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

Roads and Maritime proposes to build a New England Highway bypass of Singleton. The proposal is located to the west of Singleton and connects the New England Highway to the north and south of Singleton. The proposal area is shown in Figure: 1-1.

Key features of the proposal are shown in Figure 3-1 to Figure 3-6 and would include:

- About eight kilometres of new highway (the bypass) with a single lane in each direction
- Connection with the New England Highway at the southern end of the bypass (the southern connection) including a southbound entry ramp and northbound exit ramp
- A 55 metre long bridge over the bypass at the southern connection
- A 1.7 kilometre long bridge over the Main North railway line, the Doughboy Hollow and Hunter River floodplain, Army Camp Road and Putty Road (bridge over the floodplain)
- Connection to Putty Road including a northbound entry ramp and southbound exit ramp (the Putty Road connection)
- A 40 metre long bridge over the entry ramp at the Putty Road connection
- A 100 metre long bridge over Rose Point floodway
- A 205 metre long bridge over the Hunter River
- A 40 metre long bridge over the New England Highway west of the existing Main North railway line overbridge (known as Gowrie Gates)
- Connection with the New England Highway at Gowrie Gates consisting of a southbound entry ramp and northbound exit ramp. The northbound exit ramp would connect to the New England Highway via a new roundabout intersection at Maison Dieu Road
- A 1.7 kilometre northbound climbing lane between Gowrie Gates and the northern connection
- Connection at Magpie Street providing access to the nearby industrial area (the northern connection) consisting of a southbound entry ramp, southbound exit ramp and northbound entry ramp
- A 60 metre long bridge over the bypass at the northern connection.

Additional features and aspects of the proposal include:

- Demolition of buildings
- Vegetation clearing
- Tie-in work with the New England Highway at the northern and southern ends of the proposal
- Tie-in work with Putty Road and the New England Highway at Gowrie Gates
- Utility adjustment or relocation, including electricity, water and sewerage, gas and telecommunications
- Operational spill containment basins
- Drainage infrastructure
- Boundary fencing
- Noise walls
- Headlight screen at the southern connection
- Provision of permanent access roads for maintenance activities

- A heavy vehicle stopping bay at the southern connection
- Diversion of an ephemeral creek line north of the Hunter River
- Creek bank stabilisation work near Hunter River bridge northern abutment
- Upgrade to access between Newington Lane and the New England Highway
- Property access adjustments
- Earthworks including construction of embankments
- Temporary ancillary facilities during construction including site offices, site compounds, laydown areas, and temporary access tracks
- An aerial crossing for fauna
- Finishing roadworks including pavement, road stabilisation, kerb and gutter, signage, lighting and line marking works
- Demobilisation of ancillary facilities following the completion of the construction of the proposal
- Landscaping works.

Timing for construction of the proposal has not been confirmed and is subject to approval and funding availability. Construction would take about three years to complete. The NSW Government has committed \$92 million towards the proposal and allocated \$2.7 million in 2019-2020 to continue development of the proposal.



FIG. 3-1 Overview of the key features of the proposal

Legend

Proposal features

- Main North railway line

Proposal design

Proposal area

Watercourse

Other features

State roads

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FIG. 3-2 The southern connection

Legend

- -Proposal area
- New road surface
- Median
- Bridge
- Earthworks



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FIG. 3-3 Bridge over the floodplain

Legend

Proposal features

Proposal area
 New road surface

Median

Bridge

Earthworks Other features — Roads — Main North railway line N 0 100 200 Meters

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FIG. 3-4 Putty Road connection to the bridge over the Hunter River

Legend

Proposal features

- -Proposal area
- New road surface
- Earthworks
- Median
- Bridge

Other features

- -Roads
- --- Watercourse
- -+ Main North railway line

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FIG. 3-5 Connection to the New England Highway at Gowrie Gates

Legend

Proposal features

Proposal area

New road surface

Earthworks

- Median
- Bridge

Shared user path Other features

-+ Main North railway line

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Meters



FIG. 3-6 The northern connection

Legend

- -Proposal area
- New road surface
- Median
- Bridge
- Earthworks

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3.2 Design

This section describes the concept design which is shown in Figure 3-1 to Figure 3-6. The concept design would be refined during the detailed design phase.

3.2.1 Design criteria

Standards

The concept design was prepared in accordance with a number of road and bridge standards as outlined in Table 3-1.

Table 3-1: Road and bridge standards relevant to the design

Road standards	Bridge standards
Guide to Road Design – Austroads (Austroads, 2019)	Australian Standard 5100 Bridge Design
Guide to Road Safety – Austroads (Austroads, 2009)	Roads and Maritime Bridge and Geotechnical Technical Direction Manual
Roads and Maritime Austroads Guide Supplement (Roads and Maritime, 2019)	Roads and Maritime Bridge Waterway Manual (Roads and Maritime, 1994)
Road Design Guide (Roads and Traffic Authority of NSW (undated))	Austroads Waterway Design (A Guide to the Hydraulic Design of Bridges, Culverts and Floodways) (Austroads, 1994)
Guidelines for Road Safety Audit Practices (Roads and Maritime Services, 2011)	Roads and Maritime Structural Drafting and Detailing Manual
Beyond the Pavement, RTA urban design policy, procedures and design principles (Roads and Traffic of NSW, 2009)	Roads and Maritime Aesthetics of Bridges – Design Guidelines to Improve the Appearance of Bridges in NSW (Roads and Maritime, 2004)
Roads and Maritime Delineation Manual (Roads and Maritime, 2008-2015)	Roads and Maritime PS261 – Concept Design of Bridges
Roads and Maritime Road Technical Directions	Roads and Maritime Bridge Technical Directions
NSW Speed Zone Guidelines (Roads and Traffic Authority of NSW, 2011)	Roads and Maritime QA Specifications - Bridge
	Roads and Maritime Bridge Standard Drawings
Roads and Maritime Supplement to Australian Standard 1742 Parts 1-15 (Roads and	Austroads Guide to Bridge Technology (including Roads and Maritime supplement)
Maritime, 2019)	ARTC Heavy Haul Infrastructure Guidelines

Design criteria

The key design criteria for the proposal are summarised in Table 3-2. The criteria generally apply to the main alignment of the bypass. Other relevant criteria in the guidance listed in Table 3-1 has been applied to other components of the proposal including the connections and bridges.

Table 3-2: Design Criteria

Design element	Design criteria
Roadway	 New England Highway – one lane in each direction, undivided with wide centreline treatment
Posted speed	 New England Highway – 100 kilometres per hour
Lane width (through lanes)	• 3.5 metres (minimum)
Shoulder widths	 3 metres (generally) 2.5 metres (outside shoulder on the bridge over the floodplain)
Median width	1 metre generally without barrier
Minimum horizontal radius	 1200 metres (desirable minimum) 875 metres (absolute minimum)
Maximum vertical grade	• 8 per cent maximum (the actual maximum grade for the proposal is around 4.5 per cent)
Vertical clearance to overhead bridge	 7.1 metres over the Main North railway line 6.5 metres over the bypass at the northern and southern connection 5.4 metres over local roads
Design vehicle	 New England Highway: B-double Turning movement for up to a 19 metre semi-trailer and B-double truck check vehicle
Cut and fill batters	 4 Horizontal:1 Vertical (typical batter slopes) 2 Horizontal:1 Vertical (where height of the batter is greater than 2.5 metres) Minimum 4.0 metre wide bench at each 10 metre height increment
Pavement type	Flexible with slow setting heavily bound sub-baseMinimum asphalt layer thickness 105 millimetres
Safety barriers	 Type F concrete crash barrier (adjacent to bridge piers) W beam or wire rope safety barrier (on approaches)

3.2.2 Engineering constraints

The engineering constraints to the design and construction of the proposal include:

- The need to minimise property acquisition, adjustment and access impacts
- Maintaining the existing flood regime and minimising flooding impacts associated with the construction and operation of the bypass
- Maintaining traffic flow during construction

- Maintaining vehicle access on the New England Highway under the bypass including access for heavy vehicles
- Constructing the bypass to cross over the Main North railway line, the Hunter River and the New England Highway
- Soils associated with floodplains
- Minimising operational noise impacts
- Minimise impacts to fauna movement corridors
- Minimise impacts to Endangered Ecological Communities (EECs)
- The requirement for intersections to cater for turning movements of heavy/oversized vehicles
- Existing utilities located within the proposal area
- Topographical constraints including hilly regions in the northern section of the proposal and at the northern abutment of the Hunter River.

3.2.3 Major design features

The major design features of the proposal are described in the following sections and shown in Figure 3-2 to Figure 3-6.

Southern connection

The bypass would depart the existing New England Highway at the southern connection in a westerly direction. An exit ramp would be provided for vehicles travelling northbound into Singleton. This ramp would divert to the west, before crossing over the bypass on a bridge, before reconnecting to the existing New England Highway. Vehicles travelling southbound from Singleton would merge with vehicles travelling southbound onto the existing New England Highway.

At the southern connection there would be a bridge over the bypass. The bridge would be a deep voided slab bridge with soil wall abutments consisting of two spans. The bridge would be around 55 metres long and around 6.5 metres above ground level.

The bridge at the southern connection has been designed to allow for a potential future northbound carriageway (including provision for an 8.5 metre wide median). This northbound carriageway would be subject to a separate environmental assessment.

The existing intersection of Newington Lane and the New England Highway would be closed to facilitate the nearby construction of the southern connection. Access to the New England Highway from Newington Lane would be via a new access road which would connect to White Falls Lane.

The southern connection is shown in Figure 3-2.

Bridge over the floodplain

West of the southern connection, the bypass would rise up on an embankment and the southern abutment of the bridge would be located east of the Main North railway line. The bridge would span the railway line, and then continue to curve to the north-east over Army Camp Road and Putty Road. The northern abutment of the bridge would be located south of the Putty Road connection, where the main alignment of the bypass would primarily be located on an embankment.

The bridge would be a girder bridge consisting of 51 spans and spill through abutments. The bridge would be around 1.7 kilometres long and seven metres above ground level.

The Doughboy Hollow floodplain is located west of the Main North railway line and acts as a flood channel during flood events. The alignment of the bridge in the floodplain would cross the main flood channels in a perpendicular direction to minimise impacts to peak flood levels.

The bridge over the floodplain is shown in Figure 3-3.

Putty Road connection

The Putty Road connection consists of a southbound exit ramp and northbound entry ramp. It is anticipated that this connection would service a large proportion of the existing heavy vehicles, as it provides a connection between the McDougalls Hill and Mount Thorley industrial areas, along with Muswellbrook and the Lower Hunter Region, avoiding the township of Singleton and existing Hunter River crossing.

There are no southbound entry and northbound exit ramps proposed at this location. Traffic modelling confirmed that traffic demand for these ramps is low, and that the southern connection provides suitable access to the town centre for northbound travellers, with a comparable travel time.

The entry and exit ramps have been designed to be inundated when major flood events (between 20 per cent Annual Exceedance Probability (AEP) and 10 per cent AEP events) occur, allowing flood waters to maintain existing flow patterns through the flood relief structure, beneath the Main North railway line, opposite Rose Point Park. Currently, without the bypass, Putty Road south of the Main North railway line crossing is inundated under major flood events which prevents access in and out of the township of Singleton via Putty Road. The flood immunity of the proposed connection would be generally consistent with the existing conditions.

There would be a bridge over the entry ramp at the connection. The bridge would be a girder bridge consisting of a single span and spill through abutments. The bridge would be around 40 metres long and around 5.4 metres above the entry ramp level.

The Putty Road intersection is shown in Figure 3-4.

Bridge over Rose Point Floodway

A bridge would be constructed to provide an opening in the embankment to maintain the flow path for the Rose Point Floodway through Rose Point Park. The bridge would be a girder bridge consisting of three spans and spill through abutments. The bridge would be around 100 metres long and six metres above ground level.

The bridge is shown in Figure 3-4.

Bridge over the Hunter River

A bridge over the Hunter River is proposed to the west of the existing Main North railway line bridge. The bridge would be a girder bridge consisting of six spans and spill through abutments. The bridge would be around 205 metres long and around 16 metres above the surveyed river level. The bridge includes piers within the Hunter River, consistent with the existing Main North railway line bridge.

The bridge is shown in Figure 3-4.

Bridge over New England Highway

A bridge over the New England Highway would be constructed west of the Main North railway line bridge at Gowrie Gates. The bridge would be a girder bridge with soil wall abutments consisting of a single span. The bridge would be around 40 metres long and around 5.4 metres above the existing road level.

The bridge is shown in Figure 3-5.

Connection with the New England Highway at Gowrie Gates

An entry ramp would be provided for vehicles travelling southbound (only) on the New England Highway to access the bypass and travel south.

An exit ramp would be provided for northbound vehicles on the bypass. The exit ramp would connect to a new roundabout at the intersection of the New England Highway and Maison Dieu Road. This roundabout provides access to Maison Dieu Road (westbound) and the New England Highway (northbound and southbound). The intersection would include a slip lane to allow for the continuous movement of vehicles travelling southbound on the New England Highway.

The connection is shown in Figure 3-5.

Northbound climbing lane

The vertical alignment of the proposal rises from a low point at the Hunter River in the south to a high point near Rixs Creek Lane in the north near the northern connection. An assessment of heavy vehicle speeds and power identified the need for a climbing lane in this section of the proposal, given there would otherwise be no nearby overtaking opportunities. The climbing lane would be 1.7 kilometres in length and allow heavy vehicles to reach an acceptable speed before merging at the end of the climbing lane.

Northern connection

The northern connection located near Magpie Street would comprise of a southbound exit ramp, a southbound entry ramp and a northbound entry ramp. All of the ramps provide access to and from the adjacent McDougalls Hill industrial area.

A bridge would be provided over the bypass, connecting both southbound ramps to the bypass. The bridge would be a girder bridge with soil wall abutments consisting of two spans. The bridge would be around 60 metres long and around 6.5 metres above the proposed bypass level.

The bridge span has been designed to accommodate a potential future southbound carriageway. The southbound carriageway would be subject to a separate environmental assessment.

The southbound exit ramp would provide the northern access to Singleton for vehicles travelling south from Muswellbrook. The ramp includes a slip lane to avoid the traffic signals at Magpie Street.

The southbound entry ramp would be via a small loop on the eastern side of the bypass that would pass over the bridge and loop under the bridge before merging into the bypass.

North of Magpie Street, linemarking would be carried out on the existing pavement to tie the existing New England Highway into the bypass.

The northern connection is shown in Figure 3-6.

Typical cross section

Typical road and bridge cross sections are shown in Figure 3-7 and Figure 3-8 respectively.



Figure 3-7: Typical road cross section (measurements shown in metres)



Figure 3-8: Typical bridge cross section (measurements shown in millimetres)

Tie-ins

The proposal would tie in to the existing alignment of the following roads:

- The New England Highway at the southern connection
- Putty Road at the Putty Road connection
- The New England Highway at Gowrie Gates
- Magpie Street at the northern connection
- The New England Highway at the northern extent of the proposal.

Activities to tie the proposal into the existing roads would include pavement work to create consistent levels between existing and new surfaces. The extent of tie-in work would be determined during the detailed design.

Drainage

The proposal crosses the Hunter River and its alluvial floodplain and a series of tributary creeks watercourses.

The drainage design considers:

- Transverse drainage (e.g. transverse culverts) to convey run-off from upslope catchments beneath the bypass
- Longitudinal drainage to convey flows either towards swales or transverse culverts
- Bridge drainage (except for the bridge over the floodplain) would be piped and provide adequate drainage of surface water. Runoff would be discharged via a spill containment basin or to existing drainage infrastructure depending on the location and subject to detailed design
- Drainage from the bridge over the floodplain would be via outlets onto the floodplain
- Operational spill containment, including spill containment basins, would be provided to the north and south of the Hunter River.

Property access

All properties affected by changed access arrangements, as a result of the proposal, would be provided with restored or new permanent access arrangements. Two properties south of the bypass at the southern connection, with existing access from Waddells Lane (Lot 2 DP 744891) and New England Highway (Lot 2/3/4 DP 1139915), would be provided with alternative access via Waddells Lane.

Parking facilities

No permanent parking facilities would be removed or provided by the proposal.

Pedestrian and bicycle facilities

The proposal would not provide any new pedestrian or dedicated bicycle facilities along the bypass. Cyclists would be able to use the road shoulders on the bypass.

A separated shared pedestrian and cyclist path is located adjacent to the New England Highway in the area where the highway passes beneath the Main North railway line at Gowrie Gates. This footpath provides connectivity under the rail bridge. This shared path has been upgraded as part of work to the Main North railway line bridge being carried out by the Australian Rail Track Corporation (ARTC).

The proposal would modify the shared path west of the Main North railway line bridge to pass through the southern entry ramp to the bypass at Gowrie Gates, and beneath the bridge over the New England Highway at Gowrie Gates.

Bus facilities

No dedicated bus facilities would be removed or provided by the proposal.

Public utilities

There are a number of public utilities within the proposal site that would require adjustment or relocation as part of the proposal. Refer to Section 3.5 for further details.

Lighting

New roadway lighting or adjustments to existing lighting would be provided at the Putty Road connection, New England Highway connection at Gowrie Gates, and the northern connection adjacent to Magpie

Street. Lighting would be designed in accordance with relevant guidelines and standards to minimise light spillage into residential properties and minimise glare that could impact on driver visibility. Lighting would be further refined during the detailed design phase.

Urban and landscape design

A Landscape Character, Visual Impact Assessment and Urban Design Objectives Report was prepared for the proposal (refer Appendix B). In recognition of the potential impacts of the proposal, six urban design objectives were developed as follows:

- **Objective 1** Respond to the landform: Embrace the undulating hills and gullies that rise above the Hunter River agricultural floodplains
- **Objective 2** Contribute to the urban structure: Acknowledge the connection the proposal has to Singleton township physically and visually
- **Objective 3** Maximise the travel experience: Utilise the unique characteristics of the region to provide an enjoyable travel experience
- **Objective 4** Respond to landscape patterns: Respond to the colours and shapes in the agricultural floodplains and vegetated lines and hills surrounding the proposal
- Objective 5 Design for minimal lifestyle costs: Design a low maintenance and sustainable landscape
- **Objective 6** Coordinate a simple and consistent design language along the road corridor: Coordinate the urban design treatments for bridges, walls, barriers, landscaping and standard roadside furniture and infrastructure.

The urban design objectives are provided in further detail in Appendix B. These objectives were developed with reference to principles contained in the *New England Highway Urban Design Framework* (Roads and Maritime, 2016). The objectives have been integrated into the concept design and would be considered further in the detailed design phase of the proposal.

Signage and line marking

Appropriate signage and line marking would be provided to suit the proposal.

Safety barriers

The proposal would include the modification of existing safety barriers as required and provision for new safety barriers would also be required in accordance with relevant standards and guidelines.

3.3 Construction activities

Construction activities would be guided by a construction environmental management plan (CEMP) to ensure work is carried out to Roads and Maritime specifications within the specified work area. Construction activities would be carried out within the proposal area (refer to Figure: 1-1).

3.3.1 Work methodology

Detailed work methodologies would be determined during detailed design and construction planning. The indicative work methodology is described below, however activities may vary to suit the construction staging plans, which would be determined by the construction contractor. The proposal is anticipated to involve the following general work methodologies and sequencing:

- Site establishment work including set up of ancillary facilities and compound areas
- Utility adjustments

- Building demolition
- Vegetation clearing
- Earthworks and drainage
- Bridge construction including approaches
- Pavement construction including local roads
- Landscaping and finishing work
- Removal of ancillary facilities and site rehabilitation.

Site establishment work including set up of ancillary facilities and compound areas

A number of ancillary facilities and compound areas would be set up and would remain in operation for the duration of the construction period. Ancillary facilities included as part of the proposal are further described in Section 3.4.

Establishment work would include:

- Identification and marking out sensitive areas as defined by this REF and the CEMP
- Installation of traffic management measures including temporary traffic signs and barricades
- Installation of fencing
- Property adjustment work including relocation of fences, accesses and boundary features
- Minor earthworks to establish temporary construction roads and level areas for site compounds
- Utility connection work
- Establishment of site compounds and ancillary facilities
- Sediment and erosion control work including installation of temporary sediment basins together with localised treatments such as sediment fences and earth bunds/channels to separate on-site and off-site water
- Minor road work to establish access points.

Utility adjustments

Services and utilities identified within the proposal area that may require relocation or protection include overhead and underground electricity (owned by Ausgrid), water and sewage services (owned by Singleton Council), telecommunications (owned by Telstra, AAPT/TPG and the National Broadband Network (NBN) Corporation) and gas services (owned by Jemena).

Utilities that would be protected or relocated for the proposal are generally located around the southern connection, Putty Road connection, bridge over the New England Highway at Gowrie Gates and northern connection.

Utility relocation is further discussed in Section 3.5.

Activities that would be carried out to relocate utilities include:

- Identification and removal of redundant asbestos cement pipes
- Excavation and construction of new underground cutover locations with the existing utility network
- Installation of new poles to carry overhead services
- Excavation of trenches along new utility routes
- Installation of bedding material and new utilities within the trenches or onto new poles
- Testing and cutover of utilities into new infrastructure
- Under bore for new utilities beneath the Hunter River
- Decommissions and removal of redundant utilities where required.

Building demolition

As identified within Section 3.6, a number of properties would need to be partially and wholly acquired by Roads and Maritime. Following the acquisition of the required properties by Roads and Maritime, existing buildings within these properties would be demolished as described below. Buildings that would be demolished are generally in the vicinity of the bridge over the floodplain between the existing New England Highway and the Hunter River.

Demolition activities would generally include:

- Identification and removal of asbestos
- Removal fittings and other reusable elements using hand tools
- Progressive demolition of the building structures using modified excavators
- Sorting and temporary storage of demolition material into recyclable and waste components
- Loading and transporting recyclable and waste material to a licenced facility.

Vegetation clearing

Most of vegetation clearing would occur in the northern end of the proposal. Clearing of trees along the Hunter River for the new bridge and some clearing of isolated paddock trees would also be required.

Vegetation clearing would include:

- Identification and marking out of clearing limits and hollow bearing trees
- Identification of suitable habitat nearby for release of fauna that may be encountered
- Checking for the presence of fauna species onsite and relocate if there is the potential for the animal to be disturbed or injured
- Clearing of non-hollow bearing trees including removal of stumps (trees in riparian zones would have their stumps retained wherever possible)
- Checking tree hollows for fauna and then removal of the habitat trees
- Reuse of vegetation or mulch for use in rehabilitation.

Earthworks and drainage

Earthworks are required to achieve the design levels along the entire length of the bypass, including raised embankments and sections of cutting. Some existing drainage systems such as culverts may need to be extended across the new road formation at tie in points with the existing road system. Completely new drainage structures and systems would be installed along the entire length of the bypass.

Earthworks and drainage work include:

- Stripping, stockpiling and management of topsoil and unsuitable material
- Excavate and fill to the road formation levels, including excavation for embankments and cuttings and boxing out of new pavements
- Disposal of unsuitable and surplus material
- Install new drainage lines, temporary sediment basins, sediment fences, earth bunds and channels and protection of existing stormwater pits.

Bridge construction

As described in Section 3.2.3, a number of bridges would be constructed for the proposal. The construction methodology for the bridges would include:

- Stripping, stockpiling and management of topsoil and unsuitable material
- Foundation construction including:
 - o Piling
 - o Pile cap construction including localised excavations
- Bridge pier or column construction
- Construction of bridge, likely through the placement of pre-cast segments (eg girders) lifted into place using a crane or gantry.

Given the constraints associated with the construction of the bridge over the floodplain and the bridge over the Hunter River, indicative construction methodologies are provided in further detail below.

Construction of the bridge over the floodplain

Construction access for the bridge over the floodplain is unconstrained with good level access. A detailed work methodology for the construction of the bridge would be determined during detailed design, however an indicative methodology is provided below to inform the assessment of the potential impacts in this location throughout the REF:

- Construction of a temporary access road adjacent to the bridge to provide access to the bridge piers and abutments
- Establishment of a crane pads near each pier location to construct pile foundations, piers, and lift and place pre-cast bridge structural components
- To minimise impact on the aquifer, the pile holes will be installed by advancing a steel casing into the ground as they are drilled. The steel casing prevents the ground from collapsing into the excavation and protects the groundwater from potential contamination
- The steel casing would be advanced into bedrock through the zone of weathering and seal the layers above and below the aquifer
- The steel casing would be backfilled with reinforced concrete to form the bridge foundations.
- Bridge piers would be constructed on the foundations by casting reinforced concrete into formwork supported by temporary scaffold
- Bridge girders and barriers would be lifted into place using cranes.

Construction of the bridge over the Hunter River

The construction of a bridge over the Hunter River is constrained by the river channel and the steep banks lining the river to the north and south. A detailed work methodology for the construction of the bridge would be determined during detailed design, however an indicative methodology is provided below to inform the assessment of the potential impacts in this location throughout the REF:

- Diversion of ephemeral creek channel north of the Hunter River
- Construction of temporary access roads to access the northern and southern bridge abutments
- Construction of a temporary access ramp from the temporary access track down to the southern river bank, to access the sand bed. The northern abutment will be accessed via the alignment of the bypass
- Establishment of a crane pad near the river bank to place pre-cast bridge structural components
- Construction of a temporary rock platform within the Hunter River to provide access for construction of the in-river pier
- Construction of pile casings in the river to prevent the riverbed from collapsing into the excavation

- Excavation of casing and construction of concrete pile
- Pier and superstructure construction through the use of cranes on either side of the Hunter River.

The indicative methodologies represents a worst-case approach to the construction of the bridge regarding potential disturbance area and overall impact. The assessment of environmental impacts at this location throughout the REF is therefore conservative and would potentially be reduced if the contractor chooses to use an alternate construction methodology.

Pavement Construction (including local roads)

Pavement would be laid across the entire length of the bypass (including bridges) and would tie in to existing roads at each connection.

Work would include:

- Rolling and grading of road formation foundation
- Placement and compaction of bound gravel road pavement
- Installation of subsoil interpavement drainage with connections to existing and new drainage pits where required
- Placement of a bitumen material over the bound gravel road pavement
- Placement of an asphalt wearing course and compaction with a roller.

Landscaping and finishing work

Landscape and finishing work would include:

- Installation of new street lights
- Installation of road furniture including signage, noise walls, headlight screens and roadside barriers
- Rehabilitation of disturbed areas and landscaping in accordance with the urban design and landscape plan
- Line marking and installation of raised reflective pavement markers.

Removal of ancillary facilities and site rehabilitation

Upon completion of the work, construction advisory and warning signage would be removed and the road would be opened to traffic. The ancillary facilities would be removed and areas disturbed during construction would be rehabilitated. Once disturbed areas are established, erosion and sediment control measures such as sediment fencing would be removed.

3.3.2 Construction hours and duration

Construction would largely be carried out during standard construction working hours in accordance with the Interim Construction Noise Guideline (DECC, 2009):

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

Construction activities that involve impulsive or tonal noise emissions would be limited to the following hours in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime, 2016):

- Monday to Friday: 8am to 5pm
- Saturday: 9am to 1pm
- Sundays and public holidays: no work.

To minimise disruption to daily traffic and disturbance to surrounding land owners and businesses, it would be necessary to carry out some work outside of these hours. The following activities are likely to take place outside standard construction working hours:

- Construction activities within the rail corridor during rail possessions
- Delivery of construction materials such as precast bridge structures
- Intersection and tie-in activities of the bypass to existing roads
- Installation and adjustment of barriers and signage for construction zones during each construction stage
- Construction of the bridge over the New England Highway at Gowrie Gates
- Operation of construction compounds to support the above work.

3.3.3 Plant and equipment

A range of plant and equipment would be used during construction. The final equipment and plant requirements would be decided by the construction contractor. An indicative list of plant and equipment which would be used in each construction stage is provided below in Table 3-3.

Table 3-3: Indicative plant and equipment to be used during the construction period

Stage	Equipment
Establishment work including set up of ancillary facilities and site compounds	 Medium rigid truck Road truck Scissor lift Franna crane Grader Vibratory roller Dump truck Water cart Power generator Light vehicles Front end loader Concrete vibrator and pump
Utility relocations	 35 tonne tracked excavator 20 tonne franna crane Crane (up to 300 tonne) Pneumatic hammer Concrete saw Vacuum truck Backhoe Power generator
Building removals	Bulldozer D935 tonne tracked excavator

Stage	Equipment
	 Chainsaw Dump truck Hydraulic hammer 23 tonne front end loader
Vegetation clearing	 Bulldozer D9 35 tonne tracked excavator Chainsaw Mulcher Dump truck
Earthworks and drainage	 Backhoe 20 tonne franna crane 35 tonne tracked excavator Concrete truck Truck compressor Vibratory roller Road truck
Bridge construction including approaches	 Crane (up to 600 tonne) 20 tonne franna crane Pilling rig (driven and bored) Power generator Concrete pump and truck Compressor Pneumatic hammer Welding equipment
Pavement construction including local roads	 Pavement laying machine Asphalt truck and sprayer Concrete truck Smooth drum roller Concrete saw
Landscaping and finishing works	 Road truck Scissor lift 20 tonne franna crane Line marking truck
Removal of ancillary facilities and site rehabilitation	 Medium rigid truck Road truck Scissor lift Franna crane Dump truck Power generator Light vehicles Front end loader

3.3.4 Earthworks

Earthworks activities required for the proposal include excavation where the design of the road is lower than the existing ground level, construction of fill embankments where the design of the road is above the existing ground level (such as approaches for bridges) and boring into the ground for bridge structural supports.

The estimated quantities of materials associated with earthworks are provided in Table 3-4. Precise quantities will be identified during detail design.

Table 3-4: Indicative earthwork quantities

Area	Cut (m ³)	Fill (m³)
Southern connection to Putty Road	5250	122,350
Putty Road to Gowrie Gates	65,200	87,650
Gowrie Gates to northern connection	486,800	198,600
Total	557,250	408,600
Balance	148,650 surplus	

3.3.5 Source and quantity of materials

The construction of the proposal would require (but is not limited to) the materials listed in Table 3-5. The exact quantities of materials required would be confirmed during the detailed design.

Imported materials would be sourced from Roads and Maritime pre-qualified commercial suppliers in nearby areas, wherever possible. As part of the concept design, a preliminary assessment of potential sources of material was completed and identified that suitable material is available at local quarries.

Table 3-5: Source and quantities of materials required for the proposal

Material	Quantity	Source
Earthworks materials (limited to select fill, other fill to be sourced from excavations for the proposal)	46,000 m ³	
Road base for the construction of a flexible road surface	4050 m ³	Roads and
Asphalt	4000 tonnes	Maritime prequalified
Precast concrete elements for drainage construction (culverts, pits and headwalls) and miscellaneous work	950 tonnes	suppliers and locally, where practical
Structural steel	1650 tonnes	
Conduits, pits, cables and pipes	28,800 metres	
Bridge materials (concrete)	78,550 tonnes	

Material	Quantity	Source
Bridge materials (steel reinforcement)	6150 tonnes	
Linemarking, raised reflective pavement markers and signs, and safety barriers	Painted area – 8900 m² Reflective markers – 3300 Signs – 150	
Safety barriers	Steel post and rail – 1050 metres Wire rope – 4300 metres Concrete – 3950 metres	
Steel for barrier railings and reinforcement in concrete	6350 tonnes	
Noise wall materials (concrete)	524 tonnes	
Noise wall materials (steel reinforcement)	15 tonnes	
Water	The amount of water that would be required during construction is unknown at this stage. The amount would depend on material sources and methodologies applied by the contractor.	Construction sources such as sediment basins or alternatively from the local water supply network.
Concrete for drainage construction, road surface construction, and miscellaneous work such as barrier kerbs, paving, kerbs and gutters and signpost footings	8850 tonnes	Roads and Maritime prequalified suppliers and locally, where practical.

Re-use opportunities

Material excavated to the north of Gowrie Gates would be used as a source of fill material across the proposal, reducing the need to import fill material. Excess fill left over from other local road projects could be used for this proposal where suitable.

3.3.6 Traffic management and access

Construction traffic numbers

Construction of the proposal would generate a total of up to 220 light and heavy vehicle movements per day. These construction vehicle movements would mainly be associated with:

- Movement of construction workers
- Delivery of construction materials
- Spoil and waste removal
- Delivery and removal of construction equipment and machinery.

The estimated number of construction vehicle movements is shown in Table 3-6.

Table 3-6: Indicative construction vehicle movements

Vehicle type	Peak number of movements per day
Light vehicles	80
Heavy vehicles	140

Access for construction vehicles

Construction vehicles would access the site via arterial roads wherever possible. Indicative construction traffic access points are shown on Figure 3-9 and would generally be via the New England Highway.

Indicative heavy vehicle haulage routes have been identified for the movement of spoil between different locations within the proposal area during construction. The routes to and from the New England Highway are shown on Figure 3-9. The haulage routes have been designed to minimise use of local roads where possible.

Traffic management measures

It is expected that temporary speed limits and lane closures would be required during the construction phase. Final construction methods would be refined to minimise traffic and transport impacts, however traffic restrictions would be unavoidable during some construction activities, such as piling work for the bridge supports, foundation and road surfacing work at tie in points with the southern and northern connections, Putty Road connection and connection with the New England Highway at Gowrie Gates.

Local property access management

Property access would be maintained as far as practicable throughout the construction period, however there may be temporary disruptions to private property access. The management of property access would be considered by the construction contractor and detailed as part of the final staging plan for the proposal. Refer to Section 6.12.2 for further information.

Temporary construction access roads

Temporary access roads would be built to facilitate the movements of construction vehicles and construction materials (e.g. girders for bridges) to key construction work areas for bridges and bypass connection points.

Pedestrian and cyclist access

A separated shared pedestrian and cyclist path is located adjacent to the New England Highway in the area where the New England Highway passes beneath the Main North railway line, providing connectivity under the rail bridge. This shared path has been upgraded as part of work to the Main North railway line bridge carried out by the ARTC.

The shared pedestrian and cyclist path west of the Main North railway line bridge would be temporarily impacted during activities required for the construction of the bridge over the New England Highway and southern entry ramp at Gowrie Gates. Connectivity would be maintained through localised diversions where feasible, however temporary diversion of the shared path into the road shoulder, with temporary concrete barriers for protection, may be required.

There is an informal pedestrian access to the Hunter River beneath the Main North railway line near Rose Point Road. The informal access is used primarily to access the Hunter River for recreational activities. This access would be closed during the construction of the proposal due to the work required for the bridge over the Hunter River.

Recreational users of the Hunter River would continue to have the option to access the river east of the proposal area, to the north of Rose Point Park.

3.4 Ancillary facilities

Construction ancillary facilities have been identified for the proposal which are shown in Figure 3-9 and described further below. Potential compound sites have been investigated using the following criteria:

- Proximity to the proposal
- Where possible, away from residential and sensitive receivers
- Where possible outside of the 1 in 10 year Average Recurrence Interval (ARI) floodplain
- At least 40 metres away from the nearest waterway
- On land of low heritage conservation significance
- Does not require clearing of native vegetation
- Relatively flat ground that does not require substantial reshaping
- In plain view of the public to deter theft and illegal dumping.

Should the need for additional or alternative ancillary facilities be required, the positioning of additional or alternative compound sites would be carried out in consideration of the above criteria.

Construction compound sites would include portable buildings with amenities such as toilets, secure and bunded storage areas for site materials, including fuel and chemicals, office space for on-site personnel, and associated parking.

Stockpiling would be undertaken at the Waterworks Lane, Gowrie Gates and Northern connection construction compounds. Stockpile locations would be refined during the detailed design phase using the criteria set out in the Stockpile Management Guideline (RTA, 2011).

Sites would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions. Upon completion of construction, the temporary site compound, work areas and stockpiles would be removed, and the site cleared of all rubbish and materials. It would then be rehabilitated.

An overview of the key construction activities to be carried out at the ancillary facilities is provided in Table 3-7.



FIG. 3-9 Construction ancillary facilities and haulage routes

Legend

Proposal features

Proposal area

Haulage routes

Other features

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Construction ancillary facilities

Hain North railway line

State roads

Watercourse

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3.4.1 Southern connection laydown area

The southern connection laydown area would be located west of the New England Highway at the southern extent of the proposal. The construction compound would be located on land currently used for agricultural purposes and would be accessed from the New England Highway. The land is currently privately owned and is within the area required to be acquired by Roads and Maritime for the construction of the proposal (refer to Section 3.6).

Construction activities to be carried out at this location would primarily include the laydown of construction materials and equipment required to support the construction of the southern connection and bridge over the Main North railway line, and the Doughboy Hollow and Hunter River floodplains. Key construction activities to be carried out at and supported by the southern connection laydown area are summarised in Table 3-7.

3.4.2 Army Camp Road laydown area

The Army Camp Road laydown area would be located west of Army Camp Road. The construction compound would be located on land currently used for agricultural purposes and would be accessed via Putty Road. The land is currently privately owned and is within the area required to be acquired by Roads and Maritime for the construction of the proposal (refer to Section 3.6).

Construction activities to be carried out at this location would primarily include the laydown of construction materials and equipment required to support the construction of the bridge over the Main North railway line, and the Doughboy Hollow and Hunter River floodplains. Key construction activities to be carried out at and supported by the Army Camp Road laydown area are summarised in Table 3-7.

3.4.3 Waterworks Lane construction compound

The Waterworks Lane construction compound would be located on both sides of Waterworks Lane, between the Main North railway line to the east and the Putty Road connection to the west. The eastern section of the compound would be located on an existing hardstand area that is currently owned by the ARTC, which would be leased for the duration of the construction of the proposal. The western section of the compound is currently privately owned and is within the area required to be acquired for the construction of the proposal. The construction compound would be accessed from Waterworks Lane via an existing access point until the Putty Road connection is constructed, which will then be used as the primary access.

Key construction activities to be carried out at and supported by the Waterworks Lane construction compound are summarised in Table 3-7 and would include supporting the construction of the bridge over the Main North railway line, and the Doughboy Hollow and Hunter River floodplains and the bridge over the Hunter River.

3.4.4 Gowrie Gates construction compound

The Gowrie Gates construction compound would be located south of the existing Main North railway line bridge over the New England Highway. The compound is located within land owned by ARTC and would be temporarily leased by Roads and Maritime for the construction of the proposal.

The construction compound would be located in an area of cleared land adjacent to the Main North railway line and would be accessed via Maison Dieu Road.

Key construction activities to be carried out at and supported by the Gowrie Gates construction compound are summarised in Table 3-7 and includes construction activities to support the construction of the bridge over the New England Highway and connection with the New England Highway at the Gowrie Gates.

3.4.5 Northern connection construction compound

The northern connection construction compound would be located east of the existing New England Highway west of the Main North railway line. The compound is currently located within privately owned land and is within the area required to be acquired by Roads and Maritime for the construction of the proposal. The compound would be accessed via the existing private property access road which connects to the New England Highway.

Key construction activities to be carried out at and supported by the northern connection construction compound are summarised in Table 3-7 and includes construction activities to support the construction of the northern connection.

3.4.6 McDougalls Hill facility

The McDougalls Hill facility would be located within an area of vacant land in the McDougalls Hill industrial area west of the New England Highway near the proposed northern connection. The facility would be used for site offices, laydown and light vehicle parking. The facility is shown on Figure 3-1.

Table 3-7: Summary of construction activities at ancillary facilities

Construction activities	Southern connection laydown area	Army Camp Road laydown area	Waterworks Lane construction compound	Gowrie Gates construction compound	Northern connection construction compound	McDougalls Hill facility
Vegetation clearing	Yes	Yes	No	No	Yes	No
Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities	No	No	Yes	Yes	Yes	No
Establishment of site offices, amenities and temporary infrastructure including fencing	No	No	Yes	Yes	Yes	Yes
Laydown and storage of materials	Yes	Yes	Yes	Yes	Yes	Yes
Chemical storage	Yes	Yes	Yes	Yes	Yes	No
Crushing	Yes	Yes	Yes	Yes	Yes	No
Delivery of materials, plant and equipment	No	No	Yes	Yes	Yes	No
Stockpiling	Yes	Yes	Yes	Yes	Yes	No
Demobilisation	Yes	Yes	Yes	Yes	Yes	Yes

3.5 Public utility adjustment

Consultation with public utility authorities has been carried out as part of the development of the concept design to identify and locate existing utilities and incorporate utility authority requirements for relocations and/or adjustments. Preliminary investigations have indicated that the following existing utilities were found to be within the extents of the proposal and would need relocating or protection:

- Overhead and underground electricity Ausgrid
- Water and sewage services Singleton Council
- Telecommunications Telstra, AAPT/TPG and the National Broadband Network (NBN) Corporation
- Gas services Jemena.

Specifically, utilities within the proposal area to be relocated or protected include:

- High voltage (11 and 33 kilovolt) power lines located around the northern connection and southern connection
- High voltage (66 kilovolt) power lines located around Orchard Lane
- Singleton Council's Waterworks Lane facility including water pump station, depot and stand pipe
- Fibre optic cable located underground near the Hunter River
- Fibre optic cable located underground between Gowrie Gates and the northern connection.

The proposal may also impact on the ability of utility providers to access maintenance locations for their utilities and services. Consultation would continue with the public utility authorities during the detailed design. This consultation would allow the public utility authorities to provide input into the most appropriate relocation options for the services and utilities. Modifications to the affected utilities would be in accordance with the design and construction methods approved by the relevant utility stakeholder.

The proposal area assessed as part of this REF includes areas likely to be required for utility adjustments. If it is determined during detailed design that utility work is required outside of the proposal area, then a separate environmental assessment may be required.

3.6 Property acquisition

Based on the concept design and subject to negotiations in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW) and the reforms announced in October 2016 (NSW Government 2016), the acquisition or temporary lease of the properties in Table 3-8 would be required. These properties are shown on Figure 3-10.

The need for property acquisition would be further refined during the detailed design phase. Roads and Maritime has commenced the acquisition process for some properties and will carry out ongoing consultation with affected landholders.

Description	Percentage of lot impacted	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
Rural residential	100%	Full acquisition	Roads and Maritime	1 DP196016	RU1
Rural property	100%	Full acquisition	Roads and Maritime	2 DP1240047	RU1

Table 3-8: Property acquisition for the proposal

Description	Percentage of lot impacted	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
Rural property	100%	Full acquisition	Roads and Maritime	28 DP1104815	RU1
Rural property	100%	Full acquisition	Roads and Maritime	5 DP1153724	RU1
Rural property	5%	Partial acquisition	Private	4 DP36999	RU1
Rural property	<5%	Partial acquisition	Private	1 DP1122748	RU1
Rural property	9%	Partial acquisition	Private	20 DP1129695	RU1
Rural property	100%	Full acquisition	Private	1 DP1130681	RU1
Rural property	<5%	Partial acquisition	Private	111 DP855355	RU1
Rural property	100%	Full acquisition	Private	1 DP1139915	RU1
Rural property	27%	Partial acquisition	Private	101 DP1048703	RU1
Rural property	91%	Partial acquisition	Private	2 DP1139915	RU1
Rural property	100%	Full acquisition	Private	3 DP1139915	RU1
Rural property	13%	Partial acquisition	Private	4 DP1139915	RU1
Rural property	33%	Partial acquisition	Private	110 DP1137689	RU1
Rural property	19%	Partial acquisition	Private	15 DP1117570	RU1
Rural property	6%	Partial acquisition	Private	4 DP1089420	RU1
Rural property	7%	Partial acquisition	Private	2 DP1062689	RU1
Rural property	18%	Partial acquisition	Private	1 DP8695	RU1
Rural property	13%	Partial acquisition	Private	11A DP37001	RU1
Rural property	21%	Partial acquisition	Private	1 DP1100628	RU1
Rural residential	100%	Full	Private	1 DP1100026	RU1

Description	Percentage of lot impacted	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
		acquisition			
Rural property	100%	Full acquisition	Private	2 DP798801	RU1
Rural property	<5%	Partial acquisition	Private	31 DP1108474	RU1
Rural property	17%	Partial acquisition	Private	3 DP1108792	RU1
Rural residential	100%	Full acquisition	Roads and Maritime	1 DP796721	RU1
Rural property	100%	Full acquisition	Private	2 DP1108792	RU1
Rural property	100%	Full acquisition	Private	1 DP999044	RU1
Rural property	6%	Partial acquisition	ARTC	1 DP1050582	SP2
Portion of Waterworks Lane	<5%	Partial acquisition	The Minister for Public Works	5 DP1159019	RU1
Pumping station	100%	Full acquisition	The Minister for Public Works	3 DP1159019	RU1
Pumping station	100%	Full acquisition	The Minister for Public Works	4 DP1159019	RU1
Pumping station	100%	Full acquisition	The Minister for Public Works	2 DP1159019	RU1
Pumping station	100%	Full acquisition	The Minister for Public Works	1 DP1159019	RU1
Rural property	100%	Full acquisition	Roads and Maritime	1 DP360940	RU1
Riverbed	100%	Full acquisition	Singleton Council	3 DP883810	RU1
Riverbed	9%	Partial acquisition	The State of NSW	2 DP883810	RU1
Rural land	20%	Partial acquisition	Singleton Council	4 DP1195454	RE2
Rural property	20%	Partial acquisition	Private	2 DP1195454	RE2/R1

Description	Percentage of lot impacted	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
Rural property	35%	Partial acquisition	Private	1 DP1195454	RE2
Rural property	9%	Partial acquisition	Private	1221 DP599260	R1
Rural property	20%	Partial acquisition	Private	1 DP1001760	RU1
Rural property	14%	Partial acquisition	Private	1 DP118590	RU1
Rural residential	100%	Full acquisition	Private	1 DP1047239	RU1
Rural residential	100%	Full acquisition	Private	2 DP1063069	RU1
Rural property	31%	Partial acquisition	Private	1000 DP1147316	RU1
Rural property	100%	Full acquisition	Private	3 DP614110	RU1
Rural property	<5%	Partial acquisition	Private	2 DP614110	RU1
Rural property	100%	Full acquisition	Private	1 DP614110	RU1
Rural property	66%	Partial acquisition	Private	11 DP583232	RU1
Rural property	21%	Partial acquisition	Private	26 DP248630	RU1
Rural property	<5%	Partial acquisition	Private	221 DP1046820	RU1
Rural property	6%	Partial acquisition	Private	1 DP736773	RU1
Rural property	100%	Full acquisition	Private	1 DP 561939	RU1



FIG. 3-10 Property acquisition for the proposal

Legend

Proposal features

Property acquisition

--- Watercourse Other features

- Other reatures
- -State roads
- -+ Main North railway line

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