APPENDIX 14

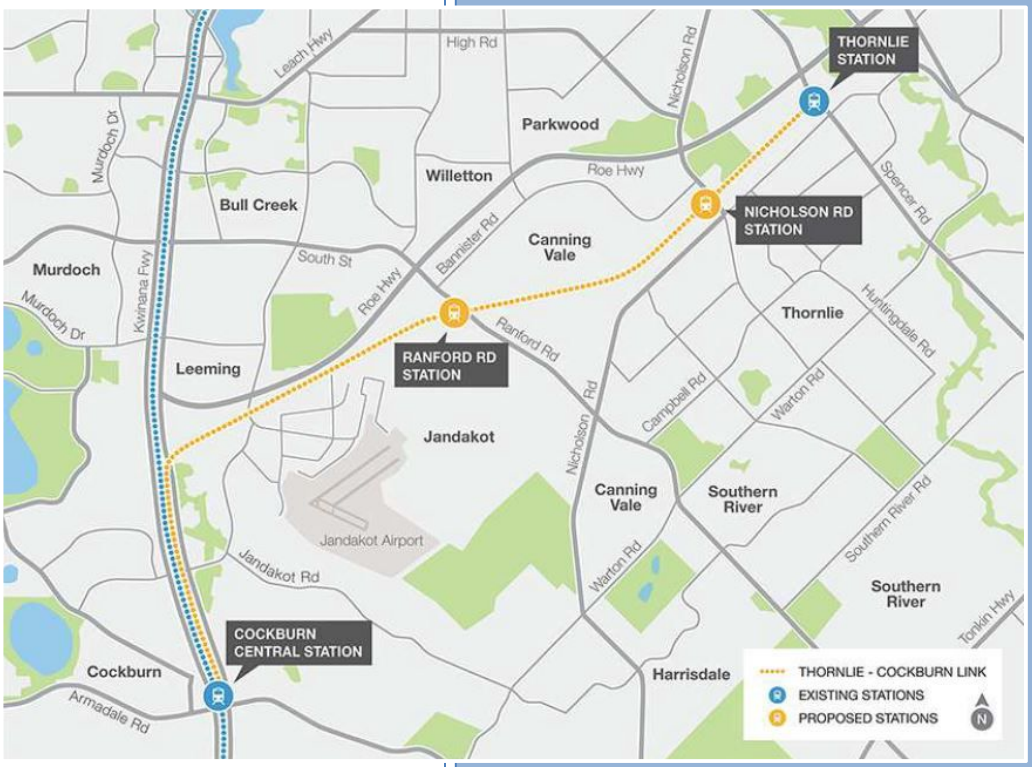
Construction Environmental Management Plan

Albany
76 Festing Street
Albany WA 6330
T 0447446343

Perth
2 Bulwer Street
Perth WA 6000
T (08) 9227 2600
F (08) 9227 2699

www.auroraenvironmental.com.au

METRONET Thornlie – Cockburn Link
Construction Environmental Management Plan



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Public Transport Centre
West Parade
PERTH WA 6000

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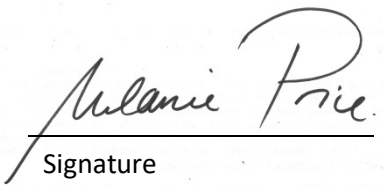
Author:	Melanie Price Associate Environmental Scientist		16 May 2019
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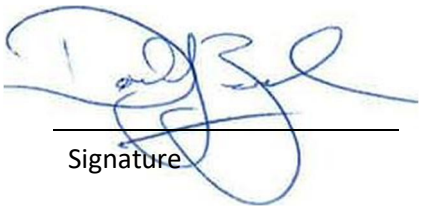
Reviewed by:	Paul Zuvela Manager – Environmental Impact Assessment		16 May 2019
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LIST OF ABBREVIATIONS

ACM	Asbestos containing materials
ASS	Acid sulfate soils
BC Act	*Biodiversity Conservation Act 2016* (Western Australian)
CCW	Conservation Category Wetland
CCWTS	City of Canning Waste Transfer Station
CEMP	Construction Environmental Management Plan
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
DBCA	Department of Biodiversity, Conservation and Attractions (Western Australian)
DoEE	Department of the Environment and Energy (Commonwealth)
DoW	Department of Water (now incorporated into DWER) (Western Australian)
DWER	Department of Water and Environmental Regulation (Western Australian)
EPA	Environmental Protection Authority (Western Australian)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EP Act	*Environmental Protection Act 1986* (Western Australian)
GBN	Ground–borne noise
GBV	Ground–borne vibration
H_2S	Hydrogen sulfide
ha	hectare
MGL	Maximum groundwater level
MNES	Matters of National Environmental Significance
MUW	Multiple Use Wetland
PEC	Priority Ecological Community
PFAS	Per- and poly-fluoroalkyl substances
PTA	Public Transport Authority of Western Australia
RAP	Remediation Action Plan

REW	Resource Enhancement Wetland
RIWI Act	*Rights in Water and Irrigation Act 1914*
SAP	Sampling and Analysis Plan
SAQP	Sampling and Analysis Quality Plan
SMP	Site Management Plan
TCL	Thornlie - Cockburn Link
TEC	Threatened Ecological Community
UFI	Unique Feature Identifier
UWPCA	Underground Water Pollution Control Area
WQPN	Water Quality Protection Note

1 INTRODUCTION

The Public Transport Authority of Western Australia (PTA) is developing the METRONET Thornlie – Cockburn Link (TCL) Proposal (the Proposal). The Proposal includes construction of a 14.5 kilometre (km) new dual railway track within existing railway and road reserves, to extend the existing Thornlie spur line to Cockburn Central station as well as the duplication of 3 km of railway track between Beckenham Junction and Thornlie train station. To enable the construction of this dual passenger line, approximately 11 km of existing freight line will be relocated within the rail reserve.

Modifications to existing train stations, bridges and roads will be required and two new train stations will be constructed at Ranford Road and Nicholson Road in Canning Vale. A principal shared path will also be constructed.

Following referral of the Proposal to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act), the EPA determined on 27 June 2018 to set the level of assessment as 'Referral Information with Additional Information - four (4) week public review' (Assessment No. 2168).

This Construction Environmental Management Plan (CEMP) has been prepared to demonstrate how construction-related environmental impacts of the Proposal on key environmental factors will be managed. This CEMP should be read in conjunction with the Thornlie – Cockburn Referral Information with Additional Information Report prepared by Aurora Environmental (2019). A summary table of the CEMP is included in Table 1.

The structure of this CEMP is as follows:

- Section 1 – Introduction and summary.
- Section 2 – Context and rationale for the CEMP and the provisions being proposed.
- Section 3 – Summary of provisions of this CEMP (the management, monitoring and reporting framework).
- Section 4 – Provisions for adaptive management and review.
- Section 5 – Details of stakeholder consultation.
- Schedule 1 – Detailed provisions of the CEMP.

TABLE 1: SUMMARY OF CEMP

ITEM	DETAIL
Title of Proposal	METRONET Thornlie - Cockburn Link
Proponent	Public Transport Authority of Western Australia
EPA Assessment No.	2168
Ministerial Statement No.	Not applicable – Proposal currently being assessed
Purpose of this CEMP	Demonstrate management of construction-related environmental impacts

TABLE 1: SUMMARY OF CEMP

ITEM	DETAIL
Key environmental factors	• Flora and Vegetation • Terrestrial Fauna • Terrestrial Environmental Quality • Inland Waters • Social Surroundings
Potential environmental management issues	• Clearing of up to 52.93 hectares (ha) of vegetation which includes up to 28.87 ha of native vegetation. • Clearing up to 2.32 ha of Banksia Woodland of the Swan Coastal Plain Threatened Ecological Community (TEC) across two separate patches. • Clearing up to 3.88 ha of Low lying *Banksia attenuata* woodlands or shrublands (Floristic Community Type 21c) which is a State listed Priority Ecological Community (Priority 3). Of this, 2.32 ha is also a component of the Federally listed TEC. • Clearing of five individuals of *Dodonaea hackettiana*, a Priority 4 listed taxa. • Potential indirect impacts to the threatened flora, including *Caladenia huegelii* which is known in close proximity to the TCL development envelope. • Clearing of vegetation within Bush Forever areas - the TCL development envelope intersects with 29.45 ha of land mapped as Bush Forever, this includes 12.01 ha of native vegetation (with 5.75 ha in a Degraded or better condition). • Potential indirect impacts to native vegetation outside of the development envelope including nearby Bush Forever areas. • Loss of 4.50 ha of significant wetlands (CCWs UFI 6911 and 6912 and REW UFI 13332) inclusive of 4.09 ha of wetland vegetation rated as Degraded or better condition. • Potential spread of dieback and weeds. • Potential dust deposition on adjacent native vegetation during construction. • Permanent loss of up to 52.92 ha of fauna habitat, of which 21.61 ha is high quality. • Injury/mortality to fauna during construction. • Potential degradation of fauna habitat located adjacent to the development envelope. • Disturbance of a known contaminated site (former landfill at Ranford Road). • Potential disturbance of acid sulfate soils (ASS). • Possible changes to hydrological regimes resulting from drainage infiltration, abstraction of groundwater to supply construction water and dewatering. • Potential direct and indirect impacts on wetlands including conservation category and resource enhancement wetlands. • Impact to local amenity associated with noise and vibration emissions during construction. • Disturbance of two registered Aboriginal heritage sites (Canning River – ID: 3538 and Swan River – ID: 3536).

2 CONTEXT, SCOPE AND RATIONALE

2.1 DESCRIPTION OF THE PROPOSAL

The PTA is proposing to implement the first stage of METRONET's priority projects, which includes the connection of the existing Thornlie Station (located on a spur from the Armadale line), to Cockburn Central Station on the Mandurah line (Figure 1). The State Government is committed to working with the community to deliver integrated land and transport infrastructure and services for sustainable growth.

The proposed TCL comprises 17.5 km of rail between the existing Mandurah line and Armadale line within the existing railway reserve. Figure 2 shows the TCL development envelope and provides an overview of the Proposal. The TCL development envelope encompasses 119.41 ha and is shown in more detail on:

- Figure 3.1 – Section between the existing Cockburn Central station, via the Glen Iris Tunnel to approximately Hope Road, Jandakot.
- Figure 3.2 – Section between the Glen Iris Tunnel and Ranford Road, Canning Vale.
- Figure 3.3 – Section between Ranford Road and Thornlie station.
- Figure 3.4 – Section between Thornlie station and the existing Armadale line.
- Figure 4 – Proposed Ranford Road Station.

The development envelope incorporates all activities associated with the Proposal including construction (e.g. laydown areas). Not all of the development envelope will be required for the TCL Proposal and its construction and therefore, the scale of the impacts is expected to be less than stated in this document. The development envelope also provides opportunities to accommodate alternative design options for the Ranford Road station.

For the purposes of this CEMP, it has been assumed that clearing of the entire development envelope will occur. However, this represents a worse-case scenario and it is expected that opportunities to reduce environmental impacts will be investigated during detailed design stages.

Railway and Associated Infrastructure

The Proposal requires:

- Construction of dual railway tracks connecting Thornlie and Cockburn Central Stations along with associated earthworks, traffic signals, communications, drainage infrastructure, lighting, noise barriers, fencing, landscaping and signage.
- Realignment of the existing dual freight railway tracks to the north within the existing railway reserve, to make room to install the new passenger dual railway tracks.
- Widening of the existing Mandurah Line between the Glen Iris Tunnel and Cockburn Central Station. This will involve realigning the existing Mandurah Line tracks from the existing Glen Iris Tunnel to Cockburn Central Station to allow for two extended TCL tracks to run in between them, converging into a single track at Cockburn Central Station.

- Duplication of the 3 km of existing single track from Beckenham Junction to Thornlie Station.
- Other key elements include construction railway stations, noise walls, laydown areas, bridges and associated infrastructure.

2.2 ENVIRONMENTAL CONTEXT

The Proposal is located within the Perth Metropolitan Region (Figure 1) on the Swan Coastal Plain. Elements of the Proposal are within four Local Government Areas; City of Cockburn, City of Canning, City of Melville and City of Gosnells, and pass over the Canning River through the Swan River Trust Development Control Area administered by the Department of Biodiversity, Conservation and Attractions (DBCA) (Figures 3.1 to 3.4).

Regional elevation ranges from approximately 40m Australian Height Datum (AHD) in the west to around 10m AHD prior to Canning River, where the elevation is approximately 3m AHD. The region is characterised by a Mediterranean climate with mild wet winters and hot dry summers. Typically, strong offshore breezes occur during the daytime followed by corresponding onshore breezes as the land cools during the evening.

The majority of the development envelope comprises Bassendean Sands described as white to pale grey at surface, yellow at depth. Sands are likely to be greater than 30m deep and overlie the Guildford Formation, described as sandy silty pale brown clay. In places limestone may be present at depth (Jordan, 1986). Sands are highly permeable. Pockets of peaty sand and peat-rich sand intersect the development envelope. Around the Canning River the geology is Guildford Formation. The section between the Canning River and Beckenham Junction is sandy clay, clay and Bassendean Sands.

Soil-landscape mapping of the South West of Western Australia (DAFWA, 2007) indicates the Proposal sits within the Pinjarra Zone, Bassendean Zone and just into the Spearwood Dunes of the Perth Coastal Zone. Acid sulfate soils (ASS) mapping indicates the Proposal is located within high and moderate risk areas.

The Proposal is located within the Jandakot and Perth proclaimed groundwater areas, and within multiple subareas; South Lakes, Airport, City of Canning, City of Melville, City of Cockburn and City of Gosnells.

The Proposal is situated in the South West Botanical Province of Western Australia (Beard, 1990) within the Interim Biogeographic Region of Australia (IBRA) Swan Coastal Plain (SWA) bioregion and the Perth (SWA2) subregion (Environment Australia, 2000). The SWA bioregion is a low lying coastal plain, mainly covered with woodlands. The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone. Heath and/or Tuart woodlands occur on limestone, *Banksia* and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages and Marri on colluvial and alluvial soils. The subregion also includes a complex series of seasonal wetlands (Mitchell et al. 2002).

Regional vegetation mapped by Heddle et al. (1980) based on major geomorphic units on the SWA indicates two vegetation complexes on Aeolian deposits of the SWA and two vegetation complexes of fluviatile deposits of the SWA are present within the survey area:

- Southern River Complex: Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - *Banksia* species with fringing woodland of *E. rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds (System 6 42 on Aeolian deposits).
- Bassendean Complex-Central and South: Vegetation ranges from woodland of *E. marginata* (Jarrah) - *Allocasuarina fraseriana* (Sheoak) - *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites. This area includes the transition of *E. marginata* (Jarrah) to *E. todtiana* (Pricklybark) in the vicinity of Perth (System 6 44 on Aeolian deposits).
- Guildford Complex: A mixture of open forest to tall open forest of *C. calophylla* (Marri) – *E. wandoo* (Wandoo) – *E. marginata* (Jarrah) and woodland of *E. wandoo* (Wandoo) (with rare occurrences of *E. lane-poolei* (Salmon White Gum)). Minor components include *E. rudis* (Flooded Gum) – *M. rhaphiophylla* (Swamp Paperbark) (System 6 32 on fluviatile deposits).
- Swan Complex: Fringing woodland of *E. rudis* (Flooded Gum) – *M. rhaphiophylla* (Swamp Paperbark) with localised occurrence of low open forest of *Casuarina obesa* (Swamp Sheoak) and *M. cuticularis* (Saltwater Paperbark) (System 6 33 fluviatile deposits).

No Commonwealth, National or World or State heritage listed places are within or adjacent to the Proposal.

Key environmental features either intersected by or close to the Proposal are:

- The Proposal is located in the vicinity of the Jandakot Mound, a source of Perth's drinking water supply. Within the Jandakot Mound is an area defined as the 'Underground Water Pollution Control Area' (UWPCA). The section of TCL between the Kwinana Freeway and Jandakot is within the UWPCA and traverses Priority 1, Priority 2 and Priority 3 designated areas (Figures 3.1 and 3.2).
- The Canning River is a major surface water receptor intersected by the Proposal and an Environmentally Sensitive Area protected under the EP Act. The Canning River is also a registered Aboriginal heritage site (ID: 3538, mythological site, Figure 3.4).
- A total of 18 wetlands (in the Geomorphic Wetlands of the Swan Coastal Plain dataset) intersect the development envelope, however the majority of these have been cleared, filled, developed or landscaped. A
- Four Bush Forever Sites:
    - Canning River and Southern River Bush Forever Site (No. 246).
    - Tom Bateman Reserve / Nicholson Road Bushland Bush Forever Site (No. 456).
    - Ken Hurst Park Bush Forever Site (No. 245).
    - Jandakot Airport Bush Forever Site (No. 388).

2.3 KEY ENVIRONMENTAL FACTORS

The following key environmental factors are relevant to the construction phase of the Proposal and are addressed in this CEMP:

- Flora and vegetation;
- Terrestrial fauna;
- Terrestrial environmental quality;
- Inland waters; and
- Social surroundings.

The EPA advised in a statement 'further explanation of decision on Level of Assessment' (EPA, 2018) that the key environmental issues relevant to the Proposal are:

- Clearing of native vegetation, including the Threatened Ecological Community (TEC) Banksia Woodlands of the Swan Coastal Plain ecological community;
- Loss of Bush Forever areas;
- Loss of threatened fauna habitat including potential Black cockatoo habitat trees;
- Disturbance of a known contaminated site;
- Loss and disturbance of wetlands of the Swan Coastal Plain; and
- Localised impacts to neighbouring residential areas from noise and vibration.

The scale of impacts has been reduced as a result of changes to the development envelope. Assuming clearing of the entire revised development envelope, the following impacts are considered relevant to the Proposal:

- Clearing of native vegetation, including up to 2.32 ha of the TEC - Banksia Woodlands of the Swan Coastal Plain ecological community;
- Loss of Bush Forever areas;
- Loss of threatened fauna habitat including 48 potential Black Cockatoo habitat trees;
- Disturbance of a contaminated site;
- Loss and disturbance of wetlands of the Swan Coastal Plain; and
- Localised impacts to site workers and neighbouring residential areas from noise and vibration.

Noise and vibration are only addressed in this CEMP in relation to construction activities. Noise and vibration generated during operations after construction will be governed by an Operational Noise and Vibration Management Plan.

Potential impacts of the Proposal, as they relate to the key environmental factors, are outlined in Table 2. Figures relating to environmental factors are listed in Table 3.

The potential impacts listed above will be reduced by:

- Avoiding clearing where possible, once determined through detailed design; and
- Investigating design options to minimise impacts at Ranford Road Station.

TABLE 2: ENVIRONMENTAL ASPECTS OF THE PROPOSAL

KEY ENVIRONMENTAL FACTOR	ENVIRONMENTAL ASPECT OF THE PROPOSAL	AFFECTED ENVIRONMENTAL VALUES	POTENTIAL IMPACTS	ACTIVITY OR THREATENING PROCESS
Flora and Vegetation	Clearing of native vegetation	Native vegetation Threatened species TEC and PEC Bush Forever Sites Geomorphic wetlands	• Clearing of up to 52.93 ha of vegetation which includes up to 28.87 ha of native vegetation. • Clearing of up to 12.01 ha of native vegetation within Bush Forever sites, with 5.75 ha being in a Degraded condition or better (inclusive of 0.71 ha that occurs on land reserved for railway purposes). • Clearing of up to 2.32 ha of Banksia Woodland of the Swan Coastal Plain TEC. • Clearing of up to 3.88 ha of Priority 3 PEC - Low lying *Banksia attenuata* woodlands or shrublands (Floristic Community Type 21c). • The loss of 4.50 ha of significant wetlands (CCWs UFI 6911 and 6912 and REW UFI 13332) inclusive of 4.09 ha of wetland vegetation rated as Degraded or better. • Indirect impacts related to stormwater infiltration, dewatering, spread of dieback, and dust may affect surrounding native vegetation.	Clearing of native vegetation. Fragmentation of ecological linkages. Dieback introduction or spread. Weed introduction or spread.
	Vehicle and machinery movement	Native vegetation TEC and PEC Bush Forever Sites Geomorphic wetlands	• Degradation of vegetation adjacent to the development envelope.	Dieback introduction and spread. Weed introduction and spread. Unauthorised access to adjacent vegetation.
Terrestrial Fauna	Clearing of native vegetation	Fauna habitat Fauna species (including Threatened and Priority species)	• Clearing of up to 52.92 ha of fauna habitat (inclusive of 23.18 ha of Mixed grasslands in paddocks). • Clearing of up to 24.59 ha of Black Cockatoo foraging habitat, inclusive of 24.59 ha of foraging habitat suitable for Carnaby's Black Cockatoo and 17.29 ha of foraging habitat suitable for the Forest Red-tailed and Baudin's Black Cockatoos. • Clearing of 48 potential Black Cockatoo habitat trees (trees with diameter at breast height >500mm). • Clearing of up to 12.4 ha of habitat that may support the South Brown Bandicoot. • Impact to up to 0.10 ha of habitat that may support Carter's Fresh Water Mussel. • Clearing of up to 27.58 ha of possible foraging habitat for the Peregrine Falcon. • Clearing of up to 4.37 ha that may support *Throscodectes xiphos,* although this species' habitat requirements are not known. • Clearing of up to 9.51 of habitat suitable for the Jewelled Ctenotus and the Black-striped Snake. • Clearing of up to 7.35 ha of potential habitat for the Perth Slider/Lined Skink. • Clearing of up to 4.37 ha that may support the Graceful Sunmoth. • Fragmentation of habitat. • Death or injury to fauna during construction of the TCL. • Indirect impacts (disturbance and avoidance behaviour) related to construction of the TCL.	Vehicle and machinery movement. Clearing of fauna habitat. Fragmentation of ecological linkages.
	Vehicle and machinery movement	Fauna habitat	• Degradation of fauna habitat adjacent to the development envelope.	Dieback introduction and spread. Weed introduction and spread. Unauthorised access to adjacent vegetation.
Terrestrial Environmental Quality	Vegetation clearing and earthworks	Soils	• Changes to soil quality through loss of soil organic matter. • Potential disturbance of ASS due to excavation, dewatering or removal of riverine sediments. • Contamination of soils from construction activities associated with storage of chemicals and potential spills. • Disturbance of contaminated or potentially contaminated soils due to excavation or dewatering. • Contamination of soils from stockpiling activities or stockpiled waste materials.	Disturbance of previously contaminated soils. Disturbance of ASS. Risk of uncontained spills, refuelling and plant and vehicle fluid leaks during earthworks.

KEY ENVIRONMENTAL FACTOR	ENVIRONMENTAL ASPECT OF THE PROPOSAL	AFFECTED ENVIRONMENTAL VALUES	POTENTIAL IMPACTS	ACTIVITY OR THREATENING PROCESS
			•	
Inland Waters	Vegetation clearing and earthworks Dust suppression Dewatering Infiltration of stormwater	Hydrological processes Groundwater levels and quality Surface water quality and quantity Geomorphic wetlands Groundwater dependent ecosystems	• Dewatering / displacement of water to install footings and to extend or modify bridges. • Construction of the TCL within the Canning River floodway and flood fringe which may obstruct surface water flows in the event of flooding. • Risks to groundwater quality and the Canning River from contaminated groundwater. • Disturbance of ASS or spread of contaminated groundwater via dewatering, groundwater abstraction, ground improvement or ground disturbance works. • Contamination of groundwater from stockpiling activities. • Alteration to hydrological regimes of groundwater and wetlands. • Impacts to water quality of wetlands. • Obstruction/alteration of surface water flows and water quality. • Decline in wetland vegetation in areas adjacent to the development envelope due to weed encroachment or spread of pathogens. • Construction activities within the Underground Water Pollution Control Area (UWPCA) and Wellhead Protection Zones which may cause pollution and affect water quality. • Abstraction of groundwater for construction purposes and drawdown of groundwater which may affect private and public groundwater users. • Impacts to inland water quality from unplanned discharges.	Dewatering and treatment of water. Disturbance of previously contaminated groundwater. Erosion and sedimentation. Stormwater management during construction. Management of interface of TCL, Underground Water Pollution Control Area (UWPCA), Wellhead Protection Zones and Canning River during construction. Groundwater abstraction. Extraction of groundwater for dust suppression and other construction uses. Chemical storage and refuelling.
Social Surroundings	Vegetation clearing and earthworks Vehicle and machinery movement	Noise, dust and vibration Aboriginal heritage	• Increase in dust, noise and vibration emissions to site workers and nearby residential receptors during construction. • Dust deposition on adjacent native vegetation - impacting the plant's ability to photosynthesize. • Vibration may affect integrity of surrounding buildings and other structures, and deter fauna that utilise the surrounding area. • Disturbance of or damage to of identified/ unidentified Aboriginal Heritage Sites.	Earthworks and use of machinery generating noise, dust or vibration (movement and stockpiling of soils). Disturbance of soil and changes to landscape. Aboriginal sites/objects unearthed or identified during vegetation clearing and earthworks or unauthorised vehicle and personnel access.

TABLE 3: GUIDE TO FIGURES ILLUSTRATING ENVIRONMENTAL FACTORS

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2.4 RATIONALE AND APPROACH

The results of the baseline environmental assessments and a number of assumptions based on anticipated project activities inform the approach for meeting the management provisions outlined in Section 3.2 and Schedule 1. The identified actions, targets and proposed review and revision of actions are aligned with the overall management approach and are designed to ensure that the environmental objectives for each key environmental factor can be met.

To supplement the approach identified in this CEMP, a Contractor's CEMP will be developed and implemented which will include site specific actions and more detailed instructions on day-to-day management. The Contractor's CEMP will be prepared in consultation with the DBCA and DWER, noting that input from the Rivers and Estuaries Division will be required when determining appropriate management of works in the Swan-Canning Development Control Area.

2.4.1 Study and Survey Outcomes

Environmental studies have been undertaken within the development envelope to clarify the values and likely impacts on the five key environmental factors. The key findings of these assessments are outlined in Table 4.

TABLE 4: KEY ENVIRONMENTAL STUDIES UNDERTAKEN FOR THE PROPOSAL

KEY ENVIRONMENTAL FACTOR	REPORT	SCOPE OF STUDY	KEY FINDINGS
General	**Thornlie Extension Environmental Assessment** GHD, September 2013	The scope and purpose of this report was to provide an assessment of potential environmental constraints associated with the proposed extension of the Thornlie spur line including the construction of two new train stations, drainage infrastructure and duplication of the existing bridge over the Canning River. The environmental assessment was based on a review of available desktop information, including published literature, government databases and other publicly available data sources, in addition to the findings of Level 1 flora and fauna surveys (undertaken between 24 and 27 September 2012) of five targeted investigation areas within the Proposal area.	An environmental assessment (GHD, 2013) described potential environmental constraints associated with the Proposal based on desktop information and the results from Level 1 flora and fauna surveys. Based on the assessment, no fatal flaws were identified. However, a range of additional studies were identified in order to more fully investigate potential environmental impacts and related management approached. The assessment identified the need for the following to be investigated/ considered: • The exact location of the Ranford Road Station which is in close proximity to a Bush Forever site, Environmentally Sensitive Area and Conservation Category wetland; and • Design of the Canning River bridge duplication to minimise impacts on the foreshore and aquatic environment. A more detailed assessment of potential environmental impacts associated with the Proposal was recommended, to coincide with more detailed design and in order to quantify and mitigate impacts.
Flora, Vegetation and Terrestrial Fauna	**Thornlie–Cockburn Link Project Flora and Fauna Survey** GHD, January 2019 **Thornlie-Cockburn Link Project Targeted Flora Survey Memorandum** GHD, January 2019 **Thornlie-Cockburn Link Project *Phytophthora* Dieback Assessment** Glevan, October 2018 **Thornlie-Cockburn Link Wetland Assessment** PGV Environmental, 2018	Describes the flora, vegetation and fauna values of the survey area. Includes a desktop review and results of field surveys: • Detailed flora and vegetation survey conducted between 6 to 8 September 2017, 6 October 2017, 14 February 2018 and 1 March 2018. • Targeted surveys for *Caladenia huegelii* conducted on 6 October 2017 and *Tetraria australiensis* on 12 December 2018. • Level 1 fauna survey conducted between 6 to 8 September 2017 and 14 February 2018. • Targeted Black Cockatoo assessment conducted between 6 to 8 September 2017 and on 14 February 2018. • Dampland vegetation assessment of Geomorphic Wetlands of the Swan Coastal Plain conducted on 14 February 2018. The targeted flora survey undertaken between 19 September and 11 October, and on 12 December 2018 provides additional information about the presence or absence of conservation significant flora species. A *Phytophthora* dieback survey of the Proposal area was completed by Glevan during September 2018.	**Vegetation and Flora:** GHD (2019) identified approximately 52% of the survey area (157.90 ha) contained small areas of scattered remnant bushland. However, the remaining 48% of the survey area has been cleared and modified by infrastructure and weed invasion. Vegetation types are shown in Figures 8.1-8.9. Eleven vegetation types were defined within the survey area. Seven types represent remnant native vegetation communities; two dryland (VT01 & VT08) and five dampland (VT02, VT02a, VT02b, VT05 & VT09). The remaining four communities vary between drylands and damplands and are in a varied state of degradation due to previous modifications to the landscape. Majority of the remaining vegetation in the survey areas was mapped as Degraded-Completely (70%). Vegetation condition within the development envelope is shown on Figures 9.1 to 9.9. The development envelope intersects portions of four Bush Forever Sites, including Ken Hurst Park (BF Site 245), Canning and Southern Rivers – Beckenham to Martin/ Kelmscott (BF Site 246), Jandakot Airport (BF Site 388) and Nicholson Road Bushland (BF Site 456). The vegetation type and condition of each Bush Forever site is shown in Figures 11.1 to 11.8. One hundred and eighty seven (187) flora taxa (including subspecies and varieties) representing 52 families and 140 genera were recorded from the survey area during the field surveys. DBCA databases indicate the potential presence of 85 conservation significant flora species. A likelihood of occurrence assessment conducted post-field surveys concluded that two taxa are known to occur, *Caladenia huegelii* and *Dodonaea hackettiana*. The remaining taxa are considered unlikely to occur within the survey area. *Caladenia huegelii* is an ephemeral generally found in deep sandy soils of *Banksia* spp. – *Eucalyptus marginata* woodlands and favours areas of dense undergrowth. Suitable habitat within the Proposal development envelope includes: • *Banksia menziesii* and *B. attenuata* woodland (VT01) • *Banksia* spp. isolated trees *Regelia inops Hypocalymma angustifolium* (VT02a). *Dodonaea hackettiana*, which is listed as a Priority 4 species under the *Biodiversity Conservation Act 2016* (BC Act) was previously recorded by GHD (2013) near the Ranford Road Waste Transfer Station. This species was not recorded during the 2017 and 2018 surveys (GHD 2019). However, PGV Environmental (2018) recorded five individuals of this species at the Ranford Road site within vegetation type VT01. **Threatened and Priority Ecological Communities:** • Of the seven vegetation types within the survey area, VT01 (*Banksia menziesii and B attenuate* woodland) and VT02a (*Banksia spp. isolated trees Regelia inops Hypocalymma angustifolium shrubland*) are of relevance in terms of PECs / TECs. • One Federally listed TEC (*Banksia* Woodlands of the Swan Coastal Plain) was recorded in four separate patches in the survey area (Figures 6.1 and 6.2) comprising 12.47 ha. • No State listed TECs were recorded in the survey area. • One State listed PEC (Low lying *Banksia attenuata* woodlands or shrublands, Floristic Community Type 21c (Priority 3))

KEY ENVIRONMENTAL FACTOR	REPORT	SCOPE OF STUDY	KEY FINDINGS
			was recorded in the survey area. • Areas of the Federally listed TEC overlap the PEC, i.e. Floristic Community Type 21c is also a component of the Federally listed TEC. **Wetland vegetation:** • Seventeen wetlands in the Geomorphic Wetlands of the Swan Coastal Plain dataset intersect with the development envelope (Figures 15.1 to 15.9) – four Conservation Category wetlands (CCWs), six Resource Enhancement wetlands (REWs) and seven Multiple Use wetlands (MUWs), two of which are cleared of native vegetation (UFIs 6652 and 6655). **Introduced flora and declared pests:** • The most commonly recorded weed species were; *Hypochaeris glabra, Ursinia anthemoides, Solanum nigrum, Pelargonium capitatum, Gladiolus caryophyllaceus, Ehrharta calycina, Sonchus oleraceus, Arctotheca calendula, Briza minor* and *Cenchrus setaceus*. • Six Declared Pests (under the *Biosecurity and Management Act 2007* (WA)) and two Weeds of National Significance (WONS) were identified within the survey area: *Zantedeschia aethiopica* (Arum Lilly) – Declared Pest, *Moraea flaccida* (One-leaf Cape Tulip) – Declared Pest, *Echium plantagineum* (Paterson's Curse) – Declared Pest, *Rubus laudatus* (Blackberry) – Declared Pest, *Lantana camara* (Lantana) – Declared Pest and WONS and *Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WONS. ***Phytophthora* Dieback:** • Glevan (2018) completed a dieback assessment of the Proposal area in September 2018. *Phytophthora* dieback status is shown in Figure 10. This survey assessed 306.4 ha (with 267.1 ha not assessed as it did not contain vegetation or was in degraded or completely degraded state). Five *Phytophthora* dieback infestations were mapped, comprising a total of 12.4 ha (31% of the assessed area). The remaining 26.9 ha (69%) was considered to be uninfested. One of the five areas intersects the development envelope at Canning Landfill and Recycling Facility area on the western side of Ranford Road (Glevan, 2018; Map 2). The development envelope abuts an infested area on the opposite side of Ranford road at the northern boundary of Caladenia Grover Reserve and also the narrow section of infested vegetation to the east of the Reserve. Previously identified infested areas associated with Ken Hurst Park do not appear to have spread beyond the water gaining areas. • The *Ken Hurst Park Strategic Management Plan 2014-2019* (Waters, 2014) includes mapping of the extent of *Phytophthora cinnamomi* dieback infestation within Ken Hurst Park. **Fauna:** • 66 species (native and introduced) were recorded in the survey area comprising 45 birds, 11 reptiles, 7 mammals and 3 frogs. • 45 conservation significant fauna species were identified from database searches as being present or potentially being present in the survey area. An additional 34 species were included within the desktop review following a review of species listed under Schedules 1 to 4 of the BC Act. Of these, GHD assessed 10 species to be present or likely to be present (refer to Appendix E of GHD, 2019). • Three conservation significant species were recorded in the survey area; Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*) and the Southern Brown Bandicoot (*Isoodon obesulus fusciventer*. • Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) has previously been recorded in the Caladenia Grove Wetland Reserve and the Ranford Road Bushland (Bush Forever site 388) during the 2015 survey (NACMS, 2016). • Seven other species are likely to occur in the survey area based on the desktop review, but were not recorded during the surveys. These were the; Great Egret (*Ardea modesta*), Peregrine Falcon (*Falco peregrinus*), Perth Slider (*Lerista lineata*), Jewelled South West Ctenotus (*Ctenotus gemmula*), Black Striped Snake (*Neelaps calonotos*), Graceful Sunmoth (*Synemon gratiosa*), and the cricket (*Throscodectes xiphos*). • Black Cockatoo habitat was identified within the survey area comprising 46.83 ha of foraging habitat and 176 potential habitat trees; however, there is no evidence of these trees currently being used for nesting or containing hollows

KEY ENVIRONMENTAL FACTOR	REPORT	SCOPE OF STUDY	KEY FINDINGS
			suitable for breeding. • Eight broad fauna habitats were mapped, with three of high ecological value. These three habitats cover 28% of the total survey area. The vegetation types associated with habitats (Table T of GHD, 2019d) and observations of conservation significant fauna are presented on Figures 12.1 to 12.9.
Terrestrial Environmental Quality	**Lots 302, 303 and 500 Ranford Road, Canning Vale Preliminary Site Investigation** GHD, September 2018 **Ranford Road METRONET Sampling and Analysis Plan for Detailed Site Investigation** GHD, October 2017 **Ranford Road METRONET Detailed Site Investigation: Interim (Draft)** GHD, July 2018 **Ranford Road - Contamination Status and Remediation Options** GHD, September 2018	The 2016 PSI describes the work undertaken on the former landfill located at the proposed site for the Ranford Road station: • Preliminary Site Investigation including desktop assessment, site inspection and preliminary conceptual site model. • Sampling and analysis plan for a limited investigation. • Soil sampling and results from four test pits. • Installation of four groundwater monitoring wells and four ground gas monitoring wells. • Groundwater sampling and results from four groundwater monitoring wells. • Landfill gas monitoring and results from four ground gas monitoring wells. The 2017 SAP was prepared to address data gaps from the PSI and guide field investigations during the Detailed Site Investigation of Lots 302, 303 and 500 Ranford Road, Canning Vale. The DSI report outlines outcomes of the investigation which involved soil testing, gas monitoring and groundwater sampling. The 2018 letter provides a status update and summary of the DSI with options for management and remediation.	The proposed Ranford Road station location within the development envelope is classified as *Possibly contaminated – investigation required* under the *Contaminated Sites Act 2003* due to former landfill activities (Figure 14). It therefore represents constrained land with soil and groundwater contamination. The Preliminary Site Investigation (PSI) (GHD, 2016) and Sampling and Analysis Plan (SAP) (GHD, 2017), which investigated Lots 302, 303 and 500 associated with the Ranford Road station site, included a Conceptual Site Model (CSM) describing the preliminary risks to human health and the environment, based on identified contamination sources, transport mechanisms, exposure pathways and receptors. Prior to completion of the Detailed Site Investigation (DSI), the following risks to the environment were documented: • Very low risk to ecological receptors from groundwater contaminants (metals, hydrocarbon, pesticides, major ions, nutrients and per- and poly-fluoroalkyl substances (PFAS)) and surface water contaminants (metals, hydrocarbon, pesticides, major ions and nutrients) identified in the general landfill area. • Low risk to terrestrial flora and fauna from ground gases (CO_2, CO, H_2S, CH_4 and vapours) identified in the general landfill area. Future development risk is considered to be Moderate without appropriate management measures. • Low risk to ecological receptors from hydrocarbons from the City of Canning Waste Transfer Station (CCWTS). • Very Low risk to ecological receptors from hydrocarbons from the oil pipelines in the vicinity of the development envelope, with appropriate operational/management measures. A detailed site investigation (DSI) was undertaken by GHD in 2017 and 2018 and was subject to independent review by an accredited contaminated sites auditor. The DSI comprised preparation of a Sampling and Analysis Quality Plan (SAQP) (GHD, 2017), soil profile investigation and monitoring of gas and vapour. The key outcome of the DSI was that there were no significant sources of contamination associated with the CCWTS at the Ranford Road site. Substances which represent potential sources of contamination associated with the former landfill include asbestos containing material (ACM), aluminium, chloride and ammonia in groundwater beneath the site (exceeding non-potable use of groundwater guidelines), Per and poly-flouroalkyl substances (PFAS) in groundwater (exceeding guidelines for the protection of freshwater aquatic species) and landfill gases and vapours in the former landfill. It was also noted that aluminium and PFAS in groundwater (at lower concentrations) was recorded in groundwater which flows towards the site. An assessment of risks posed to relevant human health and ecological receptors undertaken in the DSI for development and operation of a new station at the Site identified the following risks (GHD, 2018c - Table 1) to relevant receptors: • Waste inclusions in the landfill capping material (ACM, physical hazards (also odour and aesthetics): Very low risk rating (with the implementation of appropriate management measures during construction) • Landfill waste material: Very low risk rating (with the implementation of appropriate management measures during construction) • General landfill areas (groundwater: aluminium, chloride, ammonia, PFAS): Very low risk rating (with the implementation of appropriate management measures during construction) with moderate risk for PFAS to down gradient aquatic ecosystems. • General landfill areas (ground gases: CO_2, CO, H_2S and CH_4) represent a moderate risk to members of the public and a high risk to below ground workers. Options for management during construction will be provided in more detail through preparation of a Contractor's CEMP, remedial action Plan (RAP) or a construction specific site management Plan (SMP) for the Ranford Road site with endorsement by the auditor. Options for management of identified risk are outlined in GHD (2018c) and include:

KEY ENVIRONMENTAL FACTOR	REPORT	SCOPE OF STUDY	KEY FINDINGS
			• Waste inclusions in landfill capping: removal and disposal to landfill, treatment by screening with reuse of some inert materials. • Landfill waste material: Avoidance of development features which require deep excavation and specification of measures for protection of foundations and buried structures. • General landfill area: Management consistent with RAP or SMP including for dust, odours, noise, vibration, stockpiling, waste management, materials tracking, stormwater run-off, drainage sedimentation, leachate management and groundwater protection, traffic management (including measures to prevent dust or mud being deposited on public roads by vehicles leaving the site), existing (protected) vegetation, contamination, unexpected finds, emergency preparedness and response, monitoring requirements, security, training and community engagement. • General landfill area – groundwater: Timing and staging of construction works and minimising scale of disturbance to landfill. • General landfill – gases and vapours: Expansion of gas monitoring network and modification of gas extraction system.
	Preliminary Acid Sulfate Soil Investigation Golder Associates March 2018	A desktop and limited site investigation for ASS associated with the development envelope was undertaken by Golder Associates in 2018.	**Acid Sulfate Soils:** A desktop and site inspection was undertaken by Golder Associates (2018a). ASS risk mapping (NationalMap, 2018) indicates the majority of the development envelope is located within moderate to low risk areas of ASS occurring within 3m of the natural soil surface, but high to moderate risk of ASS occurring beyond 3m. Several pockets of high risk areas (Figure 13), where ASS is potentially present within 3m of the natural ground surface occur along the alignment. These are associated with the Canning River sediments and mapped wetlands. Golder recommended a detailed ASS investigation in *high to moderate* risk and *moderate* risk areas likely to be impacted by construction activities (Figure 13). The Ranford Road site is classified as Class 2: *High to moderate risk of ASS beyond 3 m of natural soil surface*) and has previously been highly disturbed/modified. Therefore, the possible presence of ASS with respect to current, natural soil surface is considered limited (except for areas outside the landfill extent). Field and laboratory analytical data obtained during the DSI (GHD 2018b) did not indicate the presence of ASS in the areas investigated.
	Preliminary Site Investigation – Thornlie Cockburn Link Golder Associates June 2018	Golder Associates (2018b) developed Conceptual Site Models (CSM) for two extents related to the development area as part of a Preliminary Site Investigation (PSI) of the development envelope.	The PSI considered potential ASS, railway activities, fill material, rubbish fly tipping/waste dumping, the BP oil pipeline, Parmelia gas pipeline, drainage discharge, electricity power station/ transformers, market gardens/ plant nurseries, airports/ airstrips/ aerospace facilities, compost manufacturing, metal recovery, landfill sites and other industries in proximity to the development envelope. Data gaps and potential receptors were identified in relation to construction activities (including risks to workers, dewatering, groundwater quality (potential impacts on plume movement), materials management and impacts on surrounding land uses (nuisance and or dust). Recommendations include: • Development of unexpected finds protocol for waste dumping. • Quality testing for any groundwater abstracted for use during construction. • Establishment of baseline data for soil and groundwater across the site. • Installation and monitoring of groundwater wells. • Review of the PSI when detailed design is more fully developed.
Inland Waters	**Thornlie – Cockburn Link Referral Information with Additional Information** Aurora Environmental, 2019 **PTA METRONET – Thornlie Cockburn**	The Referral Information with Additional Information (Aurora Environmental, 2019) was prepared to fill information gaps, inform the referral to the EPA, outline existing environments, identify possible impacts and outline mitigation and management proposed for the Proposal. Golder Associates (2018c) undertook a desktop review to characterise groundwater, identify publicly listed bores, identify 5C licences and assess the possible existence of private bores not included in online databases. A desktop review and fieldwork (rapid assessment) were undertaken for wetland assessment by GHD (2018f) with 18 wetlands in the desktop, with fieldwork indicating a number of inaccuracies in the Swan Coastal Plain dataset.	DWER Perth Groundwater Mapping indicates that the development area is underlain by the Superficial Swan Aquifer, the Leederville aquifer and the Yarragadee North aquifer and the Yarragadee North aquifer. The development area is located north of the centre of the Jandakot Mound, which is the main hydrological feature in the area and an important water supply source fo the Water Corporation (Golder Associates, 2018c). Groundwater levels indicate the following flow directions: • West of John Connell Reserve, generally inferred to the west towards the Bibra Lake/ South Lake region. • Between Baile Road and John Connell Reserve, generally inferred to the north towards the Swan River. • East of Baile Road, generally inferred to the east towards the Canning River. General depth to groundwater (Golder, 2018 and Advisian, 2017) is as follows: • 2.5m BGL between Thornlie Station and Nicholson Road Station. However, closer to Nicholson Road Station, groundwater levels are expected to be deeper than 3 m BGL.

KEY ENVIRONMENTAL FACTOR	REPORT	SCOPE OF STUDY	KEY FINDINGS
	Link Groundwater Desktop Study and Conceptual Sampling and Analysis Quality Plan Golder Associates (2018) **Rapid Wetland Assessment** GHD, 2018 **Metronet – Thornlie Cockburn Link: Groundwater Level Monitoring Information Technical Memorandum** Golder Associates (2019)	1.	• The groundwater level between Nicholson Road Station and Ranford Road Station is expected to be deeper than 3 m BGL. However closer to Ranford Road Station, the groundwater is expected to be deeper than 6 m BGL. • The groundwater level from Ranford Road Station to Glen Iris Tunnel is expected to be generally deeper than 12 m BGL. Portions of the development envelope will be located within the 1 in 100 (1%) annual exceedance probability (AEP) floodway and flood fringe mapping (Figure 16). Based on the available data from the WIN bore records and recent Golder Associates (2019) monitoring, the site specific groundwater conditions are summarised as (Aurora Environmental, 2019): • Within the City of Cockburn groundwater is shallow and within the top 15m of the soil profile. Groundwater sits between 19m and 26m AHD. The highest maximum recorded water level was 19.8m AHD (in WIN ID: 3197 in 1992). In relation to the rest of the TCL alignment, the water table is at its deepest within the City of Cockburn. • Groundwater within the City of Melville is shallow and within the top 12m of the soil profile. Two records suggest the water table sits at around 22m AHD. The highest maximum recorded water level was 22.81m AHD (in TCL-BH015 on 19 February 2019). • Within the City of Canning groundwater is shallow and within the top 11m of the soil profile. Groundwater sits between 20m and 24m AHD. The highest maximum recorded water level was 20.31m AHD (in GW10 on 30 January 2019). • Within the City of Gosnells groundwater is present on the ground surface or shallow and within the top 6m of the soil profile. Groundwater sits between -0.16m and 18m AHD. The highest maximum recorded water level was -0.16m AHD (in TCL-BH001 on 19 February 2019). In relation to the rest of the TCL alignment, the water table is at its shallowest within the City of Gosnells. The development envelope is located within the following four unproclaimed surface water catchments including: Swan–Avon Lower Swan, Coastal, Swan–Avon Canning River and Bartram Road. The Canning River is a major tributary of the Swan River and is a proclaimed river under the *Rights in Water and Irrigation Act 1914*. The Proposal area is located within the Jandakot and Perth proclaimed groundwater areas and within multiple subareas; South Lakes, Airport, City of Canning, City of Melville, City of Cockburn and City of Gosnells. The depth to groundwater is shallowest beneath the development envelope in the vicinity of the Canning River, where maximum groundwater level (MGL) is approximately 3mAHD (Figure 5). Within the Jandakot Mound is an area defined as the UWPCA. The section of TCL between the Kwinana Freeway and Jandakot is within the UWPCA and traverses Priority 1 and Priority 3 designated areas (Figures 3.1-3.2). Production Bores and Wellhead Protection Zones: The section of TCL between the Kwinana Freeway and Jandakot is within the vicinity of Jandakot Mound production bores and wellhead protection zones (Figures 3.1-3.2). Specifically, Production Bore J400 (which abstracts water from the superficial aquifer) and the corresponding wellhead protection zone intersects the development envelope (Figures 3.1-3.2). The DWER's Water Register (DWER, 2018) indicates a groundwater licence (GWL: 165600) has been granted in the vicinity of the development envelope for abstraction of water from the Leederville aquifer for irrigation of various parks/reserves in the City. No other licences for the aquifer have been granted adjacent to the development envelope. Golder Associates (11 April 2018) identified 17 water licences within or intersecting the 50 m buffer of the development envelope, with seven drawn points identified within the buffer (noting that licences are based on cadastral boundaries). Small annual abstraction licences are likely to have a greater potential for vulnerability to lowering of groundwater via dewatering. Some licences are short term and related to construction projects and therefore will not be impacted by the TCL Proposal. One water licence was identified as associated with a Water Corporation supply (but does not intersect the 50 m buffer to the development envelope. Water licence areas are shown in Golder Associates 2018c; Appendix B Figs 6A – 6H). Publicly listed bores and private bores are shown in Figure 10 of Golder Associates 2018c. The GHD (2018f) desktop review identified 18 mapped geomorphic wetlands (Swan Coastal Plain dataset) that intersected the survey area (GHD, 2019; Table M). A field assessment (GHD, 2019) was undertaken to verify the mapping contained in the Swan Coastal Plain dataset. The assessment found a number of inaccuracies in the Swan Coastal Plain dataset. Ten wetlands have either been cleared or landscaped (GHD, 2019; Table M). Within the development envelope, five wetlands confirmed by GHD (2018f) as comprising dampland vegetation will be

KEY ENVIRONMENTAL FACTOR	REPORT	SCOPE OF STUDY	KEY FINDINGS
			affected by the TCL construction and operation, including: • One conservation category wetland (CCW) (Unique Feature Identifier (UFI): 7446) located at Tom Bateman Reserve. • Three resource enhancement wetlands (REW) located south of the proposed Ranford Road station (UFI:13332), the Canning River (UFI: 7447) and 100m north of the Canning River (UFI: 15926). • One multiple use wetland (MUW) (UFI: 13621) located in the City of Gosnells near the proposed Nicholson Road station and Tom Bateman Reserve.
Social Surroundings	**Thornlie–Cockburn Link Noise and Vibration Assessment** SLR Consulting Australia Pty Ltd, October 2018	This report describes: • Airborne noise modelling prediction and assessment. • Ground–borne vibration (GBV) prediction and assessment. • Ground–borne noise (GBN) prediction and mitigation/control. • Existing noise and vibration environment, and existing rail traffic noise and vibration emissions.	Noise measurements of the existing freight operations have been modelled and SLR (2018a) has identified that greater than 50% of the 707 residential noise sensitive premises are currently subject to noise emissions from existing infrastructure greater than the Default Design Level20. The SLR report notes: • During the daytime period 354 residential premises receive average noise levels > 60 decibels (dB), the Default Design Level. • During the night time period 366 residential premises receive average noise levels > 55dB, Default Design Level. • Maximum levels (> 80dB Default Design Level) are received at 508 residential premises (74%), with the greatest level being 99 dB. There are no noise predictions for the construction phase of the Proposal.
	Noise and Vibration Management Plan Thornlie–Cockburn Link Transport Corridor Rail Operations SLR Consulting Australia Pty Ltd, November 2018	This report describes: • PTA's management commitments for airborne noise, GBV and GBN. • Noise and vibration monitoring methodology and assessment criteria. • Complaint handling procedure. • Corrective actions.	Freight trains currently cause vibration, with the measured level of an average freight train travelling at 80km/hr at a distance of 10m being 130 dB re 1nm/s22. At a distance of 40m the vibration level reduces to 112 dB re 1nm/s. Regenerated noise is more likely to be noticeable at this distance from the railway (SLR, 2018b). There is no vibration modelling predictions for the construction phase of the Proposal.
	Aboriginal Heritage Survey R. O'Connor, September 2017a	This report describes the Aboriginal heritage survey. The survey methodology undertaken was: • Examination of existing aboriginal heritage sites database. • On-site inspection of areas of proposed works by the anthropologist to decide upon a suitable venue for the initial survey meeting. • Consultation with Whadjuk representatives nominated by SWALSC after consideration of the Activity Notice. • Inspection of areas of proposed works by nominated Whadjuk representatives.	The Proposal is within the Whadjuk Indigenous Land Use Agreement area. Consultation and inspection of the development envelope was undertaken on 18 September and 4 October 2017 by representatives of the Whadjuk people nominated by the South West Aboriginal Land and Sea Council (SWALSC). The survey identified: • One registered site – Canning River (ID: 3538, mythological site). • An additional registered site – Swan River (ID: 3536, mythological site) also intersects the development envelope.
	Addendum to report on Thornlie-Cockburn Link, Aboriginal Heritage Survey R. O'Connor, October 2017b	A second inspection as requested by Whadjuk representatives was undertaken on 4 October 2017 of the proposed Nicholson Road Station site and the northern bank of the Canning River. This addendum report details the methodology, execution and results of that additional consultative process and Aboriginal heritage survey.	On completion of the consultative meetings in October 2018, the Whadjuk representatives signed an approval for the proposed works, with the following requests: • Monitors to be on site for initial ground disturbance; and • Avoid major disturbance to wetland site at Nicholson Road Station and try to retain as much as possible in a landscaped area.

2.4.2 Management Approach

The management approach has been informed by best practice and recent experience on similar linear infrastructure projects in Western Australia. The hierarchical approach focuses on avoiding impacts to the key preliminary environmental factors, with particular attention on the ix key environmental issues that were identified in 'Further explanation of decision on Level of Assessment' (EPA, 2018). Where impacts are unavoidable, management aims to minimise the duration, intensity and/or extent of impacts on key environmental factors during construction.

2.4.3 Rationale for Choice of Provisions

The management provisions detailed in this document align with the mitigation measures outlined in the Thornlie – Cockburn Link Referral Information with Additional Information (Aurora Environmental, 2019). In addition, recommendations from various specialist reports have also been included.

Six Water Quality Protection Notes (WQPN) published by the former Department of Water (DoW) have also been considered to ensure that relevant water quality management measures are incorporated into the CEMP to manage potential contamination risks:

- WQPN 10: Contaminant spills – emergency response (DoW, 2006a)
- WQPN 44: Roads near sensitive water resources (DoW, 2006b)
- WQPN 51: Industrial wastewater management and disposal (DoW, 2009a)
- WQPN 56: Tanks for fuel and chemical storage near sensitive water resources (DWER, 2018);
- WQPN 68: Mechanical equipment wash down (DoW, 2013); and
- WQPN 83: Infrastructure corridors near sensitive water resources (DoW, 2007).

2.4.4 Key Assumptions

Key assumptions of this CEMP include:

- The key environmental factors of Flora and Vegetation and Terrestrial Fauna are considered to have the greatest risk of significant environmental impacts in relation to management of project construction. Therefore, the management of the potential impacts related to these key environmental factors from the Proposal has been given the highest priority.
- Management of potential contamination at the Ranford Road Station location will be managed in accordance with the requirements of the *Contaminated Sites Act 2003* to the satisfaction of the Contaminated Sites Auditor.
- Impacts on Matters of National Environmental Significance (MNES) listed under the EPBC Act have been assessed as part the EP Act assessment process.
- No rehabilitation or replacement of native vegetation (e.g. as an offset for vegetation cleared) is proposed within the development envelope. The Proposal will result in some areas of the development envelope being planted for targeted purposes such as landscaping around stations, stabilisation of batters around cuttings and in association with drainage structures

and basins. While these vegetation works may include native species and result in the revegetation of areas cleared during construction, they are not attempting to restore the vegetation communities that existed prior to clearing, but rather establish plantings that undertake functions such as nutrient treatment, stabilisation or are sympathetic to the surrounding vegetation and landform.

- In relation to timeframes for management actions or monitoring, the term 'construction' is used to refer to the period from which construction works and/or ground disturbance are substantially commenced (i.e. not including any preliminary site investigative works, for example) until the substantial completion of such works. The term 'substantial completion' recognises that the change from construction to operations is a transition over a period of time and may occur at different times in different places within the development envelope, requiring interpretation on a case by case basis with respect to the provisions in this plan.
- If there is any inconsistency between Schedule 1 and any other part of this document, Schedule 1 prevails to the extent of the inconsistency.
- Risks associated with hazardous materials/chemicals and working on potentially contaminated sites during construction will require specific management through the implementation of a CEMP prepared by the appointed Contractor.

3 CEMP PROVISIONS

This section of the CEMP sets out the provisions that will be implemented as part of this plan.

3.1 OUTCOME-BASED PROVISIONS

No outcome-based provisions are proposed.

3.2 MANAGEMENT BASED PROVISIONS

The provisions that form the key component of this CEMP are identified in Schedule 1 (attached) and summarised below.

Flora and Vegetation

- FV1 & FV2: Prevention of unauthorised clearing inside and outside of the building envelope through delineation and demarcation of areas for clearing/protection with daily inspection and reporting.
- FV3: Weed risk management (hygiene and access control), monitoring and reporting.
- FV4: Management of *Phytophthora* dieback introduction risk and prevention of spread through identification of uninfested and infested areas, implementation of hygiene measures consistent with DBCA *Phytophthora* dieback guidelines (e.g. clean down of vehicles, sourcing of materials), training of personnel, annual monitoring (in dieback free areas) and reporting.
- FV5: Dieback and weed risk management for Ken Hurst Park with monthly visual inspections for weeds along the clearing edge adjacent to retained native vegetation and annual monitoring of *Phytophthora* dieback in previously uninfested areas for the duration of construction activities.
- FV6: Dust suppression and management to prevent deleterious deposition on native vegetation with annual monitoring and reporting.
- FV7: Procedures to prevent and manage risk of causing fire during construction.

Terrestrial Fauna

- TF1: Management of native vegetation clearing, (including trapping and relocation of conservation significant fauna, provision of fauna spotters, clearing from disturbed edge and management of trenches to prevent fauna trapping) with daily inspections, record keeping and reporting in PTA's Annual Reporting. Personnel to receive training regarding minimising impacts on fauna.

Terrestrial Environmental Quality

- TE1: Management and removal of contamination (including dumped rubbish) in accordance with the Contractor's CEMP, SMP, RAP, ASS and dewatering management plans. Monitor as determined in consultation with DWER and DBCA with weekly inspections for rubbish dumping near native vegetation, wetlands and well head protection zones. Record keeping and reporting in the PTA's Annual Reporting. An 'unexpected finds protocol' will be included in the Contractor's CEMP.

Inland Waters

- IW1: Management of dewatering and groundwater abstraction according to ASS and dewatering management plans with monitoring of groundwater levels and water quality in accordance with licence requirements. Monitoring of production bores adjacent to Banksia Woodlands TEC for drawdown. Recording and reporting in the PTA's Annual Reporting.
- IW2: Prevention of prohibited activities (abstraction, excavation, discharge) that could impact on CCWs, REWs, UWPCA and wellhead protection zones with weekly visual inspections and record keeping. Consultation with Water Corporation and DWER regarding management of construction adjacent to Production bore J400. Management of stormwater and surface water to prevent erosion, sedimentation and discharge with monthly visual inspections and following rainfall events. Risk management of hazardous materials and spill risk with physical measures (bunds, containment) and training of personnel. Monitoring and treatment as per Contractor's CEMP, SMP, RAP and/or ASS and dewatering management plans. Recording and reporting in the PTA's Annual Reporting and in accordance with licences and/or plans.

Social Surroundings

- SS1 – Dust suppression and management (water cart, hydro mulch, speed limits, use of daily weather forecasts) with daily visual monitoring, recording and reporting in the PTA's Annual Reporting. Use of complaints register with investigation and resolution recorded.
- SS2 – Noise and vibration management through implementation of a Noise and Vibration Management Plan (NVMP) with controls in accordance with *Environmental Protection (Noise) Regulations 1997* and *AS24360-2010 (R2016) Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites,* including selection of equipment, timing of works, and noise and vibration monitoring. Establishment of complaints register with records of investigation and outcomes. Reporting in the PTA's Annual Reporting.
- SS3 – Management of Aboriginal heritage in accordance with Section 18 Notice and commitments during stakeholder engagement. Site monitors for initial ground works at nominated sites. Compliance with Aboriginal Heritage Management Protocol in the event of identification of artefacts. Inspection and records associated with activities with reporting in the PTA's Annual Report.

Activities associated with management will include:

- Preparation of individualized plans, where required (Contractor's CEMP, SMP, RAP, ASS and dewatering management plans).
- Induction and/ or training of personnel in key management practices.
- Fencing and/or delineation of sensitive areas.
- Application of water sprays, use of ground covers and installation of screens to act as wind breaks, to aid in the control of dust generation.
- Temporarily re-covering of exposed evacuations from within the landfill waste mass (if disturbed) overnight and/or during periods of low excavation activity, to aid in the control of nuisance odours.

- Creation of appropriate (temporary) stormwater and surface run-off drainage system (e.g. temporary bunding and collection ponds), to aid in the control of surface and stormwater run-off.
- Appropriate management of excavated spoil particularly where generated from within the landfill waste mass (if disturbed), such as limiting the height of stockpiles and installation of leachate collection systems to contain potentially contaminated stockpile run-off.
- Exclusion of worker access to excavations/confined spaces or other contact with waste in the former landfill area wherever possible.
- Implementation of controls for access which is unavoidable.
- Confirm appropriate control measures are in place for below ground maintenance works undertaken by owners/operators of underground services infrastructure in the vicinity of the former landfill.
- Monitoring of the above actions with respect to relevant developed 'trigger levels' to determine when and how an additional management action should be implemented (i.e. contingency measures – see below).

Contingency measures, if determined to be required, should include, but not be limited to:

- Re-instatement of surfaces and/or fencing.
- Increased monitoring or further site characterisation, amendment of management measures.
- Targeted community engagement.

3.3 MONITORING

To determine whether the management actions and the EPA's objectives for each preliminary key environmental factor are being met, monitoring is proposed as set out in Schedule 1 and summarised in Table 5 below.

TABLE 5: SUMMARY OF MONITORING PROVISIONS

MONITORING BASIS	SUMMARY OF MONITORING
Daily	• Inspection of clearing front/extents to ensure no clearing outside of the approved development envelope or in excess of identified clearing targets during clearing activities. • Walkover inspection for fauna ahead of and during vegetation clearing activities (such that further fauna relocation can be undertaken where appropriate using qualified personal as per pre-clearing management action). • Daily inspections of trenches in the morning and afternoon to identify any trapped fauna and to enable capture and relocation. • Record any known injuries or mortalities of fauna. • Visual monitoring of airborne dust in relation to dust generation beyond the

MONITORING BASIS	SUMMARY OF MONITORING
	perimeter of the development area to ensure no offsite dust impacts and efficacy of dust control measures. • Visual monitoring during construction to identify and manage any potential disturbed contamination or heritage objects. • Noise monitoring for works outside of standard construction hours, in accordance with the Noise Management Plan approved by relevant local government authority (if applicable).

Weekly	• Visual inspection for evidence of unauthorised access to areas of native vegetation surrounding the development envelope, attributable to construction.
	• Spot checks of compliance with vehicle clean on entry/exit procedures at each entry and exit point.
	• Undertake a weekly visual inspection of construction activities to check that no prohibited activities are being conducted in the following areas:
	  • Wetlands – CCWs and REWs;
	  • UWPCA and well head protection zones.
	• Visual inspection of any identified heritage sites to ensure no disturbance by contractor outside of the approved development envelope.

Monthly	• Visual inspections for weeds along the clearing edge adjacent to retained native vegetation. • Visual inspection for evidence of erosion. • Visual inspection of hazardous material storage, handling and disposal. In the event of a major spill, undertake groundwater and/or surface water monitoring.
Annually	• Annual monitoring of dieback free (uninfested) areas of native vegetation within and adjacent to the development envelope. • Visual monitoring of vegetation health in accordance with vegetation health monitoring plan.
As required	• Record any fire occurrences during construction. • Monitoring as required by the Contractor's CEMP, SMPs, RAPs and/or ASS and Dewatering Management Plans. • If other contamination is encountered during construction, monitoring may be developed as part of a strategy for dealing with the contamination. • Conduct post-construction assessment of areas previously uninfested by Phytophthora dieback approximately 12 months after construction ceases. • Monitoring of dewatering activities including dewatering effluent and groundwater in line with ASS and Dewatering Management Plans. • Monitoring of groundwater abstraction in accordance with licence requirements. • Ranford Road station site: Monitoring for dewatering cone of depression in relation to potential contaminated groundwater (to reduce risk of treating contaminated dewatering effluent), if required. Monitoring groundwater for potential offsite plume

MONITORING BASIS	SUMMARY OF MONITORING
	migration. Monitoring of gas via monitoring well network to detect lateral migration of gases from landfill area, where deemed appropriate. • Monitoring to ensure prohibited activities are not carried out in CCW, REW, UWPCA and wellhead protection zones. • Monitoring in consultation with Water Corporation and DWER during construction in the UWPCA and wellhead protection zone for Production Bore J400. • Monitoring of production bores in the vicinity of the Banksia Woodlands TEC for drawdown of groundwater as indicated by hydrogeological assessment outcomes and approval requirements. • Monitoring of groundwater and/or surface water monitoring following a major spill, in consultation with relevant agencies. • Visual inspection of offsite discharges following rainfall events. • Monitoring of noise and vibration emissions. • Monitor noise levels during approved out-of-hours work, to ensure compliance with the NVMP. • Aboriginal monitors will be present when initial ground disturbance is undertaken at registered or potential aboriginal sites, as per the Aboriginal Heritage Management Protocol. • Record number and description of any Aboriginal objects identified during construction activities.

Note: if there is any inconsistency between Table 5 and Schedule 1, the monitoring provisions in Schedule 1 prevail to the extent of the inconsistency. In addition, monitoring detail may be presented in the Contractor's CEMP, ASS and Dewatering Management Plans, Site Management Plans (SMPs) and/ or Remediation Action Plans (RAPs).

3.4 REPORTING

For the duration of the construction activities, potential non-compliances or events outlined in this CEMP will be documented by PTA and reported to the relevant authority. This will include, but is not limited to:

- Any clearing of native vegetation outside demarcated clearing areas;
- Details relating to fauna trapping and relocation;
- Deaths of, or injuries to fauna;
- Hazardous materials spills and leaks;
- Disturbed, previously unidentified contamination in the development envelope;
- Groundwater abstraction volumes;
- Dewatering volumes; and
- Aboriginal objects identified in the development envelope.

In addition to the record keeping identified above, Annual Reporting will be prepared by the PTA to report the outcomes of management actions and monitoring over each 12-month reporting period for the duration of construction. This will be from the commencement of construction activities until construction is completed. The PTA's Annual Reporting will be issued no later than 3 months after the 12-month reporting period. The Annual Reporting will include:

- A summary of compliance against the management actions detailed in Schedule 1.
- Potential non-compliances (such as management actions not implemented or management targets not met), reporting of non-compliances and triggering of adaptive management.
- The results of monitoring will be included in the appendices of the Annual Reporting including the following information:
    - Demonstration of compliance with management measures.
    - Documentation of monitoring undertaken.
    - Comparison of monitoring results against the management targets.
- The achievement of the environmental objective for each key environmental factor.

If the environmental objectives and/or management targets have not been achieved during the reporting period, the PTA's Annual Reporting will include a description of revised and/or additional management actions to be implemented to achieve the targets, the rationale behind these changes and an analysis of monitoring data to describe trends.

The full suite of reporting commitments is identified in Schedule 1.

4 ADAPTIVE MANAGEMENT AND REVIEW

4.1 ADAPTIVE MANAGEMENT

PTA will implement adaptive management in response to any issues identified in the implementation of management measures, monitoring and evaluation against the management targets, to more effectively meet the environmental objective. Examples of potential adaptive management actions are outlined in Table 6 for the key environmental factors of Flora and Vegetation and Terrestrial Fauna, as the Proposal represents the highest risk to these factors during construction.

TABLE 6: POTENTIAL ADAPTIVE MANAGEMENT MEASURES FOR FLORA AND VEGETATION AND TERRESTRIAL FAUNA

MANAGEMENT TARGET Flora and Vegetation	POTENTIAL ADAPTIVE MANAGEMENT MEASURES IF TARGETS NOT MET
No clearing of vegetation attributable to construction will occur outside of the development envelope. Clearing of native vegetation within the development envelope will not exceed 28.87 ha of native vegetation including 2.32 ha of TEC *Banksia* Woodland of the Swan Coastal Plain across two separate patches and 3.88 ha of Low lying *Banksia attenuata* woodlands or shrublands (Floristic Community Type 21c) PEC (of which 2.32 ha also comprises TEC).	• Cease clearing activities. • Review clearing boundaries. • Investigate cause and extent of over clearing. • Report over clearing to regulators. • Ensure all areas to be retained are clearly flagged. • Review training of personnel involved in clearing to avoid clearing outside of approved limits.
No introduction of new weed species in development envelope during and attributable to construction. No introduction or spread of weed species into surrounding native vegetation during and attributable to construction.	• Quarantine affected areas. • Restrict access to quarantined areas. • Investigate cause or source of infestation. • Inspect surrounding area to determine extent of infestation. • Review weed hygiene measures for efficacy. • Review training and implementation of, weed hygiene measures. • Implement control (e.g. spraying). • Monitor success of control actions.
No spread of *Phytophthora* dieback attributable to construction to dieback free areas of vegetation surrounding the development envelope, as observed for the duration of construction.	• Quarantine affected areas. • Restrict access to affected areas. • Investigate cause of infestation. • Inspect/survey surrounding area to determine extent of infestation. • Update mapped distribution of dieback affected areas.

MANAGEMENT TARGET Flora and Vegetation	POTENTIAL ADAPTIVE MANAGEMENT MEASURES IF TARGETS NOT MET
	• Review dieback management measures for efficacy. • Review training and implementation of dieback management measures. • Implement control measures such as application of phosphite, in consultation with regulators. • Implement revegetation if applicable. • Monitor success of dieback control measures.
Terrestrial Fauna	
No avoidable deaths of fauna confirmed during vegetation clearing or construction.	• Investigate cause. • Report to regulators as required. • Enforce construction site speed limits. • Review training and update as required. • Undertake targeted trapping and relocation if animals cannot egress fenced development envelope. • Inspect and repair any damaged or ineffective fauna fencing. • Review management measures and update as required.

4.2 DOCUMENT REVIEW

This plan will be reviewed:

- At the completion of the first twelve months of construction;
- If one or more management targets are not being met (within three months of target not being met);
- If adaptive management is required; and
- As required by DWER, if directed to do so.

The management actions and associated provisions in this plan may be required to be altered, due to:

- Changes to construction methods and timing;
- Trends being observed in monitoring data that might indicate an issue;
- New or revised information becoming available; and
- Other triggers of adaptive management.

The CEMP will be revised if the outcome of a review requires amendments to be made to the provisions in Schedule 1. It will also be revised if DWER directs PTA to amend it based on performance or compliance issues. Revised versions of the plan will be submitted to DWER for assessment and feedback. The most recently approved version of the plan will be implemented until either a new version has been approved by DWER or DWER advises that the plan no is no longer required to be implemented.

5 STAKEHOLDER CONSULTATION

PTA has consulted with various stakeholders in the development of the TCL Proposal and this CEMP, including meetings with DWER (as EPA support) and Commonwealth Department of Environment and Energy (DoEE). Appendix 1 provides a summary of consultation and PTA's responses. A Communications and Stakeholder Engagement Plan has also been developed by the PTA to guide the community relations activities for the various phases of the Proposal.

6 REFERENCES

Advisian (2017) Geotechnical Desktop Study Report: Thornlie-Cockburn Link (301012-02527-SS-REP-001). March 2017.

Aurora Environmental (2019) Thornlie-Cockburn Link Referral Information with Additional Information. Prepared for Public Transport Authority. Report No. AP2018-210, Version 5.

City of Melville (2014) Ken Hurst Park Strategic Management Plan 2014 – 2019. Final.

Department of Conservation and Land Management (2003) Management Guidelines – *Phytophthora cinnamomi* and Disease Caused by It.

Department of Parks and Wildlife (2015) Corporate Policy Statement No. 3 Management of *Phytophthora* Disease

Department of Transport (no date) Perth Freight Transport Network Plan, available at: https://www.transport.wa.gov.au/mediaFiles/projects/PROJ_P_Perth_Freight_Transport_Network_Plan_section__2.pdf

Department of Transport (2017) Freight Information, available at: https://www.transport.wa.gov.au/Freight-Ports/freight-information.asp

Department of Water (DoW) (2016) Water Quality Protection Note 25: Land use compatibility in Public Drinking Water Source Areas, available at http://www.water.wa.gov.au/publication-search?queries_title_query=&queries_subject_query=&queries_seriesname_query=water+quality+protection+note&queries_all_query=&search_page_5702_submit_button=Submit

Department of Water (DoW) (2013) Water Quality Protection 68: Mechanical equipment wash down. Available at: https://www.water.wa.gov.au/__data/assets/pdf_file/0016/4066/106044.pdf

Department of Water (DoW) (2009a) Water Quality Protection Note 51: Industrial wastewater management and disposal. Available at: https://www.water.wa.gov.au/__data/assets/pdf_file/0008/4040/89343.pdf

Department of Water (DoW) (2007) Water Quality Protection Note 83: Infrastructure corridors near sensitive water resources, available at: http://www.water.wa.gov.au/publicationsearch?queries_title_query=&queries_subject_query=&queries_seriesname_query=water+quality+protection+note&queries_all_query=&search_page_5702_submit_button=Submit

Department of Water (DoW) (2006a) Water Quality Protection Note 10: Contaminant spills emergency response, available at: http://www.water.wa.gov.au/publicationsearch?queries_title_query=&queries_subject_query=&queries_seriesname_query=water+quality+protection+note&queries_all_query=&search_page_5702_submit_button=Submit

Department of Water (DoW) (2006b) Water Quality Protection Note 44: Roads near sensitive water resources, available at: http://www.water.wa.gov.au/publicationsearch?queries_title_query=&queries_subject_query=&queries_seriesname_query=water+quality+protection+note&queries_all_query=&search_page_5702_submit_button=Submit

Department of Water and Environmental Regulation (DWER) (2018) Water Quality Protection Note 56: Tanks for fuel and chemical storage near sensitive water resources, available at https://www.water.wa.gov.au/__data/assets/pdf_file/0010/5131/82577.pdf

Environmental Protection Authority (EPA) (2018) Thornlie – Cockburn Link – Further explanation of decision on Level of Assessment. Sourced from: http://www.epa.wa.gov.au/proposals/thornlie-cockburn-link

GHD (2013) Thornlie Extension Environmental Assessment. Unpublished report prepared for Public Transport Authority.

GHD (2016) Lots 302, 303 and 500 Ranford Road, Canning Vale Preliminary Site Investigation. Unpublished report prepared for Public Transport Authority.

GHD (2017) Ranford Road METRONET – Sampling and Analysis Plan (SAQP) for Detailed Site Investigation. October 2017. Prepared for Public Transport Authority.

GHD (2018a) Lots 302, 303 and 500 Ranford Road, Canning Vale. Preliminary Site Investigation. September 2018. Prepared for Public Transport Authority.

GHD (2018b) Ranford Road METRONET – Detailed Site Investigation: Interim (Draft). July 2018. Prepared for Public Transport Authority.

GHD (2018c) METRONET Ranford Road – Contamination Status and Remediation Options Letter Report. 17 September 2018. Ref: 6136438-61690

GHD (2019) Thornlie–Cockburn Link Project Flora and Fauna Survey. Unpublished report prepared for Public Transport Authority. January 2019. Prepared for Public Transport Authority.

Glevan Consulting (2018) Thornlie Cockburn Link – Phytophthora Dieback Occurrence Assessment. Version 1. October 2018. Prepared for Public Transport Authority.

Golder Associates (2018a) PTA METRONET – Thornlie to Cockburn Link – Preliminary Acid Sulfate Soil Investigation. March 2018. Prepared for Public Transport Authority.

Golder Associates (2018b) Preliminary Site Investigation – Thornlie Cockburn Link. June 2018. Prepared for Public Transport Authority.

Golder Associates (2018c) PTA METRONET – Thornlie Cockburn Link – Groundwater Desktop Study and Conceptual Sampling and Analysis Quality Plan. June 2018. Prepared for Public Transport Authority.

Natural Area Consulting Management Services (NACMS) (2016) Ranford Road Bushland Flora and Fauna Report. Unpublished report prepared for City of Canning.

O'Connor, R. (2017a) Aboriginal Heritage Survey. Unpublished report prepared for Public Transport Authority. September 2017.

O'Connor, R. (2017b) Addendum to report on Thornlie-Cockburn Link, Aboriginal Heritage Survey. Unpublished report prepared for Public Transport Authority. October 2017.

PGV Environmental (2018) Thornlie to Cockburn Link – Wetland Assessment. Prepared for Public Transport Authority. November 2018. V2 Report No: 2018-396.

SLR Consulting Australia Pty Ltd (SLR) (2018a) Thornlie–Cockburn Link Noise and Vibration Assessment. Version 4.2. Unpublished report prepared for Public Transport Authority.

SLR Consulting Australia Pty Ltd (SLR) (2018b) Noise and Vibration Management Plan Thornlie–Cockburn Link Transport Corridor Rail Operations. November 2018. Prepared for Public Transport Authority.

SCHEDULE 1

CEMP PROVISIONS

SCHEDULE 1 CEMP PROVISIONS

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
Flora and Vegetation *EPA's objective: to protect flora and vegetation so that biological diversity and ecological integrity are maintained* Environmental aspects of the Proposal: Clearing of native vegetation & Vehicle and machinery movement Affected values: Native vegetation, Threatened species, TEC and PEC, Bush Forever Sites and Geomorphic wetlands				
FV1 – Prevent unauthorised clearing outside of development envelope	• Provide GPS co-ordinates of areas approved to be cleared to the contractor to ensure no unapproved clearing is undertaken. • Demarcate the development envelope (e.g. via installation of temporary fencing and/or flagging) to prevent clearing outside of approved areas. • Demarcate Tree Protection Zones at Tom Bateman Reserve and Canning River Precincts.	• No clearing of native vegetation to occur outside of the development envelope during and attributable to construction. • No clearing of habitat trees in Tree Protection Zones.	• Daily inspection during clearing activities of the condition of boundary demarcation and the location of the vegetation cleared to ensure no clearing outside of the development envelope.	• PTA to report any unauthorised clearing to DWER as soon as practicable after it is identified. • To be included in PTA's Annual Reporting with the location and area of vegetation cleared.
FV2- Prevent unauthorised clearing inside development envelope	• Provide GPS co-ordinates of areas approved to be cleared to the contractor to ensure no unauthorised clearing is undertaken.	Clearing of native vegetation within the development envelope will not exceed: • 52.93 ha of vegetation in total, which includes: ○ Up to 28.87 ha of native vegetation, 23.21 ha of vegetation type VT07 and no more than 2.32 ha of TEC Banksia Woodland of the Swan Coastal Plain, during and attributable to	• Daily inspection during clearing activities of clearing extents to ensure that total area of native vegetation cleared does not exceed the identified targets.	• Report any unauthorised clearing to DWER as soon as practicable after it is identified. • To be included in PTA's Annual Reporting with the area and location of vegetation cleared.

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
		construction. ○ 3.88 ha of Low lying *Banksia attenuata* woodlands or shrublands (Floristic Community Type 21c). Of this, 2.32 ha is also the Banksia Woodland TEC listed above.		
FV3 – Weed control and management	**Weed risk management** • Plan for site access and wash down areas. • Develop and implement clean on entry/exit procedures for key areas (native vegetation and wetlands). • Inspect vehicles entering and exiting key areas of the development envelope and implementation of clean down, as required. • Restrict unauthorised access to and from the development envelope by installing temporary fencing or barriers and signage as required. **Sourcing materials** • Source clean fill, limestone, gravel and topsoil or other materials from suppliers with appropriate weed control measures. • As far as practicable, inspect imported fill, limestone, gravel and topsoil or other materials for visible	• No new introduction of declared or WONS weed species into the development envelope during and attributable to construction. • No introduction or spread of declared and WONS weed species into surrounding native vegetation/wetlands during and attributable to construction. • No declared pests or WONS weeds distributed off site.	• Weekly visual inspections for evidence of unauthorised access, attributable to construction to the surrounding native vegetation from the development envelope, e.g. observations of vehicles or machinery, damage to fencing. • Weekly spot checks of vehicle compliance with clean on entry/exit procedures throughout the duration of construction of activities at each entry and exit point. • Monthly visual inspections for weeds along the clearing edge, adjacent to native vegetation, commencing at the commencement of clearing activities, and to continue for the duration of construction.	• Report increase and subsequent control in declared or WONS weed species, density and/or numbers from pre-construction monitoring observations within the development envelope and surrounding native vegetation/wetlands to be reported in the PTA's Annual Reporting. • Maintain records of all weed inspections of vehicles, machinery, equipment, fill and other weed vectors. • Results of spot checks of vehicle compliance with clean on entry/exit procedures.

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	evidence of weeds. • For fill, limestone, gravel and topsoil or other materials infested with weed or weed seed, either treat prior to use, reuse at least 1.5 m under fill or dispose of appropriately offsite. **Management practices** • Manage declared and WONS weeds and any other newly identified declared weeds within the development envelope in accordance with the *Biosecurity and Agriculture Management Act 2007* and subsidiary regulations, noting that existing weeds include: - *Zantedeschia aethiopica* (Arum Lilly) – Declared Pest - *Moraea flaccida* (One-leaf Cape Tulip) – Declared Pest - *Echium plantagineum* (Paterson's Curse) – Declared Pest - *Rubus laudatus* (Blackberry) – Declared Pest - *Lantana camara* (Lantana) – Declared Pest and WONS. - *Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WONS. • Undertake regular weed spraying in areas of weed infestation along the			

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	edge of the development envelope and within cleared areas. **Personnel training** • Require all personnel to complete a site induction that will include hygiene training with regards to weed management requirements.			
FV4 – Dieback risk management	**Dieback management and hygiene** • Provide contractors with maps/ shapefiles from dieback assessment (Glevan, 2018) with plan for site access and washdown areas. • Identify appropriate clean on entry points (if appropriate), based on values of native vegetation, infested and uninfested areas. • Inspect and verify all vehicles and machinery are free of soil prior to entering uninfested, uninterpretable or areas not assessed for dieback in the development envelope. • Have clean down stations at key points to clean vehicles identified as inadvertently carrying soil. • If practicable, conduct ground disturbance activities in dry months to reduce the risk of introduction and spread of disease. • Avoid soil movement from infested, uninterpretable and areas not	• *Phytophthora* dieback is not introduced to dieback free areas of vegetation surrounding the development envelope attributable to construction activities as observed within five years from the commencement of construction.	• Weekly spot checks of vehicle compliance with clean on entry/exit procedures throughout the duration of construction of activities at each entry and exit point. • Annual dieback assessments during the construction period (and one year after completion of construction) will be undertaken in identified uninfested areas of native vegetation within and adjacent to the development envelope (0 - 30 m from the boundary) • The assessment will include dieback occurrence mapping in previously uninfested areas, conducted by an accredited person in accordance with DBCA's Manual for detecting *Phytophthora* dieback disease (Procedures for DPAW managed lands) (2013) including:	• Compliance with these measures to be documented and reported in the PTA's Annual Reporting. • Maintain records of all inspections of vehicles, machinery, equipment, fill and other disease vectors.

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	assessed to uninfested areas. • Ensure any materials to be used in uninfested areas of the development envelope are certified dieback free (if area is deemed protectable and source is certifiable). • Install a temporary fence or appropriate buffer to infested or uninterpretable areas to prevent access to surrounding vegetation. **Personnel training** • Require key personnel to complete a site induction that includes dieback awareness and hygiene management requirements, the environmental implications of the introduction and spread of dieback and obligations to follow this CEMP. • Dieback management practices to be consistent with DBCA *Corporate Policy Statement No. 3 Management of Phytophthora Disease* (Department of Parks and Wildlife, 2015) and *Management Guidelines – Phytophthora cinnamomi and Disease Caused by It* (Department of Conservation and Land Management, 2003).		• Identifying visible symptoms of disease in species susceptible to Phytophthora dieback. • Confirming, where practicable, disease presence through laboratory analysis of soil and plant tissues.	
FV5 – Dieback and weed	• Plan for site access and wash down areas.	• No evidence of vegetation decline in the development	• Undertake visual inspections monthly along the clearing edge	• Compliance with these measures to be

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
hygiene	• Undertake dieback and weed hygiene measures and pest management within the development envelope adjacent to Ken Hurst Park as listed above.	envelope from significant weeds, pests and plant pathogens as a result of the Proposal within five years from the commencement of construction, noting the existing infestations and risks present in the Park.	adjacent to retained native vegetation. • Monitor annual presence of *Phytophthora* dieback in areas recorded as uninfested for the duration of construction activities.	documented and reported in the PTA's Annual Reporting.
FV6 – Dust management	• Dust suppression as detailed in SS1 to avoid indirect impacts on surrounding native vegetation.	• To avoid dust deposition on native vegetation, particularly during dry months.	• Annual monitoring of vegetation health in accordance with the vegetation monitoring plan.	• Reporting of adjacent vegetation health in the PTA's Annual Reporting.
FV7 – Fire management	• Undertake fire prevention and management measures during construction including: - No smoking on the work site; - No fires in the work place; - Fire extinguishers to be fitted to all mobile plant equipment; - All fuel stored on site to be in a secure bund with fuel storage to be minimised where possible; - Refuelling of equipment and machinery to be completed in the early morning where possible; - Machinery (chainsaws etc.) not to be placed on the ground where long grass exists following use; and - The area immediately surrounding 'hot work' (e.g. welding) to be dampened with water if vegetated and vegetation is not already	• No fires directly caused by TCL construction works.	• Record any fire occurrences during construction.	• Reporting of any fire incidences in the PTA's Annual Reporting.

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	naturally damp.			
Terrestrial Fauna *EPA's objective: to protect terrestrial fauna so that biological diversity and ecological integrity are maintained* Aspect: Clearing of native vegetation & vehicle and machinery movement Values: Fauna habitat and Fauna species (including Threatened and Priority species)				
TF1 – Clearing and Fauna Management	**Management of clearing** • Provision of coordinates for clearing extents to the contractor; • In field demarcation of clearing extents using site fencing; • In field demarcation of Tree Protection Zones and other exclusion zones; • Ensure that seven days prior to clearing of native vegetation at Bush Forever Site 456 (Tom Bateman Reserve) and Bush Forever Site 388 (Jandakot Airport), a qualified fauna expert undertakes a trapping and relocation program for conservation significant vertebrate fauna in accordance with a licence to take fauna for education or public purpose issued under Section 15 of the BC Act from DBCA. • Conduct fauna trapping and relocation in accordance with DBCA's Standard Operating Procedures (SOPs) or permit	• No avoidable deaths of fauna attributable to construction during vegetation clearing.	• Daily inspection for fauna species at clearing boundaries and in the construction area during native vegetation clearing activities. • Regular inspection of the development envelope for trapped fauna (in excavations or equipment) during construction works. • Details of any trapped fauna are recorded. • Record any known injuries or mortalities of fauna. • Twice daily monitoring (early morning and late afternoon) of trenches that have been left open overnight, with recording, removal and release of macrofauna.	• Record any known injuries to, or deaths of fauna in a Fauna Interaction Register as soon as possible as the injury or death is identified (when attributable to construction) preferably on the same day. • A report on the trapping program will be prepared, providing details of the methods used, number of animals caught and relocated, and location of where they were released. This report will be attached to the PTA's Annual Reporting. • Yearly reporting on the number of fauna relocated, injured or killed, and the adaptive management measures implemented in the PTA's Annual Reporting.

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	conditions. • Contact DBCA prior to the trapping and relocation program to assist with the identifying suitable relocation sites. • Install fences between cleared areas and adjacent native vegetation to limit opportunities for fauna to return to the cleared area. Where practicable, install fences at time of trapping or within 7 days of clearing activities. • Ensure fauna spotters/handlers are present during clearing of native vegetation to supervise dispersal/relocation of any remnant fauna, and identification of any potential injured fauna. • Undertake vegetation clearing commencing from a disturbed edge, where practicable, to encourage remaining mobile fauna to naturally relocate to areas of adjacent vegetation. **Management of trenches and fencing** • Soil ramps will be installed in open trenches (e.g. if open overnight) at 500m intervals. • Visually inspect fencing and trenches twice daily within the development envelope during			

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	clearing and trenching activities for isolated or trapped macrofauna. Facilitate the relocation of trapped macrofauna. • Replacement of fencing along TCL corridor to exclude fauna from the Rail Reserve to minimise train strike. **Personnel training** • Ensure all personnel complete a site induction that will cover fauna values within and adjacent to the development envelope.			
Terrestrial Environmental Quality *EPA's objective: to maintain the quality of land and soils so that environmental values are protected* Aspect: Vegetation clearing and earthworks Values: Soils				
TE1 – Management of contamination	**Contamination management** • Remove illegally dumped material in the development envelope prior to the commencement of vegetation clearing activities. Manage any contaminated, or suspected contaminated material or soil disturbed during construction activities and report in compliance with the *Contaminated Sites Act 2003*.**SMP, RAP, ASSMP and Dewatering MP Implementation** • Implement the Site Management Plan (SMP) / Remediation Action	• Manage any contamination on site in accordance with the *Contaminated Sites Act 2003*. • No breaches of the *Contaminated Sites Act 2003* identified. • Implementation of SMP / RAP for the Ranford Road station site. • Adequate management of any additional site contamination encountered during construction through implementation of an	• Daily visual monitoring during construction to ensure any potential source of contamination is identified and managed. • Monitoring as required by SMP, RAP and/or ASS and Dewatering Management Plans. • If other contamination is encountered during construction, monitoring may be developed as part of a strategy for dealing with the contamination in consultation	• Any disturbed contamination will be managed and reported in accordance with the *Contaminated Sites Act 2003*. • Any disturbance of contamination will be reported in the PTA's Annual Reporting. • Completion of reporting as required by Contractor's CEMP, SMP/RAP and/or ASS and Dewatering

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	Plan (RAP) for the Ranford Road station site to manage landfill materials. • Implementation of ASS and Dewatering Management Plan(s) if required. • Implementation of Contractor's CEMP. **Unexpected finds protocol** • Prepare an 'unexpected finds' protocol, to be implemented if additional contaminated sites are identified, including consultation with DWER, local government and DBCA (if within Swan River Trust Development Control Area) and the parties responsible for contamination (if identified).	'unexpected finds' protocol. • Appropriate management of dust, odours, noise, vibration, stockpiling, waste management, materials tracking, stormwater run-off, drainage, sedimentation, leachate management and groundwater protection, traffic management (including measures to prevent dust or mud being deposited on public roads by vehicles leaving the site), existing (protected) vegetation, contamination, unexpected finds, emergency preparedness and response, monitoring requirements, security, training and community engagement.	with DWER, DBCA (if within the Swan River Trust DCA) and the parties responsible for the contamination (if they can be identified). • Weekly inspections to ensure prohibited activities are not carried out in CCW, REW, UWPCA and wellhead protection zones.	Management Plans (if required).
Inland Waters *EPA's objective: to maintain the hydrological regimes and quality of groundwater and surface water so that the environmental values are protected* Aspect: Vegetation clearing and earthworks, Dust suppression, Dewatering, Infiltration of stormwater Values: Hydrological processes, groundwater levels and quality, surface water quality and quantity, geomorphic wetlands and groundwater dependent ecosystems				
IW1 – Management of dewatering and groundwater abstraction.	**Dewatering** • Dewatering management measures and remedial actions will be implemented as per ASS and Dewatering Management Plans (if required). **Groundwater abstraction** • Groundwater abstraction from the	• Minimising the extent and duration of dewatering and maximising infiltration/re-injection and/or utilisation of discharge water (if water quality is acceptable) for construction purposes. • No significant reduction to local	• Monitoring of dewatering activities in line with ASS and Dewatering Management Plan(s). • Monitoring of groundwater abstraction in accordance with license requirements. • Ranford Road station site:	• Reporting in line with ASS and Dewatering Management Plan(s) or in the PTA's Annual Reporting. • Groundwater abstraction volumes and locations to be documented and reported in the PTA's

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	superficial aquifer will be regulated under the *Rights in Water and Irrigation Act 1914* and will avoid *Banksia* Woodlands TEC where possible.	groundwater levels attributable to construction activities identified one year following completion of construction. • No breach of license conditions under RIWI Act.	Monitoring for dewatering cone of depression and water quality in relation to potential contaminated groundwater (to reduce risk of treating contaminated dewatering effluent), if required. • Monitoring in consultation with Water Corporation and DWER during construction of the railway in the UWPCA and wellhead protection zone for Production Bore J400. • Monitoring of production bores in the vicinity of Banksia Woodlands TEC for drawdown of groundwater as indicated by hydrogeological assessment outcomes and approval requirements.	Annual Reporting.
IW2 – Prevention of prohibited activities and management of storm water	**Prohibited activities** • Ground level / underground chemical storage tanks (equal to or greater than 250 L) are prohibited in P1 and P2 areas of the UWPCA. • Elevated chemical storage tanks (equal to or greater than 250 L capacity) are prohibited in P1 and P2 areas and wellhead protection	• No storage of fuel or chemicals (greater than 250 L capacity) that could lead to risk of contamination in CCW, REWs, UWPCA and wellhead protection zones. • No unauthorised offsite discharges. • No unintentional spills or leaks	• Visual inspection of offsite discharges following rainfall events. • Monthly visual inspections of hazardous materials storage, handling, and disposal to ensure compliance with safe use practices. In the event that a major spill occurs, undertake	• Maintain an inventory of hazardous materials storage including type of material, volume stored, and Material Safety Data Sheets • Maintain a register of spills and leaks including location, date, nature of

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	zone of the UWPCA. • On-site wastewater treatment systems should be located outside of the wellhead protection zone. • Consultation with Water Corporation and DWER during construction of the realignment of the railway in the UWPCA and wellhead protection zone for Production Bore J400 with subsequent implementation of agreed approach (based on hydrological study, if required). **Storm and surface water management** • Stormwater and surface water management measures and controls will be implemented during construction to ensure that no unauthorised offsite discharges occur during construction. These measures will incorporate best practice water management practices, such as: • Diversion of surface water around laydown or chemical / hazardous material storage areas.	of hazardous materials in the development envelope during construction. • No impacts from disturbance of ASS. • No contaminated groundwater drawn into the development envelope. • No restricted activities within the Canning River floodway.	groundwater and/or surface water monitoring in consultation with the relevant agencies. • Establishment and monitoring of strategically located monitoring wells as per SMPs, RAPs and/or ASS and Dewatering Management Plans (if required). • Groundwater and dewatering effluent monitoring in accordance with ASSMP that identify dewatering management measures. • Monitoring of groundwater and/or surface water monitoring following a major spill, in consultation with relevant agencies.	material spilt, and remedial action taken. • A summary of spills and leaks to be reported annually in the PTA's Annual Reporting. • Reporting of any monitoring undertaken in line with Contractor's CEMP, SMPs, RAPs and/or ASS and Dewatering Management Plans.

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	• Facilitation of infiltration at-source. • Prevention of erosion using sediment trapping devices and structures to slow water velocity. • Management of offsite sedimentation from runoff. • Prevent unauthorised discharges offsite. • Install drainage diversion around chemical storage areas. • Implement drainage controls to prevent offsite discharge of runoff. • Implement sediment control measures to prevent offsite sedimentation. **Restricted activities in Canning River Floodway** • Implement restrictions on activities within the floodway to meet the DWER and DBCA requirements and ensure no obstruction to major flows of the Canning River during flood events. **Preventing contamination** • Ensure all relevant employees and contractors are trained for safe			

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	handling procedures, incident response and good environmental practice. • No fuel or chemical storage will be located in well head protection zones unless approved by the Water Corporation. • Fuel and chemical storage tanks will be established on stable soil in an area that is not subject to flooding. • Unless otherwise approved, all fuel or chemical supply lines shall be above ground so leaks are detectable. • Fuel or chemicals should be placed in bunds capable of storing 110% of the capacity of the largest storage tank. • Secondary spill containment around tanks (with a perimeter bund) should have sufficient freeboard capacity to contain all captured rainwater from a 20- year average return interval, 72-hour storm. • Any significant fuel or other			

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	chemical spill to the environment should be reported to DWER within 24 hours. • The site operator will inspect spill containment compounds as soon as practicable after any rainfall and following tank refuelling. Any liquids including rainwater captured within the tank containment compound should be professionally tested for the presence of petroleum hydrocarbons. If no petroleum hydrocarbons (or other toxic materials) are present, then the stormwater may be discharged to soakage. If petroleum hydrocarbons or other potentially harmful fluids are detected, all liquid within the compound should be transferred by a licensed waste disposal contractor. • Implement a spill response procedure, which may include groundwater or surface water monitoring or soil testing as required.			

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	• Spill kits to be located in storage and refuelling areas. **Acid Sulfate Soils** • ASS managed as part of ASS and Dewatering Management Plan(s), if required (see HP1). **Contaminated groundwater** • Where hydrogeological assessment or monitoring suggests a risk of drawing contaminated water into the development envelope, PTA/Contractor will review the available technical reports (including any pre-existing SMPs) for those sites and consider how the construction may be affected by existing sources of contamination. Where appropriate management measures will be incorporated into this CEMP (or activity specific sub plan) to minimise the dewatering cone of depression to avoid drawing down contaminated groundwater from these sites (and avoid the			

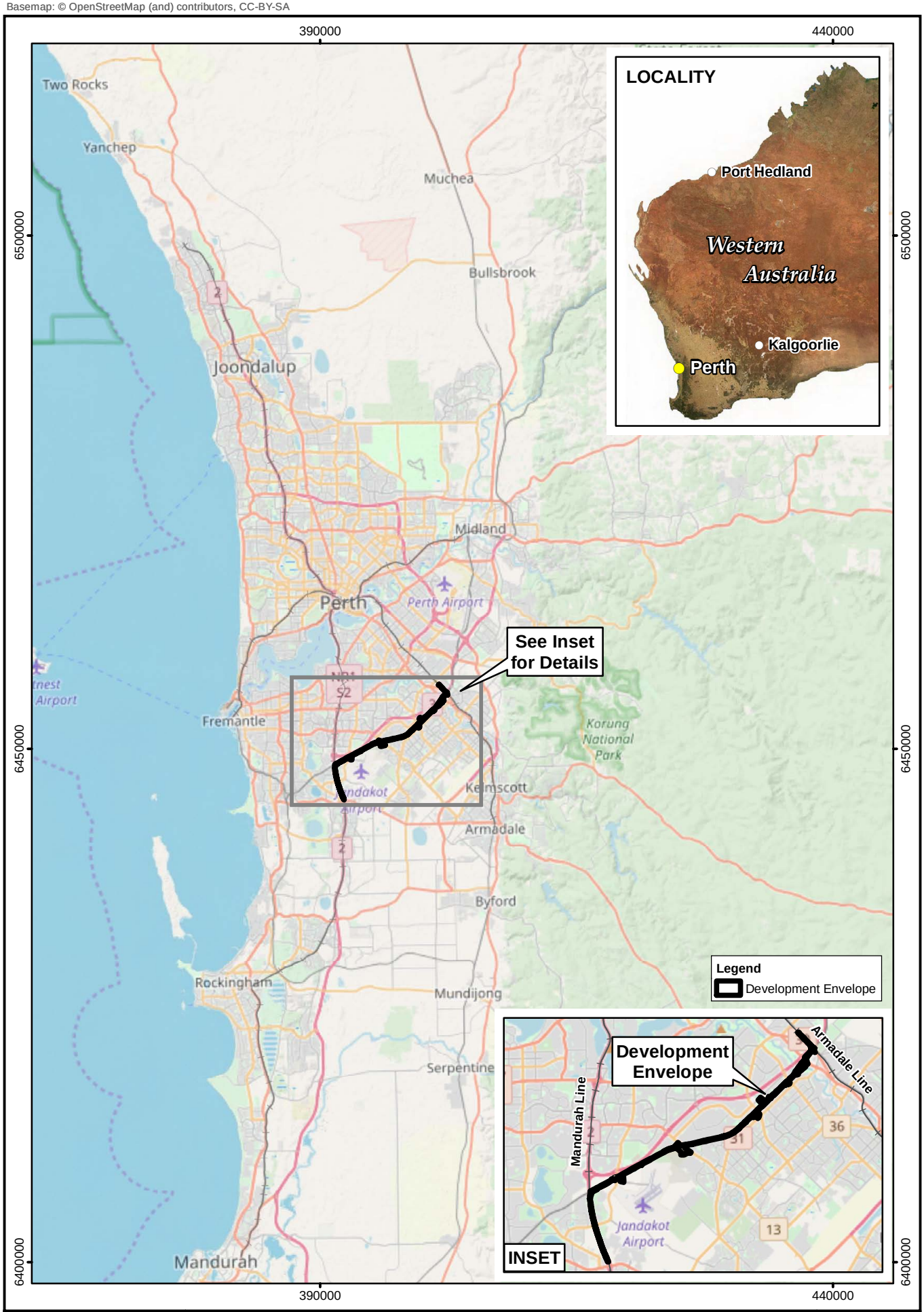
ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	requirement to manage potentially contaminated dewatering effluent).			
Social Surroundings *EPA's objective: to protect social surroundings from significant harm* Aspect: Vegetation clearing and earthworks & Vehicle and machinery movement Values: Noise, dust and vibration & Aboriginal heritage				
SS1 – Management of dust	**Dust** • Implement dust suppression measures on unsealed roads and access tracks, cleared areas and at locations and times of high dust risk, including: • Use of water carts on unsealed roads and tracks. • Use of water-assisted dust sweeper(s) on access and local roads to remove any material, as necessary. • Enforce speed limits in construction areas. • Apply hydromulch or similar soil stabiliser to exposed areas if they will remain for extended periods. • Retain mulched native vegetation for dust suppression.	• No fugitive dust emissions outside of the development envelope.	• Daily visual monitoring of airborne dust to ensure no offsite dust impacts and efficacy of dust control measures.	• Establish a complaints register and record details of the complaint including date, time, location, nature of complaint and complainant details • All registered complaints will be investigated and complainants contacted within seven days of complaint • The outcomes of the investigation will be recorded in the register and reported in the PTA's Annual Reporting.

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	• Wind break fencing will be installed to prevent dust spreading in high-risk areas. • Review of daily weather forecasts, and limit, and if practicable prohibit, construction activities during high wind conditions.			
SS2 – Management of noise and vibration	**Noise & Vibration** • Unless otherwise approved by the local government authorities, undertake all construction works during standard construction hours only, defined as 7 a.m. to 7 p.m. on days other than Sundays and public holidays. • Prepare a Noise and Vibration Management Plan (NVMP) in accordance with *AS24360-2010 (R2016)* Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites. The NVMP shall be approved by the local government authority and will include information on: - Equipment choices based on noise and vibrations levels and noise reduction devices that can be fitted to equipment; - If and when acoustic screens may be used; - Low vibration work practices;	• No exceedance of construction noise limits in accordance with *Environmental Protection (Noise) Regulations 1997.* • No unauthorised out of hours noise associated with construction.	• Monitoring of noise and vibration emissions. • Noise monitoring for works outside of standard construction hours (if required).	• Establish a complaints register to record noise and vibration complaints, including location, date, time, nature of complaint and complainant details. • Complaints will be investigated and the complainant contacted within seven days. • The outcomes of the investigation to be recorded in the complaints register. • The PTA's Annual Reporting to include a summary of noise and vibration complaints and a summary of the outcomes of investigations • The PTA's Annual Reporting to include the outcome of the investigation and resolution of any

ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	- Time restrictions on processes involving exposure to potentially hazardous vibration; - Signposting of vibration hazard areas; - Mobile equipment to be inspected and maintained regularly to ensure noise levels are minimised; - Out of hours noise management if works are required outside of standard construction hours including: ▪ The need and reasons for the construction work to be done; ▪ Types and durations of activity likely to result in noise emissions above assigned noise levels; ▪ Predictions of noise emissions; ▪ Control measures for noise emissions, including vibration; and ▪ A protocol for receiving, handling and resolving complaints.			complaints, including the management measures implemented.
SS3 – Protection of Aboriginal heritage	**Aboriginal Heritage** • Comply with any Section 18 Notices under the *Aboriginal Heritage Act 1972*.	• Disturbance to registered or potential heritage site does not exceed approved limits. • No avoidable disturbance to	• Record number and description of any Aboriginal objects identified during construction activities.	• Report any new Aboriginal objects identified during construction activities to the DPLH.

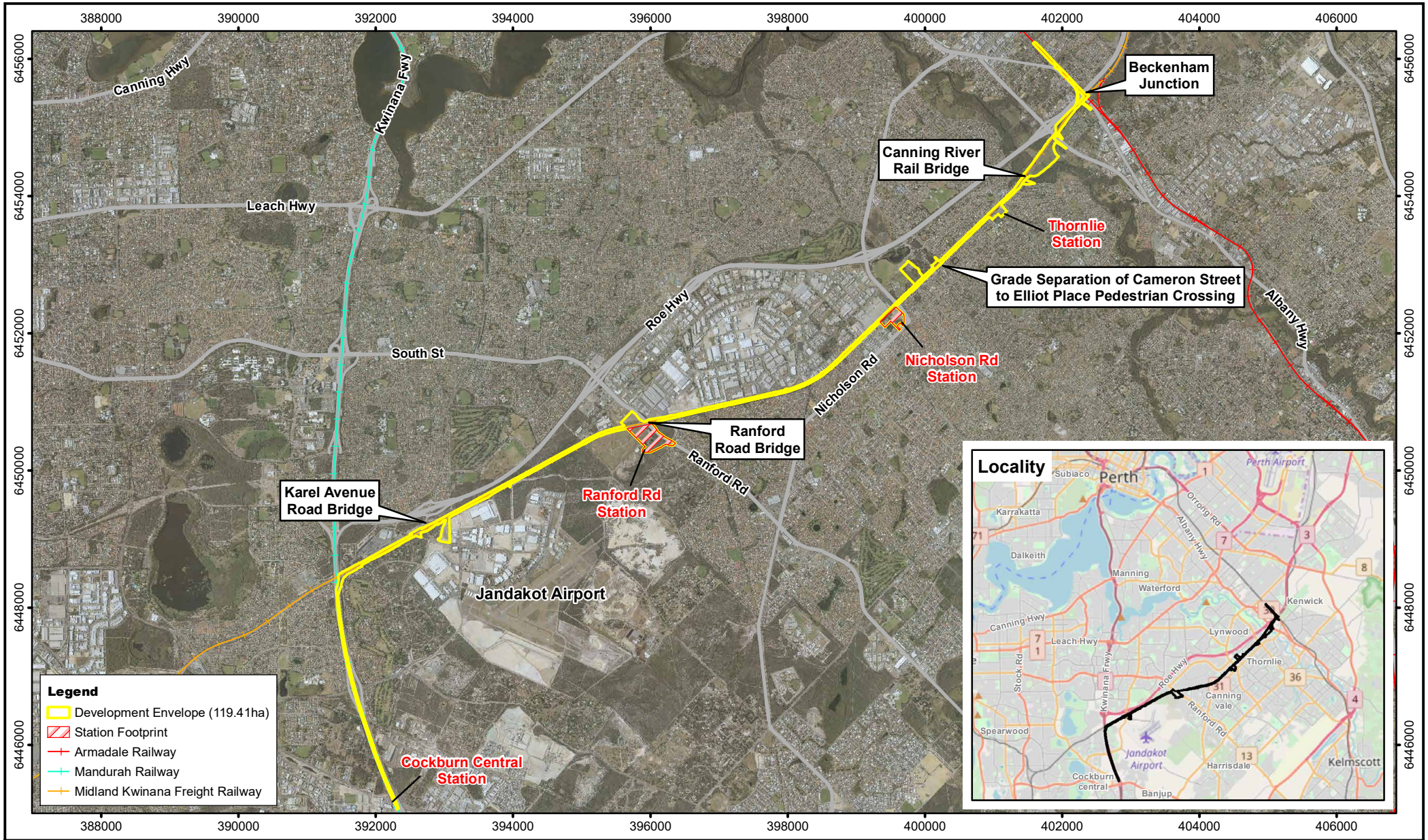
ID	MANAGEMENT ACTIONS	MANAGEMENT TARGETS	MONITORING	REPORTING
	• Ensure monitors are onsite for clearance and initial groundworks at registered heritage sites to assist with the identification and management of any Aboriginal objects identified or unearthed during construction (as recommended in heritage reporting addendum, O'Connor 2017b). • Prepare and implement an Aboriginal Heritage Management Protocol outlining procedures to be implemented if during works potential Aboriginal sites/artefacts are identified.	Aboriginal objects identified or unearthed during construction activities.	• Weekly inspection of the registered heritage sites to ensure no disturbance as a result of the Proposal outside of the approved development envelope. Implement adaptive management measures if it is determined that the construction of the proposal is facilitating unauthorised disturbance.	• Report to DPLH in accordance with any conditions of the Section 18 consents. • Compliance with these measures to be documented and reported in the PTA's Annual Reporting.

FIGURES



N 0 5 10 km Scale: 1:500,000 MGA94 (Zone 50) CAD Ref: a2600_CEM_F01 Date: Nov 2018 | Rev: A | A4	Aurora environmental Author: P. Zuvela | AU Ref: PTA2018-001 Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax (08) 9246 3202	Thornlie to Cockburn Link Project **Regional Location** Construction Environmental Management Plan

Figure: **1**



Imagery: Landgate (Nov 2017)
ESRI, OpenStreetMap

N

0 0.75 1.5km

Scale: 1:75,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F02

Date: December 2018 | Rev: A | A4

Aurora environmental
ASSESS · ADVISE · APPLY

Author: P. Zuvela | AU Ref: PTA2018-001

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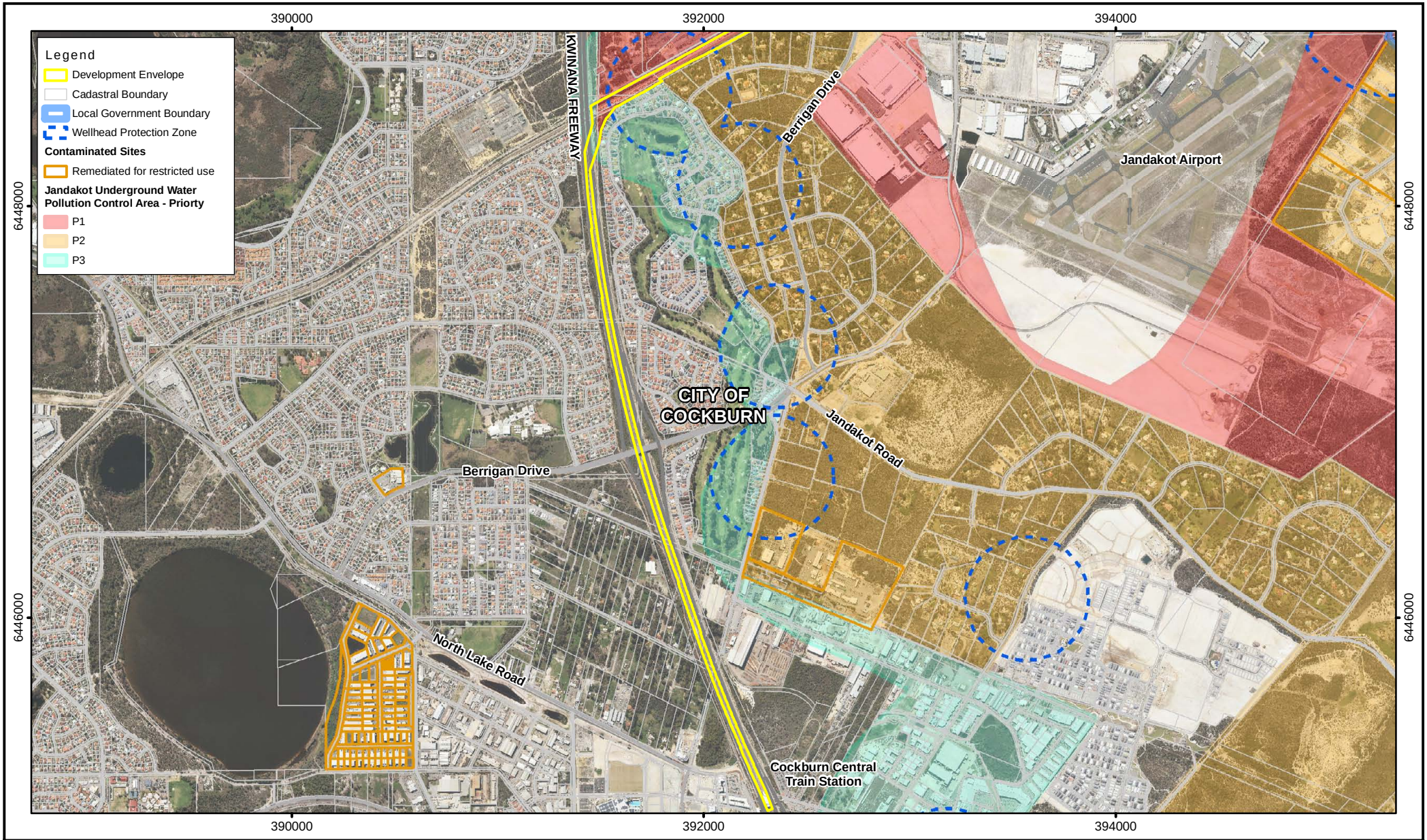
Thornlie to Cockburn Link Project

Project Overview

Construction Environmental Management Plan

Figure: **2**



Local Gov Bndry, Cadasta: Landgate
Wellhead Water Priority & Contaminated Sites: DWER
Roads: MRWA
Imagery: Landgate (Aug 2017)

N

0 250 500m
Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F03_01
Date: November 2018 | Rev: A | A4

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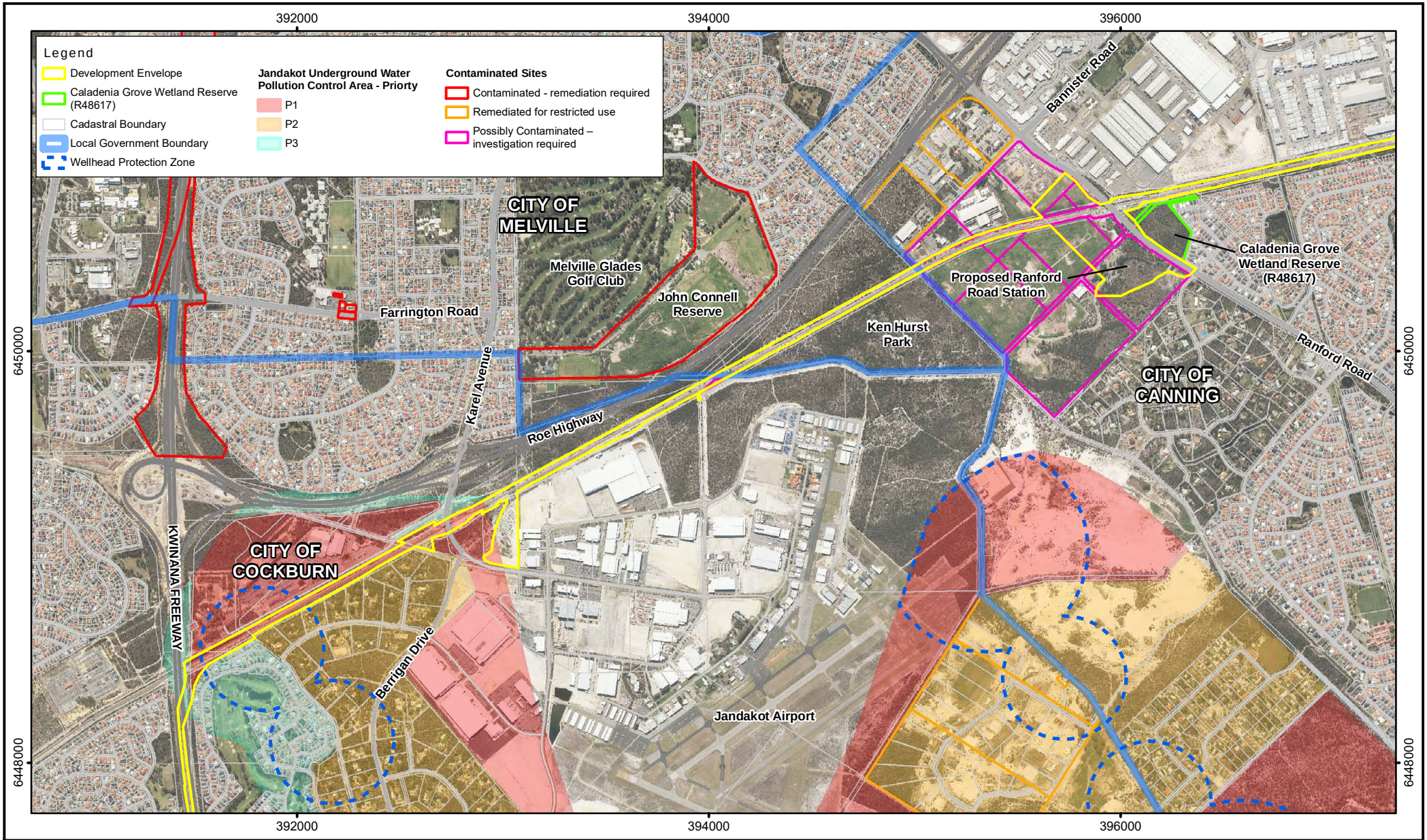
Thornlie to Cockburn Link Project

Environmental Context

Construction Environmental Management Plan

Figure:

3.1



Local Gov Bndry, Cadasta: Landgate
Wellhead Water Priority & Contaminated Sites: DWER
Roads: MRWA
Imagery: Landgate (Aug 2017)

N

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Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F03_02
Date: November 2018 | Rev: A | A4

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Thornlie to Cockburn Link Project

Environmental Context

Construction Environmental Management Plan

Figure:

3.2

Cadasta: Landgate
Local Gov Bndry: Landgate
Contaminated Sites: DWER
Roads: MRWA
Imagery: Landgate (Aug 2017)

N

0 250 500m
Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F03_03
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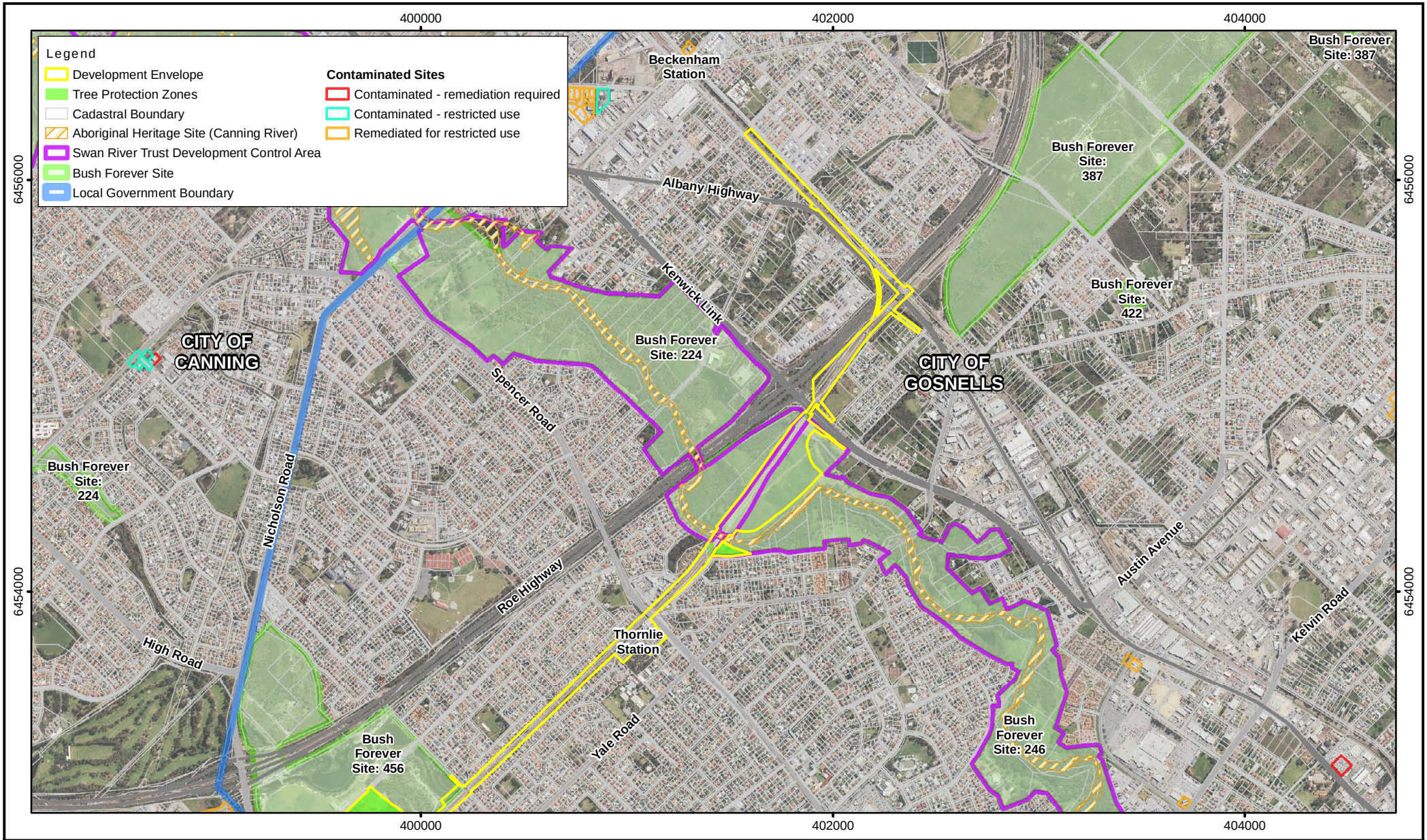
Thornlie to Cockburn Link Project

Environmental Context

Construction Environmental Management Plan

Figure:

3.3



Local Gov Bndry, Cadasta: Landgate
Wellhead Water Priority & Contaminated Sites: DWER
Roads: MRWA
SRTDCA: DBCA
Imagery: Landgate (Aug 2017)

N

0 250 500m
Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F03_04
Date: November 2018 | Rev: A | A4

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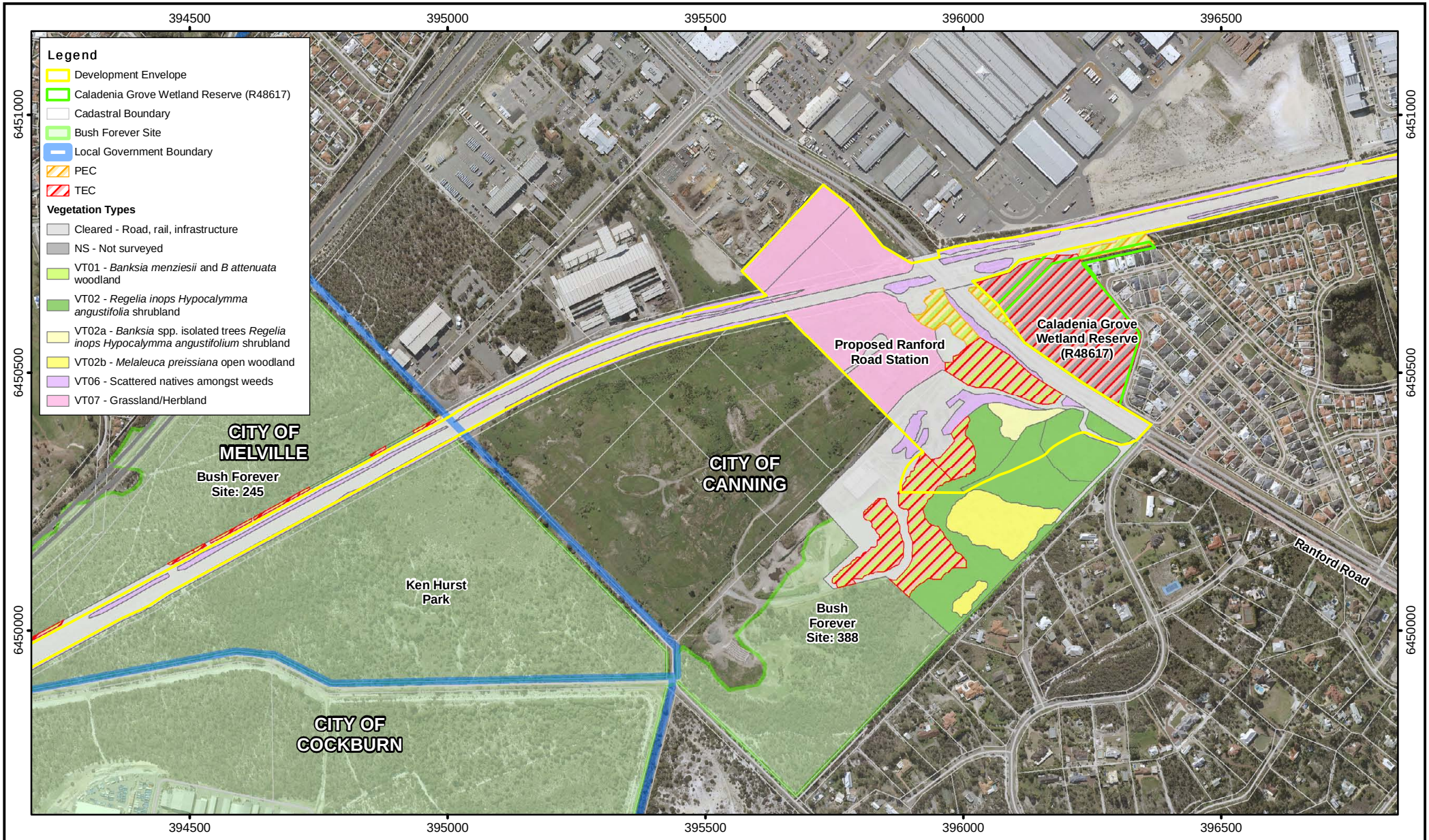
Thornlie to Cockburn Link Project

Environmental Context

Construction Environmental Management Plan

Figure:

3.4



Local Gov Bndry, Cadasta: Landgate
Roads: MRWA
Bush Frever: DPLH
Imagery: Landgate (Aug 2018)
Flora/Fauna: GHD

N

0 100 200 m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F04
Date: November 2018 | Rev: A | A4

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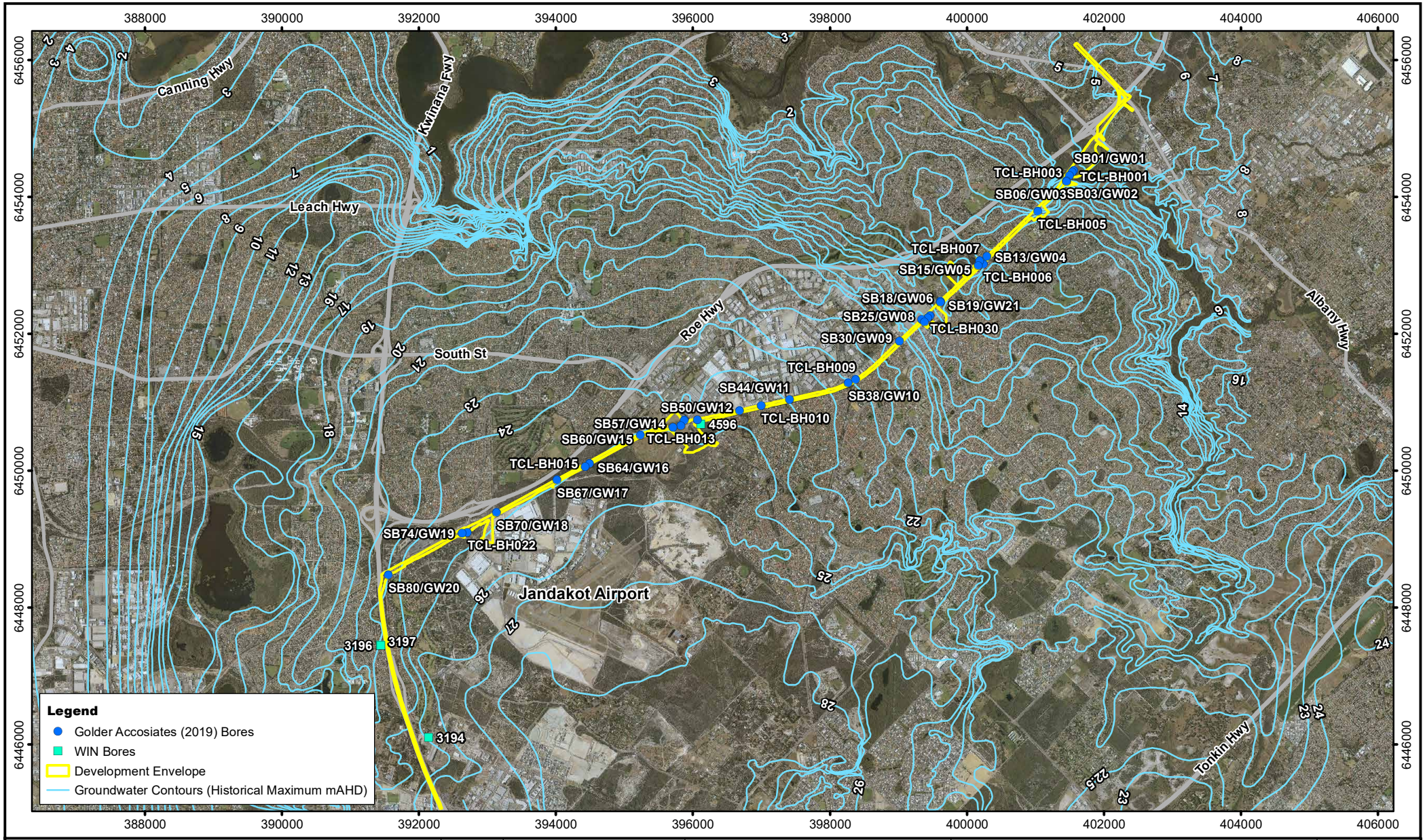
Thornlie to Cockburn Link Project

Proposed Ranford Road Station

Construction Environmental Management Plan

Figure: 4



Imagery: Landgate (Nov 2017)

N

0 0.75 1.5 km

Scale: 1:75,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F05

Date: April 2019 | Rev: A | A4

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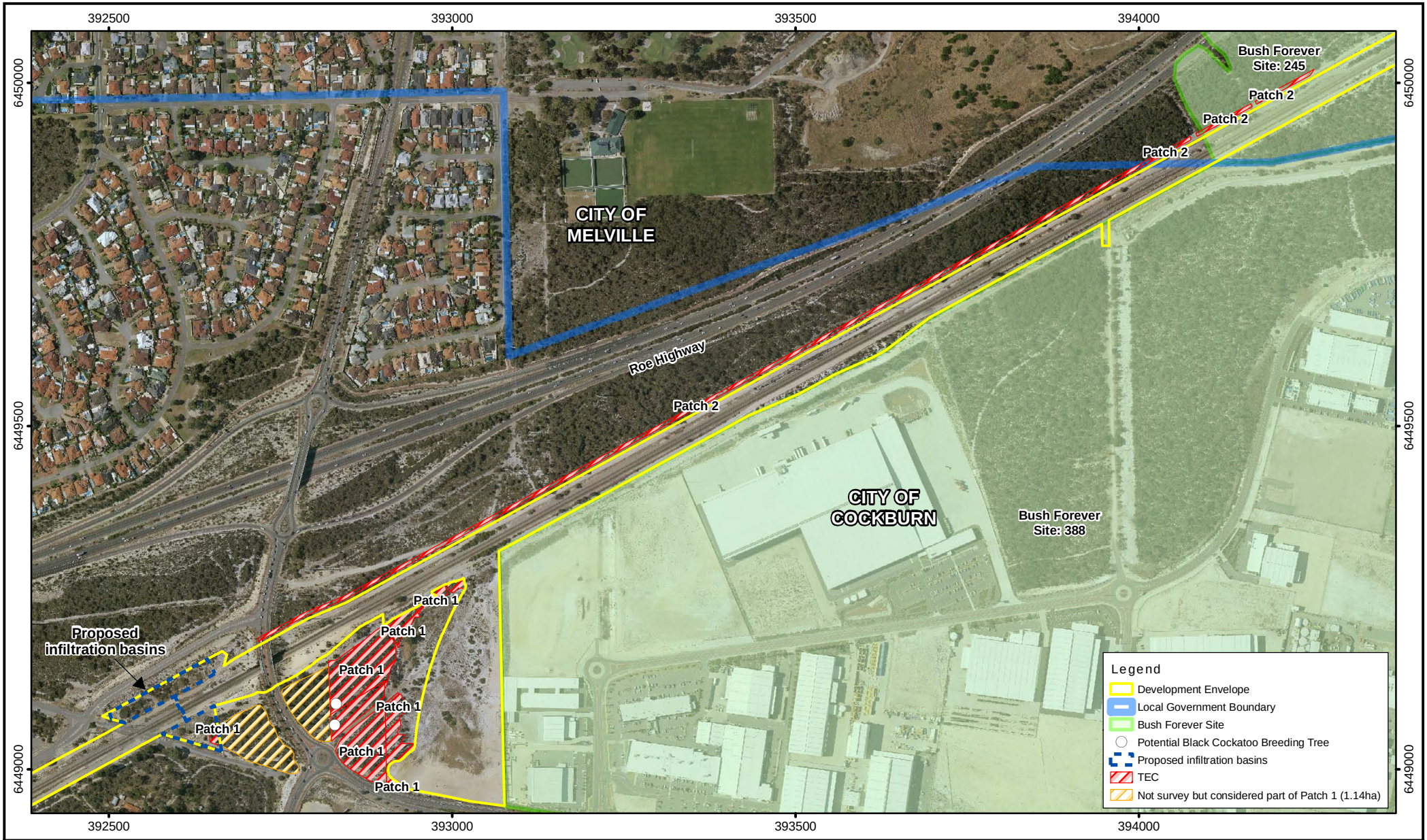
Thornlie to Cockburn Link Project

Groundwater Contours

Construction Environmental Management Plan

Figure: 5



Local Gov Bndry: Landgate
Bush Forever: DPLH
Flora/Fauna: GHD
Imagery: Landgate (Aug 2017)

N

0 70 140 m
Scale: 1:7,500
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F06_01
Date: November 2018 | Rev: A | A4

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Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project
Threatened Ecological Community Patch Analysis
Construction Environmental Management Plan

Figure:
6.1

Local Gov Bndry: Landgate
Bush Forever: DPLH
Flora/Fauna: GHD
Imagery: Landgate (Aug 2017)

N

0 75 150m
Scale: 1:7,500
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F06_02
Date: December 2018 | Rev: A | A4

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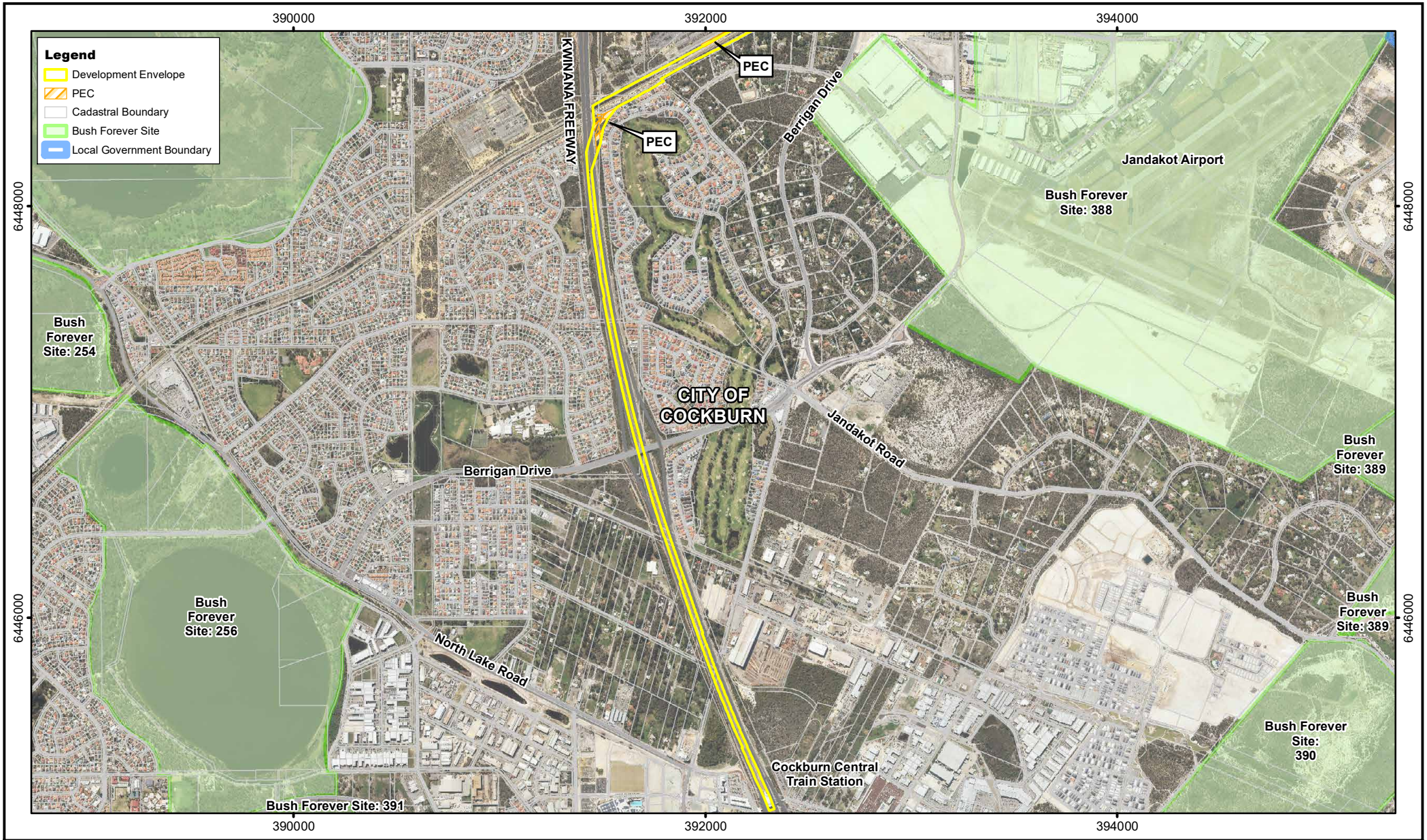
Thornlie to Cockburn Link Project
Threatened Ecological Community Patch Analysis
Construction Environmental Management Plan

Figure: **6.2**



Local Gov Bndry, Cadasta: Landgate
Roads: MRWA
Bush Frever: DPLH
Imagery: Landgate (Aug 2017)
Flora/Fauna: GHD

N

0 250 500m
Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F07_01
Date: April 2019 | Rev: A | A4

Aurora environmental
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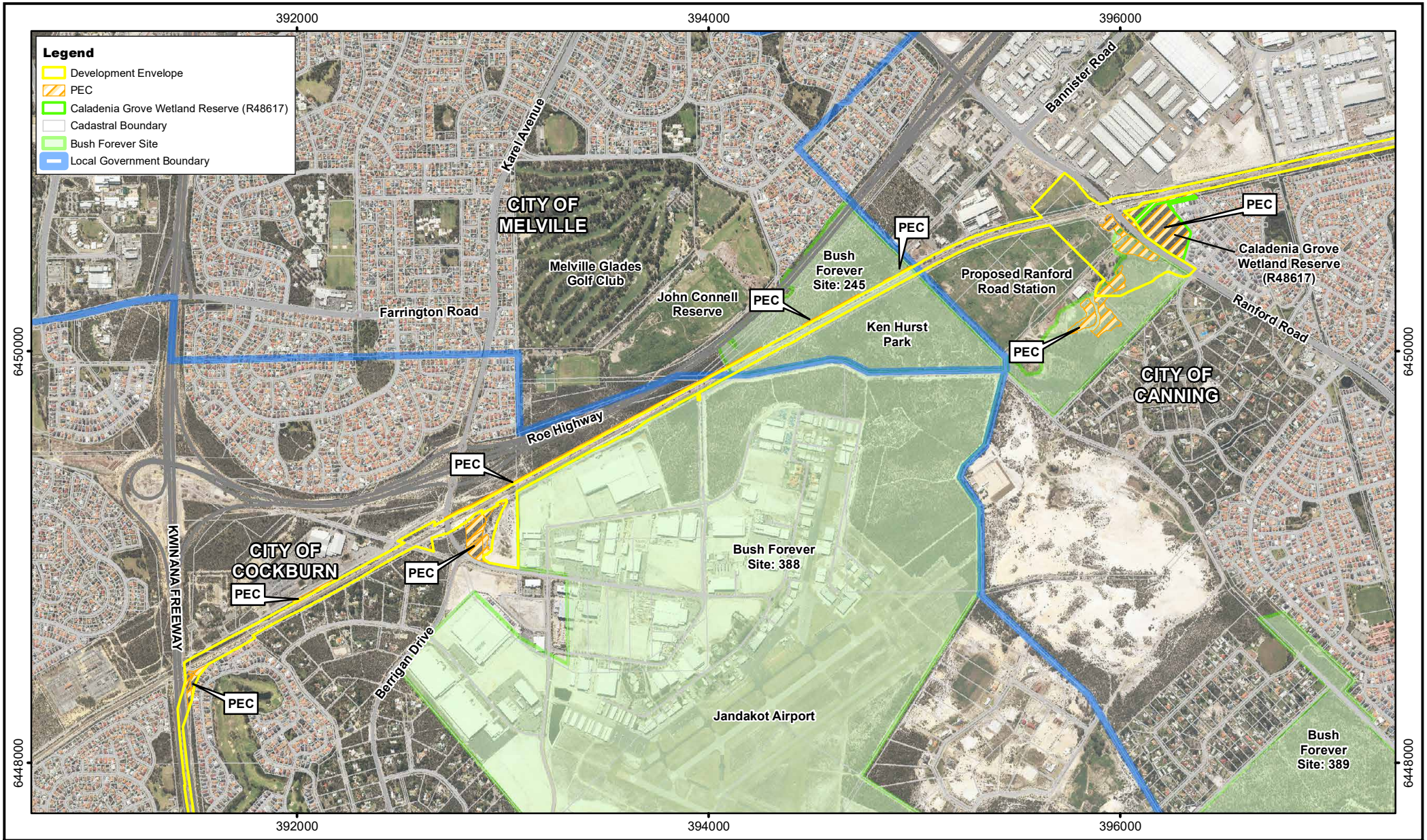
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project
Bush Forever Sites and Priority Ecological Communities
Construction Environmental Management Plan

Figure: **7.1**



Local Gov Bndry, Cadasta: Landgate
Roads: MRWA
Bush Frever: DPLH
Imagery: Landgate (Aug 2017)
Flora/Fauna: GHD

N

0 250 500m
Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F07_02
Date: April 2019 | Rev: A | A4

Aurora environmental
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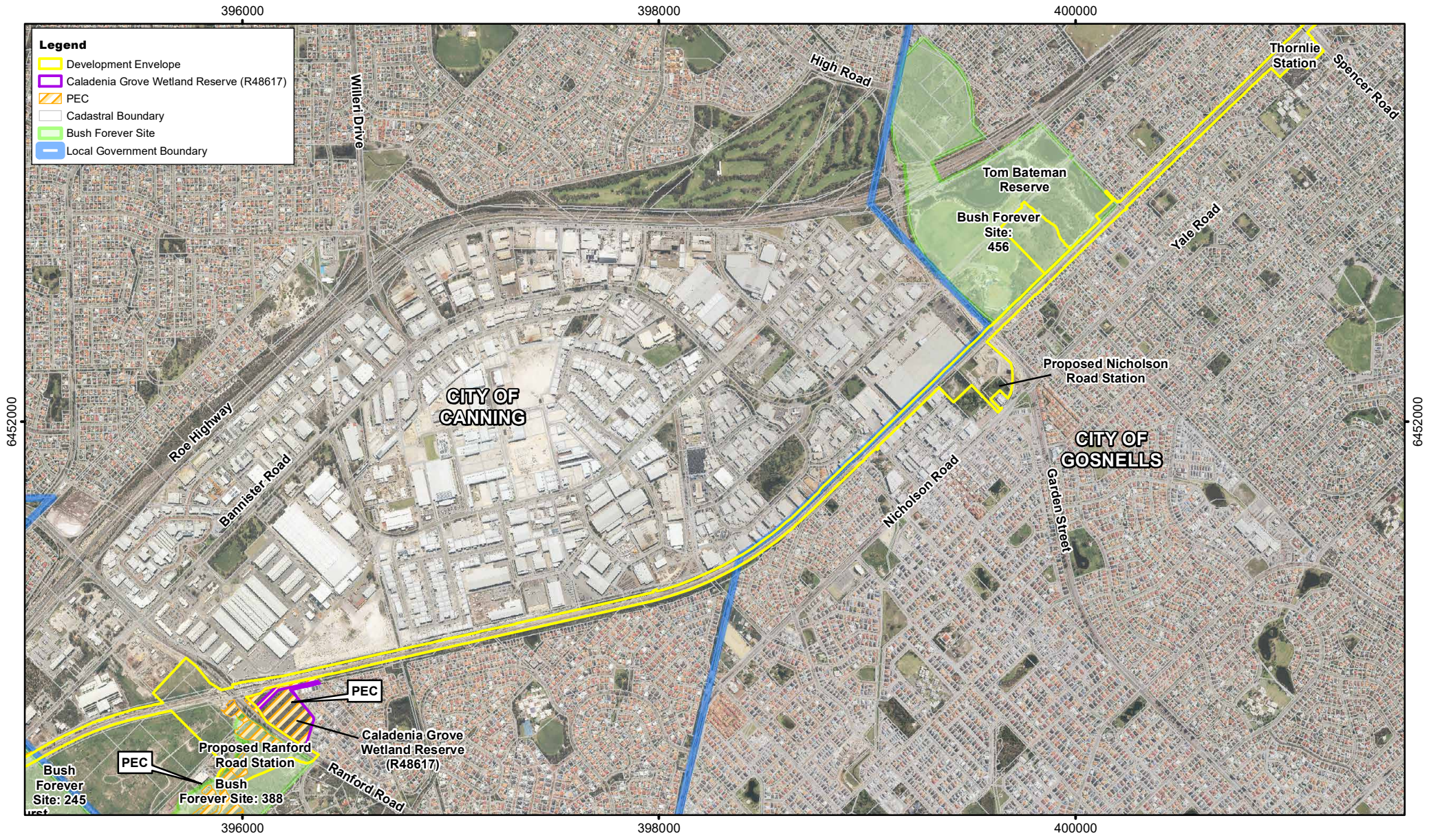
Thornlie to Cockburn Link Project
Bush Forever Sites and PriorityEcological Communities
Construction Environmental Management Plan

Figure: **7.2**



Cadasta: Landgate
Local Gov Bndry: Landgate
Roads: MRWA
Bush Frever: DPLH
Flora/Fauna: GHD
Imagery: Landgate (Aug 2017)

N

0 250 500 m
Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F07_03
Date: April 2019 | Rev: A | A4

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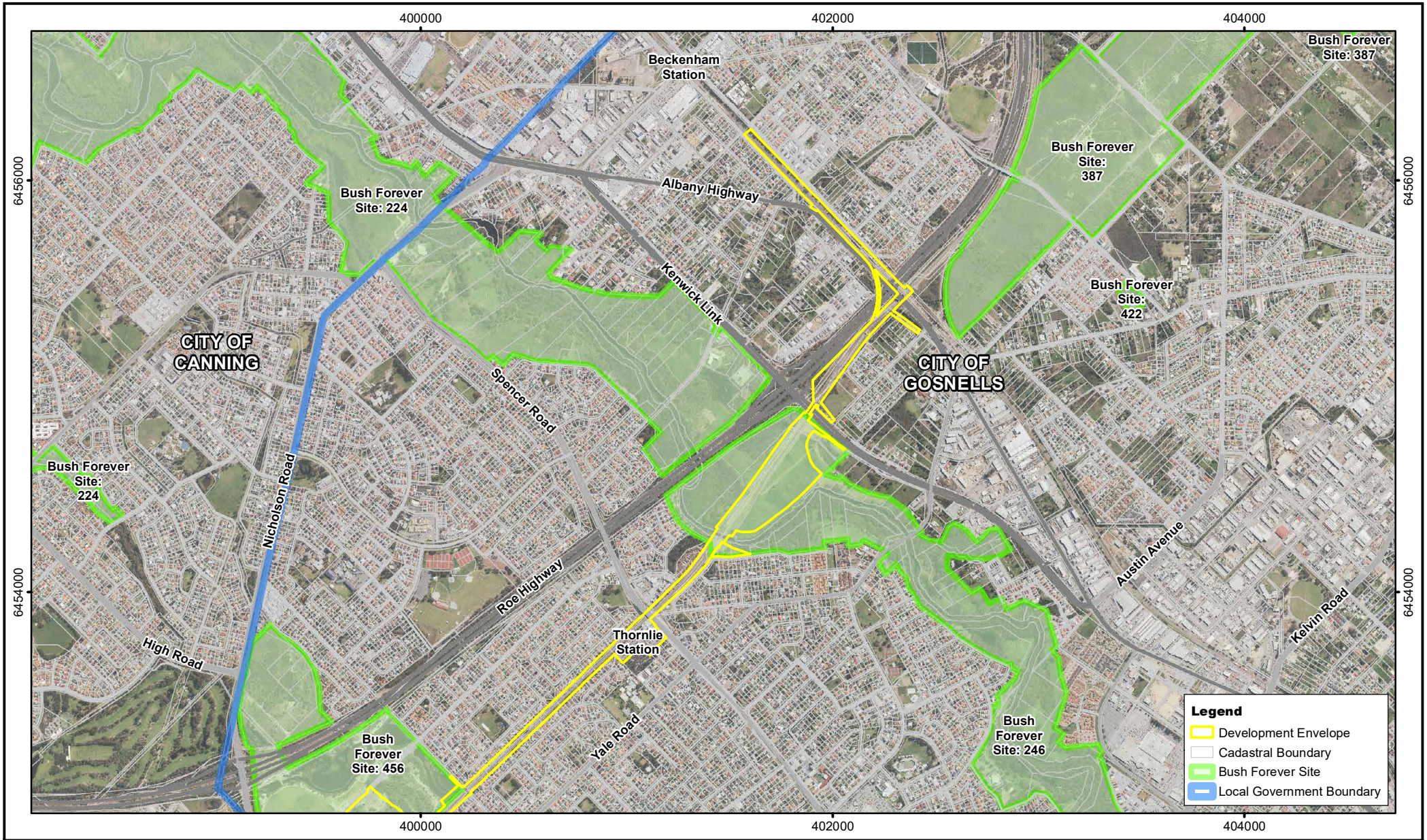
Author: P. Zuvela | AU Ref: PTA2018-001
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project
Bush Forever Sites and Priority Ecological Communities
Construction Environmental Management Plan

Figure: **7.3**



Local Gov Bndry, Cadasta: Landgate
Roads: MRWA
Bush Frever: DPLH
Imagery: Landgate (Aug 2017)
Flora/Fauna: GHD

N

0 250 500 m
Scale: 1:25,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F07_04
Date: April 2019 | Rev: A | A4

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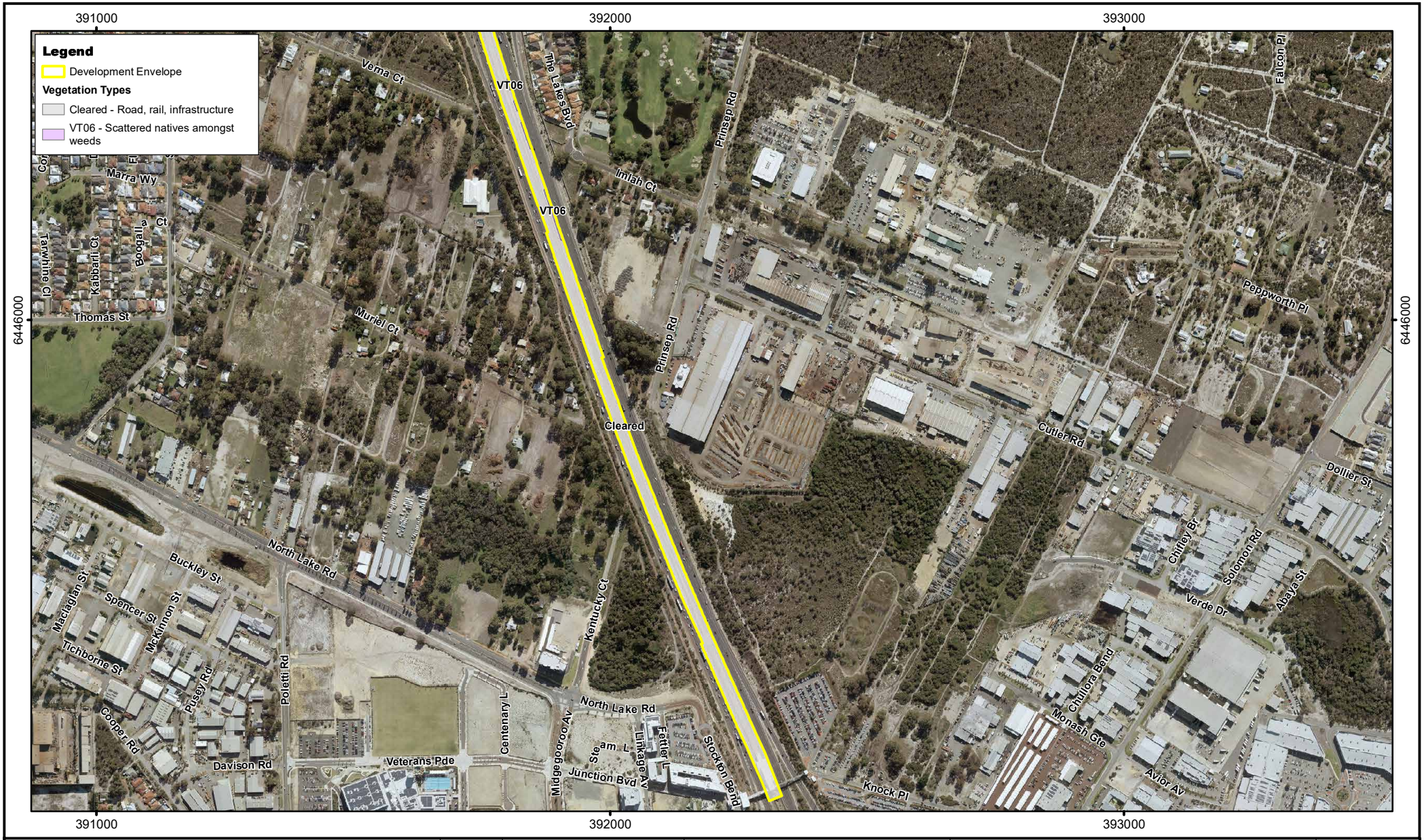
Author: P. Zuvela | AU Ref: PTA2018-001
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project
Bush Forever Sites and Priority Ecological Communities
Construction Environmental Management Plan

Figure: **7.4**



Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
Date: April 2019 | Rev: A | A4

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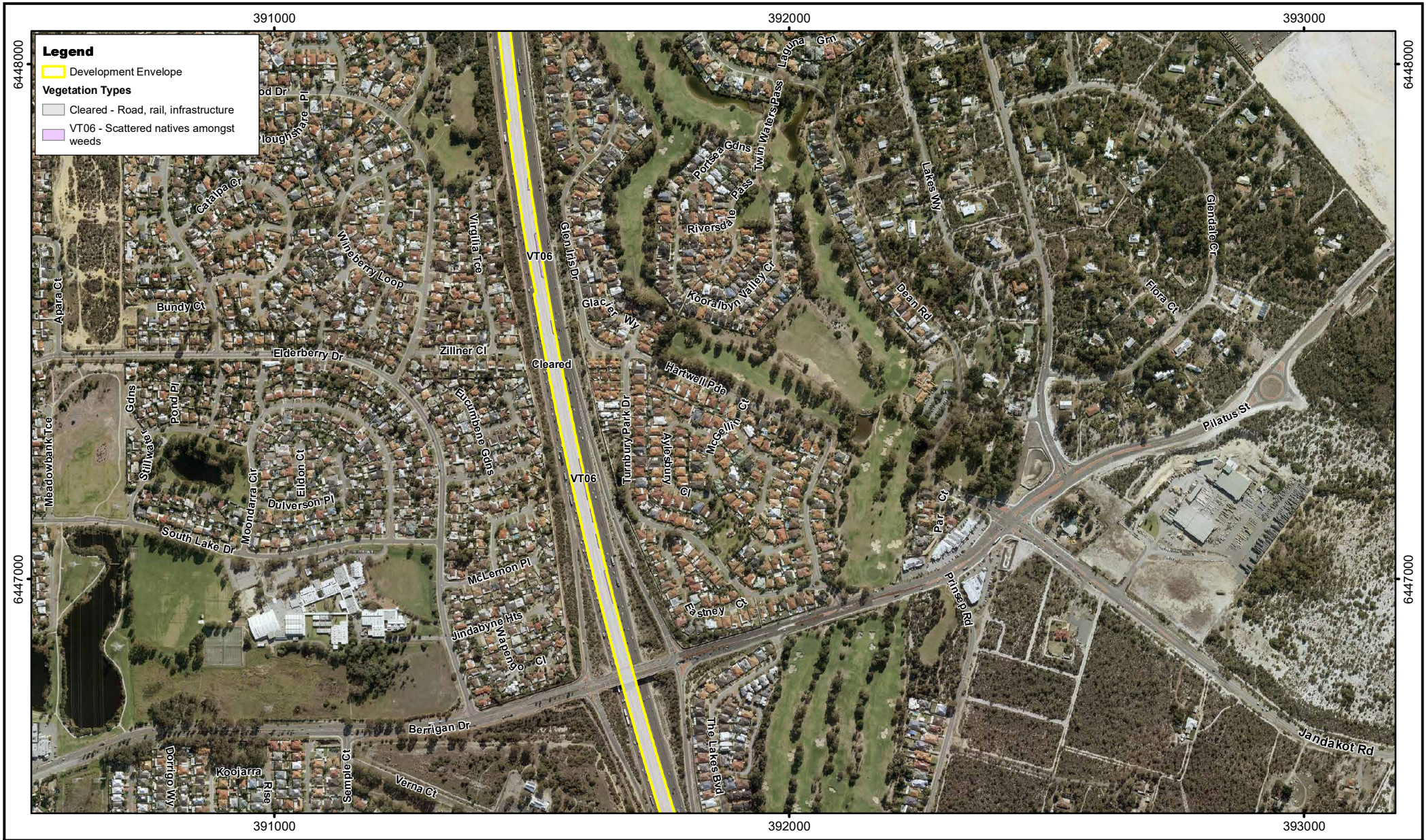
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure: **8.1**



Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
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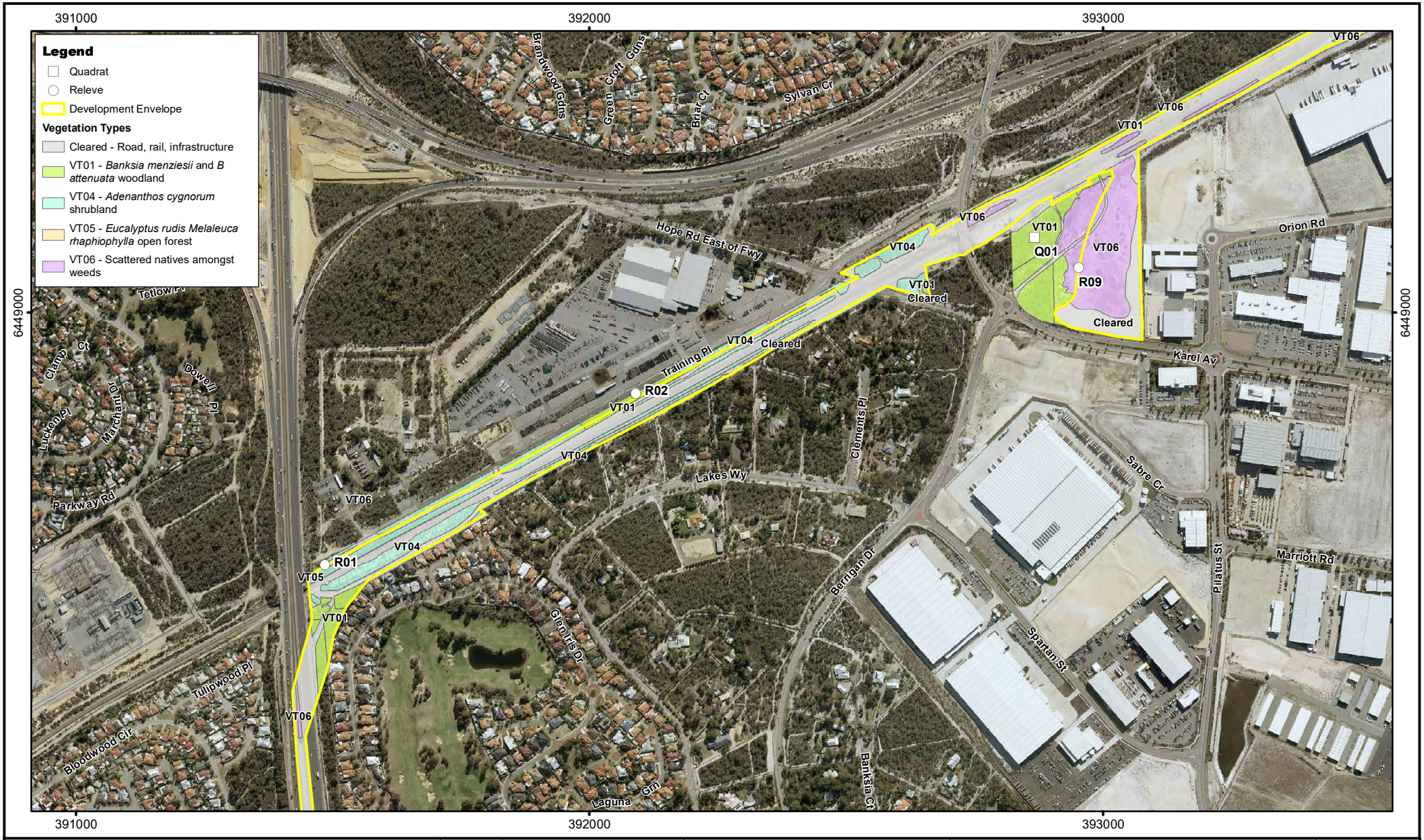
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure: **8.2**



Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
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Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure: **8.3**

Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
Date: April 2019 | Rev: A | A4

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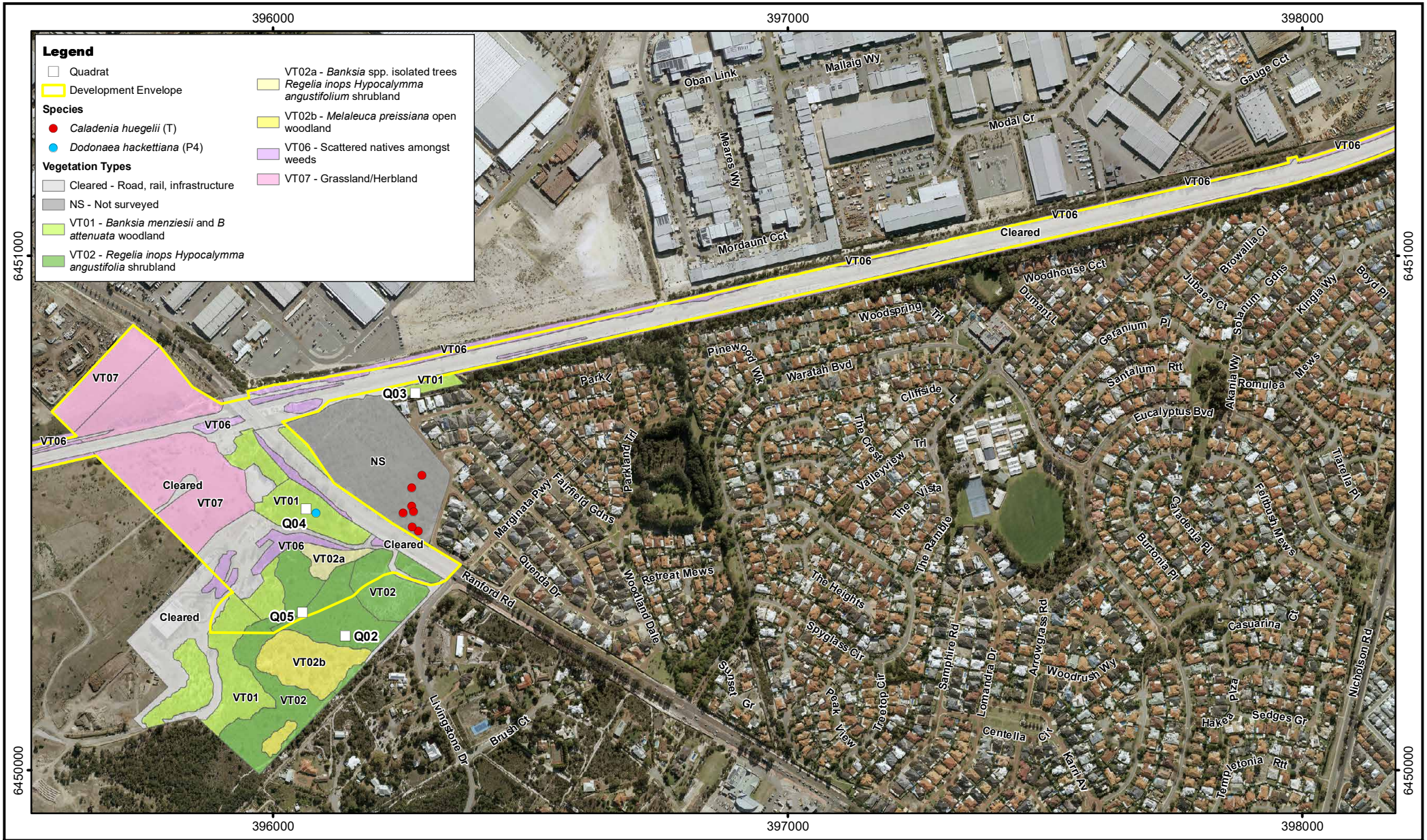
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure: **8.4**



Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
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Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure: **8.5**

Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
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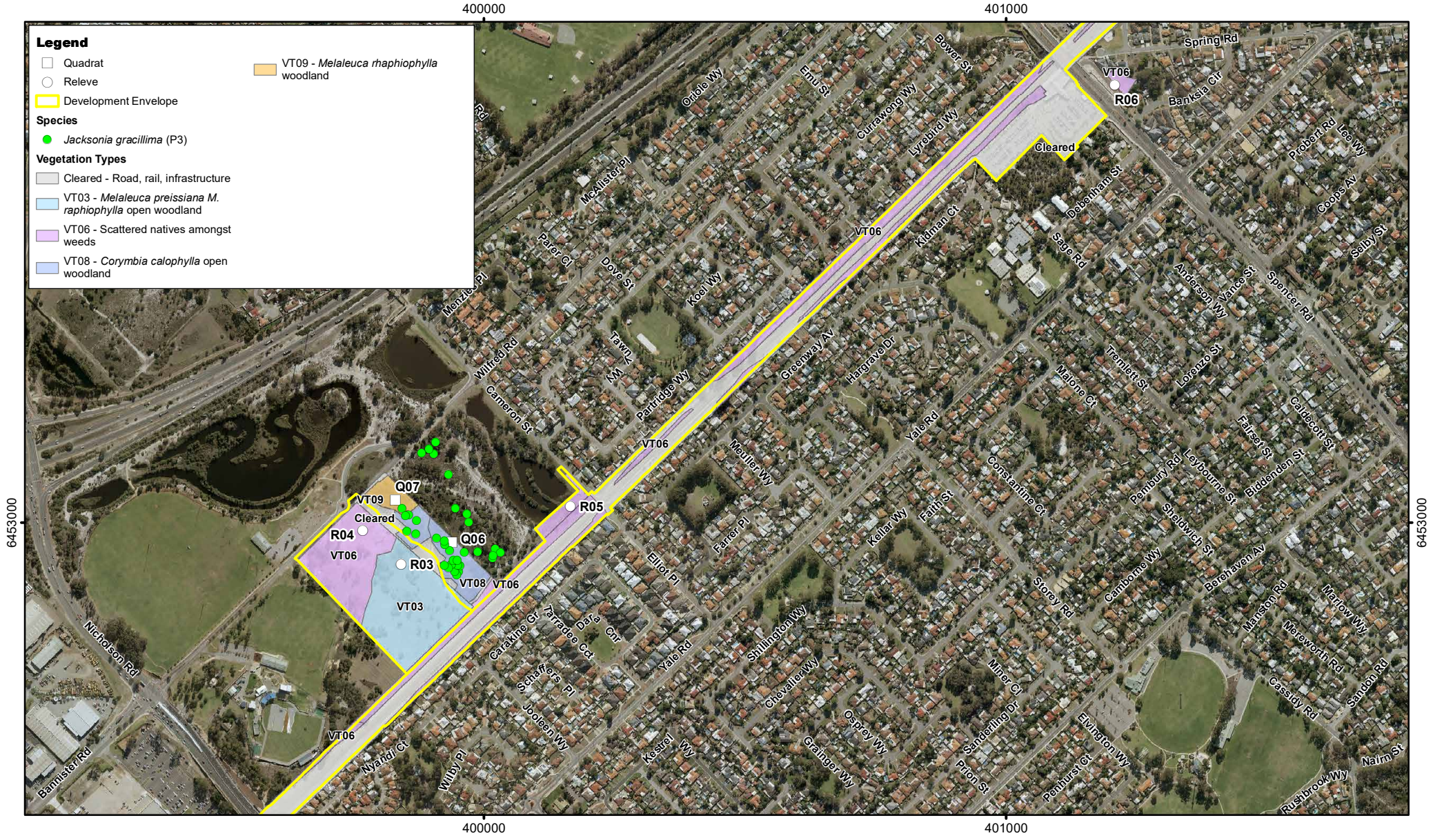
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure: **8.6**



Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
Date: April 2019 | Rev: A | A4

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Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure: **8.7**

Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
Date: April 2019 | Rev: A | A4

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Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure:

8.8

Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F08
Date: April 2019 | Rev: A | A4

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Thornlie to Cockburn Link Project

Vegetation Types

Construction Environmental Management Plan

Figure: **8.9**

Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F09
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Author: P. Zuvela | AU Ref: PTA2018-001
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Thornlie to Cockburn Link Project

Vegetation Condition

Construction Environmental Management Plan

Figure:

9.1

Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F09
Date: November 2018 | Rev: A | A4

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Thornlie to Cockburn Link Project

Vegetation Condition

Construction Environmental Management Plan

Figure:

9.2

Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F09
Date: November 2018 | Rev: A | A4

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Thornlie to Cockburn Link Project

Vegetation Condition

Construction Environmental Management Plan

Figure: **9.3**

Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F09
Date: November 2018 | Rev: A | A4

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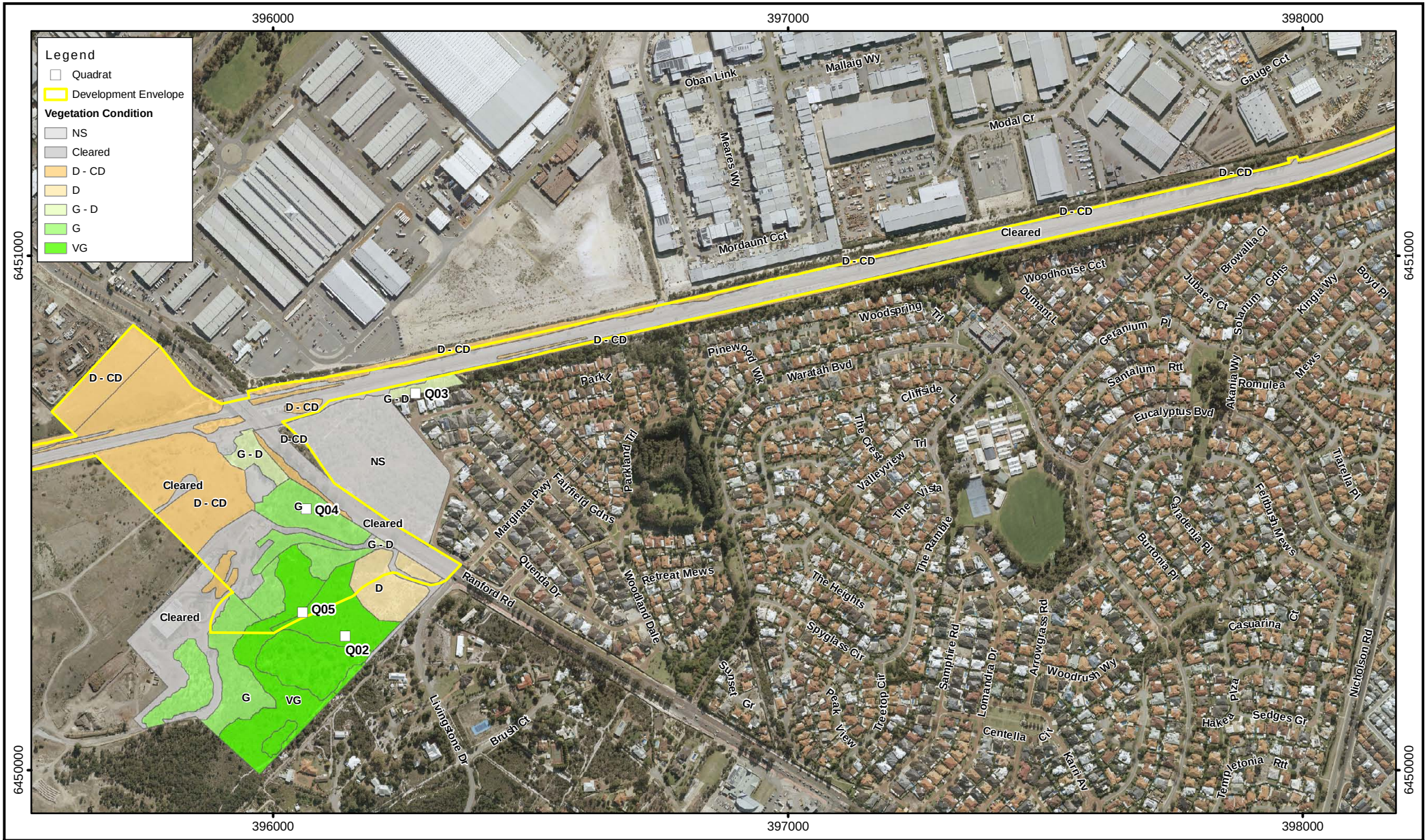
Thornlie to Cockburn Link Project

Vegetation Condition

Construction Environmental Management Plan

Figure:

9.4



Cadasta: Landgate
Imagery: Landgate (May 2018)
Vegetation: GHD

N

0 100 200m
Scale: 1:10,000
MGA94 (Zone 50)

CAD Ref: a2600_CEM_F09
Date: November 2018 | Rev: A | A4

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Thornlie to Cockburn Link Project

Vegetation Condition

Construction Environmental Management Plan

Figure: **9.5**