Golden Highway Upgrade, Mudies Creek Flood Mitigation Works

Review of Environmental Factors

Transport for New South Wales | October 2022

NSW GOVERNMENT

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SMEC

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Executive summary

The proposal

Transport for NSW (Transport) proposes to upgrade the B84 Golden Highway at Mudies Creek (the proposal) as part of a package of works identified in the *Golden Highway Corridor Strategy* (NSW Government, 2016a). The proposed upgrade starts about 1.9 kilometres west of the intersection of the Golden Highway and the New England Highway and is located in the suburb of Whittingham in the Singleton Local Government Area (LGA). Key features of the proposal include:

- About 1,100 metres of new road alignment south of the existing Golden Highway at Mudies Creek
- A new 28 metre long, single span, bridge over Mudies Creek
- Provision for widened shoulders and safety barriers
- Adjustment to private property accesses to suit new highway alignment
- Removal of the existing five cell culvert structure at Mudies Creek.

Construction is expected to commence in mid-2023 and would take 18 to 24 months to complete.

Need for the proposal

The Golden Highway is an important link across the Great Dividing Range for freight traffic. As freight productivity is a valuable contributor to the economy, maintaining a safe and efficient road is necessary along all sections of the highway, including the section relevant to this proposal. The existing culvert over Mudies Creek and approaches are subject to flooding in a one in five-year Average Recurrence Interval (ARI) storm event, so is unpassable on a periodic basis. The proposal addresses the vision of the *Golden Highway Corridor Strategy* by:

- Boosting productivity through accommodating agriculture and mining activities and enabling access for high productivity vehicles
- Providing safe and efficient travel for all road users
- Improve road network reliability and access by reducing the impact of flooding.

Proposal objectives

The proposal is part of a broader strategy to upgrade the Golden Highway. The objectives of the proposal include:

- Improve travel efficiency for local and regional road users, by providing a new bridge and road alignment to improve flood immunity (one in 50-year ARI storm event) at Mudies Creek
- Cater for higher productivity vehicles (HPVs), including up to Performance Based Standards (PBS) Class 2B of up to 30 metres in length, by carrying out isolated carriageway improvements where safety or freight efficiency is compromised, and providing wider and stronger road pavement surfaces
- Maintain and improve the ability to cater for oversized and over mass (OSOM) vehicles
- Reduce fuel consumption and vehicle operating costs for vehicles travelling along the corridor by providing consistent road conditions which meet class 3 and 4 road standards
- Minimise impacts to stakeholders including traffic disruptions during construction, and residents to the north of the proposal.

Options considered

Transport has carried out multiple investigations to identify a preferred option. These investigations included consideration of several corridors on both sides of the existing Golden Highway as well as within the existing road corridor.

Selection of the preferred option considered social, environmental and economic factors as well as stakeholder feedback. The preferred option to upgrade the Golden Highway on the southern side of the existing road was chosen as it best met the project objectives.

Statutory and planning framework

The proposal is for a road and road infrastructure facilities and is to be carried out on behalf of Transport for NSW and can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Development consent from council is not required.

The proposal is partially located on Commonwealth government land within the Singleton Military Area (SMA). Approval is required for an action taken by any person on Commonwealth land that is likely to have a significant impact on the environment (Section 26(1)) in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The self-assessment was completed in accordance with the Significant impact guidelines, 1.2 *Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* (Commonwealth of Australia 2013) to determine whether the proposal is likely to have a significant impact, including indirect consequences as a result of the proposal. The self-assessment found that the proposal is not likely to have a significant impact on the environment of the Commonwealth land.

Community and stakeholder consultation

In 2016, consultation was carried out by Transport during preparation of the *Golden Highway Corridor Strategy* (NSW Government 2016a). The *Golden Highway Corridor Strategy Community Consultation Report* (NSW Government 2016b) was released in October 2016. The report summarised the issues raised by the community and stakeholders in response to the public exhibition of the *Golden Highway Draft Corridor Strategy*.

Transport consulted with the community during April and May 2018 on the concept designs for the Mudies Creek upgrades and these outcomes are contained in the *Golden Highway Upgrades Mudies Creek and Whittingham Community Consultation Report (*Roads and Maritime, July 2018).

Aboriginal community consultation was carried out in accordance with the Transport *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime, 2011).

Transport has undertaken consultation with the Department of Defence regarding the proposal on a range of matters including property acquisition and adjustment, access, and design. Consultation with the Department of Defence is ongoing and expected to be completed in late 2022.

Environmental impacts

The main environmental impacts of the proposal are:

Aboriginal heritage

An assessment of potential impacts to Aboriginal heritage were undertaken in accordance with the PACHCI (Roads and Maritime, 2011). The proposal will directly impact four sites, resulting in both the partial and total loss of value. An assessment of Aboriginal heritage significance determined that the project area is of moderate cultural significance to the local Aboriginal community. An Aboriginal Heritage Impact Permit (AHIP) will be sought for the proposal.

Recommendations to manage impacts on identified Aboriginal heritage sites have been developed based on the environmental context and condition, background research, and consultation with stakeholders.

Biodiversity

The proposal would result in the clearing of 4.06 hectares of vegetation comprising 2.63 hectares of cleared/disturbed or revegetation/regeneration vegetation, 1.24 hectares of Endangered Ecological Communities (EECs), 0.25 hectares of Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregion (Endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act)), and 0.99 hectares of Swamp Oak Floodplain Forest in the NSW North Coast and Sydney Basin and South East Corner Bioregions (Endangered under the BC Act, and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Clearing for the proposal is below Transport's biodiversity offset threshold (terrestrial), so no biodiversity offsets are required.

A *Tree and Hollow Replacement Plan* will be developed to achieve a no net loss of biodiversity outcome, consistent with the Transport for NSW *No Net Loss Guidelines* (July 2022).

Targeted microbat surveys identified five threatened microbat species in a sentry box within the proposal boundary. To manage potential impacts, a *Microbat Management Plan* (SMEC 2022) has been prepared to identify management and impact mitigation options, including a Supplementary Microbat Habitat Program with monitoring requirements throughout construction.

Assessments of significance have been carried out for threatened species and ecological communities that are likely to occur within the proposal area. The assessments determined that the proposal is unlikely to have a significant impact on these species and communities protected under the BC Act and EPBC Act.

Water quality, hydrology and flooding

The proposal will increase the road height with the construction of a new single span bridge to meet the 1 in 50-year flood immunity. This would restrict the upstream flow of water to the South of the Golden Highway (Department of Defence land) during a flood event, and result in an afflux of 411 millimeters along the creek centerline in the 1 in 50-year ARI. The proposal would attenuate peak flows by approximately 1 percent. The proposal would result in a higher duration of inundation; however the impact is considered imperceptible (SMEC, 2019c).

The proposal will also result in an afflux of up to 20mm downstream of the Golden Highway for a 100-year ARI event. This afflux affects the property to the northeast of the proposed bridge and is considered not to be significant.

Traffic and transport

At times during construction, traffic flow would be reduced to a single lane under contra flow. This will be kept to a minimum. Full closure of the Golden Highway will also be required occasionally.

These temporary road closures would be short-term in duration (less than 48 hours) and minimised as much as possible.

Road users will be detoured via the New England Highway and Range Road which would add about four kilometres and four minutes time. During construction the posted speed limit would be reduced to 40 km/h in both directions during working hours, outside of working hours the speed limit would be 60 km/h.

Noise and vibration

The *Construction and Operation Noise and Vibration Assessment* (SLR 2019) identified noise impacts associated with earthworks and pavement as being highly intrusive particularly during out of hours work. Most of the works are expected to be conducted during standard working times with some key activities associated with bridge girder installation and asphalt works being completed during out of hours.

During temporary road closures of the Golden Highway vehicles travelling along the highway would be re-routed along the New England Highway and Range Road. On the Range Road detour route, some sensitive receivers are predicted to have an increase of greater than 2 dB due to the increase in traffic volume. The impacts associated with the detours will be able to be mitigated with the noise and vibration safeguards recommended within the *Mudies Creek Review of Environmental Factors* (*REF).* At-receiver noise treatments are not recommended.

Changes to operational noise are predicted to be minimal due to the minor change in alignment. At-receiver noise treatments are not required.

Contamination

A Phase 2 Detailed Site Investigation (DSI) was prepared for the proposal by SMEC in March 2022. A single sample recorded Perfluorooctane sulfonic acid (PFOS) concentration above the Per- and Poly- Fluoro Alkyl Substances (PFAS) ecological indirect exposure criteria (*National Environmental Management Plan* 2020 (NEMP) *Version 2*). Additional sampling of sediment in the existing culvert cells beneath the Golden Highway were tested for PFAS, which was not detected (detection limit of 0.005 mg/kg). It was concluded that the PFAS/PFOS is unlikely to pose an unacceptable risk.

The DSI concluded there is a low likelihood of contamination being present within the proposal that would pose an unacceptable risk to human and ecological receptors under the proposed land use as a road corridor. It is considered that any soil contamination can be managed at the construction stage through the recommended safeguards in the *Mudies Creek REF* and by implementing an ‘unexpected finds’ protocol.

Non-Aboriginal heritage

Archaeological excavations identified a fireplace structure and associated artefacts on the eastern side of Mudies Creek near the present day Dochra Gate. The structure is not documented historically. An assessment of significance has determined that this site has the potential to reach the threshold for both Local and State Significance. Further destructive investigation of the hut to determine the potential heritage significance of the site was not recommended. The proposal was amended to ensure construction activities will not impact this site.

The safeguards within the *Mudies Creek REF* will ensure any potential impacts to areas of non-Aboriginal heritage are mitigated during construction.

Justification and conclusion

The proposal area has a history of flooding which results in the periodic closure of the Golden Highway and requires detours for users of the highway. The proposal is recommended as it would best address the objective to provide flood immunity for the Golden Highway at Mudies Creek.

The proposal would result in some adverse impacts to the environment, road users and the community, however the safeguards and mitigation measures provided in this REF would mitigate these expected impacts. The proposal is justified because it would provide a reliable crossing over Mudies Creek, improve road safety and meet future traffic needs.

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

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1. Introduction

1.1 Proposal identification

Transport for NSW (TfNSW) proposes to upgrade the B84 Golden Highway at Mudies Creek (the proposal) as part of the *Golden Highway Corridor Strategy* (NSW Government, 2016a). The proposed upgrade would start about 1.9 kilometres west from the intersection of the Golden Highway and the New England Highway at Belford for a distance of about 1,100 metres (refer Figure 1-1 and Figure 1-2). The proposal is within the suburb of Whittingham, which is within the Singleton Local Government Area (LGA), and partially in the Singleton Military Area (SMA).

The Golden Highway crosses Mudies Creek which is an ephemeral waterway that currently experiences periodic flooding during one in five-year Average Recurrence Interval (ARI) and greater storm events. This results in the current crossing over Mudies Creek being inundated by stormwater and impassable for traffic. Key features of the proposal would include:

- New road alignment to the south of the existing highway at Mudies Creek
- New single span bridge to the south of the existing culvert at Mudies Creek
- Removal of the existing five cell culvert structure at Mudies Creek
- Property acquisition to the south of the existing road alignment at Mudies Creek.

The Golden Highway is a key transport link for over size and over mass (OSOM) as well as being an approved B-double vehicle route, particularly between the New England Highway at Whittingham and Denman Road at Denman, which the proposal is located within. This section of the Golden Highway services vehicles travelling between the Hunter region and Dubbo.

The proposal forms part of the *Golden Highway Corridor Strategy*, which aims to provide for the safe, efficient and sustainable travel for all vehicles along the Golden Highway and allow the conversion of the route for the use of Class 2B High Productivity Vehicles (HPVs) (up to 30 metres in length). The proposal falls within Section 1 (Belford to Mount Thorley) of the *Golden Highway Corridor Strategy*. The average daily traffic (ADT) volume on this section is 4975 with heavy vehicles accounting for 1036 or 19 per cent (Transport for NSW, 2016).

The proposal is needed to:

- Reduce frequency of closure of the Golden Highway due to flooding at Mudies Creek
- Improve travel time and efficiency
- Increase reliability of access into and out of the Singleton region. Currently the Golden Highway provides:
  - Connections for local communities between Singleton, Muswellbrook, Denman, Merriwa, Dunedoo and Dubbo
  - Connections between mines, surrounding towns and villages, the Lower Hunter and Newcastle (via the New England Highway and the Hunter Expressway)
  - Freight connections for goods moving west from Newcastle including supplies to mines in the east and fertiliser along the length of the corridor
  - Connections for agricultural industries between Dubbo, Dunedoo, Merriwa, Denman and Newcastle including the Port of Newcastle (via the New England Highway)
  - Access to the Upper Hunter vineyards
  - Connections to the M1 Pacific Motorway and Sydney via the New England Highway and Hunter Expressway
  - Connections to south-west Queensland and central-north Victoria (via the Newell Highway) and to South Australia (via the Mitchell and Barrier highways).

The proposal is a part of the four-year package of upgrades being carried out by Transport on the Golden Highway, between the Hunter Region and Dubbo. The package has been grouped into six key projects along the 313 kilometre length of the highway corridor, including this proposal. The NSW Government is providing $109 million funding, with an additional $24 million funding from the Australian Government, for the package of upgrades.

1.2 Purpose of the report

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

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

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 171 of the Environmental Planning and Assessment Regulation 2021, the factors in 'Guidelines for Division 5.1 assessments" (Department of Planning and Environment, June 2022), *Roads and Related Facilities EIS Guideline (*DUAP 1996*)*, *Biodiversity Conservation Act 2016 (*BC Act*), the Fisheries Management Act 1994* (FM Act), and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

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

- Section 5.5 of the EP&A Act including that Transport 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 Transport 's road activities on nationally listed threatened species, ecological communities and migratory species.

The findings of the REF would be considered when assessing:

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

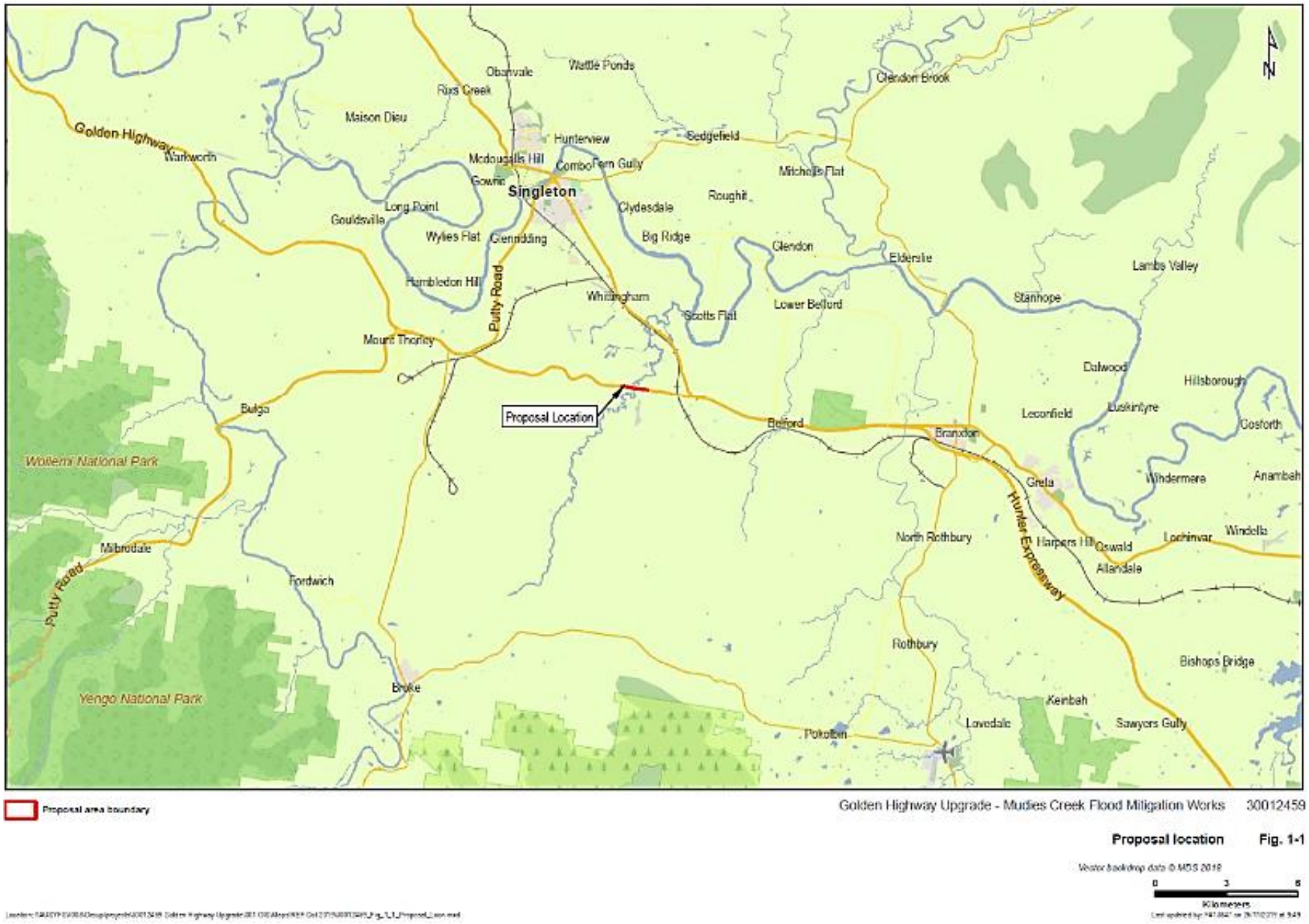

Figure 1-1: Regional context

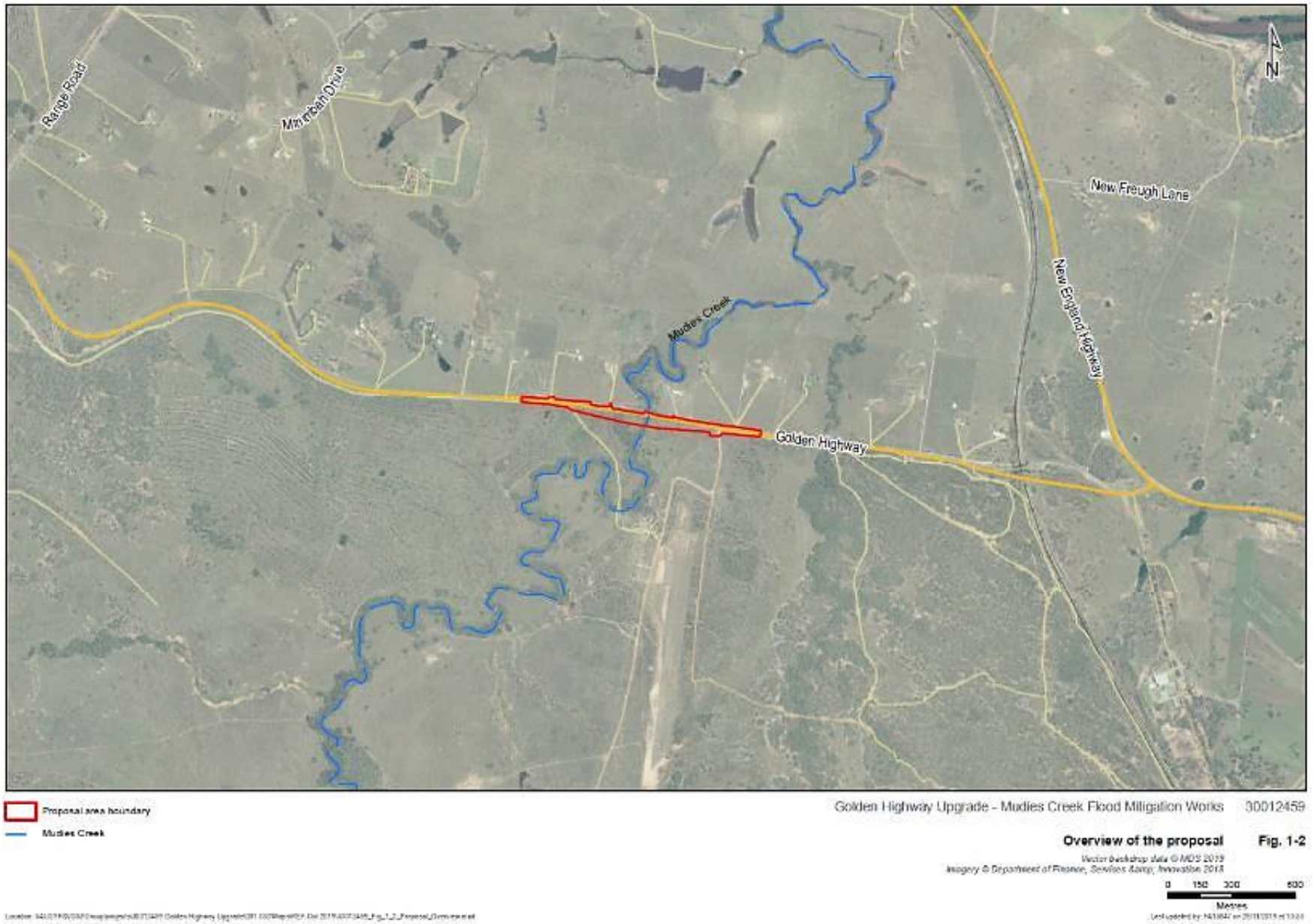

Figure 1-2: Proposal location

2. Need and options considered

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

2.1 Strategic need for the proposal

The Golden Highway is the only approved east-west 26 metre B-Double route between the Great Western Highway in the south and the New England Highway. It is an important link across the Great Dividing Range at low to moderate grades for freight traffic. As freight productivity is a valuable contributor to the economy, maintaining a safe and efficient road is necessary along all sections of the highway.

The proposal has been developed to meet the needs of a range of strategic plans (refer Figure 2-1). Further to the strategic setting, the proposal fits into the specific operational needs of improving the Golden Highway corridor performance in terms of:

- Road safety
- Road condition
- Road design and geometry
- Traffic efficiency performance.

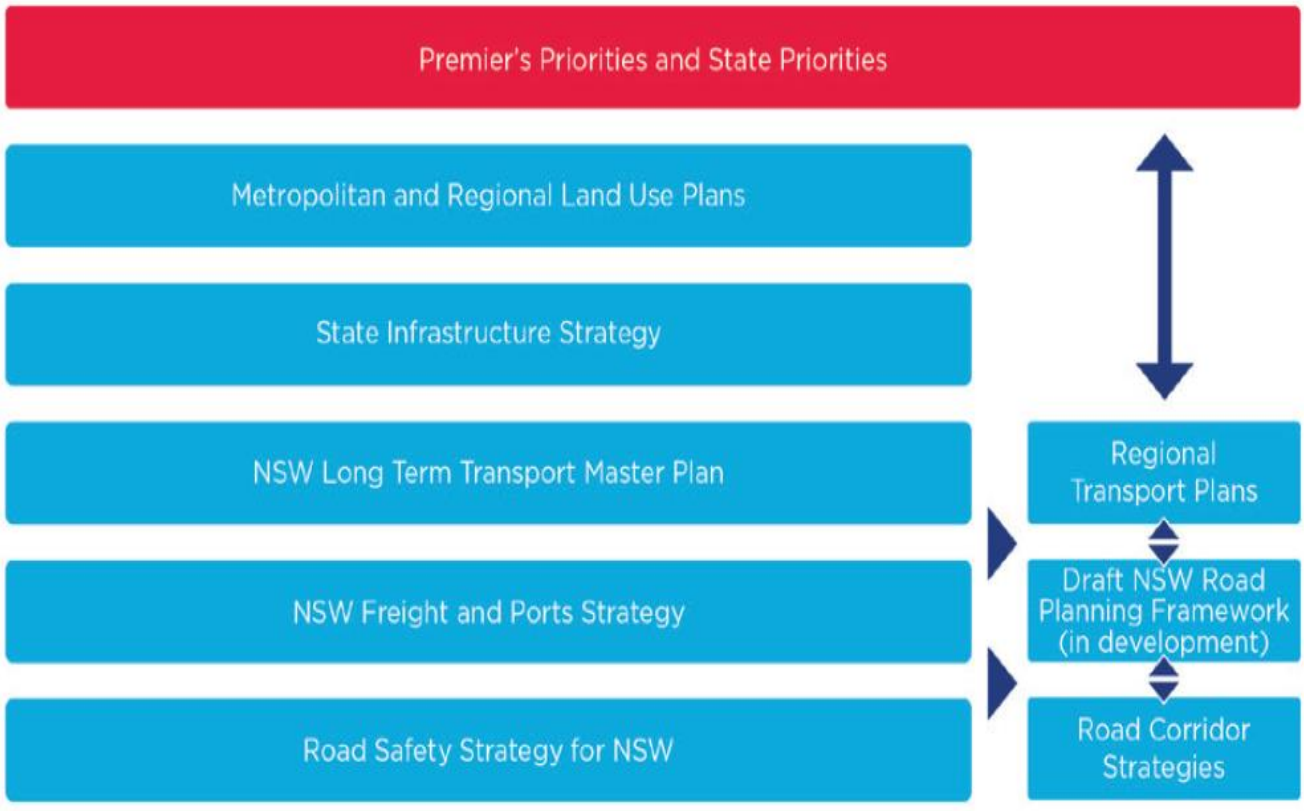

Figure 2-1: Strategic planning framework

2.1.1 NSW Road Safety Strategy

The *NSW Road Safety Plan 2021 – Towards Zero* (Transport for NSW, 2018) sets the direction of road safety in NSW for the next 10 years. NSW is committed to reducing fatalities with at least a 30 per cent reduction in fatalities and serious injuries by 2021.

The *Golden Highway Corridor Strategy* considers the safety performance of this important corridor, contributing to the Safe Systems approach of the *Road Safety Strategy*. This proposal further contributes to the *Road Safety Strategy* by improving the current infrastructure through the construction of a new bridge and new road alignment.

2.1.2 Golden Highway Corridor Strategy

The *Golden Highway Corridor Strategy* (NSW Government, 2016a) sets out the 20-year plan to manage and guide development of the 313 kilometre long highway through the Hunter Region to the Central West (refer Figure 2-2). The vision for the Golden Highway over the next 20 years is to:

- Boost productivity, support the development of agricultural and mining activities and operate as a critical freight route by enabling access for Performance Based Standards (PBS) Class 2B high productivity vehicles (up to 30 metres in length) across the Great Dividing Range from western NSW to the Hunter Region and the Port of Newcastle
- Provide safe and efficient travel for all road users by providing a '2+1' lane arrangement east of Denman Road, and two-lane, two-way arrangement
- Improve road network reliability and access by reducing the frequency of flooding.

The road corridor has been divided into sections to help in assessing the performance. The proposal is located within Section 1 – New England Highway, Belford to Mt Thorley Road Overpass of the *Golden Highway Corridor Strategy* (refer Figure 2-2). The average daily traffic (ADT) volume on this section is 4,975 with heavy vehicles accounting for 1,036 or 19 per cent (*Golden Highway Corridor Strategy)*.

There is a high volume of commuter traffic during weekdays associated with mining areas and related services businesses west of the study area. As of 2015, this section was assessed as having a Level of Service (LOS) C – having an average travel speed of greater than 70 to 80 km/h with greater than 50 to 65 per cent of time spent following heavy vehicles. The Strategy identifies several specific actions which relate to the *Regional NSW Services and Infrastructure Plan*, these being:

- Investigation of the Golden Highway as a freight corridor from the Central West region to the Port of Newcastle (short term)
- Significant investment in upgrades to the Golden Highway (medium to longer term).

This proposal is a part of the greater strategy and contributes to the vision in the following ways:

- Contributing to the increase in productivity of high 2B vehicles by widening the roads along a key section of the highway
- Providing a new single span bridge at Mudies Creek, Whittingham. The new bridge and associated elevated road alignment would both improve route reliability and safety for road users on this section of the Golden Highway.

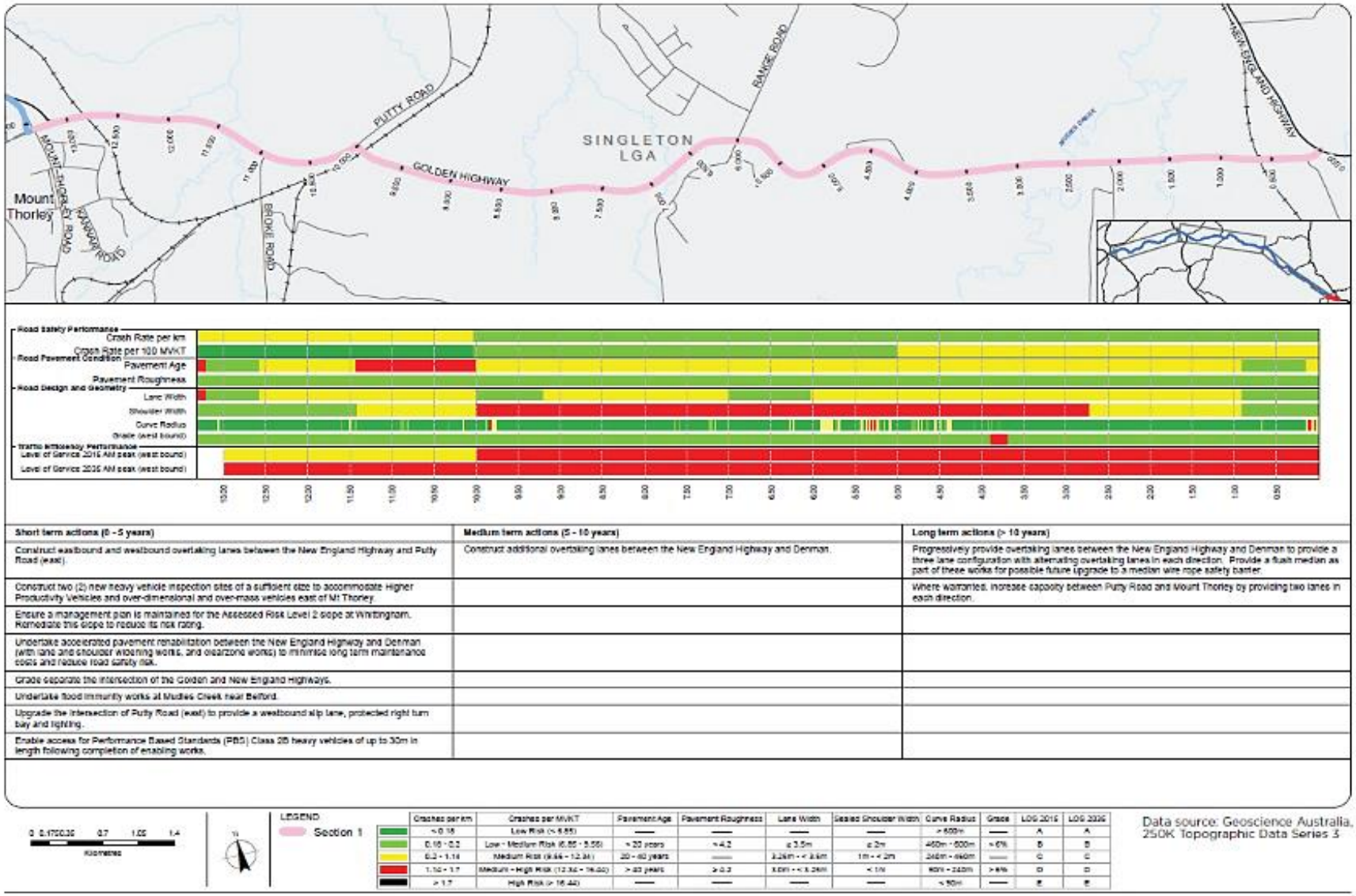

Figure 2-2: Golden Highway corridor planning sections Source: Golden Highway Strategy Document (NSW Government 2016)

2.2 Existing infrastructure

The existing Golden Highway within the proposal area is about 1,100 metres in length and consists of a single lane in each direction. Existing lane widths are around 3.5 metres, with shoulders carrying width to less than one metre. The existing posted speed limit is 100 kilometres per hour in each direction. The culvert at Mudies Creek comprises a five cell RCBC structure with each cell measuring three metres wide and 1.8 metres high which is in structurally average in condition.

Within the proposal area to the north are five access tracks that service six rural/residential properties. Within the proposal area to the south are two unsealed access tracks with locked gates that provide access into the SMA. The eastern access track (known as Dochra Gate) is used on a regular basis. All these access tracks are unsealed from the edge of pavement to the boundary of the road reserve. There are no other road intersections, footpaths, street lights or formal cycle lanes within the proposal area.

North of the current highway are the following utilities:

- 200 millimetre watermain (Singleton Council)
- Telecommunications cable (Telstra)
- Aerial power (Ausgrid).

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal are to:

- Improve travel efficiency for local, regional, state and interstate road users, by providing a new bridge and road alignment to provide flood immunity at Mudies Creek and reduce the frequency of road closure due to inundation
- Cater for HPVs, including up to Performance Based Standards (PBS) Class 2B of up to 30 metres in length, by carrying out isolated carriageway improvements where safety or freight efficiency is compromised, and providing wider and stronger road pavement surfaces
- Maintain and improve the ability to cater for OSOM loads
- Minimise disruption to road users resulting from planned and unplanned road closures, recognising the needs of isolated communities and those sections of the route which have no alternative access
- Reduce fuel consumption and vehicle operating costs for vehicles travelling along the corridor by providing consistent road conditions which meet class 3 and 4 road standards.

2.3.2 Development criteria

The development criteria for the proposal are:

- Improve safety and connectivity for road users
- Provide for safe construction while minimising impact on road users
- Minimise impact on utilities
- Best fits with existing and future planning
- Minimise changes to visual and landscape character
- Minimise direct impacts to properties
- Minimise traffic disruption during construction
- Minimise impacts on biodiversity
- Minimise impacts on Aboriginal heritage.

2.3.3 Urban design objectives

The Proposal responds to the urban design principles of Transport's overarching urban design policy *Beyond the Pavement* (Roads and Maritime, 2014) to minimise impacts to landscape character and viewpoints. The principles in *Beyond the pavement* have been considered during preparation of the Detailed Design, and achieved the following elements:

Fitting with the landform

- The road design should minimise the volume of cut and fill
- As appropriate in rural areas such as this site, a relatively shallow grade and vegetated slope has been achieved for the embankments.

Responding to natural pattern

- Impacts to the existing natural environment have been minimised such as limiting the removal of existing vegetation
- Rehabilitation and re-vegetation work that improve the biodiversity values of the riparian corridor
- Managing discharge water quality to an extent that is reasonably practical.

Designing an experience in movement

- New landscape planting complements the landscape character (i.e. local rural and creekline species).

The headings above are taken from in *Beyond the Pavement* (Roads and Maritime, 2014).

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

The assessment criteria used for the options assessment have been developed specifically for the proposal. Options assessment was carried out using a simplified multi-criteria assessment, completed during a Value Management Workshop (VMW) attended by the Transport and SMEC project team. The assessment criteria used, and weightings applied to each, are outlined in Table 2-1.

Table 2-1: Options assessment criteria and weighting

Criteria	Considerations	Weighting
Road design and road safety	Does the road alignment meet the requirements for a design speed of 100 km/h?	5%
	Are there any known design departures?	
	Are there any identified road safety deficiencies associated with the road alignment?	
Environmental impact	Minimise adverse impact on the environment. Considering specific impact to: • Biodiversity • Aboriginal heritage • Visual impact • Noise and vibration Waterway impact (including scour protection requirements)	15%

Criteria	Considerations	Weighting
Constructability and staging	Minimise construction impacts including road user delay	25%
	Considers constructability of the roadworks and structure	
	Considers OSOM vehicle impact	
Property impact	How much property acquisition is required?	15%
	How many individual properties are impacted?	
	Are any property adjustments required including changes to driveways?	
	Property impact during construction (e.g. is temporary accesses required?)	
Public utilities impact	Minimise utility impact and relocations	10%
Cost	Considers the capital cost	30%
	TOTAL	**100%**

2.4.2 Identified options

There were six options considered:

- Option 1 (Alternative option)
  - New road alignment on the northern side of the existing road
  - New bridge structure
  - Maintain two lanes of traffic (one in each direction) during construction
- Option 2 (Alternative option)
  - New road alignment on the northern side of the existing road
  - New bridge sized culvert structure
  - Maintain two lanes of traffic (one in each direction) during construction
- Option 3 (Preferred option)
  - New road alignment on the southern side of the existing road
  - New bridge structure
  - Maintain two lanes of traffic (one in each direction) during construction
- Option 4 (Alternative option)
  - New road alignment on the southern side of the existing road
  - New bridge sized culvert structure
  - Maintain two lanes of traffic (one in each direction) during construction
- Option 5 (Alternative option)
  - Build new road on existing road alignment

  - Construct new bridge
  - Maintain one lane of traffic (operating under alternate flow) during construction with possible requirement for full road closures
- Option 6 (Do nothing option)
  - No upgrade to the existing road and bridge.

2.4.3 Analysis of options

In assessing options, an important consideration was to minimise delays to traffic during construction of the proposal. Options 1, 2, 3 and 4 maintain two lanes of traffic during construction whereas Option 5 would only maintain one lane of traffic during construction. As such Options 1, 2, 3 and 4 were preferred.

A new road alignment on the northern side of the existing highway would require:

- Partial acquisition of several properties
- Channel work in Mudies Creek within the DoD property (SMA)
- Work closer to private properties resulting in increased noise and visual impacts
- Channel work that would have greater impact on Mudies Creek
- Regrading of property access to tie in with the new road level
- Temporary property access changes during construction
- Impact on Telstra and water utilities
- Higher costs.

One of the proposal's objectives is to achieve greater flood immunity over Mudies Creek of the 1 in 50-year ARI storm event. The required bridge sized structure length and the property impact associated with achieving the target flood immunity was considered unacceptable. As such Option 2 and Option 4 were considered undesirable.

Option 6 would not improve the conditions of the existing road and bridge sized culverts at Mudies Creek and was considered undesirable.

Option 1 would require a greater area of land acquisition from six properties to the north of the existing highway and would move the road alignment closer to residential dwellings. Option 1 was therefore considered undesirable.

Option 3 (preferred option) involves a new road alignment on the southern side of the existing highway and was developed as it:

- Meets the flood immunity objective
- Reduces impact on private properties
- Improves constructability
- Minimises impact on public utilities
- Avoids acquisition of private property
- Lower capital cost.

2.5 Preferred option

Option 3 involves an alignment on the southern side of the existing highway with sufficient separation from the highway to allow construction of a bridge structure. This would reduce the risks of working in the waterway and would have improved construction staging options. During the VMW, Option 3 ranked the highest when considered against the assessment criteria. This was true

for both with and without cost criteria. It was agreed with the participants at the workshop that Option 3 was the preferred option, subject to a number of criteria, including:

- Confirmation of costing (an informed estimate was used, rather than a formal costing)
- Flooding assessment of the revised vertical and horizontal amendment
- DoD land owner discussions, especially as they relate to localised afflux approvals in within the SMA.
- Option 3 takes into consideration the environment, community and other constraints of the study area as it would:
  - Minimise private property impact with the new alignment on southern side of existing road
  - Minimise noise impact on adjacent residents
  - Minimise utilities impact as all the utilities (water, communications and electrical) are located on the northern side of the existing road
  - Optimise constructability as the new alignment can generally be constructed off line and reduce the need for temporary partial or full closure of traffic lanes on the Golden Highway.

2.6 Design refinements

The proposal has been subject to a number of design refinements during the development of the proposal. Below is a summary of the major design refinements:

- Modification to the road alignment to move the road closer to the existing highway to reduce the amount of property acquisition
- Modification to the road vertical alignment to reduce the amount of imported material and improve the tie in to the existing highway
- Steepening batter slopes and provision of additional safety barrier to reduce the amount of imported material
- Widening road at driveway accesses to improve safety for local residents.

3. Description of the proposal

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

3.1 The proposal

Transport propose to upgrade the B84 Golden Highway at Mudies Creek as part of the *Golden Highway Corridor Strategy* 2016. The proposal falls within Section 1 of the Golden Highway Corridor Strategy – Belford to Mount Thorley. The proposed upgrade would start about 1.9 kilometres west from the intersection of the Golden Highway and the New England Highway at Belford and continue west for approximately 1100 metres. Key features of the proposal are:

- New road alignment (refer Figure 3-1) of the Golden Highway to the south of the existing highway at Mudies Creek comprising:
  - 3.5 metre travel lanes
  - Two metre combined cycle lane and shoulders.
- New single span concrete bridge (refer Figure 3-2) to the south of the existing five cell box culvert over Mudies Creek comprising:
  - 3.5 metre travel lanes
  - Two metre combined cycle lane and shoulders.
- Removal of the existing five cell box culvert
- Property acquisition in the SMA (refer Section 3.5 and Figure 3-6) to the south of the existing highway at Mudies Creek
- Property adjustments to SMA including relocation of entry gate and new gatehouse structure.

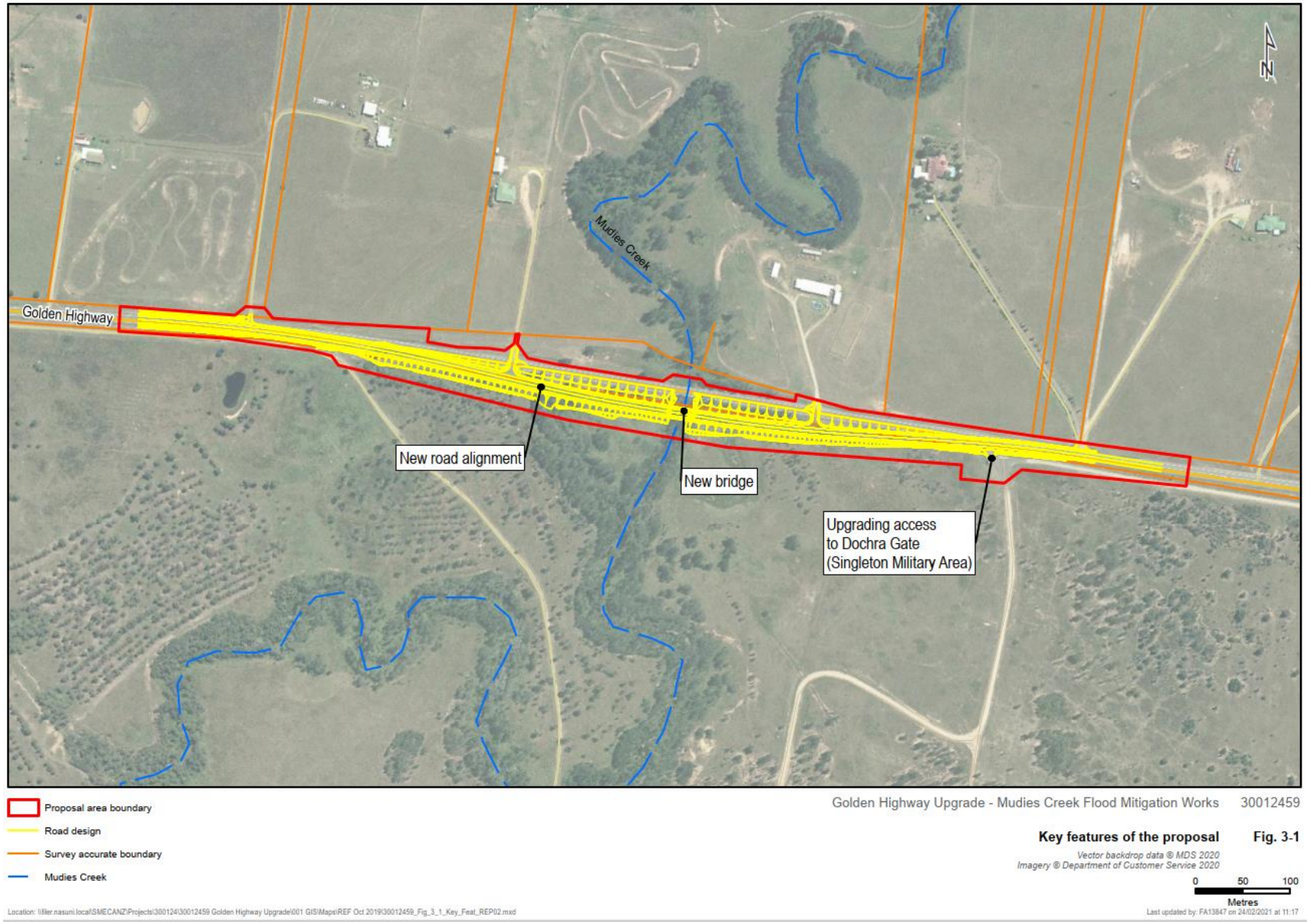

Figure 3-1: Key features of the proposal

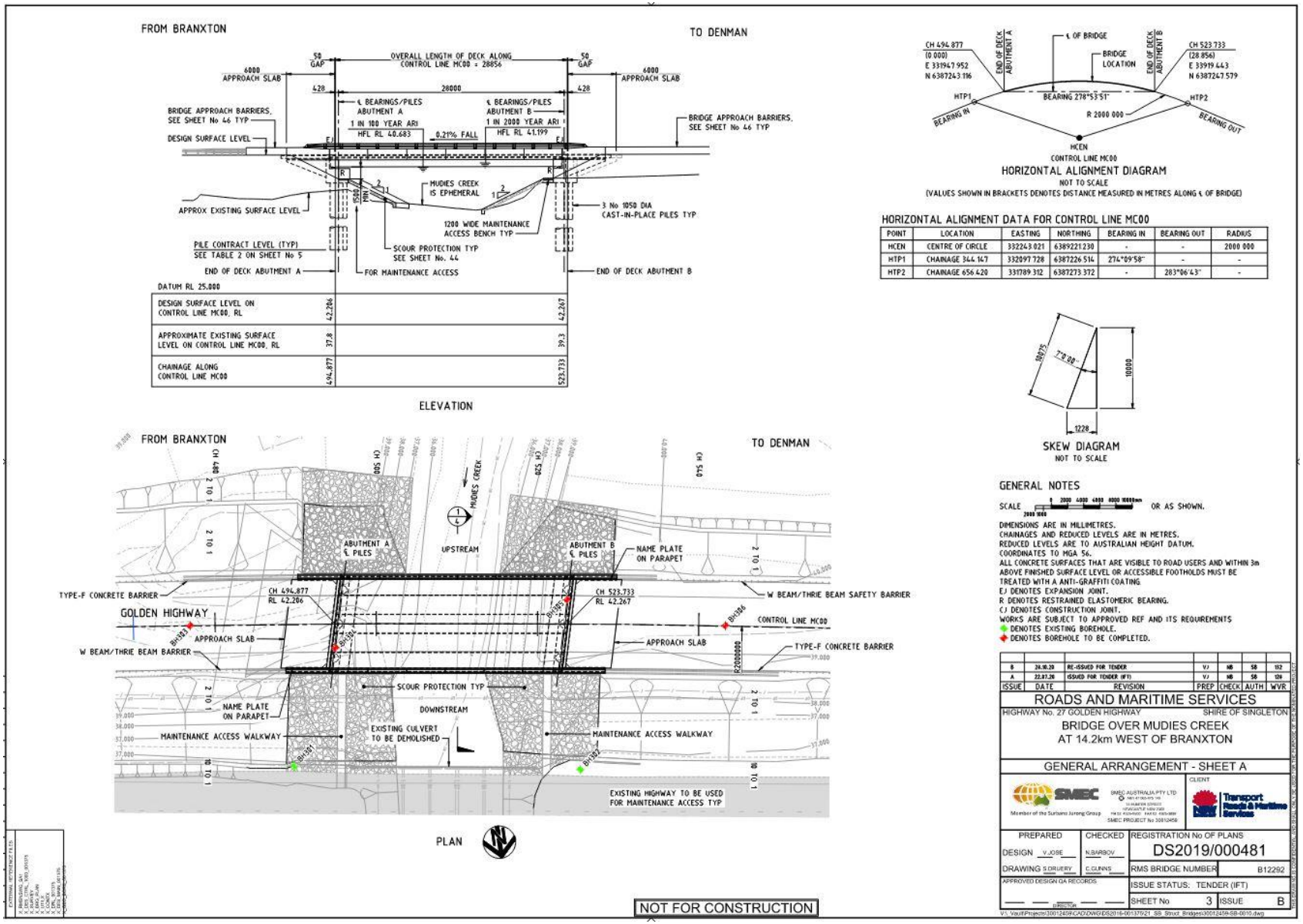

Figure 3-2: Bridge design

3.2 Design

3.2.1 Design criteria

The road has been designed in accordance with Austroads guidelines and associated Transport supplements. The design criteria developed for the proposal are summarised in Table 3-1 and Table 3-2.

Table 3-1: Design criteria

Criteria	Requirement
Road design	
Posted speed	100 kilometres per hour
Design speed	100 kilometres per hour
Min curve radius (3% adverse crossfall)	1,600 metres
Min curve radius (6% max superelevation)	437 metres
Maximum radius requiring a spiral	500 metres
Minimum spiral length	55 metres
Minimum grade (minimum / desirable)	0.3 per cent / 0.5 per cent
Max grade (desirable / minimum)	6 per cent / 8 per cent
Reaction time	2 seconds
Stopping Sight Distance (SSD) Distance / Crest K	191 metres 61 metres
Sag K (comfort criteria) Sag K (headlight criteria) (For S<L)	16 13
Nearside shoulder width (desirable)	2.0 metres
Verge width: Without safety barrier	0.5 metres
Cut batter	3:1 (desirable) 2:1 (maximum)
Clear zone (4:1 fill / 2:1 cut)	5 metres
Curve widening	30 metres B-double

Table 3-2: Hydrology and drainage criteria

Item No	Item	Minimum ARI
1	Channels and open drains	5 years
2	Piped system (including pits)	10 years
3	Culverts where surcharge is allowable	50 years
4	Structures where surcharge is undesirable	100 years
5	Nil width of flow spread onto traffic lanes	10 years
6	Gross pollutant traps	1 year
7	Road drainage wearing surface	10 years
8	Major storm event checks for no property damage	100 years
9	Major storm event checks for no structural damage	2,000 years
10	Cycleway	1 year
11	Temporary drainage	2 years

3.2.2 Engineering constraints

The key engineering constraints considered in the detailed design include:

- Design:
  - Reduce property acquisition
  - Minimise relocation of existing utilities
- Traffic:
  - Maintain traffic continuity during construction, with about 5,000 vehicles per day
  - Minimise delays caused by concurrent construction along the highway through off line construction.
- Constructability:
  - Maintain OSOM traffic during construction
  - Golden Highway to remain operational during the construction period
  - Manage issues associated with live road traffic
  - Narrow existing road width
  - Work in and adjacent to Mudies Creek
  - Work in proximity to the Dochra airstrip
- Environmental constraints:
  - Aboriginal heritage, Potential Archaeological Deposit (PAD) and artefacts found in proposal area
  - Potential unexploded ordinance within proposal area
  - Flora and fauna (terrestrial and aquatic) including threatened species and Threatened Ecological Communities
  - Hydrology and water quality of Mudies Creek

  - Proximity to sensitive noise receivers
  - Existing visual amenity and landscape character.

3.2.3 Major design features

The bridge design would involve a 28 metre single span bridge with vertical abutments and wing walls (refer Figure 3-2). The design of the bridge includes:

- Superstructure comprised of:
  - Five 1215 millimetre deep Super-T's
  - Minimum 200 millimetre thick cast-in place deck slab
  - Three per cent cross fall on the deck
  - Waterproof membrane
  - Asphalt wearing surface top the concrete slab
  - Standard 1.4 metre high concrete regular performance traffic barriers with twin rails
  - Overall width around 12 metres (two standard 3.5 metre wide traffic lanes, two metre wide shoulder and a typical 500 millimetre barrier on both sides of the bridge).
- Substructure comprised of:
  - Girders supported on reinforced concrete sill beam abutments
  - Abutments supported on three steel encased reinforced concrete bored piles
  - Pile depths to be determined during detail design
  - One metre wide maintenance access bench at both abutments for inspection purposes
  - Scour protection at both abutments.

Design aspects of the road approaches include the following:

- Batter slopes of four to one have been adopted in majority of the design
- Overall width around 12 metres (two standard 3.5 metre wide traffic lanes, two metre wide shoulder
- Cyclists may share the road using the sealed road shoulder
- Increased shoulder widths at driveway accesses
- Safety barriers provided in accordance with Austroads Part 6, Safety and Barriers
- Relocation of a number of existing signs
- New regulatory signs would be provided in accordance with Transport Delineation Guidelines, Austroads guidelines and AS 1742
- Road surface markings would be provided in accordance with the Transport Delineation Guidelines
- Property adjustments to SMA entrance at the Dochra gate.

The construction impact area (refer Figure 3-1) has been determined based on the project constraints and requirements detailed below:

- Provide erosion and sediment control measures
- Reduce noise impacts on adjacent sensitive receivers
- Provide adequate space for safe and efficient construction and access during construction
- Reduce impacts to endangered ecological communities
- Provide adequate space for future maintenance access
- Allowance for extra embankment areas to address potential geotechnical variability on site.

3.2.4 Work methodology

Construction would be up to 18 months in duration. Details of the proposed pre-construction, construction and post-construction activities are provided in Table 3-3. The methods used to construct the proposal would be conventional techniques employed on road and bridge projects, adapted to account for project-specific environmental considerations.

Geotechnical conditions would influence the final choice of construction techniques to ensure the proposal is constructed in a safe, operationally functional and efficient manner. The types of equipment and plant requirements would be refined during detailed design and during the development of the construction methodology by the construction contractor.

Before the start of construction, a detailed work methodology would be refined and finalised. In addition, a Construction Environmental Management Plan (CEMP) would be developed by the selected contractor to address the environmental safeguards and mitigation measures within the REF.

Table 3-3: Likely pre-construction, construction and post-construction activities

Component	Typical activities	Typical plant, equipment and materials
Site establishment	• Delineation of the construction areas • Installation of initial environmental safeguards including site sediment and erosion controls and pollution management measures • Establishment of construction site facilities and access • Additional surveys and geotechnical investigations as required • Installation of temporary traffic controls and line marking.	• Fences, portable sheds, portable toilets, road base and fuel storage tanks • Trucks, cranes, excavators, elevated work platform vehicle, backhoes and trenchers and small equipment
Survey	• Vehicle access • Minor vegetation trimming • Peg or marker installation.	• Four-wheel drive vehicle, chainsaw
Site preparation	• Vegetation clearing and grubbing. Processing of green waste for use in erosion and sediment controls and/or stabilisation of disturbed areas • Stripping and stockpiling of topsoil for reuse.	• Trucks, bulldozers, scrapers, graders, excavators, backhoes, mulcher and small equipment.
Relocation / protection of services	• Relocation or protection of services • Where possible, the utilities would be relocated or protected as early work.	• Trucks, cranes, excavators, elevated work platform vehicle, backhoes and trenchers and small equipment.
Earthworks	• Removal and stockpiling of spoil and unsuitable material • Earthworks, including movement of materials along the alignment from cut to fill	• Trucks, bulldozers, excavators, scrapers, graders, water carts, compactors, rollers, rock crushing equipment, and

Component	Typical activities	Typical plant, equipment and materials
	embankment areas. It is expected there would be: – About 3,000 cubic metres of cut material which would be reused as fill for the proposal – About 2,000 cubic metres of topsoil which would be reused on site or if unsuitable disposed offsite to premises with approval to accept such material. – About 25,000 cubic metres of general fill for construction of the bridge approach embankments. • The proposed road alignment sits on an embankment up to five metres in height. • Spoil would be reused on site. Where this is not possible, unsuitable spoil would be disposed of to a licensed facility, property with approval to accept such material or on another Transport projects	elevated work platform vehicle • Materials include site-won and imported earth and rock material.
Drainage	• Preparation of construction erosion and sediment control measures e.g. diversion drains and temporary sedimentation sumps • Construction of road drainage structures, including culvert subsurface drainage.	• Excavators, trucks, trenching equipment, small equipment • Materials include precast concrete pipes and pits, concrete, formwork.
Pavements including bridge approaches	• Construction of road layers including sub-base, base and surfacing layer as well as sub-surface drainage.	• Graders, backhoes, trucks, water carts, vibratory compactors, trenching equipment, bitumen sprayers, material transfer vehicle, asphalt pavers, vibratory rollers and rubber-tyre rollers. • Materials include road base and subbase material, subsoil pipes, concrete, asphalt, bitumen and bitumen emulsion.
Bridge construction	• Carry out cut earthworks at the abutment locations • Construct abutment piles (driven or bored) • Construct abutments • Backfill / complete approach work • Construct crane pads as required • Install bridge beams • Cast concrete deck • Install barrier and road surface wearing course	• Cranes, piling rig, concrete agitators and pumps, trenching machine, pad foot and smooth drum roller, compactor.

Component	Typical activities	Typical plant, equipment and materials
	• Divert traffic onto new bridge and demolish existing culverts and embankments.	
Other work	• Installation of bridge barriers • Temporary lighting, fencing and roadside furniture • Progressive restoration of disturbed areas by means of stabilisation using measures such as revegetation, geofabric, soil binders, jute matting and the like • Landscaping • Line marking, raised road markers, sign posting.	• Trucks, fencing and barrier materials, truck mounted blowers, landscaping materials, cranes, line markers and small equipment.
Finishing work	• Removal of temporary work • Decommission, restoration and landscaping of temporary sites • Site clean-up and disposal of all surplus waste materials.	• Trucks, excavators, backhoes, cranes, hand tools and landscaping materials.

3.2.5 Construction hours and duration

It is anticipated that construction of the proposal would be carried out during standard and extended working hours and outside of standard working hours.

Standard working hours are:

- Monday to Friday 7 am to 6 pm
- Saturday 8 am to 1 pm
- Sunday, no work.

Extended working hours are:

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

Night works would be required to minimise impacts on road users during traffic peaks, allow for full road closures and shorten the construction period. Typical activities carried out outside of standard working hours could include:

- Delivery of materials and oversized structural elements, required outside of standard hours
- Construction of pavements at connections to the existing highway.

3.2.6 Plant and equipment

A list of the indicative plant and equipment required for general construction activities, drainage infrastructure and road are provided in Table 3-3. It has been assumed that during each component of construction, the required plant and equipment such as vibrating and static rollers and excavators would be kept on site in designated compound areas. Refer Figure 3-4 for ancillary site locations.

3.2.7 Earthworks

Based on estimates drawn from the detailed design, it is predicted that the following approximate quantities would be required for earthworks and construction:

- 1,900 cubic metres of non-contaminated topsoil for stockpile and reuse
- 100 cubic metres of contaminated (weeds and weed seed) topsoil for disposal offsite
- 2,760 cubic metres of cut which would be used where suitable as fill
- 25,000 cubic metres of imported or borrowed material general fill for new road alignment
- 3,125 cubic metres of imported material for the selected zone
- 1,010 cubic metres of imported material for the verges
- 14,800 of imported foundation (Type E1, Type C1) treatment material
- 268 cubic metres site won material for foundation treatments.

3.2.8 Source and quantity of materials

Where possible materials would be sourced locally or from selected suppliers. In addition to the earthworks materials (noted in Section 3.2.7 above), construction of the proposal would generate or require various materials and pre-cast elements for the road and bridge. Estimates of the materials required are as follows:

- 300 cubic metres from removal of existing pavement
- 610 cubic metres of milled pavement material
- 1,750 cubic metres of mixed heavily bound pavement
- 190 cubic metres of unbound and modified pavement course
- 2,330 cubic metres of dense grade asphalt (20mm and 14mm)
- 120 cubic metres of precoated aggregate (7mm and 10mm)
- 250 cubic metres of mulch from clearing grubbing
- 14,820 litres of tackcoat spray binder
- 360 cubic metres of concrete for the bridge approaches, abutments, deck and barriers
- 2,800 square metres of geotextile
- 13,140 square metres of hydromulch
- 450 litres of cutter oil
- 13,140 litres of herbicide
- 1,370 lineal metres of 100 millimetre drainage pipe (perforated and unperforated)
- 1,065 lineal metres of fencing
- 33 cubic metres of asphalt wearing course for the bridge
- Five precast Super T girders
- 803 cubic metres of rock ballast for scour protection
- Sand for use as backfill around pipes and for asphalt and concrete
- Wood for use in formwork and other temporary or permanent structures
- Pre-cast concrete barriers, prefabricated steel barriers
- Signage and other road furniture
- Erosion and sediment control materials including sediment fencing, geofabric, jute mesh/mat
- Water.

3.2.9 Traffic management and access

Construction of the proposal would require heavy vehicle movements. These would mainly be associated with transport of construction machinery and equipment, and the import and movement

of road construction material. Table 3-4 outlines the indicative heavy vehicle movements during major aspects of the construction phases of each stage of the proposal.

Table 3-4: Heavy vehicle movements during construction

Construction activity	Anticipated duration	Heavy vehicle movements per day
Earthworks • Removal and stockpiling of spoil and unsuitable material • Earthworks and movement of materials along the alignment from cutting to fill embankment areas	• The bridge abutment earthworks and new road alignment would be staged with the construction contractor to determine the sequence. • Cut material associated with the wider road formation would be removed and moved to fill embankment locations or stockpiled. This would occur within the first six months. • Heavy vehicles would make use of the off-line sections of the alignment, which would alleviate traffic numbers along the Golden Highway during construction.	120
Bridge • Construction of formwork • Fabrication of reinforcing steel • Pouring of abutments and deck.	• Construction of the new bridge would occur over six months following the completion of the corresponding earthworks	30
Pavements • Construction of road layers including sub-base, base and surfacing layers as well as sub-surface drainage.	• Construction of the new road alignment would occur over 10 month period following the completion of the corresponding earthworks.	25

It is estimated up to 120 heavy vehicles would be required to access the site daily during the busiest construction phases. Heavy vehicle movement would mainly be associated with transport of construction machinery and equipment, and the import and movement of road construction material. Light vehicle and small plant movements would be required on site for other aspects such as the movement of workers and small plant. These light vehicle and small plant movements are estimated at around 100 movements per day.

Construction of the proposal would generally be offline with existing travel lanes on the Golden Highway remaining open. When the construction site is active, with workers in proximity to live traffic, the posted speed limit would typically be reduced to 40 kilometres per hour in both directions. When the worksite is not active the speed limit would be raised to 60 kilometres per hour. During certain phases of construction there would be the need to:

- Switch onto temporary travel lanes with reduced speed limits
- Shut one lane temporarily and provide alternate flow conditions with traffic control
- Shut both lanes and detour traffic along Range Road.

As part of construction staging, the proposal would require occasional full short-term closure of the Golden Highway for periods up to 48 hours. During closure of the Golden Highway, traffic intending to head east or west on the Golden Highway would be detoured along Range Road (refer Figure 3-3).

Access to private properties would be maintained. Temporary road closures may be required and alternate access arrangements would be put in place during construction activities. Any temporary changes to property access would be discussed and agreed with the property owner. Emergency access would be provided on all roads if required.

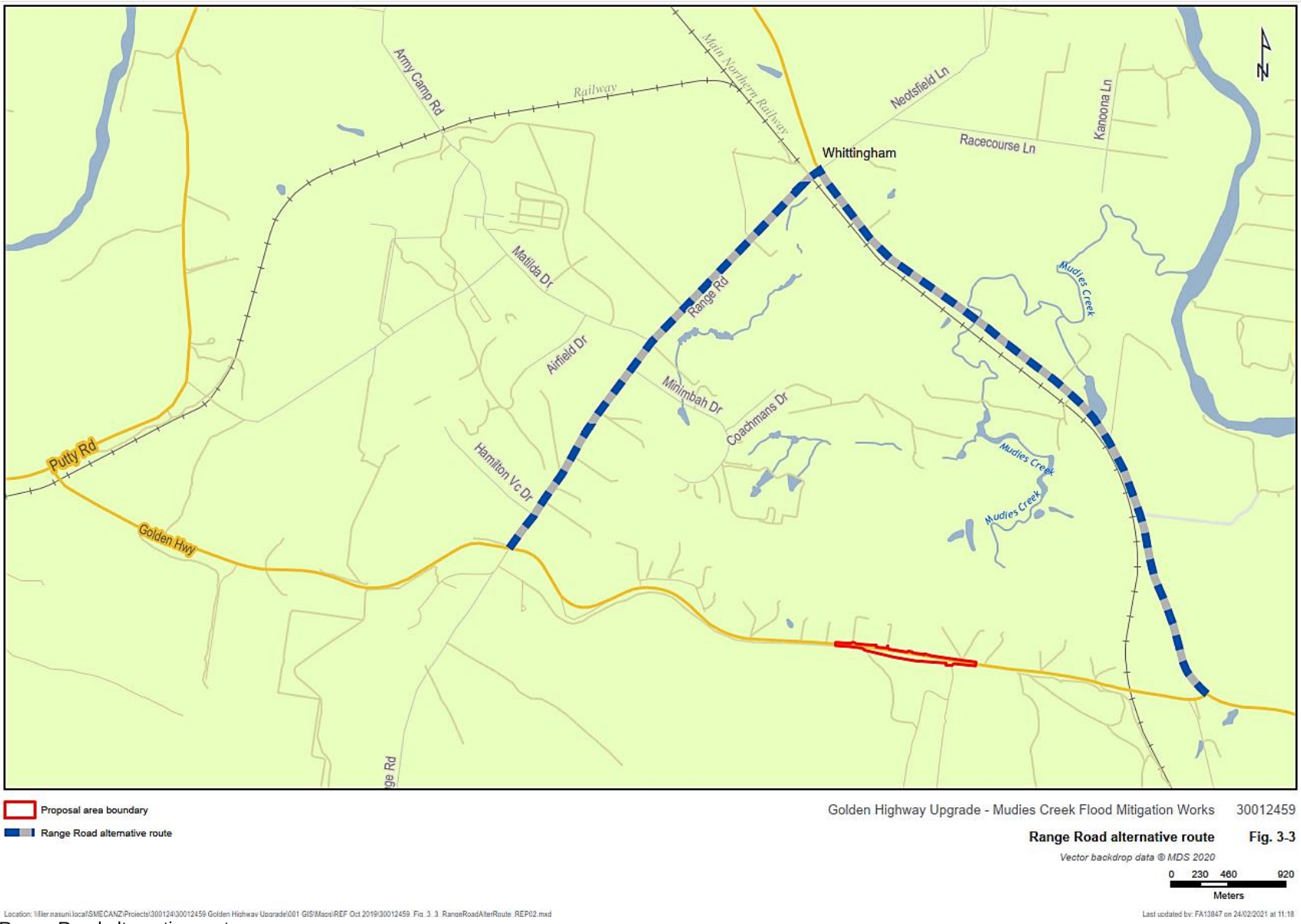

Figure 3-3: Range Road alternative route

3.3 Ancillary facilities

3.3.1 Ancillary site compounds

Ancillary site hours of operation would be dependent on construction hours so would be utilised during standard hours, outside of standard hours and at night time. There would be occasions when ancillary sites are used when the construction site is non-operational, for example to accept delivery of materials. The proposed ancillary sites (refer Figure 3-4) have been selected as they meet the following criteria:

- Within the road reserve and/or the proposal area
- Close proximity to the proposal
- Ready access to the road network
- Minimise impacts to traffic using the Golden Highway or New England Highway
- Provide sufficient area for the storage of materials
- Minimal clearing of native vegetation for the establishment and operation of facility
- Minimise noise impacts on sensitive receivers.

Ancillary site – Golden Highway Mudies Creek

Two ancillary sites would be located within the proposal area at Mudies Creek. Both ancillary sites would be on the southern side of the Golden Highway about 180 metres east and west of Mudies (refer Figure 3-4). Activities at this location would include: materials storage and stockpiling, site amenities and offices, construction vehicle parking, storage of plant and equipment.

By having the ancillary sites on the southern side of the existing highway it prevents construction vehicles needed to cross live traffic to access the site.

Ancillary sites – Belford to Golden Highway Upgrade

Up to five ancillary sites located within the Belford to Golden Highway proposal area (refer Figure 3-4) would be utilised by the proposal. Activities at these locations would include materials storage and stockpiling, site amenities and offices, construction vehicle parking, storage of plant and equipment.

3.3.2 Stockpiles

Stockpiles would be required for the duration of construction and undertaken at all ancillary facilities. Stockpile sites would temporarily store materials for construction, or materials generated from within the construction site. This could include road base constituents, asphalt millings, stripped topsoil, mulch, pre-cast concrete components and excess spoil unsuitable for use by the proposal. Stockpiling of materials would be undertaken at all the ancillary sites discussed in the previous section (refer Section 3.3.1) and are shown in Figure 3-4. In addition, it is expected that stockpiling of smaller amounts of materials would be undertaken within the work site at various locations in accordance with the proposal's erosion and sediment control plans.

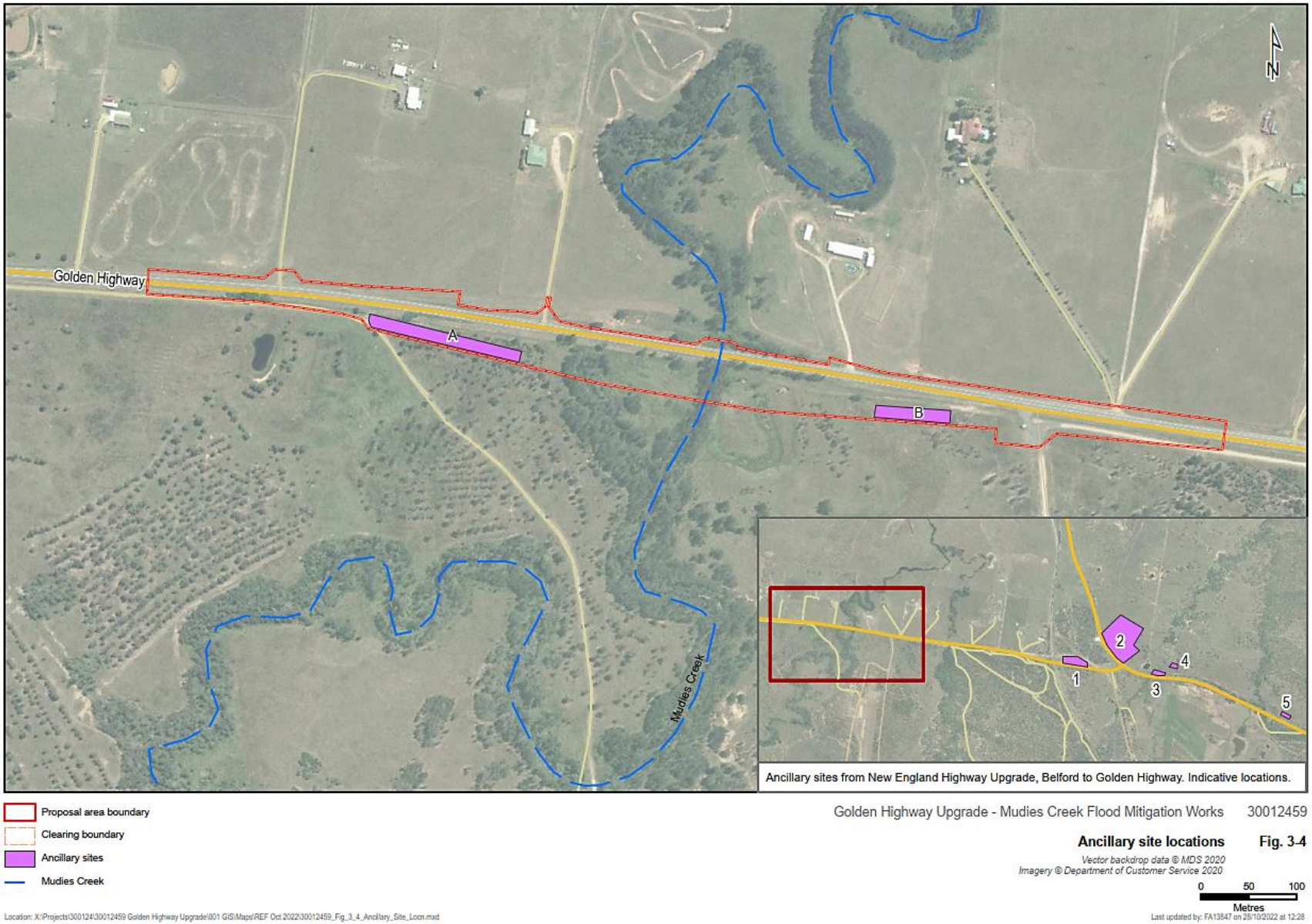

Figure 3-4: Ancillary site locations

3.4 Public utility adjustment

There are a number of utilities present in the proposal area as identified by Dial Before You Dig (DBYD) inquiry and fieldwork survey. The utilities present (refer Figure 3-5) within the proposal area are:

- Electrical – Ausgrid
- Telecommunications – Telstra
- Water – Singleton Shire Council.

Overhead wiring on Range Road on the detour route would need to be adjusted when OSOM vehicles are directed along the detour route. Any adjustments extending beyond the area assessed by the REF may require additional environmental assessment.

Consultation with the public utility authorities has been carried out as part of the development of the concept and detailed design to identify and locate existing utilities and incorporate utility authority requirements for relocations and/or adjustments. Confirmation of the relocation of utilities and associated strategies would be carried out in consultation with utility authorities during detailed design.

3.5 Property acquisition

Land ownership on either side of the highway within the proposal area comprises private property to the north and the SMA to the south, owned by the DoD. The proposed upgrade would require the acquisition of about 17,000 square metres of land within the SMA (refer Figure 3-6). The land is known as Lot 2, DP 1207737 and is zoned SP2 (Defence). Transport is consulting the DoD about this partial acquisition of land. It is likely Transport would enter into a leasing arrangement with DoD during construction of the proposal and then undertake acquisition post project completion. Acquisition would be in accordance with applicable Commonwealth legislation (*Lands Acquisition Act 1989*, *Financial Management and Accountability Act 1997*) which outlines the procedures and guidelines for the transfer of land with Australian Defence Force. It would be consistent with the requirements of the NSW *Land Acquisition (Just Terms Compensation) Act 1991* and the Land Acquisition Reform 2016. The Land Acquisition Reform 2016 was introduced with the aim of making the property acquisition process fairer, more transparent and more customer friendly.

In addition, property adjustment is required within the SMA lane to relocate the access gate and construction of a new gate house and fire-trail.

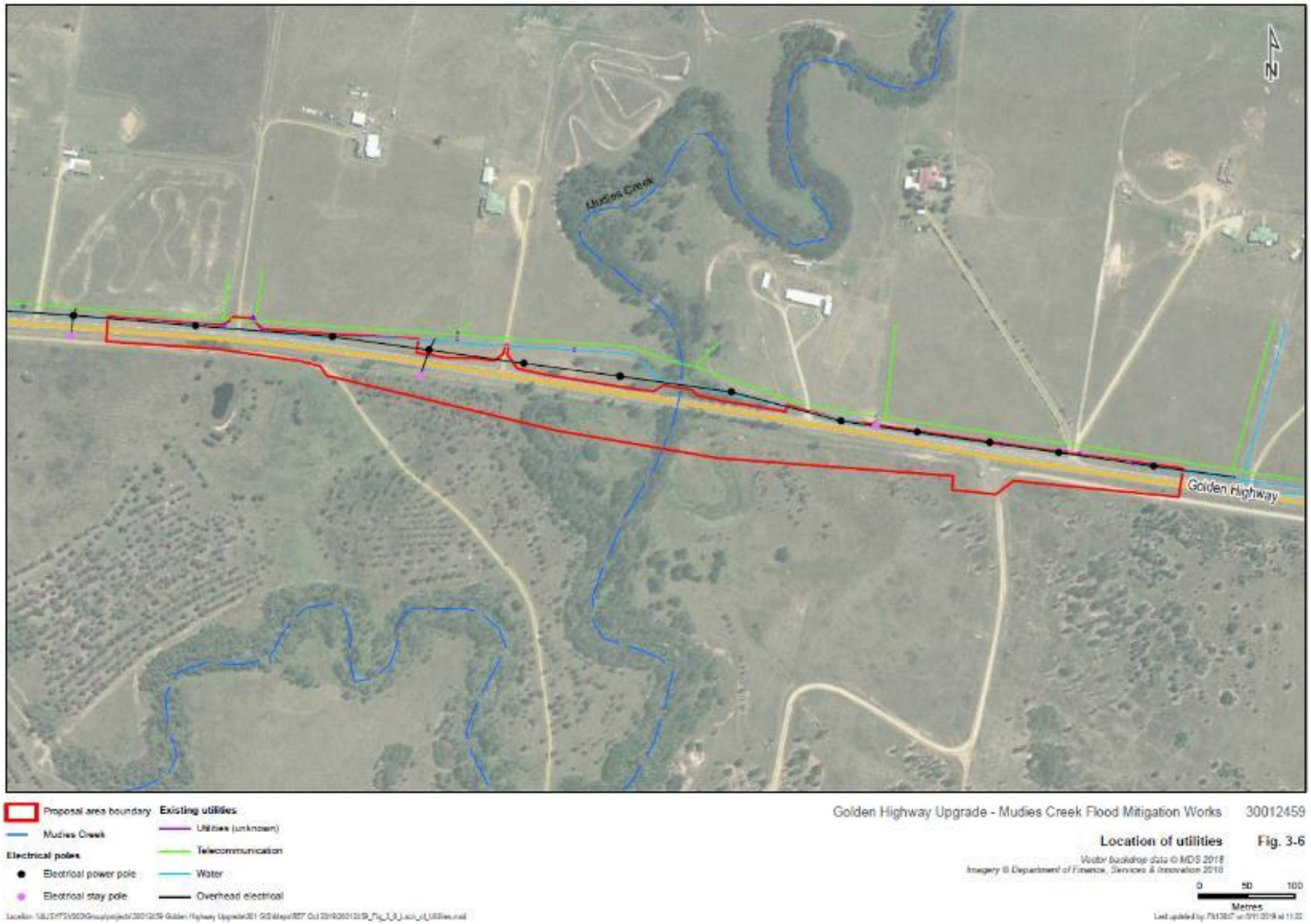

Figure 3-5: Location of utilities

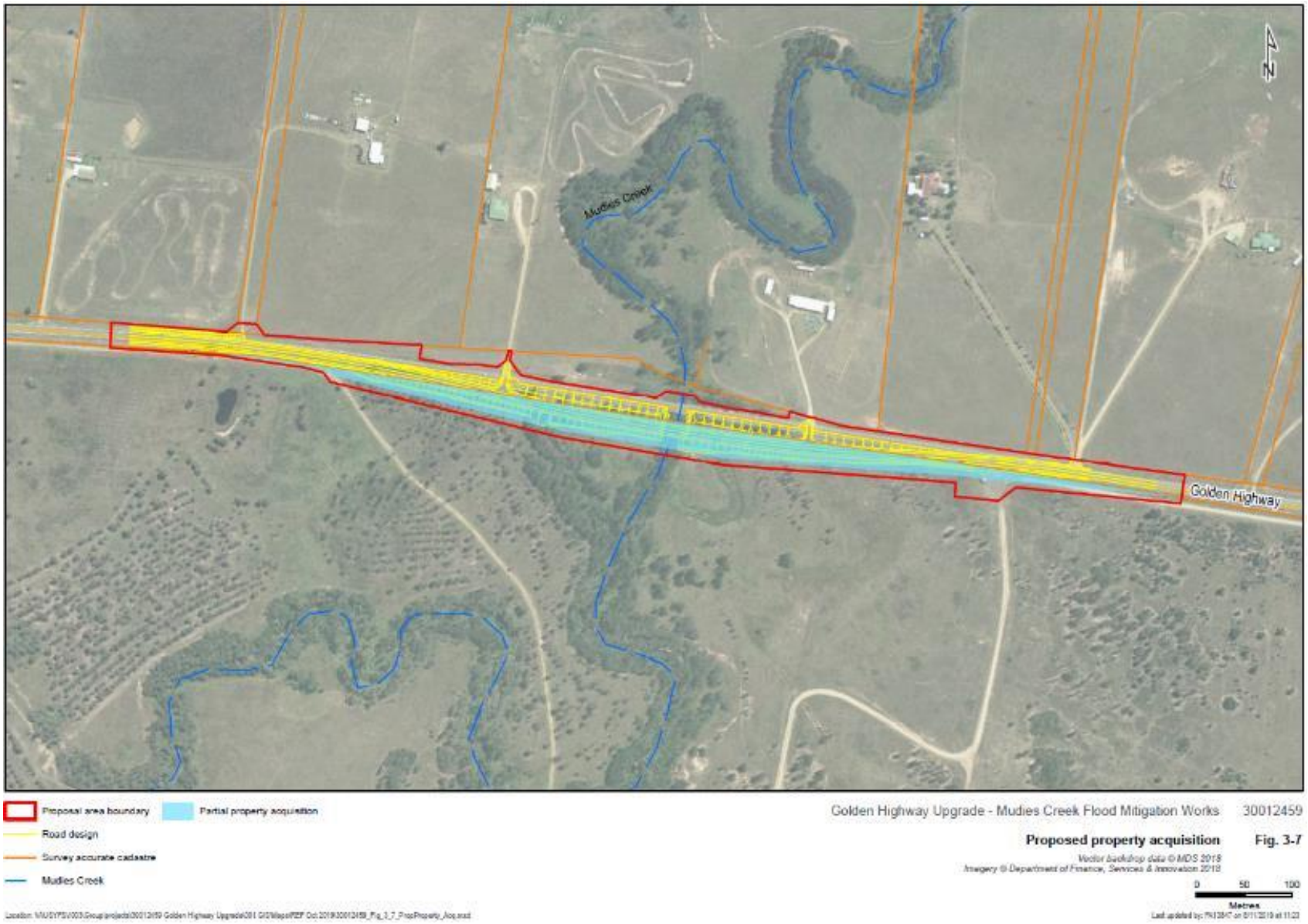

Figure 3-6: Proposed property acquisition

4. Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act), Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) and associated environmental planning instruments provide the framework for the assessment of environmental impacts and approval of development in NSW.

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

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

Clause 94 of the T&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 proposal is for a road upgrade and associated road infrastructure facilities and is to be carried out by Transport, it can be assessed under Division 5.1 of the EP&A Act. Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act), does not trigger designated development under State Environmental Planning Policy (Resilience and Hazards) 2021 and does not affect land or development regulated by State Environmental Planning Policy (Planning Systems) 2021 or State Environmental Planning Policy (Precincts – Regional).

Part 2, Division 1 of the T&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 the T&ISEPP (where applicable), is discussed in Chapter 5 of this REF.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

At the time of the initial assessment, the SEPP Policy No 44 – Koala Habitat Protection (SEPP 44) applied to some of the study area. SEPP 44 was replaced by SEPP (Koala Habitat Protection) 2019, which was repealed and replaced by SEPP (Koala Habitat Protection) 2020 (Koala SEPP 2020).

The current State Environmental Planning Policy (SEPP) addressing koala habitat protection is the Biodiversity and Conservation SEPP 2021 at Chapter 3 and Chapter 4. Chapter 3 replaces the repealed SEPP (Koala Habitat Protection) 2020, which replaced the repealed State Environmental Planning Policy (Koala Habitat Protection) 2019, which itself replaced the repealed SEPP 44 Koala Habitat Protection. Chapter 4 replaces the repealed SEPP (Koala Habitat Protection) 2021. Chapters 3 and 4 of the Biodiversity and Conservation SEPP aim to 'encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline'.

Chapter 3 applies to the RU1 zoned land to the north of the Golden Highway and Chapter 4 applies to the land south of the Golden Highway. Surveys were conducted throughout the study area to determine the occurrence of core koala habitat (such as sightings, calls, and the presence of scats and fur). With reference to 'A review of koala tree use across New South Wales' (OEH 2018), the only species commonly occurring in the study area that may be utilised by koalas is

Casuarina glauca. *Casuarina glauca* is listed as a low use species in the Central Coast Koala Management Area (KMA). The study area has therefore been assessed as unlikely to support core koala habitat. It is important to note that *Eucalyptus tereticornis* and *E. albens-moluccana* intergrade, were recorded in the Revegetation and regeneration community however these trees were uncommon, juvenile (unlikely to be utilised by koalas) and showed no signs of habitation.

On this basis, the provisions of Chapter 3 and 4 do not apply to the proposed activity and a Koala Plan of Management is not required to be prepared as part of the proposal. Further, as the proposal does not require development consent, Chapters 3 and 4 do not apply.

4.1.2 Local Environmental Plans

Singleton Local Environment Plan 2013

The Singleton Local Environment Plan 2013 (Singleton LEP) is the statutory planning document applying to all land within the Singleton LGA, modified as relevant by applicable State Environmental Planning Policies. The proposal is located within land classified as SP2 Infrastructure (Classified Road). Land to the south of the proposal is classified as Zone SP2 Infrastructure (Defence). Surrounding and to the north and west of the proposal is zoned RU1 (Primary Production). The proposal would not impact Zone SP2 Infrastructure (Defence) or RU1.

The objectives of Zone SP2 Infrastructure are to provide for infrastructure and related uses; and prevent development which is not compatible with or which may detract from the provision of infrastructure. The proposal has been identified in the Singleton LEP as being permissible with consent within Zone SP2 Infrastructure, however as noted in Section 4.1.1, consent from Singleton Shire Council is not required under the T&ISEPP.

4.2 Other relevant NSW legislation

4.2.1 National Parks and Wildlife Act 1974

The NPW Act is the primary statute for management of Aboriginal cultural heritage in New South Wales. Items of Aboriginal heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the NPW Act.

Under the Act, an Aboriginal object is defined as 'any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains'. As such, Aboriginal objects are confined to physical evidence and are commonly referred to as Aboriginal sites.

Aboriginal objects are protected under section 86 of the Act. It is an offence to harm or desecrate an Aboriginal object, either knowingly (section 86(1)) or unknowingly (section 86(2)). There are offences and penalties relating to the harm to, or desecration of, an Aboriginal object or declared Aboriginal place. Harm includes to destroy, deface, damage or move. The proposal would impact one known Aboriginal site. An Aboriginal Heritage Impact Permit (AHIP) application would be lodged for the proposal.

Aboriginal heritage is considered further in chapter 6 of the REF.

4.2.2 Protection of the Environment Operations Act 1997

The Environment Protection Authority (EPA) is the responsible agency for the administration of the *Protection of the Environment Operations Act 1997* (POEO Act) in relation to air, noise, water, pollution and waste management. Under clause 48(1), an Environment Protection Licence (EPL) is required for scheduled activities as defined by Schedule 1 of the Act. Under clause 120 of the Act, pollution of waters is an offence.

The proposal would also be classified as a scheduled activity under clause 35 (road construction) if more than 50,000 tonnes of material is required extraction. Should the proposal trigger the requirement for an EPL, the EPL would be sought prior to the commencement of work and the EPA would be a determining authority.

4.2.3 Water Management Act 2000

The *Water Management Act 2000* (WM Act) aims to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. Under section 91E(I) of the WM Act, a person who carries out a controlled activity in, on or under waterfront land, and who does not hold a controlled activity approval for said activity, is guilty of an offence. Approval from the Department of Primary Industry is required for controlled activities, however, under clause 38 of the Water Management (General) Regulation 2011 Transport, as a roads authority, is exempt from requiring approval for controlled activities associated with the proposal.

The proposal is located on land within the Water Sharing Plan for the Hunter Regulated River Water Source 2016. During construction, any water which is required would not be sourced from waterways in close proximity to the study area, and consideration would be given to other sources, such as construction sedimentation basins.

Where a proposal requires access to water from a water source which is regulated by a NSW water sharing plan, consideration needs to be given as to what, if any, approvals under the WM Act may be required. In accordance with clause 38 of the Water Management (General) Regulation

2011, Transport, as a roads authority, is exempt from requiring approval for water use for the purpose of carrying out the proposal.

Water is considered further in chapter 6 of the REF.

4.2.4 Fisheries Management Act

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. The threatened species, population and ecological communities listed in the FM Act, and that are known or are likely to occur within the area would be subject to the consideration under section 7.3 of the Biodiversity Conservation Act 2016 and in accordance with *Threatened Species Assessment Guidelines* (DECC, 2007), and if relevant, completion of an SIS.

The proposal involves works within Mudies Creek and the adjacent riparian zone. Depending on construction methodology, the proposal would likely require an approval or require notice to be given to under the FM Act, being:

- Works that involve dredging or reclamation work (section 199 of the FM Act)
- Works that would block fish passage, including temporary blockage during construction (section 219 of the FM Act).

Aquatic aspects are considered further in chapter 6 of the REF.

4.2.5 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) and its supporting regulations commenced on 25 August 2017. The BC Act sets out the environmental impact assessment framework for threatened species and ecological communities for Division 5.1 activities (amongst other types of development). Under the BC Act, if threatened species, populations, ecological communities or their habitat may be impacted by the proposal, an assessment of significance of the impact must be undertaken, in accordance with Part 7 of the BC Act and Part 5 of the EP&A Act. The BC Act also lists key threatening processes (KTPs), which are matters that threaten the survival or evolutionary development of a species, population or ecological community. A biodiversity assessment was carried out to assess the impact of the proposal on threatened flora, fauna and ecological communities (Appendix D).

Biodiversity is considered further in chapter 6 of the REF.

4.2.6 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides for the protection and conservation of NSW's environmental heritage. Under the Act, an item is defined as a place, building, work, relic, moveable object or precinct and a relic is defined as any deposit, artefact, object or material evidence which:

- Relates to the settlement of the area which comprises NSW, not being Aboriginal settlement
- Is of State or local heritage significance.

State significant items that are listed on the NSW State Heritage Register (SHR) are given protection under the Heritage Act against activities which may damage or affect its heritage significance. There are no items listed on the SHR within the proposal area.

Section 139 requires an excavation permit to disturb or excavate any land knowing or having reasonable cause to suspect the disturbance or excavation would or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed. A permit is also required to disturb or

excavate any land on which the person has discovered or exposed a relic. As there are no heritage items within the proposal area listed on either the NSW State Heritage Register or the Singleton LEP a section 139 permit is not required for the proposal.

Non-Aboriginal heritage is considered further in chapter 6 of the REF.

4.2.7 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for a coordinated approach to the removal and control of scheduled noxious weeds across NSW.

No permits or approvals are required under this Act, but it is the responsibility of Transport to provide for the removal and proper disposal of any listed weeds found within the proposal site. The proposal area falls within the boundary administered under *Hunter Regional Strategic Weed Management Plan 2017-2022* (Local Land Services Hunter, 2017). Four priority weed species listed for the Hunter were identified in the proposal area.

Noxious weeds are considered further in chapter 6 of the REF.

4.2.8 Land Acquisition (Just Terms Compensation) Act 1991

The *Land Acquisition (Just Terms Compensation) Act 1991* provides a framework for the acquisition of land by a public authority where that land is not publicly available (i.e. for sale). It establishes a process for the equitable compensation of landowners whose land is acquired and for the amount of compensation to be not less than the market value of the land (unaffected by a proposal) at the date of acquisition.

Section 21(1) of the Act provides that land is designated for acquisition by an authority of the State for a public purpose if:

> *(a) an authority of the State has, in connection with an application for development consent or building approval, given the local authority or other person dealing with the application written notice that the land has been designated by the authority of the State for future acquisition by it for a public purpose.*

The Act sets out the formal acquisition processes and procedures that must be followed in the acquisition of land for public purposes. Section 21(2) states that *"a notice given by an authority of the State constitutes notice that the land has been designated for future acquisition by that authority only if the notice states that the authority will acquire the land at some future time or that the land is affected by a proposal of that authority that requires the acquisition of the land at some future time."*

Section 21(3) provides clarification that land reserved by an EPI for use exclusively for a public purpose, such as a road, is only considered to be so if:

> *(a) the land is expressly set apart by that instrument for use exclusively for such a purpose, or*
>
> *(b) the land is expressly set apart by that instrument for use for such a purpose and also for other purposes, but those other purposes do not constitute a reasonable use of the land.*

All property acquisition would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the NSW Government Land Acquisition Reform 2016.

Property acquisition is considered further in chapter 6 of the REF.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance (MNES) or the environment of Commonwealth land. These are considered in chapter 6 and Appendix A of this REF. A referral is not required for proposed road activities that may affect nationally listed threatened species, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

As the proposal would partially cover land owned by the Commonwealth of Australia, under the EPBC Act, assessment is required for an action taken by any person on Commonwealth land that is likely to have a significant impact on the environment (section 26(1)). *Likely* is defined as a significant impact on the environment is a real or not remote chance or possibility. *Significant* is defined as an impact which is important, notable, or of consequence, having regard to its context or intensity. To determine whether the proposal would have a significant impact, a self-assessment was undertaken in accordance with the Significant impact guidelines 1.2 *Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* (Commonwealth of Australia, 2013). The EPBC Self-Assessment (Appendix E) found that the proposal is not likely to have a significant impact on relevant MNES or on Commonwealth land (SMEC 2018). Accordingly, the proposal has not been referred to the Australian Government Department of Climate Change, Energy, the Environment and Water under the EPBC Act.

Potential impacts to these biodiversity matters are also considered as part of chapter 6 of the REF, Appendix D and Appendix E.

Findings – matters of national environmental significance

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment and Energy under the EPBC Act. To determine whether the proposal would have a significant impact, a self-assessment was undertaken in accordance with the Significant impact guidelines 1.2 *Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* (Commonwealth of Australia, 2013). The EPBC self-assessment concluded that the action is not likely to have a significant impact on the environment of the Commonwealth land (Appendix E).

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

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

4.3.2 Native Title Act 1993

The *Native Title Act 1993* was passed by the Commonwealth Parliament in 1993, and laws ensuring consistency between the Commonwealth and NSW were passed by the NSW Parliament the following year on 28 November 1994. The legislation provides statutory recognition and

protection of native title, and establishes processes for claiming, mediating and determining native title, as well as for reaching agreements for compensation.

Native title is discussed further in chapter 6 of the REF.

4.3.3 Lands Acquisition Act 1989

Acquisition would be in accordance with the Commonwealth *Lands Acquisition Act 1989* (LA Act) which applies to most acquisitions and disposals of interests in land by the Commonwealth. The expression 'interests in land' is widely defined in the LA Act, and includes both freehold and leasehold interests. The LA Act specifically applies to the acquisition or disposal of an interest in land by an 'acquiring authority' (defined to mean 'the Commonwealth or a Commonwealth authority'). The acquisition or disposal of an interest in land by an acquiring authority must be authorised under the Act, either by the Finance Minister or a delegated official, unless the transaction is exempt from the operation of the LAA. Dealings in land vested in an acquiring authority are covered by Part X of the LA Act. As TfNSW intend to acquire land from the Commonwealth for construction of the proposal, Part X Dealings in Land Vested in Acquiring Authorities of the LA Act applies.

Land acquisition is discussed further in chapter 6 of the REF.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. Under clause 94 of the T&ISEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the EP&A Act. Transport is the proponent and a determining authority for the proposal. This REF fulfils Transport's obligation under section 5.5 of the EP&A Act to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

5. Consultation

This chapter discusses the consultation carried out to date for the broader *Golden Highway Corridor Strategy*, recent consultation undertaken for the proposal, and additional proposed consultation.

5.1 Consultation strategy

In December 2016, Transport prepared the *Golden Highway Program of Work, Whittingham and Mudies Creek, Community and Stakeholder Engagement Plan* (Roads and Maritime, 2016). This plan described the communication and consultation approach and activities for the proposal to keep key stakeholders and the community informed during the work. Development of the Community and Stakeholder Engagement Plan was guided by the *Community Involvement and Communications: A Resource Manual for Staff* (Roads and Maritime, 2012). All engagement work also uses the public participation practices in the International Association of Public Participation (IAP2) Public Participation Spectrum. The IAP2 spectrum provides an outline of the level of public participation and engagement for the broader corridor strategy and the proposal.

In 2018, Transport undertook additional consultation targeting the community and key stakeholders regarding the proposal. The object of the targeted consultation was to:

- Inform the community and stakeholders of the proposal and possible impacts
- Seek feedback on the proposal and issues of concern for consideration in developing the detailed design and method of construction
- Build a database of interested and concerned community members for ongoing engagement during the proposal's development.

5.2 Community involvement

5.2.1 Targeted community consultation

Transport consulted with the community during April and May 2018 on the concept designs for the Mudies Creek and Whittingham upgrades and these outcomes are contained in the *Golden Highway Upgrades Mudies Creek and Whittingham Community Consultation Report (*Roads and Maritime, 2018*)* (Appendix M). Community members were encouraged to provide their feedback and leave comments via mail, email, online feedback form or phone contact with the project team. The key consultation tools used are listed below in Table 5-1:

Table 5-1: Consultation methodology

Consultation medium	Outcome
Project update	• Delivered to 150 residents in Whittingham, Glenridding and Mount Thorley, covering the project area and the proposed detour routes. • Direct emailed to the freight network, businesses located in Mount Thorley industrial estate, emergency services, Singleton Military Base and Singleton Shire Council. A copy of the Project update is provided in Appendix M.
Media release	• A media release was distributed on Wednesday 18 April 2018 by Upper Hunter MP Michael Johnsen to local media outlets. A copy of the media release is provided in Appendix M.

Consultation medium	Outcome
Webpage	• Project webpage updated on Wednesday 18 April 2018 with the latest project information including the project update • An online feedback form was available on the webpage which provided a simple format for readers to send feedback.
Facebook	• A Facebook post inviting comment was published on the NSW Roads Facebook page on Wednesday 18 April 2018. The post linked to the webpage and encouraged readers to complete the online feedback form. A copy of the Facebook post and summary of engagement is provided in Appendix M.

Comments on the proposed upgrades closed on Wednesday 9 May 2018, with 25 submissions received about a range of issues. Some submissions included multiple comments and raised multiple issues (refer Table 5-2). The feedback received in formal submissions was generally supportive of the proposed upgrades. Key concerns or issues related to the proposed upgrades included:

- Detour arrangements and impacts
- Design of the proposed upgrades, including intersection treatments and safety barriers
- Location of overtaking lanes.

Other issues raised included:

- The need to prioritise the New England Highway and Golden Highway intersection upgrade
- That a Singleton Bypass using the Golden Highway could address flooding issues at Whittingham
- Suggestions for other road improvements along the Golden Highway.

Table 5-2: Targeted consultation submissions and responses

Issue category	*Number of submissions*	*Issues raised*	*Transport response*
Support for proposed upgrades	3	Support for the concept designs for proposed upgrades on the Golden Highway at Mudies Creek and Whittingham.	Support for the proposed upgrades has been noted.
Detour arrangements and impacts	1	Query as to whether the Mitchell Line of Road will be closed during construction.	Transport propose to close Mitchell Line Road and detour traffic via Range Road at times outside of peak hours during construction. Transport will consult further with impacted residents prior to utilising any detour.
Detour arrangements and impacts	1	Request that signs be installed telling truck drivers not to use exhaust brakes	Prior to implementing the detour Transport will review the detour, including current

Issue category	Number of submissions	Issues raised	Transport response
		along Range Road during road diversions due to increase noise for local residents.	road conditions, and implement any mitigation measures that are required. Transport will consult further with impacted residents prior to implementing any detour.
Detour arrangements and impacts	1	The new Range Road intersection with New England Highway is dangerous, unlit and the surface is breaking up. The intersection needs lighting.	Prior to implementing the detour Transport will review the detour, including current road conditions, and implement any mitigation measures that are required. Transport will consult further with impacted residents prior to implementing any detour.
Detour arrangements and impacts	1	Concerns about trucks speeding on Range Road during detour and the danger that presents for residents. Request to drop speed limit to 60km/h during the detour.	
Design of proposed upgrades	1	Clarification of proposed work specifically whether the work at Whittingham involves building dual carriageway in both directions.	The proposed upgrades at Whittingham do not provide for dual carriageway in both directions. The Golden Highway would be upgraded to provide a smoother road surface, wider road shoulders, five metre clear zones, safety barriers and overtaking lanes in both directions to improve safety and traffic flow.
Design of proposed upgrades	2	Query as to whether the plans between Whittingham and Mount Thorley provide for a dedicated westbound right turn lane into Mitchell Line Service Road.	The proposal provides for a three metre widened shoulder westbound at Mitchell Line Service Road to allow vehicles to pass by a turning vehicle.
Design of proposed upgrades	2	Query as to whether the plans between Whittingham and Mount Thorley provide for a left turning lane into Range Road.	The proposal provides for a three metre widened shoulder eastbound into Range Road to allow vehicles to pass by a turning vehicle.
Design of proposed upgrades	1	Query as to whether the planned safety barriers will be motorcycle friendly due to the area being popular for motorcycle travel.	The proposed safety barriers are standard complying barriers in accordance with relevant standards. There are no specific provisions for motorcyclists.
Overtaking lanes	1	Suggestion that the overtaking lanes should be	The proposal includes safety improvements to the

Issue category	Number of submissions	Issues raised	Transport response
		built along the hill/incline section commencing 2.3 kilometres east of Range road, for about one kilometre uphill, as this is a constant source of delays for road users heading west.	hill/incline section east of Range Road. The option of constructing a west bound overtaking lane in this area was considered; however, due to safety considerations including the existing alignment and location of property accesses in this area, this option was not adopted.
New England Highway and Golden Highway intersection	2	Request for an update on the progress of the project	Transport are also working to progress a priority project to provide two travel lanes in each direction on the New England Highway between Belford and the Golden Highway. A flyover would be built at the Golden Highway and New England Highway intersection for vehicles turning right from the Golden Highway towards Maitland and Newcastle. The NSW Government has announced $85 million under the Rebuilding NSW Plan for the upgrade to improve traffic flow, travel times and safety for motorists. Transport are now improving the design for the intersection in light of community feedback. More information is available online at rms.work/B2G.
New England Highway and Golden Highway intersection	9	Priority should be given to a flyover at the New England Highway and Golden Highway intersection to address safety and congestion issues	
New England Highway and Golden Highway intersection	1	Additional lanes should start where the Golden Highway meets the New England Highway	
Singleton Bypass	2	The Singleton bypass should utilise the Golden Highway and Putty Road to avoid the flooding at Whittingham.	A preferred option was announced in December 2016, which involves building a new section of highway west of Singleton starting near Newington Lane and rejoining

Issue category	Number of submissions	Issues raised	Transport response
			the New England Highway north of McDougalls Hill. For more information on the Singleton Bypass please visit rms.nsw.gov.au.
Singleton Bypass	1	Building the Singleton bypass would solve a lot of the road problems at Whittingham	
Suggestions for other road improvements (inside the project area)	1	Request to replace table drain from the bottom of Newthew Hill on the southbound lane due to flooding issues	This work is outside the scope of this project. However, this request has been forwarded to our Asset Maintenance team for investigation.
Suggestions for other road improvements (outside the project area)	1	Improvements are needed for the Mitchell Line of Road and Putty Road intersection. Suggestion includes providing dual lanes through to the turnoff to Broke, due to traffic congestion in the area.	The Putty Road and Mitchell Line of Road intersection has recently been upgraded. Additional upgrades in this area are outside the current scope of the Golden Highway package of work currently being delivered.

5.2.2 Golden Highway Corridor Strategy consultation

Extensive consultation was carried out by Transport during the preparation of the *Golden Highway Corridor Strategy*. The Draft Corridor Strategy was released for public comment between 30 March and 9 May 2016. As part of the consultation, briefings were held with the following stakeholders:

- Dubbo City Council
- Muswellbrook Shire Council
- Upper Hunter Shire Council
- Singleton Council
- Warrumbungle Shire Council
- Wellington Shire Council
- State Member for Barwon
- State Member for Dubbo
- State Member for Upper Hunter
- Wanaruah Local Area Land Council.

Letters which provided invitation to comment on the draft were sent to 137 Government organisations, community organisations, schools and businesses located along the Golden Highway.

The *Golden Highway Corridor Strategy Community Consultation Report* (NSW Government, 2016b) was released in October 2016. The report summarised the issues raised by the community and stakeholders in response to the public exhibition of the Golden Highway Draft Corridor Strategy. It also states how each issue has been addressed in the update to the Final Golden Highway Corridor Strategy. Four community drop-in sessions were held, attended by a total of 171 people. These were advertised using the following methods:

- Project website
- Twelve advertisements in local newspapers
- Media release: published in the Muswellbrook Chronicle and Hunter Valley News as 'Michael Johnsen announces Golden Highway Gateway Strategy funding'
- Static displays
- Letterbox drops to residents in Denman, Dunedoo and Merriwa.

A total of 58 submissions were received including two letters, four phone calls, 15 emails, 18 feedback forms and 19 online surveys.

Table 5-3 provides more information on the issues raised by the community which are relevant to this proposal. Responses where these issues are addressed in the REF are also provided.

Table 5-3: Summary of issues raised by community and stakeholders

Group	Issue raised	Response / where addressed in REF
Residents	Comment has been received about the coverage of incident response plans in the strategy. In particular, the impact on local roads of any diversions in place when an incident forces the closure of a section of the highway.	When developing Incident Response Plans, Transport consults with local Government and emergency services to minimise the impact of closures on local roads which are used as detour routes during an incident. *Section 6 describes proposed road detours and traffic management during construction.*
	Comments have been received pointing out the poor road surface conditions at locations along the corridor	Transport has investigated road surface conditions and, as part of the short-term program of work, will rehabilitate and widen about 45 km of road surface along the Golden Highway. This includes between Belford and Putty Road. *Section 3 describes proposed road safety improvement works.*
	With a large diversity of vehicle types using the Golden Highway corridor, from heavy freight vehicles to oversized farming and mining equipment, school buses and commuter vehicles, the level of service on the road could be improved by providing overtaking opportunities when these different vehicle types share the same two-lane corridor. Respondents have expressed the need to build overtaking lanes as the highest priority for the corridor strategy.	The importance of overtaking lanes on the Golden Highway has been highlighted in the final corridor strategy. This was considered along the Golden Highway between the New England Highway and Putty Road, however, did not proceed as part of the proposal scope. *Section 2.4 describes alternatives and options considered and rational for preferred option.*
Freight Industry	Comments have been received regarding the existing pavement conditions	Transport has investigated road surface conditions and, as part of the short-term program of work, will rehabilitate and widen about 45 km of road surface along the Golden Highway. This includes between Belford and Putty Road. *Section 3 describes proposed road safety improvement works.*

Group	Issue raised	Response / where addressed in REF
	Comments have been received regarding the rest areas	The corridor strategy notes a program of works for existing rest areas and new rest areas the highway. However, there are no rest areas within the proposal area or planned for the proposal are, so was not part of the proposal's scope.

5.3 Aboriginal community involvement

5.3.1 Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Aboriginal community consultation is an integral part of the assessment of Aboriginal cultural heritage significance. Consultation was carried out in accordance with the Transport *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime, 2011) (PACHCI).

Consultation to identify interested local Aboriginal parties was carried out by Transport, with the Wanaruah Local Aboriginal Land Council (LALC) and Tocomwall Pty Ltd expressing interest. Both were invited by Transport to participate in the field survey, in accordance with Stage 2 of the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI). As part of Stage 3 of the PACHCI, the consultation process involved notifying all RAPs by email of the following:

- Copy of the AHIP application submitted for approval (20 July 2020)
- Copy of the issued AHIP Permit (7 August 2020)
- Vegetation clearance and UCO clearance works schedule, including requests for applications for site officers to work on upcoming archaeological excavations (28 September 2020)
- Additional requests for site officer applications (2-11 November 2020)
- Project update regarding historic heritage finds, project delays, S140 application requirement, and a proposed AFG to discuss potential variation to the AHIP methodology (24 March 2021)
- Copy of amended AHIP methodology and invitation for an AFG meeting scheduled for 22 April 2021 to discuss and answer questions regarding the changed AHIP methodology (1 April 2021)
- Minutes of the April 2021 AFG and a copy of the presentation (29 April 2021)
- Copy of the updated CHAR (25 May 2021)
- Copy of updated AHIP permit (25 June 2021)
- Application for a variation to extend the timeframe of the issued AHIP (10 December 2021) and copy of the approved AHIP variation (28 January 2022)
- Invitation to an AFG meeting to discuss archaeological excavation results (9 August 2022), which was held on 26 August 2022
- Minutes of the August 2022 AFG, copy of the presentation, and request for comments (31 August 2022).

A summary of the Transport PACHCI stages are outlined in Table 5-4.

Table 5-4: Summary of Transport PACHCI stages

Stage	Description
Stage 1	Initial Transport assessment.
Stage 2	Further assessment, site survey.
Stage 3	Formal consultation, archaeological testing, preparation of a cultural heritage assessment report (CHAR).
Stage 4	Implement CHAR recommendations (such as salvage) in accordance with construction management sub-plans and planning approvals.

Five archaeological site surveys were carried out at the proposal area with Aboriginal stakeholders on the following dates:

- Site survey 1 – 9 August 2016, with the following representatives:
  - Tocomwall Pty Ltd
  - Wanaruah LALC
  - Transport
  - AMBS Ecology and Heritage
- Site survey 2 – 30 August 2016, with the following representatives:
  - Tocomwall Pty Ltd
  - Wanaruah LALC
  - Transport
  - AMBS Ecology and Heritage
- Site survey 3 – 27 May 2017, with the following representatives:
  - Tocomwall Pty Ltd
  - Gomeroi
  - Transport
  - AMBS Ecology and Heritage
- Site survey 4 – 19 June 2019, with the following representatives:
  - Tocomwall Pty Ltd
  - Wanaruah LALC
  - Transport
  - AMBS Ecology and Heritage
  - SMEC Australia Pty Ltd
- Site Survey 5 – 17January -15 February 2022, with the following representatives for some or all days:
  - AFT
  - AGA Services
  - Cacatua Culture Consultants
  - Culturally Aware
  - Gomery Cultural Consultant
  - HTO
  - Jarban & Mugrebea
  - Kawul/Wonn1
  - Wonn1
  - Tocomwall
  - Wallangan Cultural Services
  - Wurrumay

Information provided by the fieldwork participants during the field survey has been integrated into the PACHCI Stage 3 CHAR (Appendix H). The results of the site survey and the proposed recommendations were discussed with all representatives on the day in the field, and no objections were raised. Tocomwall representatives requested information on the potential to affect Mudies Creek.

5.3.2 Cultural heritage values assessment

Transport received advice from Aboriginal stakeholders that the Golden Highway followed the route of a song-line. In accordance with the PACHCI, Transport undertook an assessment of Aboriginal cultural heritage values for the Golden Highway between Willy Wally Road, 20 kilometres west of Merriwa, to the intersection of the Golden Highway and the New England Highway in the east.

Cultural values were sourced from interviews with Aboriginal knowledge holders as well as a desktop review of available information and compiled in a report (*Cultural Heritage Values Assessment Report April 2018)* (Appendix I). Transport conducted formal notification of the proposal through advertisements placed in the Koori Mail and Singleton Argus on Wednesday 5 April 2017 and in the Muswellbrook Chronicle on 7 April 2017. These notices informed the community of meetings to be held at the Singleton Civic Centre on Wednesday 26 April 2017 and Denman Community Technology Centre on Friday 28 April 2017 to identify people with cultural knowledge of the area and for local Aboriginal people to formally register their interest.

The cultural values expressed by the knowledge holders indicate there are strong ongoing connections to certain areas along and/or adjacent to the Golden Highway, as well as strong interests in the manner in which cultural places are managed. Knowledge holders expressed a strong on-going cultural knowledge of customary lore specific to all cultural sites (both tangible and intangible) along and/or adjacent to the Golden Highway. Based on the information provided by knowledge holders, the proposal area is not within the areas as being identified as having significant cultural values for the Aboriginal community.

5.4 T&ISEPP consultation

Singleton Shire Council has been consulted under the T&ISEPP about the proposal as per the requirements of clause 2.10(1)(b). A copy of the letter sent to Council is included in Appendix C. Appendix B contains an T&ISEPP consultation checklist that documents how the T&ISEPP consultation requirements have been considered.

No issues have been raised as a result of this consultation.

5.5 Government agency and stakeholder involvement

Various government agencies and stakeholders have been consulted about the proposal, including:

- Commonwealth Department of Defence
- NSW Department of Primary Industries – Fisheries
- Utility providers.

Issues that have been raised as a result of consultation with these agencies and stakeholders are outlined below in Table 5-5.

Table 5-5: Issues raised through stakeholder consultation.

Agency	Issue raised	Where addressed in REF
Telstra	• No issues raised	
Ausgrid	• Relocation of stay poles	• 3.5 Public utility adjustment

Agency	Issue raised	Where addressed in REF
		• 6.6 Existing environment
Singleton Shire Council	• No issues raised.	
Department of Defence	• Acquisition	• 3.5 Property acquisition • 4.2.8 Land acquisition • 6.6 Property acquisition
	• Interim Access License	• 7.3 Licences and approvals
	• Property adjustment (fencing, sentry box, fire trail access, ingress and egress for defence vehicles)	• 3.5 Property acquisition • 6.6 Property and land use
	• General environmental impacts: flora fauna, flooding, contamination PFOS/PFAS etc	• 6.7 Waste and contamination
	• Obstruction limits surface (i.e. impact to approaching aircraft)	• 6.5 Traffic and transport

5.6 Ongoing or future consultation

The *Golden Highway Program of Work, Whittingham and Mudies Creek, Community and Stakeholder Engagement Plan* (Roads and Maritime, 2018) identifies a number of activities to be carried out as part of the community engagement for concept design and REF. Outcomes from this engagement phase were then reported back to the local community and stakeholders. This was done via a project notification, targeted letters and targeted emails. After determination of the REF, community engagement would be required for activities in the next phases of the proposal, including:

- Early construction work
- Award of the construction tender
- Start construction
- Construction of the project
- Completion and opening to traffic.

The engagement techniques would include:

- Notifications and traffic alerts for early work
- Media release for the award of the construction tender
- Media release for start of construction, notifications, webpage updates, Variable Message Signs
- Traffic alerts, notifications, doorknocking, webpage updates and VMS during construction
- Media release, webpage updates, traffic alerts and notifications for completion of the construction and opening to traffic.

Other consultation activities that would be carried out include the following:

- Consultation with key stakeholders to help in managing impacts during construction

- Follow-up meetings to discuss access arrangements with directly affected landholders
- On-going meetings with Singleton Council, utility providers, nearby landowners and community
- Ongoing updates of the project website as required
- Ongoing consultation activities would be conducted in accordance with the Golden Highway Program of Work, Whittingham and Mudies Creek, Community and Stakeholder Engagement Plan.

6. Environmental assessment

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

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the *Guidelines for Division 5.1 assessments* (Department of Planning and Environment, 2022) as required under clause 171(1) of the Environmental Planning and Assessment Regulation 2021 and the Roads and Related Facilities EIS Guideline (DUAP 1996). The factors specified in clause 171(2) of the Environmental Planning and Assessment Regulation 2021 are also considered in Appendix A.

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

6.1 Aboriginal heritage

6.1.1 Methodology

The Transport *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime, 2011) (PACHCI) defines a four-stage process for investigating potential impacts to Aboriginal cultural heritage as a result of Transport activities. These Transport activities include road planning, development, construction and maintenance. The PACHCI includes a process for community consultation to ensure that the role, function, view and beliefs of Aboriginal people are considered and respected in the assessment process. The PACHCI process has been followed in the assessment of the proposal's potential impacts to Aboriginal culture and heritage.

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) database were undertaken on 1 May 2019 (AHIMS Client Service IDs 417764 and 417769), which identified a total of 128 previously recorded Aboriginal sites within areas study area. Due to the number of previously recorded sites in the local area, two searches were necessary to adequately investigate around the study area. A search of the DoD Garrison Estate Management System (GEMS) database was conducted on 5 June 2019, for records of Aboriginal sites within the SMA. DoD advised that no Aboriginal heritage results were found within the SMA on the database, and that the current study area had not been subject to any previous heritage survey by DoD.

Aboriginal community consultation is an integral part of the assessment of Aboriginal cultural heritage significance. Stage 2 of the Transport PACHCI must be carried out where there is potential for Aboriginal heritage objects to be impacted by proposed work, and requires initial engagement with key Aboriginal community stakeholders, an archaeological survey of the proposal area, and preparation of an archaeological survey report. PACHCI Stage 2 assessment methodology consisted of:

- Consultation with the local Aboriginal community
- Search and review of the OEH Aboriginal Heritage Information Management System (AHIMS) database to determine the location and nature of any Aboriginal heritage sites recorded within, or in the vicinity of, the proposal area
- Review of relevant previous archaeological reports specific to the area, to determine the extent of past Aboriginal archaeological research in the region
- Review of relevant contextual environmental information and previous land use history
- Field survey with local Aboriginal community representatives, to allow identification and assessment of Aboriginal heritage values present in the proposal area
- Preparation of an archaeological survey report describing the results of the background research, the extent and significance of heritage items recorded in the proposal area, and management recommendations and mitigation measures for any Aboriginal heritage resources, including constraints and opportunities.

Representatives from Wanaruah Local Aboriginal Land Council (Wanaruah LALC) and the then Native Title claimants, Tocomwall Pty Ltd, were invited to attend and participate in the Stage 2 PACHCI site walkover which occurred on 19 June 2019. All participants of the walkover were provided with an opportunity to submit reports in accordance with PACHCI Stage 2. The survey included the entire extent of the proposal, including the current road and bridge over Mudies Creek. The fieldwork methodology, archaeological context and results of previous investigations in the study area and surrounds were discussed with the Aboriginal stakeholder representatives during fieldwork, and aerial photographs and plans of the proposed work were made available to guide the survey.

Photographs during the survey were taken and handheld GPS units carried by different survey participants to log the survey area. The pedestrian survey inspected the entirety of the study area. A distance of 5-10m was generally maintained between individual survey participants depending on the space available within the road easement, the topography, and the density of vegetation coverage, and the entire survey team ranged no more than 60 metres apart overall during survey. Where Aboriginal objects were encountered, notes were made about their type, size, and material; and descriptions of the site were recorded including the environmental setting and details of any disturbance to archaeological material in the site's vicinity.

The cultural significance of the proposal area was assessed using both primary and secondary sources, including consultation with Aboriginal cultural knowledge holders who were identified as having specific knowledge about objects, places or cultural features. The knowledge holders did not identify any specific cultural values within the study area, however it is recognised that the project sits within a broader cultural landscape that holds significance. Aboriginal stakeholders advised Transport that the Golden Highway followed the route of a song-line. Song-line pathways link spiritual and ceremonial sites, as well as travel corridors throughout the landscape between the coast and higher ground. In accordance with the PACHCI, Transport conducted an assessment of Aboriginal cultural heritage values for the Golden Highway between Willy Wally Road, 20 kilometres west of Merriwa, to the intersection of the Golden Highway and the New England Highway in the east. Information was sourced from interviews with Aboriginal knowledge holders as well as a desktop review of available information and compiled in the Cultural Heritage Assessment Report (Appendix I).

An Aboriginal Heritage Impact Permit (AHIP) was obtained in July 2020 as part of the anomaly investigations and potential unexploded ordnance (UXO) clearance activity, given the past use of the site by Defence. During the investigations, items of Aboriginal heritage may be identified. Due to the risks involved, no RAPs were able to be on-site for the investigations. Potential items found during the investigations were collected and inspected by specialist personnel. No items of Aboriginal heritage were identified as part of the UXO investigation activity (Appendix K).

Stage 3 of PACHCI involved formal Aboriginal community consultation, archaeological testing and the preparation of an updated CHAR (Appendix H). Previous archaeological surveys and archaeological test excavations (Kelleher and Nightingale 2017, 2018), as well as the Aboriginal Archaeological Excavation Report (Appendix H) were used to inform the CHAR. Archaeological test excavations were undertaken from 17 January 2022 to 15 February 2022 in conjunction with RAP representatives. A total of 106 50cm x 50cm test pits were archaeologically excavated over 19 days across the project area (Figure 6-1, Figure 6-2 and Figure 6-3).

Figure 6-1: Excavated test pit locations east of Mudies Creek

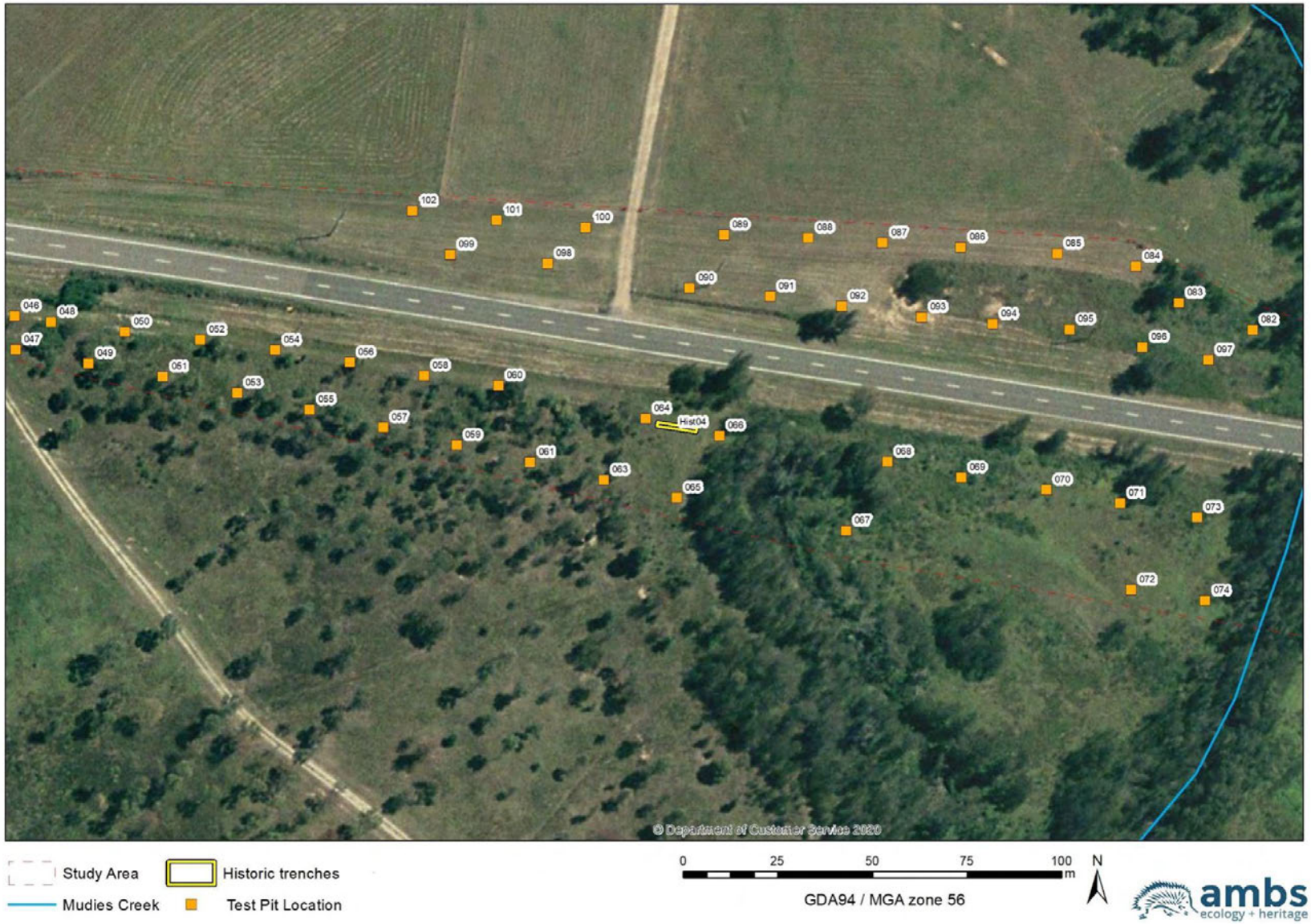

Figure 6-2: Excavated test pit locations west of Mudies Creek

Figure 6-3: Excavated test pit locations on the river terrace landform west of Mudies Creek

6.1.2 Existing environment

Lands north of the study area, on the northern side of the Golden Highway, are currently rural properties, and have been extensively disturbed by past land clearing and ongoing agricultural activities. These lands as well as lands within the road reserve have been significantly disturbed by the building of the Golden Highway, and by installation of culverts under Mudies Creek. To the south within the SMA is an unsealed access track at the eastern and western ends of the study area which crosses Mudies Creek. Vegetation within the study area is regrowth, and any trees of an age or size with potential to have been culturally modified (scarred or carved) are likely to have been removed by past land clearing for agriculture, and by road and track construction. The surrounding lands are primarily rural, currently used as grazing pasture, and have been largely cleared of native vegetation.

The study area has previously been cleared, what trees were present are predominantly regrowth, and no trees of an age suitable to bear evidence of Aboriginal cultural scarring were observed within the study area. No rock exposures with evidence of Aboriginal art or grinding grooves were observed in the study area. The study area has been subject to varying levels of ground disturbance arising from land clearing, vehicle access, establishment of unsealed access tracks within DoD lands, excavation of drains and flood control measures, and the construction of the Golden Highway and current bridge over Mudies Creek. The existing archaeological record is limited to certain materials and objects that are able to withstand degradation and decay. The most common type of Aboriginal objects remaining in the archaeological record are stone artefacts. Generally, Aboriginal artefacts are likely to be present in association with the following landscape features:

- Within 200 metres of waterways
- Within a sand dune system
- On a ridge top, ridge line or headland
- Within 200 metres below or above a cliff face
- Within 20 metres of, or in a cave, rock shelter or a cave mouth.

(Note: only low ridges and a waterway (Mudies Creek) are present within the study area.)

The entirety of the ground surface in the study area has been disturbed, from initial land clearing and subsequent natural erosion processes, establishment of unsealed vehicle access tracks, and natural processes associated with Mudies Creek, which are likely to have included periodic flooding and scouring, and movement of the creek alignment over time. For the purposes of assessing the archaeological potential of the study area, the level of disturbance across the study area was estimated during the survey. Four categories have been assigned to distinguish levels of disturbance summarising the associated impacts of past land use practices for each category (refer Figure 6-4, Figure 6-5 and Appendix H). Areas which have been impacted by land clearance and establishment of unsealed access tracks are considered to have a moderate level of disturbance. The remainder of the study area, associated with Mudies Creek and immediate surrounds is considered to have moderate/high levels of disturbance, as portions of that area are likely to have experienced scouring through high-energy flood events and movement of the creek line over time. Due to dense vegetation surrounding the creek line it was not possible to accurately identify these areas during survey.

One Aboriginal heritage site, Mudies Creek Artefact 01 (AHIMS Site 37-6-3835), was identified during a previous archaeological survey of the area in 2017 and was inspected during the current survey. The site is located on an elevated terrace landform west of Mudies Creek, within Survey Unit 08, and includes a potential archaeological deposit (PAD) associated with the terrace landform (see Section 6.1.2 and 6.2.1). An area of PAD identified as Mudies Creek Potential Archaeological

Deposit 1 (PAD 1) associated with Mudies Creek has also been recorded, based on proximity to water, landforms and observed levels of disturbance (Appendix H). The majority of the study area was obscured by vegetation away from established tracks, and consequently had varied levels of ground surface visibility.

An additional heritage site, Mudies Creek Artefact 02 was identified within the project area during archaeological excavations in February 2022. The site comprises a surface scatter of Aboriginal stone artefacts. The site is located on the sloping edge of a river terrace landform on an unsealed and eroded Defence access track located to the west of site 37-6-3966 PAD associated with Mudies Creek. It is uncertain if these indicate a sub-surface deposit or if they had been transported from higher on the river terrace.

Between 17 January 2022 and 15 February 2022, a total of 106 archaeological test pits were dug and investigated, finding 57 stone artefacts from the 32 test pits. Some test pits showed evidence of previous disturbance. Separately, eight stone artefacts were located at the historic archaeological test excavation in the eastern portion of the project area.

Taking into account the findings of the archaeological test excavations, a new assessment has been made of the potential extent of Aboriginal heritage sites and archaeological deposits within the project area (refer Figure 6-6). The Aboriginal Archaeological Excavation Report prepared in 2022 states that “The project area is considered to be of moderate cultural significance to the local Aboriginal community due to its association with the cultural landscape around the Golden Highway, and the presence of Mudies Creek, and potentially also the evidence of post contact use of the site by Aboriginal People. However, this social significance would been to be finalised following completion of Aboriginal community consultation process.”

Registered Aboriginal Parties (RAPs) confirmed that Aboriginal heritage sites in the study area are of significance to the local Aboriginal community, and that the area holds general significance as part of the wider cultural landscape. However, none of the knowledge holders identified any specific cultural values within the study area. Based on information gathered by the Cultural Heritage Values Assessment, and on input provided from RAPs the study area is considered to be of moderate cultural significance to the local Aboriginal community due to its association with the cultural landscape around the Golden Highway, and the presence of Mudies Creek.

Doughboy Hollow is about five kilometres north west of the proposal. Doughboy Hollow has been identified by Aboriginal cultural knowledge holders as an important resource area that was associated with significant pathways, supported access to nearby significant cultural sites and formed a hub for people to move across the landscape (Water, May 2019 (draft)).

The following National Native Title Tribunal registers were searched: Native Title Claims, Native Title Register and Applications, Registration Decisions and Determinations Register were all searched on 2 February 2021, and again on 7 October 2022. No native title claims or native title cover the proposal area.

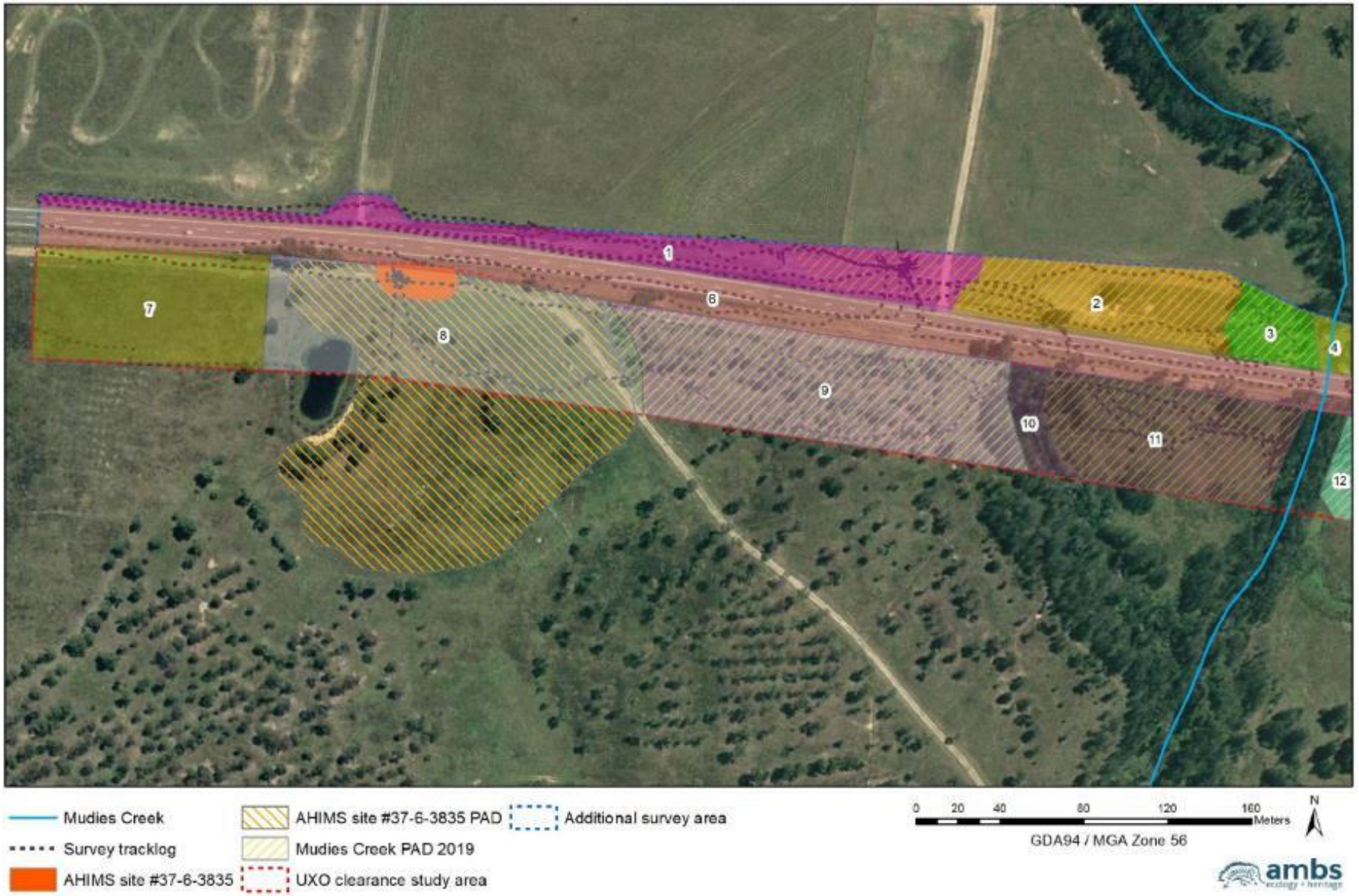

Figure 6-4: Survey units west of Mudies Creek

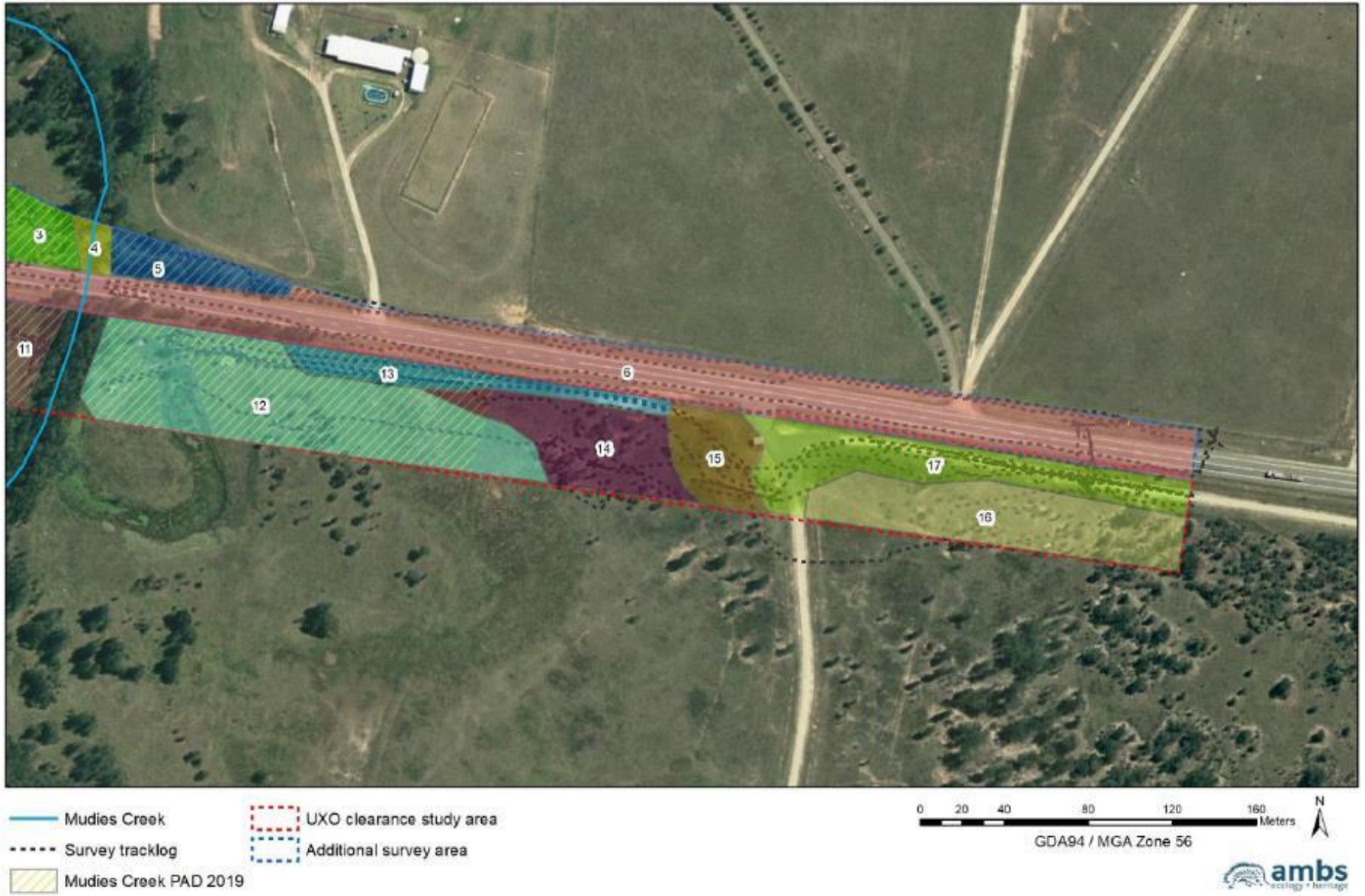

Figure 6-5: Survey units east of Mudies Creek

Figure 6-6 Reassessed Aboriginal Heritage surface sites and archaeological deposit extents

6.1.3 Potential impacts

Construction

Avoidance and minimisation of harm to Aboriginal objects during the design stage is the best and most important management strategy. The artefact site and the surrounding secondary potential archaeological deposit (PAD) as well as the PAD around Mudies Creek would be impacted by the proposal (refer Table 6-1). The scientific value of archaeological sites is linked to the physical information the sites contain. The proposal would result in a loss of scientific value to the identified sites within the proposal boundary. However, the test excavations showed that the bulk of the archaeological resource likely exists to the north of the proposal boundary. Therefore, a pre-construction salvage program would help increase the understanding of the potential resource, strengthen interpretations and improve ongoing and future management of Aboriginal heritage in the surrounding area.

The proposed development will directly impact AHIMS sites 37-6-3835, 37-6-3966, and surface scatter Mudies Creek Artefact 02, and ground levelling and surface preparation for road and bridge construction will remove any Aboriginal heritage objects and subsurface archaeological deposits in its footprint. The level of archaeological assessment undertaken, and the results of the background analysis, are such that it is unlikely that further archaeological assessment of those parts of the project area will increase the current scientific understanding of the region, and no further archaeological test excavation or salvage excavation is warranted at those sites within the project area.

Despite the testing program being unable to confirm or disprove the connection between Aboriginal stone artefacts and the historic hut site due to the level of investigation permitted under the testing approvals, further archaeological excavation at that site is not recommended. It is unlikely that a relatively low-impact testing program would be able to answer this question, and only intrusive archaeological excavation which would severely impact or destroy the site could comprehensively resolve the question. Further destructive archaeological investigations at the site are not recommended, and conservation of the historic site through in situ retention is preferred.

Suitable recommendations for the identified impacts to the sites have been developed based on the environmental context and condition, background research, and consultation with stakeholders. An AHIP is required for impacts to the identified sites/objects prior to the commencement of pre-construction or construction activities associated with the proposal. Management strategies for mitigating harm to the sites are listed below in Section 6.1.4.

Table 6-1: Degree of impact to Aboriginal archaeological sites

Site name	Proposed Impacts	AHIMS ID	Type of Harm	Degree of Harm	Consequence of Harm
Mudies Creek Artefact 01	New road alignment construction	37-6-3835	Direct	Total. Earthworks and construction new road alignment have potential to impact and remove all Aboriginal heritage objects and subsurface archaeological deposits.	Total loss of value
Mudies Creek Artefact 1 (formerly PAD)	New road alignment construction	37-6-3966	Direct	Total. Earthworks and construction new road alignment have potential to impact and remove all Aboriginal heritage objects	Total loss of value

Site name	Proposed Impacts	AHIMS ID	Type of Harm	Degree of Harm	Consequence of Harm
				and subsurface archaeological deposits.	
	New bridge construction and removal of existing bridge	37-6-3966	Direct	Total. Earthworks, construction, and removal of the current bridge have potential to impact and remove all Aboriginal heritage objects and subsurface archaeological deposits.	Total loss of value
	Relocation of Dochra entry gate	37-6-3966	Direct	Partial. Earthworks for gate approaches and installation of gate posts have potential to impact Aboriginal heritage objects and subsurface archaeological deposits within the impact footprint.	Partial loss of value
	Relocation of entry gate and new Sentry Box structure	37-6-3966	Direct	Partial. Minor construction for installation of concrete pad Earthworks for gate approaches and installation of gate posts have potential to impact Aboriginal heritage objects and subsurface archaeological deposits within the impact footprint.	Partial loss of value
	Establishment of a new fire trail on the eastern side of Mudies Creek	37-6-3966	Direct	Partial. Levelling has potential to impact Aboriginal heritage objects and subsurface archaeological deposits within the impact footprint. Where the trail is built up, deliberate compaction is not intended but adding material to the site may cause compaction to subsurface archaeological deposits.	Partial loss of value
	Installation of temporary and permanent fencing	37-6-3966	Direct	Partial. Excavation for fence posts will have a direct impact on Aboriginal heritage objects and subsurface archaeological deposits within a small footprint.	Partial loss of value

Site name	Proposed Impacts	AHIMS ID	Type of Harm	Degree of Harm	Consequence of Harm
	Deposition of soils for drainage	37-6-3966	Direct	Partial. Deposition of soils to create positive drainage has potential to cause compaction to subsurface archaeological deposits.	Partial loss of value
	Ancillary site Establishment	37-6-3966	Direct	Total. Temporary ancillary site works have potential to impact any surface and additional subsurface Aboriginal heritage items.	Total loss of value
Mudies Creek Artefact 02 artefact scatter	New road alignment construction	N/A	Direct	Total. Earthworks and construction of new road alignment have potential to impact and remove all Aboriginal heritage objects and subsurface archaeological deposits.	Total loss of value
	Establishment of a new fire trail on the eastern side of Mudies Creek	N/A	Direct	Partial. Levelling has potential to impact Aboriginal heritage objects and subsurface archaeological deposits within the impact footprint. Where the trail is built up, compaction has potential to impact subsurface archaeological deposits.	Partial loss of value
Historic Hut Site	Establishment of a new fire trail on the eastern side of Mudies Creek	N/A	Direct	Partial. The fire trail has been realigned to avoid the hut site, and will be built up where it is near to the site. Compaction has potential to impact subsurface archaeological deposits.	Partial loss of value

Operation

Operation of the proposal is not expected to have any impact on Aboriginal heritage.

6.1.4 Safeguards and management measures

The recommended safeguards and mitigation measures to minimise the impacts of the proposal on Aboriginal heritage are listed in Table 6-2.

Table 6-2: Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Aboriginal heritage	TfNSW would apply to OEH for an AHIP to cover the area impacted by construction of the proposal.	TfNSW	Pre-construction	CHAR, Chapter 9, Recommendation.1
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, 2011) and *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) 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	Pre-construction Construction	Section 4.9 of QA *G36 Environment Protection*
Aboriginal heritage	To mitigate impacts to artefacts at the Mudies Creek Artefact Site 02 surface scatter, the collection and relocation of surface Aboriginal artefacts to a location outside of the proposal impact area should be included as a condition of the AHIP, to be undertaken by representatives of the project RAPs and a suitably qualified archaeologist specialising in Aboriginal heritage. Following the relocation, to submit the updated location to AHIMS using the Aboriginal Site Impact Recording Form. Where additional, previously unidentified artefacts are found during these works, they should be recorded in accordance with AHIMS guidelines, and that information appended to the appropriate site card.	TfNSW	Pre-construction	ACHAR August 2022 Recommendation 7
Aboriginal heritage	The Transport for NSW Unexpected Heritage Items	Contractor	Construction	Section 4.9 of QA *G36*

Impact	Environmental safeguards	Resp.	Timing	Reference
	Procedure July 2022 will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport 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.			*Environment Protection*
Aboriginal heritage	Delivery of cultural awareness training for the delivery team prior to the Golden Highway program of works	Contractor	Pre-construction Construction	S.10 Conclusions and Recommendations *Cultural Heritage Values Assessment Report*
Aboriginal Heritage	TfNSW should provide a copy of this report (ACHAR) and the Draft Historical Test Excavation Report V6.pdf to the Department of Defence, Wanaruah LALC and Singleton local studies library (redacted for Aboriginal site information as appropriate).	TfNSW	Pre-construction; Construction	ACHAR August 2022

6.2 Biodiversity

6.2.1 Methodology

A biodiversity assessment was prepared by SMEC (*Golden Highway Upgrade – Mudies Creek Flood Mitigation Works Biodiversity Assessment Report* (Biodiversity Assessment) (SMEC 2022) to assess the potential impact of the proposal on threatened flora and fauna (terrestrial and aquatic) and ecological communities and to meet the requirements of the EP&A Act. An additional microbat assessment (Microbat Assessment) (SMEC 2021a) was undertaken after the discovery of microbats in the Dochra Gate sentry box. The Biodiversity Assessment and Microbat Assessment findings are provided in Appendix D and summarised below.

As Transport intends to acquire land from the Australian Government for construction of the proposal, approval is required for an action taken by any person on Commonwealth land that is likely to have a significant impact on the environment (Section 26(1)). An EPBC Act self-assessment assessment (*Golden Highway Upgrade, EPBC Act Self-Assessment Commonwealth Land*) (SMEC 2021b) was prepared and summarised below. For the purposes of the biodiversity assessment, the study area includes the construction footprint and clearing boundary (refer Figure 6-7).

Literature review and database assessment

Previous studies, reports and documentation relevant to the proposed Golden Highway upgrade were reviewed to provide information useful for informing the biodiversity assessment. This included a review of the preliminary environmental investigation, *Ten Sections of the Golden Highway between Whittingham and 7 km west of Merriwa: Preliminary Environmental Investigation – Biodiversity and Heritage* (Advitech, 2016*)* (PEI) to determine the presence of potential biodiversity constraints relevant to the proposal.

The review covered relevant curated flora and fauna, scientific literature, databases, aerial photography and GIS mapping. Database searches were completed to determine what, if any, threatened species or communities may be present within a 10 kilometre buffer around the proposal area (refer Table 6-3 and Appendix D).

Table 6-3: Database searches

Database	Date Accessed	Search Area
BioNet Atlas	• 25 August 2016 • Updated 11 September 2018, • Updated 05 November 2019 • Updated 28 September 2020 • Updated 03 March 2021 • Updated 29 September 2022	10 kilometre x 10 kilometre area centred on the study area
Protected Matters Search Tool	• 25 August 2016 • Updated 13 September 2018 • Updated 05 November 2019 • Updated 28 September 2020 • Updated 29 September 2022	10 kilometre point buffer search
Atlas of Groundwater Dependent Ecosystems (GDE)	• 25 August 2016 • Updated 5 July 2017	Study area

Database	Date Accessed	Search Area
	• Updated 24 April 2018 • Updated 11 September 2018 • Updated 28 September 2020 • Updated 7 October 2022	
Fisheries Spatial Data Portal	• Updated 5 July 2017 • Updated 24 April 2018 • Updated 11 September 2018 • Updated 28 September 2020 • Updated 7 October 2022	Singleton LGA
NSW Critical Habitat Register	• 11 September 2018 • Updated 28 September 2020 • Updated 7 October 2022	No search area required
NSW Department of Primary Industries (DPI) database for aquatic TECs	• 25 August 2016 • Updated 16 June 2017 • Updated 11 September 2018 • Updated 03 March 2021	Study area
Coastal Wetlands SEPP Resilience and Hazards SEPP (Chapter 2 – Coastal Management)	• 10 September 2018 • Updated 28 September 2020 • Updated 7 October 2022	Study area
Directory of Important Wetlands	• 25 August 2016 • Updated 11 September 2018 • Updated 22 February 2021 • Updated 7 October 2022	
OEH preliminary determinations	• 12 July 2017 • Updated 11 September 2018 • Updated 06 November 2019 • Updated 28 September 2020	No search area required

Vegetation mapping

The following vegetation mapping methodologies were reviewed before field assessments were conducted:

- Vegetation Mapping of the Singleton Military Area (SKM, 2012)
- Greater Hunter Native Vegetation Geodatabase Guide (Siversten *et al.*, 2011)
- The Vegetation of the Central Hunter Valley, New South Wales (Peake, 2006).

A review of the NSW Plant Community Types with potential to occur within the locality was also conducted. An assessment of the available habitat for each threatened species, population or community identified in the database searches was completed based on the vegetation mapping (Appendix D). A habitat assessment considered the likelihood of each species occurring in the

study area based on recent records, known distribution and the availability and quality of suitable habitat.

The State Vegetation Type Map (SVTM) Edition C1.1.M1 (DPE 2022d) was released in 2022 and contains a regional-scale map of NSW Plant Community Types (PCTs), including the revised classifications for eastern NSW PCTs. A conversion of the revised PCTs is provided in Table 6-6.

Habitat assessment

An assessment of the available habitat for each threatened species, population or community identified in the database searches was completed based on the vegetation mapping recorded in the databases and then updated after the first site visit (Appendix D). Likelihood of occurrences were based on the criteria provided in Appendix D. The habitat assessment considered the likelihood of each species occurring in the study area based on recent records, known distribution, personal knowledge and the availability and quality of suitable habitat.

Field survey

Areas of native vegetation surveyed were delineated using a handheld Global Positioning System (GPS) unit, aerial photograph interpretation and field notes. These areas were then stratified into likely Plant Community Types (PCTs), and condition class in accordance with Section 5 of the Biodiversity Assessment Methodology (BAM) (Appendix D). Once the likely PCTs were identified, 20 metre x 20 metre full floristic plots and plot and transect surveys were conducted to verify the PCTs and collect site value data.

Field surveys of the study area were carried out over the following periods:

- 30 August to 2 September 2016 (two days and three nights)
- 10 March 2017 (aquatic)
- 27 to 29 June 2017 (three days)
- 21 August 2017
- 13 April 2018 to 16 April 2018 (two days and three nights).
- 14 August 2018 (one day)
- 30 March 2021 (dusk)
- 14 to 17 September 2021 (three nights).

The type of surveys carried out were:

- Rapid assessments in areas of unmapped vegetation
- Plot surveys in accordance with BAM
- Targeted threatened species (flora) searches
- Diurnal bird surveys
- Ultrasonic bat recording
- Opportunistic fauna observations
- Culvert inspection (visual)
- Spotlighting.

The conservation significance of flora and fauna species and vegetation communities was determined according to BC Act for significance within NSW and EPBC Act for significance within Australia.

An aquatic assessment (écologique 2019) of Mudies Creek was undertaken and included:

- Visual inspection of the study area to confirm and describe the waterway classification and habitat values (in line with NSW Fisheries Habitat Protection Policy, 2013 updated)

- Assessment of riparian and instream habitat habitats (stability of bank habitats, vegetation composition and structure, stream bed characteristics)
- Measurement of physico-chemical water quality parameters (including alkalinity)
- Aquatic biota survey comprising electro-fishing to assess fin fish composition and sweep netting for macroinvertebrates (using AUSRIVAS protocols) at four sites within the study area.

Figure 6-7: Study area and clearing boundary

6.2.2 Existing environment

Mudies Creek flows in a northerly direction before its confluence with the Hunter River about 3.4 kilometres north of the study area. The majority of native vegetation within the wider locality has been previously cleared for agricultural purposes and hence the current vegetation consists mainly of regrowth of varying age classes, and simplified levels of structural and floristic complexity. The area of vegetation within the study area runs in an east-west direction on both sides of the existing Golden Highway and includes remnant dry sclerophyll forest, riparian forest and wetlands. Within this native vegetation and the cleared and disturbed areas, a large number of weeds and exotic species have become established. The existing roadside vegetation has been modified through previous land clearing activities and continuing weed poisoning, slashing and grazing.

Microbats

Mudies Creek and Mudies Creek culvert

The 2016 survey used an ultrasonic bat call detector (Songmeter SM4BAT FS, Wildlife Acoustics) for three full nights to survey bats at Mudies Creek. Three threatened species of microbat (Little Bentwing-bat, Southern Myotis and Greater Broad-nosed Bat) were recorded within the study area.

An active search of the Mudies Creek culverts was conducted in August 2016. The visual inspection involved using a torch to inspect the structure for suitable roosting habitat for microbats such as small crevices and evidence of bat guano. The culverts at Mudies Creek were inspected to determine the occurrence of suitable roosting habitat. The inspections did not identify microbats present and deemed that the culverts were too close to the ground, too small and did not possess the required structural complexity to be used as habitat by either Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Little Bentwing-bat (*Miniopterus australis*).

Dochra Gate sentry box

The preclearing survey undertaken for the Subsurface Anomaly Investigation early works identified microbats entering and exiting the sentry box at the Dochra Gate. The proposal requires the removal (demolition) or relocation of the sentry box so additional microbat assessments were undertaken in March 2021 and September 2021 (Appendix D).

The March 2021 survey (Echo Ecology and Surveying, 2021) recorded two species roosting in the sentry box, Southern Freetail Bat (*Ozimops planiceps*) and Inland Broad-nosed Bat (*Scotorepens balstoni*). At least eight individual bats of two different species were present within the sentry box at the time of inspection. Neither are listed as threatened under the BC Act or EPBC Act. This is considered a relatively small colony (Appendix D).

The September 2021 survey (NHG Consulting) found nine species of microbats roosting in the sentry box (refer Table 6-4). Of these nine species, five were listed as threatened species under the BC Act, none of the species were listed under the EPBC Act. Table 6-4 lists the species recorded during the September 2021 survey.

Table 6-4: September 2021 survey microbat species recorded

Common name	Scientific name	BC Act	EPBC Act
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Yes	No
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	Yes	No
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	Yes	No
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Yes	No

Greater Broad-nosed Bat	*Scoteanax rueppellii*	Yes	No
Gould's Wattled Bat	*Chalinolobus gouldii*	No	No
Long-eared Bat	*Nyctophilus* sp.	No	No
Inland Broad-nosed Bat	*Scotorepens balstoni*	No	No
White-striped Freetail Bat	*Tadarida australis australis*	No	No

Plant community types

Five vegetation communities have been mapped within the study area comprising three native vegetation communities, one cleared and disturbed community and one revegetated and regenerating community (refer Table 6-5 and Figure 6-8). These communities are:

- PCT1692 (HU906): Bull Oak grassy woodland of the central Hunter Valley
- PCT1731 (HU945): Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley
- Juncus Wetland
- Cleared and disturbed
- Revegetation and regeneration.

No Significant Roadside Environment Areas have been recorded within the study area (Advitech, 2016).

Table 6-5: Vegetation communities within the proposal area

Plant community type (PCT)	Threatened Ecological Community – BC Act	Threatened Ecological Community – EPBC Act	Area in study area (ha)
PCT1692 (HU906): Bull Oak grassy woodland of the central Hunter Valley	Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions (Endangered)	The vegetation within the PCT does not meet the condition requirements for the CEEC under the EPBC Act.	0.25
PCT1731 (HU945): Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (Endangered)	Coastal Swamp Oak (Casuarina glauca) Forest of the New South Wales and South East Queensland ecological community	3.22
Juncus Wetland	-	-	0.19
Revegetation and regeneration	-	-	0.36
Cleared and disturbed	-	-	2.68
TOTAL			6.70

A revised classification of PCTs in eastern NSW was publicly released on 24 June 2022. This report does not use the revised PCTs, however, the mapped vegetation communities have been converted to the most suitable new Eastern NSW PCT version 1.1 (DPE 2022e) based on research available on the BioNet Vegetation Classification Database (DPE 2022c). A desktop

conversion of the PCTs recorded during the field surveys is provided in Table 6-6, however it should be noted that conversion lineage is not perfectly 1:1.

Table 6-6: Previous and new PCT classification applied to study area

Plant community type (PCT)	NEW NSW PCT	Conversion notes based on Bionet Data	Other Notes
PCT1692 (HU906): Bull Oak grassy woodland of the central Hunter Valley	PCT 3431 Central Hunter Ironbark Grassy Woodland	The relationship between the legacy PCT and new PCTs is strong. The legacy PCT 1692 is mainly split into two new PCTs, 3431 Central Hunter Ironbark Grassy Woodland and 3314 Central Hunter Slopes Grey Box Forest, which together include over 80% of legacy member plots (Eastern NSW PCT Classification version 1.1). The former retains the higher proportion of legacy member plots. A small residual set of legacy member plots are resolved to other new PCTs. The new PCTs include a very high proportion of plots not included in the legacy classification.	The new PCT is associated with the same TECs listed under the BC Act and EPBC Act as PCT 1692 and hence would be subject to the same offset trading group when considering like-for like offsets under the NSW BOS Scheme. The vegetations eligibility to conform to a TEC can only be determined by survey and this status has not been changed by this PCT revision. This vegetation in this PCT zone was not found to meet the criteria for the EPBC listed CEEC.
PCT1731 (HU945): Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley	PCT 4023 (Central Hunter Swamp Oak Riparian Forest).	The relationship between the legacy PCT and new PCTs is strong. The standard plots for PCT 1731 are mainly split into two new PCTs, 4023 Coastal Valleys Swamp Oak Riparian Forest and 4015 Central Hunter Swamp Oak Riparian Forest, which together represent three quarters of the legacy member plots (Eastern NSW PCT Classification version 1.1). The former retains the higher proportion and includes a high proportion of new plots not included in the legacy classification. A small set of residual legacy member plots are resolved to other new PCTs.	PCT 4023 has been chosen as the man PCT with inheritance from PCT1731. The new PCT is associated with the same TECs listed under the BC Act and EPBC Act as PCT 1731 and hence would be subject to the same offset trading group when considering like-for like offsets under the NSW BOS Scheme. The vegetation's eligibility to be considered a TEC can only be determined by survey and this status has not been changed by the PCT revision.

Threatened ecological communities

The surveys identified two PCTs occurring within the study area that correspond to three threatened ecological communities (TEC) listed under the BC Act and EPBC Act (refer Figure 6-9), these TECs being:

- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions (endangered)
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (endangered)
- Coastal Swamp Oak (Casuarina glauca) Forest of South-east Queensland and New South Wales.

Central Hunter Grey Box – Ironbark Woodland is listed within the approved conservation advice as a component of Central Hunter Valley eucalypt forest and woodland, a CEEC under the EPBC Act. As previously stated, while the PCT1692 (HU906): Bull Oak grassy woodland of the central Hunter Valley can correspond to this CEEC, the field survey has determined that, in this case, it does not meet the condition requirements stipulated by the Commonwealth Department of Environment and Energy (DoEE, 2016). DoEE provides CEEC identification and condition threshold advice to help land managers, environmental assessment officers, and consultants identify Central Hunter Valley eucalypt forest and woodland. The following condition attributes were identified in the study area for PCT1692 meaning that the requirements for Central Hunter Valley eucalypt forest and woodland were not met:

- Vegetation canopy dominated by the following eucalypt species: *E. crebra, E. glaucina, Eucalyptus moluccana*
- *Allocasuarina leuhmannii* accounts for more than 50% of the projected canopy cover.

The Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (from here on in referred to as Swamp Oak Flood Plain Forest) is also listed under the EPBC Act as Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland.

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) have been mapped by the Bureau of Meteorology and Kuginis *et al* (2012) in the *Groundwater Dependent Ecosystems Atlas* (BOM, 2018). The following mapped PCT has been identified as having potential ground water interaction:

- *High potential ground water dependent* (GDE) - PCT1731 (HU945): Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley.

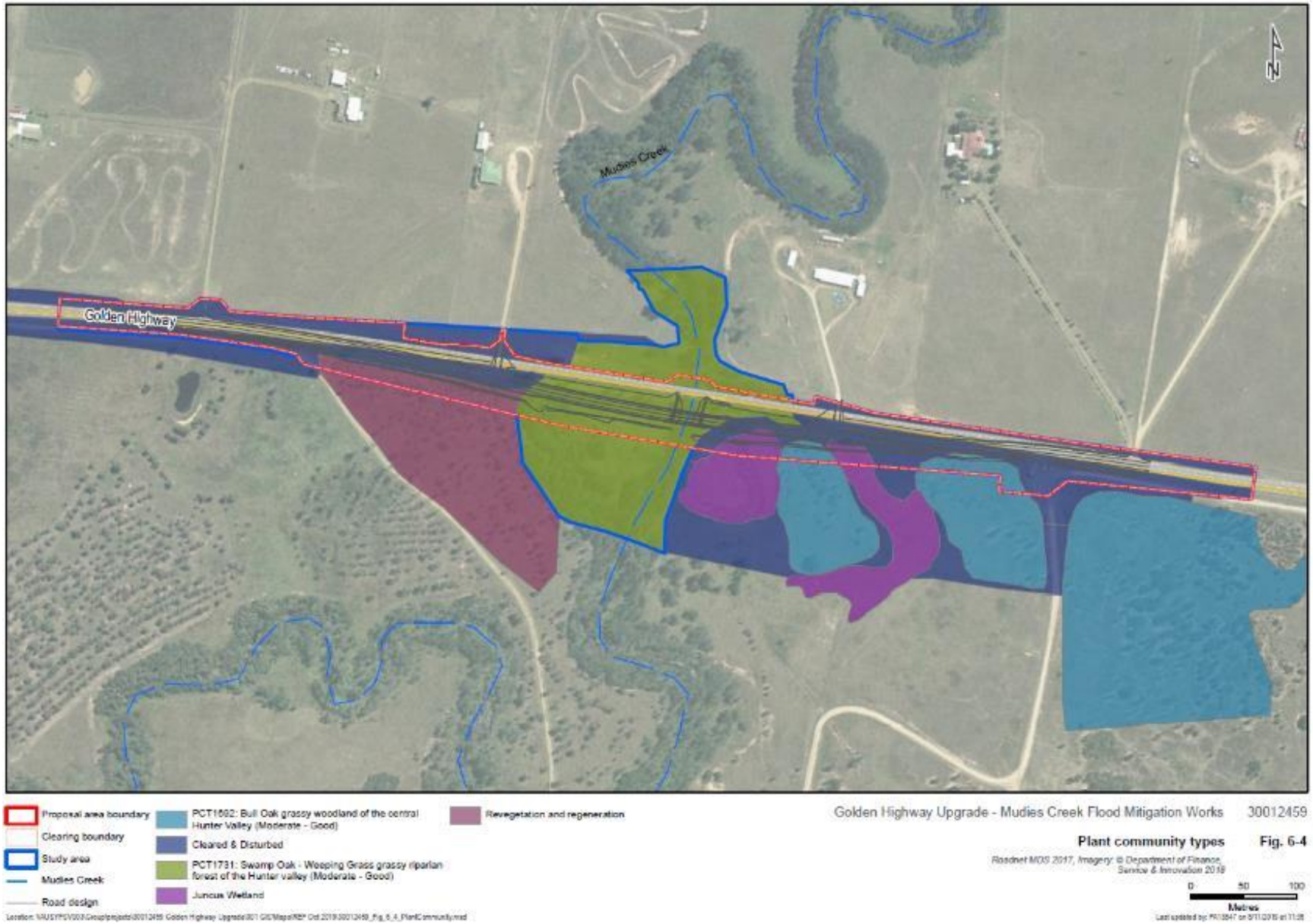

Figure 6-8: Plant community types within the proposal area

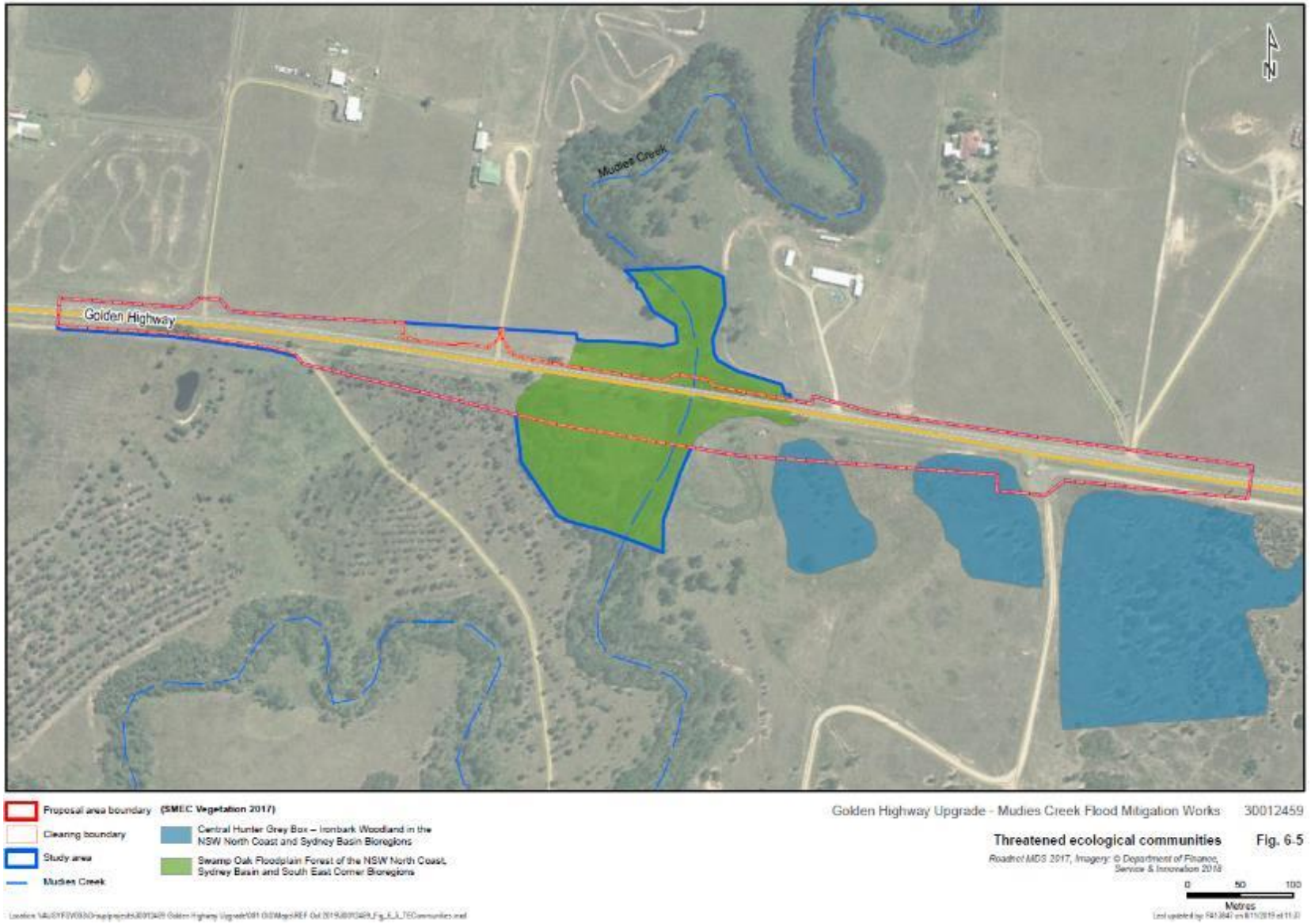

Figure 6-9: Threatened ecological communities within the proposal area

Threatened species and populations

No threatened plant species were found to occur within the study area during the field surveys. Five species or populations have been determined to have a moderate or greater likelihood of occurring within the study area.

Seven threatened microbat species were identified as occurring (recorded) and one species was identified as highly likely to occur within the study area. Five of these species were recorded roosting in the Dochra Gate sentry box (NGH 2021) (refer Table 6-7) as outlined above. The culvert over Mudies Creek was inspected to determine its suitability as bat habitat, however the absence of cracks and joins in the culvert suggests it does not provide suitable roosting habitat for any species of microbat.

Five species of threatened birds and two threatened mammal species have also been determined to have a moderate or high likelihood of occurring within the study area (refer Table 6-7). No threatened flora species were found to occur within the study area during the field surveys. The culverts under Mudies Creek were inspected to determine its suitability as bat habitat. The absence of cracks and joins in the culverts suggests they does not provide suitable roosting habitat for any species of microbat. No threatened fauna populations are considered likely to occur in the study area.

Table 6-7: Threatened species habitat assessment

Scientific name	Common Name	Status		Potential occurrence
		BC Act	EPBC Act	
Flora				
Acacia pendula	Weeping Myall, Boree (*Acacia pendula* population in the Hunter Catchment)	EP	-	Moderate
Cymbidium canaliculatum	Tiger Orchid (*Cymbidium canaliculatum* population in the Hunter Catchment)	EP	-	Moderate
Eucalyptus camaldulensis	River Red Gum (*Eucalyptus camaldulensis* population in the Hunter Catchment)	EP	-	High: individuals were recorded within the study area. They were not considered to be part of the endangered population as they were planted as part of a revegetation and regeneration effort. Refer to Appendix D for further details and justification.
Eucalyptus glaucina	Slaty Red Gum	V	V	High: was recorded to the west in Segments 4-7.
Pterostylis gibbosa	Illawarra Greenhood	E	E	Moderate

Scientific name	Common Name	Status		Potential occurrence
		BC Act	EPBC Act	
Fauna				
Artamus cyanopterus	Dusky Woodswallow	V	-	Moderate
Climacteris picumnus victoriae	Brown Treecreeper (Eastern Subspecies)	V	-	Moderate
Daphoenositta chrysoptera	Varied Sittella	V	-	Moderate
Glossopsitta pusilla	Little Lorikeet	V	-	Moderate
Pomatostomus temporalis	Grey-crowned Babbler (Eastern Subspecies)	V	-	High: recorded within PCT1603 about 4 km west of the study area.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	High: possible recording using ultrasonic detection at a culvert, west of the study area.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Recorded: roosting in Sentry Box
Miniopterus australis	Little Bent-winged Bat	V	-	Recorded: along Mudies Creek
Micronomus norfolkensis	Eastern Coastal Freetail-bat	V	-	Recorded: roosting in Sentry Box
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Recorded: roosting in Sentry Box
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Recorded: roosting in Sentry Box
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Recorded: roosting in Sentry Box
Myotis macropus	Southern Myotis	V	-	Recorded: along Mudies Creek
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	High
Phascolarctos cinereus	Koala	V	V	Moderate

V = vulnerable; E = endangered; EP = endangered population

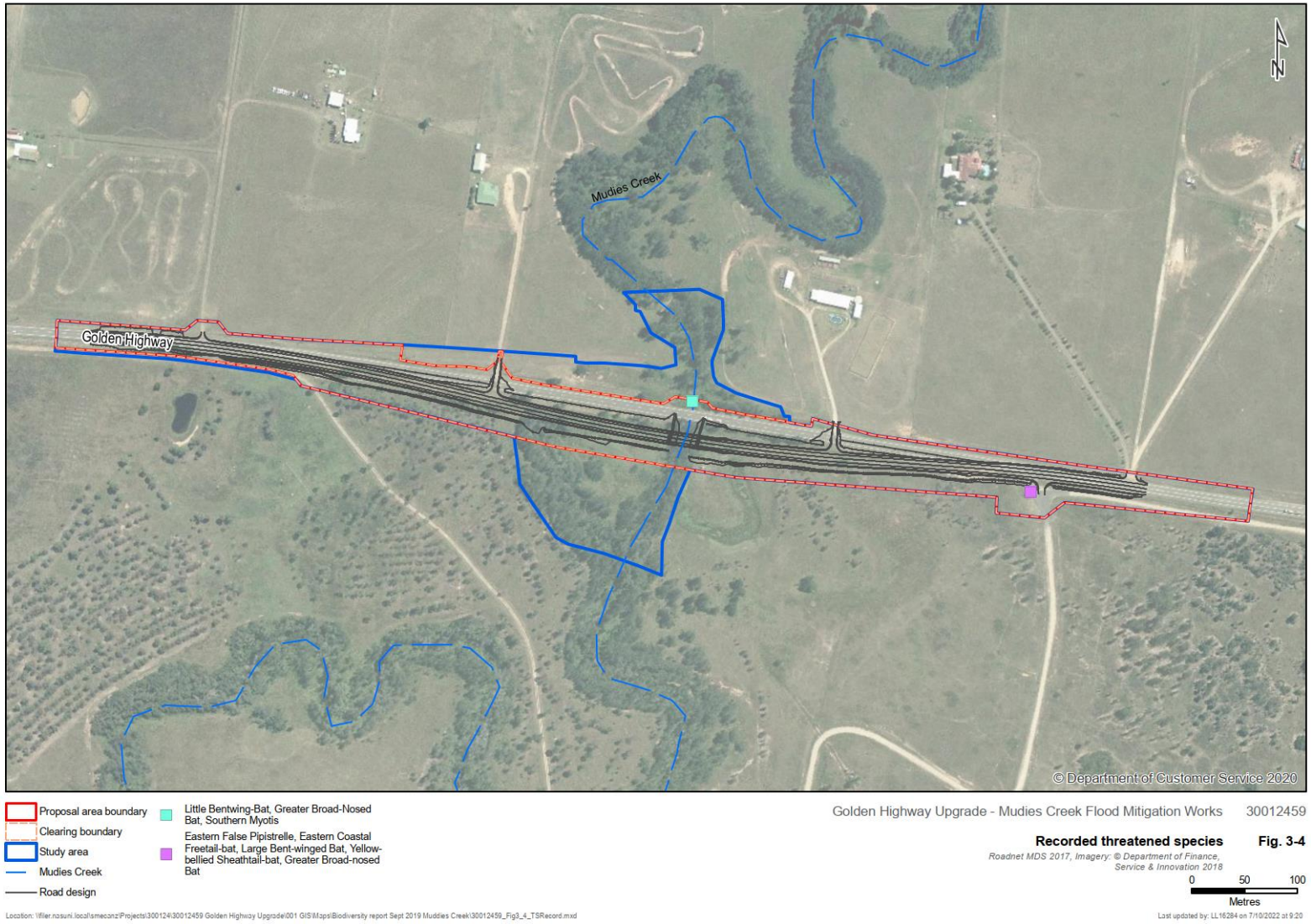

Figure 6-10: Recorded threatened species

Wildlife connectivity corridors

No wildlife corridors have been mapped within the study area. Immediately north of the Golden Highway there is very little native vegetation, as large areas have been cleared for farming. Large areas of revegetation have been carried out in the SMA between Mudies Creek and Doughboy Hollow Creek to the west of the study area. This vegetation occurs as lines of young eucalypts, about 10-15 metres tall. In some areas, regeneration of the understorey is also occurring. There is limited connectivity between these areas and vegetation to the north of the Golden Highway.

A band of vegetation that runs along the banks of Mudies Creek provides connectivity to larger areas of bushland and revegetated areas in the SMA (refer Figure 6-8). This vegetation ultimately leads to Pokolbin State Forest to the south, although there are transmission line easements and roads intersecting the corridors at various points, providing breaks of up to 30 metres in width.

Aquatic biodiversity

Mudies Creek is approximately 22 km downstream from its point of origin within the Singleton Military Area and approximately 10 km upstream of its confluence with the Hunter River. The main channel of Mudies Creek is the only channel that conveys flow through the culverts under the Golden Highway.

The *Aquatic Ecological Assessment* (écologique 2019) noted that Channel 1 appears to be an abandoned channel or anabranch of Mudies Creek (refer Figure 6-11). The construction of the Golden Highway has cut off any potential for Channel 1 to flow in a downstream direction. Contemporary flow to Channel 1 is predominantly from surface runoff from the highway and elevated land to its east and southeast. Aerial photographic interpretation over the past decade suggests that Channel 1 hydrologically reconnects with the main channel of Mudies Creek very infrequently. Both Mudies Creek and Channel 1 are predominantly ephemeral. At the time of surveys there was no flow in Mudies Creek or Channel 1, with only isolated and stagnant refuge pools observed in both watercourses (écologique 2019).

Channel 2 to the east of Mudies Creek is a depression physically disconnected from Mudies Creek and was not holding water at the time of site surveys. Aerial photography shows that Channel 2 holds water following rainfall, but it is not hydrologically connected to Mudies Creek, nor does it contain any aquatic habitat features. Aerial photography shows that it holds water after rainfall, but it is not hydrologically connected to Mudies Creek, nor does it contain any valuable aquatic habitat features (écologique 2019). It is noted that the proposal would have only minor impacts on Channel 2.

Using the Water Management (General) Regulation 2018 hydro line spatial dataset confirmed the following:

- Mudies Creek is a 4th order stream
- Channel 1 is mapped as a first order stream and tributary to Mudies Creek, despite that it might still infrequently receive flows from Mudies Creek
- Channel 2, the depression to the east of Mudies Creek is mapped as a dam with no streams feeding to or discharging from it.

Mudies Creek (within the study area) and Channel 1 have characteristics that fall within Type 1, Type 2 and Type 3 key fish habitat categories (refer Table 6-8). However, the Type 1 and Type 2 characteristics are very limited and not indicative of either category.

Table 6-8: Key fish habitat

1. Habitat type	Habitat features	Mudies Creek	Channel 1
Type 1 - Highly sensitive fish habitat	SEPP 14 coastal wetlands, internationally or nationally significant wetlands	No	No
	In-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or three metres in length, or native aquatic plants	Limited	
	Any known or expected protected or threatened species habitat or area of declared 'critical habitat'	No	No
	Mound springs	No	No
Type 2 – Moderately sensitive fish habitat	Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in Type 1	Limited	
	Weir pools and dams up to full supply level where the weir or dam is across a natural waterway	No	No
Type 3 – Minimally sensitive fish habitat	Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna	No	No
	Coastal/freshwater habitats not included in Types 1 or 2	No	No
	Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation	Yes	

While both Mudies Creek (within the study area) and Channel 1 have defined bed and banks and very limited aquatic vegetation, they are more appropriately defined as Class 3 minimal key fish habitat (refer Table 6-9). This is further supported when considering the highly degraded nature of Mudies Creek as a result of agricultural development, likely impact upstream from activities within the SMA and results from macroinvertebrate sampling (Appendix D).

Table 6-9: Study area waterway classification

Classification	Characteristics	Mudies Creek and Channel 1
Class 1 Major key fish habitat	Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (e.g. river or major creek), habitat of a threatened or protected fish species or 'critical habitat'.	Not permanently flowing and habitat for threatened or protected species or critical habitat absent, not applicable
Class 2 Moderate key fish habitat	Non-permanently flowing (intermittent) stream, creek or waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Freshwater aquatic vegetation is present. Type 1 and 2 habitats present.	Clearly defined beds and banks, sporadic individual occurrences of aquatic vegetation, Type 1 and 2 habitats absent, not applicable
Class 3 Minimal key fish habitat	Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi- permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other Class 1 to 3 fish habitats.	Applicable
Class 4 Unlikely key fish habitat	Waterway (generally unnamed) with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free- standing water or pools post rain events (e.g. dry gullies or shallow floodplain depressions with no aquatic flora present).	Clearly defined beds and banks, not applicable

Searches of available databases did not identify any threatened populations or species within the proposal area. NSW DPI indicative threatened species distributions suggests the potential for the endangered Southern Purple Spotted Gudgeon (*Mogurnda adspersa*) to occur in Mudies Creek about 2.65 kilometres downstream of the subject area and about 7.3 kilometres upstream of the Hunter River (écologique 2019). The potential for the proposal to result in direct and/or indirect impact on this species has been considered through a significance of impact assessment in accordance with NSW *Threatened Species Assessment Guidelines* (OEH 2007) (Appendix D)

Figure 6-11: Surface water locations

Matters of National Environmental Significance

Two threatened flora species listed under the EPBC Act (refer Figure 6-12) have been assessed to have a moderate or above likelihood of occurring in the study area:

- Slaty Red Gum (*Eucalyptus glaucina*)
- Illawarra Greenhood (Pterostylis gibbosa).

Both species are also listed under the BC Act and have been discussed in their respective Assessments of Significance (Appendix D)

Three threatened fauna species listed under the EPBC Act have been identified or are considered to have a moderate or above likelihood of occurring in the study area:

- Large-eared Pied Bat (*Chalinolobus dwyeri)*
- Grey-headed Flying-fox (*Pteropus poliocephalus)*
- Koala (*Phascolarctos cinereus)*.

One EEC listed under the EPBC Act was identified within the study area (refer Figure 6-12):

- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland.

The actions associated with the proposal are not expected to place this EEC at risk of local extinction.

Migratory species identified within 10 kilometres of the study area are included in Appendix D. None of these species are considered likely to occur in the study area based on recent records and the availability of suitable habitat. The migratory birds that have been identified through the desktop assessment are also unlikely to use the habitat in the study area in a significant way throughout their lifecycles.

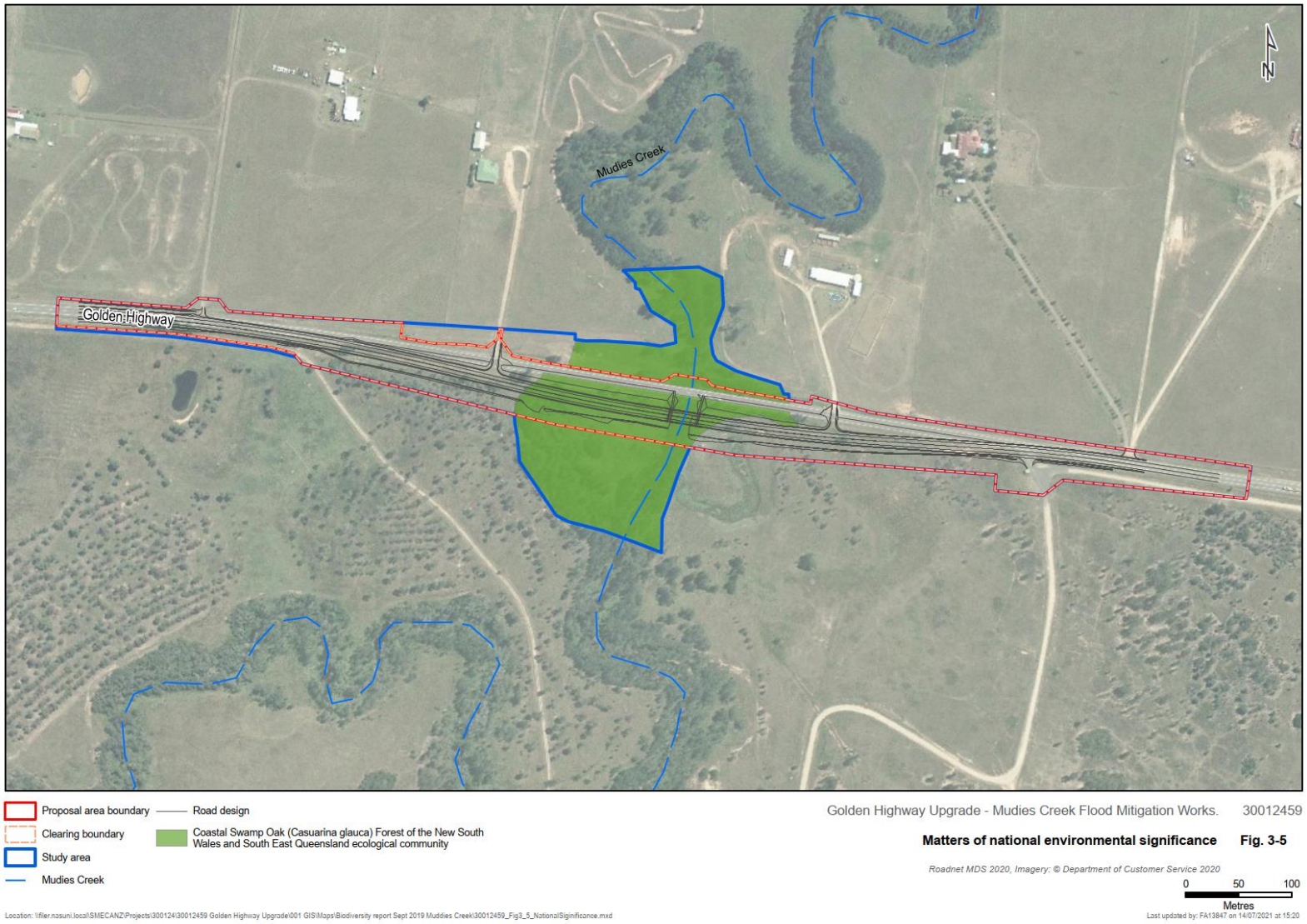

Figure 6-12: Matters of National Environmental Significance

6.2.3 Potential impacts

Construction

Removal of native vegetation

The proposal would result in the clearing of up to 4.06 hectares of vegetation (refer Table 6-10). Of this total, 2.63 hectares vegetation is either cleared/disturbed or revegetation/regeneration, 1.24 hectares of EEC, and 0.19 hectares of Juncus Wetland (refer Table 6-10 and Figure 6-8). The vegetation to be removed ranges from poor to good condition, although the latter occurs as highly fragmented stands that are all less than a hectare in size. Vegetation removal would occur early during the construction phase of the proposed development. The areas provided in Table 6-10 (column five) represent the maximum potential vegetation clearance.

Table 6-10: Impact on native vegetation

Plant community type (PCT)	Status		Study area (ha)	Vegetation to be cleared (ha)
	BC Act	EPBC Act		
PCT1731 (HU945): Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley (Swamp Oak Floodplain Forest EEC)	E	E	3.22	0.99
PCT1692 (HU906): Bull Oak grassy woodland of the central Hunter Valley	E	-	0.25	0.25
Juncus Wetland	-	-	0.19	0.19
Cleared and disturbed land			2.68	2.27
Revegetation and regeneration			0.36	0.36
Total			**6.70***	**4.06***

E = endangered, *rounded to 2 decimal places

Threatened fauna habitat impact

Fauna habitat within the study area includes riparian forest, woodland, regenerating vegetation in plantations and areas of wetland. Open grassland occurs throughout the remainder of the study area where native vegetation has been cleared for the road reserve and other land uses.

No large hollows (greater than 30 centimetres in diameter) or medium hollows (greater than 10 centimetres in diameter) were observed within the study area during the threatened fauna habitat assessment. A detailed survey to determine the occurrence of smaller hollows was not conducted, with the assumption being made that they exist and provide habitat for microbats in the area. The smaller tree-hollows would not to be used as maternity roosts by any of these bats as they select larger vertical cavities for such sites and hence larger cavities were the focus of surveys. Table 6-11 outlines the expected impact on habitat of threatened fauna that have a moderate or greater likelihood of occurring in the study area.

The sentry box structure is currently utilised by microbats for roosting and possibly as a maternity roost (breeding) at other times of year. At the time of the September 2021 survey multiple microbat

species were cohabiting the sentry box structure at the Dochra Gate (refer Table 6-7) of which five species of microbats are listed as threatened species under the BC Act. Microbats often use multiple roosts, regularly switching among them even during the maternity season (McConville et al. 2013). The demolition of the sentry box would remove habitat for the five threatened species of microbats roosting in the structure. Transport is currently investigating an alternative to demolition of the sentry box including the options to retain sentry box in its current location or move it a small distance beyond the construction footprint.

No habitat for any threatened aquatic species would be adversely affected by the proposal (écologique 2019).

Table 6-11: Impacts on threatened fauna habitat

Species	Potential occurrence	Impacted by proposal	Impact
Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)	Moderate	Yes	1.6 hectares of woodland habitat and regenerating vegetation would be permanently removed.
Brown Treecreeper (*Climacteris picumnus victoriae*)	Moderate		
Varied Sittella (*Daphoenositta chrysoptera*)	Moderate		
Little Lorikeet (*Glossopsitta pusilla*)	Moderate		
Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)	High		
Large-eared Pied Bat (*Chalinolobus dwyeri*)	High	Yes	1.6 hectares of woodland habitat and regenerating vegetation would be permanently removed. Relocation / removal of Dochra Gate sentry box
Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*	High/Recorded*		
Little Bent-wing bat (*Miniopterus australis*)	Recorded		
Large Bent-winged Bat (*Miniopterus orianae oceanensis)*	High/Recorded*		
Eastern Coastal Freetail-bat (*Mormopterus norfolkensis)*	High / Recorded*		
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	High / Recorded*		
Yellow-bellied Sheathtail-bat	High/Recorded*		
Southern Myotis (*Myotis macropus*)	High	Yes	0.99 hectares of riparian habitat surrounding potential

Species	Potential occurrence	Impacted by proposal	Impact
			foraging habitat on Mudies Creek.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	High	Yes	0.35 hectares of foraging habitat (the Juncus Wetland has been deducted from this total) permanently removed.
Koala (*Phascolarctos cinereus)*.	Moderate	Yes	Removal of 0.35 hectares of vegetation classed as potential koala habitat.

*Observed roosting at Dochra Gate sentry box

Threatened flora habitat impacts

No individual plants of any threatened flora species would be cleared as a result of the proposed development. The proposed development would result in the clearing of 2.88 hectares of vegetation that has been assessed as potential habitat for *Eucalyptus glaucina* and 4.21 hectares of vegetation that has been assessed as potential habitat for *Pterostylis gibbosa* (refer Table 6-12).

Table 6-12: Impacts on threatened flora habitat

Threatened species	Ecosystem or species credit species	Status		Potential habitat or individuals to be impacted	Potential habitat or individuals in the study area
		BC Act	EPBC Act		
Slaty Red Gum (*Eucalyptus glaucina*)	Species	V	V	2.88 hectares	3.29 hectares
Illawarra Greenhood (*Pterostylis gibbosa*)	Species	E	E	4.06 hectares	6.71 hectares

Aquatic impacts

Channel 1 is an abandoned channel associated with Mudies Creek which is effectively cut off by the highway and elevated land to the east and southeast but remains hydrologically connected to the main stream of Mudies Creek. The proposal requires the reclamation (filling) of about 403 square metres of Channel 1 for the new road alignment.

Potential construction impacts considered by the aquatic assessment include:

- Decreased water quality, including erosion and sedimentation and/or contaminants discharging to the waterway
- Obstruction of free fish passage
- Enhancement of key threatening processes
- Installation of temporary construction crossing

- Loss of aquatic habitat.

Refer to section 6.5.3 for impacts associated with construction of the bridge and abutments.

DPI indicative threatened species distribution mapping (DPI, 2016) suggests the potential for the endangered Purple Spotted Gudgeon (*Mogurnda adspersa*) to occur in Mudies Creek approximately 2.65 kilometres downstream of the proposal area. The potential for the proposal to result in direct and/or indirect impact on this species has been considered through a significance of impact assessment in accordance with NSW threatened species assessment guidelines (OEH 2007) (Appendix D). The assessment of significance determined that the proposal is unlikely to result in any direct or indirect impacts that would adversely affect this species.

The proposed temporary crossing over Mudies Creek for use by construction vehicles, plant and equipment.

Injury and mortality

Vegetation clearing to accommodate the road work may lead to incidences of fauna injury or mortality through interactions with vehicles. Numerous road kill (mainly Eastern Grey Kangaroos) were observed along the Golden Highway indicating the existing highway already poses a threat to native fauna for injury and mortality. It is possible that the risk would be altered during construction, particularly during habitat removal when fauna may be forced to move. Given the proposal would involve habitat clearing directly next to the existing roadway, this may result in an increase in individuals being injured or killed by vehicles in the short-term. Once constructed, it is possible that the proposal would increase the likelihood of vehicle strike in the long term due to the extra width of the road corridor.

Operational impacts

Wildlife connectivity and habitat fragmentation

There is currently limited connectivity between areas of vegetation to the north and south of the Golden Highway due to high levels of clearing for farming and military activities. The proposal would increase the gap between patches of vegetation from 12 metres up to 50 metres, a 38 metre increase.

Although the area is already heavily fragmented, there would be a reduction in extent, size, shape and connectivity of native vegetation through direct clearing of 1.6 hectares of native vegetation that may provide refuge for threatened species passing through the area.

Edge effects on nearby native vegetation and habitat

Weeds are readily spread by dispersal factors such as wind, birds and water. Clearing and opening up of new vegetation edges is likely to facilitate the recruitment of weeds and provide opportunity for the establishment of other weed species. These weeds are often able to out-compete native flora and fauna species and reduce the habitat values of these areas.

Invasion and spread of weeds

Three priority weed species listed for the Hunter Local Land Service region (DPI 2017), were identified in the study area: Fireweed (*Senecio madagascariensis*) African Boxthorn (*Lycium ferocissimum*) and Madeira Vine (*Anredera cordifolia*). The class and duty associated with all plants and specific duties for the weed species identified in the study area is outlined in Table 6-13.

Table 6-13: Priority weeds identified within study area

Weed	Duty
All plants	**General Biosecurity Duty** 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.
Fireweed *Senecio madagascariensis*	**Mandatory Measure** Must not be imported into the State or sell.
African Boxthorn *Lycium ferocissimum*	**Mandatory Measure** Must not be imported into the State or sell.
Madeira Vine *Anredera cordifolia*	**Mandatory Measure** Must not be imported into the State or sell.

Invasion and spread of pests

One pest fauna species was identified during the field investigation; the European Rabbit (*Oryctolagus cuniculus*). It is expected that other pest species would use the study area including the feral cat (*Felis catus*), wild dog (*Canis lupus familiaris/dingo*) and European Red Fox (*Vulpes vulpes*). The proposal is unlikely to increase the presence of pest species within the study area.

Hydrology

The proposal's road alignment at Mudies Creek would be about five metres higher than the lowest point of the existing road level. The change in level at Mudies Creek would affect upstream afflux by a height of about 560 millimetres and result in a higher duration of inundation in the 1 in 100 year event. It is likely the Juncus Wetland and Swamp Oak – Weeping Grass grassy riparian forest communities are able to withstand temporary inundation because both of these communities are already exposed to temporary inundation events and are partially dependent on the presence of semi-permanent water courses.

The increased catchment area of the new bridge would result in a minor increase in surface runoff volume from the new bridge as the catchment area contributing to any increase in flows to the creek is localised and relatively small. As such the potential impacts from increased flows to Mudies Creek are not expected to be significant.

Construction of the new bridge would span the existing creek line and not impede flow. The existing instream structure (RCBC), which currently impedes flow, will be removed and therefore the proposal would have a positive impact on the natural flow of Mudies Creek. The proposal replaces the existing five RCBC with a 28 metre single span bridge which would improve flow through Mudies Creek (écologique 2019).

Other potential impacts on Mudies Creek include:

- Gross pollutants including rubbish and litter entering the waterway
- Hydrocarbons, heavy metals and other pollutants from atmospheric deposition, vehicles and accidental spills, entering the waterway
- Impacts on water quality from road operation through road maintenance activities and pavement wear.

Noise, light and vibration

The proposal would not increase traffic numbers so in the operation phase it is unlikely the proposal would result in changes to existing levels of light, noise and vibration such that there would be a significant impact to native fauna species.

Groundwater dependent ecosystems

The Swamp Oak – Weeping Grass grassy riparian forest was listed with a 'moderate potential' to be a GDE. Due to the temporary and limited extent of work to be carried out for the new Mudies Creek bridge, it is not expected there would be significant changes to hydrology that would affect the mapped GDE in the study area. The new bridge would improve the flow of water through Mudies Creek that would most likely be beneficial for the GDE.

Aquatic impacts

The footprint of the proposed bridge over Mudies Creek covers approximately 300 square metres (which includes the banks as well as the main channel of Mudies Creek. The RCBC, which would be removed, shades approximately 256 square metres of Mudies Creek at present and is also considerably lower in height than the proposed bridge. The proposed bridge is approximately eight metres above the bed of the main channel of Mudies Creek and has a larger opening size due to its single span compared with the constrained openings of the RCBC. Therefore, indirect impacts on aquatic habitat through shading would be considerably reduced compared with the existing shading impacts.

The removal of the existing instream RCBC structure, which currently provides an obstacle to the natural flows in Mudies Creek, and replacement with a single span bridge would have a beneficial effect on the natural flow regime of Mudies Creek. The proposal would result in a minor increase in surface runoff volume from the new bridge, however the catchment area contributing to any increase in flows to Mudies Creek is localised and relatively small so potential impacts from increased flows to the creek are not expected to be significant (Appendix D).

The proposal may result in an increase in surface runoff volume from the new bridge, however the catchment area contributing to any increase to the waterways is localised and expected to be negligible. Any increase in flow to the predominantly ephemeral waterways is likely to have a positive impact (more persistent refuge habitat) providing table drains to the waterways are vegetated swales providing treatment prior to discharge.

Conclusion on significance of impacts

BC Act, FM Act

Table 6-14 summarises the assessments of significance undertaken for the proposal which are located in their entirety in Appendix D. The assessments of significance determined that the proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act or FM Act, therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

Table 6-14: EP&A Act significance assessments

EP&A Act significance assessments						
Threatened species or communities	**Significance assessment question**					**Likely significant impact?**
	a	**b**	**c**	**d**	**e**	
Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions	X	N	Y	N	Y	No
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions	X	N	Y	N	Y	No
Weeping Myall, Boree (*Acacia pendula* population in the Hunter Catchment)	N	X	N	N	Y	No
Tiger Orchid (*Cymbidium canaliculatum* population in the Hunter Catchment)	N	X	Y	N	Y	No
River Red Gum (*Eucalyptus camaldulensis* population in the Hunter Catchment)	N	X	N	N	Y	No
Slaty Red Gum (*Eucalyptus glaucina*)	N	X	X	N	Y	No
Illawarra Greenhood (*Pterostylis gibbosa*)	N	X	X	N	Y	No
Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)	N	X	Y	N	Y	No
Brown Treecreeper (Eastern Subspecies) (*Climacteris picumnus victoriae*)	N	X	Y	N	Y	No
Varied Sittella (*Daphoenositta chrysoptera*)	N	X	Y	N	Y	No
Little Lorikeet (*Glossopsitta pusilla*)	N	X	Y	N	Y	No
Grey-crowned Babbler (Eastern Subspecies) (*Pomatostomus temporalis temporalis*)	N	X	Y	N	Y	No
Large-eared Pied Bat (*Chalinolobus dwyeri*)	N	X	Y	N	Y	No
Little Bentwing-bat (*Miniopterus australis*)	N	X	Y	N	Y	No
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	N	X	Y	N	Y	No
Eastern Coastal Freetail-bat (*Micronomus norfolkensis*)	N	X	Y	N	Y	No
Grey-headed Flying-fox (*Pteropus poliocephalus*)	N	X	Y	N	Y	No
Greater Broad-nosed Bat (*Scoteanax rueppellii)*	N	X	Y	N	Y	No
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	N	X	Y	N	Y	No
Southern Myotis (*Myotis macropus*)	N	X	Y	N	Y	No
Koala (*Phascolarctos cinereus*)	N	X	X	N	N	No

EP&A Act significance assessments								
Threatened species/community	Significance assessment question							Likely significant impact
	a	b	c	d	e	f	g	
Purple Spotted Gudgeon (*Mogurnda adspersa*)	N	X	X	N	N	N	N	No

EPBC Act

Table 6-15 summarises the assessments of significance undertaken for the proposal which are located in their entirety in Appendix D. The assessments of significance determined that the proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the EPBC Act.

Table 6-15: EPBC Act significance assessments

EPBC Act significance assessments		
Threatened species, or communities	**Important population**	**Likely significant impact?**
Central Hunter Valley Eucalypt Forest and Woodland	No	No
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland	No	No
Slaty Red Gum (*Eucalyptus glaucina*)	No	No
Illawarra Greenhood (*Pterostylis gibbosa*)	No	No
Large-eared Pied Bat (*Chalinolobus dwyeri*)	No	No
Grey-headed Flying-fox (*Pteropus poliocephalus*)	No	No
Koala (*Phascolarctos cinereus*)	No	No

Notes: Y = Yes (negative impact), N = No (no negative impact), X = not applicable

6.2.4 Cumulative impact

Cumulative impacts on biodiversity values of projects and proposals within five kilometres of the study area (radius specified by Transport) have been considered. The proposal was originally part of a larger project on the Golden Highway from Mudies Creek through to the Putty Road including the Golden Highway Upgrade at Whittingham (subject to a separate assessment) which abuts the western boundary of the proposal. Table 6-16 provides a summary of these projects and their determined/proposed impact and Table 6-17 calculates these cumulative impacts. For some projects, there is no publicly available information about the extent of the construction and

operational impacts of the project, or they are yet to be determined. Projects identified in the Golden Highway Corridor Strategy located within a five kilometre radius are:

- Proposed heavy vehicle inspection bays at Mount Thorley
- Golden Highway Upgrade at Whittingham (Segments 4-7)
- Belford to Golden Highway duplication
- Singleton bypass.

Table 6-16: Cumulative impact of nearby projects and proposals

Project	Construction impact	Operational impact
Golden Highway Upgrade (Whittingham) Occurs immediately to west of study area.	• Removal of 12.80 hectares of vegetation, 12.36 hectares of which has been mapped as cleared and disturbed. • A total of 0.42 hectares of vegetation is from two threatened ecological communities.	Potential need for a biodiversity offset strategy to reduce potential impact.
New England Highway upgrade between Belford and the Golden Highway • Located 1.5 kilometres east of the current proposal. Work currently underway, as of March 2022 project update.	• Removal of 27.73 hectares of native and non-native vegetation. • Removal of 18 hollow-bearing trees. • Increased noise pollution within 600 metres of the site.	Proposed biodiversity offset strategy to reduce potential impact.
New England Highway bypass at Singleton • Located 5.5 kilometres north of the current proposal. Early work expected to start in early 2021, as of June 2022 project update.	• Removal of about 32.1 hectares of native vegetation listed. • Removal of 91 hollow bearing trees. • Temporary instream structures in Hunter River has potential to result in alteration of fish passage.	• Fragmentation of fauna habitat and resulting loss of wildlife connectivity corridors in the area. • Invasion and spread of weeds, pests and pathogens • Changes to surface hydrology may occur as a result of the changed landscape.
Mount Thorley Warkworth mine Located nine kilometres west of the current proposal. Ongoing mining operation with proposed expansion.	Exact construction impacts are unknown. They include, but are not limited to: • Vegetation removal (extent unknown). • Air, noise, light pollution. • Fauna habitat removal. • Alteration of water quality and flow.	Exact operational impacts are unknown. They include: • Vegetation removal. • Dust, noise, light pollution. • Fauna habitat removal. • Revegetation. • Pest and weed management. • Water quality and flow.

Project	Construction impact	Operational impact
Mount Thorley heavy vehicle inspection bay Located eight kilometres west of study area. Timing for construction has not been confirmed	Unknown.	Unknown.

Table 6-17: Quantification of cumulative impacts

Biodiversity aspect	Status	Approved and proposed clearing requirements for local projects in the IBRA Subregion common to this proposal				Sum of Impact (Combined Golden Highway proposals/Overall impacts of proposals within 5 kilometres)
		Golden Highway Upgrade: Mudies Creek	Golden Highway Upgrade: Segments 4-7	New England Highway: Belford to Golden Highway	Mount Thorley Warkworth mine	
PCT1603 (HU817): Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	EEC (BC Act) CEEC (EPBC Act)	Nil	0.13 hectares	8.2 hectares of CEEC (PCT1601)	365.5 hectares	375.29 hectares
PCT1692 (HU906): Bull Oak grassy woodland of the central Hunter Valley	EEC (BC Act)	0.25 hectares	0.29 hectares	Nil	Not known	0.54 hectares
PCT1731 (HU945): Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley	EEC (BC Act) EEC (EPBC Act)	0.99 hectares	Nil	Not known	Not Known	0.99 hectares
Eucalyptus glaucina	Vulnerable (BC Act EPBC Act)	Nil	3 individuals	Nil	Not known	3 individuals
Microbats (Large Bent-winged Bat and the Little Bent-winged Bat)	Vulnerable (BC Act)	1.6 hectares	0.42 hectares	11.23 hectares	459 hectares	13.4 hectares (2.17 hectares / 472.4 hectares)

Cumulative assessments of significance

Assessments of Significance (Appendix D) have been prepared to assess the cumulative impacts resulting from the proposal on the following entities:

- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions
- Slaty Red Gum (*Eucalyptus glaucina*)
- Microbats (Eastern Bentwing-bat and the Little Bentwing-bat).

No significant impacts were determined for the above threatened communities or species. A summary of the results of these assessments is provided in Table 6-18.

Table 6-18: EPBC Act cumulative significance assessments

EP&A Act significance assessments						
Threatened species or communities	**Significance assessment question[1]**					**Likely significant impact?**
	a	**b**	**c**	**d**	**e**	
Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions	X	X	N	N	N	No
Slaty Red Gum (Eucalyptus glaucina)	N	X	X	Y	N	No
Microbats (Large Bent-winged Bat and the Little Bent-winged Bat)	N	X	X	N	N	No

6.2.5 EPBC Act Self-assessment

The majority of the proposal is on land within the SMA which is owned by the Australian Government and would have the potential to impact on the following:

- Land use/function change – conversion of Commonwealth land use to road land use
- Upstream afflux from construction and operation of the proposal
- Increased quality of life for road users and community sedimentation
- Disturbance or damage of heritage items
- Vegetation clearing
- Air, noise, visual and traffic impacts during construction
- Impacts on water quality in Mudies Creek
- Removal of potential microbat habitat.

Under the EPBC Act, approval is required for an action taken by any person on Commonwealth land that is likely to have a significant impact on the environment (Section 26(1)). In order to determine whether a referral is required under the Act, a self-assessment was undertaken (Appendix E) in accordance with the Significant impact guidelines 1.2 *Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* (Commonwealth of Australia, 2013) to consider the following:

- Medium-scale excavation of soils – as a result of investigations and construction
- Reduction or fragmentation of available habitat for native species – through increasing the canopy gap along the highway

- Permanently destroy, remove or substantially alter the fabric of a heritage place – through the removal of any Aboriginal heritage items that may be found during the archaeological investigations.

Given the safeguards and management in Section 6.2.6 of the REF, the EPBC Self-assessment report (Appendix D) concluded that the action is not likely to have a significant impact on the environment of the Commonwealth land.

6.2.6 Safeguards and management measures

Table 6-19 lists the safeguards and mitigation measures that have been proposed to address potential impacts on biodiversity. These measures have been developed to mitigate the potential impacts of the proposal on threatened flora and fauna species and any residual impacts that cannot be mitigated would be offset in accordance with the Biodiversity Policy 2022 (TfNSW, 2022) and OEH principles for the use of biodiversity offsets in NSW (refer Section 6.2.5). The mitigation measures are designed to minimise impacts on threatened species as well as common flora and fauna species that occur in the proposal area.

Table 6-19: Biodiversity safeguards and mitigation measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Transport'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) • protocols to manage weeds and pathogens.	Contractor	Pre-construction Construction	Section 4.8 of QA G36 *Environment Protection*

Impact	Environmental safeguards	Resp.	Timing	Reference
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	TfNSW and Contractor	Detailed design	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011)
Removal of native vegetation	Pre-clearing surveys would be carried out in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines.	Contractor	Pre-construction Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*
	Vegetation removal would be carried out in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*
	Native vegetation would be re-established in accordance with Guide 3 Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Post-construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*
	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
Removal of threatened species habitat and habitat features	Habitat removal would be carried out in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
	Habitat would be replaced or re-instated in accordance with Guide	Contractor	Construction	*Biodiversity Guidelines:*

Impact	Environmental safeguards	Resp.	Timing	Reference
	5: Re-use of woody debris and bushrock.			*Protecting and managing biodiversity on RTA projects (RTA, 2011)*
	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
Removal of trees and hollows	A survey of tree and hollows must be undertaken in accordance with Transport's *Biodiversity Policy (2022)*, prior to any impacts occurring to vegetated areas.	Contractor	Pre-construction	*Biodiversity Policy (TfNSW 2022)*
	A Tree and Hollow Replacement Plan must be developed in accordance with the Transport's *Biodiversity Policy (2022)*, This Tree and Hollow Replacement Plan is to be incorporated into the project Landscaping Plan	Contractor	Pre-construction	*Biodiversity Policy (TfNSW 2022*
Removal of threatened plants	Pre-clearing surveys would be carried out in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines	Contractor	Pre-construction Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
Changes to hydrology	Changes to existing surface water flows would be minimised through detailed design.	TfNSW	Detailed design	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
Fragmentation of identified habitat corridors	Exclusion zones would be set up at the limit of clearing in accordance with Guide 2:	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing*

Impact	Environmental safeguards	Resp.	Timing	Reference
	Exclusion zones of the Biodiversity Guidelines.			*biodiversity on RTA projects (RTA, 2011)*
Injury and mortality of fauna	Any wildlife encountered within the construction footprint would be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
Invasion and spread of weeds	Weed species would be managed in accordance with Guide 6: Weed management of the Biodiversity Guidelines	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
Invasion and spread of pathogens and disease	Pathogens would be managed in accordance with Guide 7: Pathogen Management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011).	Contractor	Construction	Biodiversity assessment (Appendix D)
Edge effects on nearby native vegetation and habitat	Exclusion zones would be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines	Contractor	Construction	Biodiversity assessment (Appendix D)
Noise, light and vibration	Shading and artificial light impact would be minimised through detailed design.	TfNSW	Detailed Design	Increase in noise, light and vibration during construction
Aquatic biodiversity	An *Environmental Work Method Statement* (EWMS) for the temporary watercourse crossing will provide appropriate protocols to minimise impacts to any fish should dewatering be required.	Contractor	Construction	Biodiversity assessment (Appendix D)
	Temporary water crossing to be constructed from rock fill free of fines and of suitable size (≥ 150 mm diameter).	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on*

Impact	Environmental safeguards	Resp.	Timing	Reference
				RTA projects (RTA, 2011)
	Placement of structural components of the bridge outside waterways to avoid instream disturbance.	Contractor	Construction	Aquatic assessment (Appendix D)
	Temporary water crossing to be constructed from rock fill free of fines and of suitable size (≥ 150 mm diameter).	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
	Temporary in-stream structures to be inserted during low-flow periods, with management plans being submitted to DPI detailing how high-flow events will be managed to limit erosion of the structures and associated sedimentation of downstream waterways. An EWMS will be prepared to manage this activity and will submitted to Transport and DPI for review and approval.	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
	Temporary instream structure to ensure flow is maintained at all times.	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*

Impact	Environmental safeguards	Resp.	Timing	Reference
	Any dewatering of temporary in-stream structures will be undertaken in accordance with the following procedure: 1) DPI is to be notified 7 days prior to any dewatering activities in order to organise potential fish rescue activities. 2) A separate s.37 permit may be required from DPI to relocate fish. 3) Water is to be pumped a minimum of 30 metres away from the waterway and treated as required. 4) Any water re-entering the waterway will need to meet relevant ANZECC water quality guidelines. A water quality monitoring program is to be provided to Transport prior to commencement of this activity.	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
Microbats	Develop an Environmental Work Method Statement (EWMS) for demolition / relocation of the sentry box. The process for demolition / relocation of the sentry box is as follows: • Undertake demolition / relocation of sentry box outside of the maternity season of most microbat species (i.e. demolish only between May – September inclusive), unless otherwise approved by an appropriately qualified specialist. • Engage an ecologist with microbat experience (minimum 3 years) and Rabies vaccinations to supervise and guide the demolition / relocation of the sentry box • Undertake sentry box demolition / relocation at night after the ecologist confirms that microbats have left the roost. (There are too many entry/exit points to	Contractor	Pre-Construction Construction	Biodiversity assessment (Appendix D)

Impact	Environmental safeguards	Resp.	Timing	Reference
	successfully exclude microbats prior to demolition.) Avoid unsuitable weather conditions (i.e. very cold nights in winter) when bats are unlikely to leave the roost.			
Microbats	Prior to the commencement of works, limit use of the sentry box for essential use only to minimise disturbance to the microbat and potential disease risk to humans. Establish signs and exclusion area informing site personnel of management measures and presence of protected fauna.	Contractor	Pre-Construction	Biodiversity assessment (Appendix D)
	If microbats are observed flying during any early works activities, then stop work or move to another area further away for approximately one hour to allow bats to settle	Contractor	Construction	Biodiversity assessment (Appendix D)
	Any hazardous material sampling to be taken from the unoccupied corner of the sentry box. Refer to Appendix D for roost locations	TfNSW	Construction	Biodiversity assessment (Appendix D)
	Demolition of sentry box not to occur during the maternity season of microbat species (i.e. do not demolish between October to April inclusive)	Contractor	Construction	Biodiversity assessment (Appendix D)
	Investigate options to retain sentry box in its current location or relocate it within the proposal boundary.	TfNSW	Pre-Construction	Biodiversity assessment (Appendix D)
	Prior to relocation of the sentry box a pre-works survey to be undertaken by an ecologist with minimum 3 years microbat experience and Rabies vaccinations: • If bats are identified but are not threatened species then follow the demolition process outlined in the row below	Contractor	Pre-Construction Construction	Biodiversity assessment (Appendix D)

Impact	Environmental safeguards	Resp.	Timing	Reference
	• If threatened species are identified the demolition would be postponed and a microbat management plan would be implemented in accordance with the Transport Biodiversity Guidelines – unexpected threatened species finds procedure (RTA 2011) including consideration of hollow availability across a broader area (e.g. 5km) and the potential for compensatory habitat If no bats are identified within the structure demolition can proceed.			
	The process for demolition of the sentry box is as follows: • Undertake demolition of sentry box outside of the maternity season of most microbat species (i.e. demolish only between May – September inclusive). • Develop an environmental work method statement for demolition of the sentry box • Engage an ecologist with microbat experience (minimum 3 years) and Rabies vaccinations to supervise and guide the demolition of the sentry box • Undertake sentry box demolition at night after the ecologist confirms that microbats have left the roost. (There are too many entry/exit points to successfully exclude microbats prior to demolition.) Avoid unsuitable weather conditions (i.e. very cold nights in winter) when bats are unlikely to leave the roost.	Contractor	Pre-Construction Construction	Biodiversity assessment (Appendix D)

6.3 Non-Aboriginal heritage

6.3.1 Methodology

As part of the non-Aboriginal heritage assessment, a search of the following online statutory heritage registers was carried out:

- State Heritage Register
- Singleton LEP
- World Heritage List
- National Heritage List
- Commonwealth Heritage List
- Section 170 Heritage and Conservation registers.

The following non-statutory heritage lists were also searched:

- Hunter Region Heritage Study
- Register of the National Estate
- National Trust Register.

A Statement of Heritage Impact (SoHI) was prepared for the proposal in accordance with Transport heritage guidelines (RTA Heritage Guidelines, 2004) to assess the potential impacts associated with the early works and main project (AMBS, 2021). The SoHI was prepared with reference to the following:

- The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance
- Statement of Heritage Impact Guidelines (NSW Heritage Office, 2002).

Archaeological testing was undertaken by AMBS Ecology and Heritage (Appendix P, Appendix K). Four historical archaeological trenches were excavated (Figure 6-13):

- Two 10m x 1m test trenches were excavated west of the study area using a modified version of the Aboriginal test pit methodology to allow for exposure of the area of the trench in plan at historical archaeological levels.
- Two 5m x 5m test trenches were excavated east of the study area stratigraphically according to the historical archaeological methodology.

Historical archaeological features were recorded in accordance with the following methodology:

- Establish a site datum and lay out a grid, relevant to the size of the site, 10m, 20m or 50m, across the site in order to record the levels of extant deposits, features and relics
- All significant archaeological deposits, features and relics that are exposed during the excavations will be recorded in accordance with heritage best practice standards
- Recording included:
  - Cleaning features to facilitate photographic recording
  - Scale plans
  - Elevations of features, if relevant
  - Digital photographs (in JPG and RAW format)
  - Photogrammetry
  - Site survey
  - Detailed description of the feature, deposit or relic to ensure that a clear and comprehensive record of the archaeological resource of the site is preserved for the future
- Sequential numbering of features and deposits to facilitate preparation of a Harris Matrix and artefact labelling

- Preparation and development of a Harris matrix, to show stratigraphic relationships between all recorded archaeological features and deposits
- All information regarding the location, dimensions and characteristics of all recorded archaeological features and deposits will be recorded on pro-forma context sheet.

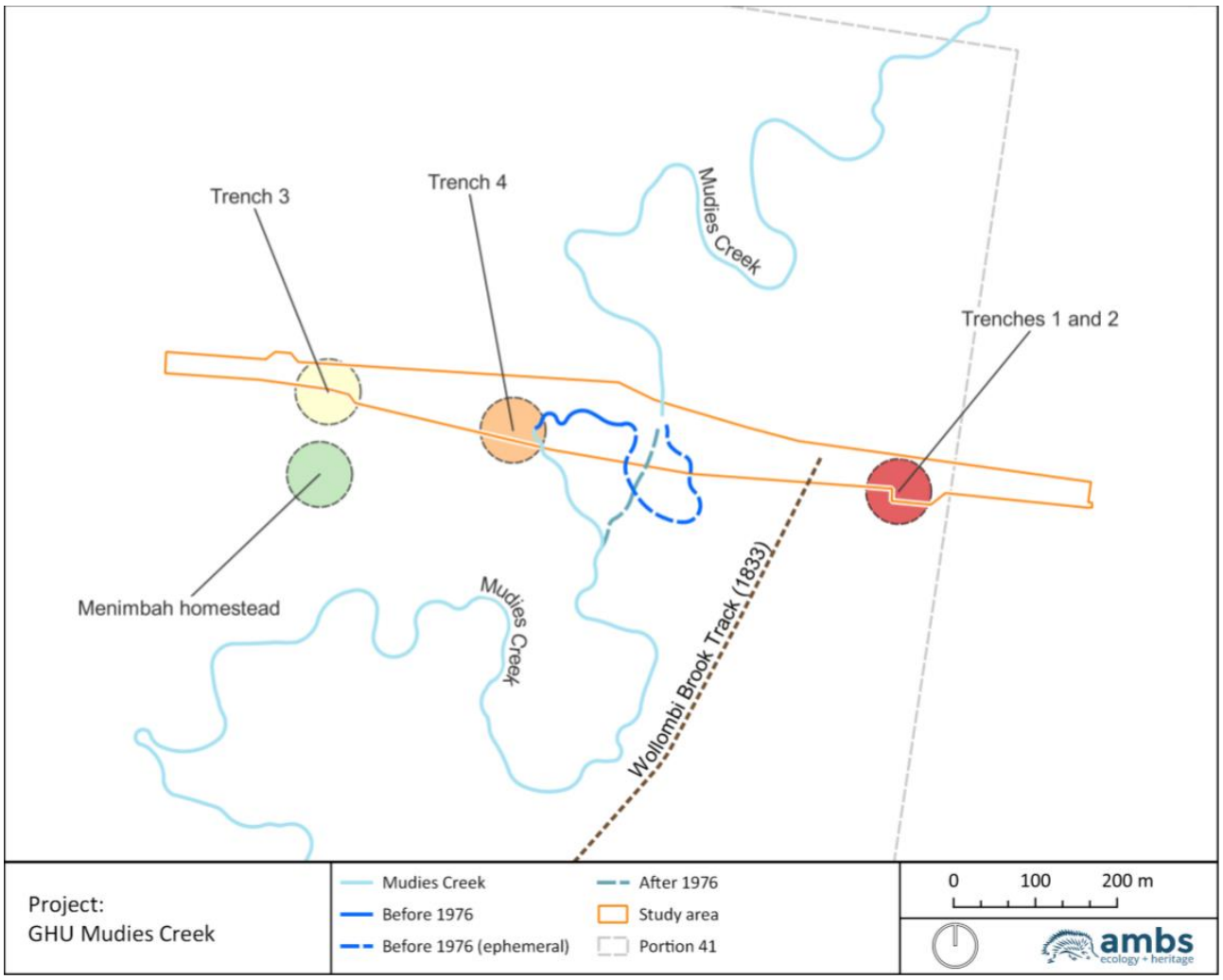

Figure 6-13: Historical investigation areas in the project area (AMBS Ecology + Heritage 2022)

6.3.2 Existing environment

The proposal area is within a 2,000 acre property that was granted to John Cobb in 1823. The Golden Highway (Mitchell's Line of Road) was surveyed in 1833, and a courthouse was built around 80 metres southwest of the proposal area on Cobb's land. It had been converted to a residence (Minembah) by 1840 and was part of a large sheep station and later a farm that included dairy and agriculture. There is very little documentary evidence concerning the early occupation of the site. Many different types of workers and the estate owner lived at the site at one time or another. Some occupants may have been permanent and some seasonal. Unlike the main homestead, the living quarters of the farm workers was not mapped or documented, and archaeological remains of their occupation and activity may still be present within the proposal area.

The archaeological remains at the site include:

- Fireplace of a structure

- Artefacts derived from living quarters have been scattered across the site during the demolition of these structures
- Rubbish pit containing waste and discarded artefacts disposed of away from the main homestead (Trench 2)
- Wells, cesspit and cisterns
- Evidence of early land management practices
- Abandoned farm machinery and tools.

A summary of the features and artefacts found in each trench are outlined in Table 6-20.

Table 6-20: Summary of features and artefacts found in Trenches 1 to 4

Trench number	Features and artefacts
1	• Fireplace of a structure, likely a timber slab hut with brick fireplace and chimney • Associated artefacts, predominantly fine earthenware • Seven Aboriginal stone artefacts.
2	• Rubbish pit containing high numbers of ceramic and glass artefacts • Associated artefacts, predominantly fine earthenware • One Aboriginal stone artefact.
3	• Low-density scatter of artefacts • Insubstantial feature, possible posthole, with no associated artefacts or visible post pipe.
4	• No features or artefacts

The Aboriginal stone artefacts found near the fireplace and in close association with high densities of European artefacts may indicate that Aboriginal people lived and worked at the property, however this could not be confirmed within the scope of the current approvals.

An updated assessment of archaeological potential (2022) rates the archaeological resources in the study are between nil and High.

6.3.3 Potential impacts

Construction

Construction of the proposal is likely to result in the complete removal of any surviving non-Aboriginal archaeological remains in the proposal area that are outside of the nominated buffer zone and exclusion zone for the archaeologically sensitive areas at Dochra Gate. In proximity to Trench 1, a new fire trail for the Singleton Military Area and a new permanent boundary fence are proposed.

Impacts to areas with suspected significant archaeology are expected to be negligible with the application of appropriate management measures.

Operation

There would be no operational impacts to non-Aboriginal heritage following construction of the proposed road and bridge upgrade at Mudies Creek.

6.3.4 Safeguards and management measures

The recommended safeguards and management measures to minimise other impacts during construction of the proposal are outlined in Table 6-21.

Table 6-21: Non-Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Non-Aboriginal heritage	Transport's Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) is to be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered during construction. Work should only re-commence once the requirements of the procedure have been satisfied.	Contractor	Construction	Section 4.10 of QA *G36 Environment Protection & Section 89A of the National Parks and Wildlife Act 1974*
Non-Aboriginal heritage	For all proposed works near Dochra Gate: Temporary fencing around Trenches 1 and 2 during construction works. Temporary fencing should be chainwire style with a foot weight and should not penetrate the ground.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
Non-Aboriginal heritage	All ground disturbance within the 8m buffer zone of Trench 1 should be avoided. Works in this area must build up and not cut down. Installation of temporary fencing and construction of the fire trail can occur within this zone outside of the temporary fenced areas. No buffer is required for Trench 2.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
Non-Aboriginal heritage	Compaction of soil in temporarily fenced areas around Trench 1 and 2 should be avoided.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
Non-Aboriginal heritage	Further testing of the site is not recommended. As conservation through in situ retention is the preferred outcome, further destructive investigations should be avoided.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
Non-Aboriginal heritage	Relocation and construction of the Sentry Box and new flagpole should occur outside of the 8m buffer around the hut and should not impact on the historic features identified in Trench 1 or 2.	Contractor	Construction	Draft Historical Test Excavation Report V4.pdf

Impact	Environmental safeguards	Resp.	Timing	Reference
Non-Aboriginal heritage	The fire trail should be built up above current ground levels to avoid impacts to the archaeology around the hut (Trench 1). During construction of the fire trail the location of Trenches 1 and 2 should be demarcated with temporary fencing and not used for ancillary purposes.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
Non-Aboriginal heritage	If unexpected heritage items are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the Transport *Standard Management Procedure: Unexpected Heritage Items* must be followed. Transport Senior Environment Specialist - Heritage must be contacted immediately.	Contractor	Construction	Section 4.10 of QA *G36 Environment Protection*
Non-Aboriginal heritage	TfNSW should provide a copy of this report (draft Historical Test Excavation Report, and the Golden Highway Upgrade - Mudies Creek Aboriginal Archaeological Excavation Report) to the Department of Defence, Wanaruah LALC and Singleton local studies library (redacted for Aboriginal site information as appropriate).	TfNSW	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf

6.4 Soils

6.4.1 Methodology

The following reports have been used to inform the assessment of the impact on soils and geology from construction and operation of the proposal:

- Geotechnical Factual Report (SMEC, 2019a)
- Geotechnical Interpretative Report (SMEC, 2019b)
- Preliminary Erosion and Sediment Assessment (PESA) (SMEC 2019e)
- Erosion and Sediment Control Management Plan (SMEC 2020a)
- Phase 1 Contamination Assessment (SMEC 2020b)
- Biodiversity Assessment Report (SMEC 2021).

Database searches of registered groundwater bores within the proposal area were conducted on 4 August 2021 using the NSW Natural Resource ATLAS online resource, held by the NSW Department of Primary Industries - Water.

6.4.2 Existing environment

The topography of the study area is characterised by a large creek flat associated with Mudies Creek. From the lowest point at Mudies Creek the ground surface rises gently to the south, east and west within the extent of the proposal area with a minor gain in elevation of about 10 metres. To the north the ground gently slopes in a downward direction.

Geology

Reference to the 1:250,000 Singleton Geology sheet indicates the majority of the proposal is underlain by the Permian aged Mulbring Siltstone which makes up the upper section of the Maitland Group and comprises interbedded siltstone and sandstone.

The Rothbury soil landscape (refer Figure 6-14) covers undulating and rolling hills south and south-east of Singleton. Soils are described as poorly to moderately well drained comprising mainly Red Podzolic and Yellow Podzolic soils with some yellow Solodic and brown Soloths on lower slopes; Prairie soils are generally located within drainage lines. Limitations include low to moderate flood hazards, low to high salinity, moderate to very high erosion hazard, low to moderate soil fertility.

The Hunter soil landscape (refer Figure 6-14) is described as extensive alluvial plains on recent alluvium derived from the Hunter and Paterson Rivers, in the Hunter Plain region in the centre of the area. Soils are described as deep, poorly to well drained comprising Prairie Soils, Brown clays, Chernozems, Alluvial Soils or Siliceous Sands. Limitations include flood hazard, foundation hazard, permanently high water tables, seasonal waterlogging and productive arable land and soils of high fertility.

Within the proposal area, the contamination assessment (SMEC, 2020b) has identified the road formation as containing fill material associated with construction of the road and for potential unknown wastes to exist within the road reserve.

It is considered unlikely that acid sulphate soils exist within or proximal to the proposal due to its inland location. The proposal is situated approximately 70 kilometres inland therefore the proposal area is not currently mapped by Acid Sulfate Soil Risk Maps. A review of the 1:25,000 *DIPNR Acid Sulfate Soil Risk Map* (1998) shows the nearest available mapping of acid sulfate soil risk is within the Hunter River, approximately 21 kilometres east of the proposal area. Acid sulfate soils are acidic soil horizons (layers) resulting from the aeration of soil materials rich in iron sulfides. Acid sulfate soils generally occur within the following locations:

- Marine or estuarine sediments deposited during the Holocene period
- Soils greater than five metres above sea level
- Marine or estuarine settings/environments.

The proposal is within an area mapped as very high for salinity (*Salinity hazard report for Catchment Action Plan upgrade – Hunter-Central Rivers CMA* (NSW Dept. Primary Industries, 2013) No salinity was observed or encountered during geotechnical investigation within the proposal boundary (*Golden Highway Upgrade Mudies Creek and Segments 4-10 Geotechnical Design Report* (SMEC, 2017a)).

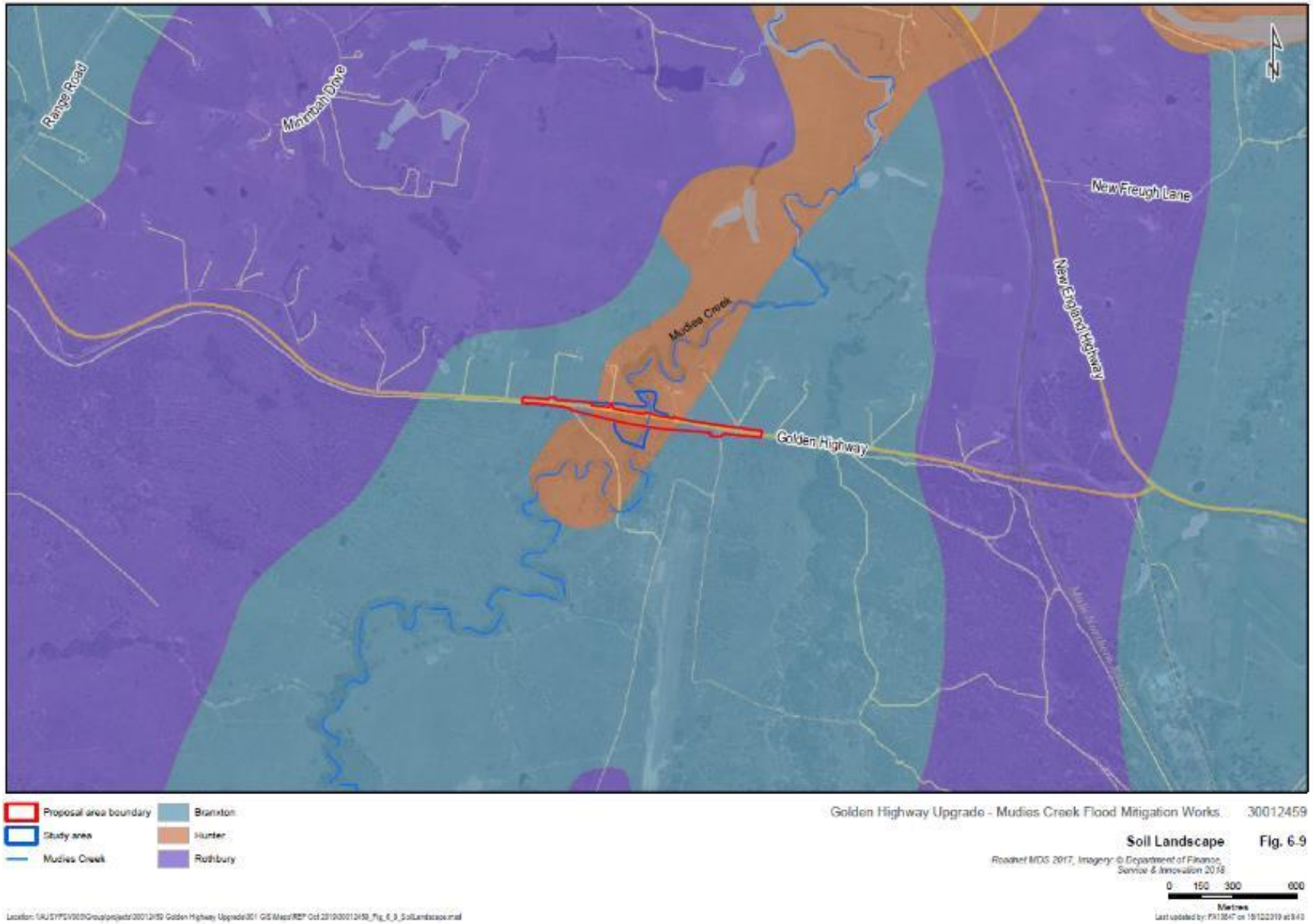

Figure 6-14: Soil landscapes

6.4.3 Potential impacts

Construction

The proposal would be constructed within the existing road corridor and on land to the south within the SMA. It is understood that Transport would lease this land for the construction period then acquire the land from the DoD when construction has been completed. It is estimated that the total area of land disturbed by the proposal would be about 40,000 square metres, excluding the existing road alignment (SMEC 2020). Ancillary sites would be required for the construction of the proposal and would be used for stockpiling of materials, laydown areas, storage of plant and equipment and office accommodation and amenities.

General construction activities that have the potential to impact on soils include:

- Ancillary site preparation and operation
- Clearing and grubbing of new road alignment
- Stockpiling of topsoil, spoil and imported materials
- Removal of unsuitable material on new road alignment
- Filling of new road alignment
- Piling for bridge abutments
- Handling and stockpiling of material (imported and spoil)
- Movement of heavy vehicles across exposed earth
- Generation of construction waste
- General waste generation from compounds
- Accidental spills of materials such as hydrocarbons and chemicals.

During construction, there would be potential for sediment and nutrient laden runoff from areas disturbed by construction to impact water quality in downstream waterways. Areas which would present a high risk of soil erosion include locations where both surface gradients and slope lengths combined would increase the erosive potential of storm water runoff. During construction, these locations would typically include:

- Areas stripped of vegetation
- Clearing and grubbing of new road alignment
- Stockpiling of topsoil, spoil and imported materials
- Fill embankments
- Road formation construction
- Construction in the vicinity of waterways including the bridge and its abutments
- Temporary waterway crossings
- Concentrated flow paths e.g. catch drains, batter drains, drainage outlets etc.

The Preliminary Erosion and Sediment Assessment (PESA) (SMEC 2019e) determined at Mudies Creek the proposal is considered to be low erosional risk and represents low potential for erosion hazards.

Operation

While it is not expected the proposal would have any operational impacts, such potential operation impacts could include:

- Failure of areas rehabilitated post-construction could result in sediment mobilising off site and causing a negative impact on the water quality of Mudies Creek

- Accidental spills or leakage of fuels, oils or other harmful substances from motor vehicles using the Golden Highway which could result in localised contamination of soils and pollution of downstream waterways
- Maintenance practices such as herbicide use, mowing, and road surface cleaning have potential to impact on downstream water quality.

6.4.4 Safeguards and management measures

Table 6-22 provides the safeguards and mitigation measures proposed to address potential impacts on soils from the proposal.

Table 6-22: Soils safeguards and mitigation measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Soil loss and water quality	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. The SWMP would address the management of stockpiles including their location.	Contractor	Pre-construction Construction	Section 2.1 of QA *G38 Soil and Water Management* Transport *Stockpile Management Guideline (2015)*
Soil loss and water quality	A site specific Erosion and Sediment Control Plan (ESCP) will be prepared and implemented as part of the SWMP. The ESCP will show the location of all erosion and sediment controls (ERSED). The ESCP will be progressively updated to address changes in construction staging. The ESCP will include arrangements for the following: • Identification of high risk construction activities (i.e. works in waterways) and preparation of environmental work method statements (EWMS) to mitigate risk • Appropriate ERSED controls including off-site/site water separation • Management of weather events, including monitoring of potential high risk events (such as storms), specific controls and follow-up maintenance • Location and management of stockpiles including ERSED controls.	Contractor	Construction	Section 2.2 of QA *G38 Soil and Water Management* Landcom's Managing Urban Stormwater: Soils and Construction series Transport *Stockpile Management Guideline (2015)*

Impact	Environmental safeguards	Resp.	Timing	Reference
Soil loss and water quality	Nomination of a Contractor environmental site representative (ESR) to monitor effectiveness of the SWMP and ESCP. The ESR would manage the monitoring and maintenance of ERSED controls, progressively update ESCPs as required.	Contractor	Construction	Section 3.3 of QA G36 *Environment Protection*
Soil loss and water quality	The rehabilitation of disturbed areas is to be carried out progressively as construction stages are completed. Topsoil should be stockpiled in cleared or disturbed areas to avoid the removal of native vegetation.	Contractor	Construction	Section 3.1 of QA *G38 Soil and Water Management* Landcom's Managing Urban Stormwater: Soils and Construction series
Management of top soil for reuse	Stripped topsoil to be managed in accordance with the requirements of R178.	Contractor	Construction	Transport QA Specification R178 Vegetation
Stockpiling of materials	Stockpiles are to be managed in accordance with the Transport requirements. Stockpiles will be located in cleared or disturbed areas. Where possible stockpiled material will be reused on site or removed off site to other Transport projects or premises with approval to accept such material. Material that cannot be reused will be disposed to a licensed waste facility.	Contractor	Construction	Transport *Stockpile Site Management Guideline* (2015)
Soil stabilisation	The rehabilitation of disturbed areas is to be carried out progressively as construction stages are completed, and in accordance with: • Landcom's Managing Urban Stormwater: Soils and Construction series • RTA Landscape Guideline • Transport Guideline for Batter Stabilisation Using Vegetation.	Contractor	Construction	Transport QA Specification R178 Vegetation
Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the	Contractor	Construction	Section 4.2 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Resp.	Timing	Reference
	immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport Environment Manager and/or EPA.			
Unexpected contamination	The CEMP, or relevant management plan, will include an unexpected finds protocol for potentially contaminated material encountered during construction work.	Contractor	Construction	Section 4.2.3 of QA *G36 Environment Protection*
Asbestos	An Asbestos Management Plan will be developed and implemented to manage asbestos and asbestos containing material if encountered during the construction. The plan will include: • Identification of potential asbestos on site • Procedures to manage and handle any asbestos • Mitigation measures if asbestos is encountered during construction Procedures for disposal of asbestos in accordance with the NSW EPA guidelines, Australian Standards and relevant industry codes of practice	Contractor	Construction	Clause 425 & 429 of Work Health and Safety Regulation 2017
Surface water and groundwater	Hydrocarbon refuelling areas and chemical stores to be lined and/or bunded and at least 50 metres from any surface water or groundwater source to minimise potential of pollution.	Contractor	Construction	Section 4.3 of QA G36 *Environment Protection*
Accidental spill	A site specific emergency spill plan will be developed and include spill management measures in accordance with the Transport *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services	Contractor	Construction	Section 4.3 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Resp.	Timing	Reference
	and relevant authorities (including Transport and EPA officers).			

Other safeguards and management measures that also address soil impacts are identified in Section 6.4 –Water quality, hydrology and flooding.

6.5 Water quality, hydrology and flooding

6.5.1 Methodology

Aspects relating to water, hydrology and flooding were assessed using the *Golden Highway Upgrade Mudies Creek Hydrology and Hydraulics Report* (SMEC, 2019c)(Appendix R1), *Mudies Creek Temporary Crossing – Hydraulics Assessment* (SMEC 2019d) (Appendix R2), *Biodiversity Assessment Report* (SMEC 2021) (Appendix D) and *Golden Highway Upgrade Aquatic Ecological Assessment* (écologique 2019). In addition, aerial photographs and topographical information was reviewed.

Hydrologic modelling was undertaken using the Watershed Bounded Network Model (WBNM) and was used to calculate flood hydrographs from input of rainfall hyetographs, subtraction of losses and routing through the channel network. Flood estimation techniques, including adoption of design rainfall depths, loss values and temporal patterns, were performed in accordance with Australian Rainfall and Runoff 1987 (ARR 1987) for the two, 20, 50 and 100 year ARI events. Water quality was assessed qualitatively through visual assessment and quantitatively through the measurement of physico-chemical parameters.

6.5.2 Existing environment

Overview

The proposal lies within the catchment area of the Upper Hunter and forms part of the largest coastal catchment in NSW, with an area of about 21,500 square kilometres. The landform is predominantly rolling hills, wide valleys, with a meandering river system on a wide flood plain. Elevations across the catchment vary from over 1,500 metres in the high mountain ranges north of the catchment, to less than 50 metres on the floodplains of the lower valley. The catchment headwaters are heavily timbered, mid reaches extensively cleared and lower reaches dominated by pasture and irrigation land use as Mudies Creek approaches confluence with the Hunter River. The waterway is well vegetated along its banks and has a silty clayey substrate (ècologique 2019). There are six rural properties with a number of farms harvesting surface water from natural drainage lines. To the south or upstream of the proposal area is the SMA which comprises areas of vegetation and grassland. Aside from the guard post at Dochra Gate there are no other SMA structures within the proposal area. About 400 metres south of the proposal area is the Dochra aircraft landing strip which is orientated in north / south direction.

Water quality

Mudies Creek flows in a northerly direction through the middle of proposal area and intersects with Emigrant Creek about 800 metres north of the proposal area before flowing into the Hunter River about 3.8 kilometres to the north east. Mudies Creek is a 4th order stream with ephemeral flow. There is an abandoned channel (Channel 1) to the west of Mudies Creek, which appears to be an historical flow path of Mudies Creek (ècologique 2019) (Appendix D). Channel 1 is now effectively dammed by the highway and elevated land to the east and southeast but remains hydrologically connected to the current day main stream of Mudies Creek. A second channel (Channel 2) is located east of Mudies Creek and also appears abandoned and is not hydrologically connected to Mudies Creek. As identified by the contamination assessment (SMEC, 2020b) carried out for the proposal, Mudies Creek is considered a sensitive receptor (refer Figure 6-15).

Figure 6-15: Surface water locations

Field surveys conducted in March 2016 assessed the extent and quality of aquatic habitat through a combination of qualitative visual assessment and the measurement of physio-chemical water quality parameters (Appendix D). At the time of field surveys only Mudies Creek and Channel 1 held water but were not flowing, and no water was held in Channel 2. The only water in Mudies Creek and Channel 1 available for sampling sites were isolated and stagnant refuge pools, upstream and downstream of Golden Highway. Conductivity was above the range of 150 microsiemens per centimetre to 500 microsiemens per centimetre. Conductivity varied between 694 microsiemens per centimetre to 22224 microsiemens per centimetre depending on the sampling location and time of day (écologique 2019). Dissolved oxygen varied 1.19 milligrams per litre to 9.95 milligrams per litre depending on the sampling location and time of day (écologique 2019). The pH range was between 7.29 pH to 7.89 pH which is considered neutral. Based on water sampling results, in general terms the water quality of Mudies Creek at the time of sampling would be classified as poor.

A search of the Department of Primary Industries - Water Online Database on 26 March 2018 (DPI, 2018) identified no groundwater bores within one kilometre of the proposal area. In addition, no groundwater was encountered during the geotechnical investigation within the limits of the boreholes which were between 14 metres and 14.72 metres in depth It is therefore considered that the groundwater level is below the proposal's level of influence.

Hydrology and flooding

Mudies Creek is a tributary to the Hunter River, intersected by the Golden Highway and with a contributing catchment area of 67.4 square kilometres at this intersection point. The Mudies Creek channel elevation drops by approximately 31.9 metres over its 15.3 kilometre length. Within the proposal area informal table drains collect surface water runoff from the Golden Highway which then flows into Mudies Creek. The existing five cell culvert arrangement at Mudies Creek consists of five culverts with each being three metres wide and 1.8 metres high. Baseline flood modelling shows the crossing over Mudies Creek has a flood immunity of one in five year ARI event (SMEC 2019d). During flood events the Golden Highway is inundated up to about 300 metres in length and is impassable to traffic. The modelling showed that the:

- Peak flows range from about 96 cubic metres per second to 240 cubic metres per second from the five year to 100 year ARI event
- Peak flood wave arrived at existing culverts about 20 hours after the commencement of rainfall for the five year ARI through to the 100 year ARI events
- Peak flood wave arrived about 27 hours after the commencement of rainfall for the 2,000 year ARI and probable maximum flood (PMF)
- PMF peak flow is an order of magnitude greater than all other events assessed.

6.5.3 Potential impacts

Construction

Construction of the proposal has the potential to impact directly on the water quality of Mudies Creek from areas disturbed by construction. During earthworks topsoil would be stripped and underlying material excavated, creating the potential for erosion, runoff and the mobilisation of sediment offsite. The risk of offsite sediment mobilisation is increased during heavy rainfall events. In nominal chronological order, the proposed work would include:

- Vegetation clearing and grubbing
- Importation, stockpiling and placement of general and engineered fill
- Excavation and piling for bridge abutments
- Excavation of unsuitable material in new road alignment

- Construction of new road alignment and bridge approaches
- Construction of bridge
- Construction of abutment scour protection
- Removal of the five cell culvert structure and reshaping of creek banks.

Areas which would present a high risk of soil erosion include locations where both surface gradients and slope lengths combine and result in concentrated flow which increase the erosive potential of stormwater runoff. Erosion from stockpiles of excavated spoil, fill and other erodible materials would also result in sediment runoff. A potential source of water pollution includes accidental spills or leakage of fuels, oils or other potentially harmful substances, which would result in localised contamination of soils and pollution of Mudies Creek.

A proposed temporary crossing would be built over Mudies Creek to allow vehicles, plant and equipment associated with construction internal access within the work site to avoid using the Golden Highway to cross from one side of the creek to the other. The location of the temporary crossing would be about 40 metres upstream (south) of the existing RCBC crossing. The temporary crossing arrangement is based on four 450 millimetre corrugated steel pipes (CSP) with one metre clean fill material (rock ballast or similar) from the channel invert to the crest of the crossing (refer Figure 6-16). The temporary crossing would require lowering the eastern and western banks of Mudies Creek to achieve a 15 per cent grade on the approaches. It is expected the crossing track top would be about five metres wide and 10 metres long.

Assessment of potential flooding impacts of the temporary crossing was undertaken (Appendix R) (SMEC 2019). The assessment determined a low (less than six month) flood immunity with the majority of creek discharge overtopping the temporary crossing. The benefits of a low flood immunity crossing is that flood flows would pass over the temporary crossing and the resultant flood afflux is maintained within the Mudies Creek channel banks. The proposed temporary crossing would have the potential to increase velocity at the CSP downstream outlet and cause upstream afflux (rise in water level) during storm events (Appendix R). The increase in velocity and upstream afflux is not expected to have more than a minor temporary impact on the waterway and upstream land respectively. Other potential impacts from the temporary include pollution from plant and equipment spills, sediment mobilising off site from access track cuts, and loss of CSP and hardstand material during flood events.

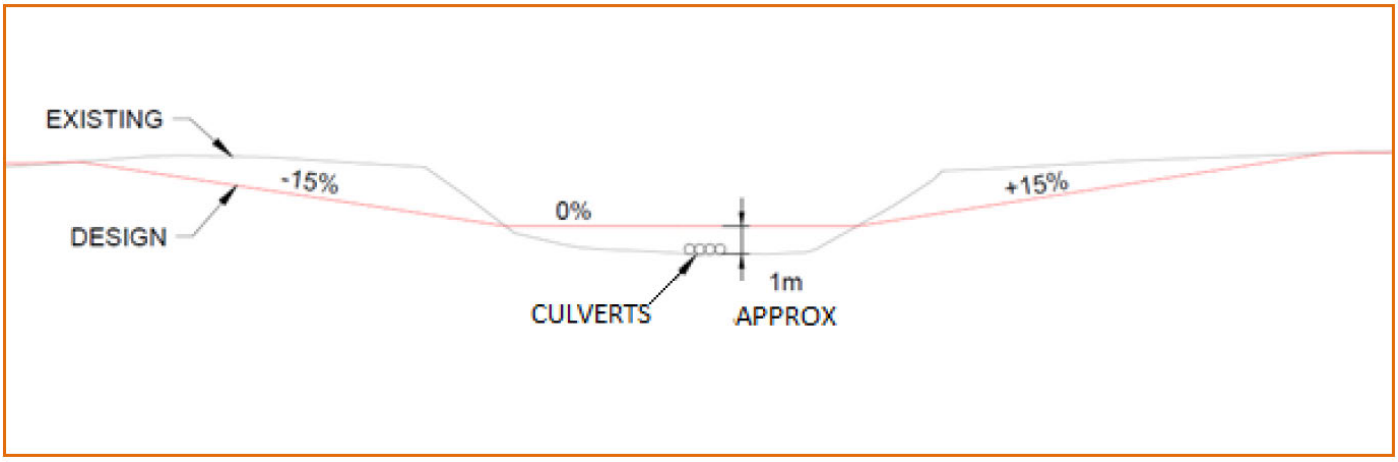

Figure 6-16: Temporary crossing arrangement

Operation

To achieve the required one in 50 year flood immunity on the Golden Highway at Mudies Creek, the proposal's new road alignment would be about five metres higher than the existing road level. The change in level at Mudies Creek would restrict upstream water on the southern side of the

Golden Highway during flood events and would affect upstream afflux by a height of about 411 millimetres in the one in 50 year event. In general, the proposal would attenuate peak flows by about one percent and upstream inundation time increased by about five minutes. The proposal would result in a higher duration of inundation, however in hydrological terms, the impact is considered imperceptible (Appendix R1).

The baseline flood mapping demonstrated properties located directly downstream of the proposal already have a high flood immunity (Appendix R1). The proposal would have minor downstream flow attenuation effects with only a slight decrease in flood levels due to the bridge forming a flow constriction and increasing velocities. The main property currently affected by flooding is located on the east side of Mudies Creek, north of the Golden Highway road reserve. For the 1 in 100 year ARI flood event, the proposal is predicted to cause afflux of up to 20 millimetres at this residence, which is not considered significant (Appendix R1).

Other operational impacts include:

- Failure of areas rehabilitated post-construction has the potential for sediment to mobilise off site and impacts on the water quality of downstream receiving waterways
- Accidental spills or leakage of fuels, oils or other potentially harmful substances from motor vehicles using the Golden Highway which could result in localised contamination of soils and pollution of downstream waterways
- Maintenance practices such as herbicide use, mowing, and road surface cleaning have potential to impact on downstream water quality through the mobilisation of sediment offsite

Larger impermeable surface area has potential to increase surface water runoff volumes as well as transport pollutants within the pavement into the receiving waterway.

6.5.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to surface water and hydrology during construction of the proposal are outlined in Table 6-23.

Table 6-23: Water quality, hydrology and flooding safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Spills during construction	A Spill Management Plan would be prepared for the proposal. If a spill or incident occurs, the Transport Environmental Incident Classification and Management Procedure (Roads and Maritime, 2018) would be followed and the Transport Contract Manager notified immediately.	Contractor	Pre-construction Construction	Section 4.3 of QA *G36 Environment Protection*
	Store chemicals, fuel and lubricants in suitably located and bunded areas not within 50 m of any aquatic habitat, flood prone areas, or on slopes steeper than 1:10.	Contractor	Construction	Section 4.3 of QA *G36 Environment Protection*
	Do not refuel or maintain plant and equipment, mix cutting oil with bitumen, or carry out any other activity which may result in spillage of a chemical, fuel or lubricant at any location which drains directly to	Contractor	Construction	Section 4.3 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Resp.	Timing	Reference
	waters or environmentally sensitive areas, without the appropriate temporary bunding being provided. Do not leave refuelling operations unattended..			
Pollution of downstream waterways due to maintenance practices during operation	Transport's standard maintenance controls will be applied in a manner that will minimise any potential water pollution due to maintenance practices (such as herbicide use, mowing, and road surface cleaning).	TfNSW	Operation	*Transport Environmental Assessment Procedure for Routine and Minor Works, Standard Safeguards*

Refer Section 6.3 – Soils, for other applicable safeguards and management measures.

6.6 Traffic and transport

6.6.1 Methodology

Assessment of the proposal's construction impact on traffic and transport was carried out using data from construction staging plans and projected vehicle volumes.

Operationally, the proposal has been assessed using the criteria of road safety and current access arrangements.

6.6.2 Existing environment

The proposal is about 1.8 kilometres west from the intersection of the Golden Highway and the New England Highway at Belford and continues west for 1100 metres. Within the proposal area, the Golden Highway is a single carriageway with narrow shoulders of one metre or less and has a posted speed limit of 100 kilometres per hour.

The Golden Highway is an approved higher mass limit (HML) B-Double route, one of only three east-west B-Double routes north of Sydney over the Great Dividing Range. It is also an important freight corridor that accommodates over size over mass (OSOM) vehicles and loads in the Lower Hunter. OSOM movements are only permitted in off-peak times.

The proposal area currently has limited public transport services, which reflects the low level of demand along the corridor. School buses, provided by Hunter Valley Buses, operate along the proposal area, providing a service for students living in agricultural areas. These stops are unformed and typically provided on the existing road shoulder.

Cyclist numbers are low in the proposal area due to the long distances between small towns along the Golden Highway corridor. Shoulder widths do not meet current standards for on-road cycling, however shoulder widths are wider in isolated locations. There are no pedestrian or off-road cycle paths in the vicinity of the proposal.

Current traffic volumes and network performance

Traffic count station 05841 was used for this assessment and is located along the Golden Highway (Mitchell Line of Road), 1.65 kilometres west of the New England Highway (refer Figure 6-17). The AADT data for this site (refer Figure 6-18) for 2008 and 2010 indicates an eight per cent growth in total vehicles between 2008 and 2010 (RMS, 2018). The annual average daily traffic (AADT) volume recorded in 2014 on this section is 4,975 with heavy vehicles accounting for 1,036 or 19 per cent. Annual traffic growth has experienced steady annual growth of between one to two per cent (linear) over the 2004 to 2014 period (Golden Highway Corridor Strategy, 2016). The westbound peak period is around 5am to 7am, while the eastbound peak period is around 2pm to 5pm. The afternoon peak extends for a longer period of time however has less severe peak vehicle volume.

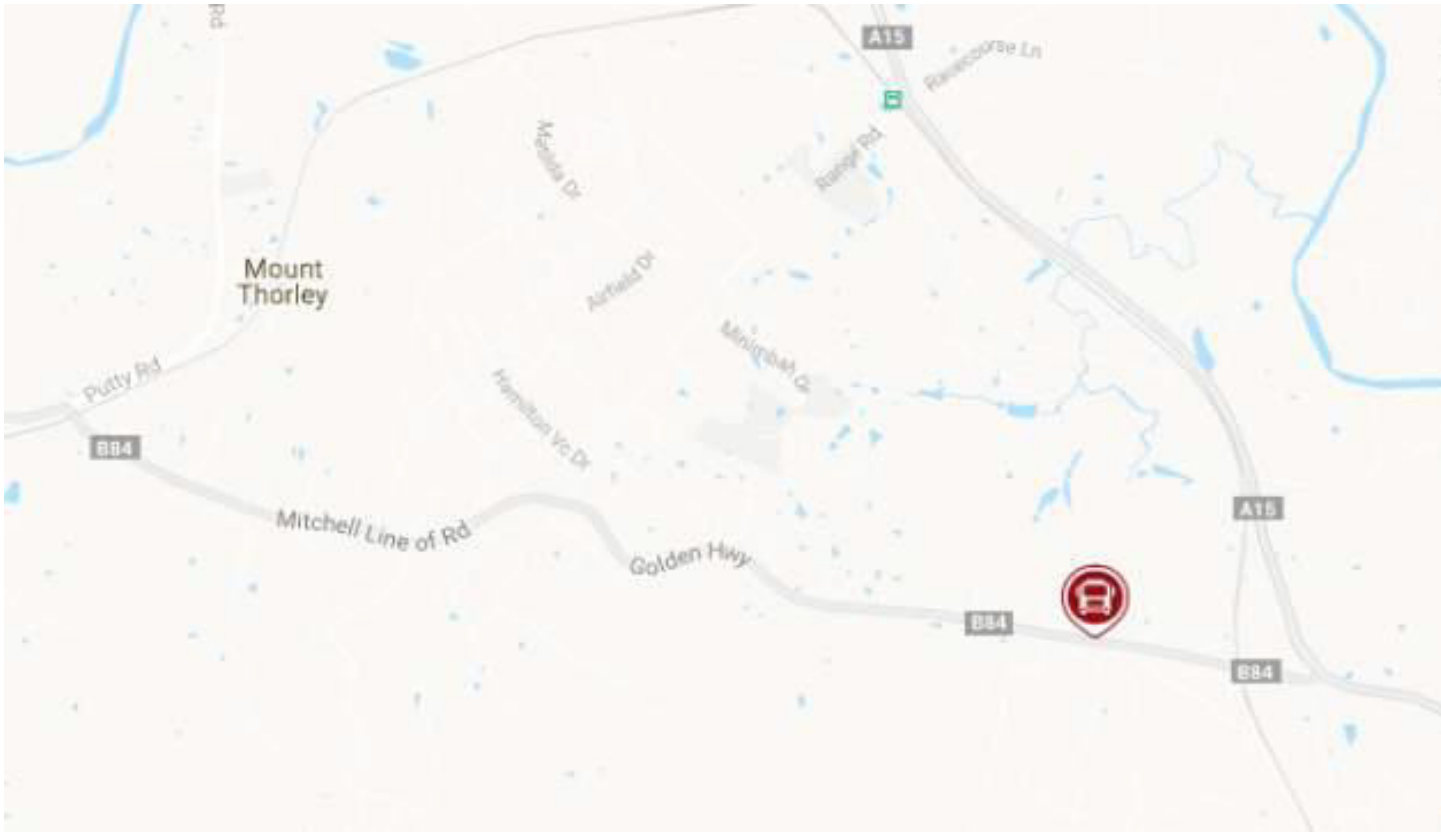

Figure 6-17: Location of traffic count station 05841

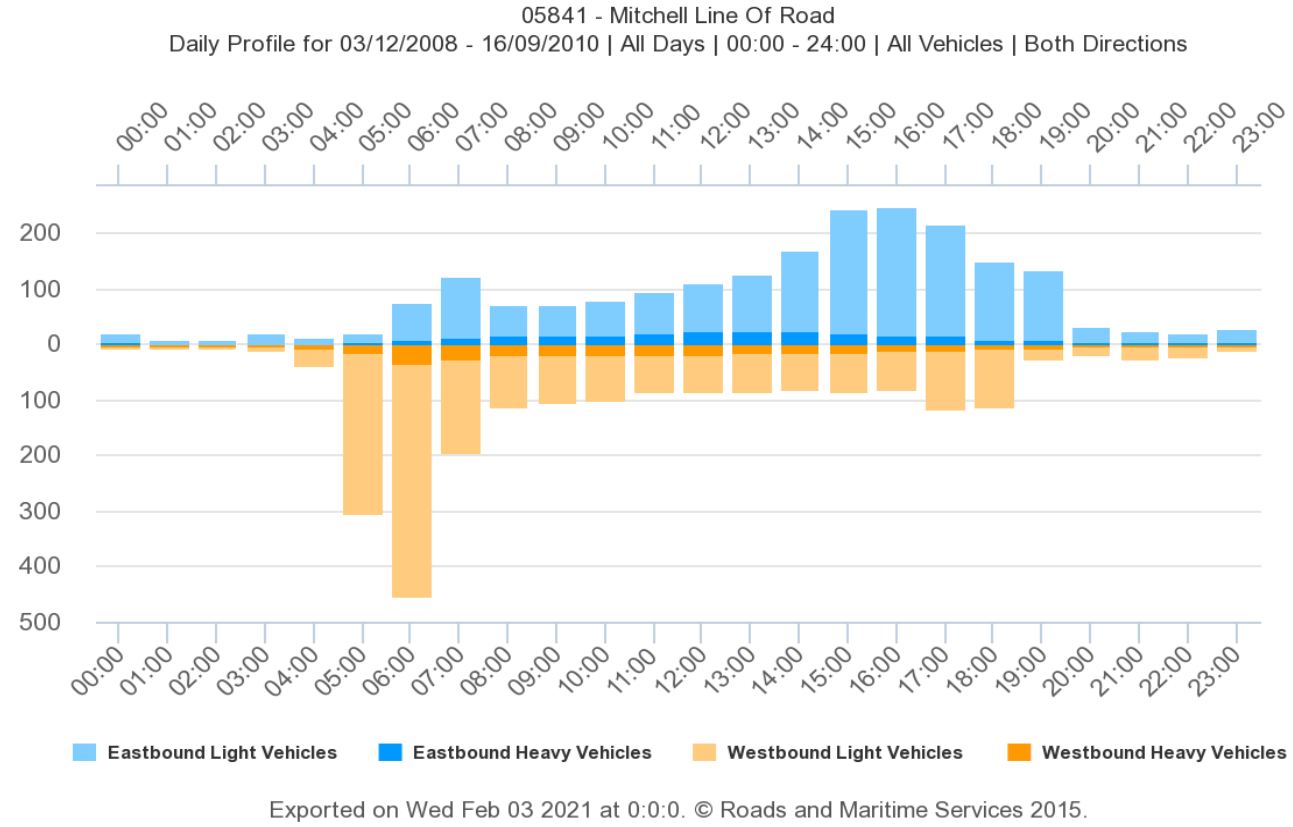

Figure 6-18: Average annual daily traffic

Current safety implications

Between August 2011 and July 2016, 12 crashes were reported on the Golden Highway within the proposal area. Of these crashes, two crashes resulted in fatalities, and eight resulted in injuries. The remaining two crashes were reported as non-injury crashes. These crashes are spread out through the proposal area, with a small cluster of crashes occurring on the curve to the west of the intersection with Range Road. Eight of these crashes resulted vehicles leaving the roadway, predominantly on curves. Of the 12 reported crashes, nine were reported as having speed and/or fatigue a factor in the crash.

6.6.3 Potential impacts

Construction

It is expected that up to 120 heavy vehicle movements would occur during the peak construction period on a typical working day. The movement of workers, supervisors and small plant are estimated at 100 movements per day. For the duration of the construction phase when the construction site is active and workers are undertaking activities next to live traffic, the posted speed limit would be reduced to 40 kilometres per hour in both directions. When the worksite is not active the speed limit would be 60 kilometres per hour. Access to the construction site would be from the Golden Highway with exact access locations determined by the construction contractor and dependent on the construction phase.

Construction staging would be managed to minimise impacts on traffic during construction. Where possible, one trafficable lane would be provided in each direction for through traffic, however, there would be times where this would be reduced to a single lane under alternate-flow. As part of construction staging, the proposal would require full temporary closure of the Golden Highway. Full temporary closures would be required to safely complete activities such as tying in the new road alignment to the existing road network. During temporary closures, the proposed detour routes for all motor vehicles traveling along the Golden Highway would detour along Range Road and the New England Highway (refer Figure 3-3). For road users using the detours the increase in distance and travel time using Range Road would be about three kilometres and four minutes respectively.

One ancillary site is located within the proposal area at Mudies Creek on the southern side of the Golden Highway west of Dochra Gate (refer Figure 3-4). Up to five ancillary sites located within the Belford to Golden Highway project area (refer Figure 3-4) would be utilised by the proposal. Construction staff parking would be provided at various ancillary sites. Temporary construction speed limits would be implemented and when work activities are being undertaken adjacent to live traffic 40 kilometre per hour speed limits would be required. When construction vehicles and plant and equipment are entering and exiting ancillary sites temporary control would be required. Short term delays of up to a few minutes in duration would be expected.

Access to private properties would be maintained during construction, including during the temporary road closures. Temporary changes to property access from the road reserve would be required during some construction phases. Property owners would be consulted prior to any changes and access would be maintained. Safe access for emergency vehicles would be provided at all times during the construction period.

Construction of the proposal is not expected to have any impact on the operation of the military airfield, south of the proposal area within the SMA.

Operation

The upgrade of this section of the Golden Highway would provide improved safety and efficiency for road users (including heavy and OSOM vehicles) by providing a reliable road network which provides immunity from flooding and meets current safety standard.

Operation of the proposal is not expected to have any impact on the operation of the military airfield, south of the proposal area within the SMA.

6.6.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to traffic and transport during construction of the proposal are outlined in Table 6-24.

Table 6-24: Traffic and transport safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
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 Transport's *Traffic Control at Work Sites Manual* (Transport for NSW, 2020) and *QA Specification G10 Control of Traffic*. The TMP will include: • Confirmation of haulage and detour routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) 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 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.	Contractor	Pre-construction Construction	*Traffic Control at Work Sites, Technical Manual* (Transport for NSW, 2020) and *QA Specification G10 Control of Traffic*

Impact	Environmental safeguards	Resp.	Timing	Reference
Changed transport and access	Road users, local residents and local businesses are to be informed a minimum of five days of changed conditions, including the likely disruptions to access	Contractor	Pre-construction Construction	Section 3.7 of QA *G36 Communication*
Disruptions to traffic and transport	Real-time information is to be made available through temporary Variable Message Signs (VMS), the Live Traffic and 131 500 websites, and the media	Contractor	Construction	*Traffic Control at Work Sites, Technical Manual* (Transport for NSW, 2020) and *QA Specification G10 Control of Traffic*
Disruptions to traffic and transport	Construction staging and materials are to be managed to minimise the number of haulage and delivery vehicles required on site	Contractor	Construction	*Traffic Control at Work Sites, Technical Manual* (Transport for NSW, 2020) and *QA Specification G10 Control of Traffic*
Disruptions to traffic and transport	The designated site access points and haulage routes are to be used	Contractor	Construction	*Traffic Control at Work Sites, Technical Manual* (Transport for NSW, 2020) and *QA Specification G10 Control of Traffic*

Other safeguards and management measures that would address traffic and transport impacts are identified in the REF Section 6.11 Socio-economic.

6.7 Property and land use

6.7.1 Methodology

The proposal's impact on property and land use has been considered through a qualitative assessment referencing the Singleton LEP, land ownership details, the proposed design of the new bridge and road, and property acquisition requirements.

Consultation with the DoD was carried out by Transport during the development phase of the proposal. When the southern alignment was determined as the preferred option and property acquisition deemed necessary for the proposal to proceed, Transport commenced negotiations with the DoD.

Consultation with the public utility authorities has been carried out as part of the development of the concept and detailed design to identify and locate existing utilities and incorporate utility authority requirements for relocations and/or adjustments. Confirmation of the relocation of utilities and associated strategies would be carried out in consultation with utility authorities during detailed design.

6.7.2 Existing environment

Land use and property

Rural farmland properties are located north of the proposal area, in between Range Road and the New England Highway. Properties typically comprise a main building structure (residential or commercial) with farm dams and cleared agricultural areas. Land to the south of the proposal is occupied by the SMA.
Land within and adjacent to the proposal area is classified within the following zones of the Singleton LEP:

- SP2 Infrastructure (Classified Road)
- SP2 Infrastructure (Defence)
- RU1 Primary Production.

Defence

The SMA is a 14,000 hectare facility located between Brokenback Range, the Hunter Vineyards, Lone Pine Barracks and the Mount Thorley Mine area. The SMA is owned by the Commonwealth of Australia and was established in 1940. It is primarily used for military training, including several firing and weapons ranges, explosives testing as well as no-firing training facilities for all units of the Australian Defence Force and other government agencies including the police. The SMA adjacent to the road reserve contains native vegetation comprising a mix of trees and grassland which is traversed by access tracks. About 500 metres south of the proposal is an airstrip about 1.1 kilometres in length running in a north/south axis.

Utilities

A Dial Before You Dig (DBYD) search was undertaken on 3 March 2018 (DBYD job no. 13806689 and 13806726) to determine public utility providers with assets within the vicinity of the proposal. The search identified the following authorities as having assets present in the vicinity of the proposal area):

- Electrical – Ausgrid
- Telecommunications – Telstra
- Water – Singleton Council.

Council records indicated there are no sewerage system within the vicinity of the proposal area.

Electrical

The proposal is in the area of electrical infrastructure associated with Ausgrid's 66kV and 11kV network. Up to two stay poles would need to be relocated and raised to meet required cable height clearance over the road. Overhead wiring on Range Road and Putty Road detour routes would need to be adjusted when traffic is directed down these roads.

Telecommunications

Telstra has copper telecommunication cables throughout the proposal area, primarily running parallel and to the north of the Golden Highway for the full extent of the proposal.

Water

Singleton Council has a water main running along the northern side of the Golden Highway from east of the proposal boundary to Chainage 1100, before the line diverges away from the Golden Highway heading north.

6.7.3 Potential impacts

Construction

Acquisition and adjustment

The proposal would require the permanent acquisition of about 17,000 square metres of land within the SMA from the DoD on the southern side of the existing road corridor at Mudies Creek (refer Figure 3-6). Acquisition of this land is required for the new road alignment and bridge over Mudies Creek. In addition, property adjustment is required within the SMA to relocate the access gate, build a new gate house, relocate a flag pole, construct a fire-trail, install new fencing and relocate two gates.

Property access

The proposal would alter existing property access and letter boxes within the road reserve of up to six private residences on the north side of the road corridor. The property to the north on the east side of Mudies Creek would require the existing access track to be regraded to about one in 10 to bring the tie in up to the height of new road. The remaining four property access tracks would be extended within the road reserve to tie into the new road alignment. Temporary alterations to property access may be required to suit construction staging. Agreement with the property owner would be sought prior to any temporary alteration.

Operation

Operationally, the proposal would provide positive impacts. When completed, the proposal would provide a safe and reliable road network as well as improved access to properties as existing tracks would be upgraded where they tie into the highway. Operation of the Golden Highway would not affect land uses adjacent to the proposal corridor.

Shoulder widths on the Golden Highway have been increased at driveways to improve safety for local residents and through vehicles. This allows safe width to pass a turning vehicle and improves line of sight to driveways.

6.7.4 Safeguards and management measures

The recommended safeguards and mitigation measures to minimise the impacts of the proposal on property and land use are listed in Table 6-25.

Table 6-25: Property and land use safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Property acquisition	Property acquisition will be carried out in accordance with Transport's Land Acquisition Information Guide (Roads and Maritime, 2012).	TfNSW	Pre-construction Post-construction	Core standard safeguard PL1
Property acquisition	Property acquisition will be in accordance with Commonwealth legislation.	TfNSW	Pre-construction Post-construction	Common-wealth Lands Acquisition Act 1989

Property acquisition would be in accordance with the Commonwealth *Lands Acquisition Act 1989* (LA Act) which outlines the procedures and guidelines for the transfer of Australian Defence Force land. As acquisition is by agreement Section 40 of the LA Act applies. Property acquisition would be consistent with the requirements of Transport's Land Acquisition Information Guide (Roads and Maritime, 2012).

6.8 Waste and contamination

6.8.1 Methodology

A Phase 1 Contamination Assessment was prepared for the proposal by SMEC in February 2020 (SMEC 2020b). The findings are summarised below and provided in Appendix G. The following methodology was followed in the preparation of the Phase 1 assessment:

- Site inspections were carried out to visually assess present and past potentially contaminating activities, current landforms and site condition
- A review of past and present aerial photographs obtained from the NSW Department of Lands, limited to 1963, 1990 and 2016
- Database search of NSW EPA contaminated land record and public record for licences, applications, notices, audit or pollution studies and reduction programs
- A desktop review of information relevant to the history of sites within the proposal area to determine past and present land uses
- Identification of preliminary Areas of Environmental Concern (AEC), preliminary assessment of risk for contamination to have occurred and possible exposure pathways and media.

A Phase 2 Detailed Site Investigation was prepared for the proposal by SMEC in March 2022 for two areas (AEC3 and AEC5) identified of concern from the Phase 1 assessment. The findings are summarised below and provided in Appendix G. The following methodology was followed in the preparation of the Phase 2 investigation for the two areas:

- Preliminary sampling of sediment and surface water monitoring at two locations within Mudies Creek
- Soil sampling from 15 test pits excavated with hand tools
- Sediment / soil sampling from 9 hand auger locations within Mudies Creek and embankments
- Groundwater quality monitoring of one existing groundwater bore
- Surface water quality monitoring at two locations within Mudies Creek.

Sampling was undertaken over five site visits, during April 2021, January 2022, and February 2022.

6.8.2 Policy setting

The safe storage, handling, transport, recovery and disposal of waste is governed by the POEO Act (refer Section 4.2.2 of this REF) and the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act). Generators of waste are responsible for the correct classification of the waste they produce in accordance with the EPA Waste Classification Guidelines Part 1: Classifying waste (the Waste Classification Guidelines). A waste register is required to ensure that legislative requirements are met.

The WARR Act provides a framework for considering resource management and is given effect by the NSW Waste Reduction and Purchasing Policy (WRAPP). Under the WRAPP Reporting Guidelines, agencies are required to give priority to buying materials with recycled content, when it is cost and performance competitive to do so. Their plans must set out how the agency would reduce waste and increase purchases of recycled products, with baseline and performance data on:

- Total quantities of wastes being generated and recycled
- Total quantities of recycled content materials being purchased.

Transport contractors are required to propose recycled-content materials where they are cost and performance competitive and are the environmental equivalent (or better) than non-recycled alternatives. Specific materials that are targeted for reuse or recycling in the Transport Environmental Sustainability Strategy that are specifically relevant to this proposal are included in Table 6-26.

Table 6-26: Targeted waste for reuse

Targeted wastes	Recover target
Asphalt removal and replacement	Recover 95% of all asphalt for reuse
Concrete pavement and infill areas	Recover 76% of concrete for reuse
Waste steel from traffic control devices, including signage and electrical infrastructure	Recover 76% of steel for reuse
Waste aggregate	Recover 76% of aggregate for reuse
Virgin excavated natural materials (VENM)	Recover 95% of all VENM for reuse

The Transport *Re-use of waste off-site: Waste Fact Sheet 9* outlines the potential off-site re-uses for typical wastes from Transport construction projects. These re-use opportunities do not require environmental licensing from the EPA, provided that all conditions under appropriate EPA resource recovery exemptions for off-site re-use are met.

The Transport *Management of Wastes on Roads and Maritime Services Land Procedure* was developed in 2014 to minimise the risks of construction wastes on Transport land. The procedure includes best practice and contingency planning for construction wastes on sites, benchmark pre-construction site assessments to establish the condition of a Transport owned site prior to hand over to a construction contractor, and a post-construction site condition assessment guide to verify that no unauthorised wastes remain on a site post-construction.

6.8.3 Existing environment

Road corridor

The site inspection noted stockpiles of road pavement materials, including asphalt and road base within areas of the road verge. In addition, there is evidence of minor amounts of fly-tipping (household general rubbish and travelling litter) in the proposal area. An online search of the NSW EPA Contaminated Land register on 17 February 2021 noted two contaminated sites within the Singleton LGA (NSW EPA, 2021). The contaminated sites are the Putty Road Saw Mill and the Singleton Gasworks neither of which are in the vicinity of the proposal area.

Within the proposal area, the contamination assessment has identified the road formation as containing fill material associated with construction of the road and for potential unknown wastes to exist within the road reserve (Appendix H). Sensitive receptors in proximity to the proposal area which may be impacted by any potential contamination include the following:

- Residential, rural, commercial, industrial and recreational land uses in proximity to the proposal area
- Mudies Creek and Emigrant Creek.

Based on the findings of the desktop assessment and site inspection for the Phase 1 Contamination Assessment, four potential areas of environmental concern (AEC) have been identified within or adjacent to the proposal area (refer Table 6-27). The likelihood of contamination within the AECs are assessed as being low based on information available.

An online search of the POEO Act public register conducted on 24 February 2021 identified two premises which hold or previously held, an EPL issued under the POEO Act near to the proposal, these being:

- Singleton Abattoir (EPL 11279). The licence applies to livestock processing activities including pollution limits for waterways of effluent produced. The Singleton Abattoir is located at the corner of the Golden Highway and New England Highway, and is about two kilometres east of the proposal.
- Gromor Enterprises Pty Ltd (EPL 1112). The licence was held for the mushroom composting facility between 2000 and 2008 (surrender date) for the activities of 'composting and related processing' for the intended purpose of 'mushroom substrate production'.

Due to the location and distance from the proposal area, it is not expected that these sites would contribute to contamination of the proposal area.

Table 6-27: Potential areas of environmental concern

AEC	Potential contaminating activity	Description	Risk	Potential chemicals of concern (PCOC)
AEC 1: within soils beneath existing road pavements	Potential for coal tar in pavement built prior to 1987. Fill material of unknown origin and quality.	Roads constructed prior to 1987 have potential to contain coal tar. Historical aerial photos suggest pavements were constructed prior to 1990 and in the absence of road construction records there is potential for coal tar to be present. The Golden Highway is generally built at grade and only minor areas of filling within the road alignment. Where filling has occurred, material is likely to have been locally sourced and of engineering quality. For these reasons there is a low potential for contaminants to be present within fill areas of the existing road.	Low Low	Metals, PAH's, Coal tar, TPH and Phenols Metals, PAH's, TPH, BTEX and asbestos
AEC 2: unknown wastes within road reserve	Fly tipping of wastes of unknown quality and origin.	No significant illegal dumping was observed within the proposal area, however there remains a potential for this to have occurred within areas of dense vegetation, creeks and depressions in the landscape. There is a potential for contaminants to be present within soils in close proximity to illegal dumping.	Low	Metals, PAH's, TPH, BTEX and asbestos
AEC 4: adjacent land in designated SMA	Potential storage of fuels and refuelling of planes. Potential localised landfilling of	Aerial photos show the presence of an airstrip adjacent to the proposal area. The absence of supporting infrastructure suggest that these may be used as runways only. There is little available information about the activities within these airfields. Aerial photos indicate very little human activities within the military area prior to	Low Low	Lead, PAH's, TPH's, BTEX Metals, PAH's, TPH's, BTEX and asbestos

AEC	Potential contaminating activity	Description	Risk	Potential chemicals of concern (PCOC)
	wastes and chemicals.	1963. There is little information on the specific activities which occurred on the SMA, however there is potential for wastes and chemicals to have been buried on site.		
AEC 5 – Sediments in Mudies Creek	Potential military activities including firefighting activities associated with the use of aqueous film forming foams (AFFF) and PFAS	Anecdotal information suggests that AFFF was likely utilised at Dochra airfield (Aecom 2019). Mudies Creek and Emigrant Creek flank Dochra airfield and are thought to receive runoff from the area via overland flow. Both Mudies Creek and Emigrant Creek reported surface water and sediment PFAS concentrations above the reporting limit of the laboratory however below the adopted NEMP (2018) guidelines.	High	Firefighting foams (PFOS/PFOA)
AEC 6: surrounding rural land	Potential localised landfilling of wastes and chemicals. Application of pesticides.	Historical aerial photography and site observations suggest the area to the north of the proposal has been used primarily for cattle grazing. There is little information on the specific activities which occurred in these properties. There is potential for burial of wastes and chemicals associated with rural agricultural land use. Information is limited as to the type and/or extent of chemical application associated with agricultural activities adjacent to the proposal area. Using aerial photographs and soil landscape maps, areas to the north of the proposal appear mainly associated with rural grazing lands, suggesting a low likelihood for chemical application to have occurred.	Low Low	Metals, PAH's, TPH's, BTEX and asbestos Pesticides and herbicides

Phase 2 Detailed Site Investigation Contamination Assessment

The Phase 2 Detailed Site Investigation contamination assessment focused upon AEC 3 and AEC 5 (Appendix G). PFAS was detected in these sites. Based on the results of the investigation, it is considered that there is a low likelihood of contamination being present within the soils of AEC 3 and AEC5 that would pose an unacceptable risk to human and ecological receptors under the proposed land use as a road corridor. It is considered that any soil contamination can be managed at the construction stage through the implementation of an 'unexpected finds' protocol. An exception applies to an existing fill stockpile observed within the site.

This existing fill stockpile was observed west of Mudies Creek within the site during the site inspection. This stockpile was not previously observed or noted in earlier contamination assessment due to site constraints. The fill stockpile origan and quality remain unknown until further details are provided. Assessment of the stockpile was not within the scope of the DSI.

Waste classification of soils was not part of the scope of DSI noting majority of soils are expected to be retained onsite as fill (balance to be imported). If excavated soils are required to be removed offsite for beneficial reuse or disposal to licenced facility, the results of the DSI would need to be assessed as part of a formal waste classification assessment which may have implications on waste management processes.

Water quality monitoring carried as part of this DSI provide preliminary 'baseline' concentrations of contaminants of potential concern recorded during two rounds of surface water sampling within Mudies Creek (including upstream and downstream of the Site) and one round of groundwater sampling within existing offsite well (Dochra_MW) immediately south of the Site.

Concentrations of Per- and Poly- Fluoro Alkyl Substances (PFAS) detected in the analysed samples were below the adopted site assessment criteria, except for sample TP23/0.0-0.1 which had a recorded Perfluorooctane sulfonic acid (PFOS) concentration of 0.0159 mg/kg (0.0059 mg/kg above the PFAS NEMP (2020) ecological indirect exposure criteria) (Appendix G). This is unlikely to pose unacceptable risks to identified ecological receptors.

The results of the investigation indicate contamination risks to surface water and groundwater are likely to be low. Based on the conceptual site model, groundwater interactions are expected to be minimal during construction, thus presenting a lower risk of exposure to groundwater contamination (if any). Surface water interactions are expected to be managed via soil and water management plans prepared prior to construction.

Singleton Military Area

The SMA is immediately adjacent to the southern boundary of the proposal area. The SMA is a 14,000 hectare firing range located between Brokenback Range, the Hunter Vineyards, Lone Pine Barracks and the Mount Thorley Mine area. The SMA was established in 1940 and is primarily used for military training, including several firing and weapons ranges and explosives testing as well as no-firing training facilities for all units of the Australian Defence Force and other government agencies such as police. About 800 metres southeast of the proposal area is a military airfield.

Dochra Airfield was used sporadically by the Army and Royal Australian Airforce and has not been used for many years. Anecdotal information suggests that Aqueous Film Forming Foams (AFFF) was used as part of firefighting activities at the Dochra airfield. Mudies Creek (situated within the proposal area) and Emigrant Creek flank Dochra airfield and potentially receive runoff from the area via overland flow. This represents a potential for widespread impacts of Per-and poly-fluoroalkyl substances (PFAS) within downstream surface water, sediment and groundwater. These contaminants of concern can migrate down gradient via preferential pathways, such as surface drainage lines or via groundwater perched or regional water tables.

Previous site investigation data indicated that Mudies Creek reported detectable concentrations of PFAS within sediment just above the reporting limit of the laboratory however below the adopted NEMP (2018) guidelines. Additional soil sampling and testing for potential contaminants of concern was carried out during geotechnical investigation works in 2018 and 2019 at nominated geotechnical test locations (Appendix G). A total of five samples were collected from bore holes and test pits and were tested for potential chemicals of concern including TRH, BTEX, PAH, PCB's, OCP's, heavy metals and asbestos in soil. Two additional samples were collected from sediments within existing culvert cells beneath the Golden Highway (access on the north side). Due to access restrictions in place at the time, the creek sediments directly beneath the proposed new bridge alignment could not be sampled. Samples were tested for PFAS in order to represent contaminant concentrations likely to be found within Mudies Creek sediments. Soil analytical results indicated the following:

- PFAS was not detected within two soil samples representing alluvial clays (detection limit of 0.0002mg/kg) or within two sediment samples representing culvert sediments (detection limit of 0.005mg/kg)
- Except for heavy metals, no detections were recorded for remaining contaminants tested within five soil samples representing fill and alluvial clays.

Other activities at the SMA include vehicle maintenance, a wash-down facility for vehicles and weapons, and storage and distribution of fuel from underground storage tanks. The SMA contains several hazardous materials storage facilities which are used for the holding a wide range of chemicals including solvents, paints, cleaning chemicals, thinners, battery acids, welding gases, and chlorine (Department of Defence, 2016). Historical activities within the SMA include the use of landfills to dispose of waste materials from demolition works, base operations, and in some cases domestic waste. Known contamination around the base includes elevated levels of heavy metals and explosives residues around some of the firing and weapons ranges. Elevated levels of heavy metals, petroleum related compounds, nutrients, and phosphorous have also been found in soil in some of the surrounding surface water bodies and groundwater (Department of Defence, 2016). Asbestos containing materials and elevated levels of heavy metals, hydrocarbons and pesticides in soils, and elevated levels of heavy metals in surface water and groundwater have been identified in landfill areas (Department of Defence, 2016). The location of the contaminated areas noted above is not known.

6.8.4 Potential impacts

Construction

Construction activities have the potential to generate waste, some of which would be able to be reused or recycled. The calculated estimated waste volumes would be:

- About 1,900 cubic metres of non-contaminated topsoil for stockpiling and reuse
- About 100 cubic metres of contaminated topsoil for offsite disposal
- About 250 cubic metres of green waste with an unknown quantity contaminated with weeds
- An unknown amount of unsuitable material from the new alignment
- Up to 300 tonnes of concrete from the removal of the existing Mudies Creek culverts
- 355 cubic metres asphalt millings from the existing pavement where the new pavement ties into existing.

In addition, other expected waste streams likely to generate waste include:

- Wastewater and effluent from ablutions blocks
- Packaging materials from with items delivered to the site, such as pallets, crates, cartons and plastics
- Wastes including oils and paints and synthetic materials from line markings

- Wastes produced from the maintenance of construction plant and equipment
- Waste material resulting from any on-site spills
- General office wastes including paper, cardboard, beverage containers and food wastes, generated by workers at construction facilities.

Quantities of hydrocarbons, chemicals and other hazardous substances would be stored on site and used during construction. As a result, there would be the potential for accidental spills of these materials resulting in localised contamination of soil within the proposal area or if material moves off site then the contamination of soils in drainage lines and water in Mudies Creek.

Operation

Operational waste aspects of the proposal would be generally similar to those that currently exist with the operation and maintenance of the Golden Highway. There would be limited volumes of waste generated and minimal resources used and the primary source of waste (litter, fly tipping) would be from road users. The proposal would therefore have a negligible impact on resource use and waste management during operation. There are minor contamination risks associated with the operation of proposal which include:

- Accidents or leaks from heavy vehicles causing hydrocarbon or chemical spills
- Accidents from general motorists causing oil and petrol spills
- Residual hydrocarbons in the pavement from motor vehicles mobilising off the road during storm events.

6.8.5 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to waste and contamination during construction of the proposal are outlined in Table 6-28.

Table 6-28: Waste and contamination safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Construction waste	A Waste Management Plan (WMP) is to be prepared and implemented as part of the CEMP. The WMP should provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. It would also address the importation of waste to the site for use in undertaking the project. The WMP would give effect to any management measures contained in any waste assessment carried out for the project and include, but not necessarily be limited to • Measures to avoid and minimise waste associated with the project • Classification of wastes generated by the project and	Contractor	Pre-construction Construction	Section 4.11 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Resp.	Timing	Reference
	management options (re-use, recycle, stockpile, disposal) • Separation of waste to avoid cross contamination • Classification of wastes received from off-site for use in the project and management options • Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions. The WMP would be prepared taking into account the Transport Environmental *Procedure – Management of Wastes on Roads and Maritime Services Land* and relevant Transport Waste Fact Sheets.			
Construction waste	Waste would be classified in accordance with the methods and specifications of the NSW EPA Waste Classification Guidelines 2014.	Contractor	Construction	NSW EPA *Waste Classification Guidelines 2014*
Construction green waste	Weed species, or vegetation not considered appropriate for re-use on-site, would be removed and disposed of to an appropriately licenced facility.	Contractor	Construction	
Contaminated land	If contamination is encountered a Contaminated Land Management Sub-Plan (CLMS-P) would be prepared and implemented. Any contaminated material would be managed in accordance with CLMS-P.	Contractor	Construction	Section 4.2 of QA *G36 Environment Protection*
	Additional groundwater and surface water monitoring is required during construction works where Site construction activities require groundwater abstraction (such as dewatering) or have	Contractor	Pre-construction: Construction	

Impact	Environmental safeguards	Resp.	Timing	Reference
	potential to introduce contaminants from leaks and spillages within disturbance areas impacting surface water runoff.			
	Further assessment (including soil sampling and testing) should be carried out within the fill stockpile observed west of Mudies Creek prior to reuse at construction stage. Based on the findings of the DSI, no further contamination soil investigations are required within AEC3 and AEC5 at the Site.	Contractor	Pre-construction	
	An Unexpected Finds Protocol would be prepared and implemented to manage remaining contamination risks at the Site (if any) during construction stage.	Contractor	Pre-construction; Construction	
	Environmental management measures should be implemented during construction works to mitigate the risk of introducing further site contamination through spillages / pollution releases to Site soils and surface water within Mudies Creek.	Contractor	Pre-construction; Construction	

Refer Section 6.3 - Soils and groundwater for other applicable safeguards and management measures.

6.9 Air quality

6.9.1 Methodology

The proposal's impact on air quality has been considered in a qualitative assessment referencing existing local air quality information and the likely extent of emissions during construction and operation.

The following databases were searched to inform the baseline characterisation of the local environment:

- National Pollutant Inventory (NPI)
- OEH Air Quality Index (AQI)
- Bureau of Meteorology Climate change data.

6.9.2 Existing environment

The proposal is located in a predominantly rural environment, between the urban and industrial setting of Newcastle and the Hunter region's wine and coal mining industries.

The NPI contains data on 93 substances around Australia which have been identified by the Department of Environment and Energy as important due to their possible effect on human health and the environment. A review of the NPI database undertaken on 8 March 2018 identified four facilities within a 10 kilometre radius of the proposal, being:

- Singleton Beef Processing Facility (the EC Thorsby abattoir)
- Singleton Sewage Treatment Plant
- The Hunter Bottling Company
- Mount Thorley Coal Loader Operations.

The 2014/2015 data for these facilities reports that collectively they emitted 22 different pollutants, including:

- Ammonia
- Nitrogen
- Oxides of nitrogen (NOx)
- Carbon monoxide (CO)
- Particulate matter 10 µg (PM_{10})
- Particulate matter 2.5 µg ($PM_{2.5}$)
- Total Volatile Organic Compounds (TVOCs)
- Sulfur dioxide (SO2)
- Polycyclic aromatic hydrocarbons (PAH)
- Total nitrogen
- Total phosphorus.

This emissions data is included in Appendix N**.**

Exhaust emissions from light and heavy motor vehicles on the Golden Highway and the surrounding road network (New England Highway, Putty Road) is expected to be an influencer in the local ambient air quality. Dust and vehicle movements from local agricultural and industrial practices are also expected to have an influence. Operation of the Hunter Valley rail network within the area is also expected to have an influence on local air quality. Other sources of emissions include two coal mines which operate less than 15 kilometres south west from Singleton, the Bulga Coal complex and the Mount Thorley Warkworth operation. These sites are required to monitor air emissions as a condition of their environment protection licences.

Data sourced from the Mount Thorley monitoring station was used to as it is the closest monitoring station to the proposal area, located about eight kilometres west of Mudies Creek. A plot of the Daily Regional Air Quality Index (RAQI) in the Mount Thorley area for the last 12 months is shown in Figure 6-19.

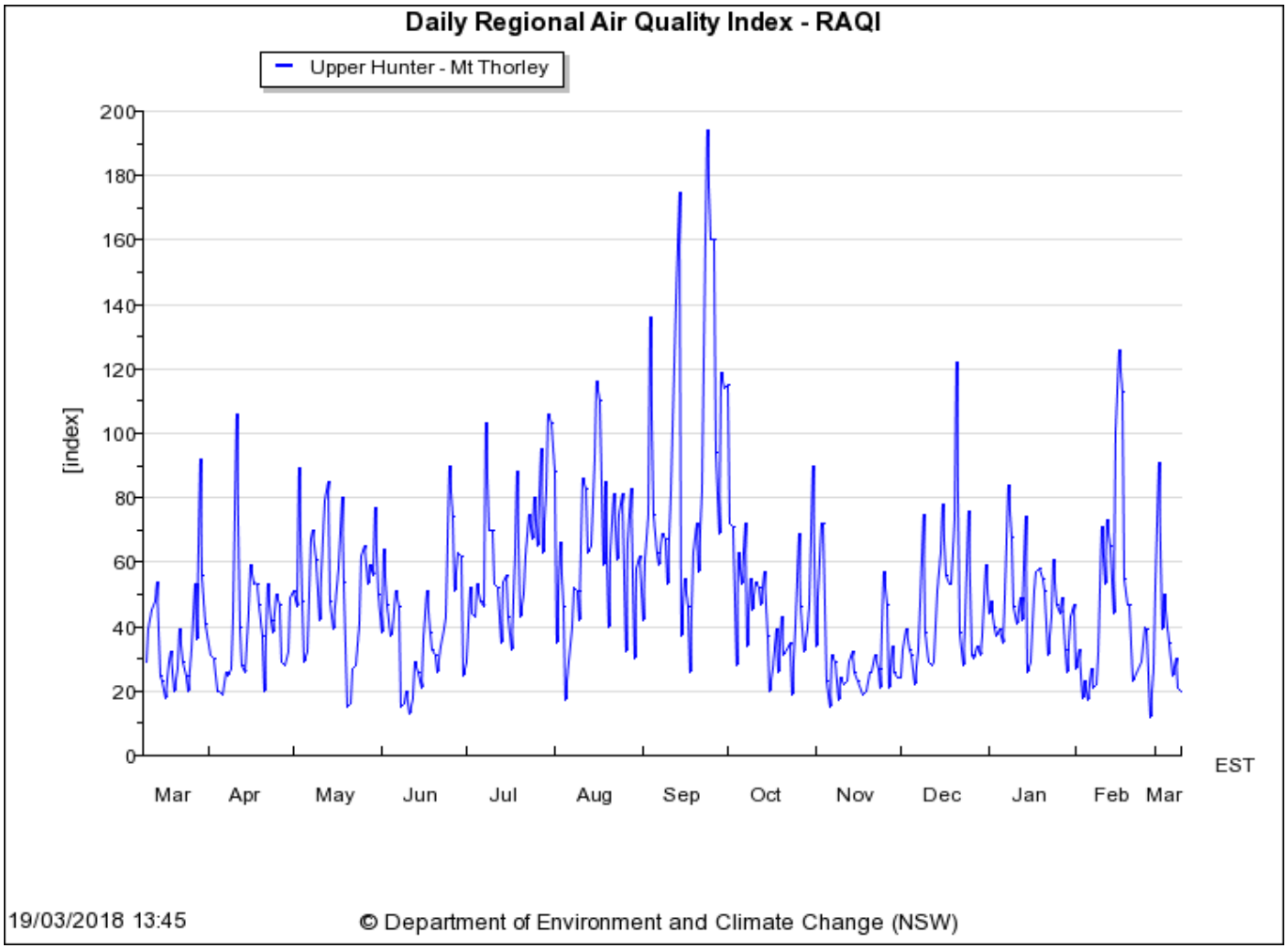

Figure 6-19: Daily RAQI values for Mount Thorley

A health alert is issued when the RAQI value reaches 100 or above, this is considered to be poor (100-149) or very poor air quality (150-200).

As shown in Figure 6-20 between 09/03/2017 and 09/03/2018 there were 15 days of poor air quality and five days of very poor air quality during the period March 2017 to March 2018. Poor air quality was scattered throughout this period, primarily in July to September. The days of very poor air quality were 13 and 22 to 25 September 2017.

The Mount Thorley monitoring site also measures particulate matter 10 micrometres or less in diameter (PM_{10}) at hourly intervals. Figure 6-20 shows a plot of the daily averages of PM_{10} for the last 12 months. There have not been any PM_{10} exceedances above RAQI value of 100 which is the threshold for poor air quality.

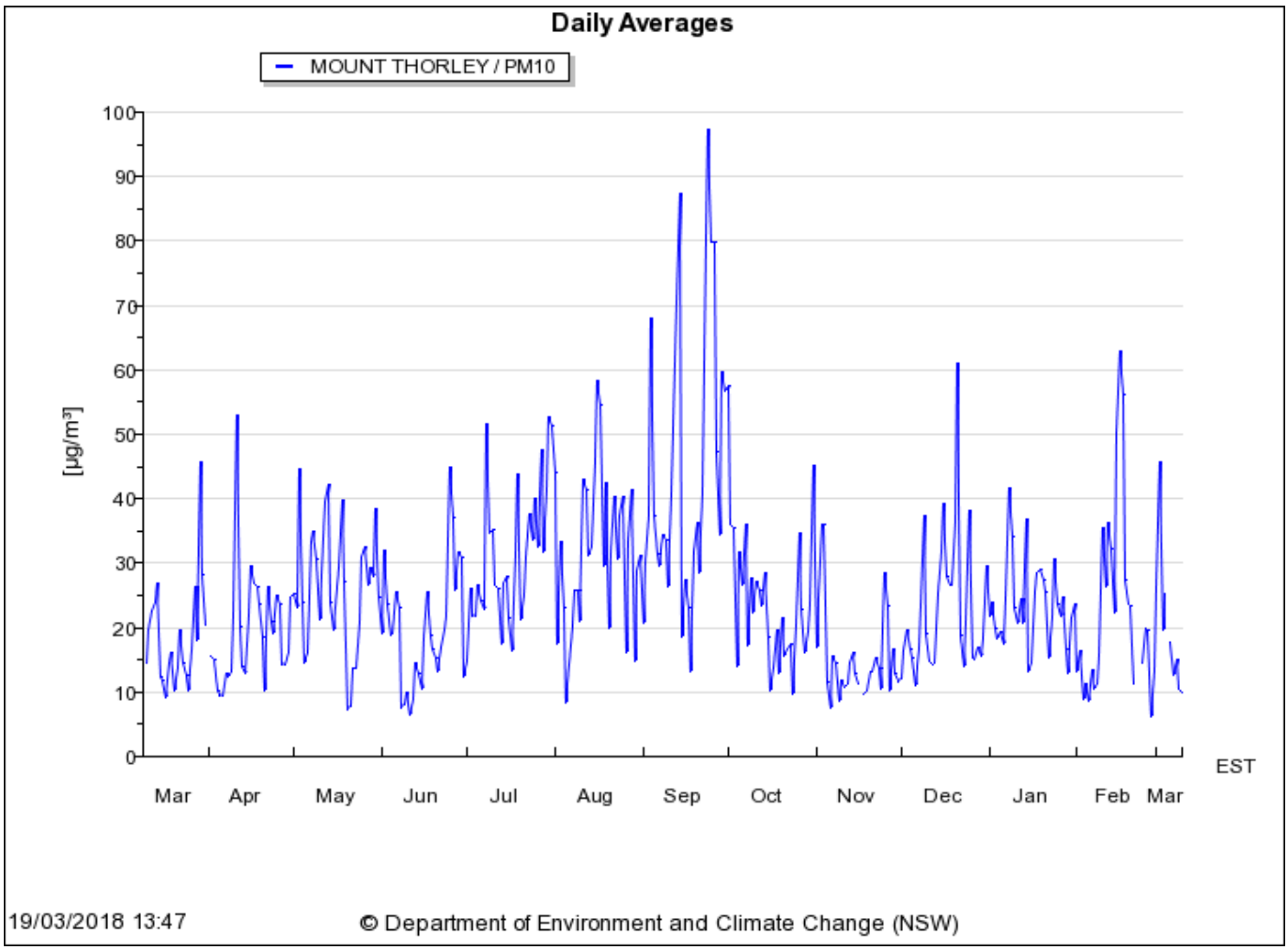

Figure 6-20: PM_{10} levels for Singleton South

Climate data for the local area was obtained from the Bureau of Meteorology (BoM) station located at the Singleton Sewage Treatment Plant (station number 061397). Climate data for the period 09/03/2017 to 09/03/2018 is summarised as follows (BoM, 2018):

- Annual average rainfall is 658.6 millimetres, with February receiving the highest average monthly rainfall of about 85.2 millimetres
- Annual mean maximum temperature is 25.1 degrees. The warmest months are December to February, with mean maximum temperatures during these months ranging from 30.2 degrees to 31.9 degrees. The coolest months are July, with a mean maximum temperature of 17.8 degrees and August with a mean minimum temperature of 4.1 degrees.

Air pollutants can be dispersed and transported by local wind patterns. The nearest weather station with this information is Cessnock Airport (station number 061260) location about 20 kilometres south west of the proposal area. The Cessnock Airport weather station indicates mean 9am wind speed ranges from 8.7 kilometres per hour in March to 14.0 kilometres per hour in September.

Potentially sensitive receivers within and around the proposal area the rural / residential properties located on the northern side of the Golden Highway.

6.9.3 Potential impacts

Construction

About 40,000 square metres of vegetation would need to be cleared for construction of the proposal which would result in the generation of about 2,000 cubic metres of topsoil. Vegetation removal may be staged or undertaken simultaneously. About 3,000 cubic metres of material cut from the site and 25,000 cubic metres of general fill material imported for the new road alignment. These activities have the potential to generate dust as areas would be temporarily disturbed and exposed. The stockpiling of excavated and imported materials has the potential to generate during the stockpiling of spoil and delivery of materials to the site. During construction, dust levels would vary in relation to the type and extent of activities being carried out, weather conditions and the area of soil being exposed. Sources of dust and dust generating activities are expected to include:

- Vehicle and plant movements around the site
- Vegetation clearing and topsoil stripping
- Earthworks, including excavation and fill activities
- Construction of the bridge and abutments
- Handling, transfer and stockpiling of soil and materials
- Erosion of stockpiles and exposed areas.

Other potential air quality impacts during construction would be associated with emissions from the generation of dust from construction work and from plant, equipment and vehicles associated with this work. The potential sources of gaseous emissions and suspended particulates during the construction phase include construction vehicle movement and plant and equipment operation. These sources would generate particles 10 micrometres or less in diameter and 2.5 micrometres or less in diameter from exhaust, road abrasion, tyre wear, brake wear and the resuspension of particles.

Operation

The proposal does not increase capacity of the road network so during operation, air quality impacts are not expected to differ greatly from the existing situation. Potential impacts to air quality would be offset by the reduction in fuel consumption for vehicles travelling along the corridor by consistent road conditions which meet Class 3 and 4 road standards.

6.9.4Safeguards and management measures

Safeguards and management measures would be implemented to avoid, minimise or manage potential air quality impacts. These safeguards and management measures have been identified in Table 6-29.

Table 6-29: Air quality safeguard and management measures

Impact	Environmental safeguards	Resp	Timing	Reference
General air quality impacts	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include • Identification of potential risks/impacts due to the work/activities as dust generation activities • Plan and carry out all your construction activities to avoid where practicable, or	Contractor	Pre-construction Construction	Section 4.4 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Resp	Timing	Reference
	minimise, the generation of dust and vehicle emissions. • Management measures to minimise risk of dust generation including use of water carts for dust suppression • Where air quality monitoring is required, it must comply with the EPA publication "Approved Methods for Sampling and Analysis of Air Pollutants in NSW". Monitoring data must include reporting of insoluble solids in accordance with the EPA publication "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW". • A process for altering management measures as required and reprogramming construction activities if the safeguards and management measures do not adequately restrict dust generation.			
Dust emissions	Work will cease when levels of visible airborne dust become excessive	Contractor	Construction	Section 4.4 of QA *G36 Environment Protection*
Dust emissions	Works that disturb vegetation, soil or stockpiles will not be carried out during strong winds (over 40 km/h) as this may affect receivers (visibility on roads dust and debris near residences and commercial premises)	Contractor	Construction	Section 4.4 of QA *G36 Environment Protection*
Dust emissions	Stockpiles materials will be covered or stabilised	Contractor	Construction	Section 4.4 of QA *G36 Environment Protection*
Dust emissions	All trucks will be covered when transporting material to and from the site	Contractor	Construction	Section 4.4 of QA *G36 Environment Protection*

6.10 Landscape character and visual

6.10.1 Methodology

The methodology for assessing the proposals potential landscape and visual impact assessment (Appendix Q) is consistent with Transport 's *Environmental Impact Assessment Practice Note EIA - N04* (2013) *Guidelines for Landscape Character and Visual Impact Assessment* (the Guideline). Reference to the Guideline, and the level of detail, are commensurate with the scale and project type.

Landscape characteristics assessment approach

An assessment of the potential impacts during construction and operation of the proposal was carried out by considering the sensitivity of each landscape character zone (LCZ) and viewpoint and the expected magnitude of change (Appendix Q). The Transport impact grading matrix has been utilised to quantify landscape character and visual impacts (refer Table 6-30). Two factors were used to determine the overall impact to an area:

- Sensitivity refers to the qualities of an area, including the completeness of the view and perceived value.
- Magnitude is the nature of the project and refers to the magnitude of change and extent/proximity of the change to the view as a result of the proposal.

Combined, these factors form an impact rating. According to the Guideline, the landscape character assessment includes the following components:

- Landscape character zones: identification of different areas of landscape character, usually by spatial or character properties
- Sensitivity of the area's landscape character: discussion of the sensitivity of the landscape character, i.e. the inherent capability of the area to absorb change caused by the proposal, and the rationale for the rating of sensitivity given
- Landscape character impact: impacts based on both the sensitivity of the character zone and magnitude of the proposal in that zone.

Table 6-30: Matrix of sensitivity and magnitude

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

Visual impact assessment approach

The potential impact to views from private properties was undertaken through a combination of accessing publicly available viewpoints (such as from along the Golden Highway) and topographic mapping, with that information used to infer likely views from private viewpoints. In a process similar to that used for landscape character impact assessment, the visual impact is assessed by combining the viewpoint sensitivity and the magnitude of the proposal using the landscape

character and visual impact matrix (refer Table 6-31). To assess the likely visual impact of the proposal from the key viewpoints the three main components are:

- Visibility of the proposal: identification of the general area that the proposal would be visible from was generally defined
- Identification of key viewpoints: a schedule of representative viewpoints within a reasonable distance of the proposal and within the visual catchment was developed. The viewpoints have been rated as to their sensitivity to change by the proposal
- Assessment of visual impact: the impact of the proposal on each viewpoint or group of viewpoints has been assessed. Impacts were based on a composite of the sensitivity of the view and magnitude of the proposal in that view.

Table 6-31: Landscape character and visual impact matrix

		Magnitude			
		High	**Moderate**	**Low**	**Negligible**
Sensitivity	**High**	High	Mod/High	Moderate	Negligible
	Moderate	Mod/High	Moderate	Mod/Low	Negligible
	Low	Moderate	Mod/Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.10.2 Existing environment

General

The proposal begins about 1.9 kilometres west of the major intersection of the New England Highway with the Golden Highway near Belford and extends west just past Mudies Creek. The proposal is within the upper catchment of the Hunter River. The broader landform is predominantly rolling hills and valleys, which lead to a wide flood plain (refer Figure 6-21). The Hunter River catchment is the largest coastal catchment in NSW, with an area of about 21,500 square kilometres. Mudies Creek is a minor tributary of the Hunter River which is situated to the north east of the proposal.

Native vegetation is concentrated along Mudies Creek and is dominated by native Casuarina (Swamp Oak) species which cluster along both sides of the highway and along the creekline (refer Figure 6-22). These trees occur in quite a dense stand of mature Casuarinas 10 to 15 metres high that are visually obvious due to their single species composition and dull green-grey colouring. Away from the creek the landform is largely cleared and used for pastoral purposes.

Landscape character

The existing landscape character of the site reflects its mostly rural nature, with rural land uses and small to large landholdings (refer Figure 6-22). The landscape still comprises a relatively high coverage of native trees, yet within the highway boundary it is mostly clear, with the main area of trees focused along the meandering Mudies Creek. The wider rural landscape is comprised of houses that are usually set well-back from the Golden Highway, with trees and gardens usually clustered around houses and the properties dominated by pasture grasses.

The main natural landmarks are the forested ranges to the south, north and west) with the most recognisable peaks - Mount Bright to the south-east, Mount Dyrring to the north-east and Mount Wambo to the far west (refer Figure 6-21). The intersection of the Golden Highway with the New England Highway forms a recognisable landmark for travellers just to the east of the proposal.

Figure 6-21: View of surrounding landscape.

Visual

Within the proposal area, the Golden Highway is two lanes, widening in some places near intersections and main property accesses. The Golden Highway fits well into the existing landscape, reflecting the undulating landform and winding over the local ridgelines and watercourses. There are opportunities for regional views towards the higher forested hills, particularly the higher peaks seen to the west, north and south at particular locations. Due to its role as a regional transport route, viewpoints from the Golden Highway have been assessed as having a moderate sensitivity. The visibility of the section of the Golden Highway within the proposal area changes along its length, with the main viewers being users of the Highway and residents, workers and visitors of nearby properties.

The current crossing over Mudies Creek is low and visually indistinct from the surrounding roadway and enclosed by the Swamp Oak trees. This serves to highlight the crossing to travellers and forms an important visual cue (refer Figure 6-22). Around Mudies Creek there is a cluster of smaller rural holdings on the northern side with views towards the proposal. Private viewing locations from surrounding private rural properties, are limited to a low number due to the pattern of rural development and intervening landform and vegetation. The SMA immediately to the south of the proposal, has limited views and no permanent potential viewers. Figure 6-24 shows the visual environment and potential viewpoints.

6.10.3 Potential impacts

Landscape character

The proposal's main impacts to landscape character would be the:

- Construction of a slightly wider two-lane bitumen carriageway and new bridge with approach embankments up to about five metres in height extending either side of Mudies Creek
- Removal of native trees (mostly Swamp Oaks) and Juncus Wetland adjacent to Mudies Creek
- Removal of other adjacent native vegetation in the new road alignment of the Golden Highway
- Rehabilitation and revegetation work around Mudies Creek.

The main impact would be due to the loss of vegetation to allow for construction of the new bridge over Mudies Creek and the realigned section of the Highway on either side (Figure 6-22). The magnitude of change to the landscape character has been assessed as moderate. Based on the relationship between the sensitivity of the landscape character (moderate) and the magnitude of visual change (moderate), the overall predicted impact level to landscape character is assessed as being moderate. The level of impact is considered in keeping with a project of this scale in this environment.

Figure 6-22: Mudies Creek landscape

Visual

As a regional transport route, viewpoints from the Golden Highway have been assessed as having a moderate sensitivity. The main area of visual change would be on either side of Mudies Creek, where the new road alignment and bridge which would requires embankments up to 4.7 metres high as well as the loss of some mature trees and other vegetation (refer Figure 6-22 and Figure 6-23). Immediately following construction, road users would notice a moderate extent of visual change around Mudies Creek due to the removal of vegetation and the construction of the new bridge and the approach embankments. Based on the relationship between the sensitivity of the viewpoints from the Golden Highway (moderate), and the magnitude of visual change (moderate), the overall impact level is assessed as being moderate.

There are no private properties that would be notably directly affected by the proposal. The main change to views from private properties would be from a number of small rural holdings located close to the works associated with the new bridge over Mudies Creek (refer Figure 6-24). The visual impact to the six private viewpoints of the houses about 500 metres north of the new alignment is predicted to be moderate-low.

The main impacts to the SMA occur around Mudies Creek from construction of the new bridge and re-aligned section of Highway. Apart from the small airstrip just to the east of Mudies Creek, there are no structures evident within the nearest part of the SMA, and therefore no viewing locations have been identified. Other changes close to the SMA boundary would be limited to minor earthworks and a low amount of vegetation removal, and hence are minor.

Construction

To allow for construction to occur there would be temporary works required such as traffic diversions, temporary traffic control measures and a number of ancillary sites. Elements seen around the ancillary sites (i.e. site compounds) would include temporary fencing, stockpiling of materials and storage of construction equipment. Two potential ancillary sites are identified in Figure 3-4.

During construction of the proposal there would be temporary works including traffic diversions, temporary traffic control measures and a number of ancillary sites. Views of the construction works would be seen by road travellers and from some surrounding residents, however, these would be of a temporary nature and not have a long-term visual impact. It is possible that some works may occur at night and therefore some temporary lighting would be required with the potential for light spill to impact on adjacent residences. Any disturbed areas would be stabilised with vegetation where possible. Construction impacts would be temporary and would not have a long-term visual impact.

Operation

Post construction, road users would notice a moderate extent of visual change around Mudies Creek due to the removal of vegetation and the construction of the new bridge and the approach embankments.

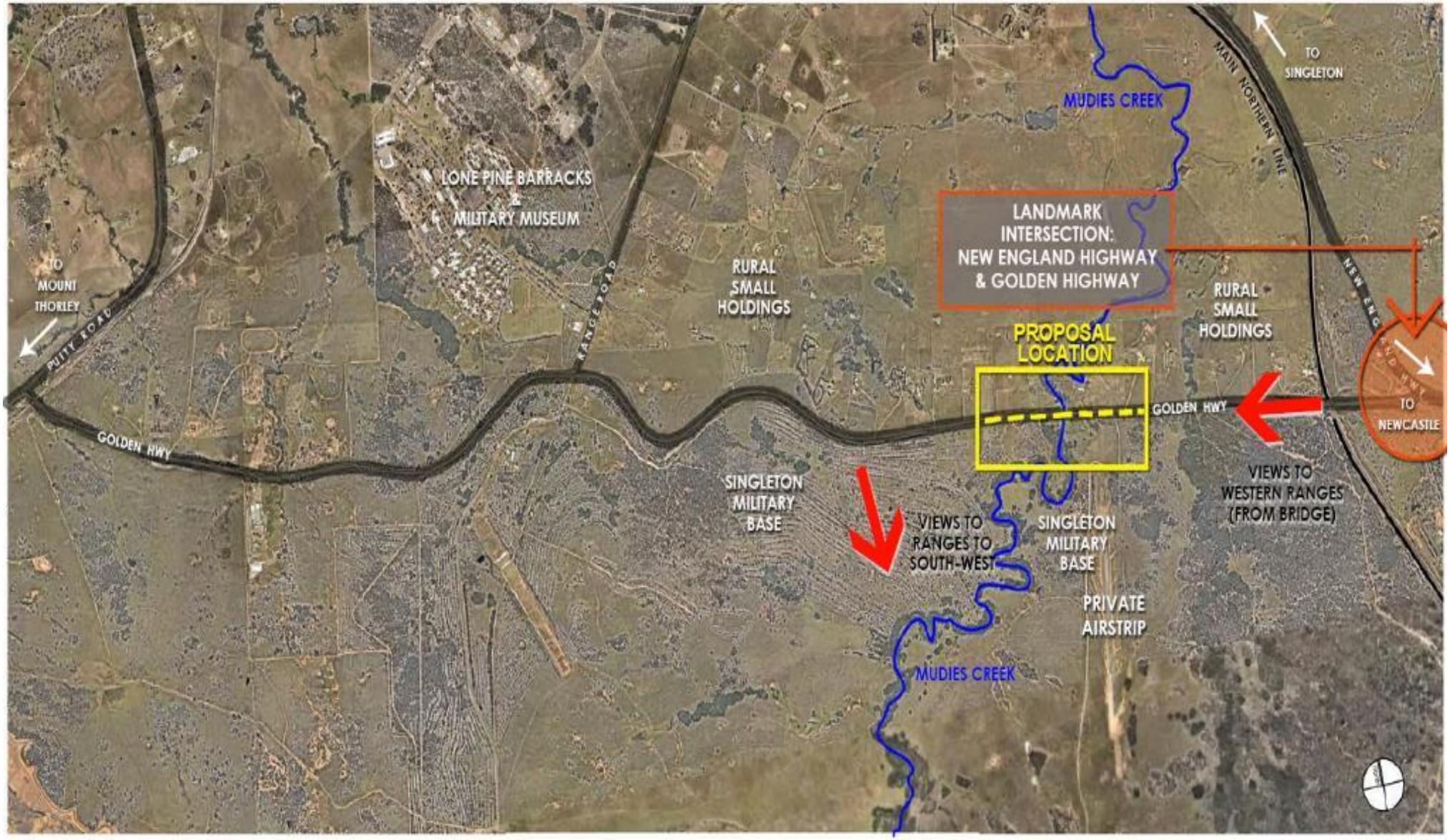

Figure 6-23: Proposal location and visual context

Figure 6-24: Visual environment and potential viewpoints

6.10.4 Safeguards and management measures

The recommended safeguards and mitigation measures to minimise the impacts of the proposal on landscape and visual are listed in Table 6-32.

Table 6-32: Landscape and visual safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Landscape and Visual	A Landscaping Plan is to be prepared. This plan will need to incorporate the Tree and Hollow Replacement Plan (refer Biodiversity safeguards).	Contractor	Pre-construction	
Landscape and visual	Integrate earthworks with the natural landform, by rounding off the tops, bottoms and ends of embankments where possible	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.2
Landscape and visual	Fencing limited to simple, unobtrusive structures and be of a rural-style where possible	Contractor	Detailed design Construction	*LCVIA* Appendix P Historical Archaeological Assessment Appendix Section 6.2
Vegetation	Use local native vegetation species to stabilise fill embankments and rehabilitate creek banks	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.2
Landscape and visual	Redundant sections of highway to be removed, hyrodmulched with local native species	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.2
Landscape and visual	Landform at bridge approaches to blend with the surrounding landscape topography by easing of batter slopes and adopting a grading solution which considers slope geometry as part of the bridge design.	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.3
Vegetation	Minimise damage to vegetation and trees by locating ancillary infrastructure on existing cleared areas	Contractor	Construction	*LCVIA* Appendix Q Section 6.4
Light spill	Minimise temporary light spill beyond the construction site	Contractor	Construction	*LCVIA* Appendix Q Section 6.4
Disturbed areas	Rehabilitation of all areas disturbed by construction	Contractor	Construction	*LCVIA* Appendix Q Section 6.4

6.11 Noise and vibration

6.11.1 Methodology

A specialist noise and vibration assessment was prepared to assess the potential impacts of construction noise and vibration related to the proposal on nearby sensitive receivers (Appendix F) (SLR 2019). In accordance with Transport guidelines, sensitive receivers within the proposal area have been identified as part of the construction noise assessment. Sensitive receivers located along the proposed detour route have also been identified and assessed for road traffic noise. The assessment also considers the potential impacts of road traffic associated with the proposed detour on Range Road.

Unattended baseline noise monitoring was conducted in November 2016 to quantify and characterise the existing ambient noise environment for the wider locality as part of the larger Golden Highway Corridor project. One ambient noise logger (B01) continuously measured noise levels in 15-minute sampling periods for seven days to determine the Rating Background Level (RBL) and LAeq noise levels for the *NSW Interim Construction Noise Guideline (*ICNG) daytime, evening and night-time periods for the proposal area. B01 was located about 200 metres to the north of proposal (refer Figure 6-25). Data from this noise logger was used to characterise the existing acoustic environment for the proposal.

Noise monitoring equipment was deployed with consideration of other noise sources that may influence the measurements, accessibility and security, and with the consent of relevant land owners. The results of the noise monitoring have been processed to exclude noise identified as extraneous and/or data affected by adverse weather conditions (such as strong wind or rain) to establish representative noise levels at the proposal area.

The measured noise levels have been used to establish existing noise levels as a basis for assessing potential noise impacts of the proposal. The assessment uses Transport ’s Construction Noise Estimator, with reference to the methodologies and criteria in the NSW EPA Interim Construction Noise Guideline, the Transport ’s *Construction Noise and Vibration Guideline* and the NSW EPA *Road Noise Policy*. The assessment also considers potential impacts for a detour on Range Road required during construction. The results are presented on the basis of the most affected receiver in each NCA and assume the works are at their closest to each assessed receiver.

Operational noise was assessed using a three-dimensional noise model of the proposal area was made using SoundPLAN software, using the UK Department of Transport Calculation of Road Traffic Noise (CoRTN) algorithms. The CoRTN prediction methodology allows traffic noise levels to be assessed based on traffic volume and composition, road surface, vehicle speed, road alignment and gradient, reflections off building surfaces, ground absorption and shielding from ground topography. Traffic volumes for the 2020 and 2030 assessment years as used in the modelling is provided in Appendix F. The assessment has been based on the predicted change in noise level which results from the proposal (i.e. the difference between the ‘Build’ and ‘No Build’ scenarios).

(Source: SLR 2018)

Figure 6-25: Noise catchment areas, sensitive receiver and noise logger location

6.11.2 Existing environment

The proposal is in the rural environment of Whittingham and is entirely within the Singleton LGA. The area surrounding the proposal consists of sparsely distributed rural residential properties to the north with SMA to the south. The existing ambient noise environment is typically influenced by road traffic noise from Golden Highway, together with general rural and agricultural type noise.

The section of Golden Highway within the proposal area is about 1.1 kilometres in length, consisting of a single lane in each direction with a posted speed limit of 100 kilometres per hour. Based on traffic counts undertaken by Matrix Traffic and Transport Data in November in 2016, there are in the region of 7,000 vehicles per day with heavy vehicles constituting about 11 percent of the total using the Golden Highway within the proposal area (refer Table 6-33). Vehicle movements through the proposal area are seen to increase when shift works change over, which typically occurs around the 5.00 am - 7.00 am period. PM peak periods are less pronounced and are seen to vary between the hours of 3.00 pm - 6.00 pm.

The proposed Range Road detour route is about four kilometres in length and has a posted speed limit of 100 kilometres per hour. Based on 2015/2016 traffic count data provided by Singleton Council for the proposed Range Road detour route, forecast volumes of vehicular traffic on the detour route for the expected year of construction 2019 is expected to be about 709 vehicles per day with 7.9 per cent being heavy vehicles.

Table 6-33: Existing traffic volumes on Golden Highway

Period	**Number of vehicles**	
	Daytime	Night-time
Weekday average	5279	1735

The proposal area has been split into two Noise Catchment Areas (NCAs) with the nearest sensitive receiver being a residence at 232 Mitchell Line of Road (refer Figure 6-25). Other sensitive receivers including educational institutions, medical facilities and places of worship are located over seven kilometres north of the proposal area in Singleton.

The results of the unattended ambient noise monitoring at B01 are summarised in Table 6-34 as the RBL and L_{Aeq} noise levels for daytime, evening and night-time periods.

Table 6-34: Summary of unattended noise logging results

Noise monitoring location	***Measured Noise Level (dBA)***					
	RBL			***LA_{eq}***		
	Daytime	***Evening***	***Night***	***Daytime***	***Evening***	***Night***
B01	33	36	31	48	50	51

Note ICNG Governing Periods –
Day: 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday;
Evening: 6.00 pm to 10.00 pm;
Night: 10.00 pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday.

The nearest sensitive receiver to the proposal in each NCA is at 232 Mitchell Line of Road (refer Table 6-35). Sensitive receivers including educational institutions, medical facilities and places of worship are located about seven kilometres north of the proposal area in Singleton. These sensitive receivers would not be impacted by the proposal.

Table 6-35: Nearest sensitive receiver within each NCA

NCA	Representative Address	Type	Approximate Distance (metres)
NCA01	232 Mitchell Line of Road, Whittingham	Residential	120
NCA02	-	No receivers identified	-

6.11.3 Criteria

Construction noise

The ICNG provides criteria and methods to assess and manage the impacts of construction noise on residences and other sensitive land uses. Noise and vibration assessment approaches are tailored to the scale and duration of the construction works. The ICNG requires project specific Noise Management Levels (NMLs) to be established for noise affected receivers (refer Table 6-36). The ICNG provides an approach for determining $L_{Aeq(15minute)}$ NMLs at adjacent residential receivers based on measured $L_{A90(15minute)}$ RBL.

In the event construction noise levels are predicted to be above the NMLs, feasible and reasonable work practices are to be investigated to minimise noise emissions. The ICNG notes that due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels into the following categories:

- Industrial premises: external L_{Aeq} (15minute) 75 dBA
- Offices, retail outlets: external L_{Aeq} (15minute) 70 dBA.

Based on the background noise levels obtained during noise monitoring, residential NMLs have been derived for the proposal for each noise catchment area (NCA) (refer Table 6-37).

Proposed construction activities, hours and duration

Works would be carried out during the standard construction hours of:

- 7.00am to 6.00pm Monday to Friday
- 8.00am to 1.00pm on Saturdays
- No work on Sundays or Public Holidays.

Some work would also be required outside of the standard working hours to avoid peak traffic periods, allow for full road closures and shorten the construction period. Works outside of standard hours is:

- 6 am to 7 am and 6 pm to 8 pm Monday to Friday (extended hours);
- 7 am to 8 am on Saturdays;
- 1 pm to 6 pm on Saturdays
- 7 am to 6 pm on Sundays;
- 8 pm to 4 am Monday to Friday (extended hours); and
- No work on Public Holidays.

Activities outside of standard working hours would include:

- General construction activities including earthworks, milling, placing deep lift asphalt, culvert duplication

- Delivery of materials, oversized structural elements, outside of standard hours for safety reasons
- Construction and utility adjustment work requiring road occupancy and/or restricted outage timings
- Placement of asphalt overlay over the existing road
- Placement of asphalt wearing course.

Table 6-36: Construction noise criteria for residential receivers

Time of Day	NML Laeq(15minute)	How to Apply
Standard hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured Laeq (15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75 dBA	The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account: • Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools or mid-morning or mid-afternoon for works near residences • If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	RBL + 5 dBA	• A strong justification would typically be required for works outside the recommended standard hours • The proponent should apply all feasible and reasonable work practices to meet the noise affected level • Where all feasible and reasonable practises have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Note: The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW *Industrial Noise Policy*.

Table 6-37: Residential receiver NMLs for construction

NCA	Logger ID	Standard construction (RBL + 10dB)	Out of hours (RBL + 5dB)			Sleep disturbance
		Daytime	Daytime	Evening	Night-time	
NCA01	B01	43	38	41	36	65
NCA02						

Note: The measured RBL is less than 30 dBA (refer to Table 6-34) therefore the criteria uses the Noise Policy for Industry (NPfI) minimum background RBL (30 dBA) plus 5 db.

Sleep disturbance

Where construction is required to be carried out during the night-time period (10.00pm to 7.00am) the potential for sleep disturbance should be assessed. The most recent guidance in relation to sleep disturbance is contained in the EPA's *Noise Policy for Industry* (2017) which requires a detailed maximum noise level assessment if the predicted maximum noise level (L_{Afmax}) reaches 52 dBA or the prevailing RBL plus 15 dB, whichever is the greater.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy.

Based on the ICNG reference to the EPA's *Environmental Criteria for Road Traffic Noise* (ECRTN) (1999), maximum internal noise levels below 55 dBA are unlikely to result in an awakening reaction. This is consistent with guidance contained in the EPA's NSW Road Noise Policy (RNP, 2011) which concludes that '*Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep*'. It is generally accepted that internal noise levels in a dwelling with the windows open are 10 dB lower than external noise levels. Therefore, based on a worst case minimum attenuation of 10 dB, with windows open, an external L_{Amax} noise level of 65 dBA or over indicates the requirement for consideration of mitigation for potential sleep disturbance.

Construction traffic

When construction related traffic moves onto the public road network, vehicle movements are regarded as 'additional road traffic' and are assessed under the Transport *Road Noise Policy* (RNP, 2011). As required by the RNP, an initial screening test is first applied by evaluating whether noise levels would increase by more than 2 dB (an increase in the number vehicles of approximately 60 per cent) due to construction traffic or a temporary detour due to a road closure. Where noise levels increase by more than 2 dB (i.e. 2.1 dB or greater) further assessment is required using the criteria presented in the RNP.

Construction vibration

The construction of the proposal would involve intermittent sources of vibration which are associated with two main types of vibration impact: disturbance at receivers and potential cosmetic structural damage to buildings.

The safe working distances for both cosmetic damage (refer to BS7385:2 *Evaluation and Measurement for Vibration in Buildings Part 2: Guide to Damage Levels from Ground-borne Vibration, 1993*) and human comfort (refer to NSW EPA *Assessing Vibration: a technical guideline, 2006*) are shown in Table 6-38.

Table 6-38: Recommended safe working distances for vibration intensive plant

Plant item	Rating/description	Safe working distances (metres)	
		Cosmetic damage	Human response
Vibratory roller	< 50 kN (Typically 1-2t)	5	15 to 20
	< 100 kN (Typically 2-4t)	6	20
	< 200 kN (Typically 4-6t)	12	40
	< 300 kN (Typically 7-13t)	15	100
	> 300 kN (Typically 13-18t)	20	100
	> 300 kN (Typically > 18t)	25	100
Small Hydraulic Hammer	300 kg – 5 to 12t excavator	2	7
Medium Hydraulic Hammer	900 kg – 12 to 18t excavator	7	23
Large Hydraulic Hammer	1600 kg – 18 to 34t excavator	22	73
Vibratory Pile Driver	Sheet piles	2 to 20	20
Pile Boring	≤ 800 mm	2 (nominal)	4
Jackhammer	Hand held	1 (nominal)	Avoid contact with structure

Construction traffic

Construction related traffic movements on the public road network are regarded as 'additional road traffic' and the CNVG refers to criteria in the NSW EPA Road Noise Policy (RNP, 2011). For Transport projects, an initial screening test is first applied by evaluating whether noise levels would increase by more than 2 dB (an increase in the number vehicles of approximately 60%) due to construction traffic. Where noise levels increase by more than 2 dB (i.e. 2.1 dB or greater) further assessment is required using the criteria presented in the Transport 's Noise Criteria Guideline.

Noise criteria for road traffic

The Noise Criteria Guideline (NCG) provides Transport for NSW' interpretation of the RNP. The NCG provides a consistent approach to identifying road noise criteria for Transport projects. Although it is not mandatory to achieve the noise assessment criteria in the NCG, project proponents need to provide justification if it is not considered feasible or reasonable to achieve them. The NCG applies existing road criteria where minor works increase noise levels by more than 2 dB at receivers from the 'No Build' to 'Build' scenarios. Discussions with RMS noise specialists concluded that the Project is to be regarded as 'minor works'. The NCG notes the following with regard to minor works:

- Some works may be primarily to improve safety. This may include minor straightening of curves, installing traffic control devices, intersection widening and turning bay extensions or making minor road realignments.
- These works are not considered redeveloped or new as they are not intended to increase the traffic carrying capacity of the overall road or accommodate a significant increase in heavy vehicle traffic.

6.11.4 Potential impacts

Construction activities

The activities likely to be required to construct the proposal involve conventional road infrastructure construction equipment such as rock-breakers, piling equipment, earth moving equipment, concreting equipment, paving plant, and cranes. A number of scenarios have been developed to assess potential impacts associated with construction of the proposal and are shown in Table 6-39.

Table 6-39: Construction activities and period of construction

Works ID	Scenario	Indicative duration[1]	SWL (dBA)[2]	Hours of works			
				Standard Day	Day OOH	Evening	Night
W.0001	Site Establishment	One month	115	✓	✓	✓	✓
W.0002	Survey	One month	114	✓	✓	✓	✓
W.0003	Site Preparation	Two months	121	✓	✓	✓	✓
W.0004	Relocation/ Protection of services	One month	116	✓	✓	✓	✓
W.0005	Earthworks	Six months	123	✓	✓	✓	✓
W.0006	Drainage	One month	115	✓	✓	✓	✓
W.0007	Pavements	Three months	118	✓	✓	✓	✓
W.0008	Bridge Construction	Eight months	120	✓	✓	✓	✓
W.0009	Tie in works on existing Highway	One month	120	✓	✓	✓	✓
W.0010	Other works	Two months	110	✓	✓	✓	✓
W.0011	Finishing works	One month	110	✓	✓	✓	✓
W.0012	Ancillary Sites – Compound Establishment	One month	119	✓	✓	✓	✓
W.0013	Ancillary Site – Site Operations	Project Duration	114	✓	✓	✓	✓

Note 1. Durations should be regarded as indicative and represent typical works. The durations will differ at the various sites and the longest duration is presented.
2. OOH = Out of hours. During the daytime this refers to the period on Saturday between 7am – 8am and 1pm – 6pm, on Sunday and public holidays between 8am – 6pm. Transport Construction Estimator used to predict SWL.

These activities would at times be required to use highly noise-intensive items of equipment such as concrete saws, rock crushing plant or rock-breakers. When these items are in use near to sensitive receivers it is likely that impacts would be highly intrusive, especially where works are carried out during the evening or night-time.

It is however noted that during most activities, construction noise levels would frequently be lower than the worst-case levels predicted above for substantial periods of time. This would be apparent as works move around and are more distant from receivers, and when less noisy activities are being carried out.

Furthermore, receivers are typically located at distances of over 200 metres from the works, which reduces the likelihood of potential noise impacts.

- Where works are required to be undertaken outside of standard construction hours, there is potential for high (greater than 20 dBA) exceedances of the evening and night-time NMLs when noise intensive plant is in use
- No receivers are expected to be highly noise affected (greater than 75 dBA $L_{Aeq(15minute)}$).

The extent of the potential impacts is shown below in Table 6-40 for the worst-case scenario (W.0003 – Earthworks) during the night-time period. The image shows that highly intrusive impacts are expected to extend to around 200 metres from the works where highly noise intensive equipment is being carried out during the night time. Impacts would be expected to be considerably lower during less noise intensive activities or in less sensitive periods.

Noise predictions for the proposed construction works have been made using the scenario prediction method of the Transport Construction Noise Estimator spreadsheet (Appendix F). The results are presented on the basis of the most affected receiver in each NCA and assume the works are at their closest to each assessed receiver. For most construction activities, it is expected that the construction noise levels would frequently be lower than predicted at the most-exposed receiver, as the noise levels presented in this report are based on a realistic worst-case assessment (refer Table 6-40). Relatively high noise impacts are predicted during the higher noise generating construction activities when they are being undertaken near to sensitive receivers. The highest impacts are seen during the following scenarios:

- W.0003 – Site Preparation
- W.0005 – Earthworks
- W.0008 – Bridge Construction (including piling).

These activities will at times be required to use highly noise intensive items of equipment such as rock-breakers, concrete saws and rock crushers. When these items are in use near to sensitive receivers it is likely that impacts would be highly intrusive, especially where works are completed during the evening or night-time. It is noted that during most activities, construction noise levels would frequently be lower than the worst-case levels predicted above for substantial periods of time with construction phasing moving works around meaning they are more distant from receivers, and when less noisy activities are being undertaken. Where works are required to be undertaken outside of standard construction hours, there is potential for high (greater than 20 dBA) exceedances of the evening and night-time NMLs when noise intensive plant is in use. No receivers are expected to be highly noise affected (>75 dB(A) $L_{Aeq(15minute)}$).

The extents of the potential impacts are shown below in Figure 6 22 for the worst-case scenario (W.0005 - Earthworks) during the night-time period. The image shows that highly intrusive impacts are expected to extend to around 200 metres from the works where highly noise intensive equipment is being undertaken during the night-time. Impacts would be expected to be considerably lower during less noise intensive activities or in less sensitive periods.

Table 6-40: Noise predictions and NML exceedances per NCA, scenario and duration

Scenario	NCA	Type	Predicted level	NML (dB(A))				NML (dB(A) exceedance)			
				Std day	Day OOH	OOW1	OOHW2	Std day	Day OOH	OOW1	OOHW2
W.0001 Site Establishment	NCA01	RES	61	43	38	41	36	18	23	20	25
	NCA02	RES	-	-	-	-	-	-	-	-	-
W.0002 Survey	NCA01	RES	60	43	38	41	36	17	22	19	24
	NCA02	RES	-	-	-	-	-	-	-	-	-
W.0003 Site Preparation	NCA01	RES	67	43	38	41	36	24	29	26	31
	NCA02	RES	-	-	-	-	-	-	-	-	-
W.0004 Relocation/ Protection of services	NCA01	RES	61	43	38	41	36	18	23	20	25
	NCA02	RES	-	-	-	-	-	-	-	-	-
W.0005 Earthworks	NCA01	RES	69	43	38	41	36	26	31	28	33
	NCA02	RES	-	-	-	-	-	-	-	-	-
W.0006 Drainage	NCA01	RES	61	43	38	41	36	18	23	20	25
	NCA02	RES	-	-	-	-	-	-	-	-	-
W.0007 Pavements	NCA01	RES	64	43	38	41	36	21	26	23	28
	NCA02	RES	-	-	-	-	-	-	-	-	-
W.0008 Bridge Construction	NCA01	RES	66	43	38	41	36	23	28	25	30
	NCA02	RES	-	-	-	-	-	-	-	-	-
Scenario	NCA01	RES	66	43	38	41	36	23	28	25	30
W.0009	NCA02	RES	-	-	-	-	-	-	-	-	-

Scenario	NCA	Type	Predicted level	NML (dB(A))				NML (dB(A) exceedance)			
				Std day	Day OOH	OOW1	OOHW2	Std day	Day OOH	OOW1	OOHW2
Tie in works on existing Highway											
W.0010 Other Works	NCA01	RES	56	43	38	41	36	13	18	15	20
	NCA02	RES	-	-	-	-	-	-	-	-	-
W.0011 Finishing Works	NCA01	RES	56	43	38	41	36	13	18	15	20
	NCA02	RES	61	43	38	41	36	18	23	20	25

Construction traffic

Construction related heavy and light vehicles would be required to access the site. The traffic would be associated with the transport of construction machinery, equipment and personnel, together with the import and movement of road construction material. The following worst-case construction related traffic volumes are estimated to access the site during the busiest construction phases:

- Up to 120 heavy vehicles (truck and trailer, concrete agitators, water carts, etc)
- Up to 100 light vehicles (passenger vehicles, light trucks, etc).

Construction traffic would access the site via the Golden Highway itself, which already has high existing volumes of traffic. The potential noise impacts from construction traffic on existing roads are expected to be minimal given the relatively small number of additional vehicles associated with the proposal and the distance of existing receivers from the main roads.

Alternative route

During temporary road closures of the Golden Highway, vehicles travelling along the highway would be re-routed along on the Golden Highway would be detoured along Range Road and the New England Highway (refer Figure 3-3). It is noted that the Golden Highway is also a key route for oversized and/or over mass vehicles, and these vehicles would also use the alternative route. The significant volume of traffic diverted from the Golden Highway onto the alternative route has been predicted to increase noise impacts at receivers along the routes (refer Table 6-41). The assessment of road traffic noise levels during detours has been completed using the Transport *Construction Noise Estimator* spreadsheet (refer Table 6-41). Range Road is predicted to have an increase of greater than 2 dB and receivers within 90 metres during the daytime and 140 metres during the night-time are likely to exceed the noise criteria and trigger additional noise mitigation measures (refer Figure 6-27).

Table 6-41: Road traffic noise levels along alternative route

Road	Period	Change in Noise Level (dB)	Change greater than 2dB?	Require additional mitigation?	Mitigation distance (m)
Range Road	Daytime	+10	Yes	Yes	90
	Night-time	+10	Yes	Yes	140

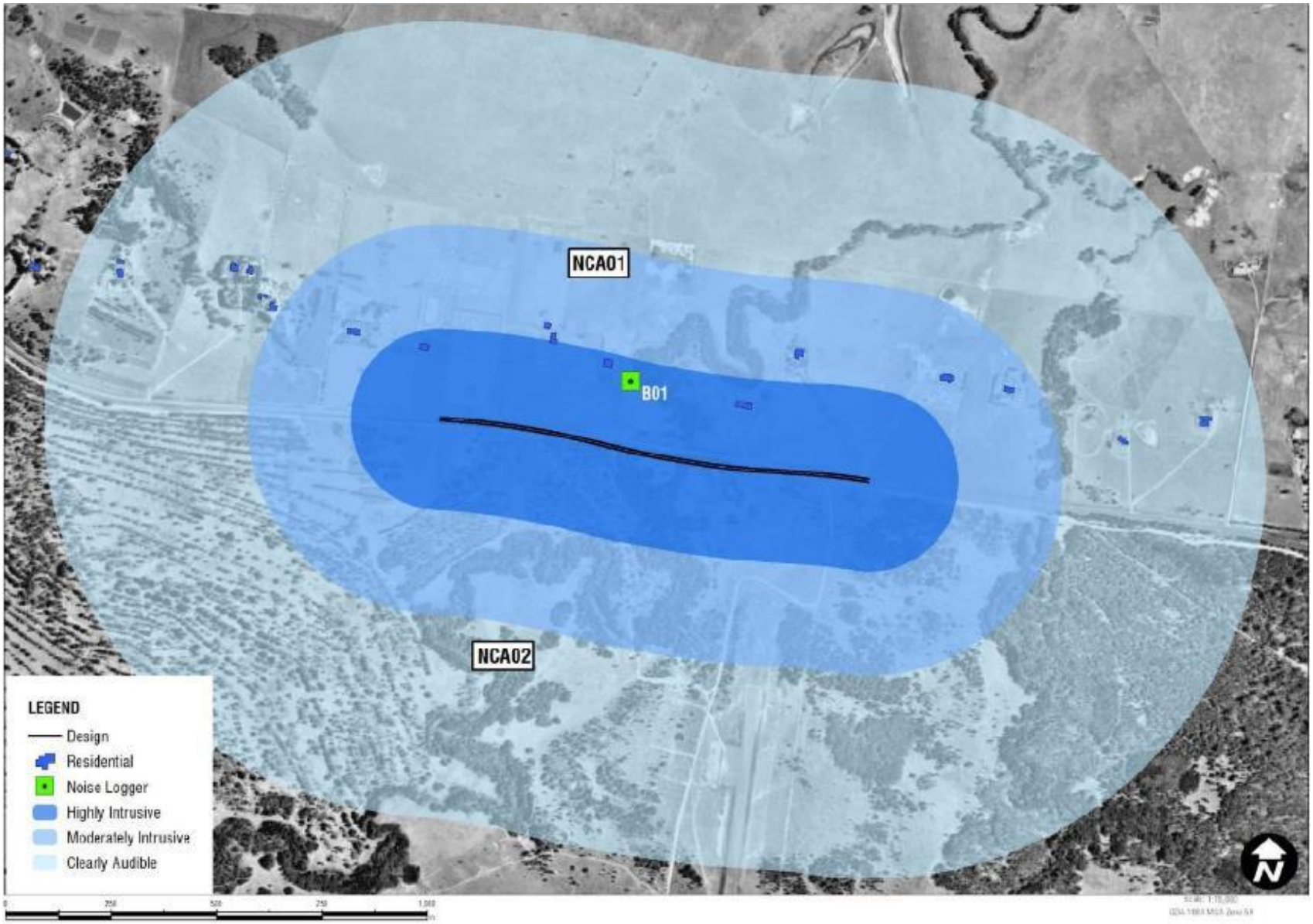

Figure 6-26: Extent of the proposed construction noise impacts (Earthworks) scenario

(Source: SLR 2019)

Figure 6-27: Range Road mitigation zone

(Source: SLR 2019)

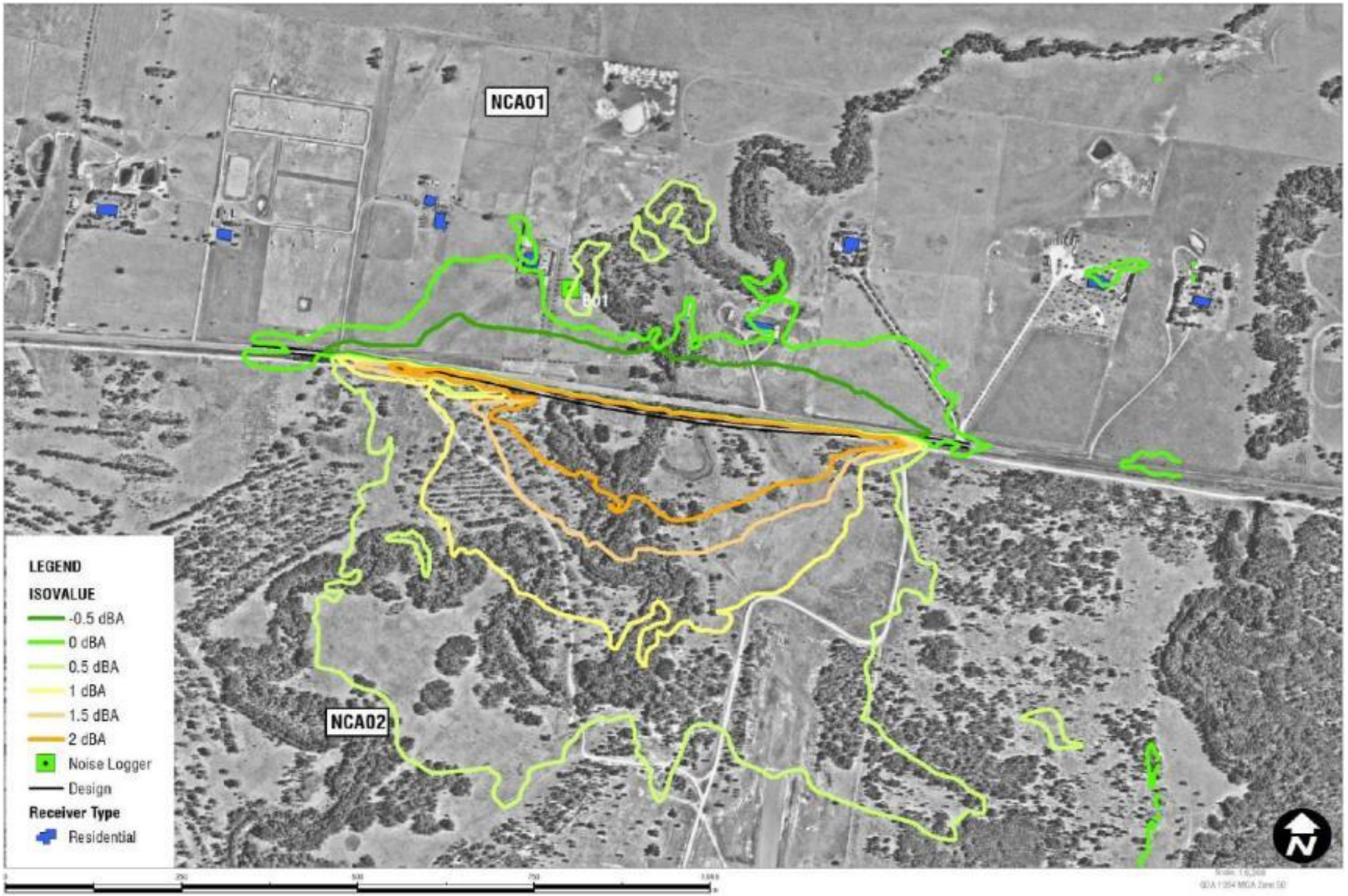

Figure 6-28: Predicted change in operational noise

6.11.5 Safeguards and management measures

Table 6-42 provides the safeguards and mitigation measures proposed to address potential impacts identified from noise and vibration during construction and operation of the proposal. Where exceedances are still expected to occur after standard mitigation measures have been applied, *the Construction Noise and Vibration Guideline* (Roads and Maritime, 2016) recommends the implementation of additional mitigation measures. Triggers for implementation, and additional management measures required are provided in Table 8 of Appendix F.

Table 6-42: Noise and vibration safeguards and mitigation measures

Impact	Environmental safeguards	Resp.	Timing	Reference
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, 2014). • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Pre-construction Construction	Section 4.6 of QA *G36 Environment Protection*
Noise and vibration	All sensitive receivers (e.g. 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 project • the construction period and construction hours • contact information for project management staff • complaint and incident reporting	Contractor	Construction	Section 3.7 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Resp.	Timing	Reference
	• how to obtain further information.			
Noise and vibration	Implementation of project specific mitigation measures including additional mitigation measures for potentially affected receivers.	Contractor	Construction	Noise and Vibration Assessment (Table 8, Appendix F)
Noise and vibration	Notification detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone numbers. Notification should be a minimum of seven calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.	Contractor	Construction	Noise and Vibration Assessment (Table 9 Appendix F)
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures.	Contractor	Construction	Noise and Vibration Assessment (Appendix F)
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios onsite. No dropping of materials from height, throwing of metal items and slamming of doors.	Contractor	Construction	Noise and Vibration Assessment (Appendix F)
Verification	Where required, a noise verification program is to be carried out in accordance with the CNVG, the Construction Noise and Vibration	Contractor	Construction	Section 4.6 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Resp.	Timing	Reference
	Management Plan and any approval and licence conditions.			
Attended vibration measurements	Where required attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.	Contractor	Construction	Section 4.7 of QA *G36 Environment Protection*
Building condition survey	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to commencement of activities with the potential to cause property damage.	Contractor	Construction	Noise and Vibration Assessment (Appendix F)
Update Environmental Management Plans	The EMP must be regularly updated to account for changes in noise and vibration management issues and strategies.	Contractor	Construction	Section 3.11 of QA *G36 Records of Environment Protection*
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and or vibration levels should be scheduled during less sensitive time periods.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Construction respite periods during normal hours and out-of-hours work	The Noise and Vibration Management Plan should address respite periods during normal hours and out-of-standard hours work. For example - high noise and vibration generating activities near receivers should be carried out in continuous blocks not exceeding 3 hours each, with a minimum respite period of one hour between each block. The duration of each block of work and respite should be flexible to accommodate the usage and amenity at nearby receivers. Unless negotiated with the community with consultation documented and approved by Transport project manager, there should be no more than • Two consecutive evening or night works per week; and • Three evening or night works per week; and • Six evening or night works per month	Contractor	Construction	Operational Noise Assessment (Appendix F)

Impact	Environmental safeguards	Resp.	Timing	Reference
	For night work these periods of work should be separated by not less than one week.			
Equipment selection.	Use quieter and less vibration emitting methods where feasible and reasonable. Ensure plant, including the silencer, is well maintained.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Rental plant and equipment.	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used onsite unless compliant with the criteria in Table 2 of the Transport CNVG.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Use and siting of plant.	The offset distance between noise intensive plant and adjacent sensitive receivers is to be maximised. Plant used intermittently is to be throttled down or shut down. Noise-emitting plant is to be directed away from sensitive receivers. Only have necessary equipment onsite.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Plan worksites and activities to minimise noise and vibration	Locate compounds away from sensitive receivers discourage access from local roads Plan traffic flow, parking and loading / unloading areas to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as operationally possible Very noisy activities should be scheduled for standard working hours. If the work cannot be undertaken during the day, it should be completed before 11:00pm. If programmed night work is postponed, the work should be re-programmed considering the approaches defined within this table.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Reduced equipment power	Use only the necessary size and power	Contractor	Construction	Operational Noise Assessment (Appendix F)

Impact	Environmental safeguards	Resp.	Timing	Reference
Non-tonal and ambient sensitive reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used onsite and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Minimise disturbance arising from delivery of goods to construction sites.	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Avoid or minimise out of hours movements where possible.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Engine compression brakes	Limit the use of engine compression brakes near residential areas. Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.	Contractor	Construction	Operational Noise Assessment (Appendix F)

6.12 Socio-economic

6.12.1 Methodology

Transport commissioned the preparation of a cumulative socio-economic impact assessment for the Golden Highway Upgrade between Singleton and Dubbo (Jacobs, 2018b), which includes the section of the highway addressed in this REF. The report is attached as Appendix L and the findings relevant to the proposal are summarised below. The report has been prepared in accordance with the Transport Environmental *Impact Assessment Practice Note: Socioeconomic assessment* (EIA-N05).

Further detail on land use and property is provided in Section 6.7 Property and land use.

6.12.2 Existing environment

Demographics

The proposal is located in the suburb of Whittingham (refer Figure 6-29) a predominantly rural area, south of Singleton. The SMA is located immediately to the south of the highway. In 2016, the Whittingham population was 363 and the total population of the Singleton LGA being 22,987 (ABS, 2016). This is expected to grow to 25,600 people by 2021, an average annual population growth of 0.8 per cent (DPE, 2018).

Table 6-43 summarises the key demographic characteristics of the study area and the Singleton LGA.

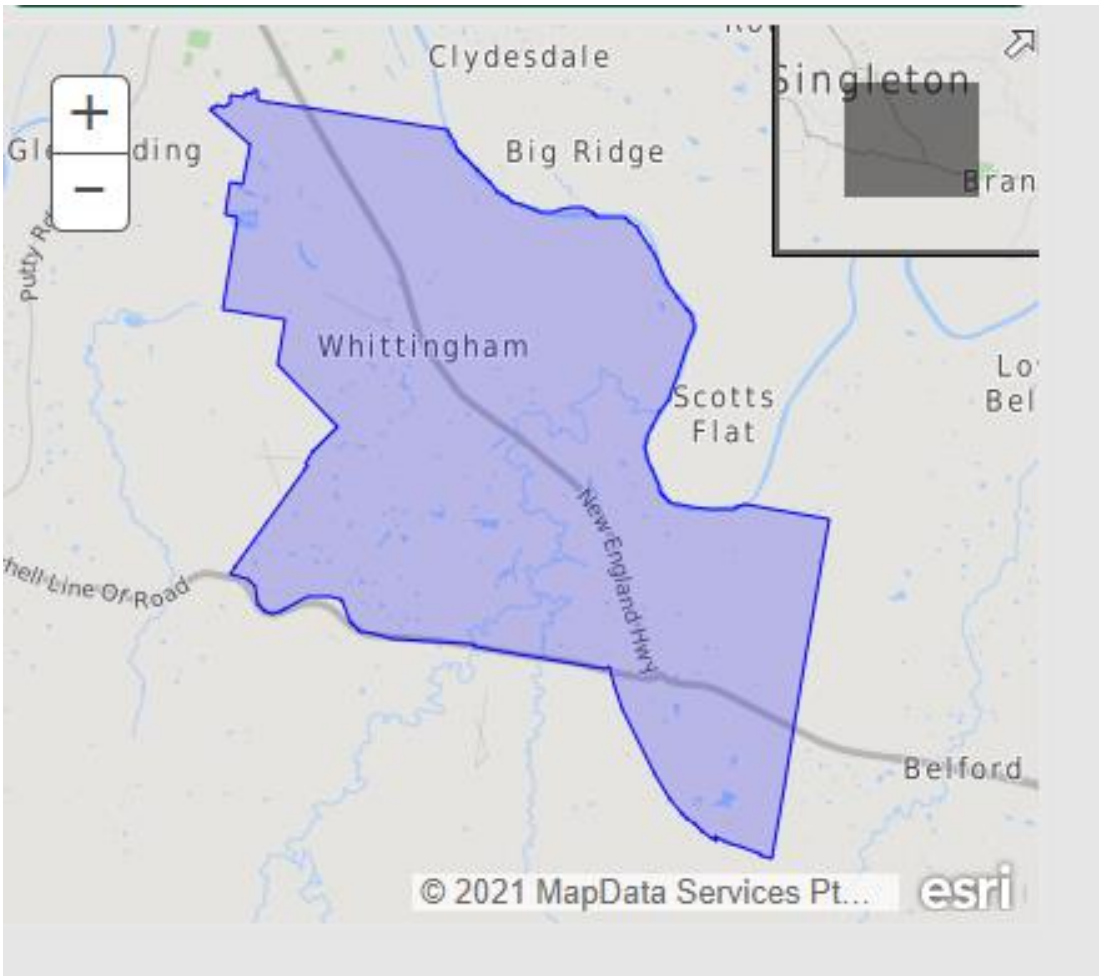

Figure 6-29: Suburb of Whittingham

Source:https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SSC14279

Table 6-43: Selected ABS demographic characteristics (2016)

Indicator	Study area	Per Cent	Singleton LGA	Per Cent
Population				
Total population	364	-	22,987	-
Proportion of people aged 14 years or younger	74	20.3	4,862	21.2
Proportion of people aged 65 years or older	78	21.42	2,923	12.7
Travel to work				
Travel to work by car (as driver – one method)	132	36.3	7,566	32.9
Travel to work by car (as passenger - one method)	5	1.38	472	2.1
Travel to work by walking or cycling (one method)	15	4.1	412	1.8

The Socio-economic Index for Areas (SEIFA) is a relative measure of aspects of socio-economic advantage and disadvantage based on the 2016 Census. This is a relative measure of people's access to material and social resources, and their ability to participate in society. The index of relative social advantage-disadvantage summarises variables that indicate either relative advantage or disadvantage. This index ranks areas on a continuum from most disadvantaged to most advantaged. An area with a high score on this index has a relatively high incidence of advantage and a relatively low incidence of disadvantage.

Travel behaviour

The Golden Highway is a designated B-double route corridor and is the main freight route between western NSW, including Dubbo, and the Hunter and the Port of Newcastle. The Golden Highway is used extensively to service coal mining, grain production and other industries in the Hunter Valley and the Central West. Residents also use this road corridor to access the local population and employment centres of Maitland and Singleton. Analysis of the information in Table 6-43 indicates the following:

- Of those who travel to work, 36.3 per cent travel by car as the driver and 1.4 per cent as a passenger in a car. Other methods of travel to work include walking or cycling (4.1 per cent)
- On average there are three motor vehicles per dwelling, far higher than 1.8 in the Singleton LGA.

Economic profile

Key economic indicators for the study area from the 2016 census include:

- The median weekly household income was $1,906, compared to $1,692 in the Singleton LGA and $1,237 in NSW
- Key employment industries for people who live in the study area include mining (18 per cent), agriculture, forestry and fishing (11.5 per cent) and education and training (seven per cent)
- The unemployment rate in the Singleton LGA was 3.7 per cent. (At 30 December 2015, this rate had risen to 7.1 per cent).

The DoD is an important contributor in the Hunter economy, and has strong relationships with housing, logistics, technology, education and manufacturing industries across the wider region. The SMA which is owned by the DoD, is a 14,000 hectare military facility located between Brokenback Range, the Hunter Vineyards, Lone Pine Barracks and the Mount Thorley Mine area. In addition to the firing range there are also offices, accommodation for military personal, repair and maintenance facilities, and two airstrips.

Business and industry

The proposal is located in the Hunter region which contains one of the largest coal export operations in the world. In 2013, the region supported over 20 coal mine operations. The majority of these coal mine operations are located near Singleton and Muswellbrook at the western end of the study area. As a whole in NSW, approximately 73.1 per cent of coal is transported via rail and 18.8 per cent by road (Jacobs, 2018b).

Tourism is an important industry in the study area and wider region, providing employment opportunities for local residents. Self-drive tourists are attracted to the region for its food and wine, as well as attractions relating to the area's natural environment and built heritage. The Golden Highway forms part of the 'Inland Adventure Trail', which includes highways and touring routes across NSW from north to south and east to west, and is marketed as providing tourists with access to the tourism areas of Upper Hunter Country, the Central West and Great Outback as well as providing access to natural attractions, wine regions and country events (Jacobs, 2018b).

Access and connectivity

Business and industry in the region rely on the Golden Highway as an important freight network. The Golden Highway has been identified as an important freight connection between Central West NSW and the Port of Newcastle. Regional transport infrastructure supports the economy and quality of life of NSW by allowing people to access employment opportunities, connecting regional communities and supporting freight movements. Currently, 63 per cent of freight movements in regional NSW by volume are by road, while 33 per cent is by rail (Transport, 2012).

Amenity

The proposal is located in an area predominantly rural in nature, with the majority of the surrounding land uses consisting of agricultural uses such as cattle grazing and cropping to the north and the SMA to the south. The existing noise environment around the proposal area is mainly characterised by road traffic noise, together with general rural and agriculture type noise. The few residential properties located along the highway through the proposal area are typically set well back from the highway.

6.12.3 Potential impacts

Construction

Demographics

The proposal is not expected to have a direct impact on the demographic profile of the study area. Any workers not from the Singleton region may temporarily take residence in the area, influencing the local demographics in the short term.

Travel behaviour

Due to the lack of alternative routes in the area, the proposal is not expected to have an impact on the current travel behaviours. However, it is expected that at times there would need to be changes to local traffic conditions. These include:

- Speed limit reductions in the construction area
- Temporary full highway closures (maximum 48 hours at a time)
- Increased truck movements associated with construction activities
- Partial or complete stoppages of traffic for some construction activities.

Where possible, the most disruptive work would be undertaken outside of peak periods. Significant impacts on the Range Road detour route during the 48 hour closures of the Golden Highway are predicted (SLR 2018).

Economic profile

Construction of the proposal is not expected to significantly influence the economic indicators for the study area. Any workers not from the Singleton region may temporarily take residence in nearby towns, such as Singleton. This may result in short-term economic benefits.

Business and industry

Impacts during construction to business, industry and tourism would be limited to impacts from changes to traffic conditions. Temporary delays and disruptions during construction would also impact on freight travel times, increasing transportation costs and vehicle operating costs. Certain businesses in Singleton may experience an increase in patronage due to the increase in traffic passing through the Singleton central business district.

Access and connectivity

During construction, temporary impacts on access and connectivity may be experienced for road users and freight networks, due to:

- Temporary changes to road conditions, including partial or full closure of lanes to allow for road widening works and intersection upgrades, and temporary speed reductions, leading to temporary traffic delays and disruptions along the Golden Highway
- Temporary delays for emergency services
- Increase in construction traffic along the Golden Highway, including heavy vehicles.

During construction, changes to road conditions near to construction works and access changes may impact on perceptions of road safety for some motorists travelling along the Golden Highway.

Amenity

Construction of the proposal would impact the local amenity of the area temporarily. These impacts relate to increased noise and dust from construction activities, additional traffic on New England Highway and surrounding roads when detour routes are in operation, delays on the Golden Highway due to partial road closures and visual amenity.

Operation

Demographics

The proposal is not expected to have a direct impact on the demographic profile of the study area.

Travel behaviour

The proposal is not expected to have an impact on travel behaviours. However, the proposal would improve travel times and provide a safer journey for road users.

Economic profile

Operation of the proposal is not expected to influence the economic indicators for the study area.

Access and connectivity

The proposal would improve the safety of the highway and reduce the likelihood and severity of vehicle crashes along the corridor. This would facilitate safer and quicker access for local and regional communities and to other areas of NSW for freight, residents and visitors. Local and regional bus services and emergency vehicles would benefit from the proposal through improved travel times.

Amenity

The proposal would result in some improvement to the local amenity through better traffic flow. No operational noise impacts on sensitive receivers are expected as a result of the proposal.

6.12.4 Safeguards and management measures

The recommended safeguards and management measures to minimise impacts to socio-economic during construction of the proposal are outlined in Table 6-44.

Table 6-44: Socio-economic safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Socio economic	Coordination between individual project Communication Plans to ensure consistency in the information provided to the community during construction. Coordinated report and sharing of information about issues raised by community and stakeholders.	Contractor	Pre-construction Construction	*Socio-Economic Impact Assessment report* (Appendix L)
Socio economic	Coordination between projects about the types of traffic management measures implemented to maintain consistency for motorists. Coordination between projects about timing of haulage activities that may result in particularly high levels of construction traffic. Early and ongoing consultation with bus operators and passengers about potential timing and duration of potential construction impacts.	Contractor	Pre-construction Construction	*Socio-Economic Impact Assessment report* (Appendix L)
Socio economic	Communication with the wider community about the timing and duration of potential impacts on road conditions and possible disruptions to assist people in planning their trips. Consultation with managers of tourism related businesses in accordance with the Communication Plan about the timing and duration of construction activities.	Contractor	Pre-construction Construction	*Socio-Economic Impact Assessment report* (Appendix L)
Socio economic	Engagement with business, industry and freight transport providers in accordance with the Communication	Contractor	Pre-construction Construction	*Socio-Economic Impact Assessment*

Impact	Environmental safeguards	Resp.	Timing	Reference
	Plan about the timing and duration of potential traffic delays and disruptions. Coordination between projects about the timing of activities that may result in increased construction traffic impacts.			*report* (Appendix L)
Socio economic	Avoiding where possible, the need for out of hours works, to minimise potential impacts on the movement of OSOM vehicles along the Golden Highway. Coordination with OSOM transport operators and police services about timing of OSOM movements to minimise potential impacts.	Contractor	Pre-construction Construction	*Socio-Economic Impact Assessment report* (Appendix L)

Other safeguards and management measures that would address socio-economic impacts are identified in Section 6.8 – Traffic and transport.

6.13 Other impacts

6.13.1 Potential impacts

Other existing and potential impacts are listed in Table 6-45 below.

Table 6-45: Potential impacts

Environmental factor	Existing environment	Potential impacts
Climate change	The existing climate within the Singleton area is characterised by hot, humid summers and mild to cool winters with more intense rainfall in the summer months The Hunter Valley region in general is known for its historic climate variability and extremes. Singleton Council note that major floods, droughts and bushfire events have had an impact on the LGA (Singleton Council, 2017).	**Construction** Fossil fuel combustion greenhouse gas (GHG) emissions would result from plant, equipment and vehicles used for construction activities. The impact would be minor and short term. A small amount of electricity would be required during construction, which would be associated with power for the on-site construction buildings and worker facilities. The impact would be minor and short term. Extraction and processing of materials used to construct the proposal, such as concrete, steel, road base, pipes, cables, conduits, would result in GHG emissions. The impact would be minor and short term. Mulching of cleared vegetation would result in increased GHG emissions, as the breakdown of organic matter to waste material directly releases stored carbon dioxide to the atmosphere. The impact would be minor and short term. GHG emissions would be generated by staff travelling to and from the construction site and by any transportation related to the movement of construction materials, equipment or plant in their delivery to the site. The impact would be minor and short term. **Operation** Maintenance of the road including the pavement and verges would generate a small amount of GHG emissions through the use of vehicles, plant and equipment.

Environmental factor	Existing environment	Potential impacts
		The impact would be negligible and long term.

6.13.2 Safeguards and management measures

The recommended safeguards and management measures to minimise other impacts during construction of the proposal are outlined in Table 6-46.

Table 6-46: Other impacts safeguards and management measures

Impact	Environmental safeguards	Resp.	Timing	Reference
Climate change	Plan construction activities to minimise disruption to traffic and to reduce the overall duration of construction Construction staging would be managed to minimise haulage and general vehicles trips to and from the construction sites Plant, vehicles and equipment to be maintained in accordance with manufacturer specifications Use recycled materials where possible.	Contractor	Construction	Additional safeguard

6.14 Cumulative impacts

6.14.1 Study area

The cumulative impact assessment has considered developments within the Singleton LGA and Upper Hunter LGA. Cumulative impacts could be experienced if construction or operation of the proposal coincided with construction or operation of other local developments such as other road upgrades, industrial development and private development.

6.14.2 Broader program of work

The following Transport program of work within the vicinity of the proposal include:

- New England Highway: Singleton bypass (development)
- New England Highway: Belford to Golden Highway duplication and over-bridge (delivery).

6.14.3 Other projects and developments

A desktop review of the major project register on the Department of Planning and Environment's website completed on 9 May 2018 identified the following major projects within the Singleton LGA which have the potential to contribute to cumulative impacts of the proposal (refer Table 6-47).

Table 6-47: Summary of other projects and developments

Project	Construction impacts	Operational impacts
Mount Owen Continued Operations	Potential impacts from the continuation of mine include: • Removal of vegetation • Noise and vibration impacts on sensitive receivers • Air quality impacts caused by dust • Delays to traffic using Hebdon Road from construction traffic and road closures.	• Increased traffic resulting in longer travel times • Increase in road traffic noise • Visual impacts of new overpass and bridge.
United Wambo Open Cut Coal Mine	Potential impacts from construction of the new mine include • Noise and vibration • Removal of vegetation • Increased dust from construction • Golden Highway realignment causing delays to traffic.	• Increased daily train movements • Increased noise and vibration • Increased dust.

The Upper Hunter Shire Council (UHSC) and Singleton Shire Council (SSC) website note recently determined Development Applications (DAs) within the respective LGAs including major developments and Council infrastructure maintenance work. A review of UHSC and SCC websites on 9 May 2018 identified a number of recent approved developments relating to residential, industrial and commercial properties within both LGAs, none of which are within the vicinity of the proposal.

6.14.4 Potential impacts

Construction

There is the potential that the construction periods of Belford to Golden Highway would overlap with the Golden Highway Mudies Creek upgrade resulting in cumulative impacts. The key cumulative potential negative impacts during construction include:

- Aboriginal heritage: disturbance to the natural landscape by construction activities
- Non-Aboriginal heritage: disturbance to the natural landscape by construction activities
- Biodiversity: removal of native vegetation that would reduce available habitat for threatened fauna and flora and result in clearing of CEEC and EEC
- Soils: untreated water and/or spills from the construction site impacting water quality of waterways including Hunter River
- Traffic and transport: increased construction vehicle traffic on the Golden Highway and local roads from both projects would increase congestion and cause delays through the construction sites
- Socio-economic: delays caused by speed zone restrictions required for construction sites would affect the network's level of service causing delays for road users
- Air quality: dust and vehicle emissions associated with construction work at both sites on the surrounding environment including sensitive receivers
- Noise and vibration: from construction of both projects affecting adjacent sensitive receivers
- Landscape character and visual: temporary changes to the visual amenity of the area caused by vegetation removal and construction infrastructure such as ancillary sites and signage.

Operation

The proposal, in combination with the Belford to Golden Highway Upgrade would result in cumulative impacts within the Whittingham locality.

The key cumulative potential positive impacts include:

- Traffic and transport: increased capacity of the road network, improved traffic flow and reduced journey times. The new bridge would provide a reliable crossing over Mudies Creek and improve road user safety
- Air quality: positive changes to air quality though elimination of queuing at the intersection of the Golden Highway and New England Highway
- Noise and vibration: road upgrades would have positive impacts on noise due to the completed developments having smoother road surfaces which would generate less noise.

The key cumulative potential negative impacts include:

- Biodiversity: removal of native vegetation that would have long term impacts on biodiversity with through the clearing of native vegetation which would also reduce available habitat for threatened fauna and flora and reduce the size of CEEC and EEC within the area. Refer to Section 6.1 Biodiversity of the REF.
- Landscape character and visual: long term negative changes to landscape character and visual amenity from the new infrastructure (including a flyover, bridge and dual carriageway). This impact would be mitigated with landscaped vegetation maturing over time and reducing landscape and visual impacts.

6.14.5 Safeguards and management measures

Refer to the safeguards listed in Chapter 6 of the REF, Sections 6-1 through to 6-12.

7. Environmental management

7.1 Environmental management plans (or system)

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

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

The PEMP and CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport Environment Officer, Hunter Region, prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP and PEMP would be developed in accordance with the specifications set out in: QA Specification *G36 – Environmental Protection (Management System)*, QA Specification *G38 – Soil and Water Management (Soil and Water Plan)*, QA Specification *G40 – Clearing and Grubbing*, QA Specification *G10 – Traffic Management..*

7.2 Summary of safeguards and management measures

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

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
GEN1	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement by the Transport Environment Manager prior to commencement of the activity. The endorsed CEMP will be implemented during the undertaking of the activity. As a minimum, the CEMP will address the following: • Any requirements associated with statutory approvals • Details of how the project will implement the identified safeguards outlined in the REF • Issue-specific environmental management plans • Roles and responsibilities • Communication requirements • Induction and training requirements • Procedures for monitoring and evaluating environmental performance, and for corrective action • Reporting requirements and record-keeping • Procedures for emergency and incident management • Procedures for audit and review.	Contractor	Pre-construction Construction	Section 4.11 of QA *G36 Environment Protection*
GEN2	General - environmental awareness	All personnel working on site will receive induction and 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 (the following are examples only):	Contractor	Pre-construction Construction	

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		• Areas of Aboriginal heritage sensitivity • Areas of historic heritage • Threatened species habitat including microbats (Sentry box) • Erosion risks • Vegetation clearing • Sensitive receivers around the project • Contamination and contaminated lands			
GEN3	Compliance	Nomination of a Contractor environmental site representative (ESR) to monitor effectiveness of the SWMP and ESCP. The ESR would manage the monitoring and maintenance of ERSED controls, progressively update ESCPs as required.	Contractor	Construction	Section 3.3 of QA G36 *Environment Protection*
Aboriginal heritage					
AB1	Aboriginal heritage	TfNSW would apply to OEH for an AHIP to cover the area impacted by construction of the proposal.	TfNSW	Pre-construction	Chapter 9, *Cultural Heritage Assessment Report*
AB2	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, 2012) and *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) 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	Pre-construction Construction	Section 4.9 of QA *G36 Environment Protection*
AB3	Aboriginal heritage	To mitigate impacts to artefacts at the Mudies Creek Artefact Site 02 surface scatter, the collection and relocation of surface Aboriginal artefacts to a location outside of the proposal impact area should be included as a condition of the AHIP, to be undertaken by representatives	TfNSW	Pre-construction	ACHAR August 2022 Recommendation 7

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		of the project RAPs and a suitably qualified archaeologist specialising in Aboriginal heritage. Following the relocation, to submit the updated location to AHIMS using the Aboriginal Site Impact Recording Form. Where additional, previously unidentified artefacts are found during these works, they should be recorded in accordance with AHIMS guidelines, and that information appended to the appropriate site card.			
AB4	Aboriginal heritage	The Transport for NSW Unexpected Heritage Items Procedure July 2022 will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport 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	Construction	Section 4.9 of QA *G36 Environment Protection*
AB5	Aboriginal heritage	Delivery of cultural awareness training for the development and delivery teams prior to the Golden Highway program of works.	Contractor	Construction	*S.10 Conclusions and Recommendations of Cultural Heritage Values Assessment Report*
AB6	Aboriginal Heritage	TfNSW should provide a copy of this report (Golden Highway Upgrade - Mudies Creek Aboriginal Archaeological Excavation Report) and the draft Historical Test Excavation Report) to the Department of Defence, Wanaruah LALC and Singleton local studies library (redacted for Aboriginal site information as appropriate).	TfNSW	Pre-construction; Construction	Golden Highway Upgrade - Mudies Creek Aboriginal Archaeological Excavation Report

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
Biodiversity					
B1	Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Transport's *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (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) • protocols to manage weeds and pathogens.	Contractor	Pre-construction Construction	Section 4.8 of QA G36 *Environment Protection*
B2	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	TfNSW and Contractor	Detailed design	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011)
B3	Threatened plants and native vegetation	Pre-clearing surveys would be carried out in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011).	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
B4	Removal of native vegetation	Vegetation removal would be carried out in accordance with Guide 4: Clearing of vegetation and removal of bush rock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*
B5	Loss of vegetation	Native vegetation would be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Post-construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)*
B6	Impacts to threatened species	The unexpected threatened species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B7	Habitat loss	Habitat removal would be carried out in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B8	Habitat loss	Habitat would be replaced or re-instated in accordance with Guide 5: Re-use of woody debris and bush rock.	Contractor	Construction	*Biodiversity Guidelines: Protecting and*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
					managing biodiversity on RTA projects (RTA, 2011)
B9	Habitat loss	The unexpected species find procedure is to be followed under Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B10	Removal of trees and hollows	A survey of tree and hollows must be undertaken in accordance with Transport's *Biodiversity Policy (2022)*, prior to any impacts occurring to vegetated areas.	Contractor	Pre-construction	*Biodiversity Policy (Transport 2022)*
B11	Removal of trees and hollows	A Tree and Hollow Replacement Plan must be developed in accordance with the Transport's *Biodiversity Policy (2022)*. This Tree and Hollow Replacement Plan is to be incorporated into the project Landscaping Plan (refer LV1).	Contractor	Pre-construction	*Biodiversity Policy (Transport 2022)*
B12	Removal of threatened plants	Pre-clearing surveys would be carried out in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines	Contractor	Pre-construction Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B13	Hydrology changes	Changes to existing surface water flows would be minimised through detailed design.	TfNSW	Detailed design	*Biodiversity Guidelines: Protecting and managing*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
					biodiversity on RTA projects (RTA, 2011)
B14	Fragmentation of identified habitat corridors	Exclusion zones would be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B15	Fauna	Any wildlife encountered within the construction footprint will be managed in accordance with the Fauna would be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B16	Invasion and spread of weeds	Weed species would be managed in accordance with Guide 6: Weed management of the Biodiversity Guidelines.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B17	Invasion and spread of pathogens and disease	Pathogens would be managed in accordance with Guide 7: Pathogen Management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011).	Contractor	Construction	Biodiversity assessment (Appendix D)

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
B18	Edge effects on nearby native vegetation and habitat	Exclusion zones would be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines	Contractor	Construction	Biodiversity assessment (Appendix D)
B19	Noise, light and vibration	Shading and artificial light impact would be minimised through detailed design.	TfNSW	Detailed Design	Increase in noise, light and vibration during construction
B20	Aquatic biodiversity	An *Environmental Work Method Statement* (EWMS) for the temporary watercourse crossing works will provide appropriate protocols to minimise impacts to any fish.	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B21	Aquatic biodiversity	Placement of structural components of the bridge outside waterways to avoid instream disturbance.	Contractor	Construction	Aquatic assessment (Appendix D)
B22	Aquatic biodiversity	Temporary water crossing to be constructed from rock fill free of fines and of suitable size (≥ 150 mm diameter).	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
					RTA projects (RTA, 2011)
B23	Aquatic biodiversity	Temporary in-stream structures to be inserted during low-flow periods to ensure flow is maintained at all times, with management plans being submitted to DPI detailing how high-flow events will be managed to limit erosion of the structures and associated sedimentation of downstream waterways. An Environmental Work Method Statement (EWMS) will be prepared to manage this activity and will submitted to Transport and DPI for review.	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B24	Aquatic biodiversity	Temporary instream structure to ensure flow is maintained at all times.	Contractor	Construction	Biodiversity assessment (Appendix D) *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*
B25	Aquatic biodiversity	Any dewatering of temporary in-stream structures will be undertaken in accordance with the following procedure: • DPI is to be notified 7 days prior to any dewatering activities to organise potential fish rescue activities. • A separate s.37 permit may be required from DPI to relocate fish. • Water is to be pumped a minimum of 30 metres away from the waterway and treated as required.	Contractor	Construction	Biodiversity assessment (Appendix D) & *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		Any water re-entering the waterway will need to meet relevant ANZECC water quality guidelines. A water quality monitoring program is to be provided to Transport prior to commencement of this activity.			
B26	Microbats	Prior to the commencement of works, limit use of the sentry box for essential use only to minimise disturbance to the microbat and potential disease risk to humans. Establish signs and exclusion area informing site personnel of management measures and presence of protected fauna.	Contractor	Pre-Construction	Biodiversity assessment (Appendix D)
B27	Microbats	If microbats are observed flying during any early works activities, then stop work or move to another area further away for approximately one hour to allow bats to settle and report to the site environmental representative for reporting in accordance with the Transport for NSW Environment Incident Procedure.	Contractor	Construction	Biodiversity assessment (Appendix D)
B28	Microbats	Any hazardous material sampling to be taken from the unoccupied corner of the sentry box. Refer to the Biodiversity Assessment (Appendix D) for roost locations.	TfNSW	Construction	Biodiversity assessment (Appendix D)
B29	Microbats	Investigate options to retain sentry box in its current location or relocate within the proposal boundary.	TfNSW	Pre-Construction	
B30	Microbats	Prior to relocation or demolition of the sentry box a pre-works survey to be undertaken by an ecologist with minimum 3 years microbat experience and Rabies vaccinations: • If bats are identified but are not threatened species, then follow the demolition process outlined in management measure B31 • If threatened species are identified the demolition would be postponed and a bat management plan would be prepared and implemented plan in accordance with the Transport Biodiversity Guidelines – unexpected threatened species finds procedure (RTA 2011) including consideration of hollow availability across a broader area (e.g. 5km) and the potential for compensatory habitat	Contractor	Pre-construction Construction	Biodiversity assessment (Appendix D) - Additional safeguard

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		If no bats are identified within the structure demolition / relocation can proceed in accordance with B31.			
B31	Microbats	Develop an Environmental Work Method Statement (EWMS) for demolition / relocation of the sentry box. The process for demolition / relocation of the sentry box is as follows: • Undertake demolition / relocation of sentry box outside of the maternity season of most microbat species (i.e. demolish only between May – September inclusive) unless otherwise approved by an appropriately qualified specialist. • Engage an ecologist with microbat experience (minimum 3 years) and Rabies vaccinations to supervise and guide the demolition / relocation of the sentry box • Undertake sentry box demolition / relocation at night after the ecologist confirms that microbats have left the roost. (There are too many entry/exit points to successfully exclude microbats prior to demolition.) Avoid unsuitable weather conditions (i.e. very cold nights in winter) when bats are unlikely to leave the roost.	Contractor	Pre-Construction Construction	Biodiversity assessment (Appendix D)
Soils					
SO1	Soil loss and water quality	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. The SWMP would address the management of stockpiles including their location.	Contractor	Pre-construction Construction	Section 2.1 of QA *G38 Soil and Water Management* Transport *Stockpile Management Guideline (2015)*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
SO2	Soil loss and water quality	A site-specific Erosion and Sediment Control Plan (ESCP) will be prepared and implemented as part of the SWMP. The ESCP will show the location of all erosion and sediment controls (ERSED). The ESCP will be progressively updated to address changes in construction staging. The ESCP will include arrangements for, but not limited to, the following: • Identification of high-risk construction activities (i.e. works in waterways) and preparation of environmental work method statements (EWMS) to mitigate risk • Appropriate ERSED controls including off-site/site water separation • Management of weather events, including monitoring of potential high-risk events (such as storms), specific controls and follow-up maintenance • Location and management of stockpiles including ERSED controls.	Contractor	Construction	Section 2.2 of QA *G38 Soil and Water Management* Landcom's Managing Urban Stormwater: Soils and Construction series Transport *Stockpile Management Guideline (2015)*
SO3	Soil loss and water quality	Nomination of a Contractor environmental site representative (ESR) to monitor effectiveness of the SWMP and ESCP. The ESR would manage the monitoring and maintenance of ERSED controls, progressively update ESCPs as required.	Contractor	Construction	Section 3.3 of QA G36 *Environment Protection*
SO4	Soil loss and water quality	The rehabilitation of disturbed areas is to be carried out progressively as construction stages are completed.	Contractor	Construction	Section 3.1 of QA *G38 Soil and Water Management &* Landcom's *Managing Urban Stormwater: Soils and Construction* series
SO5	Soil loss and water quality	Topsoil should be stockpiled in cleared or disturbed areas to avoid the removal of native vegetation.	Contractor	Construction	Section 3.1 of QA *G38 Soil and*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
					Water Management & Landcom's *Managing Urban Stormwater: Soils and Construction* series
SO6	Management of topsoil for reuse	Stripped topsoil to be managed in accordance with the requirements of TfNSW Roadworks Specification R178 Vegetation.	Contractor	Construction	Transport QA Specification R178 Vegetation
SO7	Stockpiling of materials	Stockpiles are to be managed in accordance with the *Stockpile Site Management Guideline* (2015) requirements. Stockpiles will be: • Located in cleared or disturbed areas • Have ERSED controls for temporary and permanent stockpiles Where possible stockpiled material will be reused on site or removed off site to other Transport projects or premises with approval to accept such material that cannot be reused will be disposed to a licensed waste facility.	Contractor	Construction	Transport *Stockpile Site Management Guideline* (2015)
SO8	Soil stabilisation	The rehabilitation of disturbed areas is to be carried out progressively as construction stages are completed, and in accordance with: • Landcom's Managing Urban Stormwater: Soils and Construction series • RTA Landscape Guideline • Transport Guideline for Batter Stabilisation Using Vegetation.	Contractor	Construction	Transport QA Specification R178 Vegetation
SO9	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination and a Contaminated Land Management Sub-Plan (CLMS-P) would be prepared and implemented. Any contaminated material would be managed in accordance with CLMS-P.	Contractor	Construction	Section 4.2 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport Environment Manager and/or EPA.			
SO10	Unexpected contamination	The CEMP, or relevant management plan, will include an unexpected finds protocol for potentially contaminated material encountered during construction work.	Contractor	Construction	Section 4.2.3 of QA *G36 Environment Protection*
SO11	Asbestos	An Asbestos Management Plan will be developed and implemented to manage asbestos and asbestos containing material if encountered during the construction. The plan will include: • Identification of potential asbestos on site • Procedures to manage and handle any asbestos • Mitigation measures if asbestos is encountered during construction Procedures for disposal of asbestos in accordance with the NSW EPA guidelines, Australian Standards and relevant industry codes of practice	Contractor	Construction	Clause 425 & 429 of Work Health and Safety Regulation 2017
SO12	Surface water and groundwater	Hydrocarbon refuelling areas and chemical stores to be lined and/or bunded and at least 50 metres from any surface water or groundwater source to minimise potential of pollution.	Contractor	Construction	Section 4.3 of QA G36 *Environment Protection*
SO13	Accidental spill	A site-specific emergency Spill Management Plan will be developed and include spill management measures in accordance with the Transport *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill and the Transport Environmental Incident Classification and Management Procedure (Roads and Maritime, 2014) would be followed, with the Transport Contract Manager notified immediately. The plan would include initial responses and containment, notification of emergency services and relevant authorities (including Transport and EPA officers).	Contractor	Pre-construction Construction	Section 4.3 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
Water quality, hydrology and flooding					
SW1	Spills during construction	A Spill Management Plan would be prepared for the proposal. If a spill or incident occurs, the Transport Environmental Incident Classification and Management Procedure (Roads and Maritime, 2018) would be followed and the Transport Contract Manager notified immediately.	Contractor	Pre-construction Construction	Section 4.3 of QA *G36 Environment Protection*
SW2	Spills during construction	Store chemicals, fuel and lubricants in suitably located and bunded areas not within 50 m of any aquatic habitat, flood prone areas, or on slopes steeper than 1:10.	Contractor	Construction	Section 4.3 of QA *G36 Environment Protection*
SW3	Spills during construction	Hydrocarbon refuelling areas and chemical stores to be lined and/or bunded and at least 50 metres from any surface water or groundwater source to minimise potential of pollution. Do not refuel or maintain plant and equipment, mix cutting oil with bitumen, or carry out any other activity which may result in spillage of a chemical, fuel or lubricant at any location which drains directly to waters or environmentally sensitive areas, without the appropriate temporary bunding being provided. Do not leave refuelling operations unattended.	Contractor	Construction	Section 4.3 of QA *G36 Environment Protection*
SW4	Pollution of downstream waterways due to maintenance practices during operation	TfNSW standard maintenance controls will be applied in a manner that will minimise any potential water pollution due to maintenance practices (such as herbicide use, mowing, and road surface cleaning).	TfNSW	Operation	Transport *Environmental Assessment Procedure for Routine and Minor Works, Standard Safeguards*
Traffic and transport					
T1	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 Transport *Traffic Control at Work Sites Manual* (Transport for NSW, 2020) and *QA Specification G10 Control of Traffic*. The TMP will include:	Contractor	Pre-construction Construction	*Traffic Control at Work Sites Manual* (Transport for NSW, 2020)

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		• Confirmation of haulage and detour routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) 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 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.			and *QA Specification G10 Control of Traffic*
T2	Changed transport and access	Road users, local residents and local businesses are to be informed a minimum of five days of changed conditions, including the likely disruptions to access.	Contractor	Pre-construction Construction	Section 3.7 of QA *G36 Communication*
T3	Disruptions to traffic and transport	Real-time information is to be made available through temporary Variable Message Signs (VMS), the Live Traffic and 131 500 websites, and the media.	Contractor	Construction	Section 3.7 of QA *G36 Communication Traffic Control at Work Sites Manual* (Transport for NSW, 2020) and *QA Specification G10 Control of Traffic*
T4	Disruptions to traffic and transport	Construction staging and materials are to be managed to minimise the number of haulage and delivery vehicles required on site.	Contractor	Construction	*Traffic Control at Work Sites Manual* (Transport for NSW, 2020)

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
					and *QA Specification G10 Control of Traffic*
T5	Disruptions to traffic and transport	The designated site access points and haulage routes are to be used.	Contractor	Construction	*Traffic Control at Work Sites Manual* (Transport for NSW, 2020) and *QA Specification G10 Control of Traffic*
Property and land use					
P1	Property acquisition	Property acquisition will be carried out in accordance with the Transport's Land Acquisition Information Guide (Roads and Maritime, 2012), the NSW Land Acquisition (Just Terms Compensation) Act 1991 and in accordance with the relevant Commonwealth legislation.	TfNSW	Pre-construction Post-construction	Core standard safeguard PL1 & Common-wealth Lands Acquisition Act 1989
Waste and contamination					
WA1	Construction waste	A Waste Management Plan (WMP) is to be prepared and implemented as part of the CEMP. The WMP should provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriately handle and dispose of unavoidable waste. It would also address the importation of waste to the site for use in undertaking the project. The WMP would give effect to any management measures contained in any waste assessment carried out for the project and include, but not necessarily be limited to: • Measures to avoid and minimise waste associated with the project • Classification of wastes generated by the project and management options (re-use, recycle, stockpile, disposal) • Classification of wastes received from off-site for use in the project and management options	Contractor	Pre-construction Construction	Section 4.11 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		• Separation of waste to avoid cross contamination • Identifying any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions. The WMP would be prepared taking into account the Transport Environmental *Procedure – Management of Wastes on Roads and Maritime Services Land* and relevant Transport Waste Fact Sheets.			
WA2	Construction waste	Waste would be classified in accordance with the methods and specifications of the NSW EPA *Waste Classification Guidelines 2014*.	Contractor	Construction	NSW EPA *Waste Classification Guidelines 2014*
WA3	Construction green waste	Weed species, or vegetation not considered appropriate for re-use on-site, would be removed and disposed of to an appropriately licenced facility.	Contractor	Construction	
CO1	Contaminated land	If contamination is encountered a Contaminated Land Management Sub-Plan (CLMS-P) would be prepared and implemented. Any contaminated material would be managed in accordance with CLMS-P.	Contractor	Pre-construction; Construction	
CO2	Contaminated land	Additional groundwater and surface water monitoring is not required during construction works except in scenarios where Site construction activities require groundwater abstraction (such as dewatering) or have potential to introduce contaminants from leaks and spillages within disturbance areas impacting surface water runoff.	Contractor	Pre-construction; Construction	
CO3	Contaminated land	Further assessment (including soil sampling and testing) should be carried out within the fill stockpile observed west of Mudies Creek prior to reuse at construction stage. Based on the findings of the DSI, no further contamination soil investigations are required within AEC3 and AEC5 at the Site.	Contractor	Pre-construction;	

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
CO4	Contaminated land	An Unexpected Finds Protocol should be prepared and implemented to manage remaining contamination risks at the Site (if any) during construction stage.	Contractor	Pre-construction; Construction	
CO5	Contaminated land	Environmental management measures should be implemented during construction works to mitigate the risk of introducing further site contamination through spillages / pollution releases to Site soils and surface water within Mudies Creek.	Contractor	Pre-construction; Construction	
Air quality					
AQ1	General air quality impacts	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include • Identification of potential risks/impacts due to the work/activities as dust generation activities • Plan and carry out all your construction activities to avoid where practicable, or minimise, the generation of dust and vehicle emissions. • Management measures to minimise risk of dust generation including use of water carts for dust suppression • Where air quality monitoring is required, it must comply with the EPA publication "Approved Methods for Sampling and Analysis of Air Pollutants in NSW". Monitoring data must include reporting of insoluble solids in accordance with the EPA publication "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" • A process for altering management measures as required and reprogramming construction activities if the safeguards and management measures do not adequately restrict dust generation.	Contractor	Pre-construction Construction	Section 4.4 of QA *G36 Environment Protection*
AQ2	Dust emissions	Work will cease when levels of visible airborne dust become excessive.	Contractor	Construction	Section 4.4 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
AQ3	Dust emissions	Works that disturb vegetation, soil or stockpiles will not be carried out during strong winds (over 40 km/h) as this may affect receivers (visibility on roads dust and debris near residences and commercial premises).	Contractor	Construction	Section 4.4 of QA *G36 Environment Protection*
AQ4	Dust emissions	Stockpiles materials will be covered, stabilised or stored in areas not subject to high wind. All stockpiles are to be managed in accordance with the *Transport Stockpile Management Guideline* (2015)	Contractor	Construction	Section 4.4 of QA *G36 Environment Protection*
AQ5	Dust emissions	All trucks will be covered when transporting material to and from the site.	Contractor	Construction	Section 4.4 of QA *G36 Environment Protection*
Landscape character and visual impacts					
LV1	Landscape and visual Landscape	A Landscaping Plan is to be prepared. This plan will need to incorporate the Tree and Hollow Replacement Plan (B11)	Contractor	Pre-construction	
LV2	Landscape and visual Landscape	Integrate earthworks with the natural landform, by rounding off the tops, bottoms and ends of embankments where possible.	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.2
LV3	Landscape and visual Landscape	Fencing limited to simple, unobtrusive structures and be of a rural-style where possible.	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.2
LV4	Vegetation	Use local native vegetation species to stabilise fill embankments and rehabilitate creek banks.	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.2
LV5	Landscape and visual	Redundant sections of highway to be removed, hyrodmulched with local native species.	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.2
LV6	Landscape and visual	Landform at bridge approaches to blend with the surrounding landscape topography by easing of batter slopes and adopting a grading solution which considers slope geometry as part of the bridge design.	Contractor	Detailed design Construction	*LCVIA* Appendix Q Section 6.3

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
LV7	Vegetation	Minimise damage to vegetation and trees by locating ancillary infrastructure on existing cleared areas.	Contractor	Construction	*LCVIA* Appendix Q Section 6.4
LV8	Light spill	Minimise temporary light spill beyond the construction site.	Contractor	Construction	*LCVIA* Appendix Q Section 6.4
LV9	Disturbed areas	Rehabilitation of all areas disturbed by construction.	Contractor	Construction	*LCVIA* Appendix Q Section 6.4
Noise and vibration					
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, considering *Beyond the Pavement: urban design policy, process and principles* (Roads and Maritime, 2014). • a monitoring program to assess performance against relevant noise and vibration criteria • arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Pre-construction Construction	Section 4.6 of QA *G36 Environment Protection*
NV2	Noise and vibration	All sensitive receivers (e.g. 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 project	Contractor	Construction	Section 3.7 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		• the construction period and construction hours • contact information for project management staff • complaint and incident reporting • how to obtain further information.			
NV3	Noise and Vibration	Implementation of project specific mitigation measures including additional mitigation measures for potentially affected receivers.	Contractor	Construction	Noise and Vibration Assessment (Table 8, Appendix F)
NV4	Noise and vibration	Notification detailing work activities, dates and hours, impacts and mitigation measures, indication of work schedule over the night time period, any operational noise benefits from the works (where applicable) and contact telephone numbers. Notification should be a minimum of seven calendar days prior to the start of works. For projects other than maintenance works more advanced consultation or notification may be required.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV5	Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) environmental incident procedures.	Contractor	Construction	Noise and Vibration Assessment (Appendix F)

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
NV6	Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios onsite. No dropping of materials from height, throwing of metal items and slamming of doors.	Contractor	Construction	Noise and Vibration Assessment (Appendix F)
NV7	Verification	Where specified, a noise verification programme is to be carried out for the duration of the works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.	Contractor	Construction	Section 4.6 of QA *G36 Environment Protection*
NV8	Attended vibration measurements	Where required attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.	Contractor	Construction	Section 4.7 of QA *G36 Environment Protection*
NV9	Building condition survey	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to commencement of activities with the potential to cause property damage.	Contractor	Construction	Noise and Vibration Assessment (Appendix F)
NV10	Update Environmental Management Plans	The EMP must be regularly updated to account for changes in noise and vibration management issues and strategies.	Contractor	Construction	Section 3.11 of QA *G36 Records of Environment Protection*
NV11	Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and or vibration levels should be scheduled during less sensitive time periods.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV12	Construction respite periods during normal hours and out-of-hours work	The Noise and Vibration Management Plan should address respite periods during normal hours and out-of-standard hours work. For example - high noise and vibration generating activities near receivers should be carried out in continuous blocks not exceeding 3 hours each, with a minimum respite period of one hour between each block. The	Contractor	Construction	Operational Noise Assessment (Appendix F)

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		duration of each block of work and respite should be flexible to accommodate the usage and amenity at nearby receivers. Unless negotiated with the community with consultation documented and approved by Transport project manager, there should be no more than – Two consecutive evening or night works per week; and – Three evening or night works per week; and – Six evening or night works per month For night work these periods of work should be separated by not less than one week.			
NV13	Equipment selection.	Use quieter and less vibration emitting methods where feasible and reasonable. Ensure plant, and equipment are fitted with appropriate silencers that are maintained in good working order for the duration of works.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV14	Rental plant and equipment.	The noise levels of plant and equipment items are to be considered in rental decisions and in any case should not be used onsite unless compliant with the criteria in Table 2 of the Transport CNVG or used during less sensitive time periods.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV15	Use and siting of plant.	• The offset distance between noise intensive plant and adjacent sensitive receivers is to be maximised. • Plant used intermittently is to be throttled down or shut down. • Noise-emitting plant is to be directed away from sensitive receivers. • Only have necessary equipment onsite.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV16	Plan worksites and activities to minimise noise and vibration	• Locate compounds away from sensitive receivers discourage access from local roads • Plan traffic flow, parking and loading / unloading areas to minimise reversing movements within the site. • Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of	Contractor	Construction	Operational Noise Assessment (Appendix F)

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
		impact by concentrating noisy activities at one location and move to another as quickly as operationally possible • Very noisy activities should be scheduled for standard working hours. If the work cannot be undertaken during the day, it should be completed before 11:00pm. • If programmed night work is postponed, the work should be re-programmed considering the approaches defined within this table.			
NV17	Reduced equipment power	Use only the necessary size and power in relation to plant equipment.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV18	Non-tonal and ambient sensitive reversing alarms	• Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used onsite and for any out of hours work. • Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV19	Minimise disturbance arising from delivery of goods to construction sites.	• Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. • Select site access points and roads as far as possible away from sensitive receivers. • Dedicated loading/unloading areas to be shielded if close to sensitive receivers. • Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. • Avoid or minimise out of hours movements where possible.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV20	Engine compression brakes	• Limit the use of engine compression brakes near residential areas. • Ensure vehicles are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'In-service test procedure' and standard.	Contractor	Construction	Operational Noise Assessment (Appendix F)

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
NV21	Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources should be enclosed or shielded where feasible and reasonable whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436:1981 lists materials suitable for shielding.	Contractor	Construction	Operational Noise Assessment (Appendix F)
NV22	Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.	Contractor	Construction	Operational Noise Assessment (Appendix F)
Socio-economic					
SE1	Socio economic	• Coordination between individual project Communication Plans to ensure consistency in the information provided to the community during construction. • Coordinated report and sharing of information about issues raised by community and stakeholders.	Contractor	Pre-construction Construction	*Cumulative Socio-Economic Assessment report* (Appendix L
SE2	Socio economic	• Coordination between projects about the types of traffic management measures implemented to maintain consistency for motorists. • Coordination between projects about timing of haulage activities that may result in particularly high levels of construction traffic. • Early and ongoing consultation with bus operators and passengers about potential timing and duration of potential construction impacts.	Contractor	Pre-construction Construction	*Cumulative Socio-Economic Assessment report* (Appendix L)
SE3	Socio economic	• Communication with the wider community about the timing and duration of potential impacts on road conditions and possible disruptions to assist people in planning their trips. • Consultation with managers of tourism related businesses in accordance with the Communication Plan about the timing and duration of construction activities.	Contractor	Pre-construction Construction	*Cumulative Socio-Economic Assessment report* (Appendix K Anomaly Identification,

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
					Investigation and Removal Excavation Report Appendix
SE4	Socio economic	• Engagement with business, industry and freight transport providers in accordance with the Communication Plan about the timing and duration of potential traffic delays and disruptions. • Coordination between projects about the timing of particular activities that may result in increased construction traffic impacts.	Contractor	Pre-construction Construction	*Cumulative Socio-Economic Assessment report* (Appendix L)
SE5	Socio economic	• Avoiding where possible, the need for out of hours works, to minimise potential impacts on the movement of OSOM vehicles along the Golden Highway. • Coordination with OSOM transport operators and police services about timing of OSOM movements to minimise potential impacts.	Contractor	Pre-construction Construction	*Cumulative Socio-Economic Assessment report* (Appendix L)
Non-Aboriginal heritage					
NAH1	Non-Aboriginal heritage	Transport's Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime, 2015) is to be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered during construction. Work should only re-commence once the requirements of the procedure have been satisfied.	Contractor	Construction	Section 4.10 of QA *G36 Environment Protection & Section 89A of the National Parks and Wildlife Act 1974*
NAH2	Non-Aboriginal heritage	For all proposed works near Dochra Gate: Temporary fencing around Trenches 1 and 2 during construction works. Temporary fencing should be chainwire style with a foot weight and should not penetrate the ground.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
NAH3	Non-Aboriginal heritage	All ground disturbance within the 8m buffer zone of Trench 1 should be avoided. Works in this area must build up and not cut down. (No buffer required for Trench 2) Installation of temporary fencing and construction of the fire trail can occur within this zone outside of the temporary fenced areas. No buffer is required for Trench 2.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
NAH4	Non-Aboriginal heritage	Compaction of soil in temporarily fenced areas around Trench 1 and 2 should be avoided.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
NAH5	Non-Aboriginal heritage	Further testing of the site is not recommended. As conservation through in situ retention is the preferred outcome, further destructive investigations should be avoided.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
NAH6	Non-Aboriginal heritage	Relocation and construction of the Sentry Box and new flagpole should occur outside of the 8m buffer around the hut and should not impact on the historic features identified in Trench 1 or 2.	Contractor	Construction	Draft Historical Test Excavation Report V4.pdf
NAH7	Non-Aboriginal heritage	The fire trail should be built up above current ground levels to avoid impacts to the archaeology around the hut (Trench 1). During construction of the fire trail the location of Trenches 1 and 2 should be demarcated with temporary fencing and not used for ancillary purposes.	Contractor	Pre-construction; Construction	Draft Historical Test Excavation Report V4.pdf
NAH8	Non-Aboriginal heritage	If unexpected heritage items are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the Transport *Standard Management Procedure: Unexpected Heritage Items* must be followed. Transport Senior Environment Specialist - Heritage must be contacted immediately.	Contractor	Construction	Section 4.10 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Resp.	Timing	Reference
NAH9	Non-Aboriginal Heritage	TfNSW should provide a copy of this report (draft Historical Test Excavation Report), and the Golden Highway Upgrade - Mudies Creek Aboriginal Archaeological Excavation Report to the Department of Defence, Wanaruah LALC and Singleton local studies library (redacted for Aboriginal site information as appropriate).	TfNSW	Pre-construction; Construction	Draft Historical Test Excavation Report V6
Other impacts					
O1	Sustainability	• Plan construction activities to minimise disruption to traffic and to reduce the overall duration of construction • Construction staging would be managed to minimise haulage and general vehicles trips to and from the construction sites • Plant, vehicles and equipment to be maintained in accordance with manufacturer specifications • Use recycled materials where possible.	Contractor	Construction	Additional safeguard

7.3 Licensing and approvals

Table 7-2 provides a summary of the licences and approvals required to construct and operate the proposal.

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Fisheries Management Act 1994 (s199) (s205) (s219)	Notification to the Minister for Primary Industries prior to any dredging or reclamation works (s199) Permit to obstruct the free passage of fish (temporary or permanent) from the Minister for Primary Industries (s219).	Minimum of 21 days prior to start of work Prior to start of activity.
National Parks and Wildlife Act 1974 (s90)	Aboriginal heritage impact permit from NSW Environment and Heritage Group.	Prior to start of activity.
Water Management Act 2000 (s90)	Flood work approval from DPI (Water). [Note exemption under s41E of the Water Management (General) Regulation 2011.]	Prior to start of activity.
Water Management Act 2000 (s91)	Aquifer interference approval from DPI (Water).	Prior to start of activity.
Roads Act 1993	Road occupancy licence.	Prior to start of activity.
Defence Act 1903	Dept of Defence Access Licence.	Prior to start of activity.

8. Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2021.

8.1 Justification

While there would be some environmental impacts as a consequence of the proposal including temporary traffic delays, temporary traffic detours, biodiversity impacts, noise impacts, water quality and dust impacts, they have been avoided or minimised wherever possible through design and site-specific mitigation measures and safeguards. Compared with the 'do nothing' option, the beneficial effects of upgrading the bridge and road alignment at Mudies Creek on the Golden Highway are considered to outweigh the mostly temporary adverse impacts and risks associated with the proposal.

8.1.1 Social factors

As documented in Section 6.9, there would be some short-term negative social impacts as a result of the disturbance and change during construction of the proposal. The combined effect of construction noise, traffic delays and detours, dust, property access changes, and general disturbance caused by construction activity, and associated construction traffic and machinery movements, would result in a general loss of amenity for residents, road users and others who live near the proposal area and those who visit the proposal area on a regular basis.

As documented in Section 6.9.3, speed restrictions, traffic delays and traffic detours have the potential to increase travel time for Golden Highway road users. Impacts during construction to business, industry and tourism would be limited to impacts from changes to traffic conditions.

Compared with the 'do nothing' option where the existing road and culverts are not upgraded, the long-term effect would be an overall social benefit through upgrading the bridge and road approaches at Mudies Creek on the Golden Highway at this location.

8.1.2 Biophysical factors

The design of the proposed upgrade of the bridge and road alignment at Mudies Creek on Golden Highway has reduced the amount of native vegetation removed to a total of 4.14 hectares of vegetation. Assessments of significance have been carried out and determined that the proposal is unlikely to have a significant impact on any of the biodiversity values present within the study area.

8.1.3 Economic factors

Aside from the disruption from temporary traffic delays and traffic detours during construction which have potential to increase transportation and vehicle operating costs, construction of the proposal is not expected to significantly influence the economic indicators for the study area.

Compared with the 'do nothing' option, the proposal would potentially deliver long-term economic benefits associated with upgrading the bridge and road approaches at Mudies Creek and reduce travel times for road users.

8.1.4 Public interest

The public interest is best served through the equitable distribution of resources, and investment in public infrastructure that fulfils the needs of the majority. The proposal represents a cost-efficient investment in public infrastructure that would maximise the long-term social and economic benefits, while minimising the long-term negative impacts on communities and the environment. During the construction phase, the proposal would result in impacts on Aboriginal heritage, biodiversity, air quality, water quality, landscape and visual amenity, traffic and noise. Compared with the 'do nothing' option, these impacts would be outweighed by the long-term benefits of upgrading the bridge and road approaches at Mudies Creek once the proposal is operational.

As a result, construction of the proposal is considered to be in the public interest.

8.2 Objects of the EP&A Act

Table 8-1 provides consideration of the proposal in the context of the objects of the EP&A Act.

Table 8-1: Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal would improve the transport network while minimising impacts on the natural and built environment. It is therefore consistent with the objective of promoting the social and economic welfare of the community and a better environment.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development is considered in Sections 8.2.1 to 8.2.4 below.
1.3(c) To promote the orderly and economic use and development of land.	The proposal represents the improvement of land used for arterial road purposes. The continued use of the land for that purpose and the proposed upgrade of the bridge and road at Mudies Creek represent the orderly economic use and development of land.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The proposal would have some impact on the natural environment. Measures have been proposed to reduce that impact, refer Section 6.2.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal would not have impact on built heritage, refer Section 6.12. The proposal has potential to impact Aboriginal cultural heritage. Measures have been

Object	Comment
	proposed to reduce that impact, refer Section 6.1.
1.3(g) To promote good design and amenity of the built environment.	The proposal incorporates measures to minimise impacts on the built environment including landscape plantings on the bridge approaches and at various locations on the redundant road reserve (refer Section 6.6).
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Community involvement has occurred during the proposal's development. Refer to Section 5.

Section 1.3(b) identifies that an objective of the EP&A Act is to facilitate ecological sustainable development (ESD). ESD is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been a consideration during the proposal's development. The EP&A Act recognises that ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are considered in the context of the proposal below.

8.2.1 The precautionary principle

This principle states that 'if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.

Evaluation and assessment of alternative options have aimed to reduce the risk of serious and irreversible impacts on the environment. Stakeholder consultation raised issues for consideration and a range of specialist studies were undertaken for key issues to provide accurate and impartial information to assist in the evaluation of options.

The detailed assessment of potential environmental impacts in the preparation of the detailed design has sought to minimise impacts on the urban and natural amenity of the proposal area while maintaining engineering feasibility and safety for all road users. Several safeguards have been proposed to minimise potential impacts. These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed because of lack of scientific certainty.

A construction environment management plan would be prepared prior to commencing construction. This requirement would ensure that the proposed activities achieve a high-level of environmental performance. No mitigation measures or management mechanisms would be postponed because of a lack of information.

8.2.2 Intergenerational equity

The principle states that 'the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations'. The proposal would improve reliability of access into and out of the Singleton region, improve road safety and travel time. The proposal would also benefit future generations by ensuring that it does not give rise to long-term adverse impacts on the environment.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a lower level of service on this important road. The proposal would benefit future generations by ensuring the Golden Highway at Mudies Creek has enhanced flood immunity to ensure a reliable road connection for road users providing positive benefits to road users and the wider community.

8.2.3 Conservation of biological diversity and ecological integrity

This principle states that the 'diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival'.

A thorough assessment of the existing local environment has been undertaken to identify and manage any potential impacts of the proposal on local biodiversity. Specific design efforts have been taken to avoid and minimise impacts on biodiversity. Where impacts could not be avoided, management measures for future offsetting have been provided.

8.2.4 Improved valuation, pricing and incentive mechanisms

This principle requires that 'costs to the environment should be factored into the economic costs of a project'.

The REF has examined the environmental consequences of the proposal and identified management measures and safeguards for areas which have the potential to experience adverse impacts.

Requirements imposed in terms of implementation of these mitigation measures would result in an economic cost to Transport. The implementation of management measures and safeguards would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

The design for the proposal has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the detailed design for the proposal has been developed with an environmental objective in mind.

8.3 Conclusion

The proposed upgrade of the B84 Golden Highway, Mudies Creek Flood Mitigation Work, between Whittingham and Mount Thorley is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and

their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the detailed design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on Aboriginal heritage, biodiversity, air quality, water quality, landscape and visual amenity, traffic and noise. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would provide a reliable crossing over Mudies Creek on the Golden Highway and improve road safety and reduce travel times for road users. On balance the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

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

Significance of impact under Australian legislation

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

9. Certification

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

[redacted]

Principal Engineer

SMEC Australia Pty Ltd

Date: 31 October 2022

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

[redacted]

[redacted]

Project Manager

Transport for New South Wales

Date: 31 October 2022

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Terms and acronyms used in this REF

Term / Acronym	Description
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
ADT	Average Daily Traffic
AoS	Assessment of Significance
ARI	Annual Rainfall Intensity
ATC	Average traffic count
BOM	Bureau of Meteorology
BC Act	*Biodiversity Conservation Act 2016* (NSW)
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CNVG	Construction Noise and Vibration Guideline
DoD	Department of Defence (Comm. Government)
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered Ecological Community
EIA	Environmental Impact Assessment
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW).
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Comm.)
EPL	Environment Protection Licence
ESD	Ecologically sustainable development
FM Act	*Fisheries Management Act 1994* (NSW)
GDE	Groundwater Dependent Ecosystems
GSP	Gross State Product
Heritage Act	*Heritage Act 1977* (NSW)
HPVs	High Productivity Vehicles
IAP2	International Association of Public Participation
ICNG	Interim Construction Noise Guideline
INP	Industrial Noise Policy
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
T&ISEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021

Term / Acronym	Description
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers
MNES	Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
NCA	Noise Catchment Areas
NML	Noise Management Level
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NT Act	*Native Title Act 1993*
OEH	Office of Environment and Heritage
OSOM	Over Size and Over Mass
PACHCI	*Procedure for Aboriginal Cultural Heritage Consultation and Investigation*
PBS	Performance Based Standards
PEI	Preliminary Environmental Investigation
PCT	Plant Community Type
POEO Act	*Protection of the Environment Operations Act 1997*
QA Specifications	Transport specifications for use with road work and bridge work contracts
RBL	Rating Background Level
REF	Review of environmental factors
Roads and Maritime	Roads and Maritime Services
RNP	Road Noise Policy
SAT	Spot Assessment Technique
SEPP	State Environmental Planning Policy.
SHR	State Heritage Register
Singleton LEP	Singleton Local Environment Plan 2013
SMA	Singleton Military Area
TEC	Threatened ecological community
TfNSW / Transport	Transport for New South Wales
TSC Act	*Threatened Species Conservation Act 1995*
VDV	Vibration Dose Value

Term / Acronym	Description
VMW	Value Management Workshop
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
WM Act	*Water Management Act 2000*

Appendices

Appendix A

Consideration of clause 171(2) factors and matters of national environmental significance

Clause 171(2) checklist

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

Factor	Impact
a) Any environmental impact on a community?	
The proposal will have impacts within the proposal boundary and has potential to have impacts beyond the proposal boundary. During construction, it is anticipated that there will be short-term impacts relating to noise, vibration, dust and traffic. These impacts would affect adjacent residents, residents along the Range Road detour route and road users. There would also be some temporary, short-term property access changes during construction.	Negative (minor), temporary
Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	
The long-term benefit of the proposal would result in an upgraded bridge and road and improved road safety for the community.	Positive (moderate), long term
b) Any transformation of a locality?	
Construction of the proposal would temporarily transform the existing locality, predominantly through a negative visual amenity impact, associated with the removal of vegetation and road construction activities.	Negative (minor), temporary
Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	
In the longer term, the proposal would result in the positive transformation of the locality by providing a reliable transport route for road users.	Positive (moderate), long term

Factor	Impact
c) Any environmental impact on the ecosystems of the locality?	
The proposal would result in the clearing of up to 4.06 hectares of vegetation (refer Table 6-10). Of this total, 2.63 hectares vegetation is either cleared/disturbed or revegetation/regeneration, 1.24 hectares of EEC, and 0.19 hectares of Juncus Wetland (refer Table 6-10 and Figure 6-8). The vegetation to be removed ranges from poor to good condition, although the latter occurs as highly fragmented stands that are all less than a hectare in size. The existing roadside vegetation has been modified through previous land clearing activities and continuing weed poisoning, slashing and grazing. of significance have been carried out and determined that the proposal is unlikely to have a significant impact on any of the biodiversity values present within the study area.	Negative (minor), long term
Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	Positive (moderate), long term
In the long term native vegetation could be expected to recolonise the area disturbed by the proposal	
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?	
During construction, there would be a reduction of aesthetic amenity and environmental quality/value due to road construction activities, the removal of vegetation and impacts to key fish habitat.	Negative (moderate), temporary
Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?	Managed and mitigated
Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	
f) Any impact on the habitat of protected animals (within the meaning of the *Biodiversity Conservation Act 2016)?*	
The proposed development will result in the clearing of 3.05 hectares of vegetation that has been assessed as potential habitat for *Eucalyptus glaucina* and 4.15 hectares of vegetation that has been assessed as potential habitat for *Pterostylis gibbosa*.	Negative (minor), long term
Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?	
The proposal would not be any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air.	Nil

Factor	Impact
h) Any long-term effects on the environment? It is unlikely that the proposal would have any long-term effects on the environment.	Nil
i) Any degradation of the quality of the environment? There is potential for temporary degradation of the quality of the environment during construction of the proposal through soil and water, biodiversity, air quality, and traffic and access impacts. Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	Negative (minor), temporary
j) Any risk to the safety of the environment? The construction phase has the potential to temporarily decrease safety due to road work and the movement of construction plant. Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF. Operation of the proposal would improve the safety of the environment by providing a bridge and road with improved safety performance for road users.	Negative (minor), temporary Positive (minor), long term
k) Any reduction in the range of beneficial uses of the environment? During construction, traffic impacts due to an increase in heavy vehicle movements and interruptions to traffic flow would temporarily reduce the beneficial use of the local road network. Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	Negative (minor), temporary
l) Any pollution of the environment? The proposal could potentially result in minor temporary water pollution from sediments, soil nutrients, waste, and spilt fuels and chemicals. The proposal would result in minor temporary noise pollution from plant and machinery and dust pollution from construction activities Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	Negative (minor), temporary Negative (minor), temporary
m) Any environmental problems associated with the disposal of waste? Any waste generated during the proposed works would be contained and removed for disposal to approved facilities or to licensed landfill. Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF.	Nil

Factor	Impact
n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal would require resources such as gravel, concrete and asphalt, which are common construction materials and readily available. The proposal would not create any an increased demand on these resources.	Nil
o) Any cumulative environmental effect with other existing or likely future activities? There is the potential for the proposal to have a cumulative environmental effect with other existing or likely future activities. The key cumulative impacts associated with construction include traffic congestion and delays, dust and noise, visual amenity and removal of native vegetation. Impacts would be managed and mitigated through safeguards listed in Chapter 7 of this REF. The proposal would have a long-term positive cumulative impact on travel times, road safety and efficiency by providing a reliable crossing over Mudies Creek.	Negative (minor), temporary Positive (moderate), long term
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal is not located within a coastal area and would not result in any impact on coastal processes and coastal hazards.	Nil
q) Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1,	Hunter Regional Plan 2036 (NSW Government 2016). Branxton Subregional Land Use Strategy 2016 (BSLUS). *Upper Hunter Strategic Regional Land Use Plan* 2012 (UHSRLUP).
r) Other relevant environmental factors	Nil

Matters of National Environmental Significance

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

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

Factor	Impact
(a) Any impact on a World Heritage property? The proposal would not impact on a World Heritage property.	Nil
(b) Any impact on a National Heritage place? The proposal would not impact on a National Heritage place.	Nil
(c) Any impact on a wetland of international importance (often called 'Ramsar' wetlands)? The proposal would not impact on a wetland of international importance.	Nil
(d) Any impact on nationally threatened species, ecological communities or migratory species? Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions was identified and is a component community of Central Hunter Valley eucalypt forest and woodland, which is listed as a TEC under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act). The proposal will result in approximately 0.25 hectares of this community being cleared. This represents about one percent of the community's local occurrence. The vegetation that makes up this community within the study area is highly degraded and in poor condition. It is noted that Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions within the study area **did not meet** the condition requirements to conform to Central Hunter Valley eucalypt forest and woodland. The clearing of vegetation will increase the fragmentation of this community in the locality but is unlikely to further isolate it from other stands within the Hunter Valley. The clearing of vegetation due to proposal will not lead to a local extinction of the community and will not have a significant impact. Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions can conform to the EPBC Act listed endangered ecological community, Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland. This conformity was found to occur within the study area. Actions associated with the proposal will result in the clearing of up to 0.99 hectares of this community. Conservatively, this represents approximately four percent of the extent of this community in the study area. The local occurrence of the community is in a highly degraded state due to past anthropogenic disturbances. While the clearing of some of this community will further degrade its	Negative long term

Factor	Impact
extent, it will not lead to a local extinction. The proposal **will not have** a significant impact on this community. Assessments of Significance determined that impacts to the TEC would not trigger any offsetting thresholds or cause any significant impacts (Appendix A). Any potential impacts would be minimised with the implementation of the safeguards Section 6 of the determined REF.	
(e) Any impact on a Commonwealth marine area? The proposal would not impact on a Commonwealth marine area.	Nil
(f) Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action.	Nil
(g) Any impact on the Great Barrier Reef Marine Park?	Nil
(h) Does the proposal affect water resources (that relate to coal seam gas development and large coal mining development)	Nil
Additionally, any impact (direct or indirect) on the environment of Commonwealth land? Potential impacts (direct and indirect) on Commonwealth land from the proposal are: • Disturbance or damage of Aboriginal and non-Aboriginal heritage items • Clearing of vegetation including native vegetation • Impacts on landscape and landform from vegetation clearing and construction of the proposal • Upstream afflux from construction and operation of the proposal • Air, noise, water, visual and traffic impacts during construction. The Biodiversity Assessment Report (Appendix A) (SMEC 2021) concluded that the proposal is not likely to have a significant impact (direct or indirect) on the environment of the Commonwealth land. This has been assessed against the criteria set out in the Significant impact guidelines 1.2 – Action on, or impacting upon, Commonwealth land, and actions by Commonwealth Agencies (Commonwealth of Australia 2013). Any potential impacts would be minimised with the implementation of the safeguards provided Section 6 of the determined REF.	Negative long term

Appendix B

Statutory Consultation Checklists

Transport & Infrastructure SEPP

Certain development types

Development type	Description	Yes / No	If 'yes' consult with	T&ISEPP clause
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No		T&I SEPP cl. 2.111
Bus Depots	Does the project propose a bus depot?	No		T&I SEPP cl. 2.111
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No		T&I SEPP cl. 2.111

Development within the Coastal Zone

Issue	Description	Yes / No / NA	If 'yes' consult with	T&ISEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No		T&I SEPP cl. 2.14

Note: See interactive map here: ***https://www.planning.nsw.gov.au/policy-and-legislation/coastal-management***. Note the coastal vulnerability area has not yet been mapped.

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

Council related infrastructure or services

Issue	Potential impact	Yes / No	If 'yes' consult with	T&ISEPP clause
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	No		T&I SEPP cl.2.10(1)(a)
Traffic	Are the works likely to generate traffic to an extent that will *strain* the capacity of the existing road system in a local government area?	No		T&I SEPP cl.2.10(1)(b)

Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No		T&I SEPP cl.2.10(1)(c)
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No		T&I SEPP cl.2.10(1)(d)
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	Yes	Singleton Shire Council	T&I SEPP cl.2.10(1)(e)
Road & footpath excavation	Will the works involve more than *minor* or *inconsequential* excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No		T&I SEPP cl..2.10(1)(f)

Local heritage items

Issue	Potential impact	Yes / No	If 'yes' consult with	T&ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than *minor* or *inconsequential?*	No		T&I SEPP cl.2.11

Flood liable land

Issue	Potential impact	Yes / No	If 'yes' consult with	T&ISEPP clause
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a *minor* extent?	No		T&I SEPP cl.2.12
Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the	No		T&I SEPP cl.2.13

Issue	Potential impact	Yes / No	If 'yes' consult with	T&ISEPP clause
	demolition of, a building, emergency works or routine maintenance			

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

Public authorities other than councils

Issue	Potential impact	Yes / No	If 'yes' consult with	T&ISEPP clause
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	No	Office of Environment and Heritage (NPWS)	T&I SEPP cl.2.15(2)(a)
National parks and reserves	Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No		T&I SEPP cl. 2.15(2)(b)
Structures in or over navigable waters	Do the works comprise a fixed or floating structure in or over navigable waters?	No		T&I SEPP cl.2.15(2)(c)
Artificial light	Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map?	No		T&I SEPP cl.2.15(2)(d)
Defence communications facility	Are the works on Defence communications facility buffer land?	No		T&I SEPP cl.2.15(2)(e)
Mine subsidence district	Are the works on land in a mine subsidence district?	No		T&I SEPP cl.2.15(2)(f)

Appendix C

T&ISEPP Consultation Letter

Appendix D

Biodiversity Assessment Report

Appendix E

EPBC Project Self Assessment

Appendix F

Noise and Vibration Assessment

Appendix G

Contamination Assessments

Appendix H

Aboriginal Cultural Heritage Reports

Appendix I

Aboriginal Cultural Heritage Values Assessment Report

Appendix J

Aboriginal Archaeological Excavation Report

Appendix K

Anomaly Identification, Investigation and Removal Excavation Report

Appendix L

Socio-economic Impact Assessment

Appendix M

Community Consultation Report

Appendix N

National Pollutant Inventory Search Results

Appendix O

Non-Aboriginal Heritage, State Heritage Register and Singleton LEP Search Results

Appendix P

Historical Archaeological Assessment

Appendix Q

Landscape Character and Visual Impact Assessment

Appendix R

Mudies Creek - Hydrology and Hydraulic Assessments

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