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## 4 DETAILED DESCRIPTION OF PROPOSAL

### 4.1 Key Proposal Components

The subject of this PER is the UPDC for a new section of the PDNH between Reid Highway and Muchea. The UPDC has been sufficiently defined to describe the ultimate design of the proposal when completed. However, construction is likely to be undertaken in several stages, with the first 'design and construct' tenders being called for in 2016 or 2017. The exact staging has not yet been determined, though it will be influenced by a number of factors including government priorities, funding availability, urban growth and traffic demand.

The proposal as defined in the UPDC includes the following key components:

- Approximately 38 km of new dual carriage road.
- Grade separated interchanges with key existing roads.
- Bridges and culverts.
- Water retention basins and other drainage structures.
- A PSP within the road reservation.
- A road train assembly area (RTAA).
- A traveller's rest area.
- Landscaping and revegetation works.
- Modifications to local roads.

This PER assesses the environmental impact of the works associated with construction and operation of the proposal. Activities that generally form part of the construction phase include:

- Vegetation removal and topsoil stripping.
- Earthworks.
- Excavation of road cuttings.
- Placement of fill, compaction and embankment foundations.
- Piling and construction foundations.
- Overpass construction.
- Stormwater drainage installation.
- Pavement construction.
- Road surfacing.
- Culvert supply and installation.
- Installation of associated road furniture.
- Relocation of services.
- Modifications to local roads.

- Construction of drainage basins.
- Construction of a PSP.
- Construction of noise and visual screen walls.
- Use of water for construction purposes (likely to be from existing bores).
- Traffic management.

More detail on each of the proposal components is provided in the sections below.

## **4.2 Route Alignment**

### **4.2.1 Overview of Alignment**

Approximately 38 km of new dual carriage road will be constructed along an alignment between Malaga and Muchea. Starting at the intersection of Tonkin Highway and Reid Highway, the road will travel north on a new alignment west of Beechboro Road through Cullacabardee. The road will turn to the northeast to pass through the northwest corner of Whiteman Park before crossing Gnangara Road and entering the Gnangara–Moore River State Forest. The road will travel through an existing road reservation forming the western boundary of Ellenbrook, turning north at Maralla Road. The alignment will then run parallel to and about 500 m west of Railway Parade as it passes through Bullsbrook, before turning northeast again to cross Railway Parade and the Midland–Geraldton railway line. South of Muchea, the road will cross Ellen Brook and join the existing Great Northern Highway at the approximate location of the existing Brand Highway and Great Northern Highway intersection (Figure 4.1).

In areas of flatter terrain (e.g. north of Maralla Road), the PDNH will be built up to a height of about 1 to 2 m above the surrounding landscape. Cuttings and embankments will be required in undulating areas (e.g. around Ellenbrook). North of Maralla Road, initial construction will allow for a single carriageway with at grade intersections. The UPDC will include a dual carriageway and grade separated interchanges.

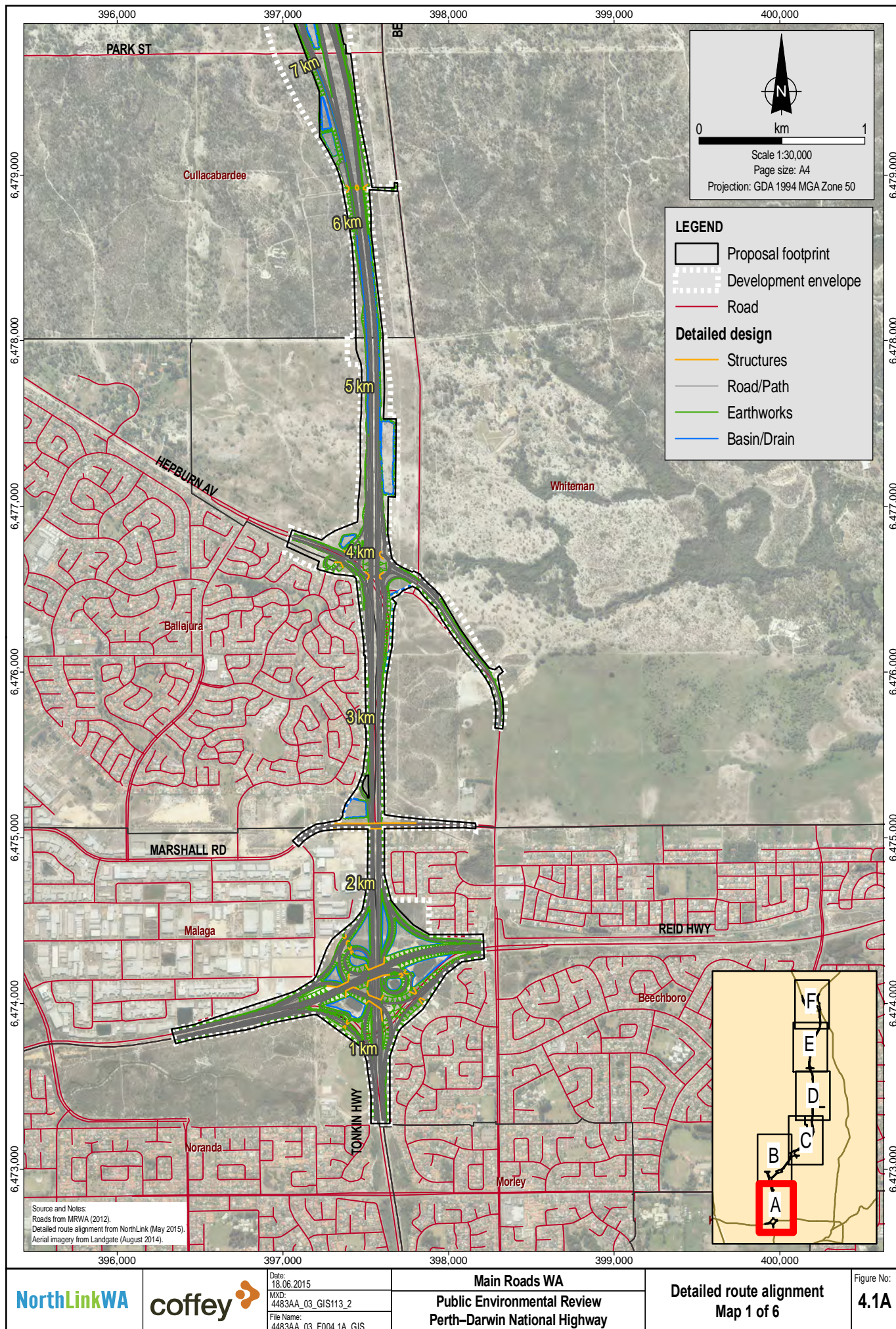
The number of traffic lanes included in the road design varies from four in each direction between Tonkin Highway/Reid Highway and Hepburn Avenue to two in each direction at the Muchea end. The final width of the road reserve will be up to approximately 100 m. The road reservation widens locally at interchanges and where additional features such as storm water retention basins are required.

Between Tonkin Highway/Reid Highway in Malaga and Gnangara Road, a reservation of 16 m will be retained in the central median for a future dual track passenger railway. A similar reservation is intended for the future EWNSR and, accordingly, the PDNH–EWNSR interchange design makes an allowance for this. Neither railway forms part of this proposal.

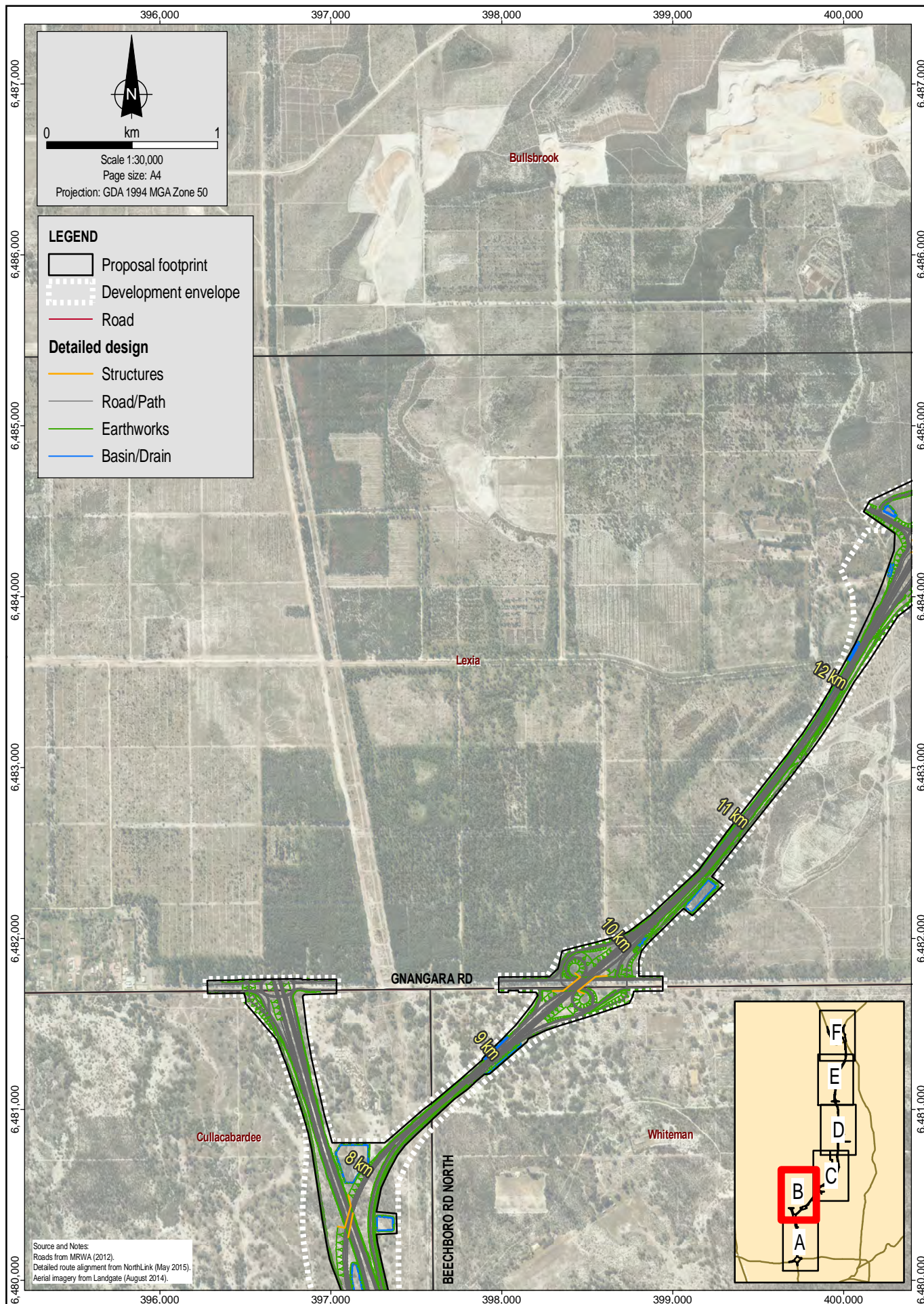
In addition to the road and the central median, the final road reservation will accommodate the PSP, noise walls, landscaping and associated earthworks to support the proposal. Figure 4.2 shows a conceptual cross-section of these components.

The final proposal footprint is expected to be approximately 746 ha.

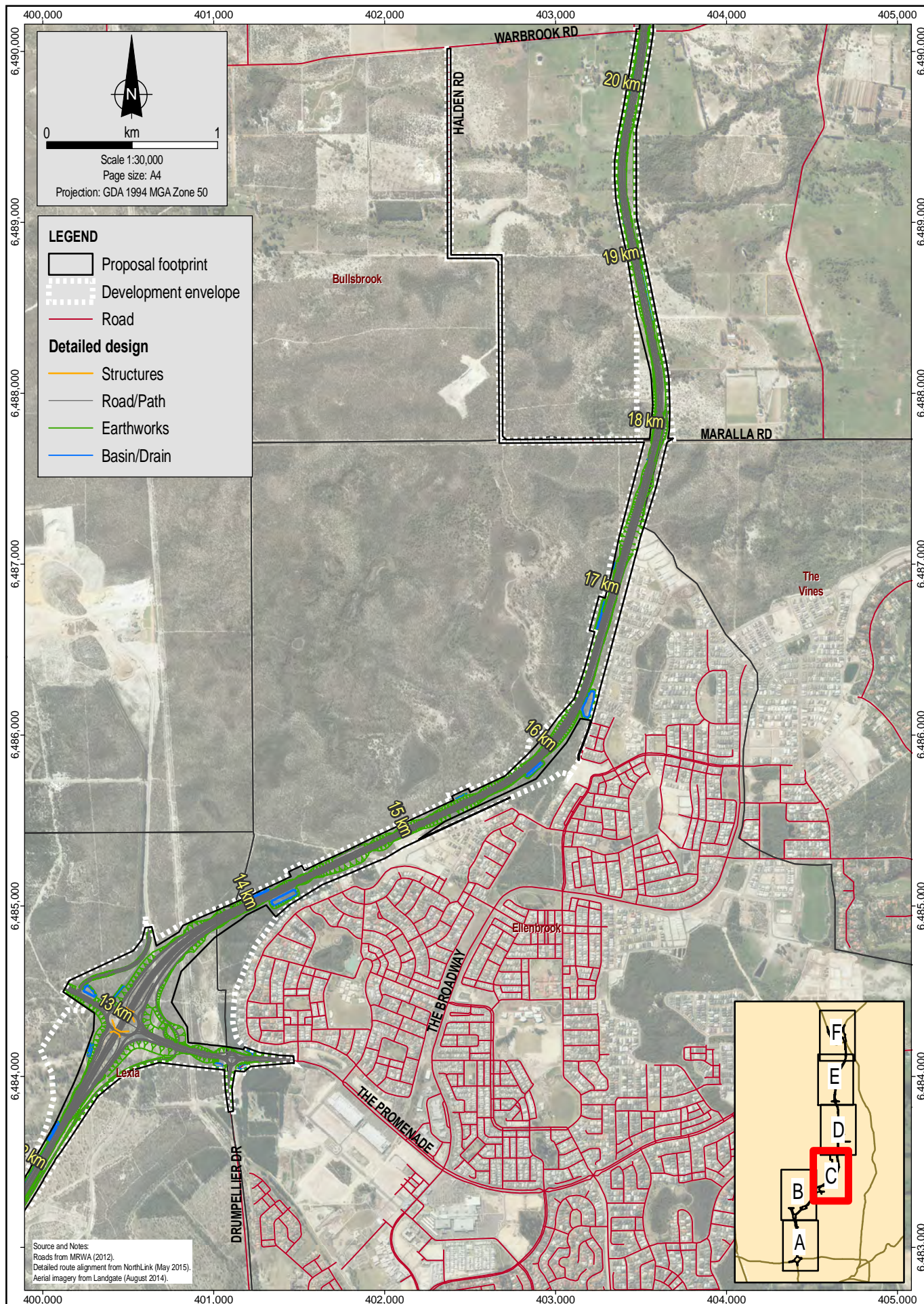




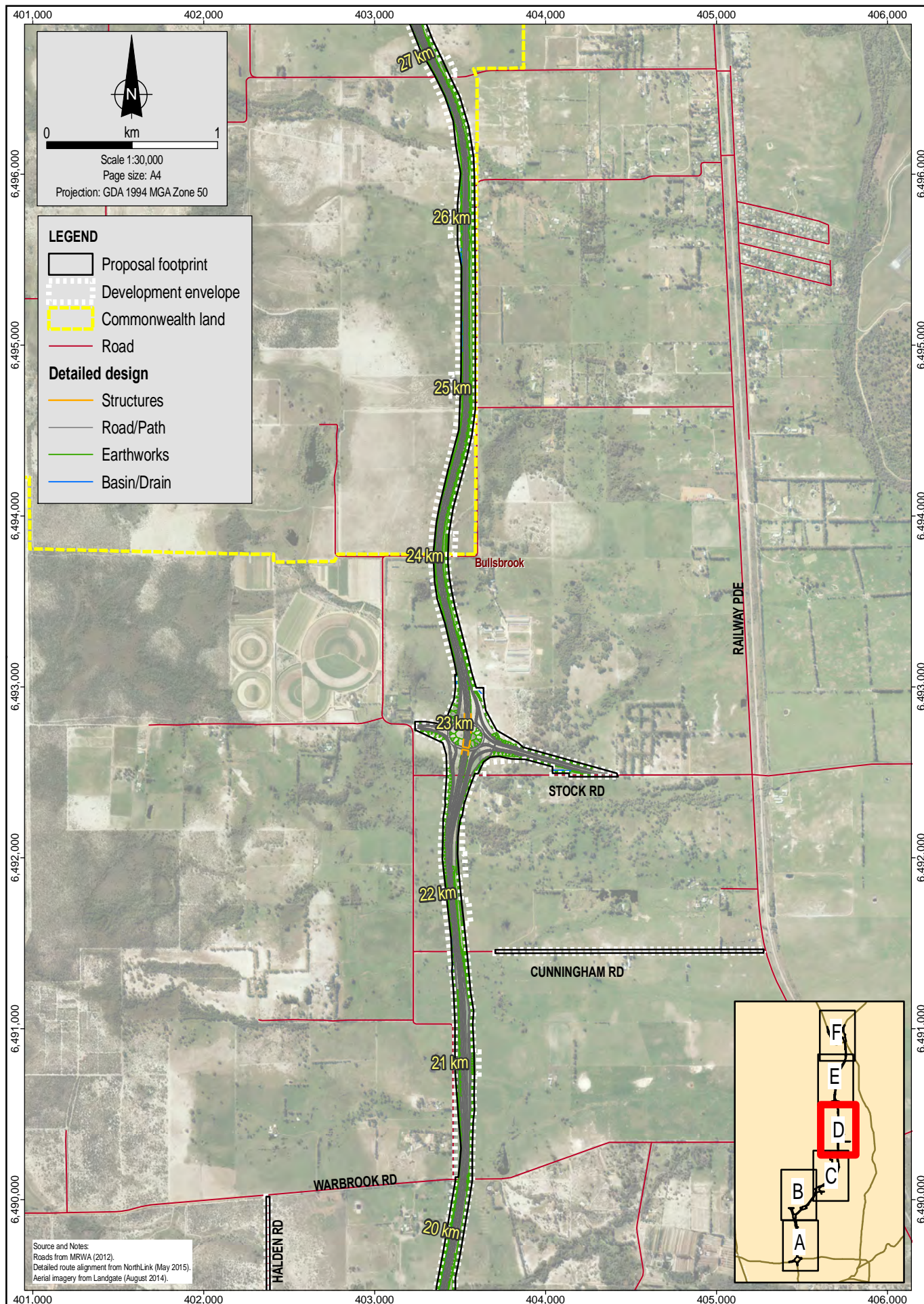




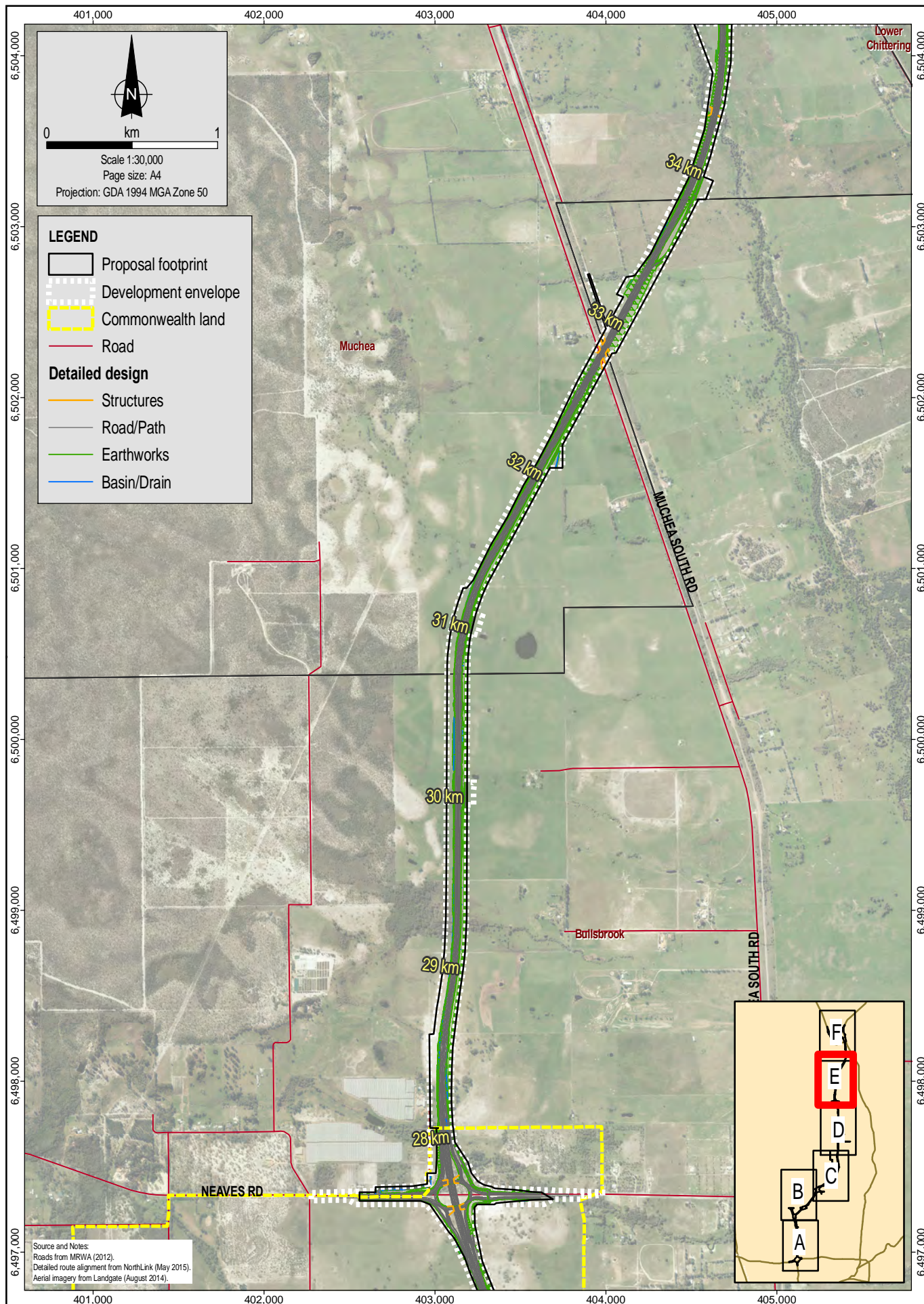




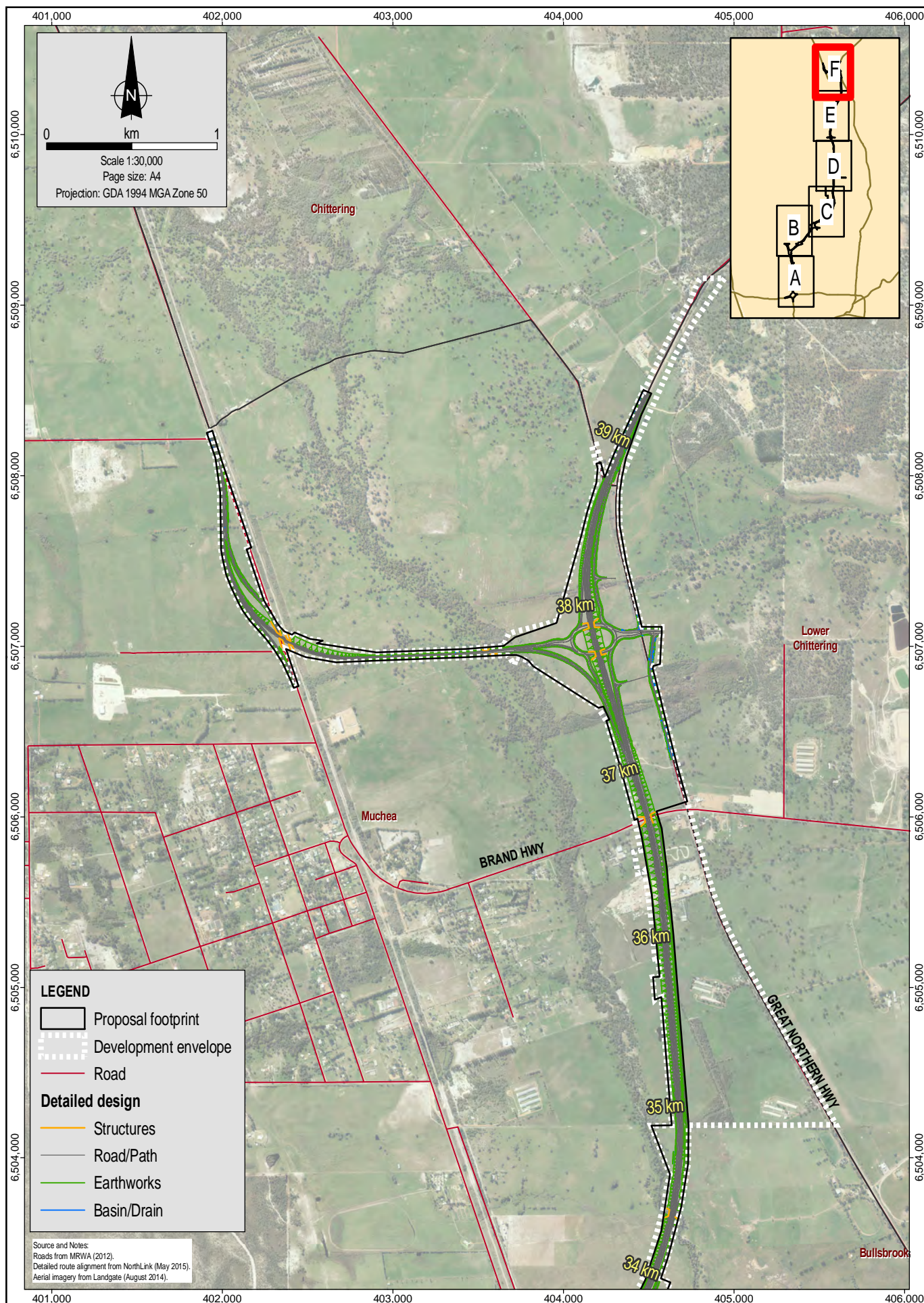






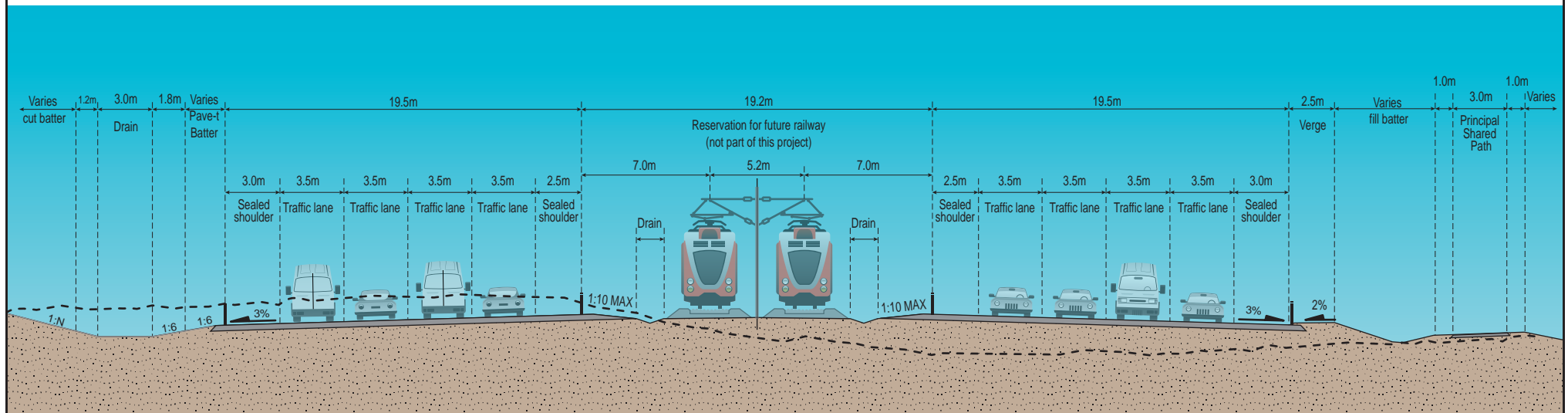




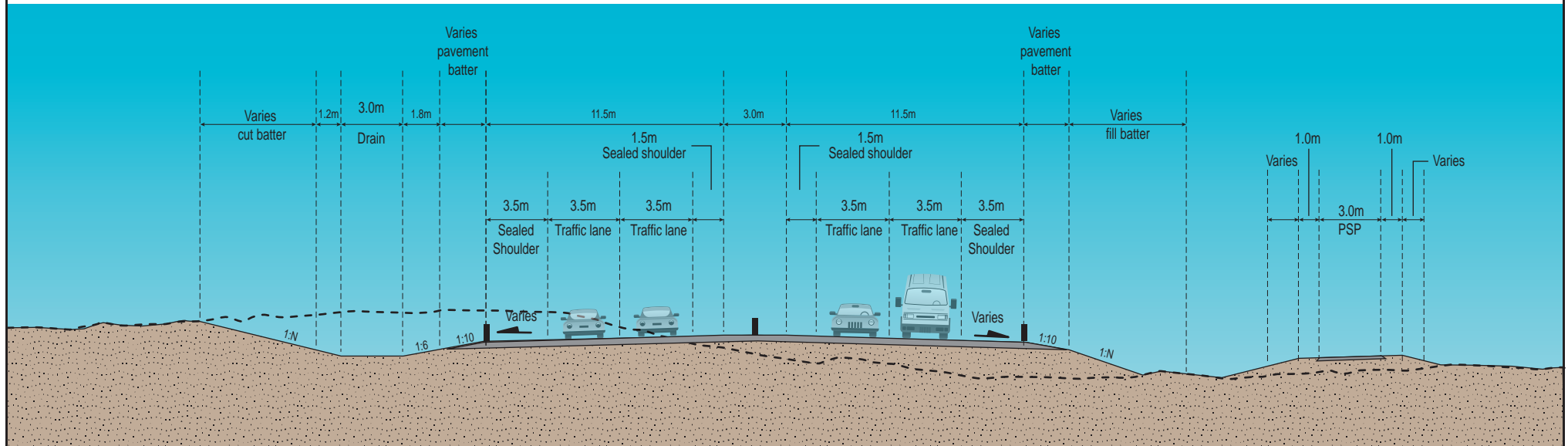




Typical urban cross-section



Typical rural cross-section



Source: NorthLink drawing NLWA-00-RD-SK-0002\_B (draft).  
Note: Drawing is not to scale and is for illustrative purposes only.  
Railway is shown only to illustrate future possible use of central median and is not proposed as part of this proposal.



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Main Roads WA  
Public Environmental Review  
Perth-Darwin National Highway

NorthLinkWA

Typical road cross-sections

Figure No:

4.2





#### **4.2.2 Alignment Changes Since Referral to Regulators**

The UPDC was developed within the nominal 100 m wide road reservation (original development envelope) that formed the basis of the referral under the EPBC Act to the DOTE on 31 October 2013 (EPBC 2013/7042) and the referral to the EPA under Section 38 of the EP Act (Part IV) on 25 October 2013. This referral boundary is shown in Figure 4.3.

However, in a number of places the UPDC has resulted in the proposal being larger than the referral boundary (see Figure 4.3) in order to optimise the design. This has resulted in a redefinition of the development envelope. The additional areas required are described in Table 4.1.

The additional areas outside the referral boundary were surveyed in respect of flora, fauna, wetlands and heritage, but as no other key environmental factors were identified, it was not deemed necessary to refer these changes to the DOTE or EPA. Impacts associated with any changes have been addressed within this PER.

The component of the proposal along Reid Highway (as per the referral to the EPA and DOTE) extended from just east of Malaga Drive in Malaga to Altone Road in Beechboro. The development envelope was subsequently reduced to extend from approximately 750 m east of Malaga Drive to just west of Beechboro Road. This development envelope is approximately 975 ha and wholly contains the proposal footprint of approximately 746 ha.

The section to the east of Beechboro Road has been excluded from the development envelope as it is the subject of a previous approval (Ministerial Statement 376: Extension of Reid Highway from Beechboro Road to Great Northern Highway). Any construction works associated with the proposal along this section of Reid Highway will be undertaken in line with the conditions contained in Ministerial Statement 376.




**Table 4.1**      **Changes in development envelope**

Location	Change in development envelope	Relative impact as a result of change
Tonkin Highway	Construction of PSP to the west of Tonkin Highway requires an additional 0.12 ha, largely within the road reserve for Tonkin Highway.	The area contains low value Black Cockatoo foraging or roosting habitat and no additional potential Black Cockatoo breeding trees. This change will therefore not result in any significant increase in the impact the proposal may have on the environment.
Marshall Road overbridge	Construction of road infrastructure to the west of the Marshall overbridge resulted in an increased development envelope of approximately 1.41 ha. This additional area is within the current road reserve and will only require the upgrade of existing road infrastructure.	This area is located within a Resource Enhancement Wetland, which is 34 ha in size. This change will not result in any significant increase in the impact the proposal may have on the environment.
Northwest quadrant of the Hepburn Avenue interchange	An additional 0.85 ha was necessary to provide for a drainage basin.	This area is covered by <i>Corymbia</i> sparse mid woodland and cleared areas. The area contains low value Black Cockatoo foraging or roosting habitat and no additional potential Black Cockatoo breeding trees. This change will therefore not result in any significant increase in the impact the proposal may have on the environment.
Southeast of the Hepburn Avenue Interchange (along Beechboro Road North)	Beechboro Road North will be realigned slightly in this area to avoid impacting on a wetland. In addition, a water retention basin will be constructed in this area, which resulted in an increased development envelope of approximately 3.32 ha.	The retention basin will largely be constructed over an area that is currently an existing road. The remainder of the increased development envelope is in <i>Xanthorrhoea</i> open tall shrubland in a degraded condition. The area contains low value Black Cockatoo foraging or roosting habitat and no additional potential Black Cockatoo breeding trees. This change will not result in any significant increase in the impact the proposal may have on the environment.



Location	Change in development envelope	Relative impact as a result of change
South of Baal Street	An additional 1.07 ha was required to accommodate earthworks and batters along the western side of the alignment.	<p>This area is <i>Banksia</i> sparse low woodland (BaBm<sup>2</sup>) and <i>Corymbia</i> sparse mid woodland (CcEm<sup>2</sup>). The vegetation association BaBm<sup>2</sup> supports the following priority taxa: <i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>, <i>Hypolaena robusta</i>, and <i>Millotia tenuifolia</i> var. <i>laevis</i>. CcEm<sup>2</sup> supports the taxon <i>Millotia tenuifolia</i> var. <i>laevis</i>. The additional area required will not directly impact on any known locations of priority flora. The additional area for the development envelope is not considered to be a significant increase. The assessment of impacts associated with these vegetation associations across the proposal is addressed in detail in Chapter 8.</p> <p>The area contains moderate to high value Black Cockatoo foraging or roosting habitat and one additional potential Black Cockatoo breeding tree. This was not considered to constitute a significant increase in the impact the proposal may have on the environment, and the overall impact is addressed in Chapter 9.</p>
Baal Street	Consultation with the Cullacabardee community indicated a preference for access towards Ballajura and consequently the design makes provision for an access road to be located along the western MRS boundary of the proposal. To this end, an additional 0.75 ha of land is required at Baal Street east of the alignment.	<p>This area is <i>Banksia</i> sparse low woodland (BaBm<sup>2</sup>), which supports the following priority taxa: <i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>, <i>Hypolaena robusta</i> and <i>Millotia tenuifolia</i> var. <i>laevis</i>. The additional area required will not directly impact on any known locations of priority taxa. The additional area for the development envelope is not considered to be a significant increase in the impact the proposal may have on the environment. The assessment of impacts associated with this vegetation association across the proposal is addressed in detail in Chapter 8.</p> <p>The area contains moderate value Black Cockatoo foraging or roosting habitat and fewer than five additional potential Black Cockatoo breeding trees. This was not considered to constitute a significant increase in the impact the proposal may have on the environment, and the overall impact is addressed in Chapter 9.</p>






Location	Change in development envelope	Relative impact as a result of change
Gnangara Road/PDNH interchange	An additional 1.65 ha was required north of Gnangara Road, with another 0.75 ha required south of Gnangara Road as a result of the interchange design. Based on the predicted traffic volumes in 2050, an interchange configuration with a larger footprint will be required to accommodate the forecast traffic.	<p>The area north of Gnangara Road is <i>Pinus</i> mid woodland, while the area south of Gnangara Road is <i>Corymbia</i> sparse mid woodland (Cc<sup>1</sup>). The vegetation is considered to support minimal environmental values (no threatened or priority listed taxa or ecological communities) and is in a degraded to completely degraded condition.</p> <p>This additional area north of Gnangara Road does not contain Black Cockatoo foraging or roosting habitat. The area south of Gnangara Road contains high value Black Cockatoo foraging or roosting habitat and fewer than five additional potential Black Cockatoo breeding trees. This was not considered to constitute a significant increase in the impact the proposal may have on the environment, and the overall impact is addressed in Chapter 9.</p>




Location	Change in development envelope	Relative impact as a result of change
Interchange west of Ellenbrook	<p>It was identified that there was a need to realign the southbound exit ramp at The Promenade interchange further to the west to minimise impacts on the residential community in the area. The exit ramp will tie into a grade separated roundabout approximately 600 m to the west. This option also significantly reduced the footprint to the north of The Promenade. In association with this shift, the interchange at The Promenade was redesigned to avoid impacts on the Resource Enhancement Wetland 8541 in the southwest quadrant, which resulted in a northward shift of the interchange. This shift required an additional 6.9 ha to the northwest of the interchange. In addition, consultation with Rocla identified the need for access to a future quarry site west of The Promenade, Ellenbrook. In the original design no western link was provided at The Promenade interchange. Subsequent to consultation, the northern leg of Gaskell Avenue was designed to tie into the future Promenade western link.</p>	<p>This area is <i>Corymbia</i> sparse mid woodland (Plain on edge of Dampland) and <i>Eucalyptus</i> sparse mid woodland (Dune slopes, crests and flats). The area contains moderate to high value Black Cockatoo foraging or roosting habitat and between five and ten additional potential Black Cockatoo breeding trees. This was not considered to constitute a significant increase in the impact the proposal may have on the environment, and the overall impact is addressed in Chapter 9.</p> <p>Interchange west of Ellenbrook – an additional area of 3.69 ha was required to accommodate the PSP and earthworks south of the interchange. This area is <i>Banksia</i> sparse low woodland (BaBmMp), <i>Eucalyptus</i> sparse mid woodland (Et<sup>2</sup>) and <i>Pinus</i> mid woodland. The <i>Eucalyptus</i> sparse mid woodland supports the following threatened and priority taxa: <i>Caladenia huegelii</i>, <i>Anigozanthos humilis</i> subsp. <i>chrysanthus</i>, <i>Hypolaena robusta</i> and <i>Poranthera moorokatta</i>. The change to the interchange to facilitate the PSP will not clear any additional individuals/populations of the threatened and priority taxa.</p> <p>The area contains low to moderate value Black Cockatoo foraging or roosting habitat and less than five additional potential Black Cockatoo breeding trees. This was not considered to constitute a significant increase in the impact the proposal may have on the environment, and the overall impact is addressed in Chapter 9.</p>
Interchange west of Ellenbrook	<p>An additional area of 3.41 ha was required to accommodate the tie in with Drumpellier Drive and the Promenade.</p>	<p>This area is located in previously Cleared areas and <i>Pinus</i> mid woodland, and will not result in a significant increase in the impact the proposal may have on the environment.</p>

Location	Change in development envelope	Relative impact as a result of change
Basin west of Ellenbrook	An additional area of 0.63 ha was required for the construction of a water retention basis to the west of the most northern extent of Ellenbrook.	This area is <i>Banksia</i> sparse low woodland (Dune slopes and crests) and is located within the Priority 3 PEC SCP21c. The area contains moderate value Black Cockatoo foraging or roosting habitat and less than five additional potential Black Cockatoo breeding trees. This was not considered to constitute a significant increase in the impact the proposal may have on the environment, and the overall impact is addressed in Chapter 9.
Local roads north of Maralla Road	Construction of the proposal will require modifications to some local roads, including an upgrade to Maralla Road and Halden Road. These modifications extend over an area of 6.92 ha.	This area is <i>Banksia</i> sparse low woodland (Dune slopes and crests, and Flat plain to lower dune slopes), <i>Eucalyptus</i> sparse mid woodland (Dune rise), <i>Corymbia</i> sparse mid woodland and areas cleared for road infrastructure. This was not considered to constitute a significant increase in the impact the proposal may have on the environment, and the overall impact is addressed in Chapter 9.
Local roads north of Maralla Road	An upgrade to a portion of Cunningham Road west of Railway Parade will also be undertaken covering an area of 3.16 ha.	This area is open paddocks with remnant <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> subsp. <i>rudis</i> and contains between five and ten additional Black Cockatoo breeding trees. This was not considered to constitute a significant increase in the impact the proposal may have on the environment, and the overall impact is addressed in Chapter 9.
Stock Road interchange	Localised increase in footprint both at the interchange to accommodate a new configuration of the interchange and make provision for heavy vehicle inspection bays. These modification to the development envelope will require 4.42 ha northwest and west of the interchange and 4.51 ha east of the interchange.	This area is <i>Corymbia</i> sparse mid woodland vegetation association and previously cleared areas. This additional area of clearance was not considered to constitute a significant increase in the impact the proposal may have on the environment.



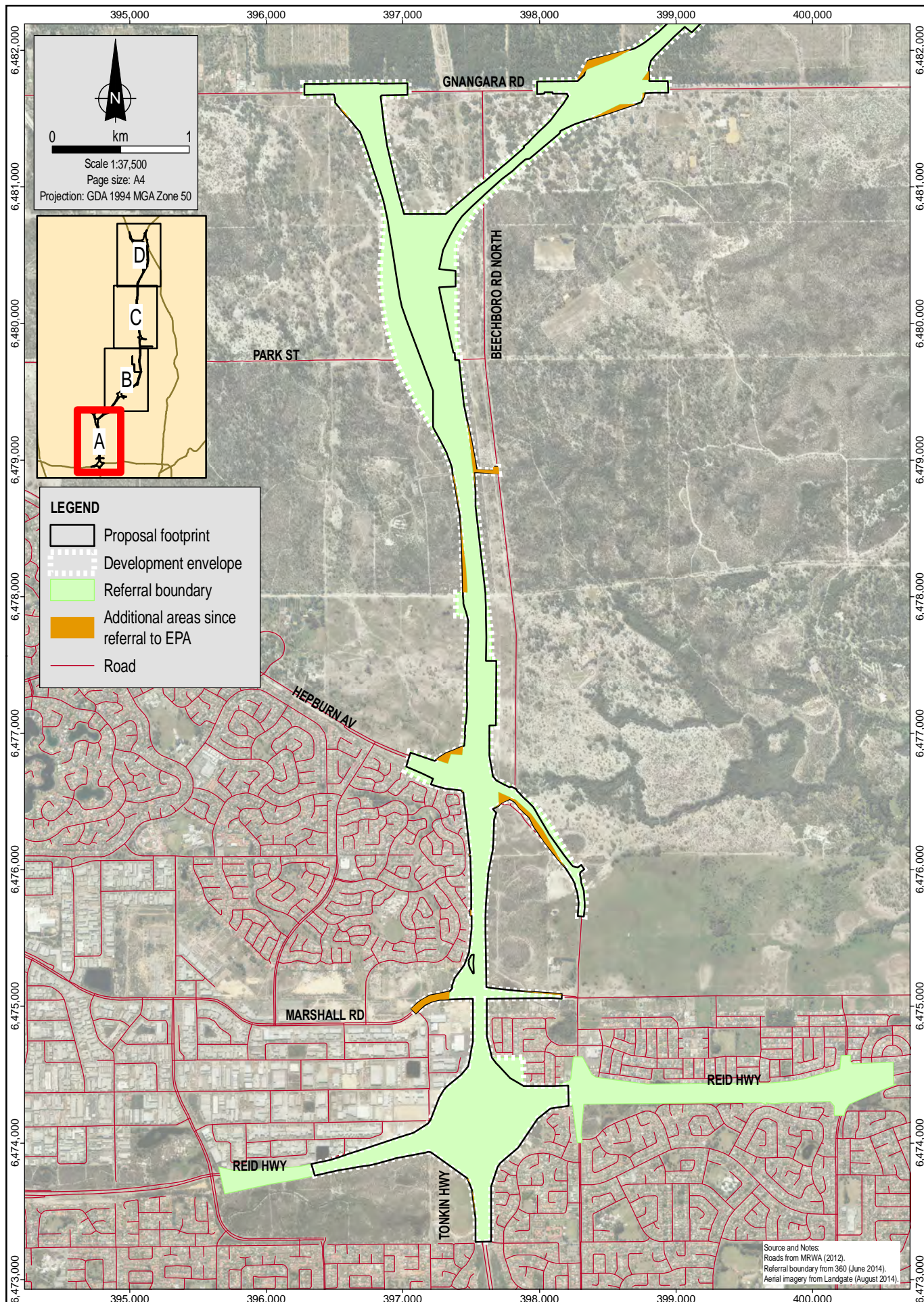


Location	Change in development envelope	Relative impact as a result of change
Neaves Road interchange	Localised increase in footprint at the interchange to accommodate a new configuration and batters. An additional area of 0.91 ha will be required northeast of the interchange.	<p>The area is largely <i>Melaleuca</i> open low woodland and <i>Corymbia</i> sparse mid woodland. This increase in the development envelope results in part of a Conservation Category Wetland being cleared. This is in addition to three other Conservation Category Wetlands already being impacted at this interchange. This impact on wetlands is addressed in Chapter 10.</p> <p>An additional 0.83 ha will be required to the southeast and southwest of the interchange. This area is <i>Corymbia</i> sparse mid woodland vegetation association, which consists of open paddocks with remnant <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> subsp. <i>rudis</i> over pasture species.</p> <p>The increased development envelope contains low value Black Cockatoo foraging or roosting habitat and no additional potential Black Cockatoo breeding trees. This was not considered to constitute a significant increase in the impact the proposal may have on the environment</p>
Local roads between Neaves Road and Muchea South Road	Localised increased in the development envelope to the west of the alignment to accommodate the construction of a local access road.	This is an existing cleared area 2.5 ha in size (comprising two areas of 2.14 ha and 0.36 ha, respectively), and will not result in a significant increase in the impact the proposal may have on the environment.

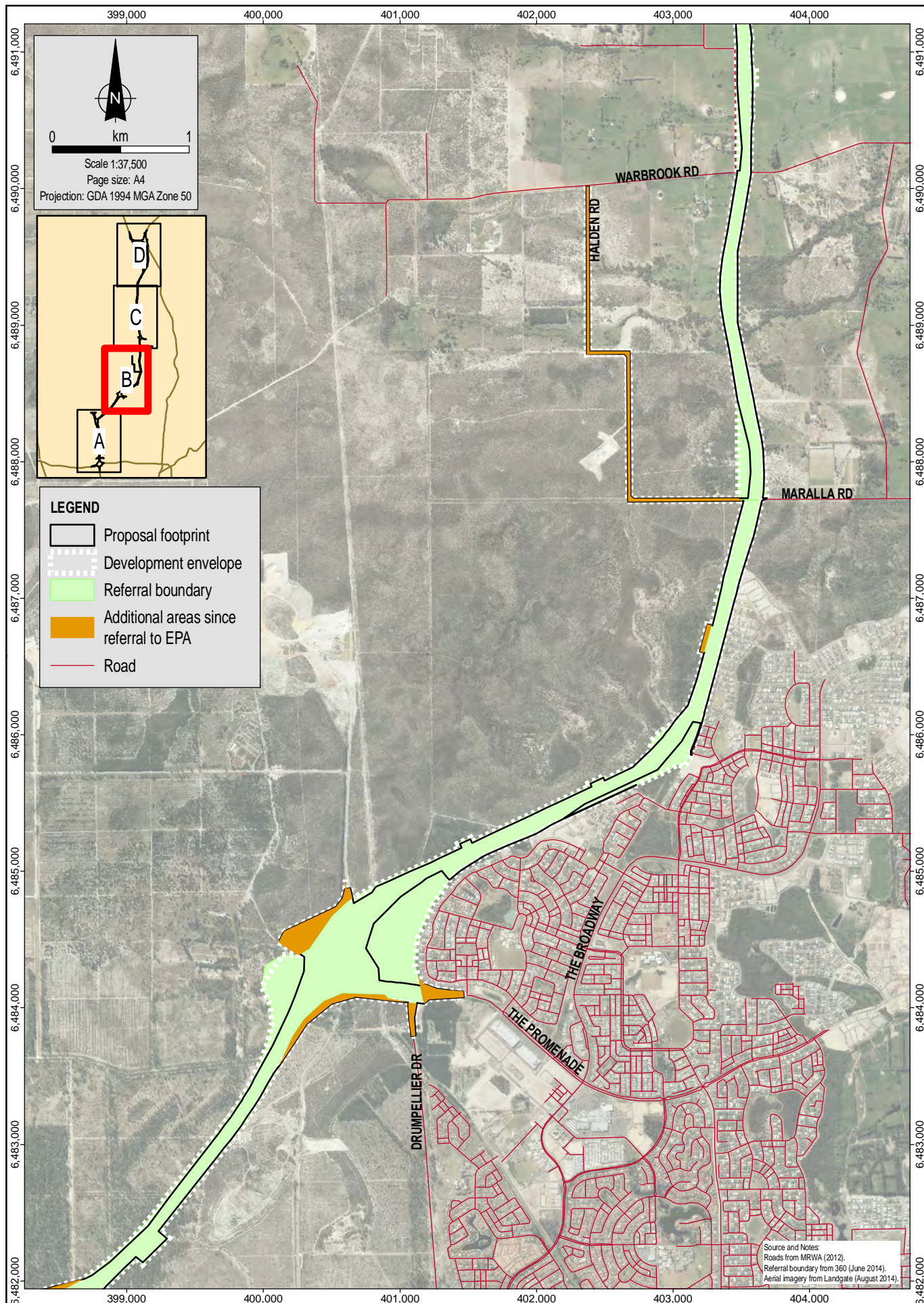


Location	Change in development envelope	Relative impact as a result of change
Interchange with Great Northern Highway and Brand Highway	Additional areas were required west of the referral boundary as a result of the interchange design. Based on the predicted traffic volumes in 2050, an interchange configuration with a larger footprint will be required. The interchange with Great Northern Highway will require an additional 17.21 ha, while the interchange with Brand Highway will require an additional 5.67 ha.	<p>The additional areas of the development envelope around Great Northern Highway are predominantly in existing cleared areas, with 0.79 ha within <i>Eucalyptus</i> sparse mid woodland (Creekline/floodplain). The area contains low value Black Cockatoo foraging or roosting habitat and between five and ten additional potential Black Cockatoo breeding trees. This was not considered to constitute a significant increase in the impact the proposal may have on the environment.</p> <p>The extended development envelope at Brand Highway is in areas previously cleared for rail and agricultural purposes, as well as open paddocks with remnant <i>Corymbia calophylla</i> and <i>Eucalyptus rudis</i> subsp. <i>rudis</i>. The amendment to the development envelope will not directly impact any threatened <i>Grevillea curviloba</i> subsp. <i>incurva</i> populations known to occur along the Brand Highway road reserve. The area contains low value Black Cockatoo foraging or roosting habitat. This increase in development envelope was not considered to constitute a significant increase in the impact the proposal may have on the environment.</p>

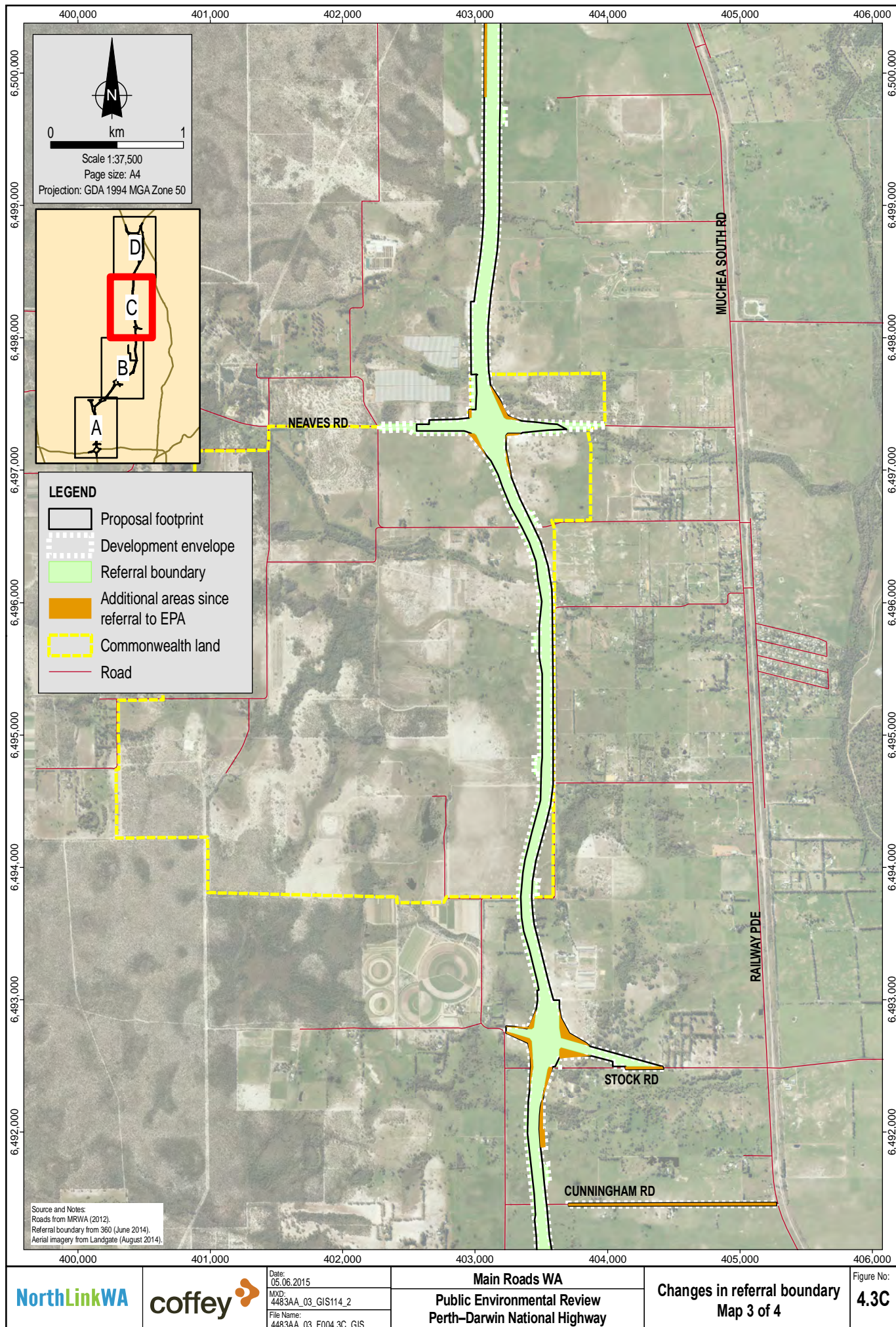




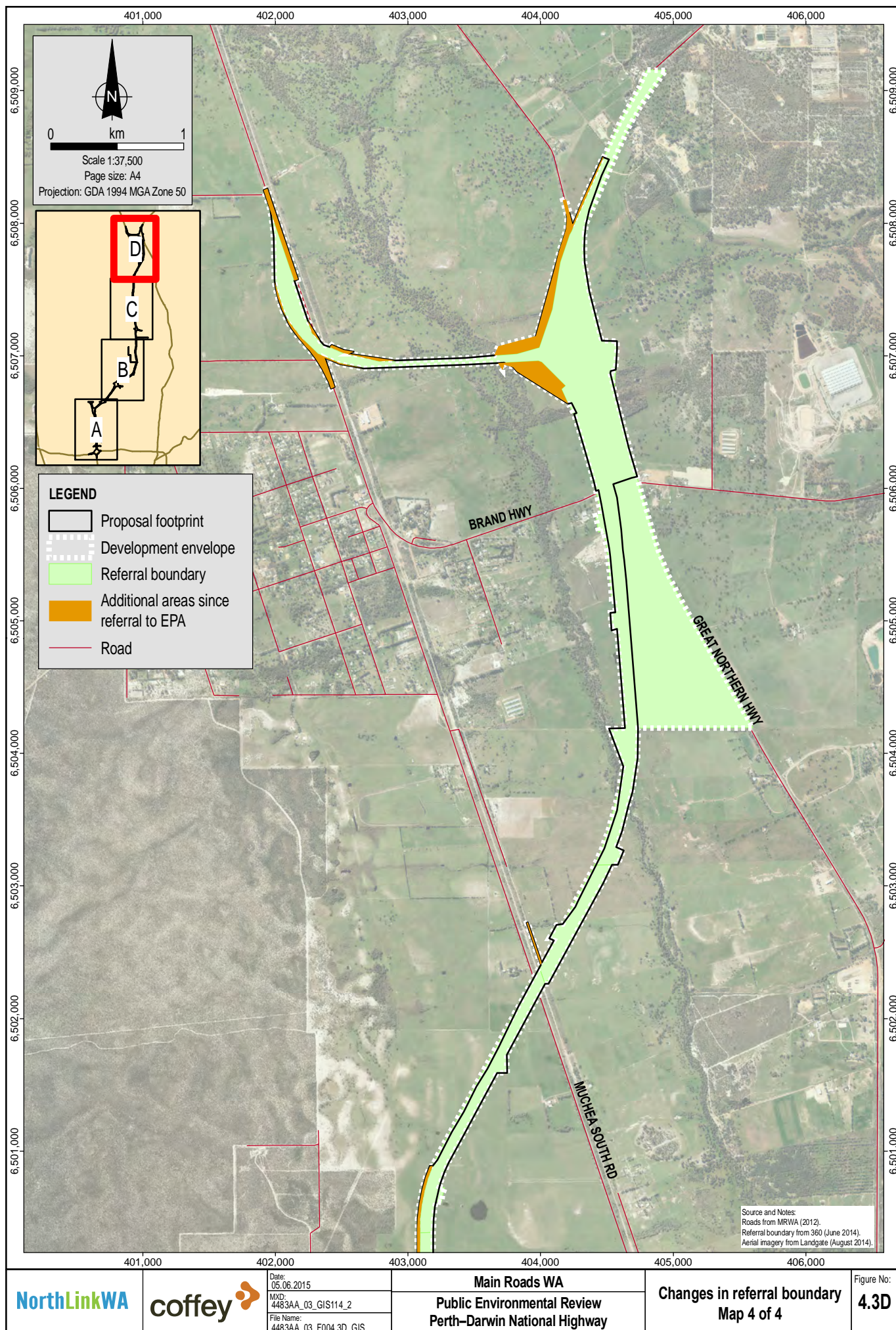
















#### 4.2.3 Avoidance Through Design Changes

A number of changes to the design were made as a result of studies undertaken as part of the PER and issues raised by stakeholders during the consultation process. These changes resulted in avoidance of impacts to key environmental factors:

- Consultation with communities in the vicinity of Ellenbrook identified the need to provide significant distance between the alignment and residential areas between The Promenade and Maralla Road by aligning the highway as close to the western referral boundary as possible. The original design came as close as 25 m to property boundaries. The UPDC has shifted the alignment to be approximately 69 m from property boundaries.
- As part of the design the proposal was realigned along the existing Great Northern Highway to avoid impacts to the Claypans of the Swan Coastal Plain TEC, located to the east of Great Northern Highway in Muchea.
- The Mound Springs SCP TEC in the vicinity of Gaston Road has been specifically avoided through the design process.
- The location of the PSP along Hepburn Avenue, north of Marshall Road was realigned to reduce the extent of impact on a potential occurrence of TEC SCP02 (Southern wet shrublands).
- During the design, the proposal was realigned to avoid direct impacts to a population of *Caladenia huegelii* (T) in the Ellenbrook region.
- The design of the Brand Highway crossover in Muchea was designed to ensure critical habitat, including known populations, for *Grevillea curviloba* subsp. *incurva* is maintained along the road and rail reserve along Brand Highway.
- The proposal was realigned to the west of Lot 5, 189 Sawpit Road, Bullsbrook (located north of Maralla Road), which is listed as Bush Forever Site 13 (Sawpit Road Bushland, Bullsbrook) to avoid any direct impacts to the site including the conservation category wetland mapped within the Bush Forever site.
- The interchange at Warbrook Road was relocated to Stock Road, to avoid impacts to habitat for the Critically Endangered Western Swamp Tortoise at Twin Swamps Nature Reserve.
- The width of the proposal footprint was reduced between Baal Street and Gnangara Road to avoid an area containing a high concentration of potential Black Cockatoo breeding trees. The amended proposal footprint reduced the number of breeding trees to be cleared from 410 to 342 (a reduction of 68 breeding trees).
- Interchanges will be constructed at selected existing roads to enable access to suburbs and key transport routes along the alignment.
- The design allows for an interchange with the EWNSR at Cullacabardee, about 1 km southwest of the existing intersection of Gnangara Road and Beechboro Road. This interchange will be the southern terminus of the EWNSR, which will connect the PDNH to the northern suburbs of Perth. The EWNSR is in early planning stages and does not form part of this proposal.

#### 4.3 Interchanges

The interchanges are summarised in Table 4.2.

**Table 4.2 Interchanges**

Interchange	Locality	Chainage <sup>1</sup> (km)	Type
Tonkin Highway/Reid Highway	Malaga	0.0	Systems interchange
Hepburn Avenue	Malaga	3.9	Grade separated roundabout
East Wanneroo North–South Route	Cullacabardee	6.1 (start of Y-bifurcation)	Bifurcation (Y-interchange)
Gnangara Road and PDNH	Lexia	9.6	Parclo interchange
The Promenade	Ellenbrook	13.0	Grade separated roundabout
Stock Road	Bullsbrook	23.0	Grade separated roundabout
Neaves Road	Bullsbrook	27.8	Grade separated roundabout
Great Northern Highway/ Brand Highway	Muchea	37.9	Grade separated roundabout

1. Chainage values are approximate.

The original design proposed conventional diamond interchanges at the majority of interchanges along the alignment. Consultation with the Safe Systems Reference Group and Main Roads Technical Working Group identified the need to implement roundabout solutions at interchanges to realise safety benefits for motorists. These grade separated roundabout interchanges have a slightly increased footprint, but will likely have a decrease in fatalities and serious injuries.

Project staging may result in some interchanges being constructed first as at-grade intersections before being upgraded to grade separated interchanges at a later date.

Not all existing roads intersected by the alignment will be directly connected to the proposal. These roads are discussed in Section 4.9.

#### 4.4 Bridges and Culverts

A number of bridges and culverts form part of the design and will be constructed. Bridges and culverts will be needed for:


- Grade separations at interchanges.
- Grade separations at non-intersecting roads.
- Facilitating pedestrian and cycling movements.
- Crossing watercourses, drainage lines and wetlands.
- Maintaining and facilitating surface water flow.
- Providing pathways for fauna movements from one side of the alignment to the other.

A summary of the main bridges and culverts required other than for grade separation at interchanges is presented in Table 4.3. Note that further engineering design work may cause bridge/culvert arrangements and locations to change.



**Table 4.3 Bridges and culverts**

No.	Type	Location	Chainage <sup>1</sup> (km)	Length (m)	Purpose	Comment
1	Culvert	Malaga	0.29	80	Fauna underpass (1.2 m wide x 0.6 m high)	Under Beechboro Road North
2	Culvert	Malaga	3.67	1x55 1x15	Fauna underpass (1.2 m wide x 0.6 m high)	Under Reid Highway
3	Bridge	Malaga	2.33	–	Marshall Road over bridge	PDNH
4	Culvert	Hepburn Ave	4.10	1x15 1x20 1x80	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
5	Culvert	Cullacabardee	5.25	82	Fauna underpass (1.2 m wide x 1.2 m high)	PDNH
6	Culvert	Cullacabardee	5.48	80	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
7	Culvert	Cullacabardee	5.56	80	Fauna underpass (1.2 m wide x 1.2 m high)	PDNH
8	Bridge	Cullacabardee	6.19	–	PDNH over PSP/Baal Street	PDNH
9	Culvert	Cullacabardee	6.37	1x65 1x50	Fauna underpass (1.2 m wide x 1.2 m high)	PDNH
10	Culvert	Cullacabardee	8.29	65	Fauna underpass (1.2 m wide x 1.2 m high)	PDNH
11	Culvert	Cullacabardee	8.27	1x65 1x15	Fauna underpass (1.2 m wide x 1.2 m high)	EWNSR
12	Culvert	Cullacabardee	8.46	1x65 1x15	Fauna underpass (1.2 m wide x 1.2 m high)	EWNSR
13	Culvert	Ellenbrook	15.35	65	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
14	Culvert	Ellenbrook	16.60	65	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
15	Culvert	Ellenbrook	17.60	70	Fauna underpass 2x2 (3.0 m wide x 1.2 m high)	PDNH
16	Culvert	Ellenbrook	17.80	70	Fauna underpass 2x2 (3.0 m wide x 1.2 m high)	PDNH
17	Culvert	Bullsbrook	18.11	70	Fauna underpass 2x2 (3.0 m wide x 1.2 m high)	PDNH
18	Culvert	Bullsbrook	18.11	70	Fauna underpass 2x2 (3.0 m wide x 1.2 m high)	PDNH



No.	Type	Location	Chainage <sup>1</sup> (km)	Length (m)	Purpose	Comment
19	Culvert	Bullsbrook	27.95	70+30 (two sections)	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
20	Culvert	Bullsbrook	28.05	85	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
21	Culvert	Bullsbrook	28.15	75	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
22	Culvert	Bullsbrook	29.25	1x40 1x12	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
23	Bridge	Bullsbrook	32.85	–	Bridge over Muchea South Road and Midland–Geraldton railway line	PDNH
24	Bridge	Bullsbrook/ Muchea	34.35	–	Bridge over Ellen Brook; fauna underpass	PDNH
25	Culvert	Muchea	37.35	80	Drainage and fauna underpass (0.3 m wide x 0.3 m high)	PDNH
26	Bridge	Muchea	2.60 (Brand Highway)	–	Pass over Ellen Brook; fauna underpass	Brand Highway
27	Bridge	Muchea	1.30 (Brand Highway)	–	Bridge over Midland–Geraldton railway line	Brand Highway

1. Chainage values are approximate.

#### 4.5 Principal Shared Path

Pedestrian and cyclist traffic will be accommodated on a new PSP parallel to the road alignment within the proposal footprint. The PSP will connect to existing footpaths at planned interchanges as well as local roads not otherwise served directly by the proposal. Underpasses will be used at interchanges to maintain grade separation of the PSP from road ramps. Signage will be provided to assist PSP users with navigation.


#### 4.6 Water Retention Basins

Approximately 74 water retention and infiltration basins have been included in the design along the alignment to control and capture runoff from the road and associated landscaping (Table 4.4). Retention basins vary in size and are designed to accommodate surface runoff. The annual recurrence interval (ARI) for the basins varies across the project; however, generally the infiltration basins between Reid Highway and Maralla Road have been designed to accommodate a 100 year ARI event. The detention basins have been designed to accommodate a 15 mm rainfall event (or 1 year ARI event). The exact location and size of each retention basin may change as more detailed design work is completed.




**Table 4.4 Water retention and infiltration basins**

Name	Type	Location	Chainage <sup>1</sup> (km)	Volume (m <sup>3</sup> )
TPR01	Infiltration	Malaga	1.10	2,010
TRP02	Infiltration	Malaga	1.07	2,980
TRP03a	Infiltration	Malaga	2.55 (Reid Highway)	4,275
TRP03b	Infiltration	Malaga	1.10	725
TRP04	Infiltration	Malaga	1.20	350
TRP07	Infiltration	Malaga	1.38	2,145
TRP08	Infiltration	Malaga	3.13 (Reid Highway)	4,940
TRP09	Infiltration	Malaga	2.50 (Reid Highway Eastbound)	615
TRP10	Infiltration	Malaga	1.53	1,445
TRP11a	Infiltration	Malaga	2.93 (Reid Highway Eastbound)	510
TRP11b	Infiltration	Malaga	1.70	480
TRP12	Infiltration	Malaga	1.68	4,550
TRP13	Infiltration	Malaga	1.73	3,980
RW01	Infiltration	Malaga	1.80 (Reid Highway Eastbound)	5,400
PDNH01	Infiltration	Ballajura	2.43	11,525
PDNH02a and PDNH02b	Infiltration	Ballajura	3.30–3.50	4,356
HEP01	Infiltration	Hepburn Ave interchange	3.78	6,410
HEP02	Infiltration	Hepburn Ave interchange	3.78	1,320
HEP03	Infiltration	Hepburn Ave interchange	4.00	2,110
HEP04	Infiltration	Hepburn Ave interchange	4.05	1,525
PDNH03	Infiltration	Cullacabardee	4.58	23,435
PDNH04	Infiltration	Cullacabardee	6.45	2,510
PDNH05	Infiltration	Cullacabardee	6.80	7,280
PDNH06	Infiltration	Cullacabardee	6.70	3,035
PDNH07	Infiltration	Cullacabardee	7.20	5,570
PDNH10	Infiltration	Cullacabardee	7.60	3,430
PDNH11	Infiltration	Cullacabardee	7.95	15,970
PDNH12	Infiltration	Cullacabardee	9.03	2,120
PDNH13	Infiltration	Cullacabardee	9.00	1,380



Name	Type	Location	Chainage <sup>1</sup> (km)	Volume (m <sup>3</sup> )
GNAN01	Infiltration	Cullacabardee/PDNH-Gnangara Rd interchange	9.45	1,830
GNAN03	Infiltration	Cullacabardee/PDNH-Gnangara Rd interchange	9.58	300
GNAN04	Infiltration	Cullacabardee/PDNH-Gnangara Rd interchange	9.68	590
GNAN05	Infiltration	Lexia/PDNH-Gnangara Rd interchange	9.68	1,365
GNAN06	Infiltration	Lexia/PDNH-Gnangara Rd interchange	9.80	1,440
GNAN07	Infiltration	Lexia/PDNH-Gnangara Rd interchange	10.05	385
PDNH14	Infiltration	Lexia	10.48	11,485
PDNH15	Infiltration	Lexia	12.18	1,545
PROM01	Infiltration	Lexia/Promenade interchange	12.70	585
PROM02	Infiltration	Lexia/Promenade interchange	12.78	7,160
PROM03	Infiltration	Lexia/Promenade interchange	13.00	585
PROM04	Infiltration	Lexia/Promenade interchange	13.00	3,880
PROM05	Infiltration	Ellenbrook/Promenade-Drumpellier Drive	1.30 (The Promenade)	735
PROM06	Infiltration	Ellenbrook/Promenade-Drumpellier Drive	1.23 (The Promenade)	375
PROM07	Infiltration	Ellenbrook/Promenade-Drumpellier Drive	1.13 (The Promenade)	455
PDNH16	Infiltration	Ellenbrook	14.05	2,120
PDNH17	Infiltration	Ellenbrook	14.18	6,365
PDNH18	Infiltration	Ellenbrook	15.35	1,555
PDNH19	Infiltration	Ellenbrook	15.80	1,630
PDNH20	Infiltration	Ellenbrook	16.28	4,895
PDNH21	Infiltration	Ellenbrook	16.80	1,770
PDNH22	Infiltration	Ellenbrook	17.10	2,280
STO05	Detention	Bullsbrook	22.47	42
STO06	Detention	Bullsbrook	22.53	40
STO07	Detention	Bullsbrook	22.69	41
STO03	Detention	Bullsbrook	22.72	52
STO08	Detention	Bullsbrook	0.42 (Cooper Road)	96





Name	Type	Location	Chainage <sup>1</sup> (km)	Volume (m <sup>3</sup> )
STO02	Detention	Bullsbrook	0.33 (Stock Road)	59
STO01	Detention	Bullsbrook	0.50 (Stock Road)	110
STO04	Detention	Bullsbrook	23.17	75
STO09	Detention	Bullsbrook	23.23	72
NEAV05	Detention	Bullsbrook	27.24	69
NEAV04	Detention	Bullsbrook	27.32	71
NEAV01	Detention	Bullsbrook	0.49 (Neaves Road West)	80
NEAV02	Detention	Bullsbrook	0.30 (Neaves Road East)	72
NEAV06	Detention	Bullsbrook	0.30 (Neaves Road East)	66
NEAV03	Detention	Bullsbrook	28.03	62
NEAV07	Detention	Bullsbrook	28.12	67
PDNH23	Detention	Muchea South Rd	32.10	400
PDNH24	Detention	Muchea South Rd	33.21	150
PDNH25	Detention	Bullsbrook	33.85	235
PDNH26	Detention	Bullsbrook	34.68	160
MUCH02	Detention	Muchea	37.43	177
MUCH01	Detention	Muchea	37.98	168

1. Chainages and volumes are approximate.

#### 4.7 Landscaping and Revegetation Works


A substantial amount of earthworks will be required as part of construction. As the majority of the alignment will be built up above the surrounding landscape, a large volume of fill will be required to support elevated ramps, bridges and flyovers at grade separated interchanges.

In general, road verges will be landscaped and replanted and/or seeded with native tubestock. Species planted will be representative of the surrounding area (see Chapter 12) for details on revegetation).

Noise walls will be installed on the road verges at some locations to reduce noise from the road on nearby communities. Noise walls may be used in conjunction with embankments and screen walls to minimise visual impacts while maximising noise attenuation.

#### 4.8 Road Train Assembly and Traveller's Rest Area

The proposal will also include a RTAA and traveller's rest area in the vicinity of Great Northern Highway and Brand Highway at the Muchea end of the proposal. The new RTAA will provide an alternative to Wubin and will facilitate the future use of longer combination vehicles between Muchea and Wubin. The RTAA will



improve operational efficiencies for logistics companies operating road trains into and out of Perth from the north.

The RTAA will consist of an asphalt apron approximately 5 ha in size. Assembly, breakdown and parking areas will be demarcated on the apron and rubbish bins will be provided to collect refuse. Street lighting will be installed to provide security and improve visibility at night. Other security measures will include perimeter fencing and closed-circuit television (CCTV) cameras monitored from a central off-site location.

The traveller's rest area will improve the road side amenity and road safety for the travelling public and will include short-term parking areas and public restrooms.

#### 4.9 Modifications to Local Roads

Construction of the proposal will require modifications to some local roads in the proposal footprint. Modifications may include severance, realignment and/or reconfiguration. Table 4.5 outlines expected modifications to local roads.

**Table 4.5 Local road modifications**

Road	Locality	Modification required
Marshall Road	Ballajura	Bridge over the proposal.
Beechboro Road	Cullacabardee	Severed and cul-de-sac installed on each side of the proposal. Emergency access provided to the north to Gnangara Road.
Gaskell Avenue	Lexia	Severed on the south side and reconfigured for integration with the Ellenbrook interchange on the north side.
Drumpellier Drive	Ellenbrook	Reconfigured for integration with the Ellenbrook interchange.
Maralla Road	Ellenbrook	Severed and cul-de-sac installed on each side of the proposal.
Gully Road	Bullsbrook	Severed and cul-de-sac installed on each side of the proposal.
Strachan Road	Bullsbrook	Severed and cul-de-sac installed on each side of the proposal.
Warbrook Road	Bullsbrook	Severed and cul-de-sac installed on each side of the proposal.
West Road	Bullsbrook	Severed and cul-de-sac installed on each side of the proposal.
Muchea South Road	Bullsbrook	PDNH bridge over Muchea South Road.
Brand Highway	Muchea	PDNH bridge over Brand Highway.
Brand Highway	Muchea	New Brand Highway Bridge over the proposal.





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