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

The proposal has been split into two stages in order to find a proposal that; improves road safety, would assist in obtaining construction funding for the proposal and provides a plan for future works.

A description of the proposal is provided below. Key features of Stage 1 include:

- Realigning about two kilometres of single carriageway starting about 1.5 kilometres north of the Dignams Creek Road intersection and extending to about 600 metres south of the Dignams Creek Road and Princes Highway intersection. The section would be constructed as a single carriageway with 3.5 metre wide lanes and three metre shoulders in each direction.
- Removal of four tight sub-standard curves along the existing Princes Highway.
- Construction of a new single carriageway bridge over Dignams Creek about 91 metres in length.
- Relocating the Princes Highway and Dignams Creek intersection about 100 metres north-west.
- Realigning around 200 metres of the most eastern section of Dignams Creek Road.
- Tie ins to the existing Princes Highway alignment.
- Provision of around 1.4 kilometres of road safety treatments along the existing Princes Highway alignment at the southern end of the proposal.
- Provision of one dedicated fauna underpass and one combined drainage culvert/fauna underpass.
- Relocating two private property access roads and formalising and consolidating one national park access point.
- Part of the existing Princes Highway alignment and Dignams Creek Bridge would be retained for private use.

Key features of Stage 2 include:

- Realigning about 1.5 kilometres of single carriageway commencing about 600 metres south of Dignams Creek Road and extending to the southern end of the proposal. The section would be constructed as a single carriageway with 3.5 metre wide lanes and three metre shoulders in each direction.
- Removal of six sub-standard curves along the existing Princes Highway.
- Tie ins to stage 1 and the existing Princes Highway alignment.
- Provision of one dedicated fauna underpass, one combined drainage culvert/fauna underpass and one rope canopy bridge.
- Relocating access roads for Kooraban National Park and Gulaga National Park.
- Removal of the existing Princes Highway between Dignams Creek Road and the access road to Gulaga National Park.

The following general features would be included for both stages of the proposal:

- Installation of operational water quality controls including:
  - Five biofiltration basins.

  - A water quality basin.
  - Two constructed wetlands.
  - Biofiltration/vegetated swales.
- Installation of four retaining walls.
- Provision of ancillary facilities such as temporary sedimentation basins, compound and stockpile sites, and access tracks.
- Removal, rehabilitation and revegetation of 0.6 kilometres of the redundant sections of the Princes Highway.
- Relocation of overhead utilities to accommodate the proposal.

Construction of the proposal would proceed following determination of the REF, obtaining other approvals as required, completion of the detailed design and the securing of funding from government sources. The construction period for Stage 1, would have duration of between 18 and 24 months. Stage 1 of the proposal has a strategic estimate of about $40 million. Whilst Stage 2 is a long term plan which is unlikely to be built for some time, the strategic cost estimate for Stage 2 is around $20 million (2013 dollars). The construction period for Stage 2 would be defined during detailed design. The major design features and construction activities and ancillary facilities are described in more detail below.

3.2 Design

The following sections provide a description of the design criteria, major design features and engineering constraints of the proposal. These features have been based on the concept design and would be subject to refinement during detailed design.

3.2.1 Design Parameters

The Princes Highway is classified as a class four rural (4R) road based on the *RTA Network Performance Measures and Network Planning Targets* (July 2010). Given this road classification a targeted operating design speed of 110 kilometres/hour has been adopted. Due to the difficult steep terrain, a reduction in design speed to 100 kilometres/hour /h has been adopted. Additional design parameters include:

- Lane Width – 3.5 metres.
- Maximum Grade – eight per cent (with the exception of the tie into the existing alignment).
- Shoulder Width –3.0 metres.
- Verge – one metre.

3.2.2 Design criteria

General

The road design has been undertaken in accordance with the following guidelines and standards:

- *RTA Road Safety Audit Manual and Checklist* (RTA 2005).
- *Austroads' Guide to Road Design* (undated).
- *RMS Supplements to Austroads Guide to Road Design.*
- *Beyond the Pavement – RTA urban design policy, procedure and design princi*ples (RTA 2009).
- *RMS Delineation Man*ual (RMS 2012).
- RMS Road Technical Directions:

  - TDT 2002/12c – *Stopping & Parking Restrictions at Intersections and Crossings* (RTA 2011).
- Austroads Guide and Commentary Series.
- *Austroads Design Vehicles and Turning Path Templa*tes (Austroads 2006).
- *RMS NSW Speed Zone Guideli*nes (RTA 2011).
- Australian Standards:
  - AS1742.2-2009 - *Manual of Uniform Traffic Control Devices as amended by RMS Supplemen*t (RMS 2012).

The bridge design has been undertaken in accordance with the following guidelines and standards:

- Australian Standard AS 5100-2004 *Bridge Design*.
- *RMS Bridge Technical Direction Manual* (RMS 2012).
- Bridge Policy Circulars, Chief Bridge Engineer's Circulars etc.
- RMS Standard Bridge Drawings.
- RMS Bridgeworks QA Specifications.
- RMS Structural Drafting and Detailing Manuals.
- *Guide to Bridge Construction Practice* – AUSTROADS.
- RMS Policy for safety screening of Bridges.
- *Bridge Aesthetics – Design Guidelines to Improve the Appearance of Bridges in NSW* (RMS 2012).
- RMS *Guidelines for the Management of Acid Sulfate Materials*.
- RMS Bridge Inspection Procedures.

The following considerations have informed the concept design:

- The proposal objectives, as detailed in **Section 2.3.**
- The urban and landscape design objectives and principles, as detailed in **Section 6.3** and the *Landscape Character and Visual Impact Assess*ment (SMM, 2013), refer to **Appendix C**.
- Designing the proposal to limit adverse impacts on the environment, while maximising the environmental benefits.
- Planning temporary arrangements that minimise disruption to local and through traffic.
- Maintaining access to adjacent properties during construction.
- Minimising land acquisition.
- Providing value for money.

The design criteria are outlined in **Table 3-1**. Typical cross sections of subject portions of the Princes Highway, including shallow cuts, deep cut with an access track, shallow fill and deep fill sections are shown in **Figure 3-1, Figure 3-2**, **Figure 3-3, Figure 3-4 and Figure 3-5** respectively. Please note all cross sections are looking south.

Table 3-1 Design criteria

Design criteria	Requirement
Design and posted speed	Design speed and posted speed limit of 100 km/hr on the Princes Highway.
Lane width	Lanes generally 3.5 metres in width along the Princes Highway.
Carriageway	Two lanes, two way carriageway with an over taking lane on the southern section of the southbound lane.
Shoulder width	Shoulder width of three metres in most areas. Shoulder width of one metre for local roads and access tracks.
Median	A central painted median, with varying widths (up to 3.5 metres) depending on the location (refer to **Appendix A**).
Intersection treatment	Provision of an at grade intersection at Dignams Creek Road with: ▪ Safe intersection sight distance, approach and entering sight distance provided on all legs of the intersection. ▪ Protected left and right turning lanes from the Princes Highway into Dignams Creek Road. ▪ Approaches on Dignams Creek Road at a 12.5 % grade. ▪ Retaining wall treatments at the fill embankments. Refer to **Section 3.2.3** for further details.
Design vehicle	Design the proposal to cater for 19 metres semi-trailer and B-doubles.
Pedestrian / cycling / buses	Provisions to be made in the shoulder for cyclists. No specific provisions to be made for pedestrians. Provision is included in the widened shoulders on the departure side of Dignams Creek Road on both sides of the Princes Highway for bus to pull over into.
Logging trucks *(use Dignams Creek Road to access forestry tracks along the road).*	Provision to be made for 19 metre semi-trailers during construction and operation.
Batters	Desirable embankment batter slopes to be 2 horizontal (H): 1 vertical (V). Potential for batter slopes to be flattened across flood plain. Localised steepening to 0.6:1 on Dignams Creek Road at the tie in to existing road.

Design criteria	Requirement
	Design life for local road embankments to be 20 years and reinforced embankments to be 100 years.
Safety barriers	Safety barrier protection would be provided in the form of a steel beam guardrail through all fill locations. A double rail safety barrier would be used for the new bridge at Dignams Creek.
Pavement type	Flexible gravel pavement comprising of base, sub base with a sealed wearing course. Design life for pavements 20 years.
Drainage	Pavement drainage (width of flow and pit inlet) – 20 year average recurrence interval (ARI). Piped system including pits – 20 year ARI. Culverts where surcharge is available – 50 year ARI. Structures where surcharge is undesirable – 100 year ARI. Kerb and gutter for pavement drainage. Design details on culverts have been provided in **Section 3.2.3**.
Bridge	Three span super-T girder bridge, 91 metres in length and approximately 12 metres high. Two 3.5 metre wide lanes, 3.0 metre outside shoulder. Minimum 4.6 metre clearance under the bridge. Flood immunity of at least 20 years ARI. Design life for the bridge to be 100 years. Design details on the bridge are provided in **Section 3.2.3**.
Retaining walls	The dimensions, locations and materials to be used for the retaining walls would be refined during detailed design. Where required, retaining walls would not be visible to highway users or local residents.
Utilities	Adjustments to utilities such as electricity and telecommunications would be designed in detailed design in consultation with the relevant authorities.

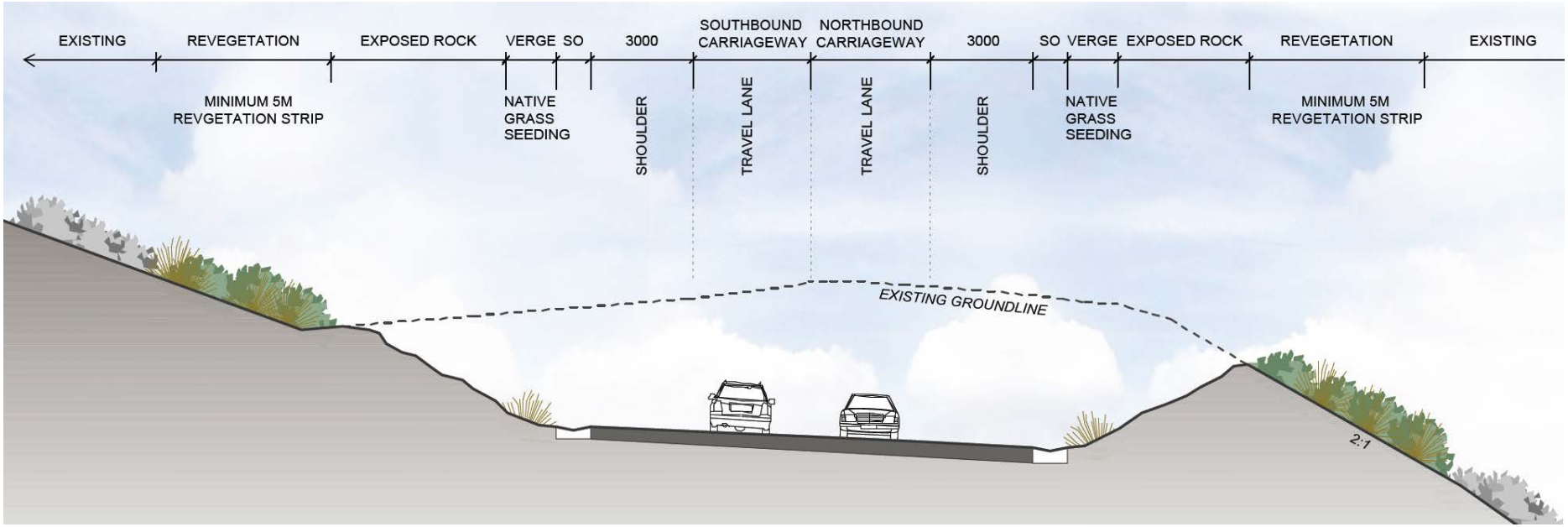


Figure 3-1 Typical cross section of a shallow cut across Princes Highway, Dignams Creek between chainages 94,770 and 95,440 (from SMM, 2013)

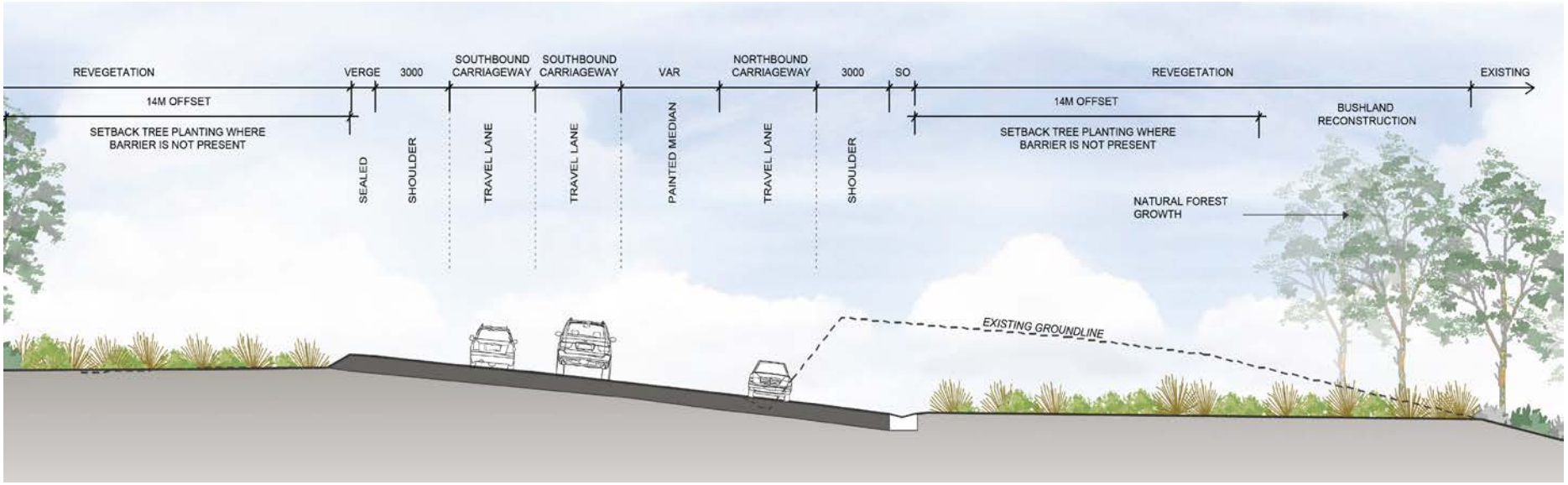


Figure 3-2 Typical cross section of a shallow cut section across Princes Highway, Dignams Creek at chainage 97,000 (from SMM, 2013)

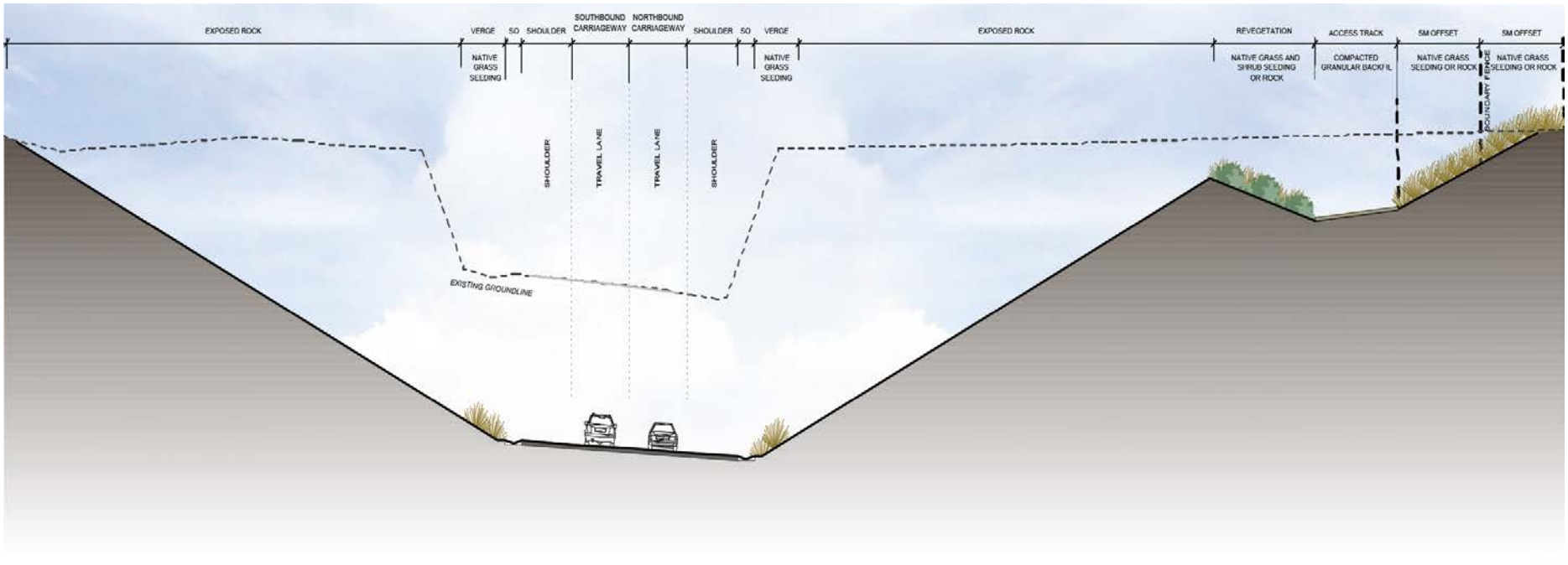


Figure 3-3 Typical cross section of a deep cut with access track adjacent to the Princes Highway, Dignams Creek at chainages 95,100 (from SMM, 2013)

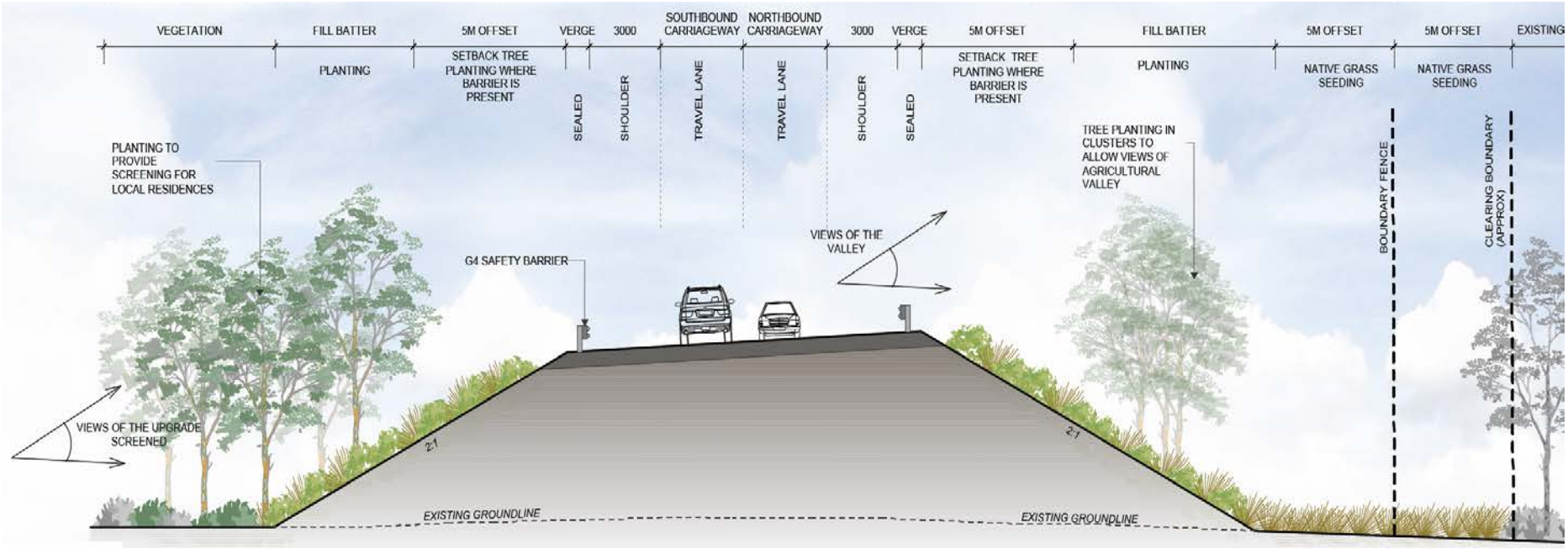


Figure 3-4 Typical cross section of a shallow fill section across Princes Highway, Dignams Creek between chainages 94,770 and 95,440 (from SMM, 2013)

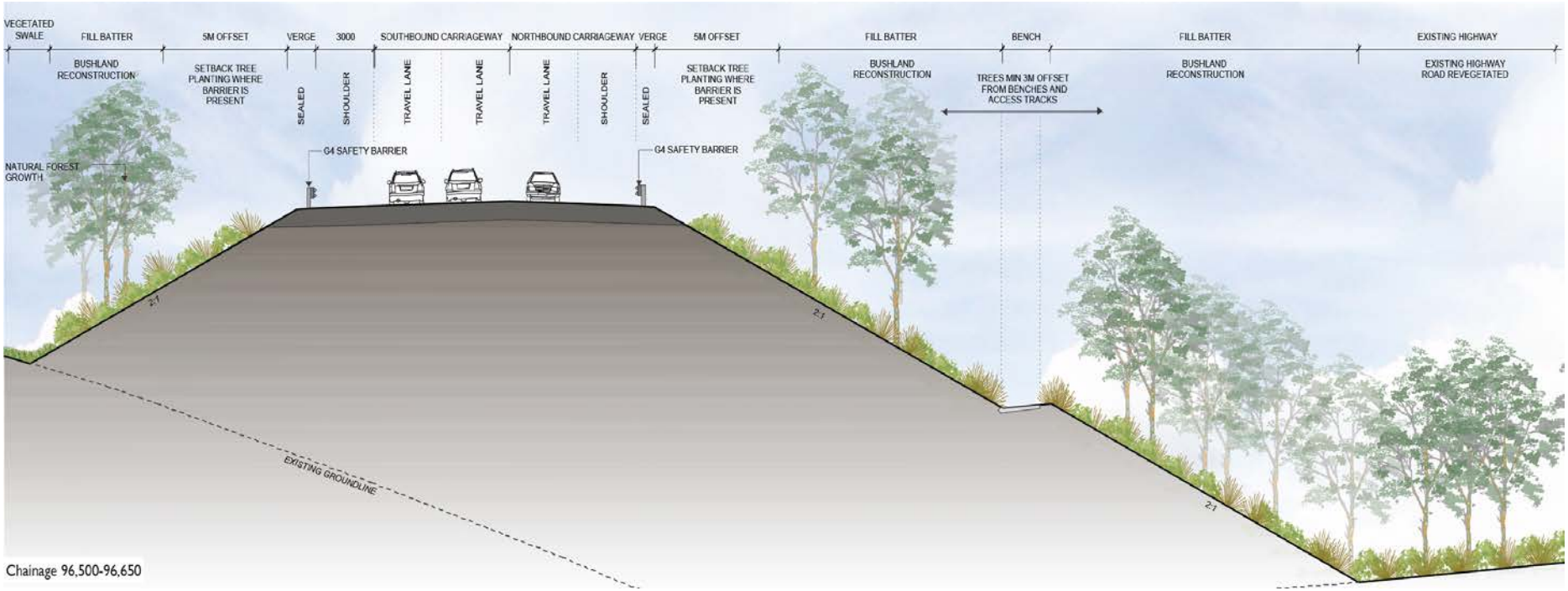


Figure 3-5 Typical cross section of a deep fill section across Princes Highway, Dignams Creek through the national park between chainages 95,500 and 96,650 (from SMM, 2013)

3.2.3 Major design features

The Princes Highway

Major design features for the proposed main alignment, waterway crossing and intersection have been outlined below. Refer to **Appendix A** for the location of the proposal relative to the existing road alignment, waterway and intersection.

The major design features for the proposal have been described within the context of the two proposal stages (refer to **Figure 1-2**) as follows:

- Stage 1 – Includes realignment of the existing Princes Highway commencing from the start of the proposal and extending to about 600 metres south of the existing Dignams Creek Road intersection. The realignment then ties back into the existing Princes Highway. Road safety treatments would then be provided from the tie in point of the realignment and the existing Princes Highway and extending 1.4 kilometres to the southern end of the proposal.
- Stage 2 – Commences 600 metres south of the Dignams Creek Road intersection and extends 1.5 kilometres to the southern end of the proposal.

Stage 1

The main alignment would be realigned to the west of the existing Princes Highway, traversing across Dignams Creek and Dignams Creek Road before tying in with the existing Princes Highway alignment 600 metres south of the Dignams Creek Road intersection. Road safety treatments are provided to the south of the tie in point of the realignment works on the existing Princes Highway and extend 1.4 kilometres to the end of the proposal. Road safety works along the southern end of the existing Princes Highway include widening the northbound road shoulder, providing a painted median to separate traffic and improving sight distances via the removal of vegetation.

An overtaking lane would be provided on the southbound carriageway, starting about 50 metres to the south of the proposed Dignams Creek Road and Princes Highway intersection. The overtaking lane would extend for around 1.6 kilometres. Ninety metre right and left turn lanes would be provided on the Princes Highway on approach to the intersection with Dignams Creek Road and Princes Highway intersection. Two private access roads would be constructed in this stage of the proposal. **Section 2.6.4** provides a description of the access roads.

The concept design incorporates 2:1 fill batters with 2.5 metre concrete lined benches required on slope lengths greater than 25 metres. The highest fill batter in stage 1 would be about 17 metres high, located about 350 metres south of the proposed Dignams Creek Road and Princes Highway intersection between chainage 96500 to 96600.

The concept design incorporates 2:1 cut batters with no benching required. The deepest cut in stage 1 would be about 16 metres deep, located at the northern end of the proposal between chainage 94920 to 95380.

Road drainage generally consists of three key elements; cross drainage, longitudinal drainage and water quality treatment. The cross drainage would provide 100 year ARI flood immunity (that is it would cater for a flood that, on average, would occur once in 100 years) for the proposed roadway and would minimise afflux at adjacent properties. Afflux is the rise in water level upstream due to an obstruction of flow downstream, which may occur as a result of the proposal. All existing cross drainage structures would be retained on the existing Princes Highway alignment, which is to be retained for private property access

following the upgrade. The concept design includes provision for cross drainage in accordance with the findings of the *Hydraulic Assessment* (refer to **Appendix D**). **Table 3-2** summarises the proposed cross drainage for Stage 1. Existing drainage structures on the Princes Highway would be retained.

Table 3-2 Stage 1 - Proposed cross drainage

Type and size (mm)	Chainage	Comment
450 RCP	94795	-
600 RCP	95160	-
600 RCP	95455	Directs water to basin B95.45L.
3000 x 3000 RCBC	95585	Combined box culvert and fauna crossing A.
Kerb inlet and batter drain	95750	Directs water to B95.75R wetland.
Kerb inlet and batter drain	95930	Directs water to B95.93L wetland.
Bridge crossing	95900	The area under the bridge would be re-vegetated on both sides of Dignams Creek.
Kerb inlet and batter drain	95940	-
Kerb inlet and batter drain	96062	-
Kerb inlet and batter drain	96162	Directs water to basin B96.15L and B96.16R.
Kerb inlet and batter drain	96487	-
Kerb inlet and batter drain	96505	Directs water to basin B96.52L
900 RCP	96575	-
3000 x 3000 RCBC	96625	Dedicated fauna crossing C contains fauna furniture.
Kerb inlet and batter drain	96765	-
Kerb inlet and batter drain	97065	-

Note: RCBC – Reinforced concrete box culvert. RCP – Reinforced concrete pipe

The scour protection measures to be applied at all cross drainage locations include:

- Rock rip rap at bridges to mitigate local scour at abutments.
- Energy dissipaters at culvert outlets.
- Rock aprons at culvert outlets to reduce discharge velocities where dissipaters were not required.

The final location and sizing of cross drainage including scour protection measures would be refined during the detailed design.

Stage 2

The Stage 2 alignment starts on the western side of the existing Princes Highway commencing around 600 metres to the south of the intersection with Dignams Creek Road. The Stage 2 alignment continues to the end of the proposal on the western side of the existing Princes Highway alignment.

Two private access roads are located about 100 metres from the end of the proposal. These access roads would remain in the existing locations but would have the access modified as part of the proposal, refer to **Section 2.6.**4.

The public access roads within the National Parks adjoining the proposal would require tie in with the proposal. The public access road located on the western side of the proposal, in the Kooraban National Park, which currently has two access points would be formalised and consolidated. As such the southern access point would be removed and the northern access formalised to reduce conflict points and improve road safety on the existing Princes Highway in stage 1 (refer to **Figure 2-14**). The northern access point was chosen as it maximises the sight distance available at this location. This access point would need to be relocated as part of stage 2 works to connect to the realignment.

The public access road located on the eastern side of the proposal, which provides access into Gulaga National Park, would also be retained during Stage 1. In Stage 2, access to the Gulaga National Park would be via the access road and existing Princes Highway, which would be retained, and a new junction with the realigned highway would be constructed. The detail of the tie ins for the two public access roads would be further refined during detailed design of Stage 2.

Stage 2 incorporates 2:1 fill batters with 2.5 metre concrete lined benches required on slope lengths greater than 25 metres. Due to the limited area available for the construction footprint in Stage 2, associated with the size of the revocation of national park, benches would be “notched” in a locally steepened section of the fill to maintain an overall footprint in keeping with a 2:1 batter. The largest fill batter in Stage 2 would be about 20 metres, between chainage 96840 to 97080.

Stage 2 cuts would be 2:1, with no benching required. The deepest cut in Stage 2 would be about 18 metres deep, located about 80 metres south of fauna crossing D, between chainages 97120 to 97660.

The cross drainage would provide 100 year ARI flood immunity for the proposed roadway and would minimise afflux at adjacent properties. The concept design includes provision for cross drainage in accordance with the findings of the *Hydraulic Assessment* (refer to **Appendix D**). **Table 3-3** summarises the proposed cross drainage for this section. The final location and sizing of cross drainage including scour protection measures would be refined during the detailed design.

Table 3-3 Stage 2 - proposed cross drainage

Type and size (metres)	Chainage	Comment
Kerb inlet and batter drain	96790	Includes rock protection at the outlet.
900 mm Drainage Pipe	97020	-
2.4 m x 2.4 m RCBC	97075	Dedicated fauna crossing D.
900 mm Drainage Pipe	97805	-
2.4 m x 2.4 m RCBC	97910 to 97890	Culvert used for drainage and fauna crossing F.
Kerb inlet and batter drain	97920	Includes rock protection at the outlet.
Kerb inlet and batter drain	97960	Includes rock protection at the outlet.

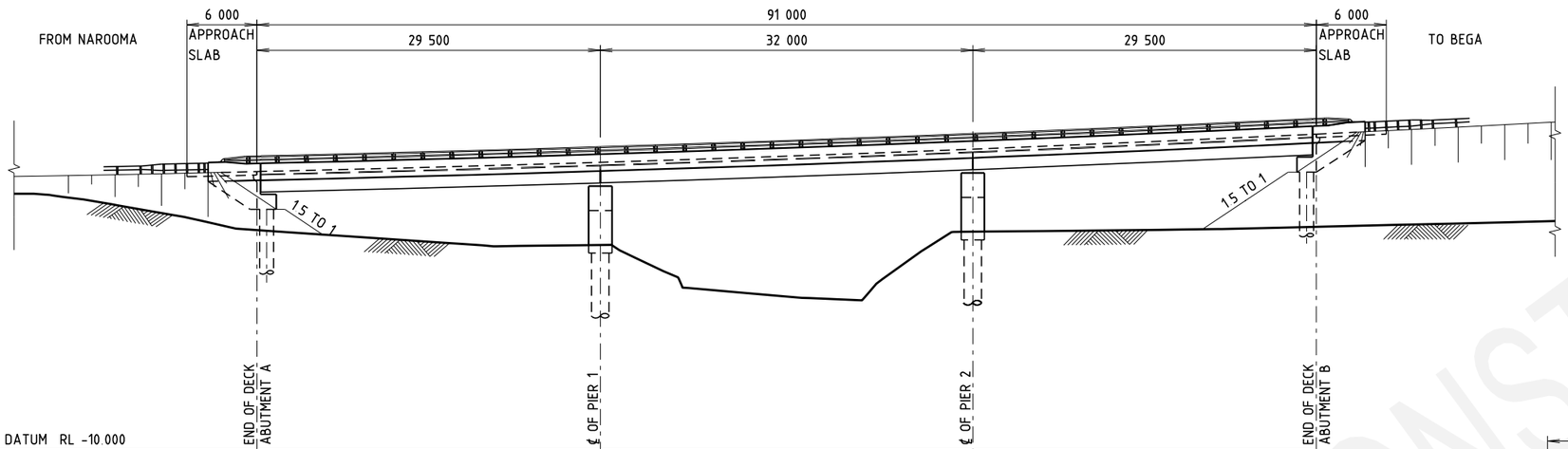
Note: RCBC – Reinforced concrete box culvert.

Scour protection measures to be applied at all cross drainage locations include:

- Rock rip rap at bridges to mitigate local scour at abutments.
- Energy dissipaters at culvert outlets where the discharging flow would be supercritical and receiving waters would be subcritical.
- Rock aprons at culvert outlets to transition velocities where dissipaters were not required.

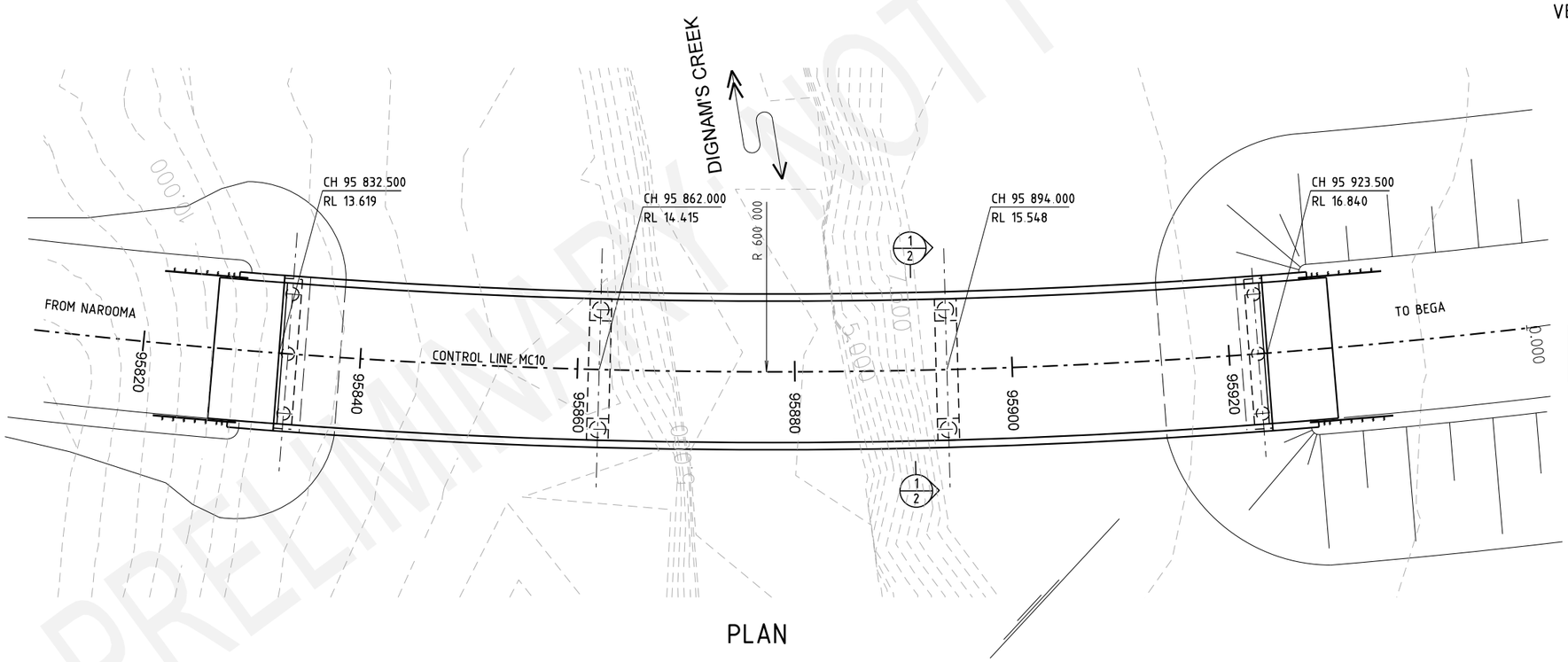
Dignams Creek Bridge

A new bridge would be constructed over Dignams Creek upstream of the existing bridge (refer to **Figure 3-6** for a plan view and **Figure 3-7** for the cross section of the bridge). The bridge would consist of a three span, super-T girder configuration about 91 metres in length, with a southbound and northbound lane. The two outer spans are 29.5 metres long with the middle span being 32 metres long. The bridge would include one set of piers that would be constructed on top of the river bank on either side of Dignams Creek. The bridge abutments would be constructed into the fill embankment at either end of the bridge. Two options were considered in the development of the concept design for the pier design however the open twin pier design was selected as it would allow more light penetration for vegetation. The exact design of the piers would be refined during detailed design. Scuppers would not be used on the bridge as the road water would be caught in kerb and discharged via a dyke pit into a constructed wetland. The existing Dignams Creek Bridge would be retained and would form part of the private property assess road located on the eastern side of the proposal.

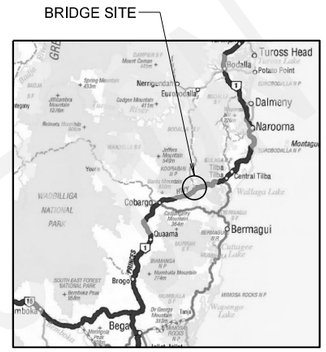


DATUM RL -10.000	END OF DECK ABUTMENT A	℄ OF PIER 1	℄ OF PIER 2	END OF DECK ABUTMENT B
DESIGN SURFACE LEVEL ALONG CONTROL LINE (MC10)	13.619	14.415	15.548	16.840
EXISTING SURFACE LEVEL ALONG CONTROL LINE (MC10)	8.9	7.6	8.7	9.2
CHAINAGE ALONG CONTROL LINE MC10	95832.500	95862.000	95894.000	95923.500

ELEVATION

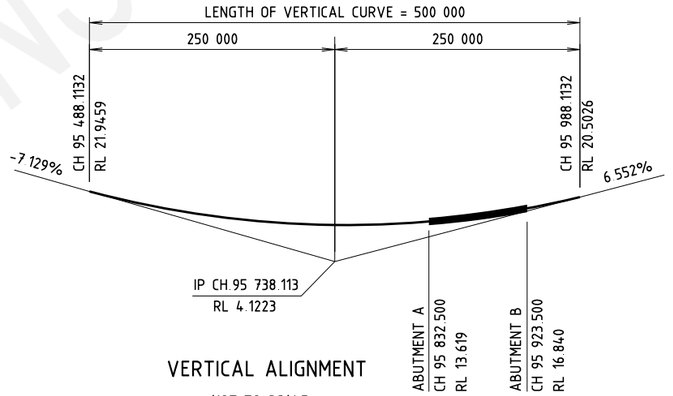


PLAN



LOCALITY PLAN

THE BRIDGE SITE IS APPROXIMATELY
km BY ROAD FROM SYDNEY



VERTICAL ALIGNMENT

NOT TO SCALE

GENERAL NOTES

SCALE 0 5 10 15m (5 2.5) OR AS SHOWN.

DIMENSIONS ARE IN MILLIMETRES.
CHAINAGES AND REDUCED LEVELS ARE IN METRES.
REDUCED LEVELS ARE RELATED TO AHD
THE NUMBER OF PILES WILL BE ADJUSTED AFTER RECEIVING THE RESULTS OF THE GEOTECHNICAL INVESTIGATION.

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

HIGHWAY No 1 — SHIRE OF EUROBODALLA

BRIDGE OVER DIGNAM'S CREEK

AT 27km SOUTH OF NAROOMA

CONCEPT SKETCH OPTION 1 - SHEET A

NSW GOVERNMENT Transport Roads & Maritime Services

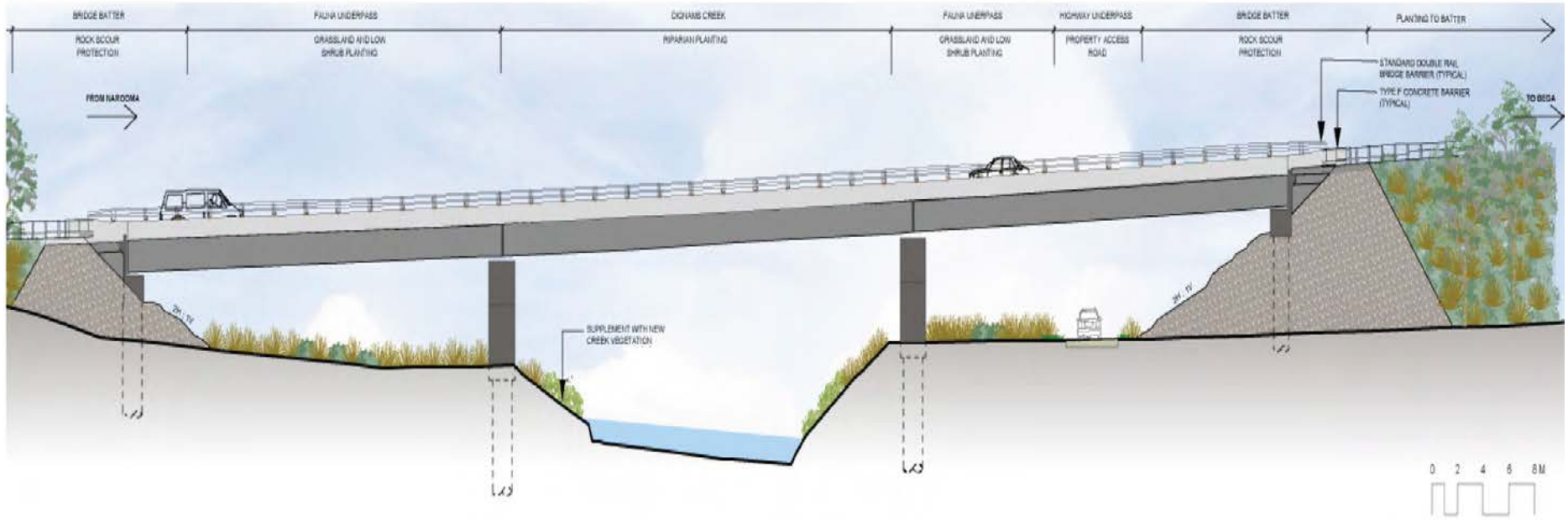
PREPARED BY
BRIDGE AND STRUCTURAL ENGINEERING BRANCH
110 GEORGE STREET PARRAMATTA NSW 2150
PHONE (02) 8837-0802 FACSIMILE (02) 8837-0055

CLIENT:
SOUTHERN REGIONAL OFFICE - RSTM
90 CROWN STREET WOLLONGONG
PHONE (02) 4221-2460 FACSIMILE (02) 4221-2777

PREPARED	CHECKED	SKETCH No
DESIGN		KD944CS1
DRAWING Y.CHEN 19.11.12		BRIDGE NUMBER
SUPERVISING BRIDGE ENGINEER (NEW DESIGN)		ISSUE STATUS: PRELIMINARY
		SHEET No 1 / ISSUE 0

CAD No KD944CON1A.dgn

Figure 3-6 Proposed Dignams Creekbridge - pier and span locations



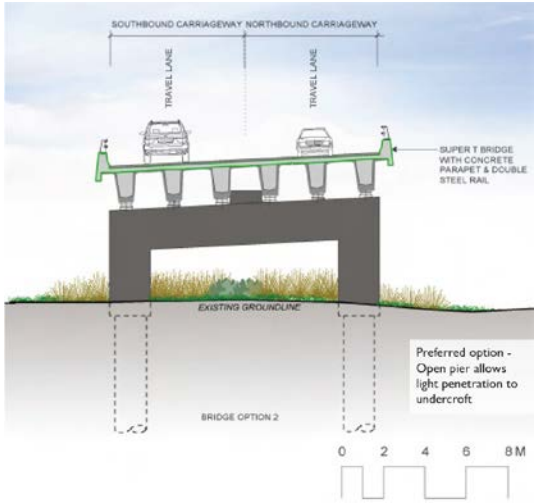


Figure 3-7 Cross section of the Dignams Creek Bridge (SMM, 2013)

Princes Highway and Dignams Creek Road intersection

The proposed intersection would be re-located about 100 metres north-west of the existing intersection, and would replace the existing intersection. The southern 100 metres of Dignams Creek Road would be realigned. The proposed intersection configuration and realignment of Dignams Creek Road is shown in **Figure 3-8** and detail of the intersection upgrade is shown in **Figure 3-9**. The footprint of the intersection has been minimised as far as practical to minimise property acquisitions and impacts on environmentally sensitive areas.

The intersection would include:

- A northbound and southbound lane on the proposed Princes Highway.
- A left hand turning lane (about 90 metres in length) on the northbound lane, south of the proposed Dignams Creek Road and Princes Highway intersection
- A right hand turning lane (about 90 metres in length) on the southbound lane, north of the proposed Dignams Creek Road and Princes Highway intersection
- Access to the northbound and southbound lanes via a T-intersection arrangement with the Princes Highway.

Figure 3-8 Dignams Creek Road and Princes Highway intersection

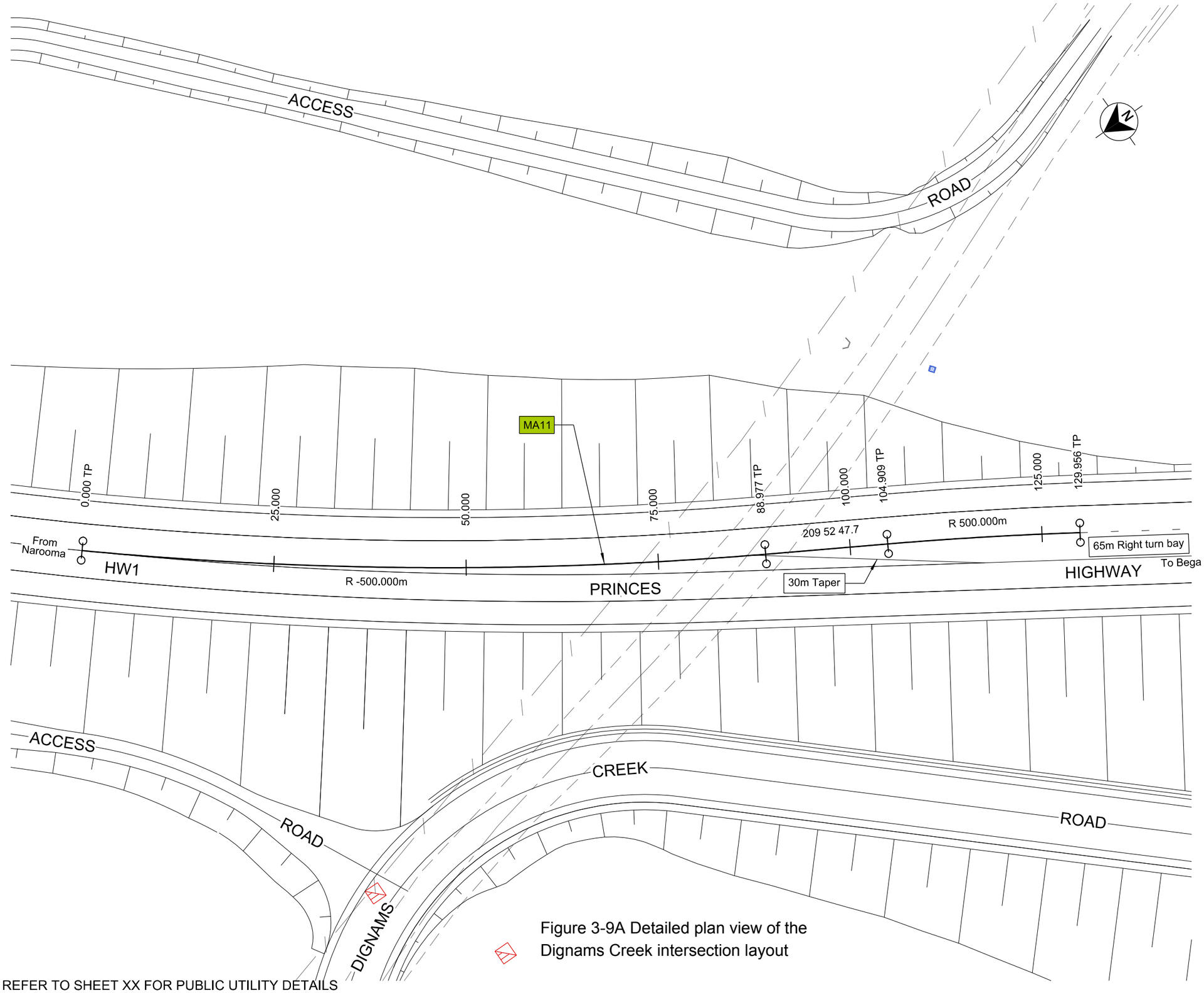


Figure 3-9A Detailed plan view of the Dignams Creek intersection layout

LEGEND

MC10 Master string label

NOTES

1. Refer to Sheet No. XXXX for median setout schedules

DIAL BEFORE YOU DIG www.1100.com.au

NOT FOR CONSTRUCTION

REFER TO SHEET XX FOR PUBLIC UTILITY DETAILS

ISSUE	DATE	ISSUE / AMENDMENT DESCRIPTION
X	00/00/0000	ISSUE / AMENDMENT DESCRIPTION LINE 5
X	00/00/0000	ISSUE / AMENDMENT DESCRIPTION LINE 4
X	00/00/0000	ISSUE / AMENDMENT DESCRIPTION LINE 3
X	00/00/0000	ISSUE / AMENDMENT DESCRIPTION LINE 2
X	00/00/0000	ISSUE / AMENDMENT DESCRIPTION LINE 1

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SCALES

0 5 10 15 20 25

NOMINAL SCALE RATIO 1:500

CO-ORDINATE SYSTEM: MGA Zone 55 HEIGHT DATUM: A.H.D.

Transport NSW GOVERNMENT Roads & Maritime Services

ENGINEERING TECHNOLOGY
PROJECTS DELIVERY
DESIGN SOUTHERN

PRODUCED: 5/02/2013 1:44:48 PM

ROADS AND MARITIME SERVICES

HW1 - PRINCES HIGHWAY
UPGRADE OF PRINCES HIGHWAY AT DIGNMANS CREEK
DIGNAMS CREEK DEVIATION
FROM 94.7km TO 98.1km SOUTH OF BATEMANS BAY
DIGNAMS CREEK ROAD CHANNELISATION SETOUT

DRAWING	STAGE	PART	ISSUE
Setout of Intersection 1.dgn	CONCEPT	1	1

REGISTRATION NUMBER: 0001_145_CD_0011

SHEET No.: XX-0000

A3 ORIGINAL 25mm ON ORIGINAL

LEGEND

MC10 Master string label

NOTES

1. Refer to Sheet No. XXXX for median setout schedules

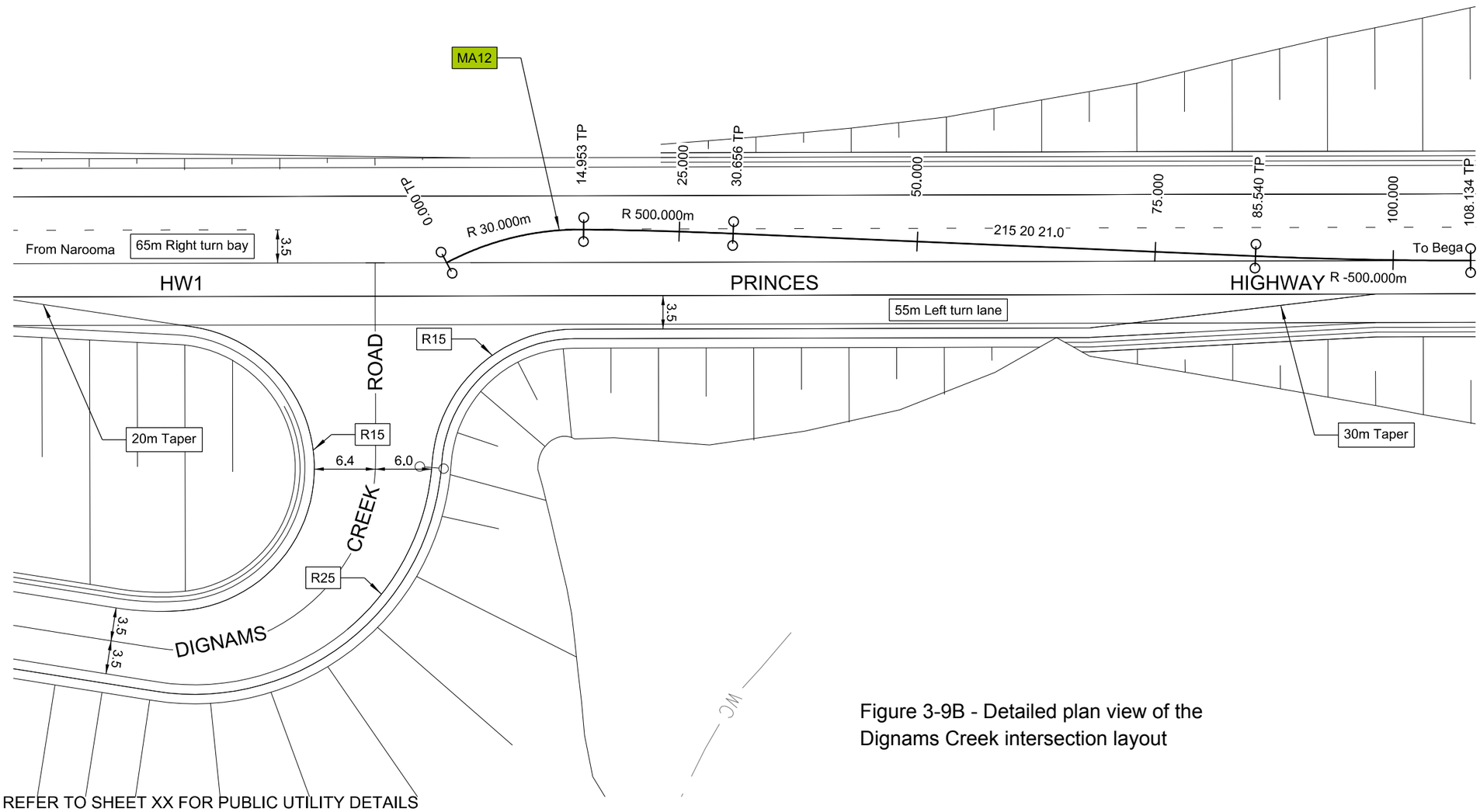

Figure 3-9B - Detailed plan view of the Dignams Creek intersection layout

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NOT FOR CONSTRUCTION

25mm ON ORIGINAL

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ISSUE	DATE	ISSUE / AMENDMENT DESCRIPTION
X	00/00/0000	ISSUE / AMENDMENT DESCRIPTION LINE 5
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SCALES

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NOMINAL SCALE RATIO 1:500

CO-ORDINATE SYSTEM: MGA Zone 55 HEIGHT DATUM: A.H.D.

NSW GOVERNMENT Transport Roads & Maritime Services

ENGINEERING TECHNOLOGY
PROJECTS DELIVERY
DESIGN SOUTHERN

PRODUCED: 5/02/2013 1:44:49 PM

ROADS AND MARITIME SERVICES

HW1 - PRINCES HIGHWAY
UPGRADE OF PRINCES HIGHWAY AT DIGNMANS CREEK
DIGNAMS CREEK DEVIATION
FROM 94.7km TO 98.1km SOUTH OF BATEMANS BAY
DIGNAMS CREEK ROAD CHANNELISATION SETOUT

DRAWING	STAGE	PART	ISSUE
Setout of Intersection 2.dgn	CONCEPT	1	1

REGISTRATION NUMBER: 0001_145_CD_0011

SHEET No.: XX-0000

Retaining walls

Four retaining walls would be required to support the road embankments at the southern end of the proposal along the Stage 1 upgrade. The location of each wall is shown in **Figure 3-10** and a description of each has been provided below:

- Wall 1 - Dignams Creek Road intersection: A retaining wall has been proposed between chainage 96050 to chainage 96140. The length of the retaining wall would be about 90 metres and would have a maximum height of about 13 metres. A proprietary product to be determined during detailed design would be used to steepen the batter from 2:1 to 0.6:1 as described in **Section 2.6.5**
- Wall 2 - Tie in at south end of Stage 1: A retaining wall has been proposed at the southern end of the Stage 1 on the eastern side of the proposal between chainage 96780 to chainage 96930. A proprietary product to be determined during detailed design would be used to steepen the batter from 2:1 to 0.6:1 as described in **Section 2.6.5**. The length of the retaining wall would be about 150 metres and would have a maximum height of about 3.5 metres.
- Wall 3 – Southern end of Stage 1 works: A retaining wall has been proposed on the western side of the proposal at the southern end of Stage 1 (between chainage 97070 and chainage 97180). The length of the retaining wall would be about 110 metres and would have a maximum height of about 2.5 metres near the Princes Highway.
- Wall 4 – Southern end of Stage 1 works: A retaining wall has been proposed on the western side of the proposal at the southern end of stage 1 (between chainage 97295 to chainage 97495). The length of the retaining wall would be about 200 metres and would have a maximum height of about 2.5 metres near the Princes Highway.

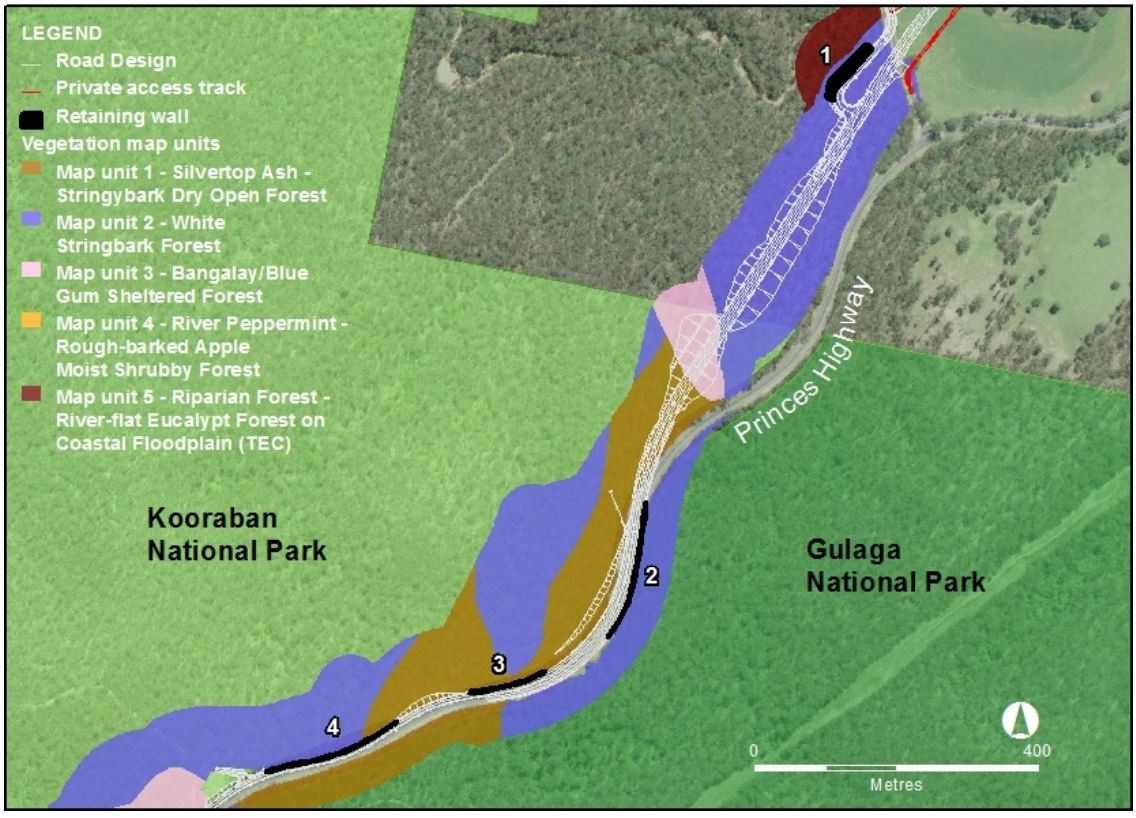

Figure 3-10 Location of retaining walls

The location, length and type of the retaining walls would be reviewed during the detail design phase. The retaining walls would remove the need for large, long fills which run parallel to the existing ground slope and as such would reduce the construction footprint and associated ecological and land use impacts.

Major cut and fill areas

Stage 1

Major cuttings (cutting areas greater than five metres deep) would be located at:

- The northern end of the proposal from about chainage 94920 to 95380 (up to 16 metres deep).
- About 100 metres south of the proposed Dignams Creek and Princes Highway intersection from chainage 96240 to 96480 (up to 13 metres deep).

The major fill locations (fill areas greater than five metres high) would be at:

- About 50 metres south of the proposed access road on the western side of the Princes Highway intersection from chainage 95480 to 95740 (up to 13 metres high).
- The northern abutment of the proposed Dignams Creek Bridge at about chainage 95840 (up to seven metres high).
- The southern side of the proposed Dignams Creek Bridge from chainage 95920 to 96060 (up to nine metres high).
- About 350 metres south of the proposed Dignams Creek Road and Princes Highway intersection at about chainage 96500 to 96600 (up to 17 metres high).

Cross section drawings of typical cut and fill are provided in **Figures 3-1 to 3-5**.

Stage 2

Major cuttings (cutting areas greater than five metres deep) would be located at:

- The start of Stage 2 from about chainage 96420 to 96480 about (up to 13 metres deep).
- About 80 metres south of fauna crossing D from about chainage 97120 to 97660 (up to 18 metres deep).

The major fill locations (fill areas greater than five metres high) would be at:

- The start of Stage 2 from about chainage 96500 to 96600 (up to 17 metres high).
- About 220 metres south from fauna crossing C between chainage 96840 to 97080 (up to 21 metres high).
- About 250 metres south of fauna crossing D between chainage 97280 to 97300 (up to six metres high)
- At the southern end of Stage 2 at about chainage 97740 to 97900 (up to 14 metres high).

The total cut and fill volumes for the proposal have been outlined in **Table 3-9**.

Operational water quality controls and spill containment

An *Operational Water Quality Assessment* has been undertaken for the proposal (refer to **Appendix E**). The water quality strategy has been designed in accordance with relevant NSW legislation and guidelines. The design criteria is based on the

NSW OEH design criteria for water quality, as described in *Managing Urban Stormwater – Council Handbook* (EPA, 1997) and summarised in **Table 3-4**.

Table 3-4 Summary of OEH design criteria for water quality (EPA 1997)

Pollutant	Minimum reduction of the annual average load
Total suspended solids (TSS)	80%
Total nitrogen (TN)	45%
Total phosphorous (TP)	45%
Oil and grease	None visible

Operational water quality controls identified in the *Operational Water Quality Assessment* include the construction of eight water quality controls that also incorporate mechanisms for capturing any accidental spills of hazardous material. This includes the construction of one permanent water quality basin, five biofiltration basins and two constructed wetlands.

The location of the operational water quality controls is shown in **Figure 3-11**. **Table 3-5** provides details of the location, sensitive receiving environment, type of water quality control, base area and volume as outlined in the *Operational Water Quality Assessment* (SKM 2013) (refer to **Appendix E**). Typical design drawings for each type of water quality control are included in the appendix of the *Operational Water Quality Assessment* (refer to **Appendix E**).

During detailed design the proposed operational water quality controls would be reviewed and opportunities for vegetated swales would be investigated to supplement the water quality controls details in **Table 3-5**. Additionally, vegetated or biofiltration swales would be incorporated into the stage 2 at drainage outlets which discharge into sensitive environments. The location of these would be further investigated during detailed design.

Upgrade of the Princes Highway, Dignams Creek

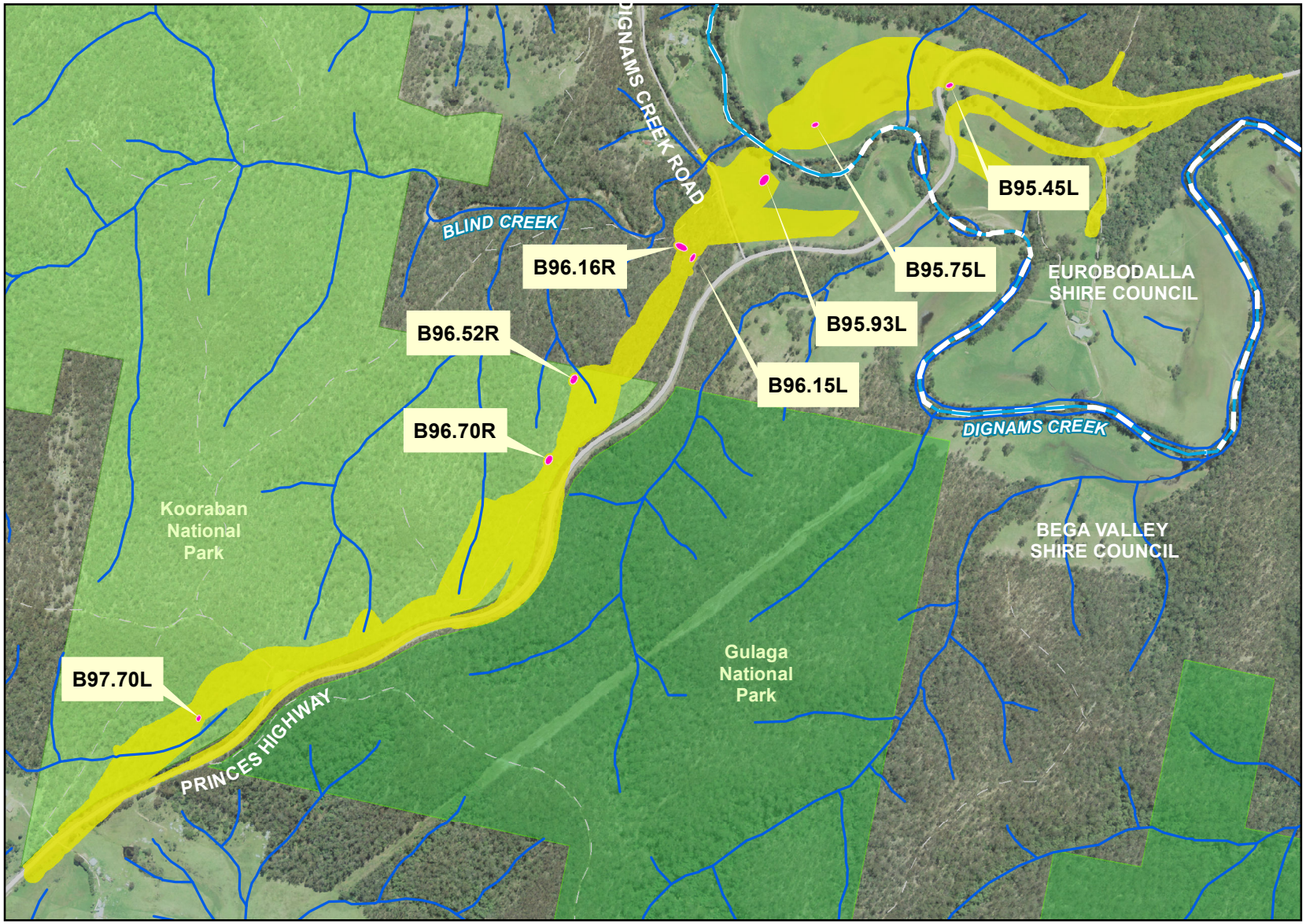

Figure 3-11 | Proposed operational water quality controls

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Newcastle Spatial Team - Prepared by : KM
Checked by : JC

Table 3-5 Operational water quality requirements and basin sizes

Location	Sensitive receiving environment	Water quality control type	Base area (m2)	Volume (m3)
B95.45L	Dignams Creek	Biofiltration basin /spill basin	50	40#
B95.75R	Dignams Creek	Wetland	73	55
B95.93L	Dignams Creek	Wetland	40	30
B96.15L	Dignams Creek	Water quality pond	120	132
B96.16R	Dignams Creek	Biofiltration basin /spill basin	35	40#
B96.52L	Dignams Creek	Biofiltration basin /spill basin	30	40#
Stage 2				
B96.70^	Kooraban National Park, Dignams Creek	Biofiltration basin /spill basin	40	40#
B97.77^	Kooraban National Park, Dignams Creek	Biofiltration basin /spill basin	80	40#

#Spill basins are designed to capture up to 20kL (or 20m3) and would have a total water volume/capacity of 40 m³.

^ Catchment values and basin volumes for Stage 2 are estimates only, as the detailed design of the pavement drainage system is being prepared by RMS has not yet been finalised

Tie in to existing roads

The start and end points of the proposal for both stages of the works include tie ins to the existing Princes Highway, refer to **Appendix A**. Tie in locations along the Princes Highway would involve the milling and re-sheeting of the flexible pavement. The length of pavement overlay required would be minimised so as to provide a smooth join with existing road surfaces at the tie in locations. A tie in to Dignams Creek Road would also be required.

Wildlife crossing structures

The proposal has a number of wildlife crossing structures, including two dedicated fauna underpasses, two combined drainage culverts/fauna underpasses and one canopy rope bridge. The new bridge over Dignams Creek at the northern end of the proposal would also provide opportunities for fauna connectivity on both sides of the creek. **Figure 1-2** shows the location of the wildlife crossing structures and **Table 3-6** provides a description of the structures to be used at each location.

Table 3-6 Wildlife crossing structure

Stage	Reference	Chainage	Type	Target species	Comment
1	A	95585	Drainage culvert/fauna underpass	Koala, Long-nosed Potoroo, Spotted-tail Quoll	Box culvert, (3 metres x 3 metres) used for drainage and fauna crossings.
1	B	95860 and 95895	Bridge	Koala, Long-nosed Potoroo, Spotted-tail Quoll	The vegetated riparian area on both sides of Dignams Creek under the bridge currently provides fauna passage. A small area of riparian vegetation (around 0.01 hectares of map unit 5) may be impacted during construction of the proposal for the temporary creek crossing. Following construction of the proposal any clearing in this area would be revegetated to ensure fauna passage is maintained. An unsealed property access track would be included on the southern side of the creek although vehicle movements are anticipated to occur infrequently and vehicles would be travelling slowly due to the tight bends and as such there would be low potential for impacts to fauna movements or for vehicle strike.
1	C	96625	Dedicated fauna underpass	Koala, Long-nosed Potoroo, Spotted-tail Quoll	Dedicated fauna crossing that would be 3 metres by 3 metres and would contain fauna furniture.
2	D	97075	Dedicated fauna underpass	Koala, Long-nosed Potoroo, Spotted-tail Quoll	Dedicated fauna crossing that would be 2.4 metres by 2.4 metres and would contain fauna furniture.
2	E	97700	Canopy rope bridge	Yellow-bellied Glider, Squirrel Glider	A rope canopy bridge that is designed for glider use to be located within the National Parks adjacent to the Yellow bellied Glider habitat.
2	F	97910 - 97890	Drainage culvert/fauna underpass	Koala, Long-nosed Potoroo, Spotted-tail Quoll	Box culvert (2.4 m x 2.4 m) to be used for drainage and fauna crossings.

Stage 1 of the proposal includes one dedicated fauna underpass which contains fauna furniture and one drainage culvert/fauna underpass. Stage 2 of the proposal includes one dedicated fauna underpass which contains fauna furniture and one drainage culvert/fauna underpass and one rope canopy bridge. Fauna fencing is proposed in all areas of bushland and national park in the southern part of the proposal along the alignments for stage 1 and stage 2. Fauna fencing is not required at the tops of cut batters. Fauna fencing is intended to guide fauna towards the wildlife crossing structures and prevent fauna accessing the road.

The dedicated underpasses would be designed to a minimum dimension of 2.4 x 2.4 metres as per the recommendations of the RMS (2010) *Wildlife Connectivity Guidelines* and where fill heights allow would be 3 metres by 3 metres as requested by OEH (refer to Section 5.4). The location of the crossing structures has taken into consideration the presence of sensitive vegetation, habitat trees and proximity of identified threatened species.

Urban and landscape design

An *Urban Design, Landscape Character and Visual Impact Assessment* (refer to **Appendix C**) was prepared to address the urban design objectives and principles as outlined in **Section 6.3**. The urban design report and the landscape plan takes into consideration the four character zones identified for the proposal (described in **Section 6.3**).

The following design considerations were used in the development of the urban design requirements for the proposal:

- The rural / agricultural character of Dignams Creek should be highly valued.
- Views to the rural landscape should be preserved in the Dignams Creek valley.
- The way vegetated steeper slopes tend to provide a dark backdrop to views from within the lighter coloured valley surfaces should be considered.
- In cuttings, batter slopes should consider the highly weathered sandstones / siltstones.
- New drainage facilities should use natural drainage patterns across the landscape wherever possible. Natural systems should be protected with water quality facilities.
- Existing vegetation communities should inform plant species lists for the proposal.
- Bushland reconstruction techniques should be used in off-line and densely vegetated sections of the proposal eg forested slopes.
- Aboriginal and non-Aboriginal cultural sites should be maintained wherever possible. Remnant rural structures and vistas should be maintained wherever possible.
- The combination of the natural and cultural scenic qualities with local heritage values should be considered during design development.

Private access tracks

Two access roads would be relocated and placed in positions with better sight distances for turning traffic. During operation the private property access road into number 9526 Princes Highway would utilise the old Princes Highway alignment prior to been tied to the proposal. The private property access road into number 9523 Princes Highway would not have direct access to the proposed Princes Highway realignment proposal as access would be via Dignams Creek Road (refer to **Figure 2-13**).

A description of the private access tracks to be constructed as part of the proposal is included in **Section 2.6.4**.

3.2.4 Engineering and environmental constraints

A number of engineering and environmental constraints have been identified for the proposal. These include, but are not necessarily limited to:

- Site topography including steep winding ridge lines.
- Inconsistency of the geometry between the proposal and the adjacent road links makes tying in difficult.
- Location upstream from Wallaga Lake (part of the Dignams Creek Sanctuary Zone (Batemans Marine Park).
- Location between two National Parks.
- Low traffic volumes.
- Proximity to privately owned land.
- Proximity of existing utility services within and around the proposal.
- Crossing of Dignams Creek
- Proximity to sensitive noise receivers.
- Presence of non-Aboriginal cultural heritage items.
- Presence of Aboriginal cultural heritage items.
- Presence of Threatened Ecological Communities.
- Presence of threatened flora and fauna.

3.3 Construction activities

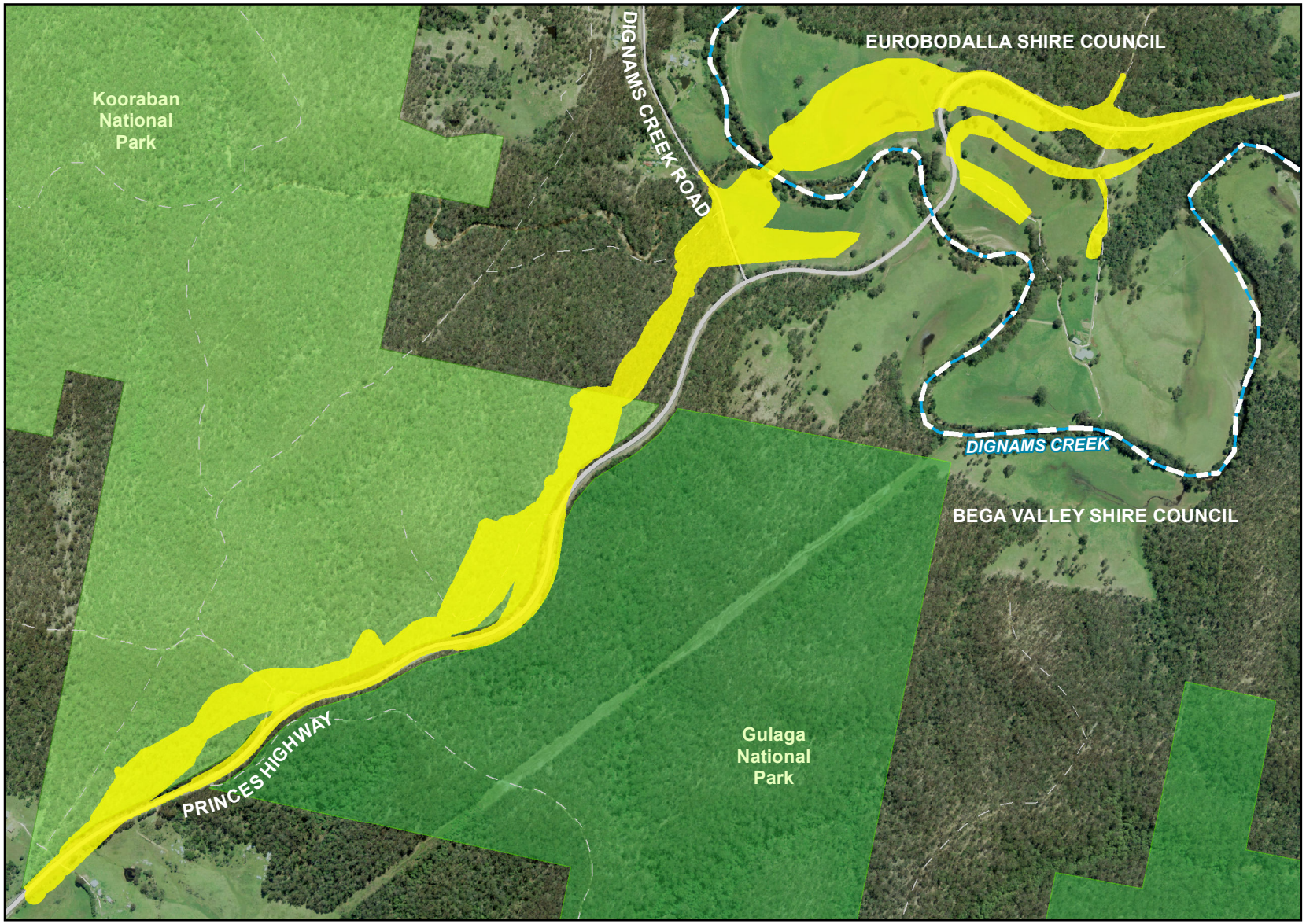
The construction footprint is defined as the area that would be directly impacted by the proposal, and comprises the design footprint and the associated ancillary facilities. The construction footprint is illustrated in **Figure 3-12.**

3.3.1 Work methodology

The work methodology for the proposal would be refined during the detailed design phase. Construction activities would be guided by a Construction Environmental Management Plan (CEMP) that would be developed in accordance with the requirements of the *RMS QA Specification G36 Environmental Protection (Management System)*. Work would be located within the works area specified within the CEMP and completed to incorporate all safeguards as described in this REF, the Submissions Report for the REF completed following display of the REF and any other relevant RMS environmental specifications. The proposal would involve the following general work methodology:

- Seed collection of local species pre-construction.
- Identification and marking of sensitive areas as identified in the REF and the relevant Construction Environmental Management Plan.
- Establishment of permanent and temporary fencing.
- Progressive installation of temporary erosion, sedimentation and drainage controls.
- Establishment of ancillary facilities such as construction access tracks, compound sites and stockpile areas.
- Installation of temporary traffic signals and controls.
- Marking of trees that require clearing.
- Clearing and grubbing of vegetation.

Upgrade of the Princes Highway, Dignams Creek



LEGEND

- Construction footprint
- Dignams Creek and LGA boundary
- Major road
- Local road
- Track

National Parks

- Gulaga National Park
- Kooraban National Park

DATA SOURCES
LPMA 2010
SKM 2011

0 400
Metres

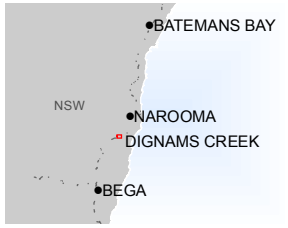


Figure 3-12 | Construction footprint

NSW GOVERNMENT Transport Roads & Traffic Authority

SINCLAIR KNIGHT MERZ SKM

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Newcastle Spatial Team - Prepared by : AL
Checked by : JC

- Stripping, stockpiling and management of topsoil.
- Removal and stockpiling of unsuitable material.
- Adjustment of utilities. If not completed during early works, adjustments would be staged during construction as required.
- Preparation for earthworks including piling of foundations etc.
- Recycling of suitable excavated material and incorporation of unsuitable material in earthworks.
- Transportation and placement of cut and fill material as compacted fill.
- Importation of gravel materials.
- Construction of bridge foundations and culverts.
- Preparation surfaces including earthworks and blasting (if required).
- Installation of cross drainage.
- Installation of retaining walls.
- Installation of pavement drainage and pits.
- Preparation of sub-grade and undertaking pavement works.
- Rehabilitation of topsoil and revegetation.
- Decommissioning of ancillary facilities and rehabilitation as required (eg compound sites, temporary stockpiles and sedimentation basins, access tracks etc).
- Progressive landscaping and re-vegetation of the proposal site.
- Installation of line marking, signs and guide posts.
- Site clean-up and removal of all surplus waste materials.

Construction sedimentation basins

Construction sedimentation basins would be required during construction to control sediment laden stormwater runoff. Construction sediment basins would collect water from disturbed areas to minimise the sediment discharge into surrounding areas. The *Erosion and Sedimentation Management Report* (SCS 2012) (refer to **Appendix F**) identified potential locations for up to 15 construction sediment basins. The design criteria for the construction sedimentation basins, including proposed location and sizing requirements, were based on the guidelines and procedures set out in *Managing Urban Stormwater: Soils and Construction – Volumes 1 and 2D* (Landcom 2004; DECC 2008), and the design aimed at meeting the performance objectives and requirements specified in these documents.

The locations of the proposed temporary sediment basins are shown on the figures in **Appendix F**. **Table 3-7** provides the basin identification, size and volume for stages 1 and 2 of the proposal. The final location, number and size of construction sediment basins would be confirmed during the detailed design phase. Should the location of these be outside the construction footprint (refer to **Figure 3-12**) assessed in this REF, further environmental impact assessment would be required.

Table 3-7 Construction basins

Basin ID	Northbound / Southbound	Area (ha)	Approximate volume (m^3)	Chainage
Stage 1				
1 (same location as operational water quality control B95.45L)	S	0.18	619	95380

Basin ID	Northbound / Southbound	Area (ha)	Approximate volume (m^3)	Chainage
2	S	0.09	300	95530
3	N	0.09	300	95540
4	S	0.03	130	95840
5 (same location as operational water quality control B95.93L)	S	0.17	663	95920
6 (same location as operational water quality control B96.45L)	S	0.10	400	96170
7 (same location as operational water quality control B96.16R)	N	0.05	190	96220
8 (same location as B96.52R	N	0.13	536	965200
Stage 2				
9 (same location as operational water quality control B96.70R)	N	0.1	400	96720
10	N	0.08	300	97080
11	N	0.01	50	97430
12	S	0.03	120	97590
13 (same location as operational water quality control B97.70L)	S	0.03	120	97700
14 (same location operational water quality control as B97.77)	S	0.03	125	97780
15	N	0.04	125	97850

At the completion of construction, the construction sedimentation basins would be decommissioned. This would involve:

- Removal of basin infrastructure.
- Treating the water before discharging.
- The basin area being filled in with appropriate fill material.
- Contouring and rehabilitating the disturbed area as prescribed in the landscape plan and rehabilitation plan.

Any access tracks that have been modified as part of the proposal would also be rehabilitated.

Embankments/cuttings

The following general methodology would be used to construct embankments:

- Stripping of top soil and organic material where embankments would be located.
- Placement of suitable general fill material including installation of retaining wall as required.
- Placement of select fill material.
- Placement of road pavement and drainage.

The following general methodology would be used to construct cuttings:

- Stripping of top soil and organic material where cuttings would be located.
- Excavation of the cut. The method of cut (rip, blast or cut) to be determined by geotechnical material classification.

Retaining walls

The anticipated construction methodology for the retaining walls would include:

- Pre-clearance survey to demarcate any sensitive areas.
- Provision of access tracks for importing materials.
- Removal of topsoil and unsuitable material.
- Installation of temporary shoring.
- Relocation of affected utility services.
- Removal of existing embankment and benching.
- Placement of bedding material.
- Extension / installation of cross drainage culverts.
- Installation of retaining wall structure and backfilling as required.
- Earthworks and installation of subsoil drainage.
- Preparation of subgrade and undertaking pavement works.
- Installation of utility services and pavement drainage.

Bridge works / works within waterways

Works within waterways would be limited to the construction works associated with the new bridge. There would be no piers within the water way for the proposed new bridge, but there would be two piers constructed at the top of the river bank, refer to **Figure 3-6** and **Figure 3-7**.

The following construction methodology is anticipated to be followed for the new bridge over Dignams Creek bridge:

- Pre-clearance survey to demarcate any sensitive areas.
- Installation of temporary barriers and fences as required to delineate the construction site.
- Installation of appropriate erosion and sediment control measures.
- Installation of piling work pads adjacent to Dignams Creek.
- Installation of crane set up pads adjacent to Dignams Creek.
- Construction of piles at abutments and piers.
- Construction of reinforced concrete abutments, column extensions and pier headstocks.

- Installation of super-T girders and construct reinforced concrete deck including end diaphragms.
- Placement of barriers and complete in-situ stitch pour.
- Construction of reinforced concrete approach slabs.
- Installation of expansion joints and steel traffic barrier railing.
- Installation of waterproof membrane and asphalt.
- Removal of piling and crane pads.
- Landscaping and re-vegetation.

Although bridge works would be undertaken from the banks where feasible, a temporary creek crossing possibly comprised of a suitably sized pipe culvert with geotextile encased clean rock fill may also be required. Construction of this temporary crossing would be undertaken in accordance with the requirements of NSW Department of Primary Industries (Fisheries) and a permit to block fish passage would be required. Any temporary bridge crossing, if required, would be designed as a fish friendly passage. The exact location of this crossing would be defined in detailed design however it would be located within 10 metres of the new bridge over Dignams Creek, refer to **Figure 1-2** and **Figure 3-7**.

Construction access tracks

During Stage 1 works a construction track may be constructed to the east of the existing alignment to access the compound site and stockpile sites. Further details of the construction track in this location are included in **Section 2.6.3**. Vegetation would be removed as part of this works including around 0.19 hectares of vegetation map unit 2 and 0.06 hectares of map unit 5. For a description of vegetation map units, refer to **Table 6-2** in **Section 6.1**.

The northern section of the existing Princes Highway would also be used as a construction access track during the Stage 1 works. No vegetation would be removed. All other access tracks used during construction would be located within the construction footprint (refer to **Figure 3-12**) and would be confirmed as part of the detailed design.

Construction of access tracks would involve placement of a layer of clean fill to create a stabilised surface and installation of appropriate sediment and erosion controls. Construction access tracks would be watered during dry periods to limit dust generation. All access tracks would be located away from environmentally sensitive areas within the construction footprint where possible.

3.3.2 Staging

The proposal would be undertaken in two distinct stages:

- Stage 1 – Includes realignment of the existing Princes Highway commencing from the start of the proposal and extending to about 600 metres south of the existing Dignams Creek Road intersection. The realignment then ties back into the existing Princes Highway. Road safety treatments would then be provided from the tie in point of the realignment and the existing Princes Highway and extending 1.4 kilometres to the end of the proposal.
- Stage 2 – Commences 600 metres south of the Dignams Creek Road intersection and extending 1.5 kilometres to the southern end of the proposal.

The general work methodology provided in **Section 3.3.1** would be used for the construction of the proposal. The following provides an overview of the main components that would be constructed in each stage:

- Stage 1: This stage would include the:
  - Establishment of the construction compound and stockpile areas.
  - Adjustment of utilities.
  - Installation of temporary traffic signals and controls.
  - Progressive installation of temporary erosion, sedimentation and drainage controls.
  - Development of the two private access tracks near the start of the proposal as described in **Section 2.6.4**.
  - Possible construction of the construction access track as described in **Section 2.6.3** at the start of the proposal. Part of the northern section of this access track would be decommissioned following the construction of Stage 2 and the remaining section would be used as part of the private property access track for 9523 Princes Highway.
  - Construction of the proposed new alignment generally on the western side of the existing Princes Highway, installation of retaining walls and permanent spill basins.
  - Construction of the new Dignams Creek Bridge and cross drainage structures.
  - Tie in with the northern section of the Princes Highway at the start of the proposal.
  - Relocation of the Dignams Creek Road and Princes Highway intersection and realignment of 200 metres of Dignams Creek Road.
  - Tie in the realignment works to the existing Princes Highway about 600 metres south of Dignams Creek Road at about chainage 96750. From this point road safety treatment works would be provided for 1.4 kilometres and would almost at the end of the proposal. The road safety works would include widening road shoulders, improving sight distances via the removal of vegetation and the elimination of tight curves and providing a painted median to separate traffic.
  - Provision of one dedicated fauna underpass containing fauna furniture and one combined drainage culvert/fauna underpass.
  - Following completion of the Stage 1 works, removal, rehabilitation and revegetation of the redundant sections of the Princes Highway.
  - Progressive decommissioning of the temporary construction sedimentation basins.
  - Removal of temporary traffic signals and controls.
  - Direction of traffic onto the new Stage 1 alignment.

- Stage 2: This stage would include the:
  - Adjustment of utilities.
  - Installation of temporary traffic signals and controls.
  - Progressive installation of temporary erosion, sedimentation and drainage controls.
  - Construction of the proposed new alignment on the western side of the existing Princes Highway including tie in with Stage 1 at about chainage 96600, and permanent spill basins as required.
  - Upgrade of the two property accesses at the southern end of the proposal as described in **Section 2.6.4**.
  - Tie in with the existing Princes Highway at the end of the proposal.

- Progressive decommissioning of the temporary construction sedimentation basins.
- Following completion of the Stage 2 works, removal, rehabilitation and revegetation of the redundant sections of the Princes Highway.
- Decommissioning of the construction access track near the start of the proposal.
- Decommissioning of the construction compound and stockpile areas.
- Removal of temporary traffic signals and controls.
- Direction of traffic onto the new Stage 2 alignment.

The final work methodology for the proposal would be refined during the detailed design.

3.3.3 Construction hours and duration

It is anticipated that construction of Stage 1 of the proposal would take about 18 to 24 months. The construction start date would be confirmed following the completion of the detailed design and the allocation of funding by the State Government. As the proposal would largely be constructed offline, the bulk of the construction works for the proposal would be undertaken during standard working hours which are based on the *Interim Construction Noise Guidelines* (ICNG) and are as follows:

- Monday to Friday: 7:00am to 6:00pm.
- Saturday: 8:00am to 1:00pm.
- Sundays and public holidays: no work.

Where practical, the removal and delivery of materials and plant would be timed to occur outside of peak traffic periods to minimise delays. However, traffic control measures would be used to manage general earthworks and the import and export of material. The construction period and timing of stage 2 of the proposal would be defined during the detailed design for that stage.

Construction outside of standard construction hours

Work would be conducted during normal construction hours; however extended working hours may be required from time to time. Typical out of hour's works may include:

- Adjustment/protection/relocation of existing utilities and installation of proposed utilities.
- Construction of the proposed bridge.
- Delivery of oversized components of plant and large construction equipment.
- Road tie-in works with the existing Princes Highway.
- Pavement line marking where the proposal ties in with the existing Princes Highway.
- Commissioning and decommissioning of barriers for the different construction stages.

Out of hours work could potentially be required during any of the construction stages. Wherever possible the noisier activities would be undertaken during the earlier evening hours of night time periods (ie prior to 10:00pm). The procedures contained in the *Environmental Noise Management Manual* (RTA 2001)*, "Practice Note vii – Roadwork's Outside of Normal Working Hours": The Interim Construction Noise Guidelines* (DECCW 2010) and the safeguards contained in this REF would be

followed for work outside of the standard working hours. This would include notifying the local community of any works planned to be undertaken outside standard construction hours and would ensure the provision of appropriate respite periods. Consultation would occur as part of the public display of this REF with potentially affected members of the community, as detailed in **Section 5.6**. The *Noise and Vibration Assessment* for this proposal is summarised in **Section 6-2** and provided in **Appendix G**.

3.3.4 Plant and equipment

Typical plant and equipment likely to be used during construction are listed in **Table 3-8**. Plant and equipment requirements would be refined during the construction planning phase by the construction contractor.

Table 3-8 Construction plant and equipment

Construction phase	Plant and equipment
General	• Crane • Excavator • Bobcat • Road sweeper • Water cart • Haulage trucks • Fuel cart • Semi-trailers and large delivery truck • Various small tools and equipment, including chainsaw • Water pump • Hand tool • Light commercial and passenger vehicles
Road embankment and drainage construction	• Piling equipment • Truck and trailer • Semi-trailer • Excavator • Pad foot and smooth drum roller • Compactor • Hand compactor (various) • Grader • Scraper • Bulldozer • Dump truck • Loader • Backhoe • Rock breaker • Rock crusher • Trenching machine • Mulch blower • Hydro mulch truck (if required)

Construction phase	Plant and equipment
Road pavement construction	• Milling machine • Grader • Smooth drum roller • Bitumen sprayer • Asphalt paver • Asphalt roller • Truck and dog • Kerb extrusion machine (if required) • Line marking machine • Line Remover
Structures including bridges and culverts	• Piling rig • Jack hammers/air compressor • Crane (including Franna) • Boom lift • Concrete pump • Concrete agitator truck • Excavator • Truck • Small equipment

3.3.5 Earthworks

Extensive earthworks would be required for the proposal including cuttings, fill embankments and retaining walls to achieve the necessary horizontal and vertical alignments. Where fill batters have been specified, typical fill batters would be 2:1 to assist in minimising the construction footprint (refer to **Figure 3-12**). **Section 3.2.3** details the major fill location (fill areas greater than five metres high) and major cuttings (cutting areas greater than five metres deep). Estimated fill and cut quantities are outlined below in **Table 3-9**.

Table 3-9 Cut and fill volumes

Stage	Cut (m^3)	Fill (m^3)	Balance (m^3)
1	233,000	222,000	11,000 (spoil to be stockpiled)
2	213,000	230,000	17,000 (import of fill required, can use 11,000 from stage 1 and only require an additional 6,000 to be imported)

The estimated quantities of materials for import, re-use and disposal would be refined during detailed design and the development of the construction methodology by the construction contractor to balance this deficit. Fill material would be sourced from surplus materials; from the proposal, other RMS projects, wherever possible.

Surplus material that cannot be used on site would be reused or disposed of in the following order of priority:

- Transfer to other RMS projects for reuse in accordance with the EPA's excavated public road material resource recovery exemption.

- Transfer to an approved RMS stockpile site for reuse on a future project only if a specific project has been identified prior to stockpiling and *Protection of the Environment Operations Act 1997* (POEO Act) waste regulatory requirements are met. If a project cannot be identified the material would not be stockpiled.
- Transported off-site for reuse by a third party in accordance with relevant EPA resource recovery exemption or to an EPA licenced waste recovery facility.
- Disposal at an accredited materials recycling or waste disposal facility.
- As otherwise provided for by the relevant waste legislation.

Should groundwater be encountered during earthworks, it would be managed in accordance with the management measures provided in **Section 6.6**.

3.3.6 Source and quantity of materials

Materials would be imported and sourced from the region, where possible. The approximate quantities of particular materials that would be required by the proposal are identified in **Table 3-10**.

Table 3-10 Estimated material quantities

Material	Estimated quantities
Spray seal	177,289 litres
Stone aggregate	1,368 tonnes
Road base	17,157 cubic metres

Water use

Water for construction would be sourced from construction basins where possible and Dignams Creek. A water permit is not required to extract water from Dignams Creek for the proposal, refer to **Section 4.3.3**. Water would be required for activities such as the compaction of earthworks and pavement layers and dust suppression. Required quantities for water are not yet known and would be calculated during detailed design.

3.3.7 Traffic management and access

It has been anticipated that during normal working days 20 to 50 truck and up to 100 light vehicle movements per day would be required on and off site. This estimate is based on construction of the full proposal. The construction traffic volumes, scheduled arrival and departure of workers and trucks transporting materials and spoil would be reviewed during detailed design phase.

The trucks would be used for the delivery of construction material to the site, and the removal of material from the site to temporary stockpile sites or to a licensed waste facility. The number of truck movements may increase during the early phases of construction for each stage when the bulk earthworks would be carried out. Light vehicles would be used by construction personnel through the day and by construction site workers arriving at the site each working day and parking in the site compound.

Designated access routes for construction vehicles would be via the northern section of the existing Princes Highway and the construction access track. Details of all

routes used for access and haulage during construction would be developed in consultation with the relevant council.

During construction, access would be maintained for residents and through-traffic. Alternative access provisions would be undertaken in consultation with the relevant affected property owners. In the case of properties adjoining the road corridor, temporary driveways would be provided as required. Final driveway configurations would be installed as part of the pavement construction.

A Traffic Management Plan would be prepared in accordance with the RTA *Traffic Control at Work Sites Manual Version 4* (RTA 2010), and approved by RMS prior to implementation. The Traffic Management Plan would consider the safety of and potential impacts to pedestrians, cyclists, public transport and emergency services during construction. This plan would also need to consider other developments that may also be under construction close to the proposal.

3.4 Ancillary facilities

Ancillary facilities would be required throughout construction of the proposal. Refer to **Figure 1-2** for the location of the ancillary facilities. Ancillary facilities include the following:

- A main construction compound site.
- Crane set up pad areas.
- Piling pads.
- Access tracks.
- Access area.
- Construction sedimentation basins.
- Stockpile sites.
- Temporary bridge crossing over Dignams Creek.

A description of each ancillary facility, where it would be located, how much vegetation removal would be required, access requirements, types of activities that would occur, hours of operation, presence of sensitive receivers and other special features is provided in **Table 3-11**.

Table 3-11 Description of ancillary facility activities

Ancillary facility	Item	Description
Main construction compound and parking area	Location and footprint	Located in the northern section of the proposal and comprises of scattered trees. The total area is 0.28 hectares. Refer to **Figure 1-2**.
	Vegetation removal	No native vegetation would require removal, although around 0.25 hectares areas of non-native vegetation (ie cleared paddocks) may be impacted.
	Access requirements	Access would be via the Princes Highway, Dignams Creek Road and the construction access track (refer to **Section 2.6.3**). The private access track for property 9523 Princes Highway (refer to **Section 2.6.4**) may also be used as construction access track by RMS during the stage 1 works as they are the

Ancillary facility	Item	Description
		property owners of this track.
	Activities	May use an existing homestead for the site facilities. Site would include portable buildings with amenities (such as lunch rooms and toilets), office space for on-site personnel and associated parking.
	Hours of operation	Generally would operate during standard working hours (7:00am to 6:00pm), however there would be limited periods when night works would occur (6:00pm to 7:00am).
	Location of sensitive receivers	Sensitive receivers are located about 1,000 metres from the proposed compound site.
	Stage of construction	Would be accessed throughout all stages of construction.
	Other special features	Not applicable.
Stockpile, material lay down site and potential borrow site.	Location and footprint	One location has been identified for a stockpile site and potential borrow site and another site has been identified as a stockpile site only. The stockpile/potential borrow site is located between the existing Princes Highway, the proposed realignment, Dignams Creek and Dignams Creek Road. The total area of the site would be about 250 metres by 60 metres and would be irregular in shape. The other stockpile site is located east of the existing Princes Highway and north of the existing bridge. The total area of the site would be about 160 metres by 60 metres and would be irregular in shape, refer to **Figure 1-2**.
	Vegetation removal	Around 0.18 hectares of vegetation map unit 2 would require removal, refer to **Section 6.1**. Around 3.25 hectares of non-native vegetation (ie cleared paddocks) would also be impacted.
	Access requirements	Access would be via the Princes Highway, Dignams Creek Road and the construction access track (refer to **Section 2.6.3**). The private access track for property 9523 Princes Highway (refer to **Section 2.6.4**) may also be used as construction access track by RMS during the stage 1 works as they are the property owners of this track.
	Activities	Site would include secure and bunded storage areas for hazardous site materials, including fuel and chemicals, and hard stand areas for material stockpiling and lay down areas. Areas of potential borrow material would be

Ancillary facility	Item	Description
		excavated if necessary.
	Hours of operation	Generally, operation would occur during standard working hours (7:00am to 6:00 pm), however there would be limited periods when night works would occur (6:00 pm to 7:00am).
	Location of sensitive receivers	Sensitive receivers are located about 250 metres from the stockpile site.
	Stage of construction	Would be accessed throughout all stages of construction.
	Other special features	Not applicable.
Crane set up pad areas	Location and footprint	There would be a number of crane or pile driving rig pads used during construction. These would be located adjacent to the bridge, piers and abutments in cleared areas adjacent to Dignams Creek on the floodplain but would avoid the river bank and the creek itself. The area of each site would be around 10 metres by 15 metres.
	Vegetation removal	About 0.2 hectares of non-native vegetation (ie cleared paddocks) would potentially be removed/impacted. Refer to **Section 6.1**.
	Access requirements	Access would be via the Princes Highway, Dignams Creek Road and the construction access track (refer to **Section 2.6.3**). The private access track for property 9523 Princes Highway (refer to **Section 2.6.4**) may also be used as construction access track by RMS during the stage 1 works as they are the property owners of this track.
	Activities	Consist of hard stand areas for bridge construction works associated with the proposed Dignams Creek bridge.
	Hours of operation	The crane pads would be constructed during standard construction hours however operation of the pad sites may require night time works.
	Location of sensitive receivers	Sensitive receivers are located about 215 metres to the west.
	Stage of construction	Would only be required during stage 1 works for construction of the new bridge.
	Other special features	Access would be via the existing Princes Highway on the north side of Dignams Creek and on the southern side of the creek would use Dignams Creek Road and the new access

Ancillary facility	Item	Description
		track for 9523 Princes Highway.
Access track	Location and footprint	The main access track to the construction footprint would be via the existing Princes Highway. All other access tracks would be located within the construction footprint as shown in **Figure 3-12**.
	Vegetation removal	Around 0.19 hectares of map unit 2 and 0.06 hectares of map unit 5 (TEC) would be removed for the access tracks.
	Access requirements	Via the Princes Highway southbound carriageway.
	Activities	Access to the construction footprint.
	Hours of operation	Generally would operate during standard working hours (7:00am to 6:00pm), however there would be limited periods when night works would occur (6:00pm to 7:00am).
	Location of sensitive receivers	Sensitive receivers are located about 670 metres to the west.
	Stage of construction	All stages of construction.
	Other special features	Uses the existing Princes Highway
Temporary creek crossing.	Location and footprint	One temporary creek crossing is proposed for use during construction. The exact area is yet to be determined but most likely be within 10 metres of the new bridge over Dignams Creek, refer to **Figure 1-2**.
	Vegetation removal	Around 0.01 hectares of map unit 5 which is the TEC would be removed for the temporary creek crossing.
	Access requirements	Via the Princes Highway southbound carriageway.
	Activities	Access to the construction footprint.
	Hours of operation	Generally would operate during standard working hours (7:00am to 6:00pm), however there would be limited periods when night works would occur (6:00pm to 7:00am).
	Location of sensitive receivers	Sensitive receivers are located about 200 metres to the west.
	Stage of construction	All stages of construction.

Ancillary facility	Item	Description
	Other special features	Uses the existing Princes Highway.
Retaining wall access area	Location and footprint	Four retaining walls would be required to support the road embankments at the southern end of the proposal along the Stage 1 upgrade and include: • Wall 1 - Dignams Creek road intersection between chainage 96050 to chainage 96140 with a length of about 90 metres and maximum height of about 13 metres. • Wall 2 - Tie in at south end of Stage 1 on the eastern side of the proposal between chainage 96780 to chainage 96930 with a length of about 150 and maximum height of about 3.5 metres. • Wall 3 – Southern end of Stage 1 works on the western side of the proposal between chainage 97070 and chainage 97180 with a length about 110 metres and maximum height of about 2.5 metres. • Wall 4 – Southern end of Stage 1 works on the western side of the proposal between chainage 97295 to chainage 97495 with a length of about 200 metres and a maximum height of about 2.5 metres.
	Vegetation removal	About 0.02 hectares of map unit 1 and 0.11 hectares of map unit 2 would be removed for the retaining walls, refer to **Section 6.1**. The rest of the retaining walls are located in areas already cleared as part of the road corridor.
	Access requirements	Access would be via the existing Princes Highway.
	Activities	Consist of a hard stand area to allow access for retaining wall construction
	Hours of operation	Generally, operation would occur during standard working hours (7:00am to 6:00pm), however there would be limited periods when night works would occur (6:00pm to 7:00am). Would include piling works.
	Location of sensitive receivers	The nearest sensitive receivers are located about 180 metres to Wall 1.
	Stage of construction	Stage 1 (no new retaining walls required for stage 2)
	Other special features	Not applicable

Ancillary facility	Item	Description
Construction sedimentation basins	Location and footprint	Fifteen sedimentation basins would be required during construction (refer to **Section 3.3.1** and **Figure 3-11**. Basins would be removed and rehabilitated throughout the various stages and/or at the end of construction with the exception of those that would be retained as operational water quality basins.
	Vegetation removal	Around 0.20 hectares of map unit 1, 0.31 hectares of map unit 2 and 0.41 hectares of map unit 3 and 0.83 hectares of non-native vegetation (ie cleared paddocks) would be cleared for all sediment basins. Location and size of basins would be reviewed in the detailed design phase.
	Access requirements	Access would be via the Princes Highway, Dignams Creek Road and the construction access track (refer to **Section 2.6.3**). The private access track for property 9523 Princes Highway (refer to **Section 2.6.4**) may also be used as construction access track by RMS during the stage 1 works as they are the property owners of this track.
	Activities	Required for sedimentation control during construction.
	Hours of operation	Not applicable.
	Location of sensitive receivers	Sensitive receivers locations range between 275 to 1,400 metres from basins (refer to **Figure 3-11)**.
	Stage of construction	All stages
	Other special features	Not applicable.

Smaller stockpile and storage areas would be required along the length of the proposal. It is envisaged that the smaller stockpile and storage areas would be located within the construction footprint. If these are to be located outside the construction footprint, additional assessment would be required.

No long term stockpile areas have been included as part of the proposal. The location of the temporary stockpile and storage areas within the main construction compound area and construction footprint would be subject to the site location criteria set out in the *Stockpile Site Management Procedure* (RTA 2011) and *QA specification R44-Earthworks - IC-QA-R44* (RMS 2011). In addition, the locations for stockpile and storage areas would be selected using the following guidelines:

- Located in areas not prone to flash flooding (ie above the 9 metre contour interval) and more than 40 metres from a watercourse.
- Located in areas more than 50 metres from residential dwellings.
- Located in previously disturbed areas and that do not require the clearing of native vegetation where possible.
- Located in plain view of the public to deter theft and illegal dumping.
- Located outside the drip line of trees and on level ground wherever possible.

Piling rig hard stands would also be required adjacent to the proposed bridge. The location of these hard stands would be defined in consultation with the RMS Regional Environmental Officer, prior to any works being undertaken, to identify if any additional environmental assessment would be required.

The location of the compound, storage, access, pads, hard stands, stockpile areas and borrow site would be reviewed during detail design. Once the preferred locations for compound, stockpile, storage, pad, hard stand and access areas has been confirmed, consultation with the RMS Regional Environmental Officer would be undertaken prior to any works being undertaken, to identify if any additional environmental assessment would be required.

Liquid and solid waste would be removed by tanker or truck and disposed of off-site at a suitably licensed facility able to accept those wastes for storage, reuse or disposal. Fuel and chemical storage areas would be bunded and protected in accordance with the specifications set out by OEH and WorkCover.

Each site would be securely fenced with temporary fencing. All necessary signage advising the general public of access restrictions would be provided. Upon completion of the construction works, the temporary construction compound sites and work areas would be removed, the sites would be cleared of all rubbish/construction materials and rehabilitated.

3.5 Public utility adjustment

Consultation with the public utility authorities has been undertaken 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. **Chapter 5** provides a summary of the consultation undertaken for the proposal.

Preliminary investigations indicated that telecommunications and overhead electrical transmission lines would require relocation or adjustment as part of the proposal. Adjoining roads have been accounted for in the utilities design and connection into the existing utilities on the adjoining roads would be undertaken. If necessary, adjoining road utilities would be adjusted where the adjoining road alignment has changed to allow for connection with the existing utilities.

The relocation of utilities would be undertaken in consultation with the relevant utility authorities during the detailed design phase. Where possible, utility relocations would be undertaken as part of the stage 1 works. This would enable relocations prior to construction activities commencing. Should relocation of utilities be necessary outside of the construction footprint, consultation with RMS's Regional Environmental Officer would be undertaken to confirm if additional environmental impact assessment would be required.

The following utilities have been identified within the construction footprint:

Telecommunications

The proposal would impact on existing telecommunications cables in the northern and southern ends of the proposal and in the area to the west of the existing Dignams Creek Bridge underneath Dignams Creek Road. Telecommunication lines affected by the proposal are operated by Telstra and are all identified in Dial Before you Dig data as direct buried Telstra Mains (Class B). Details of the affected telecommunication lines are shown in **Figure 3-13**. The exact location of the relocated telecommunication lines would be defined in detailed design.

Electrical transmission lines

The proposal would impact on one overhead electrical transmission line that crosses the existing Princes Highway around 165 metres north of the existing Dignams Creek Bridge which would require relocation. The electrical transmission line is operated by Essential Energy and consists of an 11 kilovolt (kV) overhead line that connects the Dignams Creek community with the main Bega to Cobargo transmission line which is a 33 kV line. Details of the impacted electrical transmission lines are shown in **Figure 3-13**. It is anticipated that the line to the west of the existing Princes Highway when relocated would incorporate a dog leg into the new transmission line alignment in order to provide a vegetated view down the cleared corridor for residents located at 66 Dignams Creek Road. The exact location of the relocated transmission line would be defined in detailed design.

3.6 Property acquisition

Indicative property acquisition locations and areas are shown in **Figure 3-14** and outlined in **Table 3-12**. Acquisition areas would be finalised through further discussion with land owners and specific details would be refined and finalised during the detailed design phase.

Table 3-12 Proposed property acquisition

Lot and DP	Acquisition type	Current status	Acquisition area (m^2)
DP752154 Lot 262	Full	Acquired	244,361
DP752154 Lot 78	Full	Acquired	150,078
DP752154 Lot 93	Full	Acquired	154,177
DP752155 Lot 246	Full	Acquired	166,834
DP752155 Lot 497	Full	Acquired	1943
DP752155 Lot 498	Full	Acquired	3063
DP752155 Lot 506	Full	Acquired	26,942
DP752155 Lot 57	Full	Acquired	121,674
DP1069205 Lot 7027	Partial (or full)	Proposed	~230 (3520)
DP836045 Lot 11	Partial	Proposed	~12,700

All land acquisitions and leasing would be conducted in accordance with the RMS Land Acquisition Policy and compensation would be based on the requirements of

the *Land Acquisition (Just Terms) Compensation Act 1991*. The potential impacts associated with property acquisition have been detailed in **Section 6.9**. The following provides a summary of the impacts to private and public property.

Private

One partial property acquisitions would be required on private property as part of the proposal. The directly affected property owner has been contacted as part of the development phase of the proposal, and they have provided comments on the potential impacts to their property.

During construction the proposal would result in temporary changes to around four property access arrangements. Temporary access to private properties would be provided during construction, and would be agreed in consultation with the affected land owners.

Public

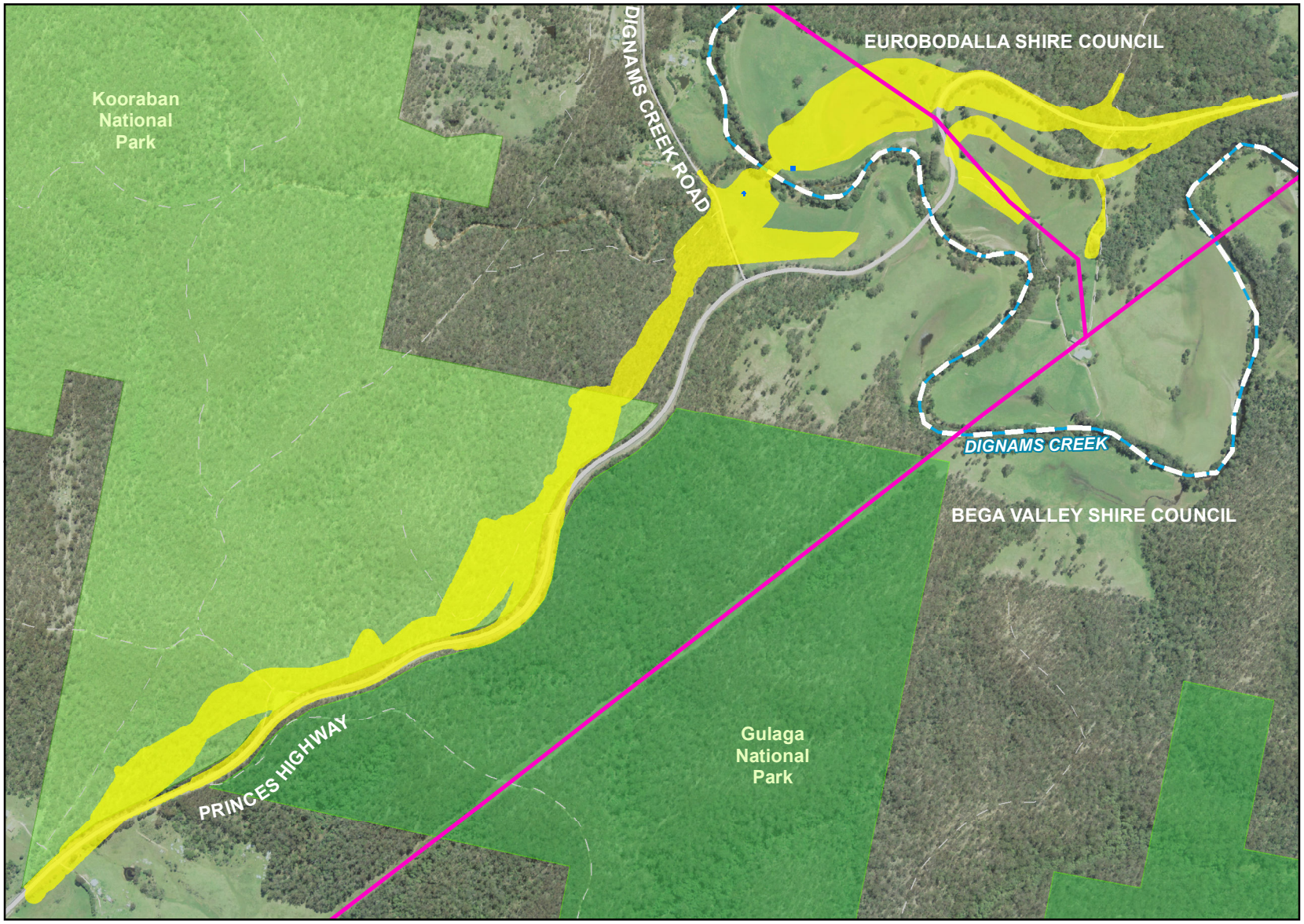
The proposal would impact directly on land previously recognised as Kooraban National Park. Under Clause 37 of the *National Parks and Wildlife Act 1974* (NP&W Act) any potential changes in boundaries of a National Park requires an Act of Parliament. Accordingly about 18.28 hectares of former Kooraban National Park land underwent revocation by the NSW Parliament, under the *National Parks and Wildlife Amendment (Adjustment of Areas) Bill 2012* for use as road reserve for the Dignams Creek proposal. The 18.28 hectares of land is currently vested in the Minister for Environment and under the management of OEH until the offset agreement is finalised between RMS and OEH. Once the offset is finalised this would be transferred to RMS.

The proposal would also impact on Lot 7027 DP1069205 which is crown land and recognised as Crown Reserve 91754. This area of crown reserve currently has an Aboriginal Land Claim (no 7761) on it and this would need to be resolved before construction commences. The proposal would impact on around 230 square metres of the overall area of this reserve which would require partial acquisition. RMS is investigating acquiring the entire property and has consulted with the Land and Property Management Authority and the NSW Aboriginal Land Council (refer to **Section 5.5**). In the event that the acquisition process could not be achieved prior to construction, a retaining wall could be built in the fill embankment to avoid impacts to the property. If necessary this wall would be designed during detailed design.

Ancillary facilities

Land required for the temporary construction compound sites, stockpile sites, temporary sedimentation basins and potential borrow site would use land already acquired by RMS. The exact location of all ancillary facilities would be confirmed during the detailed design. Upon completion of the construction works, the ancillary facilities and temporary sediment basins would be removed, and the sites cleared of all rubbish and materials and rehabilitated.

Upgrade of the Princes Highway, Dignams Creek



LEGEND

- Telstra transmission lines
- Electricity transmision lines
- Construction footprint
- Dignams Creek and LGA boundary
- Major road
- Local road
- Track

National Parks

- Gulaga National Park
- Kooraban National Park

DATA SOURCES
LPMA 2010
SKM 2011, 2013
RMS 2013

0 400
Metres

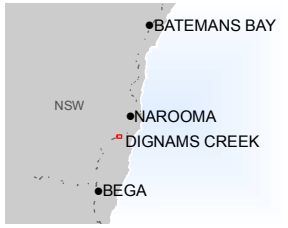


Figure 3-13 | Location of existing utilities

NSW GOVERNMENT Transport Roads & Traffic Authority

SINCLAIR KNIGHT MERZ SKM

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Checked by : JC

Upgrade of the Princes Highway, Dignams Creek

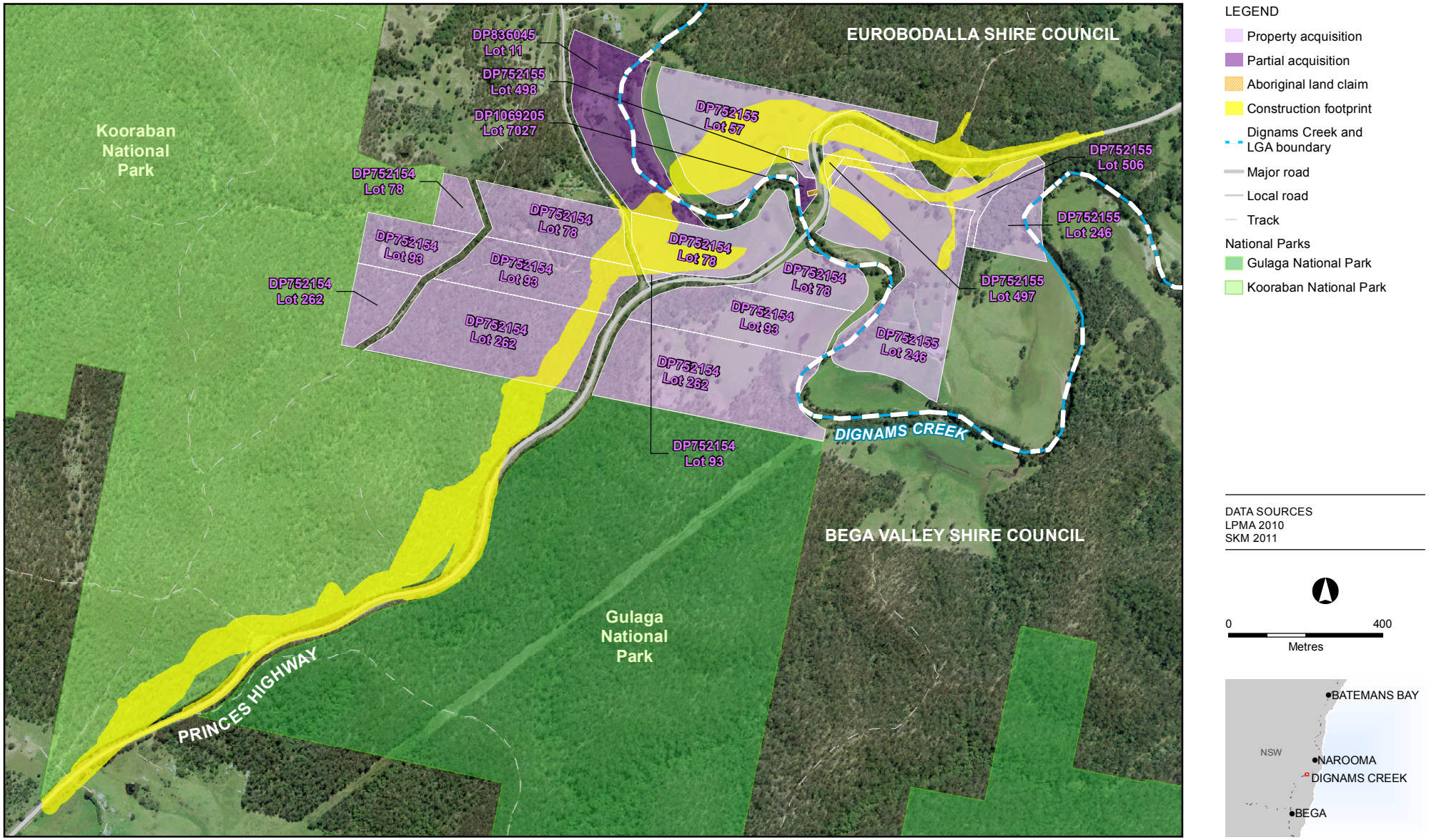

Figure 3-14 | Property acquisition

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Checked by : RV