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# Coffs Harbour Bypass

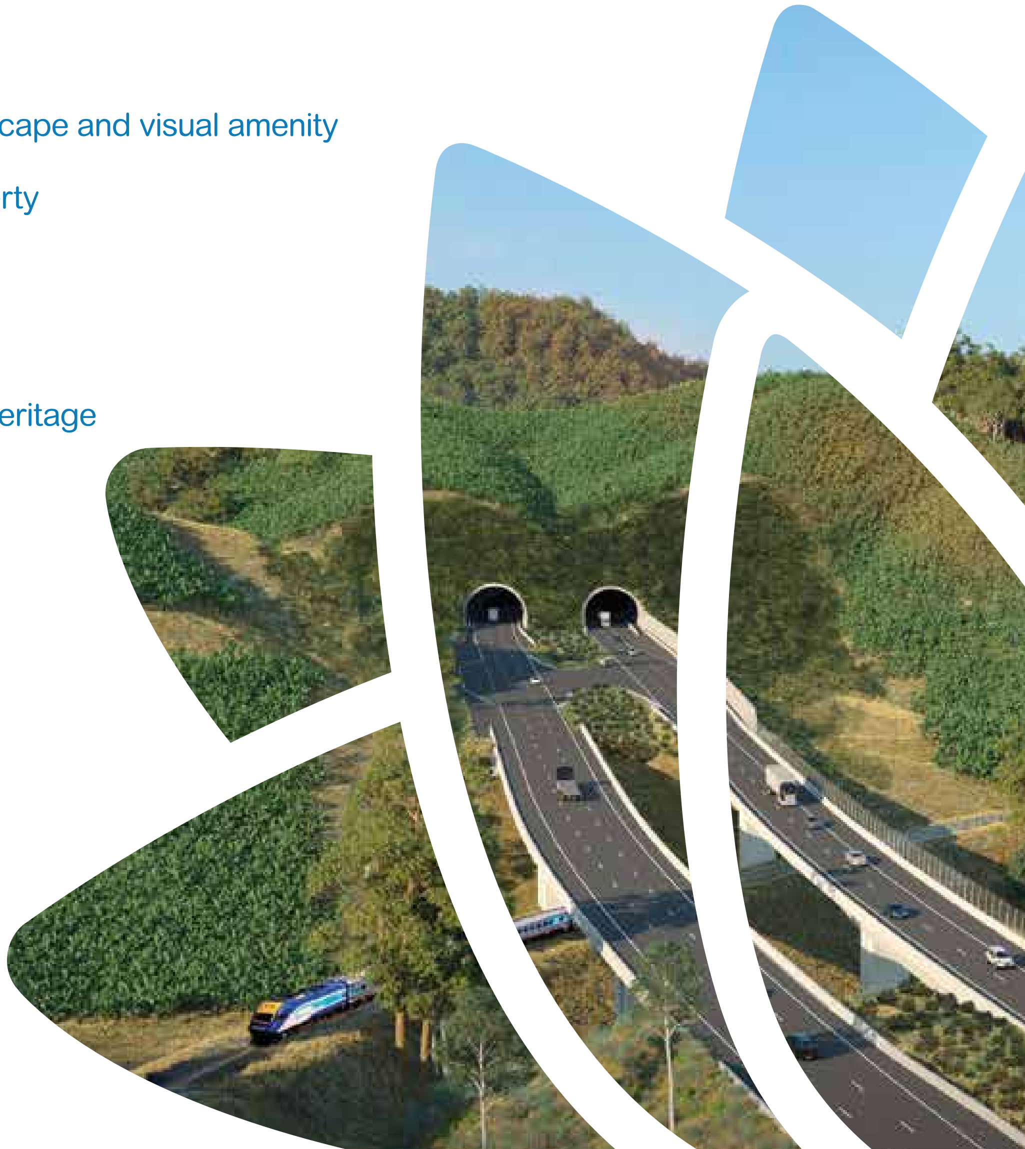
## Environmental Impact Statement

September 2019

VOLUME 1B

## Assessment of environmental impacts






RMS.19.1311

ISBN: 978-1-925891-57-7

CHAPTER

8



Chapter 8

# Traffic and transport

# 8. Traffic and transport

This chapter presents an assessment of the potential direct and indirect impacts of the project on traffic and transport during construction and operation and identifies measures to avoid and minimise these impacts. It draws on information in the traffic and transport report prepared for this EIS (refer to **Appendix F, Traffic and transport assessment**). **Table 8-1** lists the SEARs relevant to traffic and transport and where they are addressed in this chapter.

Table 8-1 SEARs for traffic and transport

| Ref | Key Issue SEARS | Where addressed |
|---|---|---|
| **1. Transport and traffic** | | |
| 1. | The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to: | |
| | a) A considered approach to the identification of transport routes and movements, particularly outside standard construction hours | Section 8.3.5<br>**Chapter 6, Construction** |
| | b) The indicative number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements) | Section 8.3.2<br>Section 8.3.3<br>**Chapter 6, Construction** |
| | c) Indicative construction worker parking requirements | Section 8.3.1 |
| | d) The nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times, land uses, in particular sensitive receivers, and parking arrangements) | Section 8.2 |
| | e) Access constraints and impacts on public transport, pedestrians and cyclists | Section 8.3.4 |
| | f) Impacts on the operation of the North Coast railway line | Section 8.3.4 |
| | g) The need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project | Section 8.3.5 |
| | h) The cumulative traffic impacts of other major development projects preparing for or commencing construction in the vicinity of the proposal | **Chapter 25, Cumulative impacts** |
| 2. | The Proponent must assess (and model) the operational transport impacts of the project including, but not necessarily limited to | |
| | a) Forecast travel demand and traffic volumes for the project and the surrounding road, cycle and public transport network | Section 8.4.1<br>Section 8.4.8<br>Section 8.4.11 |
| | b) Travel time analysis | Section 8.4.3 |
| | c) Performance of key interchanges and intersections by undertaking a level of service analysis at key locations | Section 8.4.4 |
| | d) Wider transport interactions and modifications (local and regional roads, cyclist, public and freight transport, and the North Coast railway line) | Section 8.4 |

| Ref | Key Issue SEARS | Where addressed |
|---|---|---|
| | e) Access to identified and future urban release areas, such as North Boambee Valley | Section 8.4.10 |
| | f) Impacts on cyclists and pedestrian access and safety | Section 8.4.5<br>Section 8.4.11 |
| | g) Opportunities to integrate cycling and pedestrian elements with surrounding networks (existing and proposed) and within the project | Section 8.4.11 |

## 8.1 Assessment methodology

The assessment methodology for the traffic and transport assessment involved:

- General site observations to describe the local and regional road network
- Traffic surveys carried out in June and November 2016 and May 2017 including:
  – Surveys to understand existing travel patterns, particularly 'through movements', by confirming the origin and destination of vehicles and where vehicles have travelled through Coffs Harbour along the existing Pacific Highway without stopping
  – Surveys to understand the existing transport operations of Kororo Public School (intersection turning movement counts, bus counts, parking demand and occupancy survey) and pedestrian movements to consider safety of the school children, teachers and families during construction of the project
- Traffic data analysis including review of existing traffic volumes and crash data (2014 – 2018) to determine where safety issues might exist across the project
- Computer-based transport modelling based on a three-tiered modelling approach, comprising:
  – A regional strategic model used to forecast future traffic demand/growth and redistribution for the wider region with and without the project
  – A detailed project specific mesoscopic model using Advanced Interactive Microscopic Simulator for Urban and Non-Urban Networks (AIMSUN) to assess the future traffic performance with and without the project
  – A detailed intersection model – microscopic simulation (AIMSUN) and detailed intersection assessment using the SIDRA Intersection program to determine operational demand of interchanges and performance of intersections
- Assessing the predicted traffic and transport impacts of the project (operation and construction) including impacts on public transport
- Identifying reasonable and feasible measures to mitigate and reduce predicted traffic and transport impacts during construction and operation of the project.

A base model representing existing (2016) conditions for the morning and afternoon peaks was established to develop future scenarios for the assessment of the project. The following scenarios were used to assess the potential impacts of the project:

- Traffic conditions for the morning and afternoon peaks (8am to 9am and 4pm to 5pm) at the year of opening (2024), with and without the project
- Traffic conditions for the morning and afternoon peaks 10 years after opening (2034), with and without the project
- Traffic conditions for the morning and afternoon peaks 20 years after opening (2044), with and without the project.

### 8.1.1 Traffic modelling approach

Traffic modelling for the project was carried out using a three-tiered approach with a regional strategic model being used to provide forecast traffic demands for the modelled areas. Model development was carried out with consideration to the Traffic Modelling Guidelines (Roads and Maritime 2013d) and in consultation and with rigorous peer review with Roads and Maritime.

#### *Coffs Harbour Strategic Transport Model*

The Coffs Harbour Strategic Transport Model (CHSTM) is a strategic model developed in EMME (a transportation modelling program). The strategic model considers traffic movements within the area and includes all highway, arterial, distributor, local collector roads and various key local access roads.

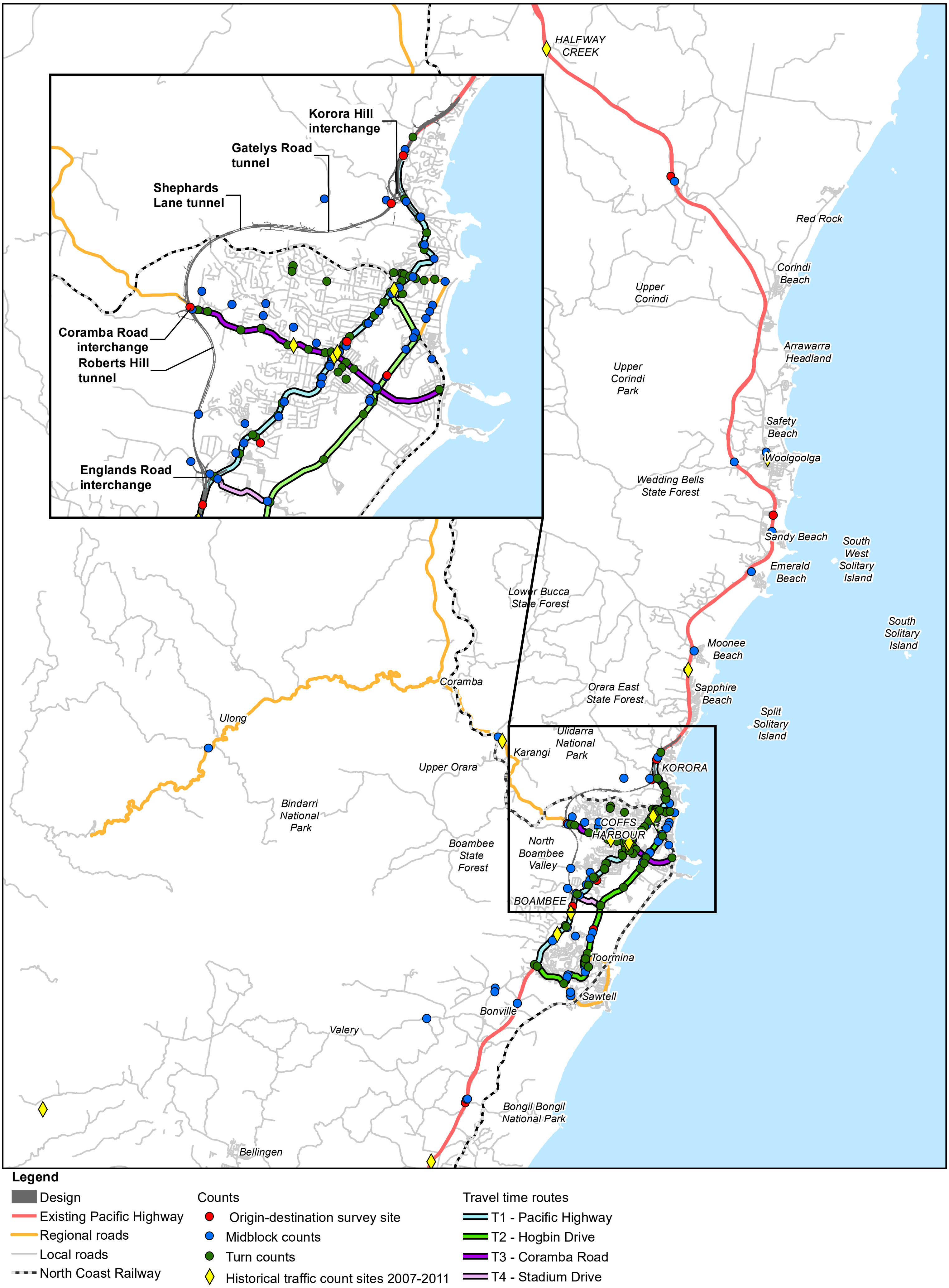
The CHSTM has been used to produce forecast traffic demands based on land use assumptions and predicted population and employment growth sourced from the North Coast Employment Land Review (DP&E 2015) and the Coffs Harbour Land Use and Employment Strategies (CHCC 2009d).

The CHSTM was developed based on the following counts and surveys (Trans Traffic Survey 2016 and Austraffic 2017):

- Origin-destination surveys carried out at 10 locations on Tuesday 16 May 2017
- Travel time surveys along four routes on Thursday 23 June 2016:
  - Existing Pacific Highway between Lyons Road and Old Coast Road
  - Hogbin Drive (and Toormina Road) between Lyons Road and Orlando Street
  - Coramba Road (and Harbour Drive) between Bennetts Road and Orlando Street
  - Stadium Drive between the existing Pacific Highway and Hogbin Drive
- Mid-block traffic counts at 60 locations between 20 and 27 June 2016
- Intersection turning movement counts at 69 locations on Thursday 23 June 2016.

The origin-destination, mid-block and intersection turning movement count locations are shown in **Figure 8-1**. The CHSTM was calibrated to existing (2016) conditions and has been used to provide forecast traffic demand for future years, both with and without the project in place, for use in the detailed Coffs Harbour Traffic Model (CHTM).

The future years assessed with the CHSTM are 2024 (project year of opening), 2034 (project 10-year design horizon) and 2044 (project 20-year design horizon). The CHSTM addressed four time periods at each design year being morning peak (8am to 9am), off-peak (9am to 4pm), afternoon peak (4pm to 5pm) and the rest-of-day (5pm to 8am).




Coffs Harbour Bypass
Origin-destination survey and traffic count locations
Figure 8-1

### *Coffs Harbour Traffic Model*

The CHTM is a mesoscopic traffic model that has been developed using AIMSUN software to assess the operational performance of the project. The CHTM is focused on the area between Sapphire Beach and Sawtell (refer to **Figure 8-2)** and provides detailed modelling of traffic conditions for the project and immediately surrounding road network.

In addition to the traffic surveys carried out in 2016 and 2017, traffic signal demand and cycle time data from the Sydney Co-ordinated Adaptive Traffic System (SCATS) was sourced from TfNSW for the 12 signalised intersections along the existing Pacific Highway for Wednesday 22 June 2016, as shown in **Figure 8-2.**

The base CHTM was calibrated against the traffic count and traffic signal data and validated against travel time survey data to predict the future traffic performance of the immediate road network with and without the project.

The future years assessed by the CHTM are 2024 (project year of opening), 2034 (project 10-year design horizon) and 2044 (project 20-year design horizon) during the peak morning and afternoon hours (ie 8am to 9am, and 4pm to 5pm).

### Intersection models

Detailed intersection and interchange performance was assessed using both microscopic (AIMSUN) and detailed intersection (SIDRA Intersection) modelling tools. These models were developed to review the local traffic operational assessment to inform the design of interchanges and intersections within the construction footprint. The intersections selected for detailed modelling and model footprints are shown in **Figure 8-3**.

SIDRA Intersection allows modelling of individual intersections to determine the level of service (LOS) and capacity, using the traffic demands sourced from the CHTM.

The intersection models were produced to determine the future LOS at key interchanges and intersections with and without the project. The future years assessed were 2024 (project year of opening), 2034 (project 10-year design horizon) and 2044 (project 20-year design horizon) for the peak morning and afternoon hours (ie 8am to 9am, and 4pm to 5pm).

### Additional traffic surveys

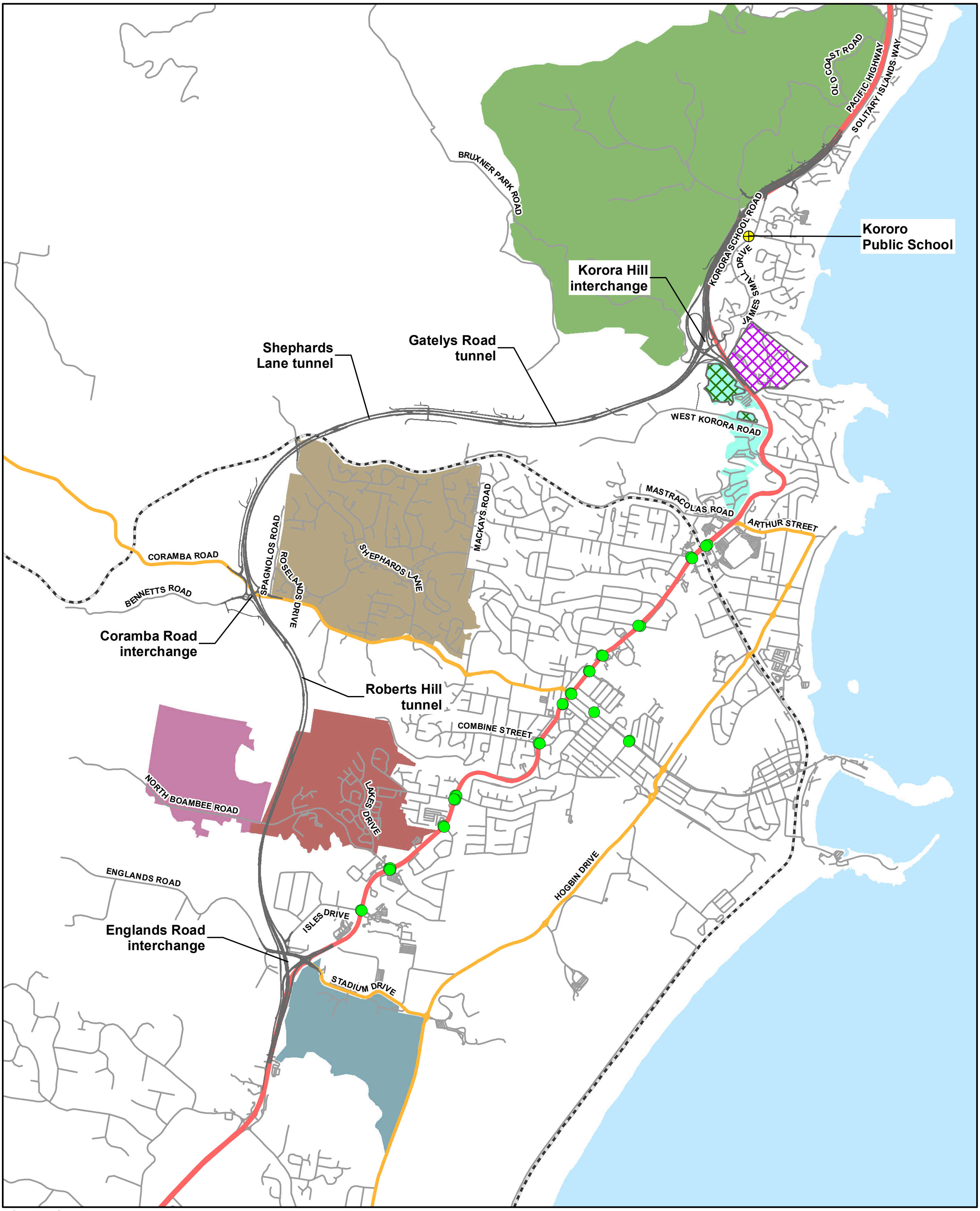
To inform the design near Kororo Public School, a number of surveys were carried out to understand the existing transport operations of the school. The surveys were carried out during the morning and afternoon school peak periods on Wednesday 30 November 2016 through to Friday 2 December 2016.

Intersection counts were carried out at the following locations:

- Pacific Highway/James Small Drive
- Pacific Highway/Old Coast Road
- Pacific Highway/Korora School Road
- Korora School Road/James Small Drive
- James Small Drive/Norman Hill Drive.

Bus counts were carried out at the northbound and southbound bus interchanges adjacent to the Kororo Public School on the Pacific Highway.

Parking demands and occupancy surveys were undertaken along Korora School Road, James Small Drive, Old Coast Road and the service road on the western side of the Pacific Highway near the school.




**Legend**

- Design
- Existing Pacific Highway
- Regional roads
- Local roads
- North Coast Railway
- Traffic signals
- Kororo Public School

**Urban release areas**

- North Coffs URA
- Korora URA
- North Boambee Valley URA
- South Coffs URA
- West Coffs URA
- North Boambee Valley (West) URA

**Furure and approved developments**

- Pacific Bay Eastern lands
- Pacific Bay Western Lands

Coffs Harbour Bypass
Existing signalised intersections and road infrastructure
Figure 8-2

0 0.5 1 1.5 km
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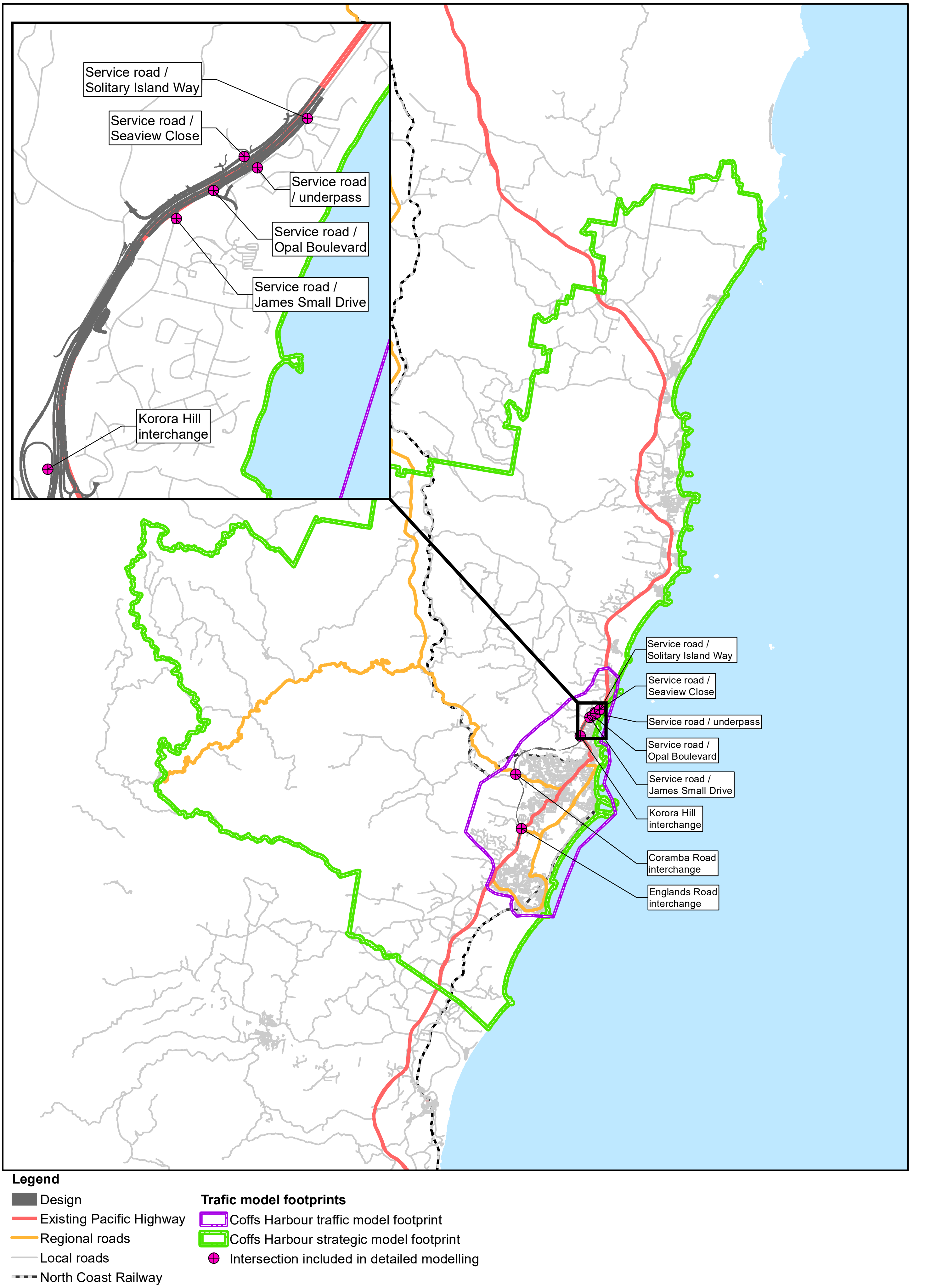
Scale @A4: 1:49,586
GDA 1994 MGA Zone 56




Coffs Harbour Bypass
Traffic modelling extents
Figure 8-3

# 8.2 Existing environment

## 8.2.1 Existing road network

### *Existing Pacific Highway*

The existing Pacific Highway at Coffs Harbour comprises a major interstate route between Sydney and Brisbane located along the coast of NSW. This major transport route forms part of the National Highway system of roads connecting all mainland states and territories of Australia. The existing Pacific Highway is a key freight, bus and tourist route for the region, as well as a local route for Coffs Harbour. It is also a designated B-double heavy vehicle route and forms part of the Higher Mass Limit road freight network, accommodating vehicles which are larger than B-doubles. **Figure 8-4** shows the heavy vehicle and restricted access vehicle routes.

The existing Pacific Highway located within Coffs Harbour is a four-lane highway. Regional and local roads intersect with the existing Pacific Highway via at-grade intersections. There is a grade separated interchange where the existing Pacific Highway passes over Mastracolas Road and Arthur Street.

The existing Pacific Highway between Stadium Drive and West Korora Road forms more of an arterial road with direct access provided for residential, commercial and industrial properties, at-grade signalised and priority (stop or give-way controlled) intersections and a speed limit of 60 km/h. Footpaths are provided on either side of the existing Pacific Highway through central Coffs Harbour, with on-street parking also available. A shared path is provided south of Combine Street on the western side of the existing Pacific Highway.

The posted speed limit of the existing Pacific Highway between West Korora Road and Solitary Islands Way is 80 km/h. North of Solitary Islands Way, the posted speed limit increases to 110 km/h. For both sections, there is limited property access available; however, an at-grade school bus interchange can be accessed via the existing Pacific Highway just south of Old Coast Road.

Traffic conditions on the existing Pacific Highway between Englands Road and Korora Hill interchange are characterised by:

- Significant traffic growth near Coffs Creek and north of Coffs Harbour
- A relatively high proportion of heavy vehicles comprising around 12 to 15 per cent of daily traffic volumes
- Stop-start traffic conditions, which are worsened by the 12 sets of traffic signals and multiple property accesses within the Coffs Harbour CBD
- Seasonal variation with increased traffic volume over school holiday periods.

### *Regional and local roads*

The regional roads intersecting the project are shown on **Figure 8-2** and include:

- **Stadium Drive** – Stadium Drive provides an east–west link between the existing Pacific Highway and Hogbin Drive to the south of Coffs Harbour. Stadium Drive is located adjacent to the Coffs Coast Sports and Leisure Park and is mostly a two-lane, two-way undivided roadway with on-street cycle lanes and limited pedestrian facilities
- **Coramba Road** – Coramba Road connects Coffs Harbour with Karangi to the west of the project. Coramba Road (turning into West High Street) intersects with the existing Pacific Highway at a signalised intersection within the Coffs Harbour CBD. To the west of the Coffs Harbour CBD, Coramba Road is a two-lane, two-way undivided roadway with limited pedestrian and cyclist facilities. As part of Main Road 151, Coramba Road / Orara Way provides an alternative route between Coffs Harbour and Grafton via the Orara Valley.

The local roads intersecting the project are shown on **Figure 8-2** and include:

- **Isles Drive** – Isles Drive intersects with Englands Road at a priority-controlled T-intersection to the west of the existing Pacific Highway. Isles Drive is a two-way, two-lane road through the Isles Industrial Park
- **Englands Road** – Englands Road is an extension of Stadium Drive west of the existing Pacific Highway and provides access to the industrial estate located north-west of the Englands Road interchange and to Coffs Coast Resource Recovery Park
- **North Boambee Road** – North Boambee Road is a two-way, two-lane local road which intersects with the project about 1.5 km north of Englands Road interchange. It provides access to Bishop Druitt College, commercial development, urban and rural residential dwellings and a quarry. It also provides access to the North Boambee Valley East and West urban release areas. North Boambee Road has a posted speed limit of 50 km/h between the Pacific Highway and Bishop Druitt College which increases to 60 km/h to the west of the college
- **Bennetts Road** – Bennetts Road intersects with Coramba Road west of Coffs Harbour, providing access to a number of private properties and developments. Bennetts Road is a rural road with no kerb or channel, limited pavement marking, no active transport provisions and a posted speed limit of 60 km/h
- **Bruxner Park Road** – Bruxner Park Road provides access to Ulidarra National Park at the northern end of the project. Bruxner Park Road is a winding rural road with no kerb or channel and limited pavement marking. It is a designated local school bus route and cycle route and incorporates signage warning motorists of the occurrence of these vulnerable users (ie pedestrians and cyclists)
- **Old Coast Road** – Old Coast Road intersects with the Pacific Highway south of Korora School Road at an at-grade unsignalised T-intersection. It is a rural road with no kerb and channel, and no pedestrian or cyclist provisions and provides access to predominantly rural residential allotments
- **Korora School Road** – Korora School Road diverges from the Pacific Highway north of the Old Coast Road and terminates at a priority-controlled T-intersection with James Small Drive. It is a one-way southbound road providing access to the adjacent Kororo Public School and residential properties
- **James Small Drive** – James Small Drive intersects with the Pacific Highway at a priority-controlled left-in/left-out/right-out intersection north of the Korora School Road diverge and continues south before terminating at the Pacific Highway opposite its intersection with Bruxner Park Road. James Small Drive is a former section of the Pacific Highway route and is a two-lane, two-way roadway that commences and terminates at the existing Pacific Highway.

The local roads which do not directly intersect with the project but are nearby include:

- **Lakes Drive** – Lakes Drive provides direct access to private properties within the North Boambee Valley and terminates to the east of the project. Footpaths are provided on the eastern side of the road and the road has a posted speed limit of 50 km/h
- **Spagnolos Road** – Spagnolos Road intersects with Coramba Road to the east of Bennetts Road linking Coramba Road with Roselands Drive. Spagnolos Road has a posted speed limit of 50 km/h and does not provide for any pedestrian or cyclist facilities. A bus stop is provided for school bus services at the intersection with Coramba Road
- **Shephards Lane** – Shephards Lane connects with Coramba Road and provides access to properties on the western side of Coffs Harbour. Shephards Lane is a two-way, two-lane local road with a posted speed limit of 50 km/h. Footpaths are provided along sections of the road; however, there are no cyclist facilities. To the west of Roselands Drive, Shephards Lane becomes a rural residential street with no kerb or channel or shoulder provisions. An overpass over the North Coast Railway is provided on Shephards Lane to provide access to properties to the west of the project

- **Mackays Road** – Mackays Road is located to the north-west of the existing Pacific Highway and provides access to the Baringa Private Hospital north of Bray Street. Mackays Road has a posted speed limit of 50 km/h and has limited pedestrian and cyclist facilities. South of Bray Street, Mackays Road forms part of a local bus route network. Mackays Road intersects with the North Coast Railway at a level crossing. To the north of this crossing, Mackays Road becomes a rural unsealed roadway providing access to a limited number of properties before terminating prior to the Ulidarra National Park
- **West Korora Road** – West Korora Road intersects with the existing Pacific Highway at an at-grade priority (give-way) all-movements intersection about 250 m north of the Big Banana Fun Park. West Korora Road has a posted speed limit of 50 km/h and does not provide for any pedestrian or cyclist facilities. West Korora Road is a rural road with no kerb and channel and limited pavement marking, terminating just prior to the Ulidarra National Park.

### *Heavy and restricted access vehicles*

Heavy vehicles are any single or combined (with trailer) vehicle with a mass of more than 4.5 t. This includes many types of trucks and large vehicles such as buses. Heavy vehicles with an overall length of 19 m or less are generally permitted to travel on all NSW roads.

Restricted access vehicles are any single or combined vehicles which when either empty or loaded, exceed the overall dimensions specified for heavy vehicles. These include vehicles such as B-doubles (up to 25/26 m), road trains and double trucks. Restricted access vehicles are not permitted to travel on a number of roads including most of the regional and local roads near the project. The key restricted access vehicle routes are shown in **Figure 8-4**.

The existing Pacific Highway and Englands Road (from existing Pacific Highway to Isles Drive) form part of the approved B-double network. Local access routes from the Pacific Highway along Orlando Drive, Hurley Drive and Cook Drive also form part of the approved B-double network. Isles Drive is an approved 25 m B-double route with the restriction that the left-turn from the Pacific Highway is not permitted. Stadium Drive and parts of Hogbin Drive are approved 25 m B-double routes but with travel conditions to prevent interference with peak school drop off and pick up times.

Permits are issued on a case-by-case basis for over-dimensional vehicles to access the industrial estate off Isles Drive. For example, a permit exists for over-dimensional vehicles to access the casting yard on Industrial Drive / Engineering Drive via the southern end of Isles Drive and Englands Road from the Pacific Highway.


**Legend**

- Design
- Regional roads
- Local roads
- North Coast Railway
- B-double vehicles (standard)
- Restricted access vehicles
- Restricted access vehicles (with travel conditions)

Coffs Harbour Bypass
B-double and restricted access vehicles
Figure 8-4

0 0.5 1 1.5 km
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Scale @A4: 1:50,000
GDA 1994 MGA Zone 56

### *Traffic volumes*

The weekday traffic volumes recorded during the June 2016 traffic surveys are shown in **Table 8-2** and on **Figure 8-5** as vehicles per day (vpd) along with the percentage of heavy vehicles.

Table 8-2 Weekday traffic volumes (2016)

| Count location | Two-way weekday average volume (vpd) (% heavy vehicles) |
|---|---|
| Existing Pacific Highway (south of Englands Road) | 31,500 (14%) |
| Pacific Highway (south of Albany Street) | 35,300 (8%)* |
| Pacific Highway (north of Orlando Street) | 43,100 (7%)* |
| Pacific Highway (north of Bruxner Park Road) | 30,000 (15%)* |
| Hogbin Drive (north of Park Beach Road) | 9500 (7%)* |
| Hogbin Drive (north of Harbour Drive) | 17,200 (3%) |
| Hogbin Drive (north of Stadium Drive) | 20,700 (7%)* |
| Stadium Drive (east of Pacific Highway) | 8900 (9%) |
| Englands Road (west of Pacific Highway) | 5300 (18%) |
| Bray Street (east of Joyce Street) | 8100 (2%)* |
| Coramba Road (from Robin Street to Shephards Lane) | 10,200 (4%)* |
| Coramba Road (from Shephards Lane to Bennetts Road) | 6300 (9%) |
| Coramba Road (west of Bennetts Road) | 5900 (5%)* |
| Bennetts Road (west of Coramba Road) | 300 (10%) |
| James Small Drive (east of Pacific Highway) | 3,000 (1%)* |
| Bruxner Park Road (west of Pacific Highway) | 700 (6%) |

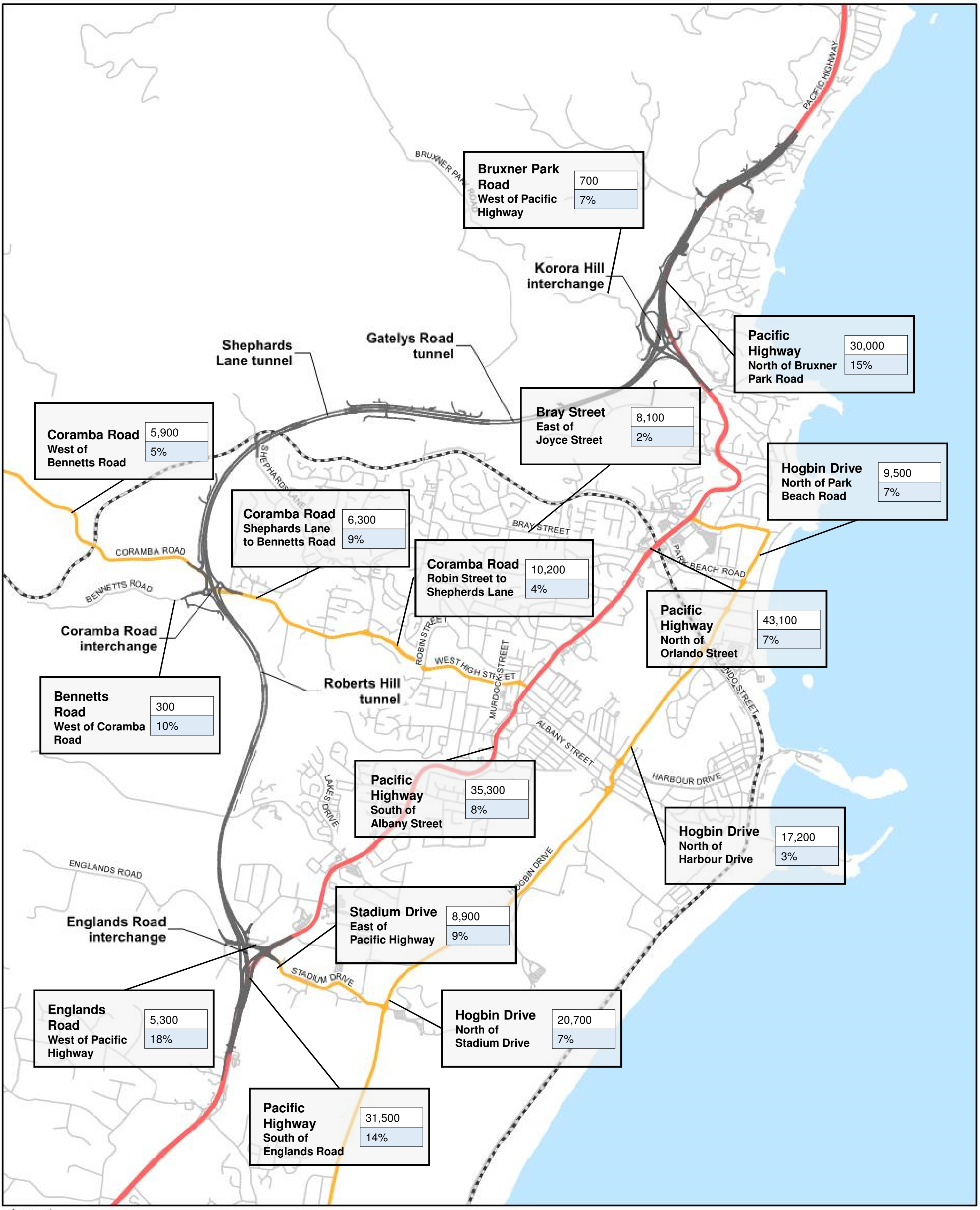
* These daily volumes are derived from 12-hour turning movement counts using conversion factors.

### *Historical traffic growth*

Average weekday traffic data was obtained from Roads and Maritime for 2007 and 2011 for historical count sites on the existing Pacific Highway. When compared with the 2016 traffic count data, the results show that from 2007 to 2016, the greatest increase in traffic volume was recorded in central Coffs Harbour (an increase of 6600 vpd or 23 per cent) and north of Coffs Harbour (an increase of 5600 vpd or 30 per cent). Traffic volumes south of Coffs Harbour increased by about 15 per cent from 2007 to 2016. The historical traffic counts and per cent increase are shown in **Table 8-3**.

Table 8-3 Historical traffic growth and existing traffic volumes (Roads and Maritime Traffic Volume Viewer, Arup 2016 traffic counts)

| Count location | Two-way weekday average volume (vpd) | | | Increase between 2007 and 2016 (%) |
|---|---|---|---|---|
| | 2007 | 2011 | 2016 | |
| Pacific Highway – south of Coffs Harbour (south of Englands Road) | 31,300 | 33,700 | 36,000 | 15 |
| Pacific Highway – Coffs Harbour CBD (north of Harbour Drive) | 28,600 | 29,300 | 35,200 | 23 |
| Pacific Highway – north of Coffs Harbour (south of Moonee Beach Road) | 18,600 | 22,000 | 24,200 | 30 |




**Legend**

- Design
- Existing Pacific Highway
- Regional roads
- Local roads
- North Coast Railway

| Count Location | |
|---|---|
| | Two-way vehicles per day |
| | % Heavy Vehicles |

0 0.5 1 1.5 km
Scale @A4: 1:50,000
GDA 1994 MGA Zone 56
N

Coffs Harbour Bypass
2016 Surveyed traffic volumes
Figure 8-5

### *Existing traffic patterns*

The origin-destination survey carried out for the project was used to understand the travel patterns, particularly through movements, along the existing Pacific Highway. Through movements are vehicles which have travelled through Coffs Harbour along the existing Pacific Highway without stopping. These have been determined by considering any vehicle which has taken the average travel time (plus up to 15 minutes) to traverse the full cordon between the north and south cordon entry points of the origin-destination survey. The survey identified:

- About 4410 vehicles comprise the two-way daily through traffic volume along the existing Pacific Highway between a point just south of Stadium Drive in the south and a point just north of Bruxner Park Road in the north
- Of the traffic observed at Coffs Harbour and areas north of Coffs Harbour, around 6700 trips originated from south of Englands Road
- Of traffic observed travelling to Coffs Harbour South and areas south of Coffs Harbour, around 6300 originated from north of Korora
- Of the traffic travelling on Hogbin Drive at Stadium Drive, 15 per cent travelled to/from the Pacific Highway north of Korora.

### *Travel speeds and travel times*

Travel time surveys carried out in June 2016 were monitored during the morning peak (8am to 9am), midday peak (11am to 12pm) and afternoon peak (4pm to 5pm). Travel times along the existing Pacific Highway between Englands Road and Korora Hill range from about 13 minutes to about 25 minutes in the morning peak hour to travel the 10 km section.

This results in the average travel speed during morning, midday and afternoon peak hours being less than the posted speed limit of 60 km/h, as shown in **Table 8-4**. During the morning peak period, the average speed along the highway through Coffs Harbour is under 40 km/h in both the northbound and southbound directions. During the midday peak period, the average speeds reduce even further, with northbound traffic slowing to under 27 km/h. By the afternoon peak period, traffic in both directions has increased speed to about 34 km/h however remains slower than the morning peak period.

Table 8-4 Existing travel times and speeds between Englands Road and Kororo Hill (2016)

| Time | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|
| | Max time (min:sec) | Average time (min:sec) | Average speed (km/h) | Max time (min:sec) | Average time (min:sec) | Average speed (km/h) |
| Morning (8am to 9am) | 26:27 | 19:04 | 33 | 20:05 | 16:40 | 38 |
| Midday (11am to 12pm) | 32:55 | 23:23 | 27 | 22:42 | 19:00 | 33 |
| Afternoon (4pm to 5pm) | 24:32 | 18:48 | 34 | 26:54 | 18:38 | 34 |

### *Intersection performance*

The performance of key intersections is assessed by assigning a LOS based on the length of time a vehicle must wait at the intersection. LOS ranges from A (very good) to F (unsatisfactory), as shown in **Table 8-5**. The existing traffic performance at key intersections in Coffs Harbour was assessed for 2016 traffic conditions. LOS has been reported in **Table 8-6** in accordance with Roads and Maritime Traffic Modelling Guidelines (2013d).

Table 8-5 LOS criteria

| Level of service | Average vehicle delay (seconds) | Traffic signals and roundabouts |
|---|---|---|
| **A** | < 14 | Free flowing traffic virtually unaffected by other road users |
| **B** | 15 to 28 | Steady flow of traffic allowing manoeuvrability |
| **C** | 29 to 42 | Stable flow of traffic restricting manoeuvrability |
| **D** | 43 to 56 | Limited stable flow and all drivers restricted in movement |
| **E** | 57 to 70 | Operating at capacity with unstable traffic flow |
| **F** | > 70 | Traffic approaching the intersection exceeds ability for traffic to pass resulting in queueing |

Table 8-6 Existing intersection LOS performance

| Intersection | Peak hour | LOS of each approach | | | | Overall LOS |
|---|---|---|---|---|---|---|
| | | South | East | North | West | |
| Pacific Highway/Englands Road/Stadium Drive | AM | B | B | B | B | **B** |
| | PM | A | D | B | B | **D** |
| Pacific Highway/Isles Drive | AM | C | E | C | E | **C** |
| | PM | C | E | C | E | **D** |
| Pacific Highway/North Boambee Road/ Cook Drive | AM | C | D | C | C | **C** |
| | PM | C | E | C | C | **C** |
| Pacific Highway/Hurley Drive | AM | A | E | A | - | **A** |
| | PM | A | E | B | - | **A** |
| Pacific Highway/Halls Road | AM | B | - | A | E | **B** |
| | PM | F | | A | E | **D** |
| Pacific Highway/Albany Street/Combine Street | AM | E | E | C | E | **D** |
| | PM | C | D | C | D | **C** |
| Pacific Highway/Park Avenue/Moonee Street | AM | C | E | B | D | **C** |
| | PM | C | E | B | D | **C** |
| Pacific Highway/Harbour Drive/West High Street | AM | B | D | B | D | **B** |
| | PM | B | D | B | D | **B** |
| Pacific Highway/Coff Street | AM | B | E | B | E | **C** |
| | PM | C | E | B | D | **C** |
| Pacific Highway/Beryl Street | AM | B | - | B | C | **B** |
| | PM | A | - | A | E | **A** |
| Pacific Highway/Marcia Street | AM | A | C | B | C | **B** |
| | PM | B | D | B | D | **B** |
| Pacific Highway/Bray Street/Orlando Street | AM | C | C | C | C | **C** |
| | PM | D | E | D | C | **D** |
| Pacific Highway/Park Beach Road | AM | A | D | B | - | **B** |
| | PM | A | D | B | - | **B** |

Traffic analysis demonstrates the current LOS experienced by traffic using the existing Pacific Highway at Coffs Harbour is LOS of D to E during peak periods at several intersections, meaning that the road has an unstable flow of traffic (ie where minor incidents can result in significant congestion and stop-and-go conditions) at a number of intersections. It is anticipated that this LOS would deteriorate to a LOS of E to F (highly congested and over capacity) under the current traffic arrangements and with continued growth in traffic volumes over the assessed design horizon (to 2044).

Deteriorating road performance is leading to road network congestion and resulting in long travel times and reducing reliability for freight and local, regional and national road users. Signalised intersections in Coffs Harbour lead to a high level of stop-starting for freight vehicles on the existing Pacific Highway, resulting in increased noise levels, higher vehicle operating costs and higher fuel consumption. Vehicle operating costs are impacted due to the running costs for significant speed fluctuations from cruise speed and the additional fuel costs due to stopping such as queuing at traffic signals. Higher fuel consumption in congested conditions leads to higher greenhouse gas emissions, air pollution and noise-related impacts.

### *Road safety*

From January 2014 to December 2018, there were 259 crashes recorded on the existing Pacific Highway between the southern tie-in at the Sawtell Road interchange and the new dual carriageway at Sapphire (crash data provided by Roads and Maritime). Of these, two crashes were fatal, 39 crashes resulted in serious injuries and 122 resulted in moderate, minor or uncategorised injuries.

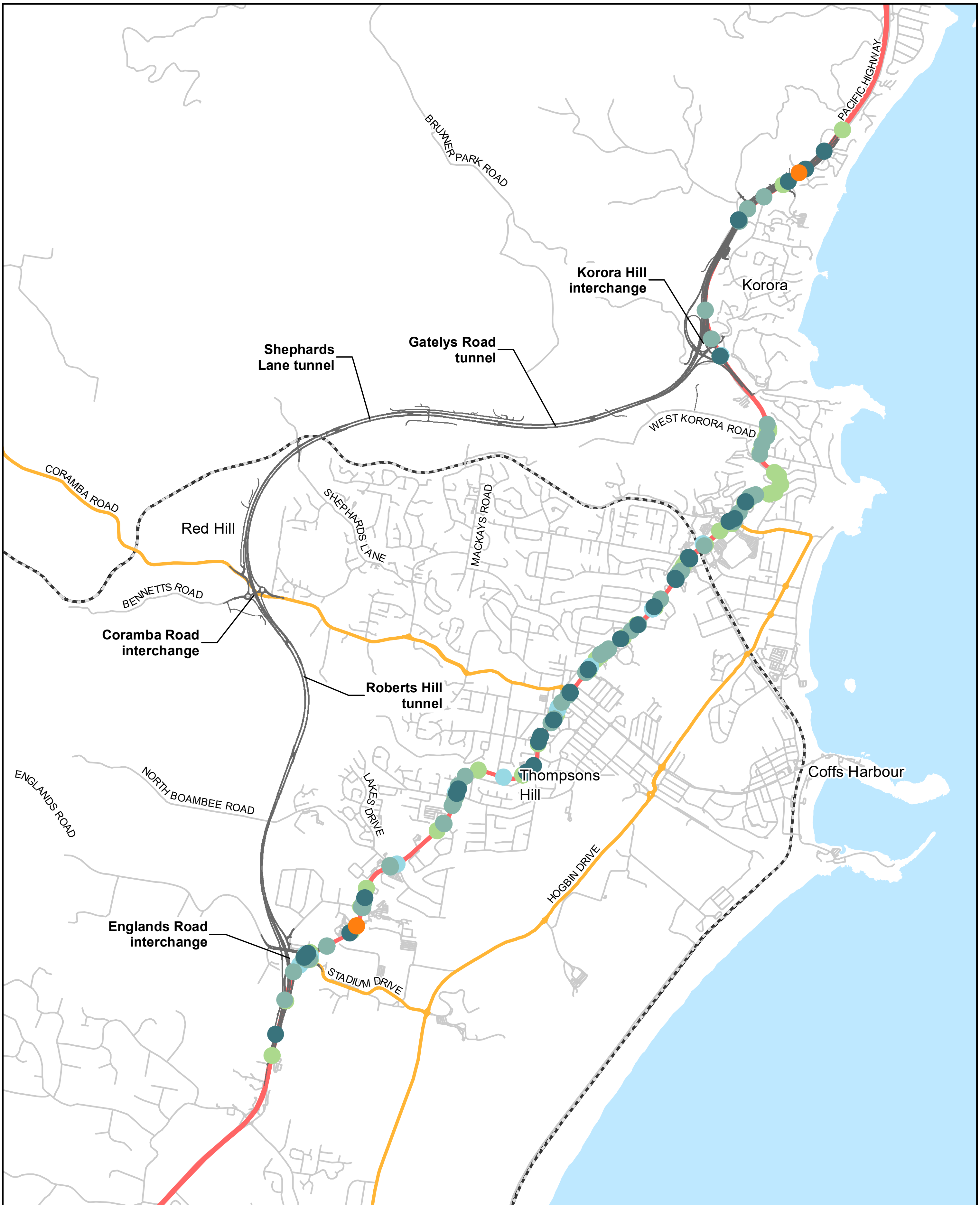
Analysis of the crash data identified:

- 67 per cent of crashes were at intersections
- 40 per cent of crashes were rear-end crashes
- There were nine cyclist crashes and nine pedestrian crashes which together account for seven per cent of all crashes
- About 14 per cent of crashes involved a heavy vehicle.

The number of crashes increase as the existing Pacific Highway approaches the Coffs Harbour CBD with most crashes recorded within the Coffs Harbour CBD as shown in **Figure 8-6.** Crash numbers increase within the CBD due to the increased number of conflict points between pedestrian, passenger and freight traffic and would continue to be a safety issue as traffic volumes increase. The most recent example of this occurred in May 2019 when a truck rolled over, resulting in injury to the driver and blockage to the Pacific Highway.

The section of the Pacific Highway to be bypassed through Coffs Harbour CBD by the project has a casualty crash rate more than three times higher than that expected of a road of this class (Roads and Maritime Services 2018a). Casualty crash rates for this section of the Pacific Highway are 2.29 crashes per kilometre per year; the network class average is 0.72. This section of the existing highway has a crash rate of 53 per 100 million vehicle kilometres travelled (mvkt) for all crashes. This is substantially higher than the expected crash rate on a bi-directional four-lane divided road which is 30.5 per 100 mvkt.

Congestion on the Pacific Highway in the study area creates a number of safety issues and this is demonstrated by the higher than average crash rates on the existing Pacific Highway. Conflict between pedestrian, passenger and freight traffic through Coffs Harbour CBD has resulted in a relatively high crash rate and would continue to be a substantial safety issue as traffic volumes continue to increase (TfNSW 2013a).




**Legend**

- Design
- Existing Pacific Highway
- Regional roads
- Local roads
- North Coast Railway

**Crash points 2014-2018**

- Fatal
- Serious Injury
- Moderate Injury
- Minor/Other Injury
- Non-casualty (towaway)

0 0.5 1 1.5 km

N

Scale @A4: 1:50,000
GDA 1994 MGA Zone 56

Coffs Harbour Bypass
Road crash data on the existing Pacific Highway (2014-2018)
Figure 8-6

## 8.2.2 Rail network

The North Coast Railway is a major trunk rail line providing both passenger and freight services from NSW to Brisbane. The Coffs Harbour Railway Station is located on Angus McLeod Place, east of the existing Pacific Highway, and is part of the North Coast Line for NSW (passenger services) operated by TfNSW. There are currently six daily (two-way) passenger rail services operating on the North Coast Line for NSW, stopping at Coffs Harbour Railway Station.

The rail network provides freight transport links between Sydney and Brisbane, servicing towns such as Casino, Grafton, Nambucca Heads, Taree and Maitland. Freight services are controlled by the Australian Rail Track Corporation (ARTC) and there are about nine freight services daily (two-way) that run along the North Coast Railway through Coffs Harbour.

## 8.2.3 Public transport network

Busways is the main public bus operator in Coffs Harbour, providing regular services within Coffs Harbour and the surrounding towns, including Bonville, Urunga, Valla Beach, Nambucca Heads and Macksville. Routes servicing Coffs Harbour are shown in **Figure 8-7**. Routes 360, 360M, 365, 366, 367 and 368 all travel along the existing Pacific Highway for portions of their service.

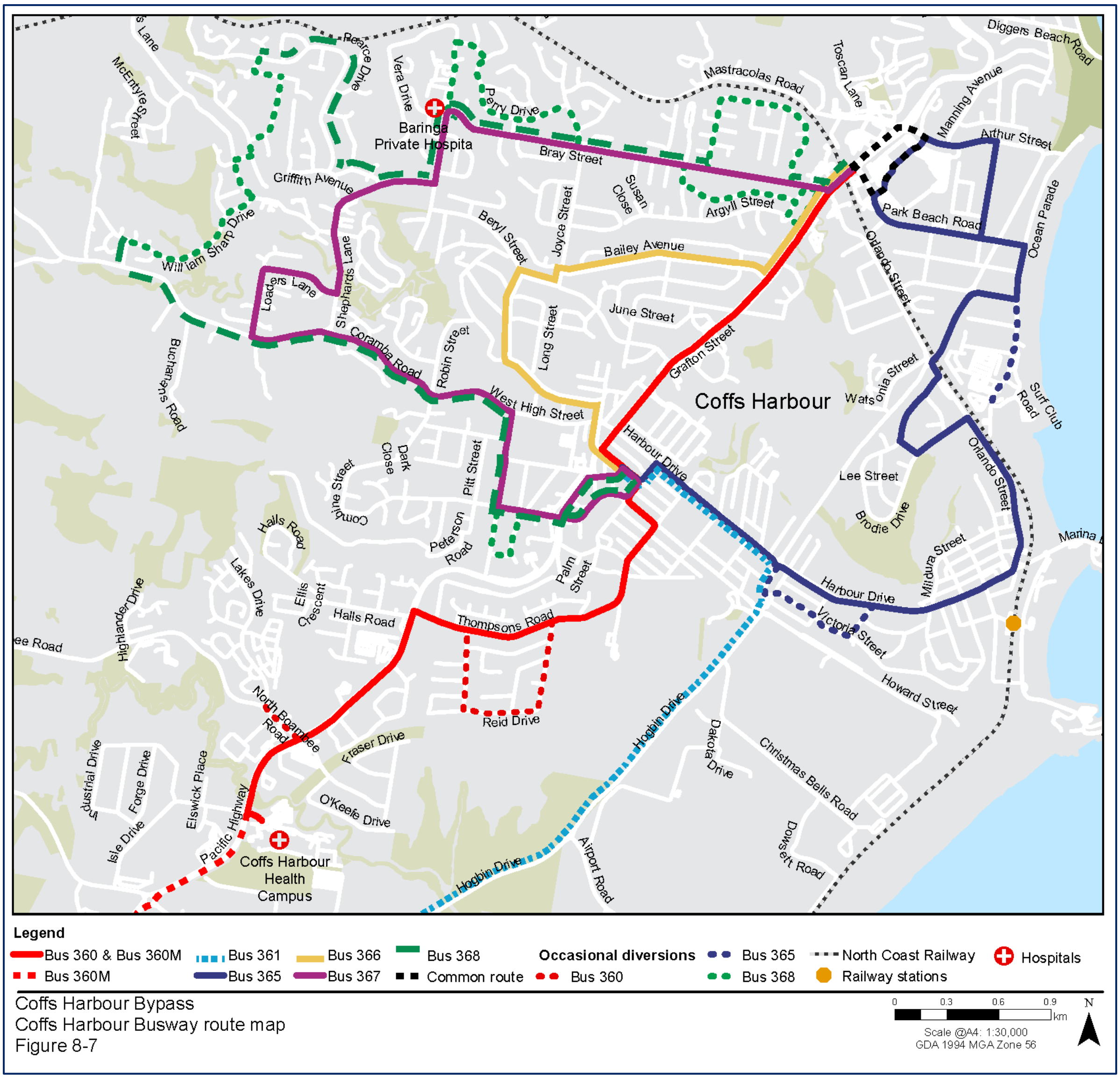



Figure 8-7 Coffs Harbour Busways route map (Busways 2018)

A number of bus companies provide regular services to/from Coffs Harbour and towns/regional centres such as Woolgoolga, Grafton, Sawtell, Tamworth, Armidale, Urunga, Warwick, Toowoomba and Brisbane. Several local bus companies also provide school and charter services to Coffs Harbour.

The Kororo Public School bus interchange is an existing school bus interchange at Korora located on the existing Pacific Highway adjacent to the Kororo Public School (**Figure 8-2**). A number of schools within and surrounding Coffs Harbour are serviced by the bus interchange, including Kororo Public School. During the site surveys, it was observed that up to seven buses utilise the southbound interchange simultaneously during the morning peak period. During the afternoon school peak period, buses arrive and depart independently of the other services. There is currently one bus shelter provided on the northbound platform with no shelter provided on the southbound platform.

There is an informal school bus stop at the intersection of Coramba Road and Spagnolos Road adjacent to the proposed Coramba Road interchange in addition to the existing school bus interchange at Korora. Site visit observations indicated that about four school buses use the existing stop as an informal interchange location.

### 8.2.4 Pedestrian and cycle network

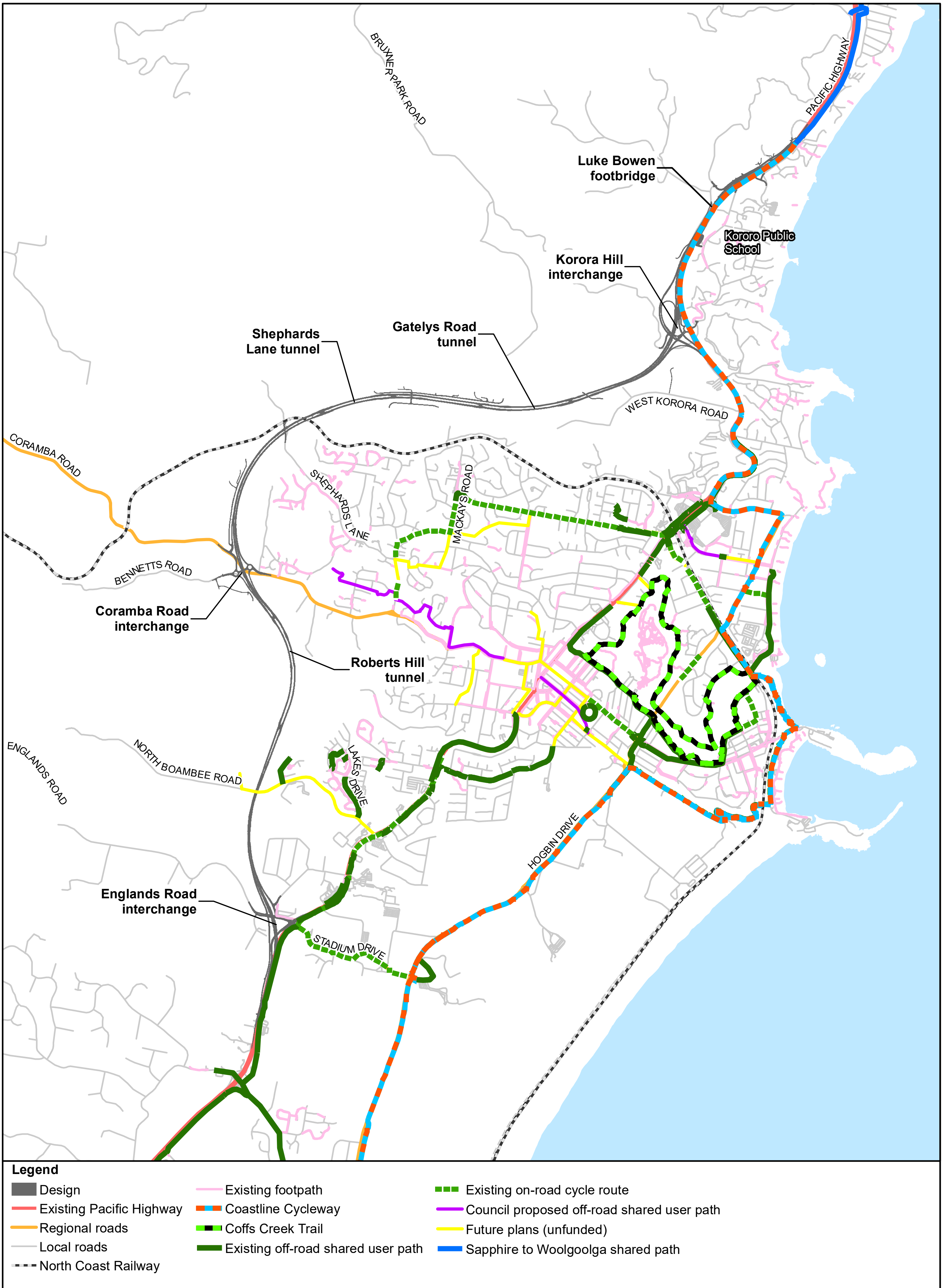
There are limited formal pedestrian and cyclist facilities that would interface with the project given the nature of the surrounding land uses and the high-speed environment of the existing Pacific Highway prior to reaching Coffs Harbour from the north and south.

There is a shared user path intermittently along the existing Pacific Highway upon entry and exit to the Coffs Harbour CBD. Through the CBD, cyclists must travel on-road until connecting with the shared user path on the northern side of the Coffs Harbour CBD. Most of the shared user path is located on the eastern side of the existing Pacific Highway; however, there are sections where the shared user path switches to the western side of the highway.

Together with Roads and Maritime, CHCC has developed the Bike Plan 2014 – 2019 (CHCC 2014) which identifies future infrastructure projects to improve cycling opportunities in the region (**Figure 8-8)**. Wider regional cycling connections are shown in **Figure 8-9**.

The shared user path and cycle network includes a combination of on-road and off-road facilities as shown in **Figure 8-8** (CHCC 2014). While there are some connections between residential areas, cyclists are required to travel within the road shoulders of the existing Pacific Highway with designated crossing points of entry and exit ramps at interchanges. On-street cycle lanes are provided on Stadium Drive, linking to the shared path alongside the existing Pacific Highway. A new shared use path is planned as part of the North Boambee Valley (West) development and will provide a connection along North Boambee Road to existing paths.

The Luke Bowen footbridge is located immediately west of the Kororo Public School (**Figure 8-8**) and provides a pedestrian/cyclist connection from the existing service road to the school over the existing Pacific Highway. The Luke Bowen footbridge also provides access to the northbound and southbound school bus interchanges on the existing Pacific Highway at this location. There is a pedestrian path next to the school pick-up/drop-off zone along Korora School Road. There is also a children’s crossing at the northern end of this set-down area which provides a safe crossing point on Korora School Road to exit the school grounds and access the Luke Bowen footbridge.




Coffs Harbour Bypass
Coffs Harbour Bike Plan 2014-2019
Figure 8-8

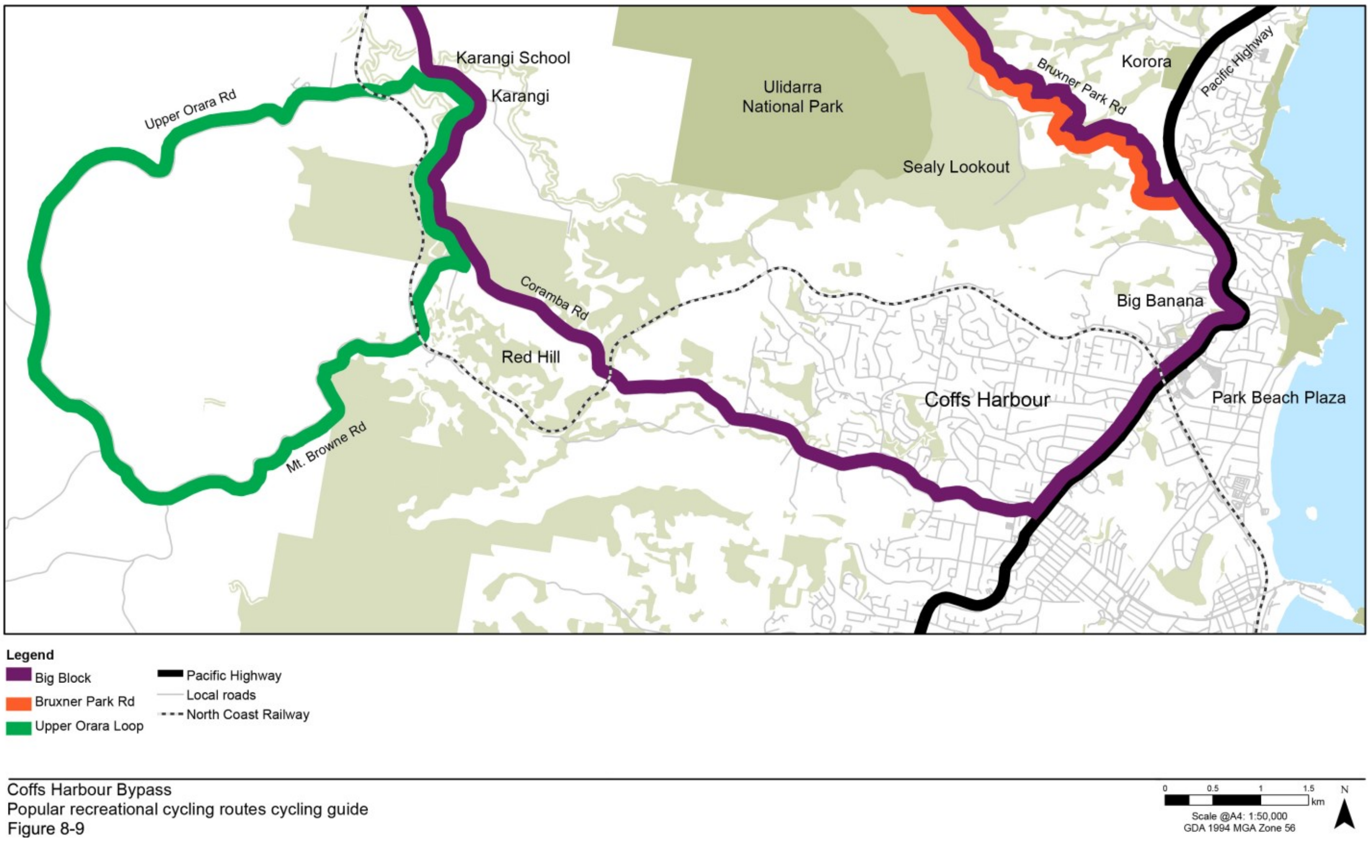



Figure 8-9 Regional cycle routes (CHCC 2018c).

## 8.2.5 Urban release areas

There are six identified urban release areas which interact with the project shown in **Figure 8-2,** which include:

- **South Coffs urban release area** – an urban release area which makes provision for a total of 308 possible residential lots, accommodating about 886 people. Includes a residential subdivision known as the Elements Estate, which is located off Stadium Drive and to the east of project
- **North Boambee Valley urban release area** – an urban release area located off North Boambee Road east of the project. Includes the residential subdivisions of the Lakes Estate and Highlands Estate
- **North Boambee Valley (West) urban release area** – an urban release area which provides for further residential expansion in the in North Boambee Valley in the order of about 938 additional lots accommodating around 2439 people. The urban release area is located off North Boambee Road west of the project
- **West Coffs urban release area** – an urban release area which provides for residential expansion of about 331 additional dwellings accommodating around 860 people. It is expected to ultimately cater for a population of about 6700 people. The urban release area is located to the west of Mackays Road, Donn-Patterson Drive and Shephards Lane. It is bounded to the north by the North Coast Railway, to the south by Coramba Road and to the west by Spagnolos Road. This area includes Sunset Ridge Estate
- **North Coffs urban release area** – an urban release area which is expected to accommodate an additional 1701 dwellings and is located to north of Mastracolas Road, south of West Korora Road and to the west of the existing Pacific Highway. The urban release area is located near the proposed Korora Hill interchange

- **Korora urban release area** – an urban release area to allow rural residential expansion on the western side of the existing Pacific Highway between West Korora Road to The Mountain Way. The urban release area makes provision for further residential expansion of about 250 additional dwellings accommodating 750 people. The Korora Rural Residential Release catchment will ultimately cater for a population of 1500 people. Key access into the area would be provided by Old Coast Road and Bruxner Park Road.

In addition to the above urban release areas, two other development sites relevant to the proposal include:

- **Pacific Bay Western Lands** – proposed residential development for about 110 housing sites at Korora on the western side of the Pacific Highway located between Bruxner Park Road (northern boundary) and West Korora Road (southern boundary). An Environmental Assessment (under former Part 3A of EP&A Act) was prepared for the Pacific Bay Western Lands in 2010 but the project application has since lapsed. However, it is understood that the proponent remains in consultation with CHCC
- **Pacific Bay Eastern Lands** – approved subdivision development as part of the Pacific Bay Resort on the eastern side of the Pacific Highway. The development includes a mix of residential, recreational and tourist facilities. The site is subject to various development applications and a master plan approved in 2005 (and amended in 2010). Key developments within the site which haven't commenced construction include a residential development consisting of 30 residential lots and 80 apartments in an eight-storey building. Consultation with the proponent has indicated that the further proposals are being investigated.

### 8.2.6 Parking

On and off-street parking is available near the project where it connects to the existing road network. These areas are associated with Kororo Public School, adjacent the informal school bus stop at the intersection of Coramba Road and Spagnolos Road, Englands Road and the existing parking available at the Oz Group Packhouse at Isles Drive.

The main parking area within the construction footprint is the existing parking at Kororo Public School which includes:

- Fourteen formalised on-street car parks (including two disabled parking spaces) on Korora School Road. Korora School Road (including the car park) at this location has one-way southbound operation
- A signed drop-off area about 40 m long, located directly opposite the school (west) along Korora School Road
- Informal parking along Korora School Road with space for around 60 vehicles.

A parking demand and use survey was carried out at and around Kororo Public School to understand the existing on-street parking demand of the school.

There is a total of 287 parking spaces (on-street) available for staff and students around the school on Korora School Road, James Small Drive, Old Coast Road and the existing service road on the western side of the Pacific Highway. The parking occupancy results of the parking demand and use survey identified:

- A steady increase in occupancy in all areas surveyed during the morning peak until 8:50am
- Full occupancy of the formalised car park on Korora School Road by 8:20am through to 8:50am
- Short intense parking peak during the afternoon between 2:50pm and 3:10pm
- Highest parking demand was observed during the afternoon peak of 158 vehicles.

# 8.3 Assessment of construction impacts

Details of the construction of the project including construction activities and work hours are provided in **Chapter 6, Construction.** Construction of the project would result in potential impacts on traffic and transport including:

- Speed limit restrictions and traffic controls on existing roads adjacent to work sites
- Increased localised traffic due to construction activities, particularly from heavy vehicle movements
- Temporary changes to property access during the construction period
- Impacts to travel times, including public transport timetables, due to traffic controls being implemented
- Detours to pedestrian and cyclist movements due to construction works.

Construction related traffic would use the surrounding public road network to:

- Haul materials from quarries/borrow sources to work site areas
- Provide access for the delivery of construction materials and the removal of waste
- Provide access for the workforce to the various locations along the construction footprint, particularly to the site compounds.

The most significant contributions to additional vehicle movements on the existing road network would occur at access points to the proposed construction ancillary sites and construction footprint access roads (refer to **Chapter 6, Construction**).

## 8.3.1 Construction traffic access and parking

Most construction traffic movements are expected to be contained within the construction footprint except for deliveries to site, disposal of waste and staff travel.

For most of the construction program, equipment and materials would be hauled along the existing Pacific Highway and the cleared construction footprint, with a few local roads needed for construction access to the project. Prior to the construction footprint being cleared and haul roads established, it is anticipated that the main haulage and construction vehicle movements would be via the local public roads identified in **Table 8-8**.

Most earthworks would be sourced from within the construction footprint; however, some may need to be imported from local quarries. Batching plants would also be located within the construction footprint; however, the contractor may choose to utilise local existing plants where possible (eg Boral Asphalt at O'Keefe Drive) which would require materials to be hauled along local public roads or the Pacific Highway.

Construction related facilities would be located on ancillary sites within the construction footprint. These ancillary facilities would include some or all of the following:

- Site compounds
- Concrete batching plant
- Asphalt batching plant
- Crushing plant
- Stockpile areas
- Precast facilities.

The ancillary sites may, where necessary, include hardstand areas for parking of staff, site vehicles and visitors. Temporary on-site parking areas would be designed to ensure that sufficient car parking provision is available for the peak construction period to minimise on-street parking impacts on surrounding public local roads.

Parking spaces for a peak estimated construction workforce of around 520 workers would be required. For the primary and secondary site compounds, the indicative number of parking spaces is estimated to be around 140 to 240 spaces at each of the three site compounds, which equates to a space requirement of about 3600 $m^2$ to 6000 $m^2$. For the other ancillary sites, it is estimated that parking for 15 to 25 spaces would be required, which equates to a space requirement of about 400 $m^2$ to 700 $m^2$. Potential impacts associated with construction worker parking would be managed through the implementation of a construction traffic management plan and ensuring the above space is available.

Further information on the use and location of each potential ancillary site is contained in **Chapter 6, Construction.**

## 8.3.2 Material haulage

Construction of the project would require a range of materials to be transported to and within the construction footprint and compound/stockpile areas. Typical materials that would be transported for the construction of the project include:

- Earthwork materials, such as topsoil, general fill and select fill
- Aggregates for drainage, and producing concrete and asphalt and spray seals
- Sand for drainage and concrete, and producing asphalt
- Cement and fly ash for producing concrete
- Concrete for drainage, road surfaces, tunnel work, bridge work and miscellaneous work such as barrier kerbs, kerbs and gutters, paving and signpost footings
- Road base for constructing flexible road surfaces
- Bitumen for spray seals and producing asphalt
- Precast concrete elements for drainage (culverts, pits and headwalls), bridge work (piles, girders and parapets) and miscellaneous work
- Steel for bridge girders, barrier railings, tunnel support, rock bolts and concrete reinforcement.

The main haulage movements and construction vehicle movements would not impact the local public roads as vehicle movements would be contained within the construction footprint. Fill material would be sourced from within the project where practicable; however, some may need to be imported from local quarries. These materials would be transported from quarries and hauled along the identified local roads shown in **Table 8-8**. Estimated construction peak heavy vehicle traffic movements required for materials that need to be sourced outside of the construction footprint are provided in **Table 8-7** with the volume of haulage trips on the local public road network shown in **Table 8-8.**

Table 8-7 Peak daily haulage vehicle trip estimates

| Construction activity | Quantity | Unit | Peak haulage trips per day (two-way) |
|---|---|---|---|
| **Earthworks** | | | |
| Dispose of excess material | 174,000 | $m^3$ | 70 |
| Select fill material | 378,000 | $m^3$ | 69 |
| **Drainage and structure** | | | |
| Concrete | 100,000 | $m^3$ | 159 |

| Construction activity | Quantity | Unit | Peak haulage trips per day (two-way) |
|---|---|---|---|
| Asphalt (external sources only) | 53,000 | $m^3$ | 59 |
| Road base | 55,000 | $m^3$ | 25 |
| Steel | 1000 | tonnes | 2 |
| **Bridges** | | | |
| Concrete | 60,000 | $m^3$ | 26 |
| Steel | 14,000 | tonnes | 5 |
| Bridge deck wearing surface | 3000 | $m^3$ | 1 |
| **Tunnels** | | | |
| Concrete | 60,000 | $m^3$ | 87 |
| Steel | 20,600 | tonnes | 21 |
| **Drainage** | | | |
| Concrete | 9000 | $m^3$ | 8 |
| Steel | 200 | tonnes | 1 |
| **Retaining walls** | | | |
| Concrete | 7000 | $m^3$ | 14 |
| Steel reinforcement | 400 | tonnes | 2 |
| **Finishing work** | | | |
| Barriers/signs/lines | 10,000 | $m^3$ | 12 |

## 8.3.3 Construction traffic volumes

Roads that would potentially be used for construction access are discussed in **Chapter 6, Construction**. Potential increases in traffic volumes on these roads as a result of construction are summarised in **Table 8-8**. The construction traffic volumes represent peak construction traffic movements for the haulage of materials and access by construction workers. These volumes are dependent on the timing and duration of construction works and would need to be refined as the construction plan is further developed during detailed design.

The delivery and removal of construction materials would mainly occur during standard work hours (ie 7am to 6pm) and would be scheduled to avoid peak traffic conditions on the road network (such as weekday peak school and commuter times and holiday periods). However, there may be requirements for construction traffic movements to occur outside of the standard work hours, particularly for the section of the project between Korora Hill and Sapphire. This is discussed in **Chapter 6, Construction**.

The distribution of construction vehicle traffic on the road network has been estimated based on the location of proposed ancillary sites in proximity to the nearest dedicated access road to the construction footprint. The volume of traffic on the access roads would depend on the timing of construction activities. As such, average construction traffic volumes would be lower than the peak volumes identified in **Table 8-8** and some minor access roads (those with lower volumes) may not be used for the full construction duration. Discussion on the impacts from increased construction traffic volumes on the roads listed in **Table 8-8** is provided below.

Table 8-8 Peak construction volume on access roads

| Road | Peak daily construction vehicles (vpd) | | | 2016 existing daily volumes (vpd) | Total daily volumes with construction traffic (vpd) | Increase (%) |
|---|---|---|---|---|---|---|
| | No. heavy vehicles | No. light vehicles | Total vehicles | | | |
| Englands Road | 200 | 290 | 490 | 5320 | 5810 | 9 |
| North Boambee Road | 240 | 290 | 530 | 6980 | 7510 | 8 |
| Coramba Road (West High Street) | 470 | 520 | 990 | 10,160 | 11,150 | 10 |
| Shephards Lane | 20 | 470 | 490 | 6700 | 7190 | 7 |
| Mackays Road | 30 | 470 | 500 | 3590 | 4090 | 14 |
| Bray Street | 30 | 470 | 500 | 8100 | 8600 | 6 |
| West Korora Road | 260 | 470 | 730 | 270 | 1000 | 270 |
| Bruxner Park Road | 250 | 310 | 560 | 730 | 1290 | 77 |
| James Small Drive | 100 | 200 | 300 | 3550 | 3850 | 8 |
| Old Coast Road | 100 | 200 | 300 | 2160 | 2460 | 14 |
| Pacific Highway (South of Englands Road) | 200 | 290 | 490 | 36,000 | 36,490 | 1 |
| Pacific Highway (North of Bruxner Park Road) | 250 | 310 | 560 | 30,000 | 30,560 | 2 |

### *Coramba Road (and West High Street)*

Coramba Road and West High Street would be classified as local sub-arterial roads which have a nominal upper limit capacity of 10,000 vpd. The total predicted daily traffic volumes on Coramba Road (West High Street) with the addition of construction traffic would be approximately 11,150 vpd, which corresponds to a ten per cent increase. The predicted volumes are greater than the nominated acceptable capacity for local sub-arterials. However, with appropriate mitigation, including a Traffic Management Plan (TMP), construction traffic is not anticipated to trigger adverse traffic impacts.

### *North Boambee Road and Shephards Lane*

North Boambee Road and Shephards Lane would be classified as collector streets based on their existing cross-section and function, and the definitions in Development Specification Design 0041 Geometric Road Layout (CHCC 2009b). This specification states that collector streets have a nominal upper limit capacity of 6000 vpd.

The total predicted daily traffic volumes on North Boambee Road and Shephards Lane with the addition of construction traffic would be about 7510 vpd and 7190 vpd respectively, which corresponds to a seven to eight per cent increase for these roads. This suggests that both roads would be operating at capacity during peak construction periods, although it should be noted that both roads were already operating above capacity based on 2016 volumes alone (6980 vpd and 6700 vpd respectively).

The predicted volumes for North Boambee Road and Shephards Lane are greater than the nominated acceptable capacity for collector streets. However, with appropriate traffic management measures described in **Section 8.5** construction traffic is not anticipated to impact significantly on the operation of North Boambee Road and Shephards Lane.

Given the location of Bishop Druitt College on North Boambee Road and proximity to the project, any traffic management measures would be developed in consultation with the college to ensure school operations and potential conflicts with school children are adequately considered.

### *Spagnolos Road*

Two of the proposed ancillary construction sites would initially be accessed via Spagnolos Road during site establishment. Following this, the project corridor would become the primary route for access to these areas. Any potential impacts associated with the temporary short-term use of Spagnolos Road would be mitigated through a construction TMP that the contractor will be required to provide.

### *Mackays Road*

Mackays Road has been classified as a collector street as per Development Specification Design 0041 Geometric Road Layout, (CHCC 2009b), which has a capacity of 6000 vpd. The total predicted daily traffic volume on this road with the addition of construction traffic would be about 4090 vpd which would be less than the nominal capacity for a collector street. Construction traffic is not anticipated to significantly impact the operation of Mackays Road and the road would be expected to operate with acceptable travel times and LOS.

### *Bray Street*

Bray Street construction access has been classified as a local sub-arterial road as per Development Specification Design 0041 Geometric Road Layout, (CHCC 2009b), which has an upper limit capacity of 10,000 vpd. The total predicted daily traffic volumes on Bray Street with the addition of construction traffic is 8600 vpd. This would be less than the nominal capacity for a local sub-arterial road and as a result, construction traffic is not anticipated to trigger adverse traffic impacts.

### *West Korora Road and Bruxner Park Road*

West Korora Road and Bruxner Park Road would experience relatively high increases in daily traffic volumes (270 per cent and 77 per cent respectively) as they currently carry relatively low levels of traffic. The total predicted daily traffic volumes on these roads with the addition of construction traffic are expected to remain less than 2000 vpd, which is the nominated design capacity of local streets within Coffs Harbour as per Development Specification Design 0041 Geometric Road Layout, (CHCC 2009b). As such, these roads would be expected to operate with acceptable travel times and LOS. Despite this, road users may experience a perceived impact due to the historically low levels of traffic.

### *Englands Road*

A section of England Road, from the intersection with the existing Pacific Highway to a location about 400 m to the west, would be used to provide construction access. This section of Englands Road is a local sub-arterial with a nominal upper limit capacity of 10,000 vpd as per Development Specification Design 0041 Geometric Road Layout (CHCC 2009b). The total predicted daily traffic volumes on this road with the addition of construction traffic would be 5810 vpd. This would be less than the maximum volume for a local sub-arterial road, as such, construction traffic is not anticipated to result in adverse traffic impacts.

### *James Small Drive*

The increase in traffic volumes on James Small Drive due to the addition of this construction traffic represent an increase of less than eight per cent of existing daily traffic volumes. This is considered a low level of impact and it is unlikely there would be any noticeable impacts to travel time or LOS on James Small Drive. However, consultation will be undertaken with Kororo Public School regarding access and parking requirements to develop appropriate traffic management measures to minimise impact on school operations and potential conflict with school children on James Small Drive.

### *Old Coast Road*

The increase in traffic volumes on Old Coast Road due to the addition of construction traffic represent increases of less than 15 per cent of existing daily traffic volumes. However, the predicted volumes are greater than the nominated acceptable capacity for local roads. With appropriate mitigation measures, including a construction TMP, construction traffic is not anticipated to significantly impact the operation of the road. In addition, prior to construction commencing, the structural integrity of two timber beam bridges located within the proposed construction access route will be confirmed by a suitably qualified structural engineer. The results from inspection will verify whether any construction vehicle restrictions would apply for Old Coast Road (refer to **Chapter 9, Noise and vibration**).

### *Pacific Highway*

The increase in traffic volumes on the Pacific Highway due to the addition of construction traffic represent increases of less than five per cent of existing daily traffic volumes. This is a low level of impact and there would not be expected to be any noticeable impacts to travel time or level of service on the Pacific Highway.

### *Other Local Access Roads*

There are several other locations where construction activities could result in temporary traffic delays as listed below:

- Bennetts Road
- Korora School Road
- Opal Boulevard
- Coachmans Close
- Seaview Close.

Speed restrictions and traffic controls would be required to manage traffic during construction of the project when construction activities are being carried out near the above listed roads as well as private property accesses.

## 8.3.4 Impacts on other transport users

### *North Coast Railway*

Construction of the project could have temporary short-term impacts on the North Coast Railway, due to the construction of a proposed bridge crossing over the railway. Construction may require closure of the rail line at times (track possessions). The duration of track possessions would be confirmed during detailed design and through consultation with the ARTC and would likely only be scheduled during planned ARTC rail network outages and during off-peak periods to minimise impacts on rail freight operations and passenger rail services, such as public holidays/long weekends, eg Easter.

### *Public transport*

Temporary delays may occur for buses travelling through the construction footprint due to the impact of temporary traffic measures associated with construction of the project.

Some construction access routes would be located along existing bus routes. Potentially affected bus routes would be:

- Routes 367 and 368 along Bray Street, Mackays Road and Coramba Road
- Route 360 along the Pacific Highway.

Consultation with Busways and school bus operators would be undertaken to ensure potential impacts during construction are communicated and managed.

### *Pedestrians and cyclists*

Temporary delays and/or detours may be required where construction activities occur across existing cycling routes and shared paths. Locations that may be impacted include:

- The shared path along the eastern side of the Pacific Highway at the southern extents of the project
- The shoulder of the existing Pacific Highway used by cyclists along the northern extents of the project between Charlesworth Bay Road and Solitary Islands Way
- Bruxner Park Road recreational cycling route
- Pedestrian and shared path facilities surrounding Kororo Public School. The new Luke Bowen footbridge would be constructed prior to the removal of the existing bridge where possible with any disruptions to access occurring outside of school terms and in consultation with Kororo Public School and NSW Department of Education.

Alternative cycling and pedestrian routes would be developed during the detailed design and detours established as required during the construction period.

### *Parking*

Some existing parking areas at Kororo Public School would be permanently removed as part of the project. The affected areas include the formal and informal parking areas along Korora School Road as well as along the service road on the western side of the Pacific Highway. The replacement parking area to be provided as part of the project would need to be constructed prior to the removal of existing parking where possible or alternative arrangements agreed in consultation with Kororo Public School and NSW Department of Education.

Existing parking arrangements associated with the informal school bus stop at the intersection of Coramba Road and Spagnolos Road, Englands Road and at the Oz Group Packhouse at Isles Drive would also be affected during construction of the project. Consultation and further parking demand and use surveys will be undertaken at these locations to confirm the extent of temporary and/or permanent impacts and alternative arrangements where reasonable and feasible.

## 8.3.5 Construction traffic management measures

Much of the project would be able to be constructed with minimal direct disruption to existing Pacific Highway traffic (ie the between Englands Road and Korora Hill); however, there are locations where construction activities would interact with the existing Pacific Highway traffic, including:

- At the tie-ins at the southern limit of the project to the north of the Englands Road interchange
- At the Korora Hill interchange where the project joins the alignment of the existing Pacific Highway
- Along the existing Pacific Highway between Korora Hill interchange and the tie-in at Sapphire.

Construction activities associated with these areas are expected to be completed in stages with multiple traffic switches likely to maintain through-traffic on existing roads as there are no appropriate alternative temporary routes or diversions to the existing Pacific Highway that could be used during construction. In addition to undertaking multiple traffic switches to maintaining through traffic, a number of construction traffic management measures will also be implemented. These could include:

- Modification to lane widths to facilitate the safe entry, exit and movement of plant and materials near existing roads
- Placement of separation barriers to protect live traffic from the worksites
- Reducing speed zones where existing road conditions are adversely modified by construction works
- Reducing shoulder widths to allow for tie-in works to be completed
- The use of temporary directional and advisory signage as well as variable message signs would be used through the surrounding road network where necessary.

Speed restrictions and traffic controls would be required to manage traffic during construction of the above sections of the project. This would likely include a minimum speed of 60 km/h and two lanes of traffic in each direction would be maintained in accordance with any ROL requirements. As described in **Chapter 6, Construction**, given the existing traffic volumes on the Pacific Highway (about 30,000 vehicles per day between Korora Hill interchange and the tie-in at Sapphire), the ROL restrictions necessary to minimise road user delays and traffic queuing would likely require work to be undertaken outside the recommended standard hours. Detailed arrangements for works in these areas would be developed during detailed design.

Additional construction traffic management measures are outlined further in **Section 8.5**.

# 8.4 Assessment of operational impacts

The CHTM was used to predict traffic volumes, delays and network performance results for with and without project scenarios. The model results presented reflect the project design as described in **Chapter 5**, **Project description**.

## 8.4.1 Traffic volumes

Future traffic demand has been modelled with the project in operation. The forecast daily traffic volumes for the project, existing Pacific Highway and several locations on key local roads are shown in **Table 8-9** for the base case (without project) and the project case (with project) at 2024, 2034 and 2044.

Table 8-9 Forecast weekday volumes (two-way)

| Location | 2024 daily volumes | | | 2034 daily volumes | | | 2044 daily volumes | | |
|---|---|---|---|---|---|---|---|---|---|
| | Without Project | With Project | Change | Without Project | With Project | Change | Without Project | With Project | Change |
| **Project** | | | | | | | | | |
| South of Coramba Road | - | 23,400 | - | - | 26,400 | - | - | 27,900 | - |
| North of Coramba Road | - | 19,300 | - | - | 22,300 | - | - | 24,000 | - |
| **Existing Pacific Highway** | | | | | | | | | |
| South of Englands Road | 34,700 | 38,600 | 3900 | 37,400 | 43,100 | 5700 | 40,400 | 45,800 | 5400 |
| South of Albany St (south of CBD) | 31,700 | 19,100 | -12,600 | 33,300 | 20,400 | -12,900 | 33,500 | 20,600 | -12,900 |
| North of Orlando St (north of CBD) | 43,900 | 33,900 | -10,000 | 47,300 | 35,900 | -11,400 | 49,900 | 38,000 | -11,900 |
| South of Bruxner Park Road | 38,000 | 28,800 | -9200 | 42,600 | 31,500 | -11,100 | 45,900 | 34,500 | -11,400 |

| Location | 2024 daily volumes | | | 2034 daily volumes | | | 2044 daily volumes | | |
|---|---|---|---|---|---|---|---|---|---|
| | Without Project | With Project | Change | Without Project | With Project | Change | Without Project | With Project | Change |
| **Local and regional road network** | | | | | | | | | |
| Hogbin Drive (north of Park Beach Road) | 9300 | 6600 | -2700 | 11,300 | 7800 | -3500 | 10,000 | 8100 | -1900 |
| Hogbin Drive (north of Harbour Drive) | 18,300 | 13,100 | -5200 | 19,500 | 13,900 | -5600 | 19,200 | 14,300 | -4900 |
| Hogbin Dive (north of Stadium Drive) | 29,900 | 20,700 | -9200 | 32,700 | 20,900 | -11,800 | 33,100 | 22,500 | -10,600 |
| Stadium Drive (east of Pacific Highway) | 11,700 | 10,700 | -1000 | 12,800 | 11,900 | -900 | 15,000 | 12,700 | -2300 |
| Englands Road (west of Pacific Highway) | 8700 | 10,300 | 1600 | 11,600 | 13,000 | 1400 | 12,500 | 14,300 | 1800 |
| Bray Street (east of Joyce Street) | 9800 | 7400 | -2400 | 10,500 | 7300 | -3200 | 11,300 | 7500 | -3800 |
| Coramba Road (Robin Street to Shephards Lane) | 11,300 | 9500 | -1800 | 12,000 | 10,000 | -2000 | 12,700 | 10,700 | -2000 |
| Coramba Road (Shephards Lane to Bypass) | 8300 | 8900 | 600 | 8600 | 9600 | 1000 | 9000 | 10,500 | 1500 |
| Coramba Road (west of Bypass) | 6800 | 6800 | 0 | 7000 | 7000 | 0 | 7100 | 7100 | 0 |
| Bennetts Road (west of Coramba Road) | 400 | 400 | 0 | 500 | 500 | 0 | 500 | 500 | 0 |
| Bruxner Park Road | 1200 | 1200 | 0 | 1600 | 1600 | 0 | 1800 | 1800 | 0 |

| Location | 2024 daily volumes | | | 2034 daily volumes | | | 2044 daily volumes | | |
|---|---|---|---|---|---|---|---|---|---|
| | Without Project | With Project | Change | Without Project | With Project | Change | Without Project | With Project | Change |
| (west of Pacific Highway) | | | | | | | | | |
| James Small Drive (east of Pacific Highway) | 4000 | 5900 | 1900 | 4200 | 6200 | 2000 | 5100 | 7500 | 2400 |

Once operational, the project would redistribute traffic to the bypass from the north–south movements on the Pacific Highway and Hogbin Drive. Additionally, east-west movements on key local roads, including Coramba Road and Bray Street would be redistributed to the project as a result of improved traffic conditions along the new route.

The key findings shown in **Table 8-9** for 2024 (opening year) include:

- The project is expected to increase traffic volumes on the existing Pacific Highway south of Englands Road by 3900 vpd, which is an 11 per cent increase, as a result of some trips diverting from Hogbin Drive to the Pacific Highway corridor
- The project is expected to substantially decrease traffic volumes on the Pacific Highway south of Albany Street (just south of the CBD) by 12,600 vpd, which is a 40 per cent decrease
- The project is expected to substantially decrease traffic volumes on the Pacific Highway north of Orlando Street (just north of the CBD) by 10,000 vpd, which is a 23 per cent decrease
- The project is expected to substantially decrease traffic volumes on the Pacific Highway south of Bruxner Park Road by 9200 vpd, which is a 24 per cent decrease
- The project is expected to substantially reduce traffic by up to around 9200 vpd on Hogbin Drive north of Stadium Drive, which is a 31 per cent decrease
- The project is expected to decrease traffic on Stadium Drive by 1000 vpd, which is a nine per cent decrease
- The project is expected to increase traffic volumes on Englands Road between the bypass and the existing Pacific Highway by 1600 vpd, which is an 18 per cent increase and is due to traffic using this short section of Englands Road to access the bypass
- The project is expected to reduce traffic on Coramba Road, between Robin Street and Shephards Lane by 1800 vpd, which is a 16 per cent decrease
- The project is expected to marginally increase traffic on Coramba Road east of the project by 600 vpd (between the bypass and Shephards Lane), which is a seven per cent increase. West of the bypass, traffic volumes on Coramba Road are not substantially affected.
- The project is expected to increase traffic at the southern end of James Small Drive by around 1900 vpd, which is a 48 per cent increase and is because of traffic from the north using the Korora Hill interchange to access James Small Drive from the southern end instead of using the northern end of James Small Drive. There is expected to be a corresponding decrease in traffic volumes at the northern end of James Small Drive.

In summary, the proposed changes to the road network would see decreases in daily traffic volumes on all local roads addressed in **Table 8-9** over the design horizon up to 2044, except for Coramba Road between the project and Shephards Lane and Englands Road between the existing Pacific Highway and the project.

## 8.4.2 Network changes and permanent road closures

New network changes and permanent road / access closures provided as part of the project include:

- Construction of a northbound property access road from a new exit from the existing Pacific Highway, just north of the Sawtell Road interchange northbound entry ramp, to the Englands Road interchange. The property access road would provide access from existing properties to Englands Road and remove direct access from the Pacific Highway
- Construction of a service road from Solitary Islands Way to Korora Hill interchange. James Small Drive (north), Opal Boulevard, Seaview Close and Solitary Islands Way would no longer intersect directly with the Pacific Highway and instead would be accessed via new intersections along the service road. This would tie in with the existing service road at Sapphire
- The Kororo Public School staff car park and adjacent bus interchange would be provided via a new facility accessed via James Small Drive. The introduction of additional traffic including school buses to James Small Drive is not anticipated to result in any operational impacts, such as, increased travel times or reduced LOS
- Direct access to the Pacific Highway from Old Coast Road would be permanently closed
- There would be no access to Isles Drive from Englands Road. Traffic bound for Isles Drive would gain access via the existing intersection of Isles Drive and the Pacific Highway or directly from the southbound exit ramp (only accessible to southbound traffic on the project). The design allows over-dimensional vehicles to exit the re-aligned Isles Drive and to access the Pacific Highway through the interchange as per the current permit for the existing casting yard on Industrial Drive. Minor modifications to the left turn from the Pacific Highway to Isles Drive may be needed to permit B-doubles to access Isles Drive. This will be investigated during detailed design in consultation with CHCC
- Direct access from Spagnolos Road to Coramba Road would be permanently closed
- Korora School Road would no longer exist as part of the project. Car parking and pick-up / drop-off for the Kororo School would be accessed via James Small Drive and the service road. Additional on-street parallel car parking would also be provided along the service road adjacent to the school.

## 8.4.3 Network performance

The network performance of the project has been determined using the CHTM. The performance, in terms of total delay and congestion, is measured with reference to:

- Total travel time: measure of the total travel time of all vehicles on the network during the modelled peak period. Sometimes also referred to as Vehicle-Hours Travelled, or VHT
- Total distance travelled: measure of the total distance travelled by all vehicles in the network during the modelled peak period. Sometimes also referred to as Vehicle-Kilometres Travelled, or VKT
- Average speed: recorded for all traffic in the network over the modelled peak period. Calculated by dividing VKT by VHT.

The total travel time anticipated at the 2024, 2034 and 2044 design years during the morning and afternoon peak hours is presented in **Table 8-10**. The total travel time savings per day are calculated by taking the difference between the base and project case and converting the morning and afternoon peak hour total to a daily equivalent using expansion factors determined using the strategic model (CHTM) outputs.

Table 8-10 Predicted network wide change in total travel time in 2024, 2034 and 2044

| Scenario | Total travel time (hours) | | | | | |
|---|---|---|---|---|---|---|
| | 2024 | | 2034 | | 2044 | |
| | Morning | Afternoon | Morning | Afternoon | Morning | Afternoon |
| Base case (without project) | 3427 | 3116 | 4008 | 3659 | 4607 | 4152 |
| Project case (with project) | 2995 | 2794 | 3240 | 3141 | 3554 | 3336 |
| Difference | -432 | -322 | -768 | -518 | -1053 | -816 |
| **Travel time savings (hours per day)** | **-4142** | | **-7059** | | **-10,262** | |

The total distance travelled anticipated at the 2024, 2034 and 2044 design years during the morning and afternoon peak periods is presented in **Table 8-11**. As above, the total change in distance travelled has been calculated by converting morning and afternoon peak hour totals to a daily equivalent by using expansion factors.

Table 8-11 Predicted network wide change in total distance travelled in 2024, 2034 and 2044

| Scenario | Total distance travelled (km) | | | | | |
|---|---|---|---|---|---|---|
| | 2024 | | 2034 | | 2044 | |
| | Morning | Afternoon | Morning | Afternoon | Morning | Afternoon |
| Base case (without project) | 141,665 | 136,461 | 152,709 | 151,250 | 160,679 | 159,041 |
| Project case (with project) | 150,333 | 142,804 | 163,758 | 159,831 | 176,030 | 169,310 |
| Difference | 8668 | 6343 | 11,049 | 8581 | 15,351 | 10,269 |
| **Change in distance travelled (km per day)** | **76,253** | | **99,722** | | **130,150** | |

**Table 8-12** presents the network statistics for average speed per vehicle type for the 2024, 2034 and 2044 design years during the morning and afternoon peak periods.

Table 8-12 Predicted network wide change in average speed in 2024, 2034 and 2044

| Scenario | Average speed (km/h) | | | | | |
|---|---|---|---|---|---|---|
| | 2024 | | 2034 | | 2044 | |
| | Morning | Afternoon | Morning | Afternoon | Morning | Afternoon |
| Base case (without project) – all vehicles | 41 | 42 | 40 | 41 | 38 | 39 |
| Base case (without project) – heavy vehicles | 46 | 48 | 43 | 46 | 43 | 45 |
| Project case (with project) – all vehicles | 46 | 47 | 46 | 46 | 45 | 46 |
| Project case (with project) – heavy vehicles | 59 | 69 | 57 | 71 | 61 | 71 |
| **Difference – all vehicles** | **5** | **5** | **6** | **5** | **7** | **7** |

| Scenario | Average speed (km/h) | | | | | |
|---|---|---|---|---|---|---|
| | 2024 | | 2034 | | 2044 | |
| | Morning | Afternoon | Morning | Afternoon | Morning | Afternoon |
| **Difference – heavy vehicles** | **13** | **21** | **14** | **25** | **18** | **26** |

The network-wide performance statistics indicate that the construction of the project would have the following impacts:

- Reduced overall travel times, with network wide travel time savings of about 12 per cent in 2024 and 21 per cent by 2044
- An increase in the total distance travelled due to the shift of traffic demand to the project. This is due to the project route being longer than the existing Pacific Highway route. However, although the project route is longer, it is more attractive as it is a faster alternative to the existing route, with free-flow conditions
- An increase in network-wide average travel speeds by 18 per cent at 2044 for all vehicles. This is expected due to the 110 km/h posted speed on the project, and the reduction of traffic congestion along routes through Coffs Harbour
- Heavy vehicles gain a larger overall increase in average speed as these vehicles mainly use the highway network and therefore gain a larger overall benefit per vehicle once shifted to the free-flow project. This is reflected in the results by the considerable increase in network-wide average travel speeds of 42 per cent to 58 per cent at 2044 for heavy vehicles.

### *Through traffic travel times*

The existing Pacific Highway serves as an important transport route, connecting regional towns and centres across New South Wales and Queensland. The project would provide an alternative route for traffic passing through Coffs Harbour. The project route would be faster than the existing Pacific Highway as it would avoid existing signalised intersections and the grade-separated interchange creates uninterrupted flow for motorists. **Table 8-13** presents the travel time savings for traffic going through Coffs Harbour calculated from the CHTM.

Table 8-13 Predicted travel time for vehicles passing through Coffs Harbour

| Scenario | Direction | Travel times (minutes) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2024 | | 2034 | | 2044 | |
| | | Morning | Afternoon | Morning | Afternoon | Morning | Afternoon |
| Existing Pacific Highway (base case 'without project' scenario) | Southbound | 21.0 | 19.3 | 20.7 | 20.7 | 29.2 | 21.8 |
| | Northbound | 19.6 | 19.6 | 20.5 | 21.4 | 20.4 | 23.7 |
| Project case ('with project' scenario) | Southbound | 8.5 | 8.6 | 8.6 | 8.6 | 8.6 | 8.6 |
| | Northbound | 8.3 | 8.4 | 8.4 | 8.5 | 8.5 | 8.5 |
| **Project travel time savings** | **Southbound** | **12.5** | **10.7** | **12.1** | **12.1** | **20.6** | **13.2** |
| | **Northbound** | **11.3** | **11.2** | **12.1** | **12.9** | **11.9** | **15.2** |

The travel time savings for road users that do not wish to stop in Coffs Harbour are significant with the introduction of the project. At 2044, travel time reductions of up to 20 minutes when travelling southbound along the project during the morning peak period are expected compared to the base case (without project) scenario. This reflects the free-flow conditions of the project and the reduction of 'through' motorists from the Pacific Highway. Should the base case (without project) scenario be adopted, travel times can be expected to increase to 29 minutes during the northbound morning peak along the congested Pacific Highway by 2044.

The travel time reductions and traffic efficiency outcomes of the project could potentially be increased by the introduction of connected and automated vehicles (CAVs). See **Chapter 3, Strategic justification and project** need for further detail on CAVs and the priorities that support Future Transport Strategy 2056 (TfNSW 2018a).

## 8.4.4 Intersection performance

Interchanges and intersections have been designed to provide a minimum LOS C in accordance with the Pacific Highway Upgrade Guidelines (refer to **Table 8-5** for a description of LOS). For signalised intersections, the average LOS over all movements is defined as the critical LOS for the assessment. For roundabouts and priority-controlled intersections, the worst turning movement at the intersection is defined as the critical LOS for the assessment.

A summary of the 2044 traffic analysis is shown in **Table 8-14** and shown on **Figure 8-10**.

Table 8-14 Summary of 2044 intersection LOS

| Intersection | Control | Overall LOS | | Worst movement LOS | | Critical LOS |
|---|---|---|---|---|---|---|
| | | Morning | Afternoon | Morning | Afternoon | |
| **Englands Road interchange** | | | | | | |
| Englands Road/the project | Signals | A | B | B | B | B |
| Isle Drives/the project | Priority | A | A | A | A | A |
| Englands Road/the project/ access road | Signals | A | B | D | D | B |
| Pacific Highway/Englands Road | Signals | C | C | D | D | C |
| **Coramba Road interchange** | | | | | | |
| Coramba Road (east) roundabout | Roundabout | A | A | B | A | B |
| Coramba Road (west) roundabout | Roundabout | A | A | A | A | A |
| Coramba Road north-west priority | Priority | - | - | A | A | A |
| **Korora Hill interchange** | | | | | | |
| Korora Hill (east) signals | Signals | A | B | D | E | B |
| Korora Hill (west) signals | Signals | B | B | D | E | B |
| James Small Drive roundabout | Roundabout | A | A | B | B | B |
| **Service Road** | | | | | | |
| Service road/James Small Drive | Roundabout | - | - | A | A | A |

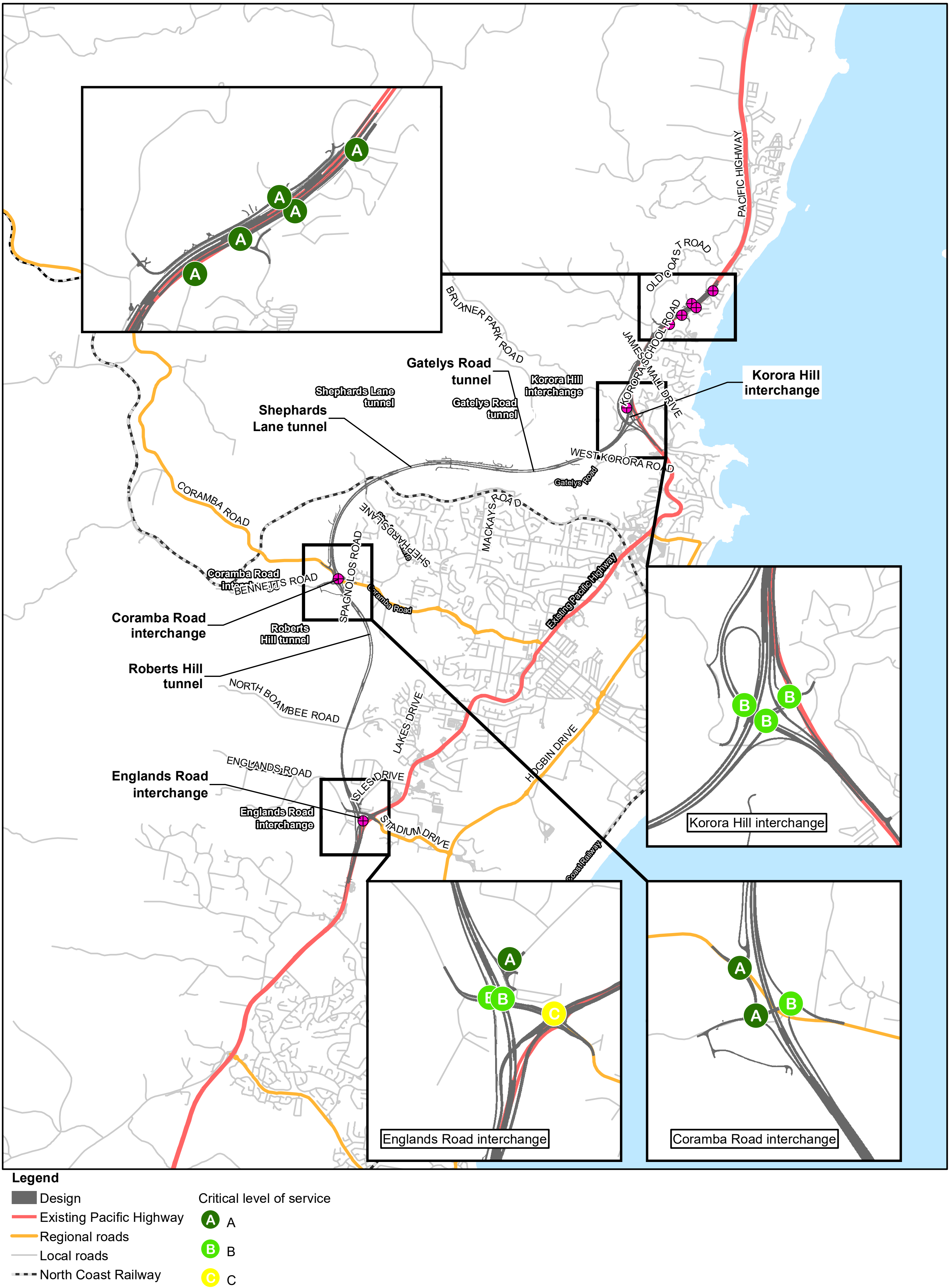
| Intersection | Control | Overall LOS | | Worst movement LOS | | Critical LOS |
|---|---|---|---|---|---|---|
| | | Morning | Afternoon | Morning | Afternoon | |
| Service road/Opal Boulevard | Priority | - | - | A | A | A |
| Service road/Seaview Close | Priority | - | - | A | A | A |
| Service road/underpass | Priority | - | - | A | A | A |
| Service road/Solitary Island Way | Priority | - | - | A | A | A |
| **Existing Pacific Highway intersections** | | | | | | |
| Pacific Highway/Isles Drive | Signals | D | C | F | E | D |

The intersection of the existing Pacific Highway with Isles Drive has been included in **Table 8-14** because of the proposed reconfiguration to the road network in this area. While the intersection is outside the extent of the project, the analysis demonstrates that it still has an acceptable LOS.

The reallocation of traffic to the project would result in reduced traffic volumes on the existing Pacific Highway through Coffs Harbour and on other alternative routes throughout the local road network. This would result in improved intersection performance, reduced traffic congestion and a reduction in delays for local traffic when compared to the base case.

Analysis demonstrates that the proposed intersection/interchange arrangements would meet the traffic and transport objectives for the project and the intersections/interchanges would operate at an acceptable LOS.

Similarly to the network performance outcomes of the project, intersection performance could also potentially be increased by the introduction of CAVs (see **Chapter 3, Strategic justification and project**).




Coffs Harbour Bypass
Critical level of service at modelled intersections in 2044
Figure 8-10

0 0.75 1.5 2.25 km
Scale @A4: 1:74,367
GDA 1994 MGA Zone 56
N

### 8.4.5 Road safety

The project is anticipated to result in road safety benefits as detailed below:

- James Small Drive, Korora School Road, Opal Boulevard and Seaview Close would no longer connect directly with the Pacific Highway at four separate unsignalised intersections. Instead, access to these roads would be provided by the service road. This arrangement and removal of at-grade priority (stop or give-way) controlled intersections along the existing Pacific Highway would improve safety by reducing the number of conflict points (safety issues) along the existing Pacific Highway
- Access to and from the project would be provided via grade-separated interchanges, which reduces potential points of conflict between vehicles. Providing the interchanges as grade-separated would also result in free-flow conditions along the project, minimising the risk of congestion-related incidents
- The project is anticipated to reduce traffic along the existing Pacific Highway through the Coffs Harbour CBD. This would reduce congestion and remove a significant proportion of heavy trucks and through traffic, increasing safety
- The project is anticipated to result in a reduction of crashes, with a reduction of 11 crashes in the year of opening (2024), and a reduction of 15 by 2044
- Removal of the existing school bus interchange from the Pacific Highway would improve safety by removing the conflict points associated with the northbound and southbound interchange diverges and merges on the Pacific Highway. This also removes any significant vehicle speed differences between the buses (as they slow or accelerate up to speed on the highway) and all other vehicles on the Pacific Highway
- Introduction of the property access road adjacent to the existing Pacific Highway alignment at the southern end of the project (south of Englands Road interchange) removes direct access onto the highway from private properties and other access points. This reduces the likelihood of collisions with vehicles travelling at high speed (100 km/h) on the highway, particularly with heavy vehicles accelerating to exit Lindsay Transport.

There may be some localised road safety impacts as a result of the project, as detailed below:

- Although the project provides an improved road safety situation than the existing situation, the proposed changes to the parking (staff and set-down) and the bus interchange at the Kororo Public School could lead to increased conflicts between users. This could be managed through bus driver awareness and training, as well as restricting staff vehicle movements to be outside of the peak periods of bus services
- The addition of traffic on Coramba Road between the project and Shephards Lane would increase the exposure rate of the opportunity for crashes to occur on this road segment. This is due to the marginal increase (600 vpd) on Coramba Road east of the project between the project and Shephards Lane. However, other segments of Coramba Road are anticipated to experience decreases in traffic (refer to **Section 8.4.1**).

In addition to the above, and as a result of road safety concerns provided in community submissions during the 2018 concept design display, the use of James Small Drive as part of operation of the project has been investigated. The investigation considered the existing condition and configuration of James Small Drive and proposed use of the bus interchange. A number of traffic management improvement opportunities were identified, including restrictions to on-street parking installation of traffic barriers. These opportunities will be further evaluated and finalised during detailed design and in consultation with CHCC, Kororo Public School, Coffs Harbour Montessori Preschool and the adjacent community.

### 8.4.6 Freight and heavy vehicles

The existing conditions create inefficient driving conditions for freight and heavy vehicles. This inefficiency occurs as a result of stop-start movements through 12 sets of traffic lights, and mixing with pedestrians, cyclists and local traffic.

The project would benefit freight and heavy vehicle movements by:

- Providing a more efficient free-flow freight route past Coffs Harbour
- Improving amenity for local and regional traffic. Traffic analysis shows that there would be a reduction in heavy vehicles along the existing Pacific Highway, once the diversion to the project has occurred
- Reducing travel times and therefore improving freight efficiency as heavy vehicles are redistributed to the project.

### 8.4.7 North Coast Railway

The project would travel over (ie would be grade separated) the North Coast Railway near Shephards Lane. As such, once operational, the project and the North Coast Railway would operate independently, with no impact on the rail passenger and freight operations.

### 8.4.8 Public transport services

The project is not expected to generate the need for any additional bus stops for the existing services. The existing busways and long-distance charter services would benefit from the improved traffic conditions from the project, including reduced congestion on the existing Pacific Highway through Coffs Harbour.

The design of the Coramba Road interchange would impact the location of the existing informal school bus stop at the intersection of Coramba Road and Spagnolos Road. Site visit observations indicated that about four school buses use the existing stop as an informal interchange location. This bus stop would likely be reinstated further east along Coramba Road near its existing location. Consultation would be undertaken with CHCC and the school bus operator to confirm the final location and requirements.

As part of the project, the Kororo Public School bus interchange would be relocated adjacent to Kororo Public School and accessed via James Small Drive. The relocated bus interchange would comprise two bus platforms with a total capacity of seven buses and an adjacent two bay bus set down area. This is anticipated to cater for the existing demand of the interchange. The relocated interchange would improve existing arrangements by providing bus shelters for waiting students along the full length of the two platforms. Passengers accessing the bus interchange from James Small Drive would be able to directly access the facility via a new footpath. This has the benefit of reducing walking distances when compared to the existing arrangement as passengers currently walk further along Korora School Road to access the existing bus interchange.

Buses using the relocated Kororo Public School bus interchange would be required to use a service road to access James Small Drive when arriving from the north. When approaching the relocated bus interchange from the south, buses would need to access the service road via the Korora Hill interchange. The additional travel distance to access the service road and James Small Drive may result in added travel time.

The design of the Kororo Public School bus interchange has been developed in consultation with the Kororo Public School (see **Chapter 7, Consultation**). Further consultation will be undertaken during the detailed design phase.

## 8.4.9 Property access

There are a number of property accesses to the existing road network that may be impacted by the project. These include current property accesses off the following roads:

- Pacific Highway
- Stadium Drive
- Englands Road
- Isles Drive
- North Boambee Road
- Coramba Road
- Bennetts Road
- Spagnolos Road
- Shephards Lane
- Mackays Road
- West Korora Road
- Bruxner Park Road
- James Small Drive
- Korora School Road
- Old Coast Road.

Existing property accesses impacted by the project would be reinstated in consultation with affected landowners.

In addition to property accesses, the existing access from the Solitary Rural Fire Service's shed to the Pacific Highway via Old Coast Road would be affected by the project. Consultation with the Solitary Rural Fire Service will be undertaken during detailed design to ensure the revised access arrangements during and after construction would be appropriate.

## 8.4.10 Urban release areas

### *South Coffs urban release area*

The South Coffs urban release area is located to the south of Stadium Drive and to the east of the Pacific Highway. It is currently being developed as the Elements Estate and is accessed from Stadium Drive. Its access would not be impacted by the project.

### *North Boambee Valley urban release area*

The North Boambee Valley urban release area is located to the east of the project and is accessed via North Boambee Road. Access would not be affected by the project.

### *North Boambee Valley (West) urban release area*

North Boambee Valley (West) urban release area is located off North Boambee Road to the west of the project. During operation, access to the area would continue to be provided via North Boambee Road. The project would pass over North Boambee Road via an overpass. The overpass has been designed with consideration of a future upgrade of North Boambee Road by CHCC as part of the development of North Boambee Valley (West) urban release area. As such, access to this urban release area would not be impacted and traffic volumes on North Boambee Road would not be affected by the project.

### *West Coffs urban release area*

The West Coffs urban release area is located to the west of Mackays Road, Donn-Patterson Drive and Shephards Lane. It is generally bounded to the north by the rail line, to the south by Coramba Road and to the west by Spagnolos Road. The project passes to the north and west of the urban release area and access to the area would not be directly affected by the project.

Some roads used to access the area such as William Sharp Drive and Coramba Road are predicted to experience increased traffic volumes once the project is operational. This is due to local traffic movements accessing the project via the Coramba Road interchange; however, the increased traffic volumes are not expected to impact access to the West Coffs area.

### *North Coffs urban release area*

The North Coffs urban release area is located to north of Mastracolas Road, south of West Korora Road and to the west of the existing Pacific Highway. The urban release area is located south of the Korora Hill interchange. Access would not be affected by the project.

### *Korora urban release area*

It is anticipated that access to the proposed Korora urban release area would be provided via Bruxner Park Road and/or Old Coast Road. Both roads currently connect with the Pacific Highway with at-grade priority-controlled intersections. The project design would connect Bruxner Park Road to the Korora Hill interchange and Old Coast Road to a service road. Therefore, access to this urban release area would not be impacted by the project.

### *Pacific Bay Western Lands*

Pacific Bay Western Lands is a proposed residential development located immediately south of the Korora Hill interchange. Consultation with CHCC and the proponent of the residential development will be undertaken during detailed design to ensure future access arrangements are considered as part of the project.

### *Pacific Bay Eastern Lands*

Pacific Bay Eastern Lands includes approved residential developments as part of the Pacific Bay Resort on the eastern side of the Pacific Highway south of the Korora Hill interchange. Access to Pacific Bay Eastern Lands is provided via Charlesworth Bay Road/Bay Drive/Resort Drive. The existing intersection of Charlesworth Bay Road/Pacific Highway would not be affected by the project. However, consultation with the proponent has indicated that the further proposals are being investigated and further consultation with the proponent will be undertaken during detailed design to ensure any future access arrangements are considered as part of the project.

## 8.4.11 Pedestrian and cyclist network

During operation, the project would not result in the severing of any existing pedestrian or cyclist routes.

The project includes provision for pedestrian and cyclist connectivity in the local area including:

- Reducing the volume of heavy vehicles; reducing the likelihood of conflicts between pedestrians and cyclists and freight traffic through the Coffs Harbour CBD
- Cyclist provisions within the shoulder of the project in both the northbound and southbound directions
- A 1.5 metre wide cycle path (on both sides of each tunnel) with a concrete barrier to separate the path from the traffic lanes

- At-grade cyclist ramp crossings at each interchange along the project. This may pose safety risks for cyclists as they cross two lanes of traffic to continue along the project. However, there are alternative non-direct paths available to cyclists through the interchange giving cyclists a choice
- Extension of the existing shared path on Solitary Islands Way. The shared path would extend for the length of the new service road
- Reinstatement of the existing shared path along the existing Pacific Highway south and through the Pacific Highway/Stadium Drive/Englands Road intersection
- Provision of signalised pedestrian/cycle crossings of the existing Pacific Highway and Stadium Drive at the Pacific Highway/Stadium Drive/Englands Road intersection
- A new shared user path would be provided through the Korora Hill interchange connecting between the service road and Bruxner Park Road with a pedestrian/cycle crossing provided at the signalised intersections
- All local road underpasses would be wide enough to include provision for pedestrians and cyclists, separated from the local road
- The Coramba Road and Shephards Lane overpasses would include a footpath on one side of the bridges for pedestrian access across the project.

At the Kororo Public School, the following changes to the local pedestrian and cycle network would be provided:

- The Luke Bowen footbridge pedestrian/cyclist overpass is to be rebuilt and would provide a link from the Kororo Public School to Old Coast Road west of the existing Pacific Highway. The proposed location is about 250 m north of the existing location with students required to walk further to enter the school
- A 2.5 m wide pedestrian path would be constructed on the eastern side of the service road from James Small Drive (north) to the existing path on Solitary Islands Way. The pedestrian path would provide linkages to the overpass and runs adjacent to the on-street parallel car parks proposed on the service road adjacent to the school
- A 2.5 m wide pedestrian ramp with 1:14 grade and landings at 9 m intervals would be provided from James Small Drive to the new bus interchange
- A 2.5 m wide pedestrian path surrounding the bus interchange and linking to the north–south path alongside the service road.

The proposed project changes would provide connections to the existing pedestrian and cycle network and enhanced options for walking and cycling. This would improve safety for pedestrians and cyclists, particularly surrounding the Kororo Public School, providing for better connections between the existing off-road path network. Additionally, by redistributing a significant proportion of heavy vehicles away from the Coffs Harbour CBD, potential conflicts between heavy vehicles and pedestrian/ cyclists would be reduced.

### 8.4.12 Parking

The project would impact the existing parking at Kororo Public School. A parking demand and use survey was carried out at and around the Kororo Public School to understand the existing on-street parking demand of the school as described in **Section 8.2.6** with the full results being detailed in **Appendix F, Traffic and transport assessment**. As such, the following changes to on-street parking are proposed to meet the existing peak parking demand of the school:

- A total of 66 parallel parking bays (including two persons with disability parking bays) on the eastern side of the service road adjacent to the school
- An additional 52 staff car parks within the Kororo Public School bus interchange, which would be accessed via James Small Drive

- A total of about 90 informal on-street parking spaces (similar to the existing layout) on the property access road (opposite the school) and on Old Coast Road.

There would be no other changes to parking as a result of the project than that already described for construction (see **Section 8.3.4**).

## 8.5 Environmental management measures

A summary of management measures relating to traffic and transport are provided in **Table 8-15,** noting there are interactions between these measures and those described in **Chapter 9, Noise and vibration.**

Table 8-15 Environmental management measures for traffic and transport impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Disruption to public transport, including school bus services | TT1 | Operational access for public transport services, including school bus services will be maintained as part of the project. The requirements for any temporary changes during construction will be confirmed following further consultation with the school bus operators, CHCC, Kororo Public School and Bishop Druitt College. | Roads and Maritime/ Contractor | Detailed design and during construction |
| Parking and access at Kororo Public School | TT2 | Further consultation will be undertaken with Kororo Public School and NSW Department of Education to confirm final parking arrangements and access during construction. | Roads and Maritime/ Contractor | Detailed design and during construction |
| Use of James Small Drive during operation | TT3 | Traffic management improvement opportunities for James Small Drive, including but not limited to restrictions to on-street parking and installation of traffic barriers, will be further evaluated and finalised during detailed design and in consultation with CHCC, Kororo Public School, Coffs Harbour Montessori Preschool, NSW Department of Education and the adjacent community. | Roads and Maritime | Detailed design |
| Solitary Rural Fire Service access | TT4 | Consultation with Solitary Rural Fire Service will be undertaken during detailed design to ensure the appropriate access requirements are achieved. | Roads and Maritime | Detailed design |
| Pacific Bay Western Lands access | TT5 | Consultation with CHCC and the proponent of the Pacific Bay Western Lands residential development will be undertaken during detailed design to ensure future access arrangements are considered as part of the project. | Roads and Maritime | Detailed design |
| Pacific Bay Eastern Lands access | TT6 | Consultation with CHCC and the proponent of the Pacific Bay Eastern Lands development will be undertaken during detailed design to ensure future access arrangements are considered as part of the project. | Roads and Maritime | Detailed design |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Traffic related risks during construction | TT7 | A Traffic Management Plan (TMP) will be prepared and implemented as part of the Construction Environmental Management Plan (CEMP). The TMP will be prepared in accordance with Traffic Control at Work Sites Manual (Roads and Maritime Services 2018c). The TMP will include:<br>• Confirmation of haulage routes<br>• Measures to maintain access to local roads, properties and Kororo Public School<br>• Measures that consider operation of Kororo Public School and Bishop Druitt College<br>• Site specific traffic control measures (including signage) to manage and regulate traffic movement<br>• Measures to maintain pedestrian and cyclist access<br>• Requirements and methods to consult and inform the local community of impacts on the local road network<br>• Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads<br>• A response plan for any construction traffic incident and consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic<br>• Monitoring, review and amendment mechanisms. | Contractor | Prior to construction |
| Access | TT8 | Existing accesses to properties will be maintained during construction. Where this is not feasible or reasonable, temporary alternative access arrangements will be provided following consultation with the affected property owners. | Contractor | During construction |
| Road condition reports | TT9 | Pre-construction and post construction road condition reports for local roads will be prepared. Any damage resulting from construction (not normal wear and tear) will be repaired unless alternative arrangements are made with CHCC. Copies of road condition reports will be provided to CHCC. | Contractor | Prior to and post construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Permanent removal of parking areas | TT10 | Parking demand and use surveys will be undertaken to confirm the extent of temporary and/or permanent impacts at the following locations:<br>• Areas associated with the informal school bus stop at the intersection of Coramba Road and Spagnolos Road<br>• Englands Road<br>• Oz Group Packhouse at Isles Drive<br><br>The results will be used to determine the need for alternative arrangements, where reasonable and feasible. | Roads and Maritime | Detailed design |
| Confirmation of assessed impacts | TT11 | A review of operational network performance will be undertaken 12 months from the opening of the project to confirm the operational traffic and transport impacts of the project on the surrounding road network, in particular at interchange locations and Coramba Road. The assessment will be based on updated traffic surveys at the time and the methodology used will be comparable with that used in **Appendix F, Traffic and transport assessment**. Where required, additional mitigation measures will be identified in consultation with CHCC to manage any additional traffic performance impacts. | Roads and Maritime | Operation |

CHAPTER

9

Chapter 9

# Noise and vibration

# 9. Noise and vibration

This chapter presents an assessment of the potential noise and vibration impacts of the project and identifies mitigation and management measures to minimise and reduce these impacts.

The assessment presented in this chapter draws on information in the noise and vibration report (refer to **Appendix G, Noise and vibration assessment**) and the human health risk assessment (refer to **Appendix Q, Human health risk assessment**) prepared for this EIS.

**Table 9-1** lists the SEARs relevant to noise and vibration and where they are addressed in this chapter.

Table 9-1 SEARs relevant to noise and vibration

| Ref | Key Issue SEARs | Where addressed |
|---|---|---|
| **2. Noise and vibration – Amenity** | | |
| 1 | The Proponent must assess construction and operational noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must include consideration of impacts to sensitive receivers, and include consideration of sleep disturbance and, as relevant, the characteristics of noise and vibration. | Section 9.1<br>Section 9.3<br>Section 9.4 |
| 2 | An assessment of construction noise and vibration impacts which must address: | |
| | (a) the nature of construction activities (including transport, tonal or impulsive noise-generating works and the removal of operational noise barriers, as relevant) | Section 9.4.1 |
| | (b) the intensity and duration of noise and vibration impacts (both air and groundborne) | Section 9.4.1 |
| | (c) the nature, sensitivity and impact to receivers (including Bishop Druitt College and Korora Public School) | Section 9.4.1 |
| | (d) the need to balance timely conclusion of noise and vibration generating works with periods of receiver respite, and other factors that may influence the timing and duration of construction activities (such as traffic management) | Section 9.5 |
| | (e) the potential for extended standard construction hours and/or works outside standard construction hours, including predicted levels, exceedances and number of potentially affected receivers and justification for the activity in terms of the Interim Construction Noise Guideline (DECCW, 2009) | Section 9.4.1<br>Section 9.5<br>**Chapter 6, Construction** |
| | (f) a cumulative noise and vibration assessment inclusive of impacts from other major development projects preparing for or commencing construction in the vicinity of the proposal. | **Chapter 25, Cumulative impacts** |
| 3 | The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required. | Section 9.3.1<br>Section 9.5 |
| **3. Noise and Vibration – Structural** | | |
| 1 | The Proponent must assess construction and operation noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must include consideration of impacts to the structural integrity and heritage significance of items (including Aboriginal places and items of environmental heritage). | Section 9.3<br>Section 9.4<br>Section 9.5 |
| 2 | The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required. | Section 9.3.1<br>Section 9.5 |

# 9.1 Assessment methodology

The construction and operation noise assessment methodology involved:

- Identifying the noise and vibration study area
- Identifying and classifying the noise and vibration sensitive receivers and noise catchment areas (NCAs)
- Defining the existing noise environment based on attended and unattended background noise monitoring at representative locations in the study area
- Determining the rating background level (RBL) for each monitoring location to give an indication of the background noise levels during the day, evening and night
- Determining appropriate noise and vibration management levels for each receiver
- Establishment of road traffic noise levels to validate the operational model and as a basis for quantifying construction noise and vibration impacts
- Building the operational noise model using the United Kingdom Department of Transport Calculation of Road Traffic Noise (CoRTN) methodology
- Validation of operational noise model
- Assessing the predicted construction noise and vibration levels associated with construction of the project
- Assessing the predicted operational road traffic noise levels at identified receivers with the project ‘build’ and without the project ‘no-build’ scenarios for the year of opening (2024) and the design year, 10 years after opening (2034)
- Identifying reasonable and feasible measures to mitigate and reduce predicted noise and vibration impacts during construction and operation of the project.

Assessment of health impacts from changes in noise associated with construction and operation of the project was largely qualitative, with some quantitative assessment included to determine what noise increases are considered to cause unacceptable health impacts. Further detail regarding methodology and uncertainties with the assessment of health impacts is provided in **Appendix Q, Human health risk assessment**.

# 9.2 Existing environment

## 9.2.1 Study area

The study area for the noise and vibration assessment includes the operational and construction footprints for the project. As recommended in the NSW Road Noise Policy (RNP) (Department of Environment, Climate Change and Water (DECCW 2011), the study area extends 600 m either side of the project construction footprint and includes areas which could be indirectly impacted by the project. The study area is shown in **Figure 9-2-01** to **Figure 9-2-06**.

The main contributors to existing noise in the study area include:

- Road traffic noise, including heavy vehicles along the existing Pacific Highway and local road traffic
- Operation of the passenger and freight rail along the North Coast Railway
- Industrial activities within industrial areas (mostly at the southern end of the project)
- Other construction activities such as building, residential and road construction.

## 9.2.2 Noise sensitive receivers

A total of 2310 sensitive receivers (residential and non-residential) were included in the noise model for the project, including 2265 residential receivers and 15 other sensitive receivers (including five outdoor recreational). Non-residential receivers and sensitive land uses include:

- Educational institutions – Kororo Public School, Coffs Harbour Montessori Preschool, Bishop Druitt College and NSW School of Natural Medicine[1]
- Health care facilities – Coffs Harbour Health Campus and Coffs Harbour GP Super Clinic
- Places of worship – The Foursquare Church Australia and Bishop Druitt School Chapel
- Childcare facilities – Petit Early Learning Centre Coffs Harbour and Cow & Koala Professional Child Care
- Active recreation – Coffs Coast Sport and Leisure Park, Boambee Equestrian Centre, Pacific Bay Resort Golf Course and Elite Training Centre, Pacific Bay Resort
- Passive recreation – Kororo Nature Reserve.

Other receivers identified include commercial receivers (such as businesses and shops) and industrial receivers. Most of these are located at the large commercial complex just north of Englands Road interchange at the southern end of the project.

To facilitate analysis, noise sensitive receivers were grouped together into 28 noise catchment areas (NCAs) based on areas that receive similar exposure to future noise from operation and construction of the project. A summary of the 28 NCAs identified for the project is provided in **Table 9-2**.

The location of all sensitive receivers and NCAs is shown in **Figure 9-2-01** to **Figure 9-2-06**.

Table 9-2 Summary of noise catchment areas

| NCA | Description |
|---|---|
| NCA 01 | Residential and commercial receivers located along the existing Pacific Highway south-east of Englands Road interchange at the southern end of the project, including Koala Villas and Caravan Park |
| NCA 02 | Residential and commercial receivers and one recreational facility (Boambee Equestrian Centre) located along the existing Pacific Highway south-west of Englands Road interchange at the southern end of the project |
| NCA 03 | A mixture of residential and commercial receivers, one recreational facility (Coffs Coast Sport and Leisure Park) and one health facility (Coffs Harbour GP Super Clinic) located along the existing Pacific Highway south-east of Englands Road interchange |
| NCA 04 | Commercial and industrial receivers located to the west of the project at Englands Road interchange |
| NCA 05 | A mixture of commercial and industrial receivers, one childcare facility (Petit Early Learning Journey Coffs Harbour), one place of worship (The Foursquare Church Australia) and one health facility (Coffs Harbour Health Campus) located between the project and the existing Pacific Highway on Isles Drive, just north of Englands Road interchange |
| NCA 06 | Residential and non-residential receivers (Bishop Druitt College) located east of the project along North Boambee Road |

[1] The NSW School of Natural Medicine is no longer in operation; however, it has been retained as a sensitive receiver for the purpose of this assessment.

| NCA | Description |
|---|---|
| NCA 07 | Residential and commercial receivers located west of the project along Englands Road |
| NCA 08 | Residential receivers located west of the project along North Boambee Road just north of Newports Creek and one educational facility (NSW School of Natural Medicine) |
| NCA 09 | The identifier NCA09 has not been used for any of the noise sensitive receivers |
| NCA 10 | Residential receivers located to the east of the project near Roberts Hill Ridge Line |
| NCA 11 | Residential receivers located east of the project, south-east of Coramba Road interchange just south of Coffs Creek |
| NCA 12 | Residential receivers located west of the project at Coramba Road interchange |
| NCA 13 | Residential receivers and one childcare facility (Cow & Koala Professional Child Care) located east of the project at Coramba Road interchange just north of Coffs Creek |
| NCA 14 | Residential receivers located south-east of the project between Shephards Lane and Coramba Road interchange |
| NCA 15 | Residential receivers located north-west of the project where the project intersects with the North Coast Railway |
| NCA 16 | Residential receivers located south of the project between Shephards Lane and the North Coast Railway |
| NCA 17 | Residential receivers located north of the project adjacent to Orora East State Forest |
| NCA 18 | Residential receivers located south of the project adjacent to the North Coast Railway |
| NCA 19 | Residential receivers located north of the project adjacent to Orora East State Forest |
| NCA 20 | Residential receivers located east of the project just south of Korora Hill interchange |
| NCA 21 | Commercial and residential receivers and one recreational facility (Elite Training Centre, Pacific Bay Resort) located west of the existing Pacific Highway just south of Korora Hill interchange, including Banana Coast Caravan Park |
| NCA 22 | Commercial receivers and one recreational facility (Pacific Bay Resort Golf Course) located east of the existing Pacific Highway just north of Korora Hill interchange |
| NCA 23 | Residential receivers and one recreational facility (Kororo Nature Reserve) located west of the existing Pacific Highway just north of Korora Hill interchange |
| NCA 24 | Residential receivers located east of the existing Pacific Highway just north of Korora Hill interchange |
| NCA 25 | Residential receivers located east of the existing Pacific Highway just north of Korora Hill interchange |
| NCA 26 | Residential commercial receivers and two educational facilities (Kororo Public School and Coffs Harbour Montessori Preschool) located east of the existing Pacific Highway just south of Pine Brush Creek |
| NCA 27 | Residential receivers located west of the existing Pacific Highway just north of Pine Brush Creek and the Kororo Nature Reserve |
| NCA 28 | Residential receivers located east of the existing Pacific Highway just north of Pine Brush Creek |
| NCA29 | Residential receivers located west of the existing Pacific Highway at the northern extent of the project |

## 9.2.3 Existing noise levels

Noise monitoring was carried out between 21 June and 30 June 2016 (representative of a seven day week prior to school holidays) and between 28 November and 12 December 2016, to establish the existing baseline noise environment along the project. Noise monitoring carried out in 2016 is considered representative of the 2019 noise environment and is applicable for the purposes of the construction and operational noise assessment.

The noise monitoring collected background noise levels at 21 locations to define the existing background noise levels and the measured road traffic noise levels.

Noise monitoring locations were chosen to be representative of the noise environment in each area as well as specific areas of the project raised by the community as particularly sensitive to noise. Noise monitoring locations (noise loggers) are shown in **Figure 9-2-01** to **Figure 9-2-06**.

The results of the monitoring were used to validate the operational noise model and to determine the ambient noise environment for daytime, evening and night-time periods to establish construction noise criteria. Continuous weather data was also obtained for the duration of the monitoring and where appropriate, all invalid weather affected data was excluded from the analysis, such as periods of rain and wind speeds greater than 5m/s (wind speeds at the microphone height).

Noise levels are reported in A-weighted decibel levels, known as dB(A). dB(A) denotes a single-number sound pressure level that includes a frequency weighting (“A-weighting”) to reflect the subjective loudness of sound level. The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. Some typical dB(A) levels are shown in Error! Reference source not found. below.

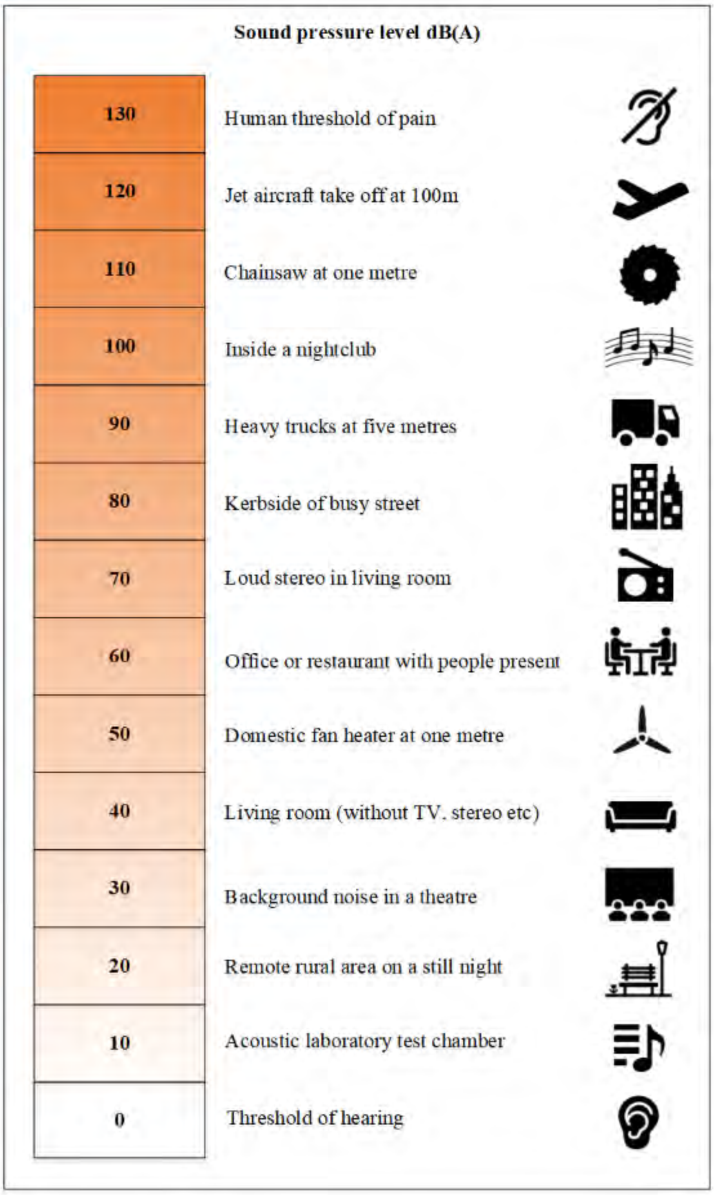



Figure 9-1 Typical dB(A) levels and examples

A summary of the background noise levels and road traffic noise levels is provided in **Table 9-3.**

Table 9-3 Summary of background noise levels and road traffic noise levels

| Logger number | Noise Catchment Area (NCA) | Address | Rating Background Level (dB(A)) | | | Measured traffic noise level dB(A) $L_{Aeq}$ | |
|---|---|---|---|---|---|---|---|
| | | | Day (7am-6pm) | Evening (6pm-10pm) | Night (10pm-7am) | 7am–10pm $L_{Aeq,}$ (15 hour) | 10pm–7am $L_{Aeq,}$ (9 hour) |
| 1 | NCA02 | 498c-498d Pacific Highway, Boambee | 47 | 45 | 39 | 54 | 51 |
| 2 | NCA06 | North Boambee Road, North Boambee Valley | 32 | 32 | 31 | 53 | 44 |

| Logger number | Noise Catchment Area (NCA) | Address | Rating Background Level (dB(A)) | | | Measured traffic noise level dB(A) $L_{Aeq}$ | |
|---|---|---|---|---|---|---|---|
| | | | Day (7am-6pm) | Evening (6pm-10pm) | Night (10pm-7am) | 7am–10pm $L_{Aeq, (15\ hour)}$ | 10pm–7am $L_{Aeq, (9\ hour)}$ |
| 3 | NCA08 | 170 North Boambee Road, North Boambee Valley | 42 | 40 | 38 | 56 | 51 |
| 4 | NCA13 | 12 Tamora Close, Coffs Harbour | 39 | 32 | 27 | 59 | 52 |
| 5 | NCA12 | 20 Bennetts Road, Coffs Harbour | 37 | 31 | 30 | 47 | 41 |
| 6 | NCA15 | 263c Shephards Lane, Coffs Harbour | 28 | 28 | 28 | 47 | 47 |
| 7 | NCA18 | 191 Mackays Road, Coffs Harbour | 28 | 39 | 28 | 45 | 40 |
| 8 | NCA21 | Opal Shop, 429a-429b Pacific Highway North, Coffs Harbour | 66 | 59 | 40 | 75 | 71 |
| 9 | NCA25 | 16 Fern Tree Place, Korora | 48 | 40 | 34 | 57 | 54 |
| 10 | NCA28 | 1 Coachmans Close, Sapphire Beach | 60 | 50 | 42 | 68 | 65 |
| 11 | NCA01 | 539 Pacific Highway, Boambee | 58 | 51 | 39 | 65 | 61 |
| 12 | NCA14 | 19 Gillon Street, Coffs Harbour | 28 | 30 | 30 | 45 | 42 |
| 13 | NCA18 | 14 Jensen Close, Coffs Harbour | 31 | 31 | 29 | 48 | 48 |
| 14 | NCA27 | Paradise Palms, 675 Pacific Highway | 55 | 51 | 42 | 65 | 63 |
| 15 | NCA26 | Korora Public School, 3 Korora School Road | 52 | 46 | 37 | 59 | 56 |
| 16 | NCA16 | 23 Rigoni Crescent, Coffs Harbour | 27 | 27 | 25 | 52 | 53 |
| 17 | NCA19 | 170 West Korora Road, Coffs Harbour | 30 | 37 | 30 | 49 | 42 |
| 18 | NCA23 | 111 Bruxner Park Road, Coffs Harbour | 43 | 38 | 34 | 50 | 45 |
| 19 | NCA19 | 133b Mackays Road, Coffs Harbour | 26 | 29 | 28 | 54 | 45 |

| Logger number | Noise Catchment Area (NCA) | Address | Rating Background Level (dB(A)) | | | Measured traffic noise level dB(A) $L_{Aeq}$ | |
|---|---|---|---|---|---|---|---|
| | | | Day (7am-6pm) | Evening (6pm-10pm) | Night (10pm-7am) | 7am–10pm $L_{Aeq, (15 hour)}$ | 10pm–7am $L_{Aeq, (9 hour)}$ |
| 20[1] | - | 20 Anniversary Place, Coffs Harbour | 31 | 30 | 30 | 45 | 39 |
| 21 | NCA06 | Bishop Druitt College, 111 N Boambee Road, North Boambee Valley | 41 | 38 | 35 | 60 | 56 |

[1] *Logger 20 is considered representative of the nearby residential receivers located in NCA09 and NCA10. This was determined to be the safest location to install the logger to measure existing background noise levels.*

The results show that noise levels are typically higher during the daytime and tend to decrease during the evening and night time periods.

Receivers located along the existing Pacific Highway at the southern end of the project (NCA01, NCA02) and the northern end of the project (NCA21, NCA23, NCA25, NCA26, NCA27 and NCA28) generally experience higher existing noise levels than receivers located in the middle section of the project (NCA14, NCA16, NCA18 and NCA19). The results also show that measured traffic noise at some receiver locations, particularly around the southern and northern ends of the project along the existing Pacific Highway, are already experiencing traffic noise levels above the RNP criteria for a new road of 60 dB(A) $L_{Aeq\ (15\ hour)}$ during the daytime and 55 dB(A) $L_{Aeq\ (9\ hour)}$ during the night-time.

The North Coast Railway runs through the construction footprint and trains currently contribute transient events to existing noise levels. The closest noise loggers to the North Coast Railway are loggers 13, 16 and 19 and these represent the existing baseline conditions near the North Coast Railway.


Legend

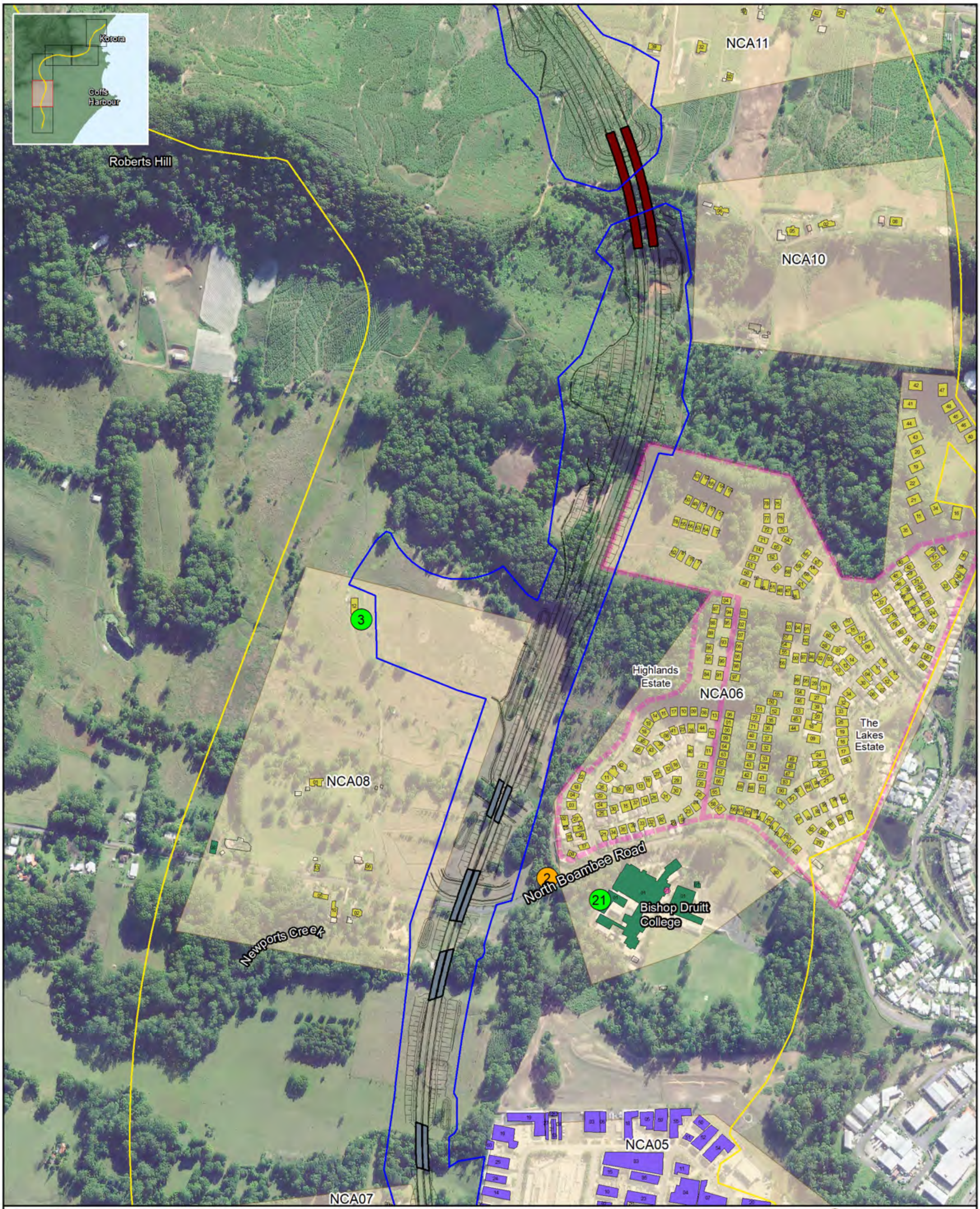
- Construction footprint
- Alignment
- Bridge
- Tunnel
- North Coast Railway
- Study Area
- Noise catchment area
- Approved DA subdivision
- Noise monitoring location (validation)
- Noise monitoring location (baseline)
- Noise monitoring location (attended only)

Receiver classification

- Active Recreation
- Passive Recreation
- Childcare
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coff Harbour Bypass
Noise catchment areas, sensitive land uses and noise monitoring locations
Figure 9-2-01

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56
N




**Legend**

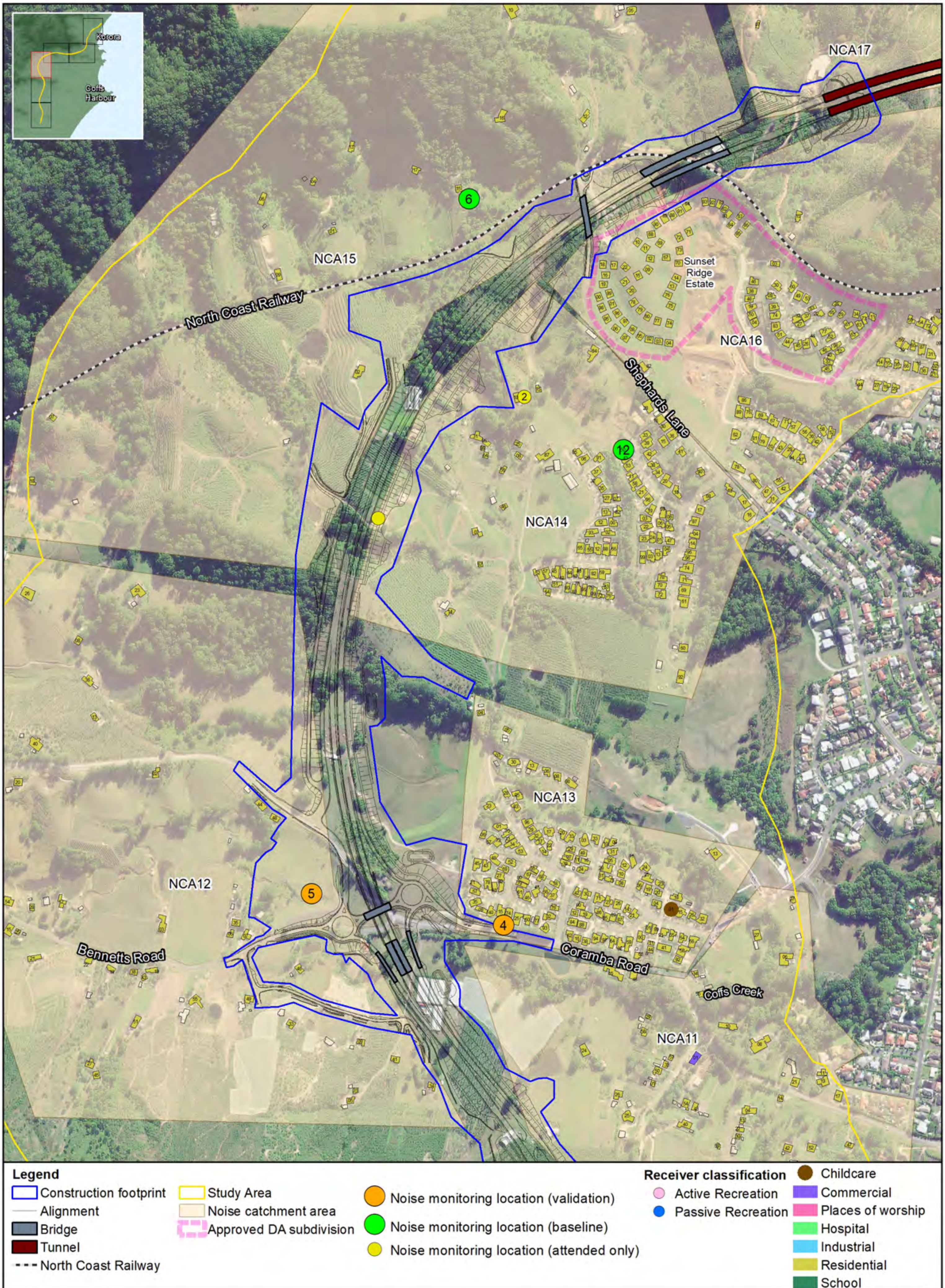
Construction footprint
Alignment
Bridge
Tunnel
North Coast Railway
Study Area
Noise catchment area
Approved DA subdivision
Noise monitoring location (validation)
Noise monitoring location (baseline)
Noise monitoring location (attended only)

**Receiver classification**

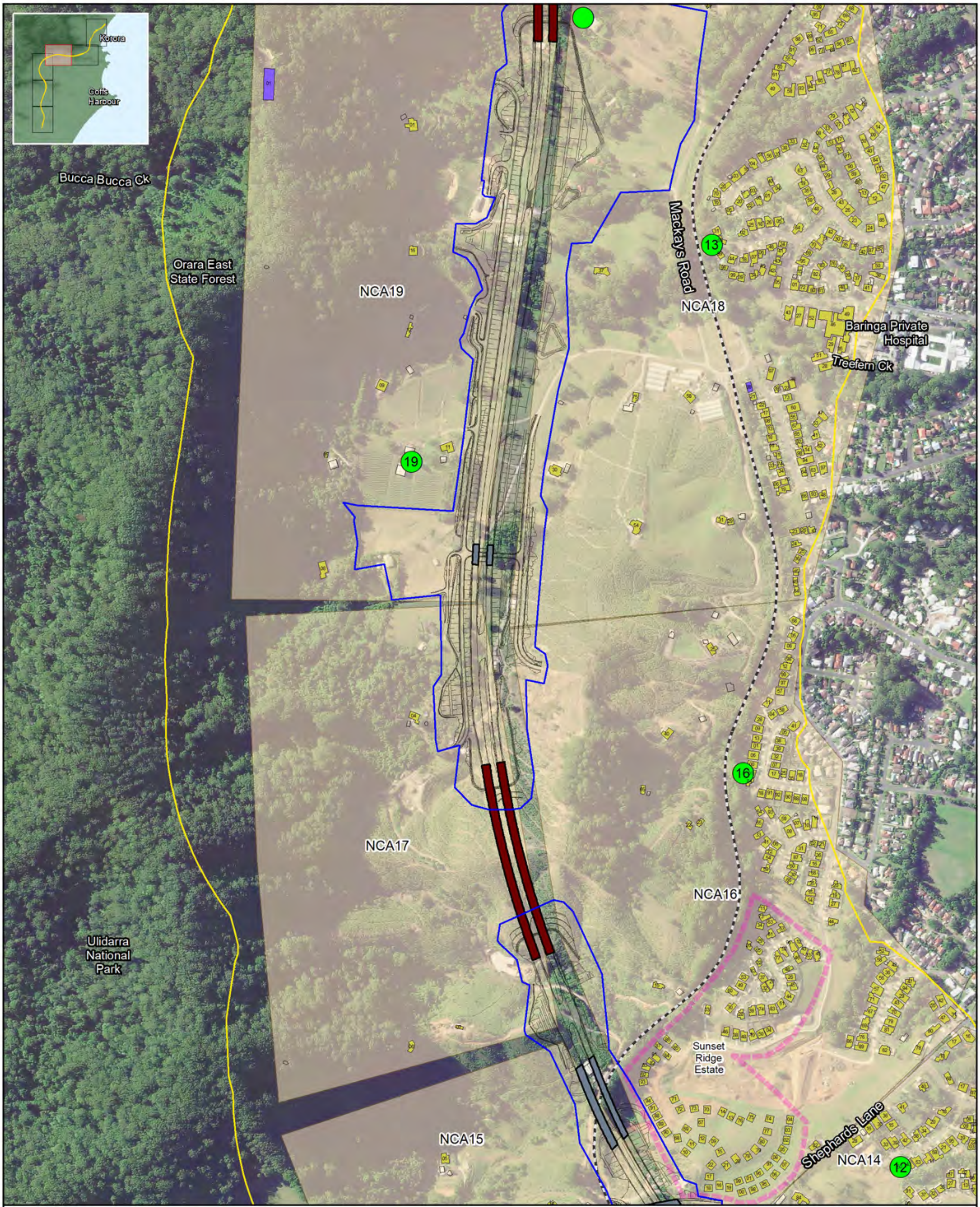
Active Recreation
Passive Recreation
Childcare
Commercial
Places of worship
Hospital
Industrial
Residential
School

Coff Harbour Bypass
Noise catchment areas, sensitive land uses and noise monitoring locations
Figure 9-2-02

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56
N




Coff Harbour Bypass
Noise catchment areas, sensitive land uses and noise monitoring locations
Figure 9-2-03




**Legend**

- Construction footprint
- Alignment
- Bridge
- Tunnel
- North Coast Railway
- Study Area
- Noise catchment area
- Approved DA subdivision
- Noise monitoring location (validation)
- Noise monitoring location (baseline)
- Noise monitoring location (attended only)

**Receiver classification**

- Active Recreation
- Passive Recreation
- Childcare
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coff Harbour Bypass
Noise catchment areas, sensitive land uses and noise monitoring locations
Figure 9-2-04

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56


**Legend**

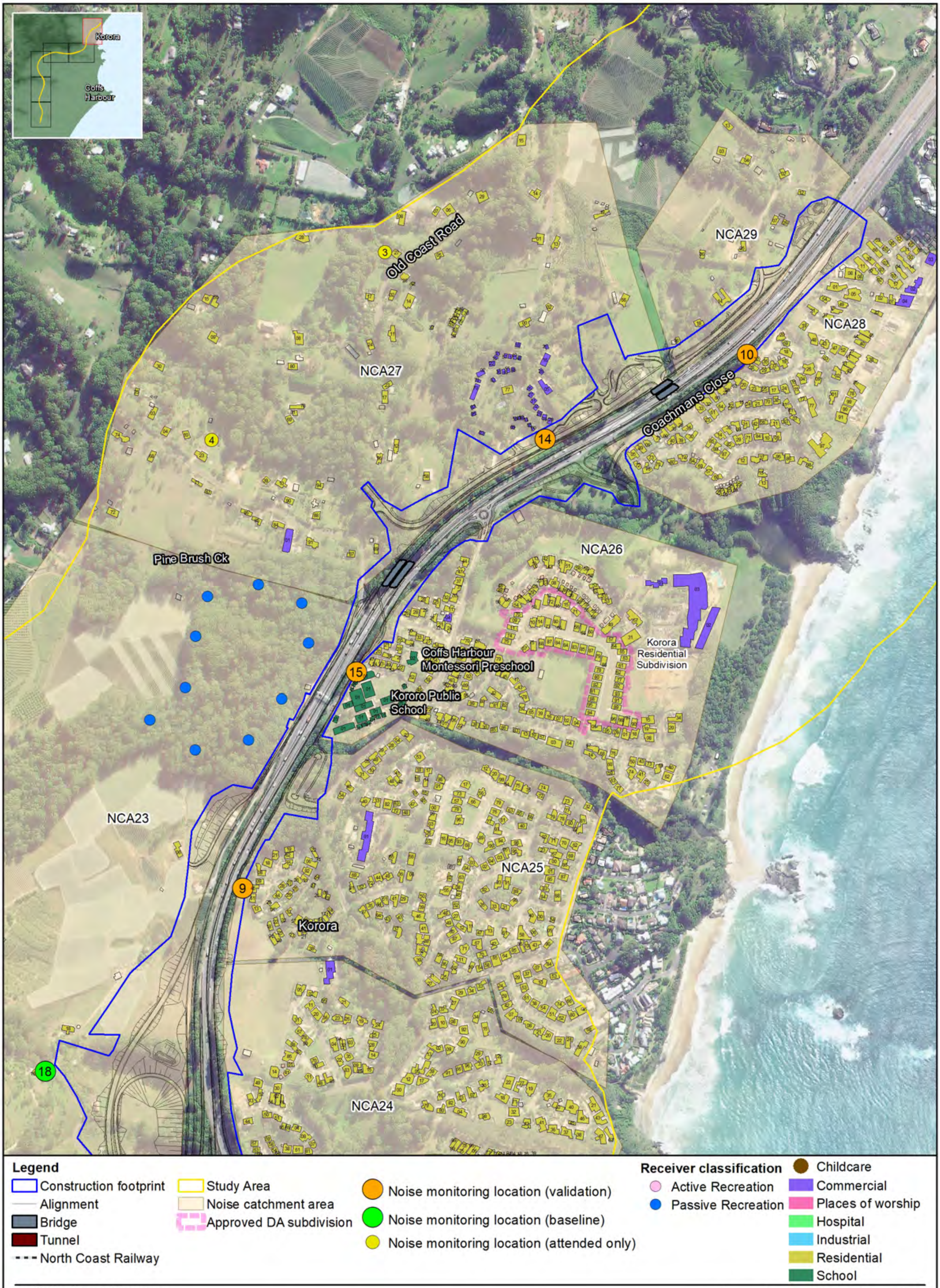
- Construction footprint
- Alignment
- Bridge
- Tunnel
- North Coast Railway
- Study Area
- Noise catchment area
- Approved DA subdivision
- Noise monitoring location (validation)
- Noise monitoring location (baseline)
- Noise monitoring location (attended only)

**Receiver classification**

- Active Recreation
- Passive Recreation
- Childcare
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

Coff Harbour Bypass
Noise catchment areas, sensitive land uses and noise monitoring locations
Figure 9-2-05

0 0.1 0.2 0.3 km
N
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56




Coff Harbour Bypass
Noise catchment areas, sensitive land uses and noise monitoring locations
Figure 9-2-06

### 9.2.4 Development applications

Following the announcement of the project's preferred route option in 2004, Roads and Maritime continued to refine the concept design in consultation with CHCC and directly affected landowners to a level where the boundaries of the road reserve corridor could be defined and incorporated into the Coffs Harbour LEP. The design was documented in the Coffs Harbour Bypass – Concept Design Report (RTA 2008a) and placed on public display. Issues raised were considered in subsequent design investigations and the revised road corridor was incorporated into the Coffs Harbour LEP 2013 with a SP2 zoning for infrastructure. This has allowed for planning certainty for the urban release areas within Coffs Harbour and allowed consent authorities to include consideration of the project within development application (DA) consent conditions.

The following approved residential subdivisions (shown on **Figure 9-2-01** to **Figure 9-2-06**) which are in various stages of development were considered as part of the noise assessment to identify the extent of at-source treatment (ie low noise pavement and noise barriers) required to address the predicted noise impact of the project:

- Elements Estate, near the Englands Road Interchange
- Highlands Estate, near North Boambee Road
- The Lakes Estate, near North Boambee Road
- Sunset Ridge Estate, near Shepherds Lane
- Pacific Bay Eastern Lands, near the Korora Hill interchange
- Korora Residential Subdivision, near Opal Boulevard.

Based on the requirements of the DA consent conditions, only The Lakes Estate, Sunset Ridge Estate and Korora Residential Subdivision have been considered for at-property treatment by the project. However, this is limited to only apply to dwellings that have been built to a stage that would allow the installation of at-property treatment before project completion, as per Practice Note ii of Environmental Noise Management Manual (ENMM) (RTA 2001b).

Any noise sensitive receivers at Elements Estate, Highlands Estate and Pacific Bay Eastern Lands that are predicted to exceed the noise criteria should have adequate at-property treatment based on the requirements set out in their DA consent conditions. Consequently, properties within these developments have been excluded from the number of at-property treatments resulting from the project.

Noise attenuation for any future subdivisions within existing urban release areas identified in Coffs Harbour Development Control Plan 2015 would be the responsibility of the developer and therefore these have not been considered as part of the assessment (eg North Boambee Valley (West) Urban Release Area, Pacific Bay Western Lands and Korora urban release area).

## 9.3 Noise and vibration criteria

### 9.3.1 Construction noise and vibration criteria

Construction noise and vibration is assessed in accordance with the Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime Services 2016a) for noise sensitive receivers. The CNVG was established in accordance with the Interim Construction Noise Guideline (ICNG) (DECC 2009) which requires noise management levels to be defined for 'noise affected' receivers and 'highly noise affected' receivers based on the measured background noise level, also known as the Rating Background Level (RBL). The noise management levels for each sensitive receiver are used to determine construction noise mitigation measures and control the noise amenity at residences, other sensitive land uses and commercial and industrial premises.

The CNVG, in accordance with the ICNG, identifies different noise management level criteria for works taking place during standard construction working hours and works taking place outside of standard construction working hours. **Table 9-4** sets out the noise management levels for residential receivers and **Table 9-5** sets out the noise management levels for other noise sensitive receivers (when in use), as required by the ICNG.

Table 9-4 Construction noise management levels for residential receivers

| Time of day | Noise management level [1] $L_{Aeq\ (15\ min)}$ | How to apply |
|---|---|---|
| Recommended standard hours:<br><br>Monday to Friday (7am to 6pm)<br><br>Saturday (8am to 1pm)<br>No work on Sundays or public holidays | Noise affected RBL + 10dB | The noise affected level represents the point above which there may be some community reaction to noise.<br>Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level<br>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly noise affected 75dB(A) | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:<br>• Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences<br>• If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| Outside recommended standard hours | Noise affected RBL + 5dB | A strong justification would typically be required for works outside the recommended standard hours.<br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community.<br>For guidance on negotiating agreements see section 7.2.2 of the ICNG. |

*[1] Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.*

Table 9-5 Construction noise management levels for other sensitive land uses

| Sensitive Land Use | Noise management level, $L_{Aeq,15min}$ (applies when properties are being used) |
|---|---|
| Classrooms at schools and other educational institutions | Internal noise level 45 dB(A) |
| Hospital wards and operating theatres | Internal noise level 45 dBA |
| Places of Worship | Internal noise level 45 dBA |
| Active recreation areas | External noise level 65 dB(A) |
| Passive recreation areas | External noise level 60 dB(A) |
| Community centres | Internal noise levels 45 dB(A) (based on the 'maximum' internal noise levels in AS 2107) |
| Commercial premises | External noise level 70 dB(A) |
| Industrial premises | External noise level 75 dB(A) |

For sensitive receivers such as hospitals, schools and places of worship, the noise management levels shown in **Table 9-5** are based on internal noise levels. For the purpose of this assessment, it is conservatively assumed that external noise levels are typically 10 dB(A) higher than internal noise levels when the windows are open. Therefore, a 55 dB(A) has been adopted for the external assessment.

The ICNG and AS 2107 do not identify noise management levels for childcare centres. For the purpose of this assessment, an internal noise management level of 45 dB(A) has been adopted for childcare centres (when in use) based on the maximum internal noise level for nurseries in AS 2107. On the basis that external noise levels are typically 10 dB higher than internal noise levels when windows are open, an external noise management level of 55 dB(A) has been adopted over a 15-minute period.

### *Groundborne construction noise criteria*

Groundborne noise is generated from underground vibration intensive works which may be transmitted through the ground into a building. This is a potential impact of tunnel construction works. The CNVG establishes criteria for groundborne construction noise as shown in **Table 9-6**.

Table 9-6 Groundborne noise criteria

| Time of day | Groundborne noise objectives $L_{Aeq\ (15minute)}$ |
|---|---|
| Daytime 7.00 am to 6.00 pm | Human comfort vibration objectives only |
| Evening 6.00 pm to 10.00 pm | 40 dB(A) - Internal |
| Night-time 10.00 pm to 7.00 am | 35 dB(A) - Internal |

### *Construction noise management levels*

The construction noise management levels established for each residential receiver (NCA) for the project are shown in **Table 9-7**.

Table 9-7 Construction noise management levels at residential receivers

| NCA | Noise management level dB(A) $L_{Aeq}$ | | | | | Sleep disturbance $L_{Amax}$ (RBL + 15 dB) Screening Criteria |
|---|---|---|---|---|---|---|
| | Standard construction hours (Daytime) | | Outside standard construction hours (RBL + 5dB) | | | |
| | Highly noise affected | Noise affected (RBL + 10 dB) | Daytime (7am to 6pm) | Evening (6pm to 10pm) | Night-time (10pm to 7am) | |
| NCA 1 | 75 | 68 | 63 | 56 | 44 | 54 |
| NCA 2 | 75 | 57 | 52 | 50 | 44 | 54 |
| NCA 3 | 75 | 57 | 52 | 50 | 44 | 54 |
| NCA 4 | 75 | 57 | 52 | 50 | 44 | 54 |
| NCA 5 | 75 | 45 | 40 | 37 | 36 | 46 |
| NCA 6 | 75 | 45 | 40 | 37 | 36 | 46 |
| NCA 7 | 75 | 45 | 40 | 39 | 41 | 51 |
| NCA 8 | 75 | 45 | 40 | 39 | 41 | 51 |
| NCA 9 | 75 | 45 | 40 | 35 | 35 | 45 |
| NCA 10 | 75 | 45 | 40 | 35 | 35 | 45 |
| NCA 11 | 75 | 49 | 44 | 37 | 35 | 45 |
| NCA 12 | 75 | 47 | 42 | 36 | 35 | 45 |
| NCA 13 | 75 | 49 | 44 | 37 | 35 | 45 |
| NCA 14 | 75 | 45 | 40 | 35 | 35 | 45 |
| NCA 15 | 75 | 45 | 40 | 35 | 35 | 45 |
| NCA 16 | 75 | 45 | 40 | 35 | 35 | 45 |
| NCA 17 | 75 | 45 | 40 | 35 | 35 | 45 |
| NCA 18 | 75 | 45 | 40 | 36 | 35 | 45 |
| NCA 19 | 75 | 45 | 40 | 35 | 35 | 45 |
| NCA 20 | 75 | 45 | 40 | 36 | 35 | 45 |
| NCA 21 | 75 | 75 | 70 | 58 | 43 | 53 |
| NCA 22 | 75 | 75 | 70 | 58 | 43 | 53 |
| NCA 23 | 75 | 53 | 48 | 43 | 39 | 49 |
| NCA 24 | 75 | 58 | 53 | 45 | 39 | 49 |

| NCA | Noise management level dB(A) $L_{Aeq}$ | | | | | Sleep disturbance $L_{Amax}$ (RBL + 15 dB) Screening Criteria |
|---|---|---|---|---|---|---|
| | Standard construction hours (Daytime) | | Outside standard construction hours (RBL + 5dB) | | | |
| | Highly noise affected | Noise affected (RBL + 10 dB) | Daytime (7am to 6pm) | Evening (6pm to 10pm) | Night-time (10pm to 7am) | |
| NCA 25 | 75 | 58 | 53 | 45 | 39 | 49 |
| NCA 26 | 75 | 62 | 57 | 51 | 42 | 52 |
| NCA 27 | 75 | 66 | 61 | 52 | 43 | 53 |
| NCA 28 | 75 | 70 | 65 | 55 | 47 | 57 |
| NCA29 | 75 | 66 | 61 | 52 | 43 | 53 |

### *Sleep disturbance*

The assessment for construction impacts on sleep disturbance has been informed by the guidance in the CNVG and the ICNG. The ICNG indicates that the assessment of noise impacts on sleep disturbance should consider how often high noise events occur at night and the degree of maximum noise levels above the background noise level at night.

It is noted that most receiver locations across the project study area currently experience very low ambient background noise levels, particularly during the night-time period. Considering this and to protect the community against significant health impacts, this assessment has been undertaken using the ICNG and CNVG 'screening criterion' of RBL + 15 dB and maximum external 65 dB(A) criterion (Awakening reaction) as being the most stringent of the quoted literature. The sleep disturbance screening criteria for each residential receiver is shown in **Table 9-7**.

### *Construction traffic*

In accordance with the criteria provided in the CNVG (in accordance with the RNP), construction traffic noise management levels are expected to increase by more than 2dB(A) above the existing road traffic noise levels during the daytime and night-time. The criteria provided in the RNP for construction traffic noise impacts on public roads is shown in **Table 9-8**. These levels have been adopted for the construction traffic noise assessment for the project.

Table 9-8 Construction traffic noise criteria

| Road category | Type of project/land use | Assessment criteria (dBA) | |
|---|---|---|---|
| | | Daytime (7 am - 10 pm) | Night-time (10 pm - 7 am) |
| Freeway/ arterial/ sub-arterial roads | Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments | $L_{Aeq(15hour)}$ 60 (external) | $L_{Aeq(9hour)}$ 55 (external) |
| Local roads | Existing residences affected by additional traffic on existing local roads generated by land use developments | $L_{Aeq(1hour)}$ 55 (external) | $L_{Aeq(1hour)}$ 50 (external) |

### *Construction vibration – human comfort*

The CNVG sets out criteria for the potential vibration disturbance to human occupants of buildings in accordance with the Assessing Vibration: a technical guideline (DEC 2006b) and the British Standard BS 6472-1992 Evaluation of human exposure to vibration in buildings (1-80Hz) (British Standard Institute 1992).

Sources of vibration are defined as continuous, impulsive or intermittent as described in **Table 9-9**.

Table 9-9 Types of vibration

| Type of vibration | Definition | Examples |
|---|---|---|
| Continuous vibration | Continues uninterrupted for a defined period (usually throughout the day-time and/or night-time) | Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery) |
| Impulsive vibration | A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds | Infrequent: Activities that create up to 3 distinct vibration events in an assessment period (eg occasional dropping of heavy equipment, occasional loading and unloading) |
| Intermittent vibration | Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude | Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers.<br>Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria |

The guideline recommends ‘preferred’ and ‘maximum’ weighted vibration levels for both continuous vibration sources (such as steady road traffic and continuous construction activity) and for impulsive vibration sources. The ‘preferred’ and ‘maximum’ vibration levels for maintaining human comfort in residences and other sensitive receivers for continuous, impulsive and intermitted vibration are shown in **Table 9-10**.

Table 9-10 Preferred and maximum vibration levels for human comfort

| Location | Assessment period[1] | Preferred values | Maximum values |
|---|---|---|---|
| **Continuous vibration (weighted RMS acceleration, $m/s^2$, 1-80Hz)** | | | |
| Critical areas[2] | Day- or night-time | 0.0036 | 0.0072 |
| Residences | Daytime (7am-10pm) | 0.0071 | 0.014 |
| | Night-time (10pm-7am) | 0.005 | 0.010 |

| Location | Assessment period[1] | Preferred values | Maximum values |
|---|---|---|---|
| Offices, schools, educational institutions and places of worship | Day- or night-time | 0.014 | 0.028 |
| Workshops | Day- or night-time | 0.029 | 0.058 |
| **Impulsive vibration (weighted RMS acceleration, $m/s^2$, 1-80Hz)** | | | |
| Critical areas[2] | Day- or night-time | 0.0036 | 0.0072 |
| Residences | Daytime (7am-10pm) | 0.21 | 0.42 |
| | Night-time (10pm-7am) | 0.071 | 0.14 |
| Offices, schools, educational institutions and places of worship | Day- or night-time | 0.46 | 0.92 |
| Workshops | Day- or night-time | 0.46 | 0.92 |
| **Intermitted vibration (vibration dose value (VDS), $m/s^2$, 1-80Hz)** | | | |
| Critical areas[3] | Day or night-time | 0.10 | 0.20 |
| Residences | Daytime (7am-10pm) | 0.20 | 0.40 |
| | Night-time (10pm-7am) | 0.13 | 0.26 |
| Offices, schools, educational institutions and places of worship | Day or night-time | 0.40 | 0.80 |
| Workshops | Day or night-time | 0.80 | 1.60 |

*[1] - Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am*

*[2] - Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Alternative criteria is outside the scope of the policy and other guidance documents should be referred to.*

*[3] Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous of impulsive criteria for critical areas. Source: BS 6472-2-1992 (British Standard Institute 1992)*

### *Construction vibration – structural damage*

Structural damage to buildings from construction vibration associated with the project is assessed in accordance with the BS 7385: Part 2 (British Standards Institute 1993). The BS 7385 sets out criteria for cosmetic, minor and major damage as shown in **Table 9-11**.

Table 9-11 BS 7385-2 structural damage criteria

| Group | Type of structure | Damage level | Peak component particle velocity, mm/s[1] | | |
|---|---|---|---|---|---|
| | | | 4 Hz to 15 Hz | 15 Hz to 40 Hz | 40 Hz and above |
| 1 | Reinforced or framed structures Industrial and heavy commercial buildings | Cosmetic | 50 | | |
| | | Minor[2] | 100 | | |
| | | Major[2] | 200 | | |

| Group | Type of structure | Damage level | Peak component particle velocity, mm/s[1] | | |
|---|---|---|---|---|---|
| | | | 4 Hz to 15 Hz | 15 Hz to 40 Hz | 40 Hz and above |
| 2 | Un-reinforced or light framed structures Residential or light commercial type buildings | Cosmetic | 15 to 20 | 20 to 50 | 50 |
| | | Minor[2] | 30 to 40 | 40 to 100 | 100 |
| | | Major[2] | 60 to 80 | 80 to 200 | 200 |

*1 - Peak Component Particle Velocity is the maximum Peak particle velocity in any one direction (x, y, z) as measured by a tri-axial vibration transducer.*

*2 - Minor and major damage criteria established based on British Standard 7385 Part 2 (1993) Section 7.4.2*

*All levels relate to transient vibrations in low-rise buildings. Continuous vibration can give rise to dynamic magnifications that may require levels to be reduced by up to 50 per cent*

The German Institute for Standardisation DIN 4150: Part 3: 1999 Structural Vibration – Part 3: Effects of vibration on structures (German Institute Standardisation 1999) also provides guidance for structural vibration and is used in the assessment specifically for heritage listed buildings. The DIN 4150 recommends maximum limits over a range of frequencies (Hz) measured in any direction at the foundation or in the plane of the uppermost floor of a building or structure. The structural vibration limits are shown in **Table 9-12**.

Table 9-12 DIN 4150-3 structural damage criteria

| Group | Type of structure | Vibration velocity, mm/s | | | |
|---|---|---|---|---|---|
| | | At foundation at frequency of | | Plane of floor uppermost storey | |
| | | 1 Hz to 10 Hz | 10 Hz to 50 Hz | 50 Hz to 100 Hz | All frequencies |
| 1 | Buildings used for commercial purposes, industrial buildings and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 |
| 2 | Dwellings and buildings of similar design and/or use | 5 | 5 to 15 | 15 to 20 | 15 |
| 3 | Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (eg buildings under a preservation order) | 3 | 3 to 8 | 8 to 10 | 8 |

### *Blasting*

The need for blasting is discussed in **Chapter 6, Construction**. Both the CNVG and the ICNG recommend construction working hours for blasting activities as follows:

- Monday to Friday - 9am to 5pm
- Saturday - 9am to 1pm
- Sundays/public holidays – No blasting.

Consistent with recent SSI approval conditions, eg Albion Park Rail Bypass (SSI 6878), it is anticipated blasting may also be carried out outside the above hours in the following situations:

- When no sensitive receivers would be impacted by blasting

- When Roads and Maritime has an agreement with the potentially affected receivers.

Blasting can cause noise impacts through annoyance to residents and damage to buildings or structures (in extreme cases) through either blasting noise (blast overpressure) or ground vibration. Blast overpressure is the pressure wave (sound) produced by the blast and transmitted through the air. Ground vibration is the radiation of mechanical energy within a rock mass or soil.

The CNVG refers to two standards for assessing impacts caused by blasting including, the Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives (Standards Australia 2006) and the British Standard BS 7385-2 (Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration). In addition, the assessment considers the levels provided in the Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration (ANZEC 1990).

The Australian Standard (AS2187.2) recommends air blast overpressure limits and ground vibration limits for blasting. **Table 9-13** shows the air blast overpressure limits and **Table 9-14** shows the ground vibration pressure limits. However, limits can be increased in circumstances where written agreements have been sought from affected landowners.

Table 9-13 Overpressure limits for blasting

| Category | Type of blasting operations | Peak component particle velocity (mm/s) |
|---|---|---|
| **Human comfort limits** | | |
| Sensitive site* | Operations lasting longer than 12 months or more than 20 blasts | 115 dBL for 95% blasts per year. 120 dBL maximum unless agreement is reached with occupier that a higher limit may apply |
| Sensitive site* | Operations lasting for less than 12 months or less than 20 blasts | 120 dBL mm/s for 95% blasts. 125 dBL maximum unless agreement is reached with occupier that a higher limit may apply |
| Occupied non-sensitive sites, such as factories and commercial premises | All blasting | 125 dBL maximum unless agreement is reached with the occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation |
| **Damage control limits** | | |
| Structures that include masonry, plaster and plasterboard in their construction and also unoccupied structures of reinforced concrete or steel construction | All blasting | 133 dBL maximum unless agreement is reached with the owner that a higher limit may apply |
| Service structures, such as pipelines, powerlines and cables | All blasting | Limit to be determined by structural design methodology |

The Australian Standard suggests a limit of 10 millimetres per second (mm/s) peak particle velocity for human comfort for operations lasting less than 12 months as shown in **Table 9-14**.

Table 9-14 Ground vibration pressure limits

| Category | Type of blasting operations | Peak component particle velocity (mm/s) |
|---|---|---|
| **Human comfort limits** | | |
| Sensitive site* | Operations lasting longer than 12 months or more than 20 blasts | 5 mm/s for 95 % blasts per year 10 mm/s maximum unless agreement is reached with the occupier that a higher limit may apply |
| Sensitive site* | Operations lasting for less than 12 months or less than 20 blasts | 10 mm/s maximum unless agreement is reached with occupier that a higher limit may apply |
| Occupied non-sensitive sites, such as factories and commercial premises | All blasting | 25 mm/s maximum unless agreement is reached with occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below manufacturer's specifications or levels that can be shown to adversely affect the equipment operation |
| **Structural control limits** | | |
| Other structures or architectural elements that include masonry, plaster and plasterboard in their construction | All blasting | Frequency-dependent damage limit criteria Tables J4.4.2.1 and J4.4.4.1 of the standard. |
| Unoccupied structures of reinforced concrete or steel construction | All blasting | 100 mm/s maximum unless agreement is reached with the owner that a higher limit may apply |
| Service structures, such as pipelines, powerlines and cables | All blasting | Limit to be determined by structural design methodology |

## 9.3.2 Operational noise and vibration criteria

### *Noise criteria guideline*

The operational road noise assessment has been carried out in accordance with Roads and Maritime's Noise Criteria Guideline (NCG) (Roads and Maritime Services 2015c). The NCG presents Roads and Maritime's interpretation of the RNP and establishes an approach for assessing traffic noise impacts on sensitive receivers.

The NCG define a range of assessment criteria that are to be considered when assessing road traffic noise impacts on sensitive receivers. The NCG provides different criteria based on the road development type that a residence is affected by a road project. Residences may be assigned 'new', 'redeveloped', 'transition zone' or 'relative increase criteria' depending on how the project would influence noise levels. In some instance, residences may be affected by noise from both new and redeveloped roads. In these instances, the proportion of noise from each road is used to establish ‘transition zone criteria’. A further check is made to prevent large increases in noise level using the relative increase criteria.

The new road criteria apply where the road is a tunnel/bypass or has been substantially realigned outside of the NCG tolerance band and/or existing grade. However, consideration can be given to whether a road has been substantially realigned for distances less than six times the existing lane width using the local context for guidance.

The project consists of new roads, except for the following locations:

- Redeveloped roads located at upgrades to the road network that are in the existing road corridor
- Transition zones are the interface between new and redeveloped roads and are located:
  - At the southern end of the project at Englands Road interchange where it ties-in with the existing Pacific Highway
  - At the middle section of the project where the project meets Coramba Road interchange
  - At the northern end of the project at Korora Hill interchange where it ties-in with the existing Pacific Highway.

The criteria are applied to the year of opening (2024) and the design year 10 years after opening (2034). The criteria applied for sensitive residential receivers and other sensitive land uses in accordance with the NCG, are shown in **Table 9-15** and **Table 9-16** respectively.

Table 9-15 Road traffic noise assessment criteria for sensitive residential land uses

| Road category | Type of project/development | Assessment criteria (dB(A)) | |
|---|---|---|---|
| | | Daytime (7am–10pm) | Night-time (10pm–7am) |
| Freeway / arterial / sub-arterial roads | Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors | $L_{Aeq, (15 hour)}$ 55 (external) | $L_{Aeq, (9 hour)}$ 50 (external) |
| | Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads | $L_{Aeq, (15 hour)}$ 60 (external) | $L_{Aeq, (9 hour)}$ 55 (external) |
| | Existing residences affected by noise from new and redevelopment of existing freeway/arterial/sub-arterial roads (Transition zones)[1] | $L_{Aeq, (15 hour)}$ 55 - 60 (external) | $L_{Aeq, (9 hour)}$ 50 - 55 (external) |
| | New road corridor/ redevelopment of existing road/land use development with the potential to generate additional traffic on existing road | Existing traffic $L_{Aeq, (15 hour)}$ + 12 dB (external) | Existing traffic $L_{Aeq, (9 hour)}$ + 12 dB (external) |
| Local roads | Existing residences affected by noise from new local road corridors<br>Existing residences affected by noise from redevelopment of existing local roads.<br>Existing residences affected by additional traffic on existing local roads generated by land use developments | $L_{Aeq, (15 hour)}$ 55 (external) | $L_{Aeq, (9 hour)}$ 50 (external) |

*[1] The transition zone criteria are identified from the contribution difference in noise from each road type at the residences location using Table 1, section 7.1 of the NCG*

Table 9-16 Road traffic noise assessment criteria for other sensitive land uses

| Existing sensitive land use | Assessment criteria (dB(A)) | | Additional considerations |
|---|---|---|---|
| | Day (7am–10pm) | Night (10pm–7am) | |
| School classrooms | $L_{Aeq, (1\ hour)}$ 40 (internal)[1] | - | In the case of buildings used for education or healthcare, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the 'maximum' levels shown in Australian Standard 2107:2000. |
| Hospital wards | $L_{Aeq, (1\ hour)}$ 35 (internal)[1] | $L_{Aeq, (1\ hour)}$ 35 (internal)[1] | |
| Places of worship | $L_{Aeq, (1\ hour)}$ 40 (internal)[1] | $L_{Aeq, (1\ hour)}$ 40 (internal)[1] | The criteria are internal for the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship. Therefore, in determining appropriate criteria for such external areas, it should be established what in these areas may be affected by road traffic noise.<br>For example, if there is a church car park between a church and the road, compliance with the internal criteria inside the church may be sufficient. If, however, there are areas between the church and the road where outdoor services may take place such as weddings and funerals, external criteria for these areas are appropriate<br>As issues such as speech intelligibility may be a consideration in these cases, the passive recreation criteria may be applied. |
| Open space (active use) | $L_{Aeq, (15\ hour)}$ 60 (external) | - | Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.<br>Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion such as playing chess or reading.<br>In determining whether areas are used for active or passive recreation, the type of activity that occurs in that area and its sensitivity to noise intrusion should be established. For areas where there may be a mix of passive and active recreation such as school playgrounds, the more stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses. |
| Open space (passive use) | $L_{Aeq, (15\ hour)}$ 55 (external) | - | |

| Existing sensitive land use | Assessment criteria (dB(A)) | | Additional considerations |
|---|---|---|---|
| | Day (7am–10pm) | Night (10pm–7am) | |
| Childcare facilities | Sleeping rooms $L_{Aeq, (1 hour)}$ 35 (internal)[1]<br><br>Indoor play areas $L_{Aeq, (1 hour)}$ 40 (internal)[1]<br><br>Outdoor play areas $L_{Aeq, (1 hour)}$ 55 (external) | - | Multi-purpose spaces such as shared indoor play/sleeping rooms should meet the lower of the respective criteria.<br>Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility. |

*[1] For internal noise targets, the corresponding external criterion is taken as 10 dB higher. This is a conservative estimate of the sound attenuation assumed to be provided by the facade of typical buildings when the facade glazing is open for the purpose of ventilation. The ENMM provides a summary of indicative building noise reduction for various construction types. This information is reproduced in Appendix E (Table 7) for reference. Conservative assumptions for noise attenuation across building facades will need to be refined during detailed design.*

For the purpose of this assessment, it is assumed that external noise levels are 10 dB(A) higher than internal noise levels when the windows are open. This is considered to be a conservative approach.

Consideration of feasible and reasonable noise mitigation is considered where predicted noise levels exceed the noise criteria in the Noise Mitigation Guideline (NMG) (Roads and Maritime Services 2015d). The process for qualifying a receiver for consideration of noise mitigation is discussed below.

### *Noise mitigation guideline*

The NMG provides guidance in managing and controlling road traffic generated noise and describes the principles to be applied when reviewing noise mitigation.

The NMG states that the most effective way of minimising noise from vehicles and traffic is to control vehicle noise at the source. Where at-source measures are not practical, or do not provide sufficient noise reduction, additional methods are required to reduce levels to within acceptable limits. Such additional methods may include the use of low noise pavements, noise barriers and/or consideration of at-property treatments.

The NMG criteria is shown in **Table 9-17**. Sensitive receivers that exceed these criteria qualify for consideration of additional mitigation.

Table 9-17 Road traffic noise assessment criteria for residential land uses

| Assessment | Road type | Noise criteria | |
|---|---|---|---|
| | | Day (7am-10pm) (dB(A) $L_{Aeq, (15 hour)}$ | Night (10pm-7am) (dB(A) $L_{Aeq, (9 hour)}$ |
| Cumulative limit | New Road | 60 | 55 |
| | Redeveloped Road | 65 | 60 |
| | Transition Zone | 60 – 65[1] | 55 – 60[1] |
| Acute | New and Redeveloped | 65 | 60 |

*[1] Dependant on source contribution as per Section 7.1 of the NCG.*

The procedure to determine whether a receiver qualifies for consideration of additional mitigation requires analysis of the specific contribution from new, redeveloped and existing roads is required at each façade. A receiver is to be considered for additional noise mitigation if any of the following three conditions are met during the daytime or night-time periods:

The NMG provides three triggers where a receiver may qualify for consideration of noise mitigation. These include:

#### Eligibility trigger 1

- The total noise level at the receiver in the build scenario is 5 dB(A) or greater than the NCG controlling criterion and
- The total noise level at the receiver in the build scenario minus the contribution from only existing roads in the build scenario at the receiver is greater than 2 dB(A)

#### Eligibility trigger 2

- The cumulative noise level contribution, from all new and redeveloped roads part of the road project, is greater or equal to the acute level

#### Eligibility trigger 3

- The total noise level at the receiver in the build scenario is greater than the NCG controlling criterion and
- The total noise level at the receiver in the build scenario minus the total noise level at the receiver in the no-build scenario is greater than 2 dB(A).

The eligibility of receivers for consideration of additional noise mitigation is determined before the benefit of additional noise mitigation (low noise pavement and noise barriers) is included. The requirement for the project is to provide reasonable and feasible additional mitigation for these eligible receivers to meet the NCG controlling criterion. If the NCG criterion cannot be satisfied with low noise pavement and noise barriers, then the receiver is eligible for consideration of at-property treatment.

### *Sleep disturbance*

The assessment for operational impacts on sleep disturbance has been informed by the guidance in the RNP and the ENMM.

The ENMM defines screening criteria for the 'maximum noise event' for the assessment of potential sleep disturbance - $L_{Amax} \geq L_{Aeq\ (1hour)}$ + 15 dB(A). The following is also noted in the ENMM:

- Maximum internal noise levels below 50–55 dB(A) are unlikely to cause awakening reactions
- One or two noise events per night with maximum internal noise levels of 65–70 dB(A) are not likely to significantly affect health and wellbeing.

### *Operational vibration*

Criteria for operational vibration are as per construction vibration limits presented earlier in this section. However, since vehicles are well isolated from the ground by their pneumatic tyres and suspension, vibration caused by operational road traffic is expected to be well below these criteria at all sensitive receivers and is not considered further in this assessment.

### *Industrial noise*

Relocation of the Kororo Public School bus interchange and provision of jet fans within the Shephards Lane and Gatelys Road tunnels have been identified as potential sources of industrial noise because of the short-term nature of noise generating activities at those three locations. The Kororo Public School bus interchange would only be used for short periods and predominantly used during morning and afternoon school drop-off and pick-up periods. Jet fans within the Shephards Lane and Gatelys Road tunnels are not intended for routine operation and would only be used during periodic testing of the jet fans and in the unlikely event of a fire within one of the tunnels. The industrial noise assessment has been carried out in accordance with the NSW Noise Policy for Industry (NPI) (NSW EPA 2017b), which is primarily concerned with controlling short-term intrusive noise impacts for residences and maintaining long-term noise level amenity for residences and other noise sensitive land uses.

The NPI sets out the procedure to determine the project noise trigger levels relevant to an industrial development. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community and so 'trigger' a management response. The intrusive noise trigger level is determined considering the existing background noise levels near the potential source of industrial noise.

The NPI recommends amenity noise levels, which are the noise levels which all industrial noise sources combined should remain below. These levels are recommended to limit continuing increases in noise levels from application of the intrusive noise trigger levels alone. Project amenity noise levels (PANL) represent the objective for noise from a single industrial development at a receiver location and are determined based on the recommended amenity noise levels for that location.

The project specific noise levels are the lower of the intrusive noise trigger levels and the PANL. The intrusive noise trigger levels apply for a 15-minute period while the project amenity noise levels apply for the whole day period (11 hours), evening period (4 hours) and night period (9 hours).

The NPI aims to standardise the assessment period to enable a direct comparison between the two criteria. To do this, it is assumed the intrusive noise emissions (over 15 minutes) are generally higher by three dB(A) than the amenity noise emissions (over a whole period of the day). As such, a three dB(A) correction factor is applied to the project amenity noise level ($L_{Aeq\ (period)}$) to get to a project amenity noise level ($L_{Aeq\ (15\ minute)}$). The project specific noise levels in accordance with the NPI are shown in **Table 9-18**.

Table 9-18 NPI project specific noise levels

| Receiver | Time Period[1] | Project specific noise levels | | | |
|---|---|---|---|---|---|
| | | Intrusive noise trigger levels ($L_{Aeq\ (15\ minute)}$) | Project amenity noise level (PANL)[2] ($L_{Aeq\ (15\ minute)}$) | Sleep disturbance ($L_{Aeq\ (15\ minute)}$) | Sleep disturbance ($L_{Amax\ (night)}$) |
| Residential around bus interchange | Day | 53 | 63 | N/A | N/A |
| | Evening | 45 | 53 | N/A | N/A |
| | Night | 39 | 43 | 40 | 52 |
| Residential around Gatelys tunnel[3] | Day | 45 | 53 | N/A | N/A |
| | Evening | 40 | 48 | N/A | N/A |
| | Night | 35 | 43 | 40 | 52 |
| Residential around Shephards Lane tunnel[3] | Day | 45 | 53 | N/A | N/A |
| | Evening | 40 | 48 | N/A | N/A |
| | Night | 35 | 38 | 40 | 52 |

1 - *The NPI defines day, evening and night time periods as:*

- *Day: the period from 7 am to 6 pm Monday to Saturday; or 8 am to 6 pm on Sundays and public holidays*
- *Evening: the period from 6 pm to 10 pm*
- *Night: the remaining period.*

*2 In accordance with NPI, PANL ($L_{Aeq\ (period)}$) adjusted up by 3 dB for comparison with intrusive noise trigger levels ($L_{Aeq\ (15\ minute)}$).*

*3 - NPI recommends correction factors for one off events where a single event is continuous for a period of less than two and half hours. The correction factor allows the project noise trigger level to be increased. The noise trigger levels for the Gatelys Road and Shephards Lane tunnels include a +5 dB correction on the assumption jet fan testing would occur during the daytime period and for not longer than one hour*

# 9.4 Assessment of potential impacts

## 9.4.1 Construction noise and vibration impacts

Construction and vibration impacts have been predicted based on the indicative construction activities and durations presented in **Chapter 6, Construction**. Impacts have been predicted during standard construction working hours and for the likely out of hours work.

A summary of the typical construction activities and plant and equipment likely to be used for a large-scale road project is provided in **Appendix G, Noise and vibration assessment**.

### *Predicted construction noise levels*

Predicted construction noise levels are based on the worst affected receiver(s) for the NCA and provide a comparison of the applicable noise management level for each NCA. The assessment is representative of the worst case 15-minute periods of construction activity and does not necessarily reflect the noise impact at noise sensitive receivers for an extended period of time. However, most construction activities (aside from fixed sites such as ancillary sites) would be intermittent and would generally tend to move within the construction footprint and therefore the noise impacts experienced at any sensitive receiver would be far less.

To facilitate construction of the project, ancillary facilities would be required for site compounds, batching plants (concrete and asphalt), crushing and screening plant, stockpiles and precast facilities (see **Chapter 6, Construction** for more information). A summary of NML exceedances for works in the ancillary sites is provided in **Appendix G, Noise and vibration assessment**.

Predicted construction noise exceedances for standard construction working hours and out of hours work have been provided in **Appendix G, Noise and vibration assessment** and include bridge works, tunnel works, paving and asphalting**.** Results show significant exceedances are expected to occur for all construction activities modelled and are also anticipated during typical construction activities, particularly if those activities are to be undertaken during night-time. This is largely due to the existing low noise environment (and therefore low construction noise criteria) and the proximity of residences to the construction work sites, which extend along the entire length of the project. Therefore, construction noise criteria exceedances are difficult to avoid.

Construction activities during standard working hours for the noisiest construction activities are predicted to exceed the noise management level in most NCAs, except for NCA4 (industrial), NCA21 (commercial and residential) and NCA22 (residential).

The NCAs with the greatest number of exceedances during standard working hours are NCA06 (unbuilt residential), NCA13 (residential), NCA14 (residential), NCA16 (unbuilt residential) and NCA18 (residential).

The ICNG recognises there are some situations where specific construction work may need to be carried out outside of the recommended standard construction hours. The following are the categories of work that may be carried out outside the recommended standard hours:

- Delivery of oversized plant or structures that the police or other authorities determine require special arrangement to transport along public roads
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
- Public infrastructure works that shorten the duration of construction and are supported by the affected community
- Work where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours.

Potential activities associated with the last category of work are detailed in **Chapter 6, Construction**, which includes likely locations (construction zones) and justification for the work.

Anticipated out of hours work are indicative only and would be finalised at detailed design. A project-specific Noise and Vibration Management Plans (NVMP) will be developed to identify potential noise issues and management methods to minimise noise impacts on the community. Activities would generally not take place outside standard hours without prior discussion with and/or notification of local community and the EPA except in the case of an emergency.

**Table 9-19** summarises the anticipated construction scenarios and corresponding anticipated timing for the project.

Table 9-19 Indicative construction scenarios and timing

| Scenario | Indicative duration[1] (months) | Hours of works | | | |
|---|---|---|---|---|---|
| | | Day (Standard) | Day (OOH[2]) | Evening | Night |
| Pre-construction and site establishment | 9 | Yes | Yes | Yes | Yes |
| Site preparation and bulk earthworks | 27 | Yes | No | No | No |
| Drainage | 24 | Yes | Yes | Yes | Yes |
| Bridge work | 34 | Yes | Yes | Yes | Yes |
| Tunnel work | 24 | Yes | Yes | Yes | Yes |
| Road work and road surfacing | 27 | Yes | Yes | Yes | Yes |
| Finishing work | 12 | Yes | Yes | Yes | Yes |

*1 - Durations should be regarded as indicative and represent typical works. The durations will differ at the various sites and the longest duration is presented.*

*2 - Out of hours (OOH). During the daytime, this refers to the period on Saturday between 7am – 8am and 1pm – 6pm, on Sunday and public holidays between 8am – 6pm.*

Construction activities during out of hours work are predicted to exceed the noise management level in most NCAs except for NCA04 (industrial).

The NCAs with the greatest number of exceedances during out of hours work are NCA06 (unbuilt residential), NCA13 (residential), NCA14 (residential), NCA16 (residential), NCA18 (residential), NCA26 (residential) and NCA28 (residential).

Non-residential sensitive receivers that would experience construction noise exceedances during standard construction hours are Bishop Druitt College and Kororo Public School. No non-residential sensitive receivers would experience construction noise exceedance for outside of standard hours construction work.

### Sleep disturbance

As shown in **Table 9-20**, exceedances of sleep disturbance criteria (screening criterion RBL+15) for the worst-case construction activity (Roadworks), are predicted for residential receivers in all NCAs except NCA05. Similarly, exceedances of awakening criteria are predicted for residential receivers in all NCAs except NCA05, NCA07, NCA08, NCA10, NCA11 and NCA14. All modelled construction activities in **Appendix G, Noise and vibration assessment** were shown to have the potential to exceed sleep disturbance levels.

Table 9-20 Predicted construction noise exceedances

| NCA | | Number of receivers exceeding NMLs and sleep disturbance criteria (roadworks) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | All hours | Standard hours | Outside of standard hours | | | Sleep disturbance | |
| | | Highly noise affected >75dB(A) | Daytime | Daytime | Evening | Night | Night | |
| | | | | | | | Screening criterion RBL+15 | Awakening criterion >65 dB(A) |
| NCA01 | Residential | - | - | - | 7 | 27 | 27 | 24 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA02 | Residential | - | 5 | 7 | 11 | 13 | 12 | 6 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA03 | Residential | - | - | - | - | - | - | - |
| | Residential (unbuilt) | - | 9 | 57 | 80 | 142 | 127 | 17 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| | Hospital | - | - | - | - | - | N/A | N/A |
| NCA04 | Commercial | - | - | - | - | - | N/A | N/A |
| | Industrial | - | - | - | - | - | N/A | N/A |
| NCA05 | Hospital | - | - | - | - | - | N/A | N/A |
| | Commercial | - | - | - | - | - | N/A | N/A |
| | Industrial | - | - | - | - | - | N/A | N/A |
| | Place of worship | - | - | - | - | - | N/A | N/A |
| | Childcare facility | - | - | - | - | - | N/A | N/A |

| NCA | | Number of receivers exceeding NMLs and sleep disturbance criteria (roadworks) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | All hours | Standard hours | Outside of standard hours | | | Sleep disturbance | |
| | | Highly noise affected >75dB(A) | Daytime | Daytime | Evening | Night | Night | |
| | | | | | | | Screening criterion RBL+15 | Awakening criterion >65 dB(A) |
| NCA06 | Residential | - | 24 | 25 | 26 | 29 | 27 | 15 |
| | Residential (unbuilt) | | 83 | 115 | 143 | 156 | 161 | 6 |
| | Education | - | - | - | - | - | N/A | N/A |
| NCA07 | Residential | - | 2 | 3 | 3 | 3 | 3 | - |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA08 | Residential | - | 7 | 7 | 7 | 7 | 7 | - |
| | Education | - | - | - | - | - | N/A | N/A |
| NCA09 | Residential | - | - | - | - | - | - | - |
| NCA10 | Residential | - | 2 | 3 | 5 | 5 | 3 | - |
| NCA11 | Residential | - | 1 | 7 | 32 | 35 | 25 | - |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA12 | Residential | - | 19 | 34 | 39 | 39 | 39 | 13 |
| NCA13 | Residential | - | 44 | 109 | 131 | 131 | 131 | 21 |
| | Childcare facility | - | - | - | - | - | N/A | N/A |
| NCA14 | Residential | - | 15 | 85 | 109 | 109 | 102 | - |
| NCA15 | Residential | - | 7 | 12 | 14 | 14 | 13 | 1 |

| NCA | | Number of receivers exceeding NMLs and sleep disturbance criteria (roadworks) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | All hours | Standard hours | Outside of standard hours | | | Sleep disturbance | |
| | | Highly noise affected >75dB(A) | Daytime | Daytime | Evening | Night | Night | |
| | | | | | | | Screening criterion RBL+15 | Awakening criterion >65 dB(A) |
| NCA16 | Residential | - | 3 | 15 | 40 | 40 | 43 | - |
| NCA16 | Residential (unbuilt) | - | 40 | 49 | 63 | 63 | 63 | 29 |
| NCA17 | Residential | - | 3 | 3 | 3 | 3 | 3 | 3 |
| NCA18 | Residential | - | 10 | 58 | 157 | 164 | 130 | 2 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA19 | Residential | - | 11 | 11 | 11 | 11 | 11 | 3 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA20 | Residential | - | 5 | 8 | 8 | 8 | 8 | 2 |
| NCA21 | Residential | - | - | - | 2 | 33 | 34 | 14 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA22 | Residential | - | - | - | - | 14 | 11 | 6 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA23 | Residential | - | 5 | 8 | 10 | 10 | 9 | 3 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA24 | Residential | - | 9 | 26 | 58 | 103 | 71 | 21 |
| NCA25 | Residential | - | 6 | 29 | 100 | 159 | 120 | 34 |
| | Commercial | - | - | - | - | - | N/A | N/A |

| NCA | | Number of receivers exceeding NMLs and sleep disturbance criteria (roadworks) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | All hours | Standard hours | Outside of standard hours | | | Sleep disturbance | |
| | | Highly noise affected >75dB(A) | Daytime | Daytime | Evening | Night | Night | |
| | | | | | | | Screening criterion RBL+15 | Awakening criterion >65 dB(A) |
| NCA26 | Residential | - | 12 | 27 | 67 | 176 | 123 | 43 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| | Education | - | 13 | - | - | - | N/A | N/A |
| NCA27 | Residential | - | 0 | 2 | 12 | 52 | 35 | 9 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA28 | Residential | - | 1 | 5 | 39 | 115 | 127 | 85 |
| | Commercial | - | - | - | - | - | N/A | N/A |
| NCA29 | Residential | - | 1 | 3 | 9 | 12 | 12 | 8 |

### *Construction groundborne noise*

Screening buffer zones around the tunnel sites were calculated using equation 24 from the Transport Research Laboratory Report 429: Groundborne vibration caused by mechanised construction works (Transport Research Laboratory 2000) and shown in Appendix J of **Appendix G, Noise and vibration assessment**.

Predicted construction groundborne noise levels would be below the criteria outlined in **Section 9.3.1** for receivers further than 41 m from the point of emission during daytime and receivers further than 51 m during night-time. These distances are indicative only and would need to be confirmed by the construction contractor.

### *Construction traffic noise*

Construction traffic would generate noise over a relatively wide area and beyond the construction footprint itself. It would be expected that traffic noise would be greatest where there is a concentration of vehicle movements, such as at ancillary sites, batching plant locations and where construction is occurring at a given time.

Relative increases in road traffic noise impacts are not expected to be significant for haulage routes that use established arterial roads, such as the existing Pacific Highway. For sub-arterial roads located within the project assessment, an analysis has been carried out of the expected change in overall traffic volumes due to construction of the project.

Existing traffic and projected increases in traffic volumes because of construction have been derived from a traffic study carried for the project considering the construction access routes identified in **Chapter 6, Construction**.

An assessment was carried out, using the CoRTN algorithm to predict potential increases in road traffic noise as well as potential overall noise level along the construction access routes because of construction of the project. As defined in the CNVG, an initial screening test was applied to evaluate whether noise levels were predicted to increase by more than two dBA because of construction traffic.

Results of this assessment show that where existing traffic flows are low, a two dB increase is predicted. Noise sensitive receivers situated within the minimum offset distances identified also have the potential to exceed RNP noise criteria for existing roads. Table 54 in **Appendix G, Noise and vibration assessment** provides a summary of the daily average existing traffic volumes over the construction footprint based on the following assumptions:

- For works in greenfield areas, 90 per cent of predicted daily peak construction traffic would travel along construction access roads during the daytime and 10 per cent during night-time (for deliveries)
- For works on the existing Pacific Highway, 100 per cent of daily peak construction traffic are expected during night-time on the existing Pacific Highway.

Where increases of more than two dBA were predicted, the predicted overall noise levels were assessed against the RNP criteria for sub-arterial roads. The minimum distance at which the RNP assessment criteria are met was then calculated. Noise sensitive receivers within this buffer zone have the potential to exceed noise assessment criteria.

Results show that for construction works on or near the existing Pacific Highway, increases in road traffic noise due to construction traffic are expected to remain below two dBA.

**Table 9-21** shows a summary of the results of the assessment of the average existing traffic volumes and expected peak daily construction traffic volumes over the duration of construction activities.

Further assessment of construction traffic noise impacts would be undertaken during detailed design to confirm likely impacts.

Table 9-21 Construction traffic noise assessment

| Road name | Daytime | | | Night-time | | |
|---|---|---|---|---|---|---|
| | Noise level increase (dB) | Relative increase screening criterion exceeded? | Min distance from the road at which daytime RNP criterion is met (m) | Noise level increase (dB) | Relative increase screening criterion exceeded? | Min distance from the road at which daytime RNP criterion is met (m) |
| Englands Road | 2.4 | Yes | 85 | 1.4 | No | N/A[1] |
| | 11.7 | Yes | 45 | 9.9 | Yes | 33 |
| North Boambee Road | 3.4 | Yes | 71 | 2.0 | No | N/A[1] |
| | 11.5 | Yes | 48 | 11.2 | Yes | 34 |
| Coramba Road | 2.3 | Yes | 145 | 1.2 | No | N/A[1] |
| | 2.1 | Yes | 155 | 1.1 | No | N/A[1] |
| Shephards Lane | 2.8 | Yes | 22 | 2.7 | Yes | 21 |
| | 57.3 | Yes | 12 | 50.5 | Yes | 6 |
| Mackays Road | 1.7 | No | N/A[1] | 0.9 | No | N/A[1] |
| | 4.3 | Yes | 20 | 3.0 | Yes | 9 |
| West Korora Road | 11.1 | Yes | 39 | 11.6 | Yes | 27 |
| | 63.2 | Yes | 36 | 56.9 | Yes | 29 |
| Bruxner Park Road | 9.1 | Yes | 44 | 6.1 | Yes | 33 |
| | 8.8 | Yes | 44 | 5.7 | Yes | 34 |
| James Small Drive | 0.5 | No | N/A[1] | 0.2 | No | N/A[1] |
| Old Coast Road | 2.1 | Yes | 21 | 1.3 | No | N/A[1] |
| Pacific Highway (south of Englands Road) | 0.3 | No | N/A[1] | 0.1 | No | N/A[1] |
| | 0.3 | No | N/A[1] | 0.1 | No | N/A[1] |
| Pacific Highway (south of West Korora Road) | 0.2 | No | N/A[1] | 0.1 | No | N/A[1] |
| | 0.2 | No | N/A[1] | 0.1 | No | N/A[1] |
| Pacific Highway (south of Bruxner Park Road) | 0.2 | No | N/A[1] | 0.1 | No | N/A[1] |
| | 0.2 | No | N/A[1] | 0.1 | No | N/A[1] |
| Pacific Highway (south of Opal Boulevard) | 0.2 | No | N/A[1] | 0.1 | No | N/A[1] |
| | 0.2 | No | N/A[1] | 0.1 | No | N/A[1] |

*1 - Relative increase screening criteria not exceeded therefore overall assessment of noise impact not required in accordance with CNVG.*

*Note: Road extent is outside 600 m assessment boundary and therefore is not included as part of the construction traffic noise assessment*

### *Construction vibration*

The CNVG provides minimum working distances from sensitive receivers for typical items of vibration intensive plant. These minimum distances are included in **Table 9-22**. The minimum distances are quoted for both 'cosmetic' damage as per BS 7385: Part 2 (British Standards Institute, 1993) and for human comfort as per Assessing Vibration: a technical guideline (DEC 2006b). It is noted that more stringent conditions may apply to heritage or other sensitive structures and would need to be addressed on a case by case basis.

The minimum working distances for cosmetic damage should be complied with at all times. Because the minimum working distances in **Table 9-22** are indicative only and would vary depending on the particular item of plant and local geotechnical conditions. Confirmation of the minimum working distances will be undertaken during detailed design following further consideration of construction methodologies and further geotechnical conditions. Where minimum working distances for cosmetic damage cannot be complied with and it is determined that relevant criteria are exceeded, alternative low-vibration work practices will be investigated and implemented.

Unlisted heritage items such as the Old Coast Road Bridge No. 1 and Old Coast Road Bridge No. 2 (timber beam bridges) and the North Coast Railway have been considered in the construction vibration assessment. The North Coast Railway, while identified as a heritage item, is not considered sensitive to potential vibration damage as vibration created by the operation of trains are likely to be greater than vibration created by construction works.

The Old Coast Road Bridge No. 1 and Old Coast Road Bridge No. 2 may be impacted by vibration activities because of their proximity to the construction works. However, vibration from vehicles traversing the bridge is likely to cause greater vibration impacts than those caused by construction work. The superstructure of the bridge has been replaced with modern components and this may reduce potential vibration impacts. The structural integrity of Old Coast Road Bridge No. 1 and Old Coast Road Bridge No. 2 will be confirmed by a suitably qualified structural engineer. The results from inspection will be documented and used to verify the applicable vibration criteria, any construction vehicle restrictions and any feasible and reasonable mitigation measures to be implemented.

It is not anticipated that Aboriginal sites would be susceptible to impacts from construction vibration because of the nature of the sites in the construction footprint (ie artefact scatters and significant landscape features such as Roberts Hills ridge).

Vibration impacts on other sensitive receivers (ie the Boambee Equestrian Centre) have been considered under the same criteria as that established for human comfort. Impacts are not expected provided that horses are being kept/trained outside of the human comfort buffer zone as outlined in **Table 9-22**. Further consultation with the Boambee Equestrian Centre would be carried out during detailed design following further consideration of construction methodologies and geotechnical conditions to ensure appropriate work practices are implemented to minimise the risk of potential vibration impacts.

Table 9-22 CNVG recommended minimum working distances for vibration intensive plant

| Plant item | Rating/description | Safe working distance | |
|---|---|---|---|
| | | Cosmetic damage | Human response |
| Vibratory roller | < 50 kN (Typically 1-2 t) | 5 m | 15 m to 20 m |
| | < 100 kN (Typically 2-4 t) | 6 m | 20 m |
| | < 200 kN (Typically 4-6 t) | 12 m | 40 m |
| | < 300 kN (Typically 7-13 t) | 15 m | 100 m |
| | > 300 kN (Typically 13-18 t) | 20 m | 100 m |

| Plant item | Rating/description | Safe working distance | |
|---|---|---|---|
| | | Cosmetic damage | Human response |
| | > 300 kN (Typically > 18 t) | 25 m | 100 m |
| Small hydraulic hammer | 300 kg - 5 to 12t excavator | 2 m | 7 m |
| Medium hydraulic hammer | 900 kg - 12 to 18 t excavator | 7 m | 23 m |
| Large hydraulic hammer | 1600 kg - 18 to 34 t excavator | 22 m | 73 m |
| Vibratory pile driver | Sheet piles | 2 m to 20 m | 20 m |
| Pile boring | ≤ 800 mm | 2 m (nominal) | 4 m |
| Jackhammer | Hand held | 1 m (nominal) | 2 m |

A summary of receivers within each NCA which may experience potential construction vibration impacts is provided in **Table 9-23**

Table 9-23 Potential construction vibration impacts

| NCA | Potential construction vibration impacts |
|---|---|
| 1 | Most residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at some receivers. |
| 2 | Four residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at two receivers. |
| 3 | There are no receivers within the 100 m boundary around construction activities. It is not expected receivers would perceive vibration levels from construction activities. |
| 4 | A commercial and an industrial receiver are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers. |

| NCA | Potential construction vibration impacts |
|---|---|
| 5 | A few commercial receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 6 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 7 | There are no receivers within the 100 m boundary around construction activities. It is not expected receivers would perceive vibration levels from construction activities. |
| 8 | A residential receiver is located within the 100 m boundary around construction activities. It is possible that this receiver may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receiver closest to the construction footprint around the ancillary site. |
| 10 | A residential receiver is located within the 100 m boundary around construction activities. It is possible that this receiver may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers. |
| 11 | Three residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receiver closest to the construction footprint. |
| 12 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 13 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 14 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at a receiver closest to the construction footprint. |

| NCA | Potential construction vibration impacts |
|---|---|
| 15 | A couple of residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers. |
| 16 | There are no receivers within the 100 m boundary around construction activities. It is not expected receivers would perceive vibration levels from construction activities. |
| 17 | A residential receiver is located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers. |
| 18 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at a receiver closest to the construction footprint. |
| 19 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at a receiver closest to the construction footprint. |
| 20 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at a receiver closest to the construction footprint. |
| 21 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 22 | A few residential receivers and a commercial receiver are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at a receiver closest to the construction footprint. |
| 23 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at a receiver closest to the construction footprint. |

| NCA | Potential construction vibration impacts |
| --- | --- |
| 24 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 25 | A few residential receivers and a commercial receiver are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 26 | A few residential receivers, an education facility and a commercial receiver are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 27 | A few residential receivers and a few commercial receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint or the timber bridge heritage structure |
| 28 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |
| 29 | A few residential receivers are located within the 100 m boundary around construction activities. It is possible that some receivers may perceive the construction vibration above the human comfort level when construction activities include the use of equipment including heavy vibratory rollers or large hydraulic hammers.<br>Depending on the type of equipment used, the cosmetic damage vibration criteria could be exceeded at receivers closest to the construction footprint. |

### *Blasting*

Air blast overpressure and ground vibration were estimated using distance relationship calculations. Blasting was assumed to occur in average conditions for this assessment, as recommended in BS 7385-2. Distances to the nearest potentially affected sensitive receivers were determined based on the potential blasting locations and the extent of excavations identified in **Chapter 6, Construction**.

The potential maximum blast size (or the maximum instantaneous charge (MIC)) was determined for the nearest sensitive receiver in each of the NCAs where blasting is proposed. The results are provided in **Table 9-24**. These limits are indicative only and represent the maximum blast size at each location to comply with the current guidelines, as outlined in **Section 9.3.1**. Limits would need to be confirmed by the construction contractor.

Table 9-24 Indicative maximum instantaneous charge (MIC) limits for air blast overpressure and ground vibration

| NCA | Type | Distance (m) | Air blast overpressure | | Ground vibration | |
|---|---|---|---|---|---|---|
| | | | Overpressure criterion (dBL) | MIC (kg) | Peak particle velocity (mm/s) | MIC (kg) |
| NCA06 | Residential | 100 | 120 | 3 | 5 | 12 |
| NCA10 | Residential | 178 | 120 | 15 | 5 | 36 |
| NCA10 | Residential | 81 | 120 | 1 | 5 | 7 |
| NCA11 | Commercial | 333 | 125 | 318 | 25 | 938 |
| NCA11 | Residential | 82 | 120 | 1 | 5 | 8 |
| NCA12 | Residential | 31 | 120 | <1 | 5 | 1 |
| NCA13 | Childcare facility | 494 | 120 | 314 | 5 | 275 |
| NCA13 | Residential | 143 | 120 | 8 | 5 | 23 |
| NCA14 | Residential | 108 | 120 | 3 | 5 | 13 |
| NCA14 | Residential | 128 | 120 | 5 | 5 | 19 |
| NCA14 | Residential | 190 | 120 | 18 | 5 | 41 |
| NCA15 | Residential | 76 | 120 | 1 | 5 | 7 |
| NCA15 | Residential | 136 | 120 | 7 | 5 | 21 |
| NCA16 | Residential | 157 | 120 | 10 | 5 | 28 |
| NCA16 | Residential | 28 | 120 | <1 | 5 | <1 |
| NCA17 | Residential | 116 | 120 | 4 | 5 | 15 |
| NCA17 | Residential | 155 | 120 | 10 | 5 | 27 |
| NCA19 | Commercial | 499 | 125 | 1065 | 25 | 2101 |
| NCA19 | Residential | 240 | 120 | 36 | 5 | 65 |
| NCA19 | Residential | 144 | 120 | 8 | 5 | 23 |
| NCA20 | Residential | 130 | 120 | 6 | 5 | 19 |
| NCA21 | Commercial | 412 | 125 | 599 | 25 | 1432 |
| NCA22 | Commercial | 381 | 125 | 476 | 25 | 1228 |
| NCA23 | Commercial | 380 | 125 | 471 | 25 | 1219 |
| NCA23 | Residential | 113 | 120 | 4 | 5 | 14 |

### *Health impacts from construction noise*

A review of the construction noise and vibration assessment regarding potential health impacts identified a large number of sensitive receivers exceeding the construction noise criteria described in **Section 9.3.1** for the recommended standard construction hours as well as for daytime, evening and night-time periods for out of hours works. Exceedances for sleep disturbance criteria were also noted.

The construction noise criteria have been established on the basis of noise annoyance or specific health effects such as sleep disturbance, which are considered to be the effects that precede physiological effects.

As such, where the criteria cannot be met then there is the potential for the above adverse health effects to occur for the receivers in the vicinity of the project, such as sleep disturbance and annoyance.

However, with the implementation of management and mitigation measures described in **Section 9.5**, the potential for construction noise and vibration to adversely impact community health is minimised.

## 9.4.2 Operational noise impacts

### *Predicted noise levels*

Traffic noise levels ten years on from completion of the project (2034) are predicted to exceed the NCG criteria at 1582 sensitive receivers within the study area with no mitigation applied, as shown in **Table 9-25** and on **Figure 9-3-01** to **Figure 9-3-06**.

This includes 13 non-residential sensitive receivers and 1569 individual residential dwellings. A total of 1316 sensitive receivers have been identified as qualifying for consideration of noise mitigation 10 years after project completion as shown in **Table 9-25**.

Generally, noise catchment areas located further away from the existing Pacific Highway (eg NCA06 to NCA20) would experience a greater change in the sound environment as a new sound source would be introduced. The change in noise level varies on a case-by-case basis as the exposure of each receiver to the project relies on specific features in the terrain as well as shielding from adjacent buildings.

Day and night-time noise contour maps for ten years on from completion of the project (2034) for the ‘build’ and ‘no-build’ scenarios are provided Appendix G of **Appendix G, Noise and vibration assessment**.

Although there are traffic noise exceedances at a number of sensitive receivers, it should be noted that there would be a substantial reduction in noise impacts from vehicles using the existing Pacific Highway through the Coffs Harbour CBD. The majority of semi-trailers and B-doubles would be expected to bypass the Coffs Harbour CBD, with the overall traffic numbers predicted to decrease by up to 12,600 vehicles per day on year of opening (refer to **Chapter 8, Traffic and transport**). The majority of residual heavy vehicle movements within town would likely be small to medium sized heavy vehicles.

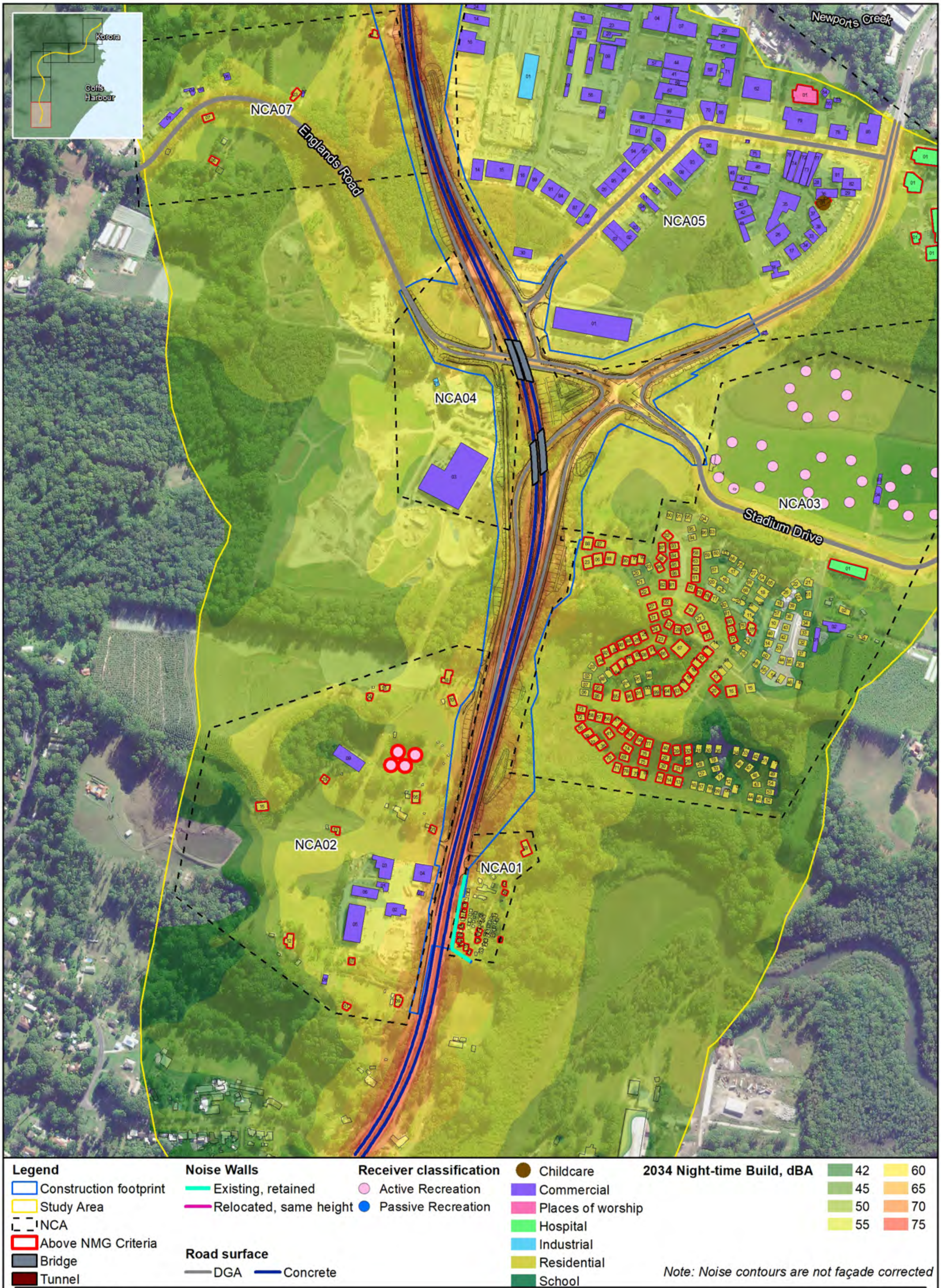
This reduction in noise impacts through the more populated area of Coffs Harbour CBD is not quantitatively captured in the noise modelling as focus has been placed on opportunities to reduce increases in noise impact. However, the overall reduction in traffic and associated traffic noise through the Coffs Harbour CBD is considered a benefit of the project.

Table 9-25 Number of noise sensitive receivers that exceed 2034 operational noise criteria with no additional noise mitigation in place and those that qualify for consideration of mitigation

| NCA | Receiver type | NCG eligibility triggers | | | Total number of exceedances of NCG | Total number receivers that qualify for consideration of noise mitigation as per the NMG |
|---|---|---|---|---|---|---|
| | | Cumulative limit | Acute | >+2dB and >NCG | | |
| NCA01 | Residential | 14 | 14 | 4 | 27 | 16 |
| NCA02 | Residential | 9 | 9 | 10 | 13 | 13 |
| | Active recreation | 0 | 0 | 1 | 1 | 1 |
| NCA03 | Residential | 69 | 39 | 75 | 169 | 108 |
| | Hospital | 1 | 0 | 0 | 1 | 1 |
| | Active recreation | 0 | 0 | 0 | 1 | 0 |
| NCA05 | Hospital | 1 | 0 | 0 | 1 | 1 |
| | Place of worship | 1 | 0 | 1 | 1 | 1 |
| | Childcare facility | 1 | 0 | 0 | 1 | 1 |
| NCA06 | Residential | 215 | 5 | 316 | 317 | 317 |
| | School | 1 | 1 | 1 | 1 | 1 |
| | Place of worship | 0 | 0 | 1 | 1 | 1 |
| NCA07 | Residential | 4 | 1 | 4 | 4 | 4 |
| NCA08 | Residential | 7 | 2 | 7 | 7 | 7 |
| | School | 1 | 1 | 1 | 1 | 1 |
| NCA10 | Residential | 4 | 1 | 4 | 4 | 4 |
| NCA11 | Residential | 2 | 0 | 9 | 23 | 9 |
| NCA12 | Residential | 12 | 5 | 23 | 29 | 25 |
| NCA13 | Residential | 9 | 0 | 95 | 117 | 95 |
| | Childcare facility | 0 | 0 | 1 | 1 | 1 |
| NCA14 | Residential | 14 | 0 | 106 | 109 | 106 |
| NCA15 | Residential | 12 | 4 | 15 | 15 | 15 |
| NCA16 | Residential | 86 | 2 | 182 | 187 | 182 |

| NCA | Receiver type | NCG eligibility triggers | | | Total number of exceedances of NCG | Total number receivers that qualify for consideration of noise mitigation as per the NMG |
|---|---|---|---|---|---|---|
| | | Cumulative limit | Acute | >+2dB and >NCG | | |
| NCA17 | Residential | 3 | 1 | 3 | 3 | 3 |
| NCA18 | Residential | 110 | 4 | 214 | 217 | 214 |
| NCA19 | Residential | 11 | 7 | 11 | 11 | 11 |
| NCA20 | Residential | 5 | 2 | 8 | 8 | 8 |
| NCA21 | Residential | 2 | 2 | 1 | 12 | 3 |
| | Active recreation | 0 | 0 | 0 | | |
| NCA22 | Residential | 0 | 0 | 0 | 27 | 0 |
| | Active recreation | 0 | 0 | 0 | | |
| NCA23 | Residential | 4 | 3 | 6 | 8 | 6 |
| | Passive recreation | 1 | 0 | 0 | 1 | 1 |
| NCA24 | Residential | 22 | 6 | 10 | 55 | 26 |
| NCA25 | Residential | 1 | 1 | 0 | 17 | 1 |
| NCA26 | Residential | 39 | 39 | 24 | 73 | 56 |
| | School | 2 | 2 | 1 | 2 | 2 |
| NCA27 | Residential | 10 | 10 | 11 | 22 | 14 |
| NCA28 | Residential | 20 | 20 | 41 | 86 | 56 |
| NCA29 | Residential | 4 | 3 | 3 | 9 | 5 |
| | | | | **TOTAL** | **1582** | **1316** |

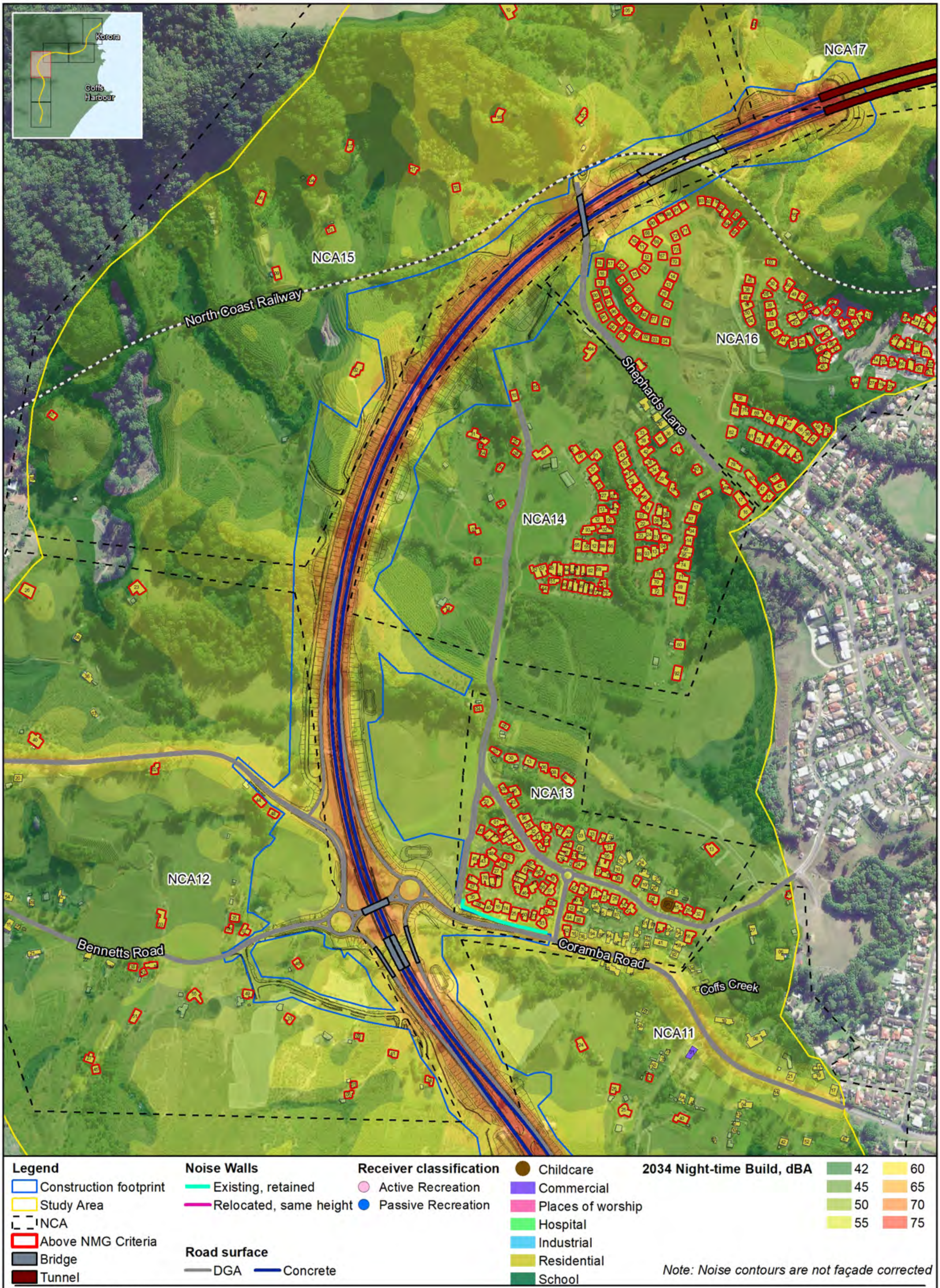
[1] *Only commercial / industrial receivers located in NCA04*



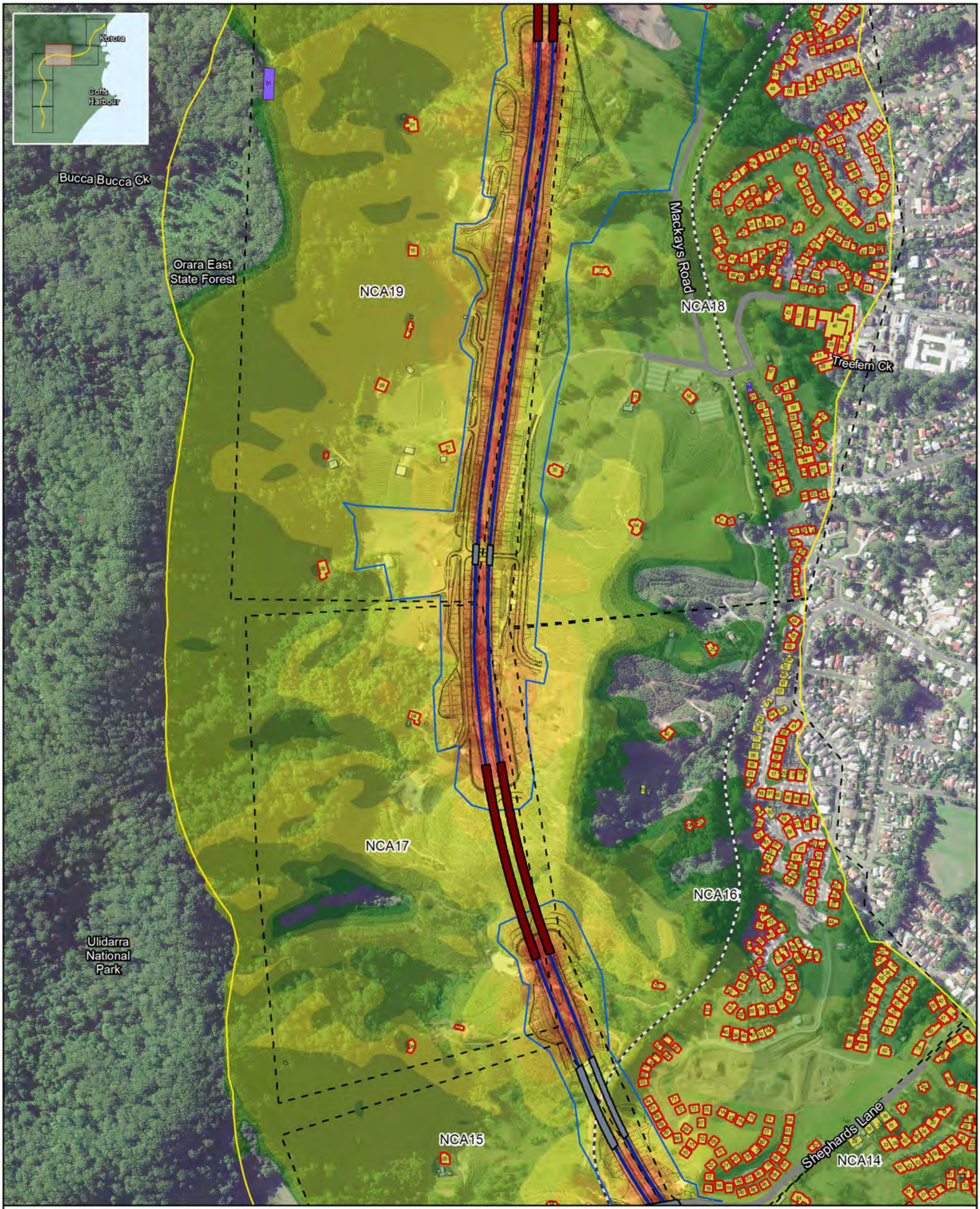

Coff Harbour Bypass
2034 night-time build - unmitigated
Figure 9-3-01

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56
N


Coff Harbour Bypass
2034 night-time build - unmitigated
Figure 9-3-02




Coff Harbour Bypass
2034 night-time build - unmitigated
Figure 9-3-03




**Legend**
- Construction footprint
- Study Area
- NCA
- Above NMG Criteria
- Bridge
- Tunnel

**Noise Walls**
- Existing, retained
- Relocated, same height

**Road surface**
- DGA
- Concrete

**Receiver classification**
- Active Recreation
- Passive Recreation
- Childcare
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

**2034 Night-time Build, dBA**
42, 45, 50, 55, 60, 65, 70, 75

*Note: Noise contours are not façade corrected*

Coff Harbour Bypass
2034 night-time build - unmitigated
Figure 9-3-04

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56


**Legend**
- Construction footprint
- Study Area
- NCA
- Above NMG Criteria
- Bridge
- Tunnel

**Noise Walls**
- Existing, retained
- Relocated, same height

**Road surface**
- DGA
- Concrete

**Receiver classification**
- Active Recreation
- Passive Recreation
- Childcare
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

**2034 Night-time Build, dBA**
42, 45, 50, 55, 60, 65, 70, 75

*Note: Noise contours are not façade corrected*

Coff Harbour Bypass
2034 night-time build - unmitigated
Figure 9-3-05

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56


Coff Harbour Bypass
2034 night-time build - unmitigated
Figure 9-3-06

### *Sleep disturbance*

Maximum noise events, including compression braking, are assessed against the provisions of Practice Note (iii) of the ENMM (RTA 2001b). The following is also noted in the ENMM:

- Maximum internal noise levels below 50–55 dB(A) are unlikely to cause awakening reactions
- One or two noise events per night with maximum internal noise levels of 65–70 dB(A) are not likely to significantly affect health and wellbeing.

One of the major causes of maximum noise level events is the use of engine brakes on heavy vehicles. This is due to the low-frequency nature of the noise, which has relatively low attenuation with propagation distance, and also the characteristic sound.

A review of relative noise impacts due to typical compression braking events as compared to free-flowing heavy vehicle traffic was undertaken in **Appendix G, Noise and vibration assessment** based on data regarding the type of heavy vehicles currently in use on NSW highways and likely to be in use on the project. This review indicates that noise levels from compression brake events are noted to be within 9 dB $LA_{max}$ of passby events at 80 km/hr. This would potentially be greater at larger distances due to the low frequency nature of compression braking. However, during detailed design Roads and Maritime would investigate opportunities to further refine the design and assess the need for installation of signage to limit use of compression brakes by heavy vehicles in highly populated residential areas. These signs are currently used on the existing Pacific Highway at Coffs Harbour to minimise compression braking events and associated potential for sleep disturbance.

### *Operational vibration*

Operational vibration arises from vehicles travelling on an uneven pavement (bumps, old joints etc) which would not be the case with a brand-new pavement. Further, operational vibration from road traffic movements is low because the vehicles are generally well isolated from the ground by pneumatic tyres and vehicle suspension systems. Therefore, there are not expected to be any operational vibration impacts associated with the project.

### *Industrial noise*

#### Kororo Public School bus interchange

Buses travelling through and idling in the bus interchange were modelled to predict noise levels generated from the operation of the bus interchange. Assumptions and data used for this assessment are summarised below:

- Bus sound power level of 104 dB(A) derived from measurements of State Transit Authority buses travelling at 40 km/h
- One bus entering and one bus exiting the site and four buses idling within a 15-minute period during the daytime
- One bus entering and exiting the site within a 15-minute period during the evening time
- A speed limit of five km/h for buses travelling through the bus interchange
- Distance travelled from entrance to exit of 345 m.

Noise levels predicted at the nearest residential receivers are 48 dB(A) at ground floor and 50 dB(A) at first floor for the daytime assessment. Daytime predicted noise levels are below the project specific trigger levels of 53 dB(A).

Noise levels predicted at the nearest residential receivers are 45 dB(A) at ground floor and 47 dB(A) at first floor for the evening assessment. Evening predicted noise levels meet the project specific trigger levels of 46 dB(A) at ground floor and are above the project specific trigger levels of 46 dB(A) by up to one dB(A) at first floor. An exceedance of one dB(A) residual noise level is deemed to represent a negligible impact and not be subjectively discernible.

Based on compliance with NPI target criteria, no further mitigation is required for industrial noise emissions associated with operation of the relocated Kororo Public School bus interchange.

#### Gatelys Road and Shephards Lane jet fans

Assessment of the potential industrial noise impacts from the proposed jet fans in the Gatelys Roads and Shephards Lane tunnels has been carried out based on the following assumptions:

- The measured sound pressure level from the bank of jet fans does not exceed 85 dB(A) measured at 1.5 m above the centreline of the road
- The nearest set of fans is located 80 m from the tunnel portals
- Fan testing can be carried out in a period between 15 minutes to one hour during daytime hours.

The sound power level for a single in-tunnel fan was calculated assuming a maximum reverberant sound pressure level of 85 dBA within the tunnel and a typical spectrum for an axial fan. This information was then used to predict potential impacts to the nearest receiver considering direct and reverberant contribution from the tunnel portal to the nearest noise sensitive receiver.

The distance to the nearest noise sensitive receiver from the Shephards Lane and Gatelys Road tunnel portals is about 180 m and 190 m respectively. The predicted noise level at each of the nearest noise sensitive receivers was found to be within one decibel of the assessment criteria of 45 dBA for daytime hours. No further mitigation is recommended for industrial noise emissions associated with operation of the in-tunnel ventilation fans at this stage however, all assumptions and inputs would be reviewed once further detail becomes available specific to the project during detailed design.

### *Noise mitigation options*

Options for noise mitigation were assessed in the following order of preference as per the NMG:

- Low noise pavement surfaces
- Noise mounds
- Noise barriers (noise walls)
- At-property treatments.

The preliminary mitigation scenario for the project includes:

- Low noise pavement consisting of open graded asphalt (OGA) from the southern tie-in to the northern extent of the project, excluding the extent of the tunnels as shown in **Figure 9-4-01** to **Figure 9-4-06**
- Construction of proposed noise barriers as shown in **Table 9-27** and **Figure 9-4-01** to **Figure 9-4-06**
- At property treatments for 478 sensitive receivers.

The noise assessment and preliminary mitigation scenario (including barrier heights and locations) would be re-evaluated at the detailed design stage and is subject to change. This may result in more or less receivers qualifying for consideration of noise mitigation.

The preliminary mitigation scenario for the project is described in the following sections.

#### Low noise pavement

A low noise pavement (OGA) was included from the southern tie to the northern extent of the project, excluding the extent of the tunnels. It is noted that the existing Pacific Highway north of the Korora interchange is a combination of dense graded asphalt and stone mastic asphalt. The inclusion of low noise pavement was based on design investigations undertaken in early 2019 (refer to **Chapter 4, Project development and alternatives**).

A total of 1009 sensitive receivers have been predicted to exceed the NCG with low noise pavement applied, with all of these qualifying for consideration of additional mitigation (as shown in **Table 9-26**).

Table 9-26 Number of noise sensitive receivers that exceed design year operational noise criteria with low noise pavement in place

| NCA | Receiver type | NCG exceedances | | | |
|---|---|---|---|---|---|
| | | < 5 dB | 5-10 dB | > 10 dB | Total |
| NCA01 | Residential | 4 | 12 | 0 | 16 |
| NCA02 | Residential | 4 | 5 | 3 | 12 |
| | Active recreation | 0 | 0 | 0 | 0 |
| NCA03 | Residential | 71 | 22 | 0 | 93 |
| | Hospital | 0 | 0 | 1 | 1 |
| | Active recreation | 0 | 0 | 0 | 0 |
| NCA04 | N/A[1] | 0 | 0 | 0 | 0 |
| NCA05 | Hospital | 0 | 0 | 1 | 1 |
| | Place of worship | 0 | 1 | 0 | 1 |
| | Childcare facility | 0 | 0 | 1 | 1 |
| NCA06 | Residential | 144 | 127 | 4 | 275 |
| | School | 0 | 0 | 1 | 1 |
| | Place of worship | 0 | 0 | 0 | 0 |
| NCA07 | Residential | 0 | 3 | 1 | 4 |
| NCA08 | Residential | 0 | 7 | 0 | 7 |
| | School | 0 | 1 | 0 | 1 |
| NCA10 | Residential | 1 | 2 | 1 | 4 |
| NCA11 | Residential | 2 | 3 | 0 | 5 |
| NCA12 | Residential | 8 | 6 | 3 | 17 |
| NCA13 | Residential | 36 | 11 | 0 | 47 |
| | Childcare facility | 0 | 0 | 1 | 1 |
| NCA14 | Residential | 81 | 6 | 0 | 87 |
| NCA15 | Residential | 2 | 6 | 6 | 14 |
| NCA16 | Residential | 53 | 43 | 26 | 122 |
| NCA17 | Residential | 0 | 2 | 1 | 3 |
| NCA18 | Residential | 114 | 32 | 7 | 153 |
| NCA19 | Residential | 0 | 1 | 10 | 11 |

| NCA | Receiver type | NCG exceedances | | | |
|---|---|---|---|---|---|
| | | < 5 dB | 5-10 dB | > 10 dB | Total |
| NCA20 | Residential | 5 | 3 | 0 | 8 |
| NCA21 | Residential | 0 | 2 | 0 | 2 |
| | Active recreation | 0 | 0 | 0 | 0 |
| NCA22 | Residential | 0 | 0 | 0 | 0 |
| | Active recreation | 0 | 0 | 0 | 0 |
| NCA23 | Residential | 3 | 2 | 1 | 6 |
| | Passive recreation | 1 | 0 | 0 | 1 |
| NCA24 | Residential | 5 | 16 | 2 | 23 |
| NCA25 | Residential | 1 | 0 | 0 | 1 |
| NCA26 | Residential | 17 | 24 | 3 | 44 |
| | School | 0 | 0 | 2 | 2 |
| NCA27 | Residential | 3 | 7 | 0 | 10 |
| NCA28 | Residential | 20 | 8 | 2 | 30 |
| NCA29 | Residential | 2 | 3 | 0 | 5 |
| **TOTAL** | | **10** | **3** | **7** | **1009** |

With low noise pavement in place, 1009 noise sensitive receivers still exceed the road traffic noise criteria and hence still qualify for consideration of additional noise mitigation. This is 573 fewer receivers than were identified as exceeding the road traffic noise criteria for the unmitigated scenario, however only 307 fewer than the number of receivers that qualify for consideration of additional mitigation.

Noise barriers

Following adoption of a low noise pavement in the noise model, there were still exceedances of the NCG criteria. Noise mounds are the next preferred form of mitigation. Mounds and noise walls were investigated through a barrier analysis (see **Appendix G, Noise and vibration assessment**).

At two locations, existing barriers are proposed to be relocated. In one instance the relocated barrier will have the same top of height as the existing barrier and in the other, the barrier will be higher. The two locations are:

- NCA25 – Along the existing Pacific Highway adjacent to residence and Kororo Public School. The existing barrier of three metres would be relocated and set to have the same effective height.
- NCA28 – At the northern tie-in beside Coachmans Close. The existing barrier height of 3 m will be supplemented with a relocated height of four metres.

**Table 9-27** provides a summary of the barrier analysis and **Figure 9-4-01** to **Figure 9-4-06** shows the location of the proposed barriers. Noise walls NCA06, NCA13, NCA14 and NCA18 have been proposed to be located on top of noise mounds. All other barriers identified in **Table 9-27** are proposed as noise walls.

The noise barrier analysis revealed that several proposed barriers (NCA08, NCA12, NCA24 and NCA27) were not feasible, as they do not meet the required noise reductions. NCA08 was proposed on top of a noise mound, however it was determined that there would not be feasible and reasonable noise mitigation beyond the noise mound should a noise barrier be installed.

Further to the noise barrier analysis, all barriers were subject to a reasonable and feasible analysis that considered a number of environmental, social, engineering and cost factors. Two barriers initially evaluated that are not considered reasonable or feasible, include:

- NCA01 – located at the southern end of the project adjacent Koala Villas and Caravan Park
- NCA27 – located at the northern end of project adjacent Seaview Close.

The barrier proposed for NCA01 was recommended at a height of eight metres to replace the existing three metre high noise wall located adjacent the Koala Villas and Caravan Park. While this noise barrier would mitigate sensitive receivers behind the barrier, this noise barrier was not considered feasible or reasonable due to potential significant overshadowing impacts, potential impacts to koala habitat and constructability and safety concerns.

The barrier proposed for NCA27 was recommended at a height of 4.5 m for receivers within the noise catchment. While this noise barrier would mitigate sensitive receivers behind the barrier, this noise barrier was not considered feasible or reasonable due to safety concerns for construction or maintenance personnel as it was proposed to be constructed on top of 3.3 to 7.2 m high retaining wall, potential conflicts with utilities and visual impacts including potential loss of ocean views.

A total of 478 sensitive receivers have been predicted to exceed the NCG with low noise pavement and barriers in place for the project as shown in **Figure 9-4-01** to **Figure 9-4-06**.

Table 9-27 Summary of reasonable and feasible noise barriers

| Barrier ID | Location | Height (m) | Length (m) |
|---|---|---|---|
| NCA03 | South of Englands Road interchange on the eastern side of the project next to NCA03 and proposed Elements Estate subdivision | 5.0 | 800 |
| NCA06 | North of North Boambee Road on the eastern side of the project next to NCA06 and Lakes Estate and Highlands Estate subdivisions | 5.0 | 1560 |
| NCA13 | North of Coramba Road interchange on the eastern side of the project next to NCA13 | 3.5 | 1020 |
| NCA14 | At Shephards Lane on the eastern side of the project next to NCA14 | 4.0 | 1310 |
| NCA18 | Mackays Road Valley on the southern side of the project next to NCA18 | 4.5 | 1110 |
| NCA26 | North of Korora Public School on the eastern side of the project next to NCA26 | 5.0 | 670 |
| NCA28 | North of Pine Brush Creek on the eastern side of the project next to NCA28 | 4.0 | 970 |


Coff Harbour Bypass
2034 night-time build - mitigated with low noise pavement and noise barriers
Figure 9-4-01


Legend

Construction footprint
Study Area
NCA
Above NCG Criteria
Bridge
Tunnel

Noise Wall
New
Existing, retained
Relocated, same height
Relocated, supplement height

Road surface
OGA
DGA
Concrete

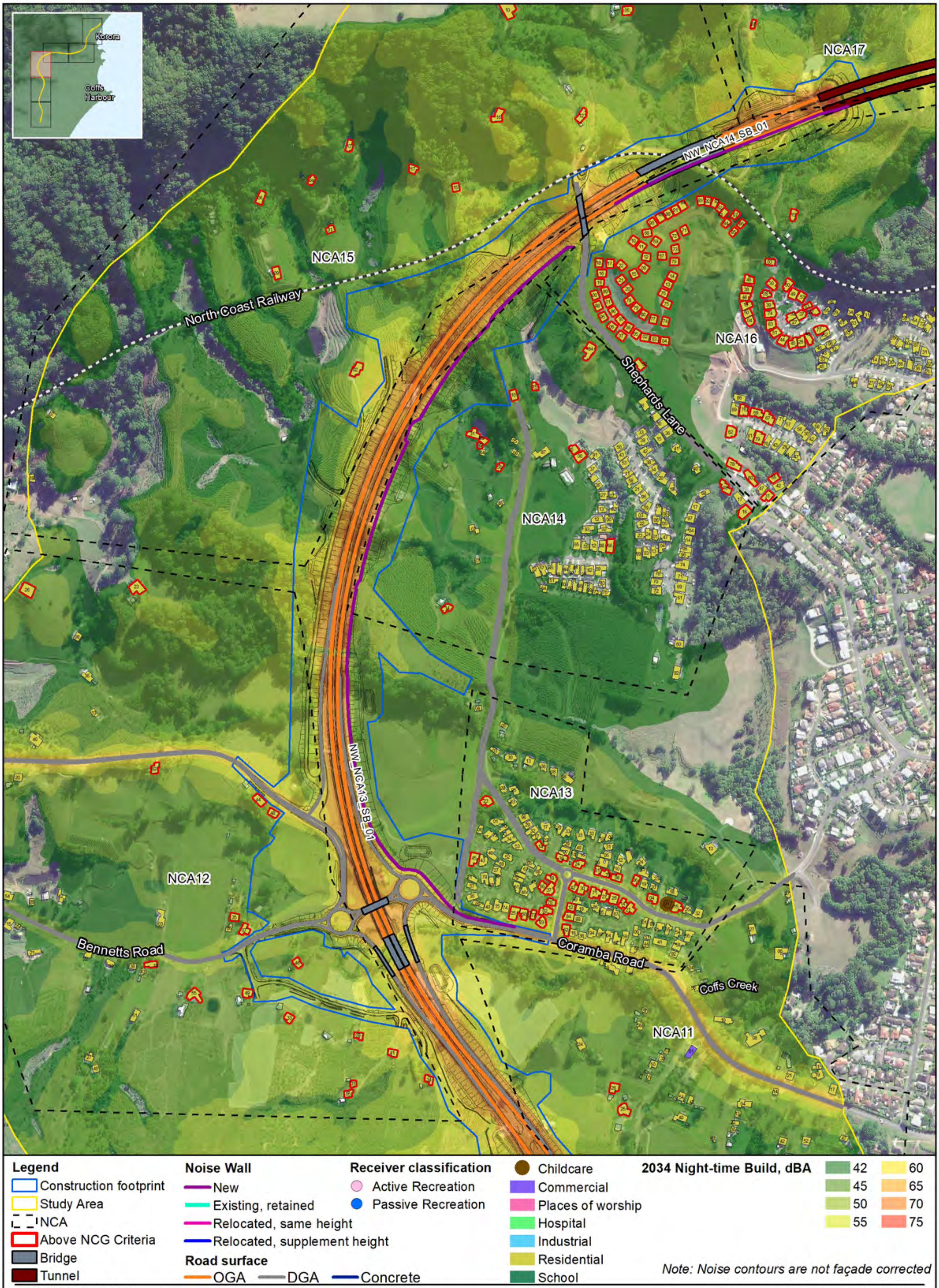
Receiver classification
Active Recreation
Passive Recreation
Childcare
Commercial
Places of worship
Hospital
Industrial
Residential
School

2034 Night-time Build, dBA
42 | 45 | 50 | 55 | 60 | 65 | 70 | 75

Note: Noise contours are not façade corrected

Coff Harbour Bypass
2034 night-time build - mitigated with low noise pavement and noise barriers
Figure 9-4-02

0 0.1 0.2 0.3 km
N
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56




Coff Harbour Bypass
2034 night-time build - mitigated with low noise pavement and noise barriers
Figure 9-4-03


**Legend**
- Construction footprint
- Study Area
- NCA
- Above NCG Criteria
- Bridge
- Tunnel

**Noise Wall**
- New
- Existing, retained
- Relocated, same height
- Relocated, supplement height

**Road surface**
- OGA
- DGA
- Concrete

**Receiver classification**
- Active Recreation
- Passive Recreation
- Childcare
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

**2034 Night-time Build, dBA**
42, 45, 50, 55, 60, 65, 70, 75

*Note: Noise contours are not façade corrected*

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

Coff Harbour Bypass
2034 night-time build - mitigated with low noise pavement and noise barriers
Figure 9-4-04


**Legend**
- Construction footprint
- Study Area
- NCA
- Above NCG Criteria
- Bridge
- Tunnel

**Noise Wall**
- New
- Existing, retained
- Relocated, same height
- Relocated, supplement height

**Road surface**
- OGA
- DGA
- Concrete

**Receiver classification**
- Active Recreation
- Passive Recreation
- Childcare
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

**2034 Night-time Build, dBA**
42, 45, 50, 55, 60, 65, 70, 75

*Note: Noise contours are not façade corrected*

Coff Harbour Bypass
2034 night-time build - mitigated with low noise pavement and noise barriers
Figure 9-4-05

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56


**Legend**
- Construction footprint
- Study Area
- NCA
- Above NCG Criteria
- Bridge
- Tunnel

**Noise Wall**
- New
- Existing, retained
- Relocated, same height
- Relocated, supplement height

**Road surface**
- OGA
- DGA
- Concrete

**Receiver classification**
- Active Recreation
- Passive Recreation
- Childcare
- Commercial
- Places of worship
- Hospital
- Industrial
- Residential
- School

**2034 Night-time Build, dBA**
- 42
- 45
- 50
- 55
- 60
- 65
- 70
- 75

*Note: Noise contours are not façade corrected*

0 0.1 0.2 0.3 km
N
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

Coff Harbour Bypass
2034 night-time build - mitigated with low noise pavement and noise barriers
Figure 9-4-06

### At-property treatments

At-property treatments would be considered at sensitive receivers where low noise pavement and noise barriers do not result in the NCG being met. At this stage in the assessment, the identification of at-property treatments is indicative only, as further consideration would be given to the following points at the detailed design stage to confirm the final extent of treatments required:

- The build date of the property and the related conditions of consent which may require that the property has been built to account for existing high levels of road traffic noise
- The condition of the property, as treatment would be less effective and may not provide any appreciable noise reduction benefit where the building is in a poor state of repair, so caution needs to be exercised
- Heritage advice should be sought if the treatments have the potential to impact the heritage significance of a property. In extreme cases this could result in a decision not to proceed with a treatment on the grounds that it was not considered to be a reasonable or feasible mitigation option.

At-property treatments are generally limited to acoustic treatment of the building elements (doors, windows, vents, etc) or courtyard fences where they reduce noise to habitable rooms. The installation of courtyard fences close to the dwelling may also provide some mitigation for outdoor living spaces.

The overall goal of the at-property treatment is to provide similar acoustic amenity and internal noise levels to those experienced within a receiver where the external noise criteria have been met.

In most instances, assuming brick construction and standard glazing, this goal equates to internal noise levels that are around 20 dBA less than the external noise criteria with windows closed. In practice there would be some variation in reduction due to the design of the existing building and other limitations such as building condition. A 20 dBA goal results in internal noise levels that are consistent with other guidelines. These guidelines include the State Environmental Planning Policy (Infrastructure) 2007 (NSW) and Australian Standard 2107. The 20 dBA goal also provides protection against a large increase in internal noise level in accordance with the NCG.

At-property treatments may include:

- The installation of courtyard screen walls
- Fresh air ventilation systems that meet building code of Australia requirements with the windows and doors shut
- Upgraded windows and glazing and solid core doors on the exposed facades of masonry or insulated weather board structures (not for light framed structures)
- Upgrading window and door seals and appropriate treatment of sub-floor ventilation
- Sealing wall vents
- Sealing of the underfloor below the bearers
- Sealing of eaves.

A total of 478 sensitive receivers are predicted to exceed the NCG with a low noise pavement and barriers in place and therefore qualify for consideration of at-property treatment (refer to **Table 9-28**). The properties are mapped in **Figure 9-4-01** to **Figure 9-4-06**. It should be noted that of these 478 sensitive receivers, 148 have not be been built yet but have been approved for construction as part of subdivision development approvals (as outlined in **Section 9.2.5**).

For the rural areas of the project, the criteria provided in **Section 9.3.2** may still be exceeded beyond the 600-metre study area. The potential for these exceedances would be investigated during detailed design with further traffic and noise monitoring and modelling being undertaken to confirm requirements for additional mitigation including at-property treatments.

Table 9-28 Sensitive receivers that qualify for consideration of at-property treatment by NCA

| NCA | Receiver type | Number of exceedances of the NCG (with mitigation) | | | |
|---|---|---|---|---|---|
| | | 0 – 5dB | 5 – 10dB | >10dB | Total |
| NCA01 | Residential | 3 | 12 | 0 | 15 |
| NCA02 | Residential | 4 | 5 | 3 | 12 |
| | Active recreation | 0 | 0 | 0 | 0 |
| NCA03 | Residential | 0 | 0 | 0 | 0 |
| | Hospital | 0 | 0 | 1 | 1 |
| | Active recreation | 0 | 0 | 0 | 0 |
| NCA04 | N/A[1] | 0 | 0 | 0 | 0 |
| NCA05 | Hospital | 0 | 0 | 1 | 1 |
| | Place of worship | 0 | 1 | 0 | 1 |
| | Childcare facility | 0 | 0 | 1 | 1 |
| NCA06 | Residential | 88 | 18 | 1 | 107 |
| | School | 0 | 0 | 1 | 1 |
| | Place of worship | 0 | 0 | 0 | 0 |
| NCA07 | Residential | 0 | 3 | 1 | 4 |
| NCA08 | Residential | 0 | 7 | 0 | 7 |
| | School | 0 | 1 | 0 | 1 |
| NCA10 | Residential | 2 | 0 | 1 | 3 |
| NCA11 | Residential | 2 | 3 | 0 | 5 |
| NCA12 | Residential | 8 | 6 | 3 | 17 |
| NCA13 | Residential | 24 | 6 | 0 | 30 |
| | Childcare facility | 0 | 0 | 1 | 1 |
| NCA14 | Residential | 12 | 1 | 0 | 13 |
| NCA15 | Residential | 2 | 6 | 6 | 14 |
| NCA16 | Residential | 50 | 33 | 10 | 93 |
| NCA17 | Residential | 0 | 2 | 1 | 3 |
| NCA18 | Residential | 45 | 12 | 5 | 62 |
| NCA19 | Residential | 0 | 1 | 10 | 11 |
| NCA20 | Residential | 5 | 3 | 0 | 8 |
| NCA21 | Residential | 0 | 2 | 0 | 2 |

| NCA | Receiver type | Number of exceedances of the NCG (with mitigation) | | | |
|---|---|---|---|---|---|
| | | 0 – 5dB | 5 – 10dB | >10dB | Total |
| | Active recreational | 0 | 0 | 0 | 0 |
| NCA22 | Residential | 0 | 0 | 0 | 0 |
| | Active recreational | 0 | 0 | 0 | 0 |
| NCA23 | Residential | 2 | 2 | 1 | 5 |
| | Passive recreation | 1 | 0 | 0 | 1 |
| NCA24 | Residential | 5 | 16 | 2 | 23 |
| NCA25 | Residential | 1 | 0 | 0 | 1 |
| NCA26 | Residential | 7 | 2 | 0 | 9 |
| | School | 0 | 1 | 1 | 2 |
| NCA27 | Residential | 3 | 7 | 0 | 10 |
| NCA28 | Residential | 7 | 2 | 0 | 9 |
| NCA29 | Residential | 2 | 3 | 0 | 5 |
| | **TOTAL** | **273** | **155** | **50** | **478** |

### *Health impacts from operational noise*

Without mitigation there are a number of sensitive receivers where noise levels exceed the operational noise criteria described in **Section 9.3.2** which are designed to be protective of health. A review of the operational noise assessment regarding potential health impacts identified the following:

- In all areas evaluated, the predicted noise levels exceed thresholds where health effects have been identified (daytime and night-time)
- The most significant exceedances of the NCG are in NCA16, NCA19, NCA18, NCA15, NCA02, NCA24, NCA06, NCA07, NCA08, NCA10-NCA14, NCA19-NCA21, NVA23 and NCA26-NCA29. Predicted noise increases in these areas are at least five dBA above the criteria and have the potential to result in unacceptable risks to human health in terms of cardiovascular health, noise annoyance and sleep-disturbance. As such, where noise mitigation is not implemented there is the potential for unacceptable health impacts at some properties in these NCAs
- Not all at-source noise mitigation measures would adequately address the increased noise levels. As such, there would be the need for some at-property treatments. The effectiveness of at-property treatments to reduce noise impacts would need to be evaluated once all at-source mitigation measures have confirmed during detailed design. However, it should be noted that at-property treatments also have downsides to health of an individual and the community including increased stress levels from reduced use of outdoor areas.

## 9.5 Environmental management measures

Noise mitigation measures discussed in **Table 9-29** are considered to represent all feasible and reasonable options available for the project.

As described in **Chapter 6, Construction** and **Section 9.4.1** above, the project would require several activities to be carried out outside the recommended standard construction hours for day, evening and night time periods. In acknowledgment of the extent of out of hours work proposed, at-property noise treatments will be implemented during the pre-construction phase of the project before the main construction activities begin, where reasonable and feasible. This would include at-property treatments to reduce potential noise impacts associated with construction (including out of hours work). In addition, an Out of Hours Work Procedure would include specific management measures to minimise or mitigate potential noise impacts and consider the need to balance the out of hours work with periods of receiver respite. Further detail on the application of the Out of Hours Work Procedure is provided in **Appendix G, Noise and vibration assessment**.

Table 9-29 Environmental management measures for noise and vibration impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Construction noise and vibration | NV01 | A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP and in accordance with the Construction Noise and Vibration Guideline (Roads and Maritime Services 2016a). The NVMP will identify:<br>• All potential significant noise and vibration generating activities associated with the activity<br>• Measures to be implemented during construction to minimise noise and vibration impacts, such as restrictions on working hours, respite periods, staging, placement and operation of ancillary facilities, temporary noise barriers, haul road maintenance, and controlling the location and use of vibration generating equipment<br>• A monitoring program to assess performance against relevant noise and vibration criteria<br>• Process for the implementation of respite periods to provide residents with respite from ongoing impact<br>• Arrangements for consultation with affected receivers, including notification and complaint handling procedures<br>• Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. | Contractor | Prior to and during construction |
| Construction vibration impacts | NV02 | Prior to commencing construction, the structural integrity of Old Coast Road Bridge No. 1 and Old Coast Road Bridge No. 2 will be confirmed by a suitably qualified structural engineer. The results from inspection will be documented and used to verify the applicable vibration criteria, construction vehicle restrictions and any feasible and reasonable mitigation measures to be implemented. A copy of the report will be provided to CHCC. | Contractor | Prior to construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Construction vibration impacts | NV03 | Building condition surveys will be conducted for buildings and other structures within 50 m of vibration generating activities before commencement of construction. A copy of the building condition survey report will be provided to the relevant property owner. | Contractor | Prior to construction |
| Construction vibration impacts | NV04 | Where vibration generating activities will be carried out within minimum working distances for cosmetic damage, vibration monitoring will be carried out. Where monitoring indicates cosmetic damage criteria are exceeded, alternative low-vibration work practices will be investigated and implemented. | Contractor | Construction |
| Construction vibration impacts | NV05 | Consultation with the Boambee Equestrian Centre will be carried out during detailed design following further consideration of construction methodologies and further geotechnical conditions to ensure appropriate work practices are implemented to minimise the risk of vibration impacts. | Contractor | Prior to construction |
| Impacts from out of hours work | NV06 | An Out of Hours Work Procedure will be included as part of the NVMP to manage any variations to the standard construction hours. The procedure will follow the approach in Roads and Maritime's Construction Noise and Vibration Guideline (Roads and Maritime Services 2016a) and include, but not be limited to:<br>• Scheduling of noise intensive or high noise impact work to evening periods where feasible<br>• Use of alternative plant and equipment and/or construction techniques to minimise noise<br>• Notification and consultation requirements including preparation of a six-month 'look ahead' program for likely out of hours work<br>• Use of temporary noise barriers<br>• Acoustic sheds will be included around tunnel portals to shield noise from within the tunnel during evening and night periods<br>• Respite periods<br>• Representative noise monitoring<br>• Offers of reasonable and temporary alternative accommodation or an act of good will<br>• Use of negotiated agreements. | Contractor | During construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
| --- | --- | --- | --- | --- |
| Impacts from out of hours work | NV07 | At-property operational noise mitigation measures will be implemented during the pre-construction phase of the project, where reasonable and feasible, to assist in reducing noise impacts associated with construction (including out of hours work). | Roads and Maritime / Contractor | Prior to construction |
| Construction noise impacts from ancillary facilities | NV08 | Ancillary facilities will be designed to ensure that primary noise sources are at a maximum distance from residences (where reasonable and feasible), with solid structures (sheds, containers, etc.) placed between residences and noise sources (and as close to the noise sources as is practical). | Contractor | During construction |
| Construction traffic noise impacts | NV09 | Management of construction related traffic noise will include the following considerations:<br>• Scheduling of vehicle movements during less sensitive time periods where possible<br>• Training/inductions to address driver behaviour and avoidance of the use of engine compression brakes<br>• Vehicle maintenance. | Contractor | Construction |
| Blasting | NV10 | A Blast Management Strategy will be prepared as part of the NVMP. The strategy will aim to demonstrate that all blasting and associated activities will be undertaken in a manner that will not generate unacceptable noise and vibration impacts or pose a significant risk impact to residences and sensitive receivers. The Blast Management Strategy will address:<br>• Details of blasting to be performed, including location, method and justification of the need to blast<br>• Identification of any potentially affected noise and vibration sensitive sites and structures<br>• Establishment of appropriate criteria for blast overpressure and ground vibration levels at each category of noise sensitive site<br>• Details of the storage and handling arrangements for explosive materials and the proposed transport of those materials to the construction site<br>• Identification of hazardous situations that may arise from the storage and handling of explosives, the blasting process and recovery of the blast site after detonation of the explosives | Contractor | During construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | | • Determination of potential noise and vibration and risk impacts from blasting and appropriate best management practices<br>• Community consultation procedures. | | |
| Operational noise impacts | NV11 | The operational noise mitigation measures, including noise barriers and/or at-property treatments, will be confirmed during detailed design. The treatments will be provided as early as practicable in the construction program to reduce potential noise impacts associated with construction. | Roads and Maritime / Contractor | Detailed design |
| Operational noise impacts | NV12 | An operational noise review will be carried out 12 months after the opening of the project to confirm the operational noise impacts. The review will be based on updated traffic surveys at the time (and once traffic flows have stabilised) and will be in accordance with the Roads and Maritime's Noise Mitigation Guideline (Roads and Maritime Services 2015d) and Practice Note viii of ENMM (RTA 2001b). The review will:<br>• Assess actual noise performance compared to predicted noise performance<br>• Assess the performance and effectiveness of noise and vibration mitigation measures<br>• Where deficiencies in performance are identified, provide recommendations for additional feasible and reasonable measures. | Roads and Maritime | Operation |

CHAPTER 10

Chapter 10

# Biodiversity

# 10. Biodiversity

This chapter presents an assessment of impacts to terrestrial and aquatic biodiversity associated with the construction and operation of the project. The assessment presented draws upon information and data presented in **Appendix H, Biodiversity assessment report.**

The project has been determined to be CSSI and approval for the project is being sought under Division 5.2 of the EP&A Act. As outlined in **Chapter 2, Assessment process,** biodiversity impacts have been assessed through implementation of the Framework for Biodiversity Assessment (FBA) (OEH 2014a) and with reference to the NSW Biodiversity offsets policy for major projects (OEH 2014d).

During the preparation of the EIS, the project was referred to the Minister for the Environment under the Bilateral Agreement between the Australian and NSW governments. On 22 September 2017, the Minister for Environment determined that the project has the potential to impact significantly on MNES (threatened species and communities) and is therefore a controlled action under the EPBC Act. Approval of the project is required from the Minister for the Environment in addition to planning approvals required under State legislation. The FBA has been endorsed under the Bilateral Agreement and is considered to provide a suitable framework for the assessment of project impacts to MNES.

The SEARs for the project were reissued under section 5.16 of the EP&A Act on 30 October 2017. This chapter addresses the SEARs relevant to biodiversity, as outlined in **Table 10-1**. Australian Government assessment documentation requirements for the project under the Bilateral Agreement are provided in **Table 10-2.**

Table 10-1 SEARs relevant to biodiversity

| Ref | General SEARs | Where addressed |
|---|---|---|
| **1. Environmental Impact Assessment Process** | | |
| 2. | The project will impact on matters of national environmental significance (MNES) protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and will be assessed in accordance with the NSW Bilateral Agreement (2015). The Proponent must assess impacts to MNES protected under the EPBC Act. The assessment must be in accordance with the requirements listed in **Table 10-2.** | Section 10.1<br>Table 10-2 |
| **2. Environmental Impact Statement** | | |
| 1. | h) a concise description of the general biophysical and socio-economic environment that is likely to be impacted by the project (including indirect impacts). Elements of the environment that are not likely to be affected by the project do not need to be described | Section 10.2<br>Section 10.3<br>**Chapter 14, Socio-economic** |
| **Ref** | **Key Issue SEARs** | **Where addressed** |
| **4. Biodiversity** | | |
| 1. | The Proponent must assess biodiversity impacts in accordance with the current guidelines including the Framework for Biodiversity Assessment (FBA) and be carried out by a person accredited in accordance with section 142B(1)(c) of the *Threatened Species Conservation Act 1995* (TSC Act). | Section 10.1<br>Section 10.3<br>**Appendix H, Biodiversity assessment report** |

| Ref | General SEARs | Where addressed |
|---|---|---|
| 2. | The Proponent must survey and assess any impacts on biodiversity values not covered by the FBA, as specified in section 2.3, including but not limited to aquatic species, riparian vegetation, instream macrophytes and habitat condition. | Section 10.2<br>Section 10.3<br>**Appendix H, Biodiversity assessment report** |
| 3. | The Proponent must assess impacts on EECs, threatened species and/or populations and provide the information specified in section 9.2 of the FBA. | Section 10.3<br>**Appendix H, Biodiversity assessment report** |
| 4. | The Proponent must identify whether the project as a whole, or any component of the project, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the TSC Act, *Fisheries Management Act 1994* (FM Act) and EPBC Act. | Section 10.3.5<br>**Appendix H, Biodiversity assessment report** |

Table 10-2 Australian Government environmental assessment requirements relevant to biodiversity

| Ref | Australian Government requirement | Where addressed |
|---|---|---|
| **General Requirements** | | |
| 4. | **Project Description**<br>The title of the action, background to the development and current status. | **Chapter 5, Project description** |
| 5. | The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on MNES. | **Chapter 6, Construction**<br>Section 10.3 |
| 6. | How the action relates to any other actions that have been, or are being taken, in the region affected by the action. | **Chapter 25, Cumulative Impacts** |
| 7. | How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES. | Section 10.4<br>**Appendix H, Biodiversity assessment report** |
| 8. | **Impacts**<br>The EIS must include an assessment of the relevant impacts of the action on threatened species and communities; including<br>• A description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts<br>• A statement whether any relevant impacts are likely to be known, unpredictable or irreversible; analysis of the significance of the relevant impacts<br>• Any technical data and other information used or needed to make a detailed assessment of the relevant impacts<br>• A comparative description of the impacts of alternatives, if any, on the threatened species and communities. | Section 10.3<br>Section 10.4<br>**Appendix H, Biodiversity assessment report** |
| 9. | **Avoidance, mitigation and offsetting**<br>For each of the relevant matters protected that are likely to be significantly impacted by the development, the EIS must provide information on the | Section 10.3<br>**Appendix H, Biodiversity assessment report** |

| Ref | Australian Government requirement | Where addressed |
|---|---|---|
| | proposed avoidance and mitigation measures to deal with the relevant impacts of the action, including:<br>• A description and an assessment of the expected or predicted effectiveness of the mitigation measures<br>• Any statutory policy basis for the mitigation measures<br>• The cost of the mitigation measures<br>• A description of the outcomes that the avoidance and mitigation measures will achieve<br>• An outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action<br>• The name of any agency responsible for endorsing or approving a mitigation measure or monitoring program<br>• A description of the offsets proposed to address the residual adverse significant impacts and how these offsets will be established. | **Appendix I, Threatened species management plan** |
| 10. | Where a significant residual adverse impact to a threatened species or community is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy. Paragraphs 13 and 14 provide further requirements in relation to offsets. | Section 10.6<br>**Appendix H, Biodiversity assessment report** |
| **Key issues – Biodiversity** | | |
| 11. | The EIS must address the following issues in relation to Biodiversity including separate:<br>• Identification of each EPBC Act listed threatened species and community likely to be impacted by the development. Provide evidence any other EPBC Act listed threatened species and communities likely to be located in the project area or in the vicinity will not be impacted. | Section 10.2.8<br>**Appendix H, Biodiversity assessment report** |
| 12. | For each of the relevant EPBC Act listed threatened species and communities likely to be impacted by the development, the EIS must provide a separate:<br>• Description of the habitat and habits (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans, threat abatement plans and wildlife conservation plans<br>• Details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements<br>• Description of the impacts of the action having regard to the full national extent of the species and communities range. | Section 10.3.3<br>**Appendix H, Biodiversity assessment report** |
| 13. | For each of the relevant EPBC Act listed threatened species and communities likely to be significantly impacted by the development the EIS must provide a separate:<br>• Identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigation all impacts are taken into account | Section 10.3.3<br>Section 10.5<br>Section 10.6<br>**Appendix H, Biodiversity assessment report** |

| Ref | Australian Government requirement | Where addressed |
|---|---|---|
| | • Details of how the current published NSW FBA has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts<br>• Details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and / or mapping and descriptions of the extent and condition of the relevant habitat and / or threatened communities occurring on proposed offset sites. | |
| 14. | Any significant residual impacts not addressed by the FBA may need to be addressed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offset Policy. | Section 10.5<br>**Appendix H, Biodiversity assessment report** |
| 15. | For each threatened species and community likely to be significantly impacted by the development, the EIS must provide reference to, and consideration of, relevant approved conservation advice or recovery plan for the species or community. | Section 10.3.3 |
| 16. | Information in relation to the environmental record of a person proposing to take action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations 2000. | **Appendix E, Roads and Maritime Environmental record** |

# 10.1 Assessment methodology

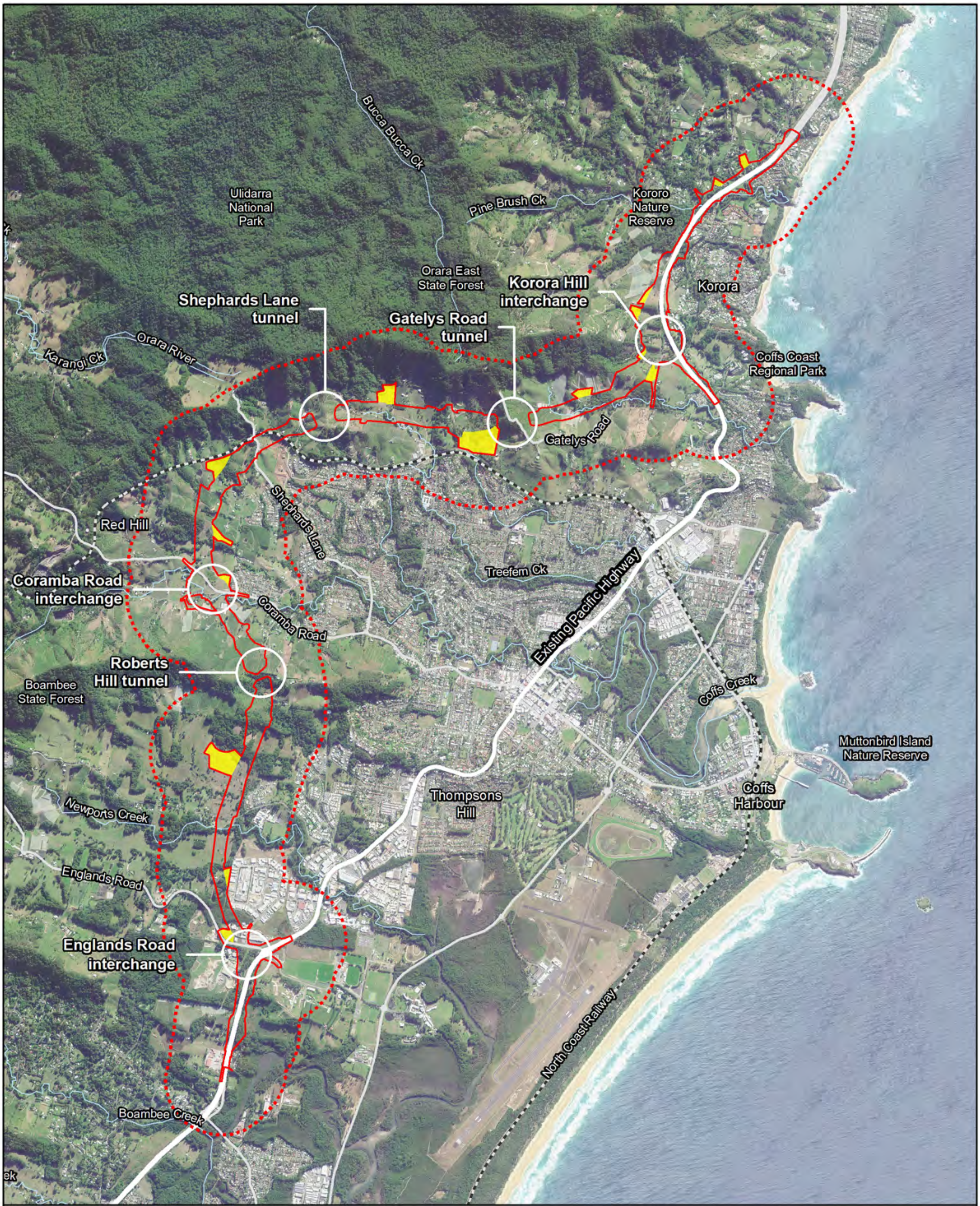
The information and data collected in this study consists of desktop sourced information and maps, as well as detailed field surveys of the study area, undertaken in accordance with the FBA (OEH 2014a) and the requirements of the SEARs (**Table 10-1**).

## 10.1.1 Study area

The project is located within the North Coast Interim Biogeographic Regionalisation for Australia (IBRA) bioregion. The study area for this chapter includes around 307 ha of land consisting of a 14 km linear footprint and associated buffers, extending from Boambee in the south to Korora in the north. A map of the study area is presented in **Figure 10-1.**

The study area consists of the construction footprint and indicative road corridor for the project as well as ridges over the tunnels. The construction footprint is the area proposed to be impacted, cleared and/or disturbed during construction and includes ancillary sites. For the purposes of this biodiversity assessment, it is assumed that there would be complete vegetation clearance within the construction footprint and identified ancillary sites. While it is unlikely that all land within the construction footprint would be cleared, this precautionary approach has been taken to ensure all potential impacts are captured and assessed as the project is in its concept design phase. The construction footprint has the same meaning as ‘development site’ for the purposes of the FBA. The indicative road corridor for the project is the area that would be physically impacted by the operation of the project. The indicative road corridor is fully contained within the construction footprint.

For the purposes of this biodiversity assessment, the study area also includes a 550 m landscape buffer area to the construction footprint, as required for linear assessments undertaken in accordance with the FBA (OEH 2014a).




Legend

- Construction footprint
- Ancillary sites
- Landscape assessment 550m buffer
- North Coast Railway
- Watercourse

Coffs Harbour Bypass
Study area and landscape buffer area
Figure 10-1

0 0.5 1 1.5 km
Scale @A4: 1:50,000
GDA 1994 MGA Zone 56
N

### 10.1.2 Desktop assessment and background sources

Prior to undertaking field investigations, a desktop review of ecological records, datasets and Geographic Information System (GIS) maps available for flora and fauna within 10 km of the project was undertaken. Relevant databases and literature included:

- The DoEE Protected Matters Search Tool (DoEE 2018)
- NSW BioNet database for the Atlas of NSW Wildlife (OEH 2018a)
- PlantNET for Rare or Threatened Australian Plants (RBGDT 2018)
- DoEE directory of important wetlands (Commonwealth of Australia 2015)
- NSW Wetlands 2006 spatial layer (OEH 2006)
- State Environmental Planning Policy (SEPP) Coastal Management 2018 (DP&E 2017b)
- BirdLife Australia, The New Atlas of Australian Birds 1998-2013 (Birds Australia 2003)
- OEH Vegetation Information System Classification 2.1 database (OEH 2018d)
- Fine-scale vegetation map for the Coffs Harbour LGA (OEH 2012)
- NSW Land and Property Information Tree canopy mapping (NSW Land and Property 2011)
- Groundwater Dependent Ecosystems mapping (DPI 2016b)
- Coffs Harbour City Koala Plan of Management, Koala Habitat Planning Map (CHCC 1999).

Aquatic fauna records were searched for the Bellinger River basin and the Clarence River basin, using:

- NSW DPI Predicted distribution maps of threatened species and fish communities (DPI 2016a)
- NSW DPI Threatened and protected species – records viewer (DPI 2016b).

Other information sources included:

- Coffs Harbour Bypass: Biodiversity Constraints Report (Biosis Pty Ltd. 2016)
- NSW Scientific Committee final determinations for threatened biota
- Commonwealth listing advice for EPBC Act listed communities
- Approved conservation advice for EPBC Act listed communities
- Recovery plans for communities listed under the EPBC Act and TSC Act, where available.

### 10.1.3 Field surveys

Field surveys were carried out between August 2016 and May 2018 by Biosis Pty Ltd to inform biodiversity within the study area. Surveys undertaken during this period included vegetation surveys, targeted surveys for threatened flora and fauna species and ecological communities listed under the TSC Act and the EPBC Act. The full study area investigated included the construction footprint including ancillary sites, as well as the area above the three tunnels. The survey covered an area of 307 ha. Further details of the scope and timing of surveys is provided in **Appendix H, Biodiversity assessment report.**

Targeted survey requirements for threatened species were informed by database search results, a review of the OEH BioBanking Credit Calculator for Major Projects and BioBanking – Version 4.1 (FBA calculator), and an assessment of suitability of available habitats. Targeted surveys were carried out for threatened flora and threatened fauna species considered to have a moderate to high likelihood of occurring within the study area. This included surveys for purple-spotted gudgeon *Mogurnda adspersa* (Endangered under the *Fisheries Management Act 1994* (FM Act)) despite the species having a low likelihood of occurring within the study area.

### *Vegetation and flora surveys*

Classification and detailed mapping of native vegetation communities was based on the vegetation type (plant community type (PCT)) grouping system in Keith (2004). PCTs identified for the study area were stratified into vegetation zones based on condition (low or moderate/good). Identification of PCTs within the study area was verified with reference to the community profile descriptors (and diagnostic species tests) from the OEH (2012) mapping project and NSW Vegetation Information System: Classification Version 2.1 (OEH 2018d).

Site value was assessed in accordance with the FBA using data from 41 plots/transects completed within the study area, as shown in **Figure 10-2**.

Targeted surveys for 24 candidate threatened flora species (**Table 10-3**) involved traversing transects through potential habitat for target species within the study area, in accordance with the FBA (OEH 2014a) and the NSW Guide to Surveying Threatened Plants (OEH 2016b).

Where access was available, survey of hollow bearing trees was undertaken within the study area in accordance with the NSW BioBanking Assessment Methodology (BBAM) (OEH 2014c) and involved the collection of the following data:

- GPS location
- Species name
- Condition (dead or alive)
- Tree height
- Diameter at breast height (DBH)
- Hollow count (approximate number of hollows)
- Position of hollows (trunk/limb).

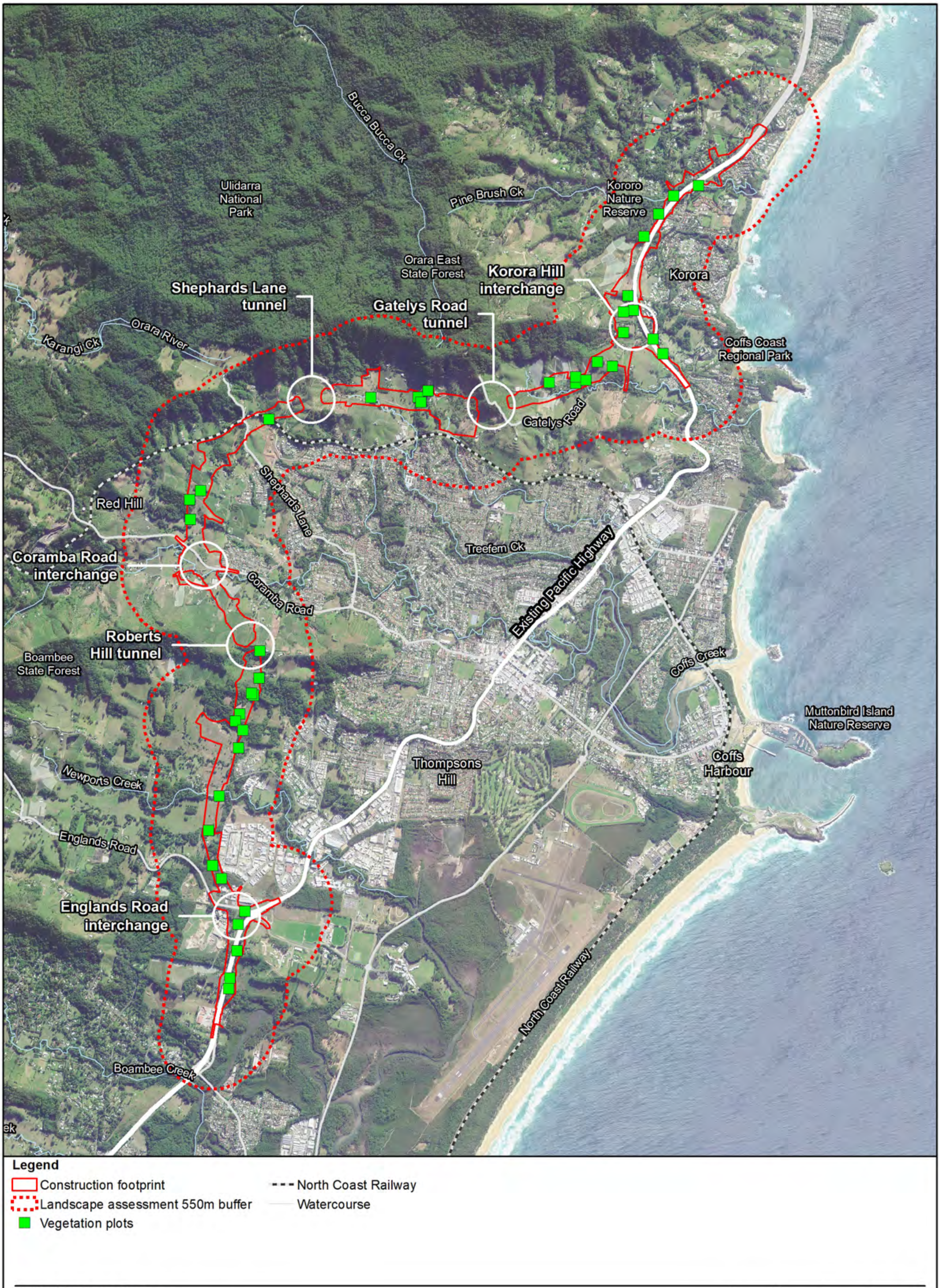
Table 10-3 Targeted threatened flora species

| Scientific name | Common name | Conservation status^ | |
|---|---|---|---|
| | | EPBC Act | BC Act |
| *Alexfloydia repens* | Floyd's grass | | E1 |
| *Arthraxon hispidus* | Hairy jointgrass | V | V |
| *Boronia umbellata* | Orara boronia | V | V |
| *Diospyros mabacea* | Red-fruited ebony | E | E1 |
| *Diploglottis campbellii* | Small-leaved tamarind | E | E1 |
| *Eidothea hardeniana* | Nightcap oak | CE | E1 |
| *Eleocharis tetraquetra* | Square-stemmed spike-rush | | E1 |
| *Endiandra floydii* | Crystal creek walnut | E | E1 |
| *Endiandra hayesii* | Rusty rose walnut | V | V |
| *Hakea archaeoides* | Big nellie hakea | V | V |
| *Kennedia retrorsa* | | V | V |
| *Lindsaea incisa* | Slender screw fern | | E1 |

| **Scientific name** | **Common name** | **Conservation status^** | |
|---|---|---|---|
| | | **EPBC Act** | **BC Act** |
| *Marsdenia longiloba* | Slender marsdenia | V | E1 |
| *Niemeyera whitei* | Rusty plum | | V |
| *Parsonsia dorrigoensis* | Milky silkpod | E | V |
| *Peristeranthus hillii* | Brown fairy-chain orchid | | V |
| *Phaius australis* | Southern swamp orchid | E | E1 |
| *Pomaderris queenslandica* | Scant pomaderris | | E1 |
| *Quassia sp. Moonee Creek* (listed as *Samdera sp Moonee Creek* under the EPBC Act) | Moonee quassia | E | E1 |
| *Senna acclinis* | Rainforest cassia | | E1 |
| *Thesium australe* | Austral toadflax | V | V |
| *Tylophora woollsii* | Cryptic forest twiner | E | E1 |
| *Typhonium sp. aff. brownii* | Stinky lily | | E1 |
| *Uromyrtus australis* | Peach myrtle | E | E1 |

^ Conservation Status:

- EPBC Act – Indicates the Commonwealth conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*, coded as Critically Endangered (CE), Endangered (E), Vulnerable (V).
- BC Act – Indicates the New South Wales conservation status of each taxon under the *Biodiversity Conservation Act 2016* coded as Endangered species (E1), Vulnerable (V)




Coffs Harbour Bypass
Vegetation plots for flora survey
Figure 10-2

### *Fauna surveys*

Targeted surveys for threatened fauna were conducted across nine separate field campaigns during spring 2016, autumn 2017, winter 2017 and spring/summer 2017–2018.

Survey methods included:

- Koala Spot Assessment Technique (SAT)
- Terrestrial Elliot A trapping
- Arboreal Elliot B trapping
- Diurnal bird surveys
- Harp trapping
- Culvert/bridge and tunnel inspections
- Nocturnal spotlight surveys
- Nocturnal and diurnal waterbody searches
- Nocturnal and diurnal call playback
- Camera trapping (spring, summer and winter)
- Frog surveys (winter)
- Invertebrate area and transect searches
- Pink underwing moth survey
- Hollow-bearing tree assessment
- Ultrasonic bat call recording.

Locations of fauna surveys are shown in **Figure 10-3-01 to Figure 10-3-06**.

Based on the desktop review, 33 species were identified as candidate threatened fauna, including 28 species credit species and five ecosystem credit species, requiring targeted surveys in accordance with the FBA (OEH 2014a) and provisions of the EPBC Act (**Table 10-4**).

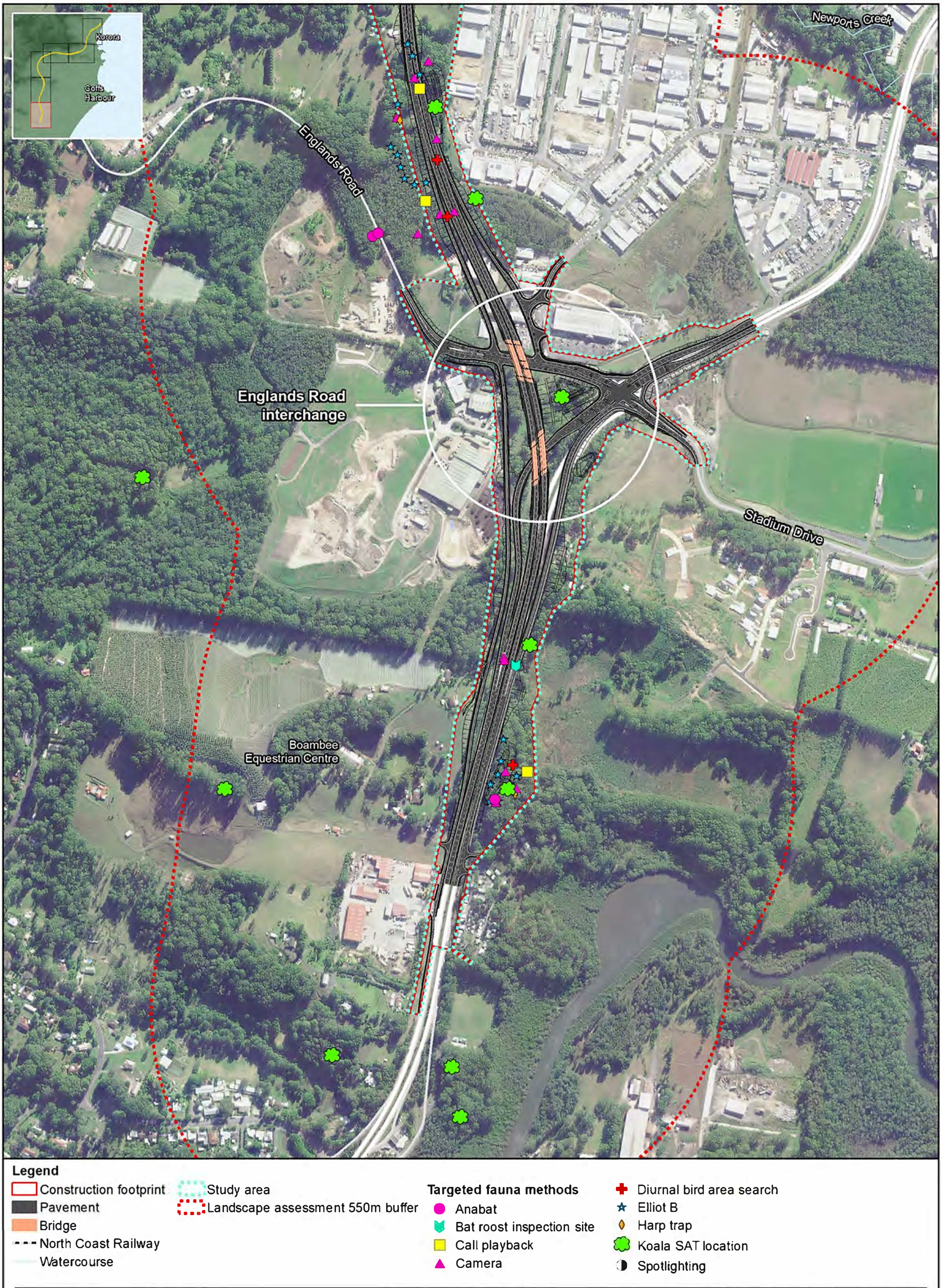
Table 10-4 Targeted threatened fauna species

| Scientific name | Common name | Conservation status^ | |
|---|---|---|---|
| | | EPBC Act | BC Act / FM Act |
| **Mammals** | | | |
| *Cercartetus nanus* | Eastern pygmy-possum | | V |
| *Dasyurus maculatus maculatus* | Spotted-tailed quoll | E | V |
| *Miniopterus australis* | Little bentwing-bat | | V |
| *Miniopterus schreibersii oceanensis* | Eastern bentwing-bat | | V |
| *Myotis macropus* | Southern myotis | | V |
| *Petaurus norfolcensis* | Squirrel glider | | V |
| *Petaurus australis* | Yellow-bellied glider | | V |
| *Phascogale tapoatafa* | Brush-tailed phascogale | | V |
| *Phascolarctos cinereus* | Koala | V | V |
| *Planigale maculata* | Common planigale | | V |

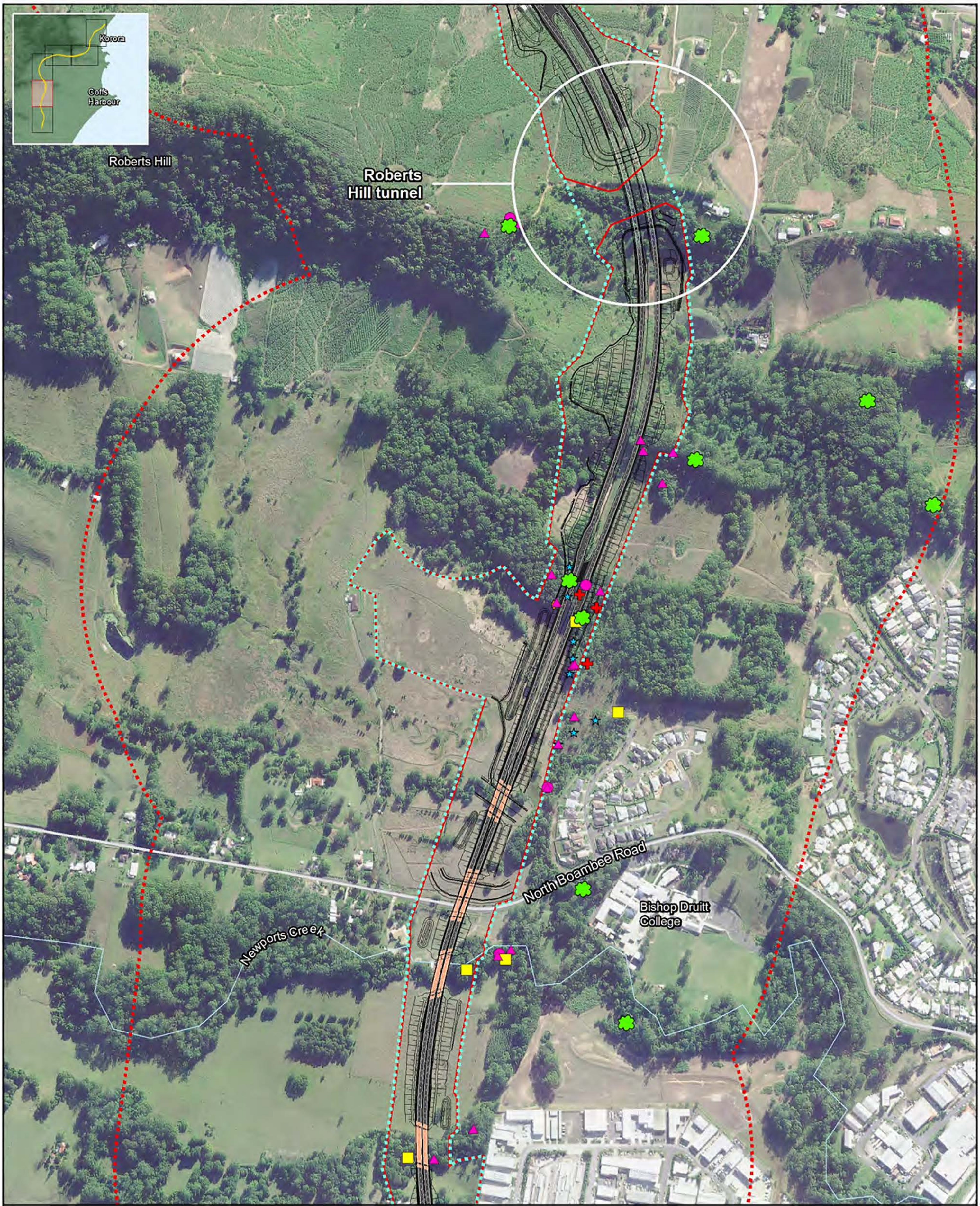
| Scientific name | Common name | Conservation status^ | |
|---|---|---|---|
| | | EPBC Act | BC Act / FM Act |
| *Potorous tridactylus tridactylus* | Long-nosed potoroo | V | V |
| *Pteropus poliocephalus* | Grey-headed flying-fox | V | V |
| **Birds** | | | |
| *Anthochaera phrygia* | Regent honeyeater | CE | E4A |
| *Dromaius novaehollandiae* | Emu | | E2 |
| *Ephippiorhynchus asiaticus* | Black-necked stork | | E1 |
| *Irediparra gallinacea* | Comb-crested jacana | | V |
| *Ixobrychus flavicollis* | Black bittern | | V |
| *Lathamus discolor* | Swift parrot | CE | E |
| *Ninox connivens* | Barking owl | | V |
| *Ninox strenua* | Powerful owl | | V |
| *Tyto novaehollandiae* | Masked owl | | V |
| *Tyto tenebricosa* | Sooty owl | | V |
| *Pandion cristatus* | Osprey | | V |
| **Reptiles** | | | |
| *Hoplocephalus stephensii* | Stephens' banded snake | | V |
| **Fish** | | | |
| Nannoperca oxleyana | Oxleyan pygmy perch | E | E1 |
| **Frogs** | | | |
| *Crinia tinnula* | Wallum froglet | | V |
| *Litoria aurea* | Green and golden Bell Frog | V | E1 |
| *Litoria brevipalmata* | Green-thighed frog | | V |
| *Mixophyes balbus* | Stuttering frog | V | E1 |
| *Mixophyes iteratus* | Giant barred frog | E | E1 |
| **Invertebrates** | | | |
| *Argyreus hyperbius* | Australian fritillary | | E1 |
| *Ocybadistes knightorum* | Black grass-dart butterfly | | E1 |
| *Petalura litorea* | Coastal petaltail dragonfly | | E1 |
| *Phyllodes imperialis smithersi* | Southern pink underwing moth | E | E1 |

^ Conservation Status:

- EPBC Act – Indicates the Commonwealth conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*, coded as Critically Endangered (CE), Endangered (E), Vulnerable (V)
- BC Act/ FM Act – Indicates the NSW conservation status of each taxon under the *Biodiversity Conservation Act 2016* and the *Fisheries Management Act 1994*, coded as Vulnerable (V); Endangered species (E1), Endangered populations (E2), Critically Endangered (E4A).




Coffs Harbour Bypass
Targeted fauna surveys
Figure 10-3-01




**Legend**

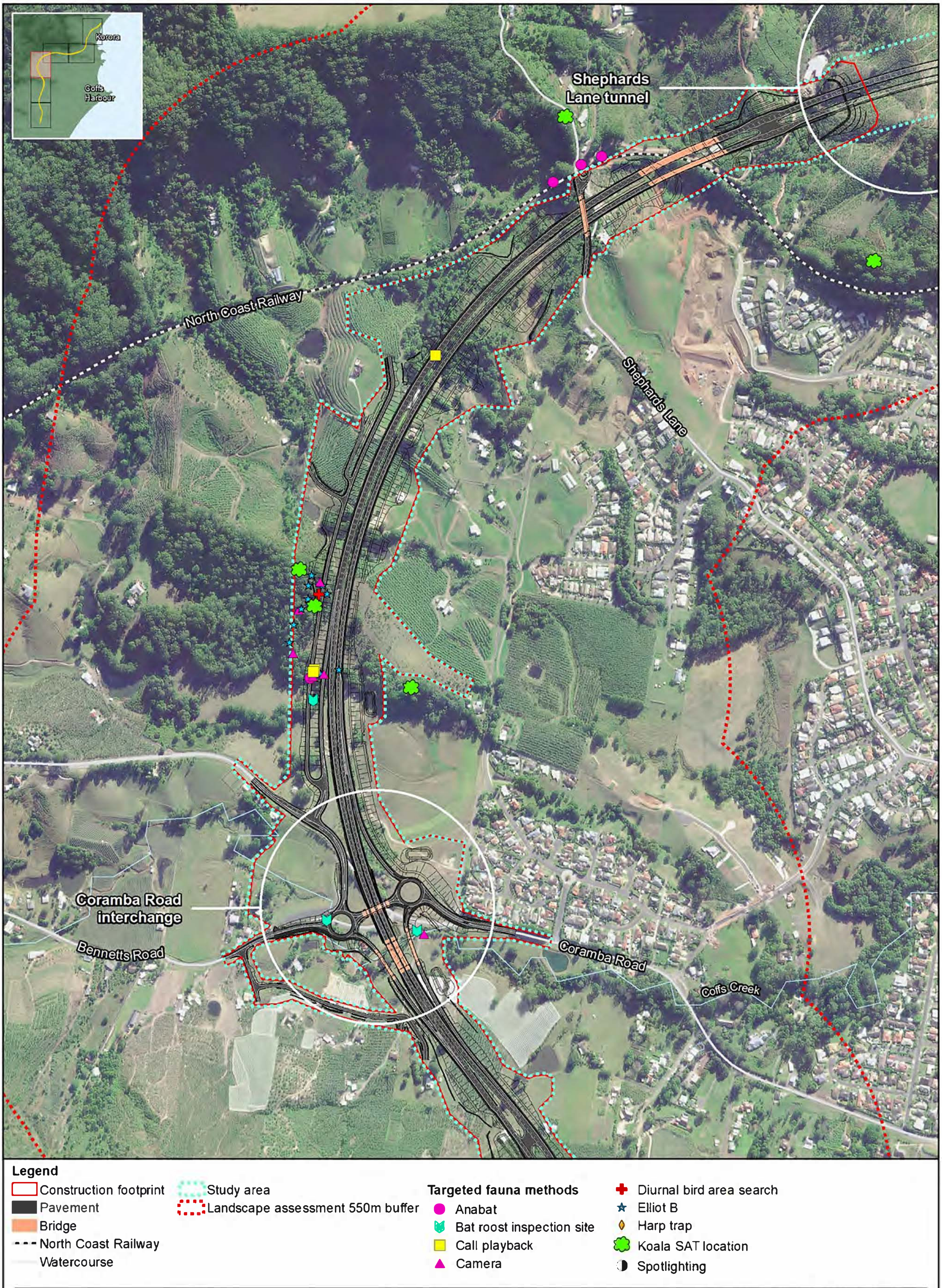
- Construction footprint
- Pavement
- Bridge
- North Coast Railway
- Watercourse
- Study area
- Landscape assessment 550m buffer

**Targeted fauna methods**

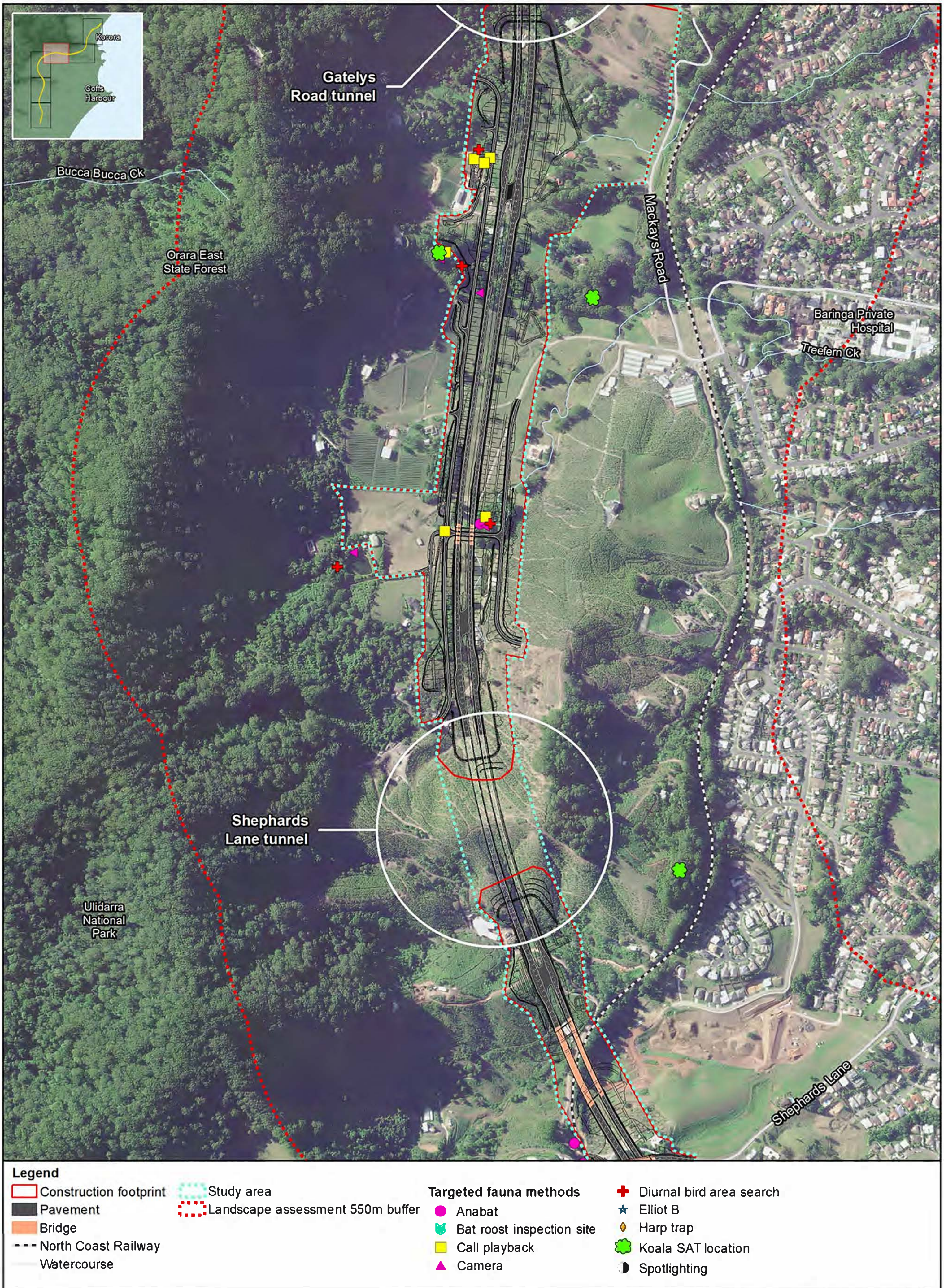
- Anabat
- Bat roost inspection site
- Call playback
- Camera
- Diurnal bird area search
- Elliot B
- Harp trap
- Koala SAT location
- Spotlighting

Coffs Harbour Bypass
Targeted fauna surveys
Figure 10-3-02

0 0.1 0.2 0.3 km
N
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56




Coffs Harbour Bypass
Targeted fauna surveys
Figure 10-3-03




Coffs Harbour Bypass
Targeted fauna surveys
Figure 10-3-04


**Legend**

- Construction footprint
- Pavement
- Bridge
- North Coast Railway
- Watercourse
- Study area
- Landscape assessment 550m buffer

**Targeted fauna methods**

- Anabat
- Bat roost inspection site
- Call playback
- Camera
- Diurnal bird area search
- Elliot B
- Harp trap
- Koala SAT location
- Spotlighting

0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

Coffs Harbour Bypass
Targeted fauna surveys
Figure 10-3-05


Legend

- Construction footprint
- Pavement
- Bridge
- North Coast Railway
- Watercourse
- Study area
- Landscape assessment 550m buffer

Targeted fauna methods

- Anabat
- Bat roost inspection site
- Call playback
- Camera
- Diurnal bird area search
- Elliot B
- Harp trap
- Koala SAT location
- Spotlighting

Coffs Harbour Bypass
Targeted fauna surveys
Figure 10-3-06

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56
N

### *Aquatic surveys*

Field surveys used to gather data on aquatic habitats and threatened aquatic species within the study area were completed over four days in September 2016 and five days in May 2018.

Thirty-two survey sites were selected to capture the broad range of aquatic habitats located within the study area, including wetlands and streams of varying sizes (**Figure 10-4**). The following survey methods were adopted at each site, where relevant:

- DPIE waterway classification – The type (sensitivity of key fish habitat present) and class (classification of the waterway for fish passage) system outlined in the DPI Guidelines (DPI 2013)
- HABSCORE assessment – Direct visual measure of physical habitat attributes likely to influence the quality of water and the condition of resident aquatic communities
- Backpack electrofishing – Using a Smith-Root LR-24 backpack electrofishing unit by operators accredited under the U.S Fisheries and Wildlife Electrofishing – Principles and Techniques of electrofishing and in accordance the Australian Code of Electrofishing Practice 1997 (NSW Fisheries 1997)
- Bait trapping – Placement of two-millimetre mesh size with a 40 mm diameter entrance traps in areas with medium to high density (≥ 20 per cent cover) instream vegetation. Undertaken where water depth did not allow electrofishing
- Nutrient water sampling – Including one round of National Association of Testing Authorities, Australia (NATA) accredited laboratory testing for Total Phosphorus, Total Nitrogen and Total Kjeldahl Nitrogen undertaken as some sites in September 2016 and remaining sites in May 2018
- On-site surface water quality sampling, using a Horiba U-52 multi-parameter probe testing for water temperature, dissolved oxygen, pH, electrical conductivity and oxidation reduction potential.

Fish community surveys, using bait traps and backpack electrofishing, were undertaken in accordance with the survey guidelines for Australia's threatened fish (DSEWPC 2011).

Desktop review indicated DPI predicted habitat for the purple-spotted gudgeon (*Mogurnda adspersa)* (Endangered FM Act) situated along sections of Newports Creek and Coffs Creek within the study area. Targeted survey for this species was undertaken along sections of predicted habitat.

Coffs Harbour Bypass
Aquatic ecology surveys
Figure 10-4

# 10.2 Existing environment

Existing biodiversity values identified for the study area are presented in this section including vegetation communities, threatened flora and fauna species, aquatic habitats and freshwater fish communities.

## 10.2.1 Landscape features

As the project is a linear development, landscape value was assessed according to Appendix 5 of the FBA (Assessing landscape value for linear shaped developments, or multiple fragmentation impacts). This applies a 550 m buffer area to the study area, as required for linear assessments undertaken in accordance with the FBA (OEH 2014a).

The landscape scale biodiversity features identified within the biodiversity study area are summarised in **Table 10-5.**

Table 10-5 Landscape values of the study area

| Landscape feature | Description |
| --- | --- |
| Interim Biogeographic Regionalisation for Australia (IBRA) bioregion and sub-region | North Coast IBRA bioregion and Coffs Coast and Escarpment IBRA subregion |
| NSW Landscape Regions (Mitchell Landscapes) | Four soil landscapes as mapped by the NSW National Parks and Wildlife Service (2002) and described by the NSW Department of Environment and Climate Change (2008) were identified, including:<br>• Brooms Head – Kempsey Coastal ramp<br>• Manning – Macleay Coastal Alluvial Plain<br>• Nymboida Great Escarpment<br>• Manning – Macleay barriers and beaches. |
| Rivers and streams | The study area is located within the Bellinger River Catchment on the mid north coast of NSW. A number of perennial and non-perennial watercourses and their tributaries intersect the study area including:<br>• Pine Brush Creek (fifth order) and several adjoining first order tributaries<br>• Jordans Creek (third order) and several adjoining first and second order tributaries<br>• Treefern Creek (third order) and several adjoining first and second order tributaries<br>• Coffs Creek (third order). Adjoining tributaries feed into Coffs Creek inlet outside of the study area to the east; a designated Habitat Protection Zone (DPI 2018c)<br>• Newports Creek (fifth order) and several adjoining first, second and third order tributaries<br>• Boambee Creek (second order) and adjoining first order tributaries. |
| Wetlands | No Ramsar Wetlands or Nationally Important Wetlands have been mapped within the study area (Commonwealth of Australia 2015). The closest Ramsar Wetland; Myall Lakes is located approximately 300 km south of Coffs Harbour. |

| Landscape feature | Description |
|---|---|
| | Three state mapped (OEH 2006) wetlands are located to the east, west and south of the study area and are associated with Pine Brush Creek, Boambee Creek and Cordwells Creek. |
| Percent native vegetation cover | Existing native vegetation cover in the 550 m buffer landscape assessment area is estimated at 619.5 ha (28%). |
| Biodiversity links and connectivity value | Biodiversity links supported within the study include:<br>• One regionally significant biodiversity link in the form of a fourth order waterway riparian buffer zone of the southern tributary of Newports Creek<br>• Several other local biodiversity links. |

## 10.2.2 Native vegetation

The study area supports 43.37 ha of native vegetation mainly consisting of isolated patches within a matrix dominated by agricultural, residential and industrial land uses. Vegetation formations identified within the study area are dominated by wet sclerophyll forest with forested wetlands and rainforest vegetation present to a lesser extent. Nine PCTs were identified within the study area, stratified into 19 vegetation zones. **Table 10-6** provides a summary of the PCTs within the study area, with full details on the floristic and structural condition, as well as the vegetation zones provided in **Appendix H, Biodiversity assessment report**.

Native vegetation condition across the study area was highly variable. Conditions ranged from sites supporting heavy weed infestation and little native species richness or diversity to more intact areas with high native species richness and structural diversity. Generally, vegetation patches in lower ecological condition also exhibited higher levels of modification and fragmentation.

Table 10-6 PCT extent in the study area

| Vegetation formation | Plant community type | Area in study area (ha) |
|---|---|---|
| Rainforest | PCT 670 Black Booyong – Rosewood – Yellow Carabeen subtropical rainforest of the NSW North Coast Bioregion (NR111) | 0.51 ha |
| Wet Sclerophyll Forest (Shrubby sub-formation) | PCT 692 Blackbutt – Tallowwood moist ferny open forest of the coastal ranges of the NSW North Coast Bioregion (NR120) | 15.40 ha |
| Wet Sclerophyll Forest (Shrubby sub-formation) | PCT 695 Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion (NR122) | 10.48 ha |
| Wet Sclerophyll Forest (Shrubby sub-formation) | PCT 747 Brush Box – Tallowwood – Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion (NR138) | 5.83 ha |
| Forested Wetland | PCT 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (NR217) | 3.65 ha |
| Wet Sclerophyll Forest (Shrubby sub-formation) | PCT 1244 Sydney Blue Gum open forest on coastal foothills and escarpment of the North Coast (NR258) | 0.94 ha |

| Vegetation formation | Plant community type | Area in study area (ha) |
|---|---|---|
| Wet Sclerophyll Forest (Grassy sub-formation) | PCT 1262 Tallowwood – Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast (NR263) | 1.62 ha |
| Wet Sclerophyll Forest (Shrubby sub-formation) | PCT 1285 Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion (NR274) | 3.03 ha |
| Rainforest | PCT 1302 White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion (NR280) | 1.91 ha |
| **Total** | | **43.37 ha** |

## 10.2.3 Threatened ecological communities

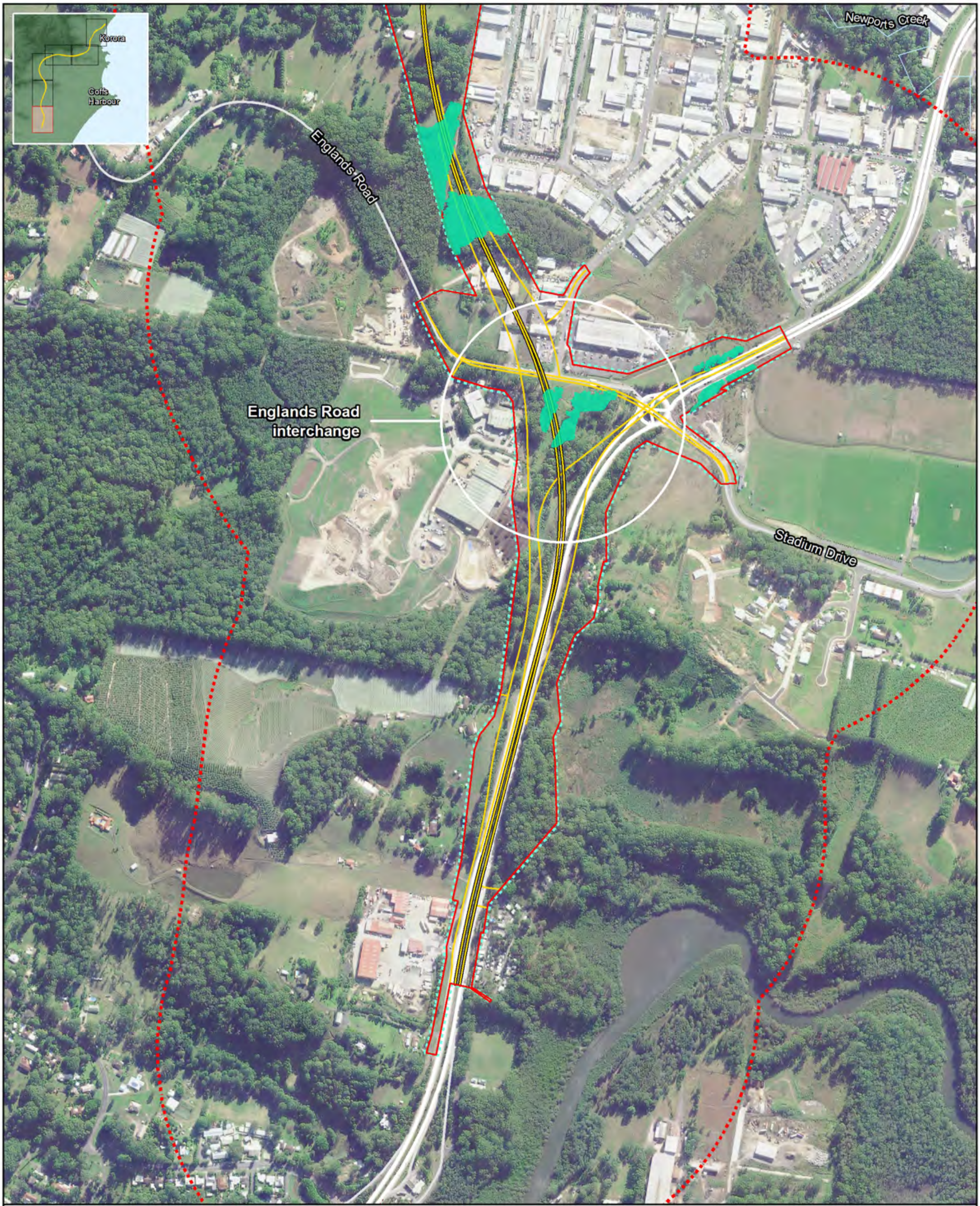
Ten threatened ecological communities (TECs) listed under the EPBC Act and/or BC Act were determined to have the potential to occur in the study area based on the results of the desktop assessment.

The field surveys confirmed the presence of two TECs listed under the BC Act, as described in **Table 10-7.** The location of corresponding PCTs are shown in **Figure 10-5-01** to **Figure 10-5-06**.

Table 10-7 Threatened ecological communities within the study area

<table>
<tr><th rowspan="2">PCT</th><th rowspan="2">TEC scientific name</th><th colspan="2">Conservation status^</th><th rowspan="2">Area (ha)</th></tr>
<tr><th>EPBC</th><th>BC Act</th></tr>
<tr><td>PCT 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (NR217)</td><td>Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Swamp Sclerophyll Forest Endangered Ecological Community (EEC))</td><td>–</td><td>E3</td><td>3.65 ha</td></tr>
<tr><td>PCT 1302 White Booyong –Fig subtropical rainforest of the NSW North Coast Bioregion (NR280)</td><td rowspan="2">Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion</td><td>-</td><td>E3</td><td rowspan="2">2.42 ha</td></tr>
<tr><td>PCT 670 Black Booyong –Rosewood – Yellow Carabeen subtropical rainforest of the NSW North Coast Bioregion (NR111)</td><td>-</td><td>E3</td></tr>
<tr><td colspan="4">Total</td><td>6.07 ha</td></tr>
</table>

^ Table codes: Endangered ecological communities (E3)




**Legend**

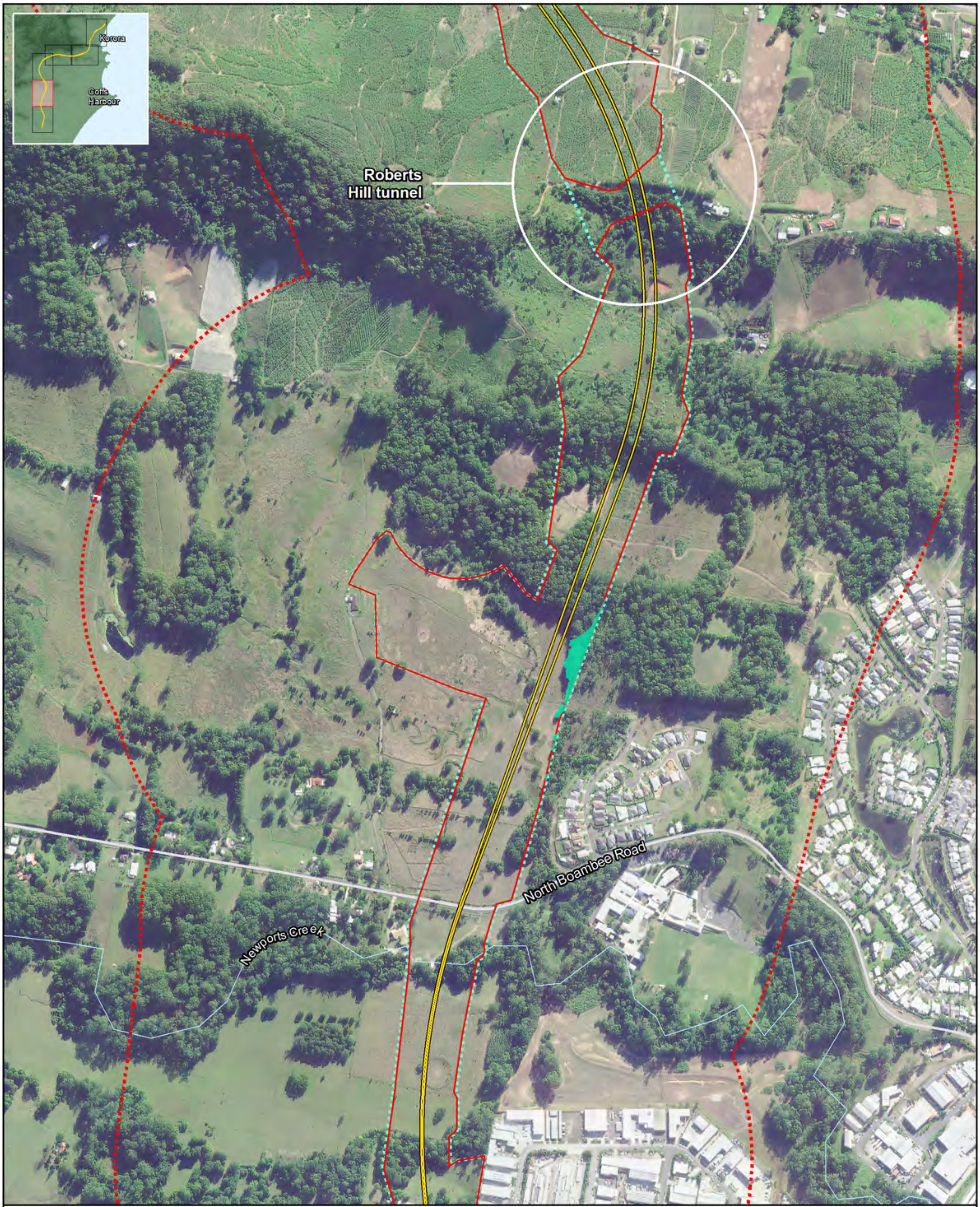
Construction footprint
Study area
Landscape assessment 550m buffer
Alignment
North Coast Railway
Watercourse

**Threatened ecological communities**

Lowland rainforest
Swamp sclerophyll forest

Coffs Harbour Bypass
Threatened ecological communities
Figure 10-5-01

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56
N




**Legend**

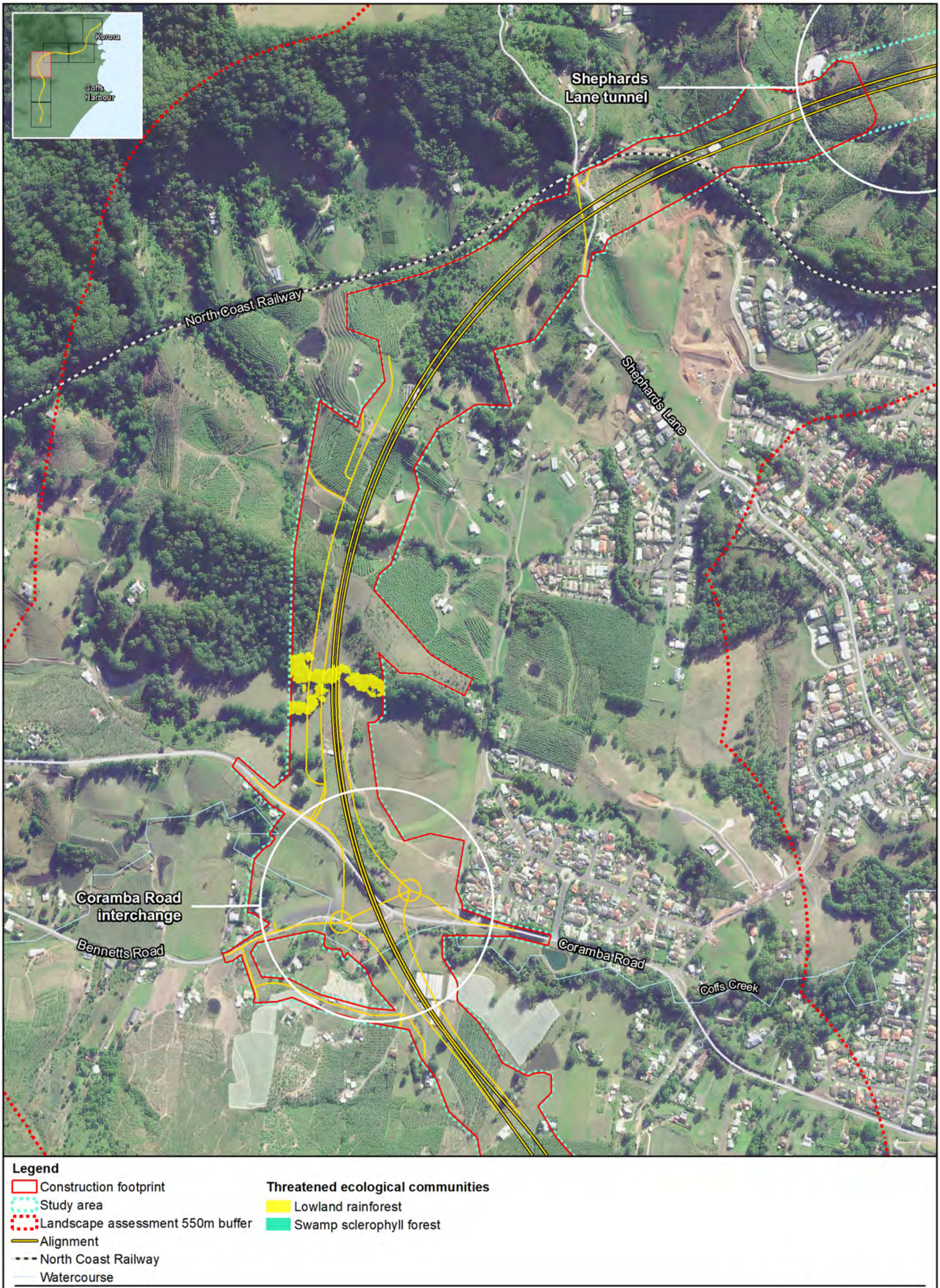
Construction footprint
Study area
Landscape assessment 550m buffer
Alignment
North Coast Railway
Watercourse

**Threatened ecological communities**

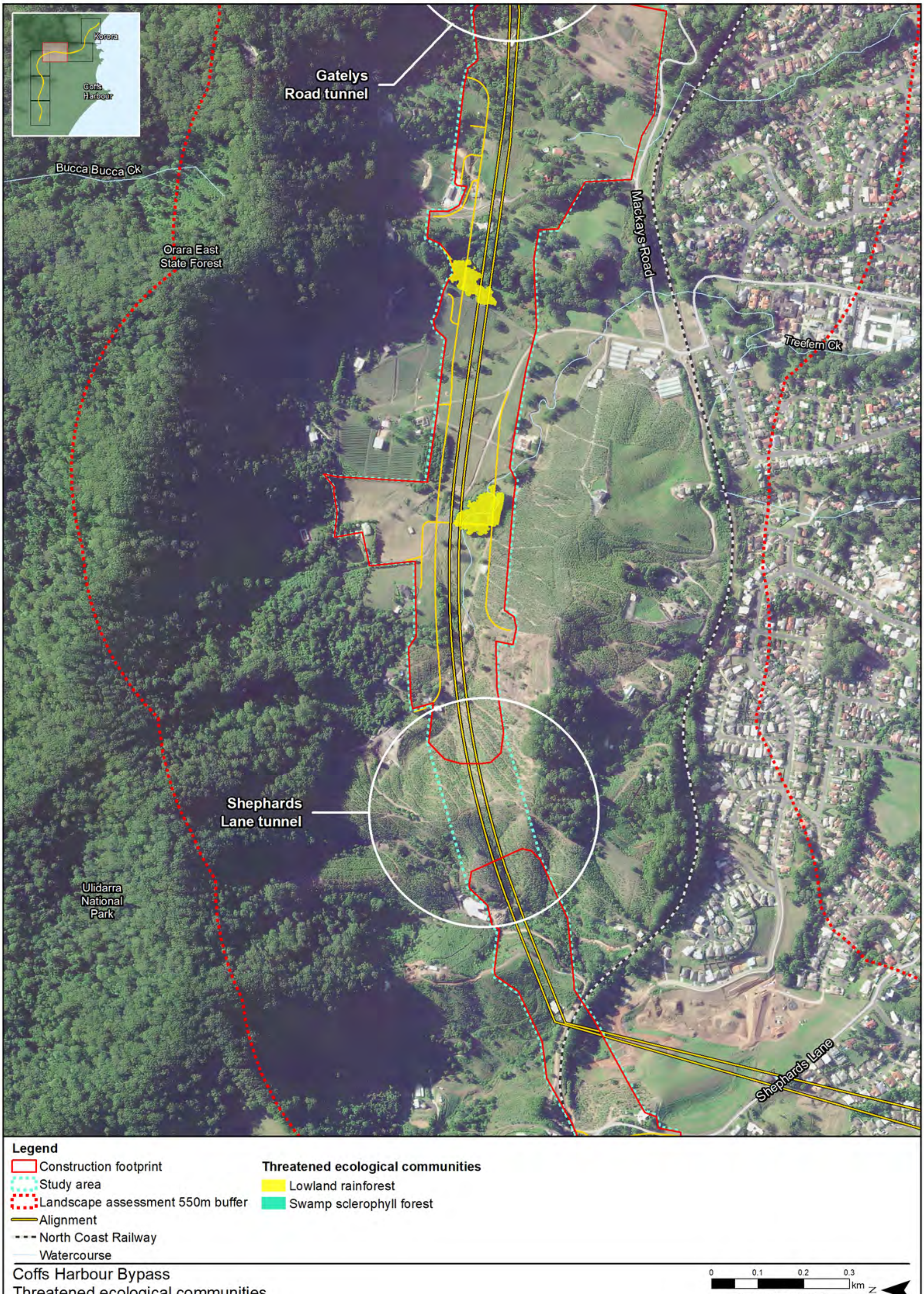
Lowland rainforest
Swamp sclerophyll forest

0 0.1 0.2 0.3 km
N
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

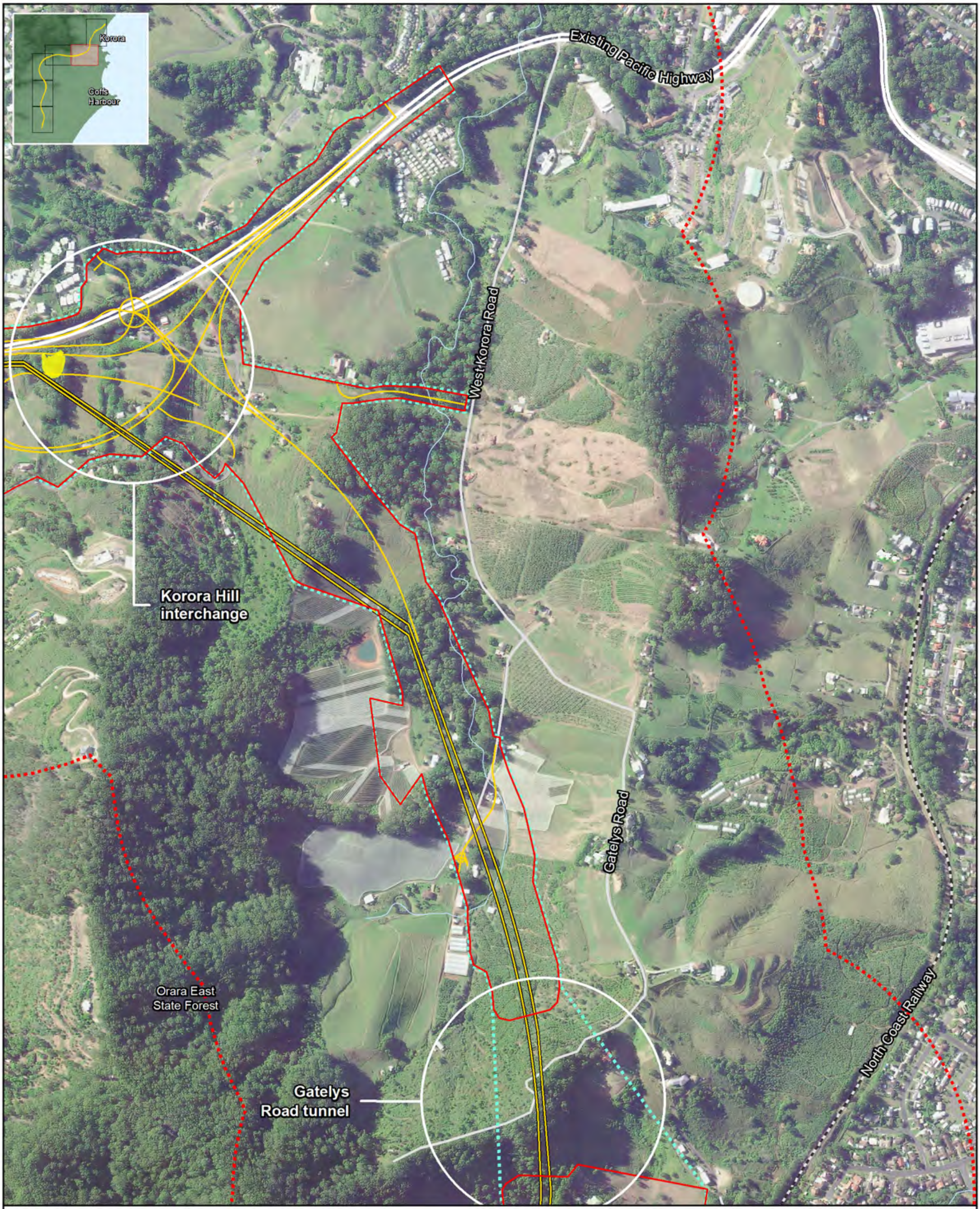
Coffs Harbour Bypass
Threatened ecological communities
Figure 10-5-02




Coffs Harbour Bypass
Threatened ecological communities
Figure 10-5-03




Coffs Harbour Bypass
Threatened ecological communities
Figure 10-5-04




**Legend**

- Construction footprint
- Study area
- Landscape assessment 550m buffer
- Alignment
- North Coast Railway
- Watercourse

**Threatened ecological communities**

- Lowland rainforest
- Swamp sclerophyll forest

Coffs Harbour Bypass
Threatened ecological communities
Figure 10-5-05

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56


**Legend**

- Construction footprint
- Study area
- Landscape assessment 550m buffer
- Alignment
- North Coast Railway
- Watercourse

**Threatened ecological communities**

- Lowland rainforest
- Swamp sclerophyll forest

Coffs Harbour Bypass
Threatened ecological communities
Figure 10-5-06

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56
N

## 10.2.4 Groundwater dependent ecosystems

Assessment of the potential for the study area to support Groundwater Dependent Ecosystems (GDEs) was assessed using the Australian Government's Bureau of Meteorology (BoM) Groundwater Dependent Ecosystems Atlas and Statewide GDE mapping (DPI 2016b). No areas reliant on the surface expression of groundwater are mapped within the study area according to the GDE Atlas or metadata (DPI Water 2016).

All nine PCTs located within the study area were identified as 'High probability GDEs from regional studies', based on a search of the GDE Atlas. This included one groundwater dependent wetland community (PCT 1064) with the remaining PCTs being equivalent to groundwater dependent vegetation, as identified in **Table 10-8.**

The State mapping suggests these areas could be dependent on the subsurface expression of groundwater (DPI 2016b). No areas reliant on the surface expression of groundwater were mapped within the study area (DPI 2016b). Similarly, no inflow dependent ecosystems are mapped within the study area.

Table 10-8 Potential GDEs mapped for the study area

| GDE Name | PCT Details | Landscape position |
|---|---|---|
| **Groundwater dependent wetland communities – High probability** | | |
| Paperbark | PCT 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (NR217) | Occurs in the southern and central parts of the study area east of Englands Road and west of Highlander Drive along and adjacent to tributaries of Newports Creek in the North Boambee Valley. Occurs on low lying, typically waterlogged ground and is associated with low-lying inundated areas on alluvial floodplains and back-swamps. |
| **Groundwater dependent vegetation communities – High probability** | | |
| Sub-Tropical Rainforest | PCT 670 Black Booyong – Rosewood – Yellow Carabeen subtropical rainforest of the NSW North Coast Bioregion (NR111) | Occurs in well sheltered gullies and slopes at low altitudes, with only one occurrence of the PCT present within the study area, north of Mackays Road. |
| Wet Sclerophyll Shrub Forests | PCT 692 Blackbutt – Tallowwood moist ferny open forest of the coastal ranges of the NSW North Coast Bioregion (NR120) | Broadly located on foothills and ranges from the Manning Valley north to the Corindi River and commonly occurs towards the northern and southern end of the study area. |
| Wet Sclerophyll Shrub Forests | PCT 695 Blackbutt –Turpentine –Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion (NR122) | Known to occur on the ranges of the great escarpment from Dingo Tops north to Chandlers Creek. Within the study areas it occurs throughout the centre and north of the alignment with the largest location adjacent to Jordans Creek. |
| Wet Sclerophyll Shrub Forests | PCT 747 Brush Box – Tallowwood - Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion (NR138) | Distributed in near coastal valleys and foothills from the Nambucca Valley north to the Corindi River, the PCTs occurrence within the study area is generally associated with creeks and drainage lines through the centre of the alignment. |
| Central Mid Elevation | PCT 1244 Sydney Blue Gum open forest on coastal foothills | Generally known to exist as a tall wet forest with an over storey dominated by Sydney Blue Gum |

| GDE Name | PCT Details | Landscape position |
|---|---|---|
| Sydney Blue Gum | and escarpment of the North Coast (NR258) | (*Eucalyptus saligna*). Two occurrences within the study area: to the north of the Kororo Nature Reserve and to the south of North Boambee Road. |
| Dry Grassy Tallowwood-Grey Gum | PCT 1262 Tallowwood – Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast (NR263) | Distributed throughout the coastal lowlands and foothills of the mid north coast from the Manning Valley north to the Corindi River. Within the study area, exists as two patches in one location in Korora. |
| Open Coastal Brushbox | PCT 1285 Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion (NR274) | Generally located on coastal lowlands and foothills from the Manning Valley north to the Corindi River. Occurs in two locations at the northern end of the study area adjacent to Kororo Nature Reserve, and adjacent to the existing Pacific Highway alignment near Charlesworth Bay. |
| Lowland Rainforest on Floodplain | PCT 1302 White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion (NR280) | Located on the floodplains in the North Coast region. Occurs in three areas within the study area including: adjacent to the Coffs Creek tributary north of Coramba Road, immediately west of Treefern Creek, and near an unnamed watercourse near Bruxner Park Road. |

*Adapted from the NSW Office of Water (DPI 2012c) Types of communities, including groundwater dependent vegetation, within the Northern Rivers Region (CMA)

Further assessment of the potential for the vegetation within the study area to be a GDE reliant on the subsurface expression of groundwater was undertaken based on the information provided in the GDE Atlas and the rulesets detailed in Atlas of Groundwater Dependent Ecosystems (GDE Atlas), Phase 2 Task 5 Report: Identifying and mapping GDEs (SKM 2012).

The GDE Atlas illustrates vegetation present in the vicinity of the Newports Creek floodplain, south of Englands Road, to be the only area of high probability GDE (from regional studies), with all other vegetation across the study area considered to be low probability GDE (from regional studies). The landscape setting and flora species composition of the vegetation within the study area supports the GDE Atlas as to the potential presence of GDEs within the study area.

### 10.2.5 Threatened flora species

The desktop review of relevant databases identified 24 candidate threatened flora species requiring further assessment. Species habitat requirements, the presence of these habitats within the study area, the presence of existing records of threatened species in the locality, and an overall likelihood of occurrence within the study area was determined for each candidate species (refer **Appendix H, Biodiversity assessment report**).

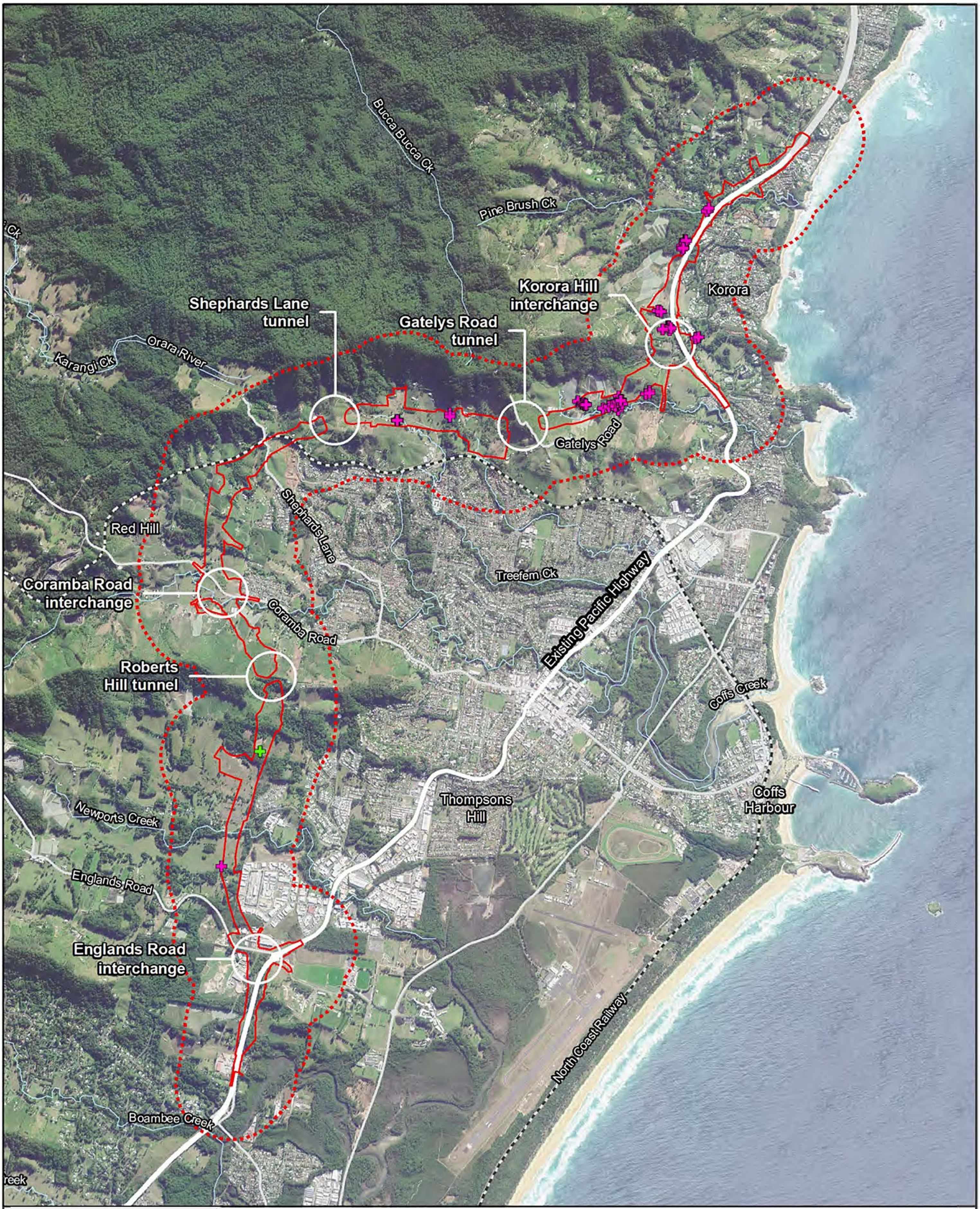
Two threatened flora species were directly observed during the targeted flora surveys. These included the southern swamp orchid *Phaius australis* and rusty plum *Niemeyera whitei* (**Figure 10-6**). Species records relative to each PCT are provided in **Table 10-9.**

Southern swamp orchids occur in swampy grassland or swampy forest in coastal areas. In NSW, most of the populations occur between Coffs Harbour and Ballina. It has a flowering stem of up to two metres tall, one of the largest species of ground orchids in Australia (DoE 2014). One individual of southern swamp orchid was recorded in the study area within a small patch of remnant vegetation consistent with PCT 695 Blackbutt – Turpentine shrubby open forest of the coastal foothills of the central North Coast. This individual was located off North Boambee Road in North Boambee Valley.

Rusty plum is a small to medium-sized tree with a fluted trunk. It typically occurs in gullies of warm temperate or littoral rainforests on poor soils below an altitude of 600 m above sea level. In addition to sightings during the field surveys, a number of historical records are also available for the study area. In total, 57 individuals have been recorded within the study area, predominantly confined to the gullies and depressions associated with the riparian corridors of Pine Brush Creek and Jordans Creek. Records for this species occurred across six PCTs with highest densities recorded within PCT 695 Blackbutt – Turpentine shrubby open forest of the coastal foothills of the central North Coast.

Table 10-9 Summary of threatened flora records and associated PCT

| Threatened species | Habitat | Number of records |
|---|---|---|
| Southern swamp orchid | PCT 695 Blackbutt – Turpentine shrubby open forest of the coastal foothills of the central North Coast | 1 |
| Rusty plum | PCT 670 Black Booyong – Rosewood – Yellow Carabeen subtropical rainforest of the North Coast | 2 |
| | PCT 747 Brush Box –Tallowwood – Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion | 9 |
| | PCT 692 Blackbutt – Tallowwood moist ferny open forest of the coastal ranges of the North Coast | 7 |
| | PCT 695 Blackbutt – Turpentine shrubby open forest of the coastal foothills of the central North Coast | 23 |
| | PCT 1285 Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion | 3 |
| | PCT 1302 White Booyong – Fig subtropical rainforest of the NSW North Coast | 13 |




Legend

- Construction footprint
- Landscape assessment 550m buffer
- North Coast Railway
- Watercourse

Threatened flora species

- Niemeyera whitei - rusty plum
- Phaius australis - southern swamp orchid

Coffs Harbour Bypass
Threatened flora records
Figure 10-6

0 0.5 1 1.5 km
Scale @A4: 1:50,000
GDA 1994 MGA Zone 56
N

## 10.2.6 Threatened fauna species

Based on the desktop review, 33 species were identified as candidate threatened fauna requiring targeted surveys in accordance with the FBA (OEH 2014a) and provisions of the EPBC Act.

Fourteen threatened terrestrial fauna species were confirmed for the study area as summarised in **Table 10-10** and **Figure 10-7** during the field investigations for this project. Threatened species polygons have been prepared for the six species credit fauna species recorded within the study area in accordance with Section 6.5.1.18 of the FBA (**Figure 10-7**). The full study area included the area above the three tunnels and covered an area of 307 ha. The study area contains habitat for koalas and 13 observations were recorded during the field survey, consisting of direct observations of an animal or confirmed scratch marks. Areas of suitable habitat for koalas include areas of eucalypt and paperbark forest providing foraging and movement resources for this species. Within the study area, there was generally low activity levels recorded using SAT surveys; however, the study area is in areas of identified movement corridors. Koala habitat within remnant vegetation surrounding Coffs Harbour may provide important connective corridors, particularly within gullies containing feed tree species which provide preferred habitat within the Coffs Harbour region.

Three culverts located within the 550 m buffer study area were identified as supporting microbat species including adult and juvenile southern myotis *Myotis macropus*, little bentwing-bat *Miniopterus australis* and a bentwing-bat species *Miniopterus sp*. that could not be identified to species level due to a lack of sufficient culvert access (**Appendix H, Biodiversity assessment report**). The locations of these sightings are shown in **Figure 10-7** and include:

- Englands Road in the south of the alignment (Culvert 8)
- Coramba Road beneath a property access road at 353 Coramba Road (Culvert 10)
- Culvert under the existing Pacific Highway about 800 m north of the intersection with James Small Drive (Culvert 28).

Southern myotis and little bentwing-bat were also recorded using harp-trapping methods. Hollow-bearing trees and other culvert structures located throughout the study area may also provide roosting sites for these species, although no microbats were directly observed utilising these habitat features at the time of survey.

Grey-headed flying-fox were observed foraging within the vicinity of Pine Brush Creek, Jordans Creek and Boambee Creek. There are no known roost sites within the study area and ample foraging resources are present within the study area and wider landscape, in the form of flowering native trees and other garden and horticultural fruit trees.

Potential habitat for spotted-tailed quoll *Dasyurus maculatus* was identified within the study area in larger patches of remnant vegetation and along creek corridors where there is dense vegetation for shelter and movement. Although this species was not recorded in the study area, BioNet records indicate the species is present within the surrounding area, with observations to the east adjacent to Bongil Bongil National Park and Boambee East, to the south-west at Boambee State Forest and Tuckers Nob State Forest and to the north in the Korora Basin. This species can be found in a wide range of habitats including urban areas and has a large home range. There is the potential for Spotted-tailed Quolls to move through and across the study area; however, there is limited habitat to support a population within the study area and the adjacent landscape.

Two threatened frog species, including green-thighed frog *Litoria brevipalmata* and giant barred frog *Mixophyes iteratus,* were recorded within riparian vegetation (PCT1285) associated with Pine Brush Creek; confined to the northern extent of the study area (**Figure 10-7**). PCT 695 Blackbutt – Turpentine – Tallowwood shrubby open forest, located throughout much of the study area, is also considered suitable habitat for this species. There are also recent records of giant barred frog on Newports Creek; however, no individuals were recorded during site surveys at this location or other areas of suitable habitat across the study area.

Pale-vented bush hen *Amaurornis moluccana* was recorded at two sites in proximity to vegetated creek lines (including Pine Brush Creek and Jordans Creek) and may occupy similar habitat (ie PCT 695) located elsewhere within the study area.

A single square-tailed kite *Lophoictinia isura* and a single white-bellied sea eagle *Haliaeetus leucogaster* were observed foraging over the site, but no nests were recorded. These raptors have a wide home range and construct nests in tall open forest and woodland. Foraging opportunities for the Square-tailed Kite occur across the study area and wider Coffs Harbour region, while the White-bellied Sea Eagle will forage over large waterbodies, including the ocean.

A single olive whistler *Pachycephala olivacea* was observed within an area of wet sclerophyll forest (PCT 695) in the lower foothills of the escarpment. This species is a seasonal migrant and prefers higher altitude and wetter forests but can move to lower altitudes in winter months. Although no coastal petaltail dragonfly *Petalura litorea* adults were directly observed during the field survey, approximately 50 potential burrows characteristic of the species' larval burrows were recorded. The burrows were recorded in PCT 1064 Paperbark swamp forest adjacent to Highlander Drive off North Boambee Road (**Figure 10-7-01** to **Figure 10-7-06**), over an area of approximately 0.5 ha. Burrows found within swamp vegetation are known to be associated with coastal petaltail dragonfly and as such, coastal petaltail dragonfly presence has been assumed in the study area despite a lack of direct observations.

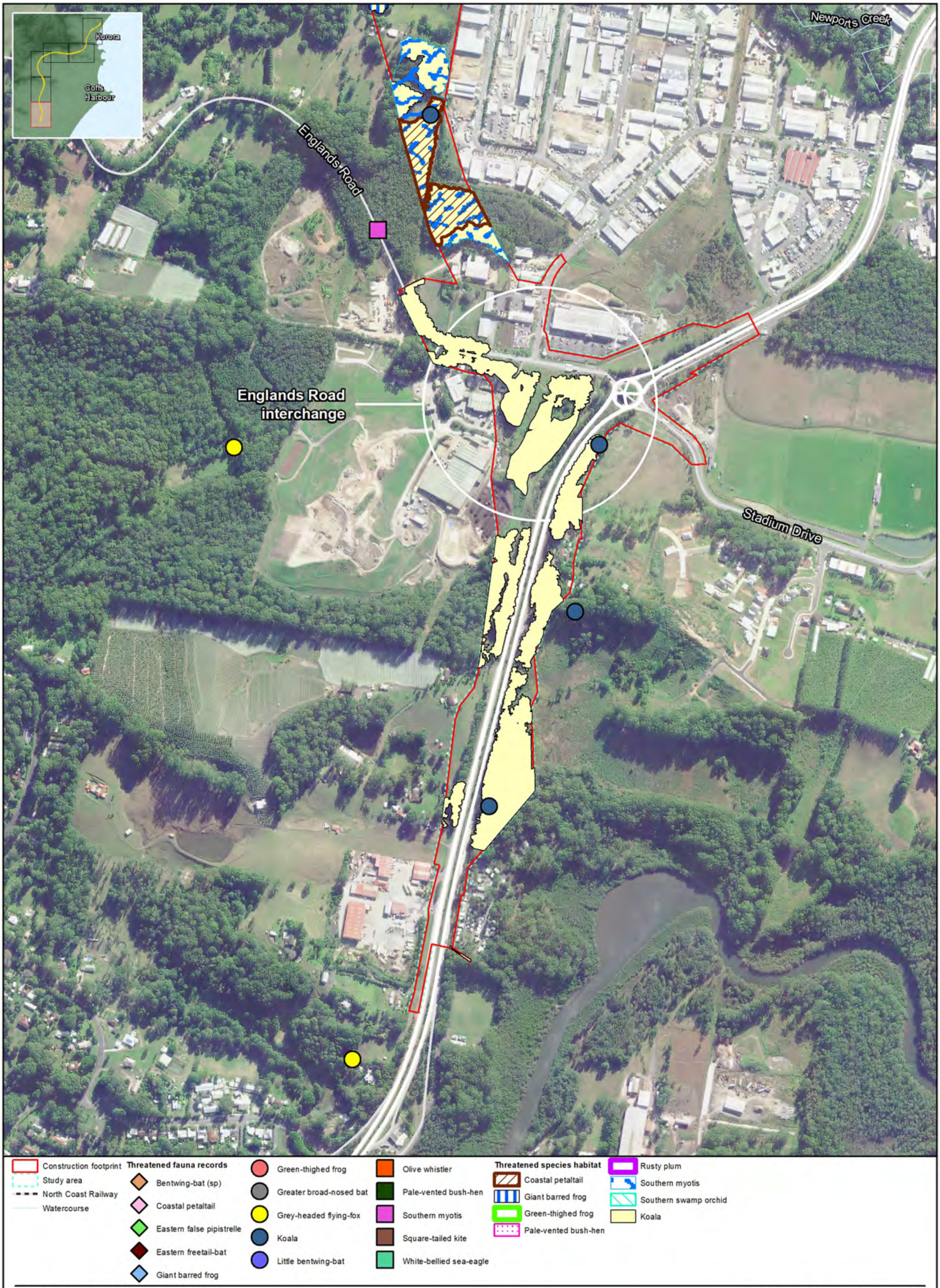
Table 10-10 Threatened fauna species and habitat within the study area

| Species name | Habitat within the study area (PCT) | Known and potential habitat |
|---|---|---|
| Green-thighed frog* | • 695 Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion. | Known: 1.79 ha<br>Potential: 4.79 ha |
| Giant barred frog* | • 695 Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion. | Known: 3.28 ha<br>Potential: 4.79 ha |
| Koala* | • 692 Blackbutt – Tallowwood moist ferny open forest of the coastal ranges of the NSW North Coast Bioregion<br>• 695 Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion<br>• 747 Brush Box – Tallowwood – Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion<br>• 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion.<br>• 1244 Sydney Blue Gum open forest on coastal foothills and escarpment of the North Coast<br>• 1262 Tallowwood – Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast<br>• 1285 Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion.<br>• 1302 White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion. | Known: 36.70 ha<br>Potential:<br>43.37 ha |

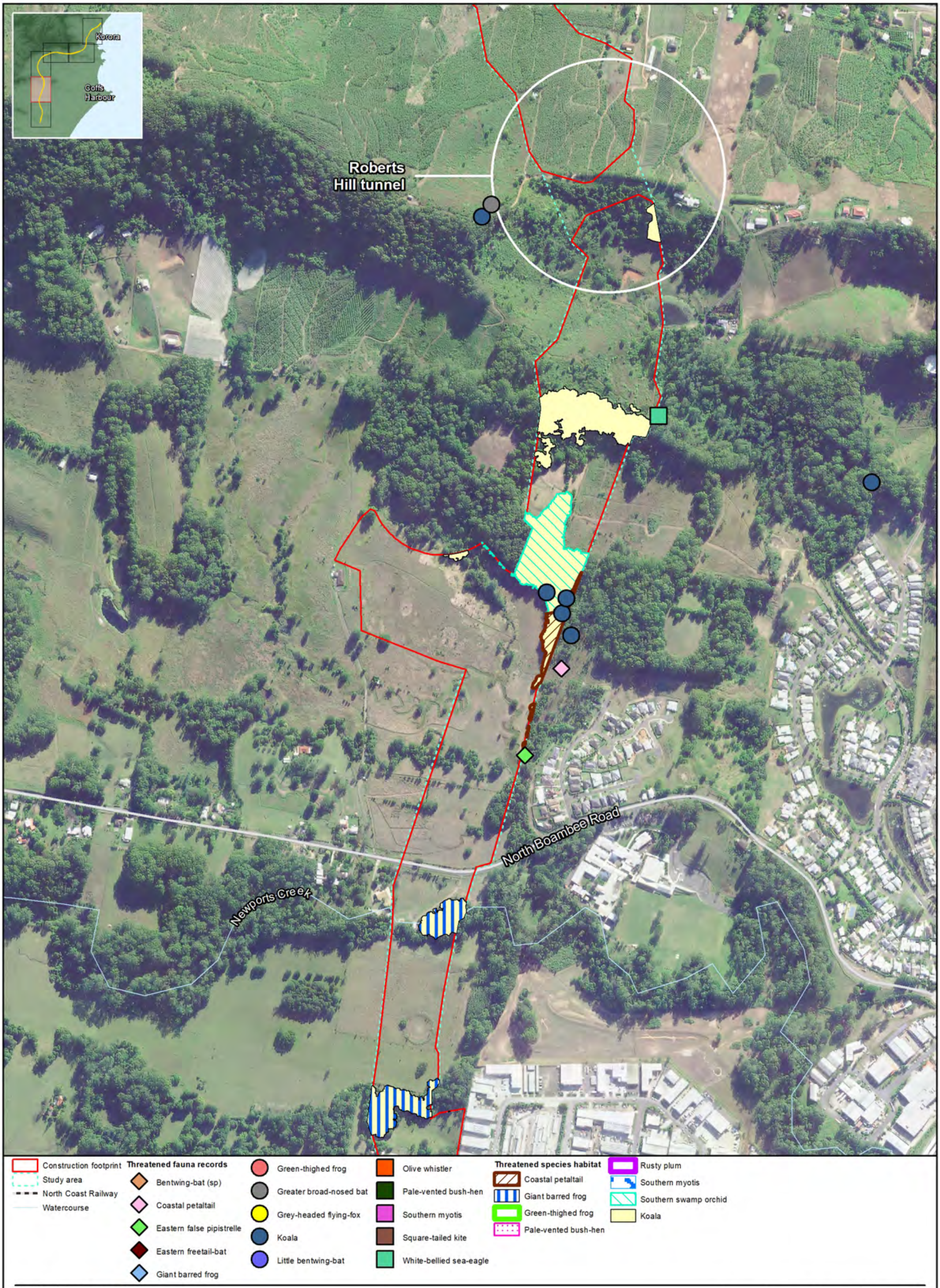
| Species name | Habitat within the study area (PCT) | Known and potential habitat |
|---|---|---|
| Pale-vented bush-hen* | • 695 Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion<br>• Non-native vegetation (farm dam) | Known: 4.95 ha<br>Potential: Up to 50ha ha |
| White-bellied sea eagle | • Foraging over site. | Known: n/a<br>Potential: Up to 307 ha |
| Square-tailed kite | • Foraging over site | Known: n/a<br>Potential: Up to 307 ha |
| Olive whistler | • 695 Blackbutt – Turpentine – Tallowwood shrubby open forest | Known: 10.48 ha<br>Potential: 10.48 ha |
| Southern myotis* | • 692 Blackbutt – Tallowwood moist ferny open forest of the coast ranges of the NSW North Coast Bioregion<br>• 695 Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion<br>• 747 Brush Box – Tallowwood – Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion<br>• 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion<br>• 1244 Sydney Blue Gum open forest on coastal foothills and escarpment of the North Coast<br>• 1285 Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion<br>• Culverts 8 and 10 and foraging over riparian areas (refer to **Appendix H, Biodiversity assessment report**) | Known: 15.10 ha<br>Potential: Up to 50 ha |
| Little bentwing-bat | • Roosting in Culvert 10, Culvert 28 (unconfirmed roost)<br>• Foraging over site | Known: 1 culvert<br>Potential: Up to 307 ha |
| Eastern false pipistrelle | • Foraging over site | Known: n/a<br>Potential: Up to 307 ha |
| Greater broad-nosed bat | • Foraging over site | Known: n/a<br>Potential: Up to 307 ha |
| Eastern freetail-bat | • Foraging over site | Known: n/a<br>Potential: Up to 307 ha |

| Species name | Habitat within the study area (PCT) | Known and potential habitat |
|---|---|---|
| Grey-headed flying-fox | • 692 Blackbutt – Tallowwood moist ferny open forest of the coastal ranges of the NSW North Coast Bioregion.<br>• 695 Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion.<br>• 747 Brush Box – Tallowwood – Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion.<br>• 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion.<br>• 1244 Sydney Blue Gum open forest on coastal foothills and escarpment of the North Coast<br>• 1262 Tallowwood – Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast.<br>• 1285 Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion.<br>• 1302 White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion. | Known: 43.37 ha<br>Potential: Up to 307 ha |
| Coastal petaltail dragonfly* | • 1064 Paperbark swamp forest | Known: 2.50 ha<br>Potential: 3.65 ha |

* Species credit species

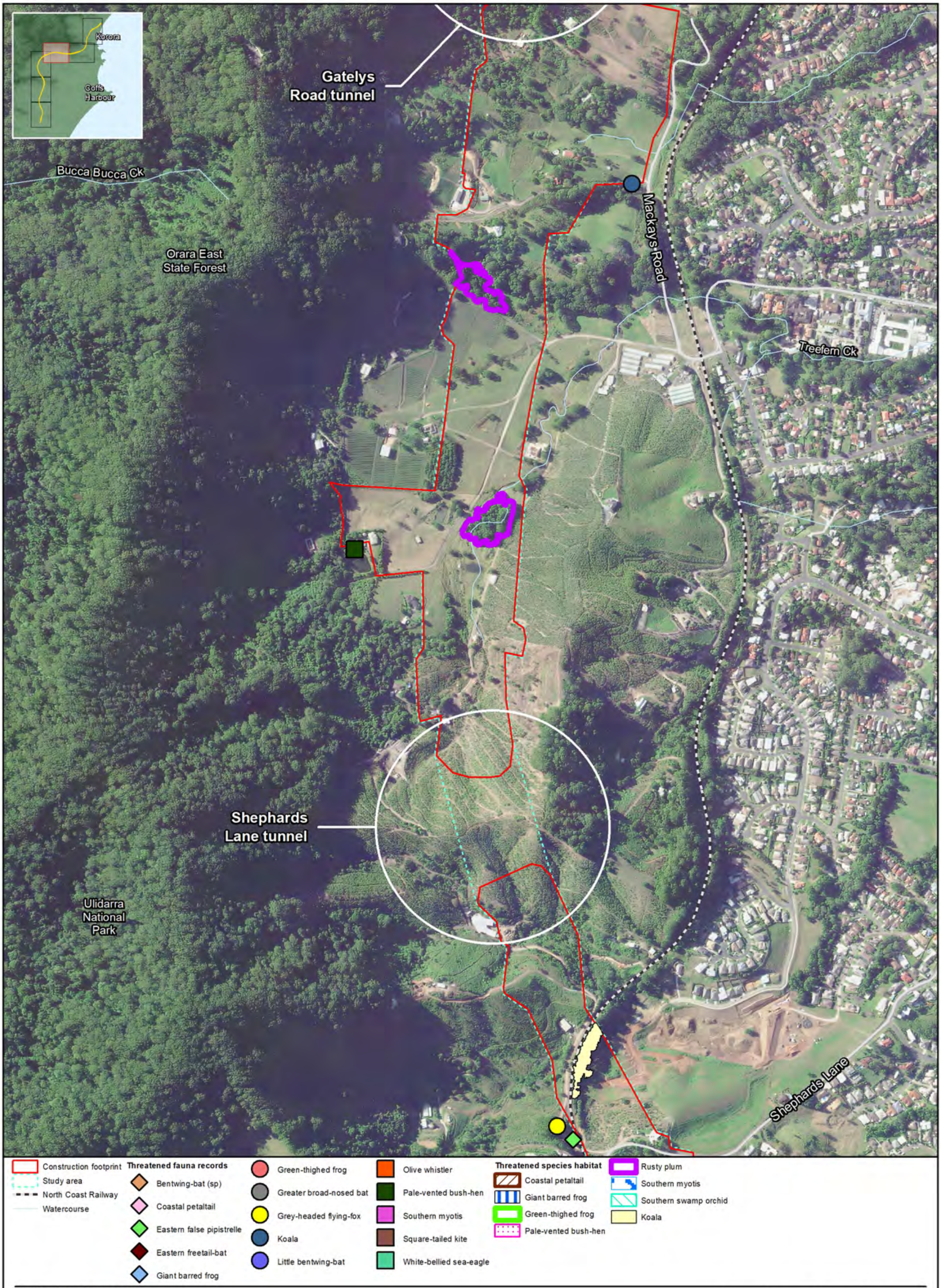



Coffs Harbour Bypass
Threatened fauna records and habitat polygons
Figure 10-7-01

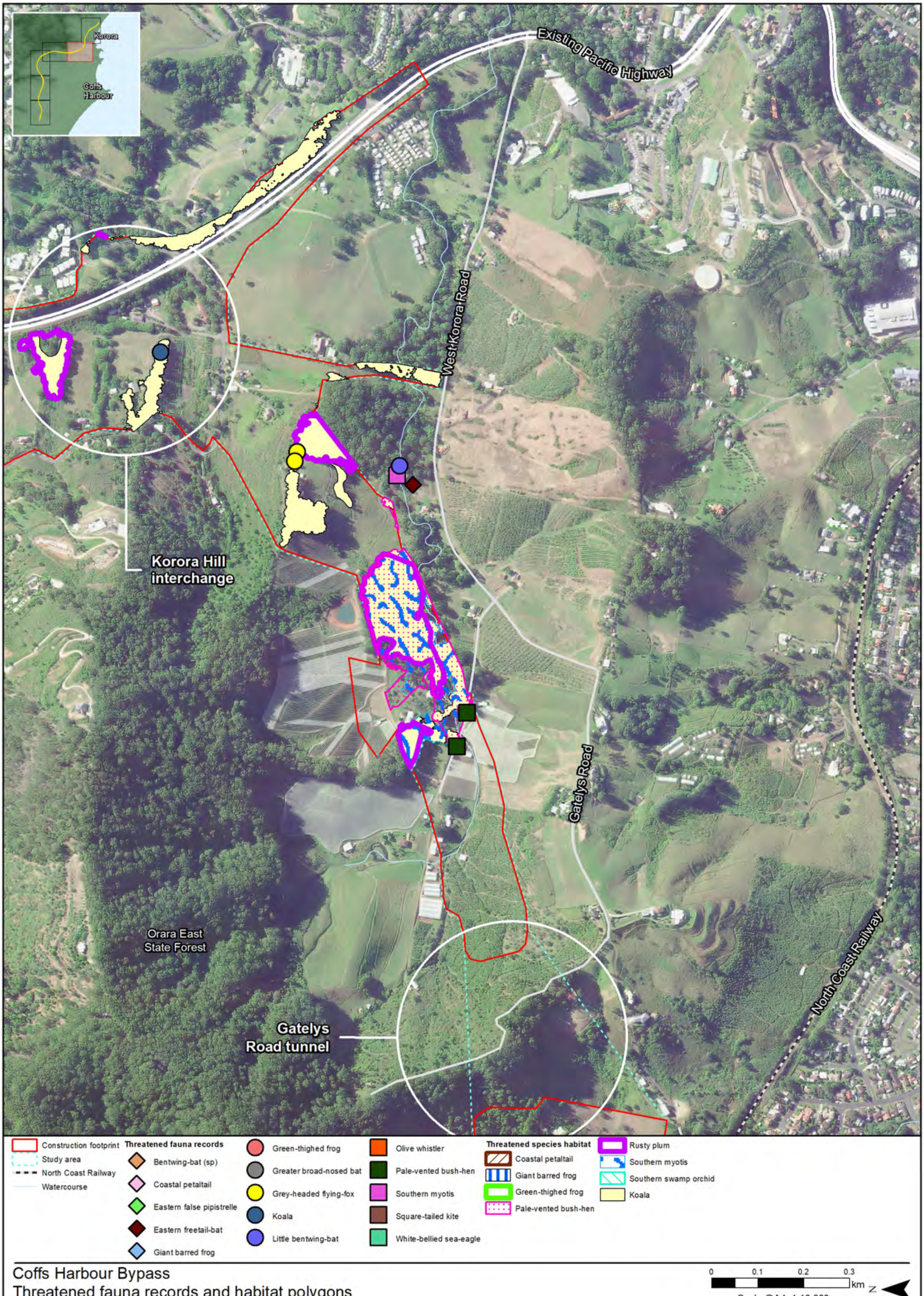



Coffs Harbour Bypass
Threatened fauna records and habitat polygons
Figure 10-7-02


Coffs Harbour Bypass
Threatened fauna records and habitat polygons
Figure 10-7-03




Coffs Harbour Bypass
Threatened fauna records and habitat polygons
Figure 10-7-04




Coffs Harbour Bypass
Threatened fauna records and habitat polygons
Figure 10-7-05

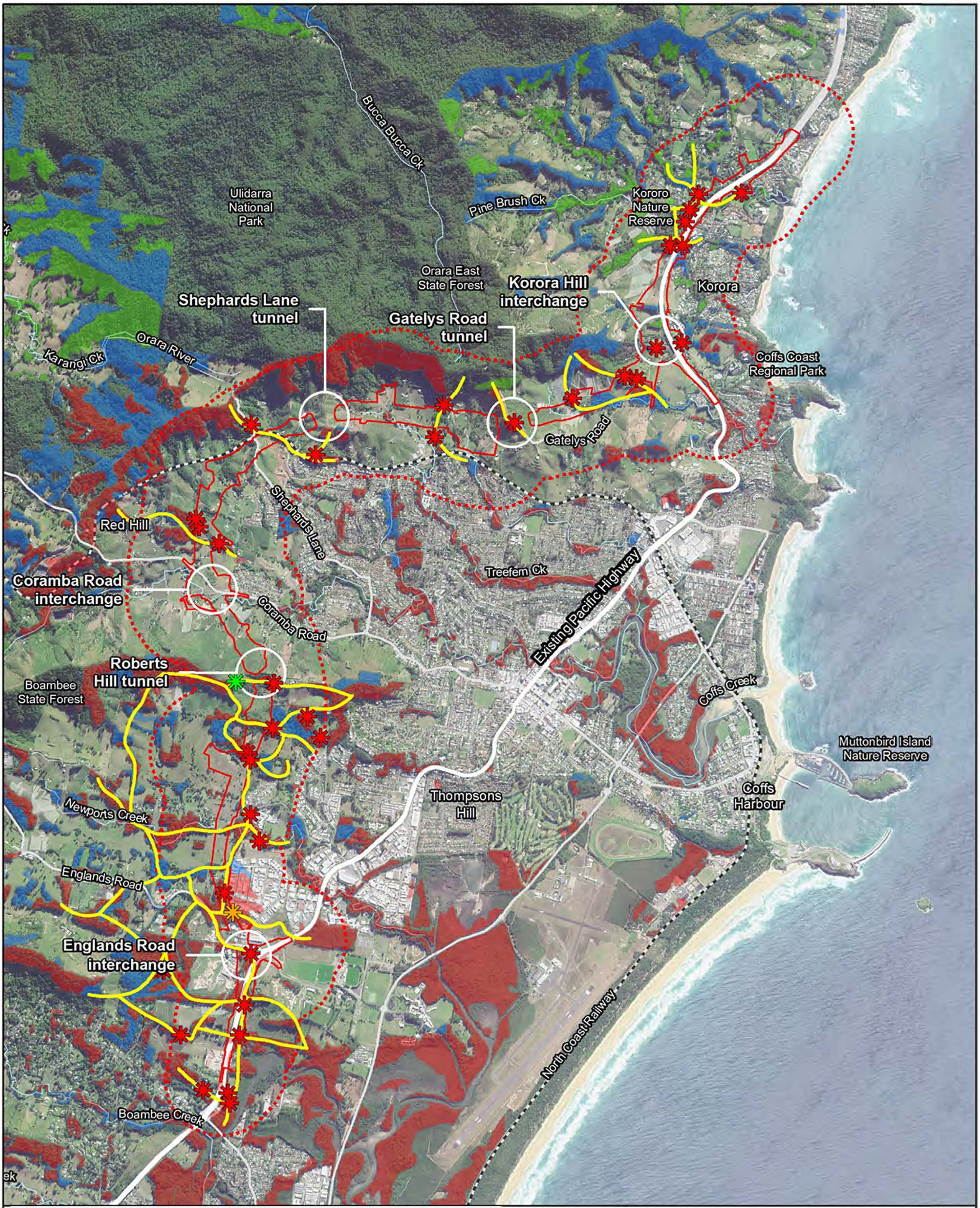

Coffs Harbour Bypass
Threatened fauna records and habitat polygons
Figure 10-7-06

### *Koala habitat and survey results*

Koala habitat is associated with eight PCTs which are dominated by suitable koala food trees and offer connectivity within the landscape. This includes 36.70 ha of known habitat.

The desktop review and field survey results indicate 20 koala habitat corridors cross the study area where native vegetation links habitats to the east and the west. These corridors have been based on the local and regionally significant habitat corridors provided in the Coffs Harbour Koala Plan of Management (CHCC 1999), as well as the presence of koala habitat on either side of the study area, the presence of linking vegetation, often associated with waterways and riparian areas, and the presence of koala records or evidence of activity. Koala movement corridors that intersect the study area are shown in **Figure 10-8.**

Koalas were directly observed during field surveys undertaken within the study area using spotlighting and call playback survey methods. Surveys indicated koala activity to be generally low within the study area with the exception of two sites recording medium and high activity levels (**Figure 10-8**).




**Legend**

- Construction footprint
- Landscape assessment 550m buffer
- North Coast Railway
- Watercourse
- Identified koala corridors

**Koala SAT activity levels**

- High
- Medium
- Low

**CHCC Koala Habitat**

- Primary
- Secondary
- Tertiary

Coffs Harbour Bypass
Koala SAT and corridors
Figure 10-8

0 0.5 1 1.5 km
N
Scale @A4: 1:50,000
GDA 1994 MGA Zone 56

## 10.2.7 Aquatic habitats

### *Waterway classification*

Thirty-two sites were surveyed using DPIE waterway classification methods. **Table 10-11** shows the named waterways that traverse the construction footprint as well as classification and type, according to the Policy and Guidelines for Fish Habitat Conservation and Management (DPI 2013). A site inspection was carried out with DPIE (Regions, Industry, Agriculture & Resources) on 18 December 2018 to confirm these waterway classifications.

Table 10-11 Named waterways that traverse the study area and their classification

| Waterway name | Class | Type |
|---|---|---|
| Newports Creek (southern branch) | Class 2 – Moderate key fish habitat | Type 2 - Moderately sensitive key fish habitat |
| Newports Creek (northern tributary) | Class 2 – Moderate key fish habitat | Type 2 - Moderately sensitive key fish habitat |
| Newports Creek (northern branch) | Class 2 – Moderate key fish habitat | Type 2 - Moderately sensitive key fish habitat |
| Drainage line north of Newports Creek | Class 3 – Minimal fish habitat | Type 3 – Minimally sensitive key fish habitat |
| Coffs Creek (upstream of Bennetts Road) | Class 3 – Minimal fish habitat | Type 3 – Minimally sensitive key fish habitat |
| Coffs Creek (downstream of Bennetts Road) | Class 2 – Moderate key fish habitat | Type 2 - Moderately sensitive key fish habitat |
| Treefern Creek | Class 4 – Unlikely key fish habitat | Type 3 – Minimally sensitive key fish habitat |
| Jordans Creek (upstream of West Korora Road) | Class 4 – Unlikely key fish habitat | Type 3 – Minimally sensitive key fish habitat |
| Jordans Creek (downstream of West Korora Road) | Class 2 – Moderate key fish habitat | Type 2 - Moderately sensitive key fish habitat |
| Pine Brush Creek | Class 1 – Major fish habitat | Type 1 – Highly sensitive key fish habitat |

Eighteen sites (56 per cent) offer moderate key fish habitat characterised by intermittent flows or permanent to semi-permanent pools in connected wetland areas. The majority of these sites supported moderately sensitive key fish habitat; however, seven were identified as highly sensitive key fish habitat. The remaining eight sites (25 per cent) were unlikely, minimally sensitive key fish habitats, generally comprising ephemeral streams located within the study area.

### *HABSCORE assessments*

Two sites (Newports Creek and Boambee Creek) recorded an optimal rating due to the availability of water, the presence of relatively undisturbed riparian vegetation, diverse pool geometries and substrate types. These sites were also identified as major highly sensitive key fish habitats.

Twelve sites (40 per cent) are considered suboptimal, typically offering good aquatic habitats with reduced water availability, homogenised substrates and moderately degraded riparian vegetation. Marginal sites

(23 per cent) were those with high levels of disturbance as a result of clearing, grazing and weed invasion. Nine sites (30 per cent) recorded poor scores, generally due to their ephemeral nature and highly disturbed condition due to their location within maintained farm paddocks. These include sites identified as moderate, minimal and unlikely key fish habitats using DPIE waterway classification methods.

#### *Water quality*

The results of the on-site surface water quality monitoring and sampling are summarised in **Chapter 19, Surface water quality.** The water quality results recorded during one survey round, that included two separate survey events, indicate the surface water quality of waterways within the project area ranged from moderate to poor. Electrical conductivity and pH were generally within the guideline values at most sites.

#### *Freshwater fish communities*

Desktop review indicated DPIE predicted habitat for the purple-spotted gudgeon situated along sections of Newports Creek and Coffs Creek within the study area. A targeted survey for this species was undertaken along sections of predicted habitat however no species were recorded.

Fish communities were surveyed at 12 sites comprising streams identified as major and moderate key fish habitats (DPIE waterway classification) and optimal and suboptimal habitats (HABSCORE). No threatened fish species were identified during the field surveys.

### 10.2.8 Matters of national environmental significance

Desktop review and field survey results indicate the presence of MNES within the study area including threatened flora, fauna and migratory species listed under the EPBC Act. The only MNES flora species identified within the study area was the southern swamp orchid.

Listed threatened fauna species identified in the study area were:

- Giant barred frog
- Koala
- Grey-headed flying-fox.

A number of migratory species listed under the EPBC Act were also identified within the study area. Other migratory species may also have a transient presence within the study area due to the availability of suitable resources and foraging opportunities; however, habitats within the study area are considered marginal for these migratory species and are unlikely to be required for significant life stages. As a result, the impacts of the project on these migratory species have not been assessed. Migratory species identified in the study area include:

- Spectacled monarch *Symposiachrus trivirgatus*
- Rufus fantail *Rhipidura rufifrons*
- Black-faced monarch *Monarcha melanopsis*
- Wanderer butterfly *Danaus plexippus.*

A number of other MNES have the potential to occur with study area due to the presence of vegetation communities that may offer suitable habitats or foraging opportunities. These include four threatened fauna species and five threatened flora species identified as having a moderate to high likelihood of occurring within the study area (**Table 10-12**). These species were not detected within the study area during field investigations carried out in accordance with the methods outlined in **Section 10.1**.

Two PCTs occurring within the study area (PCT 1302 and PCT 670) may be considered potential TEC (Lowland Rainforest for Subtropical Australia) under the EPBC Act (**Table 10-12**). However, the field survey results indicated these PCTs did not meet the condition class or key diagnostic species requirements for this TEC.

Table 10-12 Threatened MNES with potential to occur within the study area

| MNES | Species | EPBC Act Status^ | Likelihood of occurrence |
|---|---|---|---|
| Threatened fauna | Spotted-tailed quoll<br>*Dasyurus maculatus maculatus* | E | High |
| | Regent honeyeater<br>*Anthochaera Phrygia* | CE | High |
| | Swift parrot<br>*Lathamus discolor* | CE | Moderate |
| | Long-nosed potoroo<br>*Potorous tridactylus tridactylus* | V | Moderate |
| Threatened flora | Hairy-joint grass<br>*Arthraxon hispidus* | V | Moderate |
| | Orara boronia<br>*Boronia umbellata* | V | Moderate |
| | Clear milkvine<br>*Marsdenia longiloba* | E | Moderate |
| | *Samadera* sp. *Moonee Creek* | E | Moderate |
| | *Tylophora woollsii* | E | Moderate |
| Threatened ecological community | Lowland Rainforest of Subtropical Australia | CE | Low |

^ Commonwealth conservation status of each taxon under the Environmental Protection and Biodiversity Conservation Act 1999, coded as Extinct in the wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V), Conservation Dependent (CD) or Migratory (M).

## 10.3 Assessment of potential impacts

This section discusses the potential impacts of the project on biodiversity values, including terrestrial and aquatic flora and fauna known to occur within the study area. Direct and indirect impacts are discussed as are design measures that have been implemented to avoid and minimise project impacts on biodiversity.

### 10.3.1 Avoidance and minimisation

The construction footprint has been refined and selected based on a staged approach of route selection and alignment revision throughout the CHHPS (RTA 2001a), through to the refinement of the concept design as part of the current phase of the project.

**Chapter 4, Project development and alternatives** provides a summary of route option development and identifies alternatives considered during the CHHPS and initial corridor identification. The initial phase of the CHHPS included identification and assessment of corridor options for the future upgrading of the Pacific Highway that were spread across the Coffs Harbour LGA. Four alignment options were considered including:

- Inner Corridor – a bypass about 11 km long skirting the western edge of the existing Coffs Harbour urban area
- Central Corridor – a longer corridor option of about 25 km passing by the outskirts of Coffs Harbour, and providing a more westerly bypass of the town and surrounding area
- Outer Corridor – an even wider bypass at its southern section and sharing the same northern section as the Central corridor, about 31 km long
- Far Western Corridor – a bypass that traverses the Orara Valley and re-joins the existing highway in the north, either at Halfway Creek or to the south of Grafton.

The Far Western, Outer and Central corridors were severely constrained in terms of known and potential habitat for threatened species and severance of numerous wildlife corridors. By contrast, the Inner Corridor had a relatively low impact on biodiversity as it passed through largely cleared lands and any adverse effects on wildlife corridor were anticipated to be mitigated.

An ecological assessment of the Inner Corridor was carried out as part of the CHHPS Strategy Report (RTA 2001a), which identified threatened species and communities listed under the BC Act and EPBC Act as having the potential to occur within the study area. Impacts to these State and EPBC Act listed species and ecological communities were raised as potential project impacts during these early project phases, as well as the potential to impact on fauna habitat connectivity. Measures to avoid and minimise these impacts have been fully explored throughout the development of the concept design and would continue to be revisited as project design progresses to detailed design, where reasonable and feasible.

Project design and development of the bypass assessed in the EIS has been iterative with biodiversity constraints being communicated to the design team including identification of high priority areas for avoidance and minimisation of impacts. The current assessment is based on a concept design which provides for further scope for flexibility and refinement at the detailed design stage, allowing for further avoidance and/or minimisation of impacts on biodiversity values during future project stages.

Throughout the refinement of the design, a number of elements have been included to avoid and minimise impacts on biodiversity during construction and in operation of the project, including:

- Impact associated with loss of connectivity for terrestrial fauna have been minimised by providing 16 locations where terrestrial fauna crossings have been included in the design
- Major ridges that provide existing fauna corridors at Roberts Hill and Gatelys Road have been retained by including tunnels as part of the design and existing native vegetation on the ridges would be retained. A tunnel at Shephards Lane would also provide opportunistic fauna movement opportunities, although the existing banana plantation would be retained
- Refining the drainage design to allow for bridge structures across both tributaries of Newports Creek to protect giant barred frog habitat and to provide improved terrestrial and aquatic fauna connectivity
- Bridge crossings, rather than culverts, have been included for both higher order streams within the study area at Pine Brush Creek and Newports Creek.
- Bridge design has considered placement of piers and alignment of bridge spans to minimise impacts to existing channel morphology, aquatic habitat and riparian vegetation. However, creek realignments during the construction stage are still likely with channels to be reinstated using natural channel design principles and revegetation to restore aquatic and riparian habitats
- Earthworks strategy and design has included batters with low shallower slopes to allow for revegetation with native species, connecting patches of native vegetation along the wider road corridor
- Review of flood modelling in the North Boambee Valley and the corresponding drainage design, has demonstrated that the existing hydrological regime in the area of retained coastal petaltail dragonfly habitat would not be changed as a result of the project

- Design options for improvements to the school drop off zone and pedestrian bridge at Kororo Public School avoided any direct impacts on the adjacent Kororo Nature Reserve
- Potential locations for temporary ancillary sites used for construction purposes have been identified in **Chapter 6, Construction** and are located outside areas of threatened flora and fauna habitat.

Review and implementation of the project's Threatened Species Management Plan (TSMP) will be undertaken during detailed design. The TSMP identifies site-specific mitigation measures and management procedures to be implemented during future design, construction and operation phases to further avoid and/or reduce project impacts on threatened flora and fauna. Further details are provided in **Appendix I, Threatened Species Management Plan**.

## 10.3.2 Impacts on existing environment

### *Landscape values*

The project would not substantially reduce the width of vegetation in the riparian buffer zone bordering rivers of streams fourth order or higher, impact state biodiversity links, or impact buffer zones along estuaries.

Two higher order streams occur within the study area, Pine Brush Creek (fifth order) and an unnamed tributary of Newports Creek (fourth order). However, both would be crossed by bridge and impacts would be limited to a narrow section of the riparian corridor.

The FBA defines an important wetland as a wetland that is listed in the Directory of Important Wetlands of Australia (Environment Australia 2001) or a wetland mapped under SEPP14 (which is now mapped under SEPP (Coastal Management) 2018).

Two Coastal Management SEPP wetlands occur within 100 m of the study area on Pine Brush Creek and Boambee Creek; however, no project work would occur within the wetlands, or the 50 m wetland buffers.

In addition, there are no mapped Coastal Management SEPP wetlands within the expected long-term zone of groundwater drawdown around any of the cuttings or drained tunnels. Further details are provided in **Chapter 20, Groundwater**.

### *Native vegetation*

The project would impact on a total of 43.37 ha of native vegetation comprising nine PCTs.

**Table 10-13** provide details of PCTs impacted as a result of the project relative to vegetation condition, conservation status and regional extent.

Table 10-13 Impacts to native vegetation

| PCT | Condition | Status | | % cleared CMA* | Impact area (ha) |
|---|---|---|---|---|---|
| | | BC Act | EPBC | | |
| 670 – Black Booyong – Rosewood - Yellow Carabeen subtropical rainforest of the NSW North Coast Bioregion | Moderate/Good 82.67 | Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion | | 75% | 0.51 |
| 692 – Blackbutt – Tallowwood moist ferny open forest of the coastal | Moderate/Good 57.33 – 82.00 | n/a | n/a | 15% | 15.40 |

| PCT | Condition | Status | | % cleared CMA* | Impact area (ha) |
|---|---|---|---|---|---|
| | | BC Act | EPBC | | |
| ranges of the NSW North Coast Bioregion | | | | | |
| 695 – Blackbutt – Turpentine – Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion | Moderate/Good 46.67 – 89.33 | n/a | n/a | 5% | 10.48 |
| 747 – Brush Box – Tallowwood – Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion | Moderate/Good 79.33 – 82.00 | n/a | n/a | 30% | 5.82 |
| 1064 – Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion | Moderate/Good 72.67 – 87.33 | Swamp Sclerophyll Forest | n/a | 75% | 3.65 |
| 1244 – Sydney Blue Gum open forest on coastal foothills and escarpment of the North Coast | Moderate/Good 82.67 | n/a | n/a | 60% | 0.94 |
| 1262 – Tallowwood – Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast | Moderate/Good 71.33 – 88.00 | n/a | n/a | 30% | 1.62 |
| 1285 – Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion | Moderate/Good TBC – 76.00 | n/a | n/a | 55% | 3.04 |
| 1302 – White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion | Moderate/Good 72.67 | Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion | n/a | 75% | 1.91 |
| **Total** | | | | | **43.37 ha** |

* % cleared in CMA is the per cent cleared in the catchment management area

### *Threatened flora*

Threatened flora species recorded for the study area would be directly impacted as a result of the project. This includes one southern swamp orchid individual and 57 rusty plum individuals. The field surveys only recorded a single southern swamp orchid within the study area, and a larger population of 79 rusty plan plants within and immediately adjacent to the study area.

Direct impacts on threatened flora habitats would occur as a result of the removal of 43.37 ha of native vegetation which has the potential to support threatened species in the future. However, when assessed at a locality scale, impacts on habitat availability for local populations are not considered significant. **Table 10-14** provides a comparison of the broad threatened flora habitat types impacted by the project and those remaining within 10 km of the study area.

Table 10-14 Impacts to threatened flora habitat

| Threatened flora species | Individuals impacted | Key habitat features | Area to be impacted | Estimate remaining within 10 km of the study area* | Percentage habitat removed |
|---|---|---|---|---|---|
| Rusty plum | 57 | Wet sclerophyll forest vegetation | 37.30 ha | 10,180 ha | 0.4% |
| | | Rainforest vegetation | 2.43 ha | 1190 ha | 0.1% |
| | | Riparian areas^ | 9.73 ha | 2200 ha | 0.4% |
| Southern swamp orchid | 1 | Swamp vegetation | 3.65 ha | 1018 ha | 0.4% |

***** Estimates remaining are based on equivalent vegetated areas mapped by the Coffs Harbour LGA mapping (OEH 2012) with non-equivalent vegetation types excluded where appropriate.

^ Riparian areas are based on mapped vegetation (Biosis Pty Ltd. 2019 and OEH 2012) within 20m of either side of watercourses mapped on the 1:25,000 hydro line dataset from the LPI Digital Topographic Database (DTDB). Riparian areas occur within the other two key habitat feature types.

### *Threatened fauna*

The removal of 43.37 ha of native vegetation would result in the loss of fauna habitat features known to support locally occurring threatened fauna species. This includes the loss of potential breeding habitats in the form of hollow-bearing trees, riparian vegetation, dense forest vegetation and swamps, as well as forage habitat in the form of nectar, blossom and fruit producing trees, accumulated leaf litter and large woody debris and open areas of grasslands not supporting native vegetation.

Although the field surveys for this project identified 14 threatened fauna species within the study area, there is a potential for impacts on habitat used by a wider range of threatened species. The project would remove habitat and associated habitat resources for the following threatened fauna species:

- Green-thighed frog (vulnerable under BC Act)
- Giant barred frog (endangered under EPBC Act and BC Act)
- Wallum froglet *Crinia tinnula* (vulnerable under BC Act)
- Koala (vulnerable under the EPBC Act and BC Act)
- Common blossom-bat *Syconycteris australis* (vulnerable under BC Act)
- Spotted-tailed quoll (vulnerable under BC Act)
- Golden-tipped bat *Kervoula papuensis* (vulnerable under BC Act)
- Little bentwing-bat (vulnerable under BC Act)
- Eastern bentwing-bat (vulnerable under BC Act)
- Yellow-bellied glider *Petaurus australis* (vulnerable under BC Act)
- Grey-headed flying-fox (vulnerable under EPBC Act and BC Act)
- Greater broad-nosed bat *Scoteanax rueppellii* (vulnerable under BC Act)
- Pale-vented bush hen (vulnerable under BC Act)
- Regent honeyeater (critically endangered under EPBC Act and BC Act)
- Barred cuckoo-shrike *Coracina lineata* (vulnerable under BC Act)
- Square-tailed kite (vulnerable under BC Act)
- Masked owl *Tyto novaehollandiae* (vulnerable under BC Act)

- Southern myotis (vulnerable under BC Act)
- Fruit-dove *Ptilinopus magnificus* (vulnerable under BC Act)
- Black-necked stork *Ephippiorhynchus asiaticus* (endangered under BC Act)
- Squirrel glider *Petaurus norfolcensis* (vulnerable under BC Act)
- Stephen's banded snake *Hoplogchephalus stephensii* (vulnerable under BC Act)
- Coastal petaltail dragonfly (endangered under the BC Act).

#### *Aquatic habitats*

No threatened aquatic species, populations or communities were recorded within the study area and they are not considered likely to occur.

There may be some temporary displacement of aquatic fauna during the construction of waterway crossings. In addition, there may be some impacts on riparian vegetation during construction.

### 10.3.3 Matters of national environmental significance

MNES that were identified or assessed as having a high likelihood of occurrence in the study area (as listed in **Section 10.2.8**) include:

- Southern swamp orchid – endangered
- Giant barred frog – endangered
- Koala – vulnerable
- Grey-headed flying-fox – vulnerable
- Regent honeyeater – critically endangered
- Spotted-tailed quoll – endangered.

Impacts to MNES as a result of the project are summarised in **Table 10-15**. A summary of MNES impacts against the Commonwealth Significant impact guidelines 1.1 (DoEE 2013) is provided in **Table 10-16.** Project impacts to MNES are fully explored in **Appendix H, Biodiversity assessment report**.

Table 10-15 Impacts on MNES identified or assessed as having a high likelihood of occurrence in the study area

| Project impacts | MNES impacted |
|---|---|
| Direct loss of habitat<br>The project would result in a loss of 43.37 ha of native vegetation offering suitable habitat for threatened flora and fauna listed under the EPBC Act. There is the potential for short and long-term impacts to MNES as a result of vegetation clearing including direct loss threatened species and ongoing population declines. | Southern swamp orchid: one individual and 5.77 ha of known and potential habitat.<br>Giant barred frog: 4.79 ha of known and potential habitat.<br>Koala: 43.37 ha of known and potential habitat.<br>Grey-headed flying-fox: 43.37 ha of known and potential foraging habitat.<br>Regent honeyeater (foraging): 3.65 ha of potential foraging habitat.<br>Spotted-tailed quoll: 43.37 ha of potential habitat. |
| Loss of connectivity<br>Loss of connectivity as a result of the project would occur through direct loss of habitats and the physical fragmentation and isolation of vegetation offering suitable habitats for MNES. Loss of habitat connectivity may directly impact MNES in the short and long term and may reduce species home ranges, increase competition for resources and threats such as predation, vehicle strike and | Koala: fragmentation of populations and isolation of individuals through construction of physical barrier and removal of habitat.<br>Spotted-tailed quoll: potential fragmentation of populations and isolation of individuals through construction of physical barrier and removal of habitat.<br>Giant barred frog: fragmentation of two known areas of habitat. |

| Project impacts | MNES impacted |
|---|---|
| weed invasion. These may result in a direct loss of threatened species and/or contribute to ongoing population declines. | Southern swamp orchid: fragmentation of habitats and loss of pollination opportunities. |
| Modification of habitat<br>Adjacent and remaining vegetation offering suitable habitat for MNES may be impacted through weed invasion, edge effects and increased human disturbance as a result of the project. This impact would occur in the long term if it is not appropriately managed. | Southern swamp orchid: potential increase in weed invasion resulting in decline in quality of potential habitats.<br>Giant barred frog: potential increase in weeds from edge effects resulting in decline in habitat quality.<br>Koala: potential increase in woody weeds from edge effects resulting in decline in habitat quality and increased accessibility for people and dogs resulting in mortalities.<br>Spotted-tailed quoll: potential increase in weeds from edge effects resulting in decline in habitat quality. |
| Introduction of diseases/pathogens<br>Disruption to ecosystems and soil as a result of the project has the potential to introduce or exacerbate pathogens and disease into retained habitats. This impact would have long-term consequences in the form of loss of individuals and loss of habitat if it is not appropriately avoided and mitigated. | Giant barred frog: potential introduction of Chytrid virus.<br>Koala: potential increase in habitat stressors leading to increased cases of Chlamydia or retrovirus, potential introduction of *Phytophthora cinnamomi* leading to decline in habitat health.<br>Southern swamp orchid: potential introduction of *Phytophthora cinnamomi* leading to decline in habitat health.<br>Grey-headed flying-fox: potential introduction of *Phytophthora cinnamomi* leading to decline in habitat health.<br>Regent honeyeater: potential introduction of *Phytophthora cinnamomi* leading to decline in foraging habitat health.<br>Spotted-tailed quoll: potential introduction of *Phytophthora cinnamomi* leading to decline in potential habitat health. |
| Altered hydrology<br>Increased development of roadways, hardstand areas and sedimentation basins as a result of the project could affect local hydrology patterns and associated habitats. This impact could have both short and long-term consequences in the form of direct loss of habitat and ongoing decline of habitat suitability. | Giant barred frog: altered hydrological regimes could affect suitability of habitat.<br>Southern swamp orchid: altered hydrological regimes could affect suitability of habitat. |
| General disturbance of habitat<br>Construction activity has the potential to impact fauna and flora populations through increased noise, vibration, artificial lighting, vegetation disturbance and dust. These impacts would have short-term consequences, for the duration of the project construction. | Koala: potential impacts from noise, vibration and lighting.<br>Southern swamp orchid: potential impacts on viability from increased dust levels.<br>Grey-headed flying-fox: potential impacts from noise, vibration and lighting.<br>Spotted-tailed quoll: potential impacts from noise, vibration and lighting. |
| Disturbance from fire | Southern swamp orchid: loss of individuals, alteration of habitat. |

| Project impacts | MNES impacted |
|---|---|
| There is a low risk of unintentional fire resulting from ignition during construction works. Should this occur, there is potential for impact on retained habitats and species. If a significant wildfire resulted from the project, it could have both short- and long-term consequences, in the form of direct mortality and habitat loss, and ongoing decline in populations if they fail to recover | Giant barred frog: loss of individuals, loss of habitat, alteration of habitat.<br>Koala: loss of individuals, loss of habitat, alteration of habitat.<br>Grey-headed flying-fox: loss of habitat.<br>Regent honeyeater: loss of habitat.<br>Spotted-tailed quoll: loss of individuals, loss of habitat, alteration of habitat. |

A detailed assessment against the EPBC Act significant assessment criteria is provided in **Appendix H, Biodiversity assessment report** and summarised in **Table 10-16**. This assessment does not consider the management and mitigation measures outlined in **Section 10.4** of this report, with these measures defined to reduce the significance of impacts to MNES. Before mitigation measures are applied the project has the potential to result in a significant impact to koala and giant barred frog, as defined by the EPBC Act significant impact criteria.

Table 10-16 MNES significant impact assessment for MNES identified or assessed as having a high likelihood of occurrence in the study area

| Significant Impact Criteria | Southern swamp orchid | Koala | Spotted-tailed quoll | Grey-headed flying-fox | Giant barred frog | Regent honeyeater |
|---|---|---|---|---|---|---|
| Is the action likely to lead to a long-term decrease in the size of an important population of a species | No | **Yes** | No | No | **Yes** | No |
| Is the action likely to reduce the area of occupancy of an important population? | No | **Yes** | No | No | No | No |
| Is the action likely to fragment an existing population into two or more populations? | No | **Yes** | No | No | No | No |
| Is the action likely to adversely affect habitat critical to the survival of a species? | No | **Yes** | No | No | **Yes** | No |
| Is the action likely to disrupt the breeding cycle of a population? | No | **Yes** | No | No | **Yes** | No |
| Is the action likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline? | No | **Yes** | No | No | No | No |

| Significant Impact Criteria | Southern swamp orchid | Koala | Spotted-tailed quoll | Grey-headed flying-fox | Giant barred frog | Regent honeyeater |
|---|---|---|---|---|---|---|
| Is the action likely to result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat? | No | No | No | No | No | No |
| Is the action likely to introduce disease that may cause the species to decline? | No | No | No | No | No | No |
| Is the action likely to interfere substantially with the recovery of the species | No | **Yes** | No | No | **Yes** | No |

The project would result in potential significant impacts to koala and giant barred frog before mitigation is applied. This includes the direct loss of habitat. Potential indirect impacts to these species may occur from habitat fragmentation that prevents the movement of individuals. Elements have been included in the design to mitigate these impacts including the provisions of bridges over creeks supporting giant barred frog and movement structures for koala. Other indirect impacts associated with edge effects, primarily light and noise impacts from road operations, are not considered to have a significant impact to koala and giant barred frog.

### 10.3.4 Other impacts

#### *Aquatic ecology*

Aquatic fauna may be temporarily displaced during the construction of permanent waterway crossings and proposed creek realignments including between 50 and 130 m of Newports Creek and two of its tributaries, around 90 m of Coffs Creek, up to 120 m of the upper reaches of Treefern Creek, and around 35 m of the northern tributary of Pine Brush Creek. The creek realignments are described in more detail in **Chapter 5, Project description.**

The construction and operation of the project has the potential to impact on water quality in the creeks, through the introduction of sediments and pollutants in surface water runoff. **Chapter 19, Surface water quality** provides an assessment of the impacts on receiving environments. The creeks within study area may experience localised increases in sediments and nutrients at the point of discharge. This small increase is unlikely to have a significant impact on the aquatic ecology of the wider catchment.

Other impacts would include loss of riparian habitats, including the removal or relocation of stags and impacts to riparian vegetation.

#### *Changes to surface water hydrology*

Realignment of waterways within the study area where required to maintain drainage and flow characteristics of watercourses, as well as increased development of roadways, hardstand areas and sedimentation basins as a result of the project could affect local hydrology patterns and associated habitats. This impact could have both short and long-term consequences in the form of direct loss of habitat and ongoing decline of habitat suitability. The following threatened species could be affected:

- Giant barred frog – altered hydrological regimes could affect suitability of habitat
- Southern swamp orchid – altered hydrological regimes could affect suitability of habitat
- Coastal petaltail dragonfly – altered hydrological regimes could affect suitability of habitat.

At the national scale, based on species' current habitat availability, type of habitat, quality and perceived threats, altered hydrology has the potential to be important to the giant barred frog.

Within the study area, habitats that are the most sensitive to changes in surface water hydrology are riparian zones associated with the waterways and the area of swamp sclerophyll forest associated with PCT1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion. Changes to the hydrological conditions within the waterways and riparian zones are expected to occur in small, localised areas where the new highway traverses the creeks. Surface water runoff from the project has been designed to flow into stormwater treatment devices, including detention basins and grassed swales, prior to discharge into waterways. This process would provide for management of surface water quantity and quality, to minimise impacts associated with hydrology.

The swamp paperbark communities are located in the in the North Boambee Valley region in the study area. These communities can be sensitive to changes in hydrology, transitioning to different vegetation community types over time if environmental flows are altered. A review of the flood modelling completed as part of the design shows that there would be negligible changes to the extent and period of inundation in these areas.

In addition to waterway realignments, temporary crossing structures may be required to cross Newports Creek, Coffs Creek, Jordans Creek, Treefern Creek, Pine Brush Creek and other small unnamed drainage lines and watercourses to enable materials to be hauled within the construction footprint (as opposed to using the existing road network) while the adjacent culvert or bridge is being built.

Details of these realignments and temporary waterway crossings are provided in **Chapter 5, Project description** and **Chapter 6, Construction**.

### *Changes to groundwater hydrology*

Potential areas highly sensitive to alterations to groundwater flow include the Coastal Management SEPP wetland that occurs within 100 m to the east of the southern extent of the study area, as well as areas of Swamp Sclerophyll Forest, Lowland Rainforest TECs and habitat for threatened flora and fauna species including coastal petaltail dragonfly and southern swamp orchid. A higher concentration of 'High probability GDE – from regional studies' are mapped on the GDE Atlas to the east of the study area (BoM 2018b).

Direct impacts to GDEs as a result of the project include the removal of 0.77 hectares of 'High probability GDE – from regional studies' and 42.60 hectares 'Low probability GDE – from regional studies' as per the GDE Atlas (BoM 2018b).

Impacts to GDEs have been assessed in **Chapter 20, Groundwater** which states that lowering of groundwater levels caused by the excavation of cuttings and tunnels which intercept and drain groundwater from the fractured bedrock aquifer has the potential to impact GDEs within the study area. Most GDEs are considered likely to draw groundwater from shallow surficial deposits or alluvial groundwater which occur within a few metres of the surface. It is considered unlikely that GDEs are dependent directly on groundwater from the fractured bedrock aquifer except where it is close to the ground surface, for instance at spring locations.

Since groundwater inflows captured by the project are from the fractured bedrock aquifer, the potential impact on GDEs and native vegetation communities is expected to be limited. Where native vegetation communities are groundwater dependent, it is likely that they are reliant on water within alluvial aquifers (and perched water within surficial soils), which are predominantly surface water dependent.

Relevant aspects of the final design stages of the project would include measures to minimise this effect and the resultant indirect impacts on GDEs.

### *Habitat fragmentation*

The project would likely result in increased fragmentation of habitat to the east (on the coastal floodplain) and the west (the escarpment) of the study area. Biodiversity links offering east–west movement opportunities for threatened fauna, including koalas, are likely to be severed as a result of the project due to the direct clearing of vegetation. This would have impacts on fauna movement within the area with remaining habitat fragments becoming further isolated.

These impacts on habitat connectivity could have both short and long-term consequences for threatened fauna in the form of direct loss and ongoing decline. The following threatened species would be most affected at a local scale:

- Koala – fragmentation of populations and isolation of individuals through construction of physical barrier and removal of habitat
- Spotted-tailed quoll – isolation of individuals through construction of physical barrier and removal of habitat
- Giant barred frog and green-thighed frog – fragmentation of two known areas of habitat
- Southern swamp orchid – fragmentation of habitats and loss of pollination opportunities
- Pale-vented bush hen – fragmentation of movement corridors associated with riparian vegetation
- Rusty plum – fragmentation of existing habitats.

When considering the current distribution and status of these species at a national scale, habitat fragmentation has the potential to significantly impact koala and giant barred frog. Elements have been included in the design to allow for the movement of koala and giant barred frog across the road corridor. These mitigation measures have been assessed as being sufficient to reduce the potential impact of fragmentation on populations.

### *Edge effects*

Vegetation within the study area and broader locality occurs in a patchy mosaic of remnant and re-growth vegetation on hills, in gullies and surrounding watercourses and cleared areas for agriculture and urban/per-urban development. The results of the assessment of landscape values undertaken within the study area indicate only a 0.2 per cent increase in the area to perimeter ratio of native vegetation patches as a result of the project. There is the possibility for increased disturbance to these areas during construction, including increased light, dust and noise. However, these impacts are temporary in nature and may be effectively managed and mitigated through the implementation of construction controls.

There is also potential for disturbance due to edge effects including increased light, dust and noise during the operation of the project (ie road traffic); however, impacts from increased edge effects are expected to be minimal, and may be effectively mitigated through design through measures such as minimising shading and artificial light impacts.

### *Fauna mortality or injury*

The project has the potential to result in the direct mortality or injury of fauna as a result of habitat loss, fragmentation and through vehicle strike. Threatened species most likely to be impacted include koalas and Spotted-tailed quolls due to their regular movement patterns and the ability to travel large distances. However, mitigation measures including fauna underpasses and fauna fencing are likely to minimise these impacts considerably.

During construction, fauna may also be impacted as a result of increased vehicle movements in the locality, fauna presence in vegetation being removed or fauna entrapment in excavations. These impacts would be managed during construction through the implementation of suitable controls including:

- Pre-clearing inspection of vegetation for fauna and sequential clearing to allow for dispersal of fauna
- Regular inspections of open excavations
- Maintenance of low speed limits
- Timing of works to be undertaken during daylight hours, where possible.

#### *Pests and weeds*

Infestation of habitats by introduced weeds is identified as a threat to many of the threatened species and ecological communities, known or considered highly likely to occur within the study area (OEH 2018a). Patches of vegetation within the study area are significantly impacted by weed species, with many areas showing significant levels of weed invasion due to past clearing practices. Forty-six weed species were recorded during field surveys and have the potential to spread following disturbance associated with the construction phase of the project. However, strict hygiene measures to be implemented during construction would assist in preventing the spread of weeds and any potential impacts on threatened species habitat, as detailed in **Section 10.4.**

#### *Habitat disturbance*

Disturbance of habitats may occur as a result of increased noise, light and vibration associated with project construction. Although some parts of the study area are subject to increased noise and vibration levels associated with existing roads, project construction and operation is likely to expose new areas of habitat to increased noise and vibration levels associated with construction activities and ongoing vehicle traffic along the project alignment.

Sections of the project alignment are already subject to impacts from artificial lighting associated with the operation of existing roads. The project would include the installation of lighting along the new road alignment for traffic safety. As such, the project is likely to result in a degree of light spill to vegetation immediately adjacent to the new road alignment and is likely to impact native biota within these sections of the study area. Lighting used during construction and operation of the project should be designed as ‘down lights’ and be directed inwards wherever practicable so as to limit light spill into nearby areas of remnant vegetation.

Remnant vegetation immediately adjacent to areas of new road construction within the alignment would experience some artificial lighting impacts. Potential impacts may result from the operation of night time construction works, installation of street lighting and security lighting. Light spill onto areas of remnant vegetation may discourage habitat use and disrupt foraging regimes of nocturnal native species. Disruption to foraging regimes and interference to eyesight of nocturnal native species associated with artificial lighting may increase the susceptibility of these species to predation. The new road construction alignment generally occurs in semi-agricultural areas, with the amount of remnant vegetation in these areas generally being limited to small patches or riparian corridors. Recommendations to avoid and mitigate impacts on such vegetation have been made in **Section 10.4.**

### 10.3.5 Key threatening processes

A key threatening process (KTP) is defined under the TSC Act and FM Act as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

Listed KTPs are set out in Schedule 3 of the TSC Act and Schedule 6 of the FM Act.

Similarly, the EPBC Act defines a “threatening process” as a process threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community. A KTP under the EPBC Act is a threatening process that has been listed by the Minister of the Environment under that Act.

KTPs relevant to this project are listed in **Table 10-17**. Mitigation measures to limit the impacts of the KTPs are discussed in **Section 10.4**.

Table 10-17 Key threatened processes relevant to the project

| Key threatening process | Status | Comment |
|---|---|---|
| Clearing of native vegetation | TSC Act<br>EPBC Act | A total of 43.37 ha of native vegetation is proposed to be cleared for the project across nine PCTs. This total includes 3.65 ha of Swamp Sclerophyll Forest (Endangered TSC Act) and 2.42 ha of Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion (Endangered TSC Act). |
| Clearing of hollow-bearing trees | TSC Act | A total of 87 hollow-bearing trees are proposed to be removed for the project. |
| Removal of dead wood and dead trees | TSC Act | The vegetation to be removed contains a low-moderate density of dead wood and dead trees similar to that in surrounding habitat to be retained within the study area. |
| Infection of native plants by *Phytophthora cinnamomi* | TSC Act<br>EPBC Act | Increased visitation and movement of people and vehicles around the study area has the potential to introduce or spread the pathogen *Phytophthora cinnamomi.* |
| Invasion and establishment of exotic vines and scramblers | TSC Act | Vegetation within the study area has the potential to be invaded by exotic vines and scramblers. Vehicles and plant have the potential to introduce propagules of exotic vines and scramblers, as could soil disturbance during construction activities. |
| Invasion establishment and spread of *Lantana camara* | TSC Act | *Lantana camara* is already present within some sections of the study area. This KTP is likely to be exacerbated on-site without the implementation of weed management. |
| Invasion of plant communities by perennial exotic grasses | TSC Act | Parts of the study area have been subject to previous disturbances (including existing road and rail corridors, agriculture, residential housing and forestry), as a result there are exotic weed species already present in the study area. Weeds may also be introduced due to an increase in edge areas as part of the construction of the road alignment. Vehicles and plant could further spread exotic grass species, as could soil disturbance during vegetation clearing and road construction. There is the potential for perennial exotic grasses to invade retained and nearby native vegetation through project activities. |
| Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on | TSC Act | Road construction activities have the potential to introduce Myrtle Rust to the study area, by providing a new edge to retained vegetation communities where wind-borne spores can land. |

| Key threatening process | Status | Comment |
|---|---|---|
| plants of the family Myrtaceae | | |
| Infection of frogs by amphibian chytrid causing the disease chytridiomycosis | TSC Act<br>EPBC Act | Road construction activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of frogs and tadpoles. |
| Predation by the European Red Fox | TSC Act<br>EPBC Act | Evidence of foxes was observed in the study area. The project may lead to an increase in the incidence of this species by providing an increase in access routes through the study area. However, the location of the alignment is already through a highly fragmented landscape. |
| Bushrock removal | TSC Act | Construction activities would remove bushrock identified within the construction footprint. |
| Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands | TSC Act | The road construction is expected to impact 14 waterways and a number of their associated tributaries within the study area, which vary from Class 1 to Class 2 waterways (Strahler method). These waterways feed into downstream estuarine waterways to the east of the study area. |
| Anthropogenic climate change | TSC Act<br>EPBC Act<br>FM Act | The project would be constructed utilising primarily diesel-powered machinery and plant. While all machinery would be operated and maintained in good operational working order to reduce emissions, the construction of the project would result in the emission of greenhouse gases and would therefore contribute to climate change. |
| Removal of large woody debris from NSW rivers and streams | FM Act | Road construction across waterways may result in the removal of woody debris from waterways within the study area. |
| Degradation of native riparian vegetation along NSW water courses | FM Act | Road construction and access for project vehicles and plant may require clearing of native riparian vegetation along some sections of waterways within the study area. |
| Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams | FM Act | Waterway crossings as part of the road construction may require the placement of temporary or permanent instream structures. |

## 10.4 Environmental management measures

The mitigation measures from **Appendix H, Biodiversity assessment report** provide the full suite of measures that will implemented for the project and address impacts on other aspects relevant to biodiversity, including hydrology, water quality and groundwater. As such, **Table 10-18** only provides the measures applicable to biodiversity and general measures to manage impacts on hydrology, water quality and groundwater are included in **Chapter 17, Flooding and hydrology, Chapter 19, Surface water quality** and **Chapter 20, Groundwater** respectively.

More detail on the management of biodiversity impacts is provided in **Appendix I, Threatened Species Management Plan,** which has been prepared to establish the framework for threatened species and habitat management during the design, construction and operational phases of the project. This plan establishes the roles and responsibilities, species-specific mitigation measures, monitoring requirements and indicative timing for all threatened species management. Construction phase mitigation measures would be identified as part of the Flora and Fauna Management Plan (FFMP) which is a sub plan to the CEMP. The FFMP would be prepared in accordance with the measures provided below and included in **Appendix I, Threatened Species Management Plan**.

Table 10-18 Environmental management measures for biodiversity impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Removal of threatened fauna habitat | FF01 | The TSMP (**Appendix I, Threatened Species Management Plan**) would be reviewed and updated as required during detailed design and prior to operation. The purpose of the review would be to address any detailed design and/or construction refinements and to comply with relevant project approval requirements. The Plan would operate in conjunction with the FFMP. | Contractor | Detailed design and prior to operation |
| | FF02 | The FFMP would be prepared in accordance with Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) and implemented a part of the CEMP. The FFMP would build upon the strategies outlined in the TSMP and identify detailed site-specific and species-specific mitigation measures and management protocols to be implemented before, during and after all construction activities to further avoid or reduce impacts on threatened biodiversity. | Contractor | Prior to construction |
| | FF03 | Native vegetation and fauna habitat removal would be minimised through detailed design where reasonable and feasible. Particular focus would be given to minimising the removal of:<br>• Hollow bearing trees<br>• Native vegetation in riparian zones<br>• Native vegetation from known fauna connectivity corridors and near proposed fauna crossing structures. | Contractor | Detailed design |
| | FF04 | Habitat would be replaced or re-instated in accordance with Guide 5: Re-use of woody debris and bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a). | Contractor | During construction |
| | FF05 | Protection and enhancement of vegetated riparian zones would be undertaken to improve opportunities for fauna movement (including spotted-tailed quoll and pale-vented bush hen). | Contractor | During construction |
| | FF06 | Opportunities for providing roosting habitat for microbats in new bridge structures adjacent to areas of known microbat habitat would be investigated where future maintenance would not be compromised. | Contractor | Detailed design |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | FF07 | A Nest Box Management Plan would be prepared and implemented as part of the FFMP in accordance with Guide 8: Nest Boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a). The Plan would include requirements for monitoring and maintenance. | Contractor | Prior to construction |
| Removal / clearing of native vegetation (including riparian vegetation) | FF08 | Pre-clearing surveys would be undertaken in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a). | Contractor | Prior to construction |
| | FF09 | The limits of clearing within the construction footprint would be delineated using appropriate signage and barriers, identified on site construction drawings and communicated to construction staff during induction. Vegetation and habitat features to be retained, such as hollow-bearing trees, would be clearly identified and protected by suitable fencing, signage and/or markings. | Contractor | During construction |
| | FF10 | Vegetation clearing would be undertaken in accordance with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a). | Contractor | During construction |
| | FF11 | Native vegetation consisting of suitable species from locally indigenous vegetation communities of the study area would be progressively re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a). | Contractor | During construction |
| | FF12 | An unexpected species find procedure would be prepared and implemented in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a). | Contractor | During construction |
| Removal of threatened flora | FF13 | A Salvage and Re-establishment Plan for southern swamp orchid individual(s) and rusty plum would be prepared prior to construction, outlining detailed procedures for the preparation of the re-establishment and receiving sites, plant movement, pre- and post- care of target individuals as well as detailing the objectives, monitoring procedures and contingency measures. | Roads and Maritime | Prior to construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Fragmentation of identified biodiversity links and habitat corridors | FF14 | Fauna connectivity structures would be designed and constructed to facilitate safe fauna passage across the project in accordance with the locations and design principles detailed in **Appendix H, Biodiversity assessment report**. | Contractor | Detailed design and during construction |
| | FF15 | Permanent fauna fencing, including specific fencing for koala and giant barred frog in areas of known habitat, would be progressively installed as fauna connectivity structures become operational in consultation with a suitably qualified and experienced ecologist. | Contractor | Detailed design and during construction |
| | FF16 | Temporary fauna fencing would be installed if existing fauna fence at the southern end of the project on the existing Pacific Highway is removed during construction period. | Contractor | During construction |
| Edge effects on adjacent native vegetation and habitat | FF17 | Exclusion zones would be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011). | Contractor | During construction |
| Injury and mortality of fauna | FF18 | Any fauna encountered during construction would be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011). | Contractor | During construction |
| | FF19 | A native stingless bee rescue protocol would be developed and implemented to guide relocation of any native bee hives within the construction footprint. | Contractor | During construction |
| Invasion and spread of weeds | FF20 | Biosecurity risk and weed species would be managed in accordance with Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011) and Guide 7: Pathogen Management (RTA 2011). Specific protocols would be prepared and implemented to manage, Chytrid fungus, Phytophthora and Myrtle Rust. | Contractor | During construction |
| Noise, light and vibration | FF21 | Shading and artificial light impacts on areas of retained native vegetation would be minimised through detailed design where reasonable and feasible. | Contractor | Detailed design |
| | FF22 | Exclusion measures for microbats would be investigated for culverts identified as having high and medium habitat potential in consultation with a suitably qualified and experienced ecologist. Where required, timing for exclusion measures would be undertaken outside of breeding and winter torpor periods. | Contractor | Prior to and during construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Impacts to aquatic habitats and changed hydrological regimes | FF23 | Aquatic habitat would be protected in accordance with Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011), Section 3.3.2 Standard precautions and mitigation measures of the Policy and Guidelines for Fish Habitat Conservation and Management Update 2013 (DPI 2013) and with reference to Guidelines for controlled activities on waterfront land – Riparian corridors (DPI 2018d). | Contractor | During construction |
| | FF24 | Any machinery used during instream works should be verified as clean and free of potential aquatic weeds and pathogens to avoid biosecurity risk. | Contractor | During construction |
| | FF25 | Waterway crossings would be designed and constructed in accordance with DPI Fisheries guideline Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (Fairfull & Witheridge 2003) and would include maintaining existing nominal flow velocity where possible or at less than 0.3 m/sec to prevent damage to aquatic habitats. | Contractor | Detailed design and during construction |
| | FF26 | Coffer dams would be used during work undertaken within or immediately adjacent to waterways where reasonable and feasible to prevent or minimise increased turbidity. In the event that coffer dams are not reasonable and feasible, silt curtains would be used. | Contractor | During construction |
| | FF27 | Changes to existing hydrological regimes within known and potential coastal petaltail dragonfly habitats would be minimised during detailed design. Bridges and/or culverts would be located and designed to maintain existing hydrological regimes where reasonable and feasible and would consider the potential for scour impacts on downstream habitats. | Contractor | Detailed design |

## 10.4.1 Fauna connectivity measures

Fragmentation of habitats is a major risk to local, State and national biodiversity values that may result from the project. During the development of the preliminary road alignment design, Roads and Maritime identified a number of measures to be implemented during the design phase to reduce the significance of impacts associated with habitat fragmentation and maintain landscape connectivity to the east and west of the project. These measures included identifying target species movement requirements, locations for fauna connectivity structures and developing design criteria that the structures would need to meet. Additional detail is provided in **Appendix H, Biodiversity assessment report** and **Appendix I, Threatened Species Management Plan,** with a summary of the approach detailed below.

Fauna connectivity structures proposed for the project include:

- **Retained ridgelines over tunnels** which maintain the native vegetation at Roberts Hill and Gatelys Road providing a connection for fauna over the road infrastructure during construction and operation. The ridgeline at Shephards Lane will likely maintain its existing land use providing low value opportunistic fauna crossing
- **Glider poles** provide a connection for fauna over the road infrastructure
- **Dedicated underpass structures** constructed of culverts which pass underneath the road infrastructure, providing a direct connection
- **Combined underpass structures** where culverts or bridge structures contain specific design elements to enhance their attractiveness to the target fauna species. These structures are combined with drainage or road overpass structures, such as drainage culverts, waterway bridges, or road and rail bridge structures.

These structures and the road corridor would be designed to include fauna fencing to encourage movement of the target species towards the structures and exclude native fauna from the road infrastructure. Revegetation works within the road corridor would also be required to connect entry/exit points of the connectivity structures to retained native vegetation and ecological corridors on either side of the alignment.

### 10.4.2 Target species

**Appendix H, Biodiversity assessment report** has identified impacts on the following threatened fauna species associated with habitat fragmentation:

- Koala
- Spotted-tailed quoll
- Giant barred frog
- Green-thighed frog
- Pale-vented bush hen.

In addition to threatened species known to be impacted by habitat fragmentation as a result of the project, requirements for fish passage have also been considered during the design development. In accordance with the DPIE guidelines, fish passage would be required on all Class 1, 2 and 3 waterways, as identified in **Table 10-11.**

### 10.4.3 Overview of connectivity structures

A range of fauna connectivity structures have been proposed, based on the requirements of the target species, the alignment and condition of fauna corridors and the design and topographic constraints of the project. Sixteen locations have been identified along the 14 km alignment where connectivity structures can be placed to meet the required mitigation measures to minimise the impacts of fragmentation, including:

- Retained ridgelines over tunnels
- Dedicated fauna underpasses (culverts)
- Combined waterway bridges incorporating fauna underpasses
- Combined road bridges incorporating fauna underpasses
- Combined rail bridge incorporating fauna underpasses
- Combined fauna and drainage underpasses (culverts)
- Glider poles.

Additional detail on the design principles to be incorporated into the fauna connectivity structures is provided in **Appendix H, Biodiversity assessment report** and **Appendix I, Threatened Species Management Plan**. The location and final details of these structures would be subject to detailed design.

## 10.5 Impact and mitigation summary

The identification of impacts on biodiversity and measures to avoid and mitigate these impacts has been completed in accordance with the FBA, the EPBC Act *Significant Impact Guidelines* and the EPBC Act Environmental Offsets Policy. During the development of the concept design, measures have been taken to avoid and minimise impacts on threatened species and vegetation communities, with additional commitments made during detailed design, construction and operational phases to further minimise impacts. These are summarised in this chapter, with additional detail on the mitigation measures for threatened species provided in **Appendix I, Threatened Species Management Plan**.

Due to the highly fragmented distribution of native vegetation within the study area, the dominance of this vegetation in east–west creek corridors and the linear nature of the project, minimising potential impacts on terrestrial fauna connectivity has been carefully considered in the designs. This impact has been effectively mitigated by providing 16 locations for terrestrial fauna connectivity across the approximately 14 km length of the project. These crossings have been located on known fauna movement corridors, including those mapped by State and local government as Koala corridors, and ground-truthed during field studies for this EIS (**Appendix H, Biodiversity assessment report**). Additional detail on the location and design principles required for these fauna connectivity structures to be effective for the target fauna species is provided in **Appendix I, Threatened Species Management Plan**.

Following the application of measures to avoid and minimise impacts on biodiversity, the impact assessment in this chapter has identified some residual impacts that would require biodiversity offsets. Applying the FBA, residual impacts to State-listed matters include:

- Nine PCTs
- Rusty plum
- Southern swamp orchid
- Coastal petaltail dragonfly
- Giant barred frog
- Green-thighed frog
- Koala
- Pale-vented bush-hen
- Southern myotis.

Using the EPBC Act Significant Impact Guidelines, significant residual impacts to MNES include:

- Loss of habitat for koala
- Loss of habitat for giant barred frog.

The biodiversity offset requirements for these residual impacts have been calculated in accordance with the requirements of the FBA.

# 10.6 Biodiversity offset requirements

## 10.6.1 Framework for Biodiversity Assessment

The offset assessment followed the methodology outlined in the FBA (OEH 2014a). Under the FBA, biodiversity offsets are required to address impacts on biodiversity resulting from the project. A summary of credits required for the project is provided in **Table 10-19** and **Table 10-20**. All residual impacts of the project would be offset in accordance with the FBA.

A draft Biodiversity Offset Strategy (BOS) has also been prepared and is included in **Appendix H, Biodiversity assessment report**. This BOS identifies the mechanism for delivery of offsets in accordance with the FBA, which has been endorsed by the Australian Government as part of the EPBC Act assessment bilateral agreement. The BOS establishes the process for identifying and securing offsets prior to commencement of the action.

Table 10-19 Species credit summary

| Scientific name | Common name | TS offset multiplier | Loss of habitat (ha) or individuals | Species credits required |
|---|---|---|---|---|
| *Niemeyera whitei* | Rusty plum, plum boxwood | 1.5 | 57 individuals | 855 |
| *Phaius australis* | Southern swamp orchid | 1.3 | 1 individual | 13 |
| *Petalura litorea* | Coastal petaltail dragonfly | 7.7 | 2.50 ha | 192 |
| *Mixophyes iteratus* | Giant barred frog | 7.7 | 3.28 ha | 253 |
| *Litoria brevipalmata* | Green-thighed frog | 1.3 | 1.79 ha | 23 |
| *Phascolarctos cinereus* | Koala | 2.6 | 36.70 ha | 954 |
| *Amaurornis moluccana* | Pale-vented bush-hen | 1.3 | 4.95 ha | 64 |
| *Myotis macropus* | Southern myotis | 2.2 | 15.10 ha | 332 |
| **TOTAL** | | | | **2686** |

Table 10-20 Ecosystem credits summary

| Veg Zone | PCT | Plant community type name | Management zone area (ha) | Ecosystem credits required |
|---|---|---|---|---|
| 1 | 1302 | White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion | 0.51 | 35 |
| 2 | 692 | Blackbutt - Tallowwood moist ferny open forest of the coastal ranges of the NSW North Coast Bioregion | 11.27 | 754 |
| 3 | 692 | Blackbutt - Tallowwood moist ferny open forest of the coastal ranges of the NSW North Coast Bioregion | 3.39 | 136 |
| 5 | 695 | Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion | 6.26 | 438 |
| 6 | 692 | Blackbutt - Tallowwood moist ferny open forest of the coastal ranges of the NSW North Coast Bioregion | 0.74 | 36 |
| 8 | 1244 | Sydney Blue Gum open forest on coastal foothills and escarpment of the North Coast | 0.94 | 64 |
| 9 | 747 | Brush Box - Tallowwood - Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion | 2.48 | 149 |
| 10 | 1064 | Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion | 0.89 | 61 |
| 11 | 1064 | Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion | 1.15 | 80 |
| 12 | 1064 | Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion | 1.23 | 79 |
| 13 | 695 | Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion | 0.15 | 11 |
| 14 | 695 | Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion | 4.07 | 167 |

| Veg Zone | PCT | Plant community type name | Management zone area (ha) | Ecosystem credits required |
|---|---|---|---|---|
| 15 | 1262 | Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast | 0.73 | 43 |
| 16 | 1064 | Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion | 0.38 | 27 |
| 17 | 1302 | White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion | 1.91 | 109 |
| 100 | 1262 | Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast | 0.89 | 57 |
| 101 | 1285 | Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion | 1.42 | 87 |
| 102 | 747 | Brush Box - Tallowwood - Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion | 3.35 | 216 |
| 103 | 1285 | Turpentine moist open forest of the coastal hills and ranges of the NSW North Coast Bioregion | 1.61 | 97 |
| **TOTAL** | | | **43.37** | **2646** |

* PCT 1302 White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion has been used as a substitute for PCT 670 Black Booyong – Rosewood – Yellow Barabeen subtropical rainforest of the NSW North Coast Bioregion located in Veg Zone 1. This is due to the unavailability of this vegetation community in the BioBanking Calculator. This PCT has the same benchmark values, the same value for CMA percent cleared and represents the same vegetation formation (Rainforest) and class (Subtropical Rainforest) as PCT 670. As such, the offsetting calculations will result in the same requirement and offsetting options, but with a different baseline PCT.

CHAPTER

11



Chapter 11

# Urban design, landscape and visual amenity

# 11. Urban design, landscape and visual amenity

This chapter presents an assessment of the landscape character and visual impacts of the project and identifies mitigation and management measures to minimise and reduce impacts. It also summarises the urban design and landscape strategy which has been developed to integrate and respond to findings from the landscape character and visual impact assessment (LCVIA).

The assessment presented in this chapter draws on information in **Appendix J, Urban design, landscape character and visual impact assessment**.

**Table 11-1** lists the SEARs relevant to urban design and visual amenity, and where they are addressed in this chapter.

Table 11-1 SEARs relevant to urban design and visual amenity

| Ref | Key Issue SEARs | | Where addressed |
|---|---|---|---|
| **5. Urban design** | | | |
| 1. | The Proponent must: | | |
| | a) | Identify the urban design and landscaping aspects of the project and its components, including interchanges, tunnel portals, bridges, noise walls, landscaped mounds, ancillary buildings and infrastructure services; | **Chapter 5, Project description** |
| | b) | Assess the impact of the project on the urban, rural and natural fabric, including residual land treatment, and demonstration of how the proposed hard and soft urban design elements of the project would be consistent with the existing and desired future character of the area traversed or affected by the project; | Section 11.4 |
| | c) | Explore the use of Crime Prevention Through Environmental Design (CPTED) principles during the design development process, including natural surveillance, lighting, walkways, signage and landscaping; | Section 11.2.4 |
| | d) | Identify urban design strategies to enhance healthy, cohesive and inclusive communities directly impacted by the project; and | Section 11.2 |
| | e) | Describe urban design and landscape mitigation measures, having regard to the urban design and landscape objectives for the project and the overall Pacific Highway Upgrade program. | Section 11.2.1<br>Section 11.4.2<br>Section 11.5 |
| **6. Visual amenity** | | | |
| 1. | The Proponent must assess the visual impact of the project and any ancillary infrastructure (including noise walls) on: | | Section 11.4.2 |
| | a) | views and vistas | Section 11.4.2 |
| | b) | streetscapes, key sites and buildings; | Section 11.4.2 |
| | c) | heritage items including Aboriginal places and environmental heritage; and | **Chapter 15, Aboriginal cultural heritage**<br>**Chapter 16, Non-Aboriginal heritage** |
| | d) | the local community (including view loss and overshadowing). | Section 11.1.2<br>Section 11.4.2 |
| 2. | The Proponent must provide artist impressions and perspective drawings of the project from a variety of locations along and adjacent to the route to illustrate how the project has responded to the visual impact through urban design and landscaping | | Section 11.4.2<br>**Chapter 5, Project description** |

## 11.1 Assessment methodology

**Appendix J, Urban design, landscape character and visual impact assessment** has been prepared to inform the concept design for the project and to assess the potential landscape character and visual impacts of the project. This report includes the context analysis, urban design strategy, urban design context, landscape, character and visual impact assessment. The assessments also identify strategies to manage potential impacts.

The report was prepared with reference to:

- Upgrading the Pacific Highway Urban Design Framework (Roads and Maritime Services 2013e)
- EIA N04 Practice Note: Guidelines for Landscape Character and Visual Impact Assessment (Roads and Maritime Services 2018a)
- Beyond the Pavement – urban design policy, procedures and design principles (Roads and Maritime Services 2014a)
- AS4282-1997 Control of the obtrusive effects of outdoor lighting (Standards Australia 1997)
- Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW (Roads and Maritime Services 2019a)
- NSW Sustainable Design Guidelines Version 4.0 (TfNSW 2017)
- Crime prevention and the assessment of development applications (DUAP 2001)
- Crime Prevention through Environmental Design (CPTED) (Queensland Government 2007)
- Technical Guideline for Urban Green Cover in NSW (OEH 2015)
- Healthy Urban Development Checklist (Department of Health 2009)
- Landscape Design Guidelines (Roads and Maritime Services 2017c)
- Tunnel Urban Design Guideline (Roads and Maritime Services 2017f)
- Water Sensitive Urban Design Guideline (Roads and Maritime 2017g).

Assessments included:

- Site inspection to identify sensitive views and existing landscape character
- Identifying key viewpoints and potential visual impacts
- Identifying the potential impact of the project on the landscape
- Identifying strategies to be incorporated into the design to avoid and minimise potential visual and landscape impacts.

Development of the urban design and landscape strategy and carrying out the LCVIA is an iterative process. The LCVIA draws upon the urban design vision, objectives and principles and the landscape and urban design concept developed as part of the urban design and landscape strategy. Similarly, the urban design and landscape strategy draws upon key issues, constraints and mitigations identified in the LCVIA (**Figure 11-1**). The iterative process ensures that key issues, constraints and mitigations from the LCVIA are integrated into the urban design and landscape strategy and also into the design for the project.

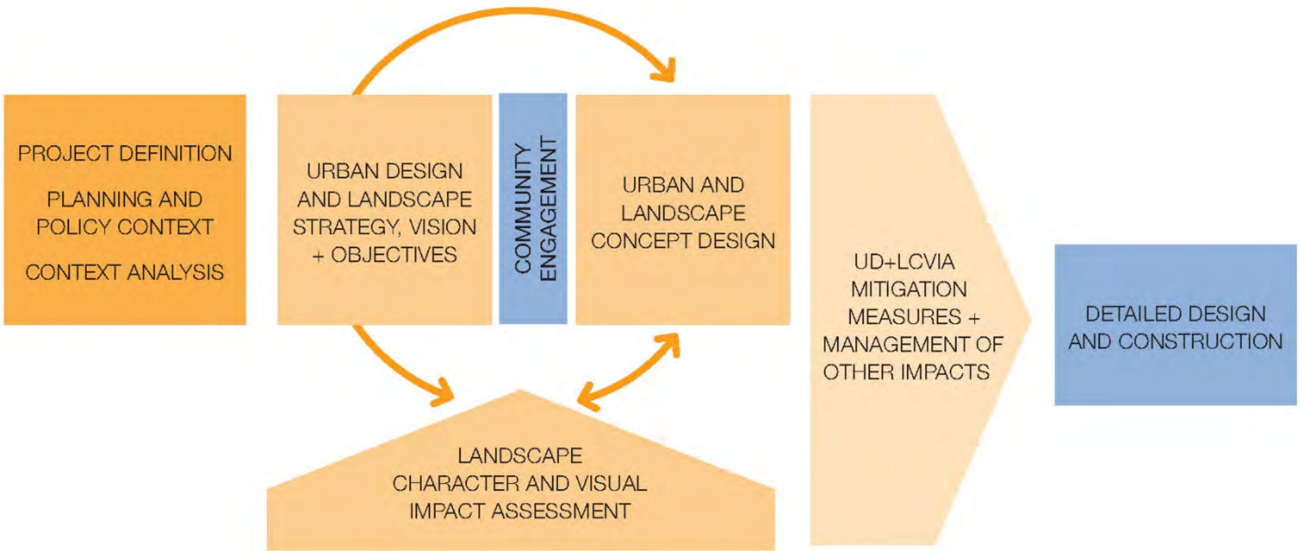



Figure 11-1 Overview of iterative process adopted for the urban design and landscape strategy and the LCVIA

### 11.1.1 Landscape character assessment

Landscape character can be defined as the aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. It includes all aspects of a piece of land – built, planted and natural topographical and ecological features.

The impact on landscape character is determined based on a combination of the ‘sensitivity’ of the character of the setting to the proposed change and the ‘magnitude’ of change (scale, nature and duration) when compared to the existing landscape character.

Landscape sensitivity considers the inherent and intrinsic nature of the landscape and the degree to which it can accommodate change. This assessment included a review of the value of the landscape in terms of its cultural and historical importance to the community, the components of the landscape such as rivers, forest, urban areas, and the overall characteristics, such as scenic quality and landscape pattern. The following sensitivity judgements were used in the assessment:

- Generally, water and natural environments are more highly valued than modified areas, though views over rolling farmland are still highly valued
- Areas of unique scenic quality have higher sensitivity
- A pristine environment would have greater sensitivity with less ability to absorb new elements in the landscape than modified landscapes or those areas with contrast and a variety of landscape types.

The magnitude and nature of landscape change considers all elements of the project that have a bearing on the physical presence of the project including, the scale (height/length), compatibility with the existing character, the location and the setting.

The severity of these impacts is a combination of the sensitivity and magnitude rating in accordance with the impact assessment grading matrix, as shown in **Figure 11-2**.

| Sensitivity \ Magnitude | High | Moderate | Low | Negligible |
|---|---|---|---|---|
| High | High Impact | High-Moderate Impact | Moderate Impact | Negligible Impact |
| Moderate | High-Moderate impact | Moderate Impact | Moderate - Low Impact | Negligible Impact |
| Low | Moderate Impact | Moderate - Low Impact | Low Impact | Negligible Impact |
| Negligible | Negligible Impact | Negligible Impact | Negligible Impact | Negligible Impact |

Figure 11-2 Landscape and visual impact assessment matrix

## 11.1.2 Visual impact assessment

A Visual Envelope Map (VEM) study was prepared to identify the potential area from which the project could be visible. The VEM was generated based on the visibility of a high sided vehicle (4.5 m above carriageway level) travelling on the road. After a desktop study, review of the VEM plans and site visits, representative viewpoints with the potential to be visually affected by some element of the project were identified and selected for further analysis. A total of 22 viewpoints were identified for the project and are considered representative of the range of viewpoints within the project's visual envelope.

The visual impact of the project is derived from an analysis of the sensitivity of the viewpoints and the magnitude of change. The severity of these impacts is a combination of the sensitivity and magnitude rating in accordance with the impact assessment grading matrix (**Figure 11-2**).

### *Overshadowing*

Shadow analysis was carried out for the project, with particular consideration given to the potential for shadows to be cast from elevated features, including high earthworks, bridge structures and noise walls. The diagrams included within **Appendix J, Urban design, landscape character and visual impact assessment** depict the shadows cast by the project during the winter solstice (21 June) at various times throughout the day (7am, 9am, 1pm and 3pm).

For the purposes of the analysis, any existing vegetation and minor buildings, as well as proposed replacement tree planting or opportunities for noise walls to include transparent panels have been excluded from the model due to the potential for these items to alter over time.

### *Coastal view analysis*

People commonly have close affinities with coastlines for recreation and admiring their inherent natural beauty. As such, the inherent sensitivity of properties with coastline views has been analysed to determine potential reduction of coastal views as a result of the construction of the project.

The analysis included creation of a 3D terrain model and generation of viewsheds from properties located to the west of the project.

## 11.2 Urban design and landscape strategy

The urban design and landscape strategy has been developed and incorporated into the design to ensure that the project is sensitively integrated with its surrounding topography, landscape and urban setting, and to cohesively integrate communities directly impacted by the project. This section provides a summary of the urban design and landscape strategy and a detailed analysis is provided in **Appendix J, Urban design, landscape character and visual impact assessment**. The urban design and landscape strategy would be further refined as the design is progressed.

### 11.2.1 Urban design objectives and principles

The following urban design objectives from Roads and Maritime's Upgrading the Pacific Highway Urban Design Framework (Roads and Maritime Services 2013e) are relevant to the project:

- Provide a flowing road alignment that is responsive and integrated with the landscape
- Provide a well vegetated, natural road reserve
- Provide an enjoyable, interesting highway
- Value the communities and towns along the road
- Provide consistency with variety in road elements
- Provide a simplified and unobtrusive road design.

The concept of the urban design elements has been based on the natural landscape of the project with the aim of integrating the project in the existing landscape. The urban design and landscape strategy has been developed and integrated into the design to respond to the landscape and visual impacts. As a result, a number of potential adverse landscape and visual impacts have been avoided or minimised.

A summary of how the urban design objectives and principles have been incorporated into the design is provided in **Table 11-2.**

Table 11-2 Urban design objectives

| Urban design objective | Summary of urban design principle | Urban design treatments |
|---|---|---|
| Provide a flowing road alignment that is responsive and integrated with the landscape | • Seamlessly integrate the project with the surrounding landscape and the local road and transport network. | • Tunnels help to minimise disturbance and provide continuous landscape and environmental corridors above the project (see **Figure 11-3** which shows an impression of the Roberts Hill tunnel)<br>• Cut and fills have been minimised where possible. Where unavoidable, planting to soften the appearance has been provided<br>• The project has been designed to tie-in at the foothills of the Great Dividing Range, assisting in the mitigation of visual impacts and concealing the highway from adjacent residential developments<br>• Where possible, the crest and toe of cutting slopes and earthworks would be rounded to tie in with the surrounding topography. |
| Provide a well vegetated, natural road reserve | • Maintain and enhance the natural environmental and ecological systems along the project<br>• Native forest planting should be consistent with the remnant native vegetation along the project and enhance the ecological value where possible<br>• Limit impacts on views by planting and integrating intrusive design elements into the landscape character. | • Planting of native vegetation along the corridor is as part of the strategy to visually integrate the project into the natural landscape by minimising the impact on biodiversity and enhancing existing views. See **Figure 11-4** which shows the proposed vegetated road reserve at Coramba Road interchange. |
| Provide an enjoyable, interesting highway | • Elements along the project should be legible yet memorable and provide a positive visual experience for road users<br>• Consideration of public open space and future developments should be incorporated into the design | • Planting of native vegetation and enhancement of the natural landscape has been provided at the key interchanges along the project to create a sense of arrival and departure and a memorable experience for road users, particularly at interchange locations. |

| Urban design objective | Summary of urban design principle | Urban design treatments |
|---|---|---|
| | • Consider opportunities for artistic work, drawing attention to and celebrate the physical, historical and cultural landmarks. | • The design of bridges and tunnels has been maximised to fit with the surrounding landscape and enhance local heritage significance and preserving Aboriginal cultural heritage where possible. |
| Value the communities and towns along the road | • Enhancing connections within the landscape, both visual and environmental<br>• Maintain and enhance elements of the landscape which have cultural and heritage significance and exploring opportunities to highlight them. | • Finishes of structures have been selected to integrate with the surrounding landscape and minimise the visual impact on the local community. |
| Provide consistency with variety in road elements | • Create a design that is sympathetic to the landscape but is familiar and memorable to travellers<br>• Provide an urban design approach that is rich in diversity and interest, giving the project its own identity. | • Planting of native vegetation along the project has been provided to help with naturally integrating the project with the surrounding landscape. Enhancing the character of key elements including bridges and creeks has been provided where possible.<br>• Tunnels have been designed to tie-in with the surrounding landscape and natural features and would retain the landscape and environmental corridors above the project. |
| Provide a simplified and unobtrusive road design | • Seamlessly integrate the project with the surrounding landscape and the local road and transport network. | • The project uses the native elements of Coffs Harbour, including native vegetation planting and colour scheme/patterning to tie in with the existing urban fabric and the existing landscape character of the area.<br>• The tunnel portals have been designed to add value to the community and adjacent landowners by retaining the major vegetated ridges within the Coffs Harbour basin to maximise user experience of the landscape before entering the tunnel.<br>• Tunnel portals also provide a distinct physical and visual indication of the tunnel's arrival and departure corridors well in advance through recognisably different corridor features and clear signage. |

Figure 11-3 Roberts Hill tunnel

Figure 11-4 Coramba Road interchange

### 11.2.2 Tunnels approach

Tunnels help to minimise disturbance and provide continuous landscape and environmental corridors above the project. Fauna connectivity can be retained during construction and operation as above ground is minimally disturbed. The concept design for tunnels focused on integration with a ‘whole of project’ identify to tie-in to the surrounding landscape and natural features. The tunnel and portal areas have been designed to add value to the community and adjacent landowners by retaining the major vegetated ridges within the Coffs Harbour basin to maximise user experience of the landscape before entering the tunnel.

### 11.2.3 Landscape strategy

The landscape strategy for the project aims to integrate the design through revegetation and preservation of existing landscape patterns. The strategy also aims to maintain natural ridgelines and work with the existing landforms by minimising excavation, cuttings and raised structures. Opportunities to preserve the existing landscape character have been identified through selection and structuring of planting.

The concept design planting strategy for the project aims to replicate and maintain the natural character of the area by revegetating with vegetation communities native to the area. Vegetation clearing would be minimised where possible and native planting would be provided to help with screening of residences, structures and built elements over time. The planting strategy is based on plant communities identified in the biodiversity assessments (refer **Chapter 10, Biodiversity** and **Appendix H, Biodiversity assessment report**).

The design has focused on the integration of cutting and embankment slopes to respond to the surrounding topography where possible. The design acknowledges the potential geological constraints in this regard and explores opportunities to vary the surface finish to allow topsoil to be retained on slopes and vegetation to be established over time.

Typical cross sections identifying potential landscape treatments are shown in **Figure 11-5** to **Figure 11-7.**

### 11.2.4 Crime prevention through environmental design

Crime prevention through environmental design (CPTED) is the use of design and space management principles in order to influence human behaviour. The principles form part of the planning and design of the project to incorporate proactive crime prevention characteristics into the built environment, which can lead to a reduction in the fear and incidence of crime, as well as an improvement in quality of life.

The six principles of CPTED have been applied to the project and include:

- Surveillance
- Ownership / Access Control
- Territorial reinforcement
- Space management
- Legibility
- Vulnerability.

Consideration of how the CPTED principles have been included in design are summarised below:

- Road shoulders: Clear sightlines, visually permeable planting on road shoulders, limited potential for areas of concealment
- Local road underpasses: Clear sightlines, short lengths, visually permeable planting, appropriate lighting, graffiti guards for wing walls and interior surfaces

- Overbridges: Robust, well-constructed material selection to prevent vandalism, clear sightlines, throw screens to prevent objects falling or being dropped from bridges
- Noise walls: Materials that deter graffiti (such as textured or patterned concrete and acrylic panels), restricted access to limit concealment opportunities, shatter proof glass or acrylic
- Retaining walls: Materials that deter graffiti (such as textured or patterned concrete and acrylic panels)
- Pedestrian bridge: Throw screens to be installed both sides, clear sightlines, planting on approach to be low and visually permeable
- Bus stops: Adequate lighting provided, positioned to allow clear visibility from surrounding areas for passive surveillance.

Further detail is provided in Appendix A of **Appendix J, Urban design, landscape character and visual impact assessment**.

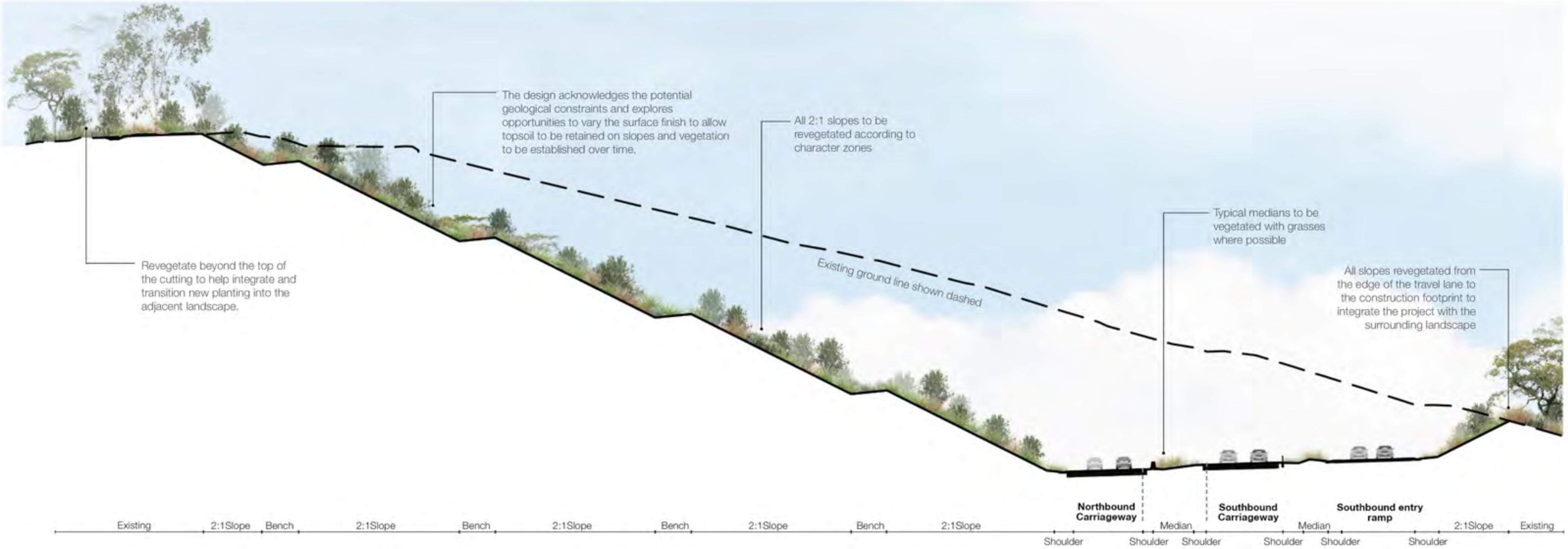



Figure 11-5 Section through main carriageway with narrow median south of Bruxner Park Road

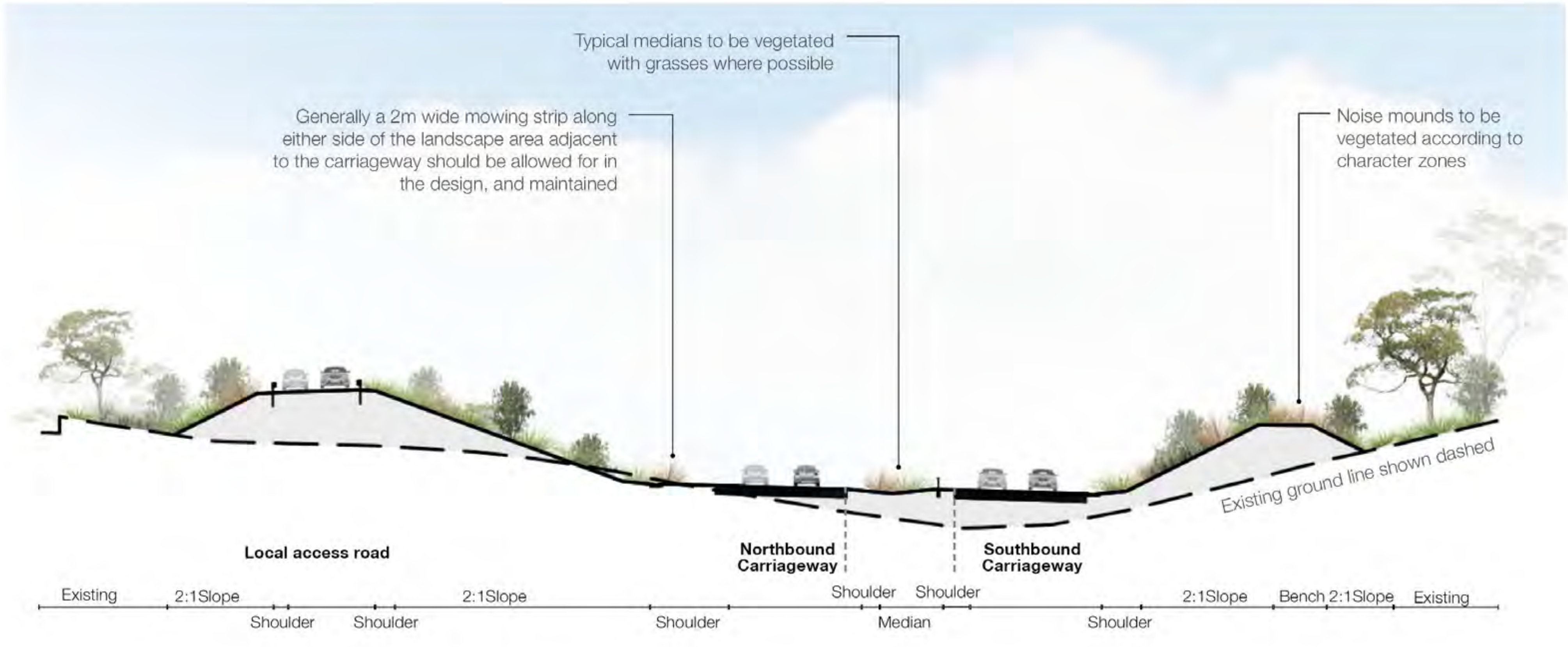



Figure 11-6 Indicative section through main carriageway with a typical median near Spagnolos Road

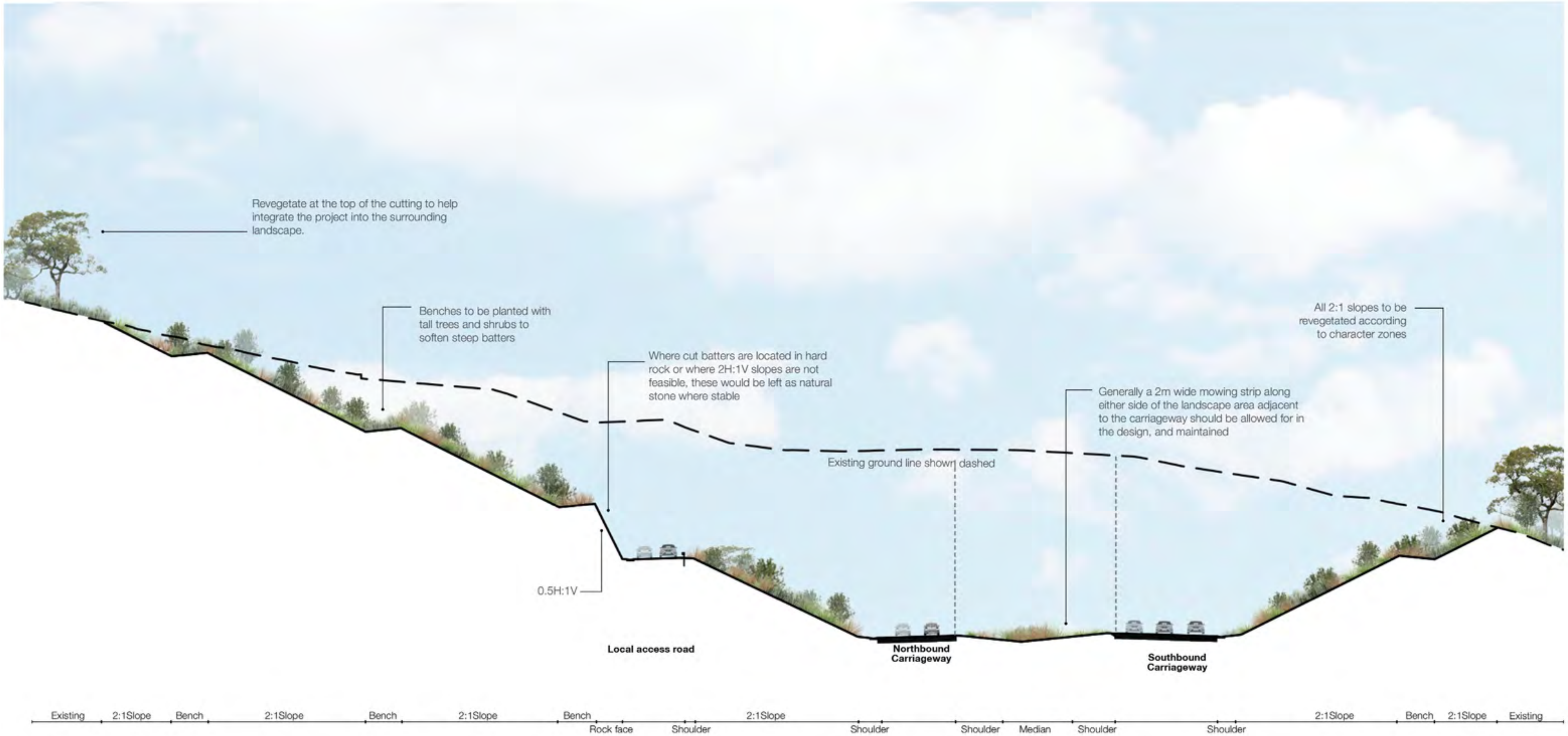



Figure 11-7 Indicative section through main carriageway with steep batters near Mackays Lane

# 11.3 Existing environment

## 11.3.1 Landscape character

To enable the assessment of impacts on landscape character, landscape character zones (LCZs) have been defined for the area. LCZs are defined as areas having a distinct, recognisable and consistent pattern of elements, making one LCZ different from another. The LCZs defined for the project can be grouped into three key areas as discussed below.

### *Boambee Valley*

The southern section of the project is located within Boambee Valley and is characterised by a low-lying basin surrounded by hills, including Roberts Hill to the north and Big Boambee Hill to the west and stretching south. The south-facing slopes of Roberts Hill are characterised by dense vegetation with pathways and ridge being of high cultural significance to the local Aboriginal community (refer to **Chapter 15, Aboriginal cultural heritage**). Within the valley basin, vegetation lines the low creek lines that traverse in an east–west direction, providing a sense of open space. Residential dwellings are scattered across the low-lying undulating terrain.

### *Coffs Harbour basin and foothills*

The central section of the project is located within the Coffs Harbour basin and foothills. The area is characterised by rural pasture land, banana and blueberry plantations on the lower slopes and dense native vegetation on the steeper upper slopes, providing a forested back drop in views to the east and north. Two distinct valley forms are present to the north before reaching Ulidarra National Park, including Mackays Road Valley and Gatelys Road Valley. Both valleys are defined by steep spur lines that extend from Ulidarra National Park and Orara East State Forest, creating two localised self-contained valleys to the north of the North Coast Railway. Landscape within the rail corridor and the rural holdings limit visibility into this isolated valley. The land uses within this valley include small rural holdings and hobby farms. This reflects the aspect being more easterly in focus and its reduced suitability for banana production. Culturally significant pathways are present at this location, extending from Sealy Point to the Orara Valley with branches leading south towards Roberts Hill (refer to **Chapter 15, Aboriginal cultural heritage)**

### *Kororo basin and foothills*

The northern section of the project consists of land between the coastline and the Great Dividing Range, including a stretch of the existing Pacific Highway. The topography is characterised by undulating to steep slopes and recognised as the point where the Great Dividing Range is closest to the coast. The land use is a combination of productive banana and blueberry plantations, open grassland paddocks, Kororo Public School and scattered residential properties to the west. Resorts and residential dwellings are located to the east with the existing Pacific Highway the primary route of access. Coastal resorts and large residential dwellings on small rural holdings take advantage of the views offered by the topography to the coast.

In addition, the area holds some important biodiversity and Aboriginal cultural significance such as the Kororo Nature Reserve and the Gumgali Storyline and Pathway. The Kororo Nature Reserve located to the west of the project is an important Koala refuge and habitat corridor (refer **Chapter 10, Biodiversity**). The Gumgali Storyline and Pathway located near Bruxner Park Road, is a landscape feature with mythological significance for Aboriginal people (see **Chapter 15, Aboriginal cultural heritage).**

A total of nine LCZs have been defined for the project as shown in **Figure 11-8** and described in **Table 11-3**. Further detail is provided for each LCZ in the technical report provided in **Appendix J, Urban design, landscape character and visual impact assessment**.

Landscape sensitivity is a record of the inherent and intrinsic sensitivity of the landscape and the degree to which it can accommodate change. The scale of sensitivity includes:

- **High sensitivity** – landscapes which by nature of their character would be unable to accommodate the proposed change
- **Moderate sensitivity** – landscapes which by nature of their character would be able to partly accommodate the proposed change
- **Low sensitivity** – landscapes which by nature of their characteristics would be able to accommodate the proposed change.


Coffs Harbour Bypass
Landscape character zones
Figure 11-8

Table 11-3 Landscape character zones

| Landscape character zone | Description | Sensitivity |
|---|---|---|
| **LCZ 1: Boambee Valley** | | |
| Zone 1A:<br>Englands Road | • Associated with the industrial area to the north of Englands Road<br>• North defined by the industrial precinct landscape and the presence of warehouse style buildings<br>• South dominated by the Pacific Highway itself and the vegetation that lines the verges<br>• Associated with commercial use and dependent on traffic movement and exposure. | Low |
| Zone 1B:<br>Boambee basin | • Located on the floodplain of Newport Creek and divided by North Boambee Road<br>• Defined by the open agricultural landscape of the valley and the vegetation associated with the creek lines traversing from east to west<br>• Low lying land bordered to the east by a small residential area with scattered properties along local roads. | Moderate |
| Zone 1C:<br>Boambee and Roberts Hill southern foothills | • Associated with the southern facing foothills of Roberts Hill and the foothills associated with Big Boambee<br>• Steeper and more undulating than the floodplain<br>• The south side of the ridge is dominated by native vegetation dominating the steeper terrain with a few residential properties situated on the elevated slopes and foothills<br>• Roberts Hill has Aboriginal cultural significance being part of the culturally significant pathway running from Corambirra Point to the Orara Valley. | High |
| **LCZ 2: Coffs Harbour basin and foothills** | | |
| Zone 2A:<br>Roberts Hill northern foothills | • Located on the northern foothills of Roberts Hill, the area is dominated by banana plantations which take advantage of the northerly aspect<br>• Marks the southern limits of the Coffs Harbour basin and is joined by residential development to the north east<br>• Roberts Hill has Aboriginal cultural significance being recorded as part of the culturally significant pathway running from Corambirra Point to the Orara Valley. | High |

| Landscape character zone | Description | Sensitivity |
|---|---|---|
| Zone 2B:<br>The Bowl | • Agricultural usage of the land is associated with banana and blueberry farms, hobby farms and open pasture<br>• The newer subdivisions that have been developed since the announcement of the preferred route for the project in 2004 bound this LCZ to the east with the Great Dividing Range rising to around 240 m AHD, defining the western and northern extent. | Moderate |
| Zone 2C:<br>End Peak and Mackays Road valley | • Characterised by a spur line that extends from End Peak within Ulidarra National Park, creating a localised contained valley<br>• Steep slopes typically occupied with banana and blueberry plantations<br>• The southern extent is marked by the North Coast Railway<br>• The topography provides a forested back drop when viewed from the adjoining residential subdivision and Brennan Close. | High |
| Zone 2D:<br>Gatelys Road valley | • Gatelys Road valley is defined by a steep spur line that stretches from Orara East State Forest, creating a localised self-contained valley located north of the North Coast Railway<br>• The topography limits visibility into this isolated valley<br>• Dominant uses are small rural holdings and hobby farms with focused production<br>• The south facing slope to the south of the valley provides a contrast with an actively managed productive banana plantation and blueberry farms. | High |
| **LCZ 3: Kororo basin and foothills** | | |
| Zone 3A:<br>Kororo basin and foothills | • Consists of the land between the coastline and the Great Dividing Range and is recognised as the point where the range is closest to the coast<br>• The area is divided by the existing Pacific Highway<br>• Overlooked both by scattered residential dwellings in the hills and the residential properties of the resort<br>• The area holds some important biodiversity and Aboriginal cultural significance such as the Kororo Nature Reserve and the Gumgali Storyline and Pathway. | High |
| Zone 3B:<br>Kororo basin edge | • This zone is bound by the existing Pacific Highway to the west and the coastline to the east<br>• Resorts and residential properties are located between the Pacific Highway and the slopes leading to the coastline to the east<br>• Pine Brush Creek crosses through the area extending a green network from the foothills towards the coast. | Moderate |

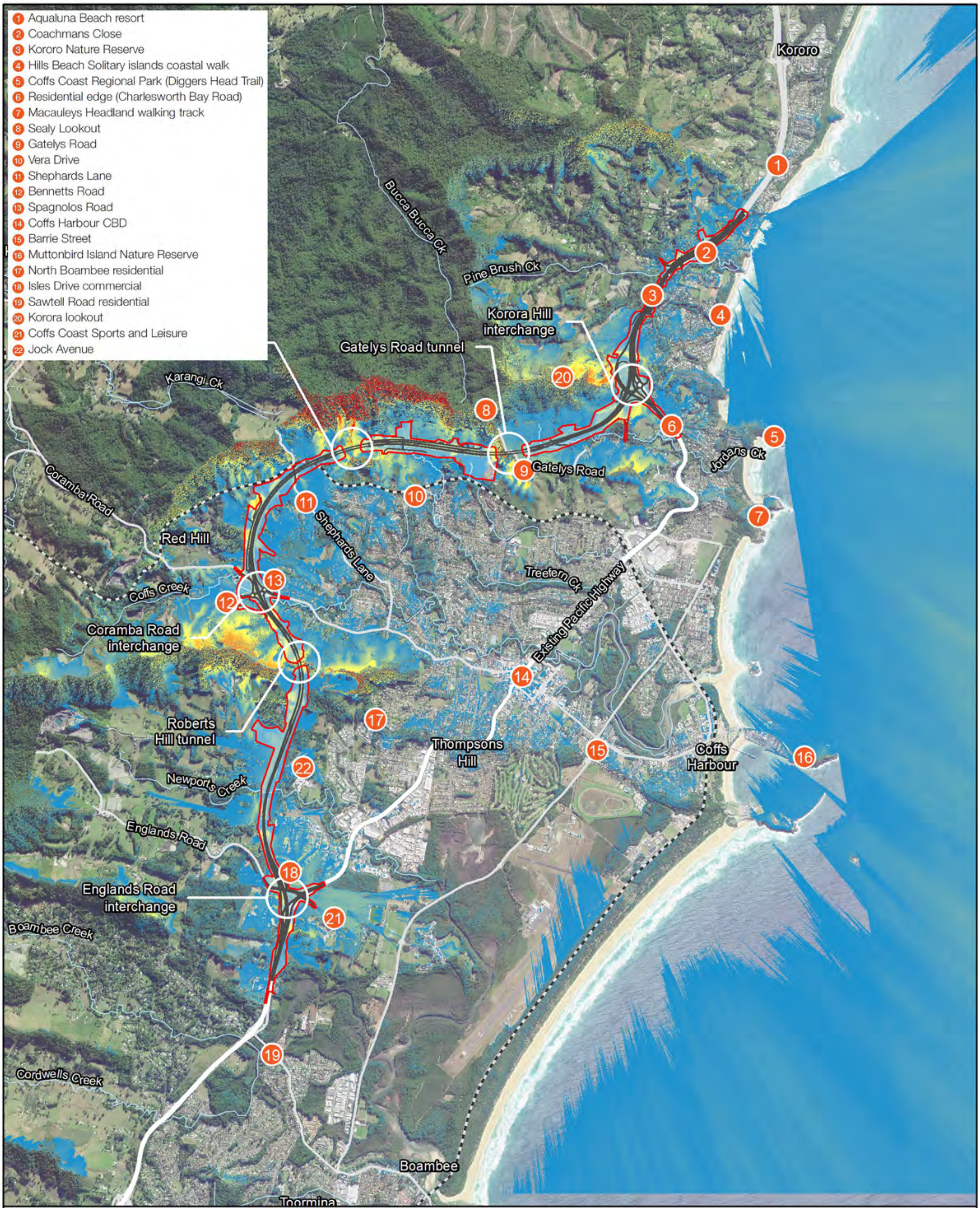
## 11.3.2 Existing views

The visual character of the area is typified by the diverse land use and topography. The landscape is dominated by rural agriculture including banana plantations and blueberry farms with limited grazing of livestock. Residential areas are largely contained by topographical and infrastructure constraints including the North Coast Railway. Industrial land uses are primarily located to the north of Englands Road roundabout, dominated by large warehouse buildings with Coffs Coast Resource Recovery Park is situated to the south of Englands Road.

A network of creeks including Boambee Creek, Newports Creek, Coffs Creek, Jordans Creek, Treefern Creek and Pine Brush Creek traverse the declining topography broadly in an east–west direction.

The topography, associated with the Great Dividing Range, is of high scenic value with the higher crests broadly orientated in a north–south direction. The foothills mark the transition of topography with ridges, including Roberts Hill, extending in an east–west direction, declining to the coastline. The heavily vegetated southern slopes of Roberts Hill provide a degree of visual enclosure to valley floor. The foothills of the Ulidarra National Park and Orara East State Forest offer localised valley forms associated with End Peak and Gatelys Road valley. The valley forms a visual enclosure, with views from within the valley restricted by the south facing slopes.

A total of 22 viewpoints have been selected to illustrate the potential visual influence of the project as shown in **Figure 11-9** and described in **Table 11-4**. To identify how visible elements of the project would be from a viewpoint, 2500 points were placed along the north and south bound carriages and at earthworks interfaces at 50 m centres. The visibility index shown on **Figure 11-9** indicates how many of these points would be visible from that particular location.




Legend

Construction footprint

Pavement

North Coast Railway

Watercourse

Viewpoints

Visibility index

High : 873

Low : 1

Coffs Harbour Bypass

Visual envelope map and viewpoints

Figure 11-9

0 0.6 1.2 1.8 km

Scale @A4: 1:60,000

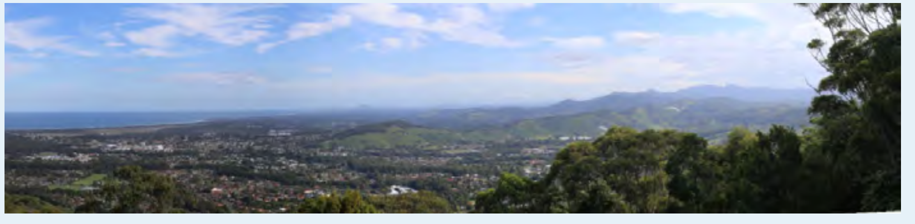
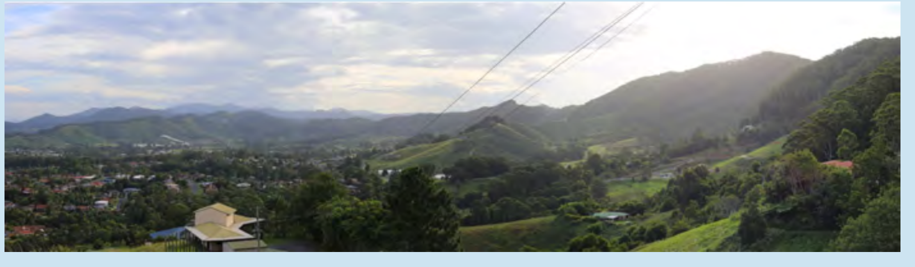
GDA 1994 MGA Zone 56

N

Table 11-4 Viewpoints

| Viewpoint | Viewpoint photo | Description of the setting | Viewer type | Sensitivity |
|---|---|---|---|---|
| 1 | **View from the existing Pacific Highway looking south west from the Aqualuna Beach Resort**  | The view is dominated by existing road infrastructure including the existing Pacific Highway, separated by a 3 m noise wall.<br><br>Powerlines cross the view in a north–south direction. | Road users | Low |
| 2 | **View from residential properties at Coachmans Close towards the existing Pacific Highway**  | The view is directed towards the existing Pacific Highway with clear views of passing vehicles. Mature vegetation between the Pacific Highway and Coachmans Close filters views slightly towards the highway, contributing to the visual character. | Residents | Moderate |
| 3 | **View from Luke Bowen footbridge looking south towards the existing Pacific Highway**  | The view is dominated by existing road infrastructure and is directed towards the existing Pacific Highway from in between the mesh panels of the Luke Bowen footbridge. Existing mature vegetation can be seen towards the east and west of the view including Orara East State Forest and Kororo Nature Reserve. | Pedestrians | Moderate |

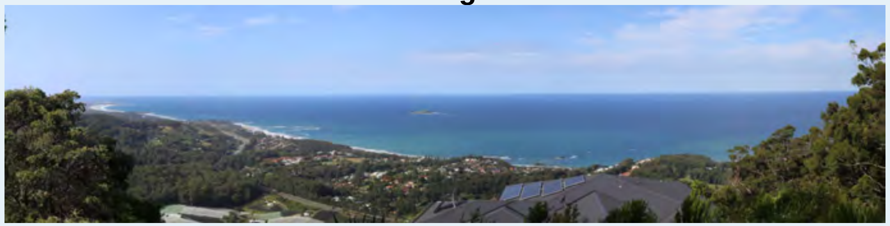
| Viewpoint | Viewpoint photo | Description of the setting | Viewer type | Sensitivity |
|---|---|---|---|---|
| 4 | **View from Hills Beach Solitary Islands Coastal Walk looking towards the walking trail and open space**  | The view is towards a section of the designated Solitary Islands Coastal Walk with views dominated by existing mature vegetation and public open space. This viewpoint is located within a regional park and part of a dedicated walking trail considered to be of regional importance. | Recreational users of the park and the walking trail | Moderate |
| 5 | **View from Coffs Coast Regional Park (Diggers Head Trail) looking towards Gatelys Road Hill and Orara East State Forest**  | A panoramic and elevated view from Diggers Head Trail within Coffs Coastal Regional Park. The view includes scattered residential properties to the south and the foothills of Orara East State Forest and Ulidarra National Park to the north. Views directly west of this location are restricted by mature vegetation. | Recreational users of the park and the walking trail | High |
| 6 | **View from the existing Pacific Highway looking towards residential properties on Charlesworth Bay Road**  | The view is dominated by existing road infrastructure with a limited number of properties fronting the road. This section of the existing Pacific Highway forms part of the transition and entry to Coffs Harbour CBD and is surrounded by mature vegetation adding to the visual character. | Road users | Moderate |

| Viewpoint | Viewpoint photo | Description of the setting | Viewer type | Sensitivity |
|---|---|---|---|---|
| 7 | **View from Macauleys Headland walking track looking towards Orara East State Forest**  | The view is directed towards the coastline with the rising hills associated with Ulidarra National Park and Orara East State Forest in the background. The view is characterised by elevated, panoramic coastal views of high scenic value. | Recreational users of the park and the walking trail | High |
| 8 | **View from Sealy lookout in Orara East State Forest looking towards Roberts Hill in the West and Coffs Harbour CBD**  | A designated scenic viewpoint from Orara East State Forest that offers a panoramic view stretching from the coastline to the Great Dividing Range. The view overlooks the Coffs Harbour CBD. | Recreational users of the park | High |
| 9 | **View from residential properties at Gatelys Road looking towards the Great Dividing Range**  | The view provides an elevated, panoramic view that stretches from the coastline to the Great Dividing Range. Views include residential properties within the Coffs Harbour basin with views of the mountain tops of Ulidarra National Park. | Residents | High |

| Viewpoint | Viewpoint photo | Description of the setting | Viewer type | Sensitivity |
|---|---|---|---|---|
| 10 | **View from residential properties at Vera Drive looking towards Ulidarra National Park and Orara East State Forest**  | The view of a local residential street surrounded by mature vegetation with the vegetated hillslopes of Ulidarra National Park and Orara East State Forest providing a backdrop to the properties. | Residents | High |
| 11 | **View from residential properties at Shephards Lane looking towards Ulidarra National Park**  | The view is dominated by the scenic nature of Ulidarra National Park and scattered residential properties. A small glimpse of the North Coast Railway is visible in the distance. | Residents | High |
| 12 | **View from residential properties on Bennetts Lane looking north**  | The view is dominated by existing vegetation and the forested mountain top of Ulidarra National Park marks the skyline with foothills extending south. There are also glimpses of the recent developments along Pearce Drive, Brennan Court, Rosina Close and Tiffany Close. | Residents | High |

| Viewpoint | Viewpoint photo | Description of the setting | Viewer type | Sensitivity |
|---|---|---|---|---|
| **13** | **View from residential properties on Roselands Drive looking towards Roberts Hill**  | The view south includes the north facing slopes of Roberts Hill dominated by banana plantations. The view is dominated by gently undulating grazing fields with views towards the vegetated mountains of the Great Dividing Range and Ulidarra National Park. | Residents | High |
| 14 | **View from the Coffs Harbour CBD looking along West High Street**   | The view is dominated by existing road infrastructure and commercial developments lining the streets. Distant views of Ulidarra National Park can be seen in the background. | Residents and visitors of Coffs Harbour | Moderate |
| 15 | **View from residential properties at the Barrie and Victoria Street intersection looking towards Ulidarra National Park**  | The view is dominated by existing road infrastructure and residential properties lining the streets. Distant views of the vegetated hillslopes of Ulidarra National Park can be seen in the background. | Residents | Moderate |

| Viewpoint | Viewpoint photo | Description of the setting | Viewer type | Sensitivity |
|---|---|---|---|---|
| 16 | **View from Muttonbird Island Nature Reserve looking towards the Coffs Harbour marina**  | The view is dominated by the Coffs Harbour marina with the view slightly elevated providing a panoramic view of the scenic area. The Great Dividing Range provides a backdrop in views with Bindarri and Dorringo National Parks visible to the south west, Roberts Hill to the west, Ulidarra National Park, Orara East State Forest and Sealy Lookout further north. | Recreational users of the park | High |
| 17 | **View from residential properties on Kratz Drive looking towards Little Boambee and Bonville peak (Big Boambee)**  | The view is dominated by residential properties located in North Boambee Valley surrounded by mature vegetation. Little Boambee Hill and Big Boambee Hill are visible in the distance. | Residents | High |
| 18 | **View from commercial buildings on Isles Drive looking towards Englands Road**  | The view is dominated by existing road infrastructure and commercial and industrial developments with glimpses of mature trees in the background. | Employees and visitors to the commercial area | Low |

| Viewpoint | Viewpoint photo | Description of the setting | Viewer type | Sensitivity |
|---|---|---|---|---|
| 19 | **View from residential properties on Sawtell Road**  | The view is dominated by existing road infrastructure including the Sawtell Road bridge overpass. The road infrastructure is bound by mature vegetation that lines Boambee Creek. | Residents | Moderate |
| 20 | **View from Korora lookout looking towards the coastline**  | The view is a designated scenic viewpoint from within Orara East State Forest and offers an elevated panoramic view from Korora Lookout stretching north along the coastline. Korora Lookout is a designated scenic viewpoint which offers views illustrating the visual character of the area. | Recreational users of the park and visitors to the area | High |
| 21 | **View of Coffs Coast Sports and Leisure Park**  | The view is dominated by the sports field towards the existing Pacific Highway and Englands Road roundabout. The eastern boundary of the sports field contains mature vegetation, filtering views to passing vehicles. Distant views can be seen towards the forested ridge of Roberts Hill. | Recreational users of the sports and leisure park | Moderate |
| 22 | **View looking along Jock Avenue**  | The view is dominated by existing road infrastructure including residential properties on Jock Avenue and Highlander Drive in the foreground. Mature vegetation that lines Newport Creek is visible as well as mature vegetation that rises in the distance associated with Little Boambee Hill and Big Boambee Hill. | Residents | High |

# 11.4 Assessment of potential impacts

## 11.4.1 Construction

The key construction activities that have the potential to result in landscape and visual impacts include:

- Pre-construction and site establishment, including vegetation clearance, site establishment works, fencing and signage, and establishment of site compounds
- Bulk earthworks, including stripping and stockpiling of topsoil, excavation of cuttings and tunnels, drilling, blasting, establishment of crushing plants, haulage of materials from excavation and construction of fill embankments, including benching and stabilisation
- Bridge works, including establishment of batching plants, preparation of bridge works, construction of foundations, abutments, piers etc
- Construction of tunnels and portals
- Construction of retaining walls and noise walls
- Demolition of bridges (Luke Bowen footbridge and northern carriageway bridge over Pine Brush Creek) and buildings
- Road work and road surfacing.

### *Landscape*

The construction works would be evident within the predominantly rural LCZs, encompassing 'Boambee Valley', 'Coffs Harbour basin and foothills' and 'Korora basin and foothills.' The contrast between the rural landscape and the gradual construction and introduction of the project would result in adverse impacts, with the impacts becoming more significant where the project is different to the natural topography. The areas of cuttings and embankments would appear out of place with the natural landform, with the introduction of elevated structures bridging topographical undulations and heightening the presence of the project. Over time, the implementation of the landscape and urban design concept plans would help integrate the project.

Construction of the project would result in moderate to high impacts. Where the project aligns with existing urban features, such as the Pacific Highway tie-in at Englands Road, the landscape would have the ability to accommodate a degree of change; however, impacts would remain at moderate adverse during the construction phase.

### *Visual*

Construction of the project would result in varying impacts along the length of the corridor (from negligible to high), influenced by the location and duration of the key construction activities. Impacts arising from the key construction activities are heightened where viewpoints are of moderate to high sensitivity and where a considerable change to the existing view is anticipated. The impacts would primarily be a result of the extensive earthworks (cuttings, tunnels and embankments) and construction of road and bridge infrastructure that would result in a loss of views towards the existing rural, agricultural landscape. The progressive implementation of the landscape and urban design concept plans would help with integrating the project and screen views towards the construction impacts.

Out of hours activities would be required during construction and are described in **Chapter 6, Construction**. Lighting would be required for any out of hours activities and any potential light spill impacts would be avoided or mitigated via the management measures identified in **Section 11.5**. This includes minimising the use of night-lighting where possible, directing light away from residential areas and other sensitive receivers, and installing and operating temporary lighting in accordance with Australian Standards.

## 11.4.2 Operation

### *Landscape character*

Potential landscape character impacts are discussed in **Table 11-5** in relation to the landscape character zones identified in **Section 11.3.1**.

Table 11-5 Landscape character impact

| Landscape character zone | Sensitivity | Magnitude | Impact |
|---|---|---|---|
| Zone 1A: Englands Road | **Low** | **Moderate**<br>The existing character of this zone is associated with the commercial use of the area and dependent on traffic movement and exposure.<br>The realignment of Isles Drive and introduction of the Englands Road interchange, and associated removal of a number of existing commercial properties is expected to result in a moderate magnitude of change. The clearance of vegetation and introduction of Englands Road interchange would result in the Coffs Coast Waste Services becoming more evident at this location. | **Moderate – Low** |
| Zone 1B: Boambee basin | **Moderate** | **High**<br>The introduction of an elevated road embankment and six bridges through this low lying agricultural landscape is considered uncharacteristic of the area. This would result in a high magnitude of change. | **Moderate – High** |
| Zone 1C: Boambee and Roberts Hill southern foothills | **High** | **High**<br>This involves vegetation removal (mature vegetation on southern slopes), benched cutting slopes and embankments on approach to Roberts Hill tunnel and the introduction of the Roberts Hill tunnel to the south. The overall severance of this significant section of native vegetation would result in a high magnitude of change. | **High** |
| Zone 2A: Roberts Hill northern foothills | **High** | **High**<br>The introduction of a tunnel portal to the north of Roberts Hill and the benched cutting slopes and altered topography associated with the northern tunnel portal results in a high magnitude of change. | **High** |
| Zone 2B: The Bowl | **Moderate** | **High**<br>This involves vegetation removal, severance of the existing vegetation along the low-lying creek lines, the introduction of the Coramba Road interchange and benched earthworks and cutting slopes. All these changes are considered uncharacteristic of the area and are expected to result in a high magnitude of change. | **Moderate – High** |

| Landscape character zone | Sensitivity | Magnitude | Impact |
|---|---|---|---|
| Zone 2C: End Peak and Mackays Road valley | **High** | **Moderate** The introduction of Shephards Lane tunnel and portals, addition of a bridge structure and elevated road over North Coast Railway, removal and severance of existing vegetation and impacts on banana plantation, and introduction of benched earthworks and cutting slopes is expected to result in a high magnitude of change. | **High – Moderate** |
| Zone 2D: Gatelys Road valley | **High** | **Moderate** The introduction of Gatelys Road tunnel and portals, addition of two bridge structures (over local access roads), and removal and severance of native vegetation and impacts to banana and blueberry farms is expected to result in a high magnitude of change. | **Moderate – High** |
| Zone 3A: Kororo basin and foothills | **High** | **High** The expansion of the Pacific Highway and introduction of the Korora Hill interchange, as well as a large cutting slope and vegetation and banana plantation removal along the edges of the Korora foothills is expected to result in a high magnitude of change. | **High** |
| Zone 3B: Kororo basin edge | **Moderate** | **Moderate** The incremental expansion of the Pacific Highway corridor (including elevated bridge structures, retaining walls and noise walls) and the introduction and realignment of access roads is expected to result in a moderate magnitude of change. | **Moderate** |

### *Visual impact*

The visual impact of the project from the 22 viewpoints identified in **Table 11-4** is described in **Table 11-6**. Detailed analysis is provided in **Appendix J, Urban design, landscape character and visual impact assessment**.

Some viewpoints would experience a moderate to high impact and some would experience a high impact due to the removal of existing mature vegetation and change to the visual character experienced at these viewpoints. These impacts would mostly be mitigated through the landscape planting proposed for the project and would continually reduce over time as vegetation matures.

Indicative photomontages with the project and embedded design mitigation in place have been provided for representative viewpoints with the potential to be visually affected by some element of the project, as shown in Error! Reference source not found. to Error! Reference source not found.. These viewpoints were selected to illustrate a range of receiver types, a range of view types, a range of viewing distances and key or protected views.

### *Overshadowing*

The overshadowing assessment is based on the winter solstice (21 June), the day with the shortest amount of daylight during the year. This is considered the worst-case scenario with regards to potential overshadowing impacts and it is anticipated that some of the impacts described below would be much less.

Results of the overshadowing assessment considered impacts from noise walls, earthworks and structures such as retaining walls and bridges. The assessment determined overshadowing from the project would be mostly contained within the construction footprint, with some localised areas of additional impact. In addition, the project is located in the foothills of the Great Dividing Range and overshadowing from the project is limited particularly in the middle and the northern end of the project as the foothills dominate the overshadowing from mid to late afternoon. These areas of impact include:

- Earthworks associated with the embankments and cutting slopes would result in marginal overshadowing impacts within Oz Group Packhouse’s car park to the north of Englands Road interchange in the late afternoon (3pm) and overshadowing to adjacent vegetation during the morning (7am)
- Three bridges associated with Newports Creek and its tributaries, a bridge over North Boambee Road, and a noise wall and associated earthworks would result in shadows east of the project on adjoining vegetation and agricultural land around 3pm. Impacts are not anticipated to extend to residential properties
- Noise walls and re-establishing vegetation would contribute to very minor and localised overshadowing to the rear of properties situated on Tiffany Close (near the Coramba Road interchange)
- Noise walls and the bridge over the North Coast Railway would result in overshadowing under the bridge structure and along the North Coast railway corridor. The shadows are anticipated to extend beyond the construction footprint to the adjacent residential properties within Sunset Ridge and agricultural land to the east. By 3pm, the existing surrounding topography casts the project into shadow
- Noise walls above Pine Brush Creek and the bridges at the entry ramp of Korora Hill interchange would result in shadows extending over residential properties by around 1pm, however by 3pm the area is cast into shadow from the existing topography
- A retaining wall and twin bridges over Fernleigh Avenue will have the potential to extend shadows over properties within Coachmans Close by 3pm in combination with shadow from the existing topography

Where possible, in situations where noise walls cause overshadowing, consideration would be given during detailed design to making noise walls (or part of the wall) transparent.

Further detail on the overshadowing assessment can be found in Appendix C of **Appendix J, Urban design, landscape character and visual impact assessment**.

### *Coastal views*

A number of properties situated in the foothills of the Ulidarra National Park and Orara East State Forest experience elevated east facing views to the ocean. An assessment of potential ocean view loss was carried out for representative receivers located between the northern side of Roberts Hill to the northern extent of the project. A summary of the outcomes of the analysis includes:

- Properties located more towards the northern side of Roberts Hill (within LCZ 2A) are generally positioned on lower terrain with limited opportunities for coastal views. Generally, the introduction of the project is not anticipated to result in a loss to ocean views at this location
- Further north, it is anticipated that a number of properties with glimpse views towards the coastlines would experience a reduction in their coastal view, specifically this would include a small number of properties located on the western side within the project within LCZ 2B

- On the eastern slopes of Orara East State Forest, the introduction of Korora Hill interchange and the elevated road structure over Fernleigh Avenue have the potential to result in isolated areas of ocean view reduction for properties located close to the project on the western side of existing Pacific Highway.

Further detail is provided in **Appendix J, Urban design, landscape character and visual impact assessment** including existing and project case viewsheds.

### *Glare and reflection*

Both the overshadowing analysis and the coastal views analysis identify opportunities for design refinement of the noise walls during the detailed design stage regarding use of transparent panels. However, the use of transparent panels would need to be considered in conjunction with the potential for associated glare impacts which could result in road user safety concerns or nuisance impacts to adjacent residential properties. The potential for glare impacts arising from full length transparent panels will be considered during this future design stage. In addition, given the alignment of Shephards Lane and Gatelys Road tunnel, the potential for glare impacts associated with the morning sun for northbound road users will also be investigated.

Table 11-6 Visual impact from viewpoints

| Viewpoint | Sensitivity | Magnitude | Embedded design mitigation | Impact |
|---|---|---|---|---|
| 1 | **Low** | **Negligible**<br>The project would tie in with the existing road infrastructure and is not considered to be uncharacteristic of the area. | • Native planting mix to integrate the earthworks<br>• Planting to the central median to help with defining the approach to the Korora Hill interchange. | **Negligible** |
| 2 | **Moderate** | **High**<br>The project would bring the existing road closer to the residences on Coachmans Close and the increased height of the noise wall would further block views. | • Planting along the eastern edge of Coachmans Close to screen views of passing vehicles<br>• Transparent panels of the noise wall to maintain natural light (consistent with existing structure). | **High – Moderate** |
| 3 | **Moderate** | **Low**<br>The width of the indicative road corridor would increase to allow for the introduction of the service road and would result in vegetation removal. Luke Bowen footbridge would be replaced and relocated about 225 m to the north. | • Screen planting between the new service road and the Pacific Highway where space allows<br>• Replacement of the Luke Bowen footbridge<br>• Planting to the central median where possible to help with defining the approach to the Korora Hill interchange. | **Low – Moderate** |
| 4 | **Moderate** | **Negligible**<br>The project is located about 1 km west of this location and mature vegetation provides screening for views towards the project. | • The proposed design is not anticipated to alter the existing view and would integrate sympathetically with the surrounding landscape. No embedded mitigation is proposed at this location. | **Negligible** |
| 5 | **High** | **Negligible**<br>The existing headland and associated vegetation screen views toward the project and is outside of the project's visual envelope. | • The proposed design is not anticipated to alter the existing view and would integrate with the surrounding landscape. No embedded mitigation is proposed at this location. | **Negligible** |
| 6 | **Moderate** | **High**<br>The removal of existing vegetation would open views towards the project and the Korora Hill interchange. The interchanges would be upgraded to include a roundabout connection to James Small | • Feature planting to Korora Hill interchange to define northern arrival point and gateway to Coffs Harbour<br>• Planting to respond to the landscape of the Pacific Highway and Coffs Harbour. | **Moderate – High** |

| Viewpoint | Sensitivity | Magnitude | Embedded design mitigation | Impact |
|---|---|---|---|---|
| | | Drive, on and off ramps, a connection to Bruxner Park Road and introduction of four bridge structures. Lighting would be added to the interchange. | • Planting of species similar to the form and structure of surrounding banana plantations | |
| **7** | **High** | **Moderate**<br>Introduction of the Korora Hill interchange, including lighting at the interchange, on and off ramps and approach roads. | • Feature planting to Korora Hill interchange to define northern arrival point and gateway to Coffs Harbour<br>• Planting to respond to the landscape of the Pacific Highway and Coffs Harbour. | **Moderate – High** |
| **8** | **High** | **High**<br>Removal of existing vegetation, introduction of earthworks for Roberts Hill tunnel approach. Views towards the southern edge of Coramba Road interchange, including lighting columns and introduction of vehicles and infrastructure within the rural edge of Coffs Harbour basin. | • Cut slopes to be benched and planted to assist with integrating the cut rock faces<br>• Sensitive design of the portals, including landscaped terraces where 2:1 gradient is not achievable, accompanied with planting<br>• Revegetation using native species to strengthen and respond to the existing character | **High** |
| **9** | **High** | **High**<br>Embankments and cutting slopes associated with the project traversing the undulating terrain through Mackays Road valley. Views towards the southern edge of Coramba Road interchange, including lighting columns and introduction of vehicles and infrastructure within the rural edge of Coffs Harbour basin. | • Cut slopes to be benched and planted to help with integrating the cut rock faces. Revegetation using native species to strengthen and respond to the existing character<br>• Sensitive design of the portals, including landscaped terraces where 2:1 gradient is not achievable, accompanied with planting<br>• Noise attenuation to be a combination of mounds and solid noise walls, with pattern and design to relate to local landscape character<br>• Treatment to rock fill embankments. | **High** |

| Viewpoint | Sensitivity | Magnitude | Embedded design mitigation | Impact |
|---|---|---|---|---|
| **10** | **High** | **Negligible**<br>The removal of existing vegetation that covers the slopes of Mackays Road Valley is predicted to be discernible and a small component of the existing view. The road alignment is not expected to be visible from this location. | • Embankments to be benched and planted to help with integrating the cut rock face.<br>• Revegetation using native species to strengthen and respond to the existing character<br>• Sensitive design of the portals, including landscaped terraces where 2:1 gradient is not achievable, accompanied with planting<br>• Noise attenuation to be a combination of mounds and solid noise walls, with pattern and design to relate to local landscape character with planting on both sides<br>• Treatment to rock fill embankments. | **Negligible** |
| **11** | **High** | **High**<br>Removal of existing vegetation, introduction of cutting slopes and embankments through the vegetated foothills and introduction of an elevated bridge over the North Coast Railway | • Integration of earthworks to respond to the natural forms of the foothills<br>• Revegetation using native species to strengthen and respond to the existing character, extending the Ulidarra National Park visual character<br>• Sensitive design of the portals, including landscaped terraces where 2:1 gradient is not achievable, accompanied with planting<br>• Twin blade piers to minimise visual size and bulk of the bridge structure<br>• Treatment to rock fill embankments. | **High** |
| **12** | **High** | **High**<br>Removal of existing vegetation associated with introduction of the Coramba Road interchange which would increase the road infrastructure visible from this viewpoint. | • Planting to integrate the proposed earthworks and respond to the low-lying flood plain character<br>• Screen planting to mitigate views on nearby properties<br>• Planting to integrate the proposed noise wall to the east of the interchange<br>• Planting of Coffs Creek riparian corridor. | **High** |

| Viewpoint | Sensitivity | Magnitude | Embedded design mitigation | Impact |
|---|---|---|---|---|
| **13** | **High** | **High**<br>The introduction of road infrastructure including the Coramba Road interchange would considerably alter the context of the existing agricultural land visible from this viewpoint. | • Planting to integrate the proposed earthworks and respond to the low-lying floodplain character<br>• Screen planting to mitigate views on nearby properties<br>• Native planting mix to the north of Coramba Road interchange to connect fragmented vegetation<br>• Noise attenuation to be a combination of mounds and solid noise walls, with pattern and design to relate to local landscape character with planting on both sides.<br>• Treatment to rock fill embankments. | **High** |
| **14** | **Moderate** | **No change**<br>The project would be located about 3 km west of the Coffs Harbour CBD and would not be visible from this viewpoint. | • The proposed design would not alter the existing view and would integrate sympathetically with the surrounding landscape. No embedded mitigation is proposed at this location. | **Negligible** |
| **15** | **Moderate** | **Low**<br>Existing residential properties line the streets in this view. The removal of vegetation would be visible however not uncharacteristic of the area. | • Revegetation using native species to strengthen and respond to the existing character, extending the Ulidarra National Park visual character. | **Low – Moderate** |
| **16** | **High** | **Moderate**<br>Removal of existing vegetation associated with cuttings through the vegetative foothills stretching to Ulidarra National Park and Mackey Road Valley would be visible form this location. View focuses on the marina. | • Planting to integrate the proposed earthworks and respond to the character of the landscape. | **Moderate – High** |
| **17** | **High** | **Low**<br>Due to the screening provided by existing vegetation, the project would be partly screened from this location and the magnitude of change is expected to be low. | • Planting to integrate the proposed embankments and screen views to passing vehicles. | **Moderate** |

| Viewpoint | Sensitivity | Magnitude | Embedded design mitigation | Impact |
|---|---|---|---|---|
| **18** | **Low** | **High**<br>Commercial/industrial environment, removal of vegetation would not result in a large-scale change. | • Interchange planting mix of native species to help with integrating the embankments. | **Moderate** |
| **19** | **Moderate** | **Negligible**<br>The view towards the project would be screened by vegetation surrounding the Sawtell Road bridge and Boambee Creek. | • The proposed design would not alter the existing view and would integrate sympathetically with the surrounding landscape. No embedded mitigation is proposed at this location. | **Negligible** |
| **20** | **High** | **Moderate**<br>The removal of existing vegetation, introduction of Kororo Hill interchange entry ramp, service road, a new Luke Bowen footbridge, local access road and associated earthworks for the project would result in a change to the scenic nature of this view. Existing road infrastructure is currently visible from this location. | • Planting to integrate the proposed embankments.<br>• Noise wall pattern and design to relate to the local landscape character with planting on both sides. | **Moderate – High** |
| **21** | **Moderate** | **Moderate**<br>The widening of the existing Pacific highway, introduction of entry and exit ramps and a series of bridge structures beyond the sports fields. | • Planting to integrate the proposed embankments, including coastal-forest planting mix<br>• Noise wall pattern and design to relate to the local landscape character with planting on both sides. | **Moderate** |
| **22** | **High** | **Moderate**<br>The removal of existing vegetation for construction and the introduction of road alignment, earthworks and a noise wall. | • Planting to integrate the proposed embankments, including coastal-forest planting mix<br>• Noise wall pattern and design to relate to the local landscape character with planting on both sides. | **Moderate -– High** |

### *Photomontages*

The proposed landscaping described in **Table 11-6** would establish over time, with pioneer species establishing more quickly compared to hardwood species. For the purposes of the photomontages, it is assumed that vegetation would reach a suitable level of maturity within about 10 years with tree heights indicatively illustrated to range between five to 15 m high.

Figure 11-10 Viewpoint 7 showing the extent of the project

Figure 11-11 showing the project with embedded mitigation

Figure 11-12 Viewpoint 11 showing the extent of the project

Figure 11-13 Viewpoint 11 showing the project with embedded mitigation

Figure 11-14 Viewpoint 13 showing the extent of the project

Figure 11-15 Viewpoint 13 showing the project with embedded mitigation

Figure 11-16 Viewpoint 16 showing the extent of the project

Figure 11-17 Viewpoint 16 showing the project with embedded mitigation

Figure 11-18 Viewpoint 20 showing the extent of the project

Figure 11-19 Viewpoint 20 showing the project with embedded mitigation

Figure 11-20 Viewpoint 21 showing the extent of the project

Figure 11-21 Viewpoint 21 showing the project with embedded mitigation

Figure 11-22 Viewpoint 22 showing the extent of the project

Figure 11-23 Viewpoint 22 showing the project with embedded mitigation

## 11.5 Environmental management measures

Environmental management measures have been developed to minimise potential impacts during construction and operation of the project on landscape character and visual amenity, as summarised in **Table 11-7**. There are interactions between the mitigation measures for landscape character and visual impacts and **Chapter 10, Biodiversity** and **Chapter 17, Flooding and hydrology**.

Table 11-7 Environmental management measures for landscape character and visual impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Landscape and visual impacts | UD01 | An urban design and landscape plan will be prepared to support the detailed design of the project. The plan will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The plan will include:<br>• Location and identification of existing vegetation and proposed landscaped areas, including species to be used<br>• Built elements including retaining walls, bridges and noise barriers (using mounds as a priority where feasible, walls to supplement where required)<br>• Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings<br>• Fixtures such as lighting, fencing and signs<br>• Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage<br>• Procedures for monitoring and maintaining landscaped or rehabilitated areas.<br>• Water sensitive urban design solutions.<br>The plan will be prepared in accordance with Roads and Maritime urban design policy and guidelines including:<br>• Beyond the Pavement: Urban design policy, process and principles<br>• Landscape design guideline<br>• Bridge aesthetics guideline<br>• Noise wall design guideline<br>• Tunnel urban design guideline<br>• Shotcrete design guideline<br>• Water sensitive urban design guideline. | Contractor | Detailed design |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Water sensitive urban design | UD02 | Temporary and permanent drainage infrastructure will be designed to incorporate water sensitive urban design principles where possible in accordance with Roads and Maritime's Water sensitive urban design guideline (Roads and Maritime 2017g). This could include replacing concrete lined longitudinal catch drains with vegetated swales and the operational water quality control measures. | Contractor | Detailed design |
| Construction visual impacts | UD03 | Temporary site lighting will be installed and operated in accordance with AS4282:1997 Control of the Obtrusive Effect of Outdoor Lighting (Standards Australia 1997). | Contractor | During construction |
| | UD04 | Project work sites, including construction areas and supporting facilities (such as ancillary sites) will be managed to minimise visual impacts, including appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials. | Contractor | During construction |
| Potential overshadowing | UD05 | Where noise walls cause overshadowing, consideration will be given during detailed design to the use of transparent panels within the noise wall design in consultation with potentially affected property owners. | Contractor | Detailed design |
| Potential glare impacts | UD06 | A reflectivity study will be undertaken during detailed design to identify adverse reflective glare from the use of transparent panels in noise walls on road users and adjacent residential properties. An appropriate glazing design will be considered where issues are identified. The reflectivity study will also investigate the potential for glare impacts on road users associated with the morning sun for Shephards Lane and Gatelys Road tunnel. | Contractor | Detailed design |

CHAPTER 12

Chapter 12

# Land use and property

# 12. Land use and property

This chapter presents an assessment of the potential land use and property impacts from construction and operation of the project and identifies mitigation and management measures to minimise or reduce these impacts. **Table 12-1** lists the SEARs relevant to land use and property and identifies where they are addressed in this EIS.

Table 12-1 SEARs relevant to land use and property impacts

| Ref | Key Issue SEARs | Where addressed |
|---|---|---|
| **7. Land Use and Property Impacts** | | |
| 2. | The Proponent must assess impacts from construction and operation on potentially affected properties, businesses, Council assets and services, recreational users and land and water users, including property acquisitions/adjustments, access amenity and relevant statutory rights. | Section 12.4.<br>**Chapter 8, Traffic and transport**<br>**Chapter 14, Socio-economic**<br>**Chapter 20, Groundwater** |
| 3. | The design, construction and operation of the project should address and minimise (existing and future) land use conflicts and operations (including existing and ongoing horticultural activities). Siting of project elements should be located in such a way that functional, contiguous areas of residual land and land uses are maximised. | Section 12.4<br>**Chapter 5, Project description**<br>**Chapter 6, Construction**<br>**Chapter 13, Agriculture** |
| 4. | The Proponent must assess potential impacts on utilities (including communications, electricity, gas, and water and sewerage) and the relocation of these utilities. | Section 12.4<br>**Chapter 5, Project description** |

## 12.1 Assessment methodology

### 12.1.1 Study area

The study area for the land use and property assessment includes a 500 m buffer around the construction footprint, as shown in **Figure 12-1**. However, consideration has been given to strategic land use planning and development in the broader area, where relevant.


Coffs Harbour Bypass
Land use and property impact assessment study area
Figure 12-1

### 12.1.2 Baseline desktop review and assessment of impact

The baseline conditions for the land use and property assessment have been established based on the following approach:

- Review of key strategic planning policies and documents relevant to the study area and Coffs Harbour LGA, to identify planned future priorities and land uses
- Review of the existing and potential future land use, considering **Appendix K2, Agricultural assessment** and the zoning maps included within the Coffs Harbour LEP 2013
- Review of current development applications (recently lodged, under assessment or approved but not yet constructed) to understand potential future development, and subsequently land use, within the study area
- Identification of existing property information including land ownership and current acquisition status.

The potential impacts of construction and operation on existing and future land use and property have been determined with consideration of the construction footprint, indicative road corridor and the construction methodology of the project. Mitigation measures have been identified to avoid or reduce impacts where required.

## 12.2 Policy and planning

### 12.2.1 North Coast Regional Plan 2036

The North Coast Regional Plan 2036 (DP&E 2017a), released in March 2017, provides strategic direction for the North Coast region and contains an indicative alignment for the Pacific Highway upgrades.

The North Coast Regional Plan states that the Pacific Highway upgrade is expected to provide greater connectivity across local government areas within the North Coast region, building broader communities of interest and creating a more vibrant and diverse economy. For example, the project would help to bring forward ‘employment land’ across Coffs Harbour-Clarence Valley and Kempsey-Port Macquarie.

The North Coast Regional Plan states that over three-quarters of future population growth within the North Coast region is projected to occur across the local government areas of Coffs Harbour, Port Macquarie-Hastings, Lismore and Tweed. To cater for projected growth, it is proposed that Coffs Harbour will need to provide an additional 43,600 dwellings by 2036. As shown on **Figure 12-2**, which is based on Figure 7 from the North Coast Regional Plan**,** key growth areas are identified along the project in support of future housing and employment. This includes two *Investigation Areas – Urban Land* (North Boambee Valley (West) and West Coffs) and one *Investigation Area – Employment Land* (North Boambee Valley (West).

The North Boambee Valley (West) – Urban Land Investigation Area has now been identified in the Coffs Harbour LEP 2013 and the Coffs Harbour Development Control Plan (DCP) 2015 as an urban release area (URA) and enables low density residential development to provide for the needs of the community as discussed further in **Section 12.3.3**.

The North Coast Regional Plan also identifies two existing URAs at South Coffs and North Coffs (refer **Figure 12-2**). Existing employment land is also shown towards the south and east of the project.


Coffs Harbour Bypass
Relevant land use and property information as shown in the North Coast Regional Plan (Figure 7)
Figure 12-2

## 12.2.2 Local Growth Management Strategy

Our Living City Settlement Strategy (CHCC 2008) is the current Local Growth Management Strategy for the Coffs Harbour LGA, as required under the North Coast Regional Plan. It establishes a framework for CHCC to formulate detailed plans and policies to guide the growth of Coffs Harbour to 2031.

CHCC is in the process of reviewing and updating the Local Growth Management Strategy. The revised strategy will replace Council's existing Local Growth Management Strategy and will guide how and where growth will occur in Coffs Harbour LGA over the next 20 years. The revised strategy will outline the future growth of the Coffs Harbour LGA and builds on the strategic priorities of the North Coast Regional Plan.

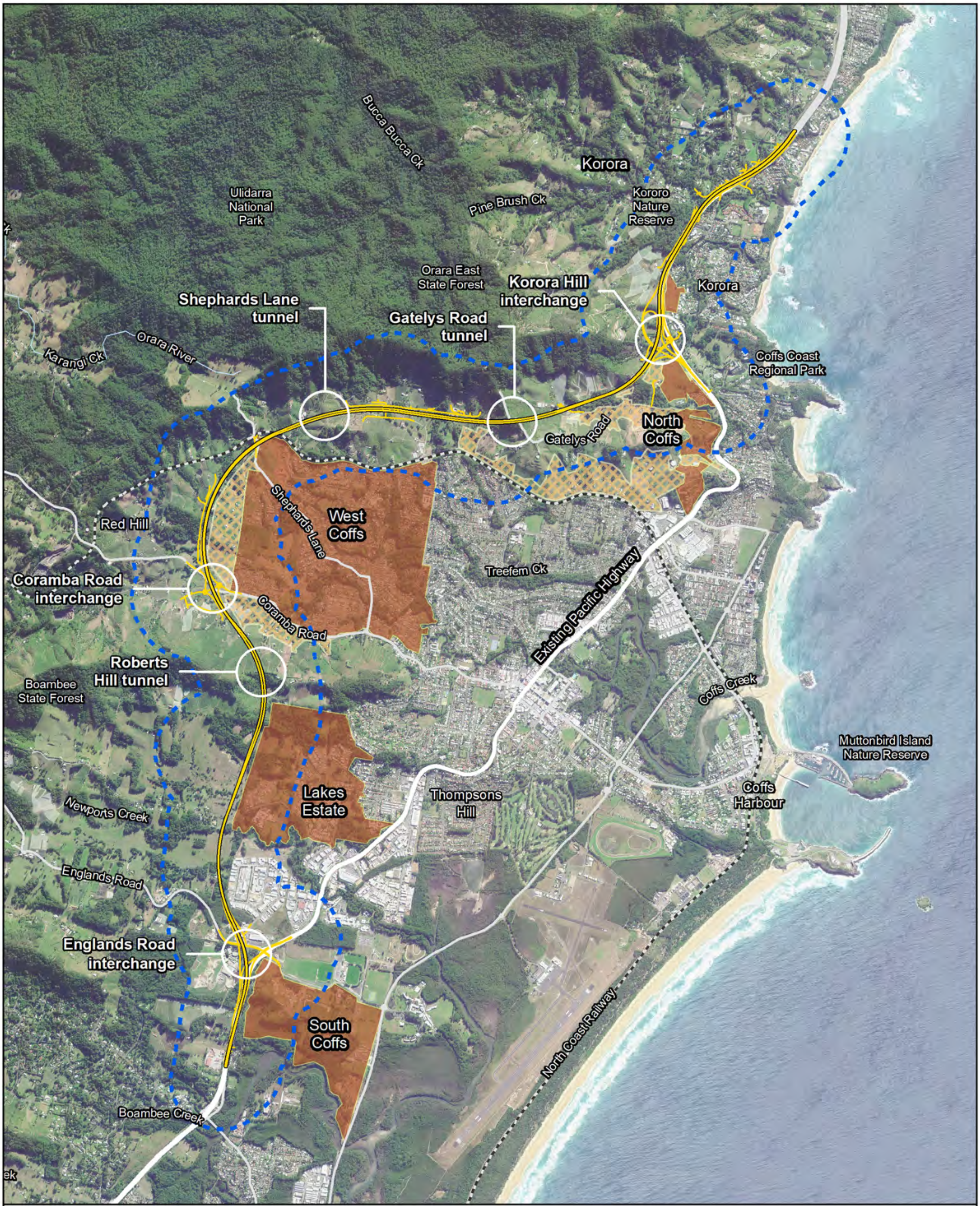
The revised strategy will comprise a number of separate, but related Chapters (previously known as Strategies) beginning with a vision and strategic approach (Chapter 1-4), and Chapters 5-8 will relate to specific land uses such as rural, large-lot residential, residential, and employment.

CHCC has prepared a draft Local Growth Management Strategy 'Strategic Approach' which sets out the introductory Chapters 1-4 of the strategy. The public exhibition period for draft chapters closed on 10 May 2019, and additional related chapters relating to specific land uses such as rural, large-lot residential, residential, and employment will be exhibited in the future.

For the purposes of the EIS, the draft introductory Chapters 1-4 of the strategy have been used to provide the baseline for the land use assessment. Chapter 4 of the draft strategy  includes information on growth, infill and renewal for Coffs Harbour LGA and identifies the following Investigation Areas and Infill Areas within the study area (in addition to those included within the North Coast Regional Plan (see **Figure 12-3**)):

- **Lakes Estate Infill Area:** This area is east of the project, aligned with the North Boambee Valley URA adopted in the Coffs Harbour DCP 2015
- **West Coffs Infill Area:** This area aligns with the West Coffs URA adopted in the Coffs Harbour DCP 2015 and is immediately east of the West Coffs Investigation Area identified in the North Coast Regional Plan
- **North Coffs General Residential Infill Area:** This area aligns with the North Coffs URA identified in the North Coast Regional Plan but has not yet been adopted in the Coffs Harbour DCP 2015
- **North Coffs Investigation Area:** This area aligns with the Investigation Area shown in the Our Living City Settlement Strategy
- **Korora South/East Infill Area.**

Infill Areas and Investigation Areas are required to help deliver housing diversity and choice in a compact form as discussed further in **Section 12.3.3**.




**Legend**

- Alignment
- North Coast Railway
- Study area
- Infill or Renewal Area
- Investigation Area- Urban Land

Note 1: The areas shown are based on available government documents and only illustrate an indicative extent.
Note 2: Infill areas idenitifed within the Draft LGMS irrelevant to the study area have been omitted

0 0.5 1 1.5 km
Scale @A4: 1:50,000
GDA 1994 MGA Zone 56
N

Coffs Harbour Bypass
Draft Local Growth Management Strategy infill areas within and adjacent study area
Figure 12-3

# 12.3 Existing environment

## 12.3.1 Land use

A detailed land use survey of the study area was carried out in 2016, and the results of this survey were reviewed and updated as part of the **Appendix K2, Agricultural assessment**. There are some differences between the results of the 2016 survey and existing conditions, given the growth of the Coffs Harbour LGA and changes to zoning that have occurred since the 2016 survey. The updated survey involved desktop review of the 2016 results, a review of 2018 aerial photography, and field investigations to identify land uses within the study area. The results are shown in **Figure 12-4-01** to **Figure 12-4-03.** Primary land uses within the study area include urban, commercial, extensive agriculture, intensive plants, native vegetation, public use and rural residential.

Coffs Harbour is a regional city located in the North Coast region of NSW. Land within the study area is used for a range of urban and rural uses including residential, commercial, industrial, agriculture, infrastructure, community uses, recreation and conservation. The land use within the study area has been described in the following sections.

### *Englands Road to Roberts Hill*

The land use between the southern extent of the project and Englands Road interchange includes:

- East of the project – extensive agriculture, rural residential and public uses (eg sporting fields)
- West of the project – rural residential, commercial (eg Lindsay Transport), irrigated plants, intensive animals (eg Boambee Equestrian Centre) and the Coffs Coast Resource Recovery Park.

The land use between the Englands Road interchange and North Boambee Road includes:

- East of the project – commercial use (eg Oz Group Packhouse) and public use (eg Bishop Druitt College)
- West of the project – native vegetation and rural residential.

The land use between North Boambee Road and Roberts Hill includes:

- East of the project – mostly native vegetation with some residential
- West of the project – extensive agriculture, native vegetation and irrigated plants with a small portion of rural residential.

### *Roberts Hill to Korora Hill*

The land use between Roberts Hill and the Coramba Road interchange includes:

- East of the project – irrigated plants, extensive agriculture and rural residential
- West of the project – irrigated plants and small areas of rural residential.

The land use between the Coramba Road interchange and the North Coast Railway includes:

- East of the project – a combination of extensive agriculture, urban residential/rural residential, vacant vegetation-cleared land, and irrigated plants
- West of the project – rural residential and irrigated plants.

The land use between the North Coast Railway and the Gatelys Road ridge includes:

- East of the project – irrigated plant farms, rural and urban residential
- West of the project – irrigated plants, rural residential, and native vegetation.

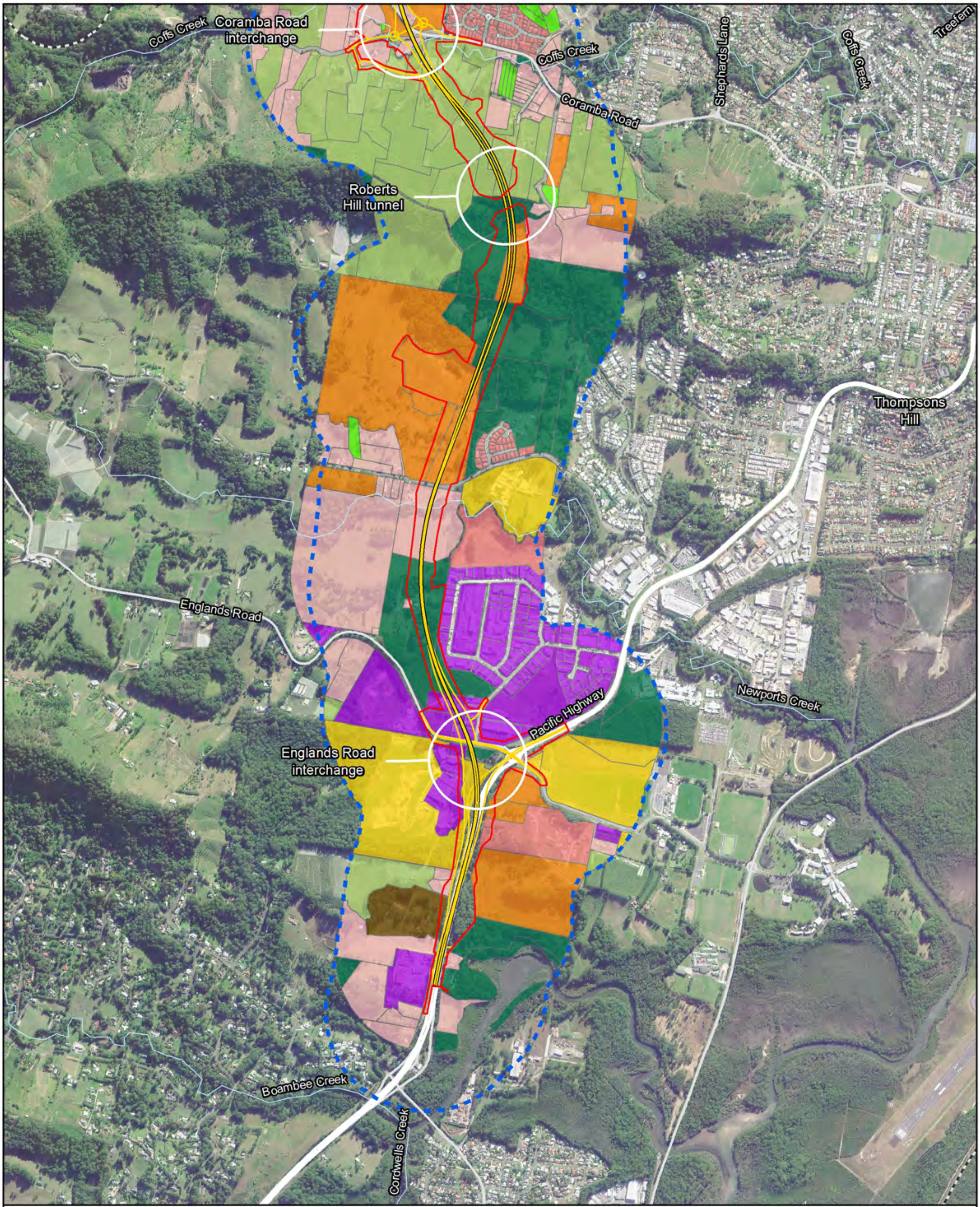
### *Korora Hill to Sapphire*

The land use between the Gatelys Road ridge and the Korora Hill interchange includes:

- East of project – irrigated plants, rural residential, urban residential, public uses (eg Elite Training Centre, Pacific Bay Resort), commercial (eg Pacific Bay Resort Golf Course) and native vegetation
- West of project – rural residential, native vegetation and irrigated plants.

The land use between the Korora Hill interchange to the northern extent of the project can be summarised as follows.

- East of project – urban residential, small portion for native vegetation and public use (eg Kororo Public School)
- West of project – irrigated plants, rural residential, native vegetation (eg Kororo Nature Reserve), commercial (eg Paradise Palms Resort) and vacant vegetation-cleared land.




**Legend**

Construction footprint
Study area
Alignment
North Coast Railway

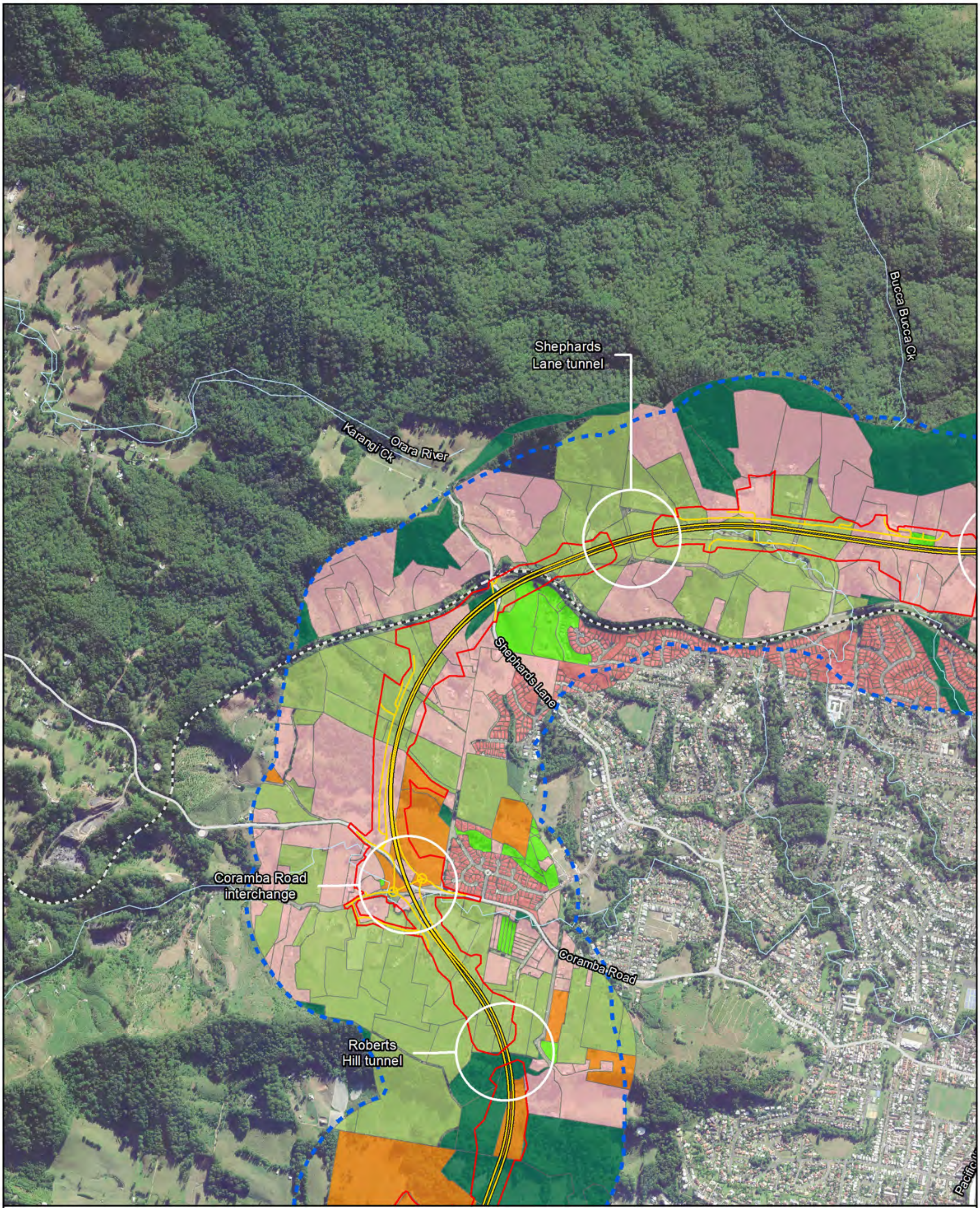
**Land use**

Vacant
Urban
Rural Residential
Public Use
Native Vegetation
Irrigated Plants
Intensive Animals
Extensive Agriculture
Commercial

Land use data source: Edge Planning (2018)

Coffs Harbour Bypass
Existing land use within the study area
Figure 12-4-01

0 0.25 0.5 0.75 km
N
Scale @A4: 1:25,000
GDA 1994 MGA Zone 56



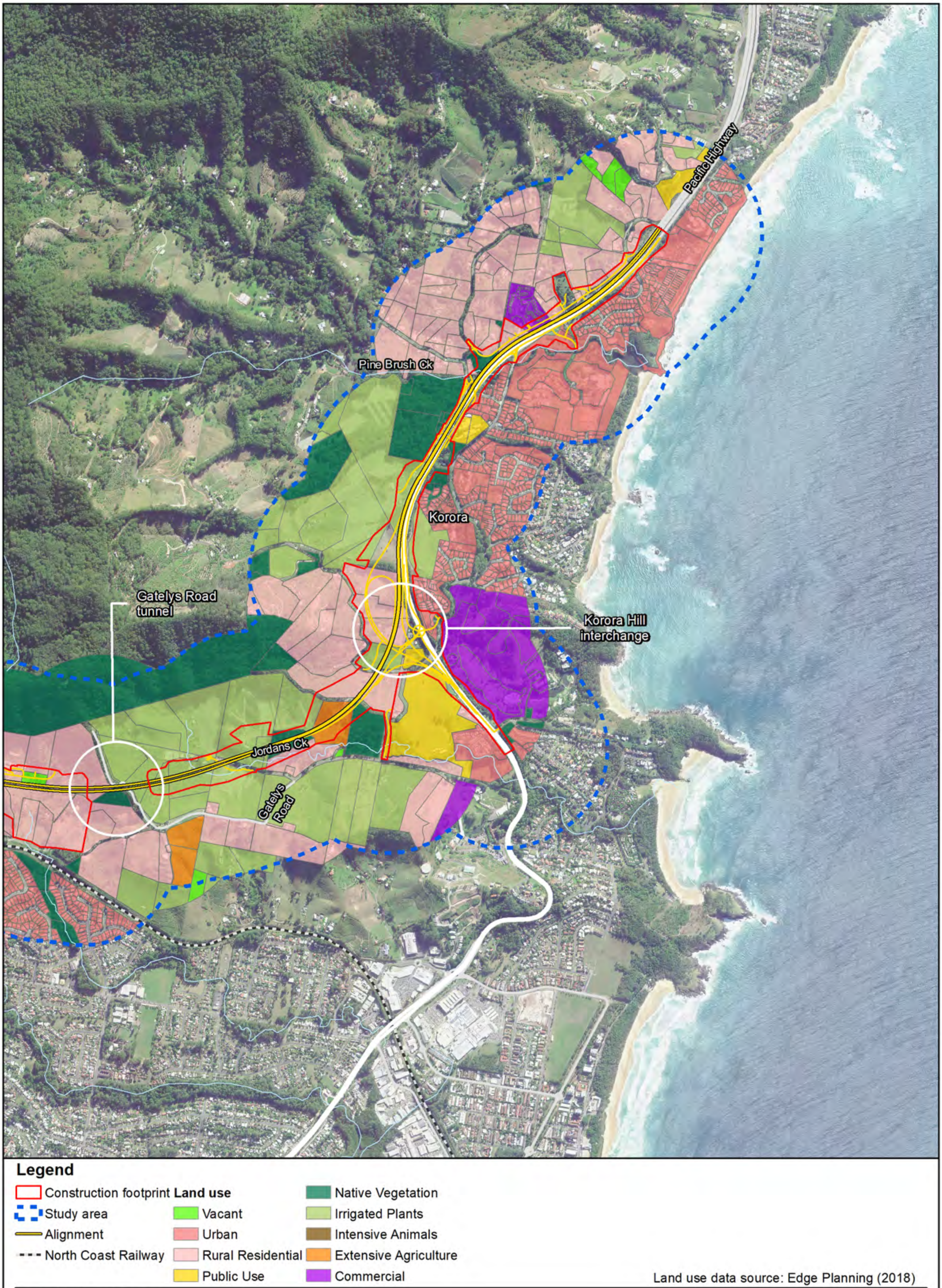

**Legend**

| | | |
|---|---|---|
| Construction footprint | **Land use** | Native Vegetation |
| Study area | Vacant | Irrigated Plants |
| Alignment | Urban | Intensive Animals |
| North Coast Railway | Rural Residential | Extensive Agriculture |
| | Public Use | Commercial |

Land use data source: Edge Planning (2018)

Coffs Harbour Bypass
Existing land use within the study area
Figure 12-4-02

0 0.25 0.5 0.75 km
N
Scale @A4: 1:25,000
GDA 1994 MGA Zone 56




Coffs Harbour Bypass
Existing land use within the study area
Figure 12-4-03

## 12.3.2 Land use zoning

One the key outcomes of the preferred corridor and option identification between 2001 and 2004 and refinement of the preliminary concept design in 2008 was to provide planning certainty for CHCC and the community by reserving the route within the Coffs Harbour LEP 2013 (see **Chapter 4, Project development and alternatives**). As such, development within the study area has been planned with consideration of the project.

As shown in **Figure 12-5** and **Table 12-2,** the majority of the construction footprint is contained within the corridor zoned for the project under the Coffs Harbour LEP 2013 as Infrastructure (SP2) – Classified Road (68.6 per cent). The objective of this zone is to provide for infrastructure and related uses, and to prevent any development that is not compatible with, or that may detract from, the provision of infrastructure.

Where the construction footprint is outside of the SP2 zone, it traverses land within multiple zones as shown in **Figure 12-5**, **Figure 12-6-01** to **Figure 12-6-03** and **Table 12-2**. Most of this land (29.2 per cent) is within the RU2 Rural Landscape zone, followed by the R2 Low Density Residential zone, the E2 Environmental Conservation zone, the R5 Large Lot Residential zone and the IN1 General Industrial zone. The remaining 2.2 per cent is spread across various zones. The key objectives of each of these zones are discussed in **Table 12-3**.

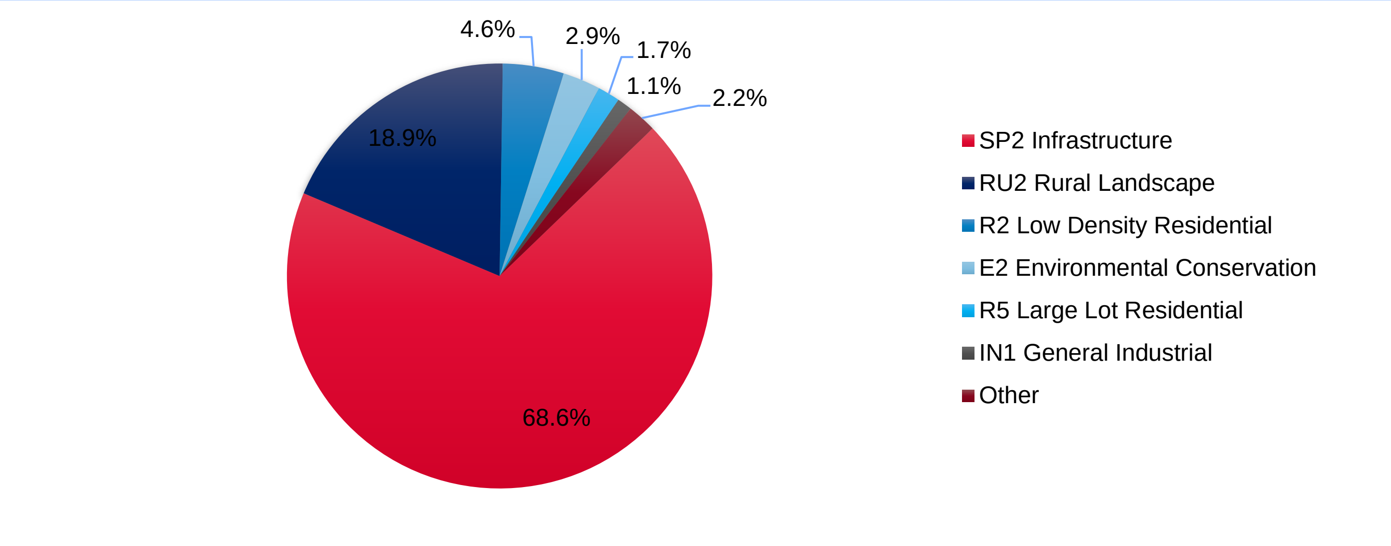



Figure 12-5 Land use zoning within construction footprint

Zoning within the study area differs from the existing land use described within **Section 12.3.1**, with regard to density and residential development, with the zoning providing for greater density and future residential development.

Table 12-2 Zoning within the construction footprint and the study area (exported May 2019)

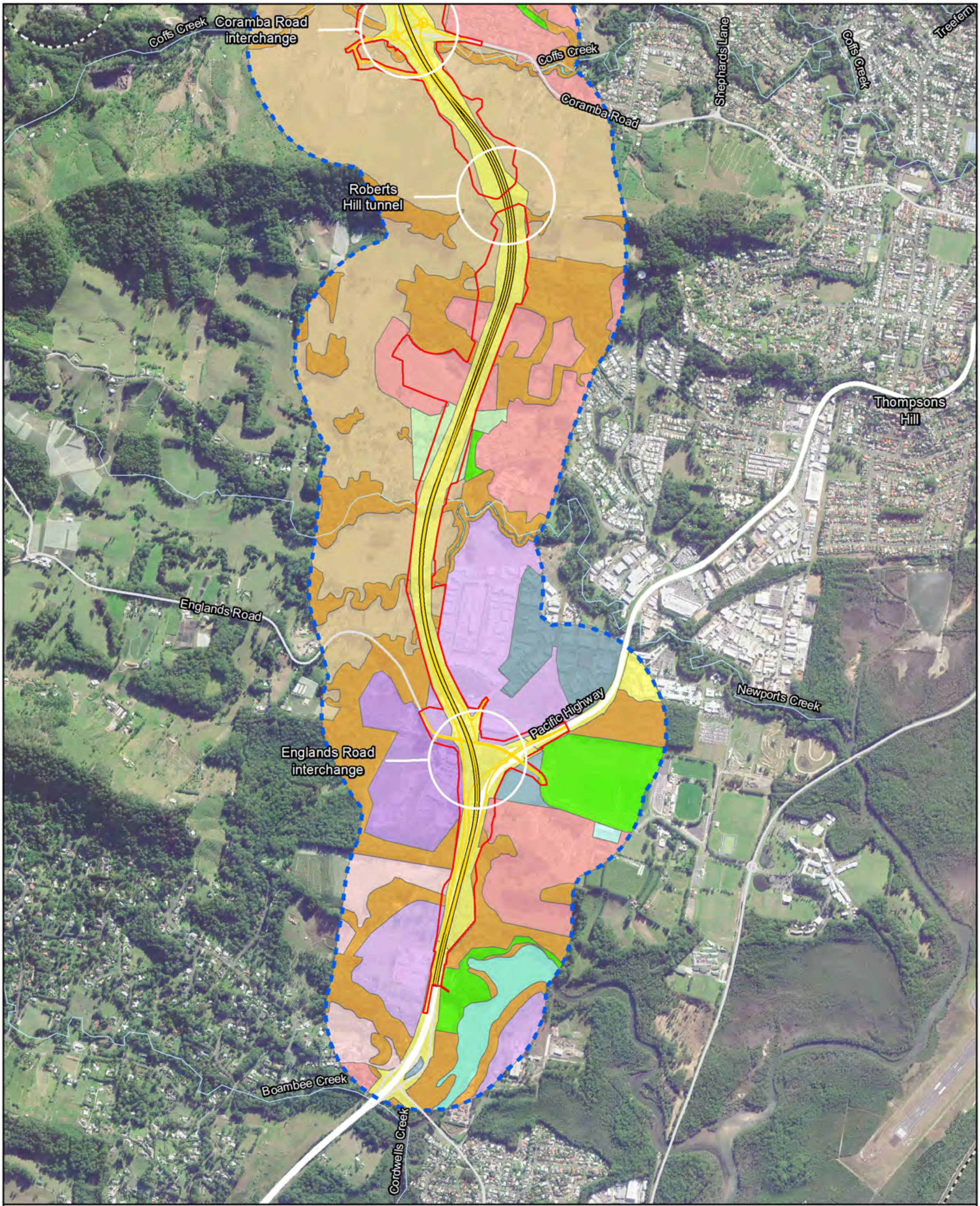
| Coffs Harbour LEP Zoning | Construction footprint | | Study area | |
|---|---|---|---|---|
| | Area (ha) | %[1] | Area (ha) | %[1] |
| B1 Neighbourhood Centre | - | - | 2.63 | 0.1 |
| B5 Business Development | - | - | 21.70 | 1.1 |
| B6 Enterprise Corridor | 0.65 | 0.2 | 4.78 | 0.2 |
| E1 National Park and Nature Reserves | - | - | 22.52 | 1.1 |
| E2 Environmental Conservation | 8.07 | 2.9 | 309.58 | 15.3 |
| IN1 General Industrial | 3.17 | 1.1 | 70.96 | 3.5 |
| IN3 Heavy Industrial | 1.50 | 0.5 | 31.03 | 1.5 |

| Coffs Harbour LEP Zoning | Construction footprint | | Study area | |
|---|---|---|---|---|
| | Area (ha) | %[1] | Area (ha) | %[1] |
| R1 General Residential | 0.14 | 0.0 | 63.47 | 3.1 |
| R2 Low Density Residential | 13.10 | 4.6 | 289.04 | 14.3 |
| R5 Large Lot Residential | 4.78 | 1.7 | 154.30 | 7.6 |
| RE1 Public Recreation | 1.25 | 0.4 | 59.60 | 2.9 |
| RE2 Private Recreation | 2.66 | 0.9 | 28.29 | 1.4 |
| RU2 Rural Landscape | 53.25 | 18.9 | 648.80 | 32.0 |
| RU3 Forestry | - | - | 49.00 | 2.4 |
| SP2 Infrastructure | 193.57 | 68.6 | 249.43 | 12.3 |
| W2 Recreational Waterways | 0.08 | 0.03 | 20.76 | 1.0 |
| **Total** | **282.21** | | **2,025.87** | |

1 - Calculation of areas are subject to rounding and total may not equal 100%

Table 12-3 Key objectives of main zones impacted by the construction footprint

| Coffs Harbour LEP Zoning | Objectives (as per Coffs Harbour LEP) |
|---|---|
| E2 Environmental Conservation | To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values and prevent development that could destroy, damage or otherwise have adverse effect on those values. Permitted with consent use includes roads. |
| IN1 General Industrial | To provide a wide range of industrial and warehouse land uses, encourage employment opportunities, minimise any adverse effect of industry on other land uses, support and protect industrial land for industrial uses, and enable other land uses that provide facilities or services to meet the day to day needs of workers in the area, but only if they do not compromise the land being used to industrial purposes. Permitted with consent use includes roads. |
| R2 Low Density Residential | To provide for the housing needs of the community within a low-density residential environment and enable other land uses that provide facilities or services to meet the day to day needs of residents. Permitted with consent includes roads. |
| R5 Large Lot Residential | To provide residential housing in a rural setting while preserving, and minimizing impacts on, environmentally sensitive locations and scenic quality, to ensure that large residential lots do not hinder the proper and orderly development of urban areas in the future, to ensure that development in the area does not unreasonably increase the demand for public services or public facilities, and to minimise conflict between land uses within this zone and land uses within adjoining zones. Permitted with consent use includes roads. |
| RU2 Rural Landscape | To encourage sustainable primary industry production by maintaining and enhancing the natural resource base, to provide for a range of compatible land uses, including extensive agriculture, to maintain the rural landscape character of the land and to minimise the fragmentation and alienation of resource lands. Within this zone, ‘roads’ is nominated as a use that is permitted with consent. |

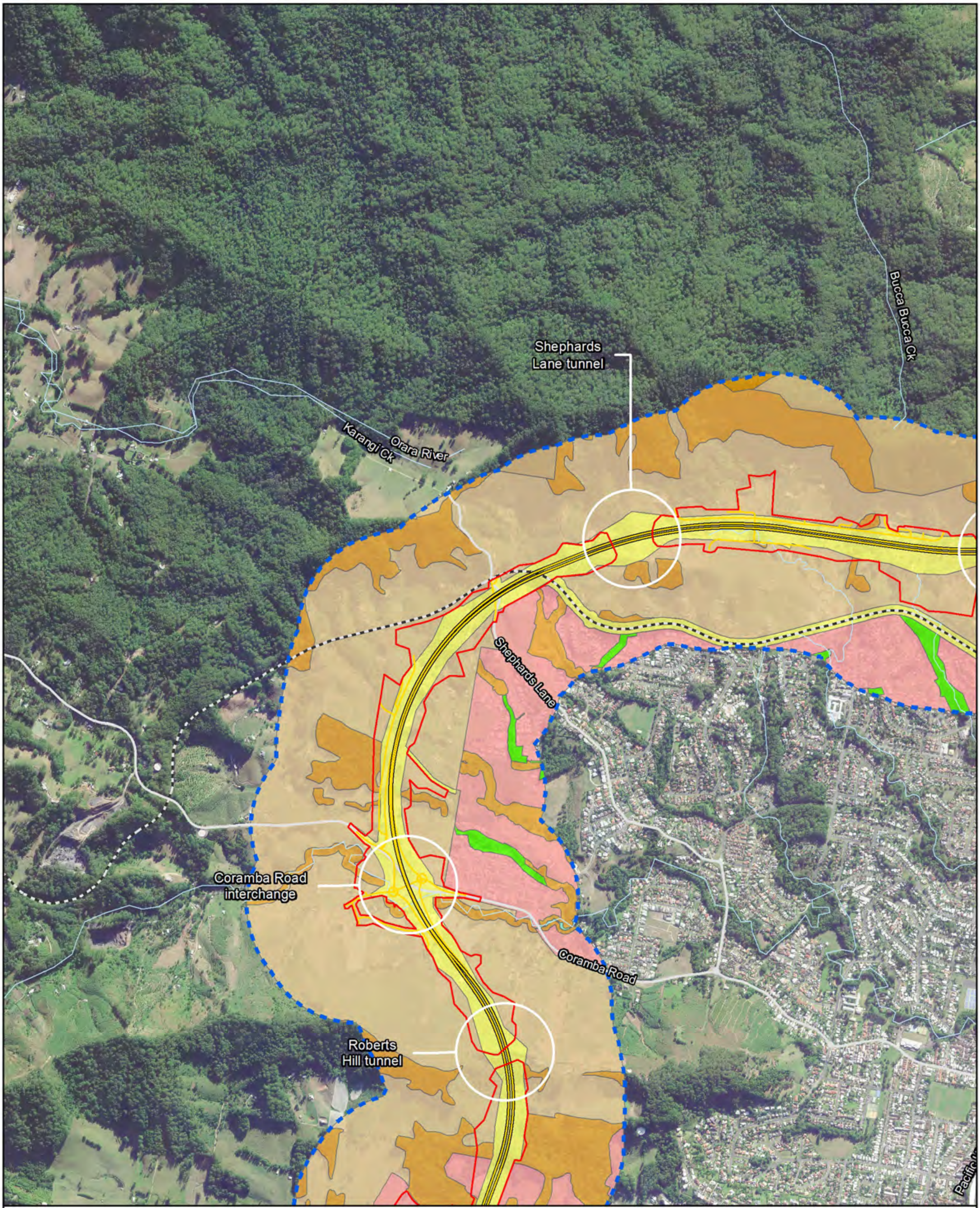



**Legend**

Construction footprint
Study area
Alignment
Watercourse
North Coast Railway
B1 Neighbourhood Centre
B2 Local Centre
B3 Commercial Core
B4 Mixed Use
B5 Business Development
B6 Enterprise Corridor
DM Deferred Matter zone
E1 National Park and Nature Reserves
E2 Environmental Conservation
IN1 General Industrial
IN3 Heavy Industrial
IN4 Working Waterfront
R1 General Residential
R2 Low Density Residential
R3 Medium Density Residential
R4 High Density Residential
R5 Large Lot Residential
RE1 Public Recreation
RE2 Private Recreation
RU2 Rural Landscape
RU3 Forestry
SP1 Special Activities
SP2 Infrastructure
SP3 Tourist
W1 Natural Waterways
W2 Recreational Waterways
W3 Working Waterways

Coffs Harbour Bypass
Land use zoning within the study area
Figure 12-6-01

0 0.25 0.5 0.75 km
Scale @A4: 1:25,000
GDA 1994 MGA Zone 56
N



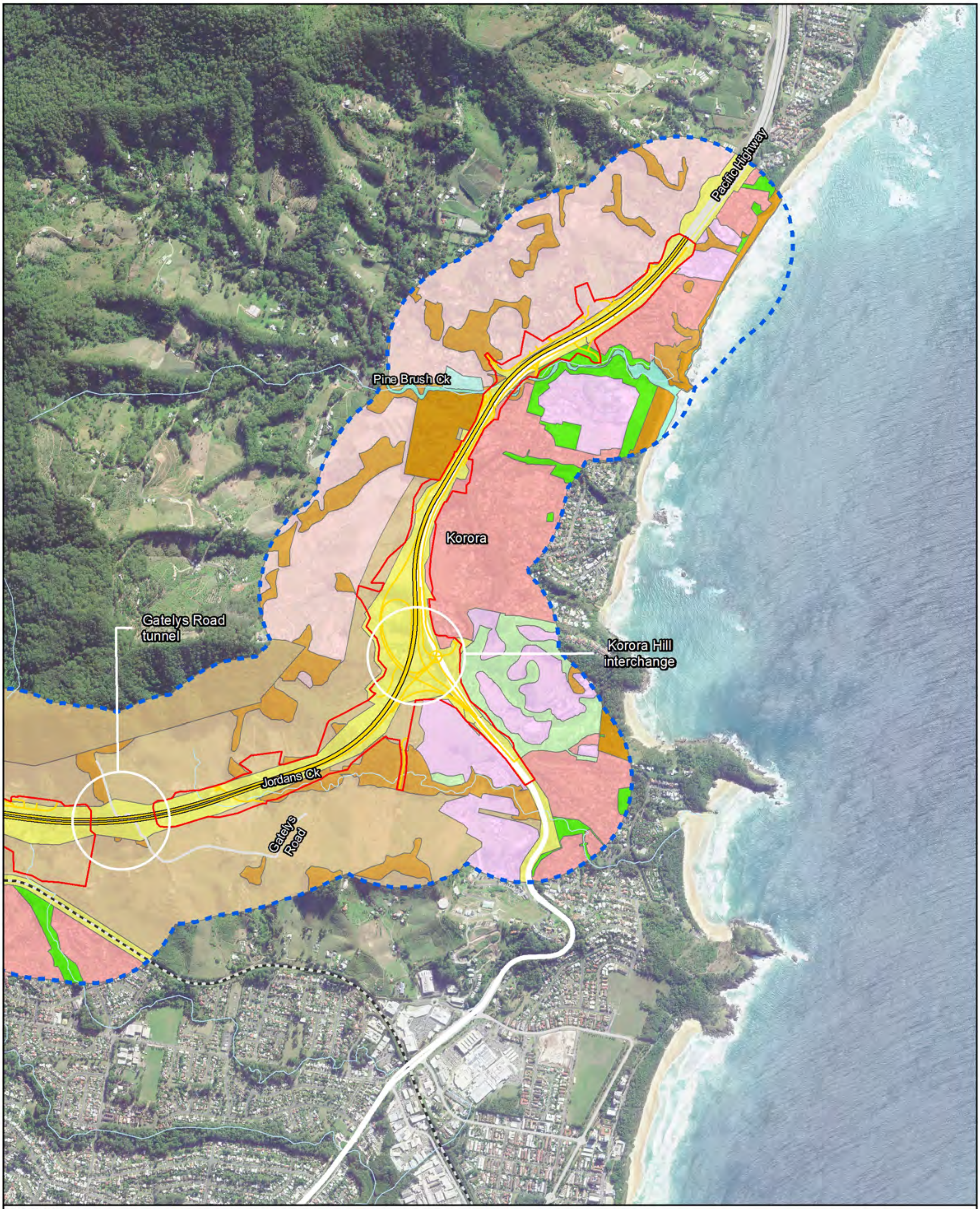

**Legend**

- Construction footprint
- Study area
- Alignment
- Watercourse
- North Coast Railway

| | | | | |
|---|---|---|---|---|
| B1 Neighbourhood Centre | E1 National Park and Nature Reserves | R3 Medium Density Residential | SP1 Special Activities |
| B2 Local Centre | E2 Environmental Conservation | R4 High Density Residential | SP2 Infrastructure |
| B3 Commercial Core | IN1 General Industrial | R5 Large Lot Residential | SP3 Tourist |
| B4 Mixed Use | IN3 Heavy Industrial | RE1 Public Recreation | W1 Natural Waterways |
| B5 Business Development | IN4 Working Waterfront | RE2 Private Recreation | W2 Recreational Waterways |
| B6 Enterprise Corridor | R1 General Residential | RU2 Rural Landscape | W3 Working Waterways |
| DM Deferred Matter zone | R2 Low Density Residential | RU3 Forestry | |

Coffs Harbour Bypass
Land use zoning within the study area
Figure 12-6-02

0 0.25 0.5 0.75 km
N
Scale @A4: 1:25,000
GDA 1994 MGA Zone 56




**Legend**

- Construction footprint
- Study area
- Alignment
- Watercourse
- North Coast Railway
- B1 Neighbourhood Centre
- B2 Local Centre
- B3 Commercial Core
- B4 Mixed Use
- B5 Business Development
- B6 Enterprise Corridor
- DM Deferred Matter zone
- E1 National Park and Nature Reserves
- E2 Environmental Conservation
- IN1 General Industrial
- IN3 Heavy Industrial
- IN4 Working Waterfront
- R1 General Residential
- R2 Low Density Residential
- R3 Medium Density Residential
- R4 High Density Residential
- R5 Large Lot Residential
- RE1 Public Recreation
- RE2 Private Recreation
- RU2 Rural Landscape
- RU3 Forestry
- SP1 Special Activities
- SP2 Infrastructure
- SP3 Tourist
- W1 Natural Waterways
- W2 Recreational Waterways
- W3 Working Waterways

0 0.25 0.5 0.75 km
N
Scale @A4: 1:25,000
GDA 1994 MGA Zone 56

Coffs Harbour Bypass
Land use zoning within the study area
Figure 12-6-03

### 12.3.3 Future development

As discussed in **Section 12.2.1** and **Section 12.2.2** there are a number of growth, infill and renewal areas within the study area including:

- South Coffs URA (North Coast Regional Plan)
- North Boambee Valley (West) Investigation Area – Employment Land (North Coast Regional Plan)
- North Boambee Valley (West) URA (North Coast Regional Plan)
- North Boambee Valley URA (North Coast Regional Plan)
- West Coffs URA (North Coast Regional Plan)
- West Coffs Investigation Area (North Coast Regional Plan)
- North Coffs URA (North Coast Regional Plan)
- North Coffs Investigation Area (Local Growth Management Strategy)
- Korora South/East Infill Area (Local Growth Management Strategy).

The Korora URA is an additional growth area that was not identified in the North Coast Regional Plan or draft LGMS but has been identified as an URA in the Coffs Harbour DCP 2015.

These areas are required to help accommodate future growth in the Coffs Harbour LGA and deliver housing diversity and choice. **Table 12-4** provides details of the anticipated capacity of the growth, infill or renewal areas within the study area.

Table 12-4 Anticipated capacity within growth, infill and renewal areas

| Growth, infill or renewal area | Anticipated capacity |
|---|---|
| South Coffs URA | The South Coffs URA makes provision for a total of 308 possible residential lots, accommodating about 886 people (CHCC 2015) |
| North Boambee Valley (West) Investigation Area – Employment Land | The North Boambee Valley (West) Investigation Area – Employment Land includes 34.1ha of land as potentially suitable for industrial land subject to further investigations (CHCC 2009a) |
| North Boambee Valley West URA | The North Boambee Valley West URA provides for further residential expansion in the order of 938 additional lots accommodating about 2,439 people (CHCC 2019) |
| West Coffs URA | The West Coffs URA provides for residential expansion in the order of 331 additional dwellings accommodating about 860 people, and is expected to ultimately cater for a population of about 6,700 people (CHCC 2017f) |
| West Coffs Investigation Area | The West Coffs Investigation Area is expected to accommodate an additional dwelling yield of 490 (CHCC 2019) |
| North Coffs URA | North Coffs is expected to accommodate an additional dwelling yield of 1701 (CHCC 2019) |
| North Coffs Investigation Area | The North Coffs Investigation Area is expected to accommodate an additional dwelling yield of 704 (CHCC 2019) |
| Korora South/East Infill Area | The Korora South / East Infill Area is expected to accommodate an additional dwelling yield of 71 (CHCC 2019) |
| Korora URA | The Korora URA makes provision for further residential expansion in the order of 250 additional dwellings accommodating 750 people. The Korora Rural Residential Release catchment will ultimately cater for a population of 1,500 people (CHCC 2017g) |

**Table 12-5** provides an assessment of the amount of growth, infill and renewal areas within the construction footprint and study area. These areas are also shown in **Figure 12-7**.

Table 12-5 Growth, infill and renewal areas within the construction footprint and the study area

| Growth, infill or renewal area | Construction footprint | | Study area | |
|---|---|---|---|---|
| | Area (ha) | % | Area (ha) | % |
| South Coffs URA | 1.85 | 1 | 47.23 | 38 |
| North Boambee Valley (West) Investigation Area – Employment Land | - | - | 26.45 | 28 |
| North Boambee Valley West URA | - | - | 82.28 | 59 |
| West Coffs URA | 2.06 | 1 | 96.98 | 29 |
| West Coffs Investigation Area | 8.06 | 15 | 51.87 | 96 |
| North Coffs URA | 1 | 2 | 27.94 | 67 |
| North Coffs Investigation Area | 7.15 | 8 | 37.20 | 43 |
| Korora South / East Infill Area | 0.7 | 19 | 4.62 | 100 |
| Korora URA | 8 | 1 | 199.80 | 24 |

A number of approved and proposed development applications from the above areas have been considered in various assessments as part of the EIS, see **Chapter 8, Traffic and transport, Chapter 9, Noise and vibration, Chapter 17, Flooding and hydrology** and **Chapter 25, Cumulative impacts** for further discussions.


Coffs Harbour Bypass
Investigation areas and urban release areas within the study area
Figure 12-7

0 0.5 1 1.5 km
Scale @A4: 1:50,000
GDA 1994 MGA Zone 56
N

## 12.3.4 Property

The construction footprint impacts a total of 151 properties (in part or in full) and 11 easements that provide access for vehicles and essential services (refer **Appendix K1, Property impacts**).

Roads and Maritime has been progressively acquiring land for the project and currently owns almost 40 per cent of properties within the construction footprint. A summary of land ownership and acquisition requirements is provided in **Table 12-6**. In some circumstances, property owners have negotiated for total acquisition although the full property would not be required for construction of the project.

Table 12-6 Total and partial land acquisition required for the project

| Acquisition type | Ownership type | Current property owner | Properties within construction footprint | Area impacted (ha) | Percentage of properties within construction footprint (%) |
|---|---|---|---|---|---|
| Partial | Government | CHCC | 8 | 3.86 | 5.3 |
| | Government | Crown Land | 2 | 11.93 | 1.3 |
| | Private | Privately owned | 63 | 67.61 | 41.7 |
| | Government | Roads and Maritime | 18 | 38.05 | 11.9 |
| Total | Government | Crown Land | 1 | 0.76 | 0.7 |
| | Private | Privately owned | 18 | 15.66 | 11.9 |
| | Government | Roads and Maritime | 41 | 187.92 | 27.2 |

In addition to the acquisition requirements detailed in **Table 12-6**, the project would require subsurface or substratum acquisition for land below the surface for construction of the tunnels. Subsurface acquisition would be within a stratum acquisition envelope around the tunnels, including any associated ground support that may be required. Subsurface acquisition would include land both privately and publicly owned, with separate processes for each as relevant.

## 12.3.5 Utilities

Several types of utilities exist within or next to the construction footprint including electrical, sewer, water and telecommunications. **Chapter 5, Project description** provides a description of utilities that would potentially require relocation or protection during construction, as well as relevant utility service providers and general location of the services. Construction of the project would potentially involve the adjustment and/or relocation of:

- Water (CHCC water mains)
- Sewerage (CHCC sewer mains and rising mains)
- Electrical (Essential Energy low voltage cable, 11kV and 66kV)
- Communications (various aerial cables, underground conduits, local optic fibre cables and nationally significant optic fibre cable for the following; Telstra, NBN, Optus, Next Gen and AARNet).

The project would require connection to existing electricity, telecommunication and water utilities. This would be required for the operation of street lighting and the traffic signals as well as the operation of the three tunnels.

# 12.4 Assessment of potential impacts

A summary of the impacts associated with the project is provided below. This section considers impacts associated with property and land use during construction and operation. Any impacts on wider socio-economic factors are discussed in **Chapter 14, Socio-economic**.

## 12.4.1 Land use

A corridor zoned SP2 Infrastructure was reserved for the project in the Coffs Harbour LEP 2013. Land within this corridor has been assessed as part of the broader strategic planning process for the Coffs Harbour LEP 2013. For land outside of the SP2 Infrastructure zone, the construction of the project would result in minor impacts to existing land uses as described below. Impacts on agriculture are discussed in **Chapter 13, Agriculture**.

### *Residential*

A number of dwellings and rural residential properties located within the construction footprint would be impacted. This includes:

- An area of rural residential land around Shephards Lane ridge
- A large area of rural residential land south of the Korora Hill interchange
- Residential land around Kororo Public School, which would involve the acquisition of around five dwellings.

A large proportion of the residential land impacted, totaling around 13 ha, would be used to support ancillary facilities for the project. As discussed in **Appendix J, Urban design, landscape character and visual impact assessment**, once construction has finished, these sites would no longer be required and would be disposed of with no change to current land use zoning. Impacts to the existing land use are considered to be short-term only.

### *Commercial and industrial*

Impacts to businesses and industry include changes to access and parking to Oz Group Packhouse at Englands Road interchange and changes to existing access to the Pacific Highway for Lindsay Transport in the south of the project. Despite changes to access, there would be no changes to existing land use. The Sapphire Motel is located on land that has been purchased by Roads and Maritime, and the hotel would be demolished prior to the construction starting. Impact on access is discussed further in **Chapter 8, Traffic and transport** and **Chapter 14, Socio-economic**.

Around 1.2 ha of land at the Coffs Coast Resource Recovery Park located at the western side of Englands Road would be impacted, though there would be no change to the existing land use. Impact on business and industry is discussed further in **Chapter 14, Socio-economic.**

While there are a number of individual land uses which would be impacted by the project during construction, generally the functions and use of land across the study area would be maintained. There would be no additional land use impacts, beyond those identified during the construction phase.

## 12.4.2 Land use zoning

As discussed in **Section 12.3.2** most of the construction footprint (193.6 ha or 68.6 per cent of land) is located within land appropriately zoned SP2 Infrastructure. The project is entirely aligned with the intent of this zone. Any potential impacts as a result of zoning the land SP2 Infrastructure, including land use impacts, would have been assessed as a part of the CHCC's broader planning process for the Coffs Harbour LEP 2013.

Outside of the SP2 Infrastructure zone, only a small area of land within each zone would be impacted by the project. The total area of each zone impacted is linear and fragmented across the construction footprint as shown in **Table 12-7**. Any impacts to land use zoning would be minimal and the loss of these areas would not compromise the achievement of each zone's objectives.

Table 12-7 Impact on land zoning outside of the SP2 zone

| LEP Zoning | Impact |
|---|---|
| E2 Environmental Conservation | The construction footprint would directly impact around 8 ha of land zoned E2 Environmental Conservation. Construction would involve the removal of some fragments of native vegetation. The project would not significantly affect the ability for the E2 Environmental Conservation zoning intention to protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. |
| IN1 General Industrial | The construction footprint would only impact around 3 ha of land zoned IN1 General Industrial. Given the minimal area of land impacted, the project would not significantly impact land supply for industrial land uses. |
| R2 Low Density Residential | The construction footprint would impact about 13 ha of land zoned R2 Low Density Residential. The impacted area is dispersed across the project in small, fragmented sections. The largest individual portion of R2 zoned land impacted is 8 ha in size and located north of Englands Road. Of this, 7 ha would be used as an ancillary site which would be surplus to the project after the construction phase and would remain in the R2 Low Density Residential zone. This is discussed further in **Appendix J, Urban design, landscape character and visual impact assessment**. |
| R5 Large Lot Residential | The construction footprint would impact on around 5 ha of land zoned R5 Large Lot Residential, including land required for ancillary sites. These sites would be used for the construction only, after which, they would be rehabilitated to their pre-construction condition (where reasonable and feasible) and the sites would remain in R5 Large Lot Residential zone. This is discussed further in **Appendix J, Urban design, landscape character and visual impact assessment**. |
| RU2 Rural Landscape | The construction of the project would impact on 53 ha of land zoned RU2 Rural Landscape. This includes ancillary sites totaling of about 6 ha. These sites would be used for the construction only, after which, they would be rehabilitated to their pre-construction condition (where reasonable and feasible) and the sites would remain in R5 Large Lot Residential zone. This is discussed further in **Appendix J, Urban design, landscape character and visual impact assessment**. |

There would be no additional land use zoning impacts, beyond those identified during the construction phase. Land within the construction footprint used for ancillary sites during construction would be disposed of by Roads and Maritime once the project is operational without change to zoning.

### 12.4.3 Future development

As identified in **Section 12.3.3** the project would impact on land included within a number of growth, infill or renewal areas. A summary of potential impacts is discussed in **Table 12-8**. Given the linear nature of the project, only a small portion of land within growth, infill or renewal areas would be impacted by the project. Given the size of these areas, the project would not result in any significant land take on any one growth, infill or renewal area land. In several instances, the direct impacts are only required for ancillary sites, and land would be available for future use in line with the future growth, infill or renewal requirements. There would be no additional direct impacts upon future development as a result of required acquisition, beyond those identified during the construction phase. Impacts on growth, infill or renewal areas are considered to be minimal.

Table 12-8 Impact on growth, infill or renewal areas

| Growth, infill or renewal area | Impact |
|---|---|
| South Coffs URA | The South Coffs URA is located to the south of Stadium Drive and to the east of the Pacific Highway. About one per cent of land within this URA would be directly impacted by the project. However, this land is shown in the South Coffs DCP Masterplan as High Conservation Value Land and is not earmarked for future residential development, and the construction footprint would not impact potential residential yield in this URA. As assessed in **Chapter 8, Traffic and transport**, access to the South Coffs URA, and Elements Estate specifically, would not be impacted by the project. |
| North Boambee Valley (West) Investigation Area – Employment Land | The North Boambee Valley (West) Investigation Area – Employment Land is identified as having significant potential for future industrial land use within the Industrial Lands Component of the current Local Growth Management Strategy (CHCC 2008), however there are no known developments currently planned within this area. None of the land within this Investigation Area would be directly impacted by the project. |
| North Boambee Valley (West) URA | Around 8.1 per cent of the land within the Northern Boambee Valley West URA would be directly impacted by the project. Most of the land impacted within the URA (about 60 per cent) would only be subject to a short-term impact as it would be used as ancillary site during construction. As noted in **Chapter 17, Flooding and hydrology**, the North Boambee Valley West URA includes existing extensive high hazard PMF areas throughout the North Boambee Valley floodplain which would potentially impact future residential yields within this URA. As assessed in **Chapter 8, Traffic and transport**, access to North Boambee Valley (West) URA would not be impacted by the project. |
| North Boambee Valley URA | None of the land within North Boambee Valley East URA would be directly impacted by the project. As assessed in **Chapter 8, Traffic and transport**, access to North Boambee Valley East URA would not be impacted by the project. |
| West Coffs URA | The project passes to the north and west of the West Coffs URA. About one per cent of land between Shephards Lane and the North Coast Railway would be directly impacted. A masterplan included with the DCP does not identify the impacted land as zoned for a specific purpose, and therefore the project would not impact on residential land within this URA. As assessed in **Chapter 8, Traffic and transport**, access to the area would not be directly affected by the project during construction. |
| West Coffs Investigation Area | Around 15 per cent of land within the West Coffs Investigation Area would be impacted during construction of the project. Within the Investigation Area, the proportion of land suitable for future development has not yet been determined. Any future masterplanning by CHCC would need to take the project into consideration. |
| North Coffs URA | The North Coffs URA, as identified within the draft Local Growth Management Strategy and North Coast Regional Plan, is required to deliver housing diversity and choice within a walkable distance and to provide tourism opportunities. The area includes existing residential developments, such as The Summit development, as well as tourism operators such as the Big Banana Fun Park. About 67 per cent of the land within the North Coffs URA is within the study area, however the construction footprint only impacts two per cent of land and would not impact potential residential yield in this URA. |

| Growth, infill or renewal area | Impact |
|---|---|
| North Coffs Investigation Area | The North Coffs Investigation Area, as identified in the draft Local Growth Management Strategy and the North Coast Regional Plan, is composed of several fragments of land, with potential to complement infill or renewal areas. There are currently no known developments planned within this area. About eight per cent of the land within this Investigation Area would be directly impacted by the project. Some of this land (about 7 per cent) would be required as ancillary sites and only be subject to a short-term impact. |
| Korora URA | Korora URA is a large area to the west of the project. Less than one per cent of land within this URA would be directly impacted by the project, including a number of ancillary sites which would not be required post-construction. As detailed in **Chapter 25, Cumulative impacts**, there is low potential that construction of individual subdivisions would occur in the same timeframe as the project as no current development applications have been identified within this URA. It is anticipated that access to the Korora URA would be provided via Bruxner Park Road and/or Old Coast Road. Both roads currently connect with the Pacific Highway with at-grade priority-controlled intersections. The project would connect Bruxner Park Road to the Korora Road interchange and Old Coast Road to a service road. Refer to **Chapter 8, Traffic and transport** for further detail. |

## 12.4.4 Property

The main property impacts would occur where land is required for construction of the project, though some areas would be required for the relocation of utilities which may need to be carried out outside the construction footprint. A large portion of the land required is already owned by Roads and Maritime and was acquired in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and Roads and Maritime Services Land Acquisition Information Guide (Roads and Maritime Services 2014).

Where privately owned land would be required for the project (and has not yet been acquired by Roads and Maritime), discussions are being held with the affected property owners concerning the purchase, lease or licence of the land. All property boundary adjustments will continue to be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and Roads and Maritime Services Land Acquisition Information Guide (Roads and Maritime Services 2014). As discussions progress, Roads and Maritime would appoint a Personal Manager Acquisitions to assist each of the landowners, residents and commercial tenants affected by acquisition for the project. The Personal Manager Acquisitions would work with the landowners, residents and commercial tenants to offer them assistance and support throughout the process.

A total of 151 properties would be impacted by the project. This includes 59 properties already owned by Roads and Maritime. Of the properties impacted, around 91 would be partially acquired and around 60 would be fully acquired. The property impacts include impact on 110 buildings, of which 74 are residential. Some properties contain more than one building (ie residential farm house and sheds or garages). A full list of the properties impacted by the project is presented in **Appendix K1, Property impacts**, including information on ownership, area impacted, land use impacted, building impacts and potential management option for each impacted property.

In addition to impacts on residential properties, the project would also impact several agricultural properties that would need to be partially or fully acquired as part of the project. This is discussed further in **Chapter 13, Agriculture**.

A number of business and industry properties would be impacted during construction of the project including:

- Partial acquisition of the CHCC owned Coffs Coast Resource Recovery Park (about five per cent of the total land area) which includes loss of some parking areas, impacts to buildings and stockpile areas
- Partial acquisition of the Oz Group Packhouse at Isles Drive (about 20 per cent of its total land area) which includes loss of some car parking
- Full acquisition of privately-owned land
- Tourist accommodation including full acquisition of the Sapphire Motel and partial acquisition of the Paradise Palms Resort.

Impacts relating to relocation, amenity and changes to demographic profile as a result of these acquisitions are discussed in **Chapter 14, Socio-economic**.

In addition to the properties affected by surface activities, land (or interests in land, such as easements) below the surface of the ground would be acquired. Subsurface acquisition would be a stratum acquisition envelope around the tunnels, including any associated ground support that may be required. Subsurface acquisition would include land both privately and publicly owned, with separate processes for each as relevant.

Subsurface acquisitions would be required at the tunnel locations and would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and Roads and Maritime’s Fact sheet: Property acquisition of subsurface lands (Roads and Maritime, 2015). Land at Shephards Lane tunnel is currently owned by Roads and Maritime. Roads and Maritime has commenced discussions with many landowners and would continue to contact the owners of the properties requiring subsurface acquisition.

Generally, the introduction of a subsurface stratum and tunnel infrastructure has the potential to limit development above the project in some circumstances, which may affect land use. Locations of tunel portals and general depths are described in **Chapter 5, Project description**. The tunnel depth is generally shallowest at tunnel portals, however for each tunnel, a minimum depth of five metres is allowed for in the design. Based on this depth and the tunnels and clearance achieved, no impacts to the surface of the properties and the use of the properties are expected. Subject to CHCC regulations and approvals, landowners would generally be able to:

- Continue to carry out farming related activities, for example banana farming
- Carry out improvements, such as installing a swimming pool
- Dig foundations for a new building or second storey additions
- Undertake property development.

There would be no additional property impacts, beyond those identified above, once the project was operational.

### 12.4.5 Utilities

As detailed in **Chapter 5, Project description**, the construction phase of the project would likely involve the adjustment and/or relocation of utilities including electrical, sewer, water and telecommunications as detailed in **Table 12-9**. Construction of the project would also involve installation of electricity supply infrastructure to power the tunnels.

Table 12-9 Location of utilities potentially requiring relocation or protection

| Area | Utility | General locations for relocations or protection |
|---|---|---|
| Englands Road to Roberts Hill | Water, sewer, electrical, communications | Pacific Highway south of Englands Road, Englands Road, Stadium Drive, Isles Drive, Industrial Drive and North Boambee Road |
| Roberts Hill to Korora Hill | Water, electrical, communications | Buchanans Road, Coramba Road, Bennetts Road, Shephards Lane and West Korora Road, |
| Korora Hill to Sapphire | Water, sewer, electrical, communications | Bruxner Park Road, James Small Drive, Old Coast Road, Coachmans Close, Seaview Close, Pacific Highway between Bruxner Park Road and Solitary Islands Way, and Opal Boulevard |

Where possible, all utility adjustments and/or relocations would be contained within the construction footprint and impacts to land use and property would be limited to that described in **Section 12.4**. Generally, utility adjustments and/or relocations are located within existing road corridors, and therefore the impact on land use and property is minimal.

Depending on the utility service being relocated, some work may be required to occur outside the construction footprint to meet the utility service provider requirements. The location of such utilities would be determined in consultation with the utility provider, and any land use and property impacts associated with the relocation of utilities outside of the construction footprint would be assessed during detailed design in consultation with the utility service providers.

As detailed in **Chapter 5, Project description**, the project would require connection to existing electricity, telecommunication and water utilities for the operation of the three tunnels. Any access required to maintain mechanical and electrical equipment associated with operation would be accounted for as part of the subsurface acquisition.

## 12.5 Environmental management measures

Environmental management measures to mitigate land use and property impacts during construction and operation of the project are presented in **Table 12-10.**

Other mitigation measures which would manage impacts to the users of land use and property are addressed in **Chapter 8, Traffic and transport**, **Chapter 13, Agriculture** and **Chapter 14, Socio-economic**.

Table 12-10 Environmental management measures for land use and property impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Future land use | LUP01 | Consultation with CHCC will be undertaken during detailed design regarding the West Coffs Investigation Area to ensure appropriate consideration of the project is provided in any future masterplanning. | Roads and Maritime | Detailed design |
| Property impacts | LUP02 | Property acquisition will be carried out in accordance with the Land Acquisition Information Guide (Roads and Maritime, 2014b), Fact sheet: Property acquisition of subsurface lands (Roads and Maritime, 2015) and the *Land Acquisition (Just Terms Compensation) Act 1991*. | Roads and Maritime | Prior to and during construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Management of residual land | LUP03 | Ancillary sites will be rehabilitated to their pre-construction condition (where reasonable and feasible) and managed in accordance with Appendix B – Residual land treatment in **Appendix J, Urban design, landscape character and visual impact assessment**. | Roads and Maritime / Contractor | During and post construction |
| Management of utilities adjustment and/or relocation | LUP04 | The following strategy for managing utilities will be implemented prior to construction in consultation with the relevant utility providers:<br>• Further detailed utility investigations (revised 'Dial before you Dig' queries and/or potholing will be carried to confirm location of buried services)<br>• Detailed utility design be undertaken in accordance with the relevant utility providers requirements<br>• Relocation or protection work will be undertaken in a manner that minimises environmental impacts and addresses the relevant utility service providers requirements and construction methods. | Roads and Maritime/ Contractor | Prior to construction |

CHAPTER 13



Chapter 13

# Agriculture

# 13. Agriculture

This chapter presents an assessment of the impacts to agricultural land and practice associated with the construction and operation of the project. The assessment presented draws upon information and data from the agricultural assessment report provided in **Appendix K2, Agricultural assessment**.

**Table 13-1** identifies the related SEARs to agriculture and where they have been addressed in this chapter.

Table 13-1 SEARs relevant to agriculture

| Ref | Key Issue SEARs | Where addressed |
|---|---|---|
| **7. Socio-economic, Land Use and Property** | | |
| 1. | The Proponent must assess social and economic impacts in accordance with the current guidelines (including cumulative ongoing impacts of the project). | Section 13.3<br>**Chapter 12, Land use and property**<br>**Chapter 14, Socio-economic**<br>**Chapter 25, Cumulative impacts** |
| 2. | The Proponent must assess impacts from construction and operation on potentially affected properties, businesses, Council assets and services, recreational users and land and water users, including property acquisitions/adjustments, access amenity and relevant statutory rights. | Section 13.3 |
| 3. | The design, construction and operation of the project should address and minimise (existing and future) land use conflicts and operations (including existing and ongoing horticultural activities). Siting of project elements should be located in such a way that functional, contiguous areas of residual land and land uses are maximised. | Section 13.3<br>Section 13.4 |
| **9. Soils** | | |
| 1. | The Proponent must assess whether the land is likely to be contaminated and identify if remediation of the land is required, having regard to the ecological and human health risks posed by the contamination in the context of past, existing and future land uses. Where assessment and/or remediation is required, the Proponent must document how the assessment and/or remediation would be undertaken in accordance with current guidelines. | Section 13.3<br>**Chapter 18, Soils and contamination** |
| **16. Safety and risk** | | |
| 3. | The Proponent must assess the biosecurity risk of the project to minimise the inadvertent spread of disease and pathogens affecting horticultural activities, vegetation and threatened fauna. | Section 13.3<br>**Chapter 10, Biodiversity**<br>**Chapter 18, Soils and contamination** |

## 13.1 Assessment methodology

The project passes through a number of agricultural properties farming bananas, blueberry, cucumbers, avocados and custard apples. An agricultural assessment was prepared to assess direct or indirect impacts of the project on the agricultural properties.

The following sections outline the methodology that has been used to assess the direct and indirect impact of the project on agriculture within the region. The study area for this assessment consists of properties within the construction footprint (to assess direct impacts of the project) as well as properties within a buffer 500 m either side of the construction footprint (to assess the indirect impacts which may potentially occur during construction of the project). The study area is shown in **Figure 13-1**.


**Legend**

- Construction footprint
- Agricultural study area
- Alignment
- North Coast Railway
- Watercourse

Coffs Harbour Bypass
Agricultural assessment study area
Figure13-1

0 0.5 1 1.5 km
Scale @A4: 1:50,000
GDA 1994 MGA Zone 56
N

## 13.1.1 Land use survey and interviews

### *Preliminary land classification*

Preliminary classification of land use within the construction footprint and 500 m buffer area to identify agricultural properties was established by desktop investigation, using aerial photography (dated 2018). Major agricultural characteristics were identified including extensive agriculture, intensive plants (particularly bananas and blueberries), irrigation water sources and other uses.

### *Site inspection and interviews*

The construction footprint was inspected to verify the land use categories identified during preliminary classification and to identify potential secondary land uses not identified from the aerial photos.

Interviews were arranged with 15 property owners as a representative sample of farms being directly impacted within the construction footprint. The interviews were conducted in late August 2018 and each property was also inspected. Farmers were asked a number of questions in a semi-structured interview.

The purpose of the interviews was to gather information on agricultural land use within the construction footprint (eg the type and nature and scale of the agricultural business, operations, access and water requirements) and perceptions of business owners and managers about potential benefits and impacts of construction and operation of the project.

## 13.1.2 Impact assessment and criteria

The following impacts have been assessed for the project:

- Direct – an assessment of the impacts on properties that fall wholly or partially within the construction footprint
- Indirect – an assessment of potential impacts on properties outside the construction footprint, but within the 500 m buffer
- Panama disease – consideration of the potential to spread the pathogen and impact on industry
- Microclimate – consideration of the potential to impact the existing microclimate
- Industry – a qualitative assessment of impacts to the blueberry and banana industries.

### *Direct impacts*

A range of assessment criteria for direct physical impacts was considered for each agricultural property within the construction footprint, outlined in **Table 13-2**.

Table 13-2 Direct impact assessment criteria

| Criteria | Description |
|---|---|
| Direct land take | Amount of land being directly impacted (acquired) as a percentage of the total farm. |
| Crop impact | The extent of the direct physical impact on the crops on the property. |
| Structures | The direct impact on structures required for operation of a farm (eg packing shed, protective netting, etc), and consideration of the impact on the overall farm operation and management. |

| Criteria | Description |
|---|---|
| Type of acquisition | Three types of acquisition were considered, including:<br>• Strip acquisition – where a small strip of the lot is to be acquired for the project<br>• Subsurface – where a tunnel is to be constructed beneath a property, subsurface acquisition would be required. This generally would allow farming to continue on the surface<br>• Fragmentation – where the existing farm would be fragmented or severed as a result of the project. |
| Access | The degree of impact on internal access, eg the project may affect one end of the property, change the entry into the farm, cross the farm and/or impact on farming operation. |
| Irrigation water | Impacts on water supply such as bores and dams, and the degree to which access to water is affected. Includes reliance on water for agricultural purposes. |
| Dust | Risk level for dust, considering proximity and extent of earthwork and ancillary facilities, as well as crop sensitivity to dust impacts. |

Each property was evaluated against the criteria in **Table 13-2** and a level of impact was assigned between minor and critical. A description of these impact levels is provided in **Table 13-3.**

Table 13-3 Level of Impact

| Impact level | Description |
|---|---|
| Minor | The farm would continue in its current state, with potential impacts being minor in nature and able to be adequately mitigated. |
| Moderate | The project would have an influence on the operation of the farm, but farming would be able to continue operating with some alterations and management measures being implemented. |
| Serious | Farming viability is likely to be seriously compromised unless significant mitigation measures are implemented. This may include measures such as provision of replacement structures (packing sheds) or water sources. |
| Critical | Farm is likely to cease operation in its current capacity. There is the opportunity for the residual agricultural land to be purchased by adjacent property owners. |

### *Indirect impacts*

Indirect impacts were considered for agricultural properties within a 500 m buffer either side of the construction footprint. The assessment considers elements such as dust potentially affecting crops, temporary or permanent road closures and irrigation water source impacts.

### *Panama disease*

Panama disease is a soil-borne fungal disease that kills banana plants. It invades plants through the roots and blocks the vascular tissue, cutting off the supply of water and nutrients and leads to the death of the plants. Given the pathogen’s longevity, a precautionary approach has been followed for the purposes of the agricultural assessment and it is assumed the Panama disease pathogen could be present within former and existing plantations within the construction footprint. The assessment considers the risk of spreading Panama disease and potential impacts to the industry.

### *Microclimate*

To identify the potential impacts from the construction of the project on microclimate, quantitative and qualitative evaluation was undertaken to assess potential changes to wind speed and temperature, with particular focus on the tunnel portals (see Appendix 2 of **Appendix K2, Agricultural assessment**). The assessment included evaluation of the statistical meteorological data around the tunnel portals and the outward flow of air from the portals, including wind speed and temperature. Meteorological conditions were assessed, with an assessment of the current conditions and the post-construction conditions to determine what changes in wind speed and temperature may be expected after the construction of the tunnels.

### *Industry*

Agriculture in Coffs Harbour is a key contributor to the economy. It supplies the food processing and manufacturing industry and is serviced and supported by the local agribusiness sector. To assess the potential impact on the agricultural industry, the horticulture of the Coffs Harbour region was considered, in the context of NSW and Australia's agricultural production, particularly considering the contribution of banana and blueberry crops. This assessment included consideration of the number of banana and blueberry farms within the region, and the contribution of these crops to the agricultural industry on a local, state and national scale. The assessment then considered what impact the industry could experience with the loss of some agricultural properties as a direct result of the project.

# 13.2 Existing environment

## 13.2.1 Landscape form

The project traverses a hilly to steep terrain with areas of level ground on the valley floors (see **Photograph 13-1** and **Photograph 13-2**). The foothills of the Great Dividing Range mark the transition of topography extending in an east-west direction declining in height to the coastline. The landscape form has created a microclimate that is influenced by the proximity to the ocean and east facing valleys with relatively steep ridges. The steepness of the valleys is conducive to the growing of bananas and the north facing slope is preferred due to its longer daily exposure to sun, especially in winter. Blueberries are grown on the less steep land.

Photograph 13-1 Looking south from Gatelys Road ridge towards Shephards Lane ridge

Photograph 13-2 View from Sealys Lookout looking south towards Roberts Hill

## 13.2.2 Agricultural industry

Historically the Coffs Harbour area was a grazing landscape before bananas were grown on the steep lands around the Coffs Harbour urban area and on land to the north and south along the coastal strip. Northern NSW was the home of the first major commercial banana plantations in Australia and in the 1950s and 1960s Coffs Harbour was the major banana producing LGA in Australia (Centre for Coastal Management 1995a). The Coffs Harbour area and further north along the far north coast of NSW were the main growing regions for bananas in Australia up until the late 1900s when North Queensland began to increase production. NSW now produces 1.4 per cent of Australia's overall banana crop, with 43.3 per cent of this grown in the Coffs Harbour region, with Queensland producing the majority (ABS 2017).

Over the past 10-15 years, the banana industry has reduced as the blueberry sector has had a major increase in production. Blueberries are now the most significant agriculture sector in the Coffs Harbour LGA. Over the past 15 years many banana growers transitioned to growing blueberries, and Coffs Harbour is now the number one blueberry producing LGA in Australia. As of 2017, there are 127 blueberry farms within the Coffs Harbour LGA.

There are around 151 individual lots within the construction footprint, noting that multiple lots can be combined to form one property. Of the 151 individual lots, there are 24 intensive plant land uses (ie farms) within the construction footprint (formed by one or more lots) which farm individual or multiple crops. Crops grown within the construction footprint include bananas, blueberries, avocados, custard apples and protected cropping (generally cucumbers). **Figure 13-2** shows the locations of farms and their primary crops within the study area.

### *Value of agriculture*

The agricultural sector provides a rural backdrop to the region which is a significant tourism asset to the local economy. The identity of Coffs Harbour is synonymous with the Big Banana, which is a tourist attraction that was built in 1964 when the local banana industry was much bigger than it is today (Centre for Coastal Management 1995a).

In 2017-2018, the Coffs Harbour agricultural industry added $116.5 million to the local economy and generated 1395 jobs in Coffs Harbour LGA (.idcommunity 2018e). This represented 4.2 per cent of the LGA's value add and four per cent of all jobs in the LGA.

In 2017-18, the gross value of agricultural production in Coffs Harbour-Grafton region was $278 million, which was two per cent of the total value of agricultural production in NSW of $13.2 billion (ABS 2019). By far, the most important commodity in the region based on gross value of agricultural production were fruit and nuts ($135 million or almost 50 per cent of the region's value of agricultural commodities).

Data for agricultural commodities provided by ABS (2015-2016) provides a further breakdown of commodity and crop types. The gross value of agricultural production in Coffs Harbour LGA was about $113.5 million, with fruit and nuts accounting for almost eighty-five per cent of this gross value. With a gross value of more than $89 million, blueberries accounted for about 80 per cent of the LGA's value of agricultural production, followed by livestock (about nine per cent), nurseries (about five per cent), vegetables (about three per cent) and bananas (about two per cent).

## 13.2.3 Existing agriculture

The 24 farms that intersect the construction footprint cover a total area of about 240 ha. These farms cultivate crops including bananas, blueberry, cucumbers, avocados and custard apples, or some combination of these. More information on the 24 farms is available in **Appendix K2, Agricultural assessment**.

### *Bananas*

There are 12 banana farms within the construction footprint, with an additional five properties growing bananas with another crop. Data from OEH & ABARES states that in 2017, there were 111 banana farms in the Coffs Harbour LGA. Data from ABS states that in 2015-2016, bananas grown in the Coffs Harbour LGA contributed $2.69 million to the agricultural industry, or around 43 per cent of total NSW banana production. The most common banana variety grown in the area is Cavendish, as well as Lady Finger and Ducasse.

The Coffs Harbour area has a long history of producing bananas. The topography of ridges and valleys with steep, well drained slopes with an orientation that means they are protected from more destructive winds and are frost free, are well suited to banana production. Bananas are predominantly grown on the Megan and Suicide soil landscapes because of the good drainage which is suited to banana growing (see **Chapter 18, Soils and contamination** for more information on soil landscapes).

Cavendish variety is grown on a dryland basis and Lady Finger and Ducasse varieties require irrigation to get the best yield.

After harvesting the fruit, the banana corms (the above-ground structure) are cut down and left to mulch the surrounding land, and a new trunk is grown from the root system. The composting of the old corms adds to the soil fertility by adding organic matter to the soil. It is not uncommon for the banana plants to be 20 to 30 years old.

Once banana fingers emerge from the bell, they are covered with plastic bags. The bunches are cut and then transported to the packing shed, then they are sorted, packed and sent to the ripening facility where they are ripened and then sent to the local, Sydney and interstate markets.

Banana plants are susceptible to wind damage and are normally staked to prop the trunks up. The northerly aspect is the best for growing and gets a much higher yield than the southerly sloping lands, particularly in winter when from 2 pm the southern slopes are in shade whilst the northern slopes are still in full sun. When the temperature is lower, the bananas are slower to grow, and the cooler weather can also lead to dull coloured fruit rather than the bright yellow that comes from warmer areas.

### *Blueberries*

There are six blueberry farms within the construction footprint, and another three properties growing blueberries with another crop. Data from OEH & ABARES states that in 2017, there were 127 blueberry farms within the Coffs Harbour LGA. Data from ABS states that in 2015-2016, blueberries grown in the Coffs Harbour LGA contributed $89.8 million to the agricultural industry, or over 75 per cent of total NSW blueberry production. The blueberry industry in NSW was valued at $117 million in 2015-2016 and has grown considerably since then, and is expected to continue to grow, with overseas export markets currently being investigated (ABS 2017).

Blueberries are harvested all year round, but the main harvest season is from March to December. The plants are grown in raised beds which are irrigated via drip or sub-surface irrigation. Water is sourced from bores, pumped from creeks or farm dams which are mostly spring fed. They are grown on flat to hilly land, but most farmers prefer flatter land because of the ease of harvest which happens by hand. Netting is often used to protect the crop from birds and other animals.

### *Cucumbers*

Cucumbers are often grown as secondary crops for banana and blueberry farms to provide an alternate source of income for some farmers. There are no statistics available on the contribution of cucumbers to the agricultural industry in Coffs Harbour LGA or NSW. They are more commonly grown in conjunction with blueberries to provide an income stream when there is no production from the blueberries. There is only one farm that grows cucumbers as its sole crop within the construction footprint.

Cucumbers are grown in protected cropping structures (greenhouses) and require a constant source of water.

### *Avocados and custard apples*

Avocados and custard apples are also grown as a secondary crop. They can be either grown on a dryland basis or irrigated, with irrigated crop generally producing a better yield. Data from ABS states that in 2015-2016, avocados grown in the Coffs Harbour LGA contributed $684,840 to the agricultural industry, or less than two per cent of total NSW avocado production. No statistics on custard apples are available.

There are two avocado growers in the construction footprint and only one is irrigated. Coffs Harbour grows 0.2 per cent of Australia’s avocado crop. There is only one custard apple grower in the construction footprint, as most of Australia’s custard apples are grown in the sub-tropical and tropical coast of Queensland and Northern NSW.

## 13.2.4 Panama disease

Panama disease is caused by the soil-borne fungus *Fusarium oxysporum f. sp.cubense*. This pathogen is considered a serious threat to banana plantations as it is known to invade banana plants through the roots, cutting off the supply of nutrients to the plant and leading to death (DPI 2017).

There are four races of Panama disease, including:

- Race 1 which infects Lady Finger, Sugar and Ducasse bananas, but not Cavendish
- Race 2 which infects cooking bananas like Bluggoe and Blue Java bananas
- Race 3 which infects only Heliconia species, not bananas
- Race 4 which infects most varieties of bananas, including the main commercial variety, Cavendish.

Races 1 and 4 are relevant to the Coffs Harbour LGA given the varieties of bananas grown, however; the two strains of Race 4 (Tropical and Subtropical) have not been detected Coffs Harbour LGA.

The disease is easily spread by the movement of infected planting material and over short distances via root to root contact and through soil. Spread can also occur from parent plants to suckers. The disease can also be moved with soil (including dust), water and on contaminated equipment, vehicles and people. Fungal spores can survive in the soil for over 50 years and once Panama disease is present in the soil it cannot be eradicated (Queensland Government Department of Agriculture and Fisheries 2018).

Consultation with DPIE (Regions, Industry, Agriculture & Resources) in September 2018 identified three properties with known Panama disease close to the project. All areas are infected with Race 1.

## 13.2.5 Microclimate

The project is located to the west of the Coffs Harbour urban area and traverses a hilly to steep terrain for the majority of the project with some flat land on the valley floors. The landscape form in this area creates a unique microclimate, which is important for the agricultural land uses in the area. The Banana Growers Association of Coffs Harbour and District have raised concerns about potential microclimate impacts if cuttings were used to cross the major ridges. This included potential for increased winds, particularly from the south, which would impact banana trees and the southerly winds would also blow in colder air, causing fruit chilling.

In the three years from 2015 – 2017, the most common winds have been from the south-west and north-west, with smaller varying degrees of winds from the eastern to southern quadrants (BoM 2019).

Regular winds at a speed between 2.5 and five metres per second (m/s) can cause dust abrasion of fruit, and speeds of between five and ten m/s can cause tearing of banana leaves, which leads to reduced productivity. Blow downs (where the wind may knock down the banana plant) occur when winds speeds are higher than 15 m/s (Robinson and Sauco 2010). Currently, the five to ten m/s range occurs around 30 per cent of the time. The risk of speeds higher than 15 m/s occurs less than 0.01 per cent of the time.

Some banana plantations enjoy a shielding effect from winds from certain directions, being on the lee side of a hill. Some farmers have raised concern that the construction of a tunnel through these hills could impact on this lee-side protection. This is discussed further in **Section 13.3.4**.

A review of the observed temperatures was also undertaken as part of the microclimate assessment. The results showed that the temperatures range between 10 – 30 degrees Celsius (°C) the vast majority of the time (93.3 per cent), with the temperate not exceeding 40°C. Cooler winds (defined as less than 10°C) come from the west (inland) and the north but are relatively infrequent, occurring only 6.3 per cent of the time.

Further details on the microclimate relevant to the project are discussed in Appendix 2 of **Appendix K2, Agricultural assessment**.


Coffs Harbour Bypass
Primary crops within study area
Figure 13-2

# 13.3 Assessment of potential impacts

## 13.3.1 Direct impact assessment

Each of the 24 farms was assessed to determine the level of impact as detailed in **Table 13-2.** The sections below provide a summary of the level of impact on each criterion. More detailed property assessments are provided in Appendix 1 of **Appendix K2, Agricultural assessment.**

### *Direct land take*

The size of the 24 farms within the construction footprint range from less than one hectare in size, to close to 50 ha. On average, farms are around 10 ha. The area of farm land for each property acquired for the project ranges from less than one per cent (of a property of 11 ha) to total acquisition (100 per cent), with a greater area of bananas being impacted than any other crop. The majority of the agricultural land take is through the central section of the project. Less agricultural land take is required at the southern and northern extents as the project ties into existing infrastructure.

### *Crop impact*

The impact on crops for each property ranged from no impact on any crops, through to removal of small strips or sections of crops, large crop areas and removal of the entire area of crop so that no viable cropping area remains. **Table 13-4** provides a summary of the levels of impact on crops within the construction footprint.

Table 13-4 Impact on crops summary table

| Level | Description | Number of farms |
|---|---|---|
| No impact | No area of crop impacted | 3 |
| Minor | Only a small impact on total crop area | 7 |
| Moderate | Generally, less than 50% of total crop area impacted by the project | 6 |
| Serious | Generally, more than 50% total crop area impacted, with enough crop area retained to remain potentially viable | 4 |
| Critical | No viable area of crop would be retained | 4 |

### *Structures*

The level of impact on structures required for operation of a farm (such as packing sheds) was assessed, including consideration of how removal of these structures could potentially impact overall farm operation and management. Impacts range from no impact, an impact on one packing shed or cropping structure when there are multiple structures on the farm through to the removal of all structures, including the removal of worker's facilities. Packing sheds are the most commonly impacted structure as a result of the project. **Table 13-5** provides a summary of the levels of impact on structures within the construction footprint.

Table 13-5 Impact on structures summary table

| Level | Description | Number of farms |
|---|---|---|
| No impact | No structures impacted | 9 |
| Minor | Limited impact or single structure when multiple structures are used on the farm | 1 |
| Moderate | Structures impacted by the project, but use could continue with modification | 7 |
| Serious | Main operating structure/s impacted | 4 |
| Critical | All structures removed. | 3 |

### *Type of acquisition*

The type of acquisition has been assessed for the farms within the construction footprint. Acquisition ranges from areas of less than a one per cent strip acquisition, to a longer strip generally along one side of the property. Subsurface acquisition has the potential to limit development above the project in some circumstances, though there would be no direct impact to the properties at the surface, or the use of the land. Generally, property owners would be able to continue farming activities. Where properties are fragmented or severed, it is unlikely that they could continue to operate in the existing capacity and would likely cease to operate as a farm.

Roads and Maritime currently owns three agricultural farms within the construction footprint (two banana farms and one blueberry farm). This land is currently being farmed under a lease arrangement and is being considered as part of the agricultural assessment. Leased agricultural land within the construction footprint would have its lease extinguished prior to the start of construction with other areas unaffected by construction likely to remain being leased for farming and/or sold afterwards as a viable farming operation.

**Table 13-6** provides a summary of the numbers of farms impacted by each type of acquisition within the construction footprint.

Table 13-6 Acquisition assessment summary

| Level | Description | Number of farms |
|---|---|---|
| Minor | Small strip of lot acquired for the project or area of subsurface acquisition required | 9 |
| Moderate | Larger strip of lot acquired for the project and / or area of subsurface acquisition required | 4 |
| Serious | Lot could be fragmented or severed, or large proportion of the lot acquired | 4 |
| Critical | Whole property would be fragmented or acquired in total | 7 |

### *Access*

Impacts on both internal and external access have been assessed. Levels of impact range from no change to access, minor changes to access to properties that would be reinstated once the project was constructed, impacts to internal access roads and paths or critical where the property has been fully acquired by Roads and Maritime. **Table 13-7** provides a summary of the number of each type of impact on access.

Table 13-7 Summary of impacts to access

| Level | Description | Number of farms |
|---|---|---|
| No impact | No changes to access | 3 |
| Minor | Minor impacts to access arrangements and existing access would be reinstated | 10 |
| Moderate | Access arrangements would be altered by the project | 7 |
| Serious | Significant changes or adjustments to the original access to the property required | 1 |
| Critical | Access cut off, likely where property has been fully acquired | 3 |

### *Irrigation water*

Producing blueberries, avocados and cucumbers, Lady Finger and Ducasse bananas generally relies on irrigation. Although avocados and these banana varieties can grow without irrigation, they get the best yield if they are irrigated. Cavendish bananas do not need irrigation and rely only on rainfall. For the farms being impacted by the project, irrigation is sourced from dams, creeks and bores.

Irrigation water is generally sourced from spring fed dams, creeks and bores. Of the eleven farms within the construction footprint that use irrigation, there are seven farms that have spring fed dams, four who have a licence to extract from creeks, one that has a bore and two that have rain fed dams. Some of these farms have both creek extraction and spring fed dams.

Where these sources of irrigation water are impacted, these sources would be replaced (such as providing a new water pump, or relocating a bore), and this is likely for two properties. However, there are circumstances where there are no appropriate alternative sources of water, and three banana farms would have their irrigation water source critically impacted. One of these farms would be entirely acquired as a result of the project and cease to operate, and the other two properties have no appropriate alternative sources of water. Potential impacts on water sources is summarised in **Table 13-8**.

Table 13-8 Summary of impact on irrigation water

| Level | Description | Number of farms |
|---|---|---|
| No impact | No change to existing conditions | 13 |
| Minor | N/A | - |
| Moderate | Source such as a pump is impacted by the project but could be replaced | 2 |
| Serious | Dam or bore impacted by the property but could potentially be relocated or deepened | 6 |
| Critical | Water source would be completely removed and no possibility of replacement | 3 |

### *Risk of dust impacts*

Dust can impact farm crops in various ways. Bananas are bagged when they emerge from the bell, however, when the fingers are young and not bagged there is potential for dust to coat them. This can lead to discolouration of the skin as well as the banana fingers rubbing on the dust and leading to discolouration. While this does not impact the quality of the fruit inside the skin in the case of bananas, consumers reject purchasing discoloured fruit.

Dust can also coat blueberries and avocados, affecting the skin colour and again leading to consumer rejection. While washing can remove some dust, there is the risk that not all dust would be removed. If not washed off, dust can become a permanent stain on the fruit. Cucumbers are generally grown in cropping structures which are opened for climate control. Dust can enter these structures when they are open, however dust can generally be washed off cucumbers.

A coating of dust on leaves of farm crops may also interfere with photosynthesis and delay growth and reduce yields.

The risk of dust impact from the project has been assessed based on the proximity of crops to proposed earthwork and ancillary sites, as well as the sensitivity of the crop. No farms would be critically impacted by dust impacts, with most being assessed as having a moderate to serious risk of dust impact. Potential risk of dust impact has been assessed and **Table 13-9** provides a summary of the assessment. The property with a minor impact is a blueberry farm where the impact is limited to a small section of property frontage, some distance from the crops. All other farms have the potential to experience moderate to serious dust / impacts during construction.

Table 13-9 Summary of potential risk of dust impacts

| Level | Description | Number of farms |
|---|---|---|
| Minor | Limited earthworks, crops further from construction footprint | 1 |
| Moderate | Closer to areas of earthworks, proximity of crops to construction footprint | 7 |
| Serious | Substantial areas of earthworks, crops in close proximity to construction footprint and ancillary sites | 16 |
| Critical | N/A | - |

### *Summary of direct impacts*

The overall impact on farms has been assessed considering all of the criteria discussed above and a summary of these results is provided in **Table 13-10**, with the detailed assessment provided in **Appendix K2, Agricultural assessment**. Six farms within the construction footprint would be critically impacted and cease operation entirely. These farms are all banana farms and range from 1.4 ha to 5.6 ha in size, so they are all relatively small farms compared to the average within the construction footprint.

Three of these critically impacted properties would be fully acquired as a result of the project, while the others would only be partially acquired, and there would be residual land following acquisition. One property would only have about 16 per cent of its land acquired, however the area impacted consists entirely of banana crop, with the remaining area being covered with native vegetation. While the direct impact to the property is relatively minor, the impact on agriculture is critical and farming could no longer continue.

**Table 13-11** provides a summary of the six properties that would be seriously impacted as a result of the project, including the size of the farm and percentage of land required for construction, as well as a summary of potential mitigation measures required for the farm to remain operational.

Table 13-10 Summary of total impact on farms within the construction footprint

| Impact level | Description | Number of farms assessed at this level | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Banana | Blueberry | Banana & blueberry | Banana, blueberry & cucumber | Banana, avocado & cucumber | Banana, avocado & custard apple | Protected cropping[1] | **Total** |
| **Minor** | The farm would continue in its current capacity, with potential impacts being minor in nature and adequately mitigated during construction. | 1 | 2 | 1 | | | 1 | 1 | **6** |
| **Moderate** | The project would have an influence on the operation of the farm, but farming would be able to continue operating with some alterations and management measures being implemented. | 2 | 3 | 1 | | | | | **6** |
| **Serious** | Farming viability is likely to be seriously compromised unless extensive mitigation measures are implemented. This may include measures such as provision of replacement structures (packing sheds) and/or water sources, reconfiguration of internal farm management access, etc. | 3 | 1 | | 1 | 1 | | | **6** |
| **Critical** | Farm is likely to cease operation in its current capacity. There is the opportunity for the residual agricultural land to be purchased by adjacent property owners. | 6 | | | | | | | **6** |

1 – Protected cropping structures (greenhouses) generally grow cucumbers and has been assumed for the purposes of the assessment

Table 13-11 Summary of seriously impacted properties

| Crop | Farm area (ha) | Land take (%) | Impact assessment summary and management discussion |
|---|---|---|---|
| Banana, blueberry and cucumber | 21.20 | 39.01 | This property would be seriously impacted and is likely to cease operation in its current capacity. Impacts on the blueberry plantation have been avoided and this crop production could continue. One dam, packing sheds and protected cropping structures (for cucumbers) would be removed by the project, however two dams would remain. There is the opportunity for the residual agricultural land to be purchased by an existing adjacent land owner. |
| Banana | 10.19 | 20.18 | This farm would not continue to operate in its current capacity as it would be severed by the project. For farming to continue at this property, the connection to Coffs Creek would need to be reinstated. There is the opportunity for the residual agricultural land to be purchased by an existing adjacent land owner |
| Banana | 3.99 | 37.75 | In order for the farm to remain viable, a new packing shed would need to be provided. Around a third of the existing crop would be removed as a result of the project. |
| Banana, avocado and blueberry | 7.30 | 17.02 | While the design has been refined to reduce potential impacts on packing sheds, one would still be removed as a result of the project. In order for the farming to continue to be viable, mitigation measures will need to include replacement or movement of a packing shed, new irrigation system and altered internal access tracks. |
| Blueberry | 6.95 | 25.39 | Packing sheds, worker's facilities and water supply bores would be removed as a result of the project. For the farm to remain viable a replacement water bores would need to be provided, as well as the relocation of packing sheds and worker's facilities. |
| Banana | 10.29 | 61.17 | The farm would need to adjust management practices in order to continue operation, and a large portion of banana plantations would be impacted. However, opportunity remains for banana farming to continue on land not impacted by the project, provided the packing shed could be relocated. |

## 13.3.2 Indirect impacts

Potential indirect impacts are likely to be temporary and experienced during the construction phase of the project. These impacts include dust, temporary access changes and temporary impacts on irrigation water sources.

The Oz Group Packhouse is located within the construction footprint within the Isles Drive industrial area adjacent the intersection of Englands Drive and the existing Pacific Highway. This is the primary packaging facility for blueberries in the Coffs Harbour region, and also packages raspberries and blackberries. While this is not an agricultural property and has not been assessed as such, it is an important facility for the local area and would be highly sensitive to potential dust impacts during construction. A small strip of the property would be acquired for the project which would result in the loss of some car parking, and temporary changes to access, however access would be maintained at all times. More information on the potential parking and business impact is provided in **Chapter 8, Traffic and transport** and **Chapter 14, Socio-economic** respectively.

### *Dust*

Dust impacts would vary depending on the construction activity occurring, duration, soil type and the topography, wind speed and direction. Agricultural properties outside the construction footprint, but within the 500 m buffer area may experience dust soiling as winds may transport dust and emissions, which can stain or bruise the skin of fruit and may not be entirely removed through washing.

For all construction activities, the construction contractor will adopt appropriate mitigation measures to reduce the risk of significant impacts on nearby properties, including farms within the 500 m buffer area. As shown in **Figure 13-2**, there are a range of farms within this 500 m buffer area which are at risk of experiencing occasional dust spoiling impacts. Further detail on dust impacts during construction is provided in **Chapter 21, Air quality**.

### *Temporary access changes*

Some roads would be required to be temporarily closed during construction and there would also be property adjustment works which may result in temporary access impacts. Diversions would be implemented to provide access to private properties and farms. There would be temporary changes to traffic conditions, including access to local roads and the existing Pacific Highway and increased travel times due to construction works. Property owners may need to change their usual travel routes and may also experience traffic delays during the construction phase.

Construction traffic management measures will be included in the Traffic Management Plan prepared for the project to minimise impacts during construction. This plan will include requirements and methods to consult and inform the local community of impacts on the local road network. This would include the agricultural properties in proximity to the project. More information on temporary traffic changes and potential impacts during construction are discussed in **Chapter 8, Traffic and transport**.

### *Irrigation Water*

In terms of impacts outside the construction footprint, **Appendix N, Groundwater assessment** states that changes to groundwater levels or local throughput in the fractured bedrock may impact on the availability of water recharging the agricultural dams.

There are several agricultural dams which could potentially be affected by changes in groundwater levels caused by the project (ie they are located within the one metre drawdown contour). Dams that are spring fed from the fractured bedrock aquifer are likely to be most at risk of impact from changes in the groundwater environment as a result of construction and long-term changes to groundwater levels. Local changes to surface water flows may also affect nearby dams. Changes to groundwater levels or through flow down gradient of drained tunnels and cuttings could have a direct impact on those agricultural dams which are partially reliant on the underlying groundwater.

Site investigations for the project have not confirmed the exact source of water for those agricultural dams, which means that it is not possible to accurately predict the impact at these locations. It is likely that some of the agricultural dams are reliant on multiple sources of water for supply, with spring discharge or direct connection with the fractured bedrock likely making up some contribution along with surface run-off (but not necessarily at every location). For the purposes of the assessment, a conservative assumption is made that agricultural dams within the zone of drawdown of the cuttings could be impacted by a reduction in groundwater flow into the dams. **Chapter 20, Groundwater** provides more information with regards to groundwater drawdown and impacts.

In addition, there is a risk that the quality of irrigation water may be affected through the disturbance of soils and sediments during construction. This could release stored nutrients including nitrogen and phosphorus, which could increase the potential of algae blooms that may interfere with irrigation equipment (clogging filters and pumps and resulting in reduced water flow).

During construction there is the risk of disturbance of contaminated soils, which may increase risk the release of contaminants such as heavy metals into the receiving environment. This is discussed further in **Chapter 18, Soils and contamination**.

Where the quality of irrigation water may be impacted by construction, potential impacts would be minor and temporary in nature. Standard mitigation measures will be employed to manage impacts, as discussed in **Chapter 19, Surface water quality**.

Additionally, during construction, the contributing catchment area of several agricultural dams immediately downstream of the project would be reduced, potentially affecting supply reliability from surface runoff. Some storages may have limited or negligible demand requirements, hence differences may not be considered adverse. More information is provided in **Chapter 17, Flooding and hydrology**.

### 13.3.3 Panama disease

Excavation of soil and movement of material, plant and equipment, vehicles and personnel around the site during construction has the potential to spread Panama disease into uncontaminated areas resulting in banana plant deaths and potentially risking the viability of banana plantations. Given the characteristics of Panama disease and the ease with which it can be spread, effective controls and procedures will need to be developed and implemented to manage risks associated with spreading the disease. A Panama Disease Control Management Plan will be developed to manage risks associated with potentially infected plant material prior to, during and following clearing and grubbing, movement of the pathogen in soils and water due to erosion and sedimentation during construction and movement of the pathogen via contaminated construction equipment, vehicles and personnel entering and leaving the construction footprint. The plan will be developed in consultation with DPIE (Regions, Industry, Agriculture & Resources) and representatives of the Banana Growers Association of Coffs Harbour & District.

### 13.3.4 Microclimate

An assessment of the impact of the tunnels at Roberts Hill, Shephards Lane and Gatelys Road was undertaken to consider the changes to wind speed and changes to temperature once the tunnels have been constructed (Appendix 2 of **Appendix K2, Agricultural assessment**). Depending on the length of a tunnel, wind flowing through and exiting the portals can cause disruption. Generally, tunnels longer than one kilometre provide resistance to allowing wind to pass through the tunnel, due to friction of the surfaces (eg walls and floor of the tunnel). Very little air can be forced through by larger atmospheric forces (such as ambient wind) and only traffic-induced air flows will occur. For tunnels between 500 - 1000 m in length, the wind can have an effect, as the roughness or pressure resistance inside the tunnel does not always prevent wind from flowing into and through the tunnel. Mostly this is regarded as minimal, and only traffic-induced air flow out of the tunnel needs to be considered. For tunnels shorter than 500 m, the wind can overcome the resistance to flow inside the tunnel, and the local surrounding terrain and the metrological conditions will determine if it is easier for the wind to pass over, rather than through the short tunnel section.

It is mainly wind above a certain speed, and from specific directions, that is able to pass through a shorter tunnel. In particular, if the wind direction is within about 30˚ of the longitudinal direction of the tunnel, wind may blow through the tunnel. This flow of wind is affected by internal resistance due to traffic and fixed installations within the tunnel. As described above, when a tunnel is short it has less internal resistance, therefore more potential through-flow of the wind can occur. If the traffic is equal in both directions, the wind flow inside the tunnel will be reduced further due to the interaction of the vehicles’ turbulent wakes and the wind-forced flow.

The Shephards Lane and Gatelys Road tunnels would be aligned nearly east-west, and Roberts Hill tunnel would be aligned nearly south-north. **Table 13-12** shows the frequency these aligned wind speeds currently occur.

Table 13-12 Frequencies of wind speeds for relevant wind directions

| Wind speed (m/s) | Criteria (Robinson and Sauco 2010) | Shephards Lane and Gatelys Road tunnels | | Roberts Hill tunnel | | All directions (% of time) |
|---|---|---|---|---|---|---|
| | | From east (% of time) | From west (% of time) | From south (% of time) | From north (% of time) | |
| All speeds | | 6.5 | 16.9 | 13.0 | 19.9 | 100 |
| 0 – 2.5 | | 0.5 | 7.0 | 0.6 | 3.0 | 15.8 |
| 2.5 – 5 | Dust abrasion | 4.6 | 8.8 | 5.3 | 11.7 | 51.2 |
| 5 – 10 | Leaf tearing | 1.3 | 1.2 | 6.6 | 5.1 | 30.8 |
| 10 – 15 | | 0.1 | 0.01 | 0.5 | 0.1 | 2.1 |
| > 15 | Blow down | 0.000 | 0.000 | 0.010 | 0.000 | 0.010 |

The most commonly occurring wind range of 2.5 to 5 m/s can cause dust abrasion, and currently occurs about half (51.2 per cent) of the time. This wind speed is only aligned with the Shephards Lane or Gatelys tunnels' eastern entrances 4.6 per cent of the time and western entrances 8.8 per cent of the time. The construction of a tunnel through the ridge would increase the overall frequency of east-west wind within the dust abrasion range to 13.4 per cent, which is considered a modest increase.

For the Roberts Hill tunnel, the wind direction is aligned with the northern entrance only 11.7 per cent of the time, and with the southern entrance only 5.3 per cent of the time. Construction of this tunnel would increase the frequency of north-south wind to 17 per cent, which is also considered a modest increase.

The next most commonly occurring wind range is between 5 to 10 m/s, which occurs about 30 per cent of the time. However, this range is only aligned with Shephards Lane and Gatelys Road tunnels 1.3 per cent and 1.2 per cent of the time (wind from each direction). Introduction of a tunnel through these ridges would increase the likelihood of this wind range occurring to a total of 2.5 per cent of the time, which is considered a very minor increase.

For Roberts Hill tunnel, the introduction of the tunnel would increase likelihood of the same wind range occurring to 11.7 per cent of the time, which is considered a modest increase.

Based on the above it can be concluded that the tunnels at Roberts Hill, Shephards Lane and Gatelys Road will have a very low wind-induced impact, given the existing local wind environment and the alignment of the tunnel portals. Additionally, any changes due to the outflow of wind from the tunnels would be limited to an area immediately downwind of the tunnel portal and within the indicative road corridor described in **Chapter 5, Project description**. This is due to the internal 'friction' of the tunnel and the traffic slowing down the airflow within the tunnel.

With regards to impacts from temperature, in order for effects to be noticeable, the cooler wind would need to be aligned with the tunnels. The microclimate assessment showed that the combination high wind speeds and low temperatures would be very infrequent and would happen less frequently than either high wind speed or low temperature alone. The assessment concluded that the winds are so seldom aligned with the tunnels that potential changes might occur, at most, three per cent of the time.

It is possible that cooler southerly winds would currently travel over the existing ridgelines, rather than be blocked by any significant degree, in which case the change as a result of the tunnels would be minimal.

As such, any changes in other microclimate parameters like temperature or humidity would similarly only be experienced immediately adjacent the portals and within the indicative road corridor.

Notwithstanding, an Automatic Weather Station (AWS) will be established for the project at a representative location to confirm the outcomes of the wind flow and microclimate investigations.

More information on the microclimate assessment and conclusion is available in Appendix 2 of **Appendix K2, Agricultural assessment.**

### 13.3.5 Industry

It is considered that the loss of six banana farms out of 111 within the Coffs Harbour LGA would not have a significant impact on the banana industry in Coffs Harbour. No blueberry farms would be removed by the project, and there is unlikely to be a significant impact on the industry. There may be some impacts on the industry during the construction period as dust impacts could negatively impact crop quality and yield. These potential impacts are likely to be minor and temporary in nature. Further consideration of agricultural industry impacts is provided in **Chapter 14, Socio-economic**.

## 13.4 Environmental management measures

**Table 13-13** provides a range of mitigation and management measures proposed to address and minimise impacts on agricultural properties during construction and operation of the project.

In addition to the measures provided in **Table 13-13**, Roads and Maritime would continue consulting with directly affected property owners during the construction and land acquisition processes. This consultation may identify additional or revised mitigation and management measures to further minimise impacts. Appendix 1 of **Appendix K2, Agricultural assessment** provides a summary of which environmental management measures are to be applied to each agricultural property within the construction footprint.

There are interactions between the mitigation measures for agriculture and **Chapter 8, Traffic and transport, Chapter 18, Soils and contamination, Chapter 20, Groundwater** and **Chapter 21, Air quality**.

Table 13-13 Environmental management measures for agricultural impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Partial property acquisition | AG01 | Where a property is not subject to a total acquisition, a specialist agricultural consultant will be engaged at the request of affected property owners whose properties are seriously or critically impacted by the project to assist in assessing opportunities for agricultural diversification and/or revised farm management practices. | Roads and Maritime | Prior to construction |
| Impact on irrigation water source | AG02 | Impacted irrigation water sources and/or infrastructure will be restored, replaced, relocated or compensated for in consultation with affected property owners. | Roads and Maritime / Contractor | Prior to construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Impact on agricultural structures | AG03 | Impacted structures, eg packing sheds and cropping structures, etc, will be replaced or reconfigured in consultation with affected property owners where feasible. | Roads and Maritime / Contractor | Prior to construction |
| Impact on property access | AG04 | Internal farm access impacted by the project will be reconfigured in consultation with affected property owners where reasonable and feasible. | Roads and Maritime / Contractor | Prior to construction |
| | AG05 | Existing property accesses will be maintained during construction. Where this is not feasible or reasonable, temporary alternative access arrangements will be provided in agreement with and following consultation with the affected property owners with consideration given to existing farming practices. | Contractor | Prior to and during construction |
| Dust impacts | AG06 | Real time dust monitoring will be undertaken at representative locations of dust sensitive agricultural receivers along the project alignment to allow for the timely management of dust generation on-site and to minimise potential impacts. The representative locations of dust sensitive agricultural receivers will be determined during detailed design and will include the Oz Group Packhouse.<br>Monitoring would be undertaken in accordance with the Approved Methods for the sampling and analysis for air pollutants in NSW (DEC 2005) where applicable. | Contractor | Prior to and during construction |
| Wind and microclimate impacts | AG07 | An Automatic Weather Station (AWS) will be established at a representative location to confirm the outcomes of the wind flow and microclimate investigations. The AWS will be established in accordance with the Bureau of Meteorology's Observation Specification No. 2013.1: Guidelines for siting and exposure of meteorological instruments and observing facilities. | Roads and Maritime | Prior to, during and post construction |
| Managing the spread of Panama disease | AG08 | A Panama Disease Control Management Plan will be prepared and implemented during construction in consultation with DPIE (Regions, Industry, Agriculture & Resources) and representatives of the Banana Growers Association of Coffs Harbour & District. The Plan will be prepared in accordance with relevant Queensland's Department of Agriculture and Fisheries guidelines including Panama disease tropical race 4: Biosecurity standards and guidelines (QDAF 2015) and Panama disease tropical race 4: Decontamination guide (QDAF 2016). | Roads and Maritime / Contractor | Prior to and during construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | | Specific management measures and controls will address the following as a minimum for all existing and former banana plantations within the construction footprint:<br>• Cleaning and washdown procedures for construction plant, vehicles and equipment and personnel<br>• Clearing and grubbing practices<br>• Stockpile management procedures for topsoil and other materials<br>• Procedures for the management and/ or disposal of contaminated and/ or potentially contaminated Panama disease soils including its identification as such to prevent accidental spread of the disease by others<br>• Erosion and sediment control requirements<br>• Dust management controls<br>• The movement of construction plant, vehicles and equipment and personnel both within the project and externally, including where construction plant and equipment may have previously worked in other affected areas such as north east Queensland<br>• Revegetation and rehabilitation practices. | | |

CHAPTER 14

Chapter 14

# Socio-economic

# 14. Socio-economic

This chapter presents an assessment of the potential socio-economic impacts of construction and operation of the project and identifies mitigation and management measures to minimise or reduce these impacts. **Table 14-1** lists the SEARs relevant to socio-economic impacts and where they are addressed.

Table 14-1 SEARs relevant to socio-economic impacts

| Ref | Key Issue SEARs | Where addressed |
|---|---|---|
| **7. Socio-economic** | | |
| 1. | The Proponent must assess social and economic impacts in accordance with the current guidelines (including cumulative ongoing impacts of the project). | Section 14.2.1<br>Section 14.3<br>**Chapter 12, Land use and property**<br>**Chapter 13, Agriculture**<br>**Chapter 25, Cumulative impacts** |
| 2. | The Proponent must assess impacts from construction and operation on potentially affected properties, businesses, Council assets and services, recreational users and land and water users, including property acquisitions/adjustments, access amenity and relevant statutory rights. | Section 14.3<br>**Chapter 8, Traffic and transport**<br>**Chapter 12, Land use and property**<br>**Chapter 13, Agriculture** |
| 4. | The Proponent must assess potential impacts on utilities (including communications, electricity, gas, and water and sewerage) and the relocation of these utilities. | Section 14.3<br>**Chapter 12, Land use and property**<br>**Chapter 5, Project description** |
| 5 | A draft Community Consultation Framework must be prepared identifying relevant stakeholders, procedures for distributing information and receiving/responding to feedback and procedures for resolving stakeholder and community complaints during the design, construction and operation of the project. Key issues that must be addressed in the draft Framework include, but are not limited to:<br>(a) traffic management (including property access, pedestrian access),<br>(b) landscaping/urban design matters,<br>(c) construction activities including out of hours work, and<br>(d) noise and vibration mitigation and management,<br>(e) soil erosion and water quality management, and<br>(f) interaction with existing land uses. | **Appendix D, Draft Community consultation framework** |

## 14.1 Assessment methodology

The socio-economic assessment was carried out in accordance with the Roads and Maritime Environmental Impact Assessment Practice Note Socio-economic assessment 2013 (Roads and Maritime Services 2013a) for a 'comprehensive' assessment. The assessment is based on quantitative data, such as population statistics, and qualitative data, such as location and types of social infrastructure.

The following steps were taken to carry out the socio-economic assessment:

- Identification of relevant study area
- Review of existing information to establish baseline conditions
- Undertaking an impact assessment to assess the significance of potential impacts and benefits associated with the project
- Planning mitigation and management actions to address potential impacts.

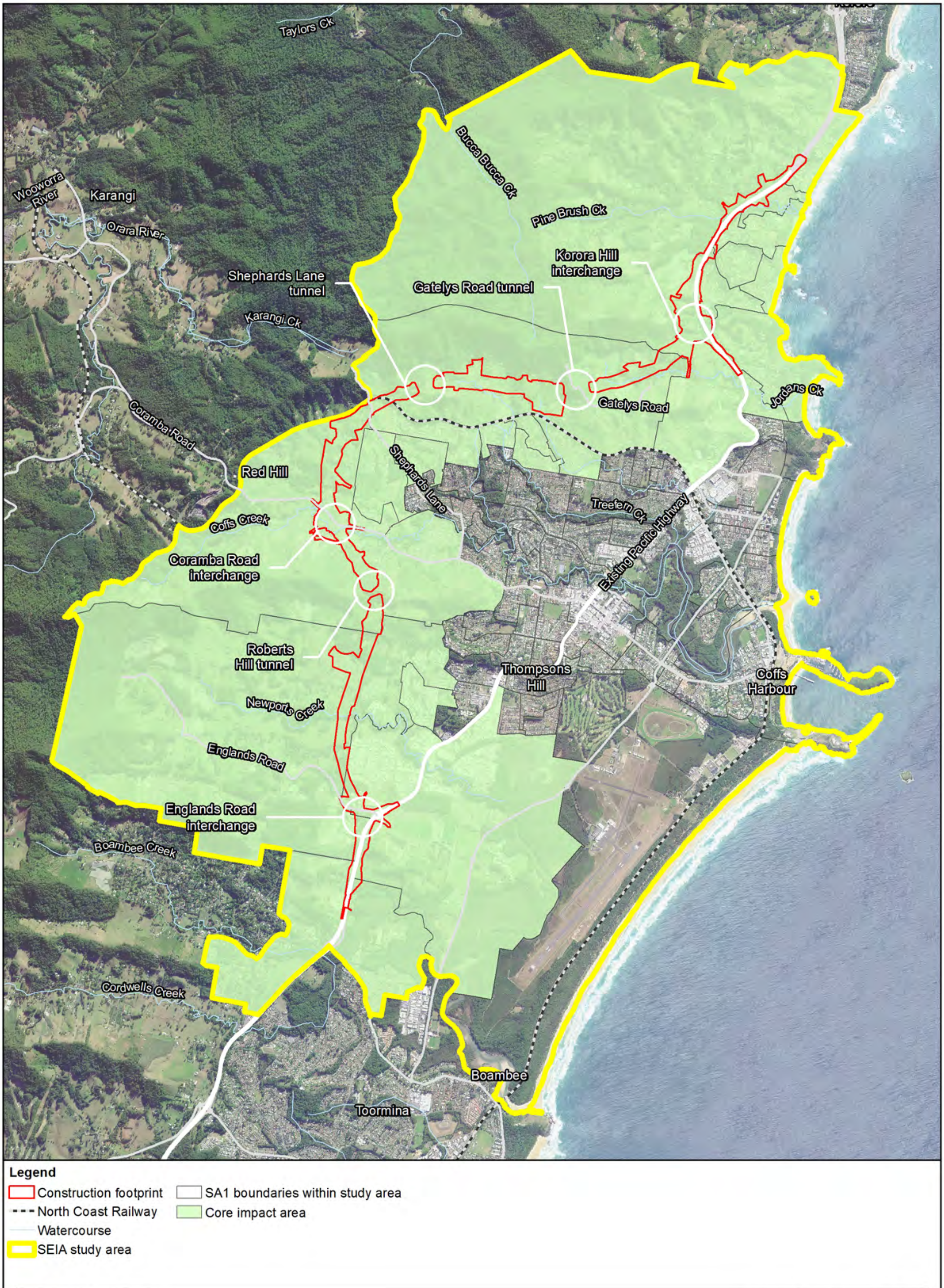
### 14.1.1 Study area

The study area for the socio-economic impact assessment (SEIA study area) is a compilation of 86 Australian Bureau of Statistics (ABS) Statistical Areas level 1 (SA1). This allows for reporting of census data by statistical area and maximises the spatial detail for investigation (ABS 2011; ABS 2016).

The SEIA study area consists of communities intersecting the project and the existing Pacific Highway, as well as those located between these elements. It includes SA1s extending east of the Pacific Highway as these contribute an important employment role. These communities have the potential to experience a change in conditions as a result of the project.

A core impact area has also been established to enable more refined reporting of demographic data for the communities immediately adjacent to the project, which consists of 27 SA1s. The communities immediately adjacent to the project would experience more direct impacts than those of the broader SEIA study area. The SEIA study area and the core impact area are shown on **Figure 14-1.**

Where relevant, demographic and economic data for the Coffs Harbour LGA and NSW statistical areas have been used for comparative purposes.




Coffs Harbour Bypass
SEIA study area
Figure 14-1

### 14.1.2 Baseline review

The socio-economic baseline was established by carrying out the following tasks:

- Reviewing relevant existing state and local government policies and strategies, including:
  - North Coast Regional Plan 2036
  - Coffs Harbour 2030 Plan
  - MyCoffs Community Strategic Plan 2017-2020
  - Coffs Harbour Economic Development Strategy 2017-2022
- Analysing population and demographic data such as population size and growth, families and housing, diversity, employment and income, and socio-economic advantage/disadvantage, including a review of ABS 2016 census data
- A review of community plans and surveys to identify existing community values through indicators such as amenity, sense of place and connections to land
- Reviewing existing community infrastructure near the project such as education facilities, health and emergency services and recreation uses
- Identifying travel patterns and behaviours through a review of ABS data, transport infrastructure and services, and travel information
- Understanding key businesses and industries such as local businesses, agriculture, and tourism by review of data available from:
  - .id consulting
  - DPIE
  - Tourism Research Australia
  - Australian Bureau of Agricultural and Resource Economics and Sciences
  - Destination NSW 2016 – Local Government Area Profile for Coffs Harbour
- Analysing aerial photography and reviewing land uses within the SEIA study area
- Carrying out a range of consultation and engagement activities, including Business Surveys (2016 and 2017), Business (Passing Trade) survey (2018) and agricultural property owner discussions (2018)
- Reviewing the findings from consultation and stakeholder engagement undertaken for the broader project, including the outcomes of meetings, briefings, correspondence and surveys.

### 14.1.3 Consultation

The socio-economic assessment has been informed by stakeholder and community consultation undertaken for the project as described in **Chapter 7, Consultation.** In addition, a number of specific engagement activities have been undertaken including:

- Business survey 2016 - Coffs Harbour businesses were engaged via a phone survey to gather information to assist with the traffic model. 418 businesses participated in the survey
- Community and Business survey 2016/2017 - an online survey was made available for businesses and the community to answer a number of questions regarding the preliminary concept design and potential impacts to the business and wider community. A total of 103 responses were received during November 2016 to December 2017
- Business (passing trade) survey 2018 - businesses located along the existing Pacific Highway were invited to participate in a survey that focused on understanding their reliance on passing trade from the existing Pacific Highway

- Agricultural property owner discussions - Edge Land Planning was engaged to undertake an agricultural impact assessment (see **Chapter 13, Agriculture**). As part of this assessment, a series of interviews were conducted with property owners that carry out agricultural activities on their land.

### 14.1.4 Assessment of significance

The level of significance of each potential adverse socio-economic impact was assessed by considering the sensitivity of those affected and the magnitude of impact. This assessment framework is shown in **Figure 14-2**. The framework for identifying the levels of sensitivity and magnitude is described below.

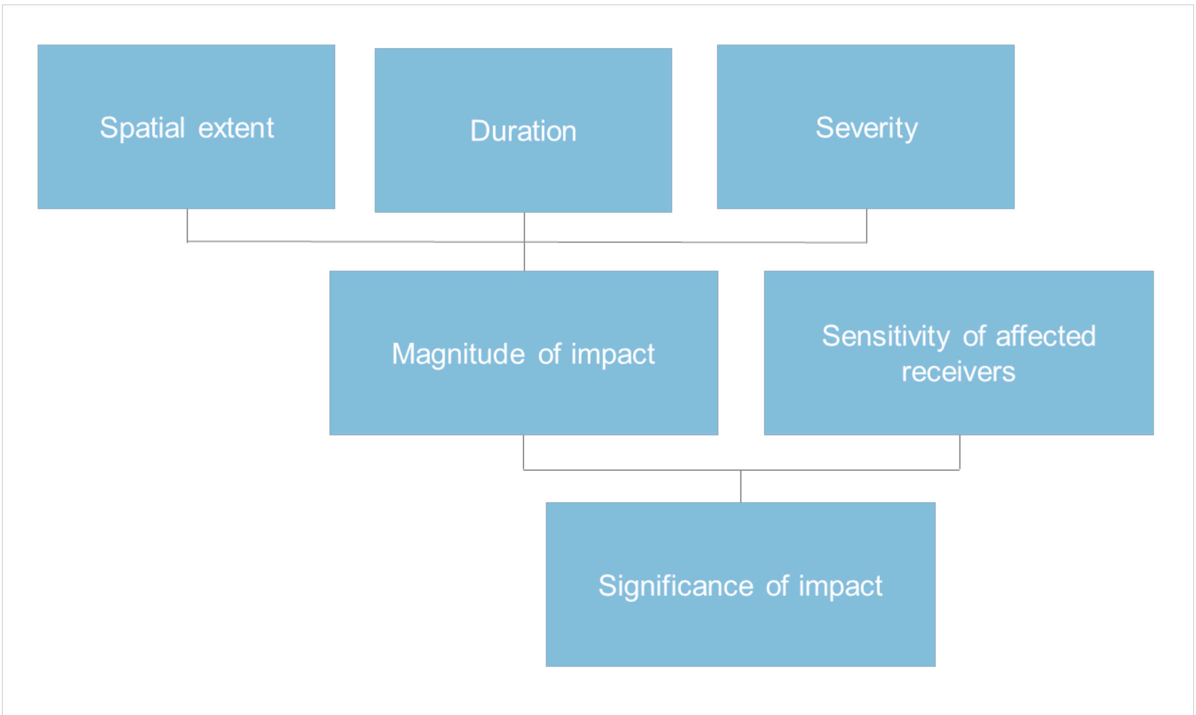



Figure 14-2 Socio-economic impact assessment framework

#### *Sensitivity*

Sensitivity refers to vulnerability to change and capacity to adapt. Receivers may include environmental characteristics, communities, businesses, business clusters, social infrastructure and residences.

Qualities that contribute to the level of sensitivity of a receiver may include existing aspects of the socio-economic environment such as:

- Demographic composition and patterns
- Economic activity and types of industry and/or businesses present
- Connectivity and access
- Property and land use types and known future changes (eg re-zoning)
- Community values
- Community cohesion
- Level of community concern
- Amenity such as noise levels, visual quality, air quality etc.

**Table 14-2** provides examples of sensitivity levels.

Table 14-2 Levels of sensitivity

| Sensitivity | Example |
|---|---|
| Negligible | No vulnerability and able to absorb or adapt to change. |
| Low | Minimal areas of vulnerability and a high ability to absorb or adapt to change. |
| Moderate | A number of vulnerabilities but retains some ability to absorb or adapt to change. |
| High | Multiple vulnerabilities and/or very little capacity to absorb or adapt to change. |

### *Magnitude of impact*

Magnitude refers to the scale, duration, intensity and scope of the project including how it would be constructed and operated. Qualities of magnitude include, but are not limited to:

- Spatial extent (the geographical area affected which may be local, suburb, regional, state, national or to community groups)
- Duration (short, medium or long-term, hours of works, frequency, reversibility)
- Physical scale and intensity (the types of works, operational uses and built form).

**Table 14-3** provides examples of levels of magnitude.

Table 14-3 Levels of magnitude

| Magnitude | Example |
|---|---|
| Negligible | There would be no discernible positive or negative changes caused by the impact. Change from the baseline would remain within the range commonly experienced by receivers. |
| Low | There would be a discernible change from baseline conditions. The impact would be to a small proportion of receivers over a limited geographical area and mainly within the vicinity of the project. The impact may be short-term, or some impacts may extend over the life of the project. |
| Moderate | There would be a clearly noticeable difference from baseline conditions. The impact would be to a small to large proportion of receivers and may be over an area beyond the vicinity of the project. The duration of the impact may be short to medium-term or some impacts may extend over the life of the project. |
| High | There would be a change that would dominate over the existing baseline conditions. The change would be widespread or persist over many years or remain permanently. |

### *Assessing levels of significance*

In assessing the level of significance of impacts, consideration was given to the range of potential direct and indirect impacts during construction and operation as well as cumulative impacts. The combination of sensitivity and magnitude determines the level of significance of the impact.

The matrix provided in **Table 14-4** determines the significance of the potential adverse impacts through the combination of sensitivity and magnitude.

Table 14-4 Levels of significance

| | | Magnitude | | | |
|---|---|---|---|---|---|
| | | High | Moderate | Low | Negligible |
| Sensitivity | High | High Impact | High-Moderate | Moderate | Negligible |
| | Moderate | High-Moderate | Moderate | Moderate-low | Negligible |
| | Low | Moderate | Moderate-Low | Low | Negligible |
| | Negligible | Negligible | Negligible | Negligible | Negligible |

# 14.2 Existing environment

## 14.2.1 Policy context

In addition to the strategic planning and policy framework discussed in **Chapter 3, Strategic justification and project need**, the following State and local policies and plans are relevant to the socio-economic, land use and property assessment.

### *Coffs Harbour 2030 Plan*

The Coffs Harbour 2030 Plan documents the plans for the entire Coffs Harbour community. The Plan is organised into the following five themes:

- Learning and prospering – promote innovation, strengthen and diversify the economy, establish and maintain a balance of commercial, residential, social and cultural opportunities in the city centre, be recognised for sustainability, facilitate sharing of skills and knowledge across the community
- Looking after our community – promote health and safety, develop community resilience, promote inclusivity and cohesion, provide strong leadership and governance, support local artistic and cultural expression
- Looking after our environment – promote the region's environment, protect biodiversity, recognise Aboriginal land and sea management practices, create environmental management and restoration programs with the community
- Moving around – plan for new transport infrastructure, use existing infrastructure more effectively, promote public and active transport, reduce the impact of the highway on the community, better integrate road and rail freight
- Places for living – promote higher densities in existing urban areas, reinforce the unique identity of villages and communities, provide infrastructure that supports sustainable living, promote the foreshore as a community focal point.

### *MyCoffs Community Strategic Plan 2017-2020*

The MyCoffs Community vision is to be connected, sustainable and thriving. The plan is structured into four themes, each with supporting strategies, objectives, and outcomes. The following have been identified:

- Community wellbeing – honour the stories and culture of the Aboriginal community and promote inclusiveness
- Community prosperity – encourage active transport, nurture social connection, cultivate a sage community, stimulate economic growth and local jobs, attract people to work, live, and invest in Coffs Harbour

- A place for community – create liveable and attractive places, undertake development that is environmentally, economically and socially responsible
- Sustainable community leadership – the community is engaged and informed of key issues, community groups have the opportunity to shape their future, effectively planning for infrastructure (including the completion of this project), planning for projected growth is done collaboratively.

### *North Coast Regional Plan 2036*

The North Coast Regional Plan 2036 (DP&E 2017a), released in March 2017, provides strategic direction for the North Coast region and contains an indicative alignment for the Pacific Highway upgrades.

The North Coast Regional Plan states that the Pacific Highway upgrade is expected to provide greater connectivity across local government areas within the North Coast region, building broader communities of interest and creating a more vibrant and diverse economy. The North Coast Regional Plan states that the Pacific Highway upgrade is one of Australia's most significant infrastructure investments that will improve user safety and travel times and generate new economic and employment opportunities.

### *Coffs Harbour Economic Development Strategy 2017-2022*

The Coffs Harbour Economic Development Strategy 2017-2022 seeks to prioritise and focus Council's resources and to guide decision making by local, state, and federal agencies. The key directions of the Coffs Harbour Economic Development Strategy are:

- Manage the planning and provision of regional public infrastructure – supporting Council investment, and advocating for State and federal investment
- Create and manage vibrant places – activating precincts to encourage economic activity, social connections, and increase amenity
- Champion business, innovation and technology to stimulate economic growth and local jobs – sector development (eg tourism, transport and logistics, and retail), support digital and innovation economy, diversify the agricultural base and develop agri-tourism opportunities, promoting the visitor economy
- Attract people to invest, work, live, study and visit – implement destination marketing and promote the benefits of living in Coffs Harbour
- Prepare the future workforce – partner with universities and state agencies to ensure future workforce needs are met.

## 14.2.2 Socio-demographic profile

### *Population*

The core impact area of communities intersecting with the project had a population of 10,866 in 2016, a 15 per cent increase from 2011. About 31,720 people lived within the SEIA study area at the time of the 2016 census (refer to **Table 14-5**). This was nine per cent more than the population recorded in the 2011 census. In comparison, at the time of the 2016 ABS Census, the Coffs Harbour LGA had a population of 72,944 which was an increase of about six per cent since 2011 (ABS 2016). The population for NSW increased by 8.1 per cent between 2011 and 2016. This shows that the population within the SEIA study area, and particularly the core impact area has increased at a faster rate than is typical for the LGA and NSW.

Population projections for the core area and SEIA study area are not available specifically. However, by 2036, the population of Coffs Harbour LGA is projected to increase by more than 22 per cent from 2016 levels to 92,650. This compares to the population growth of 28 per cent in NSW by 2036 (DP&E 2016a). This demonstrates that the population is expected to continue to grow, but at a slower rate than the wider State, a difference from current trends.

Table 14-5 Population change

| | Population | | |
|---|---|---|---|
| | 2011 | 2016 | % change |
| Core impact area | 9406 | 10,866 | 15.5 |
| SEIA study area | 29,037 | 31,720 | 9.2 |
| Coffs Harbour LGA | 68,413 | 72,944 | 6.6 |
| NSW | 6,917,658 | 7,480,220 | 8.1 |

In 2016, gender was split fairly evenly and remained relatively consistent across different spatial scales (refer **Table 14-6**), with slightly more females than males in the core impact area (51.7 per cent), SEIA study area (52.2 per cent), Coffs Harbour LGA (51.4 per cent) and NSW (50.4 per cent).

Table 14-6 Gender split[1]

| Population change (by gender) | Core impact area | | SEIA study area | | Coffs Harbour LGA | | NSW | |
|---|---|---|---|---|---|---|---|---|
| | 2011 | 2016 | 2011 | 2016 | 2011 | 2016 | 2011 | 2016 |
| Male | 4543 | 5231 | 13,867 | 15,099 | 33,201 | 35,319 | 3,408,878 | 3,685,999 |
| Female | 4858 | 5627 | 15,162 | 16,623 | 35,212 | 37,629 | 3,508,780 | 3,794,189 |

### *Age distribution*

The median age of people within the core impact area and the SEIA study area was 43 years old at the time of the 2016 ABS Census. This is consistent with the median age of 44 years for people within the Coffs Harbour LGA, but higher than the median age of NSW of 38 (ABS 2016). In all cases, the median age had increased since 2011.

The majority of the population within the core impact area (59.7 per cent) and the SEIA study area (60.0 per cent) were aged between 15 and 65 years in 2016, which aligns with Coffs Harbour LGA (60.6 per cent) and is significantly lower than the broader NSW population (65.2 per cent).

Over 21 per cent of the core impact area, and almost 23 per cent of the SEIA study area's population were aged 65 years or more in 2016. This aligns with Coffs Harbour LGA at 21 per cent but is significantly higher than the broader NSW population of 16.3 per cent over 65. This demonstrates that the core impact area and SEIA study area are home to a higher average proportion of older residents, compared to the rest of the State.

In addition, there is a smaller young population than the State average, with a total of 17.3 per cent of the SEIA study area's population aged 14 years or younger, compared to 18.3 per cent for Coffs Harbour LGA and 18.5 per cent for NSW. However, 19.1 per cent of the core impact area's population was aged 14 years or younger in 2016, below the LGA and State averages. This data shows that the core impact area in particular has higher percentages of children and older people than the LGA and state averages,

[1] Any inconsistency between the totals reported in this table and the overall populations is due to inherent inconsistencies within the data. All census data is randomly adjusted to protect confidentiality of individuals. This results in adjustments to counts and totals which can result in inconsistency between datasets.

demonstrating a small working age population in comparison to LGA and State averages. **Table 14-7** provides data for each age bracket.

Table 14-7 Age distribution[2]

| | Core impact area | | SEIA study area | | Coffs Harbour LGA | | NSW | |
|---|---|---|---|---|---|---|---|---|
| Age | **Number** | **%** | **Number** | **%** | **Number** | **%** | **Number** | **%** |
| 0 – 4 years | 627 | 5.8 | 1,725 | 5.5 | 4,055 | 5.6 | 465,135 | 6.2 |
| 5 – 14 years | 1,428 | 13.2 | 3,744 | 11.9 | 9,300 | 12.8 | 921,193 | 12. |
| 15 – 19 years | 654 | 6.1 | 1,860 | 5.9 | 4,331 | 5.9 | 448,425 | 6.0 |
| 20 – 24 years | 506 | 4.7 | 1,777 | 5.6 | 3,688 | 5.1 | 489,673 | 6.5 |
| 25 – 34 years | 1,073 | 10.0 | 3,523 | 11.2 | 7,647 | 10.5 | 1,067,521 | 14.3 |
| 35 – 44 years | 1,263 | 11.7 | 3,522 | 11.2 | 8,215 | 11.3 | 1,002,893 | 13.4 |
| 45 – 54 years | 1,446 | 13.4 | 3,976 | 12.6 | 9,636 | 13.2 | 977,986 | 13.1 |
| 55 – 64 years | 1,493 | 13.9 | 4,281 | 13.6 | 10,695 | 14.7 | 889,770 | 11.9 |
| 65 – 74 years | 1,262 | 11.7 | 3,702 | 11.7 | 8,513 | 11.7 | 677,026 | 9.1 |
| 75 – 84 years | 718 | 6.7 | 2,409 | 7.6 | 4,791 | 6.6 | 373,114 | 5.0 |
| 85 years + | 308 | 2.9 | 1,051 | 3.3 | 2,070 | 2.8 | 167,506 | 2.2 |
| **Total** | **10,778** | **100** | **31,570** | **100** | **72,941** | **100** | **7,480,242** | **100** |

The following general trends have been noted:

- The proportion of population in the 0-4 and 14-19 year-old age groups has decreased slightly or stayed the same, but the proportion of 5-14 and 20-24 year-old age groups has increased in the SEIA study area. In the core impact area, all these age groups have increased
- The proportion of population in the 25-34 year-old age groups increased substantially in both the core impact area (20 per cent) and the wider SEIA study area (16 per cent), which aligns with LGA (16 per cent) and State (13 per cent) trends
- The proportion of population that is 55 years-old or over has increased in all statistical areas. In the core impact area, the proportion of the population who are in the 65-74 year-old age group increased most significantly, with 40 per cent growth, compared to 30 per cent in the wider SEIA study area, 25 per cent in the State and 29 per cent in the LGA.

These changes within the SEIA study area are shown in **Figure 14-3.**

[2] Any inconsistency between the totals reported in this table and the overall populations is due to inherent inconsistencies within the data. All census data is randomly adjusted to protect confidentiality of individuals. This results in adjustments to counts and totals which can result in inconsistency between datasets.

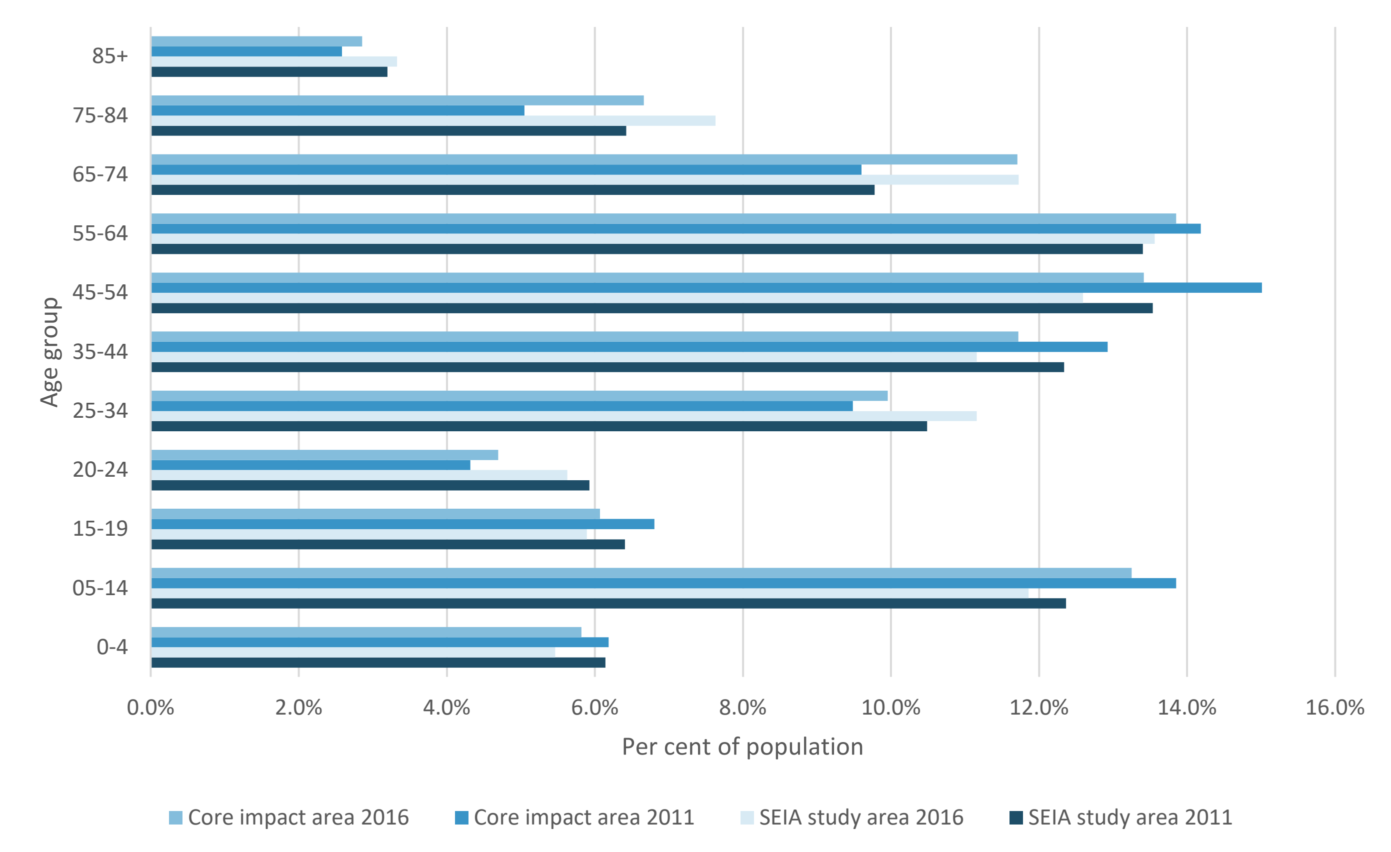



Figure 14-3 Shifts in population by age group in the SEIA study area between 2006 and 2016.

### *Families and households*

In 2016 there were 3778 households within the core impact area, and 12,100 within the wider SEIA study area. Most of these households are separate houses (78.3 per cent in the core impact area and 63.0 per cent in the SEIA study), with a further 13.4 per cent (core impact area) and 16.6 per cent (SEIA study area) being semi-detached or terraced housing. The results for the core impact area align closely with the average of 74.3 per cent separate houses in Coffs Harbour LGA, however they show a higher than average number of separate houses when compared against the 66.4 per cent for NSW.

About 65 per cent of the households within the SEIA study area were classified as 'family' households, which was lower than the average for Coffs Harbour LGA and NSW (69 and 72 per cent respectively). In comparison the proportion of family households was higher in the core impact area (76 per cent), demonstrating a larger number of families within proximity to the project than is typical for the LGA and State.

**Table 14-8** provides a breakdown of family types. There is a lower percentage of families with children and a higher percentage of families without children in the SEIA study area, which is consistent with the higher median age and greater percentage of people aged 65 and over when compared to the State averages. The average household size within the core impact area was 2.4 people, and within the SEIA study area was 2.2 people, which is similar to the Coffs Harbour LGA average of 2.4 people, but lower than NSW (2.6 people), suggesting fewer family households.

Table 14-8 Family type

| Family type | Core impact area | | SEIA study area | | Coffs Harbour LGA | | NSW | |
|---|---|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % | Number | % |
| Couples with children | 1165 | 39.6 | 2807 | 34.9 | 7141 | 37.0 | 887,358 | 45.7 |
| Couples without children | 1318 | 44.8 | 3444 | 42.8 | 8228 | 42.7 | 709,524 | 36.6 |
| One parent families | 448 | 15.2 | 1724 | 21.4 | 3699 | 19.2 | 310,906 | 16.0 |
| Other families | 10 | 0.3 | 69 | 1.0 | 210 | 1.1 | 32,438 | 1.7 |
| **Totals** | **2307** | | **7758** | | **19278** | | **1,940,226** | |

### *Housing cost and tenure*

Within the core impact area, 38.5 per cent of dwellings were owned outright in 2016 (compared to 36.4 per cent in the LGA and 32.3 per cent across NSW), 32.1 per cent were owned with a mortgage (compared to 28.7 per cent in the LGA and 32.3 per cent across NSW) and 25.6 per cent of dwellings were rented (compared to 30.7 per cent in the LGA and 31.7 per cent across NSW). At 33.9 per cent, the proportion of properties owned outright in the SEIA study area was lower than that for the core impact area, but higher than the LGA and NSW. At 25 per cent, the proportion of properties owned with a mortgage within the SEIA study area was significantly lower than the core impact area, the LGA and NSW, and rentals accounted for a larger proportion of dwellings than in the core impact area, LGA and NSW at 37.3 per cent. This suggests that while the core impact area has a significant number of outright owned properties, the wider SEIA study area has a broader spread of housing tenure, and rentals are a significant portion of properties.

In 2016, the median monthly mortgage repayments for the core impact area were $1684.79, and $1457.61 in the SEIA study area. This is similar to the median Coffs Harbour LGA monthly mortgage repayments of $1603.00 and slightly lower than the State average of $1986.00. Similarly, weekly rents within the SEIA study area were $305.01 per week, which is consistent with the Coffs Harbour LGA average of $305.00. Within the core impact area weekly rent in 2016 was $346.78 per week, which is higher than the LGA average but still lower than the State average of $380.00. This suggests that compared to a State level, housing (both rental and ownership) is relatively affordable. However, for the LGA – particularly within the core impact area – rentals and mortgage repayments are higher than the LGA average, suggesting that housing affordability could be a concern locally.

Reinforcing this concern, CHCC has identified affordable housing (both rental and ownership) as a major issue for Coffs Harbour. A discussion paper published in 2017 outlines the status of housing affordability in the LGA, noting that Coffs Harbour and Bellingen LGAs are the seventh most expensive rural LGAs in NSW, and indicates that median sales prices for houses have increased by 28.4 per cent between 2012 and 2017 (CHCC 2017e). The need for affordable housing to address impacts of overcrowding, homelessness and poverty is discussed. CHCC are working to address some of these concerns through the development of an affordable housing strategy.

### *Cultural diversity*

In 2016, almost 79 per cent of the core impact area's population and 76 per cent of the SEIA study area's population were born in Australia. This aligns with the Coffs Harbour LGA average of 78.4 per cent and is a higher percentage than the NSW average of 65.5 per cent.

Ancestry for the core impact area and SEIA study area's population is predominantly English, Australian, Irish and Scottish. Consistent with this heritage, only 9.0 per cent of the SEIA study area's population (and 7.4 per cent of the core impact area) indicated that they spoke another language at home. This aligns with the LGA average of 7.7 per cent but is significantly lower than the 25.2 per cent of NSW's total population, suggesting a lower cultural diversity in the core impact area and SEIA study area than in the wider State.

A total of 3.7 per cent of the core impact area, and 5.1 per cent of the SEIA study area population identified as being of Aboriginal and Torres Strait Islander descent in 2016, which is similar to the LGA average of 5.0 per cent, but higher than the broader NSW population of 2.9 per cent.

### *Income*

The median weekly household income within the SEIA study area was $1078.39 in 2016, which is close to the Coffs Harbour LGA median weekly household income of $1126.00. For the core impact area this was significantly higher at $1344.89, which is also higher than the State median of $1214.00.

Almost 24 per cent of households in the SEIA study area reported a weekly income less than $650, similar to the LGA average of 25 per cent. The national minimum wage in 2016 was $672.70 per week (ABC News 2016). At 15 per cent, the core impact area has a lower proportion of households with weekly income less than $650, which is also lower than the State average of 19.7 per cent. This suggests that the core impact area is home to more affluent households than the wider SEIA impact area and the LGA as a whole.

### *Employment and labour force*

In 2016, the labour force within the SEIA study area consisted of 13,592 people, of which 7042 (about 51.8 per cent) were in full-time employment, and 4877 (about 35.8 per cent) in part-time employment. This is similar to the statistics for Coffs Harbour LGA. Of its labour force of 4967 people, the core impact area had a much lower proportion of people in full-time employment (31 per cent) than the SEIA study area and Coffs Harbour LGA.

At almost seven per cent, the unemployment rate within the SEIA study area in 2016 was slightly higher than NSW (6.3 per cent) but lower than the Coffs Harbour LGA (7.3 per cent). The core impact area's unemployment rate was significantly lower at 5.5 per cent, suggesting a more active labour force in this area.

The Coffs Harbour region accounts for two per cent of total employment in NSW. The region accounts for seven per cent of the total people employed in the NSW agriculture, forestry and fishing sector (economy id, 2018).

### *Education*

The most significant level of education within high school in the core impact area and the SEIA study area is Year 12 or equivalent, similar to the Coffs Harbour LGA. The average for the State is significantly higher, at 58 per cent (**Table 14-9**)

Table 14-9 Highest school year completed

| | Core impact area | | SEIA study area | | Coffs Harbour LGA | | NSW | |
|---|---|---|---|---|---|---|---|---|
| Level of education | **Level** | **%** | **Level** | **%** | **Level** | **%** | **Level** | **%** |
| Year 12 or equivalent | 3689 | 44 | 9916 | 39 | 22,890 | 40 | 117,396 | 58 |
| Year 11 or equivalent | 535 | 6 | 1670 | 7 | 3845 | 7 | 20,753 | 10 |

| | Core impact area | | SEIA study area | | Coffs Harbour LGA | | NSW | |
|---|---|---|---|---|---|---|---|---|
| Year 10 or equivalent | 2441 | 29 | 7147 | 28 | 16,907 | 30 | 30,730 | 15 |
| Year 9 or equivalent | 528 | 6 | 1915 | 8 | 4521 | 8 | 7273 | 4 |
| Year 8 or below | 328 | 4 | 1329 | 5 | 2858 | 5 | 1791 | 1 |
| Did not go to school | 16 | 0 | 177 | 1 | 347 | 1 | 387 | 0 |
| Highest year of school not stated | 879 | 10 | 2940 | 12 | 5740 | 10 | 23,914 | 12 |
| **Total** | **8404** | | **25,109** | | **57,102** | | **202,244** | |

Considering high school leavers, the largest proportion of residents in the core impact area and SEIA study area achieved certificate level III and IV, which aligns closely with the results for the wider LGA. State-wide the largest proportion of residents have a bachelor's degree (**Table 14-10**).

Table 14-10 Post-high school level of education

| | Core impact area | | SEIA study area | | Coffs Harbour LGA | | NSW | |
|---|---|---|---|---|---|---|---|---|
| Level of Education | **Level** | **%** | **Level** | **%** | **Level** | **%** | **Level** | **%** |
| Postgraduate Degree Level | 248 | 5.6 | 547 | 4.5 | 1250 | 4 | 344,490 | 11 |
| Graduate Diploma and Graduate Certificate Level | 151 | 3.4 | 337 | 2.8 | 938 | 3 | 103,340 | 3 |
| Bachelor's Degree Level | 1106 | 24.9 | 2796 | 23.2 | 6628 | 23 | 976,888 | 32 |
| Advanced Diploma and Diploma Level | 900 | 20.3 | 2392 | 19.9 | 5433 | 19 | 543,142 | 18 |
| Certificate III & IV Level | 1691 | 38.1 | 4869 | 40.4 | 11,703 | 41 | 899,055 | 29 |
| Certificate I & II Level | 145 | 3.3 | 489 | 4.1 | 1021 | 4 | 66,918 | 2 |
| Certificate Level, nfd | 203 | 4.6 | 618 | 5.1 | 1512 | 5 | 134,981 | 4 |
| **Total highest school year completed** | **4444** | | **12,048** | | **28,485** | | **3,068,814** | |

### *Socio-economic indicators*

#### Advantage and disadvantage

The Socio-Economic Indexes for Areas (SEIFA) is an index provided by the ABS that summarises different aspects of the socio-economic conditions of people living in an area based on a range of socio-economic data from the census such as income, educational attainment, unemployment and dwellings without motor vehicles. It provides a more general measure of socio-economic status than is given by measuring income or unemployment alone. SEIFA for the 2016 ABS Census for SA1 areas has been used for this report.

The Index of Relative Socio-Economic Advantage/Disadvantage (IRSAD) is a continuum of advantage to disadvantage. It considers indicators relating to income, education, occupation, wealth and living conditions. A high value on the index represents an area of relative advantage and conversely a low index value represents an area of disadvantage.

As shown in **Figure 14-4,** areas within the centre of Coffs Harbour, generally along the existing Pacific Highway, are ranked in lower deciles of the index indicating higher levels of disadvantage. The Coffs Harbour Jetty Precinct and the suburbs of Korora, North Boambee Valley and Boambee are ranked in higher deciles of the index indicating higher levels of advantage. This is due to a larger proportion of households with higher incomes, or many people in skilled occupations, in comparison to other areas with fewer households on lower incomes or in unskilled occupations. Coffs Harbour's high percentage of people aged 65 and over, who are more likely to be retirees, is also likely to have influenced this index.

#### Service equity

Coffs Harbour is home to a number of medical and financial services. Given its population size and role as a regional centre it is more likely to host medical and financial services than smaller surrounding areas. People from these surrounding areas are likely to travel to Coffs Harbour to access services that are not available in their own towns.

With its growing (and ageing) population, Coffs Harbour has an increasing demand for medical services. To address this, the NSW Government has committed $194 million to the Coffs Harbour Health Campus expansion. The redevelopment will deliver an expanded emergency department, new and enhanced operating theatres, a short stay surgical unit, orthopaedic and vascular unit and an expansion to facilities for ambulatory care and community health. The expanded facilities will complement the existing assets and services located on the Coffs Harbour Health Campus site.

The NSW Government is also upgrading the Coffs Harbour NSW Ambulance Station as part of its Rural Ambulance Infrastructure Reconfiguration Program. The Program currently includes 23 locations across the state that will benefit from an upgraded, rebuilt or entirely new ambulance station.

North Coast TAFE in Coffs Harbour is also building a new $3.2 million health training facility to deliver new specialist training previously unavailable across northern NSW.

In relation to financial services, Coffs Harbour has branches of the major financial institutions located in the local area, but the trend towards digital banking is resulting in the closure of branches of some smaller institutions.

Overall, given the scale of Coffs Harbour's population it is well serviced by financial and medical services.

#### Employment equity

The SEIA study area supports a range of employment industries. In 2016, the largest proportion of residents within the SEIA study area were employed in health care and social assistance (18 per cent), retail trade (14 per cent) and accommodation and food services (11 per cent). Similarly, within the core impact area, key industries for employment were health care and social assistance (18 per cent) and retail trade (13 per cent). The third largest proportion of employment was in construction at ten per cent of the population. These key sectors align with highly represented sectors across the Coffs Harbour LGA and

NSW, although the proportion of representation in all cases is higher in the SEIA study area and core impact area.

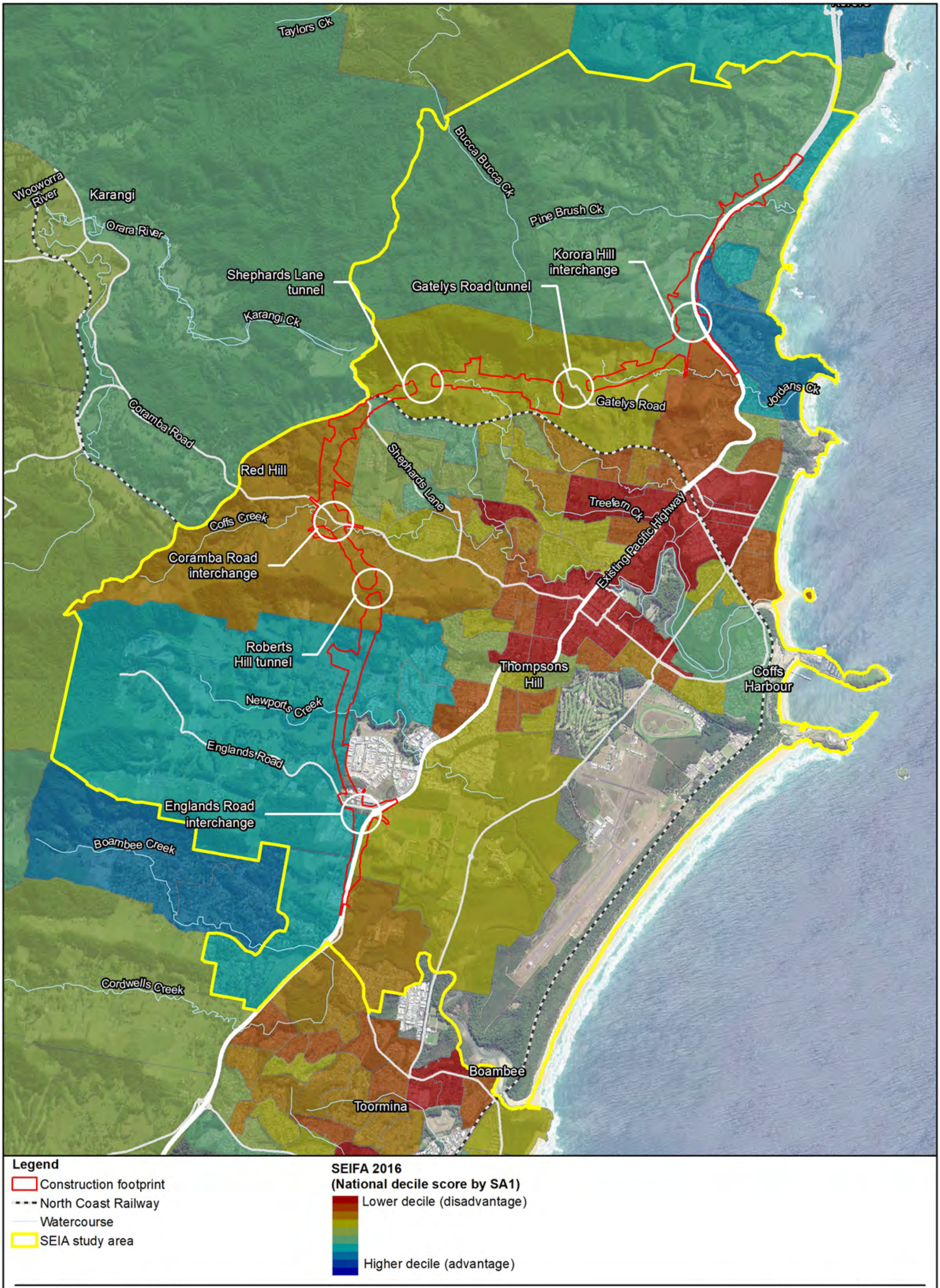
Within the SEIA study area between 2011 and 2016, there was a significant decline in manufacturing employment (almost 38 per cent decline or 212 jobs), wholesale trade (32 per cent decline or 108 jobs) and financial and insurance service jobs (almost 36 per cent decline or 90 jobs). Other industries experienced significant proportional decline, but accounted for small numbers of overall employment, including electricity, gas, water and waste services (almost 46 per cent decline or 46 jobs) and mining (almost 39 per cent decline or 14 jobs). The core impact area experienced many similar trends, with mining (48 per cent decline), electricity, gas, water and waste services (almost 38 per cent decline) and manufacturing (over 35 per cent decline) experiencing the largest declines.

During the same period in the SEIA study area there was an increase in jobs in the health care and social assistance (almost 22 per cent increase or 398 jobs) agriculture, forestry and fishing (over 98 per cent increase or 221 jobs). Health care and social assistance also saw growth in the core impact area between 2011 and 2016 (almost 29 per cent increase or 183 jobs). Contrary to the SEIA study area, growth was experienced in education and training (19 per cent increase), retail trade (almost 11 per cent increase) and construction (11 per cent increase). Proportionally, arts and recreation services increased the most (almost 60 per cent) in the core impact area.

Overall there have not been any changes to local businesses and industry in recent years that have significantly changed the employment market.

### *Need for assistance*

In 2016, 5.4 per cent of the core impact area's population and almost seven per cent of people in the SEIA study area identified as having a need for assistance with daily living. This is higher than that reported for the broader NSW area of just over five per cent, but closer to the LGA average of 6.2 per cent. This higher proportion of population requiring assistance is likely to be linked to the area's higher percentage of people aged 65 years and above.




Coffs Harbour Bypass
Socio Economic Index for Areas (IRSAD)
Figure14-4

### 14.2.3 Community values

The MyCoffs Community Strategic Plan identifies the community's vision for Coffs Harbour as "Connected, Sustainable, Thriving", and centres around four themes: Community Wellbeing, Community Prosperity, A Place for Community and Sustainable Community Leadership.

As a measure of community participation and values, 19 per cent of the population of the SEIA study area participated in volunteer work in 2016. This is consistent with the rate reported in 2011 and is comparable to that reported for Coffs Harbour LGA (almost 20 per cent) and NSW (almost 21 per cent).

In February 2017, a series of MyCoffs focus groups were held by CHCC. Topics relevant to the project include transport, place-making and economy/jobs/education. Key issues raised by the community as important include:

- The importance of connectivity between key areas
- Preservation of the natural environment
- Impact of agricultural activities on the environment
- Supporting public transport, cycling and walking
- A diversified local economy
- Opportunities for tourism.

Similar themes were apparent in the surveys undertaken for the project in 2016 (refer to **Appendix K3, Business and community surveys and outcomes**). People highlighted lifestyle, access to the beach/coast and the environment as the top three attributes that they value about Coffs Harbour. While the eastern part of the SEIA study area offers a coastal lifestyle, the rural residential properties in the western part of the SEIA study area provide for hillside, acreage living. The results of the top-rated attributes valued by the community are shown in **Figure 14-5.**

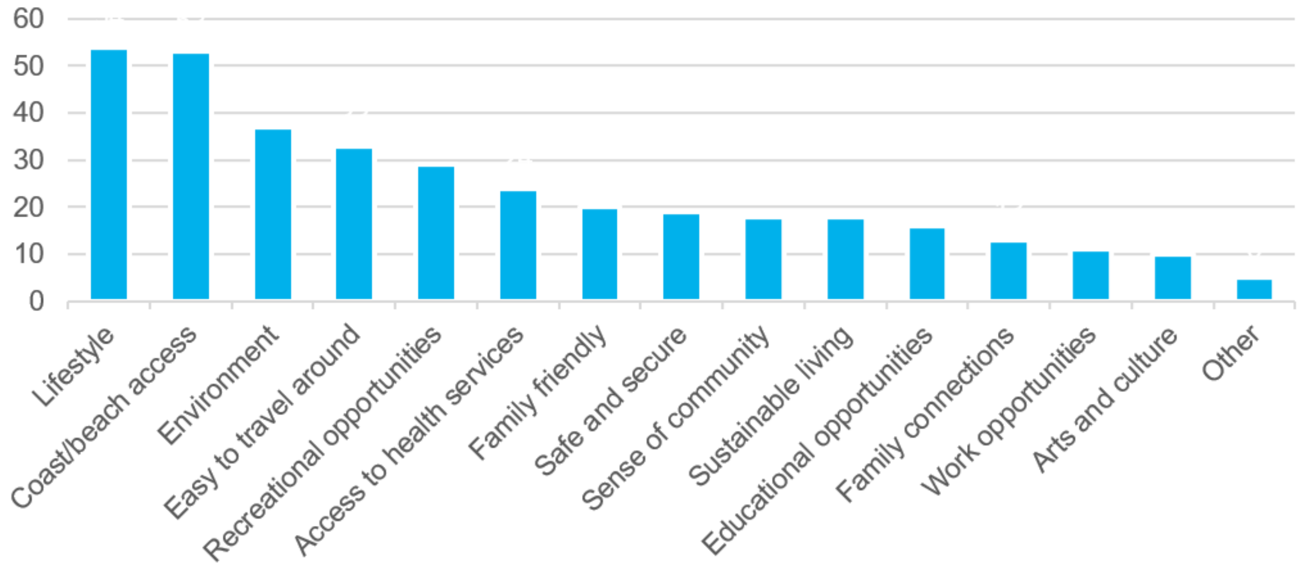



Figure 14-5 Attributes most valued by survey respondents

The survey also asked people questions about their experience with the existing Pacific Highway, their concerns about the project and the benefits they think the project would bring. Results indicated that 93 per cent of respondents experienced issues associated with the existing Pacific Highway.

The key issues reported included:

- Heavy traffic
- Exhaust break noise
- Congestion and delays (especially in peak hour)
- Traffic lights interfering with traffic flow
- Crossing the highway
- Cyclist safety on the Pacific Highway
- Separation of east and west Coffs Harbour
- Too many traffic lights
- Holiday periods are very busy
- Too many trucks.

Despite these existing challenges, a total of 61 per cent of the respondents expressed concerns about the project. Key concerns reported included:

- Impacts to wildlife corridors (including koala populations)
- 'Amphitheatre' effect of the valley and concerns about noise
- Complexity of interchanges at Englands Road and Korora Hill
- Concerns the corridor should be further west
- Noise mitigation
- Cyclist access
- Impacts on air quality
- Property values
- Visual amenity in the hills
- Length of time it is taking to build
- Business impacts, impact on schools
- Coramba Road interchange capacity of road and proximity to residential areas.

A number of respondents, however, saw opportunities associated with the project. Benefits identified included:

- Reducing traffic through the centre of Coffs Harbour
- Safer CBD area
- Removing trucks from the CBD
- Reducing noise and air quality impacts from the CBD
- Potential for businesses on highway to upgrade/reinvigorate
- Opportunity to reunite east and west
- Improved amenity would allow the CBD area to prosper
- Improved travel times within the city.

The SEIA study area also contains items of special significance to the community, including:

- The Luke Bowen footbridge (located near Kororo Public School) which provides a pedestrian/cyclist connection to the school. The footbridge was named after a Year 6 student at the school who passed away in 1997. The community recognises this footbridge as an important asset both due to the history associated with its naming, and the access it provides for students and other pedestrians

- A gravestone of Herbert Frazer Simpson (located at the intersection of the existing Pacific Highway and James Small Drive). This is an isolated grave marker, not considered to be associated with a burial
- A section of rainforest which was planted by the grandfather of current landowners on a property north-west of Mackays Road, within the construction footprint. This is used by CHCC and others for community educational purposes
- A tree planted as a memorial to a family member near Bennetts Road.

### 14.2.4 Social infrastructure

A wide range of social infrastructure is located within the SEIA study area to support the Coffs Harbour community and surrounding communities. This includes education, health, emergency and aged care, sport, recreation and cultural facilities and community support services. The following summarises the facilities within 500 m of the existing Pacific Highway and the project.

#### *Education*

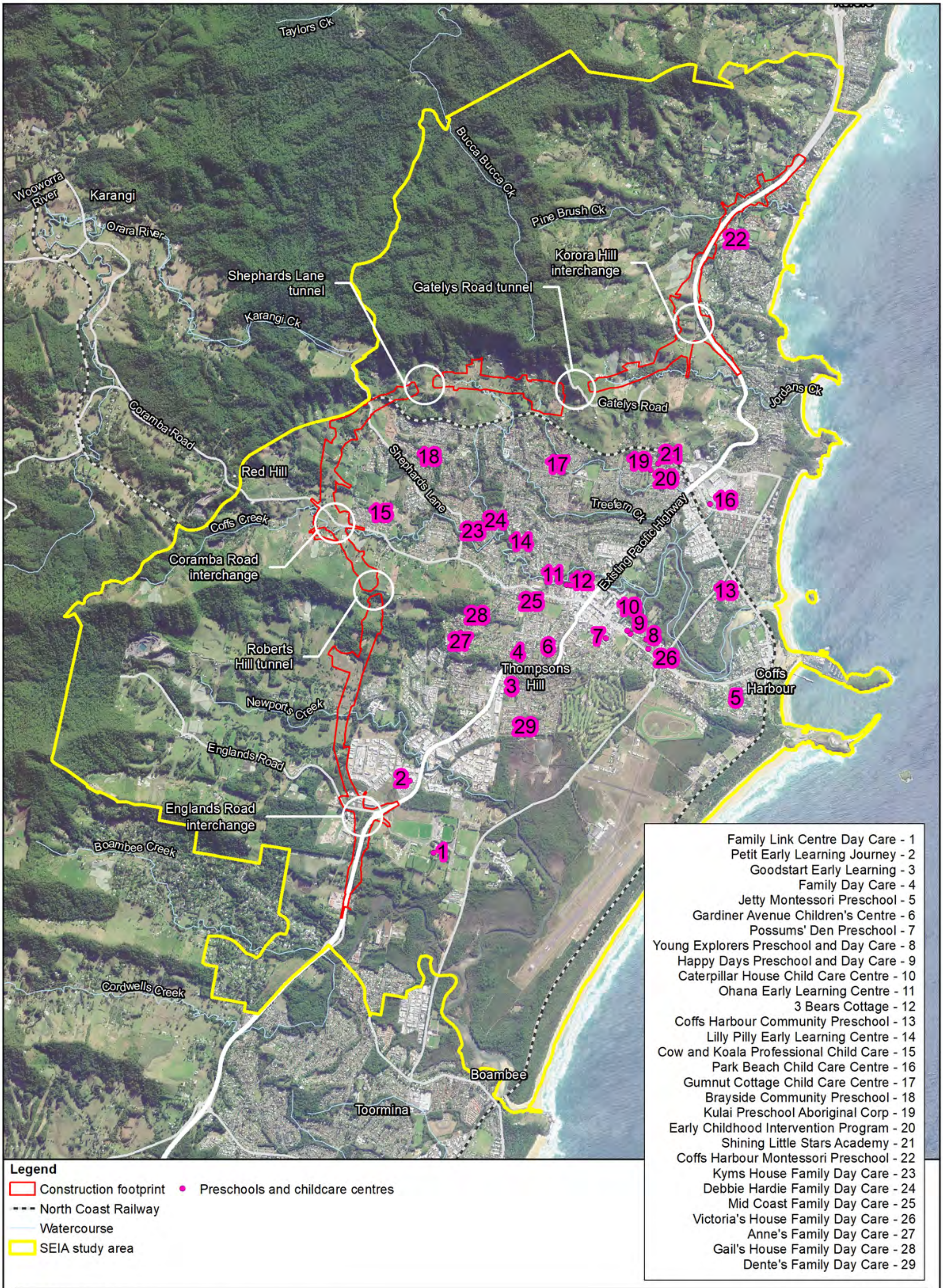
A total of 29 pre-schools and childcare facilities and 15 schools are located within the SEIA study area as shown in **Figure 14-6** and **Figure 14-7**.

Three of these schools are located within 500 m of the existing Pacific Highway (Coffs Coast Alesco Community School, Kororo Public School and St Augustine’s Primary School). A total of 11 of the preschools and childcare facilities are located within 500 m of the existing Pacific Highway (Goodstart Early Learning Coffs Harbour, Family Day Care, Gardiner Avenue Children's Centre, Ohana Early Learning, 3 Bears Cottage, Possums' Den Preschool, Early Childhood Intervention Program, Shining Little Stars Academy, Park Beach Child Care Centre, Petit Early Learning Journey and Coffs Harbour Montessori School).

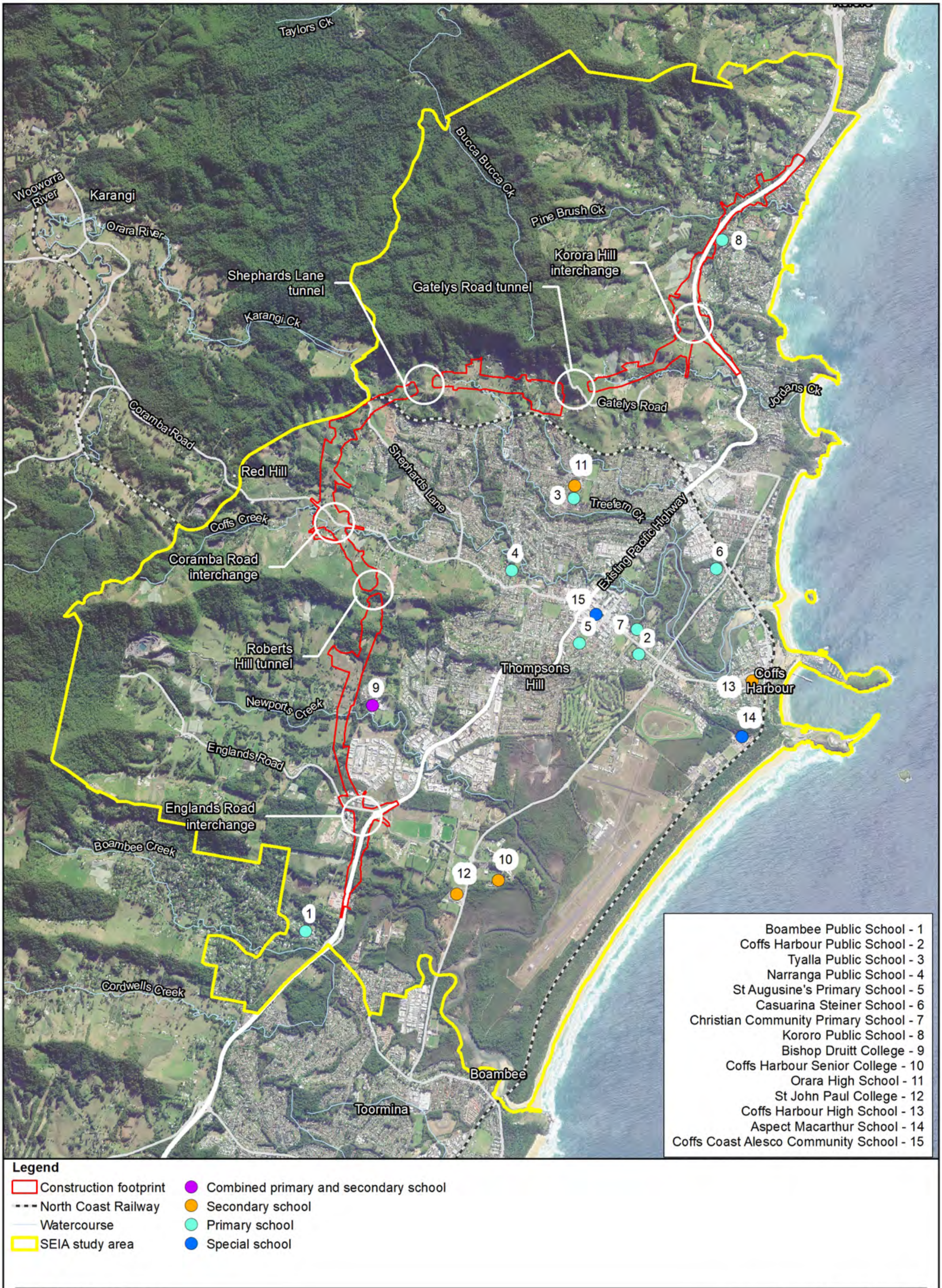
**Table 14-11** provides a summary of educational facilities that are located within 500m of the project.

Table 14-11 Educational and childcare facilities within 500 m of the project

| Facility | Details |
|---|---|
| Coffs Harbour Montessori Pre-School | A pre-school operated under the Montessori philosophy. Accommodates ages from two to six in child-led learning centre at James Small Drive. |
| Petit Early Learning Journey | Child care centre catering for ages from six weeks to five years on William Sharp Drive in Coffs Harbour. |
| Cow & Koala Professional Care | Child care centre catering for ages from six weeks to five years on Kiddell Place in North Boambee Valley. |
| Boambee Public School | A co-educational primary school, serving years K-6, with a student population of around 430 students. |
| Bishop Druitt College | A co-educational combined school, serving years K-12, with a with student population of around 1300 students. |
| Kororo Public School | A co-educational primary school, serving years K-6, with a student population of around 640 students. |




Coffs Harbour Bypass
Childcare and preschools in the SEIA study area
Figure 14-6




Coffs Harbour Bypass
Schools in the SEIA study area
Figure 14-7

### *Health, emergency and aged care*

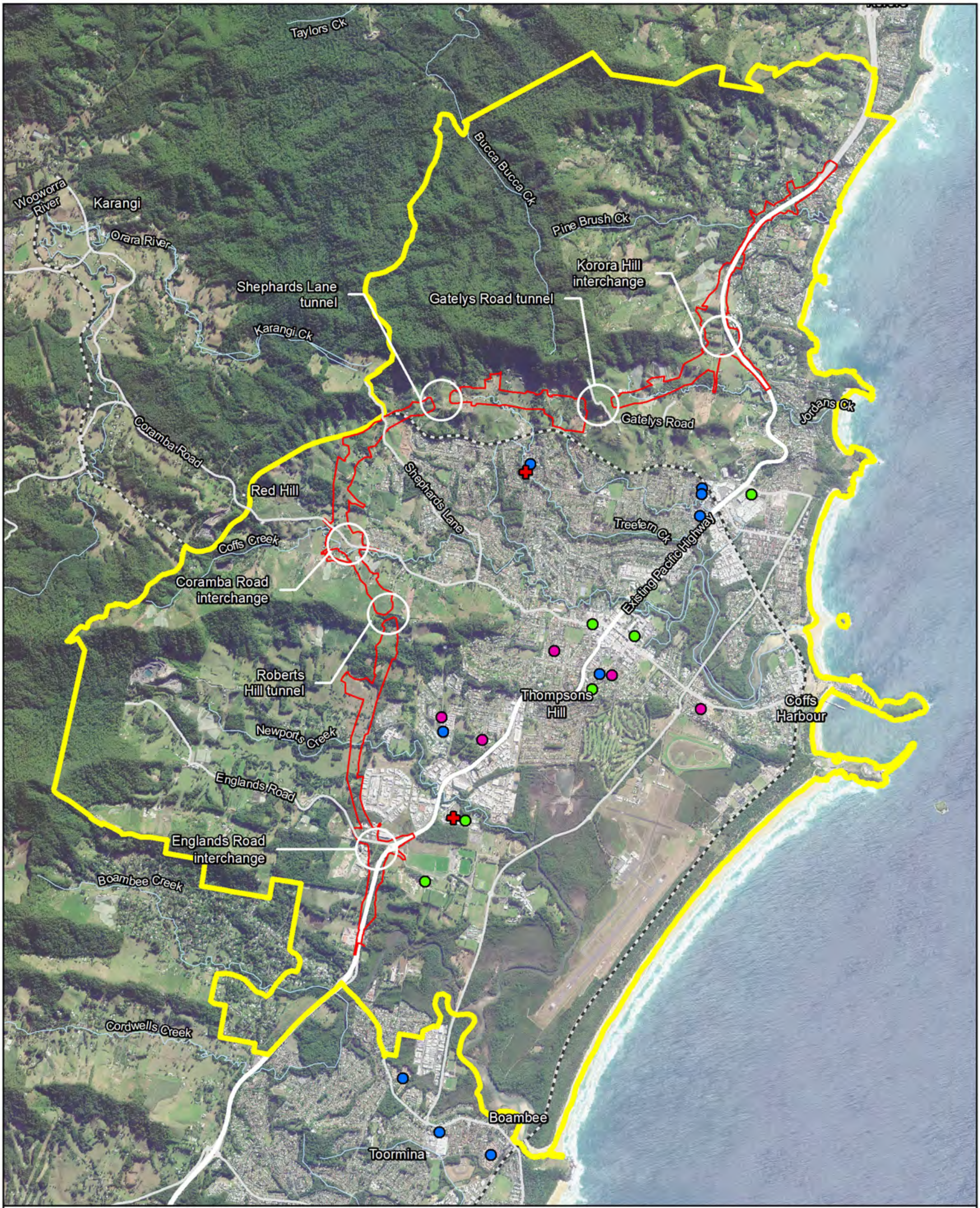
There are two hospitals, six community health care centres, one ambulance service, one fire station, one rural fire brigade service, one police station, and eleven nursing homes / retirement villages (aged care facilities) within the SEIA study area. These are shown on **Figure 14-8** and **Figure 14-9**.

Health and emergency facilities within 500 m of the existing Pacific Highway include the Coffs Harbour Police Station, Coffs Harbour Fire Station, Coffs Harbour Ambulance Station, the Solitary Rural Fire Services shed, Coffs Harbour Health Campus, Coffs Harbour Community Health Centre, Coffs Harbour Medical Centre, Coffs Harbour Women's Health Centre and Plaza Medical Centre. There are also nine aged care facilities located within 500 m of the existing Pacific Highway.

**Table 14-12** provides a summary of those health, emergency and aged care facilities that are located within 500 m of the project.

Table 14-12 Health, emergency and aged care within 500 m of the project

| Facility | Details |
|---|---|
| Coffs Harbour Ambulance Station | Located on the Pacific Highway, east of Englands Road interchange. In the Planning stage of upgrade with the Rural Ambulance Infrastructure Reconfiguration Programme |
| Solitary Rural Fire Services shed | A two-firetruck bay station that supports emergency services. Located off Pacific Highway near Kororo Nature Reserve |
| Coffs Harbour GP Super Clinic | A health facility providing a range of health and medical services |
| Baringa Private Hospital | Located beyond 500 m from the project, this private hospital is located on Mackays Road and has medical, surgical, rehabilitation and IVF facilities and operating theatres. |




**Legend**

- Construction footprint
- North Coast Railway
- Watercourse
- SEIA study area
- Hospital
- Medical centre
- Nursing home
- Retirement village

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GDA 1994 MGA Zone 56
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Coffs Harbour Bypass
Hospitals, health centres, and aged care in the SEIA study area
Figure 14-8


Coffs Harbour Bypass
Emergency services in the SEIA study area
Figure 14-9

### *Sport, recreation and cultural facilities*

The SEIA study area contains several public sporting and recreation facilities available, including one international stadium, nine ovals, one Police Citizens Youth Clubs (PCYC), four public swimming pools, two golf courses and a driving range, an equestrian facility and a squash and swim centre. These are shown in **Figure 14-10**).

The Coffs Harbour National Botanic Gardens, the Bruxner Park Flora Reserve in the Orara East State Forest, the Muttonbird Island National Park, and Jetty Beach and marina area offer numerous outdoor areas and activities for tourists and residents.

With two galleries, a museum and 12 churches, the region showcases a diversity of cultural and historical facilities. The Coffs Harbour Showground and Jetty Memorial Theatre host a variety of performing arts and events throughout the year.

Kororo Nature Reserve, Brian Navin Park, Argyle Street Park, Baden-Powell Park, Meadow Street Park, Thompson's Road Dog Park, Pioneer Park, Pacific Bay Resort Golf Course (the owner has suggested that this may be redeveloped in the future for residential purposes – see **Chapter 12, Land use and property**), Coffs Harbour War Memorial Olympic Pool, Coffs Harbour Aquatic Centre, Coffs Harbour Squash and Swim Centre, Coffs Harbour Seventh Day Adventist Church, Four Square Church (also known as Heartbeat Church), Coffs Harbour City Library, Coffs Harbour Historical Museum, Coffs Harbour Regional Gallery and Coffs Harbour Creative Arts Group are located within 500 m of the existing Pacific Highway.

**Table 14-13** provides a summary of sport, recreation and cultural facilities located within 500 m of the project.

Table 14-13 Sport, recreation and cultural facilities within 500 m of the project

| Facility | Details |
|---|---|
| Coffs Coast Sport and Leisure Park | A sport complex located from Stadium Drive with AFL and Cricket facilities, carnivals and competition fields with stadium lights, bathrooms and carparking. |
| Coffs Harbour Squash and Swim Centre | Squash courts and swimming pool located in the northern end of the study area. |
| Penny Drive park | Neighbourhood park servicing local residential community on Penny Drive. |
| Roselands Drive park | Neighbourhood park containing play equipment servicing local residential community on Roselands Drive. |
| Pacific Bay Resort Golf Course | 9-hole golf course associated with Pacific Bay Resort with access from Pacific Highway and Bay Drive. |
| Kororo Nature Reserve | A NSW 11 ha forestry reserve with wild koalas with walking tracks and creeks. Located between the existing Pacific Highway and rural residential properties in Korora. |
| Bishop Druitt College Chapel | An Anglican chapel with associated Bishop Druitt College that is operational on Wednesdays with events around academic year. Access is from North Boambee Road. |
| Four Square Church (also known as Heartbeat Church) | A Christian church located at Elswick Place. |

### *Community support services*

A wide range of community support services are located within the SEIA study area, including employment services, disability support services, advocacy services, social support, social housing and community centres. These community support services are generally located within commercial areas adjacent to the existing Pacific Highway.

Service NSW, Coffs Harbour Support Services, New Horizons Coffs Harbour, Aboriginal Housing Office, Burnside, Wright Counselling Service, Community Housing Ltd and are located within 500 m of the existing Pacific Highway.

There are no identified community support services that are located within 500 m of the project.


Coffs Harbour Bypass
Sport and recreation facilities in the SEIA study area
Figure 14-10

## 14.2.5 Business and industry

As outlined in the North Coast Regional Plan 2036, Coffs Harbour LGA is one of the wider region's primary growth anchors that will deliver new jobs, and more diverse housing as well as high quality essential services (DPE 2017). The North Coast Regional Plan also highlights that the Pacific Highway upgrade would provide business with access to new markets and offer residents greater choice in where to live and work.

The Gross Regional Product for Coffs Harbour LGA for the year ending June 2018 was estimated at $3.39 billion (id community 2018). The value added by specific industries in the 2017/2018 financial year is shown in **Figure 14-11** and shows that health care and social assistance is the most productive industry in the region ($418 million), followed by construction ($294 million), and retail trade ($232 million).

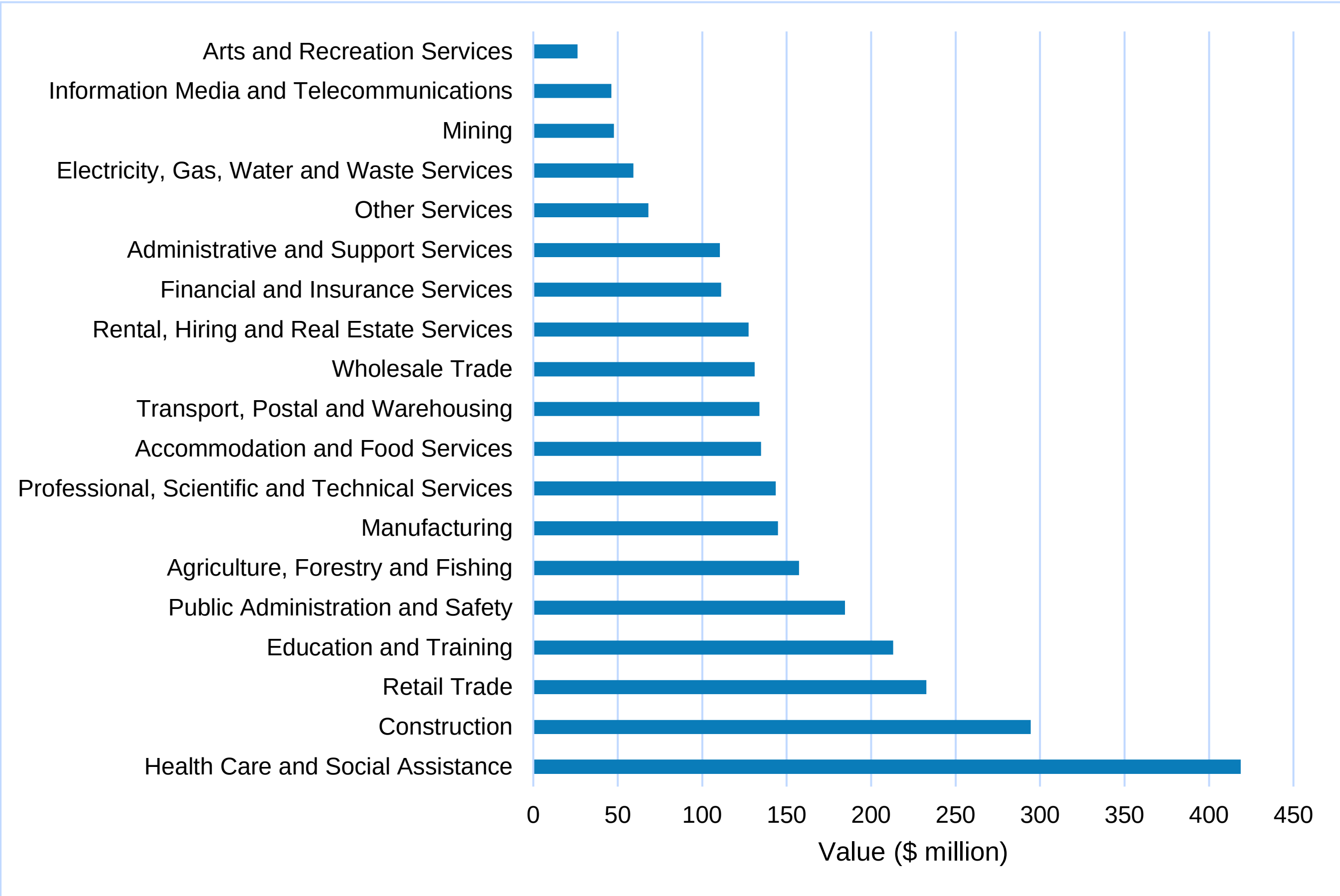



Figure 14-11 Value by industry (id community 2018).

### *Agriculture*

In 2017-2018, the Coffs Harbour agricultural industry added $116.5 million to the local economy and generated 1395 jobs in Coffs Harbour LGA (.idcommunity 2018). This represented 4.2 per cent of the LGA's value add and four per cent of all jobs in the LGA.

In 2017-18, the gross value of agricultural production in Coffs Harbour-Grafton region was $278 million, which was two per cent of the total value of agricultural production in NSW of $13.2 billion (ABS 2019). The most important commodity in the region based on gross value of agricultural production were fruit and nuts ($135 million or almost 50 per cent of the region's value of agricultural commodities).

Data for agricultural commodities provided by ABS (2015-2016) provides a further breakdown of commodity and crop types. As shown in **Table 14-14**, the gross value of agricultural production in Coffs Harbour LGA was about $113.5 million, with fruit and nuts accounting for almost 85 per cent of this gross value. With a gross value of more than $89 million, blueberries accounted for almost 80 per cent of Coffs Harbour agricultural production, followed by livestock (about nine per cent), nurseries (about five per cent), vegetables (about three per cent) and bananas (about two per cent).

Table 14-14 Agricultural commodities produced 2015-16 for Coffs Harbour LGA (ABS 2018)

| Commodity | Gross value of production ($) | |
|---|---|---|
| Broadacre crops | | 129,662 |
| Hay | | 274,621 |
| Vegetables for human consumption | | 2,856,639 |
| Nurseries, cut flowers or cultivated turf | | 5,655,561 |
| Fruit and nuts (excluding grapes) | | 94,625,489 |
| *Macadamias* | *1,264,386* | |
| *Bananas* | *2,698,802* | |
| *Blueberries* | *89,782,894* | |
| *Other fruit* | *879,406* | |
| ***Total value of crops*** | | ***103,541,972*** |
| Livestock products | | 4,445,835 |
| Livestock slaughtered and other disposals | | 5,505,241 |
| ***Total livestock*** | | ***9,951,076*** |
| **Total agriculture** | | **113,493,048** |

Northern NSW was the home to the first major commercial banana plantations in Australia. Coffs Harbour and the area to the north along the far north coast of NSW were the main growing regions for bananas in Australia through the 1900s. This continued up until the late 1900s when north Queensland began to increase production. Coffs Harbour's banana crops are currently facing threats from Panama disease, a fungal disease that kills banana plants and cannot be eradicated once a plantation has been infected.

In 2017-18, NSW accounted for two per cent of Australia's gross value of production for bananas, while Queensland accounted for 98 per cent. Of this, Coffs Harbour LGA accounted for almost 45 per cent of the reported gross value of production for bananas (ABS 2018d). Bananas are still grown in Coffs Harbour but are not as significant as in the past.

Following the increase in competition from Queensland for banana production, there has been a move to investigate the growing of a different variety of bananas and other more profitable produce in Coffs Harbour, including diversification into blueberries that can be sold in overseas and Australian markets. The gross value of blueberries for the Coffs Harbour LGA represented more than 75 per cent of the State.

**Chapter 13, Agriculture** provides further discussion of agricultural land, practices, and their value to the Coffs Harbour region.

### *Tourism*

Coffs Harbour is well known as a popular coastal holiday destination, particularly for families. It is home to a range of beaches located near the CBD, including Diggers Beach, Jetty Beach and Park Beach, alongside a variety of midrange accommodation options located nearby. Given Coffs Harbour's location about halfway between Brisbane and Sydney, it provides a ‘stop-over’ location for drivers to take a break when taking this journey.

In 2018, there were 5.7 million overnight visitors to the North Coast region of NSW (Destination New South Wales 2018), an increase of more than 11 per cent from 2017. In 2017, 1,588,000 people visited the Coffs Harbour LGA, staying an average of four nights and spending $536 million (Tourism Research Australia 2017). There were 815 tourism businesses in the LGA in 2017.

Based on the results of a visitor profile and satisfaction survey undertaken by Tourism Research Australia in January/February 2011, 85 per cent of visitors travelled to the Coffs Coast by privately owned or rented vehicles, while four per cent travelled by bus/coach. Of the routes taken to travel into the Coffs Coast, 82 per cent travelled via the Pacific Highway, with 23 per cent coming from the north and 59 per cent coming from the south (Tourism Research Australia 2011). In recent years Coffs Harbour has developed a reputation as a regional events tourism destination. It has acquired some flagship sporting events including the FIA World Rally Championship, FFA National Youth Championships and three major Oztag events (Wray, et al., 2016).

The SEIA study area includes part of a tourist drive referenced as the Legendary Pacific Coast Drive which stretches between Brisbane and Sydney. The drive traverses the SEIA study area along the Pacific Highway. The study area contains a number of tourism and accommodation businesses, which are discussed in the following sections.

### *Local businesses*

In 2018, there were 5844 registered businesses in Coffs Harbour (ABS 2019a). The greatest number (19 per cent) of these businesses were in the construction industry, followed by those in rental, hiring and real estate services (ten per cent), and agriculture, forestry and fishing (ten per cent). The number of businesses by industry is shown in **Figure 14-12**.

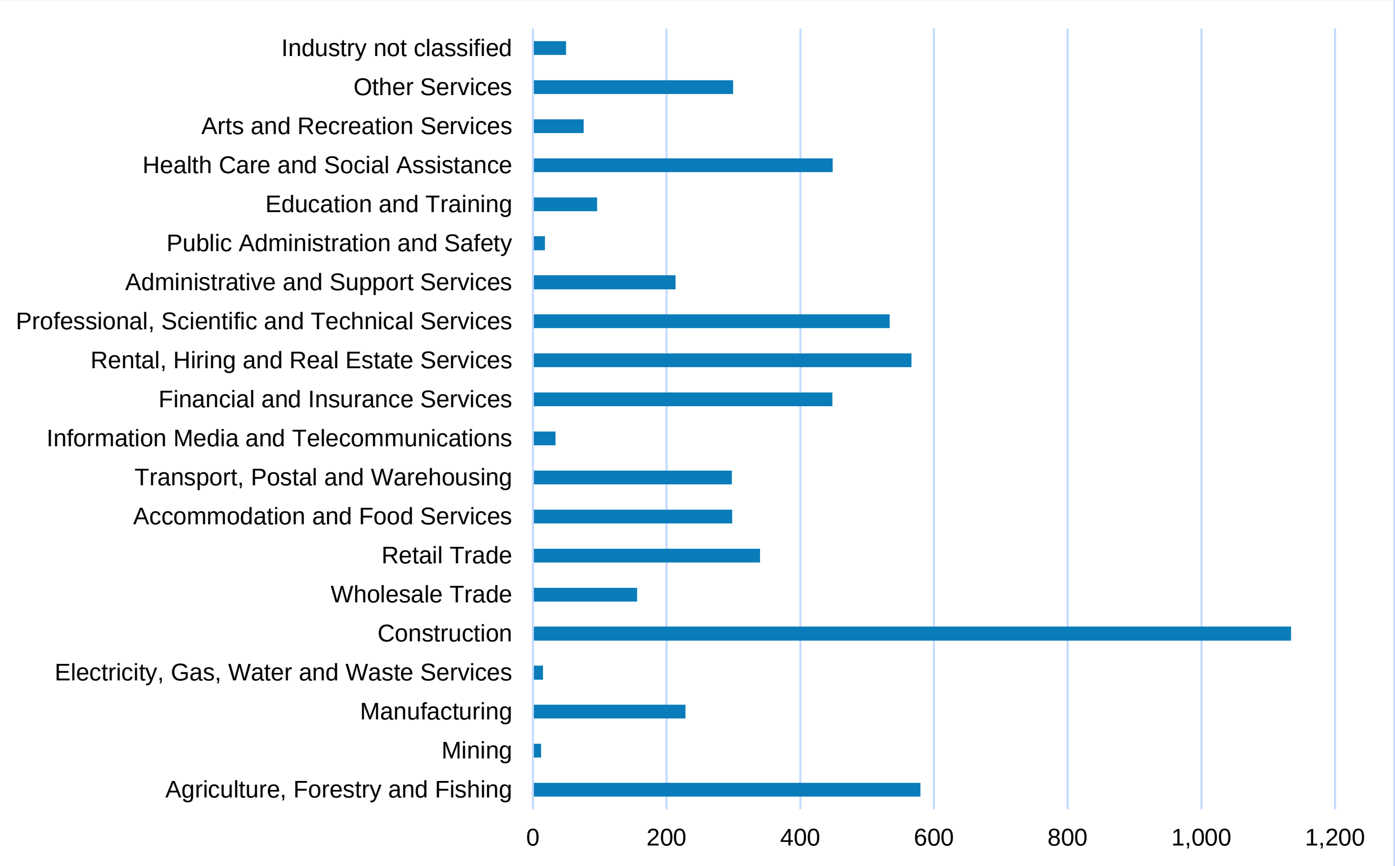



Figure 14-12 Coffs Harbour businesses by industry (ABS, 2019)

## Activity centres and business precincts

The SEIA study area includes a range of established activity centres where businesses are generally located. These centres are generally located along and have direct access to the existing Pacific Highway. The centres within the SEIA study area, by centre type as per the Coffs Harbour LEP 2013, are shown in **Figure 14-13** and include:

### Commercial core

- Coffs Harbour CBD (CBD) – A range of retail, office, entertainment and community activities.

### Local centre

- Park Beach Plaza (LC1) – A shopping centre which contains a range of retail and business activities.

### Neighbourhood centre

- Bray Street Neighbourhood Shops (NC1) – A set of various shops to cater for the local catchment
- Coffs Harbour Squash and Swim Centre (NC2) – A squash and swim centre
- Coffs Harbour GP Super Clinic (NC0) – A medical centre with associated businesses
- Northside Shopping Centre (NC4) – A set of various shops to cater for the local catchment.

### Mixed use

- Orlando Street Mixed Use Centre (MU1) – Several blocks which accommodate a range of businesses, retail and accommodation activities
- Pacific Vetcare (MU2) – Two properties which accommodate a vet and service station
- The Promenade Coffs Harbour (MU3) – A single property which contains retail and business activities.

### Business Development

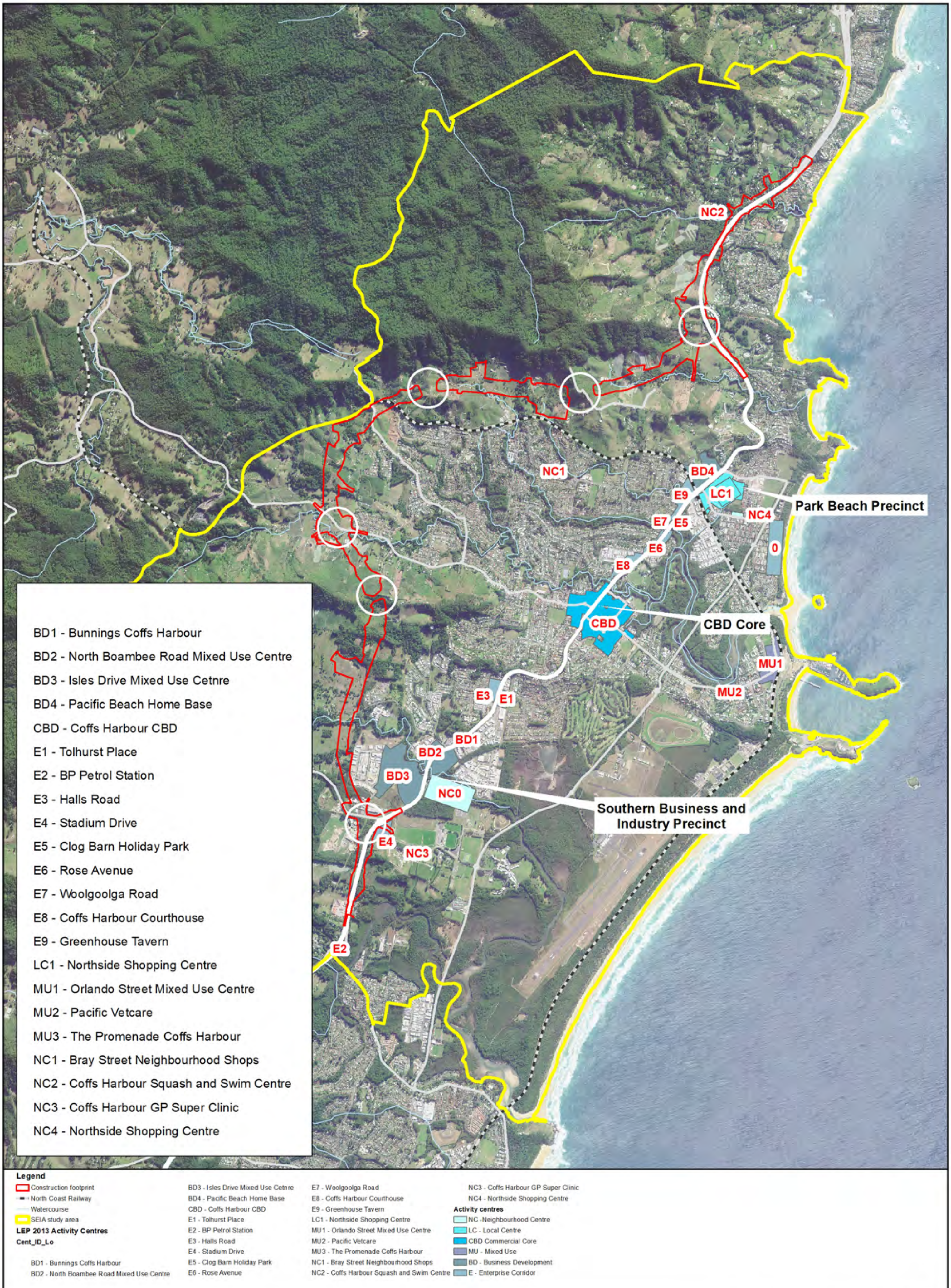
- Bunnings Coffs Harbour (BD1) – A single property which accommodates a Bunnings Warehouse development
- North Boambee Road Mixed Use Centre (BD2) – A set of various large-scale retail shops
- Isles Drive Mixed Use Centre (BD3) – A set of various large-scale retail shops and light industry activities
- Pacific Beach Home Base (BD4) – A set of various large-scale retail shops.

### Enterprise Corridor

- Tolhurst Place (E1) – Several showrooms and car-related businesses
- BP Petrol Station (E2) – A single property which accommodates a BP petrol station
- Halls Road (E3) – Several showrooms and car-related businesses
- Stadium Drive (E4) – A new Caltex service station and food store
- Clog Barn Holiday Park (E5) – A short-term accommodation development with associated recreational uses
- Rose Avenue (E6) – A set of businesses and detached dwellings
- Woolgoolga Road (E7) – A set of businesses and detached dwellings
- Coffs Harbour Courthouse (E8) – Public administration buildings and a range of large-scale retail activities
- Greenhouse Tavern (E9) – A set of businesses and detached dwellings.

Alongside these activity centres, there are three key business precincts currently along the Pacific Highway. These are shown on **Figure 14-13.**

- **Southern business and industry precinct** – located at the south the SEIA study area between Englands Road and Thompsons Road around the existing Pacific Highway. These precincts cater for industrial activities (heavy industry and general industry) and retail activities (generally bulky goods). Businesses in this area that have frontage to the Pacific Highway, include the Oz Group Packhouse, Coffs Coast Resource Recovery Park, Bunnings, Watsons Leisure Centre, Amart Furniture, AutoBarn, Bird Automotive Repairs, Tile and Carpet Court, The Good Guys, and KFC
- **Central business district (CBD)** – as the commercial core of Coffs Harbour, the CBD provides a range of retail, office, public administration, entertainment and community facilities. The CBD is in the centre of Coffs Harbour on both the eastern and western sides of the existing Pacific Highway
- **Park Beach precinct –** located to the north of the CBD, between Orlando Street and Arthur Street, this precinct caters for general industrial and retail activities. This includes general industry located along Orlando Street, the retail centre Park Beach Plaza and bulky goods retailers centred around the Park Beach Home Base.




Coffs Harbour Bypass
Activity centres and business precincts in the SEIA study area
Figure 14-13

### Businesses dependent on passing trade

The existing Pacific Highway is a key attractor for current industrial and retail type land uses, while agricultural land uses are predominantly located away from the highway in the north-western section of the SEIA study area. In Coffs Harbour accommodation businesses are generally located towards the Coffs Harbour CBD along the existing Pacific Highway, or north of Korora Hill between the existing Pacific Highway and the coast. These include Aanuka Beach Resort, Opal Cove Resort, and Paradise Palms Resort.

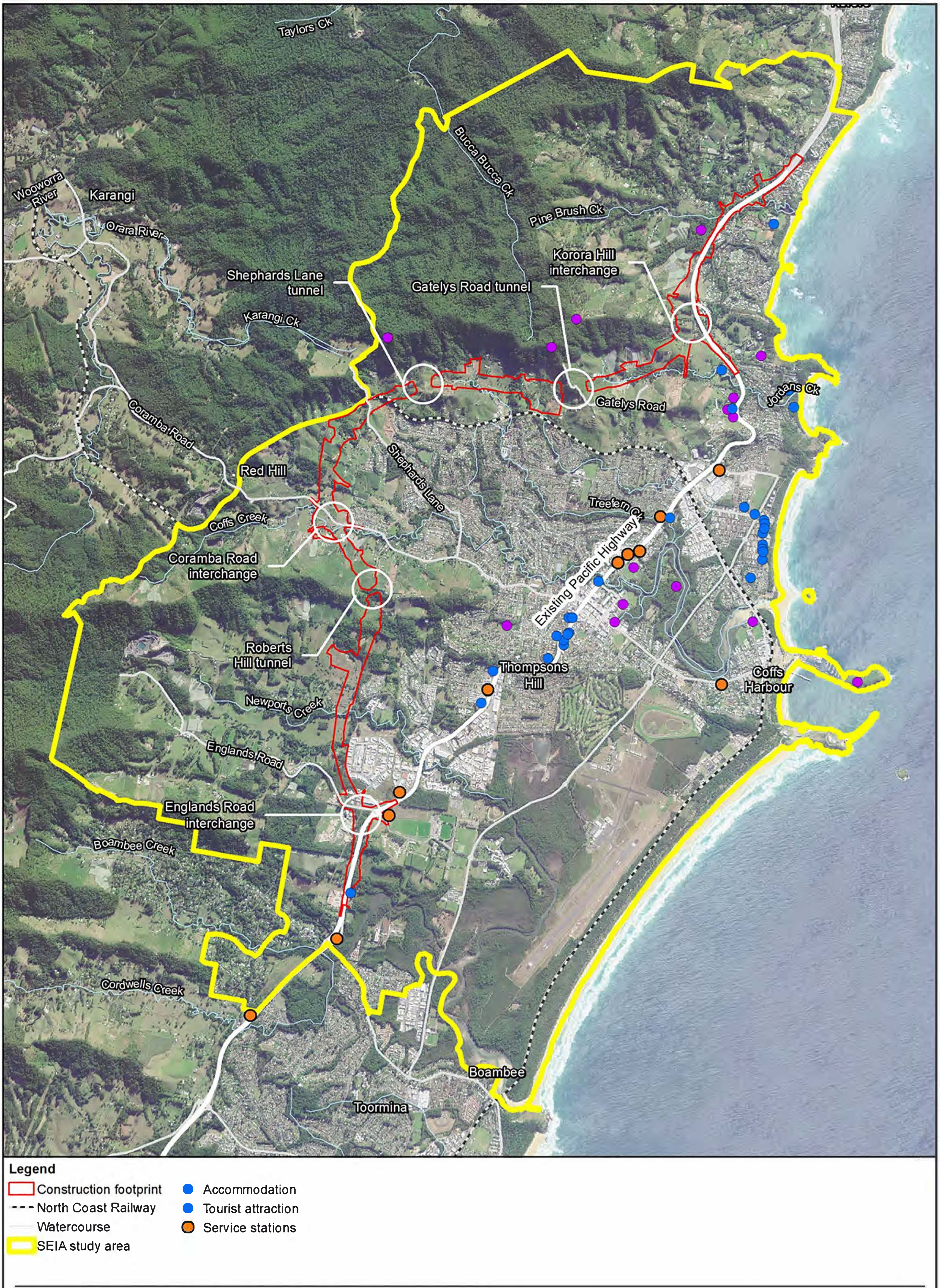
A number of businesses have a level of dependence on passing trade from the existing Pacific Highway. Based on the review of literature on the economic impacts of town bypasses, the following categories of businesses located along the Pacific Highway may attract passing trade or have some dependence on highway-related trade (Parolin 2012):

- Tourism attractions
- Accommodation eg hotels and motels
- Eateries eg restaurants, cafes, fast food, take-away, pubs
- Food stores eg groceries and convenience stores
- Other retail eg gift shops
- Service stations.

These are shown on **Figure 14-14.** The following businesses that meet these business types and have frontage along the Pacific Highway between Boambee and Korora Hill include:

- **Service stations** and related businesses – there are eight service stations located along the existing Pacific Highway. These are BP Service Centre (including eateries such as McDonalds, Red Rooster, Gloria Jeans Coffee, etc), Caltex Coffs Harbour, BP, Liberty Petrol Station, United Petroleum, Shell, Coles Express, Caltex Woolworths and the newly constructed Caltex service station and food store at the Pacific Highway/Englands Road/Stadium Drive intersection. Other related businesses include Thrifty Car and Truck Rental and Beaurepaires Tyres.
- **Accommodation** – there are about 23 accommodation providers located along the existing Pacific Highway. These include Sanctuary Resort, Sanctuary Motel, Arosa Motel, The Big Windmill Corporate and Family Motel, Sapphire Motel, Comfort Inn Premier, Matador Motor Inn, Bananatown Motel, Coffs Shearwater Motel, Bells Motel, Toreador Motel, Best Western Zebra, Quality Inn City Centre, Best Western Parkside Motor Inn, Ibis Budget Coffs Harbour, Novotel Motel, The Plantation Hotel, Bentleigh Motor Inn, Chelsea Motor Inn, CBD Motor Inn Coffs Harbour, Coffs Motel and Villas, Country Comfort Coffs Harbour, and Bananacoast Caravan Park. There are other hotels and resorts located off the Pacific Highway south of the Korora Hill interchange (eg Pacific Bay Resort and Ramada Hotel).
- **Fast food outlets** – there are about ten major fast food providers (most with drive through facilities) located along the existing Pacific Highway. There are also a range of smaller restaurants, cafes and fast food outlets along the existing Pacific Highway through Coffs Harbour.

Other businesses that do not front the Pacific Highway may also rely on passing trade and these are largely located within the identified business precincts.




Coffs Harbour Bypass

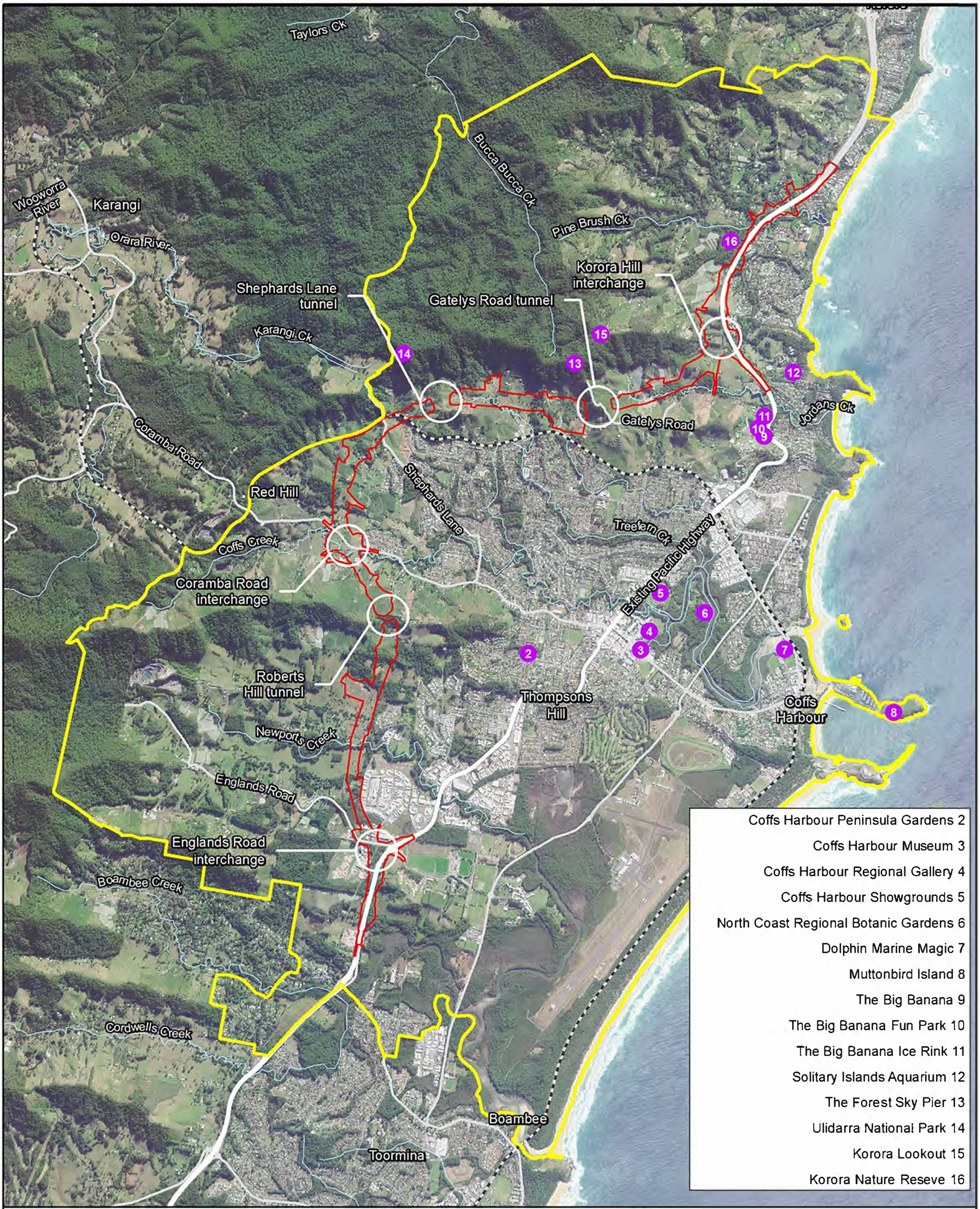
Businesses dependent on passing trade within the SEIA study area

Figure 14-14

There are a number of tourist attractions within the SEIA study area, some of which front the existing Pacific Highway, which are shown on **Figure 14-15.**

The following popular attractions are located along or within 500 m the project and/or the existing Pacific Highway.

- **The Big Banana Fun Park (351 Pacific Highway)** – opened in 1964 and is visited by around 900,000 people annually, the Big Banana Fun Park provides 'banana themed' family entertainment. The park has seen a number of upgrades and redevelopments over the years and now includes attractions including slides, an ice rink, toboggan rides, laser tag, a water park and kids aqua play area. The Big Banana is also a piece of Australian 'pop culture' due to the Australian fascination with 'big' things. Even for those not stopping, the Big Banana is an important landmark along this section of the Pacific Highway. Since 2014, The Big Banana has also been home to the Coffs Harbour Visitor Information Centre
- **R.D. Opal Centre** – Operating since 1985 at the Big Banana Fun Park selling opal gemstones and jewellery
- **Coffs Harbour Regional Gallery (Corner Coffs and Duke Streets)** – operated by CHCC, this gallery offers a program of exhibitions, talks, workshops and other events
- **The Clog Barn Tourist Attraction and Accommodation Park (215 Pacific Highway)** – a Dutch model village featuring clog making demonstrations, miniature railway, and coffee house
- **Coffs Harbour Showground (123 Pacific Highway)** – accommodates outdoor events and exhibitions
- **Solitary Islands Aquarium (2 Bay Drive)** – located at Southern Cross University's National Marine Science Centre, this attraction also provides educational exposure to the marine environment
- **Coffs Harbour Regional Museum (215 Harbour Drive)** – operated by CHCC, the museum aims to bring Coffs Harbour's history alive by reflecting the social and cultural history of the Coffs Harbour Region
- **Kororo Nature Reserve** – An 11 ha nature reserve that contains a popular walking trail and scenic lookout. It is preserved for protection of flora and fauna
- **The Forest Sky Pier (Sealy Lookout)** – a 21 m pier from Sealy Lookout which stands 15 m above the forest floor and offers opportunities to experience panoramic views of Coffs Harbour from within the Orara East State Forest
- **Solitary Islands Coastal Walk** - a 60 km walk from Red Rock through Coffs Harbour to Sawtell within the Coffs Coast Regional Park
- **Orara East State Forest** – a forest designation next to Ulidarra National Park with many points of interest including Bruxner Park Flora Reserve, designated walking, four-wheel driving and cycling tracks, barbeques, and bathrooms
- **Korora Lookout -** within the Orara State Forest, accessible from popular walking tracks that lead to the lookout, including Gumgali Pathway, that contains an interpretive walk, mural, sculpture and soundbar which showcase the region's Gumbaynggirr culture
- **TreeTops** - an adventure park contains built high-ropes courses and flying fox circuit in the trees of Orara State Forest.




**Legend**

- Construction footprint
- North Coast Railway
- Watercourse
- SEIA study area
- Tourist attraction

0 0.5 1 1.5 km

Scale @A4: 1:60,000
GDA 1994 MGA Zone 56

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Coffs Harbour Bypass
Tourist attractions in the SEIA study area
Figure 14-15

In 2016 and 2018, surveys were conducted of Coffs Harbour businesses that were considered to be reliant on passing trade - accommodation providers, service stations, tourist attractions, food outlets and some retailers. Around 100 businesses were invited to participate, with around 20 businesses completing the survey. Key outcomes from the surveys include:

- Just over half of respondents indicated that most of their customers come from people working or living locally, around 30 per cent were visitors to Coffs Harbour, and around 20 per cent were passing trade generated by the Pacific Highway
- Around half of respondents indicated that their business is heavily reliant on passing trade from the existing Pacific Highway, with most of the rest indicating some reliance on passing trade
- More than half of respondents believed there are opportunities for their business because of the project
- Most businesses (around 80 per cent) did not think they would need to operate their business differently during construction of the project
- Signage visibility is considered very important, including signage directing people from the project to their location
- Accommodation businesses identified opportunities to accommodate workers during construction
- Some businesses indicated they may need to spend more money on marketing and advertising to offset the loss of passing trade
- Some businesses saw benefits in reduced traffic within the central Coffs Harbour area in relation to deliveries and traffic flow
- Some businesses have already started working on creating a ‘destination’ that people want to come to rather than just something that people stop at as they drive by
- Some businesses indicated that they expect to lose money and reduce the number of people employed in the short-term.

A previous survey of Coffs Harbour businesses undertaken in 2016 found similar outcomes in relation to the perception of business impacts. Details from these two surveys can be found in **Appendix K3, Business and community surveys and outcomes.**

**Other businesses**

A number of other businesses are located within or near of the project. Among these are several agricultural businesses and operations which are described in detail in **Chapter 13, Agriculture**. Other businesses relevant to the project include:

- Boambee Equestrian Centre (498A Pacific Highway) – the equestrian centre located just off the Pacific Highway offers stabling, agistment and equestrian training facilities.
- Coffs Coast Resource Recovery Park – CHCC’s main waste management facility, containing a number of businesses:
  - Handy Bin Waste Services (25 Englands Road) – operates a materials recovery facility (recycling facility) that sorts domestic and commercial recyclables for sale to the recycling market
  - Coffs Coast Waste Services (25 Englands Road) - the regional service for the collection of household waste on the Coffs Coast in northern NSW. It has a fleet of trucks which collect waste and bring it to the recovery park
  - CHCC Community Recycling Centre (31a Englands Road) - accepts specific waste-streams that are processed for reuse, recycling ort safe disposal
  - Biomass Solutions (31 Englands Road) – a waste treatment facility which processes organics (greenwaste and foodwaste) and residual waste (garbage). Organic waste is processed to

create a composted product which is sold at the facility. Residual waste is also sorted and separated into its various components onsite.

- Oz Group Packhouse (37/51 Isles Drive) – This is a cooperative of more than 90 blueberry growers from the Coffs Harbour region that work together to market, pack and distribute berries. The group operates a blueberry processing plant on this site
- Isles Drive businesses – A number of businesses located on Isles Drive. These include:
  - Stihl Shop Coffs Harbour (32 Isles Drive) – a branch of a national business selling powered outdoor equipment for mowing, yard maintenance and cleaning
  - Amber tiles (28 Isles Drive) – a branch of a national business selling indoor and outdoor tiles and paving
  - Tutt Bryant Hire (28A Isles Drive) – a branch of a national business of plant and equipment hire operation that caters for earthmoving, civil construction, mining and rail maintenance to industrial, trade and DIY users
  - CNW Pty Ltd (28B Isles Drive) – a branch of a national business of electrical wholesale operation
  - Dalkleen Cleaning Equipment and Chemicals (1/34 Isles Drive) – a locally owned business of wholesale and retail cleaning supplies operation
  - Reg Latter Electrical (30 Isles Drive) – a locally owned business of electrical service operation providing electricians for domestic and commercial projects
  - Coffs Harbour Motorworld (36 Isles Drive) – A locally owned used car dealership.
- United Pacific Engineering (52 Englands Road) – An engineering and manufacturing operation that offers a range of services to clients. The operation is located on land that has been purchased by Roads and Maritime
- Industrial Drive businesses (84-90 Industrial Drive) – A new industrial complex with a range of tenants
- Sapphire Motel (673 Pacific Highway) – A motel located on the Pacific Highway at Korora, set on two hectares of land
- Paradise Palms Resort (675 Pacific Highway) – A business that provides a range of accommodation options for visitors, as well as a function and events centre (Pasfields Restaurant Bar Deck). The business also caters for weddings with an onsite chapel
- Lindsay Australia / Lindsay Transport (542 - 568 Pacific Highway) – Lindsay Australia is an integrated transport, logistics and rural supply company with an east coast network of 37 stores and depots. Lindsay Transport’s National Transport Office is located in Coffs Harbour and is responsible for overseeing the movements of its freight fleet Australia-wide.

## 14.2.6 Access and connectivity

### *Regional access and connectivity*

The SEIA study area is roughly halfway between the capital cities of Sydney and Brisbane. The primary modes of access and connectivity regionally are set out below:

- Road – the Pacific Highway / Pacific Motorway provides a corridor from Coffs Harbour south to Sydney, passing Port Macquarie, Taree, Newcastle and the Central Coast, and north to Brisbane, passing around Grafton, Ballina, Tweed Heads and the Gold Coast. It is a national highway and is a key freight, tourist bus route for the region. Currently, there is unrestricted access along the highway through Coffs Harbour, with vehicles able to turn left and right onto the highway from local roads

- Rail – the North Coast Railway is a major trunk line from Northern NSW to Brisbane and provides both passenger and freight services. There are currently six daily (two-way) passenger rail services operating on the North Coast Railway Line, and nine freight services daily (two-way)
- Bus – several bus companies operate with Coffs Harbour LGA and the area is serviced by interstate and interregional bus companies
- Air – Coffs Harbour Airport is located in the south-eastern section of the SEIA study area. It offers regular services to Sydney, Brisbane and Melbourne via Qantas, Tigerair, Virgin Australia and Fly Corporate. The airport also caters for charter flights and aviation training.

### *Local travel behaviour*

According to the 2016 ABS Census, within the SEIA study area 40.5 per cent of households owned one motor vehicle, 33.5 per cent owned two motor vehicles, and 12.6 per cent of households owned three or more motor vehicles. A total of 8.4 per cent of households within the SEIA study area did not own a motor vehicle. This compares with just 3.0 per cent in the core impact area, where the majority of people (53.7 per cent) owned two or more vehicles in 2016. This data shows that the SEIA study area and the core impact area are a car dominant population with a reliance on private vehicles. This may be due to travel distances and limited public transportation options.

Almost 76 per cent of people in the SEIA study area travelled to work via car either as a driver or a passenger (ABS 2016). Comparatively, 61 per cent of the NSW population travelled to work by car as a driver or passenger. Again, this data indicates the population's reliance on private vehicles for transportation. Less than one per cent of people in the SEIA study area reported travelling to work via public transport and less than five per cent of the SEIA study area walked or cycled to work.

### *Road network*

Key roads within the SEIA study area are identified within **Chapter 8, Traffic and transport**. These include a range of different road types, including: the existing Pacific Highway, a four-lane highway; regional roads, such as Coramba Road; and local roads, including Isles Drive, Bennetts Road, Bruxner Park Road and North Boambee Road. The SEIA study area also contains a number of local residential streets which connect residents and the wider community to Coffs Harbour and the wider area.

### *Rail*

The North Coast Railway is a major trunk line from New South Wales to Brisbane, Queensland and provides both passenger and freight services. The Coffs Harbour railway station is located on Angus McLeod Place east of the Pacific Highway and is on the North Coast NSW Line operated (for passenger services) by TfNSW and the Australian Rail Track Corporation (ARTC) for freight services. The line is the primary rail route in the Mid North Coast and Northern Rivers regions and forms part of the rail corridor between Sydney and Brisbane, servicing towns such as Casino, Grafton, Nambucca Heads, Taree and Maitland.

As indicated by the ABS travel to work data, only a small minority (0.03 per cent) of the population of the SEIA study area travel to work by train, and this is usually in combination with other modes.

### *Pedestrian and cyclist routes*

Pedestrian and cyclist routes exist across the SEIA study area (as shown in **Chapter 8, Traffic and transport**), however are generally found along the Pacific Highway and along the coastal area. Crossing points are provided at interchanges. At the southern end of the SEIA study area, a shared path on the eastern side of the Pacific Highway links to a local shared path connection to Englands Road, and an on-street cycle lane on Stadium Drive. At the northern end of the SEIA study area, a cycle path along the Pacific Highway connects to the local road network, and to a Sapphire to Woolgoolga shared path at Coachmans Close at Korora.

The Luke Bowen footbridge provides a pedestrian and cyclist connection between Kororo Public School and the Korora bus interchange located across the Pacific Highway. The footbridge was named after Luke Bowen, a Year 6 student at Kororo who passed away in 1997. The community recognises this footbridge as an important asset, due both to the history associated with its naming, and the access it provides for students and other pedestrians.

Additionally, along Korora School Road, there is a pedestrian path adjacent to the school pick-up / drop-off zone. A children's crossing on Korora School Road provides a safe crossing point from the school grounds to Luke Bowen footbridge.

#### *Bus network and services*

The SEIA study area is serviced by several bus routes as described in **Chapter 8, Traffic and transport**. Bus services within Coffs Harbour LGA are provided by Busways Group and Forest Coach Lines. Busways Group routes 360, 360M, 365, 366, 368 and 367 travel on parts of the existing Pacific Highway. Busways Group also operate dedicated school services each day, with routes 6, 8, 15,17,19, 20 and 27 travelling through the SEIA study area. School bus services in the SEIA study area are also provided by Forest Coach Lines. These include morning routes 115, 136, 137, 153, 155, 112 and afternoon routes 237, 238, 250, 255, 212 and 240. Further detail on bus routes is provided in **Appendix F, Traffic and transport assessment**.

Key bus interchanges are located at:

- Coffs Coach terminal
- Kororo Public School bus interchange
- Park Beach Plaza interchange
- Spagnolos Road (informal interchange).

### 14.2.7 Public utilities

There are a number of public utilities that provide essential services to the communities and businesses in the SEIA. These include:

- Water – CHCC water mains
- Sewerage – CHCC sewer mains and rising mains
- Electrical – Essential Energy low voltage cable, 11kv and 66kv
- Communications – various aerial cables, underground conduits, local optic fibre cables and nationally significant optic fibre cable for the following; Telstra, NBN, Optus, Next Gen and AARNET.

Refer to **Chapter 5, Project description** for further detail.

## 14.3 Assessment of potential impacts

The following section assesses potential impacts of the project during construction and operation.

### 14.3.1 Construction impacts

#### *Impact of property acquisition*

Property impacts, including details of property acquisitions and associated access are discussed in **Chapter 12, Land use and property.** This section assesses the socio-economic implications of these property impacts on the community, businesses and social infrastructure. Socio-economic impacts associated with permanent changes to land use and potential areas of residual land are assessed in **Section 14.3.2.**

As discussed in **Chapter 12, Land use and property**, around 151 properties would be impacted by the project, including 110 buildings of which 74 are residential (rural residential including farm houses, and urban residential properties such as private houses). Some properties contain more than one building (ie residential farm house and sheds or garages).

Property acquisition can impact on some people's way of life. The requirement for residents to relocate from their homes may cause anxiety and stress for the affected residents. Affected people may choose to move away, possibly leaving local communities where they may have established ties. This could have an impact for these people, as they may not resettle easily within other, new communities. Vulnerable members of the community, including the elderly, may be more adversely impacted in such situations particularly given the socio-demographic context in the SEIA study area which has a higher proportion of older residents.

The sensitivity of receivers is considered to be high, due to the associated impact of property acquisition. The level of magnitude is considered to be low, as only a small portion of the study area is impacted. Therefore, overall the socio-economic impact associated with residential property acquisition during construction is considered to be **moderate significance**.

The socio-demographic profile of the SEIA study area may be changed as result of property acquisition and therefore households leaving the area. As the majority of residential acquisitions apply to detached or semi-detached houses, there is likely to be a disproportionate impact upon families and larger households. This may result in a change to the demographic makeup of communities, with a larger proportion of smaller households which may require different services from the previous families. The number of residential properties requiring acquisition is relatively low in comparison to the overall number of homes in the SEIA study area and this impact is likely to be minimal.

The level of sensitivity of receivers to demographic change is considered to be low and the level of magnitude is also considered to be low. Overall, the socio-economic impact associated with residential property acquisition on demographic profile during construction is considered to be **low significance**.

Some properties and roadside areas contain items of special significance to their owners, which would be impacted by the project. One such item is the original gravestone of Herbert Frazer Simpson, which is located within the construction footprint at the intersection of the existing pacific Highway and James Small Drive. This is an isolated gravestone and not considered to be associated with a burial. Also located in the construction footprint is a section of rainforest which has been planted by landowners and is used for educational purposes by CHCC. A tree, planted as a memorial to a family member, may also be impacted through changes to road access near the Coramba Road interchange. Roads and Maritime would continue discussions with the property owner and seek to avoid impact on this during the detailed design stage of the project. Environmental management measures associated with the gravestone and section of planted rainforest are detailed in **Section 14.4**.

The loss or disturbance of these assets of special significance may have an impact on landowners and the wider community who have placed value upon these items, and the sensitivity of affected individuals is considered to be moderate. The magnitude of the impact is considered to be low as the impact is only to a small proportion of receivers within the vicinity of the project. The overall level of significance is therefore considered to be **moderate-low significance**.

### *Socio-demographic profile*

Beyond direct impacts associated with property acquisition, construction of the project may influence the socio-demographic profile of the SEIA study area.

The employment of a construction workforce for the project may see an increase in people employed in the construction industry moving into the SEIA study area, and the core impact area. Based on a four-year construction period, the project is expected to create around 2000 direct and indirect jobs. The construction period would also require a mix of day and night workers, across trades and personnel, subcontractors, functional and administrative staff. Given the duration of the construction program (around four years), some of the construction workforce may choose to relocate to the SEIA study area in order to be close to their work. While some increase in population may occur, the jobs created would also be considered to bring employment opportunities for existing locals within the area.

Given the spatial distribution and size of the population of the SEIA study area, it is unlikely that the changes as a result of the construction workforce and property acquisition would substantially shift the socio-demographic profile. With consideration to the established community – noting the lower proportion of families with children living in the core impact area – the sensitivity of receivers to these changes is considered to be low, and the magnitude of impact also low, resulting in overall **low significance** of social and economic significance of the project's construction on the socio-demographic profile of the SEIA study area.

During consultation about the project, CHCC raised concern that an influx of construction workers may have an adverse impact on the availability and affordability of rentals and tourism accommodation within the property market. This is because it is considered that construction workers may utilise rental properties, or temporary accommodation typically used for tourism visitors while employed on the project. However, a Construction Workforce Accommodation Study undertaken by Pacific Complete for the Woolgoolga to Ballina highway upgrade showed that there are minimal impacts of construction workforce upon these factors (Pacific Complete 2016). Based on this analysis, the sensitivity of receivers to this impact is considered to be moderate, but the magnitude of the impact is considered to be low. This results in an overall socio-economic impact of the project's construction on the rental property market of the SEIA study area of **moderate-low significance.**

### *Amenity*

People who live in close proximity to the construction footprint would potentially be impacted by a range of construction related amenity impacts such as noise, vibration, visual changes and air quality (dust), as well as traffic impacts associated with construction vehicles.

#### Noise and vibration

The potential for noise and vibration during construction was identified as a key concern for the local community and businesses during consultation, as outlined in **Section 14.2.3**. A noise assessment (**Appendix G, Noise and vibration assessment**) based on the worst-case scenario found that there would be exceedances of noise criteria for many sensitive residential and non-residential receivers (eg educational and childcare facilities) located in the proximity to the construction footprint. These include houses near North Boambee Road, Coramba Road, Shephards Lane, Mackays Road, north and south of the Korora Hill interchange, and Gatelys Road. Communities around the construction access routes would likely experience an increase in traffic noise and vibration impacts during construction.

This predicted construction noise and vibration has the potential to create annoyance for the residents affected, which may lead to stress and/or changes in people's behaviours (such as leaving windows closed or not using outdoor spaces). Construction works would take place mostly within standard construction working hours. However, certain activities would need to take place during the evening and night-time periods (out of hours) due to technical considerations, for health and safety of the public and construction personnel and to minimise disruption to the travelling public. Works undertaken at night near residential areas (or other facilities where people sleep) have the potential to cause sleep disturbance, which could have health and wellbeing implications.

**Chapter 9, Noise and vibration** provides a number of mitigation and management measures that will be implemented during construction to manage potential noise impacts.

As only a small percentage of the SEIA study area's population would experience noise and vibration impacts, the magnitude of the impact is considered to be low, with the sensitivity of receivers considered to be moderate. The socio-economic impacts associated with construction related noise and vibration have therefore been assessed as having **low-moderate** significance during the four-year construction period.

### Air quality

Adverse impacts from high dust levels during construction may include possible health effects for the local community (from smaller particles) and soiling and amenity impacts, such as dust settling on cars, or inside windows if left open (due to fallout of the larger particles). However, a risk assessment undertaken indicates that construction dust is unlikely to present a serious air quality issue, with appropriate dust suppression mitigation in place (refer to **Chapter 21, Air quality**). As with noise and vibration, there would be a range of impacts experienced at different locations depending on the sensitivity of the receiver.

Any effects would be temporary and would mainly arise during dry weather with the wind blowing towards a receiver, at a time when dust is being generated. As such, the magnitude of the impact associated with air quality is considered to be low. The sensitivity of receivers is considered to be high given the potential impacts associated with dust levels. The overall socio-economic impacts associated with construction related air quality have been assessed as having **low-moderate** significance during the four-year construction period. Further information is provided in **Chapter 21, Air quality.**

### Visual

During construction, a range of activities associated with road works would be visible from viewpoints around Coffs Harbour. There would be an adverse impact on visual amenity for people who have views of construction footprint and associated machinery and ancillary facilities. The character of the landscape would also temporarily change during construction due to the removal of vegetation, earthworks, installation of lighting, fencing and construction facilities and the actual construction of the project. From a socio-economic perspective, people are most likely to be concerned about the environmental impact of these visual changes (especially in relation to vegetation clearing), the impact of these visual changes on the value they place on views from their residence or workplaces, and the potential impact on the monetary value of their properties due to these visual changes.

These visual impacts would mostly be within the core impact area and impacts in the wider SEIA study area would generally be lower. The magnitude of the socio-economic impacts associated with visual amenity is considered to be low, and the sensitivity of receivers is considered to be moderate. The overall socio-economic impacts associated with construction related to visual amenity have been assessed as having **low-moderate** significance during the four-year construction period. Further information is provided in **Chapter 11, Urban design, landscape and visual amenity.**

### *Community values*

As discussed in **Section 14.2.3**, the Coffs Harbour community values its lifestyle, proximity to the coastline, natural environment and ability to travel easily through the local area.

Given the amount of clearing and earthworks required for the project, the community may be concerned about the loss of environmental values and the impact this would have on Coffs Harbour's natural environment. The community has indicated a preference to use construction methods that maintain the natural landform as much as possible. Where this is not possible, it is likely that there would be concerns from the community about the impact.

While much of the project would be constructed offline from the existing Pacific Highway, road users would be impacted by reduced speeds, stoppages and congestion where the project ties into the existing highway at the south and north of Coffs Harbour. This work may impact ability to travel easily through the local area (due to traffic management activities).

The Luke Bowen footbridge, which provides a pedestrian and cyclist link across the Pacific Highway at Korora, would be demolished and a new one constructed around 20 m north of the existing bridge. As this bridge was named after a local school boy, the bridge has significance to the local community. There may be a sense of loss from the demolition of this footbridge. However, the new bridge constructed as part of the project would retain the name Luke Bowen footbridge in order to retain the memorial.

While some people may experience impacts that affect their experience of Coffs Harbour and its values, overall it is considered that the project would not significantly change the overall values. Socio-economic related to community values for the broader population have been assessed as having low magnitude and sensitivity, and therefore a **low significance** during the construction period.

### *Social infrastructure*

Construction of the project would have a number of potential impacts on social infrastructure within the SEIA study area as described in **Table 14-15.**

Table 14-15 Social infrastructure impacted by the project during construction

| Facility | Details |
|---|---|
| Kororo Public School | Buildings and grounds of Kororo Public School would not be directly impacted by the project, but the access road and car parks would be directly impacted. This would result in traffic management measures being required during construction. This would not result in any significant socio-economic impacts, as permanent alternative access will be provided, and the footbridge will be relocated to continue to facilitate pedestrian and cycling connectivity.<br>Amenity impacts during construction described above could interfere with daily activities or disrupt the learning environment through interfering with concentration and memory. |
| Bishop Druitt College | Bishop Druitt College would not be directly impacted by the project. However, they would experience similar amenity impacts as described for Kororo Public School. |
| Coffs Coast Sport and Leisure Park | During construction, people using the park may experience amenity related impacts, which could impact on activities, or enjoyment of those activities. |
| Kororo Nature Reserve | The project would not directly impact the reserve, but construction work would take place adjacent to the site, which could impact on activities within the reserve, or enjoyment of those activities. |
| Pacific Bay Resort Golf Course | The nine-hole golf course located adjacent to the existing Pacific Highway may experience amenity related impacts for users of the golf course, which could impact on activities, or enjoyment of those activities. |
| Coffs Harbour Montessori Pre-School | Coffs Harbour Montessori Pre-School is located about 100 metres from the construction footprint near Kororo Public School and would not be directly impacted by the project. However, they would experience similar amenity impacts as described for Kororo Public School. |
| Solitary Rural Fire Services shed | The Solitary Rural Fire Services shed would not be directly impacted, but its access would change. See **Chapter 8, Traffic and transport** for further detail. |

In addition to the social infrastructure identified above, the Generocity Church is located on land that has already been purchased by Roads and Maritime for the purposes of the project. Attendees of the church are likely to experience potential disruption as they find an alternate church.

The magnitude of direct and indirect impacts on social infrastructure within 500 m of the project during construction is considered to be moderate, with the sensitivity of receivers also moderate. Overall impacts on social infrastructure within 500 m of the project is therefore considered to be of **moderate significance**. Through the management of noise impacts and consultation with the potentially affected schools and recreation areas, these impacts would be minimised as far as practicable.

Within the broader SEIA study area, a range of social infrastructure facilities may also experience indirect impacts associated with the project's construction. This includes schools, medical facilities and other regional services. These impacts would most likely be related to access and traffic related changes, such as temporary road closures and detours. These may impact on emergency service response times. The magnitude of impacts on social infrastructure within the wider SEIA study area is considered to be low, with the sensitivity of receivers low, resulting in impacts on social infrastructure within the wider SEIA study area that are considered to be of **low significance.**

### *Business and industry*

#### Agriculture

A total of 24 farms and the Oz Group Packhouse would require partial or full acquisition as a result of the construction of the project. The impacts to the Oz Group Packhouse during construction include loss of some car parking and temporary changes to access. However, access would be maintained at all times. The construction of the project is not considered likely to significantly impact upon the wider agricultural industry in the SEIA study area. As described in **Chapter 13, Agriculture**, six banana farms within Coffs Harbour LGA would be critically impacted and would cease to operate. This is considered to be a minor impact on the overall industry and confined only to the banana industry. Other farms would experience wider amenity impacts (eg dust and removal of irrigation water sources) which may be able to be mitigated (see **Chapter 13, Agriculture**). The sensitivity of receivers to socio-economic impacts associated with agriculture as an industry for the construction of the project is considered to be moderate, and the magnitude of impacts low. Therefore, overall socio-economic impacts associated with agricultural industry for the construction of the project are considered to be of **moderate-low significance**.

#### Tourism

The construction of the project is not considered likely to significantly impact upon the wider tourism industry in the SEIA study area however there may be impacts to individual businesses within these areas.

Minor impacts may occur as a result of construction traffic impacting on accessibility for visitors to the Coffs Harbour area. During construction, a range of activities associated with road works would be visible from viewpoints around Coffs Harbour, which are popular tourist attractions (such as Forest Sky Pier), which may impact the enjoyment and experience of visiting Coffs Harbour. Further information is provided in **Chapter 11, Urban design, landscape and visual amenity.**

The sensitivity of receivers is considered to be low, and the magnitude of impacts also low. Construction impacts to the tourism industry are therefore considered to be **low significance**.

#### Local businesses

**Activity centres and business precincts**

The activity centres and business precincts within the SEIA study area are unlikely to experience any negative socio-economic impacts during construction. There may be impacts to individual businesses within these areas, which are considered in the following sections. Impacts are therefore considered to be **negligible significance**.

### Businesses dependent on passing trade

Many local businesses in the SEIA study area are located along the Pacific Highway and would not be directly impacted during the construction of the project. Some businesses that rely on passing trade within the SEIA study area (see **Section 14.2.5**) around construction sites, tie-ins, and haulage routes may experience a reduction in trade due to amenity impacts. A range of accommodation businesses are located adjacent to the Pacific Highway to the north of Coffs Harbour at Sapphire. Access to these businesses is generally provided via local access roads that have direct access onto the Pacific Highway. During construction, direct access to the Pacific Highway north of Bruxner Park Road/James Small Drive would cease with access provided via new local access roads where required. Access to some accommodation facilities would therefore change during construction which could impact on business activities and trade. Conversely, some accommodation and food and beverage businesses may experience increased trade resulting from the construction workforce.

The sensitivity of businesses dependent on passing trade during construction is considered to be low, and the magnitude of impacts is considered to be low, as a relatively small percentage of Coffs Harbour's local businesses would be impacted by construction related activities. The overall significance has been assessed as **low significance**.

### Other businesses

A number of local businesses would be impacted by construction of the project, mainly through acquisition, amenity impacts or changes to their access. These impacts are discussed further in **Chapter 12, Land use and property**. The local businesses potentially impacted are summarised in **Table 14-16.**

Table 14-16 Local business impacts of the project during construction

| Facility | Details |
|---|---|
| Boambee Equestrian Centre (498A Pacific Highway) | Minor strip acquisition would be required from the Boambee Equestrian Centre, which would not affect the operation of the business. The Centre may also experience amenity impacts during construction. |
| Coffs Coast Resource Recovery Park (Englands Road) | A number of businesses within the Coffs Coast Resource Recovery Park would be impacted by the project and further consultation regarding impacts will be undertaken with CHCC. Impacted businesses include:<br>• **Handy Bin Waste Services** – The project would impact access roads, car parking areas and the facility's annexe, located at the eastern end of the main shed<br>• **Coffs Coast Waste Services** – The onsite parking area and vehicle maintenance sheds would be impacted by the project and would need to be relocated.<br>• **Coffs Harbour City Council Community Recycling Centre** – Access to the centre would be directly impacted during construction, however alternative access would be provided<br>• **Biomass Solutions** – The project would impact external stockpile areas, access roads and car parking areas, but the facility's main shed would not be directly impacted. Therefore it is expected that operations could continue on site. Access to the facility would be maintained at all times. |

| | |
|---|---|
| Stihl Shop Coffs Harbour (32 Isles Drive) | This premise is directly impacted by the project. This business would need to relocate prior to the commencement of construction. |
| Amber Tiles (28 Isles Drive | This premise is directly impacted by the project. This business would need to relocate prior to the commencement of construction. |
| Tutt Bryant Hire (28A Isles Drive) | This premise is directly impacted by the project. This business would need to relocate prior to the commencement of construction. |
| CNW Pty Ltd (28B Isles Drive) | This premise is directly impacted by the project. This business would need to relocate prior to the commencement of construction. |
| Dalkleen Cleaning Equipment and Chemicals (1/34 Isles Drive) | This premise is directly impacted by the project. This business would need to relocate prior to the commencement of construction. |
| Reg Latter Electrical (30 Isles Drive) | This premise is directly impacted by the project. This business would need to relocate prior to the commencement of construction. |
| Coffs Harbour Motorworld (36 Isles Drive) | This premise is directly impacted by the project. This business would need to relocate prior to the commencement of construction. |
| United Pacific Engineering (52 Englands Road) | The operation is located on land that has been purchased by Roads and Maritime. This business would need to relocate prior to the commencement of construction. |
| Industrial Drive businesses (84-90 Industrial Drive) | A portion of land along the complex boundary would be directly impacted, but the building would not be directly impacted. Businesses operating out of this complex may experience amenity related impacts. |
| Sapphire Motel (673 Pacific Highway) | The operation is located on land that has been purchased by Roads and Maritime. There is potential for the hotel to continue to operate at reduced scale during construction and operation. However, some facilities that front the existing Pacific Highway would be demolished prior to the commencement of construction. |
| Paradise Palms Resort (675 Pacific Highway) | The project would directly impact a number of accommodation units and buildings located at the southern end of the property adjacent to the existing Pacific Highway. Two tennis courts at the southern end of the property would also require acquisition. The resort currently has direct access onto the Pacific Highway. However, access would change during construction with new accesses being provided off the western local access road. |

Other businesses may experience inconvenience as a result of altered access arrangements during construction. These would include:

- Lindsay Australia / Lindsay Transport (542 - 568 Pacific Highway) – The site currently has direct access onto the Pacific Highway via left in, left out turns. During construction access into the site would be upgraded and work would take place along the highway adjacent to the site. Access to the site would need to be maintained and traffic management planning would need to allow for heavy vehicle turns into and out of the site.
- Koala Villas and Caravan Park (539 Pacific Highway) – The park currently has direct access onto the Pacific Highway via left in, left out turns. Access into the park would be upgraded and work would take place along the highway adjacent to the site. Access to the site would need to be

maintained and traffic management planning would need to allow for vehicles towing caravans into and out of the site.
- Banana Coast Caravan Park (429 Pacific Highway) – The park currently has direct access onto the Pacific Highway via left in, left out turns. Access to the site would need to be maintained and traffic management planning would need to allow for vehicles towing caravans into and out of the site.
- Businesses accessed via Charlesworth Bay Road – A number of accommodation, tourism and other businesses are accessed via Charlesworth Bay Road including but not limited to Pacific Bay Resort, Ramada Resort by Wyndham and Solitary Islands Aquarium / Southern Cross University's National Marine Science Centre. Access into Charlesworth Bay Road would be upgraded during the project's construction which may result in some traffic delays and diversions during construction. Alternate access into this area is provided via Differ Beach Road.
- Coffs Harbour Squash and Swim Centre (11 Korora Basin Road) – Access to the centre from the eastern side of Coffs Harbour is currently provided via Old Coast Road which has direct access onto the existing Pacific Highway (left and right turns). During construction, access to the Pacific Highway from Old Coast Road would cease and Old Coast Road would be made a cul-de-sac. A new local access road would be constructed on the western side of the Pacific Highway linking to an overpass located near Fernleigh Avenue. The overpass would provide access to the eastern local access road which would provide access to areas east of the highway. This would add approximately 1.5 kilometres to the journey to and from the centre, but would improve road safety compared to the existing situation.
- Accommodation businesses along the Pacific Highway – Access to these businesses is generally via local access roads that have direct access onto the Pacific Highway. During construction, north of Bruxner Park Road/James Small Drive, direct access to the Pacific Highway would cease with access provided via new local access roads where required. Access to some accommodation facilities would therefore change during construction.

Further detail on changes property accesses as a result if the project is discussed in **Chapter 8, Traffic and transport**.

Construction of the project may also provide opportunities for a number of local businesses and industries. This could include:

- Construction – locally sourced materials and labour
- Accommodation and food services – provision of accommodation and food and beverages for construction workforce and associated suppliers
- Retail and wholesale trade – opportunities for wholesale/ retail sales associated with the project and its workforce
- Automotive and construction plant businesses – provision of vehicles, plant, maintenance and fuel for construction workforce.

During construction the sensitivity of other businesses is considered to be moderate, and the magnitude of impacts is considered to be low, therefore the overall significance has been assessed as **Moderate-low significance**, as only a relatively small percentage of Coffs Harbour's local businesses would be impacted by construction related activities.

#### *Access and connectivity*

During construction, there would be interface between construction traffic vehicles and traffic on the existing Pacific Highway and local roads, particularly for the interchanges at Englands Road, Coramba Road, and Korora Hill and for the section of the project between Korora Hill and Sapphire.

Potential disruption may impact commuters, local residents, businesses, heavy vehicle operators, public transport users and active transport users for the duration of construction. In particular, it may result in traffic that could impact upon local travel (including travel times) in the short-term. Communities in the SEIA study area may change their usual travel routes or change locations where they visit within the local area during construction. Road users may also change the way they travel through the local area based on real or perceived traffic impacts.

In addition, a number of transport and access related facilities would be impacted by the project including:

- The Kororo Public School bus interchange on the existing Pacific Highway
- Luke Bowen footbridge next to Kororo Public School
- Informal school bus interchange at the intersection of Coramba Road and Spagnolos Road.

The above facilities would be relocated and/or rebuilt as part of the project and associated impacts are expected to be temporary. Further discussion on the potential access and connectivity impacts to these facilities is provided in **Chapter 8, Traffic and transport**.

Construction of the project could have temporary short-term impacts on the North Coast Railway, due to the construction of a proposed bridge crossing over the railway. Any potential impact would be managed in consultation with ARTC to minimise impacts on operations.

Possible impacts to access and connectivity would be mitigated through implementation of the environmental management measures detailed in **Chapter 8, Traffic and transport**. The magnitude of socio-economic impacts relating to access and connectivity is considered to be low, and the sensitivity of receivers is low, resulting in an overall **low significance**.

#### *Public utilities*

Changes to utilities within or close to the project may be required during construction. This would potentially include adjustment and/or relocation of water and sewerage mains, and/or electrical and communications cables. Existing street lighting may also need to be relocated or improved in certain areas. **Chapter 5, Project description** provides further details, including locations of these utilities.

Disruptions to utilities could have a range of impacts upon residents, businesses and the wider community, including loss of operation of business-critical equipment, impacts on household routines, interruptions to social services and other activities, and impacts to certain emergency services that are required to call upon backup power supplies.

This work would be undertaken in consultation with the relevant authorities and in line with their relevant procedure to minimise disruption of service. Any disruptions to services due to utility adjustments would be discussed with key stakeholders and communities would be notified of outages in advance of works.

The magnitude of impact from utility works is expected to be low as they would be local, of short duration and low severity. The sensitivity of users to the loss of services would be high. Based on this, the socio-economic impact of service disruptions and utility relocation have been assessed as having a **moderate significance**. **Chapter 12, Land use and property** provides an assessment of potential impacts on utilities that may be affected by the project.

### 14.3.2 Operational impacts

The following sections provide details of potential socio-economic, impacts associated with the project's operation.

#### *Socio-demographic profile*

Once operational there may be a minor shift in the socio-demographic profile as the construction workforce would relocate away from the area. However, this shift is anticipated to be minimal in comparison to the size of the population within the area.

The project may indirectly influence population and demographic trends in Coffs Harbour as it would improve access to and from Coffs Harbour, and between regional centres on the NSW North Coast and the capital cities of Brisbane and Sydney, make living or working in Coffs Harbour a feasible option for future residents and workers.

Given the indirect nature of these impacts, the magnitude is assessed to be low, and the sensitivity of receivers to such impacts is considered to be negligible. Therefore, the overall socio-economic impacts associated with socio-demographic profile of the SEIA study area during operation is considered to be of **negligible significance**.

### *Amenity*

Once the project is operational, people who are in close proximity to the project would potentially be impacted by a range of operational amenity related impacts such as noise, vibration, air quality and visual changes.

#### Noise and vibration

The project's operational noise was a key issue flagged by the community during engagement activities for the project. Noise associated with operation of the project has the potential to create annoyance for people who live, work or and use the recreational areas near the project. This annoyance may lead to stress and/or changes in people's behaviours (such as leaving windows closed or not using outdoor spaces). Night-time operational noise near residential areas (or other facilities where people sleep) has the potential to cause sleep disturbance.

To reduce the impact of road related noise, a number of mitigation measures would be used to reduce operational noise including low noise pavement, noise barriers and at-property treatments (see **Chapter 9, Noise and vibration**).

Once the project is operational there would be a notable reduction in noise impacts from vehicles using the existing Pacific Highway through the Coffs Harbour CBD, which would benefit those communities located along the existing route. Most heavy vehicles would be expected to bypass the CBD using the project, with the overall traffic numbers on the Pacific Highway predicted to decrease. People who currently experience noise impacts from the existing highway would likely experience an improvement in the noise environment through the CBD.

The magnitude of impacts associated with operational noise and vibration is considered to be low, and the sensitivity is high. Therefore, the socio-economic impacts associated with the operational noise of the project is considered to be **moderate significance**. **Chapter 9, Noise and vibration** provides further detail.

#### Air quality

Once operational, emissions from vehicles using the project would be the source of potential air pollutants and there would be some local increase in air emission concentrations along the project where previously roads did not exist. Contributions of vehicle emissions to ambient air quality in the area are historically low, and although these may increase in the immediate vicinity of the project, they are predicted to remain well below the relevant air quality criteria. It is considered that the changes to air quality associated with the project would not have a measurable effect on the health of the community around the project.

Additional traffic on local road connections, such as Coramba Road, would lead to an increase in traffic due to the redistribution of traffic movements. However, it is unlikely that these changes would result in any measurable change in air quality.

The sensitivity of receivers to operational air quality impacts is considered to be high, but the magnitude is considered to be negligible. Therefore, socio-economic impacts associated with the operational air quality of the project have been assessed as having **negligible significance**. **Chapter 21, Air quality** provides further detail.

### Visual

The introduction of a highway with associated earthworks and structures would create a significant visual change from a range of viewpoints. These changes and photomontages of expected views are detailed in **Chapter 11, Urban design, landscape and visual amenity**.

People who live, work and use the areas where visual and landscape character impacts from the project would be likely to experience some form of associated impact. In particular, views important to the community may no longer be available to them, or there the loss of a view may have a potential impact on the value of their property. In addition, the change in character from rural setting to highway may impact on users' enjoyment and appreciation of the area. A range of urban design and landscaping/revegetation strategies would be implemented to mitigate visual and landscape character impacts as much as possible.

The sensitivity of receivers to impacts associated with the operation of the project and related to landscape character and visual amenity is considered to be high. However, as these impacts would be contained to these specific communities, the magnitude of socio-economic impacts associated with the operation of the project related to landscape character and visual amenity for the broader SEIA study area have been assessed as moderate. Overall, the impacts associated with the operation of the project related to landscape character and visual amenity are considered to be of **high-moderate significance**. **Chapter 11, Urban design, landscape and visual amenity** provides further detail.

### *Community values*

Lifestyle is a key reason why people choose to live in Coffs Harbour. Once operational, the reduction in traffic within the Coffs Harbour CBD may provide opportunities to foster community values and cohesion. Local people would be able to travel more easily within Coffs Harbour without mixing with highway traffic – supporting easier access to those assets they value, such as beaches and other natural areas. If the existing Pacific Highway was to remain in its current location, coupled with Coffs Harbour's forecast population growth, this would put significant pressure on the lifestyle experience within Coffs Harbour into the future.

The natural environment in and around Coffs Harbour has also been identified as a major factor valued by the community. People's concern for the environment is likely to focus on fauna once the project is operational. A range of fauna management measures are proposed for operation which would be expected to maintain fauna connectivity (see **Chapter 10, Biodiversity**). Once the project is operational, landscaping and urban design treatments would also be in place to mitigate impacts to landscape values and establish vegetation on cleared areas.

Other concerns that would relate to community values include potential flooding impacts from the project. Flood impacts to property can impact the health and wellbeing of those at risk. There are several properties and buildings that are predicted to be potentially impacted by flooding during operation of the project and a number of mitigation measures have been proposed (see **Chapter 17, Flooding and hydrology**).

Overall, the operation of the project would provide benefits to road users and people who travel in and around Coffs Harbour on the local road network by removing through-traffic. Amenity impacts would be expected to affect some properties, but this is contained to those in close proximity to the project. The sensitivity of receivers is considered to be low, and the magnitude of the impact low, meaning that socio-economic impacts associated with community values during the operational phase are considered to be of having **low significance**.

### *Social infrastructure*

Once operational, no additional social infrastructure would be directly impacted by the project.

Overall, the project would improve accessibility and safe access to social infrastructure located in the SEIA study area, particularly those along the Pacific Highway and in the Coffs Harbour CBD. These include the Coffs Harbour Base Hospital, Korora Public School and the Coffs International Stadium.

The project would result in the operation of a highway close to a number of social infrastructure facilities, which is likely to have a number of amenity impacts, these include:

- Bishop Druitt College - expected to experience amenity impacts associated with noise. Noise modelling indicates that the noise criteria would be exceeded at the school by 2034, which may cause nuisance which would impact upon the learning environment. TfNSW will continue to engage with Bishop Druitt College to determine appropriate mitigation to address this.
- Kororo Public School - Kororo Public School car park, parent set-down and adjacent bus interchange would be provided via a new facility accessed via James Small Drive. This would provide an increase in formal parking and a larger drop-off area, enhancing ease of access for users and visitors. Noise modelling indicates that the noise criteria would be exceeded at the school by 2034, this may cause nuisance which would impact upon the learning environment.
- Coffs Harbour Montessori Pre-School - Noise modelling indicates that the noise criteria would be exceeded at the school by 2034. TfNSW will continue to engage with Coffs Harbour Montessori Pre-School's management to determine appropriate mitigation to address this. These impacts may cause nuisance which would impact upon the learning environment.
- Boambee Public School - Noise modelling indicates that the noise criteria would be exceeded at the school by 2034. These impacts may cause nuisance which would impact upon the learning environment.

The main impacts on social infrastructure as a result of the operation of the project would be associated with amenity which is discussed above. Social infrastructure facilities potential impacted during operation include Bishop Druitt College, Kororo Public School and Coffs Harbour Montessori Pre-School. Similar to construction, amenity related impacts during operation could interfere with daily activities or disrupt the learning environment through interfering with concentration and memory. Roads and Maritime will continue to engage with the owners and operators of these facilities to determine appropriate mitigation to address this.

The spatial extent of these impacts is local, with the duration permanent. On this basis, the overall magnitude of amenity impacts upon social infrastructure is considered to be low. The sensitivity of the nearby social infrastructure would be low. As such, socio-economic impacts associated with the operation of the project related to social infrastructure have been assessed as having **low significance**.

### *Business and industry*

#### Agriculture

Once operational, the project is unlikely to have ongoing impacts on agriculture. However, the operation of the highway may benefit the industry through improved access and movement of produce. The agriculture impact assessment indicated that indirect impacts would have a negligible impact to the region's agriculture industry. The socio-economic impacts associated with agricultural industry during operation are therefore considered to be **negligible significance.** Impact on agriculture is discussed in further detail in **Chapter 13, Agriculture.**

#### Tourism

Once operational, the reduction in traffic within Coffs Harbour CBD may provide opportunities to enhance tourism character as it would provide opportunities to change built form and enhance public open space along the existing Pacific Highway. Visitors and locals would also be able to access key natural and tourism assets such as beaches more easily due to reduced traffic within the CBD.

During operation, the sensitivity of receivers is considered to be low, and the magnitude of impacts to the tourism industry is considered to be low. Therefore, the impacts to the tourism industry has been assessed as **low significance**.

### Local business

**Activity centres and business precincts**

The operation of the project would mean the identified activity centres and business precincts of Coffs Harbour would no longer be located on the national highway.

For the CBD business precinct, this is likely to result in significant benefits for business. Once operational, the removal of traffic, especially heavy vehicles, from the CBD is expected to generate new business opportunities due to improved access and amenity.

For the southern business and industry precinct, and the Park Beach precinct, there would be a potential reduction in passing trade, impacting on retail activities in the area. However, many of these businesses and industries in these areas do not rely on passing trade and would benefit from improved amenity, particularly regarding noise.

During operation the sensitivity of receivers is considered to be low, and the magnitude of impacts to activity centres and business precinct is considered to be low. Therefore, the impacts to activity centres and business precincts has been assessed as **low significance**.

**Businesses dependent on passing trade**

Once the project is operational, the traffic volumes along the existing Pacific Highway would decrease. Drivers would need to make a conscious decision to exit the highway and travel into Coffs Harbour for fuel, food, lodgings or the tourist attractions that Coffs Harbour has to offer. This may impact the customer base of businesses that currently rely heavily on passing trade by reducing the number of 'drop-in' visitors who make a spontaneous decision to stop off in Coffs Harbour. Between the three identified business precincts, the volumes of traffic would decrease by about 10,000 to 12,000 vehicles in 2024 (see **Chapter 8, Traffic and transport**) – this may result in a reduction in the amount of passing trade experienced by businesses along the existing Pacific Highway.

Businesses currently located along the existing Pacific Highway, or reliant on passing trade may suffer economic losses due to the reduction in passing trade associated with the project. Business types that have some reliance on passing trade for their customer base are summarised in **Section 4.2.5**. These include:

- Eight service stations
- About 22 accommodation providers
- About 10 major fast food providers (most with drive through facilities).

In addition, key tourist attractions located on the existing Pacific Highway, eg the Big Banana Fun Park, will experience a reduction in through traffic. While these businesses may experience some loss in trade due to no longer being located on a national highway, these impacts would likely be minor and short-term in nature. Coffs Harbour is a major destination regionally and is located halfway between Sydney and Brisbane and forms a logical stopping point. It is likely that many of these businesses would still experience high use as visitors seek out their particular services within the area, particularly with the improved amenity of the Coffs Harbour CBD.

Other tourist attractions located off the existing Pacific Highway that may also be affected by the loss of passing trade include the North Coast Regional Botanic Gardens, the Coffs Harbour Regional Museum, and the Coffs Harbour Regional Gallery.

In previous analysis of other towns that have been bypassed, there is evidence to suggest that the accommodation sector may in fact experience higher activity levels in the immediate post-upgrade period as compared to the pre-upgrade period (Parolin and Garner 1996). Furthermore, as outlined in the Roads and Maritime Service's Economic Evaluation of Town Bypasses report, research has shown that while concern about economic impacts is warranted in the short-term (up to one year), in the longer-term, communities do recover to varying degrees from the negative impacts of bypass roads (Parolin 2012).

In similar projects, several factors were identified as contributing to a healthier accommodation sector in the post-upgrade period; namely, the improved environmental amenity of the town (reduction in through-traffic noise) is appealing to both potential short and long-term stayers, and the increased tourism promotion of the town, is translated into additional short and long-term stayers. The town of Kempsey's post-bypass success is attributed to a proactive approach to business diversification and marketing, as well as improved amenity in the town centre due to the removal of highway traffic (Parolin 2017). The opportunities for improving amenity are particularly relevant within the Coffs Harbour CBD where there are currently a number of vacant shop fronts along the highway.

Given Coffs Harbour's substantial population, the range of services it offers and its location approximately halfway between Sydney and Brisbane, it is still expected to be a destination for a large portion of highway users. During operation the sensitivity of receivers is considered to be moderate, and the magnitude of impacts to businesses dependent on passing trade is considered to be low due to the short-term nature of impacts. Therefore, the impacts to businesses that rely on passing trade has been assessed as **moderate-low significance**.

**Other businesses**

No additional businesses would be impacted by the project during operation, other than those already identified under construction impacts. Potential impacts would be mainly associated with a reduction in amenity and altered access arrangements.

However, the project is expected to increase the attractiveness of the existing industrial area near the Englands Road interchange which would benefit from improved highway access. The improvement of the transport network in the Coffs Harbour area would also improve commercial, retail and residential development opportunities along and near the existing highway.

Based on this assessment, during operation, the sensitivity of receivers is considered to be moderate, and the magnitude of impacts to other local businesses is considered to be low because of the relatively small percentage of Coffs Harbour's local businesses that would be impacted. Therefore, the significance of impacts to other local businesses has been assessed as **low-moderate significance**.

### *Access and connectivity*

During operation, existing access to all properties (that have not been fully acquired) would be reinstated, with adjustments as required to suit the new road infrastructure. The design of access arrangements to affected properties would be refined during detailed design, subject to consultation with affected property owners.

Pedestrian and cyclist connections would be improved through the addition of new facilities, which include a shared path along the service road tying into the existing shared path on Solitary Islands Way and a pedestrian bridge to replace the existing Luke Bowen footbridge. This would enhance connectivity (a highly valued community attribute in Coffs Harbour), encouraging active transport options, which in turn would have benefits for community health and wellbeing.

Once operational, the project would provide an improved and more efficient road environment for those who are not travelling to and from Coffs Harbour, by providing a bypass of the CBD, which would provide travel time savings of up to 20 minutes by 2044 (refer to **Chapter 8, Traffic and transport**). The project would involve the removal of direct access from local roads to the Pacific Highway, but access would be provided via a service road. This would also improve efficiencies on the existing highway. The project would also provide improved safety through improvements to connections to the local road network and removing the Korora bus interchange from the Pacific Highway, another highly valued community attribute.

During construction, pedestrians would experience changes in conditions and potential impacts however these would be temporary in nature. The replacement Luke Bowen footbridge would be constructed prior to the old bridge being demolished, which would reduce the extent of impacts experienced by pedestrians.

As access impacts would largely be mitigated, and the project would result in improvements to connectivity, the magnitude of socio-economic impacts associated with access and connectivity during the operational phase is considered to be negligible, while the sensitivity of receivers is considered to be moderate. Therefore, overall impacts have been assessed as having **negligible significance**. Further information on property access arrangements is provided in **Chapter 8, Traffic and transport.**

### *Public utilities*

Once operational, there would be no on-going impact on public utilities and services. There may be occasional instances where public utilities may be impacted through future upgrades or maintenance work.

The sensitivity of receivers to socio-economic impacts associated with public utilities during the operational phase is considered to be moderate, but the magnitude of impacts is considered to be negligible. Therefore, the overall operational impacts have been assessed as having **negligible significance**. **Chapter 12, Land use and property** provides further detail.

## 14.4 Environmental management measures

**Table 14-17** provides a list of mitigation measures proposed to address socio-economic impacts during the project's construction and operation. A draft Community consultation framework provided (**Appendix D**) has been prepared for the project which will guide ongoing community consultation during construction. There are interactions between the mitigation measures for socio-economic impacts and **Chapter 8, Traffic and transport, Chapter 9, Noise and vibration, Chapter 11, Urban design, landscape and visual amenity**, **Chapter 12, Land use and property**, **Chapter 13, Agriculture** and **Chapter 21, Air quality**.

Table 14-17 Environmental management measures for socio-economic impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Impacts to schools and residents (including those related to property, amenity, and access impacts) | SE01 | Consultation will be undertaken with potentially affected residences prior to the commencement of and during work in accordance with Community Liaison Implementation Plan. The Plan will be based on the draft Community consultation framework in **Appendix D** and will be implemented prior to construction. The Plan will provide specific information in relation to community involvement during construction and will include, but not be limited to:<br>• A map of impacted properties<br>• A register of potential construction impacts and timings<br>• A risk assessment and mitigation plan to minimise impacts on stakeholders<br>• A procedure for managing and responding to enquiries and complaints<br>• Procedures for notifying the community of upcoming work and impacts<br>• Procedures for communicating the details of design and construction. | Roads and Maritime / Contractor | Prior to and during construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Minimise loss of passing trade | SE02 | A Directional Signage Plan will be developed in accordance with Roads and Maritime signage guidelines to ensure effective and appropriate signposting for key locations along the project. The Plan will identify the range of services that Coffs Harbour provides and will be prepared in consultation with CHCC, Coffs Harbour Chamber of Commerce and the NSW Government's Tourist Attraction Signposting Assessment Committee (TASAC). | Roads and Maritime | Prior to operation |
| Minimising impacts on community values | SE03 | Design investigation of the property access road south of the Coramba Road interchange will be undertaken with the aim to avoid potential impacts on the tree planted as a memorial to a family member where feasible. | Contractor | Detailed design |
| | SE04 | Management of the gravestone of Herbert Frazer Simpson at the intersection of the existing Pacific Highway and James Small Drive will be undertaken in accordance with Roads and Maritime's Factsheet for Roadside Tributes (RTA 2016f). Every effort will be made to contact the family, if known, and work with them to develop an appropriate strategy for reinstallation, relocation or removal. If the family is unknown or cannot contacted, Roads and Maritime would store the gravestone off-site for future recovery if necessary. | Roads and Maritime | Prior to construction |
| | SE05 | Seed collection and salvage of representative species within the planted rainforest impacted by the project near Mackays Road will be undertaken prior to construction where reasonable and feasible. The purpose of the seed collection and salvage is to re-establish a portion of the rainforest within adjacent landscaping associated with project. Where possible, the location would allow for access from the realigned Mackays Road / new local access roads. | Roads and Maritime / Contractor | Prior to construction |
| Impacts to local businesses | SE06 | Consultation with CHCC will be undertaken prior to construction regarding impacts to the Coffs Coast Resource Recovery Park and the businesses which operate from the park. Consultation will aim to identify opportunities to reduce the extent of property acquisition, temporary construction impacts and any other associated impacts to facilities which are important to the ongoing operations of the park. | Roads and Maritime | Prior to construction |

Chapter 15

# Aboriginal cultural heritage

# 15. Aboriginal cultural heritage

This chapter presents an assessment of the impacts of the project on Aboriginal heritage and identifies mitigation and management measures to minimise and reduce these impacts.

The assessment presented in this chapter draws on information from the **Aboriginal cultural heritage assessment report** (refer to **Appendix L**) which also includes an **Aboriginal cultural values assessment report** (refer to Appendix C of **Appendix L**). **Table 15-1** lists the SEARs relevant to Aboriginal heritage and where they are addressed in this chapter.

Table 15-1 SEARs relevant to Aboriginal heritage

| Ref | Key Issue SEARs | Where addressed |
|---|---|---|
| **8. Heritage** | | |
| 1. | The Proponent must identify and assess any direct and/or indirect impacts (including cumulative impacts) to the heritage significance of: | |
| | a) Aboriginal places and objects, as defined under the *National Parks and Wildlife Act 1974* and in accordance with the principles and methods of assessment identified in the current guidelines; | Section 15.3 |
| | b) Aboriginal places of heritage significance, as defined in the Standard Instrument – Principal Local Environmental Plan; | No items of Aboriginal heritage were identified in the Coffs Harbour Local Environmental Plan 2013 |
| 2. | Where impacts to State or locally significant heritage items are identified, the assessment must: | |
| | a) Include a significance assessment and statement of heritage impact for all heritage items (including any unlisted places that are assessed as having heritage value); | Section 15.2.3<br>Section 15.2.4<br>Section 15.3.1 |
| | b) Provide a discussion of alternative locations and design options that have been considered to reduce heritage impacts; | Section 15.2.3<br>**Chapter 4, Project development and alternatives** |
| | c) In areas identified as having potential archaeological significance, undertake a comprehensive archaeological assessment in line with Heritage Council guidelines which includes a methodology and research design to assess the impact of the works on the potential archaeological resource and to guide physical archaeological test excavations and include the results of these excavations; | Section 15.1<br>Section 15.3 |
| | d) Consider impacts to the item of significance caused by, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, increased traffic, visual amenity, landscape and vistas, curtilage, subsidence and architectural noise treatment (as relevant); | Section 15.3 |
| | e) Outline measures to avoid and minimise those impacts in accordance with the current guidelines; and | Section 15.4 |

| Ref | Key Issue SEARs | Where addressed |
|---|---|---|
| 3. | Where archaeological investigations of Aboriginal objects are proposed these must be conducted by a suitably qualified archaeologist, in accordance with section 1.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b). | Section 15.1 |
| 4. | Where impacts to Aboriginal objects and/or places are proposed, consultation must be undertaken with Aboriginal people in accordance with the current guidelines. | Section 15.1.3<br>Section 15.4 |

## 15.1 Assessment methodology

The assessment has been carried out in accordance with the following current guidelines:

- Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW 2010a)
- Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010b)
- Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011)
- Procedure for Aboriginal cultural heritage consultation and investigation (PACHCI) (Roads and Maritime Services 2011a).

The PACHCI involves a four-stage process of consultation and investigation that assess known or potential impacts to Aboriginal cultural heritage. Projects that would have adverse impacts on Aboriginal objects or places are required to complete all stages. The stages include:

- Stage 1 – risk assessment to determine whether the project is likely to harm Aboriginal cultural heritage or not, and whether further assessment and consultation is required
- Stage 2 – if required to progress to Stage 2, further assessment and survey is carried out with specific Aboriginal stakeholders and an archaeologist to assess a project's potential to harm Aboriginal cultural heritage, and to determine whether formal Aboriginal community consultation and a cultural heritage assessment report is required
- Stage 3 – where Stages 1 and 2 have led to the preliminary view that harm to Aboriginal objects or places is likely to occur, consultation must be carried out, and a cultural heritage assessment must be prepared. Aboriginal parties must be involved in the preparation of the report in accordance with legislative requirements and Aboriginal cultural heritage consultation requirements for proponents (DECCW 2010a)
- Stage 4 – the aim of Stage 4 is to carry out any salvage and/or project implementation in accordance with a project approval under the EP&A Act.

In accordance with the above guidelines, the following reports were prepared:

- Aboriginal Archaeological Survey Report (Biosis Pty Ltd. 2017) (Unpublished)
- Aboriginal cultural values assessment report (Appendix C of **Appendix L, Aboriginal cultural heritage assessment report**).

The Aboriginal Archaeological Survey Report relates to Stage 2, while the Aboriginal cultural values assessment report relates to Stage 3. These reports are discussed further below.

The Aboriginal heritage impact assessment has been carried out by suitably qualified Aboriginal heritage consultants, as detailed further in **Appendix L, Aboriginal cultural heritage assessment report**.

### 15.1.1 Stage 2 Archaeological survey report

This study aimed to accurately locate registered Aboriginal sites, identify new sites within the construction footprint and assess their archaeological significance.

#### *Desktop study*

The study included a search of the Aboriginal Heritage Information Management System (AHIMS) in June 2016, with a follow up search carried out in May 2018 to ensure no new sites had been added since the previous search. AHIMS is a database operated by OEH under section 90Q of the *National Parks and Wildlife Act 1974* (the Act) and contains information and records related to registered Aboriginal archaeological sites (Aboriginal objects) and declared Aboriginal places as defined under the Act in NSW. A summary of the results of the AHIMS database search is included in **Table 15-2** and shown on **Figure 15-1-01** to **Figure 15-1-04**. The results of the AHIMS search helped to characterise the local archaeology by illustrating the distribution of known sites within the local landscape and provide a useful starting point for further investigation.

Further desktop studies were carried out to review existing archaeological studies within the construction footprint and broader Coffs Harbour region, in accordance with Requirements 1 – 4 of the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b).

Other sources of information including heritage registers and lists were also searched in 2016 and again 2019 for known Aboriginal heritage in the vicinity of the project. These included:

- Coffs Harbour LEP 2013
- Roads and Maritime Section 170 Heritage and Conservation Register
- State Heritage Register and State Heritage Inventory
- Commonwealth Heritage List
- National Heritage List
- Register of the National Estate
- Australian Heritage Places Inventory.

No other items of Aboriginal heritage were listed or registered on these databases within the construction footprint. A review of previous archaeological investigations and historical sources also indicates that the region was used for a diverse range of activities by past Aboriginal people and supports a predominantly coastal habitation pattern with less intensive use of the sub-coastal (foothills/hinterland) and escarpment landforms. However, the narrow coastal plain in the immediate Coffs Harbour area was considered likely to affect the validity of the general regional model.

#### *Predictive model*

Based on the outcomes of the desktop assessment, a landform-based predictive model was developed in accordance with Requirement 4 of the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b). It was prepared to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist throughout the construction footprint and where they are more likely to be located. The model was based on:

- Site distribution in relation to landscape descriptions within the construction footprint
- Consideration of site type, raw material types and site densities likely to be present within the construction footprint
- Findings of the ethnohistorical research on the potential for material traces to be present within the construction footprint

- Potential Aboriginal use of natural resources present or once present within the construction footprint
- Consideration of the temporal and spatial relationships of sites within the construction footprint and surrounding region.

The location of Aboriginal archaeological sites identified in the AHIMS were examined and analysed against various landscape parameters. From this modelling, the potential for the project area to contain shell middens, stone quarries and burial sites was considered to be moderate overall, and scarred trees, grinding grooves, rock shelters, Aboriginal ceremony, dreaming sites, and post-contact sites were considered unlikely.

#### *Archaeological field survey*

Archaeological field surveys were carried out with representatives from the CH&D LALC over eight days between 6 June and 1 September 2016. The construction footprint was divided into 39 survey units. The field survey targeted those portions of the construction footprint that had been assessed as having higher archaeological potential, namely crests and rises, as they were considered to possess the highest potential for artefact sites, particularly when located near creeklines.

During this process, two new Aboriginal archaeological sites were identified within the construction footprint and 20 areas of potential archaeological deposits (PADs) were recorded. PAD areas are potential sub-surface deposits of cultural material. Locations were determined based on landform context according to the predictive model, and an assessment of disturbance during the field survey. It was recommended that the identified PAD areas undergo archaeological test excavation to determine the nature, extent and significance of any Aboriginal archaeology contained within.

The Stage 2 PACHCI report (Biosis Pty Ltd 2017) (Unpublished) included information provided by the CH&D LALC which identified the Roberts Hill ridge as a significant transit route from the Orara Valley through to Coffs Harbour. At the time, this report also identified the potential for the construction footprint to pass close to the Gumgali Pathway near Bruxner Park Road. Gumgali Pathway is a landscape feature with mythological significance which tells the story of how Gumgali the black goanna moved down from the escarpment at Korora Lookout to the sea off Macauleys Headland. This pathway and the associated creation story is very significant to the Gumbaynggirr people. These cultural sites were investigated further as part of Aboriginal cultural values assessment report included in **Appendix L, Aboriginal cultural heritage assessment report,** and the findings have been summarised in **Section 15.2.4.** Further investigation identified that the construction footprint crosses the Gumgali Pathway.

### 15.1.2 Stage 3 Aboriginal cultural heritage assessment report

The results of the Stage 2 survey recommended a program of archaeological test excavation to obtain further information about the nature and significance of the Aboriginal cultural heritage resource and how it may be affected by the project. The outcomes of this are included in **Appendix L, Aboriginal cultural heritage assessment report**.

#### *2018 test excavation program*

The field methodology was developed and carried out in accordance with the SEARs and the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b). Archaeological test excavation was carried out by Kelleher Nightingale Consulting Pty Ltd (KNC) and field representatives of registered Aboriginal stakeholder groups over a seven-week period from February to March 2018.

The primary aim of the test program was to determine if intact archaeological deposits were present at each PAD area and to assess the nature and extent of these deposits, focusing on defining the boundary of any subsurface archaeological deposit. Design refinements resulted in changes to the construction footprint, and three previously identified PADs were excluded from the project area. The subsequent test excavation program was carried out at 13 of the remaining 16 PAD areas. Eight of the tested areas were found to contain the presence of Aboriginal stone artefacts and one of the PADs had indications of surface artefacts. The areas of PAD where very low density or no archaeological deposits were present, were predominately located on creek flat or slope landforms. The remaining sites consisted of low density deposits with variable levels of disturbance which may indicate transitory or low-intensity landscape use.

At each assessed PAD test excavation area, test excavation squares were placed along transects. Squares were spaced 15 m apart, in accordance with the guidance (DECCW 2010b). In some cases, square intervals were varied to 10 m or 20 m depending on landform and the size of the test area, to fully sample the PAD. In accordance with the guidelines, the first excavation unit at each PAD was excavated in 50 mm spits onto a culturally sterile deposit. Based on the results of the first excavation square, subsequent squares were excavated in 100 mm spits until culturally sterile soils were reached. The test excavation ceased when enough information had been recovered to adequately characterise any archaeological deposits or Aboriginal objects present as to their nature and significance.

All excavation was carried out using hand tools. All excavated material was placed in buckets and dry sieved on site using a combination of nested five mm and 2.5 mm wire mesh screens. Artefacts retrieved from the excavation were retained for further investigation. All test squares were backfilled with the original soil at the completion of the excavation.

#### *2019 assessment and test excavation program*

Following the 2018 investigations, the construction footprint was further refined with several locations identified as potential ancillary sites. Several of these areas were outside the previously identified construction footprint and required assessment. The assessment included a desktop review of previous archaeological investigations, landscape context, the results of the 2018 test excavation program and an archaeological survey that was conducted by representatives from KNC and the registered Aboriginal stakeholders.

This assessment identified three additional Aboriginal archaeological sites (CHB AFT11, CHB AFT12 and CHB IF7) as well as 13 new PAD locations. Three new PADs were identified outside of the updated construction footprint, and two previously identified PADs (PAD 11 and PAD 13) were determined to be heavily disturbed by modern land use and unlikely to have potential for archaeological deposits. The rest of the previously unassessed area of the project was considered to have low archaeological potential.

In accordance with the SEARs and the OEH Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b), an archaeological test excavation program was undertaken by KNC and field representatives of registered Aboriginal stakeholder groups between March and May 2019. The program included assessment of 12 PADs, as well as PAD 1 which had not been previously tested due to access restrictions. One additional PAD was not tested as further design refinement removed the area from the construction footprint. Test excavation focused on defining the boundary of any subsurface archaeological deposit in relation to artefact distribution and disturbance from land use practices or natural processes.

### 15.1.3 Aboriginal community consultation

Roads and Maritime advertised and contacted potential Aboriginal stakeholders identified from government agency notification responses. Aboriginal people who hold knowledge relevant to determining the cultural heritage significance of Aboriginal objects and Aboriginal places in the construction footprint were invited to register an interest in a process of community consultation.

The following eight Aboriginal community groups and individuals are Registered Aboriginal Parties (RAPs) for the project:

- Jagun Aged Care Elders
- National Koori Site Management
- Norman Archibald
- Kullila Site Consultants
- Wanggaan Gumbaynggir Corporation
- Gumbaynggirr People
- CH&D LALC
- Garby Elders Aboriginal Corporation.

The formal consultation process has included:

- Advertising for registered stakeholders in the Koori Mail (27 July 2016), National Indigenous Times (28 July 2016) and Coffs Advocate (27 July 2016)
- Government agency notification letters
- Notification of closing date for registration
- Initial field surveys (June, August and September 2016) with Aboriginal stakeholders
- An Aboriginal Focus Group (AFG) meeting held on 28 June 2017 to discuss archaeological assessment methodology and cultural assessment
- Provision of proposed archaeological assessment methodology, outlining the methodology to prepare the Cultural heritage assessment report (CHAR) and carry out the test excavation
- Follow-up AFG meeting on 8 February 2018 to further discuss the test excavation methodology and additional matters relating to the incorporation of Aboriginal cultural knowledge in the assessment
- Archaeological test excavation with Aboriginal stakeholders (February/March 2018)
- Face-to-face and telephone interviews with five Aboriginal cultural knowledge holders, however, seven were approached
- Provision of draft CHAR (version 1) for review on 1 August 2018 with a 28-day review period
- A third AFG meeting to discuss investigation results, draft CHAR and detailed mitigation strategies review on 13 September 2018.

The following consultation processes were also employed in relation to the design investigations carried out in early 2019:

- A fourth AFG meeting on 11 February 2019 to provide a project update and discuss potential ancillary areas and Aboriginal stakeholder comments from the draft CHAR (version 1) related to the previous 2018 concept design
- Consultation undertaken during fieldworks for the second round of survey and test excavation in 2019 to determine if there were any additional Aboriginal archaeological or cultural areas.

As part of ongoing consultation with the local Aboriginal community, the following is proposed:

- Provision of a draft CHAR (version 2) for review, with a minimum 28-day review period during the exhibition of the EIS
- A proposed fifth AFG meeting to discuss investigation results, the draft CHAR (version 2) provided during the EIS exhibition and detailed mitigation strategies.

### 15.1.4 Stage 3 Detailed Aboriginal cultural assessment

The assessment of Aboriginal cultural heritage values was undertaken collaboratively with the Aboriginal community and identified Aboriginal knowledge holders.

Roads and Maritime took the following actions to identify cultural knowledge holders:

- Letter sent to government agencies seeking nominations for cultural knowledge holders in July 2016
- AFG meeting held in June 2017, including a verbal invitation for the nomination of cultural knowledge holders
- Letters sent to government agencies and parties nominated as potential knowledge holders to seek further nominations in December 2017
- In March 2018, Waters Consultancy were engaged to undertake an Aboriginal cultural values assessment and an email was sent to all RAPs in April 2018 notifying them of this and the proposed cultural assessment methodology
- Waters Consultancy attempted to contact all registered individuals in April/June 2018 and spoke directly to all but two RAPs applicants (Wanggaan Gunbaynggirr Corporation and the Gumbaynggirr People).

As a result of this process, seven individuals were nominated as cultural knowledge holders. Detailed face-to-face interviews were conducted with three of the knowledge holders, and telephone discussions were carried out with two others. On further discussion, one of the knowledge holders decided to no longer participate as they had no cultural knowledge directly related to the project impact area. The remaining knowledge holder was overseas and was not in a position to engage in further discussions but was still provided with the draft CHAR report. The five knowledge holders spoken with, provided cultural and historical information on the broader cultural landscape of the region, which has been used to inform the identification of intangible cultural sites and the associated assessment of cultural heritage values.

A draft cultural values assessment report was issued with the draft CHAR (version 1) to all RAPs on 1 August 2018. Some concerns were raised that the importance of biodiversity had not been adequately captured and that sensitivities around the inclusion of images of deceased people had not been adequately addressed. These two concerns were discussed further at the AFG on 11 February 2019. Further follow-up engagement occurred with knowledge holders and RAPs in February and April/May 2019 in relation to the comments on the draft report and in relation to ancillary areas (which are all within the original surveyed area). Following this additional consultation with key knowledge holders and RAPs, additional text has been incorporated into the final report to address these concerns.

## 15.2 Existing environment

### 15.2.1 Landscape context

The entire construction footprint and surrounding 200 m buffer was identified by the Aboriginal cultural knowledge holders as being located within a culturally significant landscape. Mythological sites and beings are imprinted into the topography of the landscape and the energy or sentience of the mythological being is understood as remaining in the physical environment. The project passes through four major soil landscapes (Ulong, Megan, Suicide and Coffs Creek) as detailed in **Chapter 18, Soils and contamination**. The project is located within a landscape characterised by three landform groups (the escarpment, sub-coastal ramp and coastal plain). The study area for the CHAR traverses low, level to gently undulating alluvial coastal floodplains with deeper slopes, ridges and valleys down towards a coastal plain at the base of the escarpment behind Coffs Basin. A total of six general landforms are present in the coastal plains and sub-coastal ramp: flats, gentle, moderate and steep slopes, ridges and creek banks. Further information on the landscape context is provided in **Chapter 11, Urban design, landscape and visual amenity.**

Varying levels of natural and human disturbance have occurred within the construction footprint. The construction of roads, utilities and structures in addition to agriculture/horticulture, clearance of native vegetation, landscaping and natural process such as erosion were considered likely to have had a generally negative effect on archaeology. It was noted that most of the Coffs Creek catchment area was recognised as disturbed, which would affect its archaeological integrity. Land clearance and subsequent development was likely to have affected archaeological integrity, especially with respect to surface finds; however, the likely survival of sites or PADs was considered to be higher in areas of deeper soils.

## 15.2.2 Historical Aboriginal land use

At the time of European colonisation, the region was populated by the Gumbaynggirr people, whose nation stretches along the coastline between South Grafton in the north to Nambucca Heads in the south, and west to Bellingen.

The construction footprint and surrounding region are known to have been important to and extensively used by past Aboriginal people. Aboriginal people's use of the region is well-documented in historic accounts (Biosis Pty Ltd. 2017) and continues today among the contemporary Aboriginal community. The archaeology survey and historical investigation indicates support for a predominant coastal habitation pattern at the Coffs area, with the narrow coastal plain in the immediate Coffs area potentially impacting the validity of this. Members of the contemporary Gumbaynggirr community continue to experience connection with the area through cultural and family associations.

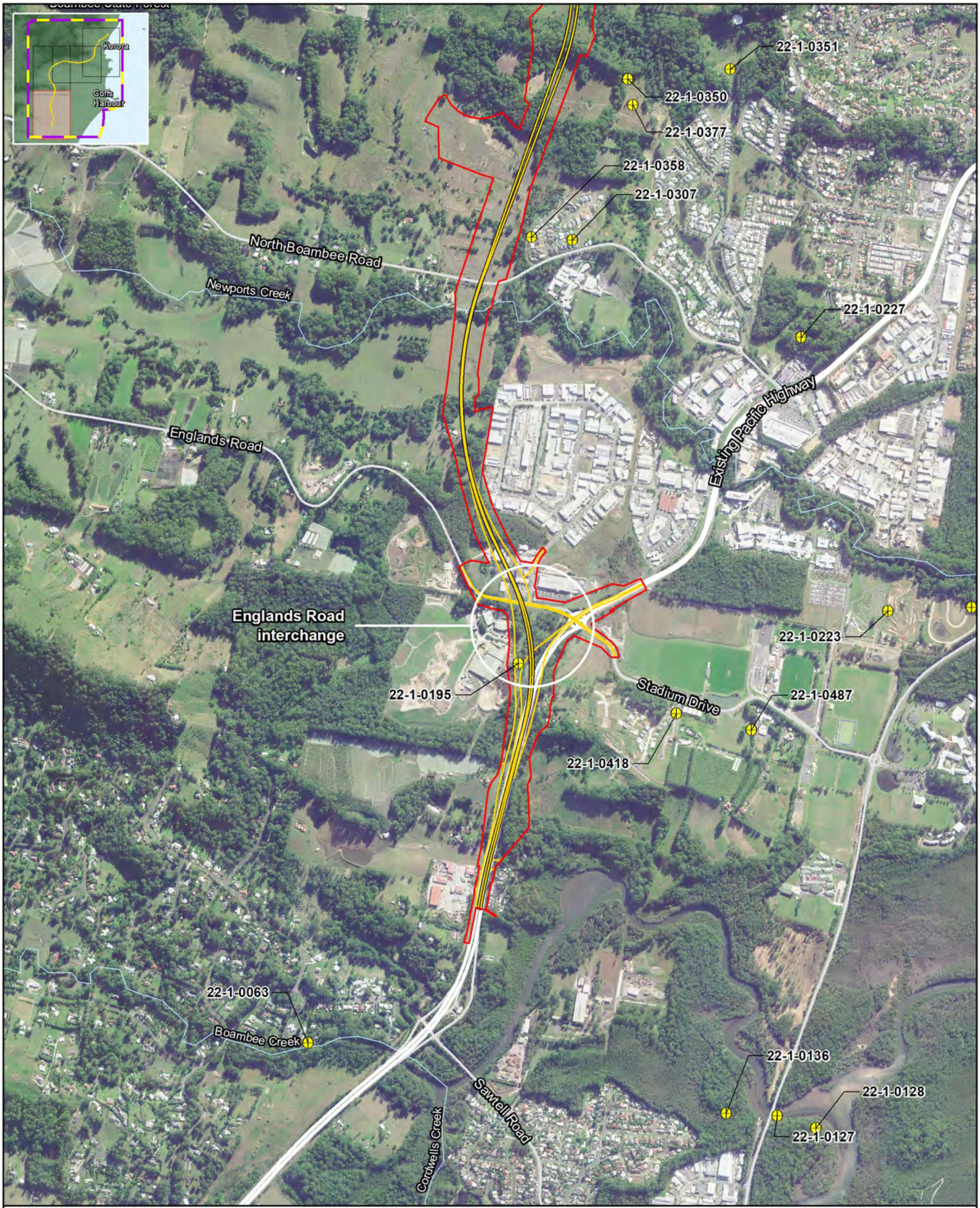
The local area contains a number of natural resources which would have been important to local Aboriginal groups and resulted in a high density of Aboriginal people in the North Coast Bioregion. Varied environmental settings including creeks, alluvial plains, rolling foothills and elevated ridges were all accessible and useful for Aboriginal land use activities. A wide variety of plant and animal resources would have been available to Aboriginal people to collect and use as they moved around the various parts of the landscape. This suggests that the Gumbaynggirr people and others on the North Coast lived a more settled lifestyle in comparison with other Aboriginal groups. Raw materials suitable for stone tool-making would also have been readily available along the creek systems, having been transported down from the eroding ranges. Local people continue to use bush foods and natural remedies and a high level of knowledge exists about the natural landscape, which is inextricably connected to the cultural landscape.

## 15.2.3 Identified sites

A search of the AHIMS database was carried out in June 2016, May 2018 and again in May 2019 to identify known Aboriginal sites or places within a defined search area around the construction footprint, including a buffer as shown in **Figure 15-1**. The distribution of recorded Aboriginal sites as per the AHIMS searches is described further in **Table 15-2** and shown in **Figure 15-1-01** to **Figure 15-1-04**.

Table 15-2 AHIMS database search results

| Site Context | Site Features | Number | Frequency (%) |
|---|---|---|---|
| Open | Aboriginal Ceremony and Dreaming | 7 | 10.3 |
| | Artefact | 40 | 58.8 |
| | Artefact; Potential Archaeological Deposit | 5 | 7.4 |
| | Artefact; Shell | 7 | 10.3 |
| | Burial | 1 | 1.5 |
| | Habitation Structure | 1 | 1.5 |
| | PAD | 2 | 2.9 |
| | Shell | 2 | 2.9 |
| | Stone Quarry | 1 | 1.5 |
| | Restricted | 2 | 2.9 |
| | **Total** | **68** | **100%** |

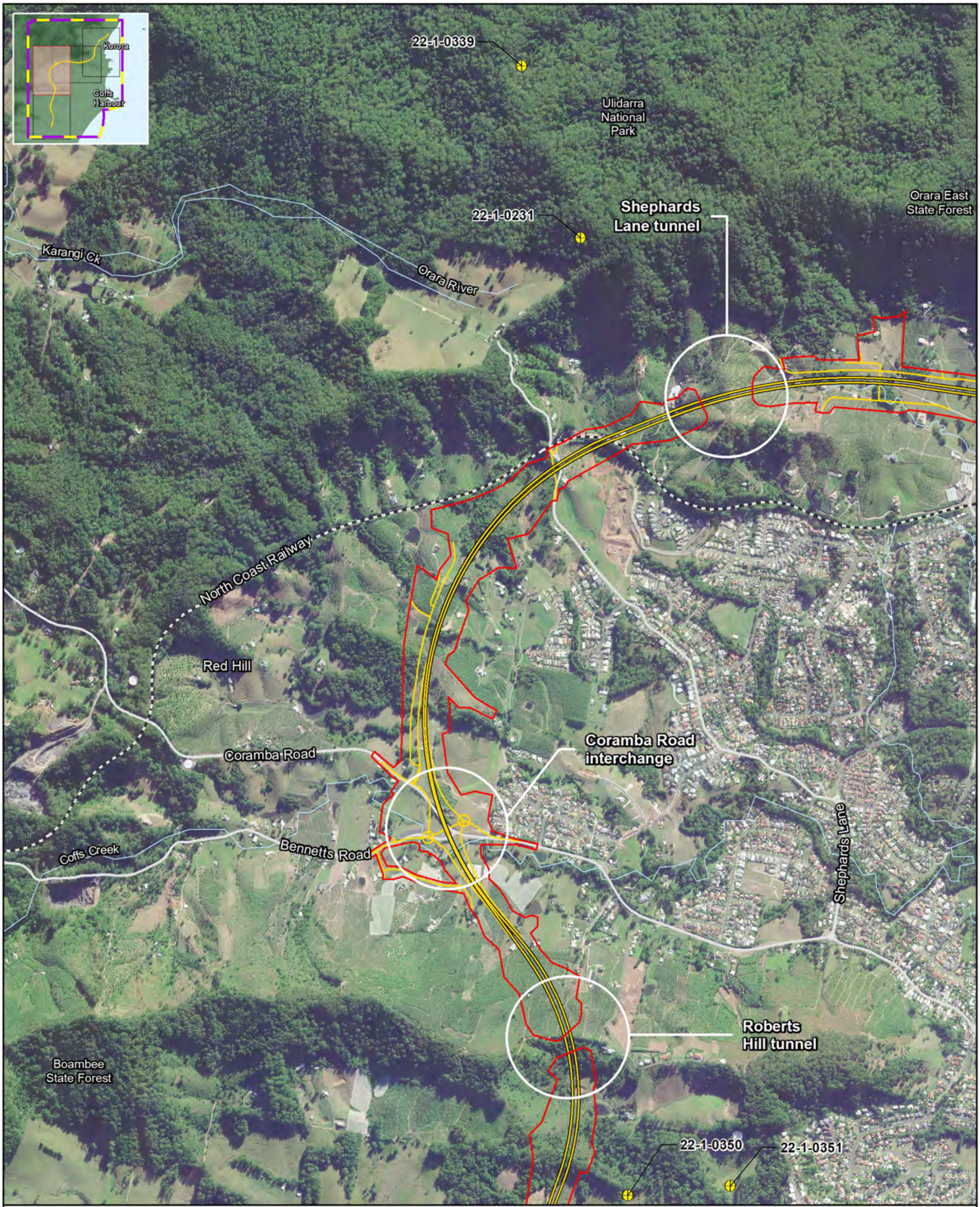



**Legend**

- Construction footprint
- Alignment
- North Coast Railway
- Watercourse
- AHIMS site location
- AHIMS search area

Coffs Harbour Bypass
AHIMS search results
15-1-01

0 0.2 0.4 0.6 km
Scale @A4: 1:20,000
GDA 1994 MGA Zone 56
N

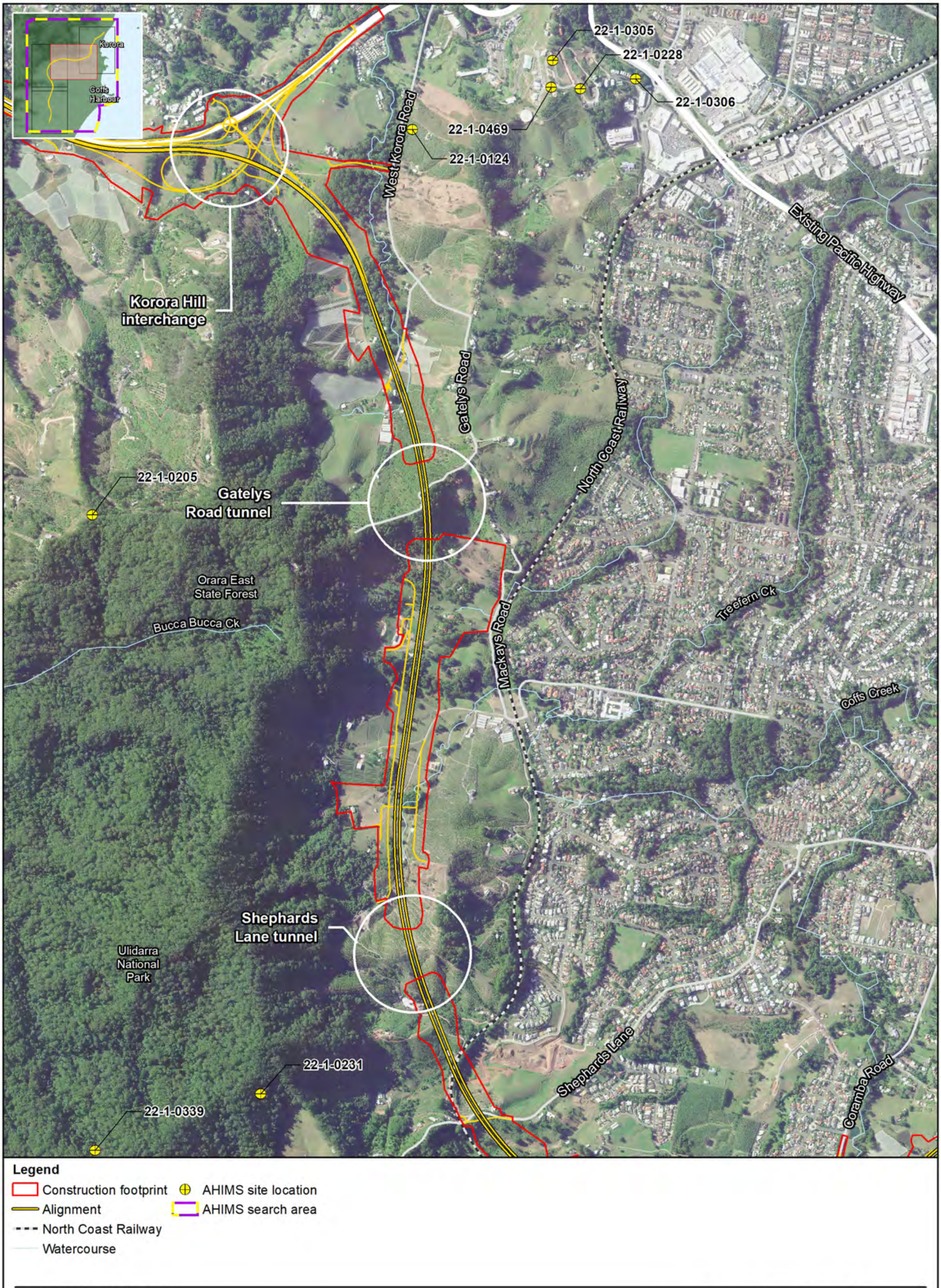



**Legend**

Construction footprint
Alignment
North Coast Railway
Watercourse
AHIMS site location
AHIMS search area

Coffs Harbour Bypass
AHIMS search results
15-1-02

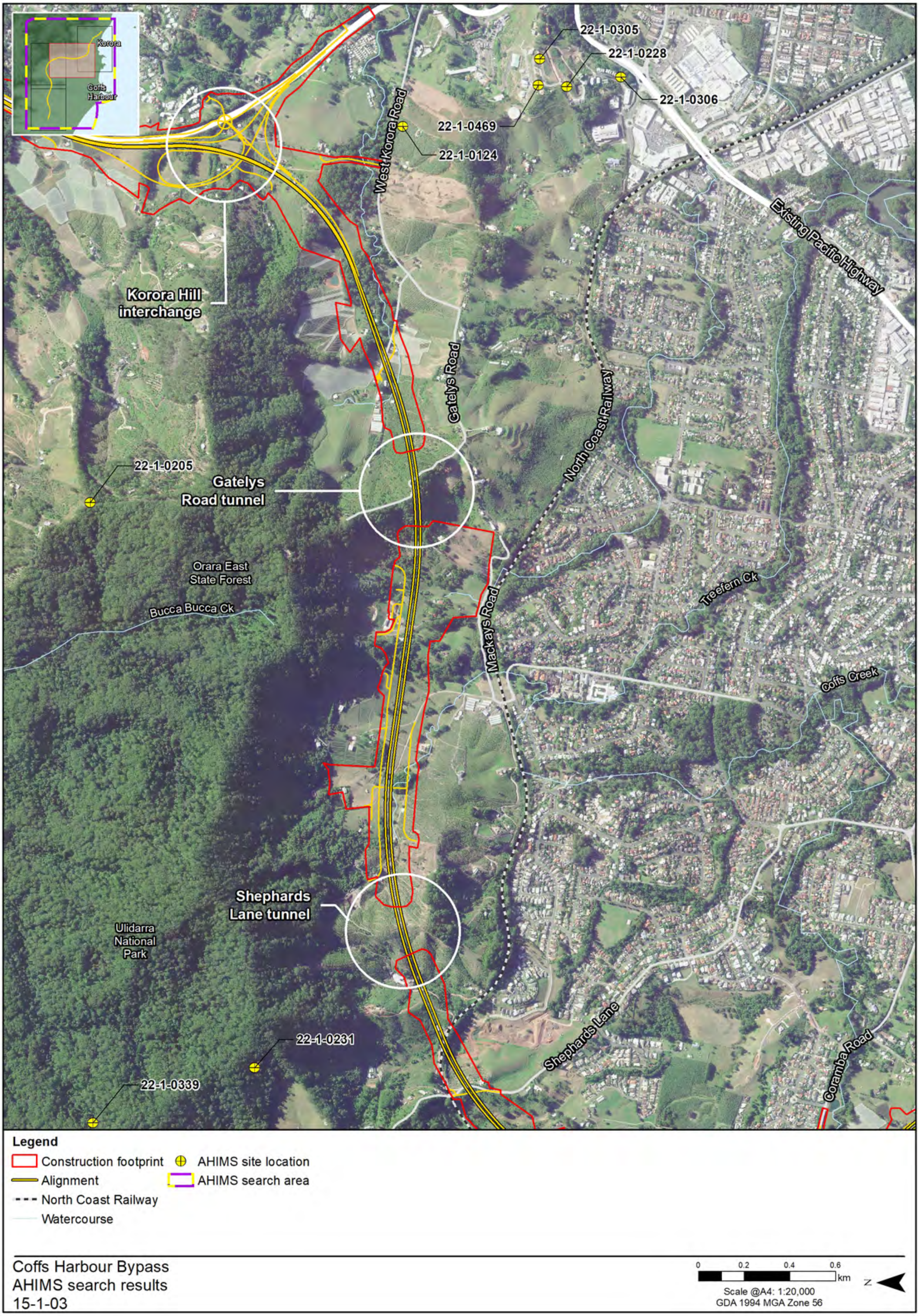
0 0.2 0.4 0.6 km
Scale @A4: 1:20,000
GDA 1994 MGA Zone 56
N




Coffs Harbour Bypass
AHIMS search results
15-1-03

0 0.2 0.4 0.6 km

Scale @A4: 1:20,000
GDA 1994 MGA Zone 56




Coffs Harbour Bypass
AHIMS search results
15-1-03

Two AHIMS sites are located within the construction footprint: CHSS-3 (AHIMS 22-1-0142) and Coffs Dump (AHIMS 22-1-0195) (refer to **Figure 15-1-01** and **Figure 15-1-04**). Both are isolated finds occurring in disturbed contexts. CHSS-3 was a greywacke flake in a disturbed context that was identified in 1998 at the base of a three-metre-high road cutting along the existing Pacific Highway. Coffs Dump is an isolated artefact located in a cleared industrial area immediately east of the Coffs Coast Resource Recovery Park. These sites were revisited during field surveys; however, no artefacts were observed at either location. These sites are considered to display low significance, based on poor site condition and high levels of disturbance, and low potential for associated intact subsurface deposits.

### *PACHCI Stage 2 survey*

An archaeological field survey was conducted in consultation with the CH&D LALC and was undertaken in June, August and September 2016. Following the survey, CH&D LALC provided a survey and cultural assessment report for Roads and Maritime in accordance with the PACHCI. The comments were incorporated into the assessment and included in the PACHCI Stage 2 survey report (Biosis Pty Ltd. 2017). This report identified Roberts Hill as a significant travelling route from the Orara Valley through to Coffs Harbour and then through Bruxner Park Road and Korora West.

Two new Aboriginal archaeological sites and 20 PADs were identified within the construction footprint during this archaeological survey (Biosis Pty Ltd. 2017), including an open artefact scatter (CHB6 AS 01) and an isolated find of a hammerstone fragment (CHB6 IF 2) (refer to **Figure 15-2-01** to **Figure 15-2-04**). The artefact scatter for CHB6 AS01 was identified across the crest and saddle of a prominent ridge to the north-east of Shephards Lane in a banana plantation area. About 50 – 100 artefacts were identified at this site, including a fragment of a basalt ground edge axe and a multidirectional silcrete core. A large area of PAD 15 was recorded in association with this site. Significance assessments carried out for the identified sites (CHB6 AS 01 and CHB6 IF 2) found that they display moderate significance, based on landform, moderate site condition and associated with PAD areas. The PACHCI Stage 2 assessment recommended the 20 areas of PAD be subject to archaeological test excavation to determine the nature, extent and significance of any Aboriginal archaeology contained in the sites.

Following design refinement in 2018, PADs 11, 13 and 14 were excluded from the impact area.

### *2018 test excavation program*

As discussed in **Section 15.1.2**, KNC and field representatives of registered Aboriginal stakeholder groups undertook test excavations over a seven-week period from February to March 2018. Due to access restrictions, PAD 1 was excluded from the program. The test excavation program identified the presence of Aboriginal stone artefacts at 11 of the 16 areas of PAD tested. The 11 archaeological sites identified during the test excavation program consisted of two subsurface isolated artefacts (CHB IF 12), six subsurface archaeological deposits with mean artefact densities of less than ten artefacts per square metre (CHB AF T2, CHB AFT 3, CHB AFT 4, CHB AFT 5, CHB AFT 6 and CHB AFT 7) and three subsurface archaeological deposits with mean artefact densities of over nine artefacts per square metre (CHB6 AS 01, CHB AFT 1 and CHB AFT 8). The results of the test excavation program indicated that the presence of Aboriginal stone artefacts and overall artefact density was influenced by landform, topographic location and disturbance.

Following the 2018 test excavation, the construction footprint was further refined, and site CHB AS 01 was excluded.

### *2019 assessment and test excavation*

As discussed in **Section 15.1.2**, following the 2018 investigations, the construction footprint was further refined with several locations identified as potential ancillary sites. A desktop review was undertaken which identified three additional Aboriginal archaeological sites (CHB AFT 11, CHB AFT 12 and CHB IF 7) as well as 13 new PAD locations. Three new PADs were identified outside of the updated construction footprint, and two previously identified PADs (PAD 11 and PAD 13) were determined to be heavily disturbed by modern land use and unlikely to have potential for archaeological deposits.

The test excavation program identified the presence of subsurface Aboriginal stone artefacts at eight of the 13 tested areas and surface artefacts at one area of PAD (CHB AFT 9). The eight archaeological sites identified during the test excavation program consisted of four subsurface isolated artefacts (CHB IF 3-6), three subsurface archaeological deposits with mean artefact densities of less than ten artefacts per square metre (CHB AFT 10, CHB AFT 14 and CHB AFT 15) and one subsurface archaeological deposit with mean artefact densities of over nine artefacts per square metre (CHB AFT 13). In addition, further subsurface artefacts were identified on the landform of CHB AFT1 and demonstrated that the site continued to the east.

The study area has been subject to a series of archaeological investigations as part of the project. The investigations have included Aboriginal community consultation, review of background information, identification of previously recorded Aboriginal sites registered on the AHIMS database, predictive modelling, Aboriginal archaeological survey and test excavation (see **Section 4**).

In total, 24 Aboriginal archaeological sites comprising Aboriginal objects are present within the construction footprint. All of the sites were assessed as having low to moderate significance. No sites of high significance were identified within the construction footprint. The significance of these sites is summarised in **Table 15-3.**

Table 15-3 Assessed significance of sites within the construction footprint

| Assessed significance | Comment | Sites |
|---|---|---|
| High | No archaeological sites in the study area were assessed as 'high' significance. | N/A |
| Moderate | These sites offer good research potential as they represent intact archaeological deposits within the study area<br>Further investigation would add to the understanding of Aboriginal activities in the various landscapes of the Coffs basin and transitional areas of North Boambee Valley and the margin of the Korora basin.<br>These sites express the Aboriginal cultural heritage of the study area.<br>Any change or loss of these sites is likely to diminish the overall Aboriginal cultural heritage values of the study area. | CHB AFT 1<br>CHB AFT 5<br>CHB AFT 8<br>CHB AFT 11<br>CHB AFT 13 |
| Low | These sites are highly disturbed, and the surrounding area showed very little potential for further archaeology.<br>While it is recognised that every Aboriginal site is important to the local Aboriginal community, there are more intact or better examples of this site type within the construction footprint and wider local area.<br>Any change or loss of these sites is unlikely to diminish the overall Aboriginal cultural heritage values of the study area and wider local area. | CHB AFT 2<br>CHB AFT 3<br>CHB AFT 4<br>CHB AFT 6<br>CHB AFT 7<br>CHB AFT 9<br>CHB AFT 10<br>CHB AFT 14<br>CHB AFT 15<br>CHB IF 1<br>CHB IF 2<br>CHB IF 3<br>CHB IF 4<br>CHB IF 5<br>CHB IF 6<br>CHB IF 7<br>CHB6 IF 2<br>CHSS-3<br>Coffs Dump |

Beyond the identified Aboriginal archaeological sites, the remainder of the construction footprint was considered to display low archaeological potential due to combinations of archaeologically unfavourable topography, geology, erosion or previous disturbance associated with past land uses.

## 15.2.4 Identified areas of cultural significance

Consultation with knowledge holders has identified five areas of cultural significance, as detailed in **Table 15-4** and shown in Appendix C of **Appendix L, Aboriginal cultural heritage assessment report**.

Table 15-4 Identified cultural sites

| Site name | Description | Cultural significance |
|---|---|---|
| Roberts Hill Pathway | A culturally significant pathway running from Corambirra Point to the Orara Valley including Roberts Hill ridge. | High significance to the local Aboriginal community as a key pathway connecting the coast with the Orara Valley. The cultural significance is a result of the pathway's association with traditional patterns of movement and resource use and the intangible storylines that link the coast to the inland valleys. The pathway links to the culturally highly significant Corambirra Point and Giidany Miirlalr (Muttonbird Island area). |
| Gumgali Storyline and Pathway | A culturally significant storyline and associated pathway running from Macauleys Headland to Sealy Point and through to Mount Coramba and the Orara Valley and Nana Glen. | Very high significance to the local Aboriginal community as a result of the pathway's association with the Gumgali or Black Goanna Dreaming storyline. The pathway links to other key sites within the region including Mount Coramba. |
| Sealy Point Pathways | A culturally significant pathway linked to the Gumgali Storyline and Pathway, running along Sealy Point to the Orara Valley, Mount Browne, the Coffs Creek headwaters and the Roberts Hill Pathway. | High significance to the local Aboriginal community as a result of the pathway's association with traditional patterns of movement and resource use, and with the intangible storylines that link the coast to the inland valleys. |
| East Boambee Camp | A traditional and historical camp area associated with seasonal and ritual movement patterns within the wider region. | Medium significance for the Aboriginal community as a traditional and historical camp area that was associated with seasonal and ritual patterns of movement into the Coffs Harbour area, bringing people together from the wider region for resource gathering and ceremonial business. |
| West Korora Living Place | A historical living place located on the West Korora Road in the 1940s, adjacent to the construction footprint. | Medium significance for the Aboriginal community as a historical living placed used in the 1940s and understood to be located on an older traditional camp site area. |

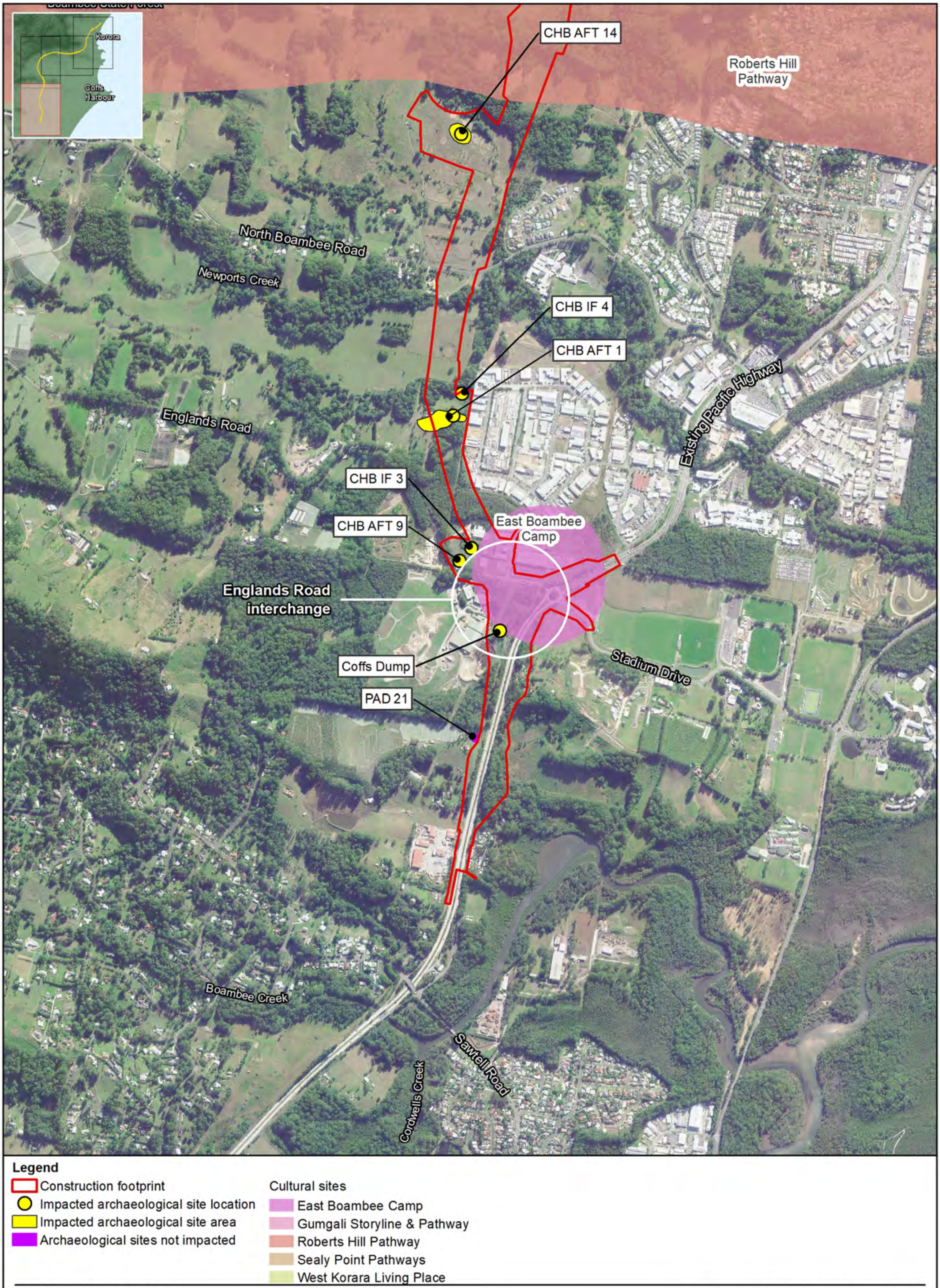
# 15.3 Assessment of potential impacts

## 15.3.1 Potential impacts on Aboriginal archaeology

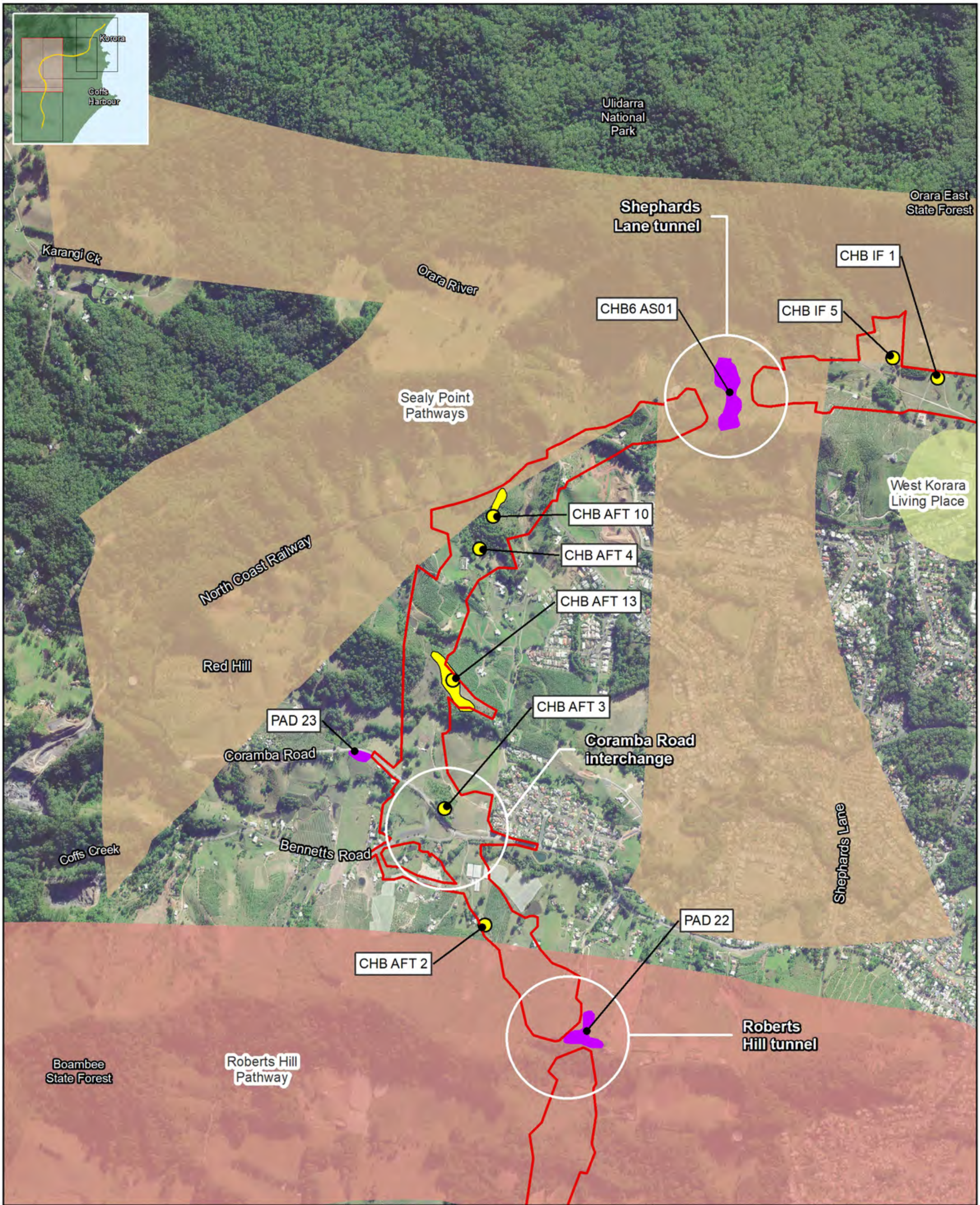
Construction of the project would impact 24 Aboriginal archaeological sites that have been identified during the archaeological test excavations carried out between 2017 and 2019, as detailed in **Table 15-5** and **Figure 15-2**.

Table 15-5 Impacts to Aboriginal archaeological sites within the construction footprint

| Site name | Feature | Assessed significance | Type/degree of harm | Consequence of harm |
|---|---|---|---|---|
| CHB AFT 1 | Subsurface deposit | Moderate | Direct/partial | Partial loss of value |
| CHB AFT 2 | Subsurface deposit | Low | Direct/total | Total loss of value |
| CHB AFT 3 | Subsurface deposit | Low | Direct/total | Total loss of value |
| CHB AFT 4 | Subsurface deposit | Low | Direct/total | Total loss of value |
| CHB AFT 5 | Surface artefacts and subsurface deposit | Moderate | Direct/partial | Partial loss of value |
| CHB AFT 6 | Subsurface deposit | Low | Direct/total | Total loss of value |
| CHB AFT 7 | Subsurface deposit | Low | Direct/total | Total loss of value |
| CHB AFT 8 | Subsurface deposit | Moderate | Direct/total | Total loss of value |
| CHB AFT 9 | Surface artefacts | Low | Direct/total | Total loss of value |
| CHB AFT 10 | Subsurface deposit | Low | Direct/total | Total loss of value |
| CHB AFT 11 | Surface artefacts and subsurface deposit | Moderate | Direct/partial | Partial loss of value |
| CHB AFT 13 | Subsurface deposit | Moderate | Direct/total | Total loss of value |
| CHB AFT 14 | Subsurface deposit | Low | Direct/total | Total loss of value |
| CHB AFT 15 | Subsurface deposit | Low | Direct/total | Total loss of value |
| CHB IF 1 | Isolated subsurface artefact | Low | Direct/total | Total loss of value |
| CHB IF 2 | Isolated subsurface artefact | Low | Direct/total | Total loss of value |
| CHB IF 3 | Isolated subsurface artefact | Low | Direct/total | Total loss of value |
| CHB IF 4 | Isolated subsurface artefact | Low | Direct/total | Total loss of value |
| CHB IF 5 | Isolated subsurface artefact | Low | Direct/total | Total loss of value |
| CHB IF 6 | Isolated subsurface artefact | Low | Direct/total | Total loss of value |
| CHB IF 7 | Isolated surface artefact | Low | Direct/total | Total loss of value |
| CHB6 IF 2 | Isolated surface artefact | Low | Direct/total | Total loss of value |
| CHSS-3 | Isolated surface artefact | Low | Direct/total | Total loss of value |
| Coffs Dump | Isolated surface artefact | Low | Direct/total | Total loss of value |




Coffs Harbour Bypass
Aboriginal heritage sites and areas within the construction footprint
Figure 15-2-01




**Legend**

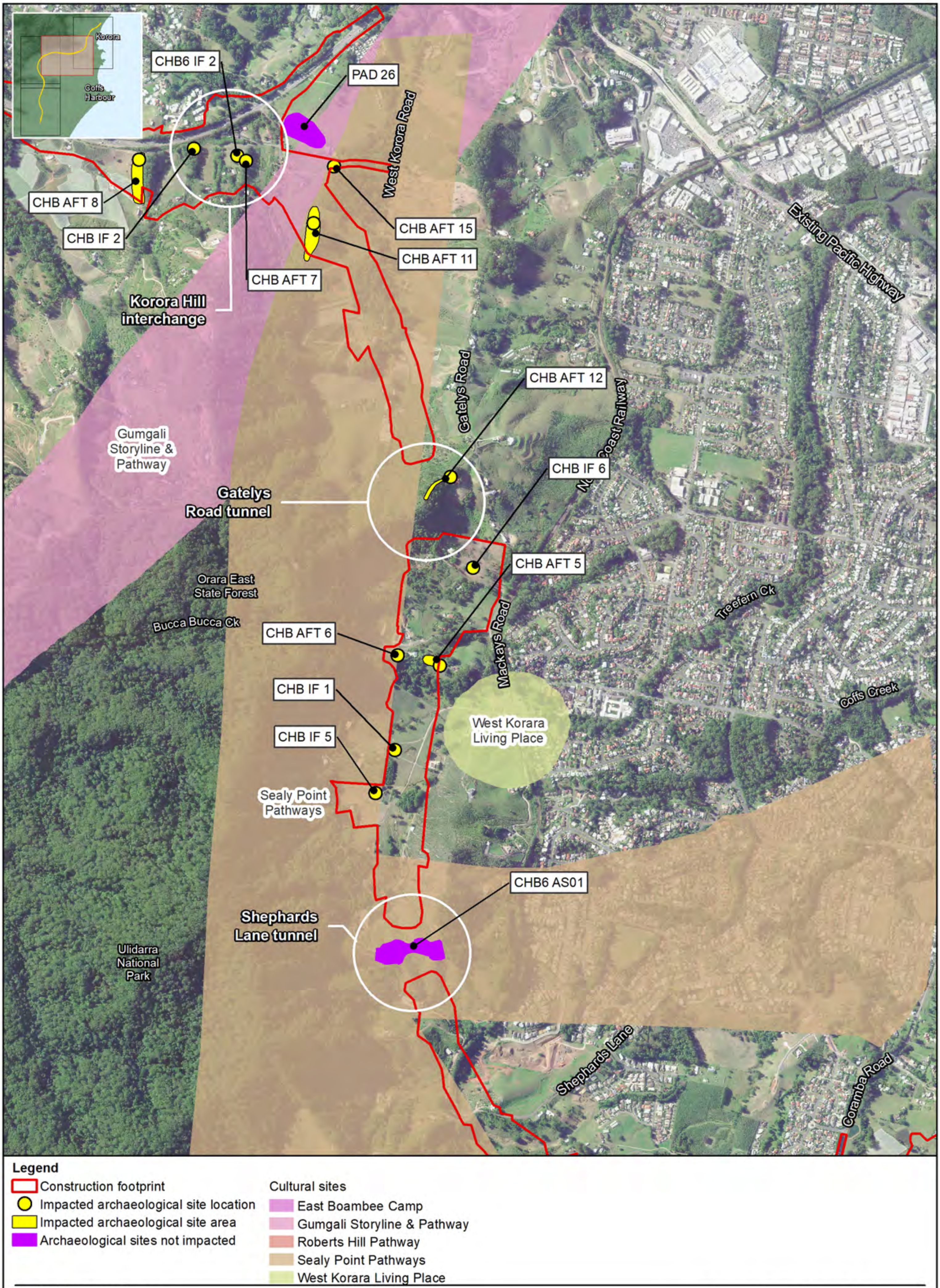
- Construction footprint
- Impacted archaeological site location
- Impacted archaeological site area
- Archaeological sites not impacted

Cultural sites

- East Boambee Camp
- Gumgali Storyline & Pathway
- Roberts Hill Pathway
- Sealy Point Pathways
- West Korara Living Place

Coffs Harbour Bypass
Aboriginal heritage sites and areas within the construction footprint
Figure 15-2-02

0 0.2 0.4 0.6 km
Scale @A4: 1:20,000
GDA 1994 MGA Zone 56
N




Coffs Harbour Bypass
Aboriginal heritage sites and areas within the construction footprint
Figure 15-2-03


**Legend**

- Construction footprint
- Impacted archaeological site location
- Impacted archaeological site area
- Archaeological sites not impacted

Cultural sites

- East Boambee Camp
- Gumgali Storyline & Pathway
- Roberts Hill Pathway
- Sealy Point Pathways
- West Korara Living Place

Coffs Harbour Bypass
Aboriginal heritage sites and areas within the construction footprint
Figure 15-2-04

0 0.2 0.4 0.6 km
Scale @A4: 1:20,000
GDA 1994 MGA Zone 56
N

## 15.3.2 Potential impacts on cultural values

Five sites of cultural significance were identified within the general construction footprint area during the cultural values assessment process. As a result of design investigations carried out in early 2019 one cultural site (West Korora Living Place) has been avoided. The inclusion of tunnels through the Roberts Hill and Shephards Lane ridges has resulted in a reduction of potential impacts on the Roberts Hill and Sealy Point Pathways and these cultural pathways would not be severed.

As detailed in **Table 15-6**, construction of the project would result in direct partial impacts on four of the identified sites of cultural significance which are located partially within the construction footprint. The West Korora Living Place is located next to the construction footprint not considered likely to be impacted by the project.

Table 15-6 Potential impacts on Aboriginal cultural sites

| Site name | Description | Cultural heritage significance | Impact |
|---|---|---|---|
| Roberts Hill Pathway | A culturally significant pathway running from Corambirra Point to the Orara Valley including Roberts Hill ridge. | This pathway is of high significance as a key pathway connecting the coast with the Orara Valley. The pathway is associated with traditional patterns of movement and resource use between the coast and the valleys and links the highly significant Corambirra Point and Giidany Miirlalr (Muttonbird Island area). | Direct partial |
| Gumgali Storyline and Pathway | A culturally significant pathway running from Corambirra Point to the Orara Valley including Roberts Hill ridge. | This pathway is of high significance as a key pathway connecting the coast with the Orara Valley. The pathway is associated with traditional patterns of movement and resource use between the coast and the valleys and links the highly significant Corambirra Point and Giidany Miirlalr (Muttonbird Island area). | Direct partial |
| Sealy Point Pathways | Culturally significant pathways linked to the Gumgali Storyline and Pathway. The pathway runs along Sealy Point to the Orara Valley, Mount Browne the Coffs Creek headwaters, and the Roberts Hill Pathway. | The Sealy Point Pathways are of high significance to the local Aboriginal community. The cultural significance is a result of the pathways' association with traditional patterns of movement and resource use and with the intangible storylines that link the coast to the inland valleys. | Direct partial |
| East Boambee Camp | This is a traditional and historical camp area associated with seasonal and ritual movement patterns within the wider region. | This site has medium significance for the Aboriginal community as a traditional historical camp area that was associated with seasonal and ritual patterns of movements into the Coffs Harbour area that brought people together from the wider region for resource gathering and ceremonial business. | Direct partial |

| Site name | Description | Cultural heritage significance | Impact |
|---|---|---|---|
| West Korora Living Place | A historic living place located on the West Korora Road in the 1940s. It is understood that this site is located on an older traditional campsite area. | This site has medium significance for the Aboriginal community as a historical living place used in the 1940s and understood to be located on an older traditional campsite area. | The site will not be impacted by the project and specific mitigation measures are not required. |

Aboriginal knowledge holders identified that the wider area holds cultural meanings, values and significance as part of the broader cultural landscape. In relation to impacts, the management measures identified in **Table 15-8** have been developed based on consultation with the identified knowledge holders and aim to help in recording, recognition preservation of the cultural values and significance of the impacted landscape.

## 15.4 Environmental management measures

Avoiding harm to Aboriginal cultural heritage has been a priority of this project development. Significant impacts to Aboriginal cultural heritage were avoided through the options selection process between 2001 and 2004 as noted in **Chapter 4, Project development and alternatives**. Further design refinements have reduced or removed potential impacts on PADs and some archaeological sites, as well as reduced potential impacts on the Roberts Hill and Sealy Point Pathways through the inclusion of tunnels through the ridgelines.

While conservation is the best approach when considering Aboriginal heritage, some level of impact on the identified archaeological sites is unfortunately unavoidable due to the construction requirements of the project. There are no areas of high archaeological significance within the construction footprint, but where impact on Aboriginal archaeological sites of moderate archaeological significance cannot be avoided, mitigation is proposed. It is recommended that recorded surface artefacts are collected, and sites of moderate significance undergo salvage excavation in accordance with the methodology detailed in **Appendix L, Aboriginal cultural heritage assessment report**. The salvage excavation will be undertaken in association with the RAPs. A summary of the proposed mitigation approach for each known Aboriginal site is outlined in **Table 15-7**.

Consultation with the RAPs has indicated that the loss of intrinsic Aboriginal cultural value for the impacted sites cannot be offset, however the information recovered from mitigation strategies is valuable to the contemporary Aboriginal community.

Table 15-7 Mitigation approach for known Aboriginal archaeological sites

| Mitigation measures | Archaeological site |
|---|---|
| Salvage excavation | CHB AFT 1<br>CHB AFT 5<br>CHB AFT 8<br>CHB AFT 11<br>CHB AFT 13 |
| Collection of surface artefact(s) | CHB AFT 5<br>CHB AFT 9<br>CHB AFT 11<br>CHB IF 7<br>CHB6 IF 2<br>CHSS-3<br>Coffs Dump |

| Mitigation measures | Archaeological site |
|---|---|
| No archaeological mitigation | CHB AFT 2<br>CHB AFT 3<br>CHB AFT 4<br>CHB AFT 6<br>CHB AFT 7<br>CHB AFT 10<br>CHB AFT 14<br>CHB AFT 15<br>CHB IF 1<br>CHB IF 2<br>CHB IF 3<br>CHB IF 4<br>CHB IF 5<br>CHB IF 6 |

Overarching management measures for Aboriginal cultural heritage are outlined in **Table 15-8**. There are also interactions between the mitigation measures for Aboriginal cultural heritage and **Chapter 16, Non-Aboriginal cultural heritage.**

Table 15-8 Environmental management measures for Aboriginal heritage impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Impacts on known Aboriginal sites or places | AH01 | An Aboriginal Heritage Management Plan will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The plan will be prepared in consultation with the RAPs. The plan will give effect to any management measures contained in the Aboriginal cultural heritage assessment carried out for the project and include:<br>• Details of investigations completed or planned to be carried out and any associated approvals required<br>• Mapping of areas of Aboriginal heritage value and identification of protection measures to be applied during construction<br>• Procedures to be implemented if previously unidentified Aboriginal objects, including skeletal remains, are discovered during construction<br>• An induction program for construction personnel on the management of Aboriginal heritage values and cultural awareness<br>• Opportunities for ongoing Aboriginal community engagement in the project. | Contractor | Prior to construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | AH02 | Before any construction activity (including pre-construction activities of minimal environmental impact), a heritage site map will be prepared identifying Aboriginal sites to be excavated and avoided (for all sites in proximity to the construction footprint) and included in relevant induction training. | Contractor | Prior to construction |
| | AH03 | Archaeological salvage excavation as detailed in **Table 15-7** must be carried out in accordance with the methodology specified in **Appendix L, Aboriginal cultural heritage assessment report**. | Roads and Maritime / Contractor | Prior to construction |
| | AH04 | Where archaeological salvage excavation or surface collection has been nominated for impacted sites, no construction activities (including pre-construction activities of minimal environmental impact) can occur on the land to be investigated until the relevant archaeological excavations at the nominated site have been completed. | Roads and Maritime / Contractor | Prior to construction |
| Unexpected finds of Aboriginal objects | AH05 | Roads and Maritime's Unexpected Heritage Items: Heritage Procedure 02 (Roads and Maritime 2015e) will be used in the event of uncovering an unexpected archaeological find during construction. | Contractor | During construction |
| Unexpected finds of human remains | AH06 | In the event that construction activity reveals possible human skeletal material (remains), all work is to halt at that location immediately and the steps outlined in the Roads and Maritime's Unexpected Heritage Items: Heritage Procedure 02 (Roads and Maritime 2015e) will be followed. Identified knowledge holders will be notified within 24 hours of any confirmed discovery of Aboriginal skeletal remains. | Contractor | During construction |
| Impacts to intangible cultural values associated with impacted cultural sites | AH07 | Rehabilitation and revegetation of the construction footprint will occur with local indigenous plant species progressively during construction. The identification of the plant species will be carried out in consultation with the identified knowledge holders and the RAPs. Opportunities will be given to local Aboriginal organisations for involvement and potential engagement in the revegetation process. | Roads and Maritime / Contractor | During construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | AH08 | A booklet (in a format appropriate for local publication) will be prepared by a cultural heritage specialist on the cultural values and historical records of the cultural sites. As part of the process, the visual documentation of the cultural landscape will occur before construction. The report will be full colour and distributed to local libraries and educational institutions. The final content of the booklet will be developed in consultation with identified Aboriginal knowledge holders. | Roads and Maritime | Prior to and during construction |
| | AH09 | Interpretative signage relevant to the cultural sites will be prepared in consultation with identified knowledge holders. Consultation with the knowledge holders will occur in regard to potential locations for the placement of the signage. | Roads and Maritime | During and post construction |

CHAPTER

16

Chapter 16

# Non-Aboriginal cultural heritage

# 16. Non-Aboriginal cultural heritage

This chapter presents an assessment of the impacts of the project on non-Aboriginal heritage and identifies mitigation and management measures to minimise these impacts. The assessment draws on information from the non-Aboriginal heritage assessment report prepared for this EIS (refer to **Appendix M, Non-Aboriginal heritage assessment**).

**Table 16-1** lists the SEARs relevant to non-Aboriginal heritage and where they are addressed in this chapter.

Table 16-1 SEARs relevant to non-Aboriginal heritage

| Ref | Key Issue SEARs | Where addressed |
|---|---|---|
| **8. Heritage** | | |
| **1.** | The Proponent must identify and assess any direct and/or indirect impacts (including cumulative impacts) to the heritage significance of: | |
| | c) Environmental heritage, as defined under the *Heritage Act 1977* | Section 16.2<br>Section 16.3 |
| | d) Items listed on the National and World Heritage lists. *Environment Protection and Biodiversity Conservation Act 1999*. | There are no heritage items listed on the National or World Heritage lists within the study area. |
| **2.** | Where impacts to state or locally significant heritage items are identified, the assessment must: | |
| | a) Include a significance assessment and statement of heritage impact for all heritage items (including any unlisted places that are assessed as having heritage value) | Section 16.2.6,<br>Section 16.3 |
| | b) Provide a discussion of alternative locations and design options that have been considered to reduce heritage impacts | Section 16.3, |
| | c) In areas identified as having potential archaeological significance, undertake a comprehensive archaeological assessment in line with Heritage Council guidelines which includes a methodology and research design to assess the impact of the works on the potential archaeological resource and to guide physical archaeological test excavations and include the results of these excavations | No excavations were undertaken for the project due to the low archaeological potential identified in Section 16.2.5 |
| | d) Consider impacts to the item of significance caused by, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, increased traffic, visual amenity, landscape and vistas, curtilage, subsidence and architectural noise treatment (as relevant) | Section 16.3 |
| | e) Outline measures to avoid and minimise those impacts in accordance with the current guidelines; | Section 16.4 |
| | f) Be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria). | **Appendix M, Non-Aboriginal heritage assessment** |

# 16.1 Assessment methodology

The assessment was carried out in accordance with current heritage guidelines including Assessing Heritage Significance (NSW Heritage Office 2001*),* Assessing Significance for Historical Archaeological Sites and 'Relics' (Heritage Branch, Department of Planning 2009), Burra Charter (ICOMOS 2013) and Statements of Heritage Impact (NSW Heritage Office and Department of Urban Affairs & Planning 1996 (revised 202) and associated guidelines). The assessment methodology is outlined below. More detail is provided in **Appendix M, Non-Aboriginal heritage assessment**.

The assessment considered heritage values within the study area (as defined in **Section 16.1.2** and shown on **Figure 16-1-01** to **Figure 16-1-06**) and determined the need for further assessment. Management measures were identified to minimise or mitigate potential impacts on these values during the construction and operation of the project. The assessment involved:

- Understanding of baseline environment
  - Review of heritage registers
  - Historical research
  - Physical inspection
- Statement of significance of heritage items within the study area
- Assessment of impacts on built heritage and conservation areas based on available information and physical inspections.

## 16.1.1 Policy and planning setting

The methodology for the non-Aboriginal heritage assessment applies the NSW heritage criteria set out in Assessing Heritage Significance (NSW Heritage Office 2001). The assessment has been carried out in accordance with the requirements of the *Heritage Act 1977* including identification of potential impacts on items of heritage value, built heritage, cultural landscapes and archaeology. The following relevant legislation and guidelines have been considered:

- EPBC Act
- Heritage Act 1977 (Heritage Act)
- EP&A Act
- Coffs Harbour LEP 2013
- Assessing Heritage Significance (NSW Heritage Office 2001)
- New South Wales Historical Themes (NSW Heritage Council 2001)
- NSW Heritage Manual: Statements of Heritage Impact (Heritage Office and Department of Urban Affairs and Planning, 1996)
- Assessing Significance for Historical Archaeological Sites and 'Relics' (Heritage Branch, Department of Planning 2009)
- The Burra Charter: the Australia International Council on Monuments and Sites (ICOMOS) Charter for Places of Cultural Significance 2013 (the Burra Charter) (ICOMOS 2013).

The EPBC Act is the national legislation protecting the natural and cultural environment. The EPBC Act establishes two heritage lists for the management of the natural and cultural environment:

- The National Heritage List – lists items that have been assessed to be of outstanding significance and define 'critical moments in our development as a nation'
- The Commonwealth Heritage List – lists items that are natural and cultural heritage places on Commonwealth land, in Commonwealth waters or are owned or managed by the Commonwealth.

The Heritage Act is designed to protect both known heritage items (such as standing structures) and items that may not be immediately obvious (such as potential archaeological remains or 'relics'). The Heritage Act provides a number of mechanisms to protect items and places of heritage significance including:

- The State Heritage Register – protects items of state significance
- Section 170 Heritage and Conservation Registers – requires that culturally significant items or places managed or owned by government agencies are listed on departmental Heritage and Conservation Registers.

The Coffs Harbour LEP 2013 is a planning instrument under the EP&A Act. It contains schedules of heritage items that are important for the community in the LGA.

### 16.1.2 Understanding the baseline environment

The study area for the non-Aboriginal heritage assessment consists of the construction footprint, which covers an area of about 285 ha, running along the eastern edge of the escarpment to the west of the Coffs Harbour CBD.

A review of the following heritage registers was carried out in June 2019 to identify if any listed heritage items were located within and immediately adjacent to the study area:

- The National Heritage List
- The Commonwealth Heritage List
- The State Heritage Register
- The State Heritage Inventory
- The Water NSW Heritage and Section 170 Heritage and Conservation Registers
- Roads and Maritime and TfNSW Section 170 Heritage and Conservation Register
- The Australian Heritage Places Inventory
- Heritage schedule of the Coffs Harbour LEP 2013.

Historical research of primary archival sources was carried out including historical maps, plans and photographs. Secondary sources such as published and unpublished works were also used to provide the historical context including:

- NSW Land and Property Information
- Heritage Division Library
- Digitised newspapers held by the National Library of Australia
- Parish maps
- Asset management lists from CHCC relating to timber beam bridges within the locality
- Specialist technical reports.

A physical inspection of the study area was carried out over seven days between 6 and 17 June 2016, and 30 August to 1 September 2016. An additional site survey was carried out on 20 March 2019.The principal aims of the survey were to identify significant views and vistas within the study area and identify any previously unrecorded heritage items. The inspection accessed around 95 per cent of available properties. Where lots could not be accessed on foot or showed signs of extensive disturbance, a visual inspection was carried out from nearby land.

## 16.1.3 Statement of significance criteria

Statements of significance were carried out for items that are not listed in any heritage register but were found to have heritage values. These statements of significance used the NSW Heritage Office assessment criteria as outlined in **Table 16-2,** which are based on the Burra Charter.

Table 16-2 NSW heritage significance criteria

| Criterion | Description |
|---|---|
| A | An item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area). |
| B | An item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area). |
| C | An item is important in demonstrating the aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area). |
| D | An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons. |
| E | An item has the potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). |
| F | An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area). |
| G | An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places; or cultural or natural environments; or a class of the local area's cultural or natural places; or cultural or natural environments. |

Items, places, buildings, works, relics, moveable objects and precincts can be of either local or state heritage significance:

- Local heritage items are those of significance to the LGA. They contribute to the individuality and streetscape, townscape, landscape or natural character of an area and irreplaceable parts of its environmental heritage. They may have greater value to members of the local community, who regularly engage with these places and/or consider them to be an important part of their day-to-day life and their identity. Collectively, such items reflect the socio-economic and natural history of a local area. Items of local heritage significance form an integral part of the State's environmental heritage
- State heritage items are those with special interest in the state context. They form an irreplaceable part of the environmental heritage of NSW and must have some connection or association with the state in its widest sense.

A description of the statement of significance for the heritage items within the study area is included in **Section 16.2.6** and **Table 16-6.**

## 16.1.4 Assessment of impacts

The impact on the heritage significance of items as a result of the project has been assessed in accordance with the heritage guidelines detailed in **Section 16.1.1**. The assessment addressed the potential impact of the project in terms of:

- Direct impact: This is defined as physical change to an item or place situated within the study area, which would result in the decrease of the historical heritage values of that item or place. Direct impacts may include minor and peripheral changes, potential archaeological disturbance, large-scale removal and demolition of structures. These can be whole or partial impacts

- Indirect impact: This is defined as an impact on an item or place outside of the study area, or on its surroundings (where it contributes to the historical heritage values of that item or place), due to the project. The potential for indirect impacts varies according to the nature of the item or place, and its proximity to the corridor. Indirect impacts can include vibration, altered historical arrangements and access, and landscape and vista (visual impacts)
- Cumulative impact: This is defined by minimal or gradual impacts from single or multiple developments on heritage values. It would constitute a minimal impact caused by the proposed development that would result in partial or total loss of heritage value to an item/place over time.

## 16.2 Existing environment

Coffs Harbour takes its name from Captain John Korff who was forced to take shelter close to the shore in 1847, while travelling to the Bellinger River. Korff noted the suitability of the site as a harbour. After Korff's visit, 960 acres of land was reserved by the government gazette in 1861 under the misspelling of 'Coff's Harbour'. Despite this, Coffs Harbour was one of the last regions settled on the north coast of NSW, and true European settlement took place in 1880. In the following years, the population of Coffs Harbour and the surrounding area gradually grew, with the main settlement concentrated around the harbour itself. The hinterland through which the study area runs was given over primarily to agricultural use, which drove the early development of the region, firstly through forestry and then once cleared, the suitability of the land for dairy and banana farming.

Roads were cut inland and along the coast from Coffs Harbour throughout the 1880s, linking Coffs Harbour with Moonee Moonee, Grafton and Bellinger. As the population grew along the east coast, the government recognised the need for a railway along the coast linking Maitland to South Grafton. The railway was constructed in stages, with the first section of the railway completed from the harbour south to Repton (located south of the study area) in 1915. Construction began on the northern portion of the railway which runs through the northern half of the study area in the same year, connecting Coffs Harbour with Glenreagh in the north in 1922. More information about the history of the existing environment is provided in **Appendix M, Non-Aboriginal heritage assessment**.

### 16.2.1 Historical themes

Historical research was carried out to identify the land use history of the study area, to isolate key phases in its history and to identify the location of any archaeological resources. The historical research places the history of the study area into the broader historical context of the Coffs Harbour region. Contextual analysis of a site is carried out by gaining an understanding of the history of a site in relation to broad historical themes. There are 38 historical themes for NSW that have been developed by the Australian Heritage Commission and the NSW Heritage Office. A review of these themes has identified three historical themes that relate to the history of the study area (refer to **Table 16-3**).

Table 16-3 Identified historical themes for Coffs Harbour

| Theme | State | Local |
|---|---|---|
| Developing local, regional and national economies | Agriculture | Activities relating to the cultivation and rearing of plant and animal species, usually for commercial purposes. It includes dairy, rural landscape and plantations. |
| | Communication | Activities relating to the creation and conveyance of information, including post office and telephone exchange. |

| Theme | State | Local |
|---|---|---|
| | Transport | Activities associated with the moving of people and goods from one place to another, and systems for the provision of such movements including railway lines and bridges. |
| | Forestry | Activities associated with identifying and managing land covered in trees for commercial purposes. |
| Environment – tracing the evolution of a continent's special environments | Environment | Natural – pre-European settlement vegetation. |
| Building settlements, towns and cities | Towns, suburbs and villages | Activities associated with creating, planning and managing urban functions, landscapes and lifestyles in towns, suburbs and villages. |

### 16.2.2 Cultural landscape

Cultural landscapes highlight the landscape-scale history and connectivity between people, places and heritage items. It recognises that the present landscape is the product of long term and complex relationships between people and the environment. The heritage value of a landscape may be related to its aesthetic, archaeological, historical, scientific, social or architectural values. Three general landscape categories have been developed and applied by heritage organisations including the NSW Heritage Office and the United Nations to help with the understanding of different types of landscapes:

- Designated landscapes – those that are created intentionally such as gardens, parks, garden suburbs, city landscapes, ornamental lakes, water storages and campuses
- Evolved landscapes – those that display an evolved land use in their form and features, e.g. former mining or rural landscapes, or modern active farms, vineyards, plantations or mines
- Associative cultural landscapes – those that represent religious, artistic, sacred or other cultural associations to individuals or communities.

The Coffs Harbour hinterland has been considered in **Appendix M, Non-Aboriginal heritage assessment** as a cultural landscape, particularly in relation to retention of the previous rural identity of the region.

The study area is encompassed by an evolved landscape with modern residential and commercial subdivisions that transition into banana plantations that occupy the slopes and valleys that surround Coffs Harbour. In particular, the north-western alignment of the study area that traverses the ridgelines associated with Roberts Hill, Red Hill, Treefern Creek and Jordans Creek contain a large number of banana plantations. The forested landscape was cleared during the late 19th to early 20th century; however, there is still evidence of this landscape in the form of the marked tree stumps and isolated areas of remnant vegetation associated with the escarpment. These cleared areas and plantations are characteristic of the system of land clearance and agriculture adopted in the 1920s in the Coffs Harbour area that supported the local economy. This landscape is referred to as the 'Coffs Harbour Banana Plantation Landscape' and is shown in **Figure 16-1-01** to **Figure 16-1-06**.

### 16.2.3 Built heritage

A review of the national, State and local heritage registers did not identify any listed heritage items within the study area. However, during the physical inspection of the study area, unlisted items of built heritage significance were identified. These items display the early development of Coffs Harbour and are described further in **Table 16-4** and shown in **Figure 16-1-01** to **Figure 16-1-06**.

Table 16-4 Unlisted items of built heritage within the study area

| Unlisted heritage item | Description | |
|---|---|---|
| Former Coffs Heights Post Office, now residential property (353D Coramba Road) | Conversations with the landowner revealed the Coffs Heights Post Office was raised and relocated to 353D Coramba Road by Richard Jack Pike, a ganger on the North Coast Railway, sometime following its closure in 1923. It has remained in the Pike family for three generations and was expanded during this time.<br>The original structure was recorded during physical inspection as the central cabin of the residence, measuring 12 feet wide and 60 feet long. Additional rooms have been added along both sides of the original central cabin. The original structure is difficult to identify from the exterior. A comparison of post offices and other government buildings constructed throughout the late 1800s in the Clarence Valley and Bellingen LGAs, have demonstrated similar architectural components as the Coffs Heights Post Office.<br>They display aesthetically rare and representative traits at a local level. As the Coffs Heights Post Office has gone through substantial relocation and repurposing, it is less representative at a local level. | <br>**Photograph 16-1 Former Coffs Heights post office with additions along both sides of the original central cabin** |
| North Coast Railway | The portion of the North Coast Railway running through the study area was constructed between 1912 and 1922, linking Coffs Harbour to Grafton. It includes segments of railways track and a concrete tunnel, the segments of which were either placed or cast in situ. The railway line remains in active use. | <br>**Photograph 16-2 North Coast Railway tracks and tunnel within the agricultural landscape** |

| Unlisted heritage item | Description | | |
|---|---|---|---|
| Old Coast Road Bridge No.1 | This timber beam bridge has been dated to post 1894 based on its capwales (a pair of horizontal timber components at the top of piles or posts providing bearing for the superstructure). The history places its date of construction as 1939 and it may represent later upgrades to the roads and bridges linking Coffs Harbour to Grafton. The bridge consists of a reasonably intact sub-structure including timber piles, bracing and headstocks. The super-structure has been heavily modified through the removal of the timber decking, kerb and rails which have been replaced with concrete slabs and metal barriers. CHCC records indicate that the original bridge was replaced in 1995. |  **Photograph 16-3 Detail of the timber truss bridge** |  **Photograph 16-4 Remains of previous bridge** |
| Old Coast Road Bridge No.2 | The Old Coast Road Bridge No.2 is a one span version of Old Coast Road Bridge No.1. It most likely dates from 1939. More recent repairs have been made as metal cross bracing and plywood have been used to stabilise one side of the embankment |  **Photograph 16-5 piles and sawn timber planks holding back the embankment** |  **Photograph 16-6 Bridge concrete deck and under bridge** |

| Unlisted heritage item | Description | |
|---|---|---|
| | A concrete mounted gravestone measuring 80 cm by 50 cm with a marble plaque is located in the northern portion of the study area at the intersection of the existing Pacific Highway and James Small Drive. The inscription on the plaque reads 'In memory of my dear husband Herbert Frazer Simpson. Passed away 1st September 1965. Age 57 years. Sadly missed by your loving wife & family'. The gravestone is not associated with a grave, as research indicates that Herbert Frazer Simpson was buried in the Anglican section of the Coffs Harbour Cemetery. As his wife was interred with him at a later date and a joint gravestone used, it is likely that this gravestone is the original that was subsequently replaced. It is considered that this item has negligible heritage significance. |  **Photograph 16-7 Gravestone of Herbert Frazer Simpson located within the construction footprint** |
| | A pair of marked tree stumps were located within the northern portion of the study area. These tree stumps display evidence of footholds and hand sawing and are representative of the exploitation of timber during the early settlement of the region. |  **Photograph 16-8 Marked tree stumps located within the northern portion of the study area** |

## 16.2.4 Conservation area

A review of the registers outlined in **Section 16.1.2** did not identify any listed heritage conservation areas within the study area. However, the High Conservation Value Old Growth Forest (listing 1487 on the State Heritage Register) was identified 200 m to the north-west of the study area. It is located within an area of land resumed by the government in 1882 and is considered to have high conservation value.

## 16.2.5 Archaeology

Archaeological potential is influenced by the geographical and topographical location, level of development, subsequent impacts, levels of onsite fill and factors influencing preservation (e.g. soil type). The historical context of the study area indicates that much of the area has been vacant or used for agriculture after initial clearing. Most construction within the study area is modern and is not considered likely to hold any archaeological potential.

During the site surveys, the study area was observed to have been significantly disturbed by the construction of the Pacific Highway at the northern and southern ends, as well as farming practices after the adoption of banana farming during the early to mid-20th century. It is likely that remains of farming implements, sheds and other paraphernalia of the early timber, dairy and banana industries are present in areas that contain the potential for intact subsurface deposits.

The impacts of modern developments, relocation, farming practices and a general lack of consistent land use within the study area have led to the assessment of the four sites identified during the physical inspection as holding low archaeological potential. There are no sites present within the study area that have the potential to provide further knowledge of the development of local, regional or national economies. In most areas, the study area has been significantly disturbed by farming practices and infrastructure development.

The original gravestone of Herbert Frazer Simpson is considered to hold no archaeological potential as it is an isolated grave marker and not considered to be associated with a burial. This item is located within the construction footprint and would be directly impacted. As it has negligible heritage significance, the assessment of the actual and potential impacts associated with moving this gravestone is included in **Chapter 14, Socio-economic**.

The archaeological potential of the items within the study area are summarised in **Table 16-5**. The archaeological potential has been based on the following three categories:

- High archaeological potential: based on the historical context and documentary evidence presented within the non-Aboriginal heritage assessment (**Appendix M, Non-Aboriginal heritage assessment**), there is a high degree of certainty that archaeological significant remains relating to this period, theme or event will occur within the study area
- Moderate archaeological potential: based on the historical context and documentary evidence presented within the non-Aboriginal heritage assessment (**Appendix M, Non-Aboriginal heritage assessment**), it is probable that archaeological significant remains relating to this period, theme or event could be present within the study area
- Low archaeological potential: based on the historical context and documentary evidence presented within the non-Aboriginal heritage assessment (**Appendix M, Non-Aboriginal heritage assessment**), it is unlikely that archaeological significant remains relating to this period, theme or event will occur within the study area.

Table 16-5 Assessment of archaeological potential

| Archaeological feature | Date | Theme | Archaeological potential |
|---|---|---|---|
| Former Coffs Heights Post Office, now residential property | 1915 – 1923 | Developing local, regional and national economies – Communication | Low |
| Old Coast Road Bridge No.1 | 1939 | Developing local, regional and national economies – Transport | Moderate |
| Old Coast Road Bridge No.2 | 1939 | Developing local, regional and national economies - Transport | Low |
| North Coast Railway | 1915 – present | Developing local, regional and national economies – Transport | Low |
| Marked tree stumps | c.1847 – 1880 | Developing local, regional and national economies – Forestry | Low |

## 16.2.6 Statement of significance

An assessment of heritage significance includes a range of heritage criteria and values, which can be broadly defined as the aesthetic, historic, scientific or social values for past, present or future generations. The archaeological significance of a site is assessed in terms of historical and scientific values, particularly by what a site can tell us about past lifestyles and people.

A detailed set of criteria for assessing the State's cultural heritage is included in Assessing Heritage Significance (NSW Heritage Office 2001). The criteria are described in **Table 16-2** and an assessment of the significance of each previously unlisted heritage item against the criteria is included below in **Table 16-6.** This also notes the level of significance (ie either local or state) as described further in **Section 16.1.3.** The High Conservation Value Old Growth Forest has not been included in the table, as it is a listed item and therefore an assessment of heritage significance has already been undertaken as part of the heritage listing.

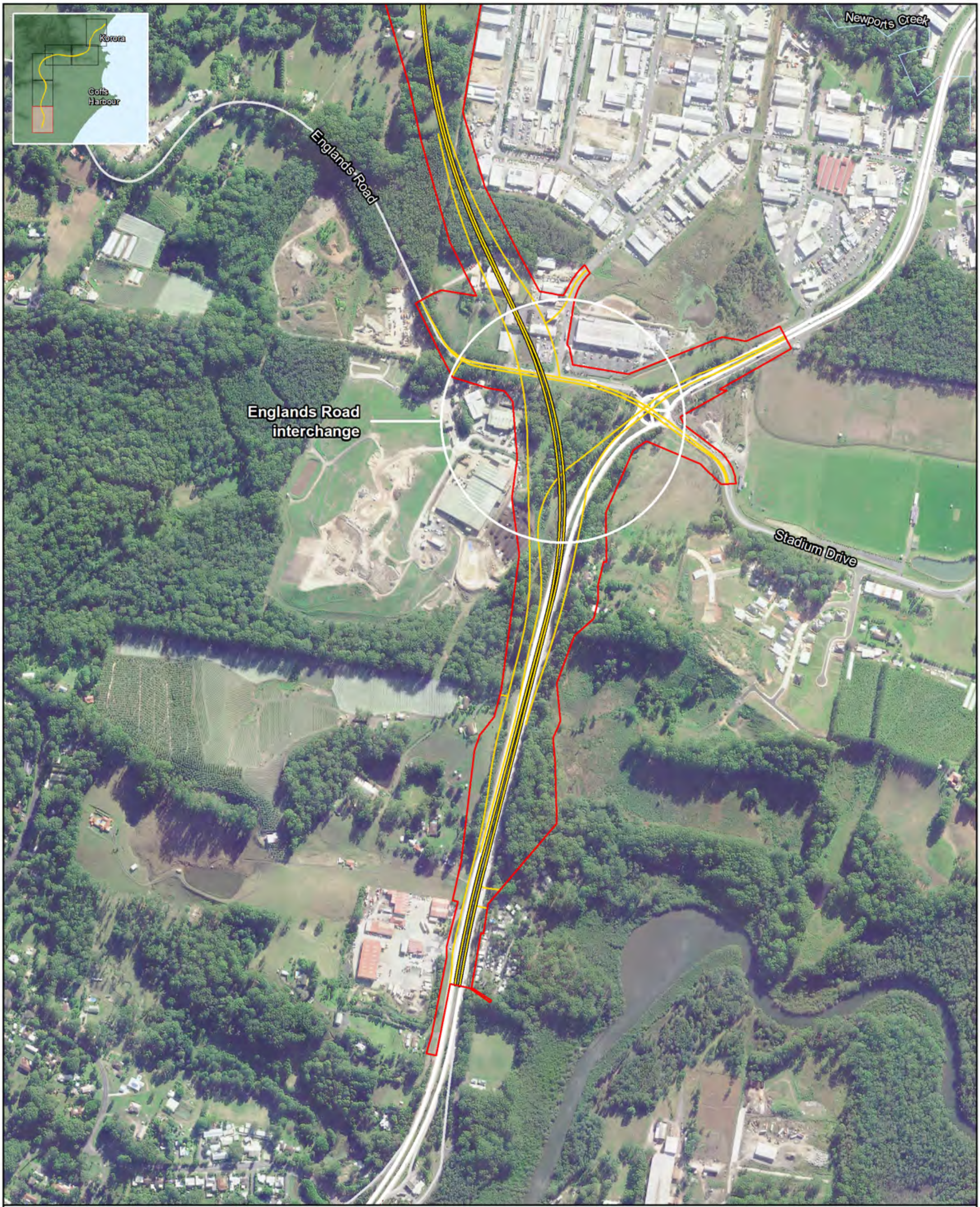
Table 16-6 Significance of heritage items within the study area

| Heritage item | Response to assessment criteria | Level of significance | Statement of significance |
|---|---|---|---|
| Coffs Harbour Banana Plantation Landscape | **Criterion (a):** This landscape is indicative of the post 1920s agricultural development of Coffs Harbour which led to banana cultivation becoming a key component of the local economy.<br>**Criterion (c):** This landscape forms a distinctive component of the surrounding rural hinterland of Coffs Harbour characterised by the farm buildings, loading docks and rows of banana plants themselves. The landscape is visible from key vantage points including the nearby ridgelines, rural roads and the rail alignment.<br>**Criterion (d):** Banana cultivation forms a key part of the local identify of Coffs Harbour. As such, the Coffs Harbour Banana Plantation Landscape is likely to be of significance to the local community as it | Local | The Coffs Harbour Banana Plantation Landscape holds significance for its historical connection to banana cultivation in Coffs Harbour. The landscape is important in demonstrating the importance of this activity as part of the historical development of Coffs Harbour. The plantations are likely to be significant to the local community as banana growing is an important part of the cultural identify of Coffs Harbour. |

| Heritage item | Response to assessment criteria | Level of significance | Statement of significance |
|---|---|---|---|
| | encompasses as number of large plantations.<br>This landscape does not meet criteria (b), (e), (f) or (g). | | |
| Former Coffs Heights Post Office, now residential property | **Criterion (a)**: This item is a rare surviving example of the temporary workers' towns that developed around Coffs Harbour during the construction of the North Coast Railway. These towns and the construction of the railway itself were important for the development of Coffs Harbour as a major economic centre on the mid-north coast.<br>**Criterion (f):** This item appears to be a unique, surviving example of a structure built for the temporary workers' towns that developed around Coffs Harbour during the construction of the North Coast Railway.<br>The item does not meet criteria (b), (c), (d), (e) or (g). | Local | The former Post Office holds local significance as a surviving example of the short-lived workers' towns that appeared around Coffs Harbour during the construction of the North Coast Railway at the start of the 20th Century. However, the relocation of the Post Office from Coffs Heights to Coramba Road and its subsequent remodelling limits the archaeological potential of the structure. |
| Old Coast Road Bridge No.1 | **Criterion (a):** This item is located on the Old Coast Road which was originally surveyed c.1893, with the bridge part of the upgrades made in 1939 and would have formed a key crossing point over Pine Brush Creek on the route north to Grafton. The Old Coast Road was a key item of infrastructure that would have been an important component in connective Coffs Harbour with Grafton and other local towns.<br>**Criterion (c):** This item is indicative of late 19th to early 20th century timber bridge technology and its use in the construction of road infrastructure in the local area.<br>**Criterion (e)**: This item has the potential to yield information relating to the use, development and modification of timber beam technology in the local area as part of the continued use of the local road network. Remains of an earlier timber bridge are present underneath the current bridge.<br>**Criterion (f):** Based upon a review of heritage listings in the Coffs Harbour area, the timber beam bridges are rare within the local area. The bridge is listed as one of three located on the Old Coast Road. Old Coast Road Bridge No.2 is also considered within the assessment, however the condition and preservation of the other bridge is currently unknown. Notwithstanding, the Old Coast Road Bridge No.1 may be one of few surviving post-1930 | Local | The bridge is representative of the use of timber beam bridge technology in the construction of the local road networks. Based upon a review of local heritage registers, the bridge appears to be unique within the local area and may be one of few surviving early 20th century timber beam bridges in the Coffs Harbour region. It appears that no major modifications or repairs have been made to the sub-structure and demonstrates aesthetic characteristics of a design uncommon in this area. remnants of an earlier bridge can be seen under the current structure, indicating multiple phases of construction and it has the potential to yield information that will contribute to the development of the local area. |

| Heritage item | Response to assessment criteria | Level of significance | Statement of significance |
|---|---|---|---|
| | timber beam bridges in the Coffs Harbour region.<br>**Criterion (g):** This item is representative in its use of timber beam technology in the construction of road bridges within the local area. While the super structure has been replaced with modern components much of the sub-structure remains in good condition.<br>The item does not meet criteria (b) or (d). | | |
| Old Coast Road Bridge No.2 | **Criterion (a):** The item is located on the Old Coast Road which was originally surveyed c.1893, the bridge was part of upgrades made in 1939 and forms a crossing point over a tributary of Pine Brush Creek on the route north to Grafton. The Old Coast Road was a key item of infrastructure that would have been an important component in connecting Coffs Harbour with Grafton and other local towns.<br>**Criterion (c):** This item is indicative of early 20th century timber bridge technology and its use in the construction of road infrastructure in the local area.<br>**Criterion (e):** This item has the potential to yield information relating to the use, development and modification of timber beam technology in the local area as part of the continued use of the local road network. More modern upgrades/repairs such as plywood boards and timber bracing can be seen underneath the bridge.<br>**Criterion (f):** Based upon a review of heritage listings in the Coffs Harbour area, the timber beam bridges appear to be rare within the local area. As for Old Coast Road Bridge No.1, the bridge is listed as one of three located on the Old Coast Road. The condition and preservation of the other bridge is currently unknown. As such, the timber beam bridge may be one of few surviving post-1930 timber beam bridges in the Coffs Harbour region.<br>**Criterion (g):** This item is representative in its use of timber beam technology in the construction of road bridges within the local area. The sub-structure has more modern repairs and it is not as original as the Old Coast Road Bridge No.1.<br>The item does not meet criteria (b) or (d). | Local | The single span timber beam bridge is of local significance as part of the Old Coast Road. The bridge is representative of the use of timber beam bridge technology in the construction of the local road networks. Based upon a review of local heritage registers the bridge appears to be unique within the local area and may be one of few surviving early 20th century timber beam bridges in the Coffs Harbour region. Repairs/modifications have been made, including plywood boards and steel bracing to reinforce the abutment planks and concrete additions to the piles to hold back the abutment fill. While the Old Coast Road Bridge No.1 is a more intact structure with multiple phases of construction, the Old Coast Road Bridge No.2 also still retains local significance and demonstrates the later, more modern phases of construction. |

| Heritage item | Response to assessment criteria | Level of significance | Statement of significance |
|---|---|---|---|
| North Coast Railway | **Criterion (a):** The North Coast Railway is a major piece of transport infrastructure and represents an important stage in the economic development of Coffs Harbour, linking the town with Sydney as well as Grafton and the north. The construction of the railway also saw a population influx into the Coffs Harbour area.<br>**Criterion (c):** The North Coast Railway traverses the hinterland of Coffs Harbour and allows for the appreciation of the surrounding landscape that is characterised by steep hillslopes, crests and ridgelines, of which many are used as banana plantations.<br>The item does not meet criteria (b), (d), (e), (f) or (g). | Local | The railway line holds significance as a major piece of transport infrastructure on the North Coast and the course of the railway represents Coffs Harbour becoming an economic centre for the region. The construction of the railway line also played a significant role in the population growth of the wider Coffs Harbour region. The alignment of the railway is significant in the local landscape and allows travellers to experience the local landscape. |
| Marked tree stumps | **Criterion (a):** The marked tree stumps display evidence of toe holds and hand sawing which indicates that the trees are likely to belong to the early settlement of the Coffs Harbour region which relied upon the felling of timber. As such, the marked tree stumps are representative of the early settlement of the region.<br>**Criterion (c):** The marked tree stumps are a remnant of a former wooded landscape that was removed as part of the early settlement of the region. The markings are also indicative of the process of timber clearing and the techniques involved. As such, the marked tree stumps add to the visual appreciation of this former landscape and the method of its clearance.<br>**Criterion (f)**: Due to the level of clearance that has occurred in the local region, the marked tree stumps are considered to be rare within the local area.<br>**Criterion (g):** The marked tree stumps are representative of timber clearance as part of the early settlement of the region.<br>The item does not meet criteria (b), (d) or (e). | Local | The marked tree stumps are of local significance as they are a rare and representative example of the process of timber clearance. This activity was a major industry on the North Coast and significantly contribute to the economy of the early settlement of Coffs Harbour. The marked tree stumps are indicative of the former forested landscape that occupied the coastal hinterland. |




**Legend**

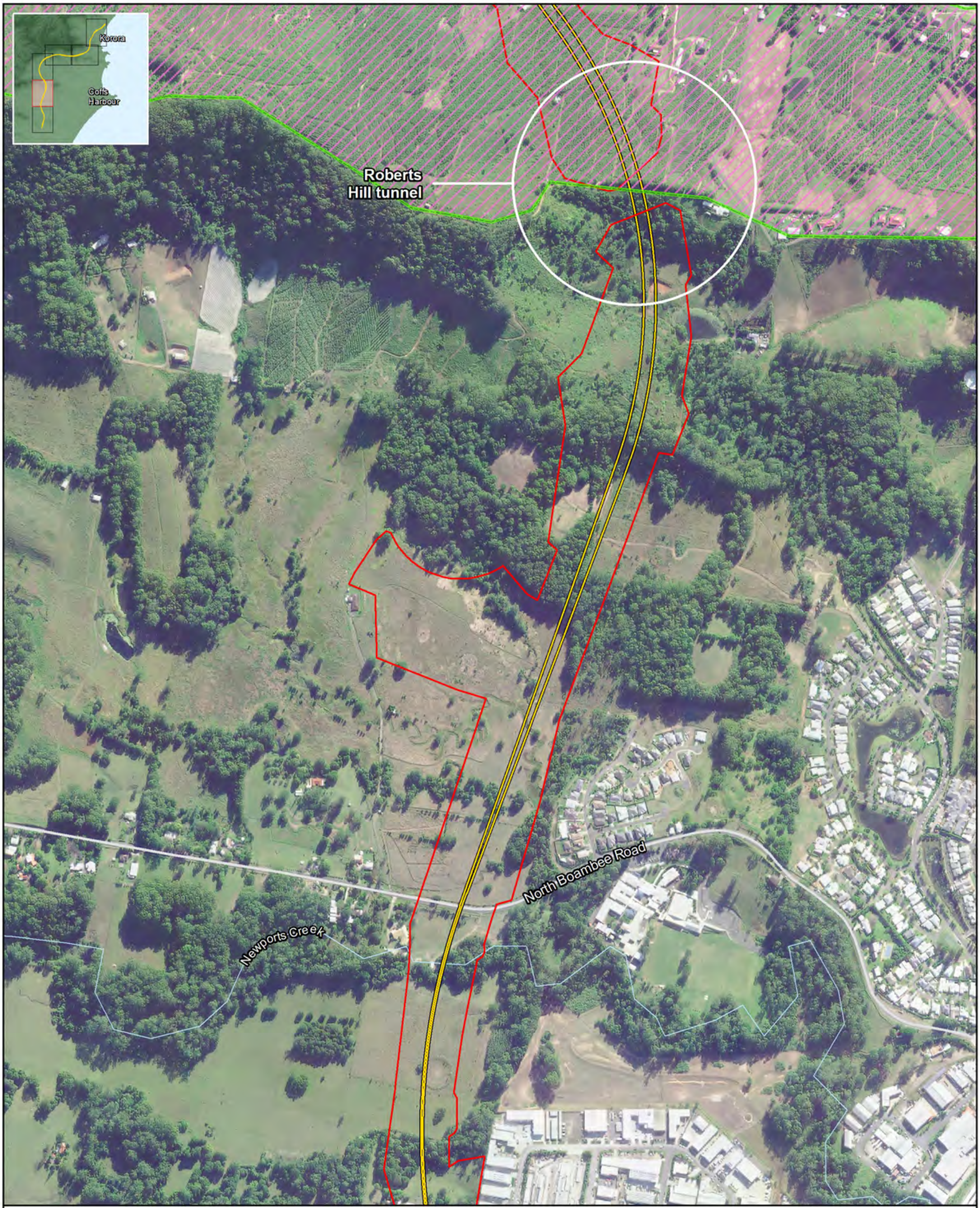
- Construction footprint
- Alignment
- Watercourse
- High Conservation Old Growth Forest
- Coffs Harbour Banana Plantation Landscape
- North Coast Railway

**Heritage items**

- Former Coffs Heights Post Office
- North Coast Railway
- Old Coast Road Bridge No. 1
- Old Coast Road Bridge No. 2
- Marked tree stumps
- Gravestone

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56
N

Coffs Harbour Bypass
Non-Aboriginal heritage items
Figure 16-1-01




**Legend**

- Construction footprint
- Alignment
- Watercourse
- High Conservation Old Growth Forest
- Coffs Harbour Banana Plantation Landscape
- North Coast Railway

**Heritage items**

- Former Coffs Heights Post Office
- North Coast Railway
- Old Coast Road Bridge No. 1
- Old Coast Road Bridge No. 2
- Marked tree stumps
- Gravestone

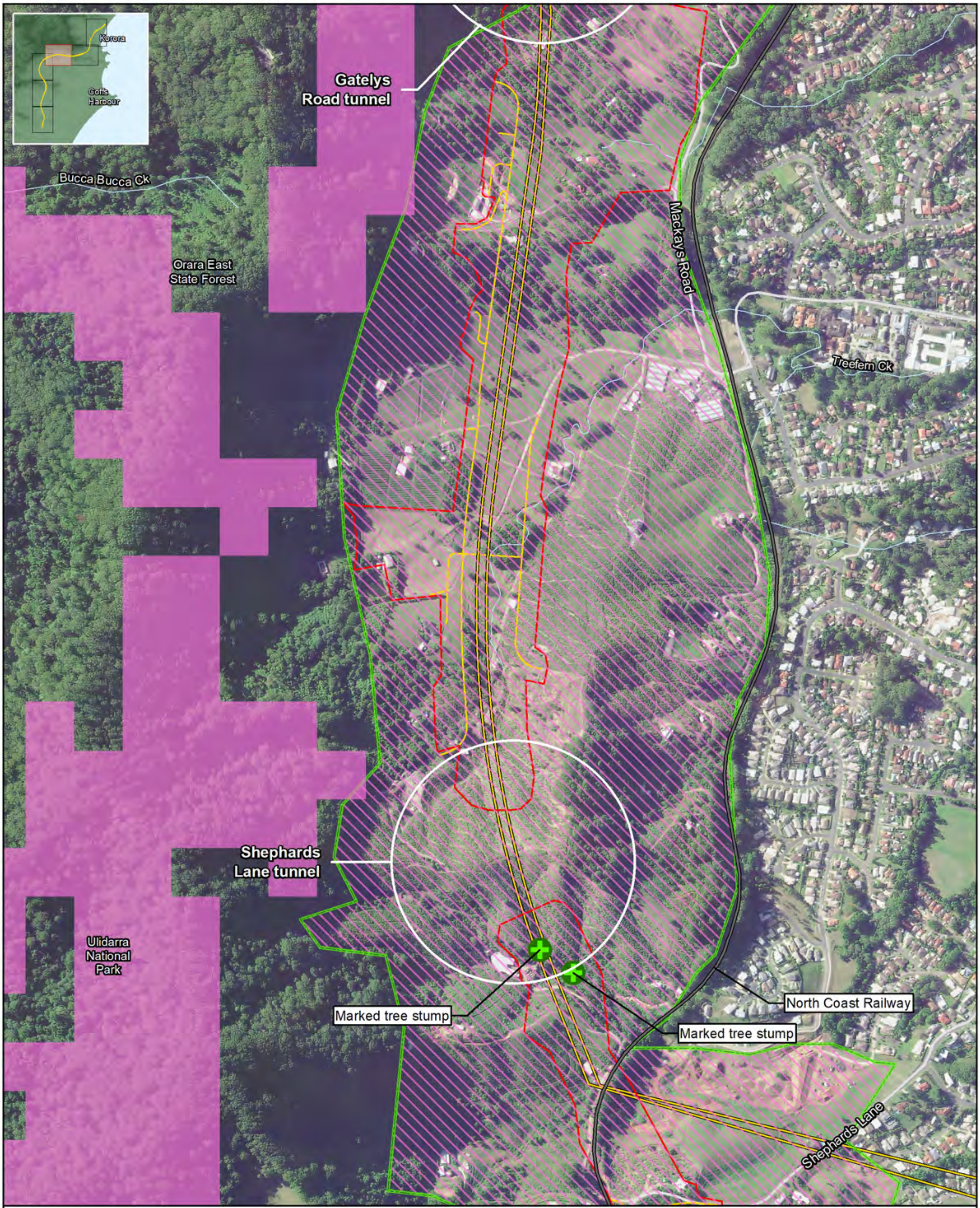
0 0.1 0.2 0.3 km

Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

N

Coffs Harbour Bypass
Non-Aboriginal heritage items
Figure 16-1-02


Coffs Harbour Bypass
Non-Aboriginal heritage items
Figure 16-1-03




**Legend**

- Construction footprint
- Alignment
- Watercourse
- High Conservation Old Growth Forest
- Coffs Harbour Banana Plantation Landscape
- North Coast Railway

**Heritage items**

- Former Coffs Heights Post Office
- North Coast Railway
- Old Coast Road Bridge No. 1
- Old Coast Road Bridge No. 2
- Marked tree stumps
- Gravestone

Coffs Harbour Bypass
Non-Aboriginal heritage items
Figure 16-1-04

0 0.1 0.2 0.3 km
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56


**Legend**

- Construction footprint
- Alignment
- Watercourse
- High Conservation Old Growth Forest
- Coffs Harbour Banana Plantation Landscape
- North Coast Railway

**Heritage items**

- Former Coffs Heights Post Office
- North Coast Railway
- Old Coast Road Bridge No. 1
- Old Coast Road Bridge No. 2
- Marked tree stumps
- Gravestone

Coffs Harbour Bypass
Non-Aboriginal heritage items
Figure 16-1-05

0 0.1 0.2 0.3 km N
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56


**Legend**

- Construction footprint
- Alignment
- Watercourse
- High Conservation Old Growth Forest
- Coffs Harbour Banana Plantation Landscape
- North Coast Railway

**Heritage items**

- Former Coffs Heights Post Office
- North Coast Railway
- Old Coast Road Bridge No. 1
- Old Coast Road Bridge No. 2
- Marked tree stumps
- Gravestone

Coffs Harbour Bypass
Non-Aboriginal heritage items
Figure 16-1-06

0 0.1 0.2 0.3 km
N
Scale @A4: 1:10,000
GDA 1994 MGA Zone 56

# 16.3 Assessment of potential impacts

The potential and actual impacts of the project on known heritage items and a discussion of alternative locations and design options are provided in **Table 16-7.**

Table 16-7 Assessment of impacts to heritage items within or next to the study area

| Heritage item | Statement of heritage impact | Type of impact |
|---|---|---|
| Coffs Harbour Banana Plantation Landscape | The project traverses the landscape and is proposing some cut and fill activities that would result in physical and visual impacts to part of the Coffs Harbour Banana Plantation Landscape. The project would impact on views to, from and within the landscape, and would result in discontinuation of agricultural activities in certain locations. As a result, the project would have a partial direct impact on this landscape that would have a negative impact on its significance.<br>Impacts from the project on key vantage points namely viewpoints 8 – 13 as identified in **Chapter 11, Urban design, landscape and visual amenity** have been mitigated through ongoing design work. This is discussed further in **Chapter 11, Urban design, landscape and visual amenity**. However, examples of design work to mitigate the impacts of the project on key vantage points include integration of cut slopes, revegetation using native species and the use of tunnels in the design to retain ridges and existing vegetation which decreases the impact of the project on the landscape.<br>In addition, the project has carried out an agricultural assessment which can be found **in Appendix K2, Agricultural assessment**. The agricultural assessment was carried out to identify potential impacts to agriculture caused by the project and develop appropriate mitigation and management measures to minimise impacts where reasonable and feasible. This is discussed further in Chapter 13, Agriculture. | Direct – partial |
| Former Coffs Heights Post Office, now residential property (353D Coramba Road) | This item would be directly physically impacted by the project due to the proximity of the works at this location and would be wholly demolished. The building has been subject to renovations and it would be difficult to isolate and relocate the original Post Office. The building is located within a rural property characterised by banana plantations and the proximity of the works will have a visual impact on the setting of the item. As it cannot be repurposed or reused in the project a detailed archival recording must be completed prior to any impacts occurring. | Direct – physical whole |
| Old Coast Road Bridge No.1 | This item is located partially within the study area; however, there would be no physical impacts on the structure. There would also be no physical impacts on the area of moderate archaeological potential under the bridge. The bridge is located within a vegetated portion of road and the proximity of the works would have a visual impact on the setting of the item. There is also potential for construction vibration impacts due to the proximity of the bridge to the project and structural impacts due to the use of Old Coast Road for | Indirect – visual and vibration |

| Heritage item | Statement of heritage impact | Type of impact |
|---|---|---|
| | construction access. It is recommended that a detailed inspection of the structural integrity of the bridge is carried out by a suitably qualified structural engineer before the start of construction. Following the inspection, if the bridge is considered to be sensitive to damage from vibration or use by certain types of construction vehicles, it would be recommended to reduce the construction vibration criteria and limit the types of vehicles to use Old Coast Road for construction access (refer to **Chapter 9, Noise and vibration**). | |
| Old Coast Road Bridge No.2 | The item is located partially within the study area, however there will be no physical impacts on the structure. The bridge is located within a vegetated portion of road and the proximity of the works will have a visual impact on the setting of the item. There is also potential for construction vibration impacts due to the proximity of the bridge to the project (refer to **Chapter 9, Noise and vibration**) and structural impacts due to the use of Old Coast Road for construction access. It is recommended that a detailed inspection of the structural integrity of the bridge is carried out by a suitably qualified structural engineer before the start of construction. Following the inspection, if the bridge is considered to be sensitive to damage from vibration or use by certain types of construction vehicles, it would be recommended to reduce the construction vibration criteria and limit the types of vehicles to use Old Coast Road for construction access. | Indirect – visual and vibration |
| North Coast Railway | About 330 m of the North Coast Railway alignment is located within the study area. The project at this location includes a revised local road alignment and a highway bridge over the railway. The project has been designed to ensure no physical impact on the existing infrastructure including the tunnel, embankment and rail infrastructure. However, there will be visual impacts on views to and from the railway, particularly due to the bridge over North Coast Railway near Shephards Lane. | Indirect – visual |
| Marked tree stumps | The marked tree stumps are located within the construction footprint, are likely to be removed as part of the project and as a result, would be directly impacted by the project. This constitutes a direct impact on this item which can be partially mitigated through the preparation of an archival recording for the item before removal. | Direct – physical |
| High Conservation Value Old Growth Forest | The High Conservation Value Old Growth Forest is located 200 m from the study area. Development of the design of the project has avoided this area and as such, the project would not have any physical impacts and minimal visual impacts on this item. | No impact |

## 16.4 Environmental management measures

Environmental management measures have been developed to avoid and minimise potential and actual impacts on items of known and unknown non-Aboriginal heritage, as summarised in **Table 16-8**. These recommendations have been guided by the Burra Charter with the aim of doing as much as possible to retain cultural significance of the area. There are also interactions between the mitigation measures for Non-Aboriginal cultural heritage and **Chapter 9, Noise and vibration**.

Table 16-8 Environmental management measures for non-Aboriginal impacts

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| Construction impacts on known non-Aboriginal heritage items | NAH01 | A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage. The plan will include:<br>• Details of investigations completed or planned to be carried out and any associated approvals required<br>• Mapping of areas of non-Aboriginal heritage value and identification of protection measures to be applied during construction<br>• Procedures to be implemented if previously unidentified non-Aboriginal relics or heritage items are discovered during construction<br>• An induction program for construction personnel on the management of non-Aboriginal heritage values. | Contractor | Prior to construction |
| | NAH02 | Consideration will be given to minimising impacts on elevated vantage points across the Coffs Harbour Banana Plantation Landscape during the preparation of the Urban Design and Landscape Plan.<br>This will include, but not be limited to, investigating opportunities to maintain views to, from and within the landscape. | Contractor | Detailed design |
| | NAH03 | Archival recording will be prepared for the Coffs Harbour Banana Plantation Landscape, former Coffs Heights Post Office, the North Coast Railway, the Old Coast Road Bridge No.1, Old Coast Bridge No.2 and the marked tree stumps.<br>The archival records should record the process of development and alterations to heritage values. A program of archival recording should be completed prior to construction. Archival recording will be completed in accordance with How to Prepare Archival Records for Heritage | Roads and Maritime / Contractor | Prior to construction |

| Impact | ID No. | Environmental management measure | Responsibility | Timing |
|---|---|---|---|---|
| | | Items (NSW Heritage Office 1998) and Photographic Recording of Heritage Items Using Film or Digital Capture (NSW Heritage Office 2006). | | |
| | NAH04 | The North Coast Railway, Old Coast Road Bridge No.1 and Old Coast Road Bridge No.2 will be marked on sensitive area maps to identify their heritage values. These areas will be marked as 'no-go' areas which are established at an appropriate distance (ie on the curtilage boundary of the item) to protect the heritage values. Where construction is to occur within 50 m of the North Coast Railway and the timber beam bridges, the use of physical fencing will be considered to further protect the heritage values but allow construction (including access) to proceed unhindered. The use of sensitive area maps and 'no go' areas will be incorporated into the induction program as part of the NAHMP. | Contractor | During construction |
| Discovery of unexpected non-Aboriginal objects | NAH05 | Should any heritage items, archaeological remains or potential relics of non-Aboriginal origin be encountered, then construction work that might affect or damage the material will cease and notification provided in accordance with the Roads and Maritime's Unexpected Heritage Items: Heritage Procedure 02 (Roads and Maritime 2015e). Work will only re-start once the requirements of that Procedure have been satisfied. | Contractor | During construction |