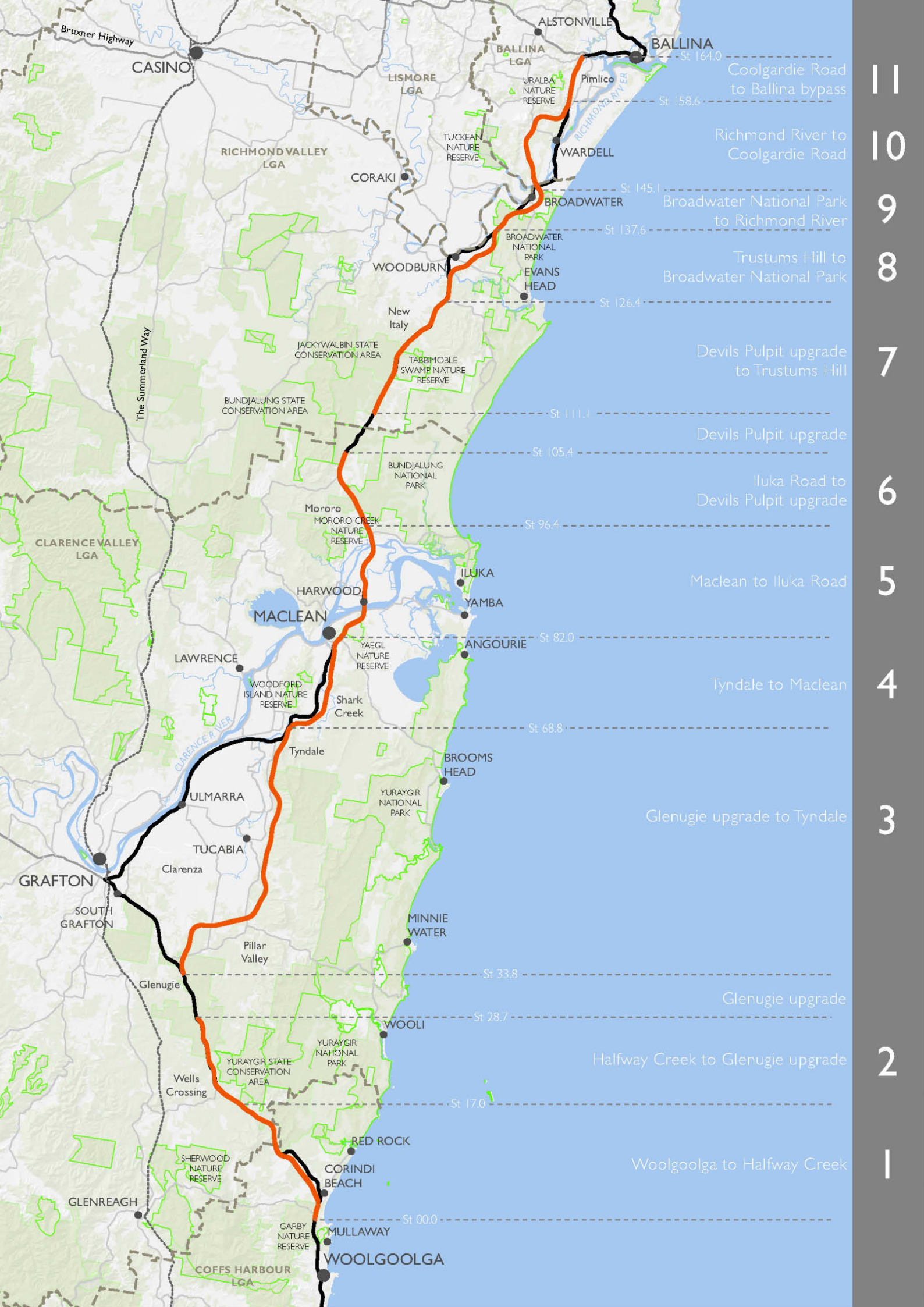


NSW Roads and Maritime Services

WOOLGOOLGA TO BALLINA | PACIFIC HIGHWAY UPGRADE SUBMISSIONS / PREFERRED INFRASTRUCTURE REPORT

Chapter 4

November 2013



Contents

4.	Preferred infrastructure report	4-1
4.1	Summary of design refinements	4-1
4.2	Scope of design refinement assessment.....	4-8
4.3	Overview of impacts on Commonwealth and State listed threatened species and communities	4-9
4.4	Main design refinements	4-10
4.5	Minor design refinements	4-239

Tables and Figures

Table 4-1	Summary of design refinements	4-1
Table 4-2	Comparison of impacts between the EIS design and design refinement at Range Road	4-16
Table 4-3:	Property impact schedule for interchange layout at Range Road (both EIS and design refinement).....	4-22
Table 4-4:	Range Road – additional mitigation	4-23
Table 4-5	Comparison of impacts at Luthers Road	4-31
Table 4-6	Fauna crossing structures in the design refinement area.....	4-32
Table 4-7:	Luthers Road overpass – construction noise assessment for design refinement .	4-33
Table 4-8	Comparison of biodiversity impacts between the EIS design and the design refinement	4-38
Table 4-9	Combined fauna crossing structures provided in the design refinement area	4-40
Table 4-10:	Property impact schedule for EIS design at Firth Heinz Road, and refined design	4-43
Table 4-11:	Firth Heinz Road – additional mitigation	4-44
Table 4-12	Comparison of impacts between the EIS design and the design refinement.....	4-50
Table 4-13:	Rest area – estimated noise emissions	4-54
Table 4-14:	Rest area – estimated noise levels at nearest dwelling.....	4-54
Table 4-15:	Property impact schedule for EIS rest area and design refinement rest area.....	4-55
Table 4-16	Impacts of the Crowley Road design refinement.....	4-59
Table 4-17:	Property impact schedule for EIS design and the design refinement at Crowleys Road	4-63
Table 4-18:	Crowleys Road – additional mitigation.....	4-63
Table 4-19:	Viewpoint 22, McIntyres Lane, Green Hill – foreground view.....	4-68
Table 4-20:	Interchange at Maclean –construction noise levels– formation, clearing and mulching	4-78
Table 4-21:	Interchange at Maclean –construction noise levels– earthworks	4-78
Table 4-22:	Interchange at Maclean – construction noise levels – asphaltting	4-78
Table 4-23:	Interchange at Maclean – construction noise levels – bridge works	4-79
Table 4-24:	Property impact schedule for interchange at Maclean	4-80

Table 4-25: Koala Drive – additional mitigation 4-87

Table 4-26: Viewpoint 34, Fischers Lane, Iluka (foreground view)..... 4-96

Table 4-27: EIS construction noise predictions for access at Carrols Lane 4-99

Table 4-28: Property impact schedule for Carrols Lane 4-100

Table 4-29 Comparison of impacts at the cutting at Mororo Road 4-104

Table 4-30: Vibration predictions (PPV) for the closest receiver to the Mororo Road cutting4-106

Table 4-31: Mororo Road – additional mitigation 4-107

Table 4-32: Lang Hill activities and associated plant 4-119

Table 4-33: Lang Hill sensitive receivers 4-120

Table 4-34: Lang Hill noise modelling results 4-122

Table 4-35: Overpressure levels 4-123

Table 4-36: Vibration levels..... 4-123

Table 4-37: Lang Hill – revised mitigation 4-124

Table 4-38 Option comparison for rest area north of the Richmond River 4-126

Table 4-39 Comparison of impacts at rest area north of the Richmond River..... 4-132

Table 4-40: Comparison of property impacts for the rest area north of Richmond River 4-134

Table 4-41: Relocated rest area – revised mitigation 4-135

Table 4-42: Activities and associated plant..... 4-140

Table 4-43: Sensitive receivers located at Bagotville borrow sites 4-141

Table 4-44: Gibsons borrow site noise modelling results 4-141

Table 4-45: Eatons borrow site noise modelling results 4-141

Table 4-46: Cumulative impact of Gibsons and Eatons borrow site operations 4-142

Table 4-47: Generic vibration impact associated with rock hammering/breaking 4-142

Table 4-48: Closest sensitive receiver overpressure prediction 4-143

Table 4-49: Closest sensitive receiver vibration prediction..... 4-143

Table 4-50: Borrow sites – additional mitigation 4-144

Table 4-51: West of Wardell sensitive receivers..... 4-149

Table 4-52: West of Wardell noise modelling results..... 4-151

Table 4-53: West of Wardell borrow site – additional mitigation..... 4-152

Table 4-54: Comparison of impacts on habitat for the Pink Underwing Moth 4-158

Table 4-55: Comparison of impacts on vegetation communities at Wardell interchange..... 4-164

Table 4-56: Comparison of impacts on threatened flora at Wardell interchange 4-164

Table 4-57: Summary of Aboriginal sites at the interchange at Wardell, survey and sub-surface testing undertaken..... 4-167

Table 4-58: Potential impacts on archaeological sites and Aboriginal cultural places from the design refinement..... 4-168

Table 4-59: Proposed hours construction noise summary – formation, clearing and mulching4-172

Table 4-60: Proposed hours construction noise summary – earthworks..... 4-172

Table 4-61: Proposed hours construction noise summary – paving and asphaltting 4-172

Table 4-62: Out-of-hours construction noise summary – formation, clearing and mulching 4-173

Table 4-63: Out-of-hours construction noise summary – earthworks	4-173
Table 4-64: Out-of-hours construction noise summary – paving and asphaltting	4-174
Table 4-65: Operational noise impact for refined design of interchange at Wardell	4-175
Table 4-66: Property impacts for interchange at Wardell – EIS design and design refinement	4-178
Table 4-67: Interchange at Wardell – additional mitigation	4-179
Table 4-68: Ancillary facility sites	4-182
Table 4-69: Minor design refinements	4-240
Figure 4-1: Location of design refinements – Sections 1 to 2	4-3
Figure 4-2: Location of design refinements – Section 3	4-4
Figure 4-3: Location of design refinements – Sections 4 to 6	4-5
Figure 4-4: Location of design refinements – Section 7 and 8	4-6
Figure 4-5: Location of design refinements – Sections 8 to 11	4-7
Figure 4-6: Overview of revised design of interchange at Range Road	4-11
Figure 4-7: Interchange at Range Road, stations 8.0 to 9.5	4-12
Figure 4-8: Interchange at Range Road, stations 9.0 to 10.5	4-13
Figure 4-9: Revised design of interchange at Range Road, showing biodiversity features ...	4-19
Figure 4-10: Revised design, Lemon Tree Road, Halfway Creek	4-25
Figure 4-11: Revised design at Luthers Road, Halfway Creek	4-30
Figure 4-12: Revised design at Firth Heinz Road	4-36
Figure 4-13: Revised design at Firth Heinz Road showing biodiversity features	4-41
Figure 4-14: Rest area at Pine brush - EIS design	4-46
Figure 4-15: Rest area at Pine brush - design refinement	4-47
Figure 4-16: EIS rest area location showing biodiversity features	4-51
Figure 4-17: Design refinement rest area location showing biodiversity features	4-52
Figure 4-18: Revised design at Crowleys Road	4-57
Figure 4-19: Design refinement at Crowleys Road showing biodiversity features	4-60
Figure 4-20: Revised design at McIntyres Lane	4-66
Figure 4-21: Revised viewpoint at McIntyres Lane (No. 22)	4-69
Figure 4-22: Revised interchange design at Maclean	4-73
Figure 4-23: Revised design to the Koala Drive access	4-83
Figure 4-24: Potential design for cycle access south of Yamba Road	4-89
Figure 4-25: Revised design at Carrols Lane	4-94
Figure 4-26: Revised viewpoint 34 at Carrols Lane	4-97
Figure 4-27: Revised design at Mororo Road	4-102
Figure 4-28: Revised design at Swan Bay New Italy Road	4-109
Figure 4-29: Revised borrow site at Lang Hill	4-115
Figure 4-30: Receiver locations in proximity to Lang Hill	4-121
Figure 4-31: Overview of rest areas north of Richmond River	4-127

Figure 4-32: Rest area north of Richmond River- northbound rest area 4-128

Figure 4-33: Rest area north of Richmond River- southbound rest area..... 4-129

Figure 4-34: Rest area north of Richmond River- biodiversity features..... 4-131

Figure 4-35: Additional borrow sites..... 4-137

Figure 4-36: Revised excavation design at the borrow source west of Wardell 4-146

Figure 4-37: West of Wardell borrow source- noise sensitive receivers..... 4-150

Figure 4-38: Overview of revised interchange design at Wardell 4-154

Figure 4-39: Revised interchange at Wardell station 155.5 to 157.5..... 4-155

Figure 4-40: Revised interchange at Wardell station 157.5 to 158.5..... 4-156

Figure 4-41: Revised interchange at Wardell station 158.5 to 159.5..... 4-157

Figure 4-42: Revised interchange at Wardell with biodiversity features station 155.5 to 157.54-159

Figure 4-43: Revised interchange at Wardell with biodiversity features station 157.5 to 158.54-160

Figure 4-44: Revised interchange at Wardell with biodiversity features station 158.5 to 159.54-161

Figure 4-45: Interchange at Wardell sensitive receivers between station 154.5 to 157.0 4-170

Figure 4-46: Interchange at Wardell sensitive receivers between station 156.5 to 158.5 4-171

Figure 4-47: Ancillary facility locations – Section 1 site 1a 4-185

Figure 4-48: Ancillary facility locations – Section 1 site 2 4-186

Figure 4-49: Ancillary facility locations – Section 1 site 3 4-187

Figure 4-50: Ancillary facility locations – Section 1 site 4b 4-188

Figure 4-51: Ancillary facility locations – Section 2 sites 1a and 1b 4-189

Figure 4-52: Ancillary facility locations – Section 2 site 4 4-190

Figure 4-53: Ancillary facility locations – Section 2 sites 5a and 5b 4-191

Figure 4-54: Ancillary facility locations – Section 2 site 6 4-192

Figure 4-55: Ancillary facility locations – Section 3 site 1 4-193

Figure 4-56: Ancillary facility locations – Section 3 site 2 4-194

Figure 4-57: Ancillary facility locations – Section 3 sites 3a and 3b 4-195

Figure 4-58: Ancillary facility locations – Section 3 site 4 4-196

Figure 4-59: Ancillary facility locations – Section 3 site 5 4-197

Figure 4-60: Ancillary facility locations – Section 3 site 6a 4-198

Figure 4-61: Ancillary facility locations – Section 3 site 6b 4-199

Figure 4-62: Ancillary facility locations – Section 3 sites 7a and 7b 4-200

Figure 4-63: Ancillary facility locations – Section 3 site 9 4-201

Figure 4-64: Ancillary facility locations – Section 3 site 10 4-202

Figure 4-65: Ancillary facility locations – Section 4 site 1 4-203

Figure 4-66: Ancillary facility locations – Section 4 site 2 4-204

Figure 4-67: Ancillary facility locations – Section 4 site 3 4-205

Figure 4-68: Ancillary facility locations – Section 4 site 4a 4-206

Figure 4-69: Ancillary facility locations – Section 4 site 5 4-207

Figure 4-70: Ancillary facility locations – Section 4 site 6 4-208

Figure 4-71: Ancillary facility locations – Section 4 sites 7a and 7b	4-209
Figure 4-72: Ancillary facility locations – Section 5 site 1	4-210
Figure 4-73: Ancillary facility locations – Section 5 sites 2a, 2b, 2c and 2d	4-211
Figure 4-74: Ancillary facility locations – Section 5 sites 3a and 3b	4-212
Figure 4-75: Ancillary facility locations – Section 5 sites 4a and 4b	4-213
Figure 4-76: Ancillary facility locations – Section 5 sites 5a, 5b and 5c	4-214
Figure 4-77: Ancillary facility locations – Section 5 site 6 and Additional site 9	4-215
Figure 4-78: Ancillary facility locations – Section 6 site 1	4-216
Figure 4-79: Ancillary facility locations – Section 6 site 2	4-217
Figure 4-80: Ancillary facility locations – Section 6 site 3a and 3b	4-218
Figure 4-81: Ancillary facility locations – Section 6 site 4	4-219
Figure 4-82: Ancillary facility locations – Section 6 site 5	4-220
Figure 4-83: Ancillary facility locations – Section 7 site 1	4-221
Figure 4-84: Ancillary facility locations – Section 7 sites 2a and 2b	4-222
Figure 4-85: Ancillary facility locations – Section 7 site 3	4-223
Figure 4-86: Ancillary facility locations – Section 7 site 4	4-224
Figure 4-87: Ancillary facility locations – Section 8 site 1	4-225
Figure 4-88: Ancillary facility locations – Section 8 sites 2a, 2b and 2c	4-226
Figure 4-89: Ancillary facility locations – Section 8 site 3	4-227
Figure 4-90: Ancillary facility locations – Section 9 site 1	4-228
Figure 4-91: Ancillary facility locations – Section 9 site 2	4-229
Figure 4-92: Ancillary facility locations – Section 9 site 3	4-230
Figure 4-93: Ancillary facility locations – Section 10 site 1a	4-231
Figure 4-94: Ancillary facility locations – Section 10 site 1b	4-232
Figure 4-95: Ancillary facility locations – Section 10 site 2	4-233
Figure 4-96: Ancillary facility locations – Section 10 sites 3a and 3b	4-234
Figure 4-97: Ancillary facility locations – Section 10 site 4	4-235
Figure 4-98: Ancillary facility locations – Section 10 site 5	4-236
Figure 4-99: Ancillary facility locations – Section 11 sites 1a and 1b	4-237
Figure 4-100: Ancillary facility locations – Section 11 site 2	4-238

4. Preferred infrastructure report

Roads and Maritime has refined a number of aspects of the project as exhibited in the EIS between December 2012 and February 2013. These design refinements have arisen through the ongoing review of the concept design, and consultation with the community and government agencies. Many refinements are in response to issues raised during the EIS exhibition period. The design refinements would minimise the environmental impacts identified in the EIS.

As required by section 115Z(6) of the EP&A Act, Roads and Maritime has prepared a preferred infrastructure report (PIR) to document these design refinements, assess their impacts and where required, provide additional measures to manage and mitigate impact.

Design refinements are presented in this chapter and include:

- A description of the design refinements.
- An environmental assessment of the design refinements.
- A comparison of each design refinement with the EIS design.
- The reason for the refinement.
- Any consultation undertaken.

4.1 Summary of design refinements

There are two types of design refinements:

- Main design refinements.
- Minor design refinements.

The main and minor design refinements are summarised Table 4-1 and shown in Figure 4-1 to Figure 4-5.

In addition, Roads and Maritime is reviewing property access with landowners as part of the property acquisition and adjustment process. In particular, property access is being reviewed to provide flood access/refuge, stock access/refuge and access to severed property, where required. This process will be ongoing through the detailed design phase of the project.

Table 4-1 Summary of design refinements

Approximate station	Design refinement	Reason
Main design refinements		
8.5-10.5	Interchange layout at Range Road, Corindi	Safety and improved access
17.0-19.0	Access at Lemon Tree Road, Halfway Creek	Improved access
20.5-21.7	Access at Luthers Road, Halfway Creek	Constructability
51.0-53.5	Realignment at Firth Heinz Road, Tucabia	Avoid landfill site
55.0-57.0	Relocation of rest area at Pine Brush	Minimise impacts on Commonwealth listed <i>Angophora robur</i>
64.8-66.5	Realignment at Crowleys Road, Tyndale	Avoid landfill site
77.0-79.0	Overpass at McIntyres Lane, Gulmarrad	Improved access
80.0-81.7	Interchange layout at Maclean	Safety and improved access
83.0-83.4	Formalisation of Koala Drive, Townsend	Improved access

85.7-86.2	Cycle access at the interchange at Yamba Road, James Creek	Cycleway connection
93.0-94.0	Access at Carrols Lane, Chatsworth Island	Improved access
97.5-99.5	Cutting at Mororo Road, Mororo	Increase in earthworks material
120.6-121.5	Access at Swan Bay New Italy Road, New Italy	Improved access
134.6-134.9	Borrow site at Lang Hill, north of Woodburn	Minimise impacts on Aboriginal heritage sites
147.5-149.7	Relocation of rest area north of the Richmond River	Minimise impacts on important Koala population
148.7-149.9	Borrow sites, north of the Richmond River	Increase in earthworks material
152.2-152.7	Borrow site west of Wardell Road, Wardell (Lumleys Hill)	Increase in earthworks material
155.5-159.5	Interchange layout at Wardell	Minimise impacts on Commonwealth listed Pink Underwing Moth
Various	Ancillary facilities for construction	Minimise impacts on environmental constraints
Minor design refinements		
	Cycle access along Eggins Drive, Corindi	Cycleway connection
	Flood immunity along Eggins Drive, Corindi	Improve flood immunity
10.4	Access at Dundoo Reach, north Range Road	Improved access
15.6	Access at Grays Road, Milleera.	Improved access
69.4-71.1	Local access at Bondi Hill Road and Byrons Lane, north Tyndale	Improved access
87.8	Local access at Watts Lane, Harwood Island	Improved access
95.9-97.2	Property access north of Iluka Road, Mororo	Provision of property access
122.9	Changes to local access south of Whites Road, New Italy	Improved access
143.3	Truck access to MacDonald Street and interchange at Broadwater	Heavy vehicle access
144.7	Project boundary south of Richmond River	Minimise land acquisition
160.0-162.7	Changes to property access and cane drains from Whytes Lane to Pimlico Road, Pimlico	Improved access and minimise agricultural impacts

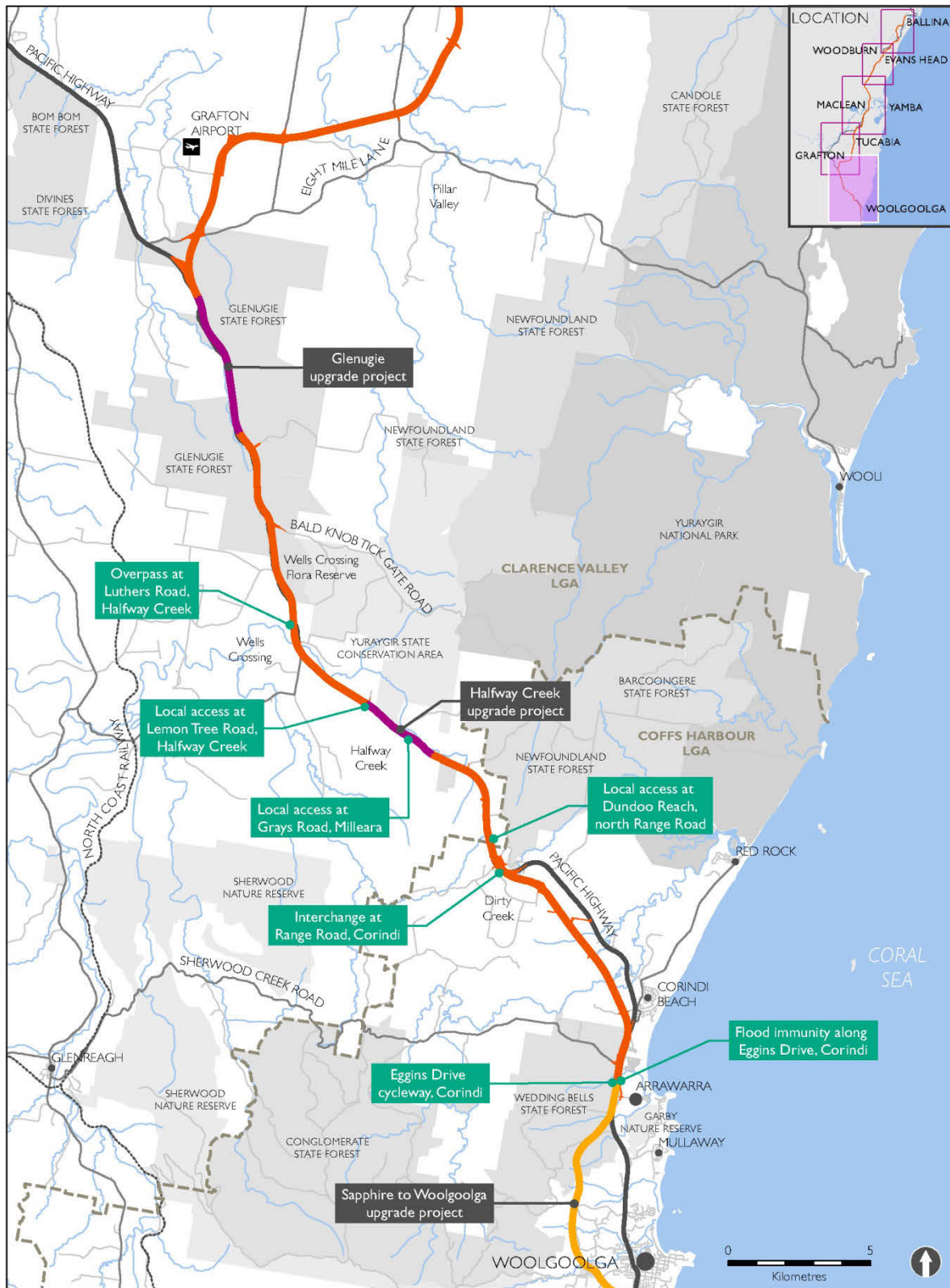


Figure 4-1: Location of design refinements – Sections 1 to 2

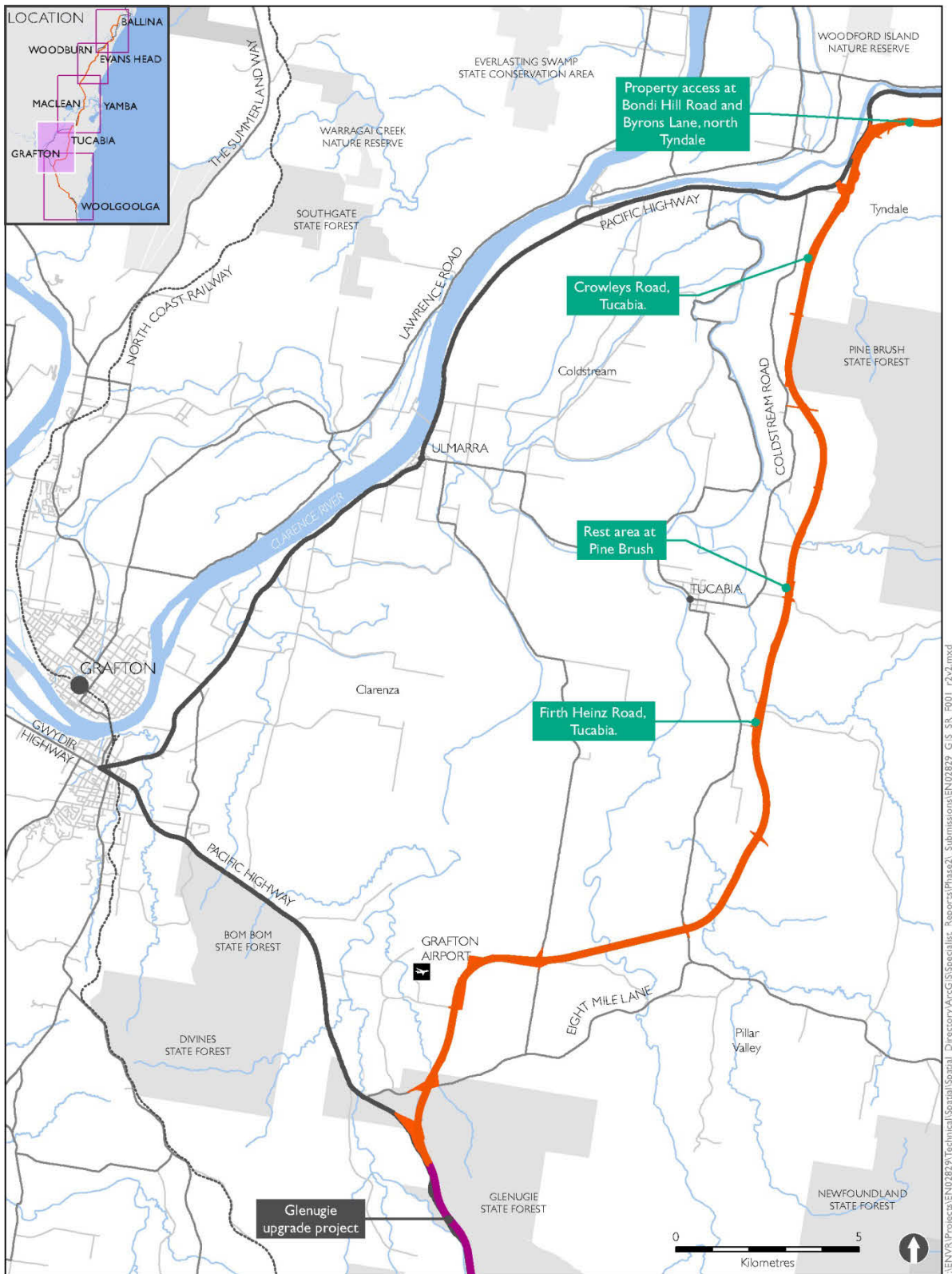
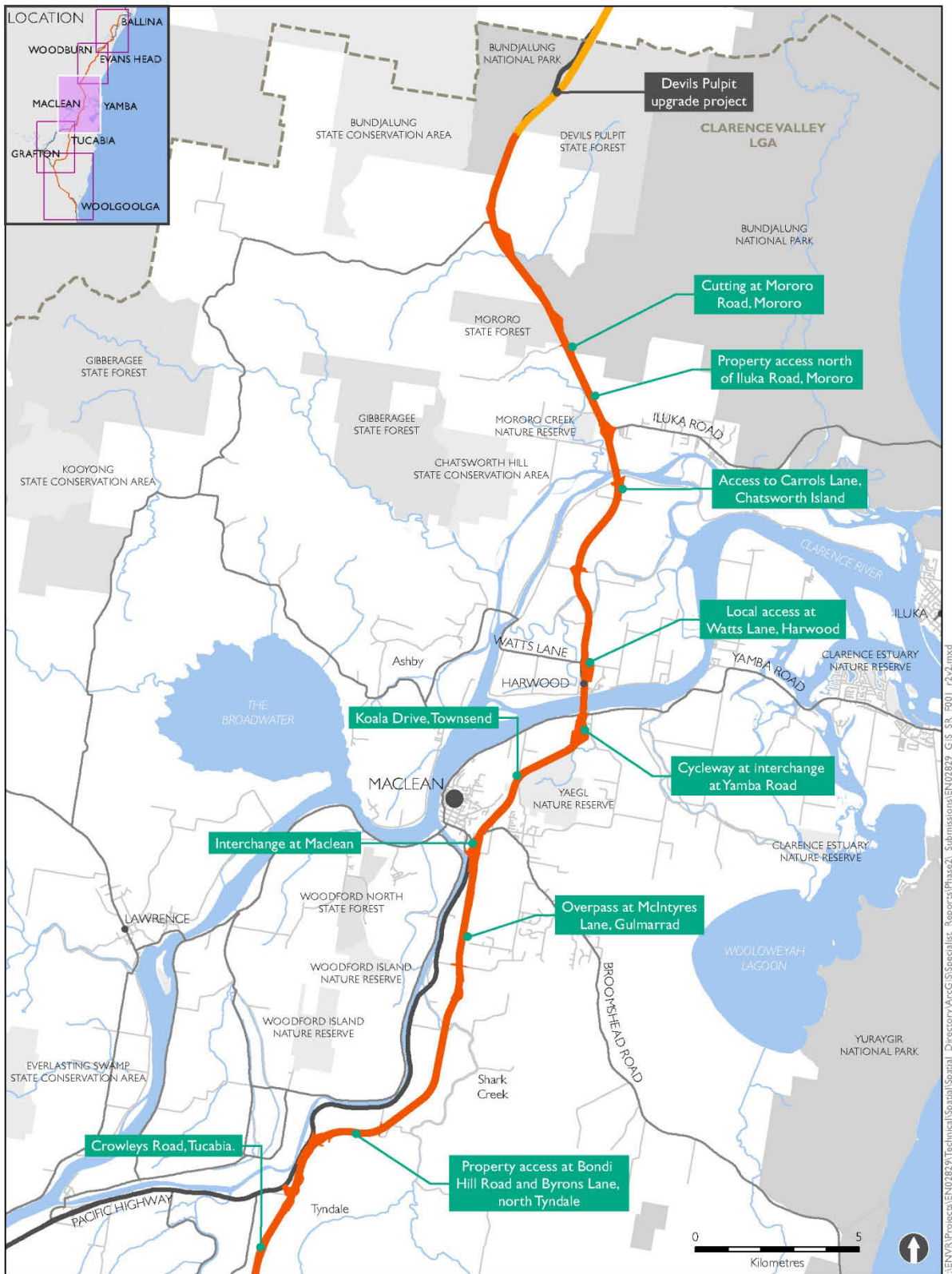


Figure 4-2: Location of design refinements – Section 3



- The project
- Upgrade completed to dual carriageway
- Upgrade under construction
- Existing Pacific Highway

Figure 4-3: Location of design refinements – Sections 4 to 6

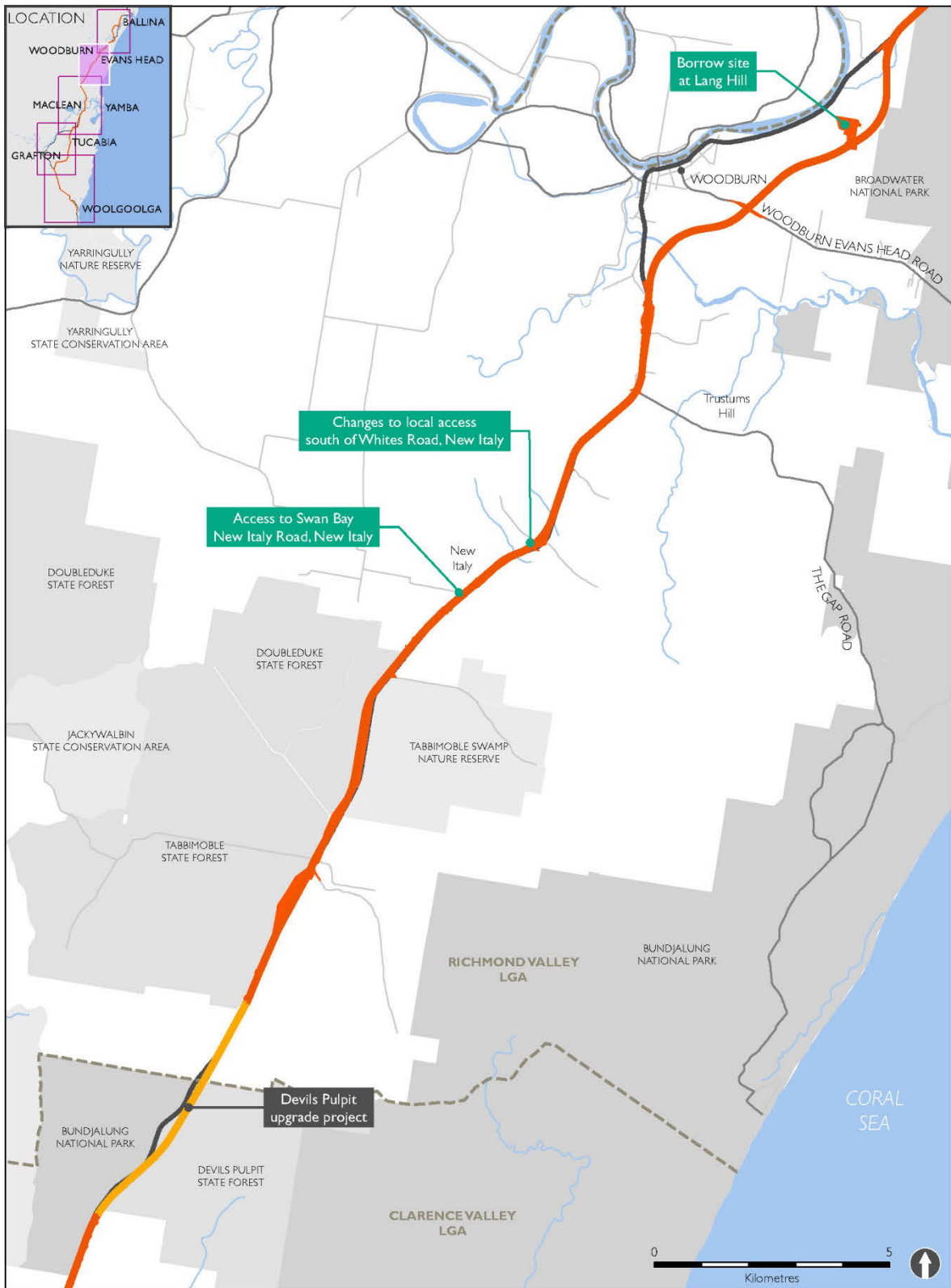
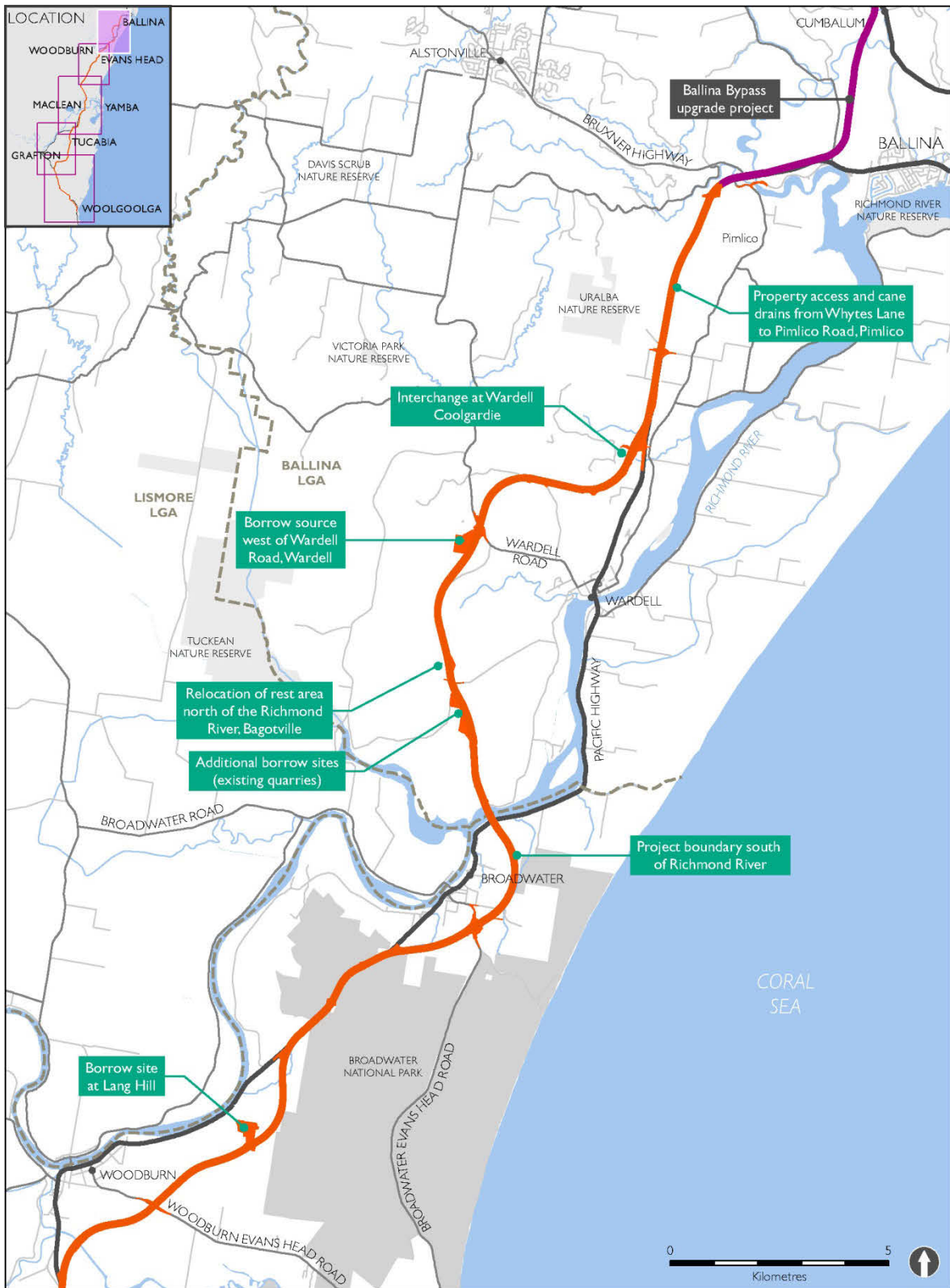


Figure 4-4: Location of design refinements – Section 7 and 8



- The project
- Upgrade completed to dual carriageway
- Upgrade under construction
- Existing Pacific Highway

Figure 4-5: Location of design refinements – Sections 8 to 11

4.2 Scope of design refinement assessment

4.2.1 Assessment process

All design refinements have been assessed against the key environmental issues identified in the Director General's Requirements. The assessment identifies where additional or different impacts are expected from those identified in the EIS. Where the impacts would not differ, a statement is made on the consistency with impacts in the EIS.

The assessment process involved desktop and field investigations (where required). Where additional impacts were identified, or extra mitigation is required, these have been detailed in the assessment. The main project design refinements involved additional field surveys for biodiversity and Aboriginal heritage.

4.2.2 Additional investigations

Roads and Maritime commissioned the following additional investigations to assess the proposed design refinements:

- **Hydrology and flooding:** Design refinements were assessed to identify changes in hydrological impacts. The assessment considered locations where the vertical alignment would change within floodplains to identify if hydrological and flood flows would be affected. Afflux impacts were modelled, where required.
- **Soils, sediments and water:** Design refinements were assessed in relation to soil, contaminated land and water quality issues. Groundwater issues were also considered where there would be a large change in the vertical alignment of the project.
- **Biodiversity:** Field surveys assessed the flora and fauna in the area for design refinement, where not covered in previous field surveys. The assessment identified whether additional vegetation would be cleared and considered potential impacts on threatened flora and fauna species, vegetation communities and populations listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Threatened Species Conservation Act 1995* (TSC Act). (Refer to Chapter 3 of the supplementary biodiversity assessment in Appendix J.)
- **Visual amenity, urban design and landscaping:** Design refinements were assessed where a change in the vertical alignment or large change would alter the visual impact on viewpoints. Where required, viewpoints identified in the EIS were updated.
- **Aboriginal heritage:** Design refinements that were not assessed in the EIS were subject to a field survey with registered Aboriginal stakeholders. In consultation with stakeholders, sample test excavations were also completed where required. (Refer to the supplementary Aboriginal Cultural Heritage Assessment Report and Addendum Aboriginal Cultural Heritage Assessment Report in Appendix D.)
- **Historical (non-Aboriginal) heritage:** Design refinements were assessed for potential impacts on new or known historic heritage items. Where required, Statements of Heritage Impact (SoHI) and Site descriptions were updated (refer to Appendix E).
- **Traffic and transport:** Design refinements were assessed to consider their potential to meet the traffic and transport objectives of the project, and changes to construction and operational traffic impacts. (None of the design refinements were considered to impact maritime use of the Richmond and Clarence rivers and safety of navigation for water based traffic.)
- **Noise and vibration:** Design refinements were assessed where there would be a horizontal or vertical shift in the alignment near sensitive receivers to ascertain if there would be any changes to the noise impacts identified in the EIS.
- **Land use and property:** Design refinements were assessed where there would be changes in land use and property impacts.
- **Social and economic:** Design refinements were assessed for potential changes in impacts on local and regional communities, highway-based business, agribusinesses, tourist and recreational access and connectivity.

4.3 Overview of impacts on Commonwealth and State listed threatened species and communities

A supplementary biodiversity assessment was undertaken (refer to Appendix J). This assessment supplements the EIS Working paper – Biodiversity. The assessment describes and assesses potential ecological impacts that would occur from the design refinements that differ from those identified in the EIS, particularly impacts on Commonwealth listed threatened species, populations, ecological communities, important habitats and key fauna corridors.

Design refinements that would reduce impacts on Commonwealth listed threatened species include the relocation of the proposed rest areas at Pine Brush and north of the Richmond River, and changes near the Interchange at Wardell.

Overall, the design refinements would result in:

- A reduction in the direct impacts on threatened ecological communities by 4.6 hectares.
- A reduction in the direct impacts on habitat critical to survival of koalas by 8.0 hectares.
- An increase in the direct impacts on non-listed vegetation communities by 2.7 hectares.

These changes would occur at the following locations:

- Pine Brush: The relocation of the rest area at Pine Brush would result in a decrease in loss of habitat for threatened flora and fauna, including the retention of around 408 *Angophora robur* trees.
- Mororo cutting and Range Road: The change in the intersection design at Range Road and the increase in Mororo cutting would result in an increase in native vegetation clearing. However, the impacts at these sites are not significant as similar plant species are present in adjoining areas and there is a lack of hollow-bearing trees or other significant features within clearing areas:
- Koala Drive: The design refinement improves the drainage and fauna underpass structure at Koala Drive. However the placement of a large cutting on the western side of the underpass may see a change to the functionality of this structure, which may impact on an important link between Yaegl Nature Reserve and informal reserves to the west. Targeted revegetation of the batter would be required to improve this situation.
- Firth Heinz Road: There would be a minor increase in the clearing of threatened ecological communities, clearing of an additional 181 threatened *Angophora robur* trees, and increased impacts on the habitat of threatened forest fauna.
- Wardell interchange: There would be a significant reduction in clearing of listed rainforest communities and habitat of the endangered Pink Underwing Moth. There would also be reduced clearing of threatened rainforest plant species (*Archidendron hendersonii*, *Macadamia tetraphylla*, *Arthraxon hispidus*). However, there would be increased impacts on a small area of koala habitat.
- Richmond River: The change in the rest area north of the Richmond River would see a significant reduction in clearing of potential habitat for koala and Long-nosed Potoroo and a significant improvement in connectivity through the inclusion of a dedicated land bridge.

The overall findings of this PIR in relation to Commonwealth and State listed threatened species and communities are that the changed impacts on threatened species by the design refinements do not affect the conclusions made in the assessment of significance under the TSC Act or EPBC Act in the Working paper – Biodiversity. In addition:

- This PIR presents additional mitigation measures, where relevant, to minimise impacts.
- The principles of avoiding and/or minimising native vegetation loss would continue to be applied to detailed design. These principles would also be applied during construction, to minimise vegetation loss further, where reasonable and feasible.
- The mitigation measures outlined in the EIS for biodiversity follow the Roads and Maritime guidelines for protection of biodiversity during pre-clearing and construction, and these are also applicable to the design refinement areas. Where further mitigation is required, this is documented for each design refinement.

4.4 Main design refinements

4.4.1 Interchange layout at Range Road, Corindi

Location

Range Road is located in Section 1 of the project (Woolgoolga to Halfway Creek). The interchange at Range Road would be located around five kilometres north of Corindi, near Flinty Road, between Section 1 and 2.

Access to the upgraded highway would be via this interchange with an access road linking Range Road to the existing highway and Corindi Beach.

EIS design

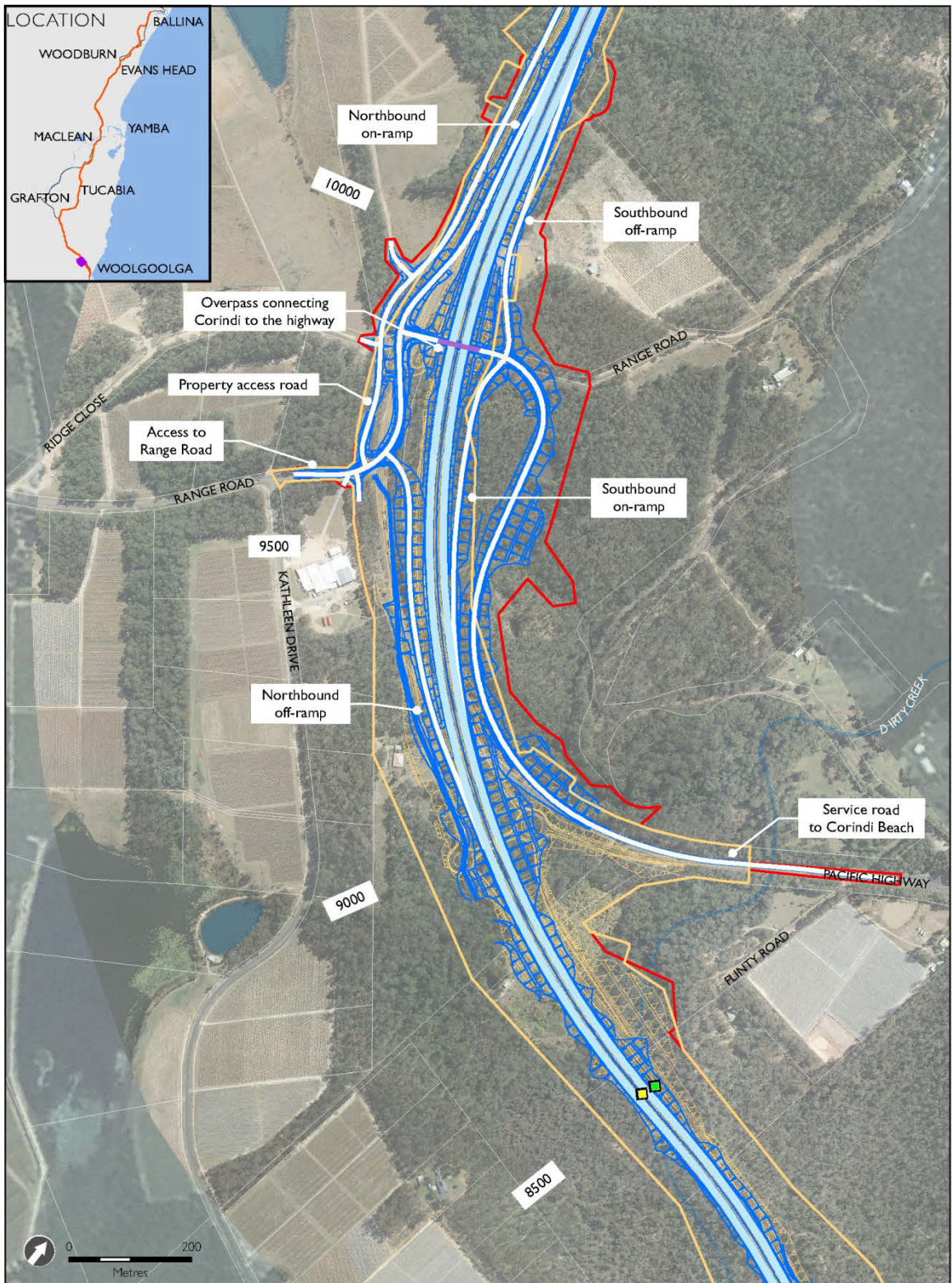
The interchange described in the EIS comprises a dual roundabout. The main features of the interchange would be at station 9.0, with a tie-in to the existing highway at station 9.4. The main features of the interchange are:

- One roundabout located on each side of the upgraded highway, connected by an underpass beneath the main carriageways that would provide a service road connection from the existing highway to Range Road. This is suitable for oversized vehicles including B-doubles.
- Southbound ramps and a northbound off-load ramp connecting to these roundabouts.
- A two-way service road to provide a connection to the western roundabout heading north. This service road would provide access to properties on Range Road, Halfway Creek and Wells Crossing. At the eastern roundabout, the service road would continue south on the existing highway, providing access to Corindi, Corindi Beach and to the interchange at Arrawarra Beach Road (which is part of the Sapphire to Woolgoolga upgrade).

Proposed design refinement

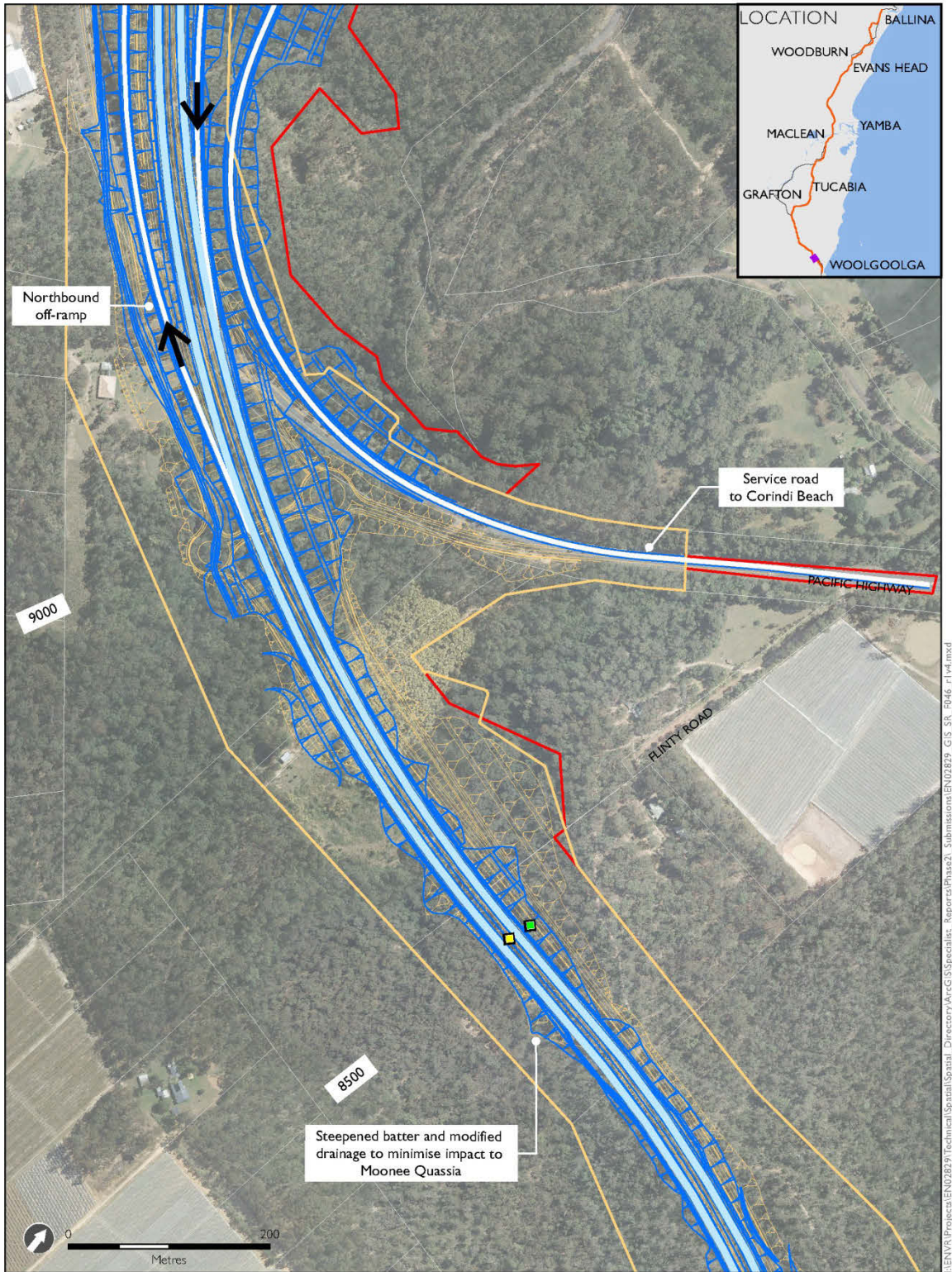
The interchange at Range Road would be located 800 metres further north than the EIS design, relocating the main features of the interchange from station 9.0 to 9.8. The refinement is shown in Figure 4-6 to Figure 4-8 and consists of:

- A diamond configuration interchange with on- and off-load ramps connected to an overpass at station 9.8.
- An overpass providing access either side of the upgraded highway to Range Road East, to connect Range Road to the existing highway.
- An intersection of Range Road and the western access road, which would also provide access from the northbound on- and off-load ramps.
- A northbound on-ramp that is realigned to the north of Range Road, east of Ridge Close at station 9.8. The northbound off-ramp would start at around station 9.1, and connect to Range Road around station 9.6.
- A southbound on- and off-load ramp providing a connection to the existing highway, located to the north and south of Range Road East. This would require an additional cutting. The existing highway would function as a service road, providing access to Corindi Beach.
- An easterly shift in the highway alignment, south of the interchange at station 8.5 and changes to drainage structures at that location to avoid the threatened flora species, Moonee Quassia (*Quassia sp. Moonee Creek*).
- A steeper fill embankment at station 8.420, from 2:1 to 1.5:1, to remove the stability bench. A toe wall placed on rock would be constructed and scour protection provided to stabilise the embankment.
- A dedicated fauna crossing at station 8.9. This would consist of a large culvert (three metres by three metres).



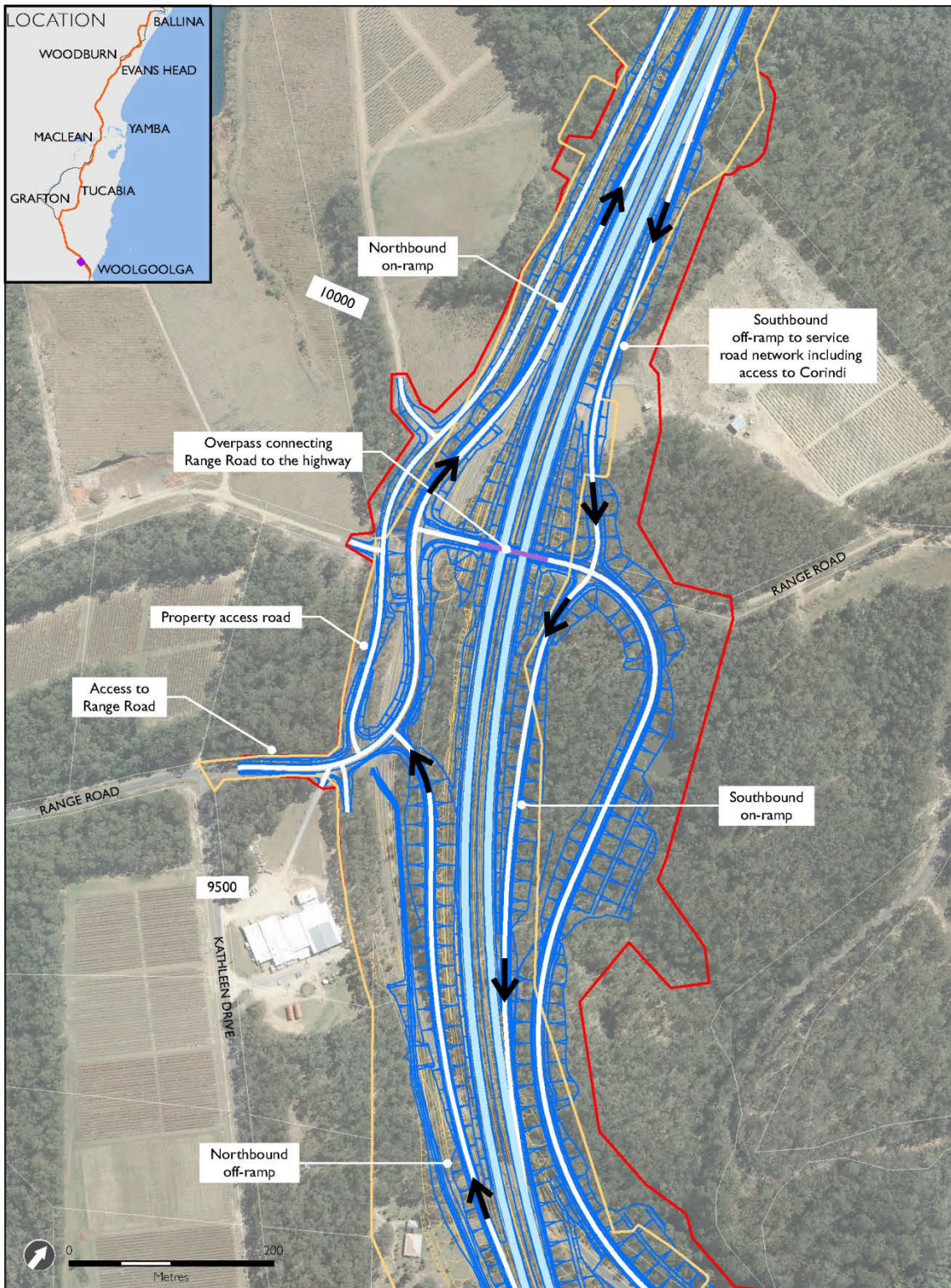
- | | | |
|----------------------|--------------------------|-----------------------------------|
| EIS project boundary | Changed project boundary | EIS fauna crossing |
| EIS road design | Proposed road design | Proposed relocated fauna crossing |
| | Proposed road alignment | |
| | Access / service road | |
| | Bridge (overpass) | |

Figure 4-6: Overview of revised design of interchange at Range Road



- EIS project boundary
- Changed project boundary
- EIS road design
- Proposed road design
- Proposed road alignment
- Access / service road
- Bridge (overpass)
- ↑ Traffic direction on-ramps
- ◆ EIS fauna crossing
- ◆ Proposed relocated fauna crossing

Figure 4-7: Interchange at Range Road, stations 8.0 to 9.5



- EIS project boundary
- Changed project boundary
- EIS road design
- Proposed road design
- Proposed road alignment
- Access / service road
- Bridge (overpass)
- ↑ Traffic direction on-ramps

Figure 4-8: Interchange at Range Road, stations 9.0 to 10.5

Reasons for design refinement

Constructability

The EIS design required the importation of large amounts of materials to create large fill embankments. The design refinement would involve locating the interchange on flatter terrain, which would improve the constructability of the interchange, remove the requirement for large embankments, and minimise the need for imported material.

Staging

The EIS design would constrain traffic movement on temporary highway diversions during construction. The speed limit on the highway would need to be reduced to below 80 kilometres per hour for the duration of construction.

To increase the speed limit to 80 kilometres per hour, the footprint of the EIS design would need to be increased substantially, resulting in additional biodiversity impacts. The design refinement provides a design that would enable a speed limit of 80 kilometres per hour during when temporary highway diversions are required.

Road safety

The EIS design was reviewed to consider road safety issues, particularly relating to sight distance, ramp gradients and merge speeds. It was found that the design refinement would increase sight distance for road users, minimise ramp gradients and provide safer merge speeds for traffic entering and already travelling along the highway.

Functionality

The design refinement would function better than the EIS design. The refined intersections would be raised above the highway to enable traffic to slow more readily when approaching the intersections. With reduced grades along the approaches to intersections, the design refinement is also likely to lower operational costs for heavy vehicles.

Access to the Berry Exchange

The design refinement would provide more direct access to the Berry Exchange, which would improve road safety and travel time benefits for heavy vehicles, particularly during peak periods.

Future roundabouts

The footprint of the design refinement provides an opportunity for roundabouts to be provided should there be an operational need in the future.

Reduced biodiversity impacts

Moonee Quassia was found around station 8.5 during supplementary biodiversity investigations. The species is listed as endangered under both the EPBC Act and TSC Act.

The EIS design would have impacted on 64 of the 274 identified individuals. The design was refined around station 8.5 at the eastern end of the Dirty Creek Range to minimise direct and indirect impacts on Moonee Quassia.

Consultation

Consultation regarding the design refinement at Range Road formed part of the EIS public display process between December 2012 and February 2013. Members of the project team attended community information sessions to discuss the EIS and the proposal to modify the interchange design. The main information sessions where the design refinement was presented for discussion were:

- Corindi (Corindi Trust Community Hall, 16 January 2013).
- Grafton (Grafton Community Hall, 18 January 2013).

The project team also discussed the design refinement at the following stakeholder meetings:

- Coffs Harbour City Council (20 December 2012). At this meeting, the requirement for appropriate urban design features and gateway signposting for Corindi Beach and Red Rock were also

discussed as important issues for detailed design. Roads and Maritime will continue to consult with Council regarding its requirements.

- Berry Exchange (12 February 2013). The Berry Exchange indicated the modification to the interchange would be acceptable as it would provide more direct access from Range Road to the northbound and southbound on-ramps, and from the service road connection to the existing highway.

As stated in the EIS, Roads and Maritime would review property impacts and consult with directly impacted property and landowners during detailed design.

Environmental assessment

Hydrology and flooding

The Coffs Harbour waterways catchment, which coincides with the southern part of the project nearest to the proposed interchange at Range Road, is a small catchment covering around 500 square kilometres. It has 13 sub-catchments, all of which originate in steep topography and flatten out towards the coast. The catchment includes Corindi River and its floodplain and the short coastal catchment of Arrawarra Creek.

Near Corindi River, the flatter sections of the catchment consist mostly of agricultural and rural residential land. There are some forested areas on higher ground and vegetation adjacent to the river. The nearest main watercourses to Range Road are Corindi River (4.9 kilometres away) and Cassons Creek (6.1 kilometres away). However, smaller watercourses (Dundoo Creek and Range Road) are just north of the design refinement (at station 10.7 and station 8.5, respectively).

The assessment found that the design refinement would continue to meet the project flood management objectives for the Corindi River catchment, which include:

- At houses: Increases in flood heights of less than 50 millimetres for a flood event less than and equal to a 100-year ARI (Annual Recurrence Interval) flood event.
- On grazing, forested and other rural areas: Increases in flood heights of generally less than 250 millimetres.
- Where there are houses: No more than five per cent increase in flood duration.

Further details are presented in Chapter 8 of the EIS.

Overall, the impacts of the design refinement would be consistent with the impacts outlined in the EIS.

The existing highway's flood immunity to the south of Range Road is less than a 5-year ARI flood event. The project is designed to improve the flood immunity of the highway. The design refinement would maintain the flood immunity described in the EIS and would not change the design criteria previously assessed. In particular:

- The design refinement would remain flood-free for a 100-year ARI flood event.
- As the rate of floodwater rise would be similar to the rate anticipated in the EIS, there would be no change to the potential for evacuation of the area adjacent to Range Road.
- There would be no additional impacts on flood level, duration, or velocity during construction and operation.

Therefore, no mitigation or management measures are required beyond those in the EIS.

Soils, sediments and water

Overall, the assessment found that the impacts of the design refinement would be consistent with the impacts outlined in the EIS. In particular:

- Acid sulfate soils: There would be no additional impact in relation to acid sulfate soils as there are no known occurrences of acid sulfate soils near the design refinement. The closest areas of low and high probability of occurrence are on the lowland coastal plains near Arrawarra and Corindi Beach.
- Contamination: There would be no additional impact in relation to contamination as there are no known areas of contamination within the boundary of the design refinement.

- Groundwater: There would be no additional impact in relation to groundwater, which would continue to be managed via the measures included in section 9.4 of the EIS.
- Runoff: There would be no additional impact in relation to sedimentation and water quality because:
 - The design includes temporary sedimentation and permanent water quality basins to capture surface runoff during construction and from the highway during operation. The design refinement would alter the location of these basins. The location and final sizing of temporary sedimentation and permanent water quality basins would be confirmed during detailed design.
 - The risk of adverse impacts would be reduced to minimal levels with the mitigation and management measures included in the EIS, including standard soil erosion and sediment controls and other construction site management procedures. Management measures would include the use of sedimentation basins to capture runoff from the works prior to discharge into surface water (and groundwater).
 - The road cuttings required for the design refinement would be similar in extent to those for the EIS design. Therefore, there are unlikely to be additional impacts on surface water or groundwater.

Therefore, no mitigation or management measures are required beyond those in the EIS.

Biodiversity

Near Range Road, vegetation types include several dry sclerophyll forests dominated by Blackbutt (*Eucalyptus pilularis*), Needlebark (*Eucalyptus planchoniana*), Spotted Gum (*Corymbia variegata*), Broad-leaved Paperbark (*Melaleuca quinquenervia*) forest and a small area of riparian rainforest.

The design refinement would result in an additional 3.9 hectares of total vegetation clearing compared to the EIS. There would be:

- Increased clearing of four of the six BioMetric vegetation types (refer to Table 4-2).
- Reduced clearing of two of the six BioMetric vegetation types.
- Increased clearing of 0.2 hectares of moist riparian forest threatened ecological community (TEC) consistent with Lowland Rainforest (NSW TSC Act listed only).
- An increase in the direct loss of non-listed dry sclerophyll forests dominated by Blackbutt (*Eucalyptus pilularis*) (4.6 hectares), and Spotted Gum (*Corymbia henryii*) and Grey Ironbark (*Eucalyptus siderophloia*) (0.7 hectares).

Table 4-2 Comparison of impacts between the EIS design and design refinement at Range Road

BioMetric vegetation types	EIS design (ha)	Design refinement (ha)	Change in vegetation loss (ha)
Black Bean – Weeping Lilly Pilly riparian rainforest of the North Coast (TEC, Lowland Rainforest – TSC Act)	0.1	0.3	+0.2
Blackbutt – bloodwood dry heathy open forest on sandstones of the northern North Coast	13.2	17.8	+4.6
Blackbutt grassy open forest of the lower Clarence Valley of the North Coast	4.3	3.7	-0.6
Needlebark Stringybark – Red Bloodwood heathy woodland on sandstones of the lower Clarence of the North Coast	12.6	11.6	-1.0
Paperbark swamp forest of the coastal lowlands of the North Coast (TEC, Swamp Sclerophyll Forest – TSC Act)	0.4	0.4	0.0
Spotted Gum – Grey Ironbark – Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast	4.8	5.5	+0.7
TOTAL	35.4	39.5	+3.9

The design refinement would have a direct impact on an additional 0.5 hectares of forest habitats (mainly dry open Blackbutt forest) for threatened species. Species predicted to use these forest

habitats include Powerful Owl (*Ninox strenua*), Masked Owl (*Tyto novaehollandiae*), Brush-tailed Phascogale (*Phascogale tapotafa*), Rufous Bettong (*Aepyprymnus rufescens*), Common Planigale (*Planigale maculata*), Squirrel Glider (*Petaurus norfocensis*) and Yellow-bellied Glider (*Petaurus australis*), which are all vulnerable species under the TSC Act. The loss of habitat for these species would reduce food, shelter and breeding resources, and potentially lead to a change in movements of populations. The design refinement also has potential to increase edge effects (noise and light levels, temperature and wind speed) on adjoining habitats given the increased edge area and there is potential for greater runoff impacts on the east of the highway and into adjoining drainage lines.

However, the design refinement would not alter the results of the assessment of significance prepared in the EIS for the abovementioned threatened species, because:

- The site does not contain any prominent habitat features that would not otherwise exist within the adjoining forest system.
- The vegetation to be removed provides foraging habitat, but the potential for this vegetation to be used as a significant nesting/roosting site is limited by the absence of hollow-bearing trees or other significant habitat features. Also, the additional habitat loss would be a relatively minor additional impact when compared to what is reported in the EIS for hollow-dependent fauna.

Impacts on Giant Barred Frog

The Giant Barred Frog (listed as endangered under the EPBC Act and TSC Act) was recorded in Dirty Creek, around 370 metres away from the location of the design refinement.

The drainage lines in the area are ephemeral with some persistent pools, and are not generally considered to be suitable for the species. At times of heavy flow, the ephemeral creek adjacent to the boundary of the design refinement would flow directly into Dirty Creek. The ephemeral creek therefore provides some temporary refuge for this species and the design refinement would directly impact on the creekline. However the creek has a high weed abundance and considered to be of low or marginal quality for the Giant Barred Frog, particularly when compared to the known habitats in Dirty Creek over 370 metres east.

Adjacent habitats for the Giant Barred Frog would be protected during construction.

Aquatic habitats

Aquatic habitats are limited to an artificially constructed remnant dam within the design area and an ephemeral creek on the eastern side of the existing highway, as discussed above.

There is no potential habitat for the Oxleyan Pygmy Perch at this location. However, there is habitat for common non-listed amphibian and fish species.

The design refinement would be located within 20 metres of the ephemeral creek and it is likely that indirect impacts of sediment runoff would degrade this habitat over the long term if not managed appropriately.

Impacts on koala habitat and populations

The site exhibits low level use by koalas and the habitat present was identified previously as marginal for koalas due to the low-density of two types of known koala feed tree species. However, design refinement would have direct and indirect impacts on koala habitat as it would involve:

- Removal of an additional 3.9 hectares of habitat being Blackbutt dry open forest, which includes a low density of the primary feed tree species Tallowwood (*E.microcorys*) and secondary feed tree species Small-fruited Grey Gum (*E.propinqua*). These two species comprise less than 10 per cent of the canopy species present. The supplementary feed tree species Stringybark (*E.tindaliae*) also occurs at low density. This habitat is classed as secondary koala habitat (class B) according to DEC (2008), but not associated with critical habitat according the DSEWPaC (2012).
- Edge effects on koala habitat that may affect the health of potential koala feed trees and overall vegetation structures and weed abundance.

Connectivity for fauna

The location of the design refinement adjoins Newfoundland State Forest to the north and cleared residential land to the south. Due to the extensive areas of habitat east and west of the highway through this location, there is a need to maintain connectivity.

In the EIS, a dedicated fauna connectivity structure was proposed at station 8.5 at the southern end of the design refinement targeting Rufous Bettong, Spotted-tailed Quoll and koala. The proposed structure (a culvert) was 65 metres long, and three by three metres. The design refinement would retain the structure, but reduce the length of the culvert to less than 50 metres. This is due to reduced fill requirements between stations 8.4 and 8.7 on the eastern side of the upgrade.

The design refinement also includes:

- An additional dedicated fauna underpass at station 8.8 (50 metres long and three by three metres).
- The expansion of an incidental structure at station 10.3 to a combined culvert for fauna passage and stormwater drainage.

Fauna connectivity structures have not been proposed around the interchange as the area is unlikely to be an important local movement corridor, given the presence of cleared agricultural land on the western side.

Moonee Quassia

The local population of Moonee Quassia consists of two clusters, which are considered to constitute a single population with a recorded total of 899 stems. These two clusters are located:

- To the west of the alignment at station 8.5. The cluster is located both downslope and upslope of the project, along an ephemeral drainage line that flows to the northeast toward the project. The plants are located where a fill batter and drainage works (culvert, headwall and scour protection) are proposed in a steep sided gully.
- About 250 metres further south and upslope of this (the above mentioned) population. This cluster contains fewer stems and is outside the impact area.

The construction footprint of the design refinement would remove 35 stems (compared to 126 under the EIS design). This constitutes 3.9 per cent of the total local population (both identified clusters).

The design refinement would also have indirect impacts on some of the remaining stems, all of which are within 50 metres of the project, with up to 167 stems within 10 metres of the construction edge. In particular, there is potential for indirect impacts to affect plants within 10 metres of the project. Indirect impacts could result from altered exposure and light levels, changed hydrological conditions and increased potential for competition from weeds and other flora due to the altered conditions.

Therefore, the design refinement would have direct impacts on 35 stems and indirect impacts on 167 stems – a total impact on 202 stems, or 22 per cent of the known population in this area.

The direct impacts could not be avoided. However, to minimise the indirect impacts:

- The Moonee Quassia population has been included in the threatened flora management plan (refer to Appendix K). This plan includes monitoring focusing on plants within the edge-affected zone.
- Targeted weed management would be conducted to minimise edge effects.

Refer to Figure 4-9 for the extent of biodiversity constraints at Range Road. For further details, refer to the supplementary biodiversity assessment included as Appendix J.

No mitigation or management measures are required beyond those in the EIS.

Aboriginal heritage

The area has moderate sensitivity for Aboriginal heritage, as it includes the slopes of a ridgeline adjacent to the floodplains of the Coldstream and Clarence rivers. However, the area has been subject to a high degree of ground disturbance from previous vegetation clearance and road construction.

The EIS identified a potential archaeological deposit (PAD site) (Dirty Creek 1) that would be impacted by the project.

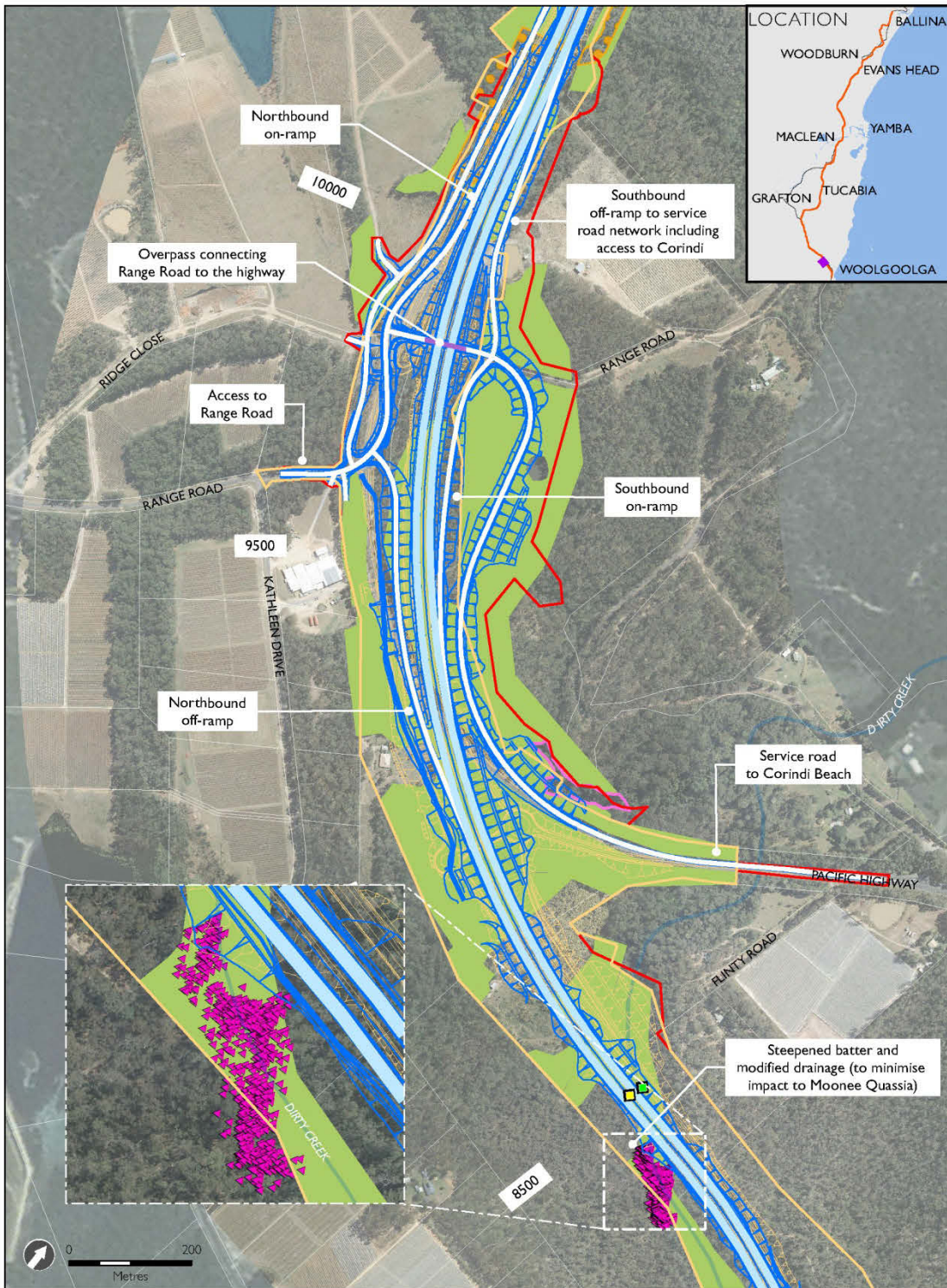


Figure 4-9: Revised design of interchange at Range Road, showing biodiversity features

The site could not be tested for the EIS, but subsequent test excavations found that part of the site (known as Dirty Creek 1a and 1b) does not have Aboriginal heritage significance. However, another part of the site, Dirty Creek 1c, located at station 7.8 either side of the highway, could not be tested to confirm the presence of a site, as it is heavily wooded. A preliminary assessment of overall significance has identified the site as potentially being of low to moderate or moderate significance.

The design refinement would have a direct impact on Dirty Creek 1c, as the whole PAD site would be situated within the project boundary. This impact would be no different from that identified in the EIS. The EIS management measure AH17 has been revised to relate only to Dirty Creek 1c.

In addition, project archaeologists and Registered Aboriginal Parties undertook a site inspection on 18 February 2013. It did not identify any new sites near the locations of the design refinement. The following Registered Aboriginal Parties were consulted prior to the site inspection and attended the fieldwork:

- Coffs Harbour Local Aboriginal Land Council.
- Yarrowarra Aboriginal Corporation.
- Garlambirla Guuyu-girrwa Aboriginal Corporation.
- Grafton-Ngerrie.

The design refinement was discussed with Registered Aboriginal Parties at an Aboriginal Focus Group meeting on 6 February 2013.

Urban design, landscape character and visual

The landscape adjacent to Range Road includes State forest, agriculture and rural residential areas, and there are croplands to the south of Range Road and west of Kathleen Drive. The existing highway is generally located in cuttings.

Although the proposed interchange would be relocated 850 metres further north, the design refinement would continue to be located in a similar landscape to the one assessed in the EIS. However, an additional cut to the east of the highway with further vegetation clearance would be required to accommodate the service road connection between the overpass and the existing highway.

The design refinement would not substantially change the landscape character and visual impact assessment included in the EIS, so overall impacts would be consistent with the EIS. In particular:

- In terms of landscape character, the EIS assessed that the project would have moderate to high impacts due to the large cutting through Dirty Creek Range. As the design refinement would increase the footprint at the interchange, this would increase the landscape character impact to high.
- In terms of visual impact, the overall visual envelope surrounding the location of the revised interchange at Range Road would be small, with topography and vegetation confining views to the road corridor. (There are a few visual receivers adjacent to the highway that would have views to the project.) The visual envelope surrounding Range Road would be altered by the addition of the new service road connection to the east of the southbound on-ramp. Although the EIS did not assess viewpoints at the revised interchange location, the closest viewpoint (2b) would not have a changed impact as a result of the design refinement.

The project would be subject to the landscape and urban design strategy documented in the EIS, and would be appropriately revegetated. However, the change in the fill embankment at station 8.420 would limit long-term revegetation of the embankment.

No mitigation or management measures are required beyond those in the EIS.

Historical (non-Aboriginal) heritage

The EIS did not identify any State Heritage Register items or Local Environmental Plan items within or adjacent to the boundary of the EIS design or the revised location of the interchange at Range Road.

Field investigations undertaken for the design refinement did not identify any further historical heritage items.

Therefore, the design refinement would not result in any additional impacts on historical (non-Aboriginal) heritage, and no mitigation or management measures are required beyond those in the EIS.

Traffic and transport

In Section 1 of the project, where Range Road is located, average daily traffic volumes on the existing highway are around 8670 vehicles (based on a November 2011 traffic count). Of this number, around 6540 vehicles per day were light vehicles (75 per cent) and 2130 were heavy vehicles (25 per cent). The design refinement would continue to accommodate the projected future growth in traffic numbers forecast to use the interchange.

The design refinement would not require any changes to the construction traffic management measures that are proposed in the EIS. This is because:

- Construction vehicles would use local roads such as Range Road and Range Road East. The EIS assumed these roads would be included in the Construction Traffic Management Plan and require traffic controls for vehicle haulage, routing and timing.
- Local access would be maintained and there would be negligible local traffic impacts during construction.
- Range Road provides access to the Berry Exchange (station 9.6), so traffic management would continue to be required for construction during peak berry-picking season (September to January) when vehicle numbers entering and exiting the exchange are high (400–500 vehicles per day).

During operation, the design refinement would provide traffic and transport benefits that are additional to those presented in the EIS. In particular the design refinement would:

- Provide more direct access from Range Road to the northbound and southbound on-ramps and to the service road to the existing highway. The modified access to and from Range Road would provide traffic flow benefits during peak periods, particularly by enabling more direct access for heavy vehicles to and from the Berry Exchange, which would minimise travel times.
- Provide an additional connection to the east of the southbound on-ramp, improving access for road users between the interchange and the existing highway to the east. This would continue to provide access to the service road and access to and from Corindi Beach, as described in the EIS. Range Road would connect to this service road, with access to the upgraded highway continuing to be via the interchange.
- Provide greater traffic and transport benefits than the EIS design by increasing sight distance for road users, minimising ramp gradients and providing safer merge speeds for traffic entering and already travelling along the highway.

In addition, while the layout of the interchange would be different from the design shown in the EIS, local access would be maintained and there would be negligible local traffic impacts during operation. The service road would continue to provide a continuous alternative route to the project, and also provide access to the interchange at Range Road.

In view of the above, no management measures are required additional to those in the EIS.

Noise and vibration

The noise environment near Range Road is dominated by road traffic noise from the existing highway. The area is sparsely populated, and includes agricultural (including berry farming), state forest and rural residential land uses. The project and existing highway adjacent would continue to be the major noise source in the area.

In the EIS, the sensitive noise receiver locations nearest to the location of the interchange would be located on the eastern side of the proposed upgrade around 200 metres from the southbound on-ramp (R453 and R455). In the design refinement, the southbound on-ramp would be relocated further north between station 9.2 and station 9.7, which would increase the distance between the project and these receivers to around 500 metres. This is expected to reduce predicted noise levels by less than 0.5 dB(A). This reduction in noise would not be perceptible. Therefore, the design refinement would not present an acoustic benefit for these sensitive noise receivers.

The nearest receiver location adjacent to the revised interchange location, R474, would also be on the eastern side of the proposed upgrade. The connection to the existing highway and service road would be relocated further north from the EIS location, moving the project around 50–100 metres closer to this receiver. However, this would not change predicted noise levels substantially.

No mitigation or management measures are required beyond those in the EIS.

Land use and property

The interchange would be located within the Coffs Harbour local government area, near the town of Corindi Beach and two tourist parks south of Corindi Beach. Nearby areas consist of rural residential land and properties, agricultural land and the Wedding Bells and Newfoundland State forests. The area adjacent to Range Road includes small numbers of residential properties, mainly located along the existing highway, Range Road and Dirty Creek Road.

Horticultural land is located west of Corindi and Halfway Creek. Horticultural uses include the Berry Exchange at Range Road, Corindi, which is a nationally important producer of raspberries and blueberries.

The design refinement would alter the project boundary and continue to impact three properties to the west, north and east of the interchange location shown in the EIS. The properties impacted by the EIS design and the design refinement are listed in Table 4-3.

Table 4-3: Property impact schedule for interchange layout at Range Road (both EIS and design refinement)

Property	Land use	EIS		Design refinement		Change in impact area
		Impact area (ha)	% of property affected	Impact area (ha)	% of property affected	
Lot 1/ DP710318	Tree and shrub cover	5.7	20	12.0	41.9	6.3
Lot122/ DP714475	Tree and shrub cover	1.6	6.2	2.05	7.9	0.45
Lot121/ DP714475	Tree and shrub cover	1.4	12.4	3.0	26.5	1.6
Total		8.7		17.05		8.35

The design refinement would require the acquisition of an additional 8.35 hectares of land (a 12.7 per cent increase) from the properties already identified in the EIS.

As stated in the EIS, property acquisition would be reviewed during detailed design in consultation with directly impacted property and landowners.

No mitigation or management measures are required beyond those in the EIS.

Social and economic

North of the revised interchange location, the upgraded highway would generally follow the existing highway alignment, with widening west of the existing highway. The socio-economic environment features agricultural properties, tourism parks and the highway, which is an important local and regional freight route.

Adjacent businesses include the Berry Exchange at Range Road located less than 100 metres to the west of the revised interchange location. Roads and Maritime consulted the Berry Exchange in February 2013 regarding its intention to modify the layout of the interchange. During a meeting with the Berry Exchange, Roads and Maritime confirmed that access would continue to be available via Range Road. Therefore, no new impacts on the operation of the business are anticipated as a result of the design refinement. While the Berry Exchange raised concerns regarding potential impacts on

their berry crop from construction dust, the EIS included proposed mitigation measures to suppress dust and minimise potential impacts.

No other highway-based businesses, agribusinesses or tourism destinations would be directly impacted by the design refinement.

As the area of the design refinement is sparsely populated, predicted socio-economic impacts would be consistent with the impacts presented in the EIS. Therefore, no mitigation or management measures are required beyond those in the EIS.

Management and mitigation

The design refinement at Range Road requires a change to the proposed Aboriginal heritage mitigation and management measures included in Chapter 19 of the EIS. The additional mitigation measures recommended for this design refinement are presented in Table 4-4 and Chapter 5.

Table 4-4: Range Road – additional mitigation

Issue	ID number	Mitigation measure	Timing	Relevant section
Impacts on WWC Dirty Creek 1	AH17	Prior to ground disturbance to WWC Dirty Creek 1c (22-1-0403), the ground surface be inspected within 50 m of the site for any Aboriginal archaeological material by an archaeologist and RAP nominated site officers. Any archaeological material be recorded, removed from the site, and a suitable location for the material determined in consultation with the RAPs. The AHIMS record be updated with any new finds and any locations where the material is to be stored – unless reburied on or near site, establishing a care agreement be necessary.	Pre-construction	1

This design refinement would not require a change to the other proposed mitigation and management measures in Chapter 19 of the EIS.

4.4.2 Access at Lemon Tree Road, Halfway Creek

Location

Lemon Tree Road is located in Section 2 of the project between Halfway Creek and the Glenugie upgrade. Lemon Tree Road has an existing intersection with the highway, and provides access to several properties including residences and a service station.

EIS design

The EIS design (under the initial arterial upgrade) provides access to Lemon Tree Road for northbound traffic via a right turn 900 metres north of Lemon Tree Road (station 18.4). This right turn would connect to an access road between Lemon Tree Road and station 18.5.

The Lemon Tree Road intersection with the highway would be left-in only. Traffic exiting Lemon Tree Road would travel along an access road further south to access an existing merge lane to the southbound carriageway.

Proposed design refinement

Under the design refinement (under the initial arterial upgrade):

- Access to Lemon Tree Road from the northbound highway carriageway would be altered. The right turn would be relocated 500 metres south to station 17.9 and connect to a U-turn bay on the southbound carriageway, with access to Lemon Tree Road via the left-in intersection, 450 metres to the south.

- The access road north of Lemon Tree Road would be retained, but it would not provide access to the southbound highway carriageway and would only provide access to properties from Lemon Tree Road.
- The existing southbound merge lane from the northbound rest area would be lengthened between station 16.3 and station 17.0.

There is no change to the ultimate motorway upgrade identified in the EIS.

The location and extent of the design refinement and the EIS design are shown in Figure 4-10.

Reason for design refinement

The EIS design was refined to:

- Improve access and reduce the distance from the northbound highway carriageway to Lemon Tree Road.
- Improve safety for vehicles exiting Lemon Tree Road and the service station, by lengthening the southbound merge lanes onto the highway.

Consultation

In April 2012, Roads and Maritime consulted with property owners, including the service station operator, regarding the potential change to access at this location.

Environmental assessment

Hydrology and flooding

The nearest watercourse to Lemon Tree Road is Halfway Creek, around 1.4 kilometres east of the intersection with the existing highway. Lemon Tree Road is near, but not within, the Halfway Creek 100-year ARI flood event level.

The design refinement would not alter the hydrology and flooding behaviour of the site. As such, potential impacts would be consistent with those described in section 8.3 of the EIS.

Therefore, no mitigation or management measures are required beyond those in the EIS.

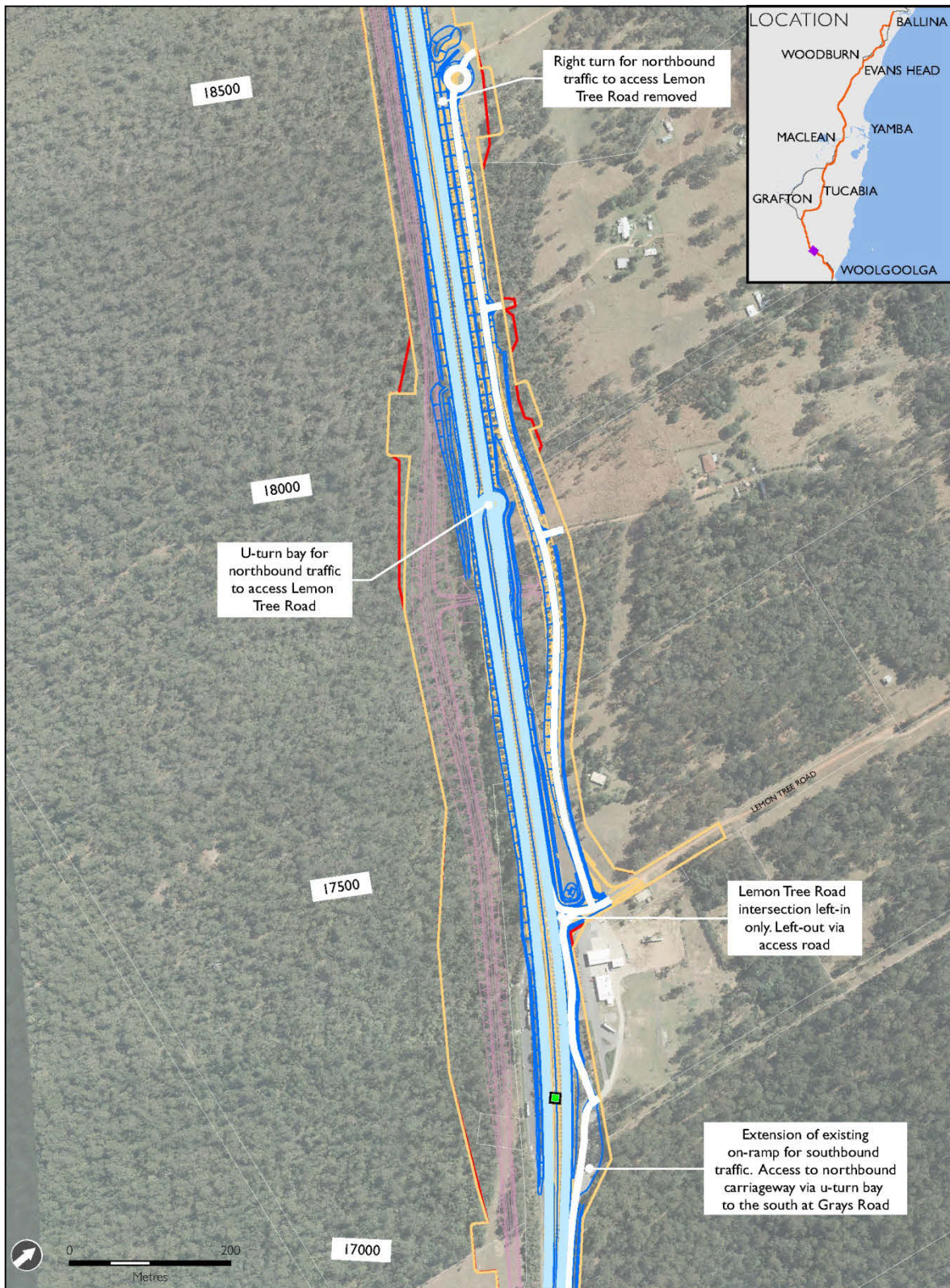
Soils, sediments and water

There is no published soil landscape map for the Halfway Creek area nearest to Lemon Tree Road. Soils are assumed to be highly erodible, particularly in cleared areas.

The design refinement would not change soils, sediments and water impacts, and potential impacts are considered to be consistent with those described in section 9.3 of the EIS. In particular:

- **Water quality and surface runoff:** Although the design refinement would increase the area of clearing and area of pavement, which would increase the area of surface runoff, the EIS identifies erosion and sedimentation controls during construction and operation to capture surface runoff minimise sediments leaving the site. These include construction sedimentation basins south and west of Lemon Tree Road. A number of these basins would be retained as permanent water quality basins to capture road runoff from the project during operation. These erosion and sedimentation controls would be retained for the design refinement. In addition, as Halfway Creek is around 1.4 kilometres away from the highway alignment, with undulating topography between, no additional impacts from runoff are anticipated.
- **Contamination:** The nearest area of potential environmental concern is the service station at Lemon Tree Road, which is likely to contain fuel stores and potentially exhibit some level of hydrocarbon contamination if any spillages or historic leakage from underground tanks have occurred. However, the project (including the design refinement) would not impact on the property. Appropriate measures are in place (refer to chapter 5 of this report) should soil contamination be identified on site.
- **Groundwater:** The design refinement would not impact the local or regional groundwater table and would not create additional groundwater impacts.

Therefore, no mitigation or management measures are required beyond those in the EIS.



- EIS project boundary
- EIS road design
- EIS class M road design
- Changed project boundary
- Proposed road design
- Proposed road alignment
- Access / service road
- ◆ EIS fauna crossing

Figure 4-10: Revised design, Lemon Tree Road, Halfway Creek

Biodiversity

The design refinement would not change the area of vegetation clearing required for the project. However, it would differ from the EIS in the following ways:

- It would increase the direct impact on the vegetation community of Blackbutt – bloodwood dry heathy open forest by 0.4 hectares.
- It would reduce impacts on Needlebark stringybark – red bloodwood heathy woodland by 0.3 hectares.
- It would reduce impacts on threatened ecological communities as it would reduce the clearing of Swamp Mahogany swamp forest by 0.1 hectares. Swamp Mahogany swamp forest provides marginal habitat for koala. While this area only has a low density of the primary koala feed tree (*Eucalyptus robusta*), a slight reduction in habitat would be impacted as a result of this design refinement.

This vegetation clearing and habitat loss would cause indirect impacts from edge effects, including weed invasion and increased light into vegetation patches. However due to the minor change of the design refinement, the impacts and area of impact would not be greater than those assessed in the EIS.

In addition, the design refinement would not impact on fauna connectivity movement corridors or connectivity structures.

Due to the minimal differences between the EIS and the design refinement, and because the management measures included in section 10.4 of the EIS would continue to apply to works at this location, no mitigation or management measures are required beyond those in the EIS.

Urban design, landscape character and visual

In Section 2 of the project, the highway would be upgraded within the existing corridor. Features of this section include low embankments and cuttings and small bridges including the 65-metre-long overpass at station 17.8.

This area includes open woodland, pasture, crops and forest.

The nearest viewpoint to Lemon Tree Road referred to in Working paper – Urban design, landscape character and visual amenity, is located at George Road, Wells Crossing, around four kilometres north of the design refinement. The EIS assessed that the potential impacts of the project on the landscape character would be low; the design refinement would not alter this impact.

While the design refinement would result in a minor increase in clearing, the visual catchment is confined to the road corridor at this location. As such, this change would not be noticeable to viewers outside the corridor.

Due to the minimal differences between the EIS and the design refinement, potential impacts would be consistent with those included in section 11.3 of the EIS and no mitigation or management measures are required beyond those in the EIS.

Aboriginal heritage

The Aboriginal heritage assessment identified only one Aboriginal heritage artefact or place near Lemon Tree Road: a scarred tree in the clearing behind the service station buildings (Lemon Tree Road 1 (13-4-0180)). The design refinement would not result in impacts on this scarred tree. Further detail on the scarred tree recorded as part of the ancillary site assessment is provided in section 3.11 of this report.

Therefore, no mitigation or management measures are required beyond those in the EIS.

Historical (non-Aboriginal) heritage

There are no historical heritage items listed on the State Heritage Register or Local Environmental Plan in proximity to Lemon Tree Road. A heritage assessment identified the former Halfway Creek rural fire brigade station building located on Lemon Tree Road. However, this site did not meet the criteria for either local or State significance and, as such, is not considered to be a heritage item (refer to Appendix E for further details). No other sites were identified during field investigations.

Therefore, the design refinement would not result in impacts additional to those assessed in the EIS, and no mitigation or management measures are required beyond those in the EIS.

Traffic and transport

The design refinement would only provide for left-in and left-out movements (via an access road). A U-turn bay located at station 17.9 would allow northbound traffic to access Lemon Tree Road via the southbound carriageway. As such, the design refinement would provide for most of the turn movements to and from the highway. The intersection at Lemon Tree Road would still accommodate turning movements for B-double trucks as Lemon Tree Road is a declared B-double route for a short length. However, northbound traffic accessing the northbound carriageway would need to travel south for around 900 metres from the southbound merge lane to access the Grays Road U-turn bay. Only a small number of vehicles would perform this movement.

The design refinement would reduce the distance that northbound traffic has to travel to access Lemon Tree Road from the EIS design by 550 metres. This would also result in a reduction in travel time. However, this would still be longer than the current intersection arrangement.

Under the ultimate motorway upgrade, access to the upgraded highway from Lemon Tree Road would be removed, restricting access for highway traffic. Access to Lemon Tree Road would be available from the western service road via an overpass to the access road north of Lemon Tree Road.

During construction, the extension of the southbound merge lane could result in some minor disruption to vehicles exiting the service station. This would be managed in line with the Construction Traffic Management Plan.

No additional impacts are anticipated during construction or operation, and no mitigation or management measures are required beyond those in the EIS

Noise and vibration

The existing noise environment at Lemon Tree Road is dominated by road traffic noise from the highway, operation of the adjacent service station and the northbound vehicle rest area. There are five sensitive receivers near the Lemon Tree Road intersection and northern access road.

The design refinement would not result in a change to construction noise impacts when compared to the EIS design. All works required by the project would be managed in line with the Construction Noise and Vibration Management Plan.

In the EIS, the predicted noise levels at the two closest sensitive receivers during the project opening year would be above the Road Noise Policy (OEH, 2011) criteria of 60 dB(A) for daytime and 55 dB(A) for night-time:

- Receiver 581 would have daytime and night-time noise levels of 62 dB(A) and 61 dB(A), respectively.
- Receiver 582 would have daytime and night-time noise levels of 65 dB(A) and 63 dB(A), respectively.

As a result of the design refinement, traffic would no longer be required to travel on the access road to Lemon Tree Road. The arterial upgrade would provide access to Lemon Tree Road via the left-in only intersection. This would reduce the amount of traffic and noise generated from the access road, with only residents of the five properties travelling on the access road. However, the dominant noise source for all five sensitive receivers would continue to be the highway. As such, there is unlikely to be any noticeable difference in predicted operational noise impact with the design refinement at these receivers.

The EIS proposes noise mitigation for the two closest sensitive receivers (R581 and R582) (refer section 15.4 of the EIS). No mitigation or management measures are required beyond those in the EIS.

Land use and property

Land uses to the north of Lemon Tree Road comprise an area of forestry, grazing land and some rural residential properties adjacent to the highway. To the south there is Yuraygir State Conservation Area.

The design refinement would require:

- Additional clearing between stations 16.5 and 17.1 adjacent to Yuraygir State Conservation Area. However, this would be undertaken entirely within the existing road boundary and would not impact Yuraygir State Conservation Area.
- Acquisition of around 0.4 hectares of additional land from two private properties already directly affected by the project. No new properties would be affected by the design refinement.

No additional impacts are anticipated beyond those in section 16.3 of the EIS, and no mitigation or management measures are required beyond those in the EIS.

Social and economic

The socio-economic environment features the Pacific Highway, the service station and Halfway Creek rest area.

The design refinement would provide improved access for passing traffic to the service station by reducing the distance that northbound traffic would need to travel to access it. However, when the highway is upgraded to the ultimate motorway standard, no access would be permitted from the highway and only those vehicles on the service road would be able to access the service station.

During construction, there may be a slight increase in patronage of the service station by the construction crew, particularly workers at the ancillary facility site to the rear of the service station (Section 2, Site 1b).

The design refinement would not directly impact or affect access to any social infrastructure.

No mitigation or management measures are required beyond those in the EIS.

Management and mitigation

The design refinement would not require additional mitigation or management measures beyond those in the EIS.

4.4.3 Access at Luthers Road, Halfway Creek

Location

Luthers Road is a local road to the east of the existing highway between station 20.5 and station 22.0 in Section 2. It is located to the north-east of Kungala Road and to the north of the twin bridges over Halfway Creek. The road provides local access to 10 or so rural-residential properties. It has low traffic volumes and no seasonal changes in traffic flows.

EIS design

Section 2 of the project would initially be upgraded to an arterial standard.

Under the initial arterial road upgrade, Luthers Road would deviate to the north (station 21.5), with a left-in, left-out and right-in intersection with the upgraded highway.

Under the ultimate motorway upgrade, the intersection would be closed and access to Luthers Road would be via the western service road and a highway underpass at station 21.3.

Proposed design refinement

Under the initial upgrade to arterial standard, the left-in, left-out and right-in highway intersection to access Luthers Road would be relocated south to station 21.0.

Under the ultimate upgrade to motorway standard, an overpass would be provided at station 21.3 to provide access to Luthers Road. It would connect to the western service road and an access road to the north of Luthers Road.

The location and extent of the design refinement are shown in Figure 4-11.

Reason for design refinement

Under the ultimate motorway upgrade in the EIS, Luthers Road would be connected to the future service road via a highway underpass. However, it was found that this would present construction

difficulties, with the highway underpass needing to be excavated under the operational highway, potentially leading to stability and safety issues during construction. This design refinement addresses these constructability issues.

Consultation

There have been no meetings where access to Luthers Road was the specific subject of the discussion with community or stakeholders. However, the design refinement is within the EIS project boundary and would maintain the Luthers Road access as discussed in the EIS, although in a different form. Due to the minor nature of the design refinement, consultation with any adjoining property owners was not undertaken.

Environmental assessment

Hydrology and flooding

The Luthers Road access is located around 100 metres west and 250 metres north of the highway crossing of Halfway Creek. Halfway Creek catchment is mostly forested with some cleared agricultural areas, mostly downstream (west) of the existing highway. The intersection/overpass would be located adjacent to the limit of the 100-year ARI flood event area for the Halfway Creek catchment.

The design refinement would change the location of the intersection in the interim arterial upgrade, and the overpass in the ultimate motorway upgrade. This may alter the footprint of the project slightly but would not impact on or be impacted by the flooding behaviour of the area.

The impacts on hydrology and flooding would be consistent with the assessment in the EIS, and no mitigation or management measures are required beyond those in the EIS.

Soils, sediments and water

There is no published soil landscape map for the Halfway Creek area nearest to Luthers Road. From previous geotechnical investigations, soils are predicted to be highly erodible, particularly in cleared areas.

The design refinement would not change soils, sediments and water impacts, and potential impacts are considered to be consistent with those described in section 9.3 of the EIS. In particular:

- There are no known areas of contamination along or adjacent to Luthers Road, so no impacts are anticipated.
- Erosion and sedimentation controls would be implemented during construction, particularly in cleared areas to capture sediment leaving the site. The EIS design includes construction sedimentation basins around the main alignment near Luthers Road. Most of these basins would remain as permanent water quality basins to collect surface runoff when the road becomes operational. No changes are proposed to the basin design.
- The design refinement does not consist of any deep cuttings and, as such, would not impact the local or regional water table. No additional groundwater impacts from those identified in the EIS are anticipated.

Therefore, no mitigation or management measures are required beyond those in the EIS.

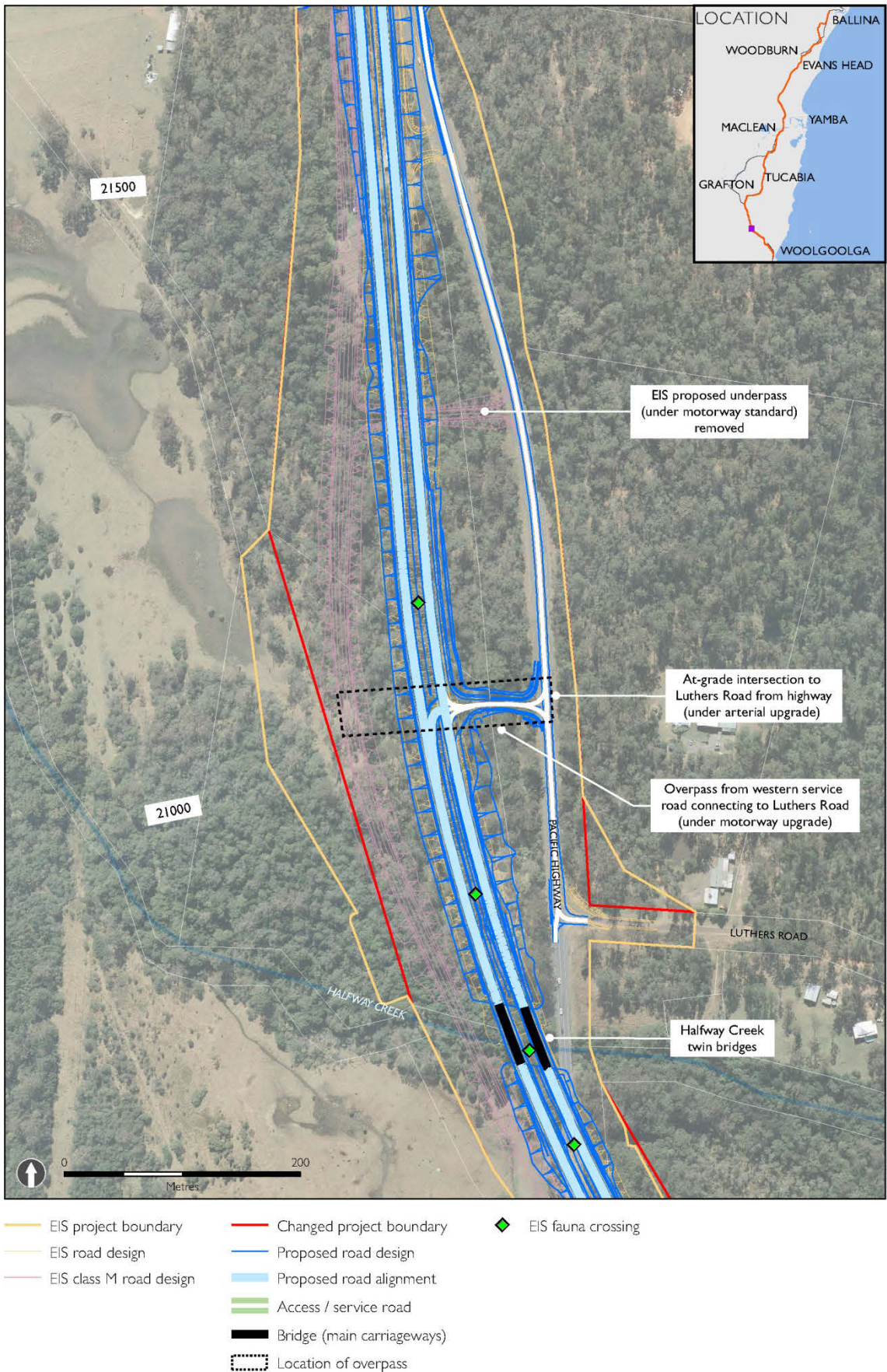


Figure 4-11: Revised design at Luthers Road, Halfway Creek

Biodiversity

The design refinement would result in increased vegetation removal (refer to Table 4-5). The additional area of vegetation to be removed comprises:

- Dry sclerophyll forest communities dominated by Blackbutt (*Eucalyptus pilularis*) (0.9 hectares).
- Needlebark Stringybark (*Eucalyptus planchoniana*) (0.1 hectares).

There would be no additional impacts on threatened ecological communities, but there would be a minor reduction (0.4 hectares) in direct impacts on Subtropical Coastal Floodplain Forest.

Table 4-5 Comparison of impacts at Luthers Road

BioMetric vegetation types	EIS design (ha)	Design refinement (ha)	Change in vegetation loss (ha)
Blackbutt – Bloodwood dry heathy open forest on sandstones of the northern North Coast	6.3	7.2	+0.9
Forest Red Gum – Swamp Box of the Clarence Valley lowlands of the North Coast (TEC, Subtropical Coastal Floodplain Forest – TSC Act)	0.9	0.9	0.0
Needlebark Stringybark – Red Bloodwood heathy woodland on sandstones of the lower Clarence of the North Coast	2.4	2.5	+0.1
Paperbark swamp forest of the coastal lowlands of the North Coast (TEC, Swamp Sclerophyll Forest – TSC Act)	0.2	0.2	0.0
Swamp Box swamp forest of the coastal lowlands of the North Coast (TEC, Subtropical Coastal Floodplain Forest – TSC Act)	4.7	4.3	-0.4
Swamp Mahogany swamp forest of the coastal lowlands of the North Coast (TEC, Swamp Sclerophyll Forest – TSC Act)	0.9	0.9	0.0
TOTAL	15.4	16.0	+0.6

The existing vegetation surrounding Luthers Road consists of the BioMetric vegetation type Blackbutt – Bloodwood dry heathy open forest on sandstones of the north coast. This community is not listed as endangered. The dry open forest provides potential habitat for threatened fauna species. These species (and their status under Commonwealth and State legislation) are:

- Powerful Owl (*Ninox strenua*) (vulnerable – TSC Act).
- Masked Owl (*Tyto novaehollandiae*) (vulnerable – TSC Act).
- Brush-tailed Phascogale (*Phascogale tapotafa*) (vulnerable – TSC Act).
- Rufous Bettong (*Aepyprymnus rufescens*) (vulnerable – TSC Act).
- Common Planigale (*Planigale maculata*) (vulnerable – TSC Act).
- Squirrel Glider (*Petaurus norfocensis*) (vulnerable – TSC Act).
- Koala (*Phascolarctos cinereus*) (vulnerable – TSC Act and EPBC Act).
- Yellow-bellied Glider (*Petaurus australis*) (vulnerable – TSC Act).
- Grey-headed Flying-fox (*Pteropus poliocephalus*) (vulnerable – TSC Act and EPBC Act).

In addition, the EIS outlines the indirect impacts of the project on threatened fauna and vegetation communities as a result of edge effects (such as weed invasion, surface runoff, noise and light impacts). Edge effects could result in the long-term degradation of the composition and structure of remaining vegetation. The design refinement would be marginally different in terms of the extent of these edge effects.

Koala habitat

A field investigation identified that the habitat is secondary koala habitat class 'C' and not 'habitat critical to the survival of koalas' under the EPBC Act. No evidence of koala activity was identified during the field investigation, and there are no records of koalas in the area.

The design refinement would have:

- Direct impacts on koala due to the additional clearing of dry sclerophyll forest (0.6 hectares), which is potential habitat for koala. However, no important populations have been reported in this location, so impacts would be unlikely.
- Indirect impacts on potential koala habitat due to degradation from edge effects mainly associated with weed invasion.

Connectivity for fauna

Connectivity movement corridors in the area are associated with the Yuraygir National Park and State Conservation Area and the Wells Crossing Flora Reserve.

The design refinement would have a minor impact on fauna movement relative to the EIS design as the fauna connectivity structures proposed in the EIS would be retained (the structures would have a combined fauna and drainage function). Fauna exclusion fencing would also be incorporated into the design to direct fauna to these safe highway crossing points.

The proposed fauna connectivity structures under the design refinement are described in Table 4-6. They were reviewed to ensure they would be suitably sized and located to target potential use by known populations of Rufous Bettong and Brush-tailed Phascogale. Due to an increase in the area of fill required for this design refinement, the combined culvert structure at station 20.88 would need to increase to around 60 metres (from 43 metres under the EIS design). This increased length may reduce the effectiveness of this structure for fauna movements.

Table 4-6 Fauna crossing structures in the design refinement area

Station	Name	Structure type	Dimensions (LxWxH) (m)	No. cells	Functionality
20.65		Culvert	48 x 3 x 2.4	4	Combined
20.71	Halfway Creek	Bridge	50.5 x 11 (L x W)		Combined
20.88		Culvert	60 x 3 x 2.4	1	Combined
21.29		Culvert	50 x 3x 3	1	Combined

In addition, the detailed design has confirmed that the proposed sediment basins in this section are located appropriately to avoid disruption to fauna connectivity.

The impacts on biodiversity would be similar to those in the EIS, and no mitigation or management measures are required beyond those in the EIS.

Urban design, landscape character and visual

Section 2 includes low embankments, cuttings and small bridges, including the 65-metre-long bridge at Wells Crossing (station 20.8).

The area includes open woodland, pasture, crops, forest and the Pacific Highway corridor.

The EIS assessed that the project would have low potential impacts on landscape character (precinct 07 Halfway Creek). The design refinement would not alter the impact on landscape character.

The visual catchment is mainly confined to the road corridor at this location. As such, the project (including the design refinement) would mostly be visible within the highway corridor. The design refinement would be directly opposite a residence to the east. However, vegetation between the design refinement and the residence means that any views would be glimpses between trees.

The potential impacts of the design refinement would be consistent with those included in section 11.3 of the EIS, and no mitigation or management measures are required beyond those in the EIS.

Aboriginal heritage

The Aboriginal heritage assessment undertaken did not identify any Aboriginal heritage items within the design refinement area. One Aboriginal heritage site was identified to the north of the design refinement (Wells Crossing Artefacts 1). The site is relatively disturbed. It comprises a flaked stone

artefact scatter with a low significance level. The design refinement would not impact on this Aboriginal heritage site.

Therefore, no mitigation or management measures are required beyond those in the EIS.

Historical (non-Aboriginal) heritage

There are no historical heritage items listed on the State Heritage Register or Local Environmental Plan within or adjacent to Luthers Road. The nearest historical heritage item is the service station complex adjacent to Kungala Road at Halfway Creek, which is of local heritage significance.

No heritage items would be impacted by this design refinement and no mitigation or management measures are required beyond those in the EIS.

Traffic and transport

In the arterial upgrade, Luthers Road would have access to the highway via an intersection on an access road. The design refinement would not alter the access to the upgrade, which would be available via a left-in, left-out, right-in intersection. However, this intersection would be relocated south to station 21.0, bringing the access closer to Luthers Road.

However, the design refinement would change the access to Luthers Road under the ultimate motorway standard. Access from the western service road to Luthers Road would be via an overpass, rather than an underpass. The impacts of this design refinement would be consistent with the impacts and mitigation described in section 14.3 of the EIS.

Therefore, no additional impacts are anticipated during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Noise and vibration

The existing noise environment at Luthers Road is dominated by road traffic noise from the highway. There are five noise receivers within 600 metres of the design refinement. Each of the receivers has been assessed in terms of the impact of both construction and operational noise and the assessment findings are included in section 15.3 of the EIS.

A further construction noise assessment was undertaken for the design refinement to assess the impacts from construction of the overpass. This included consideration of the use of higher noise- and vibration-emitting plant such as impact piling rigs that may be used during construction of the overpass.

The results of the construction noise assessment for both proposed project hours and out-of-hours construction are detailed in Table 4-7.

Table 4-7: Luthers Road overpass – construction noise assessment for design refinement

Receiver ID	Proposed hours noise management level	Out-of-hours noise management level	Noise predictions for bridges and piling (dB(A))
R624	54	42	55
R630	54	42	48
R633	54	42	49
R636	56	45	45
R639	56	45	52

The assessment found that noise levels (and, hence, impacts) during construction of the overpass would not differ from those identified in section 15.3 of the EIS. Noise impacts from the construction of the overpass would be managed through the Construction Noise Management Plan. Therefore, no mitigation or management measures are required during construction beyond those in Working paper – Noise and vibration.

In addition, during operation, the design refinement would not alter traffic movement or traffic forecasts. As such, there is not likely to be any difference in predicted operational noise levels identified in the EIS, and no mitigation or management measures are required beyond those in the EIS.

Land use and property

To the north of Luthers Road is an area of forestry, grazing land, and some rural residential properties adjacent to the highway. Further north are Glenugie and Newfoundland State forests.

The design refinement would not affect the land use of adjacent properties, and would only require minor changes to the project boundary. These minor changes would involve:

- Acquisition of an additional hectare of land from two private properties already directly affected by the project.
- Removal of the need to acquire 1.5 hectares of land from a property owned by the Department of Primary Industries.

As no additional land uses or new properties would be affected by the design refinement, no impacts are anticipated beyond those in the EIS, and no mitigation or management measures are required beyond those in the EIS.

Social and economic

The existing socio-economic environment features the highway and the service station near Kungala Road, around 250 metres to the south-west of Luthers Road. The service station relies on passing traffic and this provides some economic activity in the area adjacent to Luthers Road.

In the surrounding area are some rural residential properties where amenity is likely to be influenced by the highway and horticultural and forestry land uses.

The design refinement would maintain access to Luthers Road under both the interim arterial upgrade and the ultimate motorway upgrade.

The design refinement would not directly impact on or affect access to any social infrastructure, and, overall, is not anticipated to introduce new social and economic impacts. Therefore, no mitigation or management measures are required beyond those in the EIS.

Management and mitigation

This design refinement would not require a change to the proposed mitigation and management measures included in the EIS. Refer to Chapter 5 for details of all mitigation and management measures proposed for the project.

4.4.4 Realignment at Firth Heinz Road, Tucabia

Location

Firth Heinz Road is a local road located around station 51.8 in the Pillar Valley, about two kilometres east of Tucabia and 600 metres south of Chaffin Creek in Section 3.

Section 3 of the project would be a direct upgrade to full motorway standard that would involve constructing a new section of highway to the east of the existing highway.

EIS design

At this location, the highway would be located in a road cutting, adjacent to Firth Heinz Road. The upgrade would directly affect 0.78 hectares of the western section of the closed Tucabia landfill (Lot 1 DP 400850), previously operated by Clarence Valley Council as a waste disposal facility.

The EIS design consists of:

- A four-lane dual carriageway (two lanes in each direction), between station 51.9 and 52.9.
- A bridge crossing of Chaffin Creek at station 52.4 consisting of twin bridges 75 metres long (the twin bridges would function as a combined drainage and Emu structure).

- A 400-metre realignment of Firth Heinz Road to the east of the upgraded highway between station 51.9 and 52.3. The road would pass over the upgraded highway via an overpass, around 60 metres long (at station 51.9).
- Culverts (six cells each 3.6 by 1.2 metres) north of Chaffin Creek at station 52.4 (the overflow channel).

Proposed design refinement

The design refinement would involve realignment of the proposed highway to avoid the former landfill site adjacent to Firth Heinz Road and, therefore, would avoid the potential for contaminated land to be disturbed. The design refinement, shown in Figure 4-12, would involve:

- The realignment of a one-kilometre stretch of the highway between station 51.9 and station 52.9, around 100 metres west of the EIS alignment.
- The relocation of the twin bridges over Chaffin Creek at station 52.4, around 50 metres west of the EIS design. The bridges would still comprise twin bridges 75 metres long and function as a combined fauna crossing.
- The relocation of the Firth Heinz Road overpass, around 100 metres west of the EIS design.
- Alterations to around a 25-metre section of Firth Heinz Road either side of the highway to avoid landfill.
- A gated access point to the southbound carriageway of the upgrade from Firth Heinz Road at station 52.4 to provide emergency vehicle access.
- Culverts (nine cells each 3.6 by 1.2 metres) north of Chaffin Creek at station 52.4 (the overflow channel).

Reason for design refinement

The design refinement has been proposed to avoid directly impacting a former landfill site, previously used for disposal of waste materials. The site is currently capped and is being managed by Clarence Valley Council. By realigning the highway, the project would avoid potential impacts on contaminated land. The refinement would also avoid impacts on the flora species, *Maundia triglochoides* (listed under the TSC Act); the footprint of the EIS design would impact the edge of the population, affecting around 0.1 hectares.

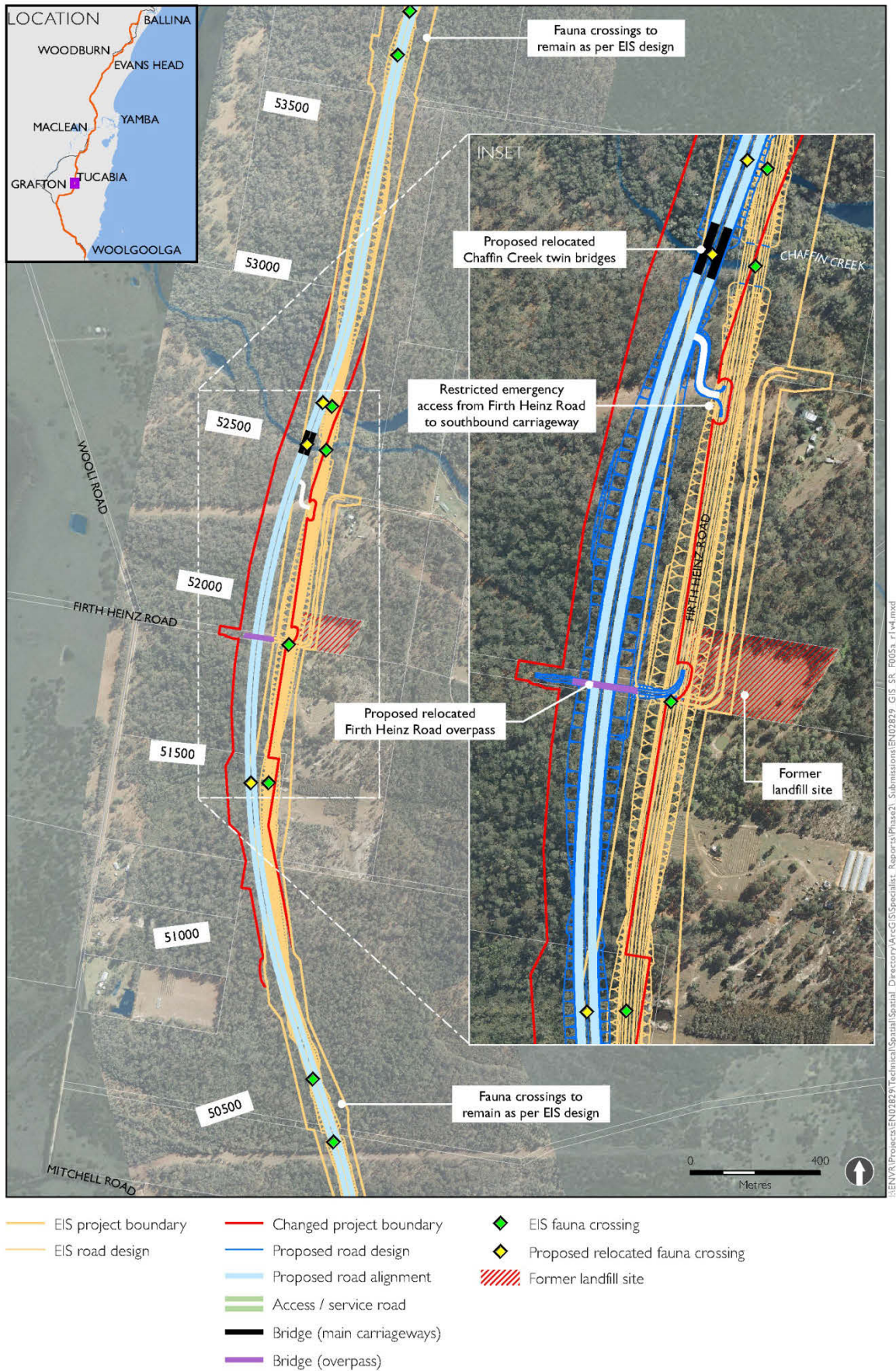


Figure 4-12: Revised design at Firth Heinz Road

Consultation

Consultation regarding the design refinement formed part of the EIS public display process between December 2012 and February 2013. Members of the project team attended community information sessions to discuss the EIS and the proposal to realign the project to avoid the landfill site at Firth Heinz Road. The main sessions where the design refinement was presented for discussion were:

- Tyndale Plantation Motel, Tyndale: 16 January 2013.
- Maclean Civic Hall, Maclean: 18 January 2013.
- Grafton Community Hall, Grafton: 18 January 2013.

The project team also attended:

- Stakeholder meetings at Clarence Valley Council on 12 December 2012.
- Staffed displays at Maclean Civic Hall on 9 February 2013; Tucabia Community Hall, Tucabia on 12 February 2013; and the Plantation Motel, Tyndale on 12 February 2013.
- A workshop with emergency services on 16 January 2013 at Corindi Trust Community Hall. Participants were informed of the inclusion of a gated access point at Firth Heinz Road to provide emergency vehicles with southbound access.

As part of the EIS, a request for information regarding the former landfill site was submitted to Clarence Valley Council to determine the boundary, extent, former land uses, and fill types. The correspondence received from Council on 21 September 2012 indicated part of the property was used as a rubbish depot. Council maintained the tip prior to its closure. In response to this information and recent geotechnical site work, the design was refined to avoid contaminated land risk.

No community concerns were raised regarding Roads and Maritime's intention to realign the project to avoid the landfill site at Firth Heinz Road.

Directly affected property owners were also consulted and no objections were received on the design refinement.

Environmental assessment

Hydrology and flooding

As stated in section 8.2.2 of the EIS, the existing hydrological environment surrounding Firth Heinz Road includes the Clarence River catchment. In this catchment, the nearest watercourse to Firth Heinz Road is Chaffin Creek, 100 metres north. The Clarence River catchment also includes Pillar Valley Creek (around four kilometres south of Firth Heinz Road), and Champions Creek (around five kilometres north).

In the EIS design, the flood level at the nearest property to the north of Firth Heinz Road, upstream of Chaffin Creek, would meet the project design criteria of 50 millimetres. The EIS hydrological model was re-run to consider the impacts of the design refinement. It was found that moving the bridge and road alignment west of Firth Heinz Road would locate the bridge structure at Chaffin Creek around 50 metres further downstream. This would result in a change to the shape and size of the channel, and an increase in flood level within Chaffin Creek from an afflux of 50 millimetres (which is the project afflux criterion) to 80 millimetres (which is well above the criterion).

To meet the flood impact criterion of 50 millimetres for the project adjacent to Firth Heinz Road, three additional culverts are proposed north of Chaffin Creek (at the overflow channel). By increasing the number of culverts at station 52.4 (from six to nine), the flood level would be reduced to within the project afflux criterion of 50 millimetres. (It is proposed to use reinforced concrete box culverts 3.6 by 1.2 metres). A new management measure is proposed to further model these culverts during detailed design.

Soils, sediments and water

Firth Heinz Road is set in a landscape with mainly rural, rural residential, and forestry land uses.

This design refinement would have significant benefits for soils, sediments and water when compared with the EIS design. In particular, it would avoid the former landfill site adjacent to Firth Heinz Road, which is identified in section 9.2 of the EIS as a potential area of environmental concern due to the

presence of contaminated land. This design refinement would therefore eliminate the potential for the site to be disturbed during construction, and minimise risks to soils, sediments and water (including groundwater) from contaminated land. However, further investigations would be undertaken to identify any impacts from contaminated groundwater (refer to SSW45).

In addition:

- The soil erosion risks would be no different from those identified in section 9.3 of the EIS. During construction, there would be an increased risk of soil erosion from exposed soil and stockpile sites, in particular during clearing and earthworks west of Firth Heinz Road, and at the twin bridge crossing of Chaffin Creek. This risk would be managed using the measures outlined in the EIS.
- Surface runoff from the upgraded highway would be managed with permanent water quality ponds, as proposed in the EIS design, to the north and south of Chaffin Creek. Larger sedimentation basins would be used to capture sediment during the construction.

Groundwater is likely to be within around two metres of the surface, and potential groundwater impacts from the former landfill would be considered during detailed design to minimise ingress and safeguard the project.

There are limited occurrences of acid sulfate soils in this project section, and the design refinement is not expected to have any further impacts on acid sulfate soils than was identified in the EIS.

Biodiversity

A biodiversity field investigation found that the design refinement would:

- Increase the loss of vegetation and fauna habitat by 3.5 hectares.
- Increase the clearing of threatened ecological communities by 0.1 hectares. While it would reduce the clearing of the threatened ecological community Subtropical Coastal Floodplain Forest (endangered TSC Act), it would increase the clearing of Swamp Oak Forest (endangered TSC Act).

Table 4-8 compares the impacts of the EIS design and the design refinement on vegetation and threatened flora species. Figure 4-13 shows the location of threatened ecological communities near Firth Heinz Road.

Table 4-8 Comparison of biodiversity impacts between the EIS design and the design refinement

BioMetric vegetation types	EIS design (ha)	Design refinement (ha)	Change in vegetation loss (ha)
Blackbutt – bloodwood dry heathy open forest on sandstones of the northern North Coast	11.2	14.1	+2.9
Forest Red Gum – Swamp Box of the Clarence Valley lowlands of the North Coast (TEC, Subtropical Coastal Floodplain Forest TSC Act)	2.3	1.4	-0.9
Scribbly Gum – Needlebark Stringybark heathy open forest of coastal lowlands of the northern North Coast	8.5	8.1	-0.4
Spotted Gum – Grey Ironbark – Pink Bloodwood open forest of the Clarence Valley lowlands of the North Coast	0.4	1.3	+0.9
Swamp Mahogany swamp forest of the coastal lowlands of the North Coast (TEC, Swamp Sclerophyll Forest TSC Act)	0.9	1.4	+0.5
Swamp Oak swamp forest of the coastal lowlands of the North Coast (TEC, Swamp Oak Floodplain Forest TSC Act)	0.2	0.7	+0.5
TOTAL	23.5	27	+3.5
<i>Angophora robur</i> (individuals)	313	494	+181
<i>Maundia triglochinos</i> (ha)	0.1	0	-0.1 ha

The design refinement would traverse open forest and moist forest habitats and would increase the area of clearing from that assessed in the EIS for the following forest fauna habitats:

- Blackbutt open forest.
- Spotted Gum / Grey Ironbark open forest.
- Swamp Mahogany open forest.
- Swamp Oak forest.

Several additional hollow-bearing trees would be impacted by the design shifts that were not impacted previously. This location provides potential habitat for a range of threatened fauna species including:

- Powerful Owl (*Ninox strenua*) (vulnerable TSC Act).
- Masked Owl (*Tyto novaehollandiae*) (vulnerable TSC Act).
- Brush-tailed Phascogale (*Phascogale tapotafa*) (vulnerable TSC Act).
- Rufous Bettong (*Aepyprymnus rufescens*) (vulnerable TSC Act).
- Squirrel Glider (*Petaurus norfocensis*) (vulnerable TSC Act).
- Glossy Black-cockatoo (*Calyptorhynchus lathamii*).
- Koala (*Phascolarctos cinereus*) (vulnerable TSC Act and EPBC Act).
- Grey-headed Flying-fox (*Pteropus poliocephalus*) (vulnerable TSC Act and EPBC Act).
- Swift Parrot (*Lathamus discolor*) (endangered TSC Act and EPBC Act).
- Several threatened microchiropteran bat species, particularly hollow-dependent fauna.

A direct loss of habitat, including food, shelter and breeding resources would affect populations of these threatened fauna in project section 3, in particular the important populations of Brush-tailed Phascogale, Rufous Bettong and Squirrel Glider. The design refinement would result in an additional loss of 3.5 hectares of potential habitat, including a greater impact on primary koala habitat.

Indirect impacts on threatened fauna would be associated with edge effects on remaining habitat adjacent to the project including weed invasion, runoff and noise and light impacts. Edge effects would be associated with long-term degradation in the composition and structure of remaining vegetation adjacent to the project, and may increase over a slightly larger area due to the increased clearing, but would only be a minor change from the EIS.

Allocasuarina species are a critical food resource for Glossy-Black Cockatoo, as are large tree hollows for nesting. The design refinement would remove an area of known food resource for the Glossy Black-Cockatoo. Potential nesting hollows (not confirmed) are present in the area and would be impacted. If a breeding pair occupies part of the habitat, and/or a nest tree is removed, this would likely have a significant impact on a local scale. The loss of habitat may lead to reduced breeding success for an established pair and affect recruitment and dispersal on a local scale. However, it is unlikely to be a significant impact on the regional population.

Impacts on *Angophora robur* and *Maundia triglochinos*

The design refinement would result in an increased impact on listed Sandstone Rough-barked Apple (*Angophora robur*) (vulnerable TSC Act and EPBC Act) when compared with the EIS design. There are two main clusters, one located at the northern end from station 52.0 to 52.4, and one at the southern end at station 50.5. At the southern end, impacts would remain the same as in the EIS. However, at the northern end, the design refinement would result in the loss of an additional estimated 181 individual *Angophora robur* trees.

The design refinement would have a lesser indirect impact (in terms of edge effects) on *Angophora robur* than the EIS design, retaining individuals between station 52.0 and 52.3 to the east of the alignment. Under the EIS design, the patch would have been bisected, with trees on both sides of the highway, increasing potential indirect impacts. The design refinement would not require the construction of a new section of Firth Heinz Road, reducing indirect impacts again. *Angophora robur* is likely to be somewhat tolerant of edge effects and indirect impacts would not be expected to significantly impact the lifecycle attributes of the species.

The design refinement would also avoid impacts on a population of the listed *Maundia triglochinos* (vulnerable TSC Act) on the northern side of Firth Heinz Road (about 0.1 hectares).

The design refinement would move the road around 40–50 metres further west, avoiding direct impacts on a large pond located on Chaffin Creek. This pond was identified as being of high habitat

value for fauna, particularly waterfowl and frogs and is also expected to provide important fish habitat. No populations of threatened fish or frogs have been identified at this location. Potential impacts on the waterway are associated with indirect impacts including noise levels and surface runoff. While noise levels at the pond would be slightly reduced, potential impacts during construction and operation would remain the same and would not directly impact calling birds and amphibians. Surface runoff during both construction and operation would be controlled via sedimentation and water quality basins.

Connectivity for fauna

This design refinement would not change the potential impact on fauna movements or alter a proposed connectivity structure. The design refinement includes a number of combined drainage structures to target potential use by known populations of threatened fauna including the Coastal Emu, Rufous Bettong and Brush-tailed Phascogale. It also includes a canopy rope structure targeted at Squirrel Glider and potentially Yellow-bellied Glider and Brush-tailed Phascogale. These are described in Table 4-9.

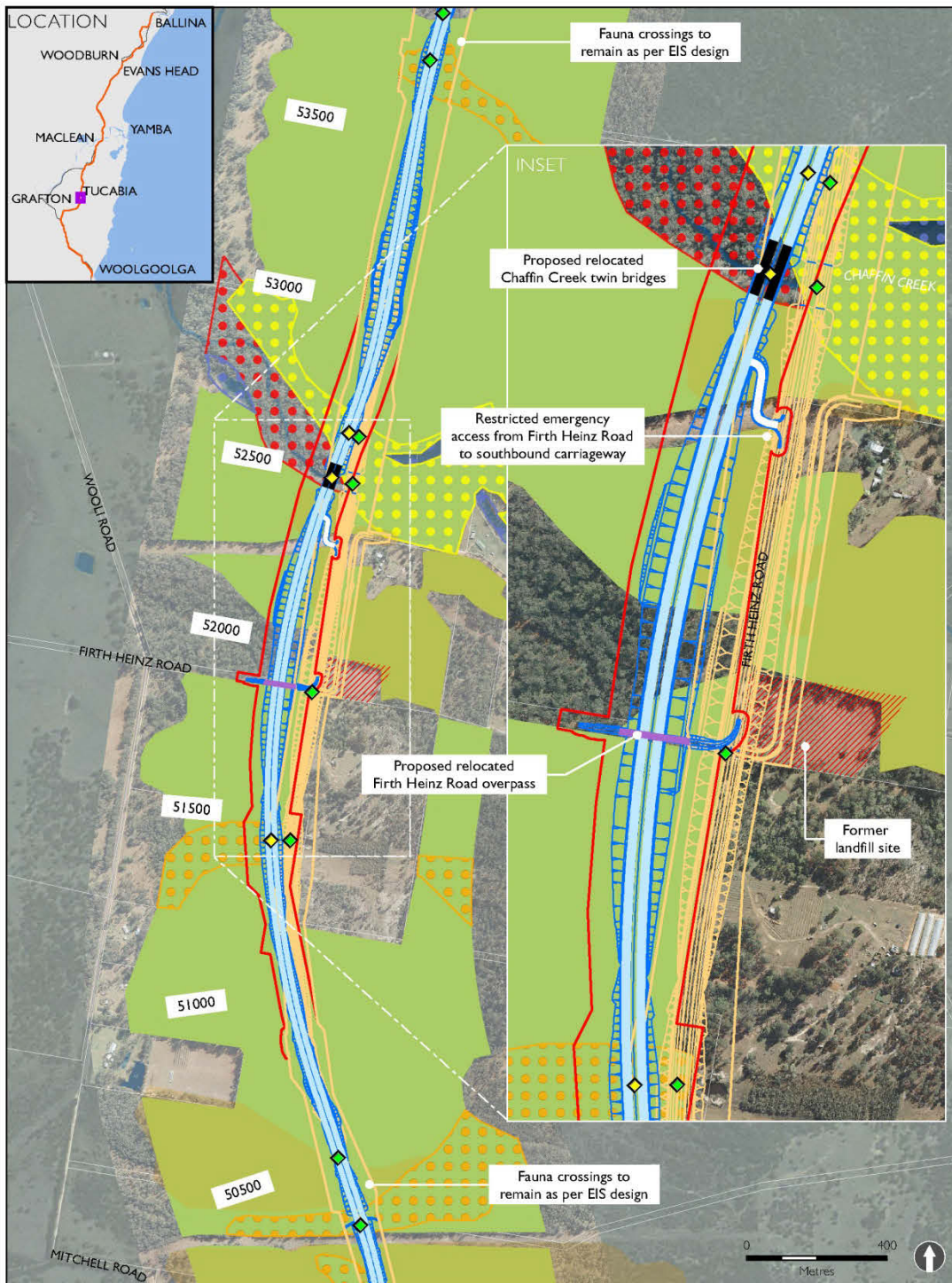
Table 4-9 Combined fauna crossing structures provided in the design refinement area

Station	Name	Structure type	Length (m)	No. cells	Width (m)	Height (m)	Bridge length/width	Functionality
50.5		Canopy rope	65					Dedicated
51.4		Culvert	62	1	2.4	3.6		Combined
52.4	Chaffin Creek	Bridge					54 x 10.5	Combined
52.6		Culvert	60	6	3.6	2.1		Combined
53.7		Culvert	63	1	3.6	3.6		Combined

At stations 50.5 and 53.7 (the start and end of the deviation of the alignment to the west) there would be no change to the widening of the project footprint, and there would be no change to the length of the structures. At stations 51.4 and 52.6 the alignment would shift to the west around 40–60 metres but the width and height of the road would remain the same and there would be no change in the design or length of the structures.

The Chaffin Creek bridge at station 52.5 would remain as part of the design refinement but shift about 60 metres to the west. This bridge (54 metres long) is a combined fauna crossing structure and was raised to a 3.6 metre clearance to provide passage for Coastal Emu. Chaffin Creek is a Class 1 waterway with potential to provide fish habitat. There would be no change in connectivity for aquatic or terrestrial fauna. The proposed combined structures for emus in the area over the Firth Heinz Road design refinement would remain.

No additional management measures beyond those identified in the EIS are required.



- | | | |
|------------------------|-------------------------------------|--|
| — EIS project boundary | — Changed project boundary | — Angophora robur distribution |
| — EIS road design | — Proposed road design | — Habitat critical to the survival of koalas (EPBC Act) |
| | — Proposed road alignment | Threatened ecological communities |
| | — Access / service road | — Freshwater Wetlands on Coastal Floodplains |
| | — Bridge (main carriageways) | — Subtropical Coastal Floodplain Forest on Coastal Floodplains (Endangered, TSC Act) |
| | — Bridge (overpass) | — Swamp Oak Floodplain Forest on Coastal Floodplains (Endangered, TSC Act) |
| ◆ EIS fauna crossing | ◆ Proposed relocated fauna crossing | — Swamp Sclerophyll Forest on Coastal Floodplains (Endangered, TSC Act) |
| ◆ Former landfill site | | |

Figure 4-13: Revised design at Firth Heinz Road showing biodiversity features

Urban design, landscape character and visual

The landscape type within the Pillar Valley includes floodplain, valley land, foothills, open woodland (pasture), forest, ranges and hilltops. The Pillar Valley and Pillar Range foothills are features. The area has a high landscape quality within wooded foothills that would be moderately impacted by the project.

The design refinement would realign one kilometre of highway, and relocate a twin bridge structure, to the west, away from two residences. However, the overall impacts of this design refinement on landscape character and visual amenity would be consistent with the impacts described in the EIS.

There are no additional impacts expected during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Aboriginal heritage

The area adjacent to Firth Heinz Road has moderate Aboriginal heritage sensitivity (refer to section 12.2 of the EIS) where the highway (under the design refinement) would cross Chaffin Creek.

Aboriginal heritage was assessed by field survey and sample test excavation. The Registered Aboriginal Parties consulted prior to the site inspection and/or in attendance during fieldwork were:

- Yaegl Local Aboriginal Land Council.
- Birrigan-Gargle Local Aboriginal Land Council.
- Yaegl People Native Title Claim.

The design refinement was discussed with Registered Aboriginal Parties at an Aboriginal Focus Group meeting on 6 February 2013 at Grafton Community Centre. A site inspection by project archaeologists on 14 February 2013 was undertaken. This identified a scarred tree (Chaffin Creek Tree 1) 50 metres west of the revised located of the Chaffin Creek twin bridges, on the southern bank of Chaffin Creek at station 54.75. This scar tree is located outside the project boundary.

A second scarred tree (Chaffin Creek Tree 2) was located on the northern bank of Chaffin Creek inside the project boundary. This is around 20 metres west of the fill batter of the relocated twin bridges, around station 54.9, so is outside the direct construction footprint. It would therefore not be directly impacted by construction and would be avoided during construction with a protective buffer zone. This additional mitigation measure is included in Chapter 5 of this report.

Historical (non-Aboriginal) heritage

Historical heritage assessment has identified few historical heritage items near Firth Heinz Road or across Section 3 of the project more generally.

The design refinement would not directly impact any historical heritage items, any State Heritage Register items including High Value Conservation Old Growth Forest.

The nearest heritage item is Tyndale Residence at Tyndale (item No 11), which is listed on the Clarence Valley Local Environmental Plan 2011 and located around 11 kilometres north of Firth Heinz Road. This would not be directly or indirectly impacted by the design refinement.

The design refinement would not result in any additional impacts from those identified in the EIS during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Traffic and transport

Firth Heinz Road would continue to pass over the highway and would be realigned east of the highway. This refinement would not change local access or travel times and there would continue to be a connection across the upgraded highway.

A gated access would provide emergency vehicles with access to the southbound carriageway from Firth Heinz Road. This would allow emergency responders to access the highway via Firth Heinz Road, rather than travel to the nearest interchange at Glenugie (to the south) or Tyndale (to the north).

The overall impacts of this design refinement would be consistent with the impacts and mitigation described in the EIS. No additional impacts are anticipated during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Noise and vibration

The existing noise environment is dominated by rural residential land uses, limited local road traffic noise, livestock and wildlife noise.

The design refinement was modelled to identify potential noise and vibration impacts during construction and operation. Two noise-sensitive receivers around 850 metres to the south-west of Firth Heinz Road, off Woolli Road, would be located 30 to 60 metres closer to the highway (R713 and R716). Five receivers to the east of Firth Heinz Road would be located 30 to 60 metres further away from the realigned highway (R717, R723, R724, R729, and R731). Receiver R729 would be within 80 metres of the revised alignment and R717 would be within around 125 metres. The remaining nearby receivers are around 300 metres (R731) and 500 metres away (R723, R724).

The construction noise assessment indicates construction noise levels from the design refinement would be consistent with those included in the EIS and no further mitigation or management measures are required beyond those in the EIS.

The operational noise assessment indicated there would be a minor increase in predicted noise levels for receivers to the west of the design refinement and a noise reduction for receivers to the east. The assessment indicated receivers R714 and R716 would experience an increase in noise levels of about 0.5 dB(A). Receivers R717, R723, R724, R729, and R731 would experience a potential reduction in noise levels of around 0.5 dB(A). An increase or decrease of 0.5 dB(A) is imperceptible to the human ear. For receiver R717, the noise reduction would be up to around 3 dB(A).

All the above receivers were identified for noise mitigation in section 15.4 of the EIS and no further mitigation and management measures are required beyond those in the EIS. The inclusion of the design refinement at Firth Heinz Road in the overall design would not affect the recommended noise mitigation. This would be confirmed during detailed design.

Land use and property

The highway upgrade alignment would pass through a mix of open grazing land and remnant bushland on the eastern side of the Pillar Valley, about four kilometres south-east of Tucabia. The properties that would be impacted by the EIS design and the design refinement are shown in Table 4-10.

Table 4-10: Property impact schedule for EIS design at Firth Heinz Road, and refined design

Property	Land use	EIS		Design refinement		Change in impact area
		Impact area (ha)	% of property affected	Impact area (ha)	% of property affected	
Lot 1 DP 254500	Grazing	1.5	72.7	0.2	10.8	-1.3
Lot 115 DP 751365	Grazing	14.4	30.7	11.8	25.1	-2.6
Lot 133 DP 751365	Grazing	1.9	11.8	3.9	24.4	2
Lot 168 DP 751365	Grazing	2.3	10.4	0.04	0.2	-2.26
Lot 44 DP 751365	Grazing	5.2	4.0	11.9	9.2	6.7
Lot 584 DP 626719	Grazing	10.9	3.9	11.4	4.1	0.5
Lot 98 DP 751365	Grazing	1.4	8.6	4.8	29.4	3.4
Lot 1 DP 400850	Grazing	0.8	38.8	0	0	-0.8
Lot 168 DP 751365	Grazing	2.3	10.4	0	0	-2.3
Lot 2 DP 400850	Grazing	2.4	16.7	0	0	-2.4
		43.1		44.0		0.9

The project boundary of the design refinement would include a further 0.9 hectares of grazing land, tree and shrub cover. The area of acquisition would increase from 43.1 hectares to 44.0 hectares. The design refinement would impact four previously affected properties to the west of the project. Three properties east of the highway would no longer be affected, including the former landfill.

Overall, the design refinement would reduce the number of directly affected properties from 10 to seven. No new properties would be affected.

The design refinement would not affect the land use of adjoining properties.

No additional impacts are expected during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Social and economic

Under the design refinement, within Section 3, the highway would be moved closer to communities and individual houses currently unaffected by the highway or other major roads including Pillar Valley and Tucabia. Two dwellings would be located closer to the highway than described in the EIS, and five dwellings would be further away.

The inclusion of a gated access would provide benefits to the community by enabling quicker and easier access by emergency services to the highway.

While the upgrade would affect the rural amenity and character of the area (from increased traffic, noise and visual changes), the overall impacts of this design refinement would be consistent with the impacts and mitigation in the EIS.

No additional impacts are expected during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Management and mitigation

The additional mitigation measures recommended for this design refinement are presented in Table 4-11.

Table 4-11: Firth Heinz Road – additional mitigation

Issue	ID number	Mitigation measure	Timing	Relevant section
Hydrology and flooding	HF26	Additional culverts north of Chaffin Creek at the overflow channel around station 52.6, will be hydraulically modelled and confirmed during the detailed design to manage potential flood impacts, to meet the flood management objectives detailed in the EIS.	Pre-construction	3
Soils, sediments and water: potential contamination impacts	SSW45	Further investigations will be undertaken to identify any impacts from contaminated groundwater from the former landfill sites at Firth Heinz Road and Crowleys Road.	Pre-construction	3
Aboriginal heritage	AH19	Chaffin Creek scarred tree (Chaffin Creek Tree 2): <ul style="list-style-type: none"> Before construction, an exclusion zone will be established as per management measure AH2. An arborist will be consulted to develop a management strategy to ensure the health and preservation of the tree. 	Pre-construction	3

The above measures are included in Chapter 5 of this report, with a list of all additional measures required to manage design refinement impacts. This design refinement would not require other changes to the proposed mitigation and management measures in Chapter 19 of the EIS.

4.4.5 Relocation of rest area at Pine Brush

Location

The rest area at Pine Brush is located in Section 3 of the project, between Bostock and Somervale roads. The rest area location in the EIS design would be adjacent to the Pine Brush State Forest around 1.5 kilometres south of Crowleys Road and Tucabia-Tyndale Road.

EIS design

A rest area was included in the EIS design (for northbound and southbound traffic), from station 63.3 to 64.3, north of the Pine Brush State Forest. The rest area would be designed to accommodate both trucks (up to B-double) and cars, and would provide:

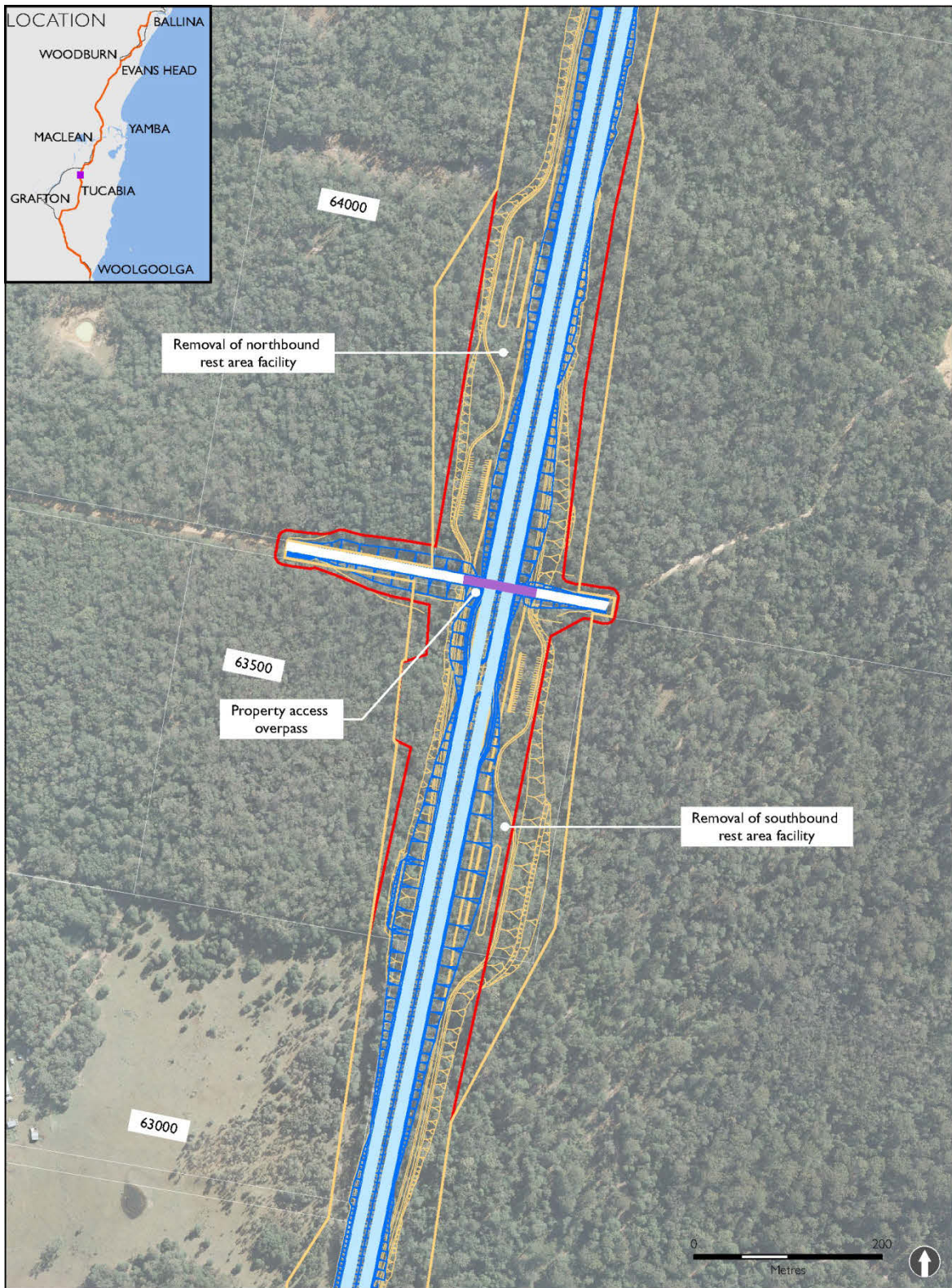
- An area about 500–1000 metres long and 150 metres wide, to accommodate road users taking a break from their journey.
- Merge and diverge lanes into the rest area.
- Suitable parking and movement for B-double trucks.
- Car parking areas separate from truck parking areas.
- Toilet and water facilities.
- A picnic area, maps and information signs.

The EIS design is shown in Figure 4-14.

Proposed design refinement

The design refinement would be located mainly within the area assessed in the EIS, in an area identified for removal of vegetation for the project. The project boundary would be increased by around 0.5 hectares, and be around 170 metres wide. The design refinement is shown in Figure 4-15. It would consist of:

- The relocation of the rest area from Pine Brush 7.5 kilometres south, to between Bostock Road and Somervale Road (station 55.2 to 56.7), on the crest of a rising slope.
- Merge and diverge lanes to provide entry and exit points, to and from the project.
- Northbound and southbound rest areas for light vehicles and heavy vehicles, located across a 1.4-kilometre section of the project.
- A larger overpass at Bostock Road around 45 metres long and eight metres wide.
- Layout, function and amenities that would be similar to the EIS design.
- A change in the footprint of the rest area.
- The removal of the rest area at station 63.3 to 64.3, and the reduction in the project boundary to the highway alignment.






- | | |
|--|--|
|  EIS project boundary |  Changed project boundary |
|  EIS road design |  Proposed road design |
| |  Proposed road alignment |
| |  Access / service road |
| |  Bridge (overpass) |

Figure 4-14: Rest area at Pine brush - EIS design

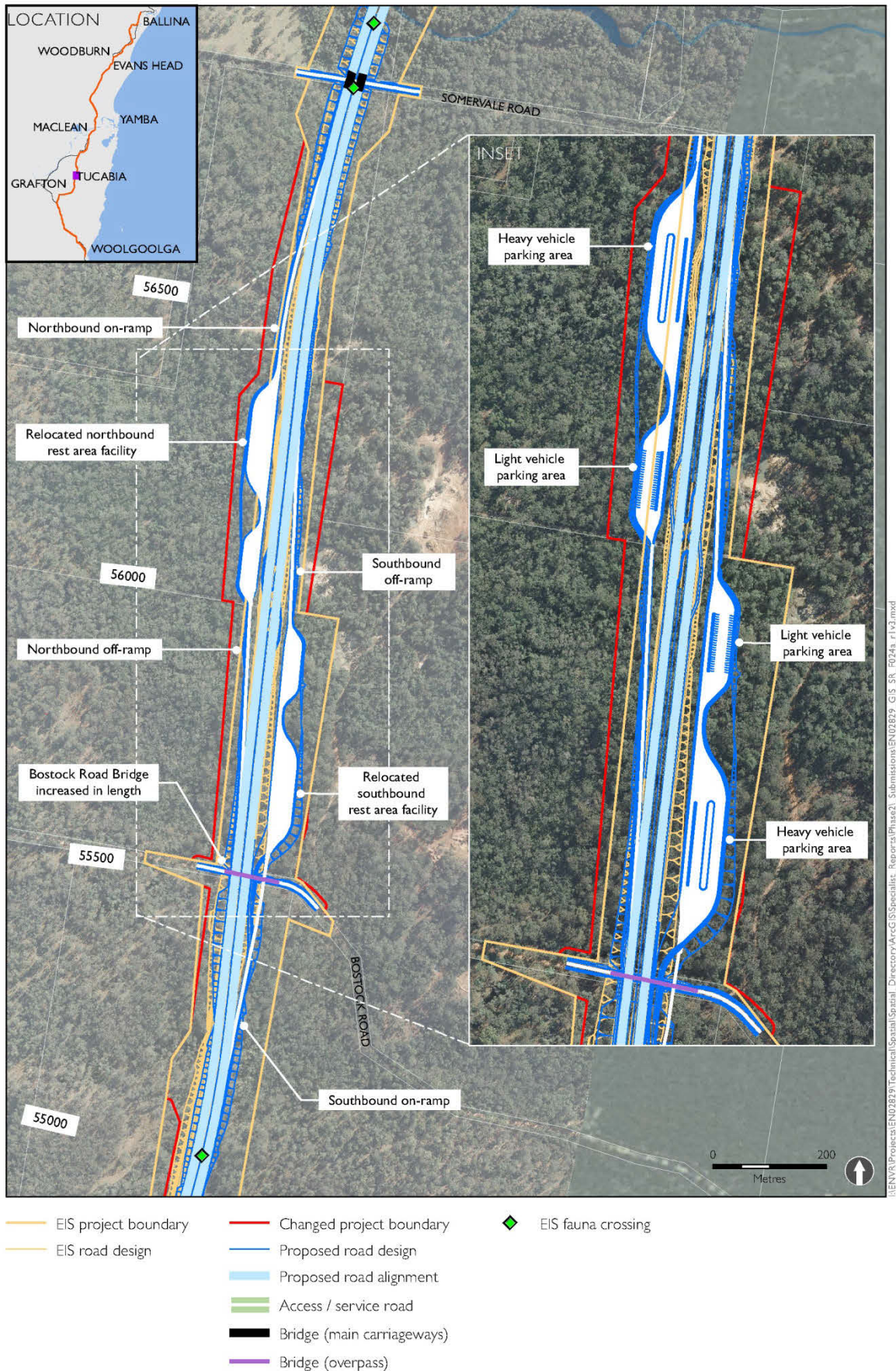


Figure 4-15: Rest area at Pine brush - design refinement

Reason for refinement

The location of the rest area has been altered to minimise impacts on threatened species. The location of the rest area is governed by the functional requirements. A brief discussion on other options considered for the rest area at Pine Brush is detailed below. Further details on the general principles in siting rest areas are in section 3.10.

In keeping with the *Strategy for Major Heavy Vehicle Rest Areas on Key Rural Freight Routes in Rural NSW* (Roads and Maritime 2010) on the Pacific Highway, rest areas for the project need to be:

- Located around 50 kilometres apart.
- Situated on or near a crest.

The first rest area on the project is located just south of the start of the project at Arrawarra. In order to be located around 50 kilometres north of the Arrawarra rest area, the next rest area (ie the rest area at Pine Brush) would need to be situated between stations 40.0 and 70.0. This entire section is through rural, floodplain and heavily vegetated areas.

The second functional criterion that needs to be met – that the location needs to be on or near a crest – is so vehicles are decelerating near the rest area and not accelerating; this improves safety and ease of access. A review of this section of the project identified 16 locations that meet this requirement. Each of these locations was then reviewed against biodiversity and social constraints. Fifteen of these locations were constrained by biodiversity features such as heavy vegetation (including the design refinement location), would pass through areas of habitat critical to the survival of koalas or would result in additional impacts on the threatened flora species Sandstone Rough-barked Apple (*Angophora robur*). There are few locations that are cleared of vegetation or partially cleared. However, these are generally found to be in proximity of sensitive receivers (eg station 40.0 and station 63.1). These sites were discounted as they would add an additional noise impact on a quiet rural environment.

The design refinement location was selected because it would minimise biodiversity impacts, even though it is in an area of heavy vegetation, it contains habitat critical to the survival of koalas, it is part of a Coastal Emu movement corridor, and it contains patches of *Angophora robur*. In particular:

- The design refinement would be mostly situated within the assessed EIS project boundary and the clearing of vegetation required for the construction of the project. As such, the location would minimise any additional vegetation clearing and would not result in additional impacts on habitat critical to the survival of koalas. A reduction in the design footprint at the southern extent of the design refinement and in the EIS rest area location would result in an overall reduction in impacts on *Angophora robur*.
- The design refinement would not constrain any proposed crossing structures for emus and would not preclude further changes to local road overpasses to facilitate combined emu crossing.
- The design refinement would be located away from sensitive receivers, which would avoid any additional noise impacts on the rural environment.
- The design refinement would reduce the footprint of the highway alignment. This would result in a reduction in the additional area of clearing required including of the threatened species *Angophora robur*.

Consultation

Consultation regarding the design refinement formed part of the EIS public display process between December 2012 and February 2013. Members of the Roads and Maritime project team attended community information sessions to discuss the EIS, and the proposal to change the rest area location. The main information sessions where the design refinement was discussed were:

- Tyndale Plantation Motel, Tyndale: 16 January 2013.
- Maclean Civic Hall, Maclean: 18 January 2013.
- Grafton Community Hall, Grafton: 18 January 2013.

Project team members also attended stakeholder meetings at Clarence Valley Council on 12 December 2012. A staffed display was also held at Maclean Civic Hall on 9 February 2013, Tucabia Community Hall, Tucabia on 12 February 2013 and at the Plantation Motel, Tyndale on 12 February

2013. Members of the project team were available to meet with the community and answer questions about the project.

The design refinement responds to submissions received by the Department of Planning & Infrastructure and the community consultation process requesting a reduction in biodiversity impacts. A review of the rest area by the project team identified that impacts on *Angophora robur* could be reduced by relocating the rest area.

Further consultation is planned with directly affected property owners during the approval and detailed design.

Environmental assessment

Hydrology and flooding

The closest watercourse to the design refinement is Champions Creek, around 200 metres north of the merge/diverge lanes. Relocation of the rest area would not result in any further impacts on the hydrology of Champions Creek, or any further impacts on overall flooding impact, duration and velocity.

The overall hydrology and flooding impacts of this design refinement would be consistent with the impacts outlined in the EIS. No additional impacts have been identified during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Soils, sediments and water

There are limited occurrences of acid sulfate soils in project section 3. Acid sulfate soils are generally associated with waterways. These waterways have a high probability of occurrence to the west of the alignment (refer to Figure 9-14 of the EIS). The design refinement is not expected to have any further impacts on acid sulfate soils than was identified in the EIS.

During construction, there would be an increased risk of soil erosion, in particular during vegetation clearing and topsoil removal. However, potential impacts would be no different from those identified in section 9.3 of the EIS. To manage surface runoff from the upgraded highway, permanent water quality ponds were included in the EIS design around the design refinement location. These basins would be retained in the design refinement to capture surface run off from the highway and the rest area pavement. The need for additional basins or resizing would be undertaken during detailed design.

The project also includes larger sedimentation basins to capture sediment during construction.

The design refinements would not substantially change the depth of cuttings in the area. No additional groundwater impacts from those identified in section 9.3 of the EIS have been identified. As stated in section 9.3.1 of the EIS, due to the absence of available groundwater data in the area, a precautionary approach would be adopted for earthworks within this area and the cutting would remain as a Type A cutting that requires mitigation.

The overall impacts of this design refinement would be consistent with the impacts outlined in the EIS. No additional impacts are anticipated during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Biodiversity

The rest area relocation would see a net improvement in impacts as vegetation clearing would be reduced by 5.4 hectares. There would be a reduction of 6.5 hectares from the smaller footprint at the EIS location and an increase of only 1.1 hectares at the relocated site (refer Table 4-12). The changes in impact in vegetation and threatened species between the EIS design and the design refinement are indicated in brackets.

Table 4-12 Comparison of impacts between the EIS design and the design refinement

BioMetric vegetation types	EIS rest area location		Relocated rest area location	
	With rest area (ha)	Rest area deleted (ha)	Without rest area (ha)	With rest area (ha)
Forest Red Gum – Swamp Box of the Clarence Valley lowlands of the North Coast (TEC, Subtropical Coastal Floodplain Forest TSC Act)	1.4	1.7 (+0.3)	1.4	1.5 (+0.1)
Scribbly Gum – Needlebark Stringybark heathy open forest of coastal lowlands of the northern North Coast	-	-	8.3	7.5 (-0.8)
Swamp Mahogany swamp forest of the coastal lowlands of the North Coast (TEC, Swamp Sclerophyll Forest TSC Act)	5.4	4.0 (-1.4)	0.9	0.9 (0.0)
Swamp Oak swamp forest of the coastal lowlands of the North Coast (TEC, Swamp Oak Floodplain Forest TSC Act)	-	-	1.3	1.1 (-0.2)
Tallowwood dry grassy forest of the far northern ranges of the North Coast	3.1	2.7 (-0.4)	-	-
Turpentine moist open forest of the coastal hills and ranges of the North Coast	12.0	7.0 (-5.0)	8.5	10.5 (+2.0)
TOTAL	21.9 ha	15.4 ha (-6.5)	20.4 ha	21.5 ha (+1.1)
<i>Angophora robur</i> individuals	709	378 (-331)	569	492 (-77)

Vegetation and fauna habitat types are homogenous across the EIS rest area location, while the design refinement location is dominated by dry sclerophyll open forests comprising Scribbly Gum (*Eucalyptus signata*) and Tallowwood (*Eucalyptus microcorys*). Moist forest habitats also occur and are dominated by Turpentine (*Syncarpia glomulifera*) and threatened ecological communities including Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest (endangered TSC Act). The habitat for fauna at both locations has been identified as high to very high value and suited to a range of threatened species in particular koala and forest-dwelling species such as Rufous Bettong and hollow-dependent birds and mammals, including Brush-tailed Phascogale, Squirrel Glider and threatened microbats. The impacts therefore would not vary in terms of the importance of the habitat and types of potential indirect impacts, but the proportion of habitat loss would be less at the revised rest area location.

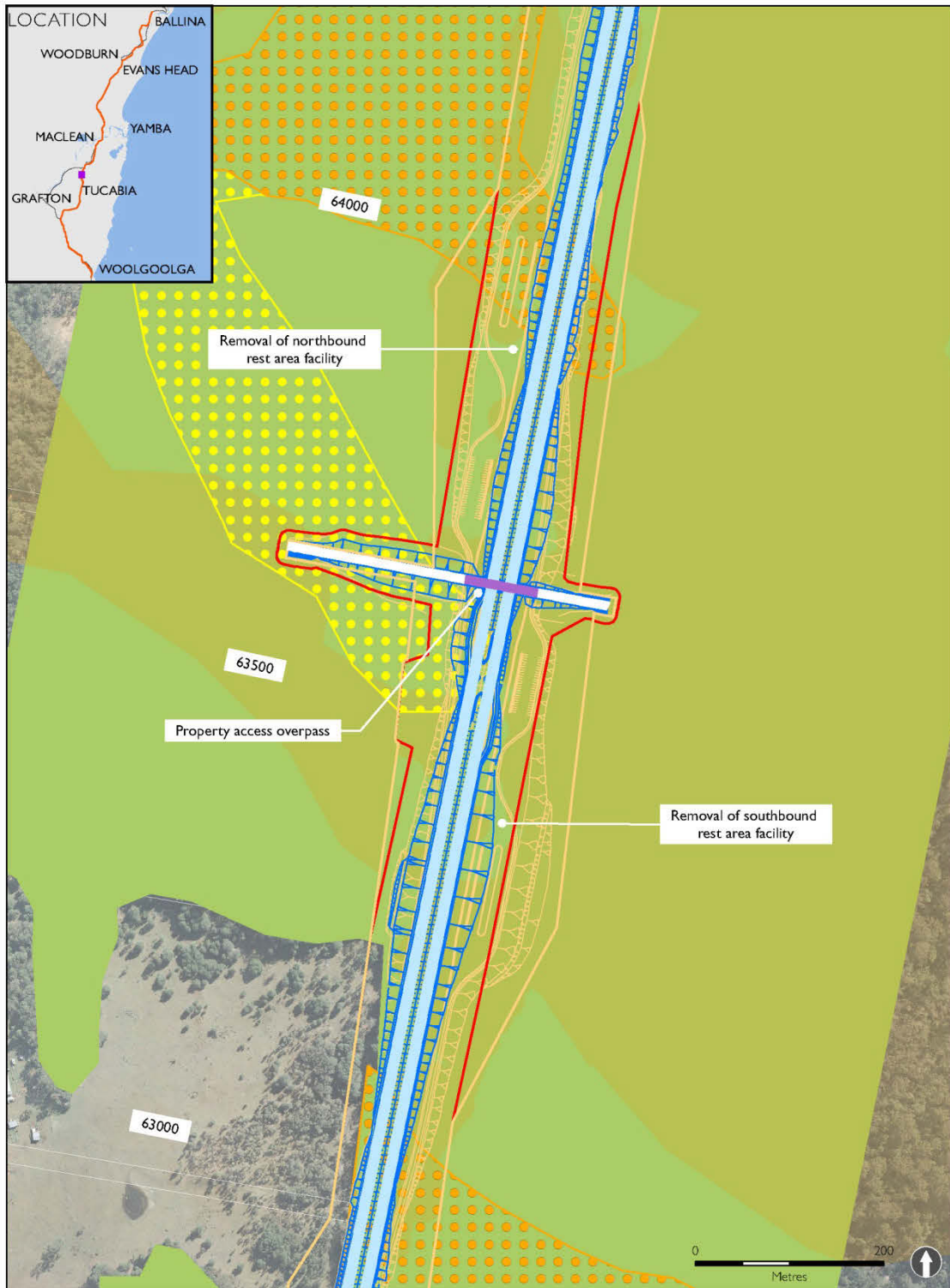
Overall the impacts on threatened ecological communities would be reduced by about 1.2 hectares (refer to Table 4-12). The reduction in the loss of known threatened fauna habitat would have a net beneficial outcome, particularly for Squirrel Glider and Brush-tailed Phascogale which were both identified near the EIS design rest area.

Although the revised rest area location would have a net beneficial outcome by reducing the impacts in this area on threatened fauna and flora, this would not impact on the results of the assessment of significance for the above threatened species or threatened ecological communities.

There are no aquatic habitats, waterways for permanent creeks at this location.

Angophora robur

A large reason for relocating the rest area further south from the location identified in the EIS is to reduce the impact on the Commonwealth listed Sandstone Rough-barked Apple (*Angophora robur*). This relocation of the rest area would see a net reduction in the direct loss of *Angophora robur* of an estimated 408 trees (through reductions at the EIS rest area location and the relocated location).



- | | | | |
|----------------------|--------------------------|--|--|
| EIS project boundary | Changed project boundary | Angophora robur distribution | |
| EIS road design | Proposed road design | Habitat critical to the survival of koalas (EPBC Act) | |
| | Proposed road alignment | Threatened ecological communities | |
| | Access / service road | Subtropical Coastal Floodplain Forest on Coastal Floodplains (Endangered, TSC Act) | |
| | Bridge (overpass) | Swamp Sclerophyll Forest on Coastal Floodplains (Endangered, TSC Act) | |

Figure 4-16: EIS rest area location showing biodiversity features

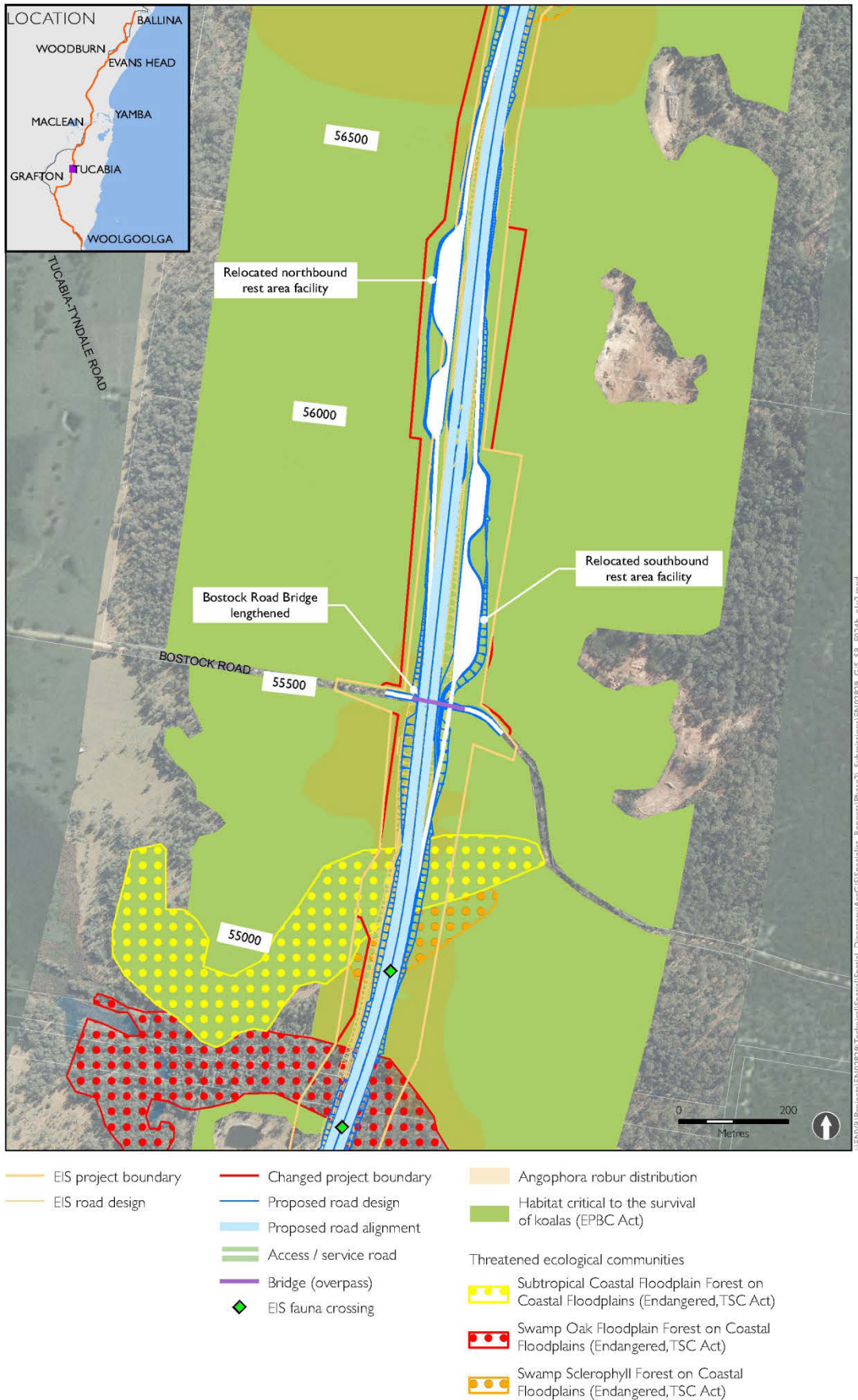


Figure 4-17: Design refinement rest area location showing biodiversity features

Despite moving the rest area to a known area of *Angophora robur* habitat near Bostock Road, the relocated rest area would still have a reduced impact of around 77 trees from the EIS design. This is due to the reduction in footprint at the southern extent of the design refinement. Figure 4-16 shows the impacts on *Angophora robur* from the EIS design, and Figure 4-17 shows *Angophora robur* impacts from the relocated rest area.

The design refinement would have the same indirect impacts as those assessed for the EIS. These would include edge effects for threatened fauna and flora habitat. However, there would be a reduction in potential edge effects on the habitat for *Angophora robur* north of Pine Brush State Forest.

Connectivity for fauna

Both the EIS and design refinement rest area locations are important areas for east–west fauna movements for a range of ground-dwelling and arboreal fauna, including the Coastal Emu. It is possible that the design refinement location, which is adjacent to Chaffin Creek and Chaffin Swamp, is more important for Emu movements than the EIS location. As the design refinement rest area would be on a crest, no dedicated or combined crossing fauna crossing structures are proposed at this location. The nearest combined structures would be two raised bridges located at Champion Creek bridge (station 57.0) and unnamed tributary at station 54.7. These structures would not be changed as a result of the relocation of the rest area.

For further details, refer to the supplementary biodiversity assessment included as Appendix J. Refer to Figure 4-16 and Figure 4-17 for the extent of biodiversity features at the EIS rest area location and design refinement rest area.

No mitigation or management measures are required beyond those in the EIS.

Urban design, landscape character and visual

As the road reserve would be widened to accommodate the relocated northbound and southbound rest areas, the landscape character of the area between Bostock Road and Somervale Road would be impacted. While the footprint would increase, due to the screening effect from surrounding vegetation and few visual receivers, the overall impact of the project at this location would not change from that described in the EIS.

The EIS included a viewpoint towards the project from Pine Brush State Forest (viewpoint 17). The visual impacts at this location would be reduced, due to the reduced footprint at this location. There are few visual receivers at this location, so only a small number of people would view the change. As stated in Table 11-18 of the EIS, the magnitude, sensitivity and impact of the upgraded highway would continue to be high overall as the landscape would change from a rural setting to transport corridor.

The EIS includes a landscape framework that would continue to apply to the rest area landscaping and urban design. This is intended to mitigate landscape and visual impacts from the project. No mitigation or management measures are required beyond those in the EIS.

Aboriginal heritage

Aboriginal heritage was assessed by field survey. A site inspection by the project archaeologists on 20 February 2013 and 7 March 2013 did not identify any new Aboriginal sites that could be impacted by construction and operation of the design refinement rest area. Yaegl Local Aboriginal Land Council was consulted prior to the site inspection and attended fieldwork.

The design refinement was discussed with Registered Aboriginal Parties at an Aboriginal Focus Group meeting on 6 February 2013 at Grafton Community Centre.

As the rest area would not impact any Aboriginal heritage items, no mitigation or management measures are required beyond those in the EIS.

Historical (non-Aboriginal) heritage

A historical heritage assessment was undertaken during the EIS, with further field investigations undertaken at the same time as the Aboriginal heritage surveys. The relocated rest area is in an area of native vegetation with no known historical heritage items. No historical heritage items listed on the Clarence Valley Local Environmental Plan or the State Heritage Register are located near the design

refinement. The assessment did not identify any further non-Aboriginal heritage items within the refined project boundary.

Therefore, no additional impacts on non-Aboriginal heritage items from those identified in the EIS are anticipated, and no mitigation or management measures are required beyond those in the EIS.

Traffic and transport

For northbound traffic, the relocated rest area would be around eight kilometres further south than the EIS location. There would not be a substantial change in travel time to and from the rest area. Assuming a travelling speed of 110 kilometres per hour for a motorway standard highway, this would equate to an additional four minutes for southbound traffic, when compared to the rest area shown in the EIS. If travelling northbound, there would be a reduction in travel time by four minutes.

Access to Bostock Road and Somervale Road would continue to be the same as described in section 5.3.7 of the EIS. Access to the upgraded highway would continue to be via the interchanges at Eight Mile Lane, Glenugie and Sheehys Lane, Tyndale. No additional impacts are anticipated during construction and operation and therefore, no mitigation or management measures are required beyond those in the EIS.

Noise and vibration

The noise environment is dominated by rural residential land uses, limited local road traffic noise and wildlife noise.

A noise assessment considered the construction and operational impacts of the design refinement.

The potential for intrusive noise impacts and sleep disturbance was assessed considering potential maximum noise levels from the rest area. The assessment considered the nearest identified dwellings shown in section 15.4 of the EIS. The assessment was based on predicted noise levels from typical rest area activities.

The layout of the northbound and southbound rest area at the design refinement location is consistent with that in the EIS. The noise assessment assumed noise emissions from car and truck movement to and from the rest area, trucks bleeding air brakes, car/truck door closing, a car starting, and the operation of refrigerated truck units. Table 4-13 lists the noise-generating activities from the use of the rest area.

Table 4-13: Rest area – estimated noise emissions

Activity	Estimated noise level at 10 metres
Truck exhaust brake (bleed off)	88 dB(A)
Truck movement (accelerating)	85 dB(A)
Truck refrigeration unit (continuous)	77 dB(A)
Truck door	76 dB(A)
Car starting	76 dB(A)

The resulting LA_{eq} and LA_{max} noise levels at the closest dwelling (receiver location R735, around 700 metres away) is presented in Table 4-14.

Table 4-14: Rest area – estimated noise levels at nearest dwelling

Receiver number	Predicted noise level	
	LA _{eq} 15 min dB(A)	LA _{max} dB(A)
R735	<25	32

The predictions indicate noise impacts at the nearest dwelling (R735) are likely to be inaudible when compared with ambient noise levels from road traffic using the upgraded highway. This dwelling was identified for noise mitigation in section 15.4 of the EIS, and this would be confirmed during detailed design.

The design refinement would provide a noise benefit to residents near Pine Brush, Tyndale as noise-generating activities from the rest area would be 7.5 kilometres further away. Two receivers located 250 metres to the west of the EIS rest area location would no longer be impacted by rest area noise.

No mitigation or management measures are required beyond those in the EIS.

Land use and property

No new land uses would be affected by relocating the rest area. Grazing, tree and shrub cover, and conservation land uses would continue to be affected at Pine Brush, Tyndale, and Bostock and Somervale roads.

The design refinement rest area would not affect any new properties or landowners. However, there would be a reduction in land acquisition from already affected landowners at Pine Brush, Tyndale and an increase in land acquisition from already affected properties between Bostock and Somervale roads. Table 4-15 compares the property impacts of the EIS rest area with the design refinement rest area.

Table 4-15: Property impact schedule for EIS rest area and design refinement rest area

Property lot/DP	Land use	EIS		Design refinement		Change in impact area
		Impact area (ha)	% of property affected	Impact area (ha)	% of property affected	
Lot 141, DP 751365	Tree and shrub cover	0.10	0.11	0.10	0.11	0
Lot 142, DP 751365	Tree and shrub cover	9.0	7.2	12.8	10.3	3.8
Lot 83 DP 751365	Tree and shrub cover	7.10	21.9	7.8	24.1	0.7
Lot 17 DP 820865	Grazing	0.8	4.8	0.8	4.8	0
Lot 137 DP 751389	Tree and shrub cover	9.5	23.3	8.42	20.6	-1.08
Lot 16 DP 820685	Grazing	1.2	7.6	1.17	7.4	-0.03
Lot 1 DP 1157762	Grazing	2.0	4.7	2.0	4.7	0
Lot SF661	Conservation area (NSW Forests)	16.3	0.89	15.5	0.85	-0.8
Lot 391 DP 1117617	Tree and shrub cover	6.9	17.3	4.8	12.0	-2.1
Total:		52.9		53.37		0.47

The difference in land area affected when comparing the two rest area locations would only amount to 0.47 hectares. Although the area of land to be impacted would change, the overall difference in land use and property impacts would be insignificant. Therefore, no mitigation or management measures are required beyond those in section 16.4 of the EIS.

Social and economic

The nearest dwelling is around 700 metres to the west of the design refinement rest area location.

While the relocation of the rest area would introduce a new feature into the landscape between Bostock Road and Somervale Road, there would be no change in access for residents and traffic using these local roads. There may be a slight change in amenity within the immediate vicinity of the relocated rest area, but the area is sparsely populated and adjacent vegetation would assist in screening the rest area.

Although, the rural character of the area would change as the project footprint would be wider in the design refinement area, the overall social and economic impact would be consistent with the impacts outlined in the EIS. No mitigation or management measures are required beyond those in the EIS.

Management and mitigation

This design refinement would not require a change to the proposed mitigation and management measures in Chapter 19 of the EIS. These are considered sufficient to manage predicted impacts. Based on the above assessment, no mitigation or management measures are required beyond those in the EIS.

4.4.6 Realignment at Crowleys Road, Tyndale

Location

Crowleys Road is a local road located in the northern part of Section 3, around three kilometres south of Tyndale. It provides property access either side of the project.

EIS design

The EIS design consists of:

- A four-lane dual carriageway highway (two lanes in each direction) between station 64.9 and 66.0
- The realignment of Crowleys Road east and west of the upgraded highway between station 64.9 and 65.1.
- A 60-metre overpass over the highway to maintain local and property access along Crowleys Road.
- Direct impacts on a closed landfill previously operated by Clarence Valley Council as a waste disposal facility.

The EIS design is shown in Figure 4-18.

Proposed design refinement

The design refinement shown in Figure 4-18 consists of:

- The realignment of around 1.1 kilometres of the highway 50 to 100 metres to the east of the EIS location to avoid impacts on the closed landfill.
- The relocation of the overpass for Crowleys Road around 30 metres south and west of the highway at station 64.9.
- Alterations to Crowleys Road along a 50-metre section of road either side of the highway.

Reason for refinement

The EIS design would directly affect around 6.26 hectares of a closed landfill site (Lot 130 DP 751389).

The design refinement would realign the highway between station 64.9 to 66.0 to avoid directly impacting the former landfill site and avoid potential impacts from disturbing contaminated land.

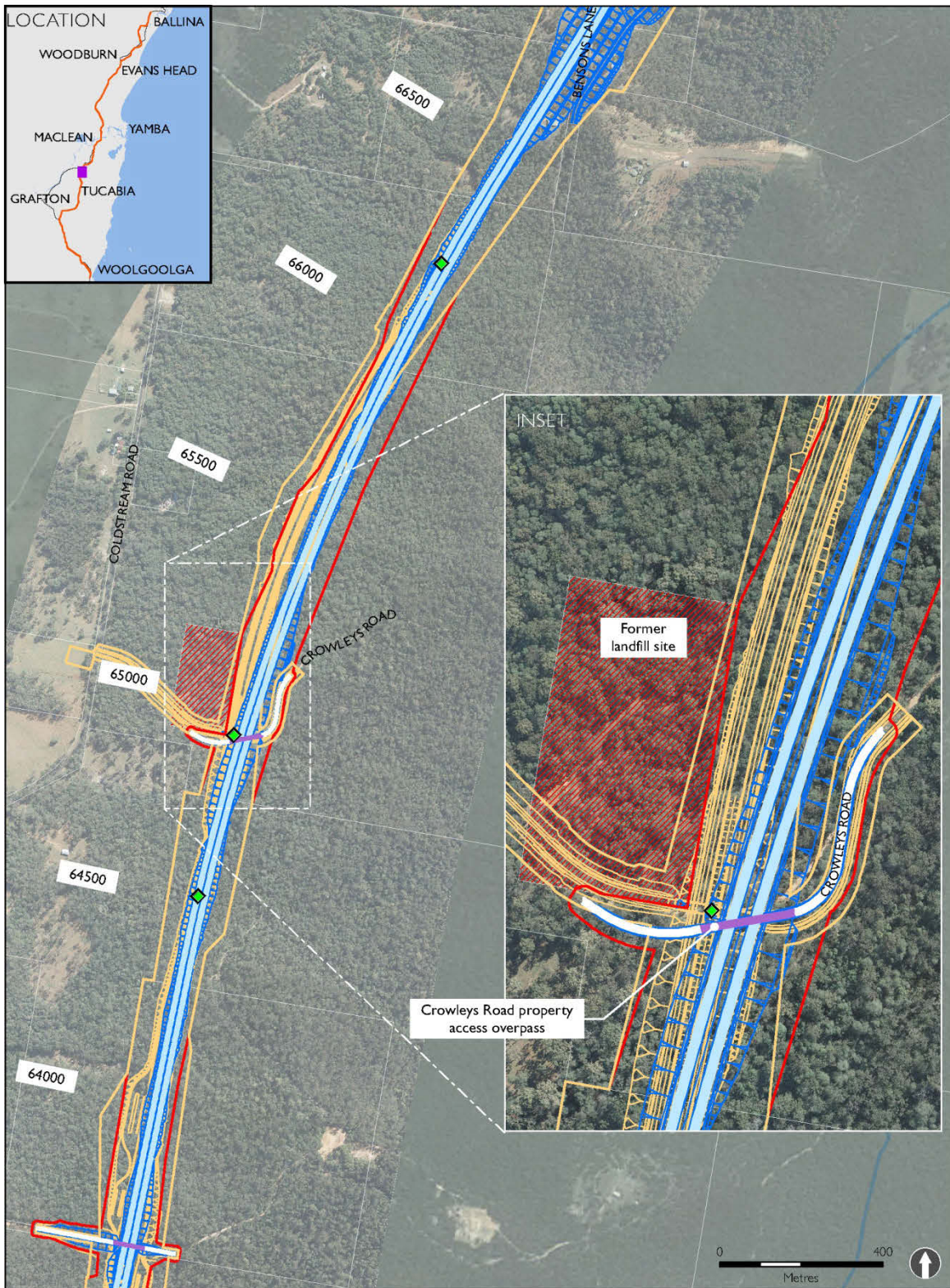


Figure 4-18: Revised design at Crowleys Road

Consultation

Consultation regarding the design refinement formed part of the EIS public display process between December 2012 and February 2013. Members of the project team attended community information sessions to discuss the EIS and the proposal to modify the highway alignment. The main information sessions where the design refinement was presented for discussion were:

- Tyndale Plantation Motel, Tyndale: 16 January 2013.
- Maclean Civic Hall, Maclean: 18 January 2013.
- Grafton Community Hall, Grafton: 18 January 2013.

The project team attended a stakeholder meeting relevant to the design refinement at Clarence Valley Council on 12 December 2012. A staffed display was also held at Maclean Civic Hall on 9 February 2013, Tucabia Community Hall, Tucabia on 12 February 2013 and at the Plantation Motel, Tyndale on 12 February 2013. Members of the project team were available to meet with the community and answer questions about the project.

As part of the EIS, a request for information regarding the former landfill site was submitted to Clarence Valley Council to determine the boundary, former land uses, and fill types. The correspondence received from Council on 21 September 2012 indicated the property was used as a rubbish depot from 1984 to around 1987 and Council maintained the tip prior to its closure. In response to this information and recent geotechnical site work, the design was refined to avoid contaminated land risk.

No community concerns were raised regarding Roads and Maritime's intention to realign the project to avoid the landfill site.

Directly affected property owners were also consulted and have no objection to the design refinement.

Environmental assessment

Hydrology and flooding

The nearest watercourse to the design refinement is around six kilometres south of Crowleys Road, at Champions Creek.

The design refinement does not fall within the 100-year ARI level for Champions Creek (or the Clarence River) and would not result in any hydrology impacts additional to those identified in the EIS.

Therefore, no mitigation or management measures are required beyond those in the EIS.

Soils, sediments and water

There are limited occurrences of acid sulfate soils in Section 3. Acid sulfate soils are generally associated with waterways, which have a high probability of occurrence to the west of the alignment (refer to Figure 9-14 of the EIS). As the design refinement is not close to any watercourse, it would not result in any impacts on acid sulfate soils additional to those identified in the EIS.

The design refinement would eliminate the potential for the former landfill to be disturbed during construction. This would minimise the risk associated with disturbing contaminated land.

As stated in section 9.2.3 of the EIS, permanent water quality ponds would be provided north of Crowleys Road. The design refinement would include the provision of water quality basins to manage surface runoff from the highway. The EIS (section 9.3.1) indicates construction presents risks to surface water quality. However, the risk of adverse impacts can be reduced to minimal levels with the mitigation and management measures in the EIS, including standard soil erosion and sediment controls and other construction site management procedures. With the implementation of the proposed measures during construction, adverse impacts on water quality and sensitive receiving environments would be unlikely. The management measures also apply to this design refinement.

By realigning the project away from the landfill, direct impacts on groundwater quality from the infiltration of contaminated water from the landfill are unlikely. However, as groundwater is likely to be within around two metres of the surface, potential groundwater impacts from the former landfill would be considered during detailed design to minimise ingress and safeguard the project (refer to management measure SSW45).

The overall impacts of this design refinement would be consistent with the impacts outlined in the EIS.

Biodiversity

A supplementary biodiversity assessment was undertaken to consider the impacts associated with the design refinement (refer to Appendix J).

The design refinement would be a minor adjustment to the east over a distance of around 1.8 kilometres. At its widest, the alignment would shift around 60 metres east of the EIS design. The design refinement would cross the same terrain and vegetation/habitat types as those assessed in the EIS. These comprise dry sclerophyll forest dominated by Tallowood (*Eucalyptus microcorys*), and threatened ecological communities Swamp Sclerophyll Forest and Subtropical Coastal Floodplain Forest (endangered TSC Act).

The design refinement would result in a small reduction of vegetation loss (0.8 hectares); including a reduction in loss of 0.4 hectares of Subtropical Coastal Floodplain Forest TEC (refer to Table 4-16).

The design refinement showing adjacent threatened ecological communities and the extent of *Angophora robur* is shown in Figure 4-19.

Table 4-16 Impacts of the Crowley Road design refinement

BioMetric vegetation types	EIS design (ha)	Design refinement (ha)	Change in vegetation loss (ha)
Forest Red Gum – Swamp Box of the Clarence Valley lowlands of the North Coast (TEC, Subtropical Coastal Floodplain Forest – TSC Act)	0.4	0	-0.4
Swamp Mahogany swamp forest of the coastal lowlands of the North Coast (TEC, Swamp Sclerophyll Forest – TSC Act)	0.5	0.5	0.0
Tallowood dry grassy forest of the far northern ranges of the North Coast	17.9	17.5	-0.4
TOTAL	18.8	18.0	-0.8
<i>Angophora robur</i> individuals	866	877	+11

Indirect impacts from the design refinement would likely include potential weed invasion in edge areas as assessed in the EIS. The edge ratio would not increase. As there would be a reduction in vegetation clearing, there would be a decreased level of indirect impacts such as edge effects and reduced penetration of weeds into native habitats. Noise and light levels and changes in temperature and wind speed would still remain and indirectly impact remaining habitats.

This location provides potential habitat for a range of threatened fauna species including:

- Powerful Owl (*Ninox strenua*) (vulnerable TSC Act).
- Masked Owl (*Tyto novaehollandiae*) (vulnerable TSC Act).
- Brush-tailed Phascogale (*Phascogale tapotafa*) (vulnerable TSC Act).
- Rufous Bettong (*Aepyprymnus rufescens*) (vulnerable TSC Act).
- Squirrel Glider (*Petaurus norfocensis*) (vulnerable TSC Act).
- Glossy Black-cockatoo (*Calyptorhynchus lathamii*).
- Koala (*Phascolarctos cinereus*) (vulnerable TSC Act and EPBC Act).
- Grey-headed Flying-fox (*Pteropus poliocephalus*) (vulnerable TSC Act and EPBC Act).
- Swift Parrot (*Lathamus discolor*) (endangered TSC Act and EPBC Act).
- Several threatened microchiropteran bat species, particularly hollow-dependent fauna.

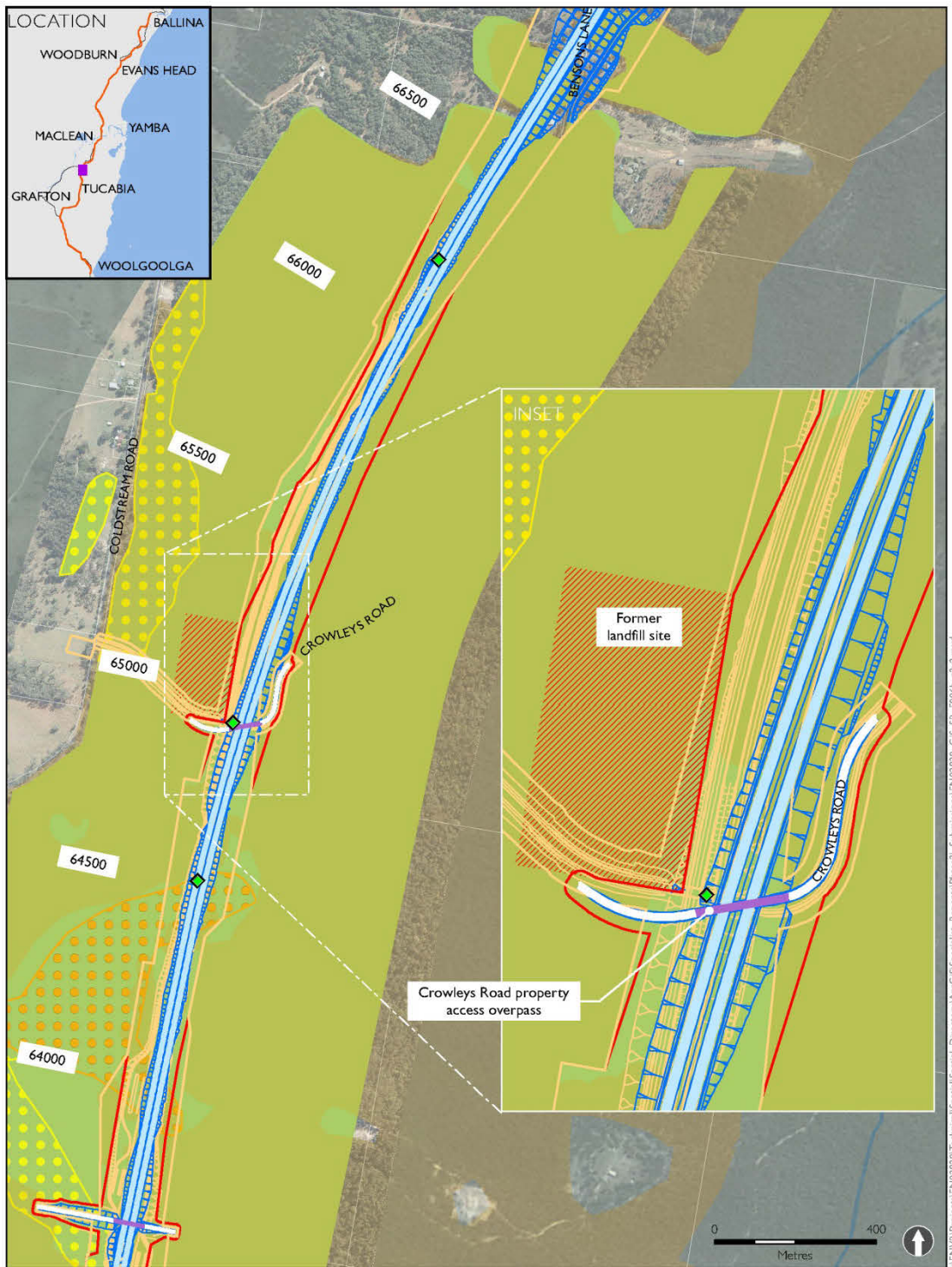


Figure 4-19: Design refinement at Crowleys Road showing biodiversity features

The design refinement would relocate the main alignment through habitat with a better condition than that in the EIS design. The direct loss of habitat for these fauna species (including food, shelter and breeding resources) would affect the viability of local populations. The only exceptions would be the Grey-headed Flying-fox and Swift Parrot, which are wide-ranging and highly mobile species capable of accessing resources over large areas of the range.

Indirect impacts on threatened fauna would include potential change in movements of populations, and edge effects on habitat adjacent to the project including weed invasion, runoff and noise and light impacts. Increased edge effects would also degrade the composition and structure of remaining vegetation.

The design refinement would reduce clearing of potential habitats for these fauna species by 0.8 hectares.

Overall, the project would have significant impacts on these fauna species with the exception of the wide-ranging and highly mobile species. The impacts on threatened fauna under the design refinement are not expected to be different from those assessed in the EIS, and the conclusion of the assessments of significance on these species would not be changed by this design refinement.

Impacts on *Angophora robur*

The threatened flora species Sandstone Rough-barked Apple (*Angophora robur*) (EPBC Act and TSC Act) occurs in relatively high abundance through this area and the design refinement would result in the removal of an additional 11 individuals (refer to Table 4-16).

Connectivity for fauna

There are no proposed connectivity structures in this location and this design refinement would not change the potential impact on fauna movements or alter any proposed structure.

No mitigation or management measures are required beyond those in the EIS.

Urban design, landscape character and visual

The design refinement would pass through Precinct 16 (Pine Brush State Forest) consisting of valley lands and foothills, forest, ranges and hilltops. This precinct has a moderate ability to absorb change due to the undulating topography and the enclosed forest. The area would be moderately impacted by the project.

While the design refinement would realign around 1.1 kilometre of the proposed highway, the overall impact on the landscape character would not alter the moderate rating of impact. Moving the alignment to the east would increase the distance between the proposed upgrade and the nearest two properties to the west by around 50 metres. These properties would be between 500 and 750 metres from the project, respectively.

The impacts of this design refinement would be consistent with the impacts outlined in the EIS. There would be no further urban design impacts during construction and operation and no further mitigation and management measures are required beyond those identified in the EIS.

Aboriginal heritage

The design refinement would be located on the slopes of a ridgeline adjacent to the Coldstream River and Clarence River floodplains. These floodplains were assessed in the EIS (refer to section 12.2) as having a low to moderate sensitivity for Aboriginal heritage.

A site inspection by Roads and Maritime project archaeologists on 14 February 2013 did not identify any new impacts that could result from construction and operation of the design refinement. The Registered Aboriginal Parties consulted prior to the site inspection and/or in attendance during fieldwork were:

- Yaegl Local Aboriginal Land Council.
- Birrigan-Gargle Local Aboriginal Land Council.
- Yaegl People Native Title Claim.

The design refinement was discussed with Registered Aboriginal Parties at an Aboriginal Focus Group meeting on 6 February 2013 at Grafton Community Centre. As no new Aboriginal heritage features or

values would be impacted by the design refinement, the impacts would be consistent with those outlined in the EIS. Therefore, there would be no additional Aboriginal heritage impacts during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Historical (non-Aboriginal) heritage

A historical heritage assessment of the design refinement area was undertaken as part of the EIS. The design refinement would not directly impact any historical heritage items or State Heritage Register items.

The closest heritage item is the Tyndale Residence (Item No 11) at Tyndale, listed on the Clarence Valley Council Local Environmental Plan, around three kilometres north of Crowleys Road. This would not be directly impacted by the design refinement.

The overall non-Aboriginal heritage impacts of this design refinement would be consistent with the impacts outlined in the EIS, and no mitigation or management measures are required beyond those in the EIS.

Traffic and transport

As part of the design refinement, Crowleys Road would continue to pass over the upgraded highway. However, it would be realigned around 200 metres east and 120 metres west of the highway. The design refinement would not change the local access or travel times. A connection to Crowleys Road would continue to either side of the proposed upgrade. The design refinement would be limited to the overpass and 50-metre sections either side of the highway. Interchange access would continue to be at each end of Section 3, at Eight Mile Lane, Glenugie (south) or Sheeys Lane, Tyndale (north).

The impacts of this design refinement would be consistent with the impacts assessed in the EIS. There would not be any additional traffic and transport impacts during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Noise and vibration

The noise environment is dominated by rural residential land uses, limited local road traffic noise and wildlife noise.

Two noise-sensitive receivers (dwellings) are located on the western side of Crowleys Road between 500 and 750 metres to the west of the project assessed in the EIS (refer to Figure 15-14 of the EIS). Both were identified for noise mitigation. The design refinement would increase the separation between the highway and the nearest dwellings by around 50 metres. Although further away, the noise model identifies these properties as still requiring noise mitigation, which would be confirmed during detailed design.

As the construction and operational noise and vibration sources would be further away from sensitive receivers, this design refinement would not introduce new noise and vibration impacts. For this reason, the assessment in the EIS is considered to be the worst case scenario and no further mitigation would be required. The noise mitigation requirements for these sensitive receivers would be confirmed during detailed design, as recommended in Chapter 15 of the EIS.

Land use and property

In Section 3, the project would traverse a mix of open grazing land and remnant bushland on the eastern side of the Coldstream River basin. The design refinement would be located around two kilometres south of Tyndale. Table 4-17 lists the property impacts from the design refinement.

Table 4-17: Property impact schedule for EIS design and the design refinement at Crowleys Road

Property	Land use	EIS		Design refinement		Change in impact area
		Impact area (ha)	% of property affected	Impact area (ha)	% of property affected	
Lot 130/DP 751389	Tree and shrub cover	6.3	15.5	4.1	10.1	-2.2
Lot 7001 DP 92573	Tree and shrub cover	11.1	5.1	14.8	6.8	3.7
Total:		17.4		18.9		1.5

By realigning the highway to avoid the landfill site adjacent to Crowleys Road, a further 1.5 hectares of grazing land including trees and shrub cover would be acquired. However, this increase is on a property that was already impacted by the project.

The design refinement would not impact any new landowners and would not impact on the land use of adjoining properties.

No mitigation or management measures are required beyond those in the EIS.

Social and economic

The design refinement would be around two kilometres to the south of Tyndale and rural residential areas currently not affected by the existing highway or other major roads. Four dwellings to the west of the project and Crowleys Road would be located around 50 metres further away as the design refinement would realign the highway slightly to the east. The design refinement would not change access for residents and traffic using this road.

The area is sparsely populated and adjacent vegetation would assist in screening the design refinement. Although the project through Section 3 would affect the rural amenity and character of the area (from increased traffic, noise and visual changes), the overall impacts of the design refinement would be consistent with the EIS. There would be no additional impacts during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Management and mitigation

The additional mitigation measure recommended for this design refinement is presented in Table 4-18.

Table 4-18: Crowleys Road – additional mitigation

Issue	ID number	Mitigation measure	Timing	Relevant section
Soils, sediments and water: potential contamination impacts	SSW45	Further investigations will be undertaken to identify any impacts from contaminated groundwater from the former landfill sites at Firth Heinz Road and Crowleys Road.	Pre-construction	3

The above measure is included in Chapter 5 of this report, with a list of all additional measures required to manage design refinement impacts. This design refinement would not require other changes to the proposed mitigation and management measures included in Chapter 19 of the EIS.

4.4.7 Overpass at McIntyres Lane, Gulmarrad

Location

McIntyres Lane is located 3.5 kilometres south of the proposed interchange at Maclean within Section 4 of the project. It provides access to Gulmarrad, an area identified as a future growth centre by Clarence Valley Council.

EIS design

The EIS design consists of:

- The closure of McIntyres Lane either side of the project at station 77.0. No access would be provided to the highway.
- Direct access from McIntyres Lane (west of the project) to the existing highway.
- An eastern access road connecting McIntyres Lane (east of the project) to the interchange at Maclean (station 80.5), with access into Maclean and the upgraded highway.

The EIS design is shown in Figure 4-20.

Proposed design refinement

Modifications to McIntyres Lane would all be located within the project boundary as identified in the EIS. The design refinement (shown in Figure 4-20) consists of:

- A 60-metre overpass to connect McIntyres Lane across the upgraded highway. The overpass would be around 12 metres wide to facilitate two-way traffic, with one-metre shoulders. The overpass would also have a single 1.8-metre pedestrian walkway.
- A 5.5-metre clearance between the upgraded highway and the overpass. The vertical alignment of the project would be refined to reduce fill and provide sufficient clearance between the highway and the overpass.
- A realigned access road to the north-east of McIntyres Lane, to provide property access only. It would not connect with the interchange at Maclean. The access road would be realigned around 20 metres to the east of the upgrade's southbound carriageway between station 77.0 and station 77.5, typically requiring a fill embankment 2.5 metres high. This access road connection to the east of the project would terminate at a property access on Causelys Lane. The flood immunity of the access road would be up to a 10-year (ARI) flood event.

Reason for refinement

While identified as an option in the EIS (refer to section 17.4), the overpass at McIntyres Lane has been included as a design refinement to provide a connection either side of the project at station 77.0. Without this connection, travel for Gulmarrad residents would be longer and less direct, and making it more difficult for Gulmarrad residents to access towns on the highway.

Consultation

A request to include the overpass option at McIntyres Lane was an outcome of consultation with Clarence Valley Council, the Clarence Harvesting Co-operative and the local community including Gulmarrad and Maclean residents. The request included an overpass that provides access either side of the upgraded highway, facilitating an east–west connection and the movement of farming vehicles and machinery.

Consultation regarding the design refinement at McIntyres Lane formed part of the EIS public display process between December 2012 and February 2013. Members of the project team attended community information sessions to discuss the EIS. The main information sessions where the design refinement was presented for discussion were:

- Maclean Civic Hall, Maclean: 18 January 2013.
- Grafton Community Hall, Grafton: 18 January 2013.

Those attending the information sessions were advised that the intention of the design refinement was to provide a connection either side of the highway.

The project team attended stakeholder meetings relevant to the design refinement at Clarence Valley Council on 12 December 2012, and with Maclean Chamber of Commerce and Harwood Canegrowers in March 2013. A staffed display was also held at Maclean Civic Hall on 9 February 2013. Members of the project team were available to meet with the community and answer questions about the project, including the design refinement at McIntyres Lane.

Clarence Valley Council expressed a preference to maintain direct access to Gulmarrad via an overpass of the highway on McIntyres Lane. Roads and Maritime has committed to Clarence Valley Council to provide that connection.

A further community information session was held on 25 March 2013 to present the design refinement options for the interchange at Maclean. Support was expressed for the overpass to be included in the project design.

The design refinement responds to Council and community feedback.

Environmental assessment

Hydrology and flooding

The watercourses that would be crossed by the project nearest to McIntyres Lane include Shark Creek and Edwards Creek. The inclusion of an overpass at McIntyres Lane (station 77.0) would be between 3.2 kilometres and 2.2 kilometres to the north and south of these two watercourses, respectively. The proposed cane drains located around 350 metres to the north of McIntyres Lane would continue to drain through the culverts proposed at station 77.4.

McIntyre's Lane is located on the edge of a floodplain. However, as the proposed overpass would not change the overall area of project impact, there would be no change to predicted flooding impacts including flood level, duration or velocity. The overall impacts of this design refinement would be consistent with the impacts outlined in the EIS. No additional impacts are anticipated during construction and operation, and no mitigation or management measures are required beyond those in the EIS.

Soils, sediments and water

Section 4 (where the design refinement is proposed) contains a moderate to high potential for acid sulfate soils to be present (refer to section 9.2.1 in the EIS). Appropriate treatment of acid sulfate soils would be undertaken during construction, as described in the EIS and no further impacts on or from acid sulfate soils are anticipated.

A soft soil site, described in section 6.2.3 of the EIS as SS-02, is located immediately north of McIntyres Lane, between station 77.1 and 77.5. The soft soils at this site are up to 16 metres deep. As this soft soil site was identified in the EIS, no new impacts are anticipated. To construct the project, these soils would need to be treated, involving substantial work to prepare the ground. The actual soft soil treatment method to be used would be confirmed during detailed design and would depend on the time available, engineering design, and site-based constraints. The need for soft soil treatments would be confirmed during detailed design.

The permanent water quality ponds proposed in the EIS would continue to be located to the west of the design refinement, north of McIntyres Lane. Surface water drainage would continue to be directed north of McIntyres Lane towards these water quality ponds. As the proposed overpass would be located around 900 metres to the east of the south arm of the Clarence River, it would be unlikely that construction would affect this watercourse.

The impacts of this design refinement would be consistent with the impacts outlined in the EIS and therefore, no mitigation or management measures are required beyond those in the EIS.

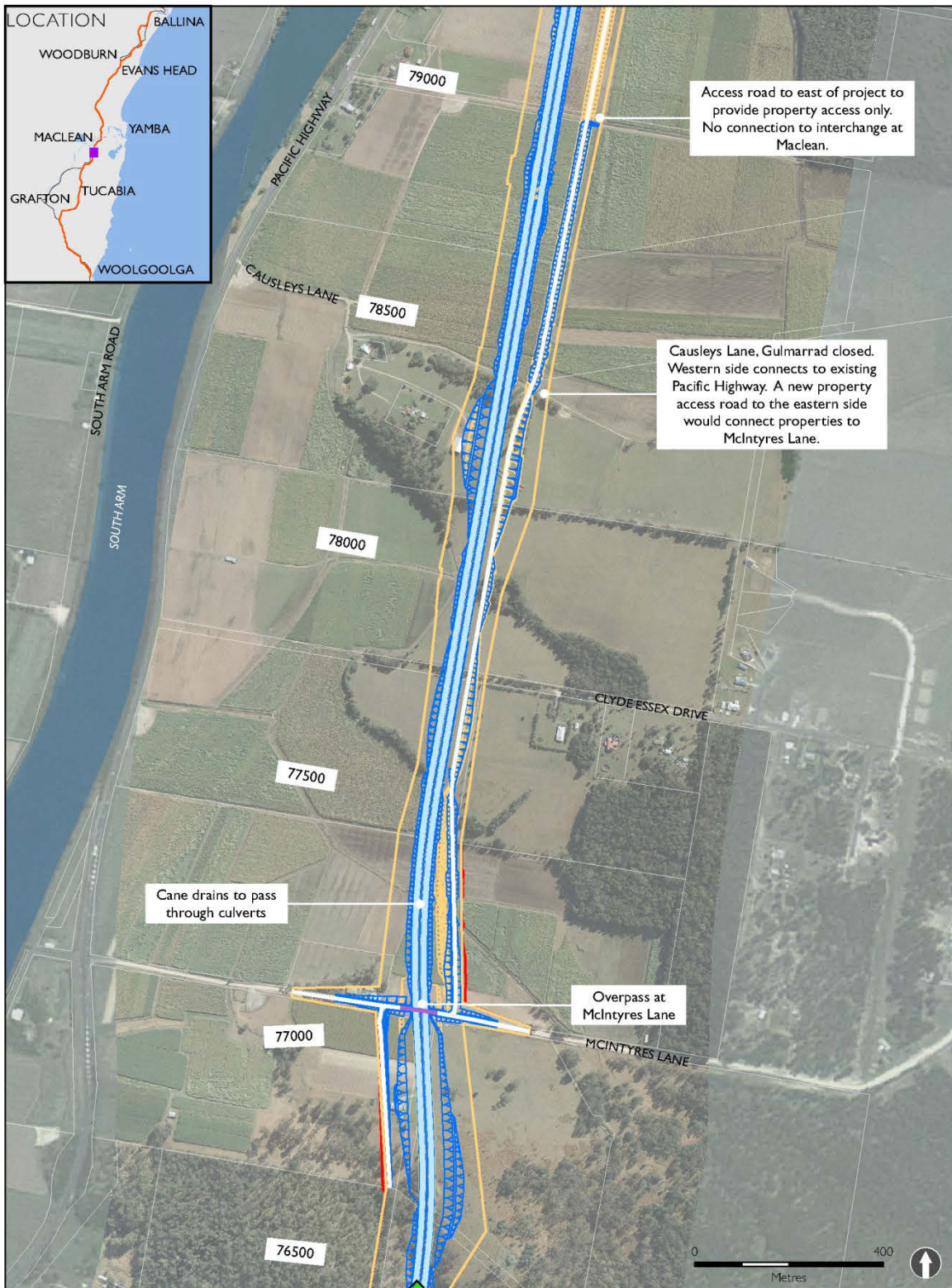


Figure 4-20: Revised design at McIntyres Lane

Biodiversity

The EIS design would remove around 0.2 hectares of Swamp Sclerophyll Forest on Coastal Floodplain TEC in this area. Provided the mitigation measures outlined in the EIS are implemented, this design refinement would have no additional impacts on TECs during construction and operation.

Similarly, this design refinement would have no additional impacts on any Commonwealth or State listed threatened species and no mitigation or management measures are required beyond those in the EIS.

Urban design, landscape character and visual

McIntyres Lane is located on the northern slopes of Green Hill within the Clarence River floodplain. Green Hill is lightly forested and surrounded by agricultural land uses. The western extent of the built-up area of Gulmarrad is on the eastern side of Green Hill. The main features of the design refinement would be the overpass and an eastern access road to the north of McIntyres Lane providing a connection to Causelys Lane.

The visual envelope across the Clarence River floodplain would not expand beyond the impacted area described in the EIS. The design refinement would, however, change the visual impact in this area. Around 10 residences from the Green Hill area within 500 metres of McIntyres Lane may have a high sensitivity to the visual change as they would have direct views of the overpass. Residents from the Maclean, Townsend and Gulmarrad area would also have a low to moderate sensitivity to mid-distance views from the local road network.

The project would be in a cutting surrounded by wide expanses of sugarcane plantations. This would reduce the visual impact of the design refinement as the new carriageway, overpass and batters would be located in an already altered agricultural setting.

The EIS describes the need for tree removal and earthwork to construct the project on the north-facing slopes of Green Hill (refer to section 11.3.3 of the EIS). Although this tree removal and earthwork are not part of this design refinement, this work is already proposed in the EIS and would be visible from a considerable distance. This work would substantially change the visual landscape near McIntyres Lane, and is described in Chapter 11 of the EIS.

The approaches to the overpass would be constructed on a fill embankment, and would be visible, along with the bridge, in the surrounding area. The main carriageways and local road connections would be in cut. They would have a low visibility, as the cuts would reduce the visual impacts within the surrounding landscape and from local residences.

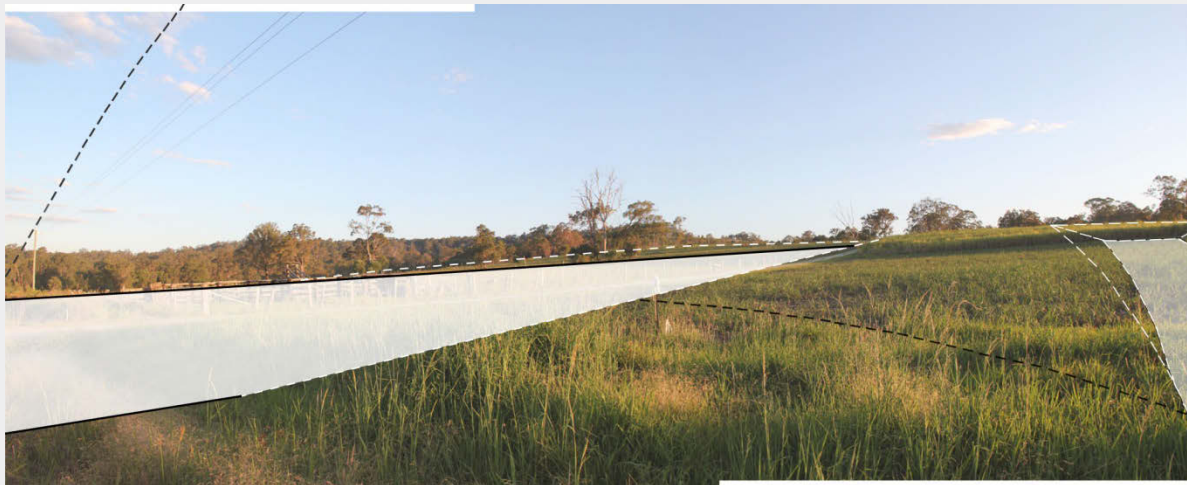
From viewpoint 22 (McIntyres Lane, Green Hill, refer to section 3.7 in Working paper – Urban design, landscape character and visual impact assessment), the overall visual impact would change from moderate (as described in the EIS) to moderate–high. The updated visual impact assessment of the project, including the design refinement for viewpoint 22, is provided in Table 4-19 and Figure 4-21.

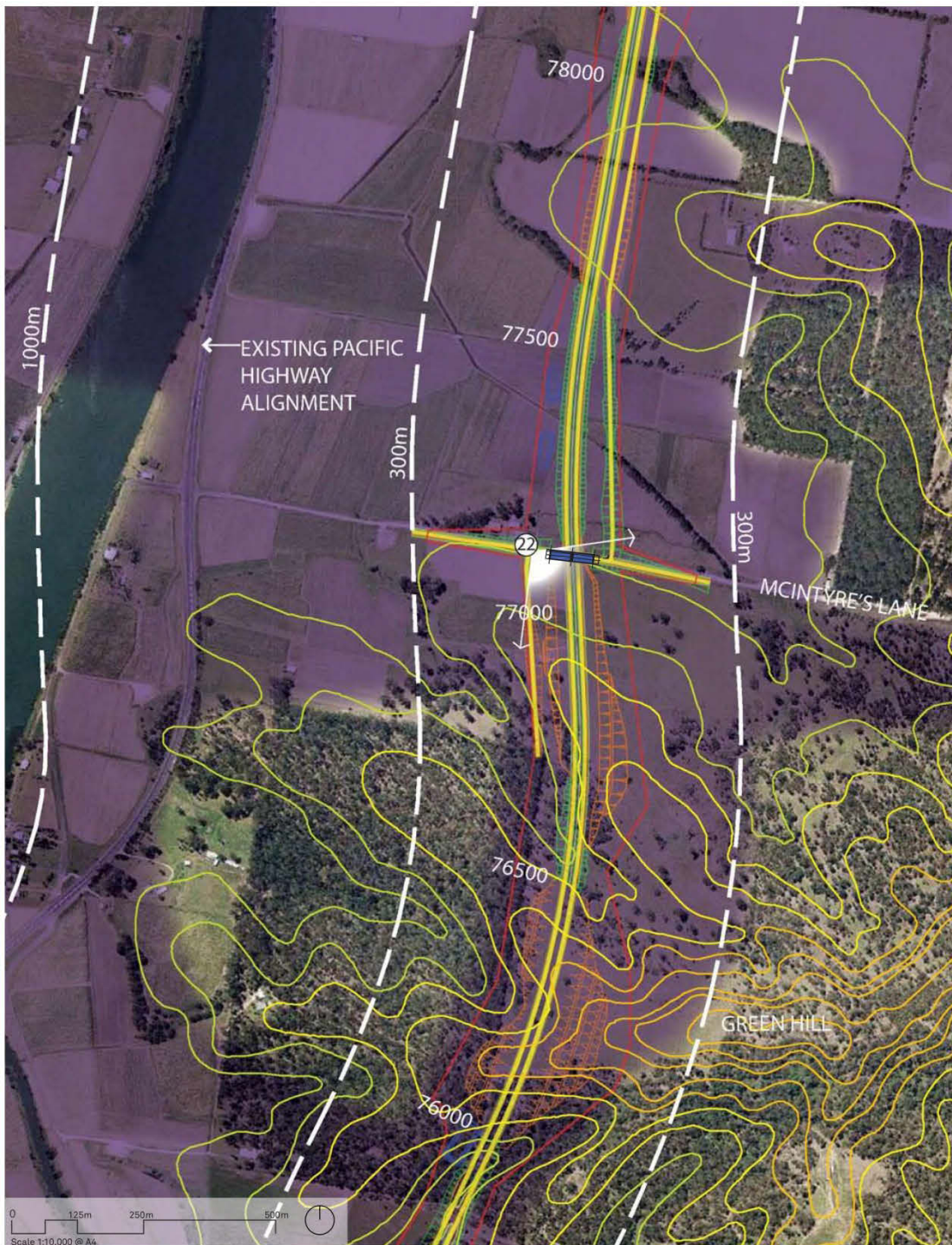
Due to the minor nature of the increase in the visual impact and the need to develop a landscape strategy, no mitigation or management measures are required beyond those in the EIS.

Table 4-19: Viewpoint 22, McIntyres Lane, Green Hill – foreground view

Magnitude	Sensitivity	Impact
High–moderate	Moderate	Moderate–high
<p>New road infrastructure in a natural setting. Major tree removal and earthworks is proposed. Overpass and batters visible on north hillside slopes. Location of the proposed highway in a cutting reduces its visibility generally from vantage points in the landscape.</p>	<p>High sensitivity for a low number of residents in local homes with direct views to the project. Low–moderate sensitivity for local residents who would have repeated views to a changed middle distance view.</p>	

Updated viewpoint 22, showing view towards new overpass





Legend

- | | | | |
|--|--|--|--|
| | Alignment and boundary with chainages | | Distance from road centreline (300m / 1000m) |
| | Areas of cut | | Visual Envelope |
| | Areas of fill | | Photo Location |
| | Bridge | | Contours at 10m interval |
| | Existing Pacific Highway Upgrade alignment | | |
| | Waterways | | |

Viewpoint 22



Figure 4-21: Revised viewpoint at McIntyre's Lane (No. 22)

Aboriginal heritage

The area has been subject to a high degree of ground disturbance from previous agricultural activities and road construction. The nearest Aboriginal heritage item is Shark Creek Site 2 (AHIMS ID 04-4-0129), around 25 to 50 metres to the north of the overpass. This item would not be directly or indirectly impacted by the design refinement. The design refinement was discussed with Registered Aboriginal Parties at an Aboriginal Focus Group meeting on 6 February 2013 at Grafton Community Centre.

As no new Aboriginal heritage items were identified, impacts from this design refinement would be consistent with the impacts in the EIS. Therefore, no mitigation or management measures are required beyond those in the EIS.

Historical (non-Aboriginal) heritage

The design refinement would not impact any historic heritage items listed on the State Heritage Register or included in the Clarence Valley Local Environmental Plan, 2011. The nearest recorded items are the Tyndale Shed and cane barracks (Item No 10) located around 1.9 kilometres to the south, a former house site at Maclean (Item No 22), and the Maclean Punt and former Ashby ferry site (Item No 12) located around three kilometres to the north of the design refinement.

As no additional sites or items of historic heritage significance would be impacted during construction and operation, the impacts of this design refinement would be consistent with the impacts outlined in the EIS. Therefore, no mitigation or management measures are required beyond those in the EIS.

Traffic and transport

While access may be temporarily disrupted during construction (with road-user delays and speed restrictions), this impact would be temporary and managed as part of a Traffic Control Plan. Additional construction traffic using the existing highway would likely be required to provide the fill material for the embankments either side of the overpass and to transport the bridge structures.

Under the EIS design, McIntyres Lane would be closed and access would be via the interchange at Maclean; this would impact travel times and the ability for road users to access the existing highway at this location.

Under the design refinement, an overpass at McIntyres Lane would provide an east–west connection and the opportunity for Gulmarrad residents and agricultural vehicles to access the existing highway, which would become the service road. Access to the project would continue to be via the interchange at Maclean (from the service road). However, termination of the eastern access road at Causelys Lane would require residents on this road to use the overpass and the existing highway for access to surrounding areas.

No mitigation or management measures are required beyond those in the EIS.

Noise and vibration

The noise model described in Chapter 15 of the EIS was updated to consider the potential for additional construction and operational noise impacts under the design refinement. This has allowed a comparison with the predicted noise impacts included in the EIS. The following is a summary of the assessment findings:

- Where the bridge works at McIntyres Lane would be confined to proposed project working hours (as per section 15.3 of the EIS), the predicted noise levels at the nearest residential receiver (R867) would comply with the target noise management level (NML) of 45 dB(A).
- Where the works are undertaken outside of these hours, there is the potential for noise levels to exceed the respective NML by up to 10 dB(A) at the nearest residential receiver (R867).
- If the overpass bridge works at McIntyres Lane were confined to the proposed project working hours, the predicted construction noise levels in Chapter 15 of the EIS would continue to apply.
- If construction were required outside of these hours (eg during the night-time), construction noise is predicted to exceed the target NML by up to 10 dB (A) at R867. (The noise assessment assumed that a pile driver would be required.)
- If a pile driver were not required, predicted noise levels are likely to be within the target NML.

Construction activities and requirements would be confirmed during detailed design.

No further mitigation measures are proposed other than those identified in the EIS. The EIS proposes that piling occur between 9am to 5 pm Monday to Friday, and 9am to 1 pm on Saturdays.

As the alignment of the upgraded highway would not be affected by the design refinement, there is no change to the operational noise assessment described in section 15.3.2 of the EIS.

Vibration impacts would be unlikely, as the nearest dwelling would be 650 metres from vibration-inducing activities such as piling. As indicated in section 15.3.1 of the EIS vibration from these types of activities would be virtually undetectable at this distance.

No mitigation or management measures are required beyond those in the EIS.

Land use and property

To the east of the project, the proposed access road to the north of McIntyres Lane east of the upgrade's southbound carriageway would be shortened by 1.5 kilometres. However, the project boundary would continue to be as shown in the EIS and no further property acquisition or impacts on adjoining land uses would result. Therefore, no mitigation or management measures are required beyond those in the EIS.

Social and economic

Gulmarrad has been identified for future growth with a higher density to cater for an overall population of 3700 people, more than doubling the existing population. The design refinement would have a positive social impact by providing more direct access for road users travelling from Gulmarrad to the existing highway and avoiding the severance impact on the town.

The overpass would provide a connection either side of the proposed highway and eliminate the severance impact at this location for Gulmarrad residents. In particular, cane vehicles would be able to access farmland to the east and west of the upgraded highway.

There would be no additional impacts during construction and operation from the design refinement and therefore, no mitigation or management measures are required beyond those in the EIS.

Management and mitigation

In section 17.4 of the EIS, the following mitigation measure was included as SE11:

- "Appropriate access arrangements to and from Gulmarrad, including the provision of an overpass at McIntyres Lane would be considered at the detailed design stage in consultation with Clarence Valley Council".

This mitigation measure has been removed from the list of management measures, as it has already been addressed and is no longer required (refer to Appendix H).

This design refinement would not require a change to the other proposed mitigation and management measures included in Chapter 19 of the EIS. Based on the above assessment, no additional mitigation measures are required for the design refinement.

4.4.8 Interchange layout at Maclean

Location

The interchange at Maclean is in Section 4 of the project at station 80.5. The interchange would provide access to Maclean, Townsend, Gulmarrad and Brooms Head.

EIS design

The EIS design of the interchange at Maclean would consist of:

- Two roundabouts located either side of the upgraded highway, connected by a bridge over the upgraded highway. The western roundabout would provide access to Maclean, Ferry Park and the existing highway.
- South-facing ramps and a north-facing on-load ramp connecting directly to the interchange roundabouts.

- A southbound off-ramp that connects with Jubilee Street via a roundabout and becomes a two-way access road down to the eastern roundabout of the interchange.
- Pedestrian and cyclist facilities along the existing Jubilee Street under the upgraded highway. There would be no vehicular access. Pedestrian and cyclist facilities would be provided within the interchange. On the western side, access to Maclean would be unchanged. On the eastern side, Jubilee Street would connect to the interchange at Maclean via the two-way service road to the eastern roundabout.

The EIS design is shown in Figure 4-22.

Proposed design refinement

The interchange would remain a dual roundabout. The design refinement shown in Figure 4-22 would involve:

- Relocating the eastern roundabout and overpass around 190 metres north of the EIS design. The eastern roundabout would connect to the overpass over the highway to Maclean and the southern access road connecting properties to the south-east of the interchange. The roundabout would have two northern connections – one to the southbound off-ramp and the other a two-way northern connection to Jubilee Street.
- Relocating the western roundabout about 100 metres west of the EIS design. The western roundabout would provide access to the existing highway to the south, access across the highway to the eastern roundabout, northbound on-ramp, Cameron Street to Maclean and direct access off the roundabout to Ferry Park.
- Locating the northbound off-ramp connecting to the existing highway around 50–100 metres south of the western roundabout.
- Realigning the southbound off-ramp around 25–50 metres west, to begin south of Jubilee Street at station 81.2. The off-ramp would no longer connect to Jubilee Street via a roundabout, as per the EIS design. A separate Jubilee Street access road would be built east of the off-ramp to provide a connection to the eastern roundabout of the interchange.
- Retaining pedestrian and cyclist access into Townsend from Maclean along the existing Jubilee Street under the highway.
- Modifying the project boundary to the west of the existing highway to accommodate the western roundabout of the proposed interchange, and to the east of the southbound carriageway of the upgraded highway to accommodate the Jubilee Street access road.
- Modifying cross-drainage, including the culvert bank beneath the southbound on-ramp.
- Modifying batters to provide fill embankments and road cuttings.

Reason for refinement

During recent geotechnical studies, the soils at Maclean south of Goodwood Street were found to be very deep soft soils. The design refinement would move the eastern roundabout north of Goodwood Street to an area of lesser soft soils to reduce the extent of soft soil treatment.

The design refinement would improve the constructability of the interchange, its layout and overall functionality. In addition, it responds to community requests for changed access into Townsend. The design refinement would provide for access to Townsend via Jubilee Street. Relocating the southbound highway off-ramp south of Jubilee Street would eliminate the conflict between exiting highway traffic and pedestrian traffic. It would also reduce impacts on amenity for Jubilee Street residents.

The design refinement would also provide an opportunity for local government to construct a Goodwood Street/Common Road connection to Gulmarrad from the eastern roundabout of the interchange.

The design refinement would maintain the current direct access between Maclean and Townsend. Pedestrian and cyclist traffic would also be maintained under the highway.

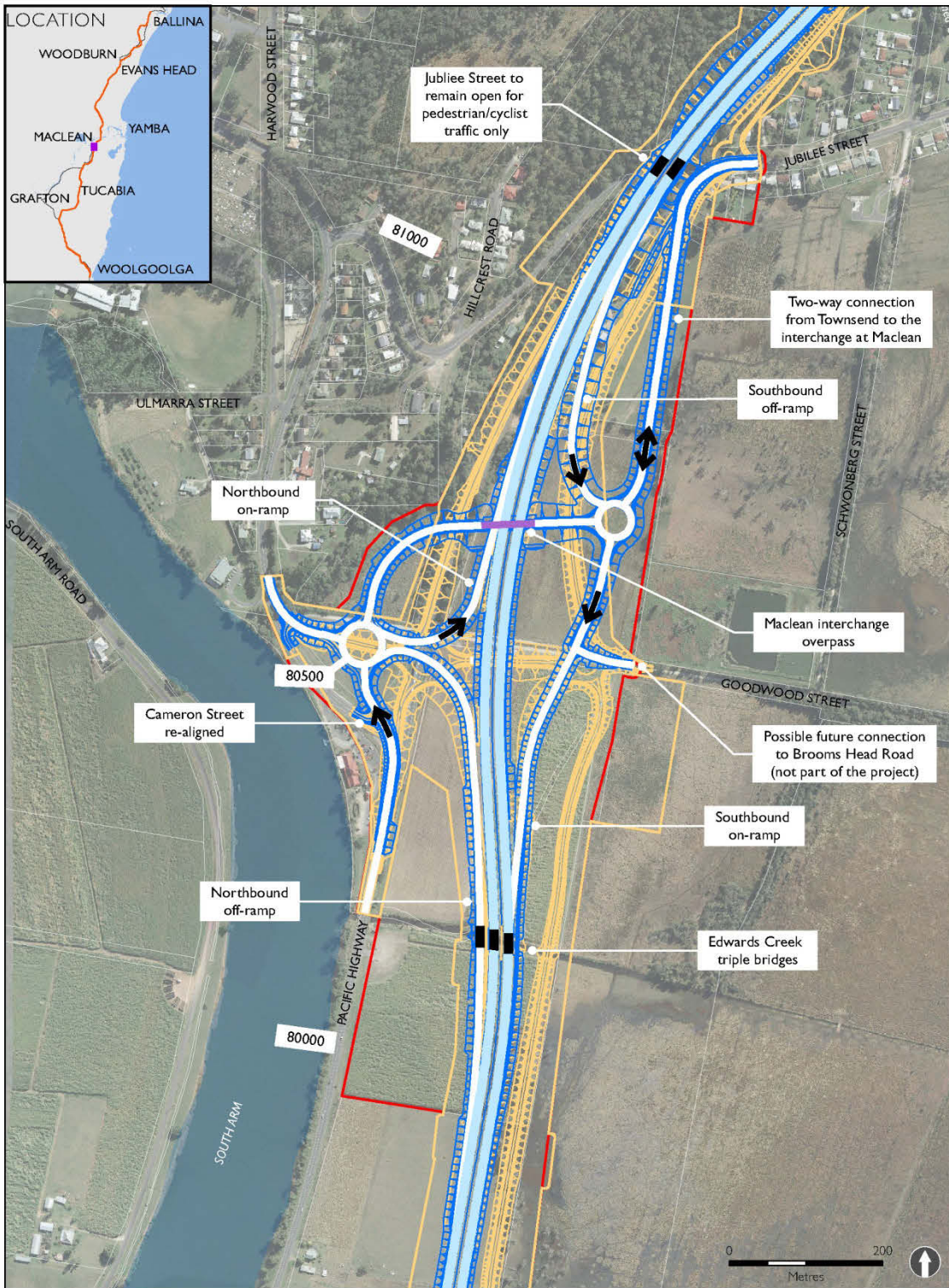


Figure 4-22: Revised interchange design at Maclean

Consultation

At community information sessions held during the development and exhibition of the EIS, the community raised concerns regarding the access arrangement proposed in the EIS design. Some community members expressed the need to consider not only current movements for traffic but also future movements, particularly considering the growth of urban areas of Townsend and Gulmarrad. Of specific concern was the issue of heavy vehicle access into Townsend Industrial Estate from Jubilee Street via the access road/ southbound off ramp off the highway.

Other key issues raised by the community include noise increases for residences emanating from the southbound off ramp and noise and dust from trucks accessing the Industrial Estate via Jubilee Street.

At the community information session held in October 2011 and January 2013, the Roads and Maritime Services (Roads and Maritime) committed to reviewing the access into Townsend and Gulmarrad and to consider whether an alternative access had merit. This commitment was also given to the Clarence Valley Council (CVC) in meetings held at the same time.

Consultation regarding the design refinement at Maclean formed part of the EIS public display process between December 2012 and February 2013. Members of the project team attended community information sessions to discuss the EIS including the proposal to modify the interchange design, displayed in the EIS. The main community information sessions where the potential design refinement options were presented for discussion were:

- Maclean Civic Hall, Maclean: 18 January 2013.
- Grafton Community Hall, Grafton: 18 January 2013.

The project team attended a stakeholder meeting relevant to the design refinement at Clarence Valley Council on 12 December 2012. A staffed display was also held at Maclean Civic Hall on 9 February 2013. Members of the project team were available to meet with the community and answer questions about the project, including the design refinement to the interchange at Maclean. Meetings were also held with Clarence Valley Council, Maclean Chamber of Commerce, and Harwood Canegrowers.

A further information session, with 51 attendees, was held on 25 March 2013 regarding the alternative access into Townsend. At the information session, the project team presented two design refinement options for the interchange at Maclean and obtained feedback on the options from those present. The options are described below.

Option one – Goodwood Street / Common Road access

The Goodwood Street / Common Road option for access into Townsend and Gulmarrad would be from the eastern roundabout of the interchange at Maclean along the existing Goodwood Street/Common Road alignment. This would require an extension and connection through to Brooms Head Road, connecting to the Brooms Head Road/Armstrong Road intersection. The highway southbound off-ramp would be relocated further south, and would exit at around station 81.0 and lead to a roundabout at the junction with Goodwood Street. It would not connect directly to Jubilee Street. The roundabout at Goodwood Street would connect to Common Road.

The two-way service road from the eastern roundabout of the interchange at Maclean to Jubilee Street would be removed. Access into Townsend and Gulmarrad would be via the Maclean interchange and Goodwood Street / Common Road and Brooms Head Road. The pedestrian and cyclist access into Townsend from Maclean along the existing Jubilee Street under the highway would remain unchanged from the EIS design.

Option two – Revised Jubilee Street access

The revised Jubilee Street option would remove the southbound ramp north of Jubilee Street and the small roundabout leading directly into Townsend at the Jubilee Street junction. Instead, the southbound ramp from the highway would exit at around station 81.0 and lead to a roundabout at the junction with Goodwood Street.

Southbound motorists travelling to Townsend would exit via the southbound off-ramp to the roundabout and then travel north along the access road to Jubilee Street. This route would cater for both light and heavy vehicles. The southbound ramp would also provide the main entry onto the interchange at Maclean and to Maclean from the north. The roundabout at Goodwood Street would allow the means to connect the interchange to Brooms Head Road through Goodwood Street should a

connection be constructed along Common Road. (At the community information session, Roads and Maritime emphasised that this connection would not be constructed as part of the Pacific Highway upgrade and would need to be built by Council.)

The pedestrian and cyclist access into Townsend from Maclean along the existing Jubilee Street under the highway would remain unchanged from the EIS design.

Support for option two

Those attending the community information sessions and stakeholder meetings supported the adoption of option two. The design refinement responds to community concerns regarding access to Jubilee Street.

The interchange layout for option two is presented in Figure 4-22.

Environmental assessment

Hydrology and flooding

The floodplain to the east of the Clarence River (south arm) between Shark Creek and Maclean is known as the Chaselings basin. The Chaselings basin is mainly a flood storage basin for the Clarence River. The culvert at the Goodwood Street underpass is an important conveyance point in the Chaselings Basin. It conveys the majority of floodwaters that fill the basin during floods. The peak flood level in the Chaselings Basin for a 20-year flood event (ARI) is 3.65 metres Australian Height Datum (AHD).

During a major flood event, Clarence River floodwaters initially enter the northern and eastern part of the basin through the Goodwood Street underpass. The southern portion of the Chaselings Basin is inundated by Clarence River flows. These overtop the existing highway and a small levee located at Causleys Lane.

Flood levels at the interchange at Maclean and the Chaselings Basin peak at around 3.75 metres AHD, with depths of up to four metres. The water is generally slow moving, with velocities of between 0.2 and 0.6 metres per second.

The EIS design included a bank of eight culverts measuring 2.4 by 1.2 metres at station 80.6, beneath the southbound off-ramp immediately to the north of the eastern roundabout. These culverts would convey floodwaters under the proposed highway into the Chaselings Basin. These culverts would be retained in the design refinement at station 80.6 to maintain flood flow into the basin.

As stated in section 8.4.11 of the EIS, the EIS design would maintain the existing flooding regime, where possible. The impact of the project on peak flood levels would be less than a 15 millimetres increase during a 100-year (ARI) flood event. The 20-year and 200-year ARI flood events would experience impacts up to 15 millimetres and 10 millimetres, respectively.

Modelling of the hydrological impacts of the design refinement predicted that flood levels would increase at this location (and beyond into the Chaselings Basin) by between 0.5 millimetres and 2.5 millimetres. There would be minimal changes in direction for velocity, with only a slight increase of about 0.4 metres per second. There would be no noticeable change to the duration of flood impacts.

As the increase in flooding impacts under the design refinement would be negligible when compared with the EIS design, no further mitigation is required beyond the measures in section 8.4 of the EIS.

Soils, sediments and water

As stated in section 9.2.1 of the EIS, mapping of acid sulfate soils in Section 4 indicates a high probability of occurrence in this area. Appropriate treatment of acid sulfate soils would be undertaken during construction, as described in the EIS and no further impacts on or from acid sulfate soils are anticipated.

As indicated in the EIS, during construction there would be an increased risk of soil erosion from exposed soil and stockpile sites, in particular areas of earthworks close to the south arm of the Clarence River (eg the stockpile site at station 79.5–80.0). The design refinement would not change this risk and, as such, no additional impacts are anticipated during construction.

In the EIS, an area north and south of Edwards Creek was identified as a soft soil site (SS-03) between station 78.4 and 80.9 with soft soils up to 22 metres deep. By relocating the eastern roundabout further north, the areas of soft soils in the construction area would be shallower. This would reduce the amount of soft soil treatment required.

No additional impacts have been identified during operation provided the mitigation measures outlined in the EIS are implemented.

Biodiversity

The interchange at Maclean would be constructed to the east of the existing highway, on land largely cleared for agriculture. However, threatened flora confirmed to the west of the project boundary at Maclean includes the Green-leaved Rose Walnut (endangered, TSC Act), Rough-shelled Bush Nut (vulnerable, TSC Act). Threatened fauna within this area includes the Grey-headed Flying-fox (vulnerable TSC Act and EPBC Act) near Maclean High School.

The EIS identifies that disturbed vegetation west of the existing highway would be removed. It consists of Grey Gum- Grey Ironbark open forest. The design refinement would not require any additional vegetation clearing from that identified in the EIS, as the refinement would be mostly within the EIS project boundary. Where the design refinement extends outside the boundary, it would be located on cleared land.

No impacts on Commonwealth or State listed threatened species are anticipated.

Therefore, no mitigation or management measures are required beyond those in the EIS.

Urban design, landscape character and visual

The Maclean interchange would be surrounded by the Clarence River floodplain. This landscape type is characterised by agricultural activities. To the north-west, the landscape rises to the Maclean Pinnacle, with the township of Maclean located behind.

As outlined in Table 11-22 of the EIS, the magnitude of the visual impact from the interchange at Maclean would be high as the project includes new infrastructure in a predominantly agricultural landscape (viewpoint 24A – Ferry Park, interchange at Maclean). Sensitivity to the view of the interchange would be moderate for the majority of residents in Maclean and visitors to the area. Although the design refinement would change the layout of the interchange, the overall visual impact would continue to be moderate–high at Ferry Park.

As outlined in Table 11-23 of the EIS, the highway would be duplicated between Maclean and Townsend. The magnitude of the visual impact from the interchange at Maclean would be moderate as the project includes new infrastructure typical of infrastructure already in place at this location (viewpoint 24B – Schwonberg Street, Townsend). Sensitivity to the view of the interchange would be moderate. There is considerable sensitivity for a low number of residents along Schwonberg Street and Jubilee Street. These residents would have repeated views to a changed setting, modified by the removal of existing roadside screening vegetation. As a result of the design refinement, the overall visual impact would change from moderate–high to moderate for residents along Schwonberg Street.

In summary, the following urban design impacts would result from the design refinement:

- Reducing the batter height, particularly on the western roundabout would aid in reducing the impacts of the interchange on the surrounding landscape.
- Increasing the height of the batters at the overbridge and service roads to the east of the main alignment would increase the extent of the visual impact.
- Relocating the eastern roundabout north may increase visual impacts for receivers along Jubilee Street.
- Relocating the off-ramp to the south of Jubilee Street would reduce the visual impact for receivers along Schwonberg Street.

As there is either no change to the landscape character and visual assessment, or a reduction in visual impact at viewpoint 24B (Schwonberg Street), no further management measures are required.

Aboriginal heritage

The area surrounding the interchange at Maclean has moderate sensitivity for Aboriginal heritage, as it is located around 100 metres to the south-east of the Hillcrest Reserve (AHIMS ID 13-1-0117, which comprises a Potential Archaeological Deposit (PAD) and a formerly habitable structure). However, the area has been subject to a high degree of ground disturbance from previous vegetation clearance and road construction.

A site inspection by project archaeologists on 14 February 2013 did not identify any new impacts that could result from construction and operation of the design refinement. The Registered Aboriginal Parties consulted prior to the site inspection and in attendance during fieldwork included:

- Yaegl Local Aboriginal Land Council.
- Birrigan-Gargle Local Aboriginal Land Council.
- Yaegl People Native Title Claim.

The design refinement was discussed with Registered Aboriginal Parties at an Aboriginal Focus Group meeting on 6 February 2013 at Grafton Community Centre.

As no new Aboriginal heritage items were identified, impacts from this design refinement would be consistent with the impacts outlined in the EIS and no further mitigation or management measures are required.

Historical (non-Aboriginal) heritage

Historical heritage assessment undertaken for the EIS did not identify any non-Aboriginal heritage items within the area of the interchange at Maclean.

The design refinement would not impact any historical heritage items listed on the State Heritage Register or included in the Clarence valley Local Environmental Plan, 2011.

As no additional non-Aboriginal heritage sites or items would be impacted, the impacts of this design refinement would be consistent with the impacts outlined in the EIS. No additional non-Aboriginal heritage impacts are anticipated during construction and operation and no further mitigation or management measures are required.

Traffic and transport

The highway provides the major interstate and regional route connecting Sydney to Brisbane along the NSW east coast. The highway runs to the east of Maclean prior to crossing the Clarence River via the existing Harwood Bridge. A traffic survey in November 2011 1.6 kilometres north of Cameron Street, Maclean, indicates that the highway carried a total daily volume of 9478 vehicles; 7327 were light vehicles and the remaining 2151 were heavy vehicles (23 per cent of the total daily volume)

The design refinement would not impact the highway's predicted capacity when open to traffic (assumed to be 2016), or the interchange's predicted level of service. Peak hourly traffic north of Maclean was forecast in section 14.2 of the EIS to be 1161 during holiday season in December. The design refinement is not predicted to impact the forecast traffic demand for vehicles travelling through the interchange.

Access to Townsend, the industrial estate and Maclean would not change, continuing to be via the interchange. The pedestrian and cyclist access described in the EIS as being provided via the overpass of Jubilee Street would also remain unchanged. Access to Gulmarrad, would be via Jubilee Street as proposed in the EIS, but a new overpass at McIntyres Lane (refer to section 4.4.7), could affect the number of vehicles travelling along Jubilee Street to access Gulmarrad.

No mitigation or management measures are required beyond those in the EIS.

Noise and vibration

There are around 90 noise-sensitive receivers within 300 metres of the refined location of the interchange at Maclean. These are located on both the eastern and western sides of the project. The closest of these receivers are R1706, R1709 and R1782. The receivers would be within 50 metres of the proposed road boundary. In altering the location of the interchange, some receivers could experience higher noise levels, but others would experience lower noise levels.

Potential construction impacts

Construction noise from the design refinement has been predicted using the same construction equipment assumed in the EIS. Noise levels are shown in Table 4-20 to Table 4-23. (EIS assessed noise levels are shown in brackets).

Table 4-20: Interchange at Maclean –construction noise levels– formation, clearing and mulching

NCA	Total no. receivers	NML, dB(A)		Maximum predicted noise level typical works, dB(A)	No. receivers exceeding NML		No. receivers highly noise affected*
		Proposed	Out of hours		Proposed	Out of hours	
4-a	22	45	44	48 (48)	22 (22)	18 (16)	0 (0)
4-b	20	45	35	60 (60)	19 (19)	20 (20)	0 (0)
4-c	31	52	41	70 (70)	28 (23)	24 (23)	0 (0)
4-d	32	53	44	64 (64)	23 (23)	28 (28)	0 (0)
4-e	84	57	43	54 (54)	0 (0)	47 (47)	0 (0)
4-f	82	54	42	53 (53)	0 (0)	69 (69)	0 (0)

*Highly noise affected is considered to be 75 dB (A) in accordance with the ICNG.

Table 4-21: Interchange at Maclean –construction noise levels– earthworks

NCA	Total no. receivers	NML, dB(A)		Maximum predicted noise level typical works, dB(A)	No. receivers exceeding NML		No. receivers highly noise affected*
		Proposed	Out of hours		Proposed	Out of hours	
4-a	22	45	44	(53)	22 (22)	22 (22)	0 (0)
4-b	20	45	35	(65)	20 (19)	20 (20)	0 (0)
4-c	31	52	41	(75)	31 (23)	24 (23)	0 (0)
4-d	32	53	44	(69)	21 (23)	21 (28)	0 (0)
4-e	84	57	43	(59)	1 (0)	71 (71)	0 (0)
4-f	82	54	42	(58)	0 (0)	72 (72)	0 (0)

*Highly noise affected is considered to be 75 dB (A) in accordance with the ICNG.

Table 4-22: Interchange at Maclean – construction noise levels – asphaltting

NCA	Total no. receivers	NML, dB(A)		Maximum predicted noise level typical works, dB(A)	No. receivers exceeding NML		No. receivers highly noise affected*
		Proposed	Out of hours		Proposed	Out of hours	
4-a	22	45	44	(51)	22 (22)	22 (22)	0 (0)
4-b	20	45	35	(63)	19 (19)	20 (20)	0 (0)
4-c	31	52	41	(73)	31 (13)	23 (23)	0 (0)
4-d	32	53	44	(67)	25 (25)	28 (28)	0 (0)
4-e	84	57	43	(57)	1 (0)	59 (59)	0 (0)
4-f	82	54	42	(56)	0 (0)	72 (72)	0 (0)

*Highly noise affected is considered to be 75 dB (A) in accordance with the ICNG.

Table 4-23: Interchange at Maclean – construction noise levels – bridge works

NCA	Total no. receivers	NML, dB(A)		Maximum predicted noise level typical works, dB(A)	No. receivers exceeding NML		No. receivers highly noise affected*
		Proposed	Out of hours		Proposed	Out of hours	
4-a	22	45	44	43 (40)	0 (0)	7 (7)	0 (0)
4-b	20	45	35	46 (44)	19 (17)	18 (18)	0 (0)
4-c	31	52	41	57 (57)	22 (22)	23 (23)	0 (0)
4-d	32	53	44	59 (54)	17 (17)	25 (25)	0 (0)
4-e	84	57	43	56 (56)	5 (5)	50 (50)	0 (0)
4-f	82	54	42	48 (48)	4 (4)	39 (39)	0 (0)

*Highly noise affected is considered to be 75 dB (A) in accordance with the ICNG.

The design refinement would result in more receivers being exposed to construction noise levels above the acceptable noise management level (for proposed project hours and out of hours criteria).

This is because the relocation of the overpass within the interchange, 200 metres north of the original location, would result in a slightly higher number of receivers exposed to higher noise levels during both proposed project hours and out-of-hours construction work. Two additional receivers would be exposed to noise levels above the proposed project hours noise management level.

Under the design refinement, no additional receivers are predicted to exceed the 'highly noise affected' criteria in the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009) above those identified in the EIS. Although a greater impact has been predicted during construction for some receivers, mitigation measures in the EIS would apply and no new mitigation measures are required.

The only source of potential vibration from this design refinement would be from piling during the construction of the overpass. The overpass was originally proposed around station 80.5, whereas the revised location is station 80.7, around 200 metres north. This change in distance may appear small, but in vibration terms it can be significant. Therefore, the impacts have been reassessed.

Where a receiver is located within 20 metres of a piling/bridge site, there is a medium to high risk of vibration levels exceeding human comfort criteria. Where a receiver or structure is located within 10 metres of a piling/bridge site there is a high risk of causing some form of structural or cosmetic damage.

The vibration assessment of the design refinement for the interchange at Maclean is consistent with the EIS as the closest sensitive receiver to the relocated overpass is around 120 metres away. At this distance, vibration is predicted to be considerably below structural damage and human comfort criteria. Therefore, the risk to structures and occupants would remain low. In practice, vibration from piling would not be perceptible by the identified receivers due to the distance separating the receivers from the construction activities. Following confirmation of each individual pile location, a further detailed assessment may be required at the detailed design stage if pile locations are within 50 metres of the closest receiver. To address this possibility, a mitigation measure requiring further noise and vibration assessment was included in section 15.4 of the EIS. No further mitigation or management measures are required beyond those in the EIS.

Potential operational impacts

Due to large traffic volumes travelling at speed on the upgraded highway, the main noise source and impact would be from road traffic on the highway, not the off-ramps and service roads.

There would be a minor increase of around 0.5 dB(A) at the closest receiver locations potentially affected by the design refinement. This increase in noise would not be perceptible. As such, no additional noise mitigation measures are proposed. The noise and vibration mitigation would be confirmed during detailed design, as recommended in section 15.4 of the EIS.

Land use and property

Residential, rural residential and commercial land uses are dispersed across Maclean, Townsend and Gulmarrad, which are the urban areas closest to the interchange at Maclean. Clarence Valley Council has identified urban release areas on land located around Townsend, Gulmarrad and James Creek.

Agriculture is the main land use in the wider Northern Rivers and Mid North Coast region, particularly cropping and grazing. Cropping mainly involves sugarcane farming and generally occurs near the towns of Tyndale and Maclean in Section 4.

The land use and property impacts of the interchange at Maclean are shown in Table 4-24. A comparison between the EIS design and the design refinement indicates whether there is an increase, decrease or similar impact when the two interchange designs are compared.

Table 4-24: Property impact schedule for interchange at Maclean

Property lot/DP	Land use	EIS		Design refinement		Change in impact area
		Impact area (ha)	% of property affected	Impact area (ha)	% of property affected	
Lot 1, DP 534051	Wetland	3.2	13	0.7	2.25	-2.5
Lot 1, DP 116105	Cropping	0.2	36	0.35	67	0.15
Lot 16, DP 230180	Cropping	0.1	100	0.1	100	0
Lot 6, DP 230180	Urban	1.4	55	2.5	100	1.1
Lot 1, DP 230180	Cropping	4.6	61	7.5	100	2.9
Lot 1, DP 798830	Cropping	5.0	77.4	6.5	100	1.5
Lot 2, DP 798830	Cropping	1.0	100	1.0	100	0
Lot 420, DP 751388	Grazing	0.2	100	0.2	100	0
Lot 8, DP 800757	Wetland	0.8	100	0.8	100	0
Lot 1, DP 800757	Urban	0.02	19.7	0.1	100	0.08
Lot 4, DP 800757	Urban	0.1	100	0.1	100	0
Lot 3, DP 800757	Urban	0.03	33.3	0.1	100	0.07
Lot 2, DP 800757	Urban	0.03	23.5	0.1	100	0.07
Lot 5, DP 800757	Urban	0.1	100	0.1	100	0
Lot 6, DP 800757	Urban	0.1	100	0.1	100	0
Lot 7, DP 800757	Urban	0.1	100	0.1	100	0
Lot 4, DP 230180	Cropping	4.6	75.7	6.0	100	1.4
Lot 1, DP 1154585	Cropping	0.4	100	0.38	86.8	-0.02
Lot 5, DP 1154045	Grazing	0.1	4.7	1.12	51.1	1.02
Total:		22.1		27.9		5.8

The analysis indicates that the design refinement would:

- Require around 27.9 hectares of property to be acquired to provide land for the refined interchange design. This is an increase of 5.8 hectares over the EIS design. The additional land to be acquired is mainly between the existing highway and the northbound carriageway of the interchange, north of Ferry Park, north of Goodwood Street, and adjacent to the proposed Jubilee Street access road.
- Increase property impacts for three landowners previously affected by the EIS design.
- Require 17 property acquisitions (three more than for the EIS design).
- Reduce property impacts for two landowners by around 2.5 hectares.
- Require 15 of the 19 properties impacted to be totally acquired; the remaining four would require partial acquisition.

The majority of properties impacted are either small rural-residential properties or used for agricultural activities including sugarcane cropping. One property that is partially identified as regionally significant agricultural land would also be affected by increased acquisition. Although, it does not appear this property is actively farmed, the design refinement would increase the overall area of regionally significant farmland impacted by the project by less than one hectare.

While the design refinement would result in new land use and property impacts, property acquisition would continue to be under the *Land Acquisition (just Terms Compensation) Act 1991* and Roads and Maritime's Land Acquisition Policy (RTA, 1999).

No further mitigation or management measures are required beyond those in the EIS.

Social and economic

Maclean, located on the Clarence River, is around 40 kilometres north of Grafton, and services the coastal communities of Brooms Head and Iluka, and the riverside villages of Harwood and Chatsworth. It also provides a range of community services supporting the Gulmarrad and Townsend communities.

Maclean is currently bypassed by the highway. It is unlikely that accessibility, visibility and the quality of amenity in the town centre would be affected by the project, as the existing highway alignment and project alignment are similar. As a major township, the local population would sustain local businesses. Of the businesses assessed in the EIS, a high proportion are highway related (65 per cent). These businesses would continue to serve local customers.

The EIS indicated that traffic-dependent businesses comprise only three per cent of total businesses. Of these, the BP service station located south of Maclean is expected to experience a reduction in passing traffic. Non-traffic-related businesses, which include 32 per cent of businesses, are expected to be unaffected, continuing to serve local customers. The design refinement does not change this assessment.

Access to the Clarence Coast visitor information centre (adjacent to the highway within the Ferry Park complex, Maclean) would be via Cameron Street. The EIS described how access to Cameron Street requires motorists to exit the highway around one kilometre north of the visitor centre or around 500 metres south of the centre. While there may be impacts on the amenity of the visitor centre from increased traffic noise, access would be maintained during operation.

The design refinement would be similar to the EIS option, but with the relocation of the southbound off-ramp. It would improve local access for properties on the existing highway and improve local access to Maclean.

Emergency services, including ambulance and police services, are located in Maclean. Access for these services to the highway and nearby communities would be improved by the design refinement. The refinement would improve access across the interchange, as the eastern roundabout would have two separate northern connections: the southbound off-ramp and the two-way northern connection to Jubilee Street.

Overall, the refinement to the interchange is not anticipated to introduce new social and economic impacts. However, it would improve connections from the interchange to the existing highway. There would be amenity benefits for Jubilee Street, when compared to the EIS design, as the southbound off-ramp would be aligned further west.