

ENVIRONMENTAL IMPACT ASSESSMENT

Yanchep Rail Extension: Part 1 – Butler Station to Eglinton Station

Prepared for **Public Transport Authority**

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1.0 Introduction

The Public Transport Authority (PTA) is proposing to implement the first stage of the Labor Government's METRONET vision to transform Perth's transport network. The first stage of METRONET's priority projects includes the extension of the existing Joondalup railway line from Butler to Yanchep.

The Yanchep Rail Extension (YRE) project is a 14.5 kilometre (km) extension of the Joondalup railway line, which includes new stations at 3 locations; Alkimos, Eglinton and Yanchep. The YRE project forms an integral component of Perth's long term public transport network and will provide essential transportation services to the rapidly expanding northern coastal suburbs. The delivery of the YRE project will foster the continued growth and development of activity centres in the North-west Sub-region, stimulating new employment opportunities, vibrancy, higher density land use and better sustainability outcomes envisioned by the State Government's draft Perth and Peel@3.5million plan (Department of Planning and Western Australian Planning Commission [WAPC] 2015).

The YRE project is located within the City of Wanneroo, which is situated approximately 26 km north of Perth's Central Business District (CBD). The YRE project's 143.11 hectare (ha) development envelope, which encompasses Part 1 and 2 development footprints (including railway extension and stations) and construction and access areas, generally lies between the suburbs of Butler and Yanchep and includes the suburbs of Alkimos and Eglinton (Figure A).

1.1 Project Staging

The YRE project is being referred to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act) in two parts:

- **Part 1: Butler Station to Eglinton Station:** includes the southern portion of the YRE project area to the north of the Butler Station and generally follows the land reserved "Railway" under the Metropolitan Region Scheme (MRS) before terminating to the north of the Eglinton Station. The Part 1 development footprint includes a contingency for a turnback facility to be constructed to the north of the Eglinton Station, to allow for the turning of two six car trains (if required), should Part 2 of the YRE project not proceed (Figures A, B and C). The 70.22 ha Part 1 development envelope is comprised of a 45.42 ha development footprint and 24.80 ha construction and access area.
- **Part 2: Eglinton Station to Yanchep Station:** includes the northern portion of the YRE project area to the north of the Eglinton Station and generally coincides with the land reserved "Railway" under the MRS before terminating within the northern section of the Yanchep City LSP. The Part 2 development footprint includes a turnback facility to the north of the Yanchep Station to allow for the turning and stowage of trains (Figures A, B and C). The 72.89 Part 2 development envelope is comprised of a 60.17 ha development footprint and 12.72 ha construction and access area.

This Environmental Impact Assessment (EIA) report specifically assesses the environmental impacts associated with Part 1 – Butler Station to Eglinton Station of the YRE project.

1.1.1 Staging Rationale

The PTA identified that an early earthworks package was required to be commenced in late 2018 in order to meet the State Government's scheduled 2021 delivery date for the YRE project. Noting that some landholdings adjacent to the southern portion (Part 1) of the YRE development envelope have already been subject to construction and development to facilitate urban land uses, and given the historical planning framework (Table 3) and Commonwealth approvals (Section 1.4.4.1), the PTA considered that Part 1 was less environmentally constrained than Part 2 (the northern portion). Therefore, in order to meet the scheduled delivery date the project has been divided into two parts with the aim that Part 1 can be implemented (pending environmental approval), whilst Part 2 is being considered by the State and Commonwealth governments.

1.2 Purpose and Scope of this Document

This EIA report has been based on the EPA's *Instructions on how to prepare an Environmental Review Document* (EPA 2016a).

1.2.1 Purpose of this Document

The purpose of this EIA report is to describe and assess the significance of the environmental impacts to the EPA's environmental factors associated with the construction and operation of Part 1 of the YRE project, with reference to specific technical investigations and detailed analysis undertaken by the PTA to assess the environmental factors.

This EIA report has been prepared to support referral of Part 1 of the YRE project to the EPA under Section 38 of the EP Act.

1.2.2 Scope of this Document

The scope of this EIA report focusses on the assessment of the environmental impacts and management requirements associated with Part 1 of the YRE project. The assessment of the environmental impacts associated with Part 2 of the YRE project will be the subject of a separate Section 38 referral.

1.2.3 Structure of this Document

This EIA report has been prepared to reflect the revised framework for environmental impact assessment under the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016* and the associated *Procedures Manual (Part IV Divisions 1 and 2)*.

The structure of the report follows the *Template for an Environmental Review Document* attached to EPA (2016a).

1.3 Proponents Details

The proponent of the YRE project is:

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West Parade
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ABN: 61 850 109 576

The key contact for the environmental approvals component is:

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Further information on the proponent can be sourced from the PTA's website (<http://www.pta.wa.gov.au/>).

1.4 Environmental Impact Assessment Process

1.4.1 Environmental Protection Act 1986

The EP Act is the key legislative tool for environmental protection in Western Australia. The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment.

The EP Act is administered by the EPA and the Minister for the Environment.

1.4.1.1 Part IV of the Environmental Protection Act 1986

Following recommendations made as a result of the independent EPA legal and governance review in early 2016, updated procedures for environmental impact assessment were formally gazetted under Section 122 of the EP Act on 13 December 2016 as the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016* (Administrative Procedures).

The Administrative Procedures are the highest level document under the EP Act and provide the overarching framework for the EPA to undertake environmental impact assessment.

The Administrative Procedures are grouped according to the following key stages:

- Stage 1: referral of a proposal to the EPA
- Stage 2: EPA to decide whether or not to assess a referred proposal
- Stage 3: assessment of proposals
- Stage 4: EPA report on the assessment of proposal
- Stage 5: deciding if proposal may be implemented and implementation of proposals.

1.4.1.1.1 Yanchep Rail Extension Context

The YRE project will be referred to the EPA under Section 38 of the EP Act as two referrals, Part 1 – Butler Station to Eglinton Station and Part 2 – Eglinton Station to Yanchep Station.

This EIA report supports the referral of Part 1 – Butler Station to Eglinton Station of the YRE project. The referral of this EIA report, and accompanying Section 38 referral form to the EPA under Section 38 of the EP Act, allows for the EPA to determine if the Part 1 referral is valid under the Stage 1 processes of the EPA's Administrative Procedures. The PTA has undertaken specific technical investigations and detailed analysis for the YRE project with the view to supporting an assessment on referral information by the EPA for Part 1 of the YRE project.

1.4.2 Other State Legislation, Regulation and Approval

Part 1 of the YRE project is required to comply with the requirements of other relevant pieces of state legislation and regulation. Table 1 provides an overview of other potential state-based approval requirements that may also be relevant to Part 1 of the YRE project.

Table 1: Other Approval Requirements

Potential Activities	Type of Approval	Legislation Regulating the Activity	Approval Agency
Clearing of native vegetation will be undertaken prior to ¹ and as part of the earthworks ²	Clearing Permit	EP Act	Department of Water and Environmental Regulation (DWER)
Disturbance of a site of Aboriginal heritage significance	Section 18	<i>Aboriginal Heritage Act 1972</i>	DPLH
Development of the railway, stations, car parks and public transport interchange outside of the rail corridor.	Development Application/s	<i>Planning and Development Act 2005</i>	City of Wanneroo (CoW) / WAPC
Storage and handling of hazardous materials may be required during construction.	Licence	<i>Dangerous Goods Safety Act 2004</i>	Department of Mines, Industry Regulation and Safety
Groundwater abstraction may be required, for instance to supply groundwater for dust suppression purposes during construction.	Licence	<i>Rights in Water and Irrigation Act 1914</i>	DWER
Crushing of excess limestone may be required during construction	Licence	Environmental Protection Regulations 1987	DWER

1.4.3 Zoning and Land Use

The majority 45.42 ha Part 1 development footprint is comprised of land reserved “Railways” under the MRS. The remainder of the land within the 70.22 ha Part 1 development envelope is reserved for “Other Regional Roads” and “Parks and Recreation” or zoned “Urban” and “Central City Area” (Figure B).

1.4.4 Commonwealth Legislation and Guidance

1.4.4.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* protects Matters of National Environmental Significance (MNES), and is administered by the Commonwealth Minister for the Environment and Energy. If an action is likely to have a significant impact on any matter of national environmental significance a referral to the DEE is required.

MNES that relate to Part 1 of the YRE project are nationally threatened species, such as Carnaby’s Black Cockatoo, and ecological communities, including the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC).

The Part 1 development envelope has been included in the following referrals to the Commonwealth under the EPBC Act:

- Eglinton / South Yanchep Residential Development (EPBC 2011 / 6021)
- Eglinton Estates – Clearing of Native vegetation from Lot 2007 and Part Lot 2008 Eglinton (EPBC 2010 / 5777)
- Residential and Commercial Development on Part of 19 (Lot 6) Taronga, Eglinton (EPBC 2017 / 7872)
- Lots 1005 and 1006 Peet Alkimos Local Structure Plan (EPBC 2008 / 4638)

¹ A clearing permit application was submitted to DWER in November 2017 to facilitate additional geotechnical works and further unexploded ordnance investigations for the YRE project to be undertaken.

² A clearing permit would be required to facilitate the clearing of native vegetation within the Part 1 development envelope if the proposal was not formally assessed by the EPA.

- Alkimos City Centre and Central Alkimos, Part Lot 9002 and part Lot 9003 Marmion Avenue, Alkimos (EPBC 2015 / 7561)
- Local Structure Plan for Mixed Residential and Commercial Development, Alkimos, WA (EPBC 2008 / 4601).

Figure D shows the extent of the EPBC Act referrals for urban development, which were assessed to be Controlled Actions, in relation to Part 1 of the YRE project. The Commonwealth has individually set conditions for the various referrals with which future development must comply. Offsets such as land acquisition have either been provided, or are pending provision, to counterbalance the residual impacts for each of these separate actions on MNES.

The MNES that are considered by the Commonwealth government are only a subset of the matters that the State government considers. The State may require offsets to other environmental values which are not relevant to the EPBC Act. In situations where these values overlap, the WA Environmental Offsets Guidelines (EPA 2014) identifies that the State government agencies will work cooperatively with the DEE to align offsets and avoid duplication to the fullest extent practicable.

Of relevance for Part 1 of the YRE project, EPA (2014) identifies where a proposal has already been assessed under the EPBC Act and offsets have been applied, the State will consider these offsets as contributing to the State requirements.

2.0 The Proposal

2.1 Background

The planning rationale for the ongoing growth of Perth's northern suburbs has been historically underpinned by the provision of rail infrastructure to the Eglinton and Alkimos communities in key strategic planning documents such as the draft Directions 2031 and Beyond (Department of Planning and WAPC 2010), Transport @ 3.5million (Department of Transport [DoT], PTA and Main Roads Western Australia (MRWA) 2017), draft Perth and Peel@3.5million (Department of Planning and WAPC 2015) and draft Perth and Peel Green Growth Plan (Department of Premier and Cabinet 2015).

Table 2 provides an overview of the relationship of the key strategic planning documents to Part 1 of the YRE project, whilst Table 3 details the historical planning framework which has provided the key drivers for the project and informed the development footprint.

Table 2: Key Strategic Planning Documents

Key Document	Alignment with YRE Project
Transport @ 3.5million (DoT, PTA and MRWA 2017)	<p>Long term plan for transport infrastructure to consider the efficient use of the transport network as the population of the Perth and Peel regions increases. Specifically, Transport@3.5million envisions the following objectives for the future transport network:</p> <ul style="list-style-type: none"> ■ optimise use of the existing network and as it grows ■ integrate with land use and across the public transport, active transport and road networks ■ deliver high frequency, 'turn up and go' mass rapid transit connected with effective public transport feeder services ■ provide a safe, connected active transport network of primarily off-road cycle ways and walkways ■ maintain a free-flowing freeway and arterial road network for the efficient distribution of people and freight. <p>Transport@3.5million identifies the planned extension of the Joondalup Line to the future stations at Alkimos and Eglinton, as part of the rapid transit network required for to support a population of 2.7 million people in the Perth and Peel region.</p>
Draft Perth and Peel Green Growth Plan (Department of the Premier and Cabinet 2015)	<p>Supports projected growth in the population of the Perth and Peel regions and deliver an efficient and liveable city while protecting its significant environmental assets. The Perth and Peel Green Growth Plan was underpinned by the EPA's interim strategic advice (EPA 2015) to deliver the following critical outcomes:</p> <ul style="list-style-type: none"> ■ cutting red tape by securing upfront Commonwealth environmental approval and streamlining State environmental approvals for the development required to support growth to 3.5 million ■ unprecedented protection of bushland, rivers, wildlife and wetlands through implementation of a comprehensive plan to protect the environment. <p>Action Plan C – Infrastructure identifies the planned extension of the Joondalup line from Butler to Eglinton, with stations at Alkimos and Eglinton.</p>
Perth and Peel @ 3.5 million Environmental Impacts, Risks and Remedies (EPA 2015)	<p>Under Section 16(e) of the EP Act the EPA provided interim strategic advice to the Minister for Environment on the four sub-regional planning frameworks and the broader implications for the environment from significantly increasing the population of Perth and Peel regions.</p> <p>The EPA noted that a number of proposed infrastructure corridors are likely to impact areas of high conservation value and that these should be the subject of whole of Government decisions that transparently demonstrate avoidance (consideration of alternatives), mitigation (minimising temporary impacts through use of innovative technologies and rehabilitation), or offsetting as appropriate. Further, the EPA considered that adhoc impacts can be avoided if there is a long term integrated plan for transport infrastructure, with a particular emphasis on public transport.</p>
Draft Perth and Peel @ 3.5 million (Department of Planning and WAPC 2015)	<p>Identifies sub-regional planning frameworks for Central, North-west, North-east and South Metropolitan Peel areas which clearly depict where future homes and jobs should be located and where important environmental assets should be avoided and protected.</p> <p>The growth of the Perth and Peel regions depends on the provision of critical infrastructure to provide road and rail transport options for both commuters and business. The four sub-regional planning frameworks facilitate and support a future regional transport network and facilitate the provision of service infrastructure. Importantly, the North-west Sub-regional Planning Framework proposes passenger rail from Butler to Eglinton with stations at the Alkimos Secondary Centre and the Eglinton District Centre.</p>
Draft Public Transport Plan 2031 (DoT 2011)	<p>Long term vision for a public transport network to support a population of 3.5 million which provides clear guidance for the medium term network (to 2031). Short term priorities along with current commitments include:</p> <ul style="list-style-type: none"> ■ extension of the northern suburbs railway from Butler to Eglinton with stations at Alkimos and Eglinton ■ providing priority bus lanes along routes that connect major centres and through congested intersections.
Draft Directions 2031 and Beyond (Department of Planning and WAPC 2010)	<ul style="list-style-type: none"> ■ Balances urban growth needs with the goal to protect natural ecosystems. The framework provides for different lifestyle choices, vibrant nodes for economic and social activity and proposes to deliver on the aspiration of a more sustainable urban transport network. ■ States that it is critical that the provision of infrastructure is fully integrated with land use planning and development. ■ Strongly supports the development of a number of key strategic activity centres well connected by public transport. ■ Included the extension of the existing Joondalup railway line to Eglinton with new stations at Alkimos and Eglinton.

Table 3: Historical Planning Framework

Key Document	General Description	MRS Amendment	EPA Consideration
Reservation of the Proposed Mitchell Freeway Transport Corridor (Environmental Review)	Reservation of the Proposed Mitchell Freeway Transport Corridor for primary regional Roads to enable future proposed extensions to the Mitchell Freeway and the Northern Suburbs Railway; the reservation of land for "Railways" for the proposed Clarkson Railway Station near Neerabup Road and a possible station near Hester Avenue; and land surplus to Freeway requirements being transferred from "Rural" and "Parks and Recreation" to the "Urban" zone.	MRS Amendment 992/33 rationalised zones and reservations in the Clarkson and Butler localities to facilitate the alignment of the Mitchell Freeway Transportation Corridor, which included the northern suburbs railway line, north of Burns Beach road.	<p>The Chairman of the EPA decided that MRS Amendment 992/33 should be formally assessed at the level of Environmental Review under the EP Act because the proposed land use changes may have potentially significant impacts on Flora and Vegetation and Terrestrial Fauna.</p> <p>The EPA considered the alignment of the Mitchell Freeway Transportation Corridor to be environmentally acceptable and recommended the following management plans be prepared and implemented for the corridor:</p> <ul style="list-style-type: none"> ■ Vegetation and Fauna Management Plan ■ Construction Management Plan ■ Noise, Vibration and Light Management Plan
Alkimos-Eglinton DSP	<p>Encompassed approximately 2,600 ha of land which included:</p> <ul style="list-style-type: none"> ■ Alkimos regional centre, Eglinton district centre and three new coastal villages ■ Rail alignment which included railway stations in Alkimos and Eglinton centres ■ A wide range of residential housing density and diversity to accommodate approximately 23,000 new dwellings and 57,000 people. 	<p>The WAPC initiated Amendment 1029/33 to the MRS to rationalise zones and reservations in the Alkimos and Eglinton localities to correspond with the Alkimos-Eglinton DSP. Figure E shows the spatial extent of MRS Amendment 1029/33.</p> <p>MRS Amendment 1029/33 proposed the relocation of the northern suburbs rail line reservation to be more centrally located within the Alkimos Regional and Eglinton District Centres. However, the (then) DPI commissioned GHD to undertake a separate alignment definition study for the extension of the northern suburbs railway to ensure that the proposed railway stations were better integrated into proposed centres.</p> <p>This review was entitled the Northern Suburbs Railway Alignment Definition – Alkimos to Yanchep –Alignment Definition Report (GHD 2005).</p> <p>No changes to the railway alignment were undertaken as part of MRS Amendment 1029/33.</p>	<p>The Chairman of the EPA decided that MRS Amendment 1029/33 should be formally assessed at the level of Environmental Review under the EP Act because the proposed land use changes may have potentially significant impacts on a number of environmental factors.</p> <p>The EPA identified that it supported the realignment of the railway reservation as part of a future amendment to the MRS to avoid the fragmentation of the geoheritage and landform values (Alkimos dune system). It was agreed by all stakeholders that changes to the railway alignment would be the subject of a separate MRS Amendment.</p>
Northern Suburbs Railway Alignment Definition (Alkimos to Yanchep) Alignment Definition Report (GHD 2005)	<p>Defined the railway alignment, major road crossings and stations to enable the preparation of land requirement plans for incorporation into an MRS amendment from Romeo Road to the Yanchep town centre station.</p> <p>The alignment definition report concluded that the proposed alignment meets current standards for urban passenger railways and is suitable for incorporation into the MRS. It was expected that the rail will be in a cutting for most of its length, especially through residential areas.</p> <p>The alignment definition report also included a preliminary drainage assessment and identified areas to be set aside for drainage basins. The alignment definition report also addressed geotechnical constraints and concluded that the soil and rock formations anticipated over the proposed alignment are generally expected to represent competent founding conditions, however the possible presence and influence of karst conditions must be considered and detailed geotechnical studies will be required as part of the railway master planning process.</p> <p>Stations were proposed at the Alkimos regional centre and at the Eglinton district centre.</p>	<p>MRS Amendment 1192/57 realigned the northern suburbs railway reservation further west, primarily between the Mitchell Freeway and Marmion Avenue, in Alkimos and Eglinton and significantly contributed to the viability of the Alkimos regional centre and the Eglinton district centre.</p> <p>Figure E shows the spatial extent of MRS Amendment 1192/57.</p> <p>MRS Amendment 1192/57 accorded with intent of draft Directions 2031 and Beyond (Department of Planning and WAPC 2010), as it rationalised the alignment of the northern suburbs railway which provided for public transport services to be accessible to a greater proportion of the community.</p>	<p>MRS Amendment 1192/57 was referred to the EPA for assessment under Section 48a of the EP Act. In May 2010 the Chairman of the EPA considered that the likely environmental impacts of the scheme amendment were not so significant as to warrant formal environmental assessment.</p> <p>The following minor modifications were made to MRS Amendment 1192/57 as a result of the submissions received during the advertising period:</p> <ul style="list-style-type: none"> ■ modification of the width of the "Railways" reservation from a minimum of 35 metres (m) to a minimum of 40 m ■ minor realignment of the northern portion of the "Railways" reservation to better accommodate the existing topography ■ rationalising a small areas of "Parks and Recreation" reservation to the Central City Area zone ■ minor rationalisation of the "Railways" reservation at various locations between Alkimos and Eglinton. <p>The EPA raised no objections to these minor modifications. The final gazetted "Railways" reservation is presented in relation to MRS Amendment 1192/57 and the Part 1 development footprint in Figure E.</p>

2.1.1 Local Structure Planning

The approved Butler-Jindalee and Alkimos-Eglinton DSPs provide the strategic framework to inform the preparation of LSPs for parcels of land zoned either “Urban” or “Central City Area” under the MRS that are situated directly adjacent to the Part 1 development footprint.

To date, the following LSPs have been approved by the City of Wanneroo (CoW) and the WAPC:

- North Eglinton
- Eglinton
- North Alkimos
- Central Alkimos
- Lot 1001 and 1002 Marmion Avenue, Alkimos.

The draft Alkimos City Centre Activity Centre Structure Plan No. 89 has also been prepared for a 212 ha parcel of land to the south of the Central Alkimos LSP, whilst the draft Western Precinct LSP covers a 28.70 ha portion of Lot 6 Taronga Place. These draft LSPs are pending endorsement by the CoW / WAPC.

The location of the approved DSPs, LSPs and draft LSPs in respect to the Part 1 development envelope is presented in Figure C.

2.2 Justification

The PTA is proposing to extend the existing Joondalup railway line from Butler Station to Eglinton Station (Part 1 of the YRE project) as part of delivering the priority projects for the Labor Government's METRONET vision, a core election promise to the Western Australian public by the recently elected government.

The planning rationale for the ongoing growth of Perth's northern suburbs has been historically underpinned by the provision of rail infrastructure to the Eglinton and Alkimos communities in key strategic planning documents (Table 2), whilst the detailed design and planning for LSPs adjacent to the Part 1 development footprint has been premised by the assumption that the YRE project will be constructed.

The Part 1 - Butler Station to Eglinton Station extension of the railway line will form the principal public transport serving the Alkimos and Eglinton growth areas, providing current and future residents with a direct rail connection to Joondalup, Perth CBD and other parts of the metropolitan region. The rail corridor will provide an important opportunity for the development of transit oriented centres in Alkimos and Eglinton within the walkable catchments of the planned stations.

The key benefits arising from Part 1 of the YRE project include:

- improved access to public transport for Perth's northern suburbs
- improved connection to Perth's CBD and other destinations across the metropolitan area for residents living in Perth's northern most suburbs
- reduction of congestion on the Mitchell Freeway and Wanneroo Road and Marmion Avenue

Part 1 of the YRE project also addresses three key local issues:

1. Worsening urban congestion due to a lack of efficient transport alternatives.
2. Continued land development that promotes private vehicle use and limits opportunities to create higher density residential areas.
3. Social inequality and lower levels of opportunity for people who do not own or are unable to use a private vehicle.

2.2.1 Rapid Population Growth

The North-west Sub-region is one of Australia’s fastest growing areas with population predicted to increase from 320,000 people in 2011 to 500,000 people by 2026 and 740,000 people by 2050 (PTA 2017a).

The estimated 27,000 people currently living between Jindalee and Two Rocks do not have access to major public transport infrastructure beyond the Butler Station. Population in this area is predicted to reach in excess of 136,000 people by 2041 (.idcommunity 2017).

Table 4 provides the anticipated number of daily boardings at the future Alkimos and Eglinton stations in 2021 and 2031.

Table 4: Anticipated Daily Boardings at Future Stations

Station	2021 Daily Boardings (people)	2031 Daily Boardings (people)
Alkimos	2,167	2,700
Eglinton	1,799	2,204

(Source: PTA 2017a)

Additionally, employment self-sufficiency in the North-west Sub-region (49.2% in 2011) is lower than all other sub-regions within Perth and Peel (Department of Premier and Cabinet 2015). The extension of the existing Joondalup rail line will provide a low-cost option for residents commuting to work in Perth’s CBD as well as other destinations across the metropolitan area.

2.2.2 Highly Congested Traffic Network

The North-west Sub-region is already experiencing significant traffic congestion along its entirety (CoW 2017). The road network is at capacity in many areas and cannot be upgraded in key areas due to a number of constraints (CoW 2017).

The extension of the Joondalup rail line addresses existing and future traffic congestion issues facing the North-west Sub-region by providing an alternative to private vehicle use which will in turn reduce local traffic volumes.

2.2.3 Sustainability Outcomes

In addition to responding to rapid population growth in the City of Wanneroo and the highly congested traffic network of the North-west Sub-region, the YRE project responds the growing need for an accessible, environmentally sensitive and economically sustainable means of public travel.

The YRE project will provide the opportunity for improved sustainability outcomes including the potential to reduce greenhouse gas emissions through reducing commuters’ reliance on private vehicle use.

Passengers will be encouraged to use sustainable modes of transport to access new stations, such as walking, cycling and catching the bus, and the YRE project will include create and connect to local pathways and cycling infrastructure at each station (PTA 2017a). Subject to future funding approval, more than 8 million additional service kilometres and up to 56 new buses will be introduced to provide passenger access to the constructed YRE project (PTA 2017a).

Further, increased use of Perth’s public transport system will likely improve its economic performance, with value capture opportunities at new stations also being assessed as part of the planning and design.

2.2.4 Alternative Alignment Options

Alternative alignment options were considered by the PTA in early in the detailed design of the YRE project, however opportunities to amend the Part 1 development footprint are now constrained due to residential development construction adjacent to the MRS “Railways” reservation. Notwithstanding the planning

constraints imposed on the YRE project by surrounding developments, the Part 1 development envelope has been iteratively modified by the PTA to minimise environmental impacts. The following amendments have been made:

- modification of the Part 1 development footprint within Lot 200 Alkimos Drive “Parks and Recreation” reservation to avoid impacting Carnaby’s Black Cockatoo foraging habitat retained as part of EPBC 2015/7561 decision
- modification of the Part 1 development envelope to avoid the clearing of native vegetation and direct impacts to Bush Forever Site No. 130: *Link between Yanchep and Neerabup National Parks* within eastern corridor of an “Other Regional Road” reserved in the MRS to the north of Lot 200 Alkimos Drive “Parks and Recreation” reservation. Construction traffic in this section will now use Marmion Avenue with only the western corridor of the reserved road being cleared to facilitate access
- construction and access areas have been selected to coincide with proposed future urban development cells or roads either reserved by the MRS (Figure B), or as detailed within approved and draft LSPs, to intentionally avoid direct impacts to native vegetation which may have otherwise been able to be retained within future POS reservations.

2.3 Proposal Description

The high-level objectives of Part 1 of the YRE project include:

- delivery of a world class public transport system
- connection of the northern suburbs to the Perth CBD
- reduction of vehicle congestion
- support for the objectives of Transport @ 3.5 million (DoT, PTA and MRWA 2017).

An overview of the Part 1 – Butler Station to Eglinton Station proposal is provided in Table 5, in accordance with the EPA’s *Instructions on how to define the key characteristics of a proposal* (EPA 2016b).

Table 5: Proposal Summary

Proposal Title	Yanchep Rail Extension: Part 1 – Butler Station to Eglinton Station
Proponent Name	Public Transport Authority
Short Description	<p>The proposal is to extend the existing Joondalup railway line from Butler Station to Eglinton Station, with a contingency turnback facility provided to the north of the Eglinton Station.</p> <p>The proposal includes the construction and operation of two new stations at Alkimos and Eglinton with intermodal rail, bus, ‘park and ride’, ‘kiss and ride’ and active mode (cycling and walking) facilities at each station.</p>

Table 6 provides a comprehensive description of the Part 1 – Butler Station to Eglinton Station proposal, in accordance with the EPA’s *Instructions on how to define the key characteristics of a proposal* (EPA 2016b). The 70.22 ha Part 1 development envelope, which includes a 45.42 ha development footprint and 24.80 ha construction and access area, is identified in Figure F. The Part 1 development footprint is inclusive of all ancillary infrastructure, such as stations, stormwater drainage basins and principal shared paths for pedestrian and cyclist use.

Table 6: Infrastructure Layout and Extent of Physical and Operational Elements

Element	Location	Proposed Extent / Description
Physical Elements		
Railway Extension	The dual narrow-gauge track will begin from a connection with the existing Joondalup railway line, north of the Butler Station. The railway will generally follow the land reserved "Railway" under the MRS before terminating at the northern boundary of the land zoned "Urban" under the MRS within the North Eglinton LSP (Figures A, B and C).	The 7.3 km of dual narrow-gauge track will be located within a 45.42 ha Part 1 development footprint (Figure F). The railway will be cut approximately 5 metres (m) below the surrounding ground level. The railway corridor will be constrained either through battering the excavation or using retaining walls. The corridor is approximately 40m wide.
Alkimos Station	Alkimos Station is located in the north of the Alkimos City Centre Activity Centre Structure Plan No. 89 area.	Alkimos Station will be an at grade station which will serve the Alkimos locality and surrounding future suburbs. Alkimos Station development footprint is included within the Part 1 development footprint and is approximately 5.3 ha in extent (Figure F). Provision has been made for an intermodal rail, bus, 'park and ride', 'kiss and ride' and active mode facilities.
Eglinton Station	Eglinton Station is located in the north of the Eglinton LSP area.	Eglinton Station will be an at grade station which will serve the Eglinton locality and surrounding future suburbs. Eglinton Station development footprint is included within the Part 1 development footprint and is approximately 6.9 ha in extent (Figure F). Provision has been made for an intermodal rail, bus, 'park and ride', 'kiss and ride' and active mode facilities.
Construction and Access Areas	Construction and access areas have been selected to coincide with proposed future urban development or roads either reserved by the MRS (Figure B) or as detailed within approved and draft LSPs.	The construction and access areas will be located within a 24.80 ha extent outside of the Part 1 development footprint but within the Part 1 development envelope (Figure F).
Operational Elements		
Railway Line	The dual narrow-gauge track will begin from a connection with the existing Joondalup railway line, north of the Butler Station. The railway will generally follow the land reserved "Railway" under the MRS before terminating at the northern boundary of the land zoned "Urban" under the MRS within the North Eglinton LSP.	The constructed railway line will operate train services between the Butler Station and the Alkimos and Eglinton stations.
Alkimos and Eglinton Stations	Alkimos Station is located in the north of the Alkimos City Centre Activity Centre Structure Plan No. 89 area, whilst the Eglinton Station is located in the north of the Eglinton LSP area.	Bus services will operate from the Alkimos and Eglinton stations.

2.4 Local and Regional Context

The Part 1 development footprint is comprised primarily of land reserved for "Railways" under the MRS and generally situated adjacent to land where residential construction has been progressed or land which is zoned for future urban development and associated uses (Figure B). Regional transport infrastructure less than 1 km to the west of the Part 1 development footprint includes Marmion Avenue, whilst the future reservation of the Mitchell freeway is situated less than 1 km to the east.

Lot 200 Alkimos Drive, Alkimos, situated to the north of the draft Alkimos City Centre Activity Centre Structure Plan No. 89, is reserved for “Parks and Recreation” under the MRS. The Part 1 development footprint includes a small portion of this lot / reservation (1.30 ha), with the remaining extents divided by the proposed railway. The regional environmental values in close proximity to the Part 1 development footprint have been adequately reserved as “Parks and Recreation” reserves in the MRS with the management of these reservations dictated by their delegation as Bush Forever areas (Figure B).

The key environmental attributes of the six Bush Forever sites located in close proximity to (but not within) the Part 1 development footprint are:

- Bush Forever Site No. 130: *Link between Yanchep and Neerabup National Parks* contains 94.3 ha of bushland comprised woodlands dominated by *Eucalyptus gomphocephala*, *E. marginata* and *Banksia attenuata*; and heaths to low shrublands dominated by *Banksia sessilis* var. *cygnorum*, *Xanthorrhoea preissii*, *Scaevola thesiodes* and *Trymalium ledifolium* var. *ledifolium*. More than 75% of the bushland considered to be in “Very Good” or better condition. These vegetation structural units include potential foraging and breeding habitat for Carnaby’s Black Cockatoo with Southern Brown Bandicoot identified as a known resident (Government of Western Australia 2000; Figure B).
- Bush Forever Site No. 288: *Yanchep National Park and Adjacent Bushland* contains 2,706 ha of bushland comprised of floristic supergroups of seasonal wetlands, uplands centred on Bassendean Dunes and Dandaragan Plateau and uplands centred on Spearwood and Quindalup Dunes. More than 90% of the bushland considered to be in “Very Good” or better condition. *Melaleuca huegelii* – *M. acerosa* [*M. systema*] shrublands on limestone ridges TEC 26a forms a part of the uplands centred on Spearwood and Quindalup Dunes supergroup, whilst the two upland supergroups include potential foraging and breeding habitat for Carnaby’s Black Cockatoo. The Southern Brown Bandicoot and Western Brush Wallaby are identified as residents, whilst over 400 caves provide an important historical record of the local geology and significant habitat resource for subterranean fauna species (Government of Western Australia 2000, Parks and Wildlife Service 2018; Figure B).
- Bush Forever Site No. 289: *Ningana Bushland, Yanchep/Eglinton* contains 551.5 ha of bushland comprised of woodland, heath, shrubland and grassland communities. More than 60% of the bushland considered to be in “Very Good” or better condition. Upland woodland and heath communities include potential foraging and breeding habitat for Carnaby’s Black Cockatoo, whilst upland heaths are dominated by *Lomandra maritima*. Contains the Alkimos Dune Complex, a system of parabolic dunes of Holocene age containing a chronological sequence (Government of Western Australia 2000; Figure B).
- Bush Forever Site No. 383: *Neerabup National Park, Lake Gnowergup Nature Reserve and adjacent Bushland, Neerabup* contains 2,706 ha of bushland comprised of floristic supergroups of seasonal wetlands and uplands centred on Spearwood and Quindalup Dunes. More than 85% of the bushland considered to be in “Very Good” or better condition. *Melaleuca huegelii* – *M. acerosa* [*M. systema*] shrublands on limestone ridges TEC 26a forms a part of the uplands centred on Spearwood and Quindalup Dunes supergroup which also includes potential foraging and breeding habitat for Carnaby’s Black Cockatoo. The Southern Brown Bandicoot is a known resident (Government of Western Australia 2000; Figure B).
- Bush Forever Site No. 397: *Coastal Strip from Wilbinga to Mindarie* contains 404 ha of bushland comprised of floristic supergroups of seasonal wetlands and uplands centred on Spearwood and Quindalup Dunes. Native vegetation condition ranges from near “Pristine” to “Degraded” (Government of Western Australia 2000; Figure B).

2.5 Proposal Delivery

The procurement options for the delivery of Part 1 of the YRE project are currently being reviewed by the PTA. Construction of Part 1 is anticipated to commence in late 2018 with completion expected in 2021.

3.0 Stakeholder Consultation

3.1 Key Stakeholders

To inform preliminary planning for the YRE project and confirm its development footprint, PTA has consulted extensively with key stakeholders. Table 7 identifies the key government and community stakeholders consulted for the YRE project.

Table 7: Key Stakeholders

Key Stakeholder	Project Role / Interest
Federal Government	
Department of the Environment and Energy	Environmental approval(s) under the EPBC Act (as required)
State Government	
Department of Water and Environmental Regulation	<ul style="list-style-type: none"> ■ Environmental assessment under the EP Act (as required) ■ Assistance with implementation of Water Sensitive Urban Design principles ■ Assistance with noise and vibration assessment and mitigation options
Environmental Protection Authority	Environmental advice under the EP Act (as required)
Department of Biodiversity Conservation and Attractions	Environmental advice
Department of Planning, Lands and Heritage	<ul style="list-style-type: none"> ■ Land acquisition and MRS Amendment ■ Liaison with other landowners ■ Interface for wider infrastructure requirements
Western Australian Planning Commission	Rezoning and development application approval(s)
Public Transport Authority	<ul style="list-style-type: none"> ■ Project definition and delivery ■ Construction delivery ■ Asset owner and operator
Water Corporation	Assistance with location of production bores and wellhead protection zones
Local Government	
City of Wanneroo	<ul style="list-style-type: none"> ■ Advocacy and community relations ■ Rezoning and development application approval(s)
Local Community	
South West Aboriginal Land and Sea Council (on behalf of the Whadjuk People)	<ul style="list-style-type: none"> ■ Compliance with the State Government's Noongar Standard Heritage Agreement (NSHA) ■ Coordination of Aboriginal heritage surveys
Whadjuk Working Group	<ul style="list-style-type: none"> ■ Compliance with the NSHA ■ Coordination of Aboriginal heritage surveys
Property developers	Project definition and delivery
Urban Bushland Council	Community organisation
Quinns Rocks Environmental Group	Community group

3.2 Stakeholder Engagement Process

A Communications and Stakeholder Engagement Plan has been developed by the PTA to guide the community relations activities for the various phases (i.e. Planning, design and procurement; and Construction and commissioning) of the YRE project.

The Communications and Stakeholder Engagement Plan's community relations activities include:

- identifying and resolving issues that affect stakeholders, residents, businesses and other community members, and managing their information needs
- issuing communication to stakeholders
- establishing and maintaining relationships with local community groups, residents, businesses, CoW and other stakeholders where relevant
- identifying and responding to local issues, including preparation of, and contribution to, communication strategies to address issues
- responding to email, telephone and general inquiries from the public and stakeholders, including directing enquiries to relevant project staff and ensuring timely responses
- managing complaints and claims
- liaising with relevant PTA project managers and contractor project managers on issue close-outs and residual community matters
- managing the PTA's database of stakeholders.

Further, a dedicated METRONET website³ has been established. In addition to providing a detailed overview of the YRE project, this allows interested parties to inquire about METRONET through a dedicated email address⁴ and register for project updates.

3.3 Stakeholder Consultation

3.3.1 Liaison with DBCA

On 11 July 2017, a meeting was held with Department of Biodiversity Conservation and Attractions' (DBCA) Land Tenure division to present the preliminary findings of GHD (2018) and review potential options for environmental offsets.

The key outcomes from the meeting were that:

- Various sites had been earmarked for acquisition by the DBCA in Gingin and Chittering localities, which could be purchased by the PTA to offset the residual impacts of clearing Banksia Woodlands of the Swan Coastal Plain TEC and black cockatoo habitat.
- Options were identified for counterbalancing the residual impacts of clearing a small area of *Melaleuca huegellii* – *M. acerosa* [*M. systena*] shrublands on limestone ridges TEC 26a.

3.3.2 Liaison with the Chairman of the EPA and DWER

A YRE project briefing was conducted for the Chairman of the EPA, Dr Tom Hatton, and officers from DWER with the PTA and its consultants on 4 September 2017.

The key outcomes of the briefing were that:

³ <http://www.pta.wa.gov.au/projects/current-projects/metronet>

⁴ <mailto:info@metronet.wa.gov.au>

- Potential environmental impacts to the following land-themed environmental factors were considered to be the critical elements of the YRE project
 - > flora and vegetation
 - > terrestrial fauna.
- DWER agreed with simultaneously referring the YRE project to the EPA and DEE with a request to trigger an accredited assessment.

Further meetings were held with DWER officers on 2 November 2017 and 1 December 2017 to progress the drafting of the referral.

3.3.3 Liaison with Department of the Environment and Energy

On 8 December 2017, a meeting was held with the DEE's Western Australia Assessments Branch to review the existing environmental approvals provided for land development projects under the EPBC Act and the associated implications for the YRE project.

The key outcome from the meeting was that the DEE confirmed that existing environmental approvals for the various land development projects were valid for impacts to MNES for the YRE project where the EPBC Act assessment boundaries of the approved referrals intersected the YRE project's development footprint. The DEE identified that, in each case, as the proponent or person taking the approved action is not the PTA then the approval holder takes responsibility for the implementation of the approval conditions associated with the YRE construction works conducted under their approval. The PTA will ensure that the YRE project is implemented in accordance with the agreed EPBC Act approval conditions for each of the land development projects (Sections 6.7.1 and 10.7).

The PTA has also undertaken ongoing liaison with the DEE to identify the requirement for an EPBC referral to be submitted for the portions of the Part 1 development envelope which fall outside of the existing environmental approvals for the various land development projects. A small amount of Carnaby's Black Cockatoo habitat (1.02 ha of foraging habitat and 3 potential breeding trees) was identified within the Part 1 development envelope and outside of the EPBC Act assessment boundaries (Figure D; Table 20).

The DEE confirmed that this small amount of clearing is unlikely to significantly impact the overall viability of Carnaby's Black Cockatoo.

3.3.4 Liaison with the Community

The PTA has consulted with community-based environmental groups as part the implementation of the YRE project's Communications and Stakeholder Engagement Plan. A brief summary of these discussions is provided below.

3.3.4.1 Quinns Rocks Environmental Group

On 17 November 2017, a meeting was held with representatives from the Quinns Rocks Environmental Group to review the environmental context of the YRE project. The Quinns Rocks Environmental Group's concerns related to the fragmentation of Bush Forever Site No. 289: *Ningana Bushland, Yanchep/Eglinton*, which is included in Part 2 of the YRE project, and Lot 200 Alkimos Drive "Parks and Recreation" reservation, which relates to Part 1.

The PTA is committed to undertaking additional consultation with the Quinns Rocks Environmental Group to inform detailed design for the YRE project.

3.3.4.2 Urban Bushland Council

On 07 December 2017, a meeting was held with representatives from the Urban Bushland Council to review the environmental context of the YRE project. The Urban Bushland Council's key consideration related to clearing of native vegetation within Bush Forever Site No. 289: *Ningana Bushland, Yanchep/Eglinton* which relates to Part 2 of the YRE project.

The PTA is committed to undertaking additional consultation with the Urban Bushland Council to inform detailed design for the YRE project.

4.0 Environmental Investigations

A summary of key environmental investigations that have been undertaken specifically for the YRE project is provided in Table 8.

Table 8: Project Specific Environmental Investigations

Environmental Factor	Investigation	Year	Key Assessment Standards	Description	Section
Flora and Vegetation	Northern Suburbs Railway, Alkimos to Yanchep, <i>Phytophthora cinnamomi</i> occurrence assessment (Glevan Consulting 2011)	2011	<ul style="list-style-type: none"> ■ <i>Phytophthora cinnamomi</i> and disease caused by it, Volume I – Management Guidelines (Department of Environment and Conservation [DEC] 2003). ■ <i>Phytophthora cinnamomi</i> and disease caused by it, Volume II – Interpreter Guidelines for Detection, Diagnosis and Mapping (DEC 2001). 	Assesses the presence of <i>Phytophthora cinnamomi</i> within the proposed Northern Suburbs Railway – Alkimos to Yanchep extension project.	Section 6.0
	Northern Suburbs Railway Alignment Butler to Yanchep Environmental Investigation (GHD 2012)	2012	<ul style="list-style-type: none"> ■ <i>Environment Protection and Biodiversity Conservation Act 1999</i> ■ <i>Wildlife Conservation Act 1950</i> ■ Guidance Statement No. 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004a) 	Describes vegetation and flora values of the proposed Northern Suburbs Railway Alignment Butler to Yanchep and provides an ecological impact assessment.	Section 6.0
	Yanchep Rail Extension, <i>Phytophthora</i> dieback Occurrence Assessment (Glevan Consulting 2017)	2017	<ul style="list-style-type: none"> ■ FEM047 <i>Phytophthora</i> Dieback Interpreter's Manual for Lands Managed by the Department (Department of Parks and Wildlife 2015) 	Assesses the presence of <i>Phytophthora cinnamomi</i> for the YRE project.	Section 6.0
	Yanchep Rail Extension Biological Assessment (GHD 2018)	2018	<ul style="list-style-type: none"> ■ <i>Environment Protection and Biodiversity Conservation Act 1999</i> ■ <i>Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016</i>⁵ ■ Technical Guidance: <i>Flora and Vegetation Surveys for Environmental Impact Assessment</i> (EPA 2016c). 	Describes vegetation and flora values of the YRE project's development footprint and provides an ecological impact assessment.	Section 6.0
Landform	Yanchep Rail Extension, Geotechnical Investigation Report (Advisian 2017)	2017	N/A	Describes the geological profile and provides an interpretation of the geotechnical engineering implications for construction.	Section 7.0
Subterranean Fauna	Northern Suburbs Railway Alignment Butler to Yanchep Environmental Investigation (GHD 2012)	2012	Guidance Statement No. 54: <i>Consideration of Subterranean Fauna in Groundwater and in Caves during Environmental Impact Assessment in Western Australia</i> (EPA 2003)	Provides an assessment of the likelihood of stygofauna, stygofauna habitat or karst formations.	Section 8.0
Terrestrial Environmental Quality	Yanchep Rail Extension, Preliminary Site Investigation (Golder Associates 2017)	2017	<ul style="list-style-type: none"> ■ Assessment and Management of Contaminated Sites (Department of Environment Regulation [DER] 2014) ■ National Environmental Protection (Assessment of Site Contamination) Measure 1999 	Provides an assessment of whether current or former site land uses are likely to have caused or contributed to contamination.	Section 9.2
Terrestrial Fauna	Report for Northern Suburbs Railway Alignment from Romeo Road (Alkimos) to Yanchep, Graceful Sun-moth Survey (GHD 2011)	2011	<ul style="list-style-type: none"> ■ <i>Environment Protection and Biodiversity Conservation Act 1999</i> ■ <i>Wildlife Conservation Act 1950</i> ■ Survey Guidelines for the Graceful Sun-moth (<i>Synemon gratiosa</i>) and site habitat requirements (DEC 2010) 	Provides the findings of a Graceful Sun-moth survey of the proposed Northern Suburbs Railway Alignment from Romeo Road (Alkimos) to Yanchep.	Section 10.0
	Northern Suburbs Railway Alignment Butler to Yanchep Environmental Investigation (GHD 2012)	2012	<ul style="list-style-type: none"> ■ <i>Environment Protection and Biodiversity Conservation Act 1999</i> ■ <i>Wildlife Conservation Act 1950</i> ■ Guidance Statement No. 54: <i>Consideration of Subterranean Fauna in Groundwater and Caves during Environmental Impact Assessment in Western Australia</i> (EPA 2003) ■ Guidance Statement No. 56: <i>Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia</i> (EPA 2004b) 	Describes fauna values of the proposed Northern Suburbs Railway Alignment Butler to Yanchep and provides an ecological impact assessment.	Section 10.0
	Yanchep Rail Extension Biological Assessment (GHD 2018)	2018	<ul style="list-style-type: none"> ■ <i>Environment Protection and Biodiversity Conservation Act 1999</i> ■ <i>Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016</i> ■ Technical Guidance: <i>Terrestrial Fauna Surveys</i> (EPA 2016d) 	Describes fauna values of the YRE project's development footprint and provides an ecological impact assessment.	Section 10.0

⁵ The *Biodiversity Conservation Act 2016* (BC Act) will eventually fully replace the *Wildlife Conservation Act 1950* (WC Act) in listing threatened species and regulating the protection of native species, however these provisions cannot be brought into effect until the necessary Biodiversity Conservation Regulations have been endorsed.

Environmental Factor	Investigation	Year	Key Assessment Standards	Description	Section
Social Surroundings	Desk-top Aboriginal Heritage Study of Proposed Northern Suburbs Railway Route (R. & E. O'Connor Pty Ltd 2012)	2012	<i>Aboriginal Heritage Act 1972</i>	Investigates and makes recommendations for managing identified Aboriginal heritage issues that may be affected by the Proposed Northern Suburbs Railway	Section 13.1
	Report on an Archaeological Survey of the Butler to Yanchep Railway Alignment (John Cecchi Heritage Management Consulting (JCHMC) 2013)	2013	<i>Aboriginal Heritage Act 1972</i>	Assesses the presence of archaeological sites within Butler to Yanchep Railway Alignment	Section 13.1
	Northern Suburbs Railway Extension Alignment (R. & E. O'Connor Pty Ltd 2017a)	2017	<i>Aboriginal Heritage Act 1972</i>	Describes methodology, execution and results of consultative process and Aboriginal heritage survey.	Section 13.1
	Addendum to report on the Aboriginal Heritage Survey of the Northern Suburbs Railway Extension (R. & E. O'Connor Pty Ltd 2017b)	2017	<i>Aboriginal Heritage Act 1972</i>	Describes methodology, execution and results of additional consultative process and Aboriginal heritage survey for the proposed station sites and associated facilities.	Section 13.1
	Northern Suburbs Railway Extension Butler to Yanchep, Noise Assessment (Herring Storer Acoustics 2012a)	2012	State Planning Policy (SPP) 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning	Determines noise emissions from trains travelling on extension of the Joondalup railway, provides an assessment of the predicted noise levels for compliance with the appropriate criteria and advises on appropriate controls	Section 13.3
	Northern Rail Extension Romeo Road to Yanchep, Ground Vibration Assessment (Herring Storer Acoustics 2012b)	2012	AS 2670.2-1990 Evaluation of human exposure to whole-body vibration; Part 2: Continuous and shock-induced vibration building (1 to 80 Hz)	Measures ground vibration from passing passenger trains on the Perth-Mandurah line, provides an assessment of the predicted vibration levels for compliance with the appropriate criteria and advises on appropriate controls	Section 13.3
	MERTONET – Yanchep Rail Extension, Transport Noise and Vibration Assessment (Lloyd George Acoustics 2018)	2018	<ul style="list-style-type: none"> ■ SPP 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning ■ AS 2670.2-1990 Evaluation of human exposure to whole-body vibration; Part 2: Continuous and shock-induced vibration building (1 to 80 Hz) 	Assesses the noise and vibration emissions from the YRE project and provides recommendations on mitigation measures to ensure compliance with the noise and vibration criteria and minimise impacts to all existing and planned sensitive premises.	Section 13.3

5.0 Environmental Principles and Factors

5.1 Environmental Principles

Section 4A of the EP Act establishes that the objective of the Act is to protect Western Australia's environment, having regard for the following principles:

1. The Precautionary Principle.
2. The Principle of Intergenerational Equity.
3. Principles relating to Improved Valuation, Pricing and Incentive Mechanisms.
4. The Principle of the Conservation of Biological Diversity and Ecological Integrity.
5. The Principle of Waste Minimisation.

Table 9 identifies how these five EP Act principles have been considered by the YRE project.

Table 9: EP Act Principles

Principle	Consideration
1. The Precautionary Principle	
<p><i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</i></p> <p><i>In application of this precautionary principle, decisions should be guided by:</i></p> <p>a) <i>careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</i></p> <p>b) <i>an assessment of the risk-weighted consequences of various options.</i></p>	<p>Part 1 of the YRE project has been underpinned by key strategic planning documents (Table 2) and MRS Assessments to support district structure planning in the Alkimos-Eglinton localities (Table 3) and the alignment of the current "Railways" reservation (Table 3). The strategic planning framework and complementary environmental assessments have been augmented by additional environmental investigations undertaken to inform the detailed design of Local Structure Plans (Section 2.1.1) and support environmental assessment under the EPBC Act (Section 1.4.4.1).</p> <p>The detailed design for the Part 1 development footprint has been informed by more than 6 years of detailed environmental investigation (Table 8). Modifications to the Part 1 development envelope have been made to avoid and minimise environmental impacts, where practicable to do so (Sections 2.2.4 and 7.4.1.1).</p> <p>The PTA has also maintained close correspondence with relevant government agencies (Table 7) to minimise any uncertainty surrounding the environmental impact of the YRE project.</p> <p>Detailed design plans, when coupled with the development and implementation of a Construction Environmental Management Plan and PTA standard operating procedures, will largely avoid or minimise impacts to the identified environmental factors within the Part 1 development envelope.</p>
2. The Principle of Intergenerational Equity	
<p><i>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for benefit of future generations.</i></p>	<p>Part 1 of the YRE project has been designed to address the EPA's objectives for the identified environmental factors, with mitigation measures provided to reduce any residual environmental impacts.</p> <p>The YRE project responds to the growing need for an accessible, environmentally sensitive and economically sustainable means of public travel in the North-west Sub-region (Section 2.2.3).</p> <p>This EIA report demonstrates that Part 1 of the YRE project can be implemented to avoid significant impacts on the health, diversity or productivity of the environment for the benefit of future generations.</p>
3. Principles relating to Improved Valuation, Pricing and Incentive Mechanisms	
<p>(1) <i>Environmental factors should be included in the valuation of assets and services.</i></p>	<p>Environmental factors were considered when evaluating design options for the YRE project.</p> <p>The PTA has assessed the relevant environmental factors and has iteratively modified the Part 1 development envelope of its preferred development option during planning to minimise its environmental impacts (Section 2.2.4).</p>
<p>(2) <i>The polluter pays principles-those who generate pollution and waste should bear the cost of containment, avoidance and abatement.</i></p>	<p>Avoidance of significant environmental attributes and ongoing management costs have been considered by the PTA in the detailed design for the YRE project.</p>
<p>(3) <i>The users of goods and services should pay prices based on the full lifecycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.</i></p>	
<p>(4) <i>Environmental goals, have been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and / or minimise costs to develop their own solution and response to environmental problems.</i></p>	
4. The Principle of the Conservation of Biological Diversity and Ecological Integrity	
<p><i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i></p>	<p>Part 1 of the YRE project is primarily comprised of land reserved under the MRS for the purpose of "Railways", whilst the construction and access areas have been selected to coincide with proposed future urban development or roads either reserved by the MRS (Figure B), or as detailed within approved and draft LSPs, to avoid direct impacts to native vegetation.</p> <p>Detailed Flora and Vegetation and Terrestrial Fauna field surveys (Table 8) have been undertaken to identify and confirm the relative environmental values of the ecological attributes identified within the Part 1 development envelope. Minimising potential impacts to the identified ecological attributes within the Part 1 development envelope has been a fundamental design consideration, with the development footprint modified to reduce impacts to land reserved for "Parks and Recreation" under the MRS (Section 2.2.4).</p>
5. The Principle of Waste Minimisation	
<p><i>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</i></p>	<p>Waste will be minimised during construction by adopting the hierarchy of waste controls; avoid, minimise, reuse, recycle and safe disposal. It is expected that significant amount of sand and limestone will be required to be removed from the Part 1 development footprint to facilitate the final finished floor levels. The PTA is investigating numerous beneficial re-use opportunities for the excess sand and limestone in close proximity to the Part 1 development footprint.</p>

5.2 Environmental Factors

This EIA report addresses the EPA’s environmental factors, as outlined in the *Statement of Environmental Principles, Factors and Objectives* (EPA 2016e), of specific relevance to Part 1 of the YRE project:

- land factors
 - > flora and vegetation
 - > landforms
 - > subterranean fauna
 - > terrestrial environmental quality
 - > terrestrial fauna
- water factors
 - > hydrological processes
 - > inland waters environmental quality
- people factor
 - > social surroundings.

Sections 6.0 to 13.0 specifically discuss the environment impacts to the relevant land, water and people factors associated with Part 1 of the YRE project. Each section identifies the EPA’s objective for the environmental factor, details the receiving environment, identifies potential impacts that may occur, provides an assessment of the potential impacts, proposes mitigation strategies that will be used to minimise the identified impacts and, finally, provides a description of the predicted outcome.

5.2.1 EPA Guidance and Technical Reports

The YRE project is subject to compliance with applicable guidelines and technical reports which have been developed to assist proponents, and the general public, in understanding the minimum requirements for the protection of the environment that the EPA expects to be met during the assessment process.

Table 10 details the EPA’s environmental factors and technical guidelines relevant to the YRE project.

Table 10: Applicable EPA Guidance and Technical Reports

EPA Environmental Factor Guidelines
Environmental Factor Guideline: <i>Flora and Vegetation</i> (EPA 2016f)
Environmental Factor Guideline: <i>Landforms</i> (EPA 2016g)
Environmental Factor Guideline: <i>Subterranean Fauna</i> (EPA 2016h)
Environmental Factor Guideline: <i>Terrestrial Environmental Quality</i> (EPA 2016i)
Environmental Factor Guideline: <i>Terrestrial Fauna</i> (EPA 2016j)
Environmental Factor Guideline: <i>Hydrological Processes</i> (EPA 2016k)
Environmental Factor Guideline: <i>Inland Waters Environmental Quality</i> (EPA 2016l)
Environmental Factor Guideline: <i>Social Surroundings</i> (EPA 2016m)
EPA Technical Guidance
Technical Guidance: <i>Flora and Vegetation Surveys for Environmental Impact Assessment</i> (EPA 2016c)
Technical Guidance: <i>Subterranean Fauna Survey</i> (EPA 2016n)
Technical Guidance: <i>Sampling Methods for Terrestrial Vertebrate Fauna</i> (EPA 2016o)
Technical Guidance: <i>Terrestrial Fauna Surveys</i> (EPA 2016d)

6.0 Flora and Vegetation

6.1 EPA Objective

To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

6.2 Policy and Guidance

- *Environment Protection and Biodiversity Conservation Act 1999.*
- *Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016.*
- Environmental Factor Guideline: *Flora and Vegetation* (EPA 2016f).
- Technical Guidance: *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016c).

6.3 Environmental Investigations

The following environmental investigations have been undertaken to assess the flora and vegetation values within the YRE project's development footprint:

- Northern Suburbs Railway, Alkimos to Yanchep, *Phytophthora cinnamomi* occurrence assessment (Glevan Consulting 2011)
- Northern Suburbs Railway Alignment Butler to Yanchep Environmental Investigation (GHD 2012)
- Yanchep Rail Extension, *Phytophthora* dieback Occurrence Assessment (Glevan Consulting 2017)
- Yanchep Rail Extension Biological Assessment (GHD 2018; Appendix A).

Table 8 provides a brief description of each these investigations and identifies the assessment standards used to inform the scope and content of the individual investigations.

6.4 Receiving Environment

6.4.1 Regional Vegetation

According to Heddle *et al.* (1980) the vegetation associations within the Part 1 development envelope belong to the following regional vegetation complexes:

- Quindalup Complex
- Cottesloe Complex-Central and South
- Herdsman Complex.

A description of these vegetation complexes and their percentage remaining on both the Swan Coastal Plain IBRA region, City of Wanneroo and within the Part 1 development envelope is provided in Table 11, whilst the complexes' relationship to the Part 1 development envelope is identified in Figure G. All three complexes have greater than 31% of their pre-European extents remaining within the Swan Coastal Plain IBRA region, and greater than 41% of their pre-European extents remaining within the City of Wanneroo (GHD 2018).

Table 11: Regional Vegetation Extents Mapped within the Part 1 Development Envelope

Vegetation Complex	Description	Swan Coastal Plain IBRA Region			City of Wanneroo			Development Envelope		
		Pre-European Extent (ha)	Current Extent (ha)	% remaining	Pre-European Extent (ha)	Current (ha)	% remaining	Pre-European Extent (ha)	Current (ha)	% remaining
Quindalup Complex	Coastal dune complex consisting mainly of two alliances- the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of <i>Melaleuca lanceolata</i> – <i>Callitris preissii</i> and the closed scrub of <i>Acacia rostellifera</i> .	54,574	33,079	61	8,818	5,368	61	48.98	47.01	96%
Cottesloe Complex – Central and South	Mosaic of woodland of <i>Eucalyptus gomphocephala</i> and open forest of <i>E. gomphocephala</i> – <i>E. marginata</i> – <i>Corymbia calophylla</i> ; closed heath on the limestone outcrops.	45,299	14,664	32	13,313	5,556	42	21.16	15.47	73%
Herdsmen Complex	Sedgeland and fringing woodland of <i>E. rudis</i> – <i>Melaleuca</i> species.	9,665	3,070	32	1,759	820	47	0.09	0.09	100%

(Source: Government of Western Australian 2000; GHD 2018)

6.4.2 Level 2 Flora and Vegetation Survey

GHD undertook a Level 2 Flora and Vegetation survey (GHD 2018; Appendix A) in accordance with the EPA's Technical Guidance: *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016c), which included:

- a desktop survey
- field surveys on 1 to 3 November 2016, 3 to 5 May 2017, 11 to 12 July 2017 and 5 to 7 December 2017.

The results of the Level 2 flora and vegetation survey are summarised in Section 6.4.2.1 to Section 6.4.2.4.

6.4.2.1 Vegetation Types

Fourteen vegetation types were identified by GHD during the flora and vegetation survey within the Part 1 development envelope (Table 12; Figure G).

Table 12: Vegetation Types

Vegetation Type	Conservation Significance		Area (ha)	% Composition
	<i>Wildlife Conservation Act 1950</i>	EPBC Act 1999		
<i>Banksia sessilis</i> and <i>Melaleuca systema</i> mid-shrubland (VT2)	Northern Spearwood shrublands and woodlands Priority Ecological Community(PEC) (Priority 3)	-	3.29	4.7
<i>Banksia sessilis</i> and <i>Spyridium globulosum</i> tall shrubland (VT3)		-	13.90	19.8
<i>Banksia attenuata</i> , <i>B. menziesii</i> low woodland (VT4)	Banksia dominated woodlands of the Swan Coastal Plain IBRA Region PEC (Priority 3)	Banksia Woodlands of the Swan Coastal Plain TEC	16.45	23.4
<i>Lomandra</i> sp. herbland (VT5)	-	-	7.08	10.1
<i>Eucalyptus gomphocephala</i> tall woodland (VT6)	Tuart (<i>Eucalyptus gomphocephala</i>) woodlands of the Swan Coastal Plain PEC	-	0.32	0.4
<i>Melaleuca huegelii</i> and <i>M. systema</i> shrubland (VT8)	<i>Melaleuca huegelii</i> – <i>M. acerosa</i> [<i>M. systema</i>] shrublands on limestone ridges TEC 26a	-	1.12	1.6
<i>Xanthorrhoea preissii</i> shrubland (VT10)	-	-	0.47	0.7
<i>Eucalyptus decipiens</i> woodland (VT11)	-	-	0.26	0.4
Planted (VT12)	-	-	0.11	0.2
Scattered Natives (VT13)	-	-	16.95	24.1
<i>Acacia rostellifera</i> tall shrubland (VT14)	-	-	0.80	1.1
<i>Banksia attenuata</i> and <i>B. grandis</i> low woodland (VT15)	Banksia dominated woodlands of the Swan Coastal Plain IBRA Region PEC (Priority 3)	-	0.001	0.001
Cleared (CL)	-	-	7.65	10.9
Re-vegetated rail corridor – not accessible (NA)	-	-	1.82	2.6
Total			70.22	100

(Source: GHD 2018)

6.4.2.2 Vegetation Condition

The condition of the vegetation within the Part 1 development envelope ranged from “Pristine” to “Completely Degraded” (Table 13; Figure H).

Table 13: Vegetation Condition

Vegetation Condition	Area (ha)	% Composition
Pristine	1.25	1.8
Excellent	20.05	28.5
Very Good	9.21	13.1
Good	6.95	9.9
Degraded	5.75	8.2
Completely Degraded	17.54	25.0
Cleared	7.65	10.9
Not Applicable	1.82	2.6
Total	70.22	100

(Source: GHD 2018)

6.4.2.3 Significant Flora

No EPBC Act, WC Act listed or priority flora species were recorded within the Part 1 development envelope by GHD (2018) or GHD (2012).

6.4.2.4 Introduced Flora

No Declared Pests listed under the *Biosecurity and Management Act 2007* were recorded by GHD (2018) within the Part 1 development envelope, however *Moraea flaccida* (One-leaf Cape Tulip) was recorded by GHD (2012) in low numbers.

6.4.3 **Environmentally Sensitive Areas**

Environmentally Sensitive Area (ESAs) are declared by the Minister for Environment under Section 51B of the EP Act. Exemptions for clearing of native vegetation under the Environmental Protection (Clearing of Native Vegetation Regulations 2004) do not apply in ESAs.

GHD (2018) outlines the aspects of the areas declared as an ESA under the Environmental Protection (Environmentally Sensitive Areas) Notice 2005. GHD (2018) identifies that the majority of the Part 1 development envelope is mapped as an ESA, which generally aligns with the presence of TECs and their mapped buffers.

6.4.4 **Phytophthora Dieback**

A *Phytophthora* dieback Occurrence Assessment was undertaken by Glevan Consulting in August 2017 for the YRE project (Appendix B). No *Phytophthora* dieback infestations were recorded within the Part 1 development footprint by Glevan in 2017 or the earlier assessment in 2011 (Glevan 2011).

The majority of the Part 1 development footprint was considered to be uninterpretable by Glevan (2017) primarily due to clearing and a lack of sufficient indicator species.

6.5 Potential Impacts

6.5.1 Direct Impacts

Table 14 provides the direct impacts to native vegetation from construction of Part 1 development envelope. The implementation of the proposal will result in the clearing of up to 62.57 ha of native vegetation within the Part 1 development envelope (Table 14). Approximately, 38.77 ha of native vegetation will be cleared in the Part 1 development footprint, whilst up to approximately 23.8 ha will be cleared within the construction and access areas (Table 14).

Table 14: Direct Impacts to Native Vegetation from Construction of the Part 1 of the YRE project

Vegetation Type	Development Footprint		Construction and Access Areas		Development Envelope	
	Area (ha)	% Composition	Area (ha)	% Composition	Area (ha)	% Composition
<i>Banksia sessilis</i> and <i>Melaleuca systena</i> mid-shrubland (VT2)	2.21	4.9	1.08	4.4	3.29	4.7
<i>Banksia sessilis</i> and <i>Spyridium globulosum</i> tall shrubland (VT3)	8.39	18.5	5.51	22.2	13.90	19.8
<i>Banksia attenuata</i> , <i>B. menziesii</i> low woodland (VT4)	12.20	26.9	4.25	17.1	16.45	23.4
<i>Lomandra</i> sp. herbland (VT5)	3.76	8.3	3.32	13.4	7.08	10.1
<i>Eucalyptus gomphocephala</i> tall woodland (VT6)	-	0	0.32	1.3	0.32	0.4
<i>Melaleuca huegelii</i> and <i>M. systena</i> shrubland (VT8)	0.53	1.2	0.59	2.4	1.12	1.6
<i>Xanthorrhoea preissii</i> shrubland (VT10)	0.47	1.0	-	0	0.47	0.7
<i>Eucalyptus decipiens</i> woodland (VT11)	0.26	0.6	-	0	0.26	0.4
Planted (VT12)	0.11	0.2	-	0	0.11	0.2
Scattered Natives (VT13)	9.02	19.8	7.93	32.0	16.95	24.1
<i>Acacia rostellifera</i> tall shrubland (VT14)	-	0	0.80	3.2	0.80	1.1
<i>Banksia attenuata</i> and <i>B. grandis</i> low woodland (VT15)	-	0	0.001	0	0.001	0.001
Cleared (CL)	6.65	14.6	1.00	4.0	7.65	10.9
Re-vegetated rail corridor – not accessible (NA)	1.82	4.0	-	0	1.82	2.6
Total	45.42	100	24.80	100	70.22	100

(Source GHD 2018)

6.5.2 Indirect Impacts

- Introduction and distribution of Declared Pests and other weed species.
- Introduction and distribution of *Phytophthora* dieback.
- Disturbance to surrounding native vegetation during construction works.

6.6 Assessment of Impacts

6.6.1 Regional Vegetation

Table 15 identifies the direct impact of clearing native vegetation within the Part 1 development envelope upon the regional and local extents of the Heddle *et al.* (1980) vegetation complexes. Table 15 demonstrates that the implementation of Part 1 of the YRE project will not result in a significant reduction in the extent of the regional vegetation complexes at either the scale of the Swan Coastal Plain IBRA region or the City of Wanneroo.

All three complexes will still have greater than 31% of their pre-European extents remaining within the Swan Coastal Plain IBRA region and greater than 41% of their pre-European extents remaining within the City of Wanneroo (GHD 2018) which is the same as prior to the implementation of Part 1 of the YRE project.

6.6.2 Conservation Significant Vegetation

Table 16 identifies the direct impact of clearing native vegetation within the Part 1 development envelope. The implementation of the proposal will result in the clearing of 29.94 ha of conservation significant vegetation in “Good” or better condition within the Part 1 development envelope (Table 16).

6.6.2.1 Construction and Access Areas

Of the 29.94 ha of conservation significant vegetation in “Good” or better condition within the Part 1 development envelope, 9.97 ha (or approximately 33%) are located outside of the Part 1 development footprint within construction and access areas. These areas have been selected to coincide with proposed future urban development cells or roads either reserved by the MRS (Figure B), or as detailed within approved and draft LSPs, to intentionally avoid direct impacts to native vegetation which may have otherwise been able to be retained within future POS reservations (Section 2.2.4).

The clearing of the native vegetation within these areas has been previously considered by the WAPC and the CoW as part of MRS Amendments (Table 3) and district and local structure planning processes (Section 2.1.1), whilst the DEE has approved EPBC Act referrals associated with approved LSPs (Section 1.4.4.1). The construction and access areas are located in areas that will be cleared by future subdivision and development in accordance with the approved LSPs and EPBC Act approvals.

6.6.2.2 MNES Consideration

Banksia dominated woodlands of the Swan Coastal Plain IBRA Region PEC (Priority 3)⁶ and Northern Spearwood shrublands and woodlands PEC (Priority 3) are considered by GHD (2018) to be potential foraging habitat for Carnaby’s Black Cockatoo (Appendix A). Environmental offsets have been previously provided / will be provided for the clearing of Carnaby’s Black Cockatoo foraging habitat within the Part 1 development envelope (Section 1.4.4.1).

Further, Banksia Woodlands of the Swan Coastal Plain TEC was not recorded by GHD (2018) outside of the EPBC Act assessment boundaries (Figure D).

As the State considers environmental offsets provided / to be provided as contributing to the State requirements (EPA 2014), and given that the recently listed Banksia Woodlands of the Swan Coastal Plain TEC has not been recorded outside the EPBC Act assessment boundaries, the remaining direct impacts to State considerations, not previously assessed under the EPBC Act, are:

- Clearing of 1.08 ha of *Melaleuca huegelii* – *M. acerosa* [*M. systema*] shrublands on limestone ridges TEC 26a in “Good” or better condition.

⁶ Banksia dominated woodlands of the Swan Coastal Plain IBRA Region PEC includes the entire extent of the EPBC listed Banksia Woodlands of the Swan Coastal Plain TEC.

Table 15: Direct Impacts to the Regional Vegetation Extents within the Part 1 Development Envelope

Vegetation Complex	Description	Development Envelope			Swan Coastal Plan IBRA region		City of Wanneroo	
		Pre European Extent (ha)	Current (ha)	Extent Cleared (ha)	Post Part 1 of the YRE Project Extent (ha)	% remaining	Post Part 1 of the YRE Project Extent (ha)	% remaining
Quindalup Complex	Coastal dune complex consisting mainly of two alliances- the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of <i>Melaleuca lanceolata</i> – <i>Callitris preissii</i> and the closed scrub of <i>Acacia rostellifera</i> .	48.98	47.01	47.01	33,031.99	61	5,320.99	60
Cottesloe Complex – Central and South	Mosaic of woodland of <i>Eucalyptus gomphocephala</i> and open forest of <i>E. gomphocephala</i> – <i>E. marginata</i> – <i>Corymbia calophylla</i> ; closed heath on the limestone outcrops.	21.16	15.47	15.47	14,648.53	32	13,297.33	42
Herdsmen Complex	Sedgelands and fringing woodland of <i>E. rudis</i> – <i>Melaleuca</i> species.	0.09	0.09	0.09	3,069.91	32	819.91	47

(Source: Government of Western Australian 2000; GHD 2018)

Table 16: Direct Impacts to Conservation Significant Vegetation within the Part 1 Development Footprint

Vegetation Type	Condition	Conservation Significance		Development Footprint (ha)	Construction and Access (ha)	Development Envelope (ha)	
		<i>Wildlife Conservation Act 1950</i>	EPBC Act 1999				
<i>Banksia sessilis</i> and <i>Melaleuca systema</i> mid-shrubland (VT2)	“Good” or better	Northern Spearwood shrublands and woodlands PEC (Priority 3)	-	2.21	1.08	3.29	
	“Degraded” or worse		-	-	-		
<i>Banksia sessilis</i> and <i>Spyridium globulosum</i> tall shrubland (VT3)	“Good” or better		-	8.39	5.06	13.45	
	“Degraded” or worse		-	-	0.45	0.45	
<i>Banksia attenuata</i> , <i>B. menziesii</i> low woodland (VT4, VT15)	“Good” or better		Banksia dominated woodlands of the Swan Coastal Plain IBRA Region PEC (Priority 3)	Banksia Woodlands of the Swan Coastal Plain TEC	8.84	3.28	12.12
	“Degraded” or worse			-	3.36	0.97	4.33
<i>Eucalyptus gomphocephala</i> tall woodland (VT6)	“Good” or better	Tuart (<i>Eucalyptus gomphocephala</i>) woodlands of the Swan Coastal Plain PEC	-	-	-	-	
	“Degraded” or worse		-	-	0.32	0.32	
<i>Melaleuca huegelii</i> and <i>M. systema</i> shrubland (VT8) in “Good” or better condition	“Good” or better	<i>Melaleuca huegelii</i> – <i>M. acerosa</i> [<i>M. systema</i>] shrublands on limestone ridges TEC 26a	-	0.53	0.55	1.08	
	“Degraded” or worse		-	-	0.04	0.04	

(Source GHD 2018)

6.7 Mitigation

6.7.1 Construction Environmental Management Plan

A Construction Environment Management Plan (CEMP) will be developed and implemented to ensure that:

- Clearing is strictly restricted to the Part 1 development envelope.
- Declared Pests and other weed species are not distributed offsite.
- *Phytophthora* dieback is not introduced to the surrounding vegetation.
- Indirect impacts to surrounding vegetation are appropriately managed.

The CEMP will be prepared to be in accordance with:

- Condition 2 of Ministerial Statement 722⁷.
- Parks and Recreation Reserve Management Plan (Strategen 2017) for the Lot 200 Alkimos Drive “Parks and Recreation” reservation as a part of the EPBC 2015 / 7561 approval.
- Existing conditions for the EPBC 2008 / 4601, EPBC 2015 / 7561, EPBC 2008 / 4638, EPBC 2010 / 5777 and EPBC 2011 / 6021 approvals.
- Future conditions for the EPBC 2017 / 7872 approval.

6.7.2 Management of Cleared Construction and Access Areas

The construction and access areas are located in areas that will be cleared by future subdivision and development in accordance with the approved LSPs and EPBC Act approvals.

Cleared construction and access areas will be managed by the PTA during and post construction to prevent weed establishment and impacts to sensitive premises and surrounding vegetation from dust and unauthorised vehicle access. The PTA will manage these areas post construction until such time as the areas are handed back to the landowner for development.

6.7.3 Offsetting Residual Impacts

To counterbalance the residual environmental impacts of clearing 1.08 ha of *Melaleuca huegelii* – *M. acerosa* [*M. systema*] shrublands on limestone ridges TEC 26a in “Good” or better condition, an appropriate Environmental Offset Strategy will be prepared and implemented to the satisfaction of DWER. Initial discussions and meetings with the DBCA confirm that the required offset types are available in the greater Perth region.

6.7.4 Operational Maintenance

The operational railway corridor will be managed by the PTA in perpetuity in accordance with its Vegetation Management Manual. The PTA’s Urban Rail Reserve Vegetation Management Plan (PTA 2016) requires herbicide application for weeds to be undertaken on a 6 monthly basis along an 8 metre track corridor and on an annual basis for fences and associated rail structures⁸. Additionally, the PTA undertakes regular inspections for and treats Declared Pests, as required (PTA 2016).

Regular weed control within the Part 1 railway corridor will reduce the potential for weed species to migrate into Lot 200 Alkimos Drive “Parks and Recreation” reservation.

⁷ Ministerial Statement 722 provides approval for MRS Amendment 1029/33.

⁸ Mechanical clearing may also be used depending upon the target species

6.8 Predicted Outcome

Through the development and implementation of a CEMP to manage the clearing of native vegetation and an appropriate Environmental Offset Strategy the EPA's objective for flora and vegetation will be met.

7.0 Landforms

7.1 EPA Objective

To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.

7.2 Policy and Guidance

Environmental Factor Guideline: *Landforms* (EPA 2016g)

7.3 Environmental Investigation

Advisian (2017; Appendix C) undertook an initial geotechnical investigation to assess the geotechnical conditions expected to be encountered during construction of the YRE project. Table 8 provides a brief description of this investigation.

7.4 Receiving Environment

7.4.1 Topography

The regional physiography and geology of the YRE project is provided on the Geological Survey of Western Australia (GSWA) 1:50,000 Environmental Geology Series map “Yanchep” (Gozzard 1982).

The Yanchep map indicates that the natural geomorphology throughout the YRE project is associated with superimposed coastal dune (aeolian) systems of varying age. The relatively old and non-active Spearwood Dune system is present as a “Degraded surface of aeolian origin” and is interspersed with “Deflation plains and basins”.

These landforms typically have natural slopes varying between 0° and 10° throughout the project area with elevations mostly varying from around 20 metres (m) to 40 m above sea-level, reflecting a general reduction in slope and relief due to erosion and deflation (‘natural settlement’). These landforms are partly overlain by a “Parabolic and nested parabolic dune complex” of the Quindalup Dunes.

The younger and more recently active Quindalup Dunes are expected to have steeper natural slopes, mostly between 10° and 20° throughout YRE project’s development footprint, with elevations varying from around 20 m to 60 m above sea-level.

The natural topography associated with the Part 1 development envelope is presented in Figure I.

7.4.1.1 Alkimos Dune System

The Alkimos dune system is considered to have national and world significance as an excellent example of parabolic dunes belonging to the Quindalup dune system (EPA 2016d). The dunes which are approximately 2 km wide and extend 4 km inland, provide both amenity and geo-heritage values in addition to supporting coastal vegetation (EPA 2016d).

7.4.1.2 Caves and Cave systems

The potential for caves and cave systems to occur within the Part 1 development footprint is discussed in Section 8.0.

7.4.2 Geology

The broad soil associations mapped within the Part 1 development envelope identify that the underlying geology is comprised of sand and limestone associations (Figure J).

7.4.2.1 Geotechnical Investigation

The general geological conditions within the Part 1 development footprint were found to be typical of what is expected in ‘limestone’ terrains common to the greater Swan Coastal Plain, and comprised of:

- Safety Bay Sand (S2)
- Cemented Safety Bay Sand (LS4)
- Tamala Sand (S7)
- Tamala Limestone (LS1).

7.5 Potential Impacts

Advisian (2017) provides the engineering long sections and cross sections from Butler to Yanchep which detail the cut and fill requirements for Part 1 of the YRE project (Appendix C). The construction will require cuts and fills up to about 15 m high and 10 m high, respectively in places (Advisian (2017)). However the average cutting works below the surrounding ground level required for Part 1 are approximately 5 m.

Recognising that the parabolic dunes adjacent to the Part 1 development footprint will be cumulatively impacted by future subdivision and development within the approved LSPs and future development in the surrounding “Urban” or “Central City Area” zoned areas, the potential impacts to the parabolic dunes discussed in this Section will be limited to the portions of the Part 1 development footprint reserved for “Parks and Recreation” in the MRS (Figure K).

7.5.1 Direct Impacts

The cut and fill requirements of the construction program will alter the localised shape of the parabolic dune formation within Lot 200 Alkimos Drive “Parks and Recreation” reservation. The height of the parabolic dune within the reservation will be reduced by approximately 14 m (Table 17).

Table 17: Area of Parabolic Dune Formation Impacted

“Parks and Recreation” Reservation	Average Project Area Width (m)	Area (ha)	Max. Cut (m)	Max. Fill (m)
Lot 200 Alkimos Drive, Alkimos	80 m	0.1 ha	~14	~7

(Sources: Figure K and Advisian 2017)

7.5.2 Indirect Impacts

Post construction, any cleared earthworks batters could result in the creation of blow outs which may further alter the parabolic dune’s morphology as well as encroaching on the adjacent extents of conservation significant native vegetation.

7.6 Assessment of Impacts

The realignment of the “Railways” reservation as part of MRS Amendment 1192/57 avoided the significant fragmentation of the Alkimos dune system (Table 3; Figure E).

Table 18 provides an assessment of the direct impact of Part 1 of the YRE project on the parabolic dune formation within Lot 200 Alkimos Drive “Parks and Recreation” reservation. Table 18 demonstrates the minor nature of the proposed impact on the parabolic dune formation within Lot 200 Alkimos Drive “Parks and Recreation” reservation at suburb and local government area scales.

Table 18: Assessment of Direct Impact on Parabolic Dune Formation

Assessment Area	Parabolic Dune Formation (ha)		
	Area (ha)	Area Impacted (ha)	Area Impacted (%)
Lot 200 Alkimos Drive “Parks and Recreation” reservation	20.83	0.1	0.5
Alkimos	442		0.022
City of Wanneroo	3,966		0.003

7.7 Mitigation

The alignment of the Part 1 development footprint is in accordance with the MRS “Railways” reservation, whilst minimises cut to fill requirements wherever practicable.

Detailed engineering design will be undertaken to minimise landform impacts and confirm the structural controls required (i.e. either battering the excavation or using retaining walls) to stabilise the affected dune formations with planting of locally endemic species or bioengineering controls to be used, where practicable.

7.8 Predicted Outcome

The physical impacts associated with Part 1 of the YRE project will be mitigated within the Lot 200 Alkimos Drive “Parks and Recreation” reservation by detailed engineering design.

8.0 Subterranean Fauna

8.1 EPA Objective

To protect subterranean fauna so that biological diversity and ecological integrity are maintained.

8.2 Policy and Guidance

- Environmental Factor Guideline: *Subterranean Fauna* (EPA 2016h).
- Technical Guidance: *Subterranean Fauna Survey* (EPA 2016n).

8.3 Environmental Investigations

The Northern Suburbs Railway Alignment Butler to Yanchep Environmental Investigation (GHD 2012) details a desktop and field investigation undertaken to assess portions of the YRE project area between Romeo Road and Yanchep for the presence of outcropping karstic features that could indicate the presence of subterranean voids suitable for supporting subterranean fauna communities. The Yanchep Rail Extension, Geotechnical Investigation Report (Advisian 2017; Appendix C) provides an assessment of the presence of karstic features.

Table 8 provides a brief description of these investigations and identifies the assessment standards used to inform the scope and content of the individual investigations.

8.4 Receiving Environment

The presence of subterranean fauna is strongly linked to the geology and hydrology and the availability of suitable air-filled voids or caves for troglofauna, and aquifers that are not hypersaline for stygofauna (EPA 2016e). The local geology and proximity to the 400+ cave systems, and Aquatic Root Mat Community in Cave of the Swan Coastal Plains TECs, in Bush Forever Site No. 288: *Yanchep National Park and Adjacent Bushland* would indicate a very high likelihood of subterranean fauna in the area (GHD 2012).

GHD's field investigation identified areas of limestone outcropping and also noted that many karstic voids show no human-sized connection with the surface. No large scale karstic features such as sinkholes or caverns, which would provide a significant habitat resource for subterranean fauna, were identified within the vicinity of the YRE project by Advisian (2017) (Appendix C).

Whilst many subterranean fauna species are only known from caves, it is recognised that numerous troglomorphic species occur within micro and meso-caverns or interstitial spaces not necessarily associated with larger karstic features. Hence, the presence of subterranean fauna within the Part 1 development footprint cannot specifically be discounted due to a lack of larger karstic features, whilst the complete absence of smaller voids which have permanently dark chambers and limited connectivity with the surface cannot be entirely discounted due to the extreme variability of Tamala Limestone (GHD 2012).

Although no significant habitat resources for subterranean fauna have been identified within the Part 1 development footprint, there is a low risk that subterranean fauna may be present in smaller voids that were not identified by the Advisian (2017) assessment.

8.5 Potential Impacts

8.5.1 Direct Impacts

Construction activities (i.e. cutting and filling works identified in Advisian [2017]) are not expected to impact on the key subterranean environmental features within the Part 1 development footprint (as none have been identified). However, a potential direct impact to subterranean fauna includes the disturbance or destruction of smaller voids close to the surface during cutting activities. Disturbance or destruction of these voids would reduce habitat availability for subterranean fauna within the Part 1 development footprint and may result in injury and/or mortality to troglofauna fauna species (if present).

8.5.2 Indirect Impacts

The following potential indirect impacts have also been identified:

- Reduction in groundwater levels and quality can adversely affect stygofauna, and to a lesser extent troglofauna, as they rely upon a saturated environment
- Contamination of groundwater during construction also may impact upon suitable micro-habitats for subterranean fauna.

8.6 Assessment of Impacts

No significant habitat resources for subterranean fauna have been identified within the Part 1 development footprint by Advisian (2017). Given the proximity of the Part 1 development footprint to larger areas of significant cave habitat locally available within Bush Forever Site No. 288: *Yanchep National Park and Adjacent Bushland* (Section 2.4), subterranean fauna species are considered unlikely to be significantly impacted by a reduction in minor potential habitat features (voids) in Part 1 of the YRE project (if present).

The average depth to ground water from the natural ground surface (approximately 31 m) is significantly greater than the average cutting works required for Part 1 of the YRE project (5 m) (Section 11.4; Table 6). Therefore modification to the local groundwater aquifers from dewatering has been avoided through the implementation of the proposed construction methodology. Any groundwater abstracted from the Yarragadee North aquifer for construction purposes is unlikely to result in a significant reduction in regional or local groundwater levels.

There is a low risk that groundwater could be contaminated by construction activities with sources including uncontained spills, refuelling and plant and vehicle fluid leaks.

8.7 Mitigation

Prior to the commencement of construction activities, a further detailed geotechnical investigation will be undertaken to supplement and validate the initial findings of the Advisian (2017) investigation and enable detailed design of key structural elements.

Should any unidentified karst or cave formations be identified within the Part 1 development footprint, the DWER will be notified and appropriate actions undertaken to the satisfaction of the DWER.

No dewatering will be required to support the construction program and any groundwater abstracted from the Yarragadee North aquifer will be regulated under the *Rights in Water and Irrigation Act 1914* to avoid significant reduction in regional or local groundwater levels.

The low risk of groundwater contamination occurring during construction will be mitigated through the implementation of a CEMP. The CEMP will include specific actions to ensure that site personnel are aware of the potential impacts to subterranean fauna (if present) that may be caused by construction works and have management measures in place.

8.8 Predicted Outcome

The identified potential direct impacts are considered to pose a low risk to subterranean fauna (if present) as the Part 1 development footprint has avoided significant subterranean habitat and will be subject to additional validation by further geotechnical investigation, whilst the risk to subterranean fauna from indirect impacts to groundwater are also considered to be low.

The implementation of a CEMP will also further reduce any residual risk of potential impacts occurring to any subterranean fauna inhabiting the area.

9.0 Terrestrial Environmental Quality

9.1 Acid Sulfate Soils

9.1.1 EPA Objective

To maintain the quality of land and soils so that environmental values are protected.

9.1.2 Policy and Guidance

- Environmental Factor Guideline: *Terrestrial Environmental Quality* (EPA 2016i).
- Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DER 2015a).
- Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DER 2015b).

9.1.3 Environment Investigation

A desktop assessment has been undertaken by RPS to assess the risk of Acid Sulfate Soils (ASS) occurring within the YRE project's development footprint.

9.1.4 Receiving Environment

The DWER's ASS risk mapping identifies that the Part 1 development envelope is not at risk of ASS occurring (Figure L).

9.1.5 Potential Impacts

Acidification and release of heavy metals from ASS into the terrestrial environment and underlying groundwater.

9.1.6 Assessment of Impacts

The Part 1 development envelope is not mapped as being at risk of ASS occurring, and dewatering will not be required to facilitate the construction program.

9.1.7 Mitigation

The construction program proposed in Advisian (2017) involves filling of the lower lying areas within the Part 1 development footprint. This approach further decreases the already low residual risk of ASS being unearthed during earthworks.

9.1.8 Predicted Outcome

The environmental values of the land and soils within the Part 1 development footprint will not be significantly impacted by ASS.

9.2 Potential Contamination

9.2.1 EPA Objective

To maintain the quality of land and soils so that environmental values are protected.

9.2.2 Policy and Guidance

- *Contaminated Sites Act 2003*.
- Environmental Factor Guideline: *Terrestrial Environmental Quality* (EPA 2016i).
- Assessment and Management of Contaminated Sites (DER 2014).

9.2.3 Environmental Investigation

A Preliminary Site Investigation (PSI) was undertaken by Golder Associates for the YRE project area (Golder Associates 2017). Table 8 provides a brief description of this investigation and identifies the assessment standards used to inform the scope and content of the investigation.

9.2.4 Receiving Environment

A search of DWER's *Contaminated Sites Database* identified no known contaminated sites within the Part 1 development envelope. However, the Part 1 development envelope traverses Eglinton Range Area which was formerly used as a live firing range with army units regularly conducting manoeuvres in the area between Pipidiny Swamp and the coast during World War II. There is a risk for Unexploded Ordnance (UXO) to occur within these areas (Figure M).

9.2.5 Potential Impacts

- Injury from UXOs.
- Contaminated soil or groundwater is unearthed during construction.

9.2.6 Assessment of Impacts

The PSI identified that the highest priority risk was potential health and safety risks to site workers, site users and the general public particularly during construction activities should UXOs be encountered (Golder Associates 2017).

9.2.6.1 UXO Search

A UXO field validation survey will be undertaken within portions of the Part 1 development envelope which intersect the Eglinton Range Area. The UXO field validation survey will locate and identify any evidence of explosive ordnance waste to characterise any remnant UXO(s). If UXOs are demonstrated or inferred to be present, delineation and remediation of the affected areas will be undertaken.

9.2.6.2 Potential Contamination

The PSI considered risks related to contamination associated with previous land uses to be low and recommended that an unexpected finds protocol be established to provide a methodology for identification, assessment of risk and required management procedures on a case by case basis (Golder Associates 2017).

9.2.7 Mitigation

Prior to the commencement of earthworks, a technical investigation will be conducted of all areas identified as being of risk of containing UXOs. If the investigation indicates that UXOs are or may be present then the affected areas will be remediated.

Potential contamination will be managed in accordance with a project specific unexpected finds protocol to comply with the *Contaminated Sites Act 2003*.

9.2.8 Predicted Outcome

- Risk of UXOs occurring within the Part 1 development envelope will be low at the time construction commences
- Construction of the railway line extension from Butler to Eglinton, including the construction of two new stations, is compliant with the *Contaminated Sites Act 2003*.

10.0 Terrestrial Fauna

10.1 EPA Objective

To protect terrestrial fauna so that biological diversity and ecological integrity are protected.

10.2 Policy and Guidance

- *Environment Protection and Biodiversity Conservation Act 1999.*
- *Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016.*
- Environmental Factor Guideline: *Terrestrial Fauna* (EPA 2016j).
- Technical Guidance: *Sampling Methods for Terrestrial Vertebrate Fauna* (EPA 2016o).
- Technical Guidance: *Terrestrial Fauna Surveys* (EPA 2016d).

10.3 Environmental Investigations

The following environmental investigations have been undertaken to assess the terrestrial fauna values within the YRE project's development footprint:

- Report for Northern Suburbs Railway Alignment from Romeo Road (Alkimos) to Yanchep, Graceful Sun-moth Survey (GHD 2011)
- Northern Suburbs Railway Alignment Butler to Yanchep Environmental Investigation (GHD 2012)
- Yanchep Rail Extension Biological Assessment (GHD 2018; Appendix A).

Table 8 provides a brief description of each of these investigations and identifies the assessment standards used to inform the scope and content of the individual investigations.

10.4 Receiving Environment

10.4.1 Level 1 Fauna Survey

GHD undertook a Level 1 fauna survey (GHD 2018; Appendix A) in accordance with Technical Guidance: *Terrestrial Fauna Surveys* (EPA 2016d), which included:

- a desktop survey
- field surveys on 1 to 2 November 2016, 3 to 5 May 2017 and 11 July 2017
- targeted black cockatoo survey.

The results of the fauna assessments are summarised in Sections 10.4.1.1 and 10.4.1.2.

10.4.1.1 Habitat Types

GHD (2018) identified the following fauna habitats within the Part 1 development envelope:

- *Eucalyptus* woodland (High habitat value)
- *Banksia sessilis* over low mixed shrubland (High habitat value)
- Mixed *Banksia* woodland (High habitat value)
- Mixed tall shrubland (High habitat value)
- *Lomandra* herb lands on secondary dunes (Medium habitat value)
- Limestone ridge lines (Medium habitat value)

- Planted *Eucalypt* woodland (Medium habitat value)
- Highly disturbed (Low habitat value).

10.4.1.2 Conservation Significant Fauna

Three species of conservation significance were recorded during the field surveys:

- Carnaby’s Black Cockatoo (*Calyptorhynchus latirostris*) (EPBC Act and WC Act)
- Western Brush Wallaby (*Macropus irma*) (Priority 4)
- Rainbow Bee-eater (*Merops ornatus*) (EPBC Act).

Additionally, two conservation significant species, Carnaby’s Black Cockatoo (*Calyptorhynchus latirostris*) (EPBC Act and WC Act) and Ground cricket (*Pachysaga munggai* [Priority 3] / *Pachysaga strobila* [Priority 1]), were recorded by GHD (2012). A further five conservation significant species were considered likely to occur within the project area by GHD (2018):

- Southern Brown Bandicoot (*Isodon obesulus* subsp. *fusciventer*) (Priority 4)
- Peregrine Falcon (*Falco peregrinus*)
- Western Quoll (*Dasyurus geoffroii*) (EPBC Act and WC Act)
- Jewelled South-west Ctenotus (*Ctenotus gemmula*) (Priority 3)
- Black striped snake (*Neelaps calonotos*) (Priority 3).

The Graceful Sun-moth (*Synemon gratiosa*) (Priority 4) was recorded by GHD (2011) to the north of the Part 1 development envelope.

Table 20 provides a detailed description of the habitat requirements for each species.

10.5 Potential Impacts

10.5.1 Direct Impacts

Table 19 provides the direct impacts to fauna habitat from construction of the Part 1 development envelope. The implementation of the proposal will result in the clearing / disturbance of up to 53.32 ha of high value fauna habitat, 9.11 ha of medium value fauna habitat and 7.79 ha of low value fauna habitat (Table 19).

Table 19: Direct Impacts to Fauna Habitat from Construction of the Part 1 of the YRE Project

Fauna Habitat	Habitat Value	Development Footprint		Construction and Access		Development Envelope	
		Area (ha)	% Composition	Area (ha)	% Composition	Area (ha)	% Composition
<i>Eucalyptus</i> woodland (VT6)	High	-	0	0.32	1.3	0.32	0.4
<i>Banksia sessilis</i> over low mixed shrubland (VT2, VT3)		10.60	23.3	6.59	26.6	17.19	24.5
Mixed <i>Banksia</i> woodland (VT4, ,VT15)		12.20	26.9	4.25	17.1	16.45	23.4
Mixed tall shrubland (VT10,VT11,VT13,NA)		11.57	25.5	7.79	31.4	19.36	27.6
Subtotal		34.37	75.7	18.95	76.4	53.32	75.9
<i>Lomandra</i> herb lands on secondary dunes (VT05)	Medium	3.76	8.3	3.32	13.4	7.08	10.1
Limestone ridge lines (VT08)		0.53	1.2	0.59	2.4	1.12	1.6

Fauna Habitat	Habitat Value	Development Footprint		Construction and Access		Development Envelope	
Planted <i>Eucalypt</i> woodland (VT12)		0.11	0.2	-	-	0.11	0.2
<i>Acacia</i> Shrubland (VT14)		-	-	0.80	3.2	0.80	1.1
Subtotal		4.40	9.7	4.71	19.0	9.11	13.0
Highly disturbed (CL)	Low	6.65	14.6	1.14	4.6	7.79	11.1
Subtotal		6.65	14.6	1.14	4.6	7.79	11.1
Total		45.42	100	24.80	100	70.22	100

(Source GHD 2018)

Additional, potential direct impacts include:

- injury and/or mortality during clearing activities and construction and operation of the railway
- fragmentation of fauna habitat and separation of non-avian fauna populations within Lot 200 Alkimos Drive “Parks and Recreation” reservation.

10.5.2 Indirect Impacts

- Disturbance during construction (clearing activities and noise) and operation of the railway (noise and vibration) may affect the local abundance of fauna populations due to interruption to fauna behaviour.
- Habitat and food source degradation through increased pollution and waste.

10.6 Assessment of Impacts

10.6.1 Fauna Habitat

Table 19 identifies that the majority (75.9%) of fauna habitat cleared within the Part 1 development envelope is of high habitat value, whilst 13.0% and 11.1% of the fauna habitat is of medium and low habitat value, respectively.

10.6.1.1 Construction and Access Areas

Table 16 identifies that of the 53.32 ha of high value fauna habitat within the Part 1 development envelope, 18.95 ha (or approximately 27%) are located outside of the Part 1 development footprint within construction and access areas. Approximately 4.71 ha (or approximately 7%) and 1.14 (or approximately 2%) of the fauna habitat of medium and low habitat value, respectively, is also located outside of the Part 1 development footprint within construction and access areas.

These areas have been selected to coincide with proposed future urban development cells or roads either reserved by the MRS (Figure B), or as detailed within approved and draft LSPs, to intentionally avoid direct impacts to native vegetation which may have otherwise been able to be retained within future POS reservations (Section 2.2.4). The clearing of the native vegetation within these areas has been previously considered by the WAPC and the CoW as part of MRS Amendments (Table 3) and district and local structure planning processes (Section 2.1.1), whilst the DEE has approved EPBC Act referrals associated with approved LSPs (Section 1.4.4.1). The construction and access areas are located in areas that will be cleared by future subdivision and development in accordance with the approved LSPs and EPBC Act approvals.

10.6.2 Conservation Significant Fauna

The direct impacts to the conservation significant species from the clearing of fauna habitat within Part 1 of the YRE project are identified in Table 20.

Table 20: Assessment of Impacts to Conservation Significant Fauna Species

Species	Conservation Status (State)	Conservation Status (EPBC)	Habitat Requirements	Occurrence within the Development Envelope	Direct Impacts	Significance of Direct Impacts
Reptiles						
Jewelled South-west Ctenotus (<i>Ctenotus gemmula</i>)	Priority 3	-	Jewelled South-west Ctenotus occurs on pale sandplains supporting heaths in association with Banksia or mallee woodlands (Wilson and Swan 2013; Kay and Keogh 2012).	Likely, the habitat within the Part 1 development envelope is suitable for this species (GHD 2018). This species was not detected by GHD's field surveys.	<ul style="list-style-type: none"> Clearing of 16.45 ha of Mixed <i>Banksia</i> woodland of high habitat value. Clearing of 19.36 ha of Mixed tall shrubland of high habitat value. Clearing of 7.08 ha of <i>Lomandra</i> herbland on secondary dunes of medium habitat value. GHD (2018) identifies that the Jewelled South-west Ctenotus may utilise / reside in these above habitats (if present). Fragmentation of Lot 200 Alkimos Drive "Parks and Recreation" reservation will isolate local populations (if present). 	GHD (2018) considers it likely that the Jewelled South-west Ctenotus is present the Part 1 development envelope. However given the proximity of Part 1 development envelope to larger areas of similar or better quality habitat locally available within Bush Forever sites (Section 2.4), the Jewelled South-west Ctenotus is considered unlikely to be significantly impacted by Part 1 of the YRE project.
Black striped snake (<i>Neelaps calonotos</i>)	Priority 3	-	Black-striped snakes are generally found on coastal dunes and sandplains vegetated with heaths and eucalypt / <i>Banksia</i> woodlands on the Swan Coastal Plain (Pearson 2013).	Likely, the habitat within the Part 1 development envelope is suitable for this species (GHD 2018). This species was not detected by GHD's field surveys.	<ul style="list-style-type: none"> Clearing of 16.45 ha of Mixed <i>Banksia</i> woodland of high habitat value. Clearing of 19.36 ha of Mixed tall shrubland of high habitat value. Clearing of 7.08 ha of <i>Lomandra</i> herbland on secondary dunes of medium habitat value. GHD (2018) identifies that the Black striped snake may utilise / reside in these above habitats (if present). Fragmentation of Lot 200 Alkimos Drive "Parks and Recreation" reservation will isolate local populations (if present). 	GHD (2018) considers it likely that the Black-striped snake is present the Part 1 development envelope. However given the proximity of Part 1 development envelope to larger areas of similar or better quality habitat locally available within Bush Forever sites (Section 2.4), the Black-striped snake is considered unlikely to be significantly impacted by Part 1 of the YRE project.
Birds						
Carnaby's Black Cockatoo (<i>Calyptorhynchus latirostris</i>)	Schedule 2	Endangered	Carnaby's Black-Cockatoo is endemic to south-west Western Australia occurring from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin. Carnaby's Black-Cockatoo foraging habitat includes native shrubland, kwongan heathland and woodland dominated by proteaceous plant species including <i>Banksia</i> spp., <i>Hakea</i> spp. and <i>Grevillea</i> spp. Carnaby's Black-Cockatoo is known to forage in pine plantations, eucalypt woodland, forest that contains foraging species and individual trees and small stands of these species (DEE 2017a).	Carnaby's Black Cockatoo was observed within the Part 1 development envelope and evidence of feeding was also recorded.	<ul style="list-style-type: none"> Clearing of 53.43 ha of foraging habitat and 27 potential breeding trees. 	Environmental offsets have been previously provided / will be provided for the clearing of Carnaby's Black Cockatoo foraging habitat within the Part 1 development envelope to counterbalance the significant residual impacts for clearing Carnaby's Black Cockatoo Habitat (Section 1.4.4.1). Approximately, 1.02 ha of potential Carnaby's Black Cockatoo foraging habitat and 3 potential breeding trees was recorded by GHD (2018) outside of the extent of the previous EPBC Act approvals (Figure D). The removal of 1.02 ha of potential foraging habitat and 3 breeding trees is at variance with one the EPBC Act Referral Guidelines (Clearing of more than 1 ha of quality foraging habitat) for the three species of black cockatoos (Department of Sustainability, Environment, Water, Populations and Communities 2012). The DEE has confirmed that this small amount of clearing is unlikely to significantly impact Carnaby's Black Cockatoo (Section 3.3.3).
Peregrine Falcon (<i>Falco peregrinus</i>)	Schedule 7	N/A	Peregrine falcons are widely distributed throughout Australian habitats inclusive of woodlands, wetlands and open country, although they are generally absent from treeless and waterless deserts and dense forests. Peregrine falcons prefer cliff faces as nest sites (Birds Australia 2012).	Likely, the nearest record is within 10 km of the Part 1 development envelope (GHD 2018). This species was not detected by GHD's field surveys.	<ul style="list-style-type: none"> Clearing of 70.22 ha of potential habitat. GHD (2018) identifies that the peregrine falcon may opportunistically use all habitat types within the Part 1 development envelope for foraging (if present). 	It is considered likely that peregrine falcons may be observed overflying the Part 1 development envelope infrequently. However, given the substantial extent of potential habitat locally available within Bush Forever sites (Section 2.4), and surrounding environments, the peregrine falcon is considered unlikely to be significantly impacted by the Part 1 of the YRE project.

Species	Conservation Status (State)	Conservation Status (EPBC)	Habitat Requirements	Occurrence within the Development Envelope	Direct Impacts	Significance of Direct Impacts
<i>Rainbow Bee-eater (Merops ornatus)</i>	Schedule 5	Listed Marine	The population size of this species within Australia is not known, but it is assumed to be quite large. It is known to occur across the majority of the mainland. It migrates between Australia, Eastern Indonesia and Japan, and has formed a colony on Rottne Island. The rainbow bee-eater tends to occupy open forests and woodlands, including cleared or semi-cleared areas and farmland, and prefers timbered landscapes. Their nests consist of an enlarged chamber at the end of a long burrow that is excavated by both the female and male bird from flat or sloping ground, cliff faces or mounds of gravel (DEE 2017b).	Rainbow bee-eaters were recorded by GHD's field surveys foraging on the outskirts of the Eucalyptus woodland habitat.	<ul style="list-style-type: none"> Clearing of 70.22 ha of potential habitat. GHD (2018) identifies that the Rainbow bee-eater may opportunistically use all habitat types within the Part 1 development envelope. 	Given the low number (8) of Rainbow Bee-eaters recorded by GHD's field surveys and the substantial extent of potential habitat locally available within Bush Forever sites (Section 2.4), and surrounding environments, it is considered unlikely to be significantly impacted by Part 1 of the YRE project.
Mammals						
Southern Brown Bandicoot (<i>Isoodon obesulus subsp. fusciventer</i>)	Priority 4	N/A	Southern brown bandicoots are broadly distributed near the south-west coast from Guilderton, north of Perth, to east of Esperance with a more patchy distribution through the jarrah and karri forests, swan coastal plain and inland regions. Southern brown bandicoots are generally found in scrubby, often swampy, vegetation with dense cover up to 1 m high and on the Swan Coastal Plain are often associated with wetlands (DEC 2012a).	Likely, the habitat within the Part 1 development envelope is suitable for this species (GHD 2018). This species was not detected by GHD's field surveys.	<ul style="list-style-type: none"> Clearing of 0.32 ha of <i>Eucalyptus</i> woodland of high habitat value. Clearing of 17.19 ha of <i>Banksia sessilis</i> over mixed shrubland of high habitat value. Clearing of 16.45 ha of Mixed <i>Banksia</i> woodland of high habitat value. Clearing of 19.36 ha of Mixed tall shrubland of high habitat value. Clearing of 0.8 ha <i>Acacia</i> Shrubland of medium habitat value. GHD (2018) identifies that the Southern Brown Bandicoot is a likely resident of these above habitat types, whilst an additional 8.52 ha of opportunistic potential foraging habitat will also be cleared. Fragmentation of Lot 200 Alkimos Drive "Parks and Recreation" reservation will isolate local populations. 	GHD (2018) considers it likely that Southern Brown Bandicoots are present the Part 1 development envelope. However, given the substantial extent of potential habitat locally available within Bush Forever sites (Section 2.4), the Southern Brown Bandicoot is considered unlikely to be significantly impacted by Part 1 of the YRE project.
Western Brush Wallaby (<i>Macropus irma</i>)	Priority 4-	N/A	The western brush wallaby's optimum habitat is open forest or woodland, particularly favouring open, seasonally to wet flats with low grasses and open scrubby thickets. Western brush wallabies are also found in some areas of mallee and heathland, however is uncommon in karri forests (DEC 2012b).	One Western Brush Wallaby was recorded by GHD's field surveys in the Mixed tall shrubland.	<ul style="list-style-type: none"> Clearing of 70.22 ha of potential habitat. GHD (2018) identifies that the Western Brush Wallaby is able to use all habitat types within the Part 1 development envelope either as a resident or for foraging, however the Mixed tall shrublands, <i>Banksia</i> woodlands and <i>Eucalyptus</i> woodlands are of higher value for seeking shelter and foraging. Fragmentation of Lot 200 Alkimos Drive "Parks and Recreation" reservation will isolate local populations. 	Given the low number (1) of Western Brush Wallabies recorded by GHD's field surveys and the substantial extent of potential habitat locally available within Bush Forever sites (Section 2.4), the Western Brush Wallaby is considered unlikely to be significantly impacted by Part 1 of the YRE project.
Western Quoll (<i>Dasyurus geoffroii</i>)	Schedule 3	Vulnerable	Western quolls are restricted to the south-west of Western Australia and are generally found in most kinds of wooded habitat including eucalypt forest (especially jarrah), dry woodland and mallee shrublands. Western quolls den in hollow logs and burrows and have also been recorded in tree hollows and cavities (DEC 2012c).	Likely, there are records present within 10 km of the Part 1 development envelope and there is suitable habitat available for this species (GHD 2018). This species was not detected by GHD's field surveys.	<ul style="list-style-type: none"> Clearing of 17.19 ha of <i>Banksia sessilis</i> over mixed shrubland of high habitat value. Clearing of 16.45 ha of Mixed <i>Banksia</i> woodland of high habitat value. Clearing of 19.36 ha of Mixed tall shrubland of high habitat value GHD (2018) identifies that the Western Quoll is a likely resident of these above habitat types, whilst an additional 9.43 ha of opportunistic potential foraging habitat will also be cleared. Fragmentation of Lot 200 Alkimos Drive "Parks and Recreation" reservation will isolate local populations (if present). 	GHD (2018) considers it likely that Western Quolls are present the Part 1 development envelope. However, given the substantial extent of potential habitat locally available within Bush Forever sites (Section 2.4), the Western Quoll is considered unlikely to be significantly impacted by Part 1 of the YRE project.
Invertebrates						
Graceful Sun-moth (<i>Synemon gratiosa</i>)	Priority 4	-	Graceful Sun Moths are restricted to its host plants <i>Lomandra maritima</i> which grows in coastal heathland within secondary Quindalup dunes and <i>L. hermaphrodita</i> which grows in <i>Banksia</i> woodland on Spearwood and Bassendean dunes (DEC 2011a).	No Graceful Sun Moths were recorded within the Part 1 development footprint by GHD (2011). However, the GHD (2011) project area included only a subset of the Part 1 development envelope.	<ul style="list-style-type: none"> Clearing of 7.08 ha of <i>Lomandra</i> herbland on secondary dunes of medium habitat value. GHD (2018) identified that this habitat is likely to be important to this species. Fragmentation of Lot 200 Alkimos Drive "Parks and Recreation" reservation will isolate local populations (if present). 	Given the substantial extent of potential <i>Lomandra</i> habitat locally available within Bush Forever Site No. 289: <i>Ningana Bushland, Yanchep/Eglinton</i> (Section 2.4) for the Graceful Sun-moth, it is considered unlikely to be significantly impacted by Part 1 of the YRE project (if present).
Ground cricket (<i>Pachysaga munggai / strobila</i>)	Priority 3/1	-	<i>Pachysaga munggai</i> has previously been recorded south of Jarrahdale on the Vasse Highway, whilst <i>Pachysaga strobila</i> has previously been recorded in jarrah- marri forest near Vasse (Rentz 1993).	One individual was recorded within a portion of the railway alignment within "Urban" zoned land to the west of the Eglinton LSP and to the north of the North Alkimos LSP (GHD 2012). This species was not detected by GHD (2018).	<ul style="list-style-type: none"> Clearing of 17.19 ha of <i>Banksia sessilis</i> over low mixed shrubland of high habitat value. GHD (2018) identified that the ground cricket is a likely resident of this habitat type. Clearing of 16.45 ha of Mixed <i>Banksia</i> woodland of high habitat value. GHD (2018) identified that this habitat type may also be suitable for the ground cricket. 	Given the low number (1) of ground crickets recorded by GHD's field surveys and the substantial extent of potential habitat locally available within Bush Forever sites (Section 2.4), and surrounding environments, it is considered unlikely to be significantly impacted by Part 1 of the YRE project.

10.6.3 Fauna Underpass Consideration

Table 20 identifies that non-avian species of conservation significant fauna, including Southern Brown Bandicoots and Western Brush Wallaby, may be impacted by the fragmentation of Lot 200 Alkimos Drive “Parks and Recreation” reservation. However, it is recognised that undeveloped land adjacent to the western portion of Lot 200 is also currently potential habitat for these species and allows for their movement within the Alkimos-Eglinton landscape thereby greatly reducing the likelihood that fauna populations will become isolated within Lot 200 as a result of the construction of Part 1 of the YRE project.

The fragmentation of Lot 200 Alkimos Drive “Parks and Recreation” reservation by the YRE project has been agreed to by the CoW and the WAPC through the endorsement of the Central Alkimos LSP. The Central Alkimos LSP identifies that residential development is to be located adjacent to both western and eastern sections of Lot 200, with a district distributor road connecting the Central Alkimos LSP to the draft Alkimos City Centre Activity Centre LSP through the eastern portion of Lot 200. Further the draft Alkimos City Centre Activity Centre LSP proposes a neighbourhood connector road to the Central Alkimos LSP through the eastern portion of Lot 200. Marmion Avenue, which borders the western boundary of the western portion of Lot 200, is also proposed to be duplicated in the near future which would likely result in additional clearing of native vegetation within the “Parks and Recreation” reservation.

Early in the detailed design of the YRE project, the PTA identified an opportunity for a fauna underpass to be provided underneath the railway line to reduce any long-term isolation risks for native fauna. However, due to the further planned dissection of both the western and eastern sections of Lot 200 by district and neighbourhood roads, the relatively small size of the western portion of Lot 200 and low likelihood of long term persistence of significant populations of Southern Brown Bandicoots and Western Brush Wallaby within the western portion of Lot 200 as urban development encroaches, it was determined by the PTA that a fauna underpass in this location would not meet its proposed intent.

10.7 Mitigation

A CEMP will be developed and implemented to ensure that:

- Conservation significant terrestrial fauna species (i.e. the reptiles and mammals identified in Table 20) are not significantly impacted as a result of native vegetation clearing.
- Measures are implemented to minimise impacts on larger species of highly mobile fauna, such as Western Brush Wallaby and Emu, to avoid isolation or entrapment in temporary construction infrastructure.
- Indirect impacts to surrounding native fauna habitat are appropriately managed.
- Interactions between native fauna and passenger trains are avoided.

The CEMP will be prepared in accordance with:

- Condition 2 of Ministerial Statement 722.
- Parks and Recreation Reserve Management Plan (Strategen 2017) for the Lot 200 Alkimos Drive “Parks and Recreation” reservation as a part of the EPBC 2015 / 7561 approval.
- Existing conditions for the EPBC 2008 / 4601, EPBC 2015 / 7561, EPBC 2008 / 4638, EPBC 2010 / 5777 and EPBC 2011 / 6021 approvals.
- Future conditions for the EPBC 2017 / 7872 approval.

10.7.1 Offsetting Residual Impacts

The residual environmental impacts of clearing Carnaby’s Black Cockatoo habitat have been previously counterbalanced through the provision of offsets by the following EPBC Act assessments:

- Eglinton / South Yanhep Residential Development (EPBC 2011 / 6021).
- Eglinton Estates – Clearing of Native vegetation from Lot 2007 and Part Lot 2008 Eglinton (EPBC 2010 / 5777).
- Residential and Commercial Development on Part of 19 (Lot 6) Taronga, Eglinton (EPBC 2017 / 7872).⁹
- Lots 1005 and 1006 Peet Alkimos Local Structure Plan (EPBC 2008 / 4638).
- Alkimos City Centre and Central Alkimos, Part Lot 9002 and part Lot 9003 Marmion Avenue, Alkimos (EPBC 2015 / 7561).
- Local Structure Plan for Mixed Residential and Commercial Development, Alkimos, WA (EPBC 2008 / 4601).

10.7.2 Predicted Outcome

The development and implementation of a CEMP will ensure that native fauna interactions are appropriately managed during construction and into railway operation.

⁹ The EPBC referral for the draft Western Precinct relates to the parent lot (Lot 6 Taronga Place) and the Commonwealth's conditions are currently pending.

11.0 Hydrological Processes

11.1 EPA Objective

To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.

11.2 Policy and Guidance

Environmental Factor Guideline: *Hydrological Processes* (EPA 2016k).

11.3 Environmental Investigation

A desktop assessment has been undertaken by RPS to assess the local hydrological regimes within the YRE project's development footprint.

11.4 Receiving Environment

11.4.1 Groundwater

The Part 1 development envelope is located in the Perth Basin, which comprises a regional sedimentary basin up to 12 km thick with several significant aquifers (Advisian 2017). The Water Register (DWER 2017a) identifies that the unconfined Superficial, semi-confined / confined Leederville and confined Yarragadee North aquifers underlie the Part 1 development envelope.

The key aquifer of interest in relation to the construction activities (i.e. cutting and filling works identified in Advisian [2017]) is the unconfined superficial aquifer which comprised of Safety Bay Sand and Tamala Limestone formations (Advisian 2017). These soil associations are highly transmissive and have a saturated thickness of approximately 20 m to 30 m (Advisian 2017).

The Perth Groundwater Map (DWER 2017b) identifies the depth from ground level to the water table fluctuates with the undulating local topography across the Part 1 development footprint from approximately 48 m in the south of the Part 1 development footprint, to around 26.5 m centrally in the North Alkimos LSP and approximately 18.5 m in the north of North Eglinton LSP.

The groundwater flows from the Gngangara Mound in a westerly direction towards the coast, where groundwater discharges over a saline wedge (Water Corporation 2007; Advisian 2017).

The Water Register (DWER 2017a) identifies that the Superficial and Leederville aquifers are fully allocated, however groundwater allocation is available within the Yarragadee North aquifer.

11.4.2 Surface Water

Recharge is primarily from rainfall infiltration and some run-off from the Gingin Scarp (Advisian 2017). There are no surface water features, such as rivers, creeks, streams or brooks, or wetlands mapped within the Part 1 development envelope.

11.5 Potential Impacts

The key direct impact to the existing hydrological processes stems from the alteration of the existing landscape within the Part 1 development envelope from the construction of the project which in turn alters the surface water flow paths and recharge locations during rainfall.

There is a low risk that temporary water drawdown of the Yarragadee North aquifer could occur if a significant amount of groundwater is abstracted for construction purposes.

11.6 Assessment of Impacts

Given an absence of surface water features within the Part 1 development envelope, the alteration of existing surface water flow paths and recharge locations is unlikely to result in significant impacts to the existing regional or local hydrological regimes.

The average depth to ground water from the natural ground surface (approximately 31 m) is significantly greater than the average cutting works required for Part 1 of the YRE project (5 m) (Section 11.4; Table 6). Therefore modification to the local groundwater aquifers from dewatering has been avoided through the implementation of the proposed construction methodology (i.e. cutting and filling works identified in Advisian [2017]). Any groundwater abstracted from the Yarragadee North aquifer for construction purposes is unlikely to result in a significant reduction in regional or local groundwater levels.

11.7 Mitigation

The PTA is committed to implementing best practice Water Sensitive Urban Design principles, where feasible, and will be collaborating with DWER and New Water Ways to inform the YRE project's detailed stormwater design and structural controls (as required) to ensure that existing hydrological regimes are maintained.

No dewatering will be required to support the construction program and any groundwater abstracted from the Yarragadee North aquifer will be regulated under the *Rights in Water and Irrigation Act 1914* to avoid significant reduction in regional or local groundwater levels.

11.8 Predicted Outcome

Surface drainage and local recharge will be appropriately managed and planned for during the YRE project's detailed design, whilst the groundwater hydrology will not be significantly altered by the YRE project.

12.0 Inland Waters Environmental Quality

12.1 EPA Objective

To maintain the quality of the groundwater and surface water so that environmental values are protected.

12.2 Policy and Guidance

Environmental Factor Guideline: *Inland Waters Environmental Quality* (EPA 2016l).

12.3 Environmental Investigation

A desktop assessment has been undertaken by RPS to assess the ground and surface water quality within the YRE project's development footprint.

12.4 Receiving Environment

12.4.1 Groundwater

The Water Register (DWER 2017a) identifies the following physiochemical information for the groundwater below the Part 1 development footprint:

- salinity is estimated to vary from approximately 250 - 500 mg/L which is considered to be suitable for gardens bores / irrigation
- low risk of iron staining
- no known ASS risk.

The Water Register (DWER 2017a) also identifies that the Part 1 development envelope is entirely contained within the Priority 3 Perth Coastal Underground Water Pollution Control Area. The Priority 3 Perth Coastal Underground Water Pollution Control Area generally extends from Warwick at its southern end to Two Rocks at its northern limit (Figure N)

12.4.1.1 Public Drinking Water Source Protection Areas

DWER's *Land Use Compatibility Tables for Public Drinking Water Source Areas* (DoW 2016) identifies that the land uses of "Railway" and "Railway Station" are considered to be "Acceptable" and "Compatible with Conditions" within Priority 3 areas respectively.

12.4.1.1.1 **Production Bores and Wellhead Protection Zones**

There are 39 production bores in the Perth Coastal Underground Water Pollution Control Area, all drawing public drinking water from the Gnangara groundwater system (DoW 2012). The Neerabup borefield (including Quinns Rock and Whitfords bores) draws from the Superficial (25), Leederville (7) and Yarragadee (1) aquifers (DoW 2012). Wellhead protection zones are declared around production bores in public drinking water source areas to protect the groundwater from immediate contamination threats in the nearby area (DoW 2012).

12.5 Potential Impacts

The following potential indirect impacts have been identified:

- Contamination of groundwater during construction activities, with potential sources including uncontained spills, refuelling and plant and vehicle fluid leaks, may impact the groundwater reserves of the Superficial aquifer.
- Contaminated stormwater runoff from the operational railway and stations may infiltrate into the Superficial aquifer.

12.6 Assessment of Impacts

Figure N displays the location of the existing and proposed production bores and wellhead protection zones in relation to the Part 1 development envelope. The wellhead protection zone of an existing production bore intersects the existing Butler Station and the most southern portion of the Part 1 development footprint (Figure N). Additionally, railway infrastructure is located upstream of future production bores (Water Corporation pers. comm. 21 December 2017).

There is a low risk that groundwater could be contaminated during construction and operation activities with potential sources including (but not limited to) uncontained spills, refuelling and plant and vehicle fluid leaks.

12.7 Mitigation

The low risk of groundwater contamination occurring during construction of the railway will be mitigated through the implementation of a CEMP. DWER's *Land Use Compatibility Tables for Public Drinking Water Source Areas* (DoW 2016) identifies that the following Water Quality Protection Notes are of relevance to the land uses of "Railway" and "Railway Station":

- *Contaminant Spills – Emergency Response* (DoW 2006a)
- *Roads near Sensitive Water Resources* (DoW 2006b)
- *Tanks for Mobile Fuel Storage in Public Drinking Water Source Areas* (DoW 2013)
- *Infrastructure Corridors near Sensitive Water Resources* (DoW 2007)
- *Rehabilitation of Disturbed Land in Public Drinking Water Source Areas* (DoW 2009)

These Water Quality Protection Notes will inform the preparation of the CEMP, to manage potential contamination risks. The CEMP will also incorporate specific actions to avoid potential impacts to the groundwater in the identified wellhead protection zone.

As noted in Section 11.7, the PTA will be collaborating with DWER and New Water Ways to inform the YRE project's detailed stormwater design and structural controls (as required) to ensure that existing groundwater quality is maintained during operation of the railway.

12.8 Predicted Outcome

Groundwater quality of the Perth Coastal Underground Water Pollution Control Area will be maintained during the construction and operation of the railway.

13.0 Social Surroundings

13.1 Aboriginal Heritage and Culture

13.1.1 EPA Objective

To protect social surroundings from significant harm.

13.1.2 Policy and Guidance

- *Aboriginal Heritage Act 1972*.
- Environmental Factor Guideline: *Social Surroundings* (EPA 2016m).

13.1.3 Environmental Investigations

A desk-top aboriginal heritage study of the, then, proposed northern suburbs railway route was undertaken by R. & E. O'Connor Pty Ltd in 2012. R. & E. O'Connor Pty Ltd (2012) identified that no aboriginal sites had been recorded within the project area of the northern suburbs railway route alignment.

An archaeological survey of the, then, Butler to Yanchep railway alignment was subsequently completed by JCHMC in 2013. JCHMC (2013) reported that no sites or isolated artefacts were recorded within the project area of the Butler to Yanchep railway alignment. JCHMC (2013) recommended that no further archaeological research was warranted.

R. & E. O'Connor Pty Ltd undertook further heritage surveys and Aboriginal consultation for the YRE project in 2017 (R. & E. O'Connor Pty Ltd 2017a and b; Appendix D).

13.1.4 Receiving Environment

A search of the Department of Planning, Lands and Heritage's (DPLH) *Aboriginal Heritage Inquiry System* identified that no Registered Heritage Sites or additional Other Heritage Places were identified within the Part 1 development envelope (Figure O).

Western Australian Government land users, such as the PTA, are required to enter into and follow the Noongar Standard Heritage Agreement in the South West Native Title Settlement Area. As part of implementing the agreement, further aboriginal heritage surveys and consultation was undertaken by R. & E. O'Connor Pty Ltd in 2017 for the YRE project (Section 13.1.4.1).

13.1.4.1 Initial Aboriginal Heritage Survey

R. & E. O'Connor Pty Ltd (2017a) confirmed that, with the exception of the Romeo Road Pinnacles, the YRE development footprint did not impact any areas of Aboriginal significance (Appendix D).

The Romeo Road Pinnacles are a series of limestone outcrops that vary in size from approximately 20 centimetres above ground level to approximately 2 metres (R. & E. O'Connor Pty Ltd 2017a). An inspection by the more able-bodied Whadjuk representatives suggested that about twenty outcrops are located within the identified area, although smaller uncounted ones may be obscured by the dense coastal scrub (R. & E. O'Connor Pty Ltd 2017a).

The Whadjuk representatives approved the YRE development footprint assessed by R. & E. O'Connor Pty Ltd (2017a) subject to the following conditions:

- avoidance or relocation of the Romeo Road Pinnacles
- further consultation for the final alignment and ancillary facilities
- submission of a Heritage Information Submission Form to DPLH by R. & E. O'Connor Pty Ltd regarding the Romeo Road Pinnacles.

13.1.4.2 Additional Aboriginal Heritage Survey

An additional Aboriginal Heritage Survey was undertaken of the station sites and ancillary facilities (R. & E. O'Connor Pty Ltd 2017b; Appendix D).

R. & E. O'Connor Pty Ltd 2017b confirmed that the station sites and ancillary facilities did not impact any areas constituting an Aboriginal site. The Whadjuk representatives approved the additional areas assessed by R. & E. O'Connor Pty Ltd (2017b) subject to the following condition:

- Monitors to be onsite for clearance and initial groundworks.

13.1.5 **Potential Impacts**

- Disturbance of the Romeo Road Pinnacles by construction activities.
- Excavation / construction activities may unearth and/or damage artefacts or other items of Aboriginal cultural significance.

13.1.6 **Assessment of Impacts**

- Part 1 development envelope intersects a portion of the mapped extent of the Romeo Road Pinnacles (Figure O).
- There is a low risk that Aboriginal artefacts or other items of Aboriginal cultural significance would be unearthed during construction activities.

13.1.7 **Mitigation**

The PTA plans to use the existing limestone track within the Romeo Road construction and access area to facilitate the movement of construction vehicles from the Part 1 development footprint to Marmion Avenue. This approach will minimise disturbance of the Romeo Road Pinnacles. A Section 18 Notice will also be submitted to the DPLH for consideration by the Aboriginal Cultural Material Committee.

Monitors will be onsite for clearance and initial groundworks at the Alkimos and Eglinton station sites to assist with the identification and management of any Aboriginal objects identified or unearthed during construction. Should any Aboriginal objects be identified or unearthed in the absence of Monitors then construction will be stopped and the findings will be reported to the DPLH.

13.1.8 **Predicted Outcome**

The construction of the railway line extension from Butler Station to Eglinton Station is compliant with the *Aboriginal Heritage Act 1972*.

13.2 **Natural and Historic Heritage**

13.2.1 **EPA Objective**

To protect social surroundings from significant harm.

13.2.2 **Policy and Guidance**

- *Heritage of Western Australia Act 1990*
- Environmental Factor Guideline: Social Surroundings (EPA 2016m).

13.2.3 **Environmental Investigation**

RPS reviewed the State Heritage Office's *inHerit* database and the CoW's Scheme Heritage List.

13.2.4 Receiving Environment

A search of the State Heritage Office's *inHerit* database identified no heritage places listed on the State Register of Heritage Places within the Part 1 development envelope (Figure P). Further, no landholdings contained on the CoW's Scheme Heritage List are located within the Part 1 development envelope.

13.2.5 Potential Impacts

No heritage places listed on the State Register of Heritage Places or the CoW's Scheme Heritage List are mapped within the Part 1 development envelope.

13.2.6 Assessment of Impacts

Part 1 of the YRE project has been designed to avoid sites of natural and historic heritage.

13.2.7 Mitigation

No mitigation actions are required to meet the EPA's objective for the Social Surroundings environmental factor.

13.2.8 Predicted Outcome

The construction of a railway line extension from Butler Station to Eglinton Station is compliant with the EPA's objective for the Social Surroundings, the *Heritage of Western Australia Act 1990* and the CoW's District Planning Scheme No. 2.

13.3 Noise and Vibration

13.3.1 EPA Objective

To protect social surroundings from significant harm.

13.3.2 Policy and Guidance

- Environmental Factor Guideline: *Social Surroundings* (EPA 2016m).
- Environment Protection (Noise) Regulations 1997.
- SPP 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning.
- AS 2670.2-1990 Evaluation of human exposure to the whole-body vibration; Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz).

13.3.3 Environmental Investigations

The following investigations have been undertaken to assess the noise and vibration considerations associated with the YRE project:

- Northern Suburbs Railway Extension Butler to Yanchep, Noise Assessment (Herring Storer Acoustics 2012a)
- Northern Rail Extension Romeo Road to Yanchep, Ground Vibration Assessment (Herring Storer Acoustics 2012b)
- MERTONET – Yanchep Rail Extension, Transport Noise and Vibration Assessment (Lloyd George Acoustics 2018; Appendix E).

Table 8 provides a brief description of each of these investigations and identifies the assessment standards used to inform the scope and content of the individual investigations.

13.3.4 Receiving Environment

A noise and vibration assessment was undertaken by Lloyd George Acoustics for the YRE project to quantify the potential noise and vibration emissions received from trains travelling on the railway line (Lloyd George Acoustics 2018; Appendix E).

13.3.4.1 Noise Criteria

Under SPP 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning, transport infrastructure providers should design mitigation measures to achieve the noise limit of $L_{Aeq(Day)}$ of 60Decibel (dB) and $L_{Aeq(Night)}$ of 55dB. Additionally, transport infrastructure providers are also required to consider design measures to meet the noise target of $L_{Aeq(Day)}$ of 55dB and $L_{Aeq(Night)}$ of 50dB and to implement these measures where reasonable and practicable.

Lloyd George Acoustics (2018) identified that the daytime noise levels $L_{Aeq(Day)}$ will dictate compliance with SPP 5.4.

13.3.4.2 Vibration Criteria

For the existing railway south of Butler Station, the ground-borne vibration criteria resulting from the train pass-bys was given in Ministerial Statement 623, which required that the proponent meet specific vibration criteria with reference to the AS 2670.2-1990 Evaluation of human exposure to the whole-body vibration; Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz).

The vibration criteria in Ministerial Statement 623 were:

1. Vibration isolation measures will be provided where the predicted or actual vibration is Curve 2 (106 dB) or greater, as defined in AS 2670.2.
2. Proposal will be designed to meet Curve 1.4 (103 dB), as defined in AS 2670.2.
3. Vibration will be managed to be as low as reasonably practicable.

13.3.5 Potential Impacts

Exposure of existing and future residents to the railway-related noise and vibration (during construction and operation).

13.3.6 Assessment of Impacts

13.3.6.1 Noise

Lloyd George Acoustics (2018) identified that the noise target of $L_{Aeq(Day)}$ of 55dB will be exceeded at a number of the assessed sensitive premises, which included existing and future noise sensitive receivers. Appendix E provides the detailed modelling outputs which indicate the locations of the sensitive premises at which the noise target of $L_{Aeq(Day)}$ of 55dB and noise limit of $L_{Aeq(Day)}$ of 60dB are achieved or exceeded.

Noise will be generated during construction of Part 1 of the YRE project which may act as a nuisance to residents occupying dwellings located adjacent to or in close proximity of the Part 1 development envelope.

13.3.6.2 Vibration

Lloyd George Acoustics (2018) identified that the vibration target of 103dB is predicted to be marginally exceeded at a number of locations along the YRE project's development footprint. Appendix E provides the locations of the sensitive premises where the vibration target of 103dB is met or exceeded.

13.3.7 Mitigation

13.3.7.1 Noise Control

Lloyd George Acoustics (2018) recommends that noise walls be constructed to achieve the noise target of LAeq(Day) of 55dB. Appendix E provides the location and details of the recommended noise walls along the YRE project's development footprint and the predicted noise levels after the noise walls have been constructed.

The design of noise barriers may change when the detailed design (i.e. design levels or building facade noise control packages) of residential subdivisions are further developed. In addition the responsibility for construction of barriers will also need to be confirmed at this time.

A Noise and Vibration Management Plan will be prepared to outline the PTA's commitments in relation to noise and vibration management and mitigation. The Noise and Vibration Management Plan will be provided to DWER for review.

A CEMP will also be prepared to manage noise generation during Part 1 of the YRE project's construction. The CEMP will include:

- information on required noise management measures
- mitigation measures and monitoring requirements, should excessive noise levels be reported.

13.3.7.2 Vibration Control

Ballast matting is to be installed adjacent to all existing and approved residential subdivisions within the Part 1 development footprint. Lloyd George Acoustics (2018) identifies that the installation of ballast matting would significantly reduce vibration levels to well below the vibration criterion.

A Noise and Vibration Management Plan will be prepared to outline the PTA's commitments in relation to noise and vibration management and mitigation. The Noise and Vibration Management Plan will be provided to DWER for review.

A CEMP will also be prepared to manage vibration generation during Part 1 of the YRE project's construction. The CEMP will include:

- information on required vibration management measures
- mitigation measures and monitoring requirements, should excessive vibration levels be reported.

13.3.8 Predicted Outcome

Sensitive receptors, such as existing and future residential landholdings, in the vicinity of the Part 1 development envelope are not significantly impacted by noise or vibration during the construction and operation of the YRE project.

13.4 Dust

13.4.1 EPA Objective

To protect social surroundings from significant harm.

13.4.2 Policy and Guidance

- A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Site Remediation and other Related Activities (DEC 2011b)
- National Environmental Protection (Ambient Air Quality) Measure.

13.4.3 Receiving Environment

Dust can arise from a range of natural and man-made sources causing various acute and chronic health effects, as well as nuisance and visibility impacts (DEC 2011b).

In the case of the YRE project, wind-borne dust may arise from:

- exposed surfaces such as cleared land
- sand stockpiles
- construction activities
- vehicle movements.

The composition of dust particles will depend on the nature of the source material (DEC 2011b). Dust generated from the construction of Part 1 of the YRE project will reflect the composition of the sands and limestone which underlie the development footprint.

Given that the Part 1 development envelope comprises of native vegetation, with risks related to contamination associated with previous land uses assessed to be low (Section 9.2), it is considered unlikely that the dust generated from the construction activities would cause significant health effects.

The consideration of dust will therefore focus primarily on amenity (nuisance and visibility) impacts.

13.4.4 Potential Impacts

13.4.4.1 Direct Impacts

- Existing residences located adjacent to or in close proximity of the Part 1 development envelope may be exposed to elevated dust levels.
- Dust may accumulate on adjacent native vegetation, where it settles on leaves and restricts physiological function.

13.4.4.2 Indirect Impacts

It is expected that significant amount of sand and limestone will be required to be removed from the Part 1 development footprint to facilitate the final finished floor levels. Dust will be generated from the loading and transport of sand and limestone offsite. Depending upon the general geological conditions encountered, excess limestone may also be required to be crushed to facilitate its transport and reuse.

13.4.5 Assessment of Impacts

Dust will be generated during construction of Part 1 of the YRE project which may act as a nuisance to residents occupying dwellings located adjacent to or in close proximity of the Part 1 development envelope.

Dust could potentially impact the physiology (i.e. reducing photosynthesis and transpiration rates) of adjacent native vegetation should significant accumulation on the leaves of individual plants be experienced.

The PTA is investigating numerous beneficial re-use opportunities for the excess sand and limestone in close proximity to the Part 1 development footprint to minimise the dust, and greenhouse gas emissions, generated by the transportation of the excess materials.

13.4.6 Mitigation

13.4.6.1 Construction Environment Management Plan

A CEMP will be prepared to manage dust generation during Part 1 of the YRE project's construction. The CEMP will include:

- information on required dust management measures
- mitigation measures and monitoring requirements, should excessive dust levels be reported
- management measures for the cleared construction and access areas (Section 6.7.2).

13.4.6.2 Licence

If significant limestone deposits are required to be crushed onsite, this activity may meet the definition of a 'prescribed premises' and be regulated through the Environmental Protection Regulations 1987.

Schedule 1 of the Environmental Protection Regulations 1987 identifies that premises on which more than 5,000 tonnes per year of material is extracted from the ground is screened, washed, crushed, ground, milled, sized or separated are a prescribed premises (Category No. 70).

If it is anticipated that the YRE project will meet the definition of a prescribed premises for the crushing of limestone a licence will be obtained from the DWER.

13.4.7 **Predicted Outcome**

Occupied residential landholdings adjacent to or in close proximity of the Part 1 development envelope are not significantly impacted by dust during the construction of the YRE project, whilst the physiological function of adjacent native vegetation stands is not significantly diminished.

13.5 **Bushfire**

13.5.1 **EPA Objective**

To protect social surroundings from significant harm.

13.5.2 **Policy and Guidance**

- *Fire and Emergency Services Act 1998*.
- SPP 3.7: Planning in Bushfire Prone Areas.

13.5.3 **Environmental Investigation**

RPS reviewed the Department of Fire and Emergency Services (DFES) *Map of Bushfire Prone Areas*.

13.5.4 **Receiving Environment**

The WAPC released SPP 3.7: Planning for Bushfire Prone Areas in December 2015 to reduce the risk of bushfire to people, property and infrastructure. SPP 3.7 defines a bushfire-prone area as an area that has been designated by the Fire and Emergency Services Commissioner under Section 18 of the *Fire and Emergency Services Act 1998* (as amended) as an area that is subject, or likely to be subject, to bushfires.

A search of the DFES *Map of Bushfire Prone Areas* identified that Part 1 of the YRE project is entirely mapped as a Bushfire Prone Area (Figure Q).

13.5.5 **Potential Impacts**

Damage to infrastructure from fire.

13.5.6 **Assessment of Impacts**

The PTA has prepared a Bushfire Management Strategy which outlines its approach to bushfire risk reduction across PTA owned, managed or leased land (Appendix F).

The Bushfire Management Strategy applies to all activities and operations undertaken by the PTA and its contractors and subcontractors on PTA land (including construction, maintenance and operational activities). These activities and operations comprise those with the potential to cause bushfire and those implemented for the purpose of mitigating bushfire risk (PTA 2017b).

13.5.7 Mitigation

The PTA's Bushfire Management Strategy (Appendix F) provides the bushfire management framework that will be implemented during the construction and operation of the YRE project. Implementation of the Bushfire Management Strategy will ensure that the PTA's following strategic actions are addressed:

1. Provide input as required into bushfire risk assessments undertaken by local governments and fire authorities.
2. Implement strategies for fuel reduction on PTA land, taking into account conservation, infrastructure, cultural and other surrounding land values.
3. Contribute to long-term bushfire mitigation strategies in conjunction with local governments and other land managers in areas where bushfire risk has been identified as an issue of concern.
4. Implement bushfire preparedness actions to address the threat of bushfire, including:
 - a. Ensuring controlled access to PTA land, including maintenance of access tracks and assistance with access for responding agencies.
 - b. Having in place safe operating procedures for high risk activities.
 - c. Designing asset protection zones on a specific risk and site basis.
 - d. Adhering to the fire emergency response procedures within the PTA's Emergency Management Manual.
 - e. Land management practices including maintenance of signage and fencing and removing dumped rubbish.
5. Contribute to bushfire hazard reduction on PTA land through in-kind donations, the funding of fuel reduction activities (such as weed control, but excluding prescribed burning) and provide any necessary assistance with regard to rail safety to allow access to PTA land.
6. Liaise with key stakeholders to ensure that up to date data are used to identify Aboriginal heritage and vegetation conservation values within PTA land and ensure bushfire hazard reduction activities take into consideration areas of high conservation value and Aboriginal sites.

13.5.8 Predicted Outcome

Risk to rail infrastructure from bushfire will be managed in accordance with the PTA's Bushfire Management Strategy. PTA's rail infrastructure will not contribute to increased bushfire risk to adjacent landowners.

14.0 Offsets

The Part 1 development envelope has been included in six previous EPBC referrals (Section 1.4.4.1; Figure D). These six referrals have been determined by the Commonwealth to be Controlled Actions with environmental offsets such as land acquisition, either having been provided, or are pending provision, to counterbalance the residual impacts for each of these separate actions on Carnaby's Black Cockatoo and Banksia Woodlands of the Swan Coastal Plain TEC¹⁰.

The WA Environmental Offsets Guidelines (EPA 2014) identifies that where a proposal has already been assessed under the EPBC Act and offsets have been applied, the State will consider these offsets as contributing to the State requirements. However, MNES that are considered by the Commonwealth government are only a subset of the matters that the State government considers. The State may require offsets to other environmental values which are not relevant to the EPBC Act.

This EIA report has identified a significant residual impact to the environmental factor of Flora and Vegetation from the implementation of Part 1 of the YRE project for which offsets have not previously been applied under the EPBC Act:

- Clearing of 1.08 ha of *Melaleuca huegelii* – *M. acerosa* [*M. systema*] shrublands on limestone ridges TEC 26a in "Good" or better condition.

To counterbalance these residual environmental impacts an appropriate Environmental Offset Strategy will be prepared and implemented to the satisfaction of DWER (Section 6.7.3). Initial discussions with the DBCA confirm that areas suitable as offsets are available in the broader Perth region.

¹⁰ Residential and Commercial Development on Part of 19 (Lot 6) Taronga, Eglinton (EPBC 2017 / 7872) is the only EPBC referral to include the Banksia Woodlands of the Swan Coastal Plain TEC.

15.0 Matters of National Environmental Significance

MNES identified within the Part 1 development envelope by GHD (2018) are:

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)
- Banksia Woodlands of the Swan Coastal Plain TEC.

These MNES are both listed as Endangered under the EPBC Act.

The clearing of approximately 51.28 ha of Carnaby's Black Cockatoo foraging habitat, 24 potential breeding trees and approximately 12.12 ha of the recently listed Banksia Woodlands of the Swan Coastal Plain TEC¹¹ has been approved for the six previous EPBC referrals which comprise the majority of the Part 1 development envelope (Section 3.3.3; Figure D).

Banksia Woodlands of the Swan Coastal Plain TEC was not recorded by GHD (2018) outside of the previous EPBC Act assessment boundaries (Figure D).

Approximately 1.02 ha of Carnaby's Black Cockatoo foraging habitat and 3 potential breeding trees have been recorded outside of the previous EPBC Act assessment boundaries but within the Part 1 development envelope (Figure D). The DEE has confirmed that this small amount of clearing is unlikely to significantly impact Carnaby's Black Cockatoo (Section 3.3.3).

¹¹ Residential and Commercial Development on Part of 19 (Lot 6) Taronga, Eglinton (EPBC 2017 / 7872) is the only EPBC referral to include the Banksia Woodlands of the Swan Coastal Plain TEC.

16.0 Holistic Impact Assessment

Table 21 provides a high level summary of the potential impacts, proposed mitigation and predicted outcomes after the application of the mitigation hierarchy for the environmental factors of specific relevance to Part 1 of the YRE project:

- land factors
 - > flora and vegetation
 - > landforms
 - > subterranean fauna
 - > terrestrial environmental quality
 - > terrestrial fauna
- water factors
 - > hydrological processes
 - > inland waters environmental quality
- people factor
 - > social surroundings.

Significant residual impacts to the environmental factor of Flora and Vegetation will be counterbalanced through the provision of an appropriate Environmental Offset Strategy (Section 6.7.3). The risk of significant residual impacts to the remaining environmental factors from the implementation of Part 1 of the YRE project has been mitigated by the PTA through the application of the mitigation hierarchy (avoid, minimise, rehabilitate).

Through the provision of an appropriate Environmental Offset Strategy and implementation of the proposed mitigation measures, it is considered that the implementation of Part 1 of the YRE project will meet the EPA's relevant environmental factor objectives.

Table 21: Summary of the Potential Impacts, Proposed Mitigation and Outcomes

Flora and Vegetation	
EPA Objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Policy and Guidance	<ul style="list-style-type: none"> ■ <i>Environment Protection and Biodiversity Conservation Act 1999</i> ■ <i>Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016</i> ■ Environmental Factor Guideline: <i>Flora and Vegetation</i> (EPA 2016f) ■ Technical Guidance: <i>Flora and Vegetation Surveys for Environmental Impact Assessment</i> (EPA 2016c)
Potential Impacts	Direct Impacts – Development Footprint Clearing of up to 38.77 ha of native vegetation including: <ul style="list-style-type: none"> ■ Clearing of 8.84 ha of Banksia dominated woodlands of the Swan Coastal Plain IBRA Region PEC (Priority 3) in “Good” or better condition / Banksia Woodlands of the Swan Coastal Plain TEC. ■ Clearing of 0.53 ha of <i>Melaleuca huegelii</i> – <i>M. acerosa</i> [<i>M. systema</i>] shrublands on limestone ridges TEC 26a in “Good” or better condition. ■ Clearing of 10.60 ha of Northern Spearwood shrublands and woodlands PEC (Priority 3) in “Good” or better condition.
	Direct Impacts – Construction and Access Areas Clearing of up to 23.80 ha of native vegetation including: <ul style="list-style-type: none"> ■ Clearing of 3.28 ha of Banksia dominated woodlands of the Swan Coastal Plain IBRA Region PEC (Priority 3) in “Good” or better condition / Banksia Woodlands of the Swan Coastal Plain TEC ■ Clearing of 0.55 ha of <i>Melaleuca huegelii</i> – <i>M. acerosa</i> [<i>M. systema</i>] shrublands on limestone ridges TEC 26a in “Good” or better condition. ■ Clearing of 6.14 ha of Northern Spearwood shrublands and woodlands PEC (Priority 3) in “Good” or better condition.
	Indirect Impacts <ul style="list-style-type: none"> ■ Introduction and distribution of Declared Pests and other weed species. ■ Introduction and distribution of <i>Phytophthora</i> dieback. ■ Disturbance to surrounding native vegetation during construction works.
Mitigation	Minimise A CEMP will be developed and implemented to ensure: <ul style="list-style-type: none"> ■ Clearing is restricted to the Part 1 development envelope. ■ Declared Pests and other weed species are not distributed offsite. ■ <i>Phytophthora</i> dieback is not introduced to the surrounding vegetation. ■ Indirect impacts to surrounding vegetation are appropriately managed. The CEMP will be prepared to be in accordance with: <ul style="list-style-type: none"> ■ Condition 2 of Ministerial Statement 722 ■ Parks and Recreation Reserve Management Plan (Strategen 2017) for the Lot 200 Alkimos Drive “Parks and Recreation” reservation as a part of the EPBC 2015 / 7561 approval. ■ Existing conditions for the EPBC 2008 / 4601, EPBC 2015 / 7561, EPBC 2008 / 4638, EPBC 2010 / 5777 and EPBC 2011 / 6021 approvals. ■ Future conditions for the EPBC 2017 / 7872 approval
	Rehabilitate Cleared construction and access areas will be managed by the PTA during and post construction to prevent weed establishment and impacts to sensitive premises and surrounding vegetation from dust and unauthorised vehicle access. The PTA will manage these areas post construction until such time as the areas are handed back to the landowner for development.
Outcomes	Residual Impact Residual environmental impacts of clearing approximately 1.08 ha <i>Melaleuca huegelii</i> – <i>M. acerosa</i> [<i>M. systema</i>] shrublands on limestone ridges TEC 26a in “Good” or better condition will be counterbalanced through the preparation and implementation of an appropriate Environmental Offset Strategy to the satisfaction of DWER ¹² .
	Operational Maintenance Operational railway corridor will be managed by the PTA in perpetuity in accordance with its Vegetation Management Manual.

¹² Environmental offsets have already been provided / will be provided through EPBC Act assessments for the other State-based Flora and Vegetation considerations (Sections 1.4.4.1 and 6.6.2.1).

Landforms		
EPA Objective	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	
Policy and Guidance	Environmental Factor Guideline: <i>Landforms</i> (EPA 2016g)	
Potential Impacts	Direct Impacts	Cut and fill requirements of the construction program will reduce the height of the parabolic dune formation within Lot 200 Alkimos Drive “Parks and Recreation” reservation by approximately 14 metres.
	Indirect Impacts	Post construction, any cleared earthworks batters could result in the creation of blow outs which may further alter the dunes morphology as well as encroaching on the adjacent extents of conservation significant native vegetation.
Mitigation	Minimise	<ul style="list-style-type: none"> Alignment of the Part 1 development footprint has been proposed to accord with the MRS “Railways” reservation whilst minimising cut to fill requirements where practicable. Detailed engineering design will be undertaken to minimise landform impacts and confirm the structural controls required (i.e. either battering the excavation or using retaining walls) to stabilise the affected dune formations with planting of locally endemic species or bioengineering controls to be used, where practicable.
Outcomes	Physical impacts associated with the construction of Part 1 of the YRE project will be appropriately mitigated within the Lot 200 Alkimos Drive “Parks and Recreation” reservation by detailed engineering design and land stabilisation.	
Subterranean Fauna		
EPA Objective	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	
Policy and Guidance	<ul style="list-style-type: none"> Environmental Factor Guideline: <i>Subterranean Fauna</i> (EPA 2016h). Technical Guidance: <i>Subterranean Fauna Survey</i> (EPA 2016n). 	
Potential Impacts	Direct Impacts	<ul style="list-style-type: none"> Disturbance or destruction of smaller voids close to the surface during cutting activities would reduce habitat availability for subterranean fauna and may result in injury and/or mortality to troglofauna fauna species (if present).
	Indirect Impacts	<ul style="list-style-type: none"> Reduction in groundwater levels and quality can adversely affect stygofauna, and to a lesser extent troglofauna, as they rely upon a saturated environment. Contamination of groundwater during construction may impact the quality of suitable micro-habitats for subterranean fauna.
Mitigation	Avoid	<ul style="list-style-type: none"> No large scale karstic features, such as sinkholes or caverns, have been identified within Part 1 of the YRE project’s development footprint. Construction of Part 1 of the YRE project will not require dewatering. Prior to the commencement of construction activities, a further detailed geotechnical investigation will be undertaken to supplement and validate the initial findings of the Advisian (2017) investigation and enable detailed design of key structural elements.
	Minimise	<ul style="list-style-type: none"> Should any unidentified karst or cave formations be identified within the Part 1 development footprint during construction, the DWER will be notified and appropriate actions undertaken to the satisfaction of the DWER. Any groundwater abstracted from the Yarragadee North aquifer will be regulated under the <i>Rights in Water and Irrigation Act 1914</i> to avoid significant reduction in regional or local groundwater levels. Low risk of groundwater contamination occurring during construction will be mitigated through the implementation of a CEMP.
Outcomes	<ul style="list-style-type: none"> Identified potential direct impacts are considered to pose a low risk to subterranean fauna (if present) as the Part 1 development footprint has avoided significant subterranean habitat and will be subject to additional validation by further geotechnical investigation, whilst the risk to subterranean fauna from indirect impacts to groundwater are also considered to be low. Implementation of a CEMP will also further reduce any residual risk of potential impacts occurring to any subterranean fauna inhabiting the area. 	
Terrestrial Environmental Quality		
EPA Objective	To maintain the quality of land and soils so that environmental values are protected.	
Policy and Guidance	<ul style="list-style-type: none"> <i>Contaminated Sites Act 2003</i> Environmental Factor Guideline: <i>Terrestrial Environmental Quality</i> (EPA 2016i) Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DER 2015a) Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DER 2015b) Assessment and Management of Contaminated Sites (DER 2014) 	
Potential Impacts	<ul style="list-style-type: none"> Acidification and release of heavy metals from ASS into the terrestrial environment and underlying groundwater. Injury from UXOs. Contaminated soil or groundwater is unearthed during construction. 	
Mitigation	<ul style="list-style-type: none"> Construction program proposed in Advisian (2017) involves filling of the lower lying areas within the Part 1 development footprint. This approach further decreases the already low residual risk of ASS being unearthed during earthworks. Prior to the commencement of earthworks, a technical investigation will be conducted of all areas identified as being of risk of containing UXOs. If the investigation indicates that UXOs are or may be present then the affected areas will be remediated. Potential contamination will be managed in accordance with a project specific unexpected finds protocol to comply with the <i>Contaminated Sites Act 2003</i>. 	
Outcomes	<ul style="list-style-type: none"> Environmental values of the land and soils within the Part 1 development envelope will not be significantly impacted by ASS. Risk of UXOs occurring within the Part 1 development envelope will be low at the time construction commences. Construction of the railway line extension from Butler Station to Eglinton Station is compliant with the <i>Contaminated Sites Act 2003</i>. 	

Terrestrial Fauna	
EPA Objective	To protect terrestrial fauna so that biological diversity and ecological integrity are protected.
Policy and Guidance	<ul style="list-style-type: none"> ■ <i>Environment Protection and Biodiversity Conservation Act 1999</i> ■ <i>Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016</i> ■ Environmental Factor Guideline: <i>Terrestrial Fauna</i> (EPA 2016j) ■ Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016o) ■ Technical Guidance: <i>Terrestrial Fauna Surveys</i> (EPA 2016d)
Potential Impacts	Direct Impacts – Development Footprint <ul style="list-style-type: none"> ■ Clearing of up to 45.42 ha of fauna habitat including: <ul style="list-style-type: none"> > Clearing of 34.37 ha of high value fauna habitat. > Clearing of 4.40 ha of medium value fauna habitat. > Clearing / disturbance of 6.65 ha of low value fauna habitat. ■ Injury and/or mortality during clearing activities and construction and operation of the railway. ■ Fragmentation of fauna habitat and separation of non-avian fauna populations within Lot 200 Alkimos Drive “Parks and Recreation” reservation.
	Direct Impacts – Construction and Access Areas <ul style="list-style-type: none"> ■ Clearing of up to 24.80 ha of fauna habitat including: <ul style="list-style-type: none"> > Clearing of 18.95 ha of high value fauna habitat. > Clearing of 4.71 ha of medium value fauna habitat. > Clearing / disturbance of 1.14 ha of low value fauna habitat. ■ Injury and/or mortality during clearing activities.
	Indirect Impacts <ul style="list-style-type: none"> ■ Disturbance during construction (clearing activities and noise) and operation of the railway (noise and vibration) may affect the local abundance of fauna populations due to interruption to fauna behaviour. ■ Habitat and food source degradation through increased pollution and waste.
Mitigation	Minimise <p>A CEMP will be developed and implemented to ensure that:</p> <ul style="list-style-type: none"> ■ Conservation significant terrestrial fauna species (i.e. the reptiles and mammals identified in Table 20) are not significantly impacted as a result of native vegetation clearing. ■ Measures to minimise impacts on larger species of highly mobile fauna, such as Western Brush Wallaby and Emu, to avoid isolation or entrapment in temporary construction infrastructure. ■ Indirect impacts to surrounding native fauna habitat are appropriately managed. ■ Interactions between native fauna and passenger trains are avoided. <p>The CEMP will be prepared in accordance with:</p> <ul style="list-style-type: none"> ■ Condition 2 of Ministerial Statement 722 ■ Parks and Recreation Reserve Management Plan (Strategen 2017) for the Lot 200 Alkimos Drive “Parks and Recreation” reservation as a part of the EPBC 2015 / 7561 approval. ■ Existing conditions for the EPBC 2008 / 4601, EPBC 2015 / 7561, EPBC 2008 / 4638, EPBC 2010 / 5777 and EPBC 2011 / 6021 approvals. ■ Future conditions for the EPBC 2017 / 7872 approval.
Outcomes	Development and implementation of a CEMP will ensure that native fauna interactions are appropriately managed during construction and into railway operation.
Hydrological Processes	
EPA Objective	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
Policy and Guidance	Environmental Factor Guideline: <i>Hydrological Processes</i> (EPA 2016k)
Potential Impacts	Direct Impacts <ul style="list-style-type: none"> ■ Alteration of the existing landscape within the Part 1 development envelope from the construction of the project which in turn alters the surface water flow paths and recharge locations during rainfall. ■ Temporary water drawdown of the Yarragadee North aquifer could occur if significant amount of groundwater is abstracted for construction purposes
Mitigation	Avoid <p>No dewatering will be required to support the construction program.</p>
	Minimise <ul style="list-style-type: none"> ■ Detailed stormwater design will be undertaken to confirm the structural controls required to ensure that existing hydrological regimes are maintained. ■ Any groundwater abstracted from the Yarragadee North aquifer will be regulated under the <i>Rights in Water and Irrigation Act 1914</i> to avoid significant reduction in regional or local groundwater levels.
Outcomes	Surface drainage and local recharge will be appropriately managed and planned for during the YRE project’s detailed design, whilst the groundwater hydrology will not be significantly altered by the YRE project.

Inland Waters Environmental Quality	
EPA Objective	To maintain the quality of the ground water and surface water so that environmental values are protected.
Policy and Guidance	Environmental Factor Guideline: <i>Inland Waters Environmental Quality</i> (EPA 2016I)
Potential Impacts	Indirect Impacts <ul style="list-style-type: none"> ■ Contamination of groundwater during construction activities, with potential sources including uncontained spills, refuelling and plant and vehicle fluid leaks, may impact the groundwater reserves of the Superficial aquifer. ■ Contaminated stormwater runoff from the operational railway and stations may infiltrate into the Superficial aquifer.
Mitigation	Minimise <ul style="list-style-type: none"> ■ Low risk of groundwater contamination occurring during construction of the railway will be mitigated through the implementation of a CEMP. ■ Detailed stormwater design and structural controls (as required) to ensure that existing groundwater quality is maintained during operation of the railway.
Outcomes	Groundwater quality of the Perth Coastal Underground Water Pollution Control Area will be maintained during the construction and operation of the railway.
Social Surroundings	
EPA Objective	To protect social surroundings from significant harm.
Policy and Guidance	<ul style="list-style-type: none"> ■ <i>Aboriginal Heritage Act 1972</i> ■ <i>Heritage of Western Australia Act 1990</i> ■ <i>Fire and Emergency Services Act 1998</i> ■ Environmental Factor Guideline: <i>Social Surroundings</i> (EPA 2016m) ■ Environment Protection (Noise) Regulations 1997 ■ SPP 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning. ■ AS 2670.2-1990 Evaluation of human exposure to the whole-body vibration; Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz). ■ A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Site Remediation and other Related Activities (DEC 2011b) ■ National Environmental Protection (Ambient Air Quality) Measure. ■ SPP 3.7: Planning in Bushfire Prone Areas.
Potential Impacts	<ul style="list-style-type: none"> ■ Disturbance of the Romeo Road Pinnacles by construction activities. ■ Excavation / construction activities may unearth and/or damage artefacts or other items of Aboriginal cultural significance. ■ Exposure of existing and future residents to the railway-related noise and vibration (during construction and operation). ■ Existing residences located adjacent to or in close proximity of the Part 1 development envelope may be exposed to elevated dust levels. ■ Dust may accumulate on adjacent native vegetation, where it settles on leaves and restricts physiological function. ■ Damage to infrastructure from fire.
Mitigation	Avoidance PTA plans to use the exiting limestone track within the Romeo Road construction and access area to facilitate the movement of construction vehicles from the Part 1 development footprint to Marmion Avenue. Minimise <ul style="list-style-type: none"> ■ Section 18 Notice to be submitted to the DPLH. ■ Monitors will be onsite for clearance and initial groundwork at the Alkimos and Eglinton station sites to assist with the identification and management of any Aboriginal objects identified or unearthed during construction. ■ Should any Aboriginal objects be identified or unearthed in the absence of Monitors then construction will be stopped and the findings will be reported to the DPLH. ■ Noise walls are to be constructed to achieve the noise target of LAeq(Day) of 55dB. ■ Ballast matting is to be installed adjacent to all existing and approved residential subdivisions within the Part 1 development footprint. ■ Noise and Vibration Management Plan to be prepared to outline the PTA's commitments in relation to noise and vibration management and mitigation. ■ Preparation of a CEMP to manage noise and dust during Part 1 of the YRE project's construction. ■ Implementation of the PTA's Bushfire Management Strategy.
Outcomes	<ul style="list-style-type: none"> ■ Construction of the railway line extension from Butler Station to Eglinton Station is compliant with the <i>Aboriginal Heritage Act 1972</i>. ■ Sensitive receptors, such as existing and future residential landholdings, in the vicinity of the Part 1 development envelope are not significantly impacted by noise or vibration during the construction and operation of the YRE project. ■ Occupied residential landholdings adjacent to or in close proximity of the Part 1 development envelope are not significantly impacted by dust during the construction of the YRE project, whilst the physiological function of adjacent native vegetation stands is not significantly diminished. ■ Risk to rail infrastructure from bushfire will be managed in accordance with the PTA's Bushfire Management Strategy.

17.0 References

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