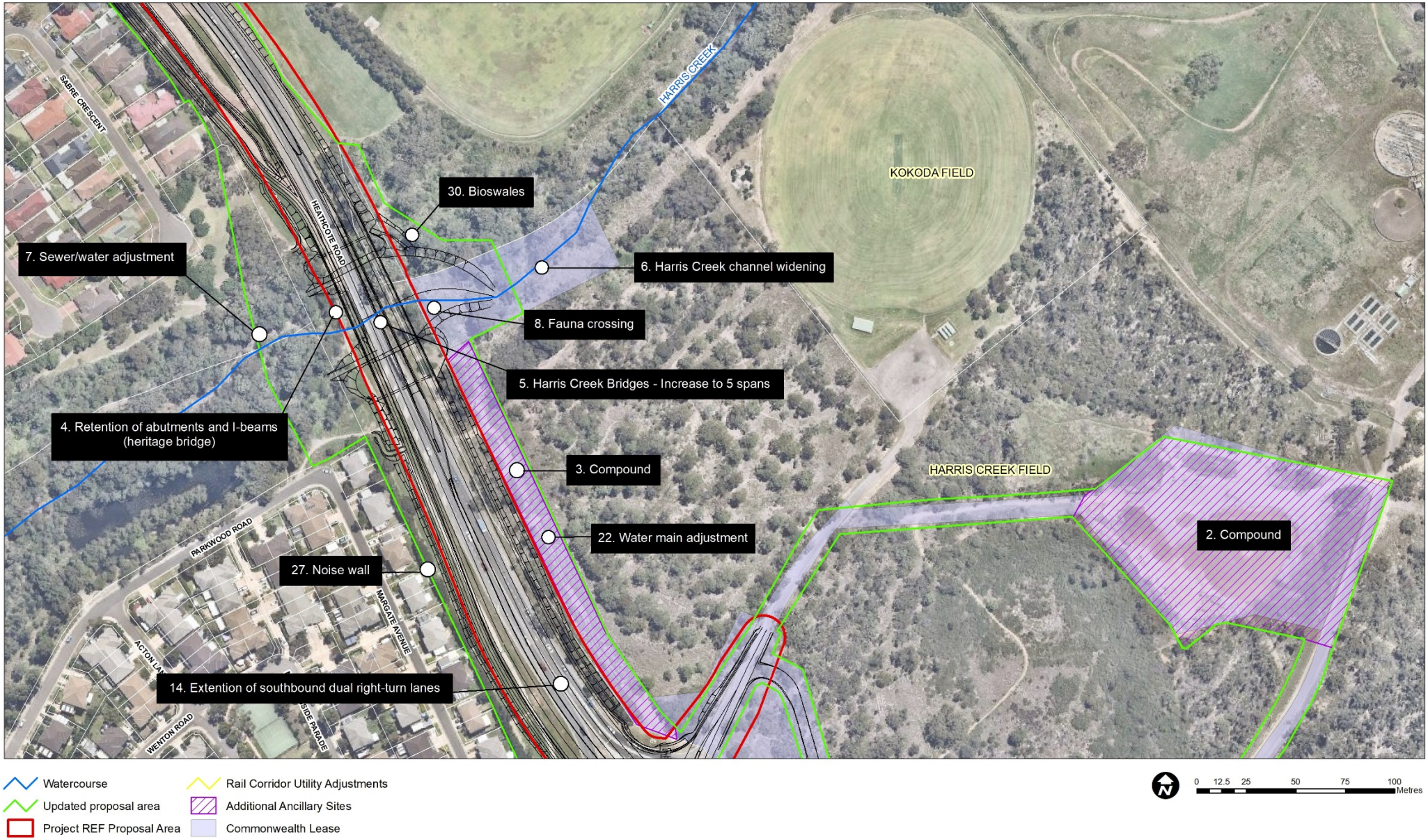

Figure 3-2: Key features of the proposed modification – map 2

Figure 3-3: Key features of the proposed modification – map 3

Figure 3-4: Key features of the proposed modification – map 4

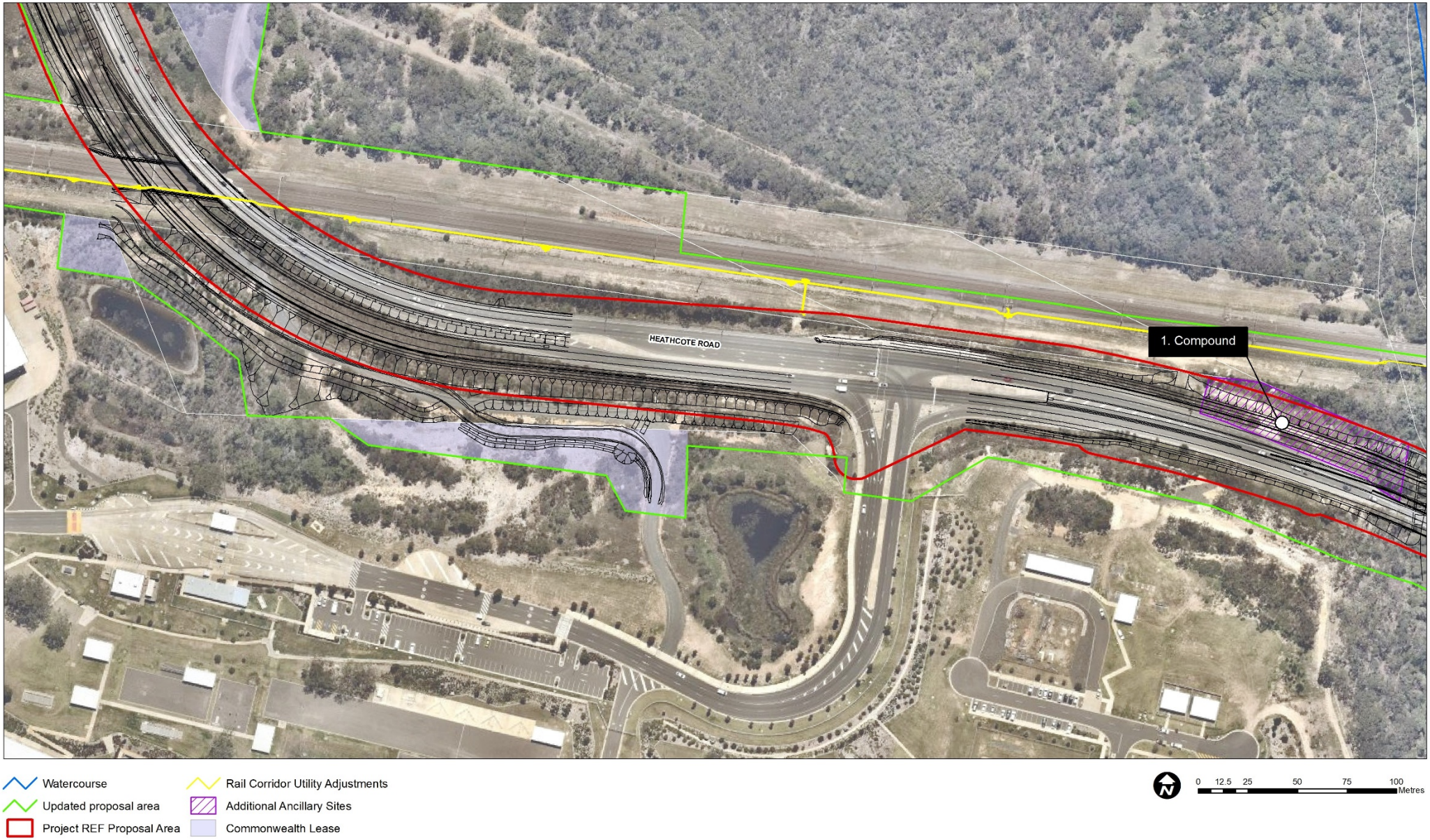

Figure 3-5: Key features of the proposed modification – map 5

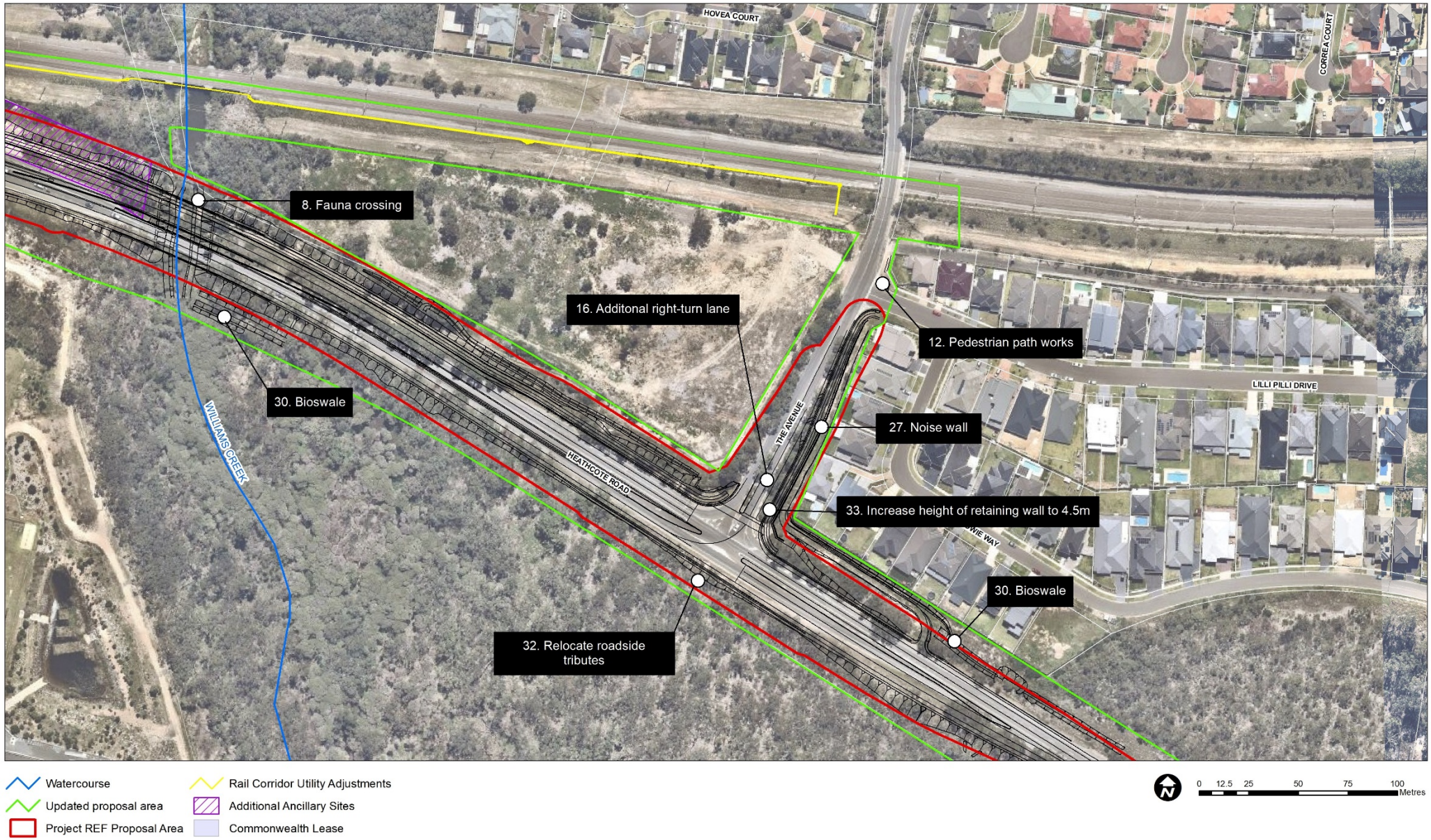

Figure 3-6: Key features of the proposed modification – map 6

Figure 3-7: Key features of the proposed modification – map 7

Table 3-1 Elements of the proposed modification

No.	Proposed change	Project REF reference	Why needed?
1.	Construction compound - west of Williams Creek southbound	Not described or assessed in project REF.	Needed to support construction (offices, amenities, storage)
2.	Construction compound - cleared area south of Holsworthy Sewerage Treatment Plant	Not described or assessed in project REF. Outside project REF boundary.	Needed to support construction (offices, amenities, storage)
3.	Construction compound - Department of Defence land from Harris Creek to Macarthur Drive on the northern side of Heathcote Road.	Not described or assessed in project REF. Outside project REF boundary.	Needed to support construction (offices, amenities, storage)
4.	Retention of abutments and Rolled Steel Joists (RSJ) and the Harris Creek Pedestrian Bridge.	The project REF proposed only retention of the piers of the Harris Creek Pedestrian Bridge. Based on the initial concept design and associated hydrological modelling, retaining the abutments and any of the superstructure would have resulted in unacceptable flooding of upstream private property.	Needed to reduce impacts on heritage values of State Heritage Register nominated item. Following design refinements, further hydrological modelling found that the piers, abutments and RSJs could be retained.
5.	Harris Creek twin bridges – increase to five spans	The project REF included twin bridges with four spans.	Needed to reduce flooding impacts and allow retention of abutments and RSJs of the Harris Creek Pedestrian Bridge.
6.	Harris Creek channel widening	Extent not described or assessed in project REF. Outside project REF boundary.	Needed to reduce flooding impacts and allow retention of abutments and RSJs of the Harris Creek Pedestrian Bridge.
7.	Sewer and water pipe realignment and construction of services bridge upstream of Harris Creek Pedestrian Bridge.	Not described or assessed in project REF. Outside project REF boundary.	Needed to reduce flooding impacts and allow retention of abutments and RSJs of the Harris Creek Pedestrian Bridge.
8.	Provision for fauna crossings (fauna benches) in the design of the bridges at Harris Creek and Williams	Added during detailed design. Not described or assessed in Project REF.	Needed to maintain fauna connectivity along Harris Creek and Williams Creek

No.	Proposed change	Project REF reference	Why needed?
	Creek.		corridors.
9.	Maintenance access track.	Not described or assessed in project REF.	Needed to provide access to the bridge structure and the rail corridor for maintenance.
10.	Northern access track.	Not described or assessed in project REF. Extends outside project REF boundary.	Needed to provide access to the Holsworthy Sewerage Treatment Plant with the proposed closure of the current access.
11.	Pavement and kerb works near Infantry Parade.	Not described or assessed in project REF. Extends outside project REF boundary.	Needed to recognise proposed pedestrian path and kerb connections to Infantry Parade.
12.	Lilli Pilli Drive kerb and pedestrian path works.	Not described or assessed in project REF. Extends outside project REF boundary.	Needed to recognise proposed pedestrian path and kerb connections at Lilli Pilli Drive.
13.	Shared path connection to Holsworthy Railway Station	Not described or assessed in project REF. Extends outside project REF boundary.	Needed to achieve connectivity for pedestrians and cyclists from Macarthur Drive to the station.
14.	Extension of southbound dual right turn lanes from Heathcote Road into Macarthur Drive by about by 70 metres.	Not described or assessed in project REF. Additional road pavement which requires extension of the project REF boundary.	Needed to increase storage capacity at the intersection, improve efficiency and reduce delays.
15.	Addition of a third northbound lane between Macarthur Drive and the rail bridge.	Not described or assessed in project REF. Additional road pavement which requires extension of the project REF boundary.	Needed to improve efficiency and reduce delays.
16.	Additional right-turn from The Avenue to Heathcote Road.	Not described or assessed in project REF. Additional road pavement which requires extension of the project REF boundary.	Needed to improve efficiency and reduce delays.
17.	Emergency stopping bay next to the northbound lanes of Heathcote Road, north of Harris Creek.	Not described or assessed in project REF. Additional road pavement which requires extension of the project REF boundary.	Needed to provide a safe pull off area for broken down vehicles.

No.	Proposed change	Project REF reference	Why needed?
18.	Shared path next to the northbound lanes of Heathcote Road, north of Harris Creek.	Not described or assessed in project REF. Extends outside project REF boundary.	Needed to improve pedestrian and cyclists connectivity and amenity.
19.	Guardrail extension at the southern extent of works.	Not described or assessed in Project REF. Extends outside project REF boundary.	Required to maintain road safety.
20.	Underground power connections near Artillery Crescent.	Not described or assessed in project REF. Extends outside project REF boundary.	Required for streetlighting.
21.	Utility works within the rail corridor including power and communications.	Not described or assessed in project REF. Extends outside project REF boundary.	Adjustments required as a result of new bridge over the railway line.
22.	Department of Defence watermain adjustment on the eastern side of Heathcote Road, north of Macarthur Avenue.	Not described or assessed in project REF. Extends outside project REF boundary.	Relocation required as a result of road works.
23.	Pedestrian and cyclist detour during construction.	Not described or assessed in project REF.	Required due to the need to close access for pedestrians and cyclists along Heathcote Road from Infantry Parade to Macarthur Drive during construction.
24.	Temporary relocation of existing bus stops (2170562 and 217387) about 40 metres to the north (towards Infantry Parade) during construction.	Not described or assessed in project REF.	Needed to ensure bus stops can operate effectively clear of the works zone
25.	Adjust speed zone signage and pavement markings on Heathcote Road (south of The Avenue). Restore speed limit in this area to from 60 km/h to 80 km/h.	Southern extent of speed zone change is outside the project REF boundary.	Increase speed limit to be consistent with new road design.
26.	Implement Heritage Interpretation Strategy works. Various locations. Signage. Interpretive designs for noise walls and throw screens.	Not described or assessed in project REF.	Needed to allow implementation of Heritage Interpretation Strategy
27.	Noise walls. Changes to noise walls: • Extension of the existing 2.75-metre-high	Not described or assessed in project REF.	Needed to address outcomes of Heathcote Road Upgrade – Operational Road Traffic Noise Assessment Report.

No.	Proposed change	Project REF reference	Why needed?
	(above existing ground surface) noise wall to address an approximate 37 metre gap outside the Child Care Centre at 3A Artillery Crescent. • Changes to the proposed noise wall at The Avenue to provide a 3.5 to 3.6-metre-high (above existing ground surface) • Provision of further detail on previously approved noise wall on the western side of Heathcote Road between Macarthur Drive and Harris Creek.		
28.	New streetlight outside of REF boundary at Macarthur Drive on approach to the station.	Not described or assessed in project REF. Located outside project REF boundary.	Requirement identified during detailed design. Needed to provide suitable road lighting.
29.	Macarthur Drive pavement works	Not described or assessed in project REF. Extends outside project REF boundary.	Needed to tie-in to existing concrete pavements at the Macarthur Drive / station access roundabout.
30.	Provision of bioswales (various locations)	Not described or assessed in project REF. Located outside project REF boundary.	Provides an opportunity to further improve water quality during operation of the project.
31.	Telecommunications tower (Hammondville Oval) – access to pit.	Not described or assessed in project REF.	Access to the pit is required to support other communications infrastructure adjustments.
32.	Relocation of roadside tributes	Not described or assessed in project REF.	Tributes are currently located within the works footprint. Change allows relocation / removal consistent with Roads and Maritime policy.
33.	Increase height of retaining wall to 4.5 metres.	Not described or assessed in project REF.	Requirement identified during detailed design due to limited space.

3.2 Design

3.2.1 Design criteria

The design criteria for the project remain as described in Section 3.2.2 of the project REF.

3.2.2 Engineering constraints

The engineering constraints for the project remain as described in Section 3.2.3 of the project REF.

3.2.3 Main features of the modification

The proposed modification includes a range of changes to the project as described in the project REF (refer to Section 3.1 for the full list). The more substantive changes are described in further detail below.

Project boundary changes and additional vegetation clearing

Various changes to the project boundary (also known as 'project area') are required to accommodate all elements of the detailed design including (refer also to Figure 3-1 to Figure 3-7 which shows the original and revised boundaries):

- Additional road pavement areas
- Additional span on the Harris Creek Road bridge and downstream channel widening
- Drainage and other infrastructure – The detailed design of drainage and other infrastructure resulted in larger and more drainage and other infrastructure, clashes between drainage and services which required relocation of services and other issues which created a larger footprint and additional clearing
- Inclusion or modification of other elements that were not in the concept design – including revised northern access track, noise walls, additional utility relocations, the Harris Creek utility bridge
- Inclusion additional and larger site compounds.

Based upon the concept design assessed in the project REF, the removal of 6.24 hectares of vegetation was estimated, 3.41 hectares of which was native vegetation and 2.83 hectares of which was exotic vegetation (Table 3-1). The 3.41 hectares of native vegetation can be broken down as follows:

- 2.37 hectares: PCT883 Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion
- 0.77 hectares: PCT724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- 0.03 hectares: PCT1067 Parramatta Red Gum Woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion.
- 0.24 hectares: PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion.

The revised clearing boundary includes 11.75 hectares of vegetation, 5.49 hectares of which is native vegetation and 6.26 hectares comprising of exotic vegetation. This represents an increase in native vegetation to be cleared of 2.08 hectares. The revised 5.49 hectares of native vegetation proposed to be cleared can be categorised as follows:

- 3.18 hectares: PCT883 Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion
- 1.55 hectares: PCT724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- 0.07 hectares: PCT1067 Parramatta Red Gum Woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion
- 0.69 hectares: PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion.

Harris Creek Bridge changes and channel widening

The project REF identified the duplication and replacement of the existing two-lane bridge over Harris Creek. The new bridges were identified as three span, 60 metre long bridges.

The proposed modification includes five span 80-metre-long twin bridges over Harris Creek. The key features of the proposed twin bridges are identified in Table 3-2.

Table 3-2 Key information – Harris Creek Bridges

Attribute	Project REF	Proposed modification
Length	60 metres	80 metres
Number of spans	3	5
Span length	30 metres	16 metres
Traffic lanes	3.5 metres	3.6 metres
Outside shoulders	1.5 metres	Minimum 1.5 metres

The elevation of the proposed northbound bridge is shown by Figure 3-8 while the plan view of the twin bridges along with pier locations is shown by Figure 3-9.

The proposed modification also includes the widening of the Harris Creek channel for about 50 metres on the downstream side of the twin bridges. The widened channel would be protected from scour with rock rip rap (medium size – 150 millimetres). The extent of channel widening is shown by Figure 3-2.

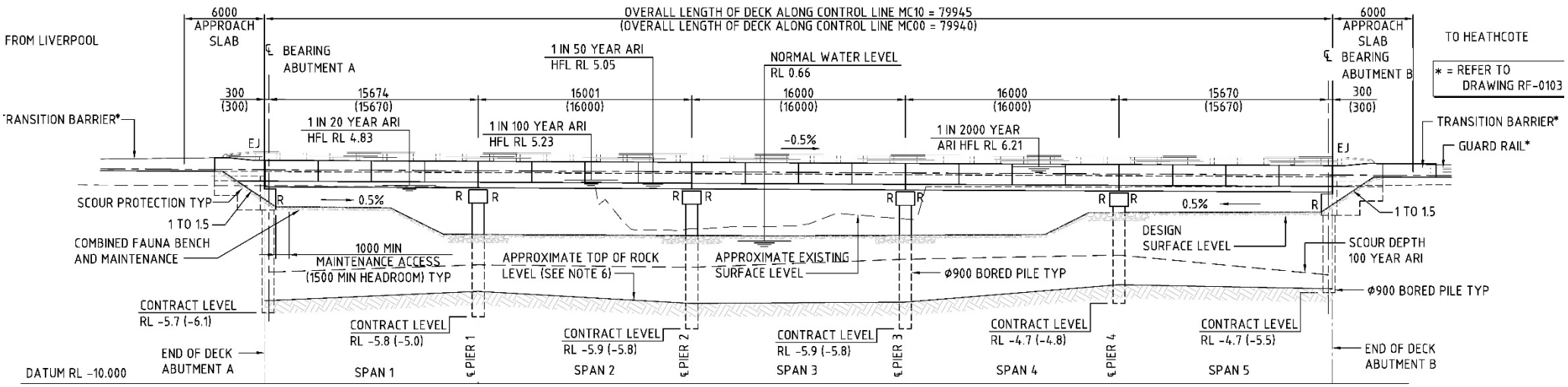

Figure 3-8: Harris Creek twin bridges – elevation of westbound bridge

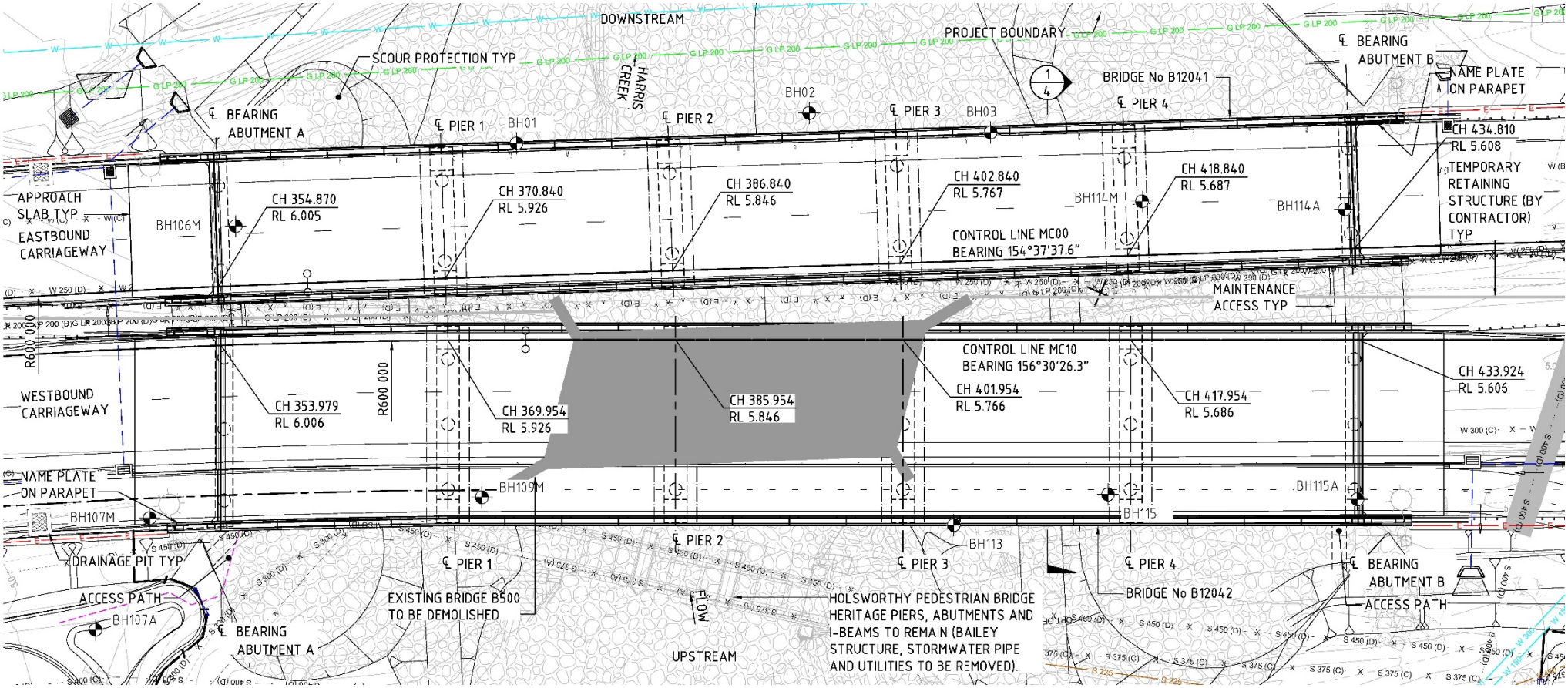

Figure 3-9: Harris Creek twin bridges – plan view

Harris Creek utility bridge

As part of the proposed modification a utility bridge is proposed about 20 metres upstream of the Harris Creek Pedestrian Bridge. The utility bridge would carry a 450-millimetre diameter sewer main, 350-millimetre water main and 150-millimetre water main. The utility bridge would have three spans about 5.5 metres wide and four 400-millimetre cast in place concrete piers with permanent steel casing. The key features of the utility bridge are shown by the elevation included in Figure 3-10.

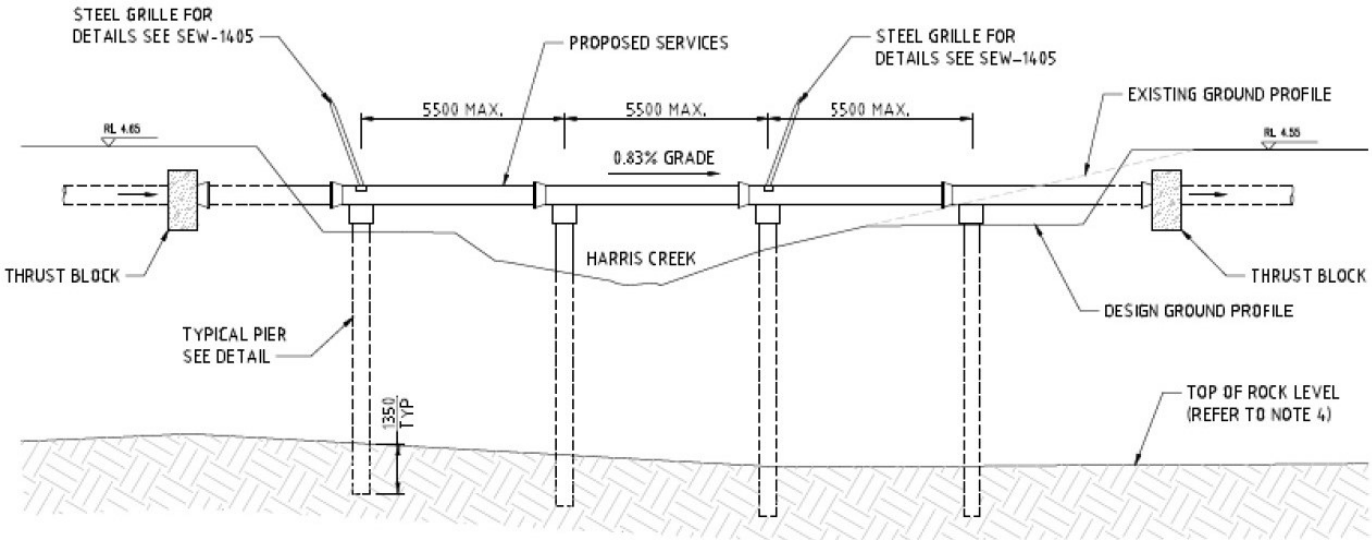

Figure 3-10: Harris Creek utility bridge – elevation

Fauna crossings

As part of the proposed modification, the bridges at Harris Creek and Williams Creek would include design features to assist fauna crossing including the following:

- 3-metre-wide roughened concrete fauna bench on both sides of the channel. At Harris creek a 1.5 metre clearance height to the fauna benches is achievable, while at Williams Creek a 4-metre clearance is achievable
- 3:1 entrance slope
- Unobstructed views through the area beneath the bridge.

Intersection changes

As part of the proposed modification, three main changes at intersections are proposed:

- Extension of southbound dual right turn lanes from Heathcote Road into Macarthur Drive by about by 70 metres
- Addition of a third northbound lane between Macarthur Drive and the rail bridge
- Additional right-turn from The Avenue to Heathcote Road.

The first two changes are illustrated by Figure 3-11 and Figure 3-12, while the third change is shown by Figure 3-13.

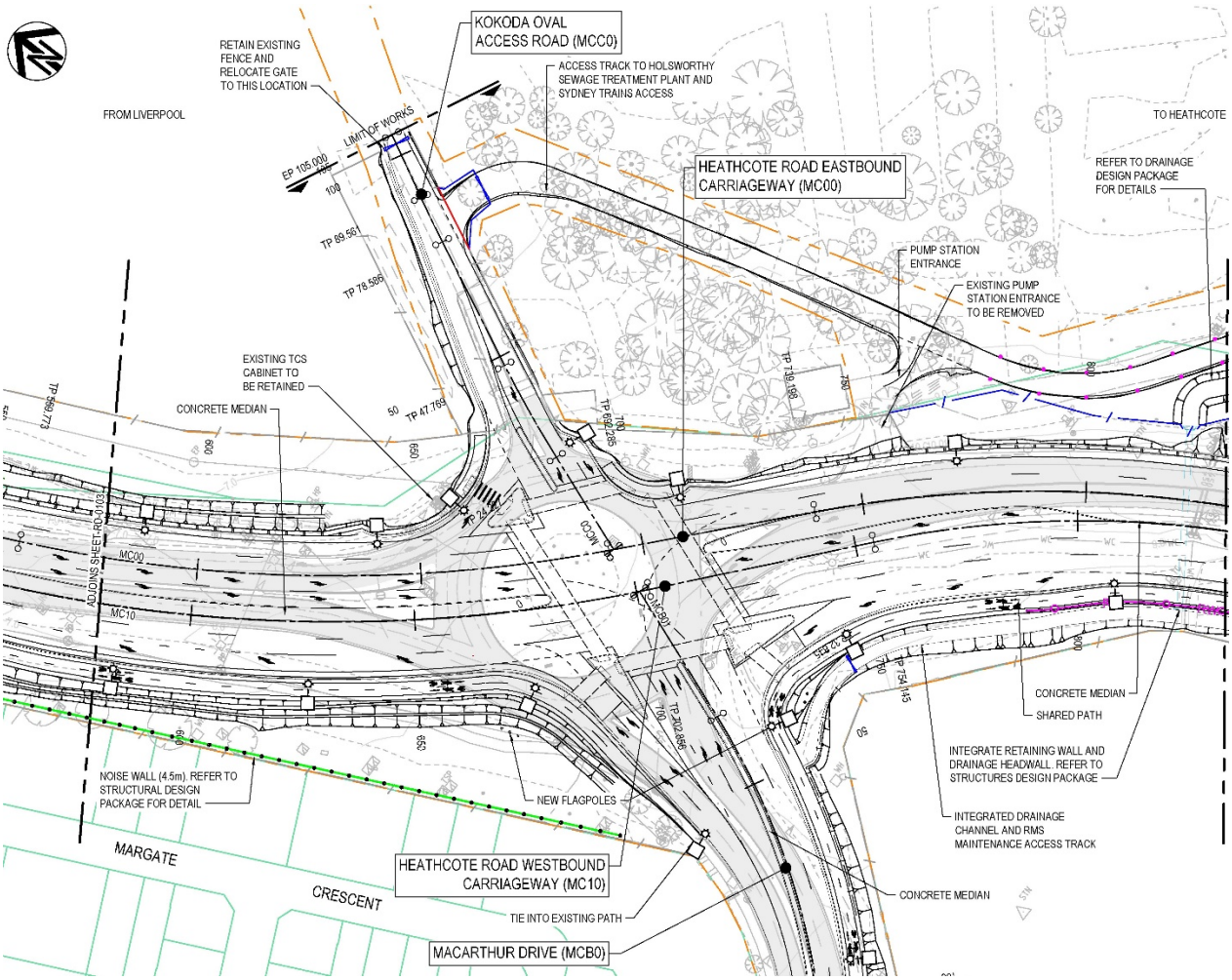

Figure 3-11: Proposed configuration – Heathcote Road / Macarthur Drive intersection

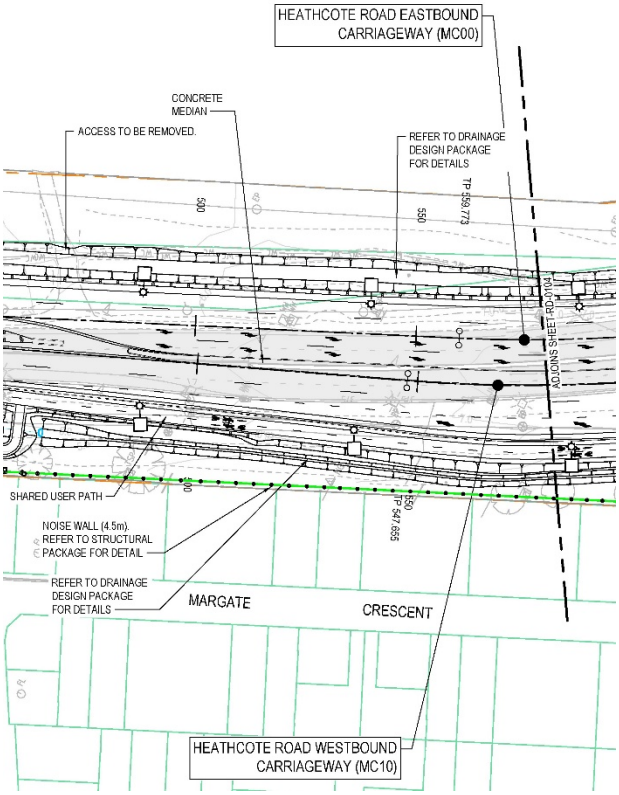

Figure 3-12: Proposed further extension of right-turn lanes to Macarthur Drive

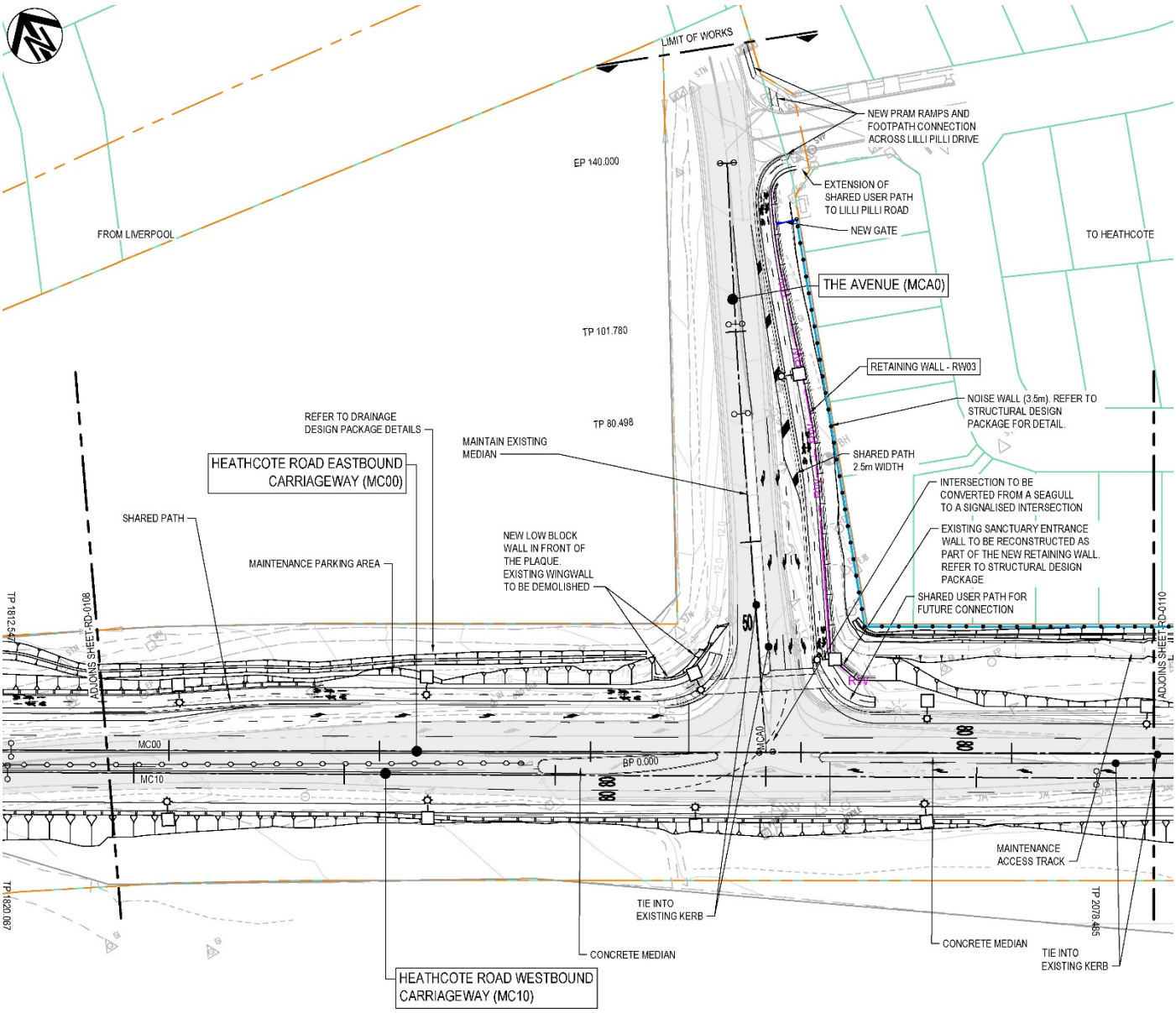

Figure 3-13: Proposed configuration – Heathcote Road / The Avenue

Pedestrian and cyclist detour

To assist construction, the proposed modification includes a cyclist and pedestrian detour and the closure of access for cyclists and pedestrians along Heathcote Road from Infantry Parade to Macarthur Drive. The proposed detour would be about 850 metres long and would use existing paths in Holsworthy before crossing Harris Creek at the existing pedestrian bridge near Holsworthy Station. The additional travel distance would depend on a person's location and destination (refer to Section 6.4.3) The proposed detour is shown by Figure 3-14.

Figure 3-14: Proposed pedestrian / cyclist detour

Noise walls and treatments

Section 6.6.4 of the project REF identified the potential provision of 4.5 metre high noise wall for residential receivers in noise catchment areas (NCAs) B (western side of Heathcote Road, east of Harris Creek) and D (The Avenue, Voyager Point). The potential extension of the existing noise barrier for the benefit of the Child Care Centre at 3A Artillery Crescent (in NCA A – western side of Heathcote Road, north of Harris Creek) was also noted. The project REF included a commitment to investigate mitigation measures (including noise walls) to minimise operational noise (safeguard NV9).

As part of the detailed design process operational road traffic noise mitigation has been considered in accordance with the Noise Mitigation Guideline (Roads and Maritime Services, 2015), with the outcomes presented in the Heathcote Road Upgrade – Operational Road Traffic Noise Assessment Report (Resonate, 2019). As a result of this consideration the following is proposed:

- Extension of the existing 2.75-metre-high (above existing ground surface) noise wall to address an approximate 37 metre gap outside the Child Care Centre at 3A Artillery Crescent (in NCA A). The extended component of the noise wall would be three metres high to allow the minimum 5 dB noise barrier performance to be achieved at the mid-point of the outdoor play area. In addition to addressing the gap, the northern section of existing noise wall would be replaced due to a limited

remaining service life. The new noise wall would consist of precast concrete panels, two panels high with some feature panels.

- Consideration of at-property treatments at three residential receiver locations and one child care centre in NCA A (consistent with the project REF) due to residual exceedances of noise criteria at the following locations:
  - Child care centre – 3A Artillery Crescent
  - Residence – 23 Sabre Crescent (first floor)
  - Residence – 27 Sabre Crescent (first floor)
  - Residence – 53A Infantry Parade (first floor)
- Consideration of at-property treatments for non-project related exceedances in NCA A in accordance with the Noise Mitigation Guideline (Roads and Maritime Services, 2015) principles that communities should receive reasonable and equitable outcomes. While the project REF identified the requirement to consider treatments at these locations it did not categorise them as non-project related. The relevant locations are:
  - Holsworthy School and Pre-School (buildings located adjacent to Infantry Parade nearest to Heathcote Road
  - Residence – 53 Infantry Parade (ground floor)
- Consideration of at-property treatments at 25 locations in NCA B (generally consistent with the project REF). The project REF did not however identify residences at 1 and 3 Macarthur Drive as exceeding the cumulative limit (i.e. where total noise level is 5dBA or more above the Noise Criteria Guideline criteria in the build year) which they now would
- Consideration of at-property treatments for non-project related exceedances
- Provision of a 3.5-3.6 metre-high (above existing ground surface) noise wall at The Avenue (NCA D), as opposed to the 4.5 metre high noise wall described in Section 6.6.4 of the project REF. This noise wall would consist of precast concrete panels with a plexiglass panel at the top
- Consideration of at-property treatments at 13 locations in NCA D (generally consistent with the project REF). The project REF did not however identify residences at 1 and 5 Willowie Way as exceeding the cumulative limit (i.e. where total noise level is 5dBA or more above the Noise Criteria Guideline criteria in the build year) which they now would.

The 4.5-metre-high noise wall in NCA B (western side of Heathcote Road, east of Harris Creek) remains as identified in the project REF. This noise wall would consist of precast concrete panels with a plexiglass panel at the top.

The location of the proposed noise wall changes is shown by Figure 3-15 and Figure 3-16 respectively, while cross sections for each wall are shown in Figure 3-17 and Figure 3-18.

Figure 3-15: Location of proposed noise wall changes – NCA A

Figure 3-16: Location of proposed noise wall changes – NCA D

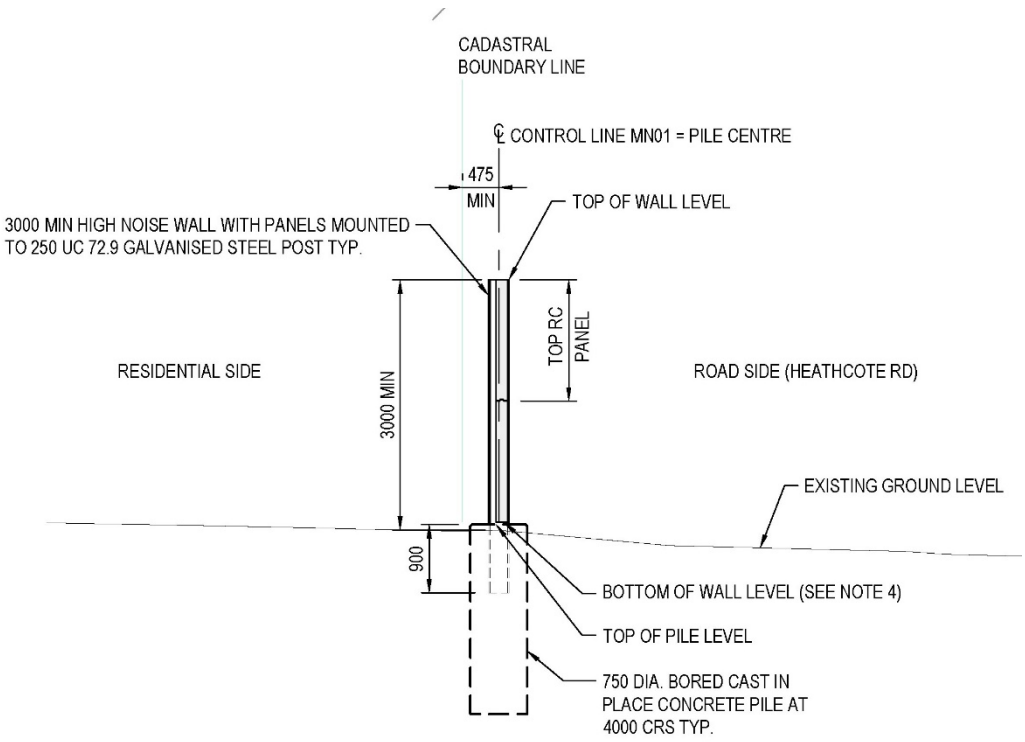

Figure 3-17: Proposed noise wall changes – NCA A – typical cross section

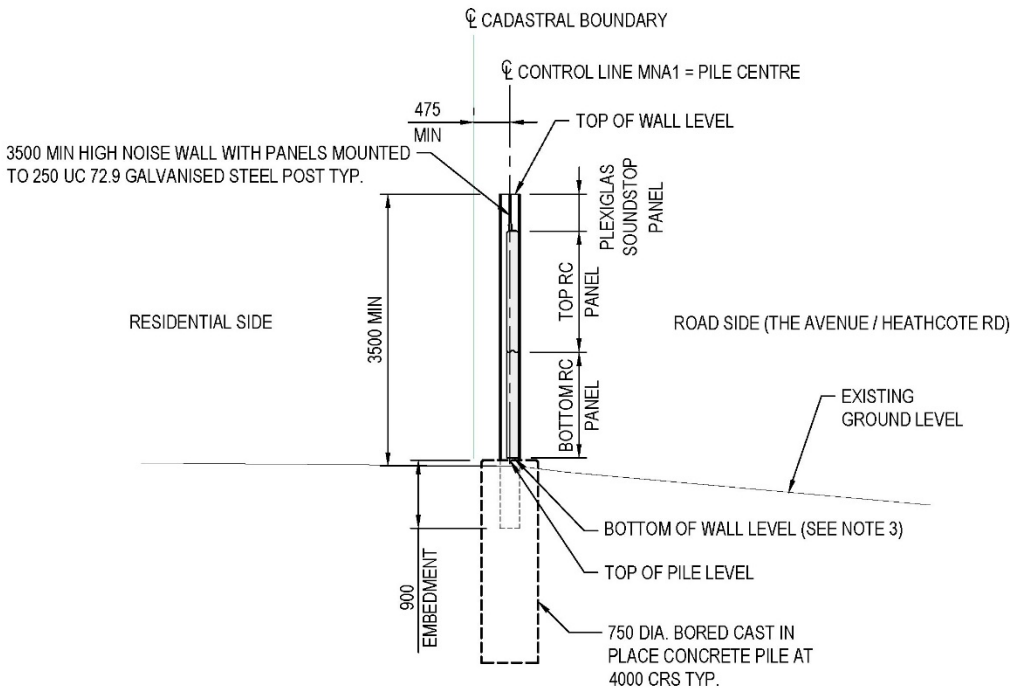

Figure 3-18: Proposed noise wall changes – NCA D – typical cross section

3.3 Construction activities

3.3.1 Work methodology

The work methodology would be generally consistent with that described in Section 3.4.1 of the project REF.

For noise walls, initial clearing and grubbing would be followed by piling and the pouring of noise wall footings. This would include a small concrete strip footing behind each wall that would be designed to ensure the area between property fencing and the noise wall does not accommodate any vegetation growth. Precast panels would then be placed using a large crane, followed by the installation of plexiglass panels using a smaller crane. Once the walls have been installed anti-graffiti coatings would be applied and landscaping treatments at the base of the panels would be completed.

3.3.2 Construction hours and duration

The construction hours and duration of works remain as identified in Section 3.4.2 of the project REF.

3.3.3 Plant and equipment

Plant and equipment required for the construction of the proposal would be consistent with Section 3.4.4 of the project REF.

3.3.4 Earthworks

There would be some changes to earthworks associated with the changes to the project footprint, however the volumes and management approach would still be generally consistent with Section 3.4.5 of the project REF.

3.3.5 Source and quantity of materials

There would be some changes to materials quantities associated with the proposed modification (such as additional concrete for the longer Harris Creek bridges, concrete for additional shared path connections, and additional road pavements), however material volumes would still be generally consistent with Section 3.4.5 of the project REF. Materials would be sourced from across Sydney as identified in the project REF.

3.3.6 Traffic management and access

Traffic management, access, construction vehicle volumes and haulage routes would be generally consistent with Section 3.4.5 of the project REF. As part of the proposed modification a temporary cyclist and pedestrian detour and the closure of access for cyclists and pedestrians along Heathcote Road from Infantry Parade to Macarthur Drive is proposed for the duration of construction (refer to section 3.2.3).

3.4 Ancillary facilities

The proposed modification includes additional and revised construction compounds. These are described in Section 3.1.

3.5 Public utility adjustment

Public utility adjustments would be generally consistent with Section 3.4.5 of the project REF, although the following were not described and now form part of the proposed modification:

- Utility works within the rail corridor including power and communications. This also includes some trimming of vegetation near the Heathcote Road rail overbridge to meet minimum Ausgrid clearance requirements.
- Department of Defence watermain adjustment on the eastern side of Heathcote Road, north of Macarthur Avenue (refer to Figure 3-2 item 22).
- Underground power connections near Artillery Crescent (refer to Figure 3-1 item 20).

3.6 Property acquisition

Section 3.7 of the project REF did not identify any property acquisition requirements based on the concept design but did note that property adjustments may be needed in relation to the use and upgrade of Department of Defence access tracks.

As part of the detailed design process, the property adjustment requirements in Table 3-3 have been identified.

Table 3-3: Proposed property adjustments

Lot and DP	Current owner	Details
Lot 2 DP747513	Liverpool City Council	Required for proposed channel widening downstream of Harris Creek bridge.
Lot 32 DP8848597	Liverpool City Council	Required for utility bridge upstream of the Harris Creek bridges.
Lot 10 DP1091209	Liverpool City Council	Required for utility bridge upstream of the Harris Creek bridges.
Lot 122 DP119515	Department of Defence	Required to accommodate the construction of the access road to Kokoda Oval and to provide access for Sydney Water (pump station and sewage Treatment plant) and Sydney Trains (rail corridor). Also accommodates scour protection at Harris Creek and Department of Defence water main relocation.
Lot 2 DP11866495	Department of Defence	Required to accommodate the relocation of the existing Sydney Trains access road provides access to the Heathcote Road overbridge.
Lot 12 DP1074413	Rail Corporation of NSW	Required to allow the connection of pedestrian/cycle access from Macarthur Drive to Holsworthy Station.

4. Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP 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/or road infrastructure facilities and is to be carried out by Roads and Maritime, it can be assessed under Division 5.1 of the EP&A Act. Development consent from council is not required.

The proposal 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 (Coastal Management) 2018 (CM SEPP), State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (State Significant Precincts) 2005.

Part 2 of ISEPP 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 ISEPP (where applicable), is discussed in chapter 5 of this addendum REF.

4.1.2 Local Environmental Plans

Section 4.1.3 of the project REF identified affected zones under the Liverpool Local Environmental Plan 2008 and considered the consistency of the project with zone objectives. The proposed modification would not affect an additional land use zones and the assessment of consistency with zone objectives provided in Section 4.1.3 of the project REF remains relevant to the proposed modification.

4.2 Other relevant NSW legislation

4.2.1 Biosecurity Act 2015

The project REF considered the provisions of the *Noxious Weeds Act 1993*, which has now been repealed and replaced by the *Biosecurity Act 2015*.

Under the *Biosecurity Act 2015*, which came into effect on 1 July 2017, ‘all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable’.

Potential impacts proposed modification in relation to weeds are considered in Section 6.1.

4.2.2 Fisheries Management Act 1994

The *Fisheries Management Act 1994* is discussed in Section 4.2.4 of the project REF. In addition to that discussion, it is noted that the proposed channel widening in Harris Creek would constitute dredging work under Part 3 Division 7 of the Act and therefore the Department of Primary Industries (Fisheries) will need to be notified of the works and any comments will need to be considered. Consultation is planned and will include discussion of offsets for impacted key fish habitat (see section 6.1.3).

4.2.3 Biodiversity Conservation Act 2016

The transitional arrangements outlined within the Biodiversity Conservation (Savings and Transitional) Regulation 2017 apply to the assessment of the proposed modification. This allows for the *Threatened Species Conservation Act 1995* (now repealed) provisions and methodologies to be applied.

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 D.

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 the Environment and Energy is not required.

4.4 Confirmation of statutory position

The proposed modification is categorised as development for the purpose of a road and/or road infrastructure facilities and is being carried out by or on behalf of a public authority. Under clause 94 of ISEPP 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.

A referral to the Australian Government Department of the Environment and Energy under the EPBC Act is not required.

5. Consultation

5.1 Consultation strategy

The consultation strategy for the project remains consistent with that described in Section 5.1 of the project REF. Public display of this Addendum REF was not considered necessary given that targeted consultation has occurred and is proposed.

5.2 Consultation outcomes

Consultation with the following stakeholders occurred during the development of the detailed design (including the elements of the proposed modification)

- Liverpool City Council – regarding road design changes, shared paths, flooding, temporary construction compounds and heritage issues.
- Department of Defence – regarding property adjustments
- Sydney Trains – regarding utility works within the rail corridor
- Utility providers – regarding required adjustments
- Office of Environment and Heritage – regarding heritage issues associated with the Harris Creek Pedestrian Bridge
- Moorebank Heritage Group – regarding heritage issues associated with the Harris Creek Pedestrian Bridge
- National Trust (including via Roads and Maritime Heritage Committee)
- Residences and other stakeholders affected by noise walls.

5.2.1 Consultation specific to the Harris Creek Pedestrian Bridge

A detailed timeline of consultation that has occurred in relation to the Harris Creek Pedestrian Bridge is provided in the Statement of Heritage Impact included in Appendix E. In summary this included:

- Provision of a response to the National Trust submission (May 2017)
- Provision of information to the Office of Environment and Heritage to assist consideration a nomination for the State Heritage Register (November 2017)
- Coordination meeting (May 2018) involving Roads and Maritime, heritage specialists, designers, Moorebank Heritage Group and Liverpool City Council to consider:
  - Design development (in particular the hydrology impacts which has caused substantial further downstream clearing, bridge lengthening from 60 metres to 80 metres, and increased level of scour protection)
  - Potential options to be considered for the development of the Heritage Interpretation Strategy
  - Existing and proposed heritage interpretation structures and strategies in the local area
  - Relevant historical resources and material held by Council and Moorebank Heritage Group
- Provision of draft Heritage Interpretation Strategy to Liverpool City Council and Moorebank Heritage Group and consideration of comments (June 2018)
- Presentation to the Office of Environment and Heritage regarding design development, hydrology outcomes, confirmation of retention of the abutments, planned retention of original RSJs onsite as part of the Heritage Interpretation Strategy (September 2018)

- Meetings with Liverpool City Council and the Department of Defence confirming that it was not necessary to retain the Bailey bridge (September and October 2018)
- Meeting with Moorebank Heritage Group and advice to Liverpool City Council and the National Trust of the proposal to retain the RSJs in situ (December 2018) with stakeholders indicating this is a positive outcome from a heritage perspective.

5.2.2 Consultation specific to noise walls

Community consultation on noise walls began in October 2018. The consultation plan specified all residences directly behind a proposed noise wall would receive targeted consultation in the form of a letter and doorknocking. The following residences were consulted in relation to the proposed extension of the noise wall outside the Child Care Centre at 3A Artillery Crescent (in NCA A – western side of Heathcote Road, north of Harris Creek).

- Holsworthy Children's Centre
- 53A Infantry Parade
- 53 Infantry Parade.

The Liverpool City Council Representative and the Holsworthy Children's Centre manager were supportive of the proposed noise wall, while contacted residences did not raise any objections.

Roads and Maritime doorknocked residents who are eligible for acoustic treatment or who live behind proposed noise walls in October 2018. Following recently revised Heathcote Road Upgrade – Operational Road Traffic Noise Assessment Report (Resonate, 2019), eligible residences have changed slightly and therefore supplementary consultation is proposed.

5.3 Ongoing or future consultation

Ongoing or future consultation would be consistent with Section 5.6 of the project REF. As noted above, further consultation with residents regarding noise treatments is proposed.

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 Road Upgrade, Infantry Parade to The Avenue. 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 clause 228(1) of the Environmental Planning and Assessment Regulation 2000. The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A.

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

6.1 Biodiversity

The potential biodiversity impacts associated with the proposed modification were assessed as part of the Biodiversity Assessment Report prepared by SMEC. The main findings are summarised below, while the full report is included in Appendix D.

6.1.1 Methodology

Background research

Background research was conducted to identify threatened flora and fauna species, endangered populations, threatened ecological communities (TECs), important habitat for migratory species and critical habitat that has been previously recorded or is predicted to occur within the modified project boundary. This included a review of the following:

- Biodiversity Assessment Heathcote Road (WSP Parsons Brinckerhoff, 2016)
- Database and spatial data searches
  - Bionet Atlas of NSW Wildlife (12 June 2019)
  - EPBC Act Protected Matters Search Tool (12 June 2019)
  - Critical habitat registers (12 June 2019)
  - Groundwater Dependent Ecosystems Atlas (Bureau of Meteorology) (13 June 2019)
  - Important wetlands, Department of Environment (13 January 2016)
  - Coastal Wetlands spatial data (13 January 2016)
  - Office of Environment and Heritage Vegetation Information System (13 January 2016)
  - Remnant Vegetation of the western Cumberland subregion, 2013 Update. VIS_ID 4207.

Habitat assessment

Habitat assessment was completed to assess the likelihood of each threatened species, population or community that was identified to occur in the modified project boundary through desktop database searches and previous reports.

Field surveys

Vegetation surveys were conducted by two SMEC botanists over two days on the 14th and 15th of

November 2018, one day on the 19th of March, and two days on the 17th and 19th of June 2019. A series of random meanders and rapid data assessments were conducted on foot to identify the vegetation communities present. The collected data was used to update the extent of each vegetation community required to be cleared, to determine offsetting requirements and to inform the revised biodiversity impact assessment.

Additional targeted flora surveys for species identified onsite in 2016 (*Grevillea parviflora* subsp. *parviflora* and *Hibbertia puberula*) were carried out by SMEC in November of 2018 and March of 2019 and consisted of 30-minute random meanders.

Additional microchiropteran bat surveys and investigations were completed in November-December 2018 and in May 2019 by SMEC. These included a general habitat assessment, bridge inspections and ultrasonic bat call detection targeting the following species.

- Little Bentwing-bat
- Eastern Bentwing-bat
- East-coast free-tailed Bat
- Greater Broad-nosed Bat.

Limitations

The absence of a species from survey data does not necessarily mean it does not inhabit the survey area. It may simply mean that the species was not detected at that time with the survey method adopted and the prevailing seasonal or climatic conditions. In this context, the brevity of some of the surveys and their timing (winter) mean that the full spectrum of flora and fauna species, as well as ecological processes likely to occur within the modified project boundary may not have been fully quantified.

6.1.2 Existing environment

Plant community types

Within the revised clearing boundary (which is shown on Figure 6-1 and is smaller than the revised project area), 5.49 hectares of vegetation was identified as native and 6.26 hectares as disturbed mixed or exotic and native species. The 5.49 hectares of native vegetation within the revised clearing boundary was assigned to Plant Community Types (PCTs) as listed in and as shown in Table 6-1.

Table 6-1: PCTs within the revised project boundary

Plant Community Class	PCT	Condition	Conservation status BC Act	Conservation status BC Act	Area within original clearing boundary	Area within revised clearing boundary	Change in cleared area
Sydney Sand Flats Dry Sclerophyll Forests	PCT883: Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion.	Moderate to Good – Good	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion (Vulnerable)	Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion (Endangered). Meets EPBC Act condition thresholds.	1.19	1.88	0.69
		Moderate to Good – Moderate			0.99	1.30	0.31
		Moderate to Good – Low		Does not meet EPBC Act condition thresholds.	0.19	0.00	-0.19
Cumberland Dry Sclerophyll Forests	PCT724: Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate to Good – Good	Shale Gravel Transition Forest in the Sydney Basin Bioregion (Endangered)	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered) Meets EPBC Act condition Thresholds.	0.05	0.52	0.47
		Moderate to Good – Moderate			0.29	0.41	0.12
		Moderate to Good – Low		Does not meet EPBC Act condition thresholds.	0.43	0.62	0.19
Sydney Sand Flats Dry Sclerophyll Forests	PCT1067: Parramatta Red Gum Woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Moderate to Good – Good	Castlereagh Swamp Woodland Community (Endangered)	-	0.03	0.07	0..04
Coastal	PCT835: Forest Red Gum	Moderate to	River-Flat Eucalypt	-	0.24	0.69	0.45

Plant Community Class	PCT	Condition	Conservation status BC Act	Conservation status BC Act	Area within original clearing boundary	Area within revised clearing boundary	Change in cleared area
Floodplain Wetlands	– Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Good - Moderate	Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered)				
Exotic grassland – with or without scattered regrowth	Miscellaneous ecosystem	-	-	-	2.30	4.70	2.40
Exotic grassland - mown	Miscellaneous ecosystem	-	-	-	0.32	0.76	0.44
Mixed indigenous or non-indigenous plantings	Miscellaneous ecosystem	-	-	-	0.21	0.79	0.58
Water bodies, rivers, lakes, streams (not wetlands)	Miscellaneous ecosystem	-	-	-	0.01	0.01	0.00
Total native vegetation					3.41	5.49	2.08
Total disturbed vegetation					2.83	6.26	3.43
Total vegetation					6.25	11.75	5.51

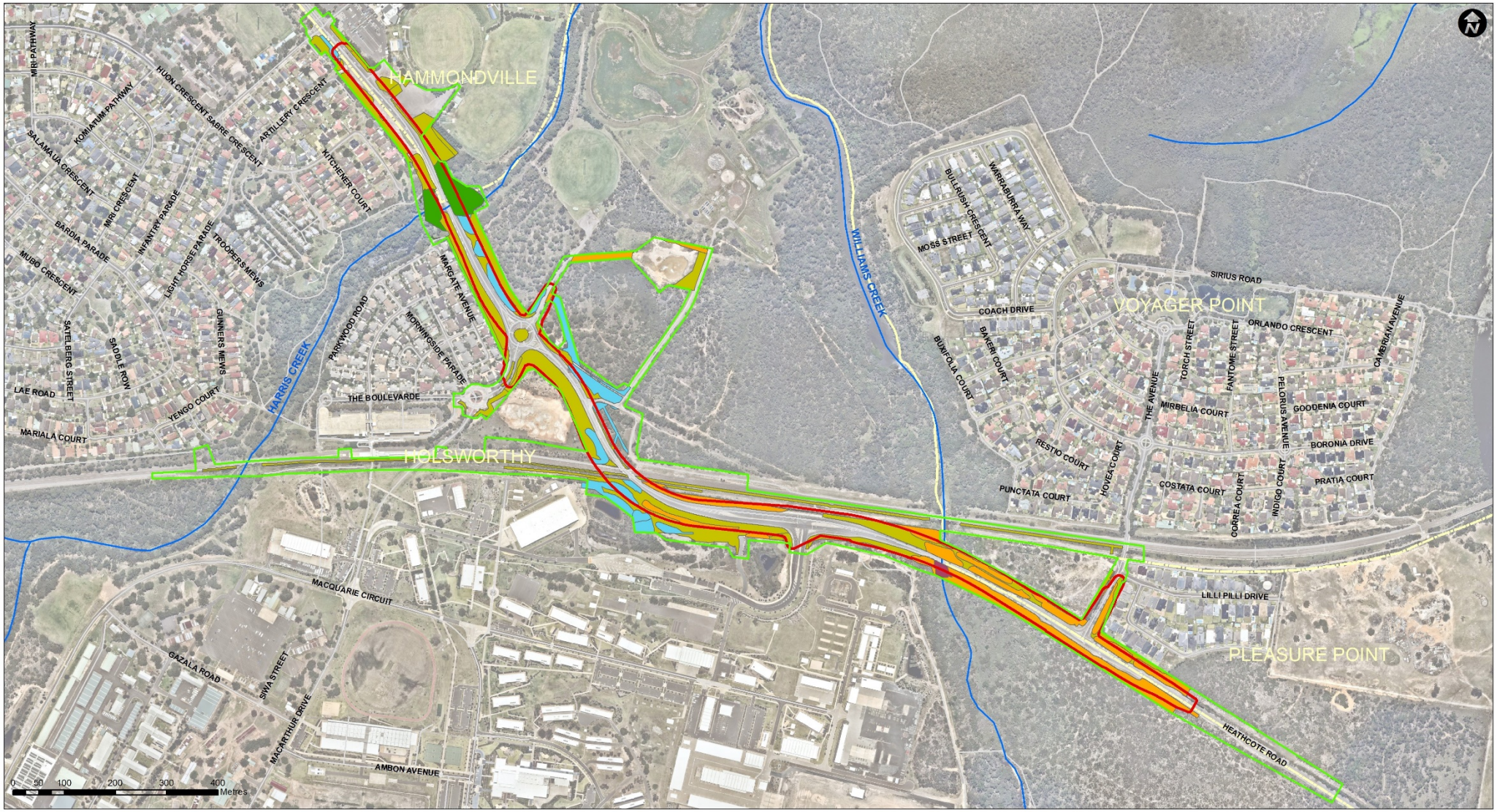

Figure 6-1: Plant Community Types

Other vegetation

Other vegetation associations that were recorded in the study area were not associated with PCT's were:

- Exotic grassland with or without scattered regrowth
- Exotic grassland – mown
- Mixed indigenous and non-indigenous planted
- Water body – dam/detention basins

These terrestrial areas were all highly disturbed and had no or limited native vegetation remaining.

Threatened ecological communities

A total extent of 5.55 hectares of PCTs mapped within the revised project boundary were found to align with TECs listed under the BC Act. Of this, 4.17 hectares of vegetation was also considered to align with TECs listed under the EPBC Act. The following four TECs were recorded:

- Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion
- Castlereagh Swamp Woodland Community
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion
- Shale Gravel Transition Forest in the Sydney Basin Bioregion.

Groundwater dependent ecosystems

A search of and area five kilometres around the revised project boundary using the Bureau of Meteorology (BoM) Atlas of Groundwater Dependent Ecosystems was carried out. The groundwater dependent ecosystems (GDEs) with surface expression of the groundwater were the Georges River and Voyager Point Wetlands, other GDEs reliant on the subsurface groundwater within the Bureau of Meteorology GDE Atlas are:

- Castlereagh Ironbark Forest – areas of moderate potential GDE
- Castlereagh Scribbly Gum Woodland – areas of moderate potential GDE
- Castlereagh Shale-Gravel Transition Forest – areas of high and low potential GDE
- Coastal Freshwater Lagoon – areas of high potential GDE
- Cumberland River Flat Forest – areas of high potential GDE
- Sydney Hinterland Transition Woodland – areas of high potential GDE
- Sydney Swamp Forest – areas of high potential GDE.

Threatened flora

The threatened flora previously recorded (by WSP for the project REF or by SMEC) are *Grevillea parviflora* subsp. *parviflora* (Vulnerable, EPBC Act and BC Act) and *Hibbertia puberula* subsp. *puberula* (Endangered, BC Act) occur within the revised clearing boundary.

After assessing the likelihood of threatened species presence there were 16 threatened flora species with a moderate or higher likelihood of occurring within the revised project boundary. Refer to Table 6-2.

Table 6-2 Threatened flora with a moderate-high likelihood of occurrence within the revised project boundary

Scientific name	Common name	BC Act status	EPBC Act status	Potential
Acacia bynoeana	Bynoe's Wattle	Endangered	Vulnerable	Moderate
Acacia pubescens	Downy Wattle	Vulnerable	Vulnerable	Moderate
Allocasuarina diminuta subsp. mimica	-	Endangered population	-	Moderate
Allocasuarina glareicola		Endangered	Endangered	Moderate
Caladenia tessellata	Thick-lipped Spider-orchid	Endangered	Vulnerable	Moderate
Callistemon linearifolius	Netted Bottle Brush	Vulnerable	-	Moderate
Hibbertia stricta subsp. furcatula	-	Endangered	-	Moderate
Leucopogon exolasius	-	Vulnerable	Vulnerable	Moderate
Leucopogon fletcheri subsp. fletcheri	-	Endangered	-	Moderate
Marsdenia viridiflora subsp. viridiflora	Native Pear	Endangered	-	Moderate
Persoonia nutans	Nodding Geebung	Endangered	Endangered	Moderate
Pimelea spicata	Spiked Rice-flower	Endangered	Endangered	Moderate
Pomaderris brunnea	Rufous Pomaderris	Endangered	Vulnerable	Moderate
Pterostylis gibbosa	Illawarra Greenhood	Endangered	Endangered	Moderate
Pultenaea parviflora	Sydney Bush Pea	Endangered	Vulnerable	Moderate

Threatened fauna

The threatened fauna previously recorded (by WSP for the project REF or by SMEC) are:

- *Pteropus poliocephalus* (Grey-headed Flying Fox) – BC Act and EPBC Act Vulnerable
- *Mormopterus (Micronomus) norfolkensis* (Eastern Freetail-bat) – BC Act Vulnerable
- *Myotis Macropus* (Southern Myotis) – BC Act Vulnerable.

After assessing the likelihood of threatened species presence there were 27 threatened species of fauna identified as having a moderate to high likelihood of occurring within the revised project boundary. Refer to Table 6-3.

Table 6-3 Threatened fauna with a moderate-high likelihood of occurrence within the revised project boundary

Scientific name	Common name	BC Act status	EPBC Act status	Potential
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	-	High
Hieraaetus morphnoides	Little Eagle	Vulnerable	-	High
Ninox strenua	Powerful Owl	Vulnerable		High
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Critically Endangered	Moderate
Burhinus grallarius	Bush Stone-Curlew	Endangered	-	Moderate
Daphoenositta chrysoptera	Varied Sittella	Vulnerable	-	Moderate
Artamus cyanopterus	Dusky Woodswallow	Vulnerable	-	Moderate
Callocephalon fimbriatum	Gang-Gang Cockatoo	Vulnerable	-	Moderate
Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable	-	Moderate
Glossopsitta pusilla	Little Lorikeet	Vulnerable	-	Moderate
Lophoictinia isura	Square-Tailed Kite	Vulnerable	-	Moderate
Petroica phoenicea	Flame Robin	Vulnerable	-	Moderate
Melithreptus gularis	Black-Chinned Honeyeater (Eastern Subspecies	Vulnerable	-	Moderate
Ninox connivens	Barking Owl	Vulnerable	-	Moderate
Petroica boodang	Scarlet Robin	Vulnerable	-	Moderate
Tyto tenebricosa	Sooty Owl	Vulnerable	-	Moderate
Varanus rosenbergi	Rosenberg's Goanna	Vulnerable	-	Moderate
Miniopterus australis	Little Bentwing-Bat	Vulnerable	-	High

Scientific name	Common name	BC Act status	EPBC Act status	Potential
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable	-	High
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	-	High
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Vulnerable	-	High
Chalinolobus dwyeri	Large-Eared Pied Bat	Vulnerable	Vulnerable	Moderate
Cercartetus nanus	Eastern Pygmy-Possum	Vulnerable	-	Moderate
Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	-	High
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable	High
Dasyurus maculatus	Spotted-Tailed Quoll	Vulnerable	-	Moderate
Meridolum corneovirens	Cumberland Plain Land Snail	Endangered	-	Moderate

Inspection of the Williams Creek bridge found no cracks, crevices or structures that could be used for roosting by any microchiropteran bats. Vegetation was also found to obstruct any potential flight path underneath the Williams Creek bridge. This bridge is therefore highly unlikely to support any roosting microchiropteran bats.

The Harris Creek bridge was originally assessed as being potential microchiropteran bat roosting habitat. No vegetation impeded access underneath the bridge and a deep (greater than one metre in depth) body of water potentially important to the Southern Myotis (*Myotis macropus*) was observed at every site inspection. An ultrasonic bat call detector recorded the Southern Myotis during the surveys however inspections of the bridge in May 2019 found no roosting microbats (or evidence of microbats).

Critical habitat

No critical habitat has been listed within the project area or the greater locality. Sections of the revised project area fall within Cumberland Plain Recovery Plan which has identified Priority Conservation Lands (PCLs) that are considered to contain habitat critical to the survival of threatened entities on the Cumberland Plain. As such, the project would impact upon extents of the Cumberland Plain Woodland TEC and remove habitat considered to be critical for the survival of the TEC under the EPBC Act.

Wildlife connectivity

Within the revised project area, habitat is largely disturbed due to urban development, however, wildlife corridors are present along Harris Creek and Williams Creek. There are also remnant habitat areas along the road reserve. These areas link northern remnant bushland areas and bushland within the Holsworthy Army Barracks to the south.

Aquatic habitat

Williams Creek and Harris Creek are classified as Class 2 (moderate key fish habitat) watercourses as they have clearly defined banks with permanent connected waters. These watercourses are not identified as potential locations for any threatened aquatic species.

6.1.3 Potential impacts

The elements of the proposed modification with most potential for biodiversity impacts are those that have required an extension of the project boundary (and the clearing limits).

Construction

Clearing of vegetation

The revised clearing boundary (which is shown on Figure 6-1 and is smaller than the revised project area) includes 11.75 hectares of vegetation, 5.49 hectares of which comprises of native vegetation and 6.26 hectares comprising of mixed native and/or exotic vegetation. This represents an increase in native vegetation to be cleared by 2.08 hectares.

Table 6-4 Impacts on native vegetation communities

Plant Community Class	BC Act	EPBC Act	Original area to be cleared (Ha)	Area to be cleared with proposed modification (Ha)
PCT883: Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion.	Vulnerable	Endangered	2.37	3.18
PCT724: Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy soils of the Cumberland Plain, Sydney Basin Bioregion open forest on clay/gravel	Endangered	Critically Endangered	0.77	1.55
PCT1067: Parramatta Red Gum Woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Endangered	-	0.03	0.07
PCT835: Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Endangered	-	0.24	0.69
Exotic grassland – with or without scattered regrowth	-	-	2.30	4.70
Exotic grassland - mown	-	-	0.32	0.76

Plant Community Class	BC Act	EPBC Act	Original area to be cleared (Ha)	Area to be cleared with proposed modification (Ha)
Mixed indigenous or non-indigenous plantings	-	-	0.21	0.79
Water bodies, rivers, lakes, streams (not wetlands)	-	-	0.01	0.01

Impacts on groundwater dependent ecosystems

Three of the PCTs that would be cleared by the project (inclusive of the proposed modification) are considered GDEs, namely Castlereagh Scribbly Gum Woodland (PCT 883), Castlereagh Shale-Gravel Transition Forest (PCT 724) and Cumberland River Flat Forest (PCT 835). There would be direct impacts on these GDE's from clearing.

There is the potential for indirect impacts on remaining areas of these GDE's adjacent to the construction area due to changes in groundwater levels from proposal.

The Dewatering Strategy prepared as part of the detailed design assessed groundwater resources in the area and nominated a preferred strategy for the dewatering activities required to install scour protection in the creeks. The Dewatering Strategy found that only a minor lowering of the groundwater table would be required – and given site constraints and feasibility of alternative methods, passive dewatering was the most viable strategy. The passive dewatering would be temporary (ie only during construction) and any lowering of the water table would be extremely localised. Also, the groundwater table is highly responsive to rainfall and therefore after rainfall would rapidly replenish.

Given the temporary and minor impacts on groundwater levels from the construction of the proposal, negligible risk or impacts are expected on remaining GDE area adjacent to the proposal.

Impacts on Key Fish Habitat

The project would require the removal of riparian vegetation beneath the bridges and both up and downstream of the bridges. At Harris Creek this would be about a length of 100 metres, however, with at least 25 per cent to be restored. At Williams Creek this would be a length of about 50 metres. Scour protection would be installed beneath and up and downstream of the bridges, and the riparian vegetation is unlikely to recolonise the scour protection. However, both up and downstream of the project riparian vegetation of both creeks is largely intact and therefore the loss of minor lengths of riparian vegetation due to the proposal would not have a substantial impact. There are also no threatened aquatic species known to occur in either creek.

The project (inclusive of the proposed modification) would not result in any barriers to fish passage – and would improve the potential for fish passage as the creeks would be made wider and deeper with better defined banks in the immediate location surrounding Harris and Williams Creek bridges.

Operation (indirect impacts)

Changes in hydrology

Flow velocities would increase upstream of the Harris Creek bridges, with smaller events (<20-year ARI) expected to have larger areas of higher velocities. However, velocities are low and even with the project would not increase above 1 m/s. Increased erosion is not expected when velocities remain below 1 m/s.

Downstream velocities would decrease immediately around the bridge and then return to previous levels further downstream.

There would no change in dry weather flows and water levels. The minor changes in upstream velocities, flooding extents and depths in wet weather would not cause increased erosion or any substantial changes in the flooding regimes in areas where there is flood dependent riparian vegetation.

Wildlife connectivity and habitat fragmentation

The proposed modification would result in a small increase in the fragmentation of the wildlife corridor along the Harris Creek as a result of additional clearing.

Edge effects on nearby native vegetation and habitat

Clearing and opening up of new vegetation edges is likely to facilitate the recruitment of weed species. Two new edges would be made within the northern section of the revised project area, within the Department of Defence lands. One edge is within PCT724 (Moderate to Good – Good Condition), where the cover and abundance of weeds is relatively low compared to other vegetation zones, however, exotic perennial grasses are still present. The other is within PCT883 (Moderate to Good – Moderate Condition), where the cover and abundance of weeds species are higher most likely as a result of disturbance within the proposed compound area. The new edges would likely increase weed density within the adjacent vegetation as a result of increased levels of sunlight, runoff, and nutrient load which tend to favour the establishment and growth of exotic species over indigenous. The edge that falls within PCT724 may be disproportionally impacted as the vegetation within the area is in relatively good condition, thus it would be expected that the floristic diversity and structural composition and integrity would diminish over time. Impacts to PCT883 as a result of the new edge would also include loss of floristic diversity and structural composition and integrity, however, given the current condition, this loss may not be as substantial as within PCT724.

Invasion and spread of weeds

Priority weeds were described in the project REF and surveys for the proposed modification did not identify any additional priority weeds.

Mechanical vegetation removal, earthworks and increased human activity during construction has the potential to facilitate the spread of weeds. Given that much of the vegetation across the revised project area suffers from weed invasion, it is considered that the proposed modification is not likely to significantly increase the presence or distribution of weeds. However, as discussed above, weed density may increase in areas where new edges are made.

Invasion and spread of pathogens and disease

No observations of pathogens or disease was observed during the biodiversity assessment for the proposed modification.

There is a risk that construction would introduce, spread or exacerbate the plant diseases caused by *Phytophthora cinnamomi* and Myrtle Rust, along with frog disease Chytridiomycosis caused by chytrid fungus during construction phase. These diseases are most likely introduced or spread through the importation or movement of soil, water and landscaping materials that contain organic materials, either directly or through incidental attachment to machinery.

Noise, light and vibration

Construction activities would cause additional noise and vibration to that which already exists from road traffic and increase light levels during night works to create well-lit and safe working conditions.

It is however unlikely the proposed modification would result in changes to existing levels of noise, vibration and light from the existing road network and surrounding environment such that there would be a significant impact to native fauna species during the construction or operation phases.

Conclusion on significance of impacts

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.

6.1.4 Safeguards and management measures

The safeguards and management measures identified in the Submissions Report would apply to address potential biodiversity impacts associated with the proposed modification. Changes to one safeguard are proposed

Impact	Environmental safeguards	Responsibility	Timing	Reference
Native vegetation removal and re-establishment	• A Biodiversity Offset Strategy would be prepared ***to provide offsets based on the ecosystem credits and species credits outlined in the Biodiversity Assessment Report (SMEC, 2019) and clearing of 0.76 hectares of key fish habitat. This strategy would be prepared in accordance with Roads and Maritime Guidelines for Biodiversity Offsets and the NSW Department of Primary Industries Policy and Guidelines for Fish Habitat Conservation and Management 2013.*** ~~during the detailed design phase to provide offsets equivalent to 145 ecosystem credits. This strategy would be prepared in accordance with the Guidelines for Biodiversity Offsets (Roads and Maritime, 2011h) and the NSW BioBanking Assessment Methodology 2014.~~	Roads and Maritime	~~Detailed design~~ ***Pre-construction / construction***	Additional safeguard

6.1.5 Biodiversity offsets

The Guideline for Biodiversity Offsets (Roads and Maritime Services, 2016) provides offset thresholds which are appropriate and proportional for the scale of EP&A Act Division 5.1 assessments, and their expected impacts on biodiversity. Table 1 within Section 4.2 of the guidelines outlines the offsetting

thresholds for REFs. Table 6-5 identifies the offset requirements relevant to the project inclusive of the proposed modification.

Table 6-5 Offset requirements

Activity or impact	Consider offsets or supplementary measures	Subject species / subject EEC meeting threshold
Works involving clearing of national or NSW listed critically endangered ecological communities (CEEC)	Where there is any clearing of an CEEC in moderate to good condition	PCT724 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest CEEC)
Works involving clearing of nationally listed threatened ecological community (TEC) or nationally listed threatened species habitat	Where clearing >1 ha of a TEC or habitat in moderate to good condition.	PCT883 Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion (Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion) *Grevillea parviflora* subsp. *parviflora*

A Biodiversity Offset Strategy will be prepared based on the ecosystem credits for the project (inclusive of the proposed modification) and will describe how the offset requirements will be met. The required biodiversity credits would need to be purchased, retired, or equivalent cost deposited into the Biodiversity Conservation Fund to fulfil the credit requirements for the project. The number of ecosystem credits required for the project outlined in the biodiversity assessment (Appendix D).

It should be noted the clearing thresholds under the offset guidelines were not met for the following threatened entities, and therefore, offsets are not required:

- *Hibbertia puberula* subsp. *puberula*
- Castlereagh Swamp Woodland Community
- River Flat Eucalypt Forest on Costal Floodplains.

The revised project area includes the clearing of 0.76 hectares of Type 2 key fish habitat (of which 0.49 hectares is attributable to the proposed modification). The Guideline for Biodiversity Offsets (Roads and Maritime Services, 2016) requires any impacts to Type 1 and 2 key fish habitat to be offset in accordance with the NSW Department of Primary Industries Policy and Guidelines for Fish Habitat Conservation and Management (Department of Primary Industries, 2013). Consultation with the Department of Primary Industries regarding offsets for impacts to key fish habitat is planned.

6.2 Surface water and flooding

6.2.1 Methodology

The assessment of surface water and flooding impacts for the proposed modification involved a review of section 6.2 of the project REF and consideration of the following documents prepared during the detailed design process:

- Hydrology and Drainage Design Report – Heathcote Road Upgrade (SMEC, 2018)
- Erosion and Sedimentation Management Report – Heathcote Road Upgrade (SMEC, 2018)

6.2.2 Existing environment

Water quality

The discussion of catchment values and water quality in Section 6.2.2 of the project REF remains relevant to the proposed modification.

In addition, it is also noted that a preliminary assessment of surface water quality was previously carried out for the adjacent Holsworthy Barracks (GHD, 2016) which included sampling in downstream waterways, including downstream of Williams Creek and Harris Creek. Laboratory testing was carried out for Per- and Poly-fluoroalkyl Substances (PFAS), Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), cations and anions, total dissolved solids and heavy metals. The results of testing indicated:

- Detectable concentrations of Perfluorooctane sulfonate (PFOS) within three surface water samples collected in Harris or Williams Creek. PFOS concentrations recorded between 0.04 mg/L and 0.2 mg/L, below or equal to the drinking water criteria
- Detectable concentrations of heavy metals (Barium Cobalt, Copper, Manganese, Nickel and Zinc)
- No detectable concentrations of organic contaminants (TRH and BTEX).

Flooding

The project REF notes that the project footprint north of Heathcote Road to the west of Williams Creek is flood prone land and that the section of Heathcote Road between Williams Creek and Harris Creek is a major road where road inundation could occur. It also notes that the existing Harris Creek Bridge can withstand water levels from a storm event that would typically occur once every five years while the Williams Creek Bridge can withstand water levels from a storm that would occur once every decade.

Flood modelling carried out as part of the detailed design process (and subsequent to the project REF) confirmed that the Harris Creek Bridge overtops in the 5 year annual recurrence interval (ARI) and that Williams Creek Bridge is overtopped for the 20 year ARI event.

6.2.3 Potential impacts

The elements of the proposed modification with most potential for surface water and flooding impacts are:

- Increased construction footprint and associated increase in vegetation clearing and ground disturbance
- Changes to the Harris Creek twin bridges and associated channel widening (items 5 and 6)
- Provision of bioswales (item 30).

Water quality

Construction

The discussion of construction surface water quality in Section 6.2.3 of the project REF remains relevant to the proposed modification.

In addition, it is noted that the proposed channel widening downstream of Harris Creek poses an elevated risk with respect to erosion and sedimentation hazards which require management.

Operation

The discussion of operational surface water quality in Section 6.2.3 of the project REF remains relevant to the proposed modification.

The project REF notes the function of existing grass swales in filtering pollution and sediments and indicates there would be no net change from the existing situation. As a result, it would be unlikely that significant sediment or pollution impacts would occur during operation.

The proposed modification includes the provision of bioswales and check dams at the stormwater outlets at Harris and Williams Creek, and therefore would improve operational water quality when compared to the design considered in the project REF.

Hydrology and flooding

With the project (inclusive of the proposed modification) flow velocities would increase upstream of the Harris Creek bridges, with smaller events (<20-year ARI) expected to have larger areas of higher velocities. However, velocities are expected to remain low and even with the project would not increase above 1 m/s. Increased erosion is not expected when velocities remain below 1 m/s. Downstream velocities would decrease immediately around the bridge and then return to previous levels further downstream.

The discussion of flooding in Section 6.2.3 of the project REF remains relevant to the proposed modification. That section notes the road would be less likely to flood as the new and replaced bridges would be built to provide greater flood protection, but also identifies the potential for scour around new structures and the increased water levels at drainage outlets.

Flood modelling carried out as part of the detailed design process identified that there would be substantial flood level reductions upstream of Harris Creek and Williams Creek bridges as a result of larger bridge openings with higher soffit levels. Major velocity reductions were also noted near the Harris Creek bridge due to proposed channel widening.

Modelled flood extents and depths and for 100-year ARI for the existing situation and with the project (inclusive of the proposed modification) are shown by Figure 6-2 and Figure 6-3 respectively.

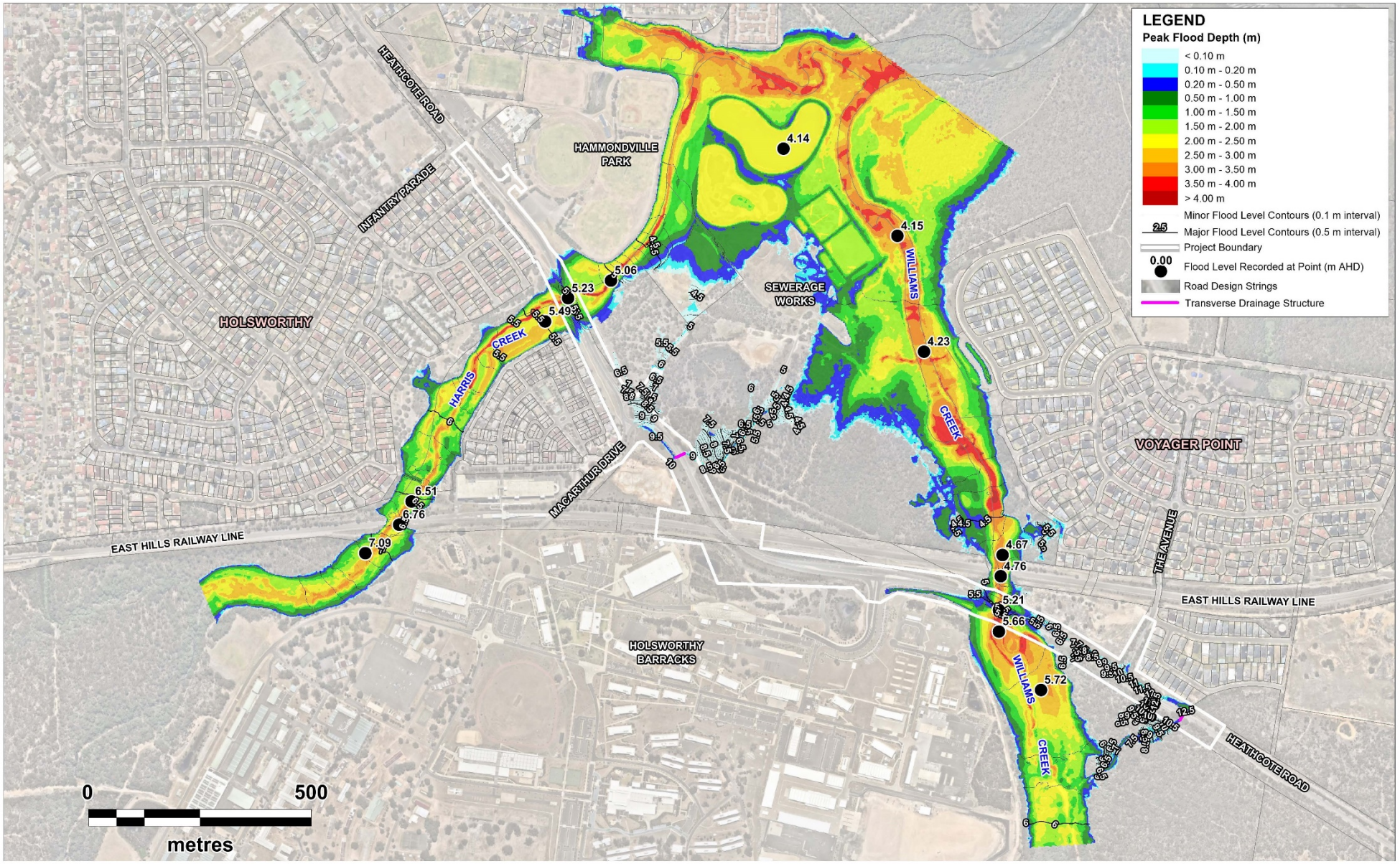

Figure 6-2: 100 year ARI flood depth – existing

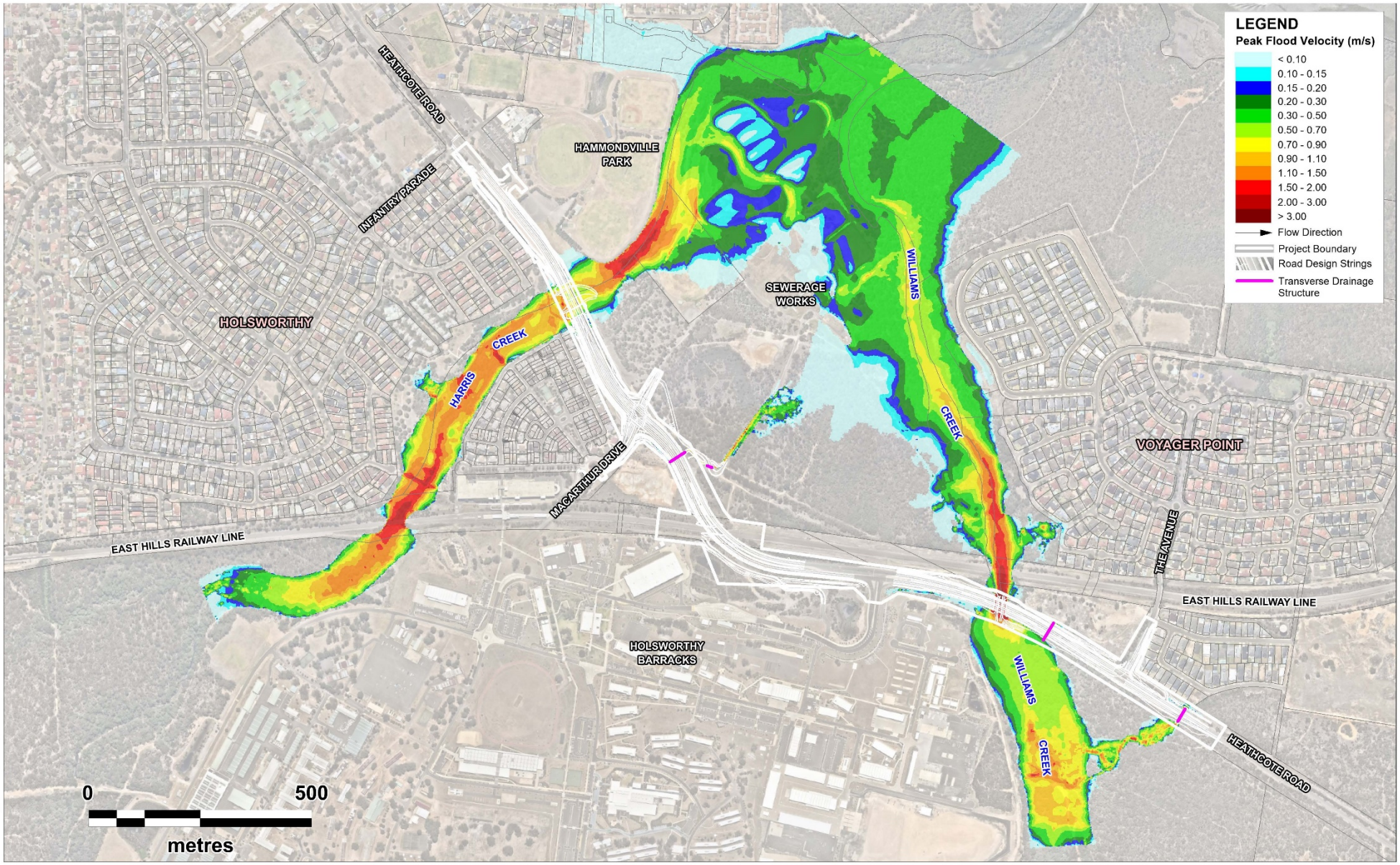

Figure 6-3: 100 year ARI flood depth – with project

6.2.4 Safeguards and management measures

The following additional measures are proposed to address the potential surface water and flooding impacts of the proposed modification.

Impact	Environmental safeguards	Responsibility	Timing	Reference
Erosion and sedimentation	• A specific Erosion and Sedimentation Control Plan (ESCP) and an Environmental Work Method Statement (or similar) will be prepared by a registered Soil Conservationist for works in and adjacent to the creeks.	Contractor	Construction	Additional safeguard
Erosion and sedimentation	• Works in Harris Creek and Williams Creek will be scheduled during winter months when less rainfall is expected, where feasible and reasonable.	Contractor	Construction	Additional safeguard

6.3 Soils and geology

6.3.1 Methodology

The assessment of soils and geology impacts for the proposed modification involved a review of section 6.4 of the project REF and consideration of the following documents:

- Phase 1 Environmental Site Assessment – Heathcote Road Upgrade (Hazmat Services, 2019), which is included in Appendix F
- Baseline Contamination Assessment – Heathcote Road Upgrade (SMEC, 2019) which considered the potential for contamination to exist within the area of the rail corridor that would be accessed by Roads and Maritime for the project
- Additional Contamination Assessment – Heathcote Road Upgrade (SMEC, 2019) which is included in Appendix F
- Geotechnical and Contamination Assessment – Proposed ancillary site – Heathcote Road Upgrade (SMEC, 2019) which is included in Appendix F
- Acid Sulfate Soil Management Plan – Heathcote Road Upgrade (SMEC, 2018).

6.3.2 Existing environment

The discussion of geology, soils and acid sulfate soil potential in Section 6.4.2 of the project REF remains relevant to the proposed modification.

In relation to acid sulfate soils, the Acid Sulfate Soil Management Plan – Heathcote Road Upgrade (SMEC, 2018) notes that while Harris Creek is identified as an area with low probability of acid sulfate soil occurrence, investigations show some samples within the alluvial soils with exceedances of the adopted acid sulfate soil assessment criteria with either existing or potential acidity likely to be associated with sulfidic sources.

The Phase 1 Environmental Site Assessment – Heathcote Road Upgrade (Hazmat Services, 2019) considered the additional areas affected by the proposed modification and noted:

- The site has historically been used for road and rail purposes, with a section of the site also situated on Department of Defence land
- Several areas of environmental concern (AECs) were identified, including fill of unknown origin, historical use of the site for rail and department of Defence purposes, dumping of potentially contaminated waste in bushland, and potentially contaminated surface water and groundwater
- The preliminary sampling program identified the presence of asbestos in one fragment sample collected from the road verge of Heathcote Road, and elevated levels of zinc within a small section of burnt ground in the cleared area of the site located on Department of Defence land.

Table 6-6 Identifies AECs and associated chemicals of concern for the proposed modification site.

Table 6-6: AECs and chemicals of concern for the proposed modification site

Area	AEC	Potential contaminating activity	Chemicals of concern	Risk
Heathcote Road from Infantry Parade to Harris Creek	Heathcote Road and surrounds	Importation of fill of unknown origin	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low
	Gravel carpark adjacent to Moorebank Sports Club	Importation of fill of unknown origin	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low
	Bushland areas	Dumping of potentially contaminated household waste	Asbestos	Low to Medium
	Harris Creek	Potentially contaminated surface water flowing to, or from, the site	Heavy metals, TRH, BTEX, PAH, OCP, PCB, nutrients, cations, anions	Low
	Groundwater beneath site	Potentially contaminated groundwater flowing to, or from, the site	Heavy metals, TRH, BTEX, PAH, OCP, PCB, nutrients, cations, anions	Low
Heathcote Road from Harris Creek to Macarthur Drive, including Macarthur Drive	Heathcote Road and surrounds	Importation of fill of unknown origin	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low

Area	AEC	Potential contaminating activity	Chemicals of concern	Risk
part of site on Department of Defence land				
	Bushland areas	Dumping of potentially contaminated household waste	Asbestos	Low to Medium
	Department of Defence land	Potentially contaminated soil due to historical operations undertaken by Department of Defence	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low
		Stockpile of unknown origin	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low
	Cleared area within Department of Defence land	Unknown historical activities undertaken across cleared area, and small burnt section of cleared area	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low
	Groundwater beneath site	Potentially contaminated groundwater flowing to, or from, the site	Heavy metals, TRH, BTEX, PAH, OCP, PCB, nutrients, cations, anions	Low
	Sewage treatment plant neighbouring Site	Unknown historical operations of treatment plant, and potential groundwater contamination emanating from treatment plant	Heavy metals, TRH, BTEX, PAH, OCP, PCB, nutrients, cations, anions, microbiological contaminants	Low
Rail corridor to the west of Heathcote Road and around Holsworthy Station	Rail corridor	Potential contamination due to historical rail operations	TRH, BTEX, PAH, asbestos	Low
Heathcote Road and rail corridor from Macarthur Drive to Williams Creek	Heathcote Road and surrounds	Importation of fill of unknown origin	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low
	Heathcote Road bridge over railway line	Importation of fill of unknown origin	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low

Area	AEC	Potential contaminating activity	Chemicals of concern	Risk
	Rail corridor	Potential contamination due to historical rail operations	TRH, BTEX, PAH, asbestos	Low
	Bushland areas	Dumping of potentially contaminated household waste	Asbestos	Low to Medium
	Harris Creek	Potentially contaminated surface water flowing to, or from, the site	Heavy metals, TRH, BTEX, PAH, OCP, PCB, nutrients, cations, anions	Low
	Groundwater beneath Site	Potentially contaminated groundwater flowing to, or from, the site	Heavy metals, TRH, BTEX, PAH, OCP, PCB, nutrients, cations, anions	Low
Heathcote Road and rail corridor from Williams Creek to The Avenue, including The Avenue	Heathcote Road and surrounds	Importation of fill of unknown origin	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low
	The Avenue bridge over railway line	Importation of fill of unknown origin	Heavy metals, TRH, BTEX, PAH, OCP, PCB, asbestos	Low
	Rail corridor	Potential contamination due to historical rail operations	TRH, BTEX, PAH, asbestos	Low
	Bushland areas	Dumping of potentially contaminated household waste	Asbestos	Low to Medium
	Stormwater detention basin	Potentially contaminated surface water flowing to, or from, the site	Heavy metals, TRH, BTEX, PAH, OCP, PCB, nutrients, cations, anions	Low
	Groundwater beneath Site	Potentially contaminated groundwater flowing to, or from, the site	Heavy metals, TRH, BTEX, PAH, OCP, PCB, nutrients, cations, anions	Low

In early 2019 additional contamination sampling and testing was carried out to supplement the previous investigations (SMEC, 2019), and included selected parts of the revised project area. The main findings were as follows:

- Asbestos containing materials (ACM) were identified within topsoil and/or fill materials at eleven across project area, with an estimated in-situ volume of about 2,200m^3 of ACM impacted fill materials within the areas investigated
- Detectable PFAS concentrations (that is above 0.2 µg/kg) were recorded in several sediment/soil samples (Harris Creek, Williams Creek and the onsite drainage line adjacent to Holsworthy Barracks) but were below the adopted soil assessment criteria (heath investigation level / heath screening level) for commercial/industrial land use. PFAS detections were noted across several soil types including creek and drainage line sediments (relatively lower), and within step out test within channel embankments in topsoil and deeper alluvium. While in relatively low detections, PFAS contaminant distribution appears to extend beyond the locations sampled
- Detectable concentrations of PFAS compounds, nutrients and heavy metals (copper only) were recorded in one surface water sample collected from the stormwater retention pond, located at the boundary with the Holsworthy Barracks.

The results of soil sampling and testing within the rail corridor (SMEC, 2019) showed contaminant concentrations were below adopted human health assessment criteria for industrial/commercial setting. Field observations of surface and subsurface conditions also indicated a low likelihood for soil contamination to be present within works areas.

The Geotechnical and Contamination Assessment – Proposed ancillary site – Heathcote Road Upgrade (SMEC, 2019) considered the proposed ancillary site on Department of Defence land (proposed modification item 2 – refer to Figure 3-2). The main findings were:

- No items of unexploded ordnance were identified during May 2019 surveys at the proposed ancillary site location
- Contaminants of potential concern were found to be below adopted human health and ecological assessment criteria and there is a low likelihood for soil contamination to be present that would pose a risk to construction workers at the proposed ancillary site.
- Two isolated fragments of ACM, consisting of bonded fibro cement were noted on the ground surface near the northern site boundary

6.3.3 Potential impacts

The assessment of potential impacts provided in section 6.4.5 of the project REF remains relevant to the proposed modification.

The proposed channel widening within Harris Creek would disturb soils with acid sulfate potential and therefore specific management measures would need to be implemented in that area.

The Phase 1 Environmental Site Assessment – Heathcote Road Upgrade (Hazmat Services, 2019) has identified a generally low risk in relation to AECs within the additional areas affected by the proposed modification, with a Low to Medium risk in relation to asbestos within dumped materials in bushland areas.

During construction, bonded asbestos containing material poses a potential risk to human health for construction workers and the public in areas required to be disturbed. The potential for exposure via inhalation exists wherever ground disturbance or heavy vehicle movements may cause mechanical abrasion to asbestos containing materials resulting in release of asbestos fibres. This risk would be addressed as part of the Contaminated Land Management Plan.

Detectable PFAS concentrations in sediment and soils are likely to be disturbed during construction activities within Harris Creek, Williams Creek and the onsite drainage line. If excavated spoil containing detectable PFAS are considered for onsite reuse (i.e. as general fill) the suitability for the intended application area will need to be established in accordance with the PFAS National Environmental

Management Plan (Heads of EPAs Australia and New Zealand, 2018). This will be addressed in the Contaminated Land Management Plan.

6.3.4 Safeguards and management measures

The safeguards and management measures identified in Section 6.4.6 of the project REF, including the preparation of contaminated land and acid sulfate soil management plans, are adequate to address the potential impacts of the proposed modification.

6.4 Traffic and transport

6.4.1 Methodology

The assessment of traffic and transport impacts for the proposed modification involved a review of section 6.5 of the project REF and consideration of the following documents / data:

- Traffic and Transport Assessment Report – Heathcote Road Upgrade (SMEC, 2018)
- Pedestrian / cyclist counts at the Harris Creek pedestrian bridge on Heathcote Road and the pedestrian bridge near Yengo Court, Holsworthy.

6.4.2 Existing environment

The discussion of the existing traffic and transport environment in Section 6.5.2 of the project REF remains relevant to the proposed modification.

Pedestrian / cyclist counts carried out between 3-9 September 2018 at the Harris Creek pedestrian bridge on Heathcote Road and the pedestrian bridge near Yengo Court, Holsworthy, identified the following:

- The Heathcote Road bridge had a daily average of 190 pedestrian / cyclist trips during the survey period
- The Yengo Court bridge had a daily average of 1108 pedestrian / cyclist trips during the survey period
- There was one recorded trip by a person using a wheelchair on the Yengo Court bridge, but no recorded wheelchair trips for the Heathcote Road bridge during the survey period.

6.4.3 Potential impacts

The elements of the proposed modification with most potential for traffic and transport impacts are:

- Shared path connection to Holsworthy Station (item 14)
- Extension of southbound dual right turn lanes from Heathcote Road into Macarthur Drive by about by 70 metres (item 14)
- Addition of a third northbound lane between Macarthur Drive and the rail bridge (item 15)
- Additional right-turn from The Avenue to Heathcote Road (item 16)
- Shared path next to the northbound lanes of Heathcote Road, north of Harris Creek (item 18)
- Pedestrian and cyclist detour during construction (item 23)

- Temporary relocation of existing bus stops (2170562 and 217387) about 40 metres to the north (towards Infantry Parade) during construction.

Construction

Construction staging and traffic

The construction staging for the project has been designed to minimise delays associated with construction. The staged demolition and construction of the Heathcote Road / Macarthur Drive intersection in addition to the maintained existing speed limit and serviceability would allow vehicles to travel through the site uninterrupted. The construction works for the project (inclusive of the proposed modification) would not require road closure or rerouting.

The proposed modification is expected to have a minimal impact on the number of required construction vehicles. Any additional trips would be scheduled to arrive outside peak traffic flow periods to minimise any delay for road users. All additional construction compounds have direct access to Heathcote Road and would not require construction vehicles to use local streets.

Pedestrians and cyclists

The proposed modification includes a temporary cyclist and pedestrian detour and the closure of access for cyclists and pedestrians along Heathcote Road from Infantry Parade to Macarthur Drive.

The detour has the potential to increase access distances and travel time for some people, depending on their location and destination. The potential impacts associated with the detour in terms of increased distances have been identified as follows:

- For those travelling to and from Holsworthy Station, there would be an increase in travel distance for about 28 residences (Infantry Parade, Artillery Crescent and Sabre Crescent, Holsworthy), with a maximum additional distance of about 255 metres
- For those travelling to Holsworthy Public School there would be an increase in travel distance for about 100 residences (all residences near Holsworthy Station south of Harris Creek and residences closest to Heathcote Road between Infantry Parade and Harris Creek), with a maximum additional distance of about 775 metres
- For those travelling between residences north and south of Harris Creek, there would be a maximum increase in travel distance of about one kilometre.

Buses

The proposed modification involves temporarily relocating two bus stops on Heathcote Road near Infantry Parade (217387 and 2170562) about 40 metres north of their current location (towards Infantry Parade intersection) in order to remove the bus stops from the construction works zone. The relocated location allows for the buses to safely operate their current routes during construction. There may be a small increase or decrease in walking distance to these bus stops depending on the location a customer is walking from.

Operation

Traffic performance

Traffic modelling conducted for the project (inclusive of the proposed modification) identified the following:

- By the year 2036 and under both AM and PM peak traffic demand, all key intersections show intersection level of service C or better with the project
- By the year 2036 and under both AM and PM peak traffic demand, modelling shows a substantial improvement in the peak direction of travel

- By the year 2036 and under PM peak demand, the Macarthur Drive / The Boulevarde / Morningside Parade roundabout shows low level of service F. This is attributable in part to the addition of the fourth leg (future shopping centre access proposed by others) and is not related to the proposed modification
- By the year 2036 and under PM peak demand, the Heathcote Road / Infantry Parade intersection show acceptable overall level of service B. Modelling also shows growth in the traffic volumes at Infantry Parade which results in long queues at Infantry Parade for vehicles turning southbound into Heathcote Road, but this is not related to the proposed modification
- By the year 2036, the Macarthur Drive / The Boulevarde / Morningside Parade roundabout is unable to accommodate the increased flow due to the upgrades on Heathcote Road and the future shopping centre access via this roundabout, however this is not directly related to the proposed modification.

Pedestrians and cyclists

The proposed modification includes additional and improved shared path connections. These would improve pedestrian and cyclist amenity and connectivity.

6.4.4 Safeguards and management measures

The following additional measures are proposed to address the potential traffic and transport impacts of the proposed modification.

Impact	Environmental safeguards	Responsibility	Timing	Reference
Pedestrian / cyclist access	• The pedestrian / cyclist detour would be adequately signposted.	Contractor	Construction	Additional measure
Pedestrian / cyclist access	• Options for improving lighting on the section of the proposed detour route between Kitchener Court and Sabre Crescent will be investigated in consultation with Liverpool City Council.	Roads and Maritime project manager	Pre-construction	Additional measure
Access to bus stops	• Relocated bus stops will be adequately signposted and advance notice (e.g. via a notice at the existing bus stop) will be provided to existing users.	Contractor	Construction	Additional measure

6.5 Noise and vibration

6.5.1 Methodology

The assessment of noise and vibration impacts for the proposed modification involved a review of section 6.6 of the project REF and consideration of the following:

- Heathcote Road Upgrade – Operational Road Traffic Noise Assessment Report (Resonate, 2019).

6.5.2 Existing environment

The discussion of the existing environment relating to noise and vibration in Section 6.6.3 of the project REF remains relevant to the proposed modification. This includes the identification of representative receivers the definition of noise catchment areas (NCAs).

6.5.3 Potential impacts

The elements of the proposed modification with most potential for additional construction noise and vibration impacts are those that have required an extension of the project boundary, specifically where that boundary is adjacent to noise sensitive receivers.

Construction noise

The project REF notes that residents would be affected at some point while the proposal is being built especially where night works are carried out. The following was specifically identified:

- Worst case predicted noise levels at residential properties indicated noise levels could be up to 30 dBA above the daytime guideline levels, 40 dBA during the evening and 50 dBA above the night time noise management levels.
- Construction activities that are likely to generate the most noise are the bulk earthworks, bridge works, pavements works and some finishing activities
- The closest receivers in NCA A and B would be highly noise affected during scenarios 5 (bridge superstructure), 7 (Pavement works) and 8 (finishing works)
- The closest receivers in NCA D would be highly noise affected during scenarios 7 (Pavement works) and 8 (finishing works)
- The Holsworthy child care centre would be impacted above the guideline levels for all construction scenarios
- Pupils and teachers at Holsworthy Public School and Holsworthy pre-school and Holsworthy early education and childcare centre would be affected by the noise generated for the majority of construction activities
- The worst case noise levels are predicted to be up to 35 dBA above the external criteria at Holsworthy School, however large exceedances more than 20 dBA above the criteria would only occur during pavement and finishing works. Other exceedances are in the order of 3 to 8 dBA.
- The residents in noise catchment areas A, B and D would be the worst affected, as they have the highest predicted noise levels which in some cases are above the highly noise affected limit of 75 dBA limit.

While the proposed modification would involve some works outside the project REF boundary and closer to residential receivers, these works are not expected to substantially change the predicted impact identified above or the required construction noise mitigation. The following is noted:

- Pavement / kerb works (item 11), noise wall extensions (item 27), power connections (item 20) and shared path works (item 18) would occur close to residences in NCA A, to the Child Care Centre at 3A Artillery Crescent and to Holsworthy Public School
- Construction works for the proposed utilities bridge across Harris Creek would occur closer to residences on Kitchener Court and Sabre Crescent in NCA A and Parkwood Road in NCA B
- The additional compound and utility works are about 60 metres from residences on Margate Avenue in NCA B, but are further away from these residences than the adjacent road works
- Other additional compounds are not located near sensitive noise receivers.
- Drainage works would occur slightly closer to residences on Willowie Way, Voyager Point.

The proposed modification is not expected to result in a major change to the quantity of night works or the types of activities that would need to occur at night.

Consistent with the assessment in the project REF, construction activities for the proposed modification would in some cases need to occur within minimum safe working distances for vibration intensive plant. The project REF includes mitigation measures to address potential vibration impacts on structures and human comfort.

Operational noise

The Heathcote Road Upgrade – Operational Road Traffic Noise Assessment Report (Resonate, 2019) considers the potential operational traffic impacts of the project inclusive of the proposed modification.

The outcomes of the noise level predictions are provided in Table 6-7 for the Year 2032 (ten years after opening) design year. The project is not predicted to increase noise levels by more than 2 dB(A), however exceedances of the cumulative limit (when the total noise level in the design build year is 5 dB(A) or more above the criterion) are predicted at numerous locations.

Table 6-7 Operational road traffic noise criteria exceedances

NCA	Predicted exceedances	Consistency with project REF
A	Child care centre located at 3A Artillery Crescent. First floor of residential receivers located at 23 and 27 Sabre Crescent and 53A Infantry Parade. Noise criteria exceedances deemed to be outside the project extents and therefore not project related*, were predicted at: • Holsworthy School and Pre-School (buildings located adjacent to Infantry Parade in closest proximity to Heathcote Road • Ground floor of 53 Infantry Parade	Generally consistent except some criteria exceedances have now been identified as not being related to the project.
B	Noise criteria exceedances were predicted at 25 locations within this NCA. The exceedances encompass: • Ground floor receivers located at 1 and 3 Macarthur Drive • First floor receivers located at:	Generally consistent except 1 and 3 Macarthur Drive and 6 Margate Avenue are now predicted to exceed the cumulative limit.

NCA	Predicted exceedances	Consistency with project REF
	– 1 and 3 Macarthur Drive – 6, 8-10, 12, 14, 16-18, 20, 22, 24-26, 28, 30, 32-34 Margate Avenue • Second floor receivers located at: – 1 and 3 Macarthur Drive – 6, 8-10, 12, 14, 20, 22, 28, 30 Margate Avenue	
C	No noise criteria exceedances have been predicted within this NCA.	Consistent
D	Noise criteria exceedances were predicted at 13 locations within this NCA. The exceedances encompass: • Ground floor receivers located at 15, 17, 21, 23, 25 Willowie Way • First floor receivers located at: – 1, 5, 7, 9, 11, 13, 23 and 25 Willowie Way	Generally consistent except 1 and 5 Willowie Way are now predicted to exceed the cumulative limit.
E	No noise criteria exceedances have been predicted within this NCA.	Consistent
F	No noise criteria exceedances have been predicted within this NCA.	Consistent

* May be considered for treatment under the Noise Mitigation Guideline (Roads and Maritime Services, 2015) principles that communities should receive reasonable and equitable outcomes and noise mitigation shall be evaluated and installed where feasible and reasonable.

6.5.4 Safeguards and mitigation measures

The safeguards and management measures identified in the Submissions Report are adequate to address potential noise and vibration impacts associated with the proposed modification.

6.6 Aboriginal heritage

6.6.1 Methodology

To assess potential impacts on Aboriginal heritage associated with the proposed modification an addendum to the Aboriginal Archaeological Survey Report included in the project REF was carried out in accordance with the Stage 2 requirements of the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (Roads and Maritime Services, 2011). The addendum is included in Appendix G.

The addendum assessment included an archaeological survey of the additional project areas on Monday 10th December 2018. Representatives from Tharawal Local Aboriginal Land Council and the South Coast People Native Title Claimants group participated in the survey. A representative from Gandangara Local Aboriginal Land Council was not available for the survey.

6.6.2 Existing environment

One previously recorded Aboriginal archaeological site (Holsworthy Isolated Find 4; AHIMS ID: 45-5-2344) was identified within the study area. The site is listed as destroyed by the Aboriginal Heritage Information Management System and is no longer extant.

No further Aboriginal archaeological sites, objects or potential archaeological deposits were identified within the extended project area.

No significant Aboriginal cultural features were identified within the extended project area by the Aboriginal stakeholders who participated in the site survey.

6.6.3 Potential impacts

The proposed modification would not impact on Aboriginal archaeological objects, sites or potential archaeological deposits.

6.6.4 Safeguards and mitigation measures

The safeguards and management measures identified in the Submissions Report are adequate to address potential Aboriginal heritage impacts associated with the proposed modification.

6.7 Non-Aboriginal heritage

Potential impacts on non-Aboriginal heritage have been addressed in a Statement of Heritage Impact prepared by Extent Heritage Advisors. The main findings are summarised below, while the full report is included in Appendix E.

6.7.1 Methodology

The methodology used in the preparation of Statement of Heritage Impact is in accordance with the principles and definitions as set out in the guidelines to The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance and the latest version of the Statement of Heritage Impact Guidelines (2002), produced by the NSW Office of Environment and Heritage.

6.7.2 Existing environment

The discussion of the existing environment relating to non-Aboriginal heritage in Section 6.8.2 of the project REF remains relevant to the proposed modification. It is noted that since the preparation of the project REF, the Harris Creek Pedestrian Bridge has been nominated for listing on the State Heritage Register.

6.7.3 Potential impacts

Except for the Harris Creek Pedestrian Bridge, the assessment of non-Aboriginal heritage impacts provided in Section 6.8.3 of the project REF.

The proposed modification would enable retention of elements of the Harris Creek Pedestrian Bridge in situ, which are considered to be significant; namely the RSJs, piers, the plaque and the abutments. As the Bailey bridge, just as an item in itself, has little significance, its proposed removal would have negligible

impact on the Harris Creek Pedestrian Bridge. However, when combined with the RSJs, abutments and piers, the Bailey Bridge can be considered to be of moderate significance and therefore its removal would impact the overall setting of the Harris Creek Pedestrian Bridge. Therefore, while the changes proposed would have a moderate impact on the overall setting of the Harris Creek Pedestrian Bridge, the retention of elements namely the piers, the plaque, the abutments and iron fixings/ RSJs would allow for the impact to be mitigated and reduced.

Views to and from the Harris Creek Pedestrian Bridge would be altered with the removal of the Bailey Bridge. However, the retention of the RSJs, piers and the north and south abutments would help retain elements that indicate the presence of the former bridge.

6.7.4 Safeguards and mitigation measures

The following additional measures are proposed to address the potential traffic and transport impacts of the proposed modification.

Impact	Environmental safeguards	Responsibility	Timing	Reference
Impacts on the Harris Creek Pedestrian Bridge	• A work method statement (or similar) will be prepared for the removal of the services from the Harris Creek Pedestrian Bridge and removal and disposal of the Bailey bridge so as to minimise any possible damage to the RSJs, piers and abutments.	Contractor	Construction	Additional safeguard
Impacts on the Harris Creek Pedestrian Bridge	• The construction methodology for the new Harris Creek road bridges will minimise any indirect and direct impacts on retained elements	Contractor	Construction	Additional safeguard

6.8 Landscape character and visual impacts

Potential visual impacts have been addressed in a Landscape Character and Visual Impact Assessment prepared by Scape Design. The main findings are summarised below, while the full report is included in Appendix H.

6.8.1 Methodology

The Landscape Character and Visual Impact Assessment has been assessed in accordance with EIA N04 Practice Note: Guidelines for landscape character and visual impact assessment V2.1 (Roads and Maritime

Services, 2018). The guidelines establish an assessment process by reference to the sensitivity of the area and magnitude of the proposal in that area.

The methodology also draws upon the key considerations and outcomes of the overarching Beyond the Pavement (Roads and Maritime Services, 2014) guidelines.

6.8.2 Existing environment

The existing visual environment remains generally as described in Section 6.9.2 of the project REF. Further information on the landscape character zones and viewpoints used for assessment of the proposed modification is provided below.

Landscape character zones

Landscape character zones are defined as having a distinct, recognisable and consistent pattern of elements, be it natural (soil, vegetation, landform) and/or human built form, distinguishing one landscape different from another. The landscape character zones used for assessment are as follows:

- Character Zone 1: Remnant Bushland
- Character Zone 2: Residential
- Character Zone 3: Sports Facilities
- Character Zone 4: Public Open Space
- Character Zone 5: Defence Land
- Character Zone 6: Future Development Site

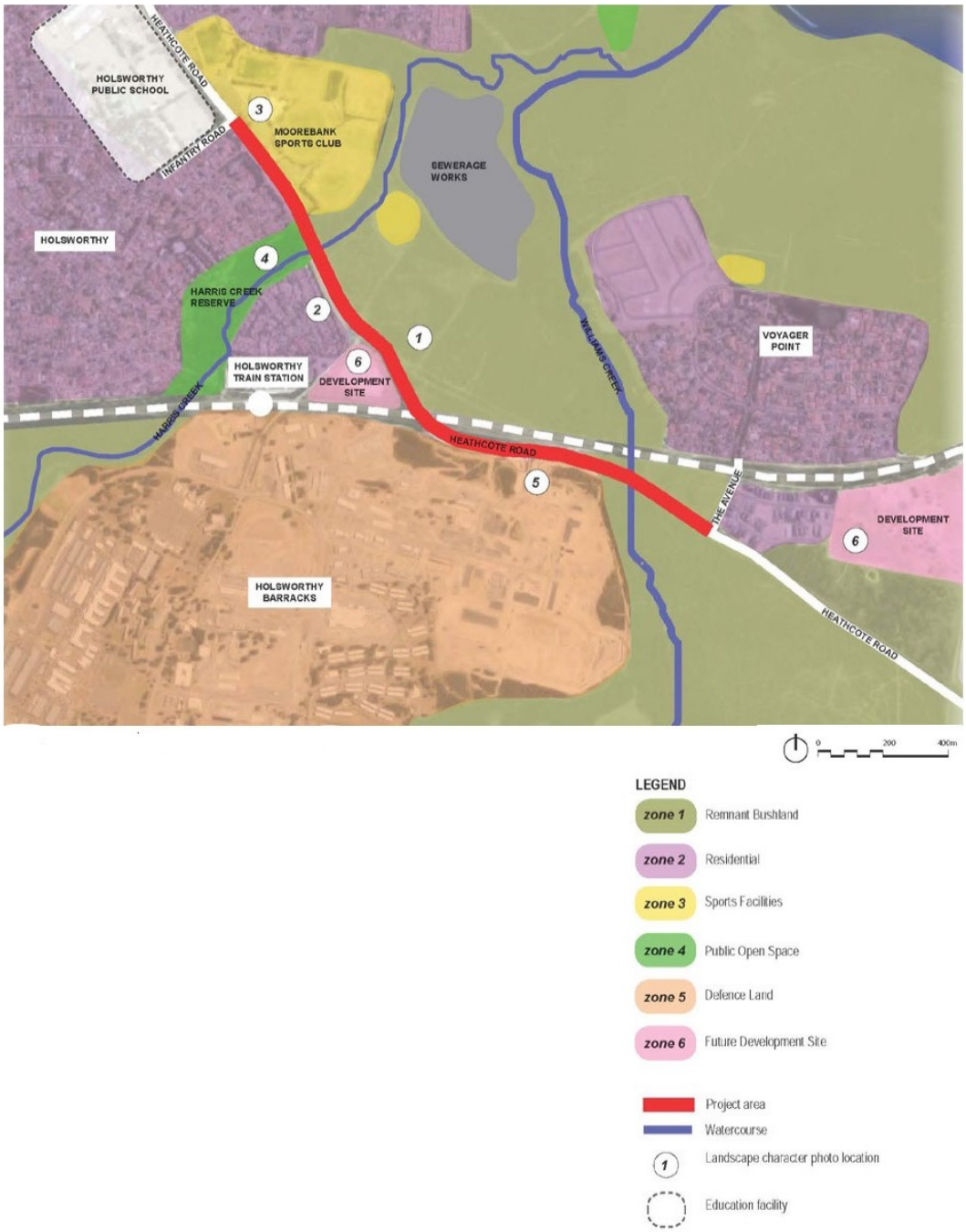

Figure 6-4: Landscape character zones

Viewpoints

Ten viewpoints were used for assessment of the proposed modification as listed in Table 6-8.

Table 6-8 Viewpoints assessed for the proposed modification

ID	Location	Viewpoint – public or private	Distance to concept design (m)	Distance to proposed modification (m)
1	Moorebank Sports Club	Public	90	60
2	Residential properties off Heathcote Road, Holsworthy	Private	15	9

ID	Location	Viewpoint – public or private	Distance to concept design (m)	Distance to proposed modification (m)
3	Harris Creek Reserve	Public	50	17
4	Residential properties off Heathcote Road, Mornington	Private	25	11
5	Intersection of Macarthur Drive and Heathcote Road	Public	30	0
6	Entry to Holsworthy Barracks	Private	50	225
7	Heathcote Road near Williams Creek Bridge	Public	0	0
8	Residential properties within Voyager Point	Private	15	5
9	Macarthur Drive looking north-east towards the intersection at Heathcote Road	Public	-	0
10	Turning left into The Avenue from Heathcote Road	Public	-	0

6.8.3 Potential impacts

The elements of the proposed modification with most potential for landscape character and visual impacts are those that have required an extension of the project boundary (and the clearing limits).

Landscape character

The assessment of landscape character impacts associated with the proposed modification is provided in Table 6-9.

Table 6-9 Landscape character impact assessment summary

LCZ	Sensitivity	Magnitude	Impact	Change in impact from concept design
1	High The project boundary has expanded and would require the clearing of a greater portion of vegetation within this character zone. As this zone has a low ability to accommodate change it maintains a high sensitivity rating.	Moderate The project modifications would impact a greater portion of the EEC vegetation in this character zone but the magnitude of change is unlikely to significantly affect the character of the whole zone but rather only narrow, linear areas next to the road corridor.	Moderate/High	No change
2	Moderate The urban context of this character zone which	High The revised road design would expand closer to	Moderate/High	Increase from Moderate

LCZ	Sensitivity	Magnitude	Impact	Change in impact from concept design
	includes an existing transport corridor ensures that detailed design elements can be accommodated without impacting its character.	residential properties and although many of the design elements are of a similar nature to other sections of Heathcote Road the scale and bulk of some elements increases with a closer proximity.		
3	Moderate The project boundary has expanded. This zone has a moderate ability to accommodate change but as very limited change proposed it maintains a moderate sensitivity rating.	Low No additional built form is proposed in this character zone with only an expansion of the project area likely during construction. A low magnitude rating is maintained.	Moderate/Low	No change
4	High The project boundary has expanded and would require the clearing of a greater portion of vegetation to accommodate changes in the vicinity of Harris Creek. As this zone has a low ability to accommodate change it maintains a high sensitivity rating.	Moderate The revised road design further impacts the edge of Harris Creek Reserve where it meets the widened road corridor, and although this is unlikely to have an adverse impact on the reserves functionality the magnitude of the proposal within this zone is rated as moderate	Moderate/High	Increase from Moderate
5	Low This zone is not publicly accessible and is utilised for defence purposes. The zone is described as having a low sensitivity to change.	Negligible Given the similar scale and bulk of the revised road design features with the existing infrastructure as well as screening vegetation. The proposal continues to have a negligible effect on this zone.	Negligible	No change
6	Low The project boundary has expanded and now accommodates drainage channels, access roads and a reduced verge however due to its positioning the character zone has a relatively high ability to	Low Although is expected that there would be a slight increase in the scale, bulk and proximity of the existing road infrastructure the proposal is not expected to have any substantial impacts on this character zone.	Low	No change

LCZ	Sensitivity	Magnitude	Impact	Change in impact from concept design
	absorb change, leading to a low sensitivity rating.			

Visual impact

The assessment of viewpoint impacts associated with the proposed modification is provided in Table 6-10.

Table 6-10 Visual impact assessment summary

ID	Sensitivity	Magnitude	Impact	Change in impact from concept design
1	Moderate This view is located in the Moorebank Sports Club adjacent Heathcote Road. Viewers are typically users of the Club who tend to be focused on activities within the grounds and associated sports fields.	Low Additional minor vegetation loss occurs on the far side of the existing road corridor however it is unlikely that the additional road widening and associated infrastructure would be more visible within Club. Views out from the playing fields remain intermittent and partially filtered by vegetation surrounding the sports ground and along the northern boundary of the road corridor.	Moderate/Low	No change
2	High Residences are near the project and consequently are considered sensitive to any change.	Moderate Magnitude of change is dependent on the impact of the loss of screening vegetation and the proximity of the proposed noise wall extension. Partial loss of vegetative screening is due to the increased length of the proposed noise wall and consequently magnitude is likely to increase.	Moderate/High	Increase from moderate
3	High Although reserve users are transitory viewers, they would have clear views of the road widening and associated vegetation removal abutting the creek.	Moderate The expanded footprint of the project would mean the works would be more discernible especially due to bridge widening and creek clearing which would	Moderate/High	Increase from moderate

ID	Sensitivity	Magnitude	Impact	Change in impact from concept design
		increase the magnitude of change.		
4	Moderate Vegetative cover provides separation to the project and reduces sensitivity.	High The scale of the road has increased, and removal of screening vegetation would open up views in the short term potentially exposing more of the project. In time, new vegetation may establish and provide a visual buffer reducing the impact.	Moderate/High	Increase from moderate
5	Low The receptors are transitory (i.e. motorists on Heathcote Road) and the proximity to the works remains similar so sensitivity is still considered to be low.	High The scale of the area of new road pavement from the concept design phase is maintained however there is a slight increase in associated road infrastructure features and larger areas of vegetation removal.	Moderate	No change
6	Moderate The distance of receptors located in the barracks from the project and the possibility of vegetative screening mitigate their sensitivity while road users are transitory.	Low The barracks are currently partially exposed to the view of Heathcote Road. Although an increase in scale of the road and associated infrastructure as a result of these works it is expected that the establishment of vegetative screening would help limit the visibility of the project.	Moderate/Low	No change
7	Moderate Motorists are experiencing the road at a close proximity and are consequently considered more sensitive to change however viewers moving through the site which somewhat reduces their sensitivity to change.	Moderate Motorists are currently exposed to the road alignment. Additional loss of screening is assumed and so an increase in scale of the project would be observed.	Moderate	No change

ID	Sensitivity	Magnitude	Impact	Change in impact from concept design
8	Moderate Properties are presently partially exposed to Heathcote Road and views are partially filtered by the existing vegetation.	Moderate The expanded footprint of the project would mean the works may be more discernible. Increased removal of screening vegetation would open up views in the short term potentially exposing more of the project. In time new vegetation would establish and provide a visual buffer reducing the impact.	Moderate	No change
9	Moderate Three residences are located in close proximity to the changes but the limited extent of change reduces sensitivity.	Low The removal of planting in the road verge has some minor impact.	Moderate/Low	Not previously assessed.
10	Moderate Residences adjacent to the intersection upgrade and the potential for vegetation screening to be removed as part of the project make this a moderately sensitive area.	High The removal of verge and median planting and impacts to the verge closest the residents add to the scale and level of change proposed. Addition of retaining wall and noise wall. Removal of entry signage.	Moderate/High	Not previously assessed.

6.8.4 Safeguards and mitigation measures

While some increases in landscape character and visual impacts have been identified for the proposed modification, the safeguards and management measures identified in Section 6.9.4 of the project REF are considered adequate to address potential impacts. This includes the preparation of an Urban Design Plan which prescribes design treatments and landscape planting.

6.9 Other impacts

6.9.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Groundwater	Consistent with Section 6.3.2 of the project REF.	Potential impacts on groundwater quality would be consistent with Section 6.3.3 of the project REF. The Dewatering Strategy prepared as part of the detailed design process assessed groundwater resources in the area and nominated a preferred strategy for the dewatering activities required to install scour protection in the creeks. The Dewatering Strategy found that only a minor lowering of the groundwater table would be required – and given site constraints and feasibility of alternative methods, passive dewatering was the most viable strategy. The passive dewatering would be temporary (ie only during construction) and any lowering of the water table would be extremely localised. Also, the groundwater table is highly responsive to rainfall and therefore after rainfall would rapidly replenish.
Socio-economic	Consistent with Section 6.10.2 of the project REF.	Consistent with Section 6.10.2 of the project REF. The proposed modification would require the relocation / removal of roadside tributes near the Heathcote Road / The Avenue. This would need to occur in accordance with the Roads and Maritime Roadside Tributes Policy.
Air quality	Consistent with Section 6.11.1 of the project REF.	Consistent with Section 6.11.1 of the project REF.
Hazard and risk	Consistent with Section 6.11.1 of the project REF.	Consistent with Section 6.11.1 of the project REF.

Environmental factor	Existing environment	Potential impacts
Greenhouse gas and climate change	Consistent with Section 6.11.1 of the project REF.	Consistent with Section 6.11.1 of the project REF.
Waste management and resource use	Consistent with Section 6.11.1 of the project REF.	Consistent with Section 6.11.1 of the project REF.

6.9.2 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Roadside tributes	• Roadside tributes would be removed / relocated in accordance with the Roads and Maritime Roadside Tributes Policy.	Contractor	Construction	Additional safeguard

6.10 Cumulative impacts

6.10.1 Potential impacts

The proposed modification is not expected to materially change the assessment of cumulative impacts provided in Section 6.12 of the project REF. It is noted that proposed modification:

- Would increase vegetation clearing but would not have significant impacts on threatened species, populations or ecological communities
- Would not substantially alter the volume or distribution of construction traffic on the network
- Would reduce impacts on the heritage listed Harris Creek Pedestrian Bridge
- Would not affect Aboriginal cultural heritage.

Minimising impacts attributable to the proposed modification is the best way to address any potential cumulative effects and some additional measures have been proposed to address impacts.

6.10.2 Safeguards and management measures

The safeguards and management measures identified in the Submissions Report are adequate to address potential cumulative impacts associated with the proposed modification.

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 Contractors 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 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 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 Roads and Maritime 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 proposal 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 / Roads and Maritime project manager	Detailed design / pre-construction	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 / Roads and Maritime 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 proposal. 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 heritage sensitivity • Threatened species habitat • Adjoining residential areas requiring particular noise management measures.	Contractor / Roads and Maritime project manager	Detailed design / pre-construction	Core standard safeguard
B1	Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (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 • Procedures for unexpected threatened species finds and fauna handling • Procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013)	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.8 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Protocols to manage weeds and pathogens.			
B2	Biodiversity	Investigate measures to further avoid and minimise the construction footprint and native vegetation or habitat removal.	Contractor	Detailed design / pre-construction	Core standard safeguard
B3	Native vegetation removal and re-establishment	Minimise native vegetation and habitat removal through detailed design. Harris Creek and Williams Creek to retain fauna passage and connectivity to areas south of Heathcote Road to enable movement for fauna south.	Roads and Maritime	Detailed design	Additional safeguard
B4	Native vegetation removal and re-establishment	A Biodiversity Offset Strategy would be prepared ***to provide offsets based on the ecosystem credits and species credits outlined in the Biodiversity Assessment Report (SMEC, 2019) and clearing of 0.76 hectares of key fish habitat. This strategy would be prepared in accordance with Roads and Maritime Guidelines for Biodiversity Offsets and the NSW Department of Primary Industries Policy and Guidelines for Fish Habitat Conservation and Management 2013.***~~during the detailed design phase to provide offsets equivalent to 145 ecosystem credits. This strategy would be prepared in accordance with the Guidelines for Biodiversity Offsets (Roads and Maritime, 2011h) and the NSW BioBanking Assessment Methodology 2014.~~	Roads and Maritime	~~Detailed design~~ ***Construction / pre-construction***	Additional safeguard
B5	General ecological mitigation	Ensure any fauna encountered onsite would be managed in accordance with Biodiversity Guidelines, Guide 9 (fauna handling) (Roads and Maritime, 2016b)	Contractor	Pre-construction	Additional safeguard
B6	General ecological mitigation	In addition to the requirements of Core standard safeguard B1, the Flora and Fauna Management Plan would also include: • A site walkover to confirm clearing boundaries and sensitive location before starting work • Identify, in toolbox talks, where biodiversity controls would be	Contractor	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		included.			
B7	Invasive and noxious weed management	Develop a weed management plan (WMP) in accordance with Biodiversity Guidelines, Guide 6 (Roads and Maritime, 2016b) to include: • Identification of the weeds on site (confirm during ecologist preclearing inspection) • Weed management priorities and objectives • Sensitive environmental areas within or adjacent to the site • The location of weed infested areas • Weed control methods • Measures to prevent the spread of weeds, including machinery hygiene procedures and disposal requirements • A monitoring program to measure the success of weed management • Communication with local Council noxious weed representative.	Contractor	Pre-construction	Additional safeguard
B8	Vegetation management	Develop a vegetation management plan for undertaking the work across Harris and Williams Creek in accordance with Greater Metropolitan Regional Environmental Plan No. 2 – Georges River Catchment.	Contractor	Pre-construction	Additional safeguard
B9	Risk of pathogen and pest species	If hygiene procedures are required onsite, ensure the Flora and Fauna Management Plan includes hygiene protocols to prevent the introduction and spread of such pathogens as specified in Biodiversity Guidelines: (Roads and Maritime, 2016b). Manage all pathogens (e.g. Chytrid, myrtle rust and phytophthora) in accordance with the Biodiversity Guidelines, Guide 7 (Roads and Maritime, 2016b).	Contractor	Pre-construction	Additional safeguard
B10	Unexpected blockage of fish	A detailed Environmental Work Method Statement (EWMS) will be prepared and implemented for all works undertaken within waterways.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
	passage	The EWMS will detail measures to avoid or minimise risks from erosion and sedimentation to water quality and biodiversity. It will be prepared in accordance with relevant guidelines including, but not limited to: • Roads and Maritime Biodiversity Guidelines - Protecting and • managing biodiversity on RTA projects (Roads and Traffic Authority, 2011). • NSW DPI (Fisheries) guidelines Why do Fish Need to Cross the • Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries, 2003). • Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013 (Department of Primary Industries 2013).			
B11	Unexpected discovery of threatened species	If unexpected flora or fauna are discovered stop work immediately and implement the Roads and Maritime Unexpected Threatened Species Find Procedure in the Biodiversity Guidelines, Guide 1 (Roads and Maritime, 2016b).	Contractor	Construction	Additional safeguard
B12	Injury and mortality impacts while building the proposal	Implement the following controls: under the Flora and Fauna Management Plan: • Manage fauna in accordance with Biodiversity Guidelines, Guide 9 (Roads and Maritime, 2016b) • Remove any habitat in accordance with Biodiversity Guidelines, Guide 4 (Roads and Maritime, 2016b).	Contractor	Construction	Additional safeguard
B13	Native vegetation removal and re-establishment threatened species habitat and habitat features	Implement the following controls under the Flora and Fauna Management Plan: • Undertake pre-clearance checks in accordance with Biodiversity • Guidelines, Guide 1 (Roads and Maritime, 2016b) • Create exclusions zones in accordance with Biodiversity Guidelines, Guide 2 (Roads and Maritime, 2016b)	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Re-establish native vegetation in accordance with Biodiversity Guidelines, Guide 3 (Roads and Maritime, 2016b) • Reinstate habitat in accordance with Biodiversity Guidelines, Guide 5 and Guide 8 (Roads and Maritime, 2016b).			
B14	Aquatic impacts	Protect aquatic habitat in accordance with Biodiversity Guidelines, Guide 10 Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011) and section 3.3.2 standard precautions and measures of the Policy Guidelines for Fish Habitat Conservation and Management (NSW Department of Primary Industry (Fisheries), 2013).	Contractor	Construction	Additional safeguard
B15	Aquatic impacts	Watercourse crossings will be designed to ensure that they meet the minimum requirements for fish passage recommended for the classes of 'fish habitat' found at the stream crossings.	Contractor	Construction	Additional safeguard
B16	Wildlife connectivity impacts	Implement connectivity controls in accordance with the Wildlife Connectivity Guidelines for Road Projects (Roads and Maritime, 2016c).	Contractor	Construction	Additional safeguard
SW1	Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Contractor	Detailed design / pre-construction	Core standard safeguard Section 2.1 of QA G38 Soils and Water Management
SW2	Soil and water	A site specific Erosion and Sediment Control Plan/s (ESCP) will be prepared and implemented as part of the Soil and Water Management Plan. The Plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and	Contractor	Detailed design / pre-construction	Core standard safeguard Section 2.2 of QA G38 Soils and Water Management

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		specific controls and follow-up measures to be applied in the event of wet weather.			
SW3	Water quality	A detailed Environmental Work Method Statement (EWMS) will be prepared and implemented for all works undertaken within waterways. The EWMS will detail measures to avoid or minimise risks from erosion and sedimentation to water quality and biodiversity. It will be prepared in accordance with relevant guidelines including, but not limited to: • RMS Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects (Roads and Traffic Authority, 2011) • The Blue Book: Managing Urban Stormwater (MUS): Soils and Construction, Volume 2 (Landcom, 2008).	Contractor	Pre-construction	Additional safeguard
SW4	Water quality	Consistent with any specific requirements of the approved SWMP and ESCP, control measures will be implemented to minimise risks associated with erosion and sedimentation and entry of materials to drainage lines and waterways. That will include, but not necessarily be limited to: • Sediment management devices, such as fencing, hay bales or sand bags • Measures to divert or capture and filter water prior to discharge, such as drainage channels and first flush and sediment basins • Scour protection and energy dissipaters at locations of high erosion risk • Installation of measures at work entry and exit points to minimise movement of material onto adjoining roads, such as rumble grids or wheel wash bays • Appropriate location and storage of construction materials, fuels and chemicals, including bunding where appropriate.	Contractor	Pre-construction	Additional safeguard
SW5	Water quality	The ESCP will also address the following regarding water quality: • Identification of catchment areas and the direction of on-site	Contractor	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		and offsite water flow • The likely run-off from each road sub-catchment • Separation of on-site and off-site water • The direction of run-off and drainage points during each stage of construction • Location and staging of scour protection • Process for monitoring and preparing for wet weather.			
SW6	Water quality	Instream works would be suspended following high rainfall events. Work would recommence once the work area and ground conditions are stabilised and potential for erosion and sedimentation is minimised.	Contractor	Construction	Additional safeguard
SW7	Water quality	During concreting, cement slurry and other contaminants will be prevented from entering waterways or any drainage lines.	Contractor	Construction	Additional safeguard
SW8	Water quality	If concreting works are required onsite, concrete washout bays located in bridge work zones would be positioned as far as reasonably practicable from waterways and be emptied on a regular basis. Any washout of the lines or chute will be in an impervious bunded area.	Contractor	Construction	Additional safeguard
SW9	Flooding / hydrology	Prior to construction commencing, final flood and hydrology assessments would be undertaken to inform detail design measures to minimise risks to the environment. Roads and Maritime would consult with Liverpool City Council for flood modelling information and consider using the TUFLOW 2D modelling. The detailed design would investigate the retention of the Holsworthy bridge abutments.	Roads and Maritime	Detailed design / pre-construction	Additional safeguard
SW10	Flooding	Scour protection measures will be identified and refined during detailed design.	Roads and Maritime	Detailed design	Additional safeguard
SW11	Spills	Emergency wet and dry spill kits would be kept onsite at all times. All staff would be made aware of the location of the spill lit and trained in	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		its use.			
SW12	Spills	All refuelling of vehicles and equipment on site would be undertaken a minimum of 50 metres away from water bodies and surface drains, wherever possible. The refuelling of vehicles would be monitored at all times and spill kits would be available within refuelling vehicles.	Contractor	Construction	Additional safeguard
SW13	Spills	Any fuel, oil or other liquids stored onsite would be stored in an appropriately sized impervious bunded area away from water bodies.	Contractor	Construction	Additional safeguard
SW14	***Erosion and sedimentation***	***A specific Erosion and Sedimentation Control Plan (ESCP) and an Environmental Work Method Statement (or similar) will be prepared by a registered Soil Conservationist for works in and adjacent to the creeks.***	***Contractor***	***Construction***	***Additional safeguard***
SW15	***Erosion and sedimentation***	***Works in Harris Creek and Williams Creek will be scheduled during winter months when less rainfall is expected, where feasible and reasonable.***	***Contractor***	***Construction***	***Additional safeguard***
GW1	Groundwater	Additional site investigation including the installation and subsequent monitoring of groundwater wells at approximate 500 metres intervals along the proposal alignment and near Harris and Williams Creeks would be undertaken.	Roads and Maritime	Detailed design / pre-construction	Additional safeguard
GW2	Groundwater	A dewatering strategy and groundwater management plan for any excavations below the groundwater table will be developed, with a focus on the construction of the pier foundations in Harris Creek. Any dewatering activities will be undertaken in accordance with the RTA Technical Guideline: Environmental Management of Construction Site Dewatering in a manner that prevents pollution of waters.	Roads and Maritime Contractor	Pre-construction / construction	Additional safeguard
GW3	Groundwater	Shoring and water-tight requirements to be implemented for foundation excavations.	Roads and Maritime	Detailed design / pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GW4	Groundwater	Concreting methods that reduce the likelihood of groundwater ingress will be employed for construction of bridge piles and foundations. This will also reduce the likelihood of washing out the cement content.	Contractor	Construction	Additional safeguard
C1	Contaminated land	A Contaminated Land Management Plan will be prepared in accordance with the Guideline for the Management of Contamination (Roads and Maritime, 2013f) and the Contaminated Land Management Act 1997 and implemented as part of the CEMP. The plan will include, but not be limited to: • Capture and management of any surface runoff contaminated by exposure to the contaminated land • Further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) • Management of the remediation and subsequent validation of the contaminated land, including any certification required • Relevant licenses and approvals to be obtained and relevant notifications to be given under the Contaminated Land Management Act 1997 • Measures to ensure the safety of site personnel and local communities during construction.	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.2 of QA G36 Environmental Management
C2	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA. Waste classification and reuse procedures will also be included in the Contaminated Land Management Plan.	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.2 of QA G36 Environmental Management

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
C3	Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime Code of Practice for Water Management (RTA, 1999) and Environmental Guidelines: Preparation of pollution incident response management plans (NSW EPA 2012). The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.3 of QA G36 Environmental Management
C4	Exposure of acid sulfate soils	Design of drainage lines and infrastructure to minimise the need for deep excavations. Minimise the need for extended dewatering of sediments around drainage lines for construction.	Roads and Maritime	Detailed design	Additional safeguard
C5	Exposure of acid sulfate soils	ASS testing (field screening and chromium reducible sulfur suite) in soils around Harris Creek and Williams Creek to be undertaken. Other areas of the alignment as required. If ASS are identified, an ASS investigation report to be prepared that identifies areas of ASS, chemistry and liming rates for treatment. The ASS investigation to be undertaken and report verified by a suitably qualified and experienced environmental consultant.	Roads and Maritime	Detailed design / pre-construction	Additional safeguard
C6	Exposure of acid sulfate soils	An ASS Management Plan (ASSMP) is to be prepared for any excavation of material in the vicinity of Harris Creek and Williams Creek. The plan is to include methods for onsite treatment or offsite disposal of excavated ASS. The plan will make reference to the ASS investigation report findings and be in accordance with the NSW ASSMAC Guidelines (1998).	Contractor	Pre-construction / construction	Additional safeguard
C7	Identification of Contaminated land	Preliminary site sampling and where necessary a detailed (phase two) site investigation is to be undertaken along the alignment. Assessments are to be undertaken in accordance with guidance made or endorsed by the NSW EPA. The contaminated land investigations are to be undertaken and report verified by a suitably qualified and	Roads and Maritime	Detailed design / pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		experienced environmental consultant.			
C8	Identification of Contaminated land	Consult with and request information from Department of Defence to determine the presence of any known contamination issues within 100 metres of the proposal alignment.	Roads and Maritime	Detailed design / pre-construction	Additional safeguard
C9	Human and ecological exposure to contaminated land	The Contaminated Land Management Plan will also include awareness training for construction staff to include the procedures for identification, reporting and management of contaminated land.	Contractor	Pre-construction / construction	Additional safeguard
C10	Handling and disposal of contaminated materials	The SWMP will include measures to minimise accidental spills and associated potential impacts such as: • Storage of chemicals within an impervious bunded area • All refuelling of vehicles and equipment would be undertaken off site or within an impervious bunded area at the compound site at least 40 metres from drainage lines. Where this cannot occur, mobile fuel trucks should be equipped with a self bunded tank, spill prevention equipment and spill kits • Requirement for an emergency spill kit to be kept on site at all times and be easily accessible and staff awareness and training in its use • Removal of contaminated material (soils, water, clean up materials) offsite by a licensed contractor and disposed of at an appropriately licensed facility.	Contractor	Construction	Additional safeguard
C11	Erosion and sediment	An ESCP shall be developed for the works. The ESCP shall provide for: • Preventing sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets • Reducing water velocity and capture sediment on site.	Contractor	Pre-construction / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Minimising the amount of material transported from site to surrounding pavement surfaces • Erosion and sedimentation controls – these are to be checked and maintained on a regular basis and records kept and provided on request • Erosion and sediment control measures – these are not to be removed until the works are complete or areas are stabilised • Work areas are to be stabilised progressively during the works • Diversion of clean water around the site (in accordance with the • Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book).			
C12	Erosion and sediment	The maintenance of established stockpile sites during construction is to be in accordance with the Roads and Maritime Stockpile Site Management Procedures, 2001.	Contractor	Pre-construction / construction	Additional safeguard
TT1	Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual (Roads and Maritime, 2010) and QA Specification G10 Control of Traffic (Roads and Maritime, 2008). The TMP will include: • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signs) to manage and regulate traffic movement • 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	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.8 of QA G36 Environmental Management

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		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	Construction traffic	The TMP will also include: • Scheduling the delivery of plant, equipment and construction materials to generally occur out of peak traffic periods • Consideration of methods to minimise peak period traffic disruptions during each stage of construction • Roads and Maritime to liaise with utilities providers and Sydney Trains to maintain service accesses to their facilities during construction and following completion of the proposal. The TMP is to ensure the work site and site compound: • Includes safe 'sight distances' to allow traffic to leave and enter the given areas • Uses temporary painted road lines to provide delineation • Provides suitable intersection layouts where required • Includes traffic management controls to allow for safe entry and exit.	Contractor	Pre-construction / construction	Additional safeguard
TT3	Intersection signalisation	Signal phasing arrangements and timings be reviewed as part of the commissioning of the proposal to determine the coordination arrangements as an extension to the existing conditions	Roads and Maritime	Pre-construction / construction	Additional safeguard
TT4	Operation of Macarthur Drive	The signal phasing of the traffic lights intersection of Heathcote Road and Macarthur Drive would be periodically reviewed. The review is	Roads and Maritime	Operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
	intersection	required to ensure traffic demands are not affecting signal operations and localised congestion. Appropriate signal timing plans to be adopted if needed.			
TT5	Operational monitoring	Monitoring of the queuing and congestion impacts along Macarthur Drive to the Morningside Parade intersection will be undertaken to manage any residual queueing impacts at this location and associated safety impacts.	Roads and Maritime	Operation	Additional safeguard
TT6	***Pedestrian / cyclist access***	***The pedestrian / cyclist detour would be adequately signposted.***	***Contractor***	***Construction***	***Additional measure***
TT7	***Pedestrian / cyclist access***	***Options for improving lighting on the section of the proposed detour route between Kitchener Court and Sabre Crescent will be investigated in consultation with Liverpool City Council.***	***Roads and Maritime project manager***	***Pre-construction***	***Additional measure***
TT8	***Access to bus stops***	***Relocated bus stops will be adequately signposted and advance notice (e.g. via a notice at the existing bus stop) will be provided to existing users.***	***Contractor***	***Construction***	***Additional measure***
NV1	Noise and vibration	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify: • All potential significant noise and vibration generating activities associated with the activity • Feasible and reasonable mitigation measures to be implemented, taking into account Beyond the Pavement: urban design policy, process and principles (Roads and Maritime, 2014e). • A monitoring program to assess performance against relevant noise and vibration criteria	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.6 of QA G36 Environmental Management

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • Contingency measures to be implemented in the event of noncompliance with noise and vibration criteria.			
NV2	Noise and vibration	All sensitive receivers (e.g. schools, local residents) likely to be affected will be notified at least five 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 proposal • The construction period and construction hours • Contact information for proposal management staff • Complaint and incident reporting how to obtain further information.	Contractor	Detailed design / pre-construction	Core standard safeguard
NV3	Noise impacts	Work will be undertaken in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime, 2016f). Stationary and directional noise sources will be orientated away from sensitive receivers. Utilise vehicles, obstacles and stockpiles on site to provide shielding to receivers, especially for static noise sources. Use equipment that has noise levels equal to or less than the sound power levels in Table 6-2 of Appendix J of the REF.	Contractor	Pre-construction / construction	Additional safeguard
NV4	Vibration	Condition surveys of areas where vibration intensive equipment is to be used will be undertaken prior to the commencement of construction within the safe working distances. Where possible, the use of less vibration intensive methods of construction or equipment should be considered where possible to reduce the potential for cosmetic damage.	Contractor	Pre-construction / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		All equipment should be maintained and operated in an efficient manner, in accordance with manufacturer's specifications, to reduce the potential for adverse vibration impacts. Site-specific safe working distances are to be established on site prior to the vibration generating works commencing. Ensure that safe working distances established on site are complied with. If vibration intensive equipment is to be used within the safe working distances, attended vibration measurements are to be undertaken when work commences to determine site specific safe working distances. Vibration intensive work should not proceed within the safe working distances unless a permanent vibration monitoring system is installed approximately one metre from the building footprint, to warn operators (via flashing light, audible alarm, SMS etc.) when vibration levels are approaching the peak particle velocity trigger levels.			
NV5	Potential noise and vibration nuisance and amenity impacts	A community information program will be developed before starting work. This would involve identification of a nominated community liaison officer and informing affected community members in advance of starting work through advertisements, flyers and community consultation sessions. A 24-hour community hotline for complaints and queries concerning construction will be provided and will be advertised ahead of starting any work. A complaints handling procedure will be developed including ensuring a timely response to complaints. Actions and progress towards resolving concerns will be provided. The work program will be made available to the community and will be routinely updated as work progresses.	Contractor	Pre-construction	Additional safeguard
NV6	Construction out of hours work	The Contractor would be required to justify the requirement for out-of-hours work and suitably demonstrate why the work cannot be reasonably undertaken during normal working hours. The Contractor	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		would be required to assess proposed out-of-hours work and take reasonable and feasible steps to mitigate construction noise. The Contractor should seek approval from the Principal to undertake out-of-hours work. Out of hours work will be undertaken to comply with quality assurance specification G36: Environmental Management (Roads and Maritime, 2014b) and the Construction Noise and Vibration Guideline (Roads and Maritime, 2016f).			
NV7	Noise and vibration complaints while building the proposal	Attended noise and/or vibration monitoring will be undertaken following a complaint. The monitoring results will be reported as soon as possible. Where exceedances of the management levels are recorded, the situation will be reviewed and means to reduce the impacts to noise and vibration sensitive receivers identified. This is to include revision to the CNVMP where required.	Contractor	Construction	Additional safeguard
NV8	The potential for exceedance of the NMLs	Ensure toolbox talks and environmental induction training is provided to include specific noise and vibration management including, but not limited to: • Avoiding the use of radios outside of standard working hours • Avoiding shouting and slamming doors • Operating machinery at low speeds or powers and switch off equipment when it is not being used • Minimising reversing • Avoiding dropping material from height.	Contractor	Construction	Additional safeguard
NV9	Operational noise mitigation	Investigate mitigation measures including: • Quieter pavement surfaces and suitability of such pavement types for through lanes and areas of acceleration, deceleration and turning movements • Noise barriers • At property treatments for residually affected receivers where	Roads and Maritime	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		feasible and reasonable. • Consideration of existing noise mitigation and any specified mitigation in development applications for acute receivers in NCAs A, B and D (both barriers and architectural) when determining reasonable and feasible mitigation.			
NV10	Property treatments	Where at property treatments are identified, these would be implemented at the commencement of construction. These treatments would alleviate any noise concerns/ complaints during the construction period.	Contractor	Construction	Additional safeguard
AH1	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the Procedure for Aboriginal cultural heritage consultation and investigation (Roads and Maritime, 2011f) and Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015d) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups.	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.9 of QA G36 Environmental Management
AH2	Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015d) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.9 of QA G36 Environmental Management
H1	Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage. The NAHMP will be	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.10 of QA G36

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		prepared in consultation with the Office of Environment and Heritage.			Environmental Management
H2	Non-Aboriginal heritage	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015d) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / pre-construction	Core standard safeguard Section 4.10 of QA G36 Environmental Management
H3	Non-Aboriginal heritage	A heritage induction will be prepared and implemented as part of the project's general induction to raise awareness to construction personnel. The induction will include: • An outline of the history and heritage values of the study area • The relevant requirements of the Heritage Act • Description and explanation of the unexpected finds procedure.	Contractor	Pre-construction / construction	Additional safeguard
H4	Impacts to Holsworthy Pedestrian Bridge	Undertake archival recording and heritage interpretation of the Holsworthy Pedestrian Bridge prior to removal of superstructure (including the Bailey bridge and pipework). This should be combined with detailed historical research. Conservation of elements of the bridge, such as the piers, iron fixings and plaque Roads and Maritime would aim to conserve the heritage elements of the Holsworthy pedestrian bridge abutments. The preservation of the abutments depends on detailed flood modelling and the abutments impact on localised flooding. Site protection measures for piers, iron fixings and plaque to be included during construction. Inclusion of a heritage interpretation to be part of the Urban Design Strategy.	Roads and Maritime	Detailed design / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Consultation with the community to be undertaken			
H5	Impacts to Harris Creek Bridge and Williams Creek Bridge	Consultation with the Office of Environment and Heritage should be undertaken prior to impacts to the bridge. This would be in accordance with s170A of the Heritage Act 1977 • Archival recording of bridges prior to removal including archival photography and measured drawings • Design of replacement bridges to a similar unobtrusive style.	Roads and Maritime	Detailed design / construction	Additional safeguard
H6	***Impacts on the Harris Creek Pedestrian Bridge***	***A work method statement (or similar) will be prepared for the removal of the services from the Harris Creek Pedestrian Bridge and removal and disposal of the Bailey bridge so as to minimise any possible damage to the RSJs, piers and abutments.***	***Contractor***	***Construction***	***Additional safeguard***
H7	***Impacts on the Harris Creek Pedestrian Bridge***	***The construction methodology for the new Harris Creek road bridges will minimise any indirect and direct impacts on retained elements.***	***Contractor***	***Construction***	***Additional safeguard***
UD1	Landscape character and visual impact	An Urban Design Plan in consultation with Liverpool City Council will be prepared to support the final detailed design and implemented as part of the CEMP. The Urban Design Plan will present an integrated urban design for the proposal, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for: • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining walls and bridges • Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • Fixtures such as seating, lighting, fencing and signs	Contractor	Pre-construction / construction	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas. • Interpretation signage for the Holsworthy pedestrian bridge The Urban Design Plan will be prepared in accordance with relevant guidelines, including: • Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014e) • Landscape Guideline (Roads and Maritime, 2008) • Bridge Aesthetics (Roads and Maritime 2012e) • Shotcrete Design Guideline (Maritime, 2005).			
SE1	Socio-economic	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints. The CP will be prepared in accordance with the Community Involvement and Communications Resource Manual (RTA, 2008).	Contractor	Detailed design / construction	Core standard safeguard
SE2	Impacts on businesses and the community during construction	Road users will be informed of changed conditions, including likely disruptions to access during construction.	Contractor	Pre-construction / construction	Additional safeguard
SE3	Community impacts during construction	Consultation will be undertaken with potentially affected residences prior to the commencement of and during works in accordance with the	Contractor	Pre-construction /	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
	across the proposal footprint	RMS's Community Involvement and Communications Resource Manual. Consultation will include but not limited to door knocks, newsletters or letter box drops providing information on the proposed works, working hours and a contact name and number for more information or to register complaints.		construction	
SE4	Community impacts during construction across the proposal footprint	A complaint handling procedure and register will be included in the CEMP. The complaints register will be maintained throughout construction.	Roads and Maritime	Pre-construction / construction	Additional safeguard
SE5	Emergency access	Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.	Roads and Maritime	Construction	Additional safeguard
SE6	Impacts to properties	Consultation will be undertaken with all affected property owners during detailed design and construction to develop and implement measures to mitigate impacts on land use viability, infrastructure and severance.	Roads and Maritime	Detailed design	Additional safeguard
SE7	***Roadside tributes***	***Roadside tributes would be removed / relocated in accordance with the Roads and Maritime Roadside Tributes Policy.***	***Contractor***	***Construction***	***Additional safeguard***
BF1	Bushfire	A Bushfire Risk Management Plan (BRMP) will be prepared and implemented as part of the CEMP. The BRMP will include but not be limited to: • Fire response equipment such as fire extinguisher and fire blanket to be kept on vehicles at the works and compound sites • The fire rating will be checked at the start of each day • Hot works will not be permitted on total fire ban days • An evacuation plan will be kept onsite and staff will be made aware of this and their responsibilities in the event of a fire • A site for smoking will be established at least 40 metres away from dense vegetation and butt disposal bins will be made	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		available			
AQ1	Air quality emissions and dust propagation across the proposal footprint	An Air Quality Management Plan (AQMP) would be prepared as part of the CEMP. The plan would include but not be limited to the following: • A procedure for monitoring dust on site and weather conditions • Identification of dust generating activities and associated mitigation measures • Limits on the area that can be opened-up or distributed at any one time • Stabilising temporary stockpiles and spoil set down locations • Compliance with Stockpile Site Management Guidelines (Roads and Maritime, 2008a) • Progressive stabilisation plans • Imposing speed limits throughout the proposal footprint and in the site compound • Implementation of additional dust control measures in exposed areas where the wind speed is excessive (including periodic gusts) or produces visible dust • Implementation of a vehicle, plant and machinery maintenance program to comply with manufacturer's specifications and ensure compliance with the NSW *Protection of Environment Operations* Act *1997* • Prevention of equipment idling for an excessive period of time while ideally locating machinery away from adjacent receivers • Prohibition of any burning onsite or in the construction compounds • Visual inspection of local conditions to ensure management measures are implemented and effective • Routine sweeping of areas (at least once a day) to minimise	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		surface dust notwithstanding the requirement to prevent sediment-laden runoff • Covering and sheeting of all trucks leaving site and ensure methods to remove sediment from truck wheels are implemented • Revision of work activities should the dust control measures prove ineffective • Avoiding emissions-generating activities (i.e. paint spraying, grout, concrete mixing) during high winds and employ methods to minimise dust dispersion • Not stockpiling fine construction materials in exposed areas • Monitoring wind conditions and schedule activities to avoid high-wind periods to avoid impacting on adjacent receivers.			
AQ2	Dust deposition impacts	Ensure that the consultation strategy (refer to chapter 5) includes provision for managing dust nuisance complaints during the work.	Contractor	Construction	Additional safeguard
AQ3	Improving energy efficiency and sustainability	Machinery onsite would be required to run efficiently to ensure optimal performance, minimise down time and improve fuel efficiency.	Contractor	Construction	Additional safeguard
AQ4	Dust deposition impacts	Stabilisation would be undertaken within the proposal as each section of work is completed or in areas that are inactive for more 20 days.	Contractor	Construction	Additional safeguard
GGCC1	Manage and reduce fuel consumption	Consider using biofuels, lower emission fuels (e.g. e10) or fuels that allow the plant to run more efficiently during construction. Vehicles, plant and machinery would be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency.	Contractor	Construction	Additional safeguard
GGCC2	Use low embodied energy materials	Consider using recycled or locally sourced materials (where readily available, economic, and fit for purpose) to reduce impacts from transportation emissions, reduce fuel costs and support local economies. Deliveries would be programmed so that the minimum	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		amount of trips are made without compromising site requirements.			
GGCC3	Use low embodied energy materials	Ensure the detailed design considers opportunities to reduce construction material quantities.	Roads and Maritime	Detailed design	Additional safeguard
GGCC4	Maintain and reduce vehicle emissions for the whole proposal	The Roads and Maritime Resource Recovery Exemptions, will be followed to maximise opportunities to reuse construction and demolitions materials where feasible and permissible.	Contractor	Construction	Additional safeguard
GGCC5	Manage the design to accommodate the climate change factors of increased temperature and rainfall events across the whole proposal	Consider options in adopting the latest pavement design to ensure resilience against extreme temperature and rainfall events. Detailed design for rainfall, runoff and waterways to take into consideration the effects of sea level rise, changes to rainfall frequency and/or intensity as a result of climate change as per the Roads and Maritime Technical Guide: Climate Change Adaptation for the State Road Network	Roads and Maritime	Detailed design	Additional safeguard
GGCC6	Manage the design to accommodate the climate change factors of increased temperature and rainfall events across the whole proposal	Detailed design would be required to consider adaptation and resilience of the proposed road design to better respond to potential climate change impacts (temperature and rainfall).	Roads and Maritime	Detailed design	Additional safeguard
W1	Waste	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: Measures to avoid and minimise waste associated with the proposal • Classification of wastes and management options (re-use, recycle, stockpile, disposal) • Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions	Contractor	Detailed design / pre-construction	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Procedures for storage, transport and disposal • Monitoring, record keeping and reporting. The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014f) and relevant Roads and Maritime Waste Fact Sheets.			
CI1	Cumulative traffic impacts when building the proposal	If required, modify the proposal's construction traffic management plan on account of any identified cumulative impacts to: • Implement traffic management controls to respect critical timing requirements of these other projects • Carefully select appropriate work site access and egress locations. • Monitor traffic levels and network performance across the proposal footprint and wider area to consider cumulative effects from other projects.	Roads and Maritime / contactor	Pre-construction / construction	Additional safeguard
CI2	Cumulative impacts	Consult with other developers to obtain information about project timeframes and impacts. Identify and implement appropriate safeguards and management measures to minimise cumulative impacts.	Roads and Maritime / contactor	Pre-construction / construction	Additional safeguard
CI3	Cumulative impacts	Consult with other developers before starting work to manage the interfaces of the proposal's staging and programming in combination with the other projects occurring in the area.	Roads and Maritime	Pre-construction	Additional safeguard
CI4	Cumulative impacts	Prepare all environmental management plans (including but not limited to the Construction Noise and Vibration Management Plan and Traffic Management Plan) to consider other developments in the area.	Contractor	Pre-construction	Additional safeguard

7.3 Licensing and approvals

All relevant licenses, permits, notifications and approvals needed for the Heathcote Road Upgrade and when they need to be obtained are listed in Table 4-2 of the Submissions Report. No additional requirements for the proposed modification have been identified.

8. Conclusion

8.1 Justification

The proposed modification is the result of further design development and stakeholder consultation and is needed to:

- Provide enough construction compounds and works areas to allow the construction of the project
- Minimise impacts on the heritage listed Harris Creek Pedestrian Bridge
- Minimise flooding impacts
- Minimise operational noise impacts
- Provide an area for emergency stopping
- Include necessary utility adjustments identified during the detailed design process
- Improve the operation of the Heathcote Road / Macarthur Drive and the Heathcote Road / The Avenue intersections
- Provide shared path connectivity for pedestrians and cyclists to the Holsworthy Station
- Provide alternative pedestrian and cyclists access to Holsworthy Station with the temporary closure of access along Heathcote Road from Infantry Parade to Macarthur Drive
- Manage traffic during construction.

While there would be some additional environmental impacts as a consequence of the proposed modification including additional vegetation clearing and visual impacts, they have been avoided or minimised wherever possible through design and the site-specific safeguards summarised in Chapter 7. It is noted that the proposed modification reduces impacts on the heritage listed Harris Creek Pedestrian Bridge and improves the operation of two key intersections.

The benefits of the proposed modification are considered to outweigh the temporary adverse impacts and risks.

8.2 Objects of the EP&A Act

Table 8-1 identifies the objects of the EP&A Act and their relevance to the proposed modification.

Table 8-1 EP&A Act objects

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 have relatively minor additional impacts and would reduce heritage impacts. The proposed safeguards and management measures detailed in this addendum REF allow for the proper management, development and conservation of natural and artificial resources.
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 consistency of the project with the principles of ecologically sustainable development remains consistent with the discussion in Section 8.2.1 to 8.2.4 of the project REF.

Object	Comment
1.3(c) To promote the orderly and economic use and development of land.	The project, inclusive of the proposed modification, would improve access to residential, recreation and defence land uses in the immediate area. It would also improve access to between Sydney's southern suburbs and employment land uses in Liverpool.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the project.
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.	Impacts of the project, inclusive of the proposed modification, have been assessed as not significant.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposed modification reduces impacts on the heritage listed Harris Creek Pedestrian Bridge.
1.3(g) To promote good design and amenity of the built environment.	The project includes measures to ensure the quality of structures, the integration of earthworks design with existing landform and minimisation of visual impacts.
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 project.
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 project.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Community and stakeholder consultation for the project is discussed in Chapter 5 of the project REF and in the Submissions Report. Further stakeholder consultation has occurred in relation to aspects of the proposed modification as discussed in Chapter 5 of this addendum REF.

8.3 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 from the proposed modification have been avoided or reduced during the design development and options assessment. The proposed modification as described in the addendum REF best meets the project objectives, but would still result in some impacts on biodiversity and visual amenity. Safeguards and management measures as detailed in this addendum REF

would ameliorate or minimise these expected impacts. The proposed modification would also traffic efficiency at key intersections and reduce heritage impacts. 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 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 proposed modification 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 the Environment and Energy is not required.

9. 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.

Stuart Hill

Environmental Consultant

Hills Environmental

Date: 5 September 2019

I have examined this addendum review of environmental factors and accept it on behalf of Roads and Maritime Services.

Ken Vo

Project ~~Development~~ CONTRACT Manager

Greater Sydney Project Office

Date: 05/09/2019

10. References

Department of Planning. (1995). *Is an EIS required? : best practice guidelines for part 5 of the Environmental Planning and Assessment Act 1979 .* Sydney: Department of Planning.

Department of Primary Industries. (2013). *Policy and Guidelines for Fish Habitat Conservation and Management.* Sydney: Department of Primary Industries.

Department of Urban Affairs and Planning. (1996). *Roads and Road Related Facilities EIS Guideline.* Sydney: Department of Urban Affairs and Planning.

GHD. (2016). *Report for Jones Lang LaSalle, Defence Per- and Poly-fluoroalkyl Substances (PFAS) Environmental Management Plan Sampling.* Unpublished.

Hazmat Services. (2019). *Phase 1 Environmental Site Assessment – Heathcote Road Upgrade.* Unpublished.

Heads of EPAs Australia and New Zealand. (2018). *PFAS National Environmental Management Plan.*

Resonate. (2019). *Heathcote Road Upgrade—Operational Road Traffic Noise Assessment Report.* Unpublished.

Roads and Maritime Services. (2011). *Procedure for Aboriginal Cultural Heritage Consultation and Investigation.* Sydney: Roads and Maritime Services.

Roads and Maritime Services. (2014). *Beyond the Pavement: Urban Design Policy, Procedures and Design Principles .* Sydney: Roads and Maritime Services.

Roads and Maritime Services. (2015). *Noise Mitigation Guideline.* Sydney: Roads and Maritime Services.

Roads and Maritime Services. (2016). *Guideline for Biodiversity Offsets.* Sydney: Roads and Maritime Services.

Roads and Maritime Services. (2018). *Environmental Impact Assessment Guidance Note EIA-N04 Guidelines for landscape character and visual impact assessment.* Sydney: Roads and Maritime Services.

SMEC. (2018). *Acid Sulfate Soil Management Plan – Heathcote Road Upgrade .* Unpublished.

SMEC. (2018). *Erosion and Sedimentation Management Report – Heathcote Road Upgrade.* Unpublished.

SMEC. (2018). *Hydrology and Drainage Design Report – Heathcote Road Upgrade.* Unpublished.

SMEC. (2018). *Traffic and Transport Assessment Report – Heathcote Road Upgrade.* Unpublished.

SMEC. (2019). *Additional Contamination Assessment – Heathcote Road Upgrade.* Unpublished.

SMEC. (2019). *Baseline Contamination Assessment – Heathcote Road Upgrade.* Unpublished.

SMEC. (2019). *Geotechnical and Contamination Assessment – Proposed ancillary site – Heathcote Road Upgrade.* Unpublished.

WSP Parsons Brinckerhoff. (2016). *Biodiversity Assessment Heathcote Road.* Sydney: Roads and Maritime Services.

Terms and acronyms used in this addendum REF

Term / Acronym	Description
ACM	Asbestos containing materials
ARI	Annual recurrence interval
BC Act	*Biodiversity Conservation Act 2016* (NSW).
CEMP	Construction / Contractor's environmental management plan
EIA	Environmental impact assessment
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
FM Act	*Fisheries Management Act 1994* (NSW)
GDEs	Groundwater dependent ecosystems
Heritage Act	*Heritage Act 1977* (NSW)
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
PCLs	Priority Conservation Lands
PCT	Plant Community Type
PFAS	Per- and poly-fluoroalkyl substances
Roads and Maritime	NSW Roads and Maritime Services
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
TEC	Threatened ecological community
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
QA Specifications	Specifications developed by Roads and Maritime Services for use with road work and bridge work contracts let by Roads and Maritime Services.