5. Design changes, EIS clarifications and additional information

5.1 Design changes

Four minor design changes have been made to the ETTT proposal since the exhibition of the EIS. These modifications were identified during a review of the proposal design (as described in Chapter 5 of the EIS) and constructability requirements. The proposed design changes are described in the following sections. The following sections also provide an assessment of the impacts likely to be associated with each design change. These assessments demonstrate that such modifications are minor and can be adequately managed with the application of suitable environmental management measures (refer to Chapter 6). Therefore, the proposed design changes do not require a Preferred Infrastructure Report to be prepared in accordance with Section 115Z of the EP&A Act.

5.1.1 Construction impact area

The construction impact area for the ETTT proposal, as shown in Figure 5.2 of the EIS, has been amended in various locations based on a review of constructability requirements. An outline of the proposed changes in construction impact area is provided in Table 5.1. A summary of the potential change in impact of the ETTT proposal as a result of each change is also provided in Table 5.1. The revised construction impact area for the ETTT proposal is shown in Figure 5.1.

Table 5.1 Proposed changes to the ETTT construction impact area and potential impacts

Changed impact area	Description of proposed change	Summary of potential impacts
A	General work area increase to allow for the connection of the proposed railway services to existing facilities.	Increase in vegetation clearing and associated visual amenity impacts.
B1 and B2	Work area increased (onto Government owned land) to provide sufficient space for construction works, including the construction of the proposed viaduct and rail bridge crossing over the M2 Motorway and the delivery/storage of construction materials.	Increase in vegetation clearing and associated visual amenity impacts. Potential minor impact to heritage listed 'Bushland – Road reserve (between Carlingford Rd and Kandy Avenue)' (Hornsby LEP I 357) as a result of B1. Potential impact to the convict-built stone causeway crossing Devlins Creek (listed on Hornsby LEP) as a result of B2.
C1 and C2	General work area increase to provide additional area for access and construction of the proposed rail bridge crossing over the M2 Motorway.	Increase in vegetation clearing and associated visual amenity impacts. Potential impact to the convict-built stone causeway crossing Devlins Creek (listed on Hornsby LEP) as a result of C1.
D	Increase in trenching or installation of galvanised steel troughing for the connection of railway services between areas north and south of the M2 Motorway.	Increase in vegetation clearing and associated visual amenity impacts.

Changed impact area	Description of proposed change	Summary of potential impacts
E	Widened impact area to facilitate the establishment of a general work area. Area required for additional laydown, materials storage, construction of cuttings, establishment of a haul road for the removal of spoil, as well as to provide access for launching the structure of the proposed rail bridge crossing over the M2 Motorway.	Increase in vegetation clearing and associated visual amenity impacts. Area located adjacent to 'Ashby', a heritage listed house at 94 The Crescent, Cheltenham (Hornsby LEP I 297). Potential reduction in screening vegetation along the road reserve.
F	Modification to the combined services route (CSR).	Increase in vegetation clearing.
G1 and G2	General works area increase for a new power room, radio antenna and equipment room, and backup power supply.	Increase in vegetation clearing and associated visual amenity impacts.
H	Impact area widened to property boundary.	Nil.
I	General works area increase to facilitate construction of a new railway services pit and connection with public utilities/services.	Increase in vegetation clearing and associated visual amenity impacts.
J	Reduction in impact area due to the review of constructability requirements.	Reduction in vegetation clearing and associated visual amenity impacts.
K	Reduction in impact area due to the reduced clearance required at construction access gates.	Reduction in vegetation clearing and associated visual amenity impacts.
L	Reduction in impact area due to the reduced clearance required at construction access gates.	Reduction in vegetation clearing and associated visual amenity impacts.
M	General works area increase to facilitate construction of a new railway services pit and connection with public utilities/services.	Increase in vegetation clearing and associated visual amenity impacts.
O	Reduced area to reduce impacts on Beecroft Station Gardens and playground.	Reduction in vegetation clearing and associated visual amenity impacts.
P	Optimised car parking area to reduce impact area without reducing the number of car parking spaces to be provided.	Reduction in vegetation clearing and associated visual amenity impacts.
N	General works area increase to facilitate construction of a new railway services pit and connection with utilities.	Increase in vegetation clearing and associated visual amenity impacts.
Q	Increased construction impact area for the establishment of the combined services route and pits. Increase in trenching for services to facilitate construction of new pits and connections to railway services.	Increase in vegetation clearing and associated visual amenity impacts. However, impacts would be mostly confined to existing access roads within the rail corridor.
R	Increase in construction impact area due to a refinement of the new high voltage cable route	Increase in vegetation clearing and associated visual amenity impacts.
S	General works area increase to facilitate construction of additional services as well as facilitating construction access from Hampden Road, if required.	Increase in vegetation clearing and associated visual amenity impacts. However, impacts would be mostly confined to existing access roads within the rail corridor.
T	General works area increase for the installation of additional railway services.	Increase in vegetation clearing and visual amenity impacts
U, V and W	Reduction in impact area due to the reduced clearance required at construction access gates.	Reduction in vegetation clearing and associated visual amenity impacts.

Vegetation type ***(vegetation condition)***

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Transition Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- A — Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE|PERFORMANCE

PARSONS BRINCKERHOFF

NSW GOVERNMENT Transport for NSW

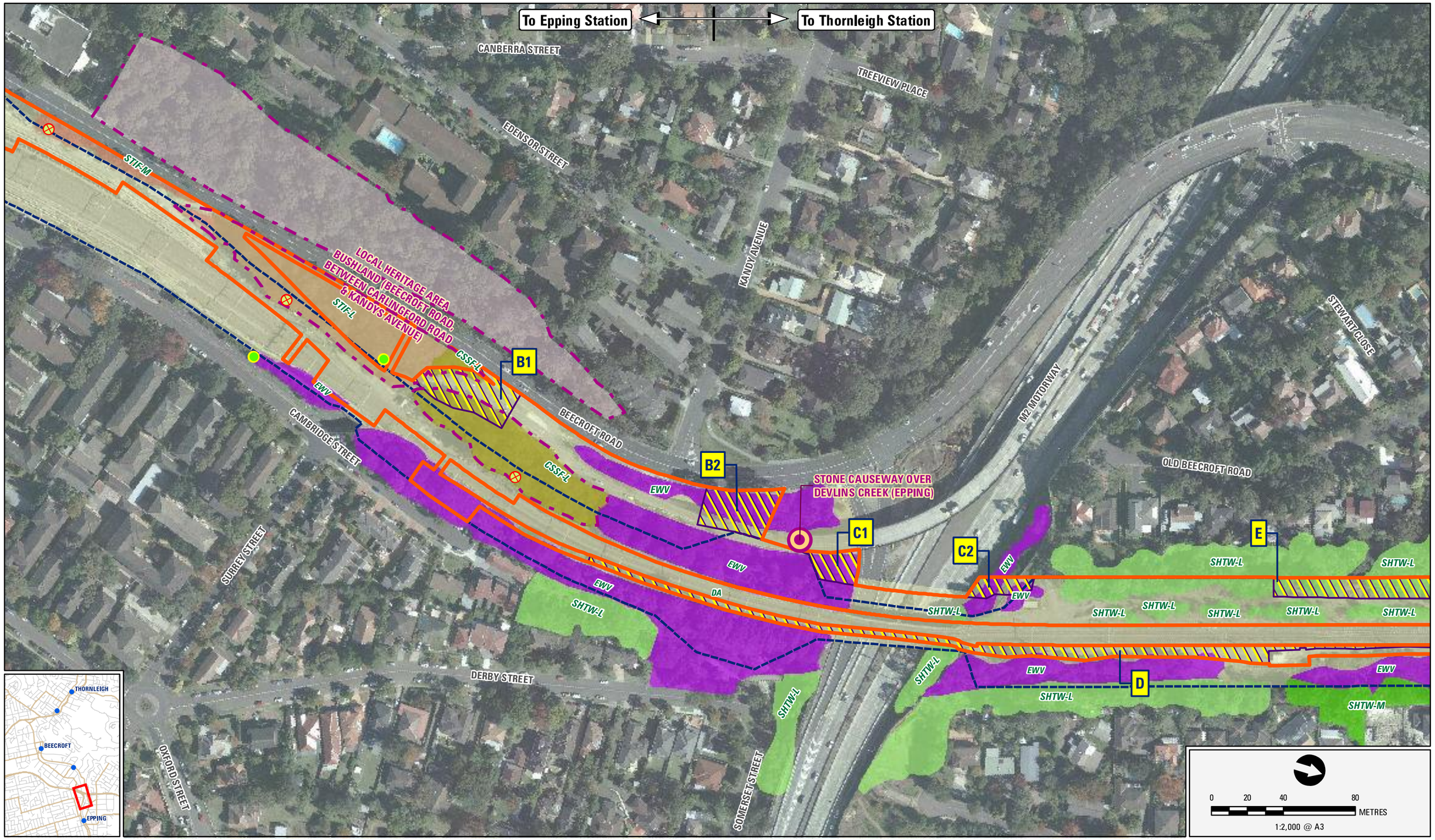
NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1a

REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

Sheet 1 of 9

\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12



Vegetation type ***(vegetation condition)***

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Transition Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE PERFORMANCE
PARSONS BRINCKERHOFF
NSW GOVERNMENT Transport for NSW

NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1b
REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

Sheet 2 of 9

\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12

To Epping Station

To Thornleigh Station

BEECROFT ROAD

STEWART CLOSE

OLD BEECROFT ROAD

LYNE ROAD

LOCAL HERITAGE AREA
HOUSE 194 THE CRESCENT,
CHELTENHAM)

THE CRESCENT

SUTHERLAND ROAD

DAY ROAD

COBRAN ROAD

E

F

G1

G2

H

SHTW-L

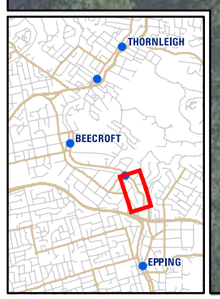
SHTW-M

SHTW-H

EWV

LG

DA



0 20 40 80 METRES

1:2,000 @ A3

Vegetation type ***(vegetation condition)***

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Transition Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE PERFORMANCE

PARSONS BRINCKERHOFF

NSW GOVERNMENT Transport for NSW

NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1c
REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

Sheet 3 of 9

\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12

To Epping Station

To Thornleigh Station

THE BOULEVARD

CHELTENHAM ROAD

THE PROMENADE

MURRAY ROAD

THE CRESCENT

SUTHERLAND ROAD

CHELTENHAM RAILWAY STATION

NORMA CRESCENT

KETHEL ROAD

SUMMERWOOD WAY

CHORLEY AVENUE

H

G2

I

J

K

LG

EWV

SHTW-L

SHTW-M

DA

STIF-L

STIF-M

BGHF-M

THORNLEIGH

BEECROFT

EPPING

0 20 40 80 METRES

1:2,000 @ A3

Vegetation type ***(vegetation condition)***

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Transition Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- A Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE PERFORMANCE

PARSONS BRINCKERHOFF

NSW GOVERNMENT Transport for NSW

NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1d

REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12

To Epping Station

To Thornleigh Station

BEECROFT ROAD

KIRKHAM STREET

WEHAM STREET

MARY STREET

MURRAY ROAD

THE CRESCENT

SUTHERLAND ROAD

GLENELG PLACE

COPELAND ROAD

STIF-L

STIF-M

EWV

BGHF-L

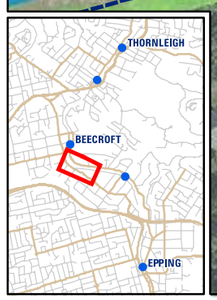
BGHF-M

SHTW-L

DA

L

W



0 20 40 80 METRES

1:2,000 @ A3

Vegetation type ***(vegetation condition)***

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Transition Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- A Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE|PERFORMANCE

PARSONS BRINCKERHOFF

NSW GOVERNMENT Transport for NSW

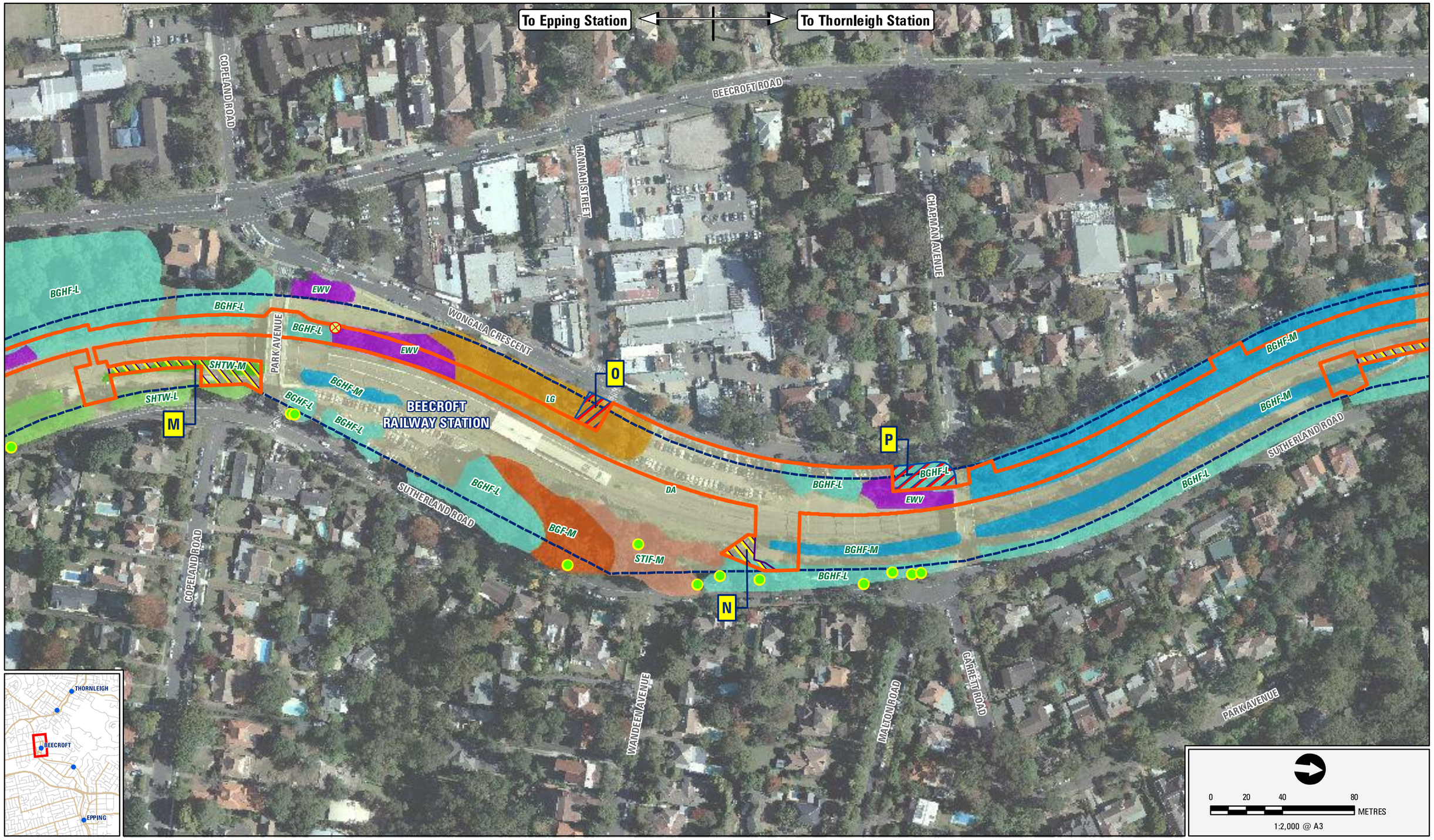
NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1e

REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

Sheet 5 of 9

\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12



Vegetation type ***(vegetation condition)***

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Transition Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- A — Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE PERFORMANCE
PARSONS BRINCKERHOFF
NSW GOVERNMENT Transport for NSW

NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1f
REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

Sheet 6 of 9

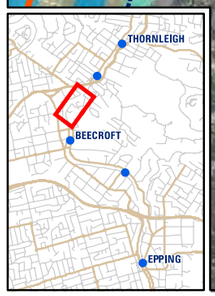
\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12

To Epping Station

To Thornleigh Station

BEECROFT ROAD
ALBERT ROAD
SHERWOOD CLOSE
LILA ROAD
BRECKS WAY
BOUNDARY ROAD
PENNANT HILLS ROAD
CITY VIEW ROAD
WONGALA CRESCENT
NARENA CLOSE
TRISTANIA WAY
CASSIA GROVE
SUTHERLAND ROAD
JACARANDA PLACE
CLEMENT CLOSE
AZALEA GROVE
BINOMEA PLACE
PARK AVENUE

BGHF-L
BGHF-M
EWV
DA
Q
R



0 20 40 80 METRES

1:2,000 @ A3

Vegetation type *(vegetation condition)*

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Transition Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- A Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE PERFORMANCE

PARSONS BRINCKERHOFF

NSW GOVERNMENT Transport for NSW

NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1g
REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12

Vegetation type ***(vegetation condition)***

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Transition Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE|PERFORMANCE

PARSONS BRINCKERHOFF

NSW GOVERNMENT Transport for NSW

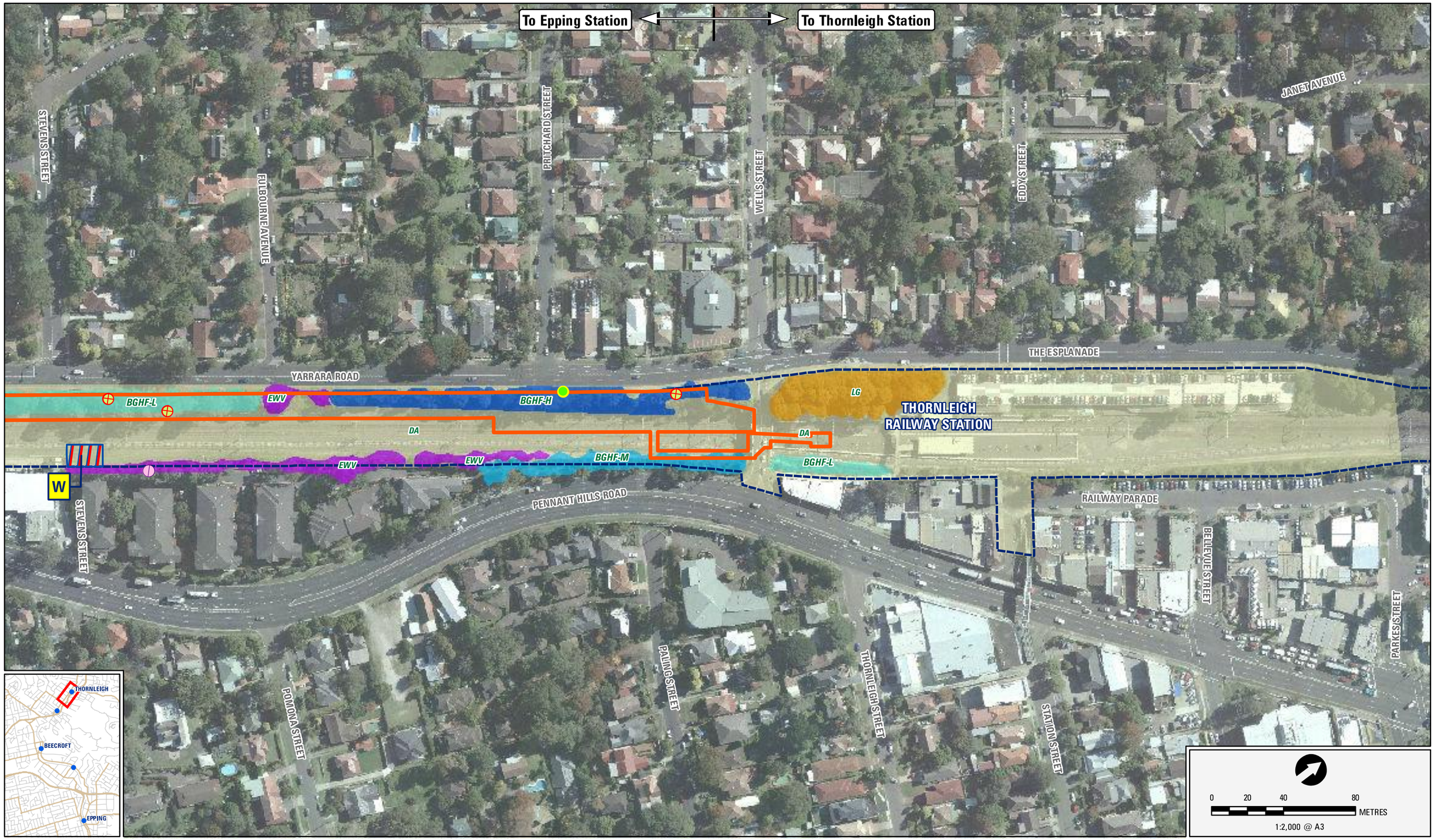
NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1h

REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

Sheet 8 of 9

\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12



Vegetation type ***(vegetation condition)***

- BGF - Blackbutt Gully Forest *(moderate)*
- BGHF - Blue Gum High Forest *(high)* (TSC Act)
- BGHF - Blue Gum High Forest *(high)* (EPBC Act)
- BGHF - Blue Gum High Forest *(moderate)* (TSC Act)
- BGHF - Blue Gum High Forest *(low)* (TSC Act)
- CSSF - Coastal Shale-Sandstone Forest *(low)*
- SHTW - Sydney Hinterland Woodland *(high)*
- SHTW - Sydney Hinterland Transition Woodland *(moderate)*
- SHTW - Sydney Hinterland Transition Woodland *(low)*
- STIF - Sydney Turpentine Ironbark Forest *(high)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(moderate)* (TSC Act)
- STIF - Sydney Turpentine Ironbark Forest *(low)* (TSC Act)
- DA - Disturbed areas
- EWV - Exotic woody vegetation
- LG - Landscaped gardens

Threat-listed species

- *Epacris purpurascens var. purpurascens*
- *Eucalyptus nicholii*
- *Epacris purpurascens var. purpurascens* community

Hollow-bearing trees

- Hollow-bearing tree to be removed
- Hollow-bearing tree to be retained

Local heritage item

- Local heritage item
- Local heritage area

Design

- A — Change in impact area - refer to report
- Impact area
- Added to impact area
- Removed from impact area
- RailCorp boundary

GHD CLIENTS PEOPLE PERFORMANCE
PARSONS BRINCKERHOFF
NSW GOVERNMENT Transport for NSW

NORTHERN SYDNEY FREIGHT CORRIDOR EPPING TO THORNLEIGH

FIGURE 5.1i
REVISED ETTT CONSTRUCTION IMPACT AREA PLUS VEGETATION COMMUNITIES AND RELEVANT HERITAGE ITEMS

\\APSYDNAS02\proj\T\transport_construct_auth\2106744_EPPING_TO_THORNLEIGH_PLANNING\10_GIS\Projects\ESRI\2106744_GIS_F009_A1.mxd // SuansriR // 17/12/12

An assessment of the impacts likely to be associated with the proposed amendments to the construction impact area is provided in the following sections. As demonstrated in the following sections, the proposed construction impact area amendments would not significantly alter the impact of the ETTT proposal, relative to that documented in the EIS.

Ecology

The proposed change to the ETTT construction impact area would not result in new types of impacts on biodiversity in the study area, compared to that already assessed in the EIS. However, the proposed design change would alter the extent and magnitude of the proposal's impacts to a small degree, namely the extent of vegetation clearing and the associated loss of habitat.

The revised vegetation clearing requirements for the ETTT proposal is outlined in Table 5.2. The vegetation clearing data in Table 5.2 is based on field mapped vegetation, as shown in Figure 5.1. For ease of reference, the vegetation clearing requirements that were reported in Table 8.2 of the EIS have been included in Table 5.2 to indicate where changes in clearing areas are proposed.

The proposed design change would increase the size of the construction impact area (previously reported in the EIS as 12.6 hectares) by 2.1 hectares. The revised construction impact area would be 14.7 hectares and would include:

- an additional 0.3 hectares of native vegetation, compared to that previously reported in the EIS (refer to Table 5.2)
- an additional 1.8 hectares of exotic vegetation (disturbed areas and exotic woody vegetation, as listed in Table 5.2), compared to that that previously reported in the EIS (refer to Table 5.2). (As discussed in section 5.2.10 of this report, these calculations include hardstand and other areas of rail infrastructure, which do not necessarily contain vegetation).

Table 5.2 Revised native vegetation clearing requirements for the ETTT proposal

Vegetation community/fauna habitat	Potential loss of native vegetation (ha)		
	EIS impact area[1]	New total clearing extent[2]	Change in clearing
Blue Gum High Forest (EEC)[3]			
Blue Gum High Forest (high condition – EPBC Act)	0.0	0.0	0.0
Blue Gum High Forest (high condition – TSC Act)	0.2	0.2	0.0
Blue Gum High Forest (moderate condition – TSC Act)	0.8	0.8	0.0
Blue Gum High Forest (low condition – TSC Act)	1.3	1.3	0.0
Sub-total (Blue Gum High Forest)	***2.3***	***2.3***	***0.0***
Sydney Turpentine Ironbark Forest (EEC)[4]			
Sydney Turpentine Ironbark Forest (moderate condition – TSC Act)	0.2 #	0.2	0.0
Sydney Turpentine Ironbark Forest (low condition – TSC Act)	0.5 #	0.6	+ 0.1
Sub-total (Sydney Turpentine Ironbark Forest)	***0.7***	***0.8***	***+ 0.1***
Sydney Hinterland Transition Woodland			
Sydney Hinterland Transition Woodland (high condition)	0.0	0.0	0.0
Sydney Hinterland Transition Woodland (moderate condition)	0.4	0.4	0.0
Sydney Hinterland Transition Woodland (low condition)	0.4	0.5	+ 0.1
Sub-total (Sydney Hinterland Transition Woodland)	***0.8***	***0.9***	***+ 0.1***

Vegetation community/fauna habitat	Potential loss of native vegetation (ha)		
	EIS impact area[1]	New total clearing extent[2]	Change in clearing
Other native vegetation communities			
Coastal Shale-Sandstone Forest (low condition)	0.2	0.3	+ 0.1
Blackbutt Gully Forest (moderate condition)	0.0	0.0	0.0
Non-native vegetation communities and disturbed areas			
Disturbed areas[5]	6.6	7.8	+ 1.2
Exotic woody vegetation	1.5	2.2	+ 0.7
Landscaped gardens	0.5	0.4	- 0.1
Total Clearing			
Total area of non-native vegetation communities and disturbed areas	8.6	10.4	+ 1.8
Total area of native vegetation communities[6]	4.0	4.3	+ 0.3
Total area of critically endangered ecological community	2.3	2.3	0.0
Total area of EEC (excluding critical EEC)	0.7	0.8	+ 0.1

Notes: 1: Vegetation clearing, as documented in Table 8.2 of the EIS and based on the construction impact area shown in Figure 5.2 of the EIS.

2: Revised vegetation clearing resulting from the proposed amendments to the ETTT construction impact area, as shown in Figure 5.1.

3: Forms part of the critically endangered ecological community of Blue Gum High Forest, as listed under the *Threatened Species Conservation Act 1995* (TSC Act).

4: Forms part of the endangered ecological community of Sydney Turpentine Ironbark Forest, as listed under the TSC Act.

5: Formerly referred to as 'exotic groundcover'. As discussed in section 5.2.10, this classification has been revised to 'disturbed areas'.

6: Includes the EECs and other native vegetation.

#: The amount of vegetation clearing for Sydney Turpentine Ironbark Forest (moderate condition – TSC Act) and Sydney Turpentine Ironbark Forest (low condition – TSC Act) documented in Table 8.2 of the EIS were transposed incorrectly. The numbers stated in Table 5.2 have been corrected.

Consideration of the proposed changes in vegetation clearing against the assessment provided in the EIS is provided in the following section.

Native vegetation and endangered ecological communities

The revised impact area would result in a slight increase in the clearing of native vegetation, including Sydney Turpentine Ironbark Forest (low condition – TSC Act), Sydney Hinterland Transition Woodland (low condition) and Coastal Shale-Sandstone Forest (low condition). The proposed changes to the construction impact area occur in the rail corridor or within close proximity to the rail corridor. The vegetation to be removed is classified as low condition as per the classification set out in the section 2.6.5 of Technical Paper 1 (Ecology). This vegetation condition is highly modified containing an exotic understorey and some native canopy species with low percentage foliage cover.

One of the vegetation communities (Sydney Turpentine Ironbark Forest) is listed as endangered on the TSC Act. The additional area of this community to be removed is not commensurate with listing for this community under the EPBC Act. The revised construction impact area would result in an additional of 0.1 hectares of this community to be removed (refer to Table 5.2). The impact of the ETTT proposal on the Sydney Turpentine Ironbark Forest community was addressed in the EIS and Technical Paper 1 (Ecology). The amended construction impact area is not likely to result in a significant impact for this community as the increased clearing (0.1 ha) is negligible (refer to Table 5.4). Therefore, no additional significance assessment is required for this vegetation community.

Threatened plant habitat

The impacts on habitat for threatened flora species predicted in the EIS are applicable to the design change and a small increase (0.3 hectares) in habitat removal is expected for threatened flora habitat. No additional *Epacris purpurascens* var. *purpurascens* species would be removed as a result of the design change. The EIS assessed the removal of three *Epacris purpurascens* var. *purpurascens* individuals; however, due to the current design changes these three individuals would now be retained as part of the ETTT proposal.

As part of the environmental management measures (refer to measure L.11 in Chapter 6 of this report), a qualified ecologist would mark out the populations of *Epacris purpurascens* var. *purpurascens* to be retained to avoid any accidental removal or damage to the existing populations or their retained habitat.

Loss of fauna habitat

Generally, habitat features to be removed, such as feeding and nesting resources, would be related to the extent and quality of native vegetation removed. Table 5.3 outlines the threatened fauna species identified as having habitat within the study area and the additional area of habitat that would be removed as part of the proposed design change. No additional hollow-bearing trees would be removed. Similarly, no additional potential nesting/roosting habitat for birds and microchiropteran bats would be removed. However, additional foraging habitat for threatened species of animals would be removed as part of the design change. The proposed design change would therefore result in a small increase in overall extent of habitat features disturbed, corresponding with the increase in vegetation clearing (refer to Table 5.2).

The additional area fauna habitat that would be removed as a result of the proposed design change would result in a change in the extent of the impacts to a small degree, namely in an increase in vegetation clearing. However, this change in extent to the impacts to fauna habitats has been adequately covered by the previous impact assessments (undertaken as part of the EIS) for threatened fauna species and populations. Therefore, no additional significance assessments are required (refer to Table 5.4).

Potential habitat for migratory species

Four migratory species – the Rainbow Bee-eater (*Merops ornatus*), Black-faced Monarch (*Monarcha melanopsis*), Satin Flycatcher (*Myiagra cyanoleuca*) and Rufous Fantail (*Rhipidura rufifrons*) – have habitat within the study area. The design change would result in a small incremental loss to foraging habitat for these species; however, it is unlikely to be significant due to the small area of removal. The assessment is consistent with the original assessment outlined in the EIS (refer to Table 5.4).

Table 5.3 Potential direct fauna impacts associated with the revised ETTT construction impact area

Habitat features	Revised extent of clearing	Species
Forest and woodland vegetation	6.5 hectares (increase of 1 hectare)	Known foraging habitat for the Powerful Owl, Gang-gang Cockatoo, Little Lorikeet and Grey-headed Flying-fox. Potential foraging habitat for the Barking Owl, Masked Owl, Swift Parrot, Glossy Black-cockatoo, Eastern Bentwing Bat, East Coast Freetail Bat, Eastern False Pipistrelle, Greater Broad-nosed Bat and Yellow-bellied Sheathtail Bat. Foraging and nesting habitat for a range of common fauna. This vegetation does not constitute potential Koala habitat as defined under *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44) and does not contain any preferred or secondary feed trees identified in the Central Coast Koala Management Area (Department of Environment and Climate Change 2008).

Habitat features	Revised extent of clearing	Species
Forest and woodland vegetation	Nine hollow-bearing trees (no change)	Potential nesting habitat (although unlikely) for the threatened Powerful Owl, Barking Owl, Masked Owl, Gang-gang Cockatoo, Little Lorikeet, Glossy Black-cockatoo, East Coast Freetail Bat, Eastern False Pipistrelle, Greater Broad-nosed Bat and Yellow-bellied Sheathtail Bat. Details of the affected hollow-bearing trees are provided in Table 5-4 of Technical Paper 1 (Ecology).
Disturbed areas	7.8 hectares (increase of 1.2 hectares)	Potential foraging habitat for the threatened Barking Owl, Masked Owl, Eastern Bentwing Bat and Yellow-bellied Sheathtail Bat. Foraging habitat for certain common fauna such as Australian Magpies and Long-nosed Bandicoots.
Ditches and ephemeral pools	0.2 hectares (no change)	Very marginal potential habitat for the Red-crowned Toadlet.
Exotic woody vegetation and gardens	2.6 hectares (increase of 0.6 hectares)	Foraging and nesting habitat for range of common fauna.

Table 5.4 outlines the threatened biodiversity with potential to occur within the study area with an assessment of whether or not the additional clearing is likely to alter the outcome of previous significance assessments.

Table 5.4 Conclusions of the significance assessments

Scientific name	Common name	Conservation status		Recorded in the study area?	Likely to be significantly affected?	Will the design changes result in a changed significance assessment outcome?[3]
		TSC Act[1]	EPBC Act[1]			
Threatened flora						
Epacris purpurascens var. *purpurascens*	–	V	–	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species. Whilst it was recorded in the study area, it was not detected in the additional areas of impact and the 0.3 hectares of additional potential habitat affected is negligible. In addition, the three individuals that were marked for removal in the EIS would no longer be removed as part of the design change.
Threatened fauna						
Ninox strenua	Powerful Owl	V	–	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (1 hectares) are negligible.
Ninox connivens	Barking Owl	V	–	No	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing (roosting/breeding habitat) and the increased impacts to foraging habitat (2.1 hectares) are negligible.
Tyto novaehollandiae	Masked Owl	V	–	No	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (2.1 hectares) are negligible.
Lathamus discolor	Swift Parrot	E	E	No	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (1 hectare) are negligible.
Calyptorhynchus lathami	Glossy Black-cockatoo	V	–	No	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (1 hectare) are negligible.
Callocephalon fimbriatum	Gang-gang Cockatoo	EP	–	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (1 hectare) are negligible.

Scientific name	Common name	Conservation status		Recorded in the study area?	Likely to be significantly affected?	Will the design changes result in a changed significance assessment outcome?[3]
		TSC Act[1]	EPBC Act[1]			
Glossopsitta pusilla	Little Lorikeet	V	–	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (1 hectares) are negligible.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there would be no removal of roosting/breeding camps and the increased impacts to foraging habitat (1 hectare) are negligible.
Miniopterus schreibersii oceanensis	Eastern Bentwing Bat	V	–	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of roosting/breeding habitat (in the form of caves) and the increased impacts to foraging habitat (2.1 hectares) are negligible.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	–	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (1 hectare) are negligible.
Mormopterus norfolkensis	East Coast Freetail Bat	V	–	No	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (1 hectare) are negligible.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	–	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (1 hectare) are negligible.
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V	–	No	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this species as there is no increase in the removal of hollow-bearing trees (roosting/breeding habitat) and the increased impacts to foraging habitat (2.1 hectares) are negligible.
Threatened Community						
Sydney Turpentine Ironbark Forest[2]		E	CE	Yes	No	No. The amended ETTT construction impact area is not likely to result in a significant impact for this community as the increased impacts (0.1 hectares) are negligible. The area to be removed does not meet the criteria for the EPBC Act listing for this community.

Notes: 1: CE = Critically Endangered; E = Endangered; EP = Endangered Population; V = Vulnerable.
2: Comprises the EEC of Sydney Turpentine Ironbark Forest, as listed under the TSC Act.
3: Consistency assessment against EIS findings based on increased impact area.

Conclusion

The proposed amendments to the ETTT construction impact area would not result in new types of impacts to biodiversity compared to the EIS. They do, however, change the extent of the impacts to a small degree, namely the extent of vegetation clearing and associated loss of habitat. The potential impacts to threatened biodiversity are only marginally increased and adequately covered by the previous impact assessments and no additional significance assessments are required (refer to Table 5.4). None of the additional impacts as a result of the design change are likely to have a significant impact on biodiversity. A significant impact to Blue Gum High Forest was previously identified in the EIS.
The proposed amendments to the ETTT construction footprint would not result in additional clearing of Blue Gum High Forest.

Biodiversity offsetting

Biodiversity credit estimates have been recalculated to reflect the changes in vegetation clearing resulting from the amended construction impact area. The revised credit estimates are included in Table 5.5.

The revised credits presented in Table 5.5 have been reduced from those originally documented in Table 8.6 of the EIS, despite a minor increase in the areas of habitat to be removed.

The initial credit estimates were completed based on a conservative assessment of the potential threatened fauna habitat values within the rail corridor. This conservative assessment resulted in the default assumed potential presence of the Threatened species, Spotted Tailed Quoll and a maximum habitat multiplier (default Tg values) in the credit calculator for the following species; Barking Owl, Masked Owl, Powerful Owl and Large Footed Myotis.

The revised Biobanking credit calculations completed for the proposed design change updated the habitat values for a number of potential threatened fauna species to be consistent with the findings of the detailed impact assessment. Changes that were made to threatened species predicted habitat values comprised the following:

- Spotted Tailed Quoll, Large Footed Myotis – No habitat within the rail corridor.
- Barking Owl, Masked Owl, Powerful Owl – Foraging habitat only within the rail corridor.

These above changes have resulted in a reduced credit requirement, despite a minor increase in the areas of habitat to be removed.

Table 5.5 Comparison of biodiversity credit estimates for the ETTT proposal impact and preferred offset site

Vegetation type (Mapped vegetation)	Threatened Ecological community (TSC Act)	Area to be impacted (ha)	Credits required to offset ETTT impacts	Vegetation area in offset (ha)	Credits potentially available in preferred offset site[1]	Alternative credits potentially available in preferred offset site[1]
ME001 - Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau (Blue Gum High Forest)	Yes – Blue Gum High Forest	2.3	93 (decrease of 5)	0.0	0	93[2]
ME041 - Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin (Sydney Turpentine Ironbark Forest)	Yes – Sydney Turpentine Ironbark Forest	0.8 (increase of 0.1)	33 (decrease of 6)	43.0	39	
ME039 - Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux (Sydney Hinterland Transition Woodland)	No	1.2 (increase of 0.2)	27 (decrease of 32)	2.3	18	9[2]
Total		**4.3** (increase of 0.3)	**153** (decrease of 43)	**45.3**	**57**	**102**

Notes: 1: Credits calculated based on 8 credits per ha using average credit ratios for similar vegetation types within recent biobank sites within the Hills Shire Council.
2: Ecosystem credits will be retired from the ME041 - Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin (Sydney Turpentine Ironbark Forest).

Design and visual amenity

The additional clearing of mature vegetation within and adjacent to the rail corridor (refer to Table 5.2 and Figure 5.1) is likely to increase the visibility of existing and proposed rail infrastructure at various viewing locations along the length of the rail corridor. As shown in Figure 5.1, the largest change in impact would occur on the western side of the rail corridor, between the M2 Motorway and Cheltenham Station. Visual amenity impacts associated with the revised construction impact area would be managed through the implementation of the urban design and landscape plan, which would be developed in consultation with RailCorp and Hornsby Shire Council. The plan would be placed on public display prior to its finalisation to allow for community ideas and feedback to be considered and adopted, where possible. Refer to environmental management measure C.1 in Chapter 6 for further information on the urban design and landscape plan.

Historic heritage

Historic heritage items located in the vicinity of the revised construction impact area are shown in Figure 5.1. These items comprise the following:

- heritage listed 'bushland - on the road reserve between Carlingford Rd and Kandy Avenue' (Hornsby LEP I 357) – new impact area B1
- convict-built stone causeway crossing Devlins Creek (listed on Hornsby LEP) – new impact areas B2 and C1
- 'Ashby' - a heritage listed house at 94 The Crescent, Cheltenham (Hornsby LEP I 297) – adjacent to new impact area E.

Heritage listed bushland

Table 12.2 of the EIS stated that the heritage listed 'bushland - on the road reserve between Carlingford Road and Kandy Avenue' (Hornsby LEP I 357) would be impacted by the ETTT proposal as a result of minor vegetation clearing on the western side of the rail corridor. Section 12.3.2 of the EIS noted that the most significant portion of this heritage item is located in the western road reserve, which would not be impacted by the ETTT proposal. A thick belt of vegetation would be retained between Beecroft Road and the rail line for the most of the item's length, thus maintaining the aesthetic significance and landmark qualities of the item. Therefore, the EIS concluded that the ETTT proposal would not have a significant impact on the heritage value of the item.

The proposed design change (specifically, the proposed new impact area B1) would result in additional impact to the heritage listed 'bushland - on the road reserve between Carlingford Rd and Kandy Avenue' (Hornsby LEP I 357), due to increased vegetation clearing on the eastern side of Beecroft Road. This additional impact is considered to be minimal due to the minor extent of vegetation clearing proposed at the fringes of the bushland area. The additional clearing would not result in any loss of amenity or screening that this bushland area provides. Therefore, the proposed design change would not alter the conclusion of the heritage impact assessment provided in section 12.3.2 of the EIS.

Devlins Creek causeway

The convict built culvert at Devlins Creek is located in close proximity to the expanded construction footprint south of the M2 Motorway. A review of the construction methodology for the proposed rail bridge over the M2 Motorway, and associated viaduct and temporary embankment, was undertaken to confirm the adequacy of the environmental management measures proposed for the convict built culvert at Devlins Creek. Three new environmental management measures (P.7, P.8 and P.10) are proposed to ensure the convict built causeway is protected during construction activities. This is discussed further in section 5.2.3.

Heritage listed house (Ashby)

The heritage listed house, 'Ashby' is located adjacent to the increased impact area labelled 'E' in Figure 5.1. The existing vegetation outside the rail corridor in this area is thick and well maintained and is considered to contribute to the setting of the heritage item. Provided that this screening vegetation is retained there would be no negative impacts to the heritage value of the item.

Land use and property

Land directly affected by the amended construction impact area is owned by Government agencies. Transport for NSW is currently negotiating with these stakeholders in regards to the land acquisition requirements for the ETTT proposal. No residential property would be impacted by the revised construction impact area (aside from the visual impacts listed above).

5.1.2 Pennant Hills pedestrian footbridge

The proposed location of the Pennant Hills pedestrian footbridge, as described in section 5.4.3 of the EIS (and shown in Figure 5.2), has been amended to address pedestrian safety concerns in consultation with Hornsby Shire Council and suggestions from the community.

Hornsby Shire Council noted that the footbridge location proposed in the EIS would require a new pedestrian crossing to be established on Yarrara Road (opposite Hillcrest Road and close to Pennant Hills Road), which could exacerbate existing traffic congestion and pose safety issues for pedestrians using the crossing.

The pedestrian footbridge is therefore proposed to be re-aligned such that its western end is immediately adjacent to the existing footbridge location. This would allow the proposed pedestrian crossing to be removed from the design. The revised location of the Pennant Hills pedestrian footbridge is shown in Figure 5.2. The proposed design change would not result in any significant adverse impacts, relative to those described in the EIS.

Figure 5.2 Revised alignment of the Pennant Hills pedestrian footbridge

Note: Indicative only, subject to detailed design.

5.1.3 Chapman Avenue overbridge

Ongoing engineering and geotechnical investigations have identified that the western abutment of the Chapman Avenue overbridge would require more significant construction works than that originally anticipated in the EIS. Section 5.4.3 of the EIS noted that the extent of works would have generally comprised the excavation of rock on the western bridge abutments and the strengthening of existing bridge piers. However, a combination of a better knowledge of geotechnical conditions, limited level working space and the condition of the existing structure requires additional works to be performed from road level prior to the construction of the third track.

The work would involve installation of piles through the existing roadway to retain the western abutment of the overbridge and to allow a steeper retaining wall face to be built. This would allow the existing western abutment to be maintained in its current position rather than contemplate a rebuilding of the abutment with a larger scope of works being required.

To facilitate the additional construction works noted above, the Chapman Avenue overbridge would require a full road closure for a period of between 2 and 3 weeks. Section 11.3 of the EIS noted that a partial road closure would be required on the Chapman Avenue overbridge to facilitate the installation of anti-throw screens; however, this closure was assumed to be of short duration and able to be undertaken outside of peak traffic times.

Alternative access routes that would be available for vehicles, buses, pedestrians and cyclists during the closure of the Chapman Avenue overbridge are shown in Figure 5.3.

An assessment of the impacts likely to be associated with the construction of the Chapman Avenue overbridge is provided in the following sections. As demonstrated in the following sections, the additional construction works would not significantly alter the impact of the ETTT proposal, relative to that documented in the EIS.

Noise and vibration

The amended proposal would result in additional temporary noise and vibration impacts over the 2-3 week construction period. These works would be generally undertaken during standard daytime working hours and would be managed through the implementation of the environmental management measures identified in Chapter 6 of this report.

Access, traffic and transport

The amended proposal would result in the temporary closure of the Chapman Avenue overbridge for a period of up to three weeks. An addendum traffic and transport impact assessment was prepared for this temporary road closure and is included in Appendix D. A summary of this addendum assessment is provided in the following sections.

Assessment approach

Intersection traffic counts were undertaken on 27 November 2012 for the following key intersections to determine the morning and afternoon peak hours to be adopted for the traffic assessment:

- Chapman Avenue/Wongala Crescent
- Chapman Avenue/Sutherland Road
- Copeland Road East/Wongala Crescent
- Copeland Road East/Sutherland Road.

SIDRA traffic modelling was undertaken for each of the above intersections to determine their ability to cope with both existing traffic levels, as well as additional traffic volumes generated as a result of the temporary closure of the Chapman Avenue overbridge (due to a redistribution of traffic). The anticipated traffic redistribution that would occur as a result of the Chapman Avenue overbridge closure is documented in section 3.2.1 of Appendix D.

Existing intersection performance

Table 5.6 summarises operational performance of each assessed intersection based upon the existing road geometries and traffic movements. The SIDRA movement outputs are shown in Attachment 1 of Appendix D.

Table 5.6 indicates that all four intersections perform at good levels of service (LoS A) for both weekday AM and PM periods with minimal average vehicle delays (less than 10 seconds) and short queue lengths (under 10 metres).

Table 5.6 Intersection summary results for 2012 existing conditions

Intersection	Intersection control	Peak hour	DoS	Average delays (sec)	LoS	95% queue (m)
Chapman Avenue/ Wongala Crescent	Give-way priority	AM	0.17	10.6	A	4.5
		PM	0.08	8.8	A	2.3
Chapman Avenue/ Sutherland Road	Give-way Priority	AM	0.28	7.6	A	9.5
		PM	0.13	7.2	A	3.7
Copeland Road (East)/ Wongala Crescent	Give-way Priority	AM	0.17	9.2	A	4.6
		PM	0.14	9.1	A	3.8
Copeland Road (East)/ Sutherland Road	Give-way Priority	AM	0.12	9.7	A	3.5
		PM	0.08	9.7	A	2.4

Intersection performance during the closure of the Chapman Avenue overbridge (no construction traffic)

Table 5.7 summarises the operational performance of each of the assessed intersections during the closure of the Chapman Avenue overbridge (without construction traffic from the ETTT proposal).

Table 5.7 indicates that all four intersections would continue to perform at a good level of service (LoS A) for both weekday AM and PM peak periods with minimal average vehicle delays (less than 12 seconds) and short queue lengths (under 13 metres).

Average vehicle delays at the intersections of Copeland Road East/Wongala Crescent and Copeland Road East/Sutherland Road increase by approximately three seconds for select movements and queue lengths increased by 8 metres for the worst case.

With the closure in place, the intersections of Copeland Road East/Wongala Crescent and Copeland Road East/Sutherland Road would carry an additional 325 vehicles in the AM peak and 167 vehicles in the PM peak. These additional traffic volumes would have minimal impact to the operational performance of each intersection during peak conditions.

Table 5.7 Chapman Avenue overbridge closure (no construction traffic)

Intersection	Intersection control	Peak hour	DoS	Average delays (sec)	LoS	95% queue (m)
Chapman Avenue/ Wongala Crescent	Give-way priority	AM	0.32	8.5	A	11.6
		PM	0.11	7.7	A	3.2
Chapman Avenue/ Sutherland Road	Give-way Priority	AM	0.03	0.0	A	0.0
		PM	0.02	0.0	A	0.0
Copeland Road (East)/ Wongala Crescent	Give-way Priority	AM	0.36	11.7	A	12.7
		PM	0.25	9.8	A	7.0
Copeland Road (East)/ Sutherland Road	Give-way Priority	AM	0.13	11.5	A	6.0
		PM	0.11	9.9	A	3.1

Intersection performance during the closure of the Chapman Avenue overbridge (with construction traffic)

It is proposed that access to the ETTT worksite by construction traffic be restricted to Wongala Crescent on the western side of the railway line. The impact of construction traffic on the surrounding road network has been assessed, with the results summarised in Table 5.8. The analyses indicated that the addition of construction traffic during the closure would have a negligible impact on intersection performance with all intersections continuing to operate at Level of Service A.

Table 5.8 Intersection summary results for 2012 with Chapman Avenue closure and construction traffic

Intersection	Intersection control	Peak hour	DoS	Average delays (sec)	LoS	95% queue (m)
Chapman Avenue/ Wongala Crescent	Give-way priority	AM	0.33	8.5	A	12.3
		PM	0.14	7.8	A	4.7
Copeland Road (East)/ Wongala Crescent	Give-way Priority	AM	0.36	12.0	A	13.0
		PM	0.26	10.3	A	7.4

Impacts to adjacent intersections during the closure of the Chapman Avenue overbridge

Previous assessment of the Beecroft Road/Copeland Road East intersection (undertaken as part of Technical Paper 4 – Access, traffic and transport) indicated queuing on the eastern approach (Copeland Road East) of up to 56 metres in the weekday AM peak and 51 metres in the weekday PM peak. The distance between this intersection and the Copeland Road East/Wongala Crescent intersection is approximately 30 metres and, therefore, inadequate storage area is provided to accommodate volumes during peak periods. This is likely to impinge on the levels of service for the Copeland Road East/Wongala Crescent intersection, as gap acceptance would be reduced due to fewer vehicle headways unless gaps are created within the intersection itself to allow for right turning movements. Local residents are familiar with the operation of the Copeland Road East/Wongala Crescent intersection and understand the need to keep the intersection clear to allow right turning movements to occur and to carefully position their vehicles within and adjacent to the intersection to allow efficient operation.

Impacts to pedestrian road safety

Whilst increased traffic volumes are expected at pedestrian ‘zebra’ crossings along the detour route, it is not envisaged that this increase would adversely impact on pedestrian safety.

Impact on emergency vehicle access during the closure of the Chapman Avenue overbridge

A review of land uses where emergency vehicle access maybe required (including hospitals and aged care facilities) has established that no such facilities are located on the eastern side of the rail line. In view of these considerations, and the existence of the nearby Copeland Road overbridge, it is apparent that a temporary road closure of the Chapman Avenue overbridge would have little or no impact on emergency vehicle access. The NSW Fire Brigade facility is located at the intersection of Beecroft Road and Copeland Road East intersection with fire truck access from Copeland Road East.

Management of traffic impacts

Construction traffic management would form part of the construction traffic management plan (refer to environmental management measure O.2). Ongoing co-ordination and consultation with road owners, Hornsby Shire Council, and local schools and other stakeholders (as appropriate) would continue, to ensure that significant impacts are avoided as far as possible during construction.

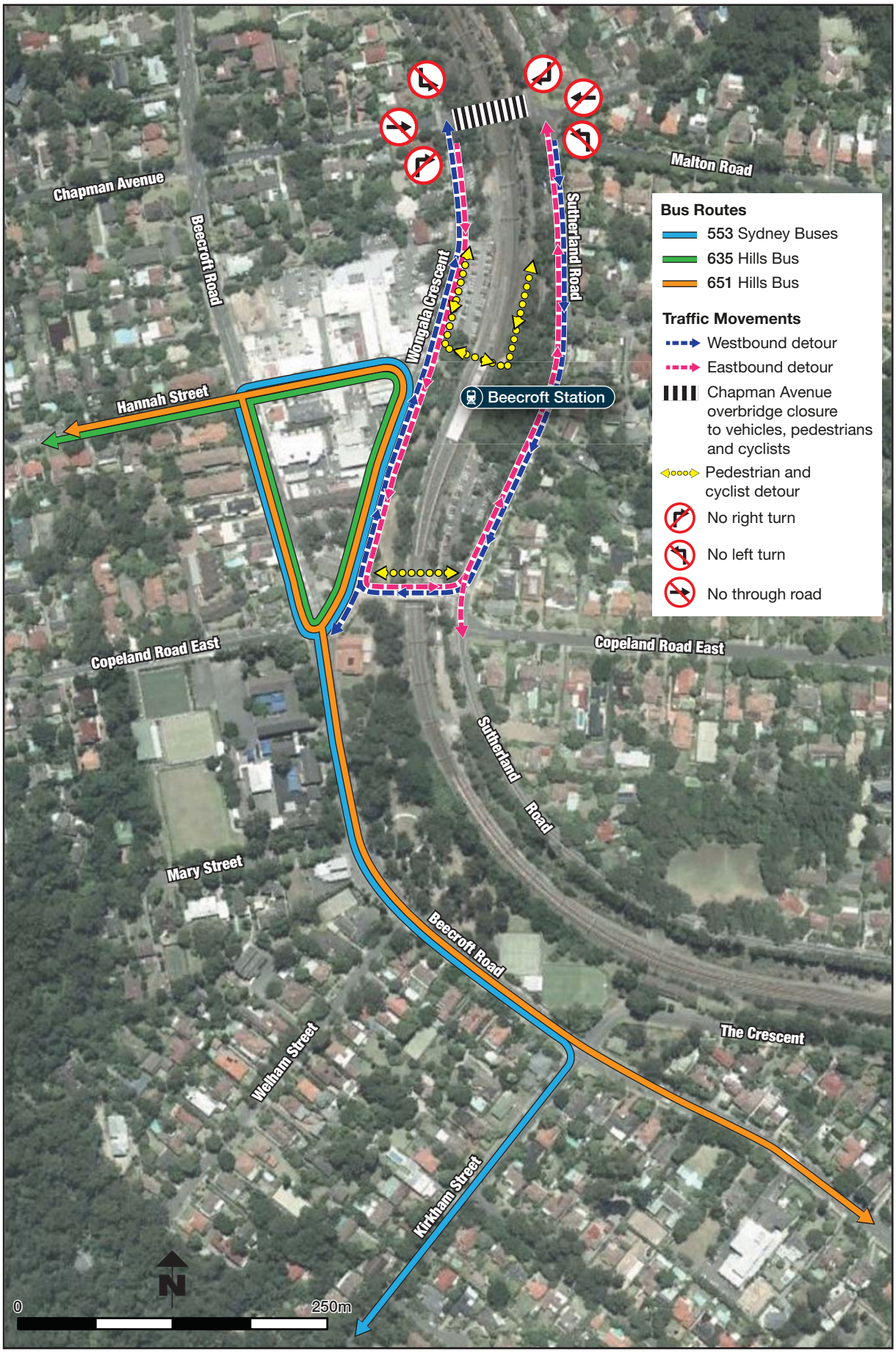


Figure 5.3 Alternative access options available during the closure of the Chapman Avenue overbridge

5.1.4 Extension of Wongala Crescent culvert

Through the submission process Hornsby Shire Council identified a future interest in constructing a cycleway between Pennant Hills and Epping (refer to Item T.26 in section 4.4.2).

Council has identified two existing 'pinch points' that are adjacent to the ETTT proposal. These two locations are:

- Between Wongala Crescent, Pennant Hills and Wongala Crescent, Beecroft. At this location, Wongala Crescent is discontinuous across a creek. Pedestrians wishing to cross the creek currently use an informal track adjacent to the rail corridor fence line.

- Between the rail corridor fence line and the tennis courts located at the corner of The Crescent and Beecroft Road, Beecroft.

Council has identified that if sufficient width was made outside the rail corridor fence line as part of the ETTT works at these two locations, this may present Council the opportunity to construct a shared pedestrian and cycle path in the future.

At the creek referred to in item 1 above, the culvert is not currently wide enough to support the proposed third track, and therefore requires extension. By increasing this extension to the culvert, outside the existing fence line, Transport for NSW would allow for reinstatement of the existing 'informal' walking route. This work would also enable Council to construct a path suitable for use as a cycleway in the future.

An assessment of the impacts likely to be associated with the additional culvert extension is provided in the following sections. This assessment demonstrates that additional construction works would not significantly alter the impact of the ETTT proposal, relative to that documented in the EIS.

In respect of item 2 above, Transport for NSW proposes to make an assessment during detailed design as to whether sufficient space would remain between the tennis courts and the proposed rail corridor fence line for the future cycleway.

Noise and vibration

Inclusion of additional works to facilitate the future cycleway may result in a minor increase in the duration of construction works; however, these impacts would be of a similar nature to that assessed in Chapter 9 of the EIS (the required culvert extension works would have already occurred as part of the ETTT proposal). Construction noise and vibration impacts would be managed through the implementation of the environmental management measures listed in Chapter 6 of this report.

5.2 Additional investigations and clarifications to the EIS

This section documents additional investigations that have been undertaken since the exhibition of the EIS. This section also provides clarifications to the EIS in response to feedback received from the community and other stakeholders during the exhibition period.

5.2.1 Noise and vibration assessment of Scout Hall, Beecroft

Hornsby Shire Council noted in their submission that the issue of noise levels at the Beecroft Scout Hall was not identified in the EIS. It is acknowledged that the EIS did not include the scout hall as a sensitive receiver for the proposal. Following public exhibition, an assessment was undertaken for this receiver. This assessment is documented in the following sections.

Overview

The scout hall at Beecroft is located within RailCorp-owned land approximately 11.5 metres from the existing track. Following construction of the new third track, the closest operational line would be located approximately 4.5 metres from the scout hall. It is understood that the hall is used by the following groups:

- cubs and venturers – Tuesday and Friday nights for around two hours
- guides – Monday and Wednesday nights for around two hours
- day care group – potentially two to three days a week between 10 am and 2.30 pm
- karate tutor – once a week on a weekday afternoon
- hiring of the hall for functions and events, such as children's parties, evening functions, garage sales and by local schools (typically when their own halls are unavailable) – typically on weekends for a few hours at a time (with the exception of local schools which is during the week)
- Rotary's annual book fair – Friday to Sunday in November.

Construction noise

Noise sensitive receivers, such as the scout hall, require separate project specific noise goals and the ICNG suggests that the internal construction noise levels at these premises be referenced to the 'maximum' recommended levels presented in AS 2107 Acoustics - Recommended design sound levels and reverberation times for building interiors.

The adopted noise management level for the scout hall is 45 dBA (internal noise level, $L_{Aeq(15\ minutes)}$). This is consistent with the assessment of other community centres within the ETTT proposal area.

For works in the vicinity of the scout hall, the predictions indicate that the worst-case $L_{Aeq(15minute)}$ construction noise levels would be in excess of 80 dBA. Based on an external noise management level of $L_{Aeq(15minute)}$ 55 dBA (windows open), an exceedance of the $L_{Aeq(15minute)}$ noise goal of greater than 25 dB is predicted for works during the construction period.

Potential impacts would need to be carefully managed via the environmental management measures outlined in the EIS including consultation with scout hall users to investigate opportunities to minimise the impact of construction works (refer to environmental management measure M.6 in section 6.2).

Construction vibration

In relation to human comfort (response), the safe working distances specified in EIS Technical Paper 2 Noise and Vibration relate to continuous vibration. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are allowed.

The scout hall is regularly used, as outlined in the overview section above. The use of the hall for a hired function would involve different occupants, the maximum human response vibration trigger level outlined in the EPA's *Assessing Vibration - a technical guideline* (applicable for offices, schools, educational institutions and places of worship), does not provide an appropriate assessment goal. Additional guidance has therefore been taken from BS 5228-2 which gives guidance on predicting human response to vibration in terms of the peak particle velocity. This information is provided in Table 5.9.

Table 5.9 Guidance on effects of vibration levels

Vibration level	Effects
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Source: BS 5228-2

Where vibration intensive activity (such as rock breaking) is required, peak particle velocity levels greater than 1 mm/s are anticipated. If vibration intensive works are to be undertaken in the vicinity of the scout hall, works should be scheduled outside of the times of use of the hall, where possible.

In relation to structural damage, vibration intensive works in close proximity to the scout hall may be within the safe working distances specified in EIS Technical Paper 2 Noise and Vibration for heavy plant items. Therefore careful selection of plant and equipment would be necessary to avoid potential damage. Vibration monitoring is also recommended to confirm the safe working distances in the event that works are required within the identified safe working distances.

During the detailed design stage, when more specific information is available in relation to the proposed construction works, it is recommended that vibration measures be integrated into the noise and vibration management plan (refer to environmental management measure M.1) with each major stage of the construction works considered and the identification of specific mitigation and management measures for these stages.

Operational noise

The scout hall has been classified as an 'other' sensitive receiver and is considered to be a teaching space or used for relatively quiet activities. The internal noise trigger level that would apply to the Scout Hall would be 45 dBA $L_{Aeq(1\ hour)}$.

The L_{Aeq1hr} predicted noise levels at the scout hall are shown in Table 5.10.

Table 5.10 Predicted noise levels at scout hall

Receiver type	Receiver address	Estimated daytime ($L_{Aeq(1hour)}$) (dBA)[1]		Increase (dB)
		Year 2016 Prior to opening	Year 2026 10 yrs after opening	Year 2016 to Year 2026
Other (community centre)	Scout hall, The Crescent, Beecroft	71.0	75.0	3.7

Note 1: External noise level. The internal trigger level is 45 dB $L_{Aeq(1\ hour)}$ trigger level which corresponds to approximately 55 dB $L_{Aeq(1\ hour)}$ externally, assuming open windows.

During the daytime, the increase in noise level due to the ETTT proposal at the scout hall is predicted to be greater than the 2.0 dB trigger and would therefore require noise mitigation to be considered.

Building treatment of the scout hall is considered likely to be reasonable and feasible for the ETTT proposal, subject to consultation with the scout hall owners. Potential treatment measures would depend on an inspection of the building, but include upgraded glazing on the affected façade (if applicable), and ceiling insulation.

Operational vibration

Structure damage

Based on vibration measurements undertaken by SLR Consulting on previous rail projects, the anticipated peak particle velocity at the scout hall from passing freight trains on the proposed new third

track is in the region of 0.5 to 1 mm/s. This level of vibration is below the level, which, according to BS 7385, could cause cosmetic damage to buildings.

Human comfort

For the scout hall, guidance is taken from BS 5228-2, which gives recommendations on predicting human response to vibration in terms of the peak particle velocity. While this guideline is predominantly concerned with vibration from construction activities, it gives a useful correlation with annoyance effect. This information is shown in Table 5.11.

Table 5.11 Guidance on effects of vibration levels

Vibration Level	Effects
0.3 mm/s	Vibration might be just perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents

Source: BS 5228-2

The anticipated peak particle velocity due to passing freight trains is expected to be below 1 mm/s. The scout hall is considered to be less vibration-sensitive than residential receivers as it is not in use for long periods of time. For this reason, the anticipated vibration impact from freight trains on the proposed new third track is considered to be acceptable at the scout hall.

5.2.2 Potential noise impacts from construction traffic

The EPA noted in their submission that an assessment on the potential noise impact of construction traffic had not been identified in the EIS. Following public exhibition, an assessment of the potential impact of construction traffic noise was undertaken, including the cumulative construction traffic noise of the ETTT proposal and the proposed NWRL project. This assessment is documented in the following sections. Further information can be found in Appendix C.

Overview

As the ICNG does not provide specific guidance in relation to acceptable noise levels associated with construction traffic on public roads, guidance is taken from the EPA's *NSW Road Noise Policy* (RNP).

The criteria for freeway/arterial/sub-arterial and local roads are set out in Table 5.12.

Table 5.12 RNP road traffic noise criteria for residential land uses

Road category	Type of project land use	Day (7.00 am to 10.00 pm)	Night (10.00 pm to 7.00 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 dBA (external)	$L_{Aeq(9hour)}$ 55 dBA (external)
Local roads	Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq(1hour)}$ 55 dBA (external)	$L_{Aeq(1hour)}$ 50 dBA (external)

Predicted construction traffic noise emissions from both heavy and light vehicle movements from the ETTT project have been assessed against the RNP criteria set out in Table 5.12.

An objective of the RNP is to protect sensitive receivers against excessive decreases in amenity as the result of a project, by applying relevant noise increase criteria. As a result, where the road traffic noise levels are predicted to increase by more than 2 dB (an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person) as a result of construction traffic, consideration should be given to applying reasonable and feasible mitigation measure to reduce the potential noise impacts.

Construction traffic noise impacts have therefore been assessed, where possible, considering existing traffic levels and traffic generated noise. Where not currently available, this information would be updated during the preparation of the Construction Noise and Vibration Management Plan.

ETTT construction traffic noise impacts

Arterial and sub-arterial roads

The construction traffic noise impacts on arterial and sub arterial roads has been based on estimated construction vehicle data provided in EIS Technical Paper 4 Traffic and Transport Assessment as well as Annual Average Daily Traffic (AADT) data from RMS. Table 5.13 shows the increase in noise levels due to ETTT construction traffic.

Table 5.13 Estimated peak traffic noise increase – arterial and sub-arterial roads

Vehicle route	Road type	Increase due to ETTT construction traffic	
		$L_{Aeq(15hour)}$ Daytime (dBA)	$L_{Aeq(9hour)}$ Night-time (dBA)
Epping Road	Arterial	No change	No change
Beecroft Road – South of M2 Motorway	Sub-arterial	No change	No change
Beecroft Road – North of M2 Motorway	Sub-arterial	0.1 dBA	0.1 dBA

The predicted noise level increase due to ETTT construction traffic on all identified arterial and sub-arterial roads is considered negligible.

Local roads

The construction traffic noise impact on local roads has been based on estimated construction vehicle data provided in EIS Technical Paper 4 Traffic and Transport Assessment. Whilst existing peak vehicles per hour is available for some of these roads, it is unlikely to coincide directly with the peak construction traffic times. As a result, the ETTT construction traffic noise contribution on local roads, as shown in Table 5.14 has been calculated in the absence of existing traffic. Numbers in bold indicate an exceedance of the relevant RNP criteria. This information would be updated as part of the construction noise and vibration management plan.

Table 5.14 Peak construction traffic noise contribution at nearest receiver – local roads

Vehicle route	Nearest receiver – distance to road (m)	Noise levels due to ETTT construction traffic	
		$L_{Aeq(1hour)}$ Daytime (dBA) – light and heavy vehicles	$L_{Aeq(1hour)}$ Night-time (dBA) – light vehicles only
Old Beecroft Road	12	53	**54**
Cheltenham Road	13	**56**	**54**
The Crescent – east of Cheltenham Road	16	52	**53**
The Crescent – west of Cheltenham Road	9	**56**	**55**
Wongala Crescent	13	52	**54**
Yarrara Road	7	55	**56**

Note: Existing vehicles per hour during the AM peak period is based on peak hour traffic volumes report in Figure 2.8 of EIS Technical Paper 4 Traffic and Transport Assessment (September 2012).

There is predicted to be exceedance of the local road $L_{Aeq(1hour)}$ RNP road traffic noise criteria by up to 1 dB during the daytime and up to 6 dB during the night-time. The potential night-time impact is restricted to potential light vehicle movements, associated with construction workers arriving at the construction site, between 6 am and 7 am, with no other traffic movements proposed during the night-time period. Heavy vehicle movements would occur after 7 am.

Cheltenham Road and Yarrara Road have relatively high existing peak traffic flows in comparison to peak construction vehicles per hour. On these roads, it is unlikely that peak construction vehicle movements will increase the noise significantly.

Existing peak traffic numbers for Wongala Crescent and The Crescent (both east and west) are not available. Old Beecroft Road has an existing peak traffic flow of approximately the same number of vehicles per hour as the peak one hour period of construction traffic. However, on these roads noise from construction traffic is likely to be noticeable and reasonable and feasible measures may be implemented.

Cumulative construction traffic noise impacts

As the ETTT proposal and NWRL proposal are proposed to be constructed concurrently, there are potential cumulative impacts, including noise from construction traffic. An assessment of the cumulative impacts has been based on construction traffic information provided in the NWRL EIS Stage 1 (Transport for NSW 2012c) and ETTT Technical Paper 4 Traffic and Transport Assessment.

Two of the NWRL construction sites (Epping Services Facility and Cheltenham Services Facility) and associated site access roads would be located in close proximity to the proposed ETTT construction traffic routes. However, only Beecroft Road is considered to have the potential for cumulative impacts at these two sites as the other roads are not proposed as main access routes for the ETTT proposal. Table 5.15 shows the estimated cumulative increase in noise associated with construction traffic from the ETTT and NWRL proposals.

Table 5.15 Estimated cumulative traffic noise increase – ETTT and NWRL

Vehicle route	Road type	Increase due to ETTT and NWRL construction traffic	
		$L_{Aeq(15hour)}$ Daytime (dBA)	$L_{Aeq(9hour)}$ Night-time (dBA)
Beecroft Road – South of M2 Motorway	Sub-arterial	0.1 dBA	0.1 dBA
Beecroft Road – North of M2 Motorway	Sub-arterial	0.2 dBA	0.1 dBA

Predicted noise increases on Beecroft Road from cumulative construction vehicle movements from both proposals are considered negligible.

Environmental management measures

Mitigation of construction traffic noise would be predominantly through implementation of Transport for NSW's *Construction Noise Strategy*. Other measures which would be considered as part of the construction noise and vibration management plan include:

- informing the community of vehicle movements and anticipated impacts
- management of traffic
- restriction of heavy vehicle movements to certain times
- management of vehicle queues and relocation of queues away from sensitive receivers
- temporary noise barriers around high traffic areas, such as site entrances
- briefing construction workers on the importance of minimising noise emissions such as driving vehicles in a sensible manner, turning vehicle radios down and not slamming car doors
- encouraging the use of alternative modes of travel to work sites, such as public transport and encouraging car-pooling where alternatives are not practical.

A new management measure (M.2) has been added to ensure that construction traffic noise is addressed during the construction phase.

5.2.3 Potential construction impacts on the Devlins Creek causeway

A number of community submissions raised concern about the proposal's impact on the heritage listed Devlins Creek causeway. A review of the construction methodology for the proposed rail bridge over the M2 Motorway, and associated viaduct and temporary embankment, was undertaken following public exhibition to confirm the adequacy of the environmental management measures proposed for the convict built culvert at Devlins Creek. The key findings of this review are provided in the following sections.

Overview of construction works

To enable the construction of the proposed M2 Motorway overbridge, a temporary embankment is required to be built, which would slope downwards to the west and north (shown as a light grey shaded area in Figure 5.4). Part of the convict-built stone causeway would be protected from the construction of this embankment by a temporary extension of the Devlins Creek culvert over a section of the causeway and the construction of two temporary retaining wing walls extending from the western end of the culvert. The temporary culvert would be constructed from a series of precast concrete arch units, and the proposed embankment would extend over the culvert. The retaining walls may consist of reinforced soil walls.

Potential impact on the Devlins Creek causeway

Provided that no excavation is required for the construction of the temporary culvert and retaining walls, the above described measures would effectively protect a large portion of the stone causeway from impact.

However, some parts of the convict built causeway would be located outside the area protected by the proposed culvert and retaining walls (as shown in Figure 5.4). It is assumed that these parts of the causeway would be covered with fill as part of the construction of the embankment. The fill would be temporary and, provided that the causeway was covered with plastic sheeting before the fill was placed on it (so that the fill could be easily removed following the completion of works), it is unlikely that there would be any permanent impacts to this heritage item. A revised environmental management measure (P.10) has been included in Chapter 6 of this report to reflect this requirement.

It is possible that the stone causeway extends beneath existing fill on either side of the creek and that some of it is not currently visible. These parts of the causeway would be of high archaeological potential as they are likely to have been subject to fewer disturbances than the exposed area. Any portions of the causeway that are currently beneath the ground surface would be protected by the existing fill, provided that no excavation is proposed within the area of high archaeological potential. However, in the event that excavation is required in the vicinity of the causeway, environmental management measure P.10 would require such excavations to be supervised by a suitably qualified archaeologist to reduce the potential for accidental impact during construction.

Additional environmental management measures

Three new environmental management measures (measures P.7, P.8 and P.10) have been included in Chapter 6 of this report to further manage the potential construction impact to the Devlins Creek causeway.

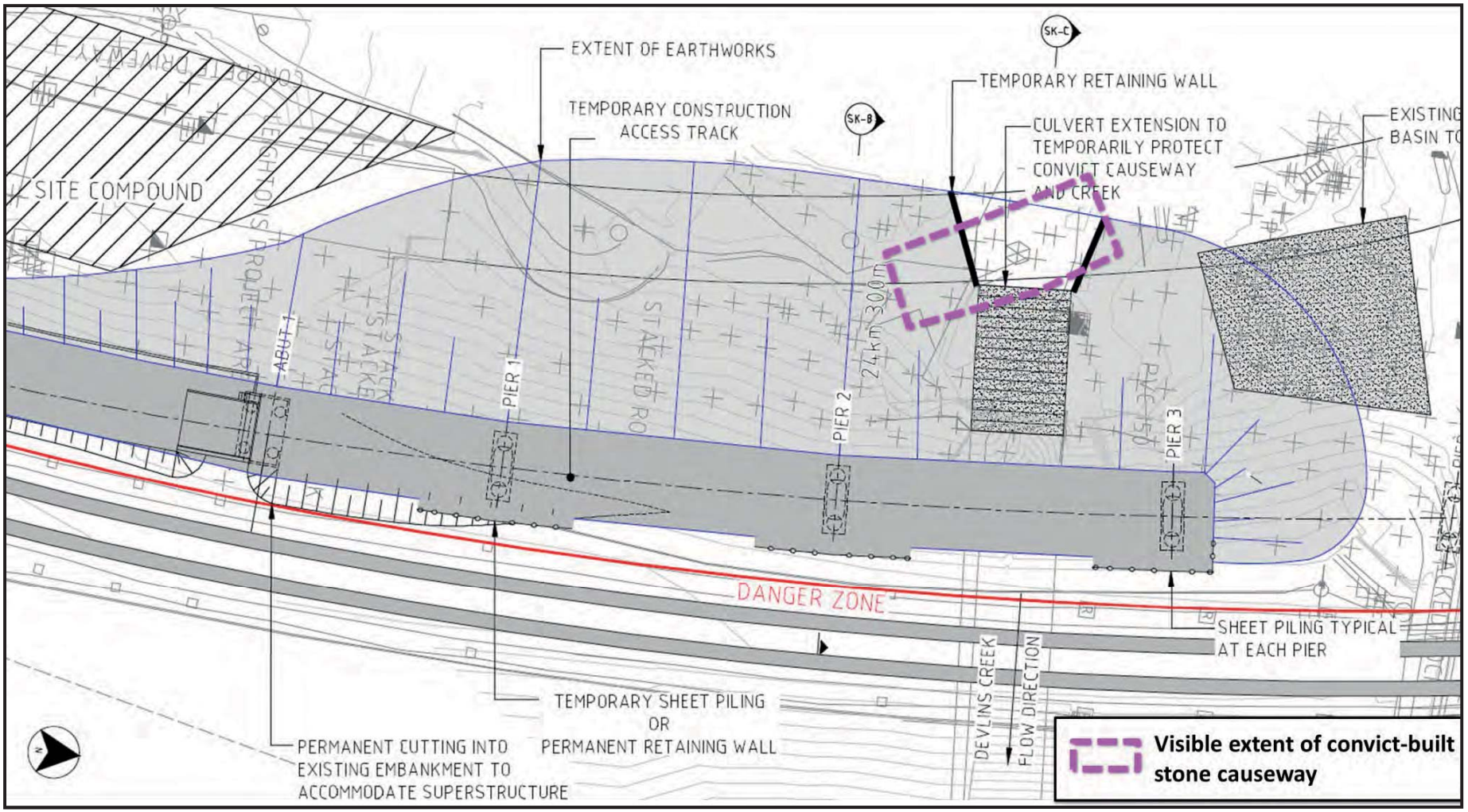


Figure 5.4 Development plan showing visible extent of convict-built stone causeway

Note: Indicative only, subject to detailed design.

5.2.4 Amendment of vegetation clearance areas

During the submissions report process, a check undertaken on the ecology mapping database uncovered an error in the quantities of Sydney Turpentine Ironbark Forest existing within the study area and proposed to be cleared as a result of the proposal. More specifically, the quantities of vegetation associated with the moderate and low condition forest were transposed in Table 8.2 of the EIS. Corrected vegetation clearing data for the EIS is provided in Table 5.2 (refer to section 5.1.1 of this report).

5.2.5 Clarification on vegetation benchmark data presented in the EIS

OEH noted in their submission that the vegetation benchmark data presented in Tables 3.4, 3.6, 3.8 and 3.10 of Technical Paper 1 (Ecology) were incorrectly denoted as being less than 25 percent of the lower benchmark value. This error is acknowledged and revised data has been provided in Tables 5.16 to 5.19.

Table 5.16 Comparison of Blue Gum High Forest quadrat data against vegetation benchmark data

Site	Native plant species richness	Native overstorey (% cover)	Native mid-storey cover (%)	Native groundcover (% cover)			Number of trees with hollows	Length of fallen timber
				Grasses	Shrubs	Other		
***Benchmark*[1]**	***37***	***23-49***	***15-67***	***0-15***	***0-5***	***22-43***	***2***	***50***
B1	34	33	9	60	4	0*	1	0*
B2	39	9	15	12	20	24	0	9*
B3	39	29	26	48	8	24	0	11*
B4	24	31	18	18	6	0*	0	0
B5	40	48	22	30	4	46	2	31
B6	23	35	20	12	1	12	0	3*
B11	20	20	14	10	0	6	0	1*
B15	3*	41	1*	0	0	0*	0	6*

Note 1: Benchmark data for equivalent community in Sydney Metro CMA (Vegetation Type: Sydney Blue Gum - Blackbutt - Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin; Keith Formation: Dry sclerophyll forests (shrubby sub-formation); Keith Class: Sydney Coastal Dry Sclerophyll Forests); source Keith (2004); Red font indicates results below benchmark value; * indicates, less than 25% of lower benchmark value.

Table 5.17 Comparison of Blackbutt Gully Forest quadrat data against vegetation benchmark data

Site	Native plant species richness	Native overstorey (% cover)	Native mid-storey cover (%)	Native groundcover (% cover)			Number of trees with hollows	Length of fallen timber
				Grasses	Shrubs	Other		
***Benchmark*[1]**	**34**	**27.5-32.5**	**44-54**	**1-10**	**6.1-10.1**	**10.7-14.7**	**0**	**0**
B14	24	49	12	4	0*	36	0	9

Note 1: Benchmark data for equivalent community in Sydney Metro CMA (Vegetation Type: Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin; Keith Formation: Dry sclerophyll forests (shrubby sub-formation); Keith Class: Sydney Coastal Dry Sclerophyll Forests); source Keith (2004); Red font indicates results below benchmark value; * indicates, less than 25% of lower benchmark value.

Table 5.18 Comparison of Sydney Hinterland Transition Woodland quadrat data against vegetation benchmark data

Site	Native plant species richness	Native overstorey (% cover)	Native mid-storey cover (%)	Native groundcover (% cover)			Number of trees with hollows	Length of fallen timber
				Grasses	Shrubs	Other		
Benchmark[1]	**40**	**28-33**	**35-45**	**1-10**	**9-13**	**15-19**	**1**	**30**
B8	35	14	10	52	18	8	0	13
B9	5*	0*	18	12	4	1*	0	46
B12	44	4*	15	36	4	8	0	0*
B13	36	13	10	30	18	18	0	0*
B17	14	17	9	2	0*	0*	0	0*
B18	19	29	19	8	0*	22	0	10

Note 1: Benchmark data for equivalent community in Sydney Metro CMA (Vegetation Type: Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin, Sydney Basin; Keith Formation: Dry sclerophyll forests (shrubby sub-formation); Keith Class: Sydney Coastal Dry Sclerophyll Forests); source Keith (2004); Red font indicates results below benchmark value; * indicates, less than 25% of lower benchmark value.

Table 5.19 Comparison of Sydney Turpentine Ironbark Forest quadrat data against vegetation benchmark data

Site	Native plant species richness	Native overstorey (% cover)	Native mid-storey cover (%)	Native groundcover (% cover)			Number of trees with hollows	Length of fallen timber
				Grasses	Shrubs	Other		
Benchmark[1]	***39***	***25-35***	***26-41***	***19-29***	***0-10***	***19-29***	***1***	***30***
B7	38	19	12	34	14	8	0	0*
B10	47	40	27	20	6	30	0	7*
B16	10	33	1*	0*	0	8	0	0*

Note 1: Benchmark data for equivalent community in Sydney Metro CMA (Vegetation Type: Turpentine - Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin; Keith Formation: Dry sclerophyll forests (shrub/grass sub-formation); Keith Class: Cumberland Dry Sclerophyll Forests); source Keith (2004); Red font indicates results below benchmark value; * indicates, less than 25% of lower benchmark value.

5.2.6 Clarification on air quality impact assessment results

NSW Health noted in their submission that the data presented in Tables 7.3 (PM_{10}) and 7.4 ($PM_{2.5}$) of Technical Paper 7 (Air Quality), which related to predicted incremental impacts for particulate material, appeared to be incorrect (as predicted absolute increases in $PM_{2.5}$ were reported to be greater than those predicted for PM_{10}). It is acknowledged that there was an error in the data presented in Table 7.3 (PM_{10}) of Technical Paper 7. Revised data for the predicted incremental impacts for PM_{10} is documented in Table 5.20. As noted in Item U.6 in section 4.4.3 of this report, the cumulative results are still well within the 24 hour and annual average air quality criteria of 50 µg/m^3 and 30 µg/m^3, respectively.

Table 5.20 Revised predicted impacts for PM_{10}

Distance from track	Predicted incremental impacts (µg/m^3)		Predicted cumulative impacts (µg/m^3)	
	Maximum 24 hour	Annual average	Maximum 24 hour	Annual average
OEH Criteria	*50*	*30*	*50*	*30*
2011				
50m	1.4	0.2	38.9	13.4
100m	1.7	0.2	39.2	13.4
200m	1.4	0.1	38.9	13.3
400m	0.6	0.1	38.1	13.3
800m	0.4	0.1	37.9	13.3
2016				
50m	1.4	0.2	38.9	13.4
100m	1.7	0.2	39.2	13.4
200m	1.4	0.2	38.9	13.4
400m	0.6	0.1	38.1	13.3
800m	0.4	0.1	37.9	13.3
2026				
50m	1.4	0.2	38.9	13.4
100m	1.7	0.2	39.2	13.4
200m	1.4	0.2	38.9	13.4
400m	0.6	0.1	38.1	13.3
800m	0.4	0.1	37.9	13.3

5.2.7 Clarification on impact on the Beecroft/Cheltenham Heritage Conservation Area

A number of community submissions raised concern about the ETTT proposal's impact on the heritage values of the Beecroft/Cheltenham Heritage Conservation Area (HCA). Further clarification on the proposal's impact on the various elements of significance for the Beecroft/Cheltenham HCA is provided in Table 5.21.

Overall, the proposal would not have a significant impact on any of the components identified as contributing to the significance of the HCA in the Hornsby Shire Heritage DCP 1995.

Table 5.21 Clarification on the ETTT proposal's impact on the Beecroft/Cheltenham HCA

Element of significance	Potential impact from the ETTT proposal
The HCA is significant because it demonstrates 'A Government subdivision for suburban investment purposes released to raise money to fund an important state-wide railway project'.	The proposal would not involve any changes to the street patterns of the area, which demonstrate the layout of this Government subdivision.
The HCA is significant because it demonstrates 'The layers of its suburban subdivision, re-subdivision, and development from 1887 to the 1960s, and less noticeably to the present day'.	The proposal would not involve any changes to the street patterns or arrangement of lots within the area, which demonstrate these subdivision and development patterns.
The HCA is significant because it demonstrates 'The socio-economic status of Sydney's railway suburbs in the late-nineteenth and early twentieth centuries (demonstrated through the substance and design of its buildings, retained to the present day)'.	The proposal would not involve impacts to the substance or design of the buildings in the area that demonstrate the socio-economic status of the suburbs. The buildings at Cheltenham Station are of modern construction and therefore do not contribute to a demonstration of the socio-economic status of the suburbs in the late-19th and early-20th centuries. The structures at Beecroft Station do date to the late-19th and early-20th centuries; however, they do not make a significant contribution to a demonstration of the socio-economic status of the suburbs as they are standard railway station structures for that era. The socio-economic status of the suburbs is largely demonstrated through the surviving large residences and gardens. The proposed impacts to Beecroft and Cheltenham stations would not involve impacts to structures that have the ability to demonstrate the socio-economic status of the suburbs. The possibility of impacts to the fabric of buildings through vibration has been considered in section 4.3.5 (refer specifically to Item E.10). As outlined in Item F.1 in section 4.3.6, there is no evidence that the proposal would result in a reduction in property value. In addition, ETTT proposal is unlikely to jeopardise the future occupation and maintenance of heritage listed houses near the rail corridor.
The HCA is significant because it demonstrates 'The Australian suburban ideal of one house and one lot (an ethic that dominated city/suburban expansion from the coming of the railways until the 1980s)'.	The proposal would not involve any changes to the pattern of allotments and suburban development in the area.
The area also demonstrates the dominant impact on the suburban fabric of the natural topography and its associated prominent native vegetation and remnant native forests, closely integrated into the street patterns and residential allotments of the area through generous gardens. The dominant character of the area is derived from the tall tree canopy in pockets of remnant and regeneration forests in reserves and generous gardens and their close relationship with the landform and the pattern of roads and buildings within that landscape.	The proposal would involve the removal of some native vegetation, with most of the vegetation to be removed, on the western side, within the rail corridor. Bands of vegetation would be retained along the inner edge of the rail corridor for the majority of its length. The existing vegetation within the road reserves adjacent to the rail corridor would be retained, except where station car parking is proposed to be extended at Cheltenham Station, noting that the vegetation in this area does not include native trees or introduced vegetation of heritage significance. The proposal would not involve impacts to the vegetation on the eastern side of the rail corridor, in private gardens, or in public reserves, aside from the removal of a small amount of vegetation in the Beecroft Station Garden, which is addressed in Item E.8 in section 4.3.5. Therefore, the vast majority of the significant pockets of vegetation within the HCA would be unaffected by the development, and the proposal would not have a significant impact on the dominant character of the area, as defined by natural vegetation, the landforms and the pattern of roads and buildings.

Element of significance	Potential impact from the ETTT proposal
	The proposal also includes a commitment to replant native vegetation wherever possible, to mitigate the impact of vegetation removal.
'The area contains a fine collection of houses from the Victorian, Federation, Arts and Crafts, Inter-War and Post-War eras. Some of which have been designed by acknowledged Sydney architects…'.	The proposal would not involve direct impacts to any of the houses located near the rail corridor, and would not affect their representative heritage values or their collective significance as a collection of fine houses from different eras of the area's development.
'The intactness of the early residential fabric and streetscapes within the area is significant. There have been comparatively few demolitions within the area…'	The proposal would not have any impact on the early residential fabric or streetscapes within the area.
'The area is also notable for its community buildings and facilities such as churches, schools, the Beecroft School of Arts Building, the Beecroft War Memorial, the Beecroft Tennis Club and Cheltenham Recreation Club which have endured as places of community value over a number of generations.'	The proposal would not involve any direct impacts to the collective heritage value of community buildings and facilities in the HCA. The word 'direct' has been used to indicate that there would be no physical impacts to any of the buildings, and no apparent reason why any of them would cease to be the focus of community activity and value as a result of the proposal. It is however possible that the proposal could involve 'indirect' changes to amenity, such as an increase in noise levels. It is considered unlikely that such changes would impact on this aspect of the heritage significance of the HCA. All of the buildings and facilities would continue to be central places for community activity. Impacts to the Beecroft War Memorials, Beecroft Tennis Club, and the Cheltenham Recreation Club are addressed in Items E.10, E.16 and E.19 in section 4.3.5.

5.2.8 Existing commuter car parking provisions at Pennant Hills

Section 11.2.5 of the EIS incorrectly stated that Pennant Hills Station currently has 80 designated commuter car parking spaces. The 80 spaces at Pennant Hills Station are timed and are for the use of customers of specific commercial premises adjacent to Pennant Hills Station. No dedicated commuter parking exists at Pennant Hills. Parking surveys undertaken for the EIS indicate that there is sufficient available street parking within 400 metre walking distance of Pennant Hills Station for commuters.

5.2.9 Potential impacts on the Beecroft Station Gardens and playground

A number of community submissions sought clarification and/or raised concern about the proposal's impact on the Beecroft Station Gardens and playground. The Beecroft Station Gardens and playground reside predominantly on land under the ownership of RailCorp. A portion of this land would be required for the construction of the new third track and the associated structural stabilisation and cutting.

Subject to detailed design, the worst-case scenario is expected to encroach into the gardens and playground by up to 3 metres. This would vary along the length of gardens and would be much less in some areas. The encroachment on the Beecroft Station Gardens is minimal and is unlikely to impact on the existing use of the area. Figure 5.5 below illustrates the worst-case scenario.

Vegetation along the existing fence line would need to be removed. Options for revegetation to provide screening between the playground and the new track would be investigated and detailed in the proposal's urban design and landscape plan. This plan would be developed in consultation with Hornsby Shire Council and made available to the community for comment (refer to environmental management measure C.1 in Chapter 6 of this report for more detail).

The playground equipment would not need to be relocated, however, Transport for NSW are investigating a suggestion by Hornsby Shire Council to temporarily or permanently relocate the playground (refer to Transport for NSW's response to Item T.28 in section 4.4.2 of this report). It is thought that users of the playground might appreciate relocation to a location less impacted by construction activities. Further investigation and consultation with regard to this matter would be undertaken during detailed design.

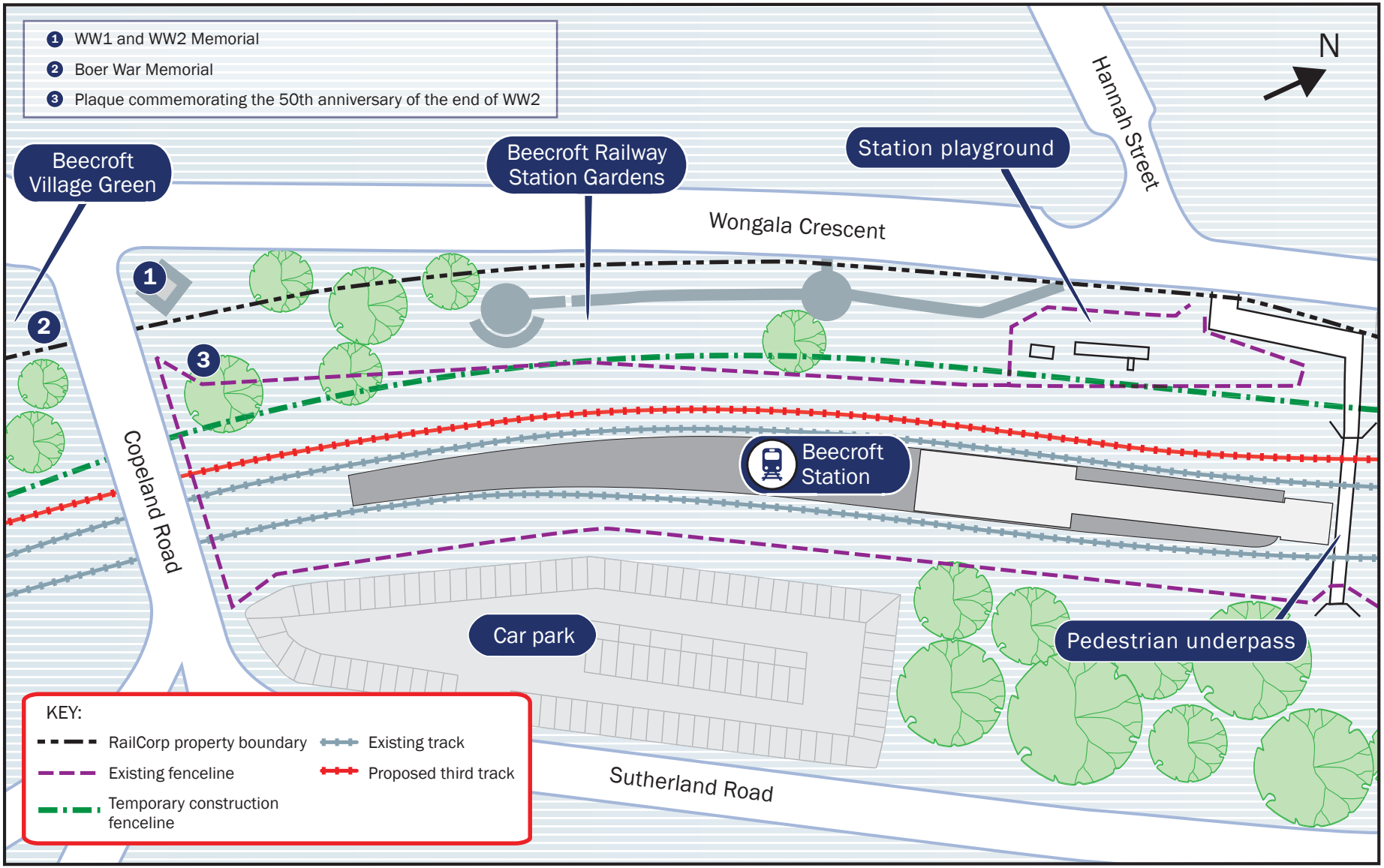


Figure 5.5 Extent of proposed construction works in the vicinity of Beecroft Station

Note: Indicative only, subject to detailed design.

5.2.10 Vegetation community classification and mapping

The vegetation community mapping presented in Figure 8.1 of the EIS (and Figure 3.1 of Technical Paper 1 – Ecology) was misleading in relation to the extent of 'exotic groundcover' present within the study area. During a review of the vegetation mapping of the area, it was identified that 'exotic groundcover' has been broadly applied to areas of the study area for which no other defined vegetation community existed. Consequently, areas that are devoid of vegetation (for example, hardstand areas associated with car parks, station platforms and existing track ballast areas) were incorrectly mapped as supporting 'exotic groundcover'.

Section 3.6.3 of Technical Paper 1 (Ecology) defined the 'exotic groundcover' community as all areas of exotic vegetation which lack substantial shrub or tree cover. This vegetation typically consisted of areas of introduced grasses (e.g. *Pennisetum clandestinum*) and herbs interspersed with bare ground, ballast and other artificial substrates. Section 3.6.3 of Technical Paper 1 (Ecology) stated that these areas were devoid of substantial vegetation and were not intended to be mapped in Figure 3.1 of the Technical Paper (or Figure 8.1 of the EIS). For this reason, the 'exotic groundcover' community has been redefined as 'disturbed areas' for the purposes of assessing the potential changes in the ETTT construction impact area, as discussed in section 5.1.1 of this report. The reclassification of this non-native vegetation community does not alter the biodiversity impacts of the ETTT proposal.

5.3 Further investigation to be undertaken post-approval

5.3.1 Further investigation of design options for Cheltenham Station

Transport for NSW sought specific feedback at community information sessions during the EIS exhibition period on the attributes people most valued about the existing station at Cheltenham. Feedback was sought in order to assist the development of Cheltenham Station design elements including building treatments and landscaping proposals. People reported that they value the existing stations:

- heritage look and feel
- small scale
- modest appearance
- vegetation, gardens and rock cuttings.

Further to this feedback and in response to a large number of submissions commenting on the proposed station design shown in the artists impression contained in the EIS, a number of possible architectural changes are being further investigated to determine their feasibility.

One of the key aspects challenged by the community related to the height and scale of the new structure. The station height is largely determined by the proposed overhead concourse which would provide disabled access to each of the platforms by lifts and stairs as is a common feature at other railway platforms including those at Pennant Hills and Epping stations.

An option being currently investigated is whether access to the proposed island platform (platform 2) created by the new third track could be provided by widening the existing Cheltenham Road bridge and providing access from the bridge via new lift and stairs. This would negate the need to construct a separate new overhead concourse structure over the tracks and would mean existing station buildings could largely remain unchanged as well as maintaining existing station accesses to the greatest extent possible. These changes would substantially reduce identified impacts and would address many of the objections raised in submissions. However issues to be worked through further would include the differential in access points between the station platforms (inconvenience for platform 2 passengers from the car parking locations); whether the required functionality could be achieved using the existing Cheltenham Road bridge; and whether substantial additional works are required; and the cost, safety and durability requirements of the pedestrian tunnel at the southern end of the platform if this were required for emergency escape reasons. The need for a taxi stand would also be further investigated following community feedback received in submissions.

Further work on this potential option is being undertaken and if found to be feasible, consultation would be conducted with the community in early 2013.

As described in the EIS, Transport for NSW intended to consult only directly affected residents on design elements of Cheltenham Station including building treatments and landscaping. Due to the overwhelming interest by the wider community on the subject, feedback would now also be invited from the broader community rather than from nearby residents only. This would include making the urban design and landscape plan available for public comment (refer to environmental management measure C.1 in Chapter 6 of this report for further detail).

6. Revised mitigation and management measures

Tables 6.1 to 6.3 outline the revised set of environmental management measures for the ETTT proposal. This list includes any changes or additions to environmental management measures that are now proposed in response to submissions received during the public display period. New mitigation or amended measures have been underlined. Removal of environmental management measures (or text removed from measures) has been shown with a ~~strikethrough~~.

6.1 Detailed design

The revised environmental management measures to be implemented during the detailed design phase of the proposal are listed in Table 6.1.

Table 6.1 Revised detailed design environmental management measures

ID number	Environmental management measure
Ecology	
A.1	Opportunities to further reduce the clearing of native vegetation would be investigated during detailed design.
A.2	A biodiversity offset strategy would be developed to mitigate the residual impacts of the ETTT proposal. The object of this strategy would be to fulfil the need to improve or maintain biodiversity values, as required under Part 5.1 of the EP&A Act.
Noise and vibration	
B.1	The PA system at Cheltenham Station would be designed and installed in accordance with applicable best practice standards/guidelines.
B.2	Potential noise and vibration impacts during blasting activities would be assessed (where required) during detailed design.
Design and visual amenity	
~~B.1~~ C .1	An urban design and landscape plan would be developed in consultation with RailCorp and Hornsby Shire Council. ~~This plan would include details of the locations of rehabilitation planting to replace vegetation or fencing that previously provided screening to adjacent sensitive visual receivers where possible.~~ This plan would include, but not necessarily be limited to details of: ▪ materials, finishes, colour schemes and maintenance procedures, including graffiti control for structures (including new walls, barriers and fences) ▪ location and design of infrastructure including stations, pedestrian pathways/footbridges and street furniture including (where relevant) bus and taxi facilities, bicycle storage, telephones and lighting equipment ▪ measures to reduce light spill and/or glare ▪ measures to maintain privacy/screening ▪ landscape treatments and street planting to integrate with surrounding streetscape ▪ design detail that is sympathetic to the amenity and character of the local heritage items ▪ total water management principles to be integrated into the design where considered appropriate ▪ design measures included to meet Transport for NSW Sustainable Design Guidelines Version 2.0 ▪ any other matters which the UDLP is required to address.

ID number	Environmental management measure
	The urban design and landscape plan would be placed on public display prior to its finalisation to allow for community ideas and feedback to be considered and adopted, where possible.
C.2	Options for revegetation to provide screening between the Beecroft Station Gardens/playground and the new track would be investigated and detailed in the proposal's urban design and landscape plan. This plan would be developed in consultation with Hornsby Shire Council and made available to the community for comment.
~~B.2~~ C.3	Minimise light spillage through designing the construction and operation lighting to ensure the site is not over-lit and to minimise additional light spillage from the rail corridor into adjacent properties. This includes consideration of the placement and specification of lighting to minimise any potential increase in light pollution.
~~B.3~~ C.4	During the detailed design phase ~~the project team would identify and engage directly affected residents in close proximity to Cheltenham Station. Feedback~~ feedback would be sought ~~from these directly affected residents~~ from the community on design elements, including building treatments and landscaping, for the proposed Cheltenham Station.
Historic heritage	
~~C.1~~ D.1	The adoption of architectural finishes consistent with the existing, matching the existing head height with the Beecroft Station pedestrian subway structure, and archival recording of the portion of the subway which is to be upgraded. The Statement of Heritage Impact contained in Technical Paper 5 – Historic heritage would be forwarded to Hornsby Shire Council in accordance with Clause 14 of ISEPP.
~~C.2~~ D.2	Archival recording of the former side platform at Beecroft Station would be undertaken prior to works commencing. Transport for NSW would provide copies of the archival recording to Hornsby Shire Council for its records.
~~C.3~~ D.3	RailCorp would be notified about the proposed impacts to the former side platform at Beecroft Station.
~~C.4~~ D.4	The design for the new bridge crossing Devlins Creek would avoid impacts to the convict-built stone causeway located underneath the former M2 bus ramp.
D.5	Interpretation signage would be installed at Beecroft Station to allow for the history and former platform configuration to be interpreted.
Surface and groundwater	
~~D.1~~ E.1	All track drainage would be designed to meet relevant standards and guidelines. This would include designing all drainage to allow for the effects of climate change and storm surcharging as appropriate.
~~D.2~~ E.2	Adequate drainage would be incorporated into the design in locations where cuts are required to manage any groundwater.
~~D.3~~ E.3	Additional investigation/assessment of dewatering requirements would be determined during detailed design.
~~D.4~~ E.4	Where required, water access entitlements, such as groundwater licences, would be obtained for dewatering activities, in accordance with the requirements of the NSW Office of Water's proposed aquifer interference policy.
~~D.5~~ E.5	Potential impacts to two existing groundwater bores located in the vicinity of the proposal would be further investigated during detailed design. Mitigation measures to minimise these impacts would be also developed as required.
Soils and earthworks	
~~E.1~~ F.1	Further geotechnical investigations would be undertaken during detailed design to confirm soil and rock properties along the alignment and appropriate design responses.
~~E.2~~ F.2	Where required by the *Epping to Thornleigh Third Track Phase II Environmental Site Assessment and In-Situ Waste Classification* report (Golder Associates 2011), soil contamination testing would be undertaken to delineate any areas which may pose risks to human health or other aspects of the environment. This would include potential for acid sulphate soils, saline soils, asbestos containing materials as well as other types of contamination. Mitigation measures would then be developed to appropriately manage (and where required or as appropriate, remediate) any contamination or saline soils likely to be encountered.

ID number	Environmental management measure
~~E.3~~ F.3	Undertake a health and safety risk assessment prior to construction.
Land use and property	
~~F.1~~ G.1	Further investigations into the location of existing utilities and the likely impact to be undertaken. This would include consultation with the asset owners to determine the appropriate measures for relocation.
Greenhouse gases	
~~G.1~~ H.1	A detailed greenhouse gas assessment, including an inventory of Scope 1, 2 and 3 emissions, would be undertaken once more accurate information is available.
Sustainability	
~~H.1~~ I.1	A detailed assessment of sustainability initiatives is to be undertaken during detailed design using NSW Sustainable Design Guidelines for Rail version 2.0 (~~TfNSW~~ Transport for NSW 2011b).
~~H.2~~ I.2	Energy efficiency and minimisation measures e.g. water, power, etc. would be incorporated into the above assessment and relevant measures would be included in construction planning.

6.2 Construction

The revised environmental management measures to be implemented during the construction phase of the proposal are listed in Table 6.2.

Table 6.2 Revised construction environmental management measures

ID number	Environmental management measure
General environmental management measures	
~~I.1~~ J.1	Construction would be undertaken in accordance with ~~TfNSW's~~ Transport for NSW's ISO 14001 accredited environmental management system.
~~I.2~~ J.2	A Construction Environmental Management Plan (CEMP) would be prepared prior to construction, which would outline the construction conditions and temporary environmental protection measures to manage the impact of construction activities. The CEMP would be consistent with the environmental management measures documented in this EIS, conditions of approval and the conditions of any licences or permits issued by government authorities.
~~I.3~~ J.3	The CEMP would identify the auditing and inspection requirements and determine the framework for the management of key environmental issues for construction. To address site specific conditions, the CEMP would delegate particular management measures to be incorporated in discrete Environmental Control Maps.
~~I.4~~ J.4	The location of sensitive areas (e.g. threatened species, endangered ecological communities and heritage items) would be clearly identified on Environmental Control Maps, which would be supplied to construction managers and workers.
~~I.5~~ J.5	All workers would be provided with an environmental induction prior to commencing work on site. This induction would include information on the following: ▪ ecological values of the site ▪ protection measures to be implemented to protect biodiversity (including weed control, erosion and sediment control, and water quality management) and penalties for breaches ▪ noise and vibration management, including good working practices and measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable. Basic training in the recognition of Aboriginal cultural heritage material. This training would include information such as the importance of Aboriginal cultural heritage material and places to the Aboriginal and non-Aboriginal community, as well as the legal implications of removal, disturbance and damage to any Aboriginal cultural heritage material and sites.

ID number	Environmental management measure
~~I.6~~ J.6	A waste management plan would be prepared as part of the CEMP. Construction waste would be managed through the waste hierarchy established under the *Waste Avoidance and Recovery Act 2001*. All waste requiring off-site disposal would be classified in accordance with the OEH's (2009; formerly DECCW) *Waste Classification Guidelines* prior to disposal.
~~I.7~~ J.7	During construction planning, seek to minimise the use of potable water and to identify any potential alternate water sources, including recycled water.
~~I.8~~ J.8	The CEMP would include measures to manage the potential impacts of construction compound operations. This would include inputs into the traffic management plan to ensure that vehicle movements to and from construction compounds do not impact on surrounding receivers.
J.9	Subject to landowner agreement, building condition surveys would be completed on the following buildings/structures prior to proximate piling, excavation or bulk fill or any vibratory impact works including jack hammering and compaction (unless otherwise determined as not being adversely impacted by a qualified geotechnical engineer): ▪ all buildings/structures/roads within a plan distance of 50 metres from the edge of the works ▪ all heritage listed buildings and other sensitive structures within 150 metres from the edge of the works. Any damage to buildings, structures, lawns, trees, sheds, gardens etc. as a result of construction activity direct and indirect (i.e. including vibration and groundwater changes) shall be rectified at no cost to the owner(s).
Stakeholder engagement	
~~J.1~~ K.1	A Community and Stakeholder Involvement Plan would be established prior to construction commencing. The Plan would identify: ▪ ~~key~~ project stakeholders ▪ methods to inform the community of the progress and performance of the proposal and issues of interest to the community ▪ processes to receive and manage enquiries and complaints ▪ processes to consult with affected property owners, including property ~~inspections~~ condition surveys, where appropriate ▪ protocols to notify stakeholders of relevant activities (e.g. out of hours work and traffic disruptions) and any incidents should they occur e.g. unscheduled service interruptions.
~~J.2~~ K.2	Newsletters and other communication tools would be distributed to keep the community informed of construction progress, upcoming activities and impacts. This would ~~especially outline the need to undertake~~ include providing information on out of hours works and ~~the process for the community~~ how to find out more about the project and register complaints in relation to the works.
~~J.3~~ K.3	~~A~~ 24 hour ~~toll free~~ complaint~~s~~ and ~~enquiries~~ enquiry numbers (1800 684 490 and 1800 775 465, respectively) and an email address (projects@transport.nsw.gov.au) would be established for the duration of construction.
Ecology	
~~K.1~~ L.1	All workers would be provided with an environmental induction prior to commencing work on-site. This induction would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches.
~~K.2~~ L.2	Disturbance of vegetation would be limited to the minimum amount necessary to construct the ETTT proposal.
~~K.3~~ L.3	The limits of clearing would be clearly demarcated on-site (where appropriate) prior to construction to avoid unnecessary vegetation and habitat removal. This could include the installation of fencing around the construction footprint.
~~K.4~~ L.4	Equipment storage, stockpiling of resources and vehicle access would be restricted to designated areas situated on cleared land, where practicable.
~~K.5~~ L.5	Vehicles and other equipment to be used on site would be cleaned to minimise seeds and plant material entering the site to prevent the introduction of further exotic plant species (including Myrtle Rust).

ID number	Environmental management measure
~~K.6~~ L.6	Any culvert that is proposed to be extended would be checked for roosting bats immediately prior to commencement of the culvert works. Culverts would remain open (on at least one side) at all times to allow any roosting bats to fly in or out of the culvert.
~~K.7~~ L.7	Protocols to prevent the introduction and/or spread of chytrid fungus would be implemented. These protocols would be based on the OEH Hygiene Protocol for the Control of Disease in Frogs (DECCW 2008a).
~~K.8~~ L.8	A trained ecologist would be present during the undertaking of construction activities that are in areas where frogs are likely to occur to enable the capture and relocation of any frogs. Frogs would be moved in a sterile container to the nearest area of similar habitat. Any handling of frogs would be undertaken in accordance with the OEH Hygiene Protocol for the Control of Disease in Frogs (DECCW 2008a).
~~K.9~~ L.9	Riparian and fringing aquatic vegetation would be replanted in disturbed areas immediately after construction to stabilise creek banks.
~~K.10~~ L.10	Riparian vegetation clearance would be avoided (where possible) to protect soils from erosion. If clearance cannot be avoided, the area of vegetation cleared at any one time would be minimised.
~~K.11~~ L.11	Pre-clearing surveys for *Epacris purpurascens var. purpurascens* would be undertaken prior to construction by a qualified ecologist. Temporary fencing would be established around any identified remaining populations of *Epacris purpurascens var. purpurascens* prior to construction to avoid accidental impacts to this species.
~~K.12~~ L.12	Pre-clearing surveys would be undertaken by a trained ecologist to mark out the limits of the Critically Endangered vegetation community, Blue Gum High Forest as listed under the EPBC Act. Temporary fencing would be established around the community prior to construction to avoid accidental impacts during construction.
~~K.13~~ L.13	The clearing of mature (native) and hollow-bearing trees would be minimised as far as practicable.
~~K.14~~ L.14	Any hollow-bearing trees to be felled would be marked on site prior to the clearing of vegetation. The removal of hollow-bearing trees would be undertaken in the presence of a qualified ecologist or wildlife specialist experienced in the rescue of fauna, and in accordance with a tree hollow management protocol (to be included in the CEMP).
~~K.15~~ L.15	Dead wood within the impact area would be relocated into areas of native vegetation adjacent to the proposal site to provide habitat for fauna.
~~K.16~~ L.16	Weed control measures would be developed to manage the dispersal and establishment of weeds during the construction phase of the proposal. This would include the management and dispersal of the following weeds that are known to occur within the rail corridor: ▪ exotic perennial grasses, such as *Chloris gayana, Eragrostis curvula* and *Pennisetum clandestinum* ▪ the noxious weeds listed in Table 3-11 of Technical Paper 1 - Ecology, in accordance with the *Noxious Weeds Act 1993*.
~~K.17~~ L.17	Rehabilitation works would be undertaken for any areas that are likely to require revegetation at the completion of construction works. These rehabilitation works would be undertaken by a qualified bushland regeneration contractor (as part of the CEMP) and are to reflect the vegetation mapped within the vicinity.
L.18	Nest boxes would be installed in adjoining/nearby areas of retained vegetation prior to clearing activities at a ratio of 2 nest-boxes for every hollow removed. The proposed biodiversity offset package would provide offset for habitat loss as a result of the proposal.
L.19	Additional surveys of potential bat roost sites (i.e. large culverts, and under bridge and viaducts) would be undertaken at an appropriate time of year to determine if bats are using such features as temporary diurnal or hibernation roosts. Surveys would be undertaken by an appropriately qualified ecologist. Measures would be implemented where necessary to exclude bats from such roost sites prior to the commencement of and during the winter hibernation periods throughout the project.
Noise and vibration	
~~L.1~~ M.1	The construction noise and vibration management plan would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable.

ID number	Environmental management measure
M.2	The construction noise and vibration plan would specifically address the issue of construction traffic noise and identify measures to minimise construction traffic noise impacts.
~~L.2~~ M.3	Mitigation measures documented in the ~~TfNSW~~ Transport for NSW *Construction Noise Strategy* would be adopted, as specified in section 7.2.6 of *Technical Paper 2 – Noise and vibration*. These measures may include, but not be limited to: ▪ letter box drops and noise monitoring ▪ individual briefings, notifications respite periods, or where highly intrusive noise levels are anticipated alternative accommodation for specific construction activities would be considered ▪ use of localised acoustic hoarding around significant noise generating items of plant, where reasonable and feasible ▪ briefing of the work team in order to create awareness of the locality of sensitive receivers and the importance of minimising noise emissions ▪ planning the higher-noise activities and work near residential receivers to be undertaken predominantly during less sensitive periods, where reasonable and feasible ▪ ensuring spoil is placed and not dropped into awaiting trucks ▪ use of less noise-intensive equipment, where reasonable and feasible ▪ non-tonal reversing alarms fitted on construction vehicles.
M.4	In addition to the measures contained within Transport for NSW's *Construction Noise Strategy*, where reasonable and feasible, vibration mitigation measures may include: ▪ vibration generating plant and equipment would be located in areas with lower vibration impacts on sensitive receivers ▪ work generating high vibration levels would be scheduled during less sensitive time periods ▪ lower vibration generating equipment and plant would be used ▪ consecutive works with high vibration levels in the same locality would be minimised ▪ high vibration generating activities would be carried out in continuous blocks, not exceeding 4 hours each with respite periods between each block ▪ dampened rockbreakers and/or 'city' rockbreakers would be used to minimise impacts associated with rockbreaking works.
~~L.3~~ M.5	Consultation would be undertaken with Our Lady Help of Christians Primary School, Cheltenham Girls High School, Beecroft Primary School and Arden Anglican School Preschool and Primary Campus prior to noise intensive works to ensure impacts are minimised during examination periods and/or other critical periods in the school calendar (where works are predicted to exceed the relevant construction noise management level for this receiver). Consultation with nearby childcare centres to be undertaken to potentially avoid noisy works during rest periods at the centres.
~~L.4~~ M.6	Consultation would be undertaken with the following sensitive receivers prior to noise intensive works to ensure impacts are minimised during the most sensitive activities at these receivers (where works are predicted to exceed the relevant construction noise management levels for these receivers): ▪ Beecroft Community Centre ▪ Pennant Hills Library and Community Centre~~.~~ ▪ Uniting Church Retirement Home (at Copeland Road, west of Beecroft Road) ▪ Beecroft Lawn Tennis Club ▪ Cheltenham Recreational Club ▪ The Beecroft Scout Hall.
M.7	Vibration monitoring would be initially carried out at nearby structures within the safe working distances for cosmetic damage as a result of vibration intensive construction activities and where the vibration levels are greater than the maximum recommended values.

ID number	Environmental management measure
M.8	Monitoring for the effects of vibration on historic buildings and structures within the vicinity of the proposal would be undertaken on a regular basis and in accordance with the heritage best practice standards (including German Standard DIN 4150-3 1999, *Structural Vibration in Buildings – Effects on Structures*), to avoid adverse effects on the original fabric of these items.
Design and visual amenity	
~~M.1~~ N.1	Avoid unnecessary loss or damage to vegetation within the rail corridor and adjacent road reserve by protecting trees prior to construction and/or trimming vegetation to avoid total removal. This includes vegetation that makes a substantial and positive contribution to landscape character and/or provides screening to adjacent properties.
~~M.2~~ N.2	Undertake rehabilitation planting as early as possible to replace vegetation that provided screening to adjacent sensitive visual receivers.
~~M.3~~ N.3	Minimise light spill from the rail corridor into adjacent visually sensitive properties by directing construction lighting into the construction areas and ensuring the site is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution.
~~M.4~~ N.4	Temporary hoardings, barriers, traffic management and signage would be removed when no longer required.
~~M.5~~ N.5	Work/site compounds would be screened, with shade cloth (or similar material) (where necessary) to minimise visual impacts from elevated locations.
~~M.6~~ N.6	Graffiti would be required to be managed by the contractor throughout construction.
~~M.7~~ N.7	New embankments would be landscaped to complement the existing visual character of the study area.
~~M.8~~ N.8	Measures such as the provision of visual screening/retention of existing vegetation would be considered for visually sensitive areas and the restriction of works to the existing rail corridor would be implemented, wherever possible.
~~M.9~~ N.9	Materials and machinery should be stored tidily during the works.
Access, traffic and transport	
~~N.1~~ O.1	Road occupancy licenses/road opening permits for temporary closure of roads would be obtained, where required.
~~N.2~~ O.2	Traffic management plans would be prepared and provided to the relevant Roads Authority as required.
~~N.3~~ O.3	Heavy vehicles would be restricted to specified routes, with the aim of avoiding local streets, high pedestrian areas and school zones. Where feasible, route markers would be installed for heavy vehicles along designated routes.
~~N.4~~ O.4	Directional signage would be provided at each corridor access point to assist in deliveries to each work site.
~~N.5~~ O.5	Signs would be provided at each access point for pedestrian and cyclist guidance.
~~N.6~~ O.6	Limit off-site construction vehicle parking to designated areas. Areas of temporary on-street parking during peak construction events would be identified in the traffic management plans to minimise the impact on surrounding properties and businesses.
~~N.7~~ O.7	The queuing and idling of construction vehicles in residential streets would be minimised.
~~N.8~~ O.8	An emergency response plan would be developed for construction traffic incidents.
~~N.9~~ O.9	A pre and post construction assessment of road pavement assets would be conducted in areas likely to be used by heavy construction vehicles.

ID number	Environmental management measure
~~N.10~~ O.10	Where required, public communications would be conducted to advise the community and local residents of vehicle movements and anticipated effects on the local road network relating to site works in accordance with the CEMP.
~~N.11~~ O.11	Access to all private properties adjacent to the works would be maintained during construction, unless otherwise agreed with property owners.
~~N.12~~ O.12	During project inductions, all heavy vehicle drivers would be provided with the emergency response plan for construction traffic incidents.
~~N.13~~ O.13	Undertake construction vehicle traffic movements outside of peak road traffic periods and outside of school peak periods where feasible.
~~N.14~~ O.14	Where required, improvements to the existing access tracks within the rail corridor would be provided to facilitate safe construction vehicle access into/out of the construction compounds.
~~N.15~~ O.15	Bus stops, taxi ranks and kiss-and-ride locations affected by construction would be temporarily relocated to nearby convenient locations so that they remain available throughout construction. Agreement of the asset owners and consultation with transport providers would be undertaken.
~~N.16~~ O.16	Local bus operators would be consulted to ensure that the timing of short term road or kerb closures (if required) minimise impacts to bus services.
~~N.17~~ O.17	Coordination of proposal staging, vehicle movement and scheduling, equipment and resourcing, joint use of access points and regular project liaison between the NWRL and ETTT projects.
~~N.18~~ O.18	Affected stakeholders, such as local government authorities, emergency services, local schools, public transport operators, public transport users, road users, local businesses, local employees and residents, would receive advance notification of scheduled construction works to allow for planning of required journeys.
~~N.19~~ O.19	The construction of the ETTT proposal would be undertaken and staged so that it does not affect timetabled passenger and freight operations other than during scheduled track closedowns or and as otherwise agreed with RailCorp and ~~TfNSW~~ Transport for NSW. As discussed in Section 5.7.1 of the EIS, additional closedowns may potentially be required.
~~N.20~~ O.20	Construction methods would seek to minimise the number of trucks using the public road network by: ▪ delivering construction materials via rail to the construction sites, where possible and feasible ▪ using the rail corridor, where possible, to move machinery and materials.
~~N.21~~ O.21	Changes to station facilities would be staged and communicated via signage so that new or temporary facilities are commissioned before the old facilities are closed, where possible.
~~N.22~~ O.22	Any loss of designated commuter car parking during construction at Cheltenham and Beecroft Stations would be accommodated on local streets within a 400 metres walking distance of these stations.
~~N.23~~ O.23	Any loss of other parking near construction sites, for example street parking, would be minimised in terms of duration. Consultation with Council to determine any temporary mitigation measures such as replacement timed parking would be carried out.
~~N.24~~ O.24	Any affected bicycle facilities, e.g. lockers, racks hoops/rails, would be reinstated to a location close to the new station entrance in consultation with Hornsby Shire Council.
~~N.25~~ O.25	Appropriate information signage, road and traffic signage, pavement markings and linemarking are to be implemented to advise commuters of the changed designated commuter car parking conditions.
~~N.26~~ O.26	Left-in and left-out only vehicle movements would be provided ~~at construction worksites S1 and S6~~ at the following locations: ▪ into and out-of construction compound S1 from Beecroft Road ▪ at the Beecroft Road/Old Beecroft Road intersection ▪ at the Beecroft Road/The Crescent/Kirkham Road intersection ▪ into and out-of construction compound S6 from Yarrara Road.

ID number	Environmental management measure
O.27	Site accesses for construction compounds would be designed so that left-in-left out movements occur within existing kerbside lanes, vehicles do not encroach onto the wrong side of the road when entering or leaving the sites and all vehicles can enter and exit the sites in a forward direction. Where this is not feasible, consultation would be undertaken with Hornsby Shire Council or RMS (depending on road ownership) and Traffic Management Centre (TMC) to determine appropriate traffic management measures.
Historic heritage	
~~O.1~~ P.1	Historic heritage items would be identified on the construction contractor's environmental control maps.
~~O.2~~ P.2	As much vegetation as possible would be retained between the rail corridor and Beecroft Road/Wongala Crescent. Cleared vegetation would be replanted, where appropriate, as soon as possible after completion of construction.
~~O.3~~ P.3	Vibration monitoring would be undertaken to monitor vibration levels in the vicinity of the Devlins Creek causeway. Where levels are deemed to potentially result in impacts to the causeway, vibration intensive works would stop and an investigation ~~to be~~ undertaken to identify actions to minimise the vibration levels.
~~O.4~~ P.4	Wherever possible, screening vegetation would be retained or replanted along the southern side of the proposed Cheltenham Station commuter car park to mitigate any impacts to the views and setting of Numbers 50–56 The Crescent.
~~O.5~~ P.5	Should any 'relics' be discovered during works, the NSW Heritage Council would be notified in accordance with Section 146 of the *Heritage Act 1977*.
~~O.6~~ P.6	If any unanticipated archaeological deposits are identified within the proposal site during construction, work likely to impact on the deposit would cease immediately and the NSW Heritage Council and an archaeologist would be contacted. Where required, further archaeological work and/or consents would be obtained prior to works recommencing at the location.
P.7	The causeway over Devlins Creek would be fenced off during construction to assist in identifying its location on the ground and minimise potential accidental damage (except where the causeway is within the waterway).
P.8	If any vibration damage to the causeway is identified, works are to stop while investigation of the damage and potential options to minimise further damage are undertaken. Any damage to the causeway is to be reported to the Heritage Council immediately.
P.9	Measures would be implemented during construction to ensure the protection of the remaining Bunya Pines within the formal garden at Beecroft Station.
P.10	Prior to the construction of the temporary embankment for the proposed M2 Motorway overbridge, the exposed portions of the causeway (that would not be protected by the culvert and retaining walls) would be covered with plastic sheeting so that the embankment can be easily removed following the completion of works, without any impacts to the stone. Excavations in the vicinity of the causeway would be supervised by a suitably qualified archaeologist to reduce the potential for accidental impact during construction.
Aboriginal heritage	
~~P.1~~ Q.1	If Aboriginal objects are located during works, all works must stop in the vicinity of the find, and the NSW Office of Environment and Heritage, Metropolitan Local Aboriginal Land Council, Deerubbin Local Aboriginal Land Council and an archaeologist would be notified. Where required, further archaeological investigations would be undertaken before works recommence.
~~P.2~~ Q.2	If the proposal design is changed, and areas not surveyed are to be impacted, further archaeological assessment would be undertaken.
Surface and groundwater	
~~Q.1~~ R.1	Clean water would be diverted around the work site using drainage and management techniques within Landcom's (2004) *Managing Urban Stormwater: Soils and Construction* document.
~~Q.2~~ R.2	Surface water quality would be managed in line with Landcom's (2004) *Managing Urban Stormwater: Soils and Construction* document and ~~TfNSW's~~ Transport for NSW's Water Discharge and Reuse Guidelines (2012e).
~~Q.3~~	Procedures to maintain acceptable water quality and for the management of chemicals and hazardous materials (including spill management procedures, use of spill kits and procedures for

ID number	Environmental management measure
R.3	refuelling and maintaining construction vehicles/equipment) would be implemented during construction.
~~Q.4~~ R.4	No stockpiles of materials or storage of fuels or chemicals would be located within high/medium flood risk areas or adjacent to existing drainage culverts.
~~Q.5~~ R.5	Routine inspections of all construction vehicles and equipment would be undertaken for evidence of fuel/oil leaks. If found, vehicles would be serviced to remove the risk of leaks.
~~Q.6~~ R.6	All fuels, chemicals and hazardous liquids would be stored within bunded area in accordance with Australian standards and EPA Guidelines.
~~Q.7~~ R.7	Emergency spill kits would be kept on-site at all times. All staff would be made aware of the location of the spill kits and be trained in their use.
~~Q.8~~ R.8	Construction plant, vehicles and equipment would be refuelled off-site, or in designated re-fuelling areas located at a minimum distance of 50 metres from drainage lines or waterways.
~~Q.9~~ R.9	Existing RailCorp and Council drainage systems would remain operational throughout the construction of the proposal.
~~Q.10~~ R.10	Groundwater encountered during the construction of the proposal would be managed in accordance with the requirements of the *Waste Classification Guidelines* (DECCW 2009a) and ~~TfNSW's~~ Transport for NSW Water Discharge and Re-use Guideline (2012e).
Soils and earthworks	
~~R.1~~ S.1	An erosion and sediment control plan would be prepared in accordance with Volume 2D of Managing Urban Stormwater: Soils and Construction (DECCW 2008b). The erosion and sediment control plans would be established prior to the commencement of construction and be updated as relevant to the changing construction activities. Particular emphasis would be placed on areas identified as high or extremely high erosional hazard. The following measures would be included in the erosion and sediment control plan: ▪ Disturbed surfaces would be stabilised as quickly as practicable after construction. ▪ The amount of material transported from the site to surrounding pavement surfaces (in particularly road surfaces) would be minimised. ▪ Erosion and sediment control measures would be regularly inspected and maintained (particularly following rainfall events) to ensure their effectiveness. ▪ Erosion and sediment control measures would be left in place until the works are complete or areas are stabilised. ▪ Temporary and permanent energy dissipation measures would be designed and implemented to protect receiving environments from erosion. ▪ Works would be managed during rainfall (or whilst the ground remains sodden) to minimise vehicle disturbance to the topsoil. ▪ Procedures for handling asbestos contaminated materials, including record keeping, site personnel awareness and waste disposal would be undertaken as necessary in accordance with Workcover requirements.
S.2	A Contamination Management Plan would be prepared as part of the CEMP. The Contamination Plan would include specific requirements for further investigation, remediation and management of any contamination identified from the Stage 1 and Stage 2 site investigations. Should unidentified contamination (excluding asbestos) be discovered during construction, work in the affected area would cease immediately, and an investigation would be undertaken and a report prepared to determine the nature, extent and degree of any contamination. The level of reporting would be appropriate for the identified contamination in accordance with EPA *Guidelines for Consultants Reporting on Contaminated Sites*.
S.3	An Asbestos Management Plan would be developed in accordance with the *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia (2009)* and included as part of the CEMP. If previously unidentified asbestos contamination is discovered during construction, work in the affected area would cease immediately, and an investigation would be undertaken and report

ID number	Environmental management measure
	prepared to determine the nature, extent and degree of the asbestos contamination. The level of reporting would be appropriate for the identified contamination in accordance with relevant EPA and WorkCover Guidelines and would include the proposed methodology for the remediation of the asbestos contamination. Remediation activities would not take place until receipt of the investigation report. Works would only recommence upon receipt of a validation report from a suitably qualified contamination specialist that the remediation activities have been undertaken in accordance with the investigation report and remediation methodology.
~~R.2~~ S.4	All spoil would be tested to determine the appropriate waste classification under the *Waste Classification Guidelines* (DECCW 2009) and method of disposal prior to removal from site.
S.5	Erosion and sediment control measures would be installed prior to the commencement of any works.
S.6	Reuse options at offsite locations would be investigated prior to disposing excess spoil material to landfill.
Air quality	
~~S.1~~ T.1	Limit vehicle movements to designated entries and exits, haulage routes and parking areas. Site exits would be fitted with hardstand material or other appropriate measures to limit the amount of material transported off-site (where required).
~~S.2~~ T.2	Visually monitor dust and where necessary implement the following measures: ▪ Apply water to exposed surfaces that are causing dust generation. Surfaces may include unpaved roads, stockpiles, hardstand areas and other exposed surfaces (for example recently graded areas). ▪ Cover loads on trucks transporting material to and from the construction site. Securely fix tailgates of road transport trucks prior to loading and immediately after unloading. ▪ Prevent where possible, or remove, mud and dirt being tracked onto sealed road surfaces. ▪ Limit vehicle speeds along unsealed construction access routes. ▪ Limit the area and duration of exposed or unconsolidated areas. For example, stage vegetation stripping or grading where possible, cover unconsolidated stockpiles, or apply hydro mulch or other revegetation applicant to stockpiles or surfaces left standing for extended periods. ▪ Promote and maintain awareness of weather forecasts to support anticipation of unfavorable conditions.
~~S.3~~ T.3	Ensure plant and machinery is regularly checked and maintained in a proper and efficient condition.
Land use and property	
U.1	The construction contractor would 'make good' any inadvertent damage to private property arising directly from the construction of the ETTT proposal at no cost to the owner.
Greenhouse gases	
~~T.1~~ V.1	Methods for management of emissions would be incorporated into site inductions, training and pre-start talks.
~~T.2~~ V.2	Activities with the potential to cause substantial emissions such as material delivery and loading and bulk earthworks would be identified. Work practices which minimise emissions during these activities would be investigated and applied where reasonable and feasible. These would potentially include: ▪ use of biodiesel and other low carbon fuels in vehicles and equipment. ▪ use of fuel-efficient construction equipment with the latest technology.
~~T.3~~ V.3	Procurement of construction services and materials locally to minimise the distance travelled and therefore emissions of vehicles accessing the site.
~~T.4~~ V.4	During construction planning, ensure that deliveries are managed in an efficient manner to minimise the number of trips required and therefore reduce the amount of emissions.
~~T.5~~ V.5	Vehicles are to be switched off when not in use to minimise idling.

ID number	Environmental management measure
~~T.6~~ V.6	Selection of materials during construction planning to ensure products that reduce embodied carbon are considered and used.
Cumulative issues	
~~U.1~~ W.1	The potential cumulative construction impacts associated with the proposal would be further considered as the detailed design of the proposal is developed. Mitigation measures would be developed and implemented as appropriate during the construction of the proposal. Mitigation measures during construction of the proposal would include, but not be limited to: ▪ preparation of the following sub-plans as part of the project CEMP to mitigate the following potential impacts: ‣ traffic management plan ‣ noise and vibration management plan ‣ water quality including natural waterways and stormwater run-off.
~~U.2~~ W.2	~~TfNSW~~ Transport for NSW would coordinate activities with the proponents of other major projects, including the NWRL project, in the area to minimise any potential cumulative impacts.

6.3 Operation

The revised environmental management measures to be implemented during the operation of the proposal are listed in Table 6.3.

Table 6.3 Revised operation environmental management measures

ID number	Environmental management measure
General	
~~V.1~~ X.1	Contingency management would be managed in line with RailCorp's existing procedures.
Ecology	
~~W.1~~ Y.1	Post-construction weed control activities would be undertaken in accordance with RailCorp's existing weed control protocols.
Noise and vibration	
~~X.1~~ Z.1	Upon completion of detailed design for the ETTT proposal, a further reasonable and feasible review would be undertaken to confirm the final mitigation measures for operational noise and vibration that would be implemented. The review would: ▪ consider any changes to the predicted noise and vibration levels resulting from design refinements ▪ examine all reasonable and feasible noise and vibration mitigation measures consistent with the IGANRIP ▪ identify specific physical and other mitigation measures for controlling noise and vibration at the source and at the receiver (if relevant) including location, type and timing implementation of the proposed operational noise and vibration mitigation measures ▪ seek feedback from directly affected receivers on the final mitigation measures proposed in the review ▪ consider measures identified in the NSW Government's broader noise mitigation program and the role this would play in mitigation at the project level.
~~X.2~~ Z.2	In order to validate the predicted noise levels identified in the noise and vibration assessment, monitoring would be undertaken within three months of commencement of operation. This noise and vibration monitoring would be undertaken to confirm compliance with the predicted noise and vibration levels, or as modified by the reasonable and feasible review. Should the results of monitoring indicate that the predicted noise and vibration levels are exceeded, additional reasonable and feasible mitigation measures would be implemented in consultation with the affected property owners.

ID number	Environmental management measure
Surface and groundwater quality	
~~Y.1~~ AA.1	Operational water quality impacts would be managed in accordance with RailCorp's existing environmental management and maintenance procedures.
Soils and earthworks	
~~Z.1~~ AB.1	Potential erosion and sedimentation impacts would be managed through the implementation of RailCorp's operational and management procedures.

7. Conclusion

The ETTT EIS included a comprehensive assessment of the likely environmental impacts of the proposal and proposed, where appropriate, environmental management measures to address these potential impacts. This included an assessment of issues raised by the community during consultation held during the development of the EIS.

The EIS was placed on public exhibition from 19 September 2012 to 5 November 2012. A comprehensive community engagement program was undertaken to encourage community feedback on the proposal during this period.

A total of 426 submissions (including 15 third-party submissions) were received from the community. This included a petition signed by 582 people. A further six submissions were received from government agencies. This Submissions Report has documented submissions received and outlined Transport for NSW's responses to them.

A number of design changes and new environmental management measures are proposed in response to the submissions received and further design development. Additionally, some of the existing environmental management measures have been amended or removed. These changes would minimise and mitigate impacts of the ETTT proposal.

8. References

Australian Rail Track Corporation (ARTC) 2008, 2008-2024 Interstate and Hunter Valley Rail Infrastructure Strategy.

Commonwealth of Australia 2007, Sydney – Brisbane Corridor Strategy: Building Our National Transport Future, June 2007.

Department of Environment and Climate Change (DECC) 2007, Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects.

Department of Environment and Climate Change 2008, *Recovery Plan for the Koala (Phascolarctos cinereus) (Approved)*, Department of Environment and Climate Change, Sydney.

Department of Environment and Climate Change (DECC) 2009, *Interim Construction Noise Guideline*.

Department of Environment and Conservation (DEC) 2004, Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft)

Department of Environment and Conservation (DEC) 2005, Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.

Department of Environment, Climate Change and Water (DECCW) 2008a, *Hygiene Protocol for the Control of Disease in Frogs*.

Department of Environment, Climate Change and Water (DECCW) 2008b, *Managing Urban Stormwater: Soils and Construction – Volume 2D*.

Department of Environment, Climate Change and Water (DECCW) 2009, *Waste Classification Guidelines: Part 1 Classifying Waste*.

Department of Planning 2008, Development near rail corridors and busy roads – interim guideline.

Department of Transport and Regional Services (DOTARS) 2007, *Sydney Urban Corridor Strategy, DOTARS*.

Environment Protection Authority (EPA) 2006, *Assessing Vibration: a technical guideline*.

Keith, D. 2004, Ocean shores to desert dunes: the native vegetation of New South Wales and the Act, Department of Environment and Conservation, Hurstville.

Golder Associates 2011, Epping to Thornleigh Third Track Phase II Environmental Site Assessment and In-Situ Waste Classification, 22 December 2011.

Infrastructure Australia 2011, National Land Freight Strategy: Discussion Paper, February 2011.

LandArc Pty Ltd 2008, Hornsby Shire Heritage Review – Stage 4, Volume 1 of 4, Part A: Review of Heritage Listed Trees, Beecroft – Hornsby.

Landcom 2004, Managing Urban Stormwater: Soils and Construction.

Lilley W. B. 1996, Quantification and Dispersion Modelling of Diesel Locomotive Emissions, Thesis.

National Environment Protection Council 1998, National Environmental Protection (Ambient Air Quality) Measure.

National Environment Protection Council 2003, National Environmental Protection (Ambient Air Quality) Measure.

NSW Government 2004, Planning Guidelines for Walking and Cycling.

NSW Heritage Office 1996, *NSW Heritage Manual*.

NSW Office of Environment and Heritage (OEH) 2011, Interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects.

Perumal Murphy Wu Pty Ltd 1993, *Hornsby Shire heritage study*.

RailCorp 2006, Revegetation Treatments for RailCorp Lands — Design Guidance and Specification.

Transport for New South Wales (Transport for NSW) 2011a, *Construction Noise Strategy*.

Transport for New South Wales (Transport for NSW) 2011b, NSW sustainable design guidelines for rail, version 2: Transport for New South Wales Transport Project Division and RailCorp. Prepared for Transport for NSW, December 2011.

Transport for New South Wales (Transport for NSW) 2012a, *Draft NSW Freight and Ports Strategy*.

Transport for New South Wales (Transport for NSW) 2012b, *Final Long Term Transport Master Plan.*

Transport for New South Wales (Transport for NSW) 2012c, *North West Rail Link: Environmental Impact Statement Stage 1 – Major Civil Construction Works*.

Transport for New South Wales (Transport for NSW) 2012d, *Northern Sydney Freight Corridor Strategic Review Report*.

Transport for New South Wales (Transport for NSW) 2012e, *Water Discharge and Reuse Guidelines*.

World Health Organization (WHO) 1999, *Guidelines on Community Noise*.

World Health Organization (WHO) 2009, European Night Noise Guidelines for Europe.

World Health Organization (WHO) 2011, Burden of Disease from Environmental Noise.