Baldivis Tramway
MASTER PLAN

JUNE 2014

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city of Rockingham

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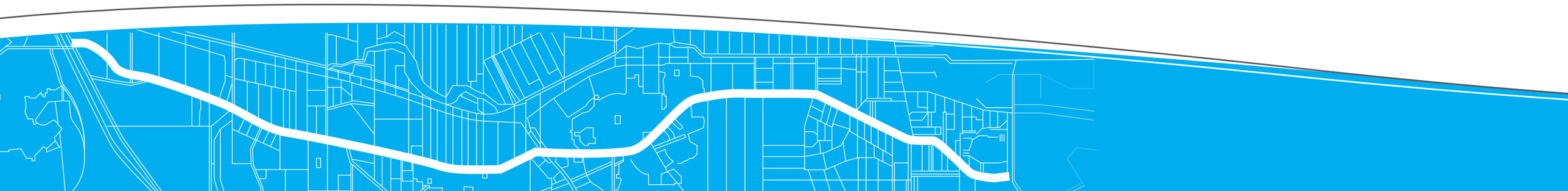

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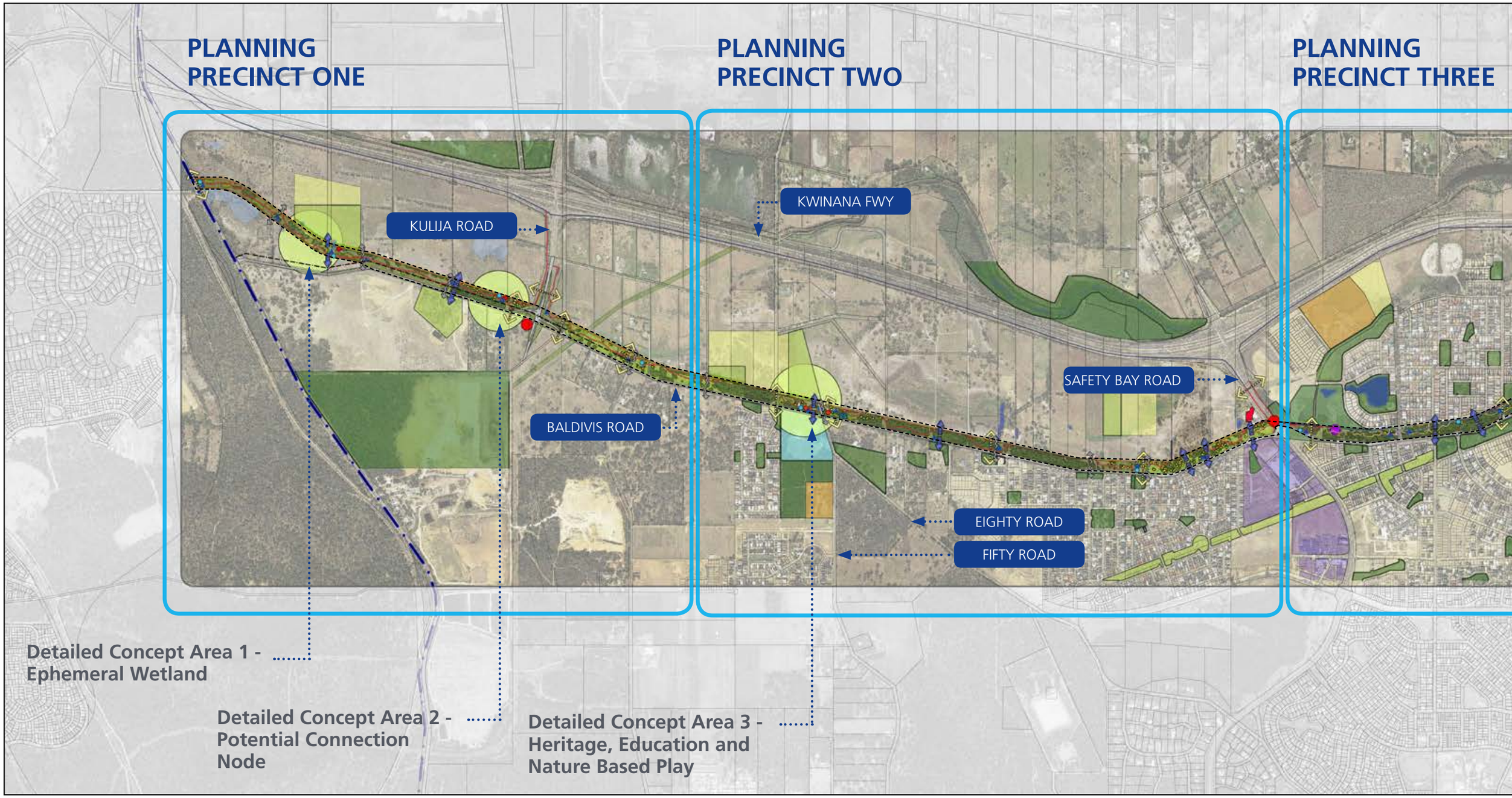
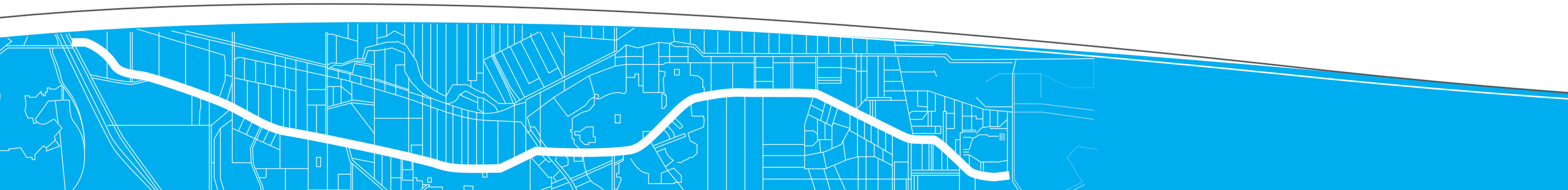
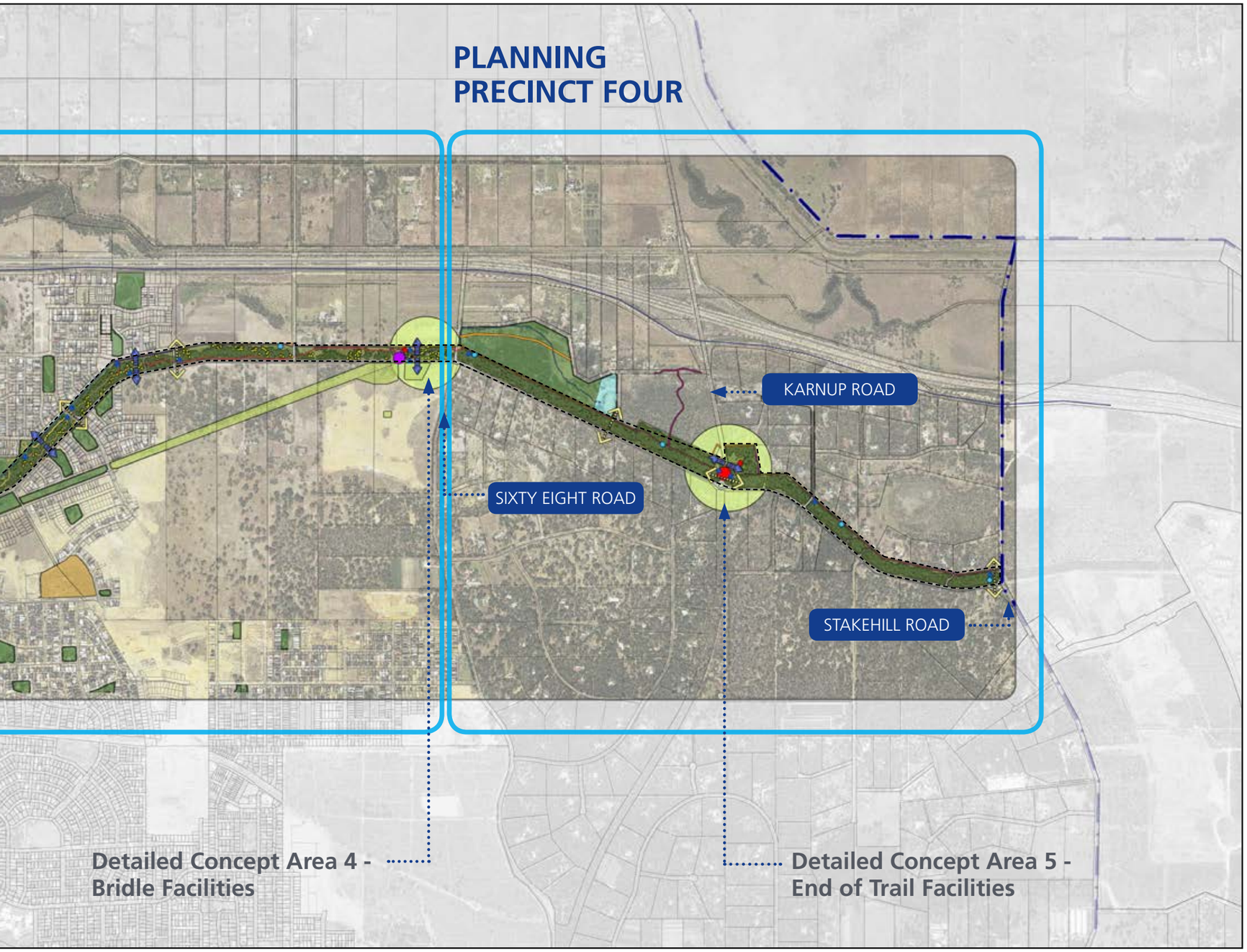

PLANNING PRECINCT ONE
PLANNING PRECINCT TWO
PLANNING PRECINCT THREE
KULIJA ROAD
BALDIVIS ROAD
KWINANA FWY
SAFETY BAY ROAD
EIGHTY ROAD
FIFTY ROAD
Detailed Concept Area 1 - Ephemeral Wetland
Detailed Concept Area 2 - Potential Connection Node
Detailed Concept Area 3 - Heritage, Education and Nature Based Play

FIGURE 1



PLANNING PRECINCT FOUR



Legend

- Existing Dual Use Path
- Proposed 2.5m Dual Use Path
- Existing Firebreak
- Proposed 4m Firebreak
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- Community Facility
- Shopping Centre
- Bridle Trail Facilities
- Existing Principal Shared Path along Kwinana Fwy
- Existing Telstra Building
- Black Cockatoo Breeding Tree Locations
- Baldivis Vet Hospital

1. INTRODUCTION

MASTER PLAN

1. Executive Summary

The Baldivis Tramway Reserve (the Tramway) is an area of significant remnant bushland located within the suburb of Baldivis approximately 40 km south of Perth. It comprises an area of 95 ha and spans an approximate length of 12 km.

The Tramway sits entirely in the City of Rockingham municipality and is vested with the local government for management. It is zoned Parks and Recreation under the Metropolitan Region Scheme and currently supports a combination of recreation, conservation and cultural values. Located within a highly urbanised environment, the reserve provides a unique opportunity to act as a linear network for biodiversity and as an asset for nature appreciation and unstructured recreation. From an urban landscape perspective, The Baldivis Tramway Master Plan (the Plan) indicates various connections throughout the reserve to maximise connectivity to adjoining development, community facilities and Public Open Space (POS).

A prominent feature to enhance the recreational capacity of the Tramway will be a Dual Use Path (DUP). This pathway will span the length of the reserve and will encourage unstructured recreation without compromising significant areas of remnant vegetation. Sections of good quality remnant vegetation will form key conservation areas, where rehabilitation of bushland will occur.

The Plan identifies a number of potential concept areas throughout the reserve, that together encompass and reflect the environmental, recreational and heritage values of the Tramway. These areas will encourage recreation, education and relaxation in a natural setting, providing an invaluable experience within a highly urban environment.

1.1 Vision

To protect and improve the natural environment and habitat corridor of the Baldivis Tramway Reserve whilst providing sustainable nature based recreation opportunities which encourage greater community participation in the use and management of the reserve.

1.2 Purpose

The purpose of the Baldivis Tramway Reserve Master Plan is to establish key directions; including use, development and management of the reserve over the next ten years. The vision and purpose of the Plan are to be driven by the following overarching objectives.

1.3 Overarching objectives

1. Conserve and enhance the natural and cultural environment
2. Encourage community use of and engagement in the reserve
3. Coordinate management practices and responsibilities within the reserve
4. Improve sense of place through landscaping, infrastructure and interpretive opportunities
5. Ensure equity and safety of reserve users.

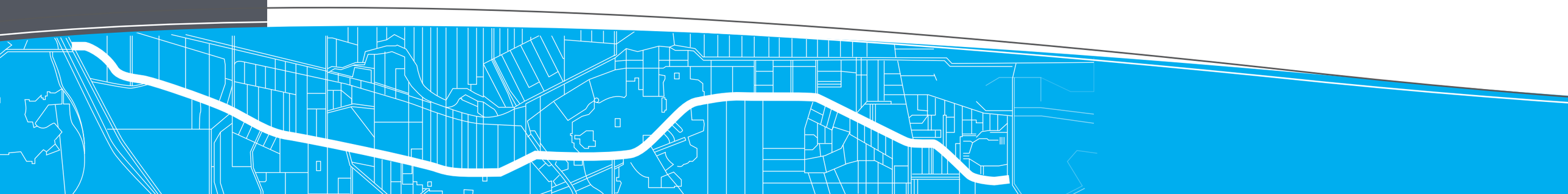
1.4 Study area

The Tramway is a linear reserve closely aligned to Baldivis Road (figure 1.6.1). The scope of this Plan begins at Millar Road in the north and ends at Stakehill Road in the south. Although a future connection south of Stakehill Road may be possible via the proposed regional sporting reserve adjacent to the Kwinana Freeway. The Tramway reserve also extends further north beyond the City of Rockingham, into the cities of Kwinana and Cockburn.

1.5 Tramway reserve history

The City recognises the Nyungar people as the traditional owners of the land that is now known as Baldivis. The Aboriginal heritage of the Tramway will be recognised through ongoing consultation with traditional landowners. Although no registered Aboriginal site intersects the reserve, any interpretive information provided on signage will be designed in consultation with these traditional landowners. All management and use of the reserve is to have due regard to the Aboriginal and European heritage of the area.

The Tramway Reserve was created in the early 1920's as the backbone of a temporary rail network built to enable the development of the Peel Estate by transporting harvested local timbers for use in furniture, building and railway construction out of the region; and the transport of construction and farming materials into the region. The Tramway Reserve stretches from Jandakot in the north (City of Cockburn) and to Karnup in the south (City of Rockingham), providing access to the Group Settlements Scheme Land. Although the Tramway Reserve was created, the rail line itself was never constructed in Baldivis.

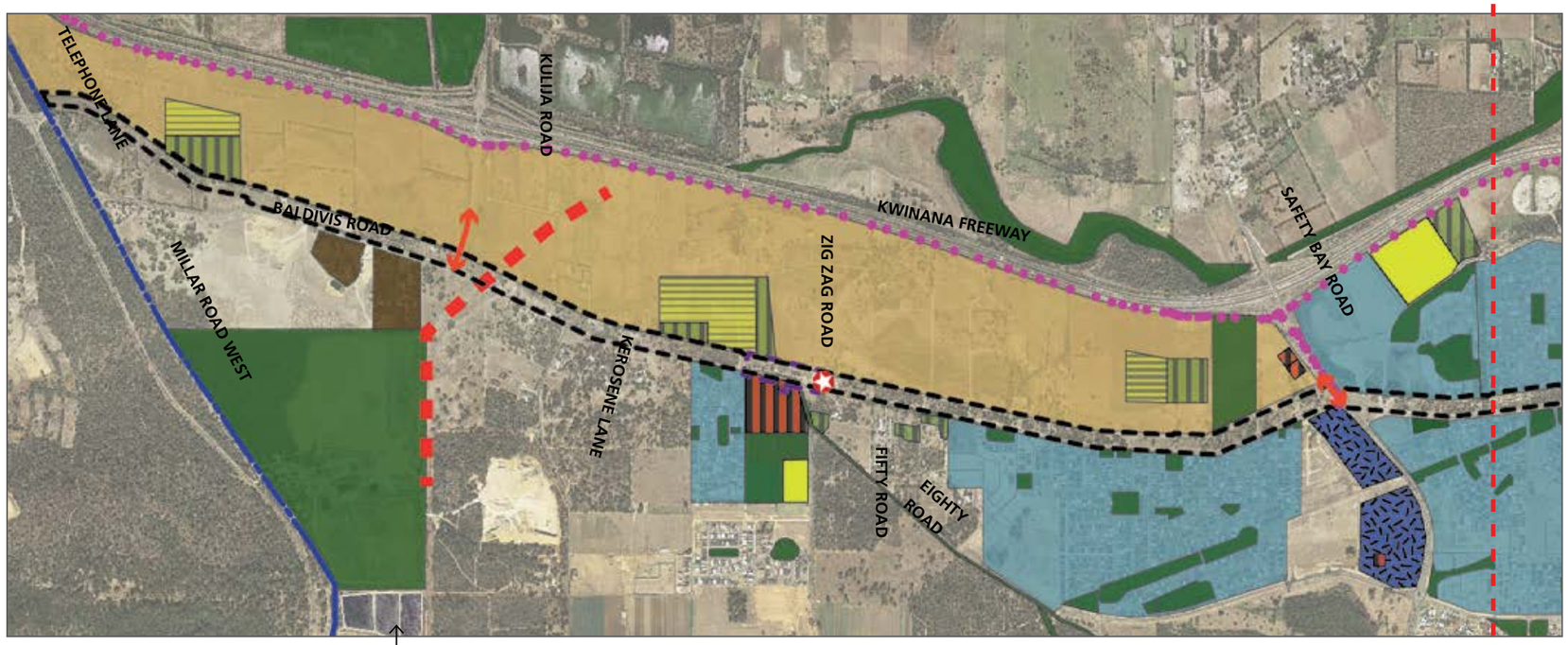


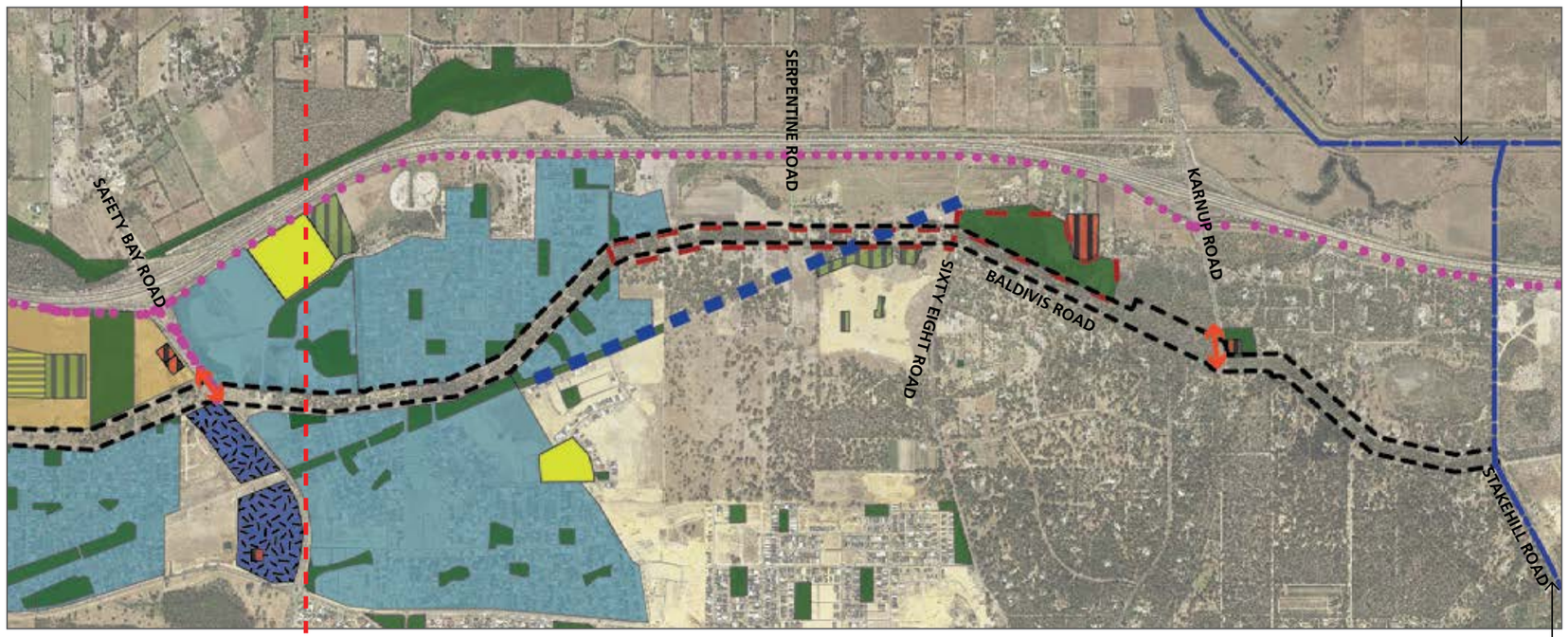
OVERALL SITE CONTEXT MAP

FIGURE 1.6.1

LEGEND

- TRAMWAY ALIGNMENT
- EXISTING RESIDENTIAL DEVELOPMENT
- CITY OF ROCKINGHAM PUBLIC OPEN SPACE
- FUTURE PROPOSED PUBLIC OPEN SPACE
- FUTURE RESIDENTIAL DEVELOPMENT - EAST BALDIVIS STRUCTURE PLAN
- CURRENT SCHOOL FACILITIES
- FUTURE PRIMARY SCHOOL/HIGH SCHOOL
- HERITAGE PRECINCT
- HERITAGE BUILDINGS
- MEMORIAL PARK/CEMETERY
- COMMUNITY FACILITIES (HALL, PLAYGROUND, RECREATIONAL CENTRE)
- CURRENT EXTENT OF BRIDLE TRAIL
- SHOPPING CENTRE
- DAMPIER TO BUNBURY NATURAL GAS PIPELINE CORRIDOR - FUTURE POS CONNECTION
- PARMELIA GAS PIPELINE CORRIDOR - FUTURE POS CONNECTION
- MAJOR ROAD CROSSINGS OVER THE TRAMWAY
- TELSTRA COMMUNICATION BUILDING
- KWINANA FWY PSP





1. INTRODUCTION

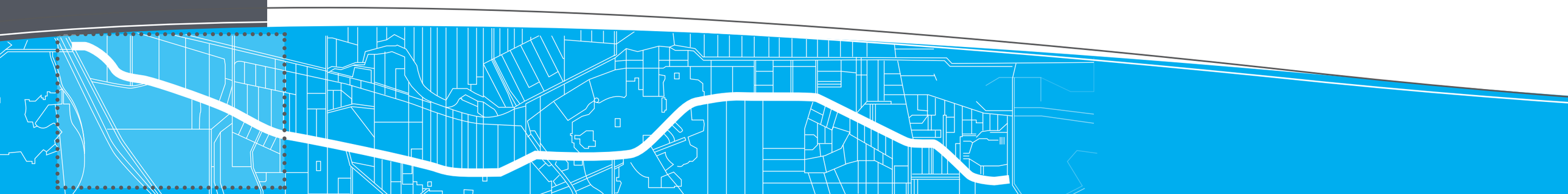
1.6 Social context

The Tramway is situated in a rapidly developing residential area. Traditionally the area has been dominated by rural landscapes, rural-residential landholdings, remnant agricultural properties such as market gardens and significant bush blocks. The current population of Baldivis is approximately 16,000. However it is predicted that this figure will rise to 65,000 by the year 2036. Due to the rapidly increasing residential population in the area, the reserve is currently situated within a broader POS and residential subdivision network which fans out from Baldivis Road. POS near or abutting the Tramway contains a variety of facilities, including playgrounds, BBQs, picnic areas and sporting ovals. Additionally, a number of areas of future POS are proposed in the vicinity of the Tramway. The location of such POS as well as the location of residential subdivisions and various community facilities in the vicinity of the Tramway is depicted in figure 1.6.1. To further meet the needs of an expanding residential population, a boulevard treatment upgrade of Baldivis Road is also proposed.

1.7 Current use

The Tramway is currently being used by surrounding residents for walking, dog exercising, cycling, nature appreciation and horse riding. These activities occur on established DUPs and bridle trails adjoining residential areas from Safety Bay Road to Heritage Park Drive. A network of firebreaks and informal paths are also used, including a small section of mulched path in the southern portion of the Tramway between Lugg Road and Karnup Road that is currently used for walking and nature appreciation. Surrounding residential areas are well supplied with a variety of open space reserves, so current pressure on Tramway facilities is minimal.

In the longer term, it is predicted that the use of the Tramway will increase as population increases. Demand should also increase due to the ability of the Tramway to provide a natural bushland environment for recreation, providing a desirable alternative to the grassed POS reserves that dominate the urban landscape.



STRUCTURE 2.

2. Structure of The Baldivis Tramway Master Plan: Planning Precincts

Through an analysis of environmental, landscape and recreational conditions, the Baldivis Tramway Master Plan has been divided into four planning precincts for the purposes of deriving site specific management actions.

Furthermore, environmental management actions that encompass all four planning precincts were derived from comprehensive ecological surveying. These environmental management actions are concerned with the protection and enhancement of native vegetation through the removal of threatening processes. For more information please refer to the accompanying Baldivis Tramway Environmental Management Plan.

PRECINCT ONE 3.

3. Precinct One

3.1 Site Characteristics

The vegetation in Precinct One is highly degraded, with only small patches of remnant vegetation. The area is prone to seasonal inundation and contains a multiple use category wetland, with few ecological attributes and functions remaining. A number of planned resource enhancement wetlands are located adjacent to the Tramway that, despite being modified, still support substantial ecological attributes and functions. Small localised water bodies are also present within the reserve. Bassendean, Spearwood and Pinjarra soil systems all occur in Precinct One. Mapping of these site characteristics can be found in Section 2 of the Environmental Management Plan.

PRECINCT ONE
3.

OVERALL PRECINCT PLAN PRECINCT ONE

EPHEMERAL WETLAND

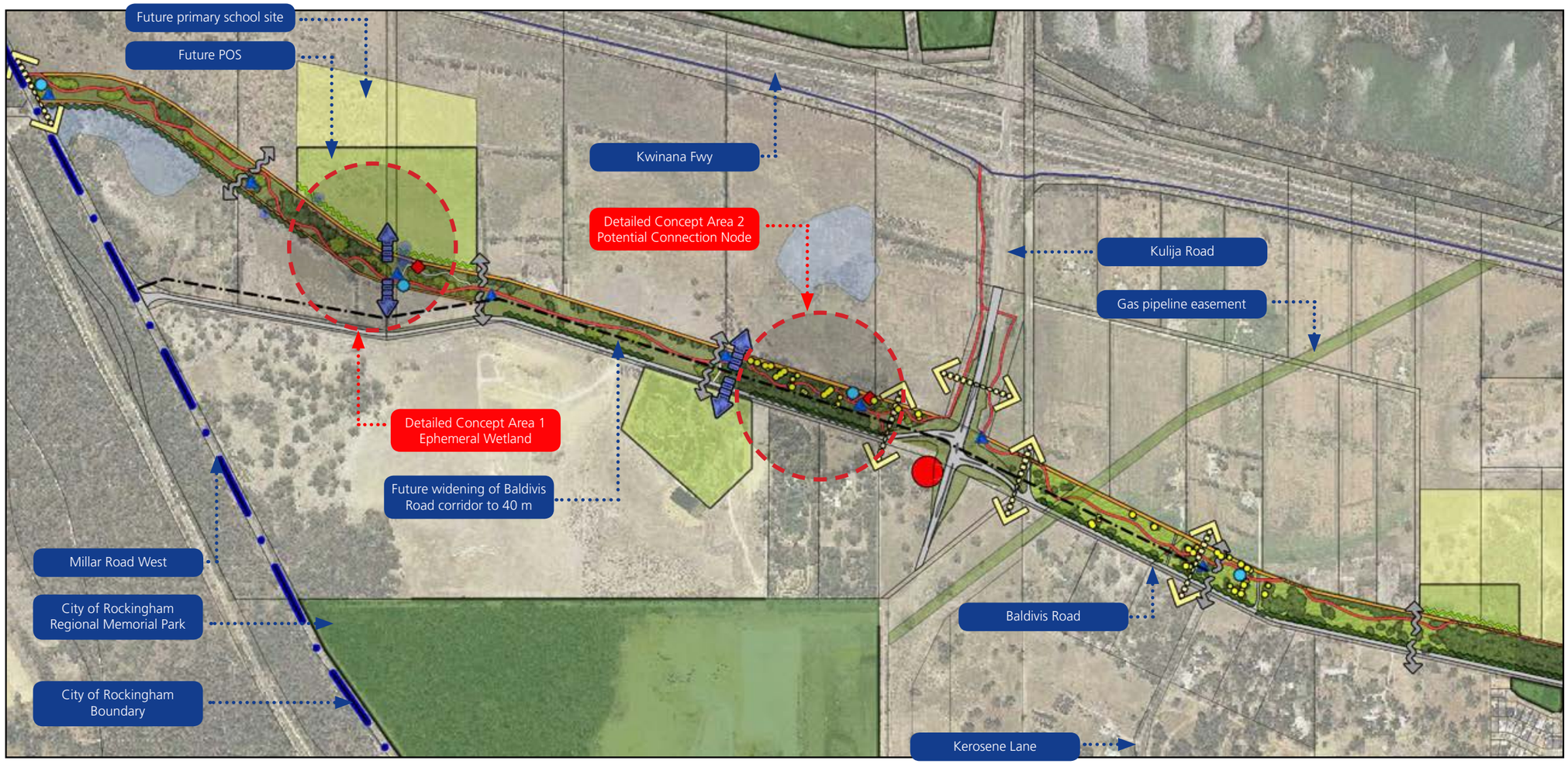
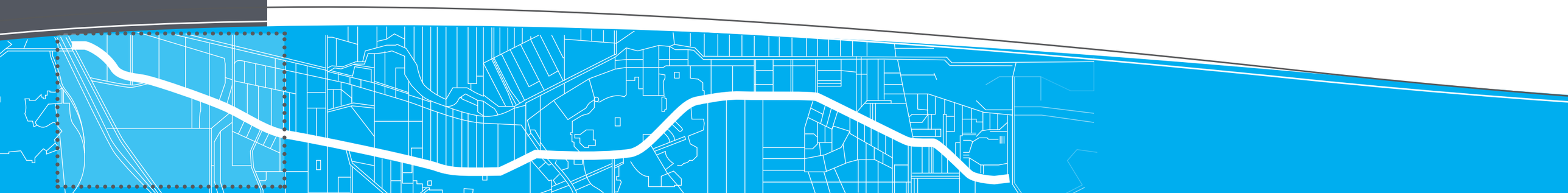


FIGURE 3.1.4

Management Objectives:

- Maintain and protect all existing vegetation
- Manage priority weed species
- Focus revegetation of native species in key feature nodes and primary access points
- Utilise designated offset areas for future revegetation of native species to improve landscape connectivity
- Ensure adequate fire safety measures, such as breaks and slashing
- Establish an integrated DUP network
- Provide a safe pedestrian detour around the Kulija Road intersection
- Create a Wetland Concept Area for nature appreciation and interpretation



PRECINCT ONE
3.

Legend

- Existing Dual Use Path
- Proposed 2.5m Dual Use Path
- Existing Firebreak
- Proposed 4m Firebreak
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- Proposed Bridle Trail
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- Pedestrian Access Points Associated with Road Intersection Interfaces
- Future Neighbourhood Connector Roads to Transect the Tramway
- Rural Fence Treatment to Edge of Tramway. (other edges along Baldivis Road to be lined with timber bollards, treatment for interface with future urban development to depend on treatment of level difference and adjacent amenity unless indicated)
- Soft Edge between Development and Tramway (no walls or fencing)
- Proposed Information/Interpretation Signage
- Proposed Directional Signage
- Proposed 1km Distance Marker
- Remnant Vegetation to be Retained and Protected
- Potential Areas for Revegetation
- Areas Designated for Future Offset Revegetation Planting
- Existing Adjacent POS
- Future Adjacent POS
- Existing Adjacent School Site
- Future Adjacent School Site
- Major Road Junction
- Localised Wet Areas/Water Bodies
- Community Facility
- Shopping Centre
- Bridle Trail Facilities
- Existing Principal Shared Path along Kwinana Fwy
- Existing Telstra Building
- Black Cockatoo Breeding Tree Locations

3.2 GOAL ONE – Sustainable recreation and improved infrastructure (working towards overarching objectives 2 and 4)

Previous agricultural use of the land in Precinct One has left the area highly denuded of vegetation. As such, it was deemed that sustainable recreation through improved infrastructure would be a suitable goal for this precinct. The area is prone to seasonal flooding and contains a number of small wetland areas. As such 'Ephemeral Wetland' was chosen as the theme to reflect the recreational experience proposed in Precinct One.

It is predicted that this precinct will be used for informal recreation due to the future residential development adjoining this area of the Tramway, which is proposed to include a primary school and large areas of POS. Designated access points will provide links to neighbouring development and POS. These primary pedestrian connections are indicated in the overall concept plans for each precinct. The primary connections and location of adjoining development in Precinct One can be seen in figure 3.1.4. The delivery of an integrated network of POS will allow for a variety of sustainable informal recreational opportunities.

Informal recreation activities such as walking and cycling will be encouraged through the provision of a 2.5 m wide concrete DUP. The pathway will be continuous through all four planning precincts and will connect to existing pathway already present within the reserve. The location of the proposed pathway in Precinct One can be seen in figure 3.1.4. It should be noted that the recommended placement of the DUP is to be used as an indicative guide only. The exact placement of the pathway within the reserve should be staked out on site to minimise disturbance to remnant vegetation where possible. The DUP is a crucial infrastructural element as it forms the basis of all proposed recreational opportunities within the reserve. It also provides the opportunity for future connections to existing trails within the Cities of Kwinana and Cockburn.

As indicated in Figure 3.1.4, Baldivis Road could possibly be widened to a 40 m road reserve between Kerosene Lane and Millar Road, claiming a portion of the Tramway. This will need to be taken into consideration during the implementation of proposed landscaping treatments within the Tramway as per this Master Plan, including the placement of the DUP.

Throughout the Tramway the DUP will be complemented by directional and interpretive signage, indicative signage typologies for the Tramway Reserve can be seen in Section 7 of this Plan.

While the DUP will be the primary means of recreation a number of concept areas are also proposed to increase opportunities for unstructured recreation.

PRECINCT ONE
3.

DETAILED CONCEPT PLAN ONE - EPHEMERAL WETLAND

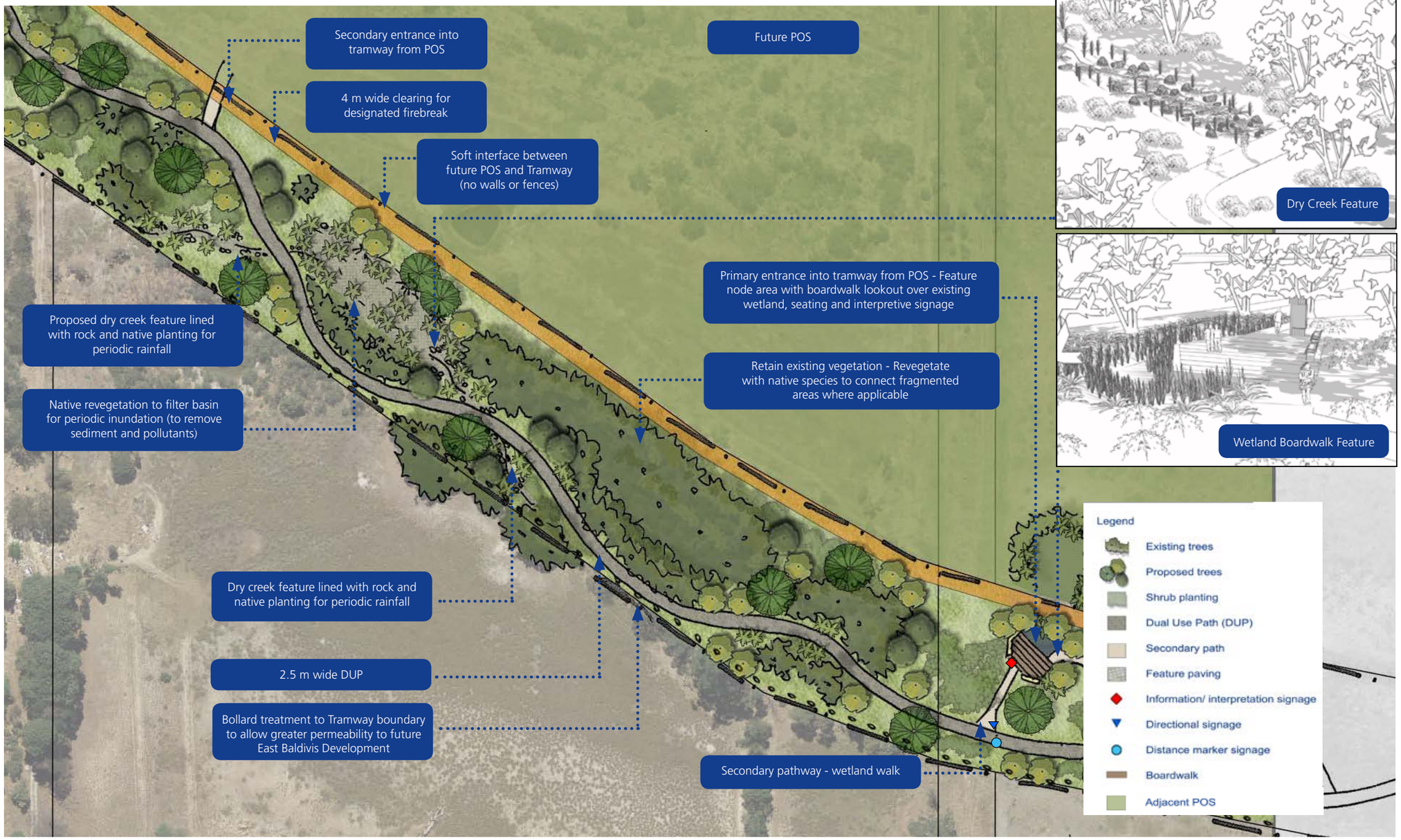
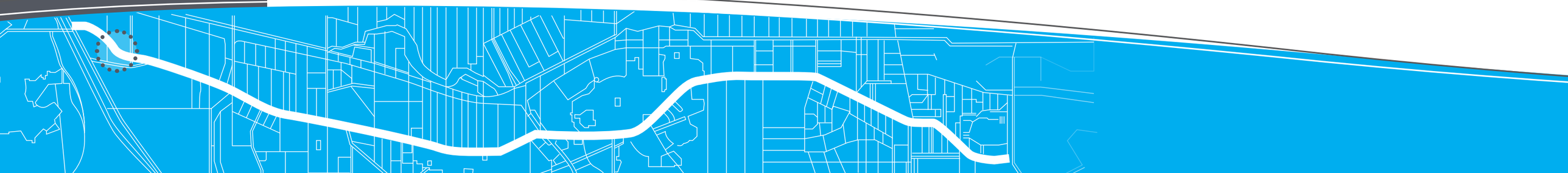


FIGURE 3.2.1



PRECINCT ONE
3.

3.2.1 Proposed Ephemeral Wetland Concept Area

An Ephemeral Wetland Concept Area is proposed for Precinct One to emulate the ephemeral wetland theme of the precinct. The design of this recreational space may incorporate the use of bio detention basins and/or nutrient stripping vegetation to ensure nutrient loading in this area is not increased. Suitable native plant species should be utilised when revegetating the area to attract native birds and provide an aesthetic space for nature appreciation and interpretation. This will be supported by the provision of seating and interpretive signage. The installation of a boardwalk is also desirable to ensure year round recreational use is achievable. These details can be seen in Figure 3.2.1.

A dry creek feature with large boulders and native vegetation will also be incorporated into Precinct One, functioning as an aesthetic interactive element for nature-based play. The location and design of the dry creek feature can be seen in figure 3.2.1.

Due to the sheer size of the Tramway it is not feasible to revegetate the entire reserve. Rather, revegetation of native species will be focused in key concept area nodes and primary access points, such as the Wetland Concept Area. Proposed planting in concept area one can be seen in figure 3.2.1. In areas where revegetation does occur it will also be necessary to undertake weed control to maximise chances of vegetation survival. The recommended planting palette of suitable species should guide revegetation. For further information regarding the planting palette, revegetation and weed control please refer to the Environmental Management Plan that supports this Master Plan document.

3.3 GOAL TWO – Providing suitable revegetation and ecological restoration areas to provide offsets for external development (working towards overarching objective 1)

The denuded nature of the vegetation in Precinct One and Two of the Tramway renders them suitable for potential ecological restoration and revegetation projects. Currently a number of corporations have expressed interest in utilising sections of the Tramway to undertake revegetation as a means of offsetting clearing for external development. The location of proposed offsetting areas can be seen on overall concept plans for Precincts One and Two (figure 3.1.4 and 4.1.4).

Although amenable to outside parties undertaking revegetation works within the reserve, the City would like to have a coordinated approach to possible offsetting projects within the Tramway. Any future offsetting areas will be chosen with due regard to this plan and the proposed landscaping treatments. Ecological surveying information will also be used to determine the most appropriate location and species composition for revegetation/restoration programs. For further information regarding the utilisation and management expectations of these offset areas please refer to the Baldivis Tramway Environmental Management Plan that supports this Master Plan document.

3.4 GOAL THREE – Identify pedestrian traffic management solutions at major road crossings to ensure user safety (working towards overarching objective 5)

The intersection of major roads through the Tramway poses a significant management issue for both user safety and pathway continuity. The location where the Kulija Road extension will intersect the Tramway can be seen in Figure 3.1.4. When the road extension is complete, it is expected to be a heavily trafficked dual carriage way with a 70-80 km/h speed limit, acting as a major arterial road for trucks transporting goods to the Rockingham and Kwinana Industrial Area.

Furthermore, it is proposed that the Kulija Road and Baldivis Road intersection may be elevated. As such, it is not expected to be feasible for pedestrians to cross at the intersection. Rather, the DUP will direct pedestrians along Kulija Road to a safer crossing point and lead pedestrians back to the Tramway on the other side. The location of the DUP and proposed crossing point can be seen in figure 3.1.4. Signage will be utilised along the DUP to direct pedestrians to the crossing point as well as along Kulija Road to notify motorists of pedestrians crossing. The creation of a median strip for pedestrian refuge should also be investigated in conjunction with Main Roads.

3.5 Management Actions for Precinct One

TABLE 3.5.1

	Precinct One Management Actions	Priority
1	Construct 2.5 m wide concrete DUP	High
2	Install directional, regulatory and interpretive signage	Medium
3	Liaise with future developers adjoining the Tramway regarding interface treatments	Ongoing
4	Maintain and protect all existing vegetation	High
5	Manage priority weed species	High
6	Focus revegetation of native species in key concept area nodes and primary access points	High
7	Utilise designated offset areas for future revegetation of native species to improve landscape connectivity	Ongoing
8	Ensure adequate fire safety measures, such as breaks and slashing	High
9	Establish an integrated DUP network with the Kwinana Fwy Principle Shared Pathway (PSP) and future Gas Pipeline POS	Medium
10	Provide a safe pedestrian detour around the Kulija Road intersection	High
11	Create an Ephemeral Wetland Concept Area for nature appreciation and interpretation	Medium

Please see the accompanying Baldivis Tramway Environmental Management Plan for specific information regarding environmental management objectives and actions.

4. Precinct Two

PRECINCT TWO
4.

4.1 Site Characteristics

The vegetation in Precinct Two is primarily degraded cleared pasture, encompassing small pockets of remnant vegetation types consistent with the Karrakatta and Serpentine River complexes. Potential revegetation offset areas exist in this precinct. A localised water body occurs within the Tramway, with portions of the precinct classified as a Multiple Use Category Wetland, with few ecological attributes and functions remaining. The Tramway in Precinct Two is composed entirely of Spearwood soil classification, with low nutrient export, water logging and erosion risk. Mapping of these site characteristics can be found in Section 2 of the Environmental Management Plan.

PRECINCT TWO

OVERALL PRECINCT PLAN PRECINCT TWO

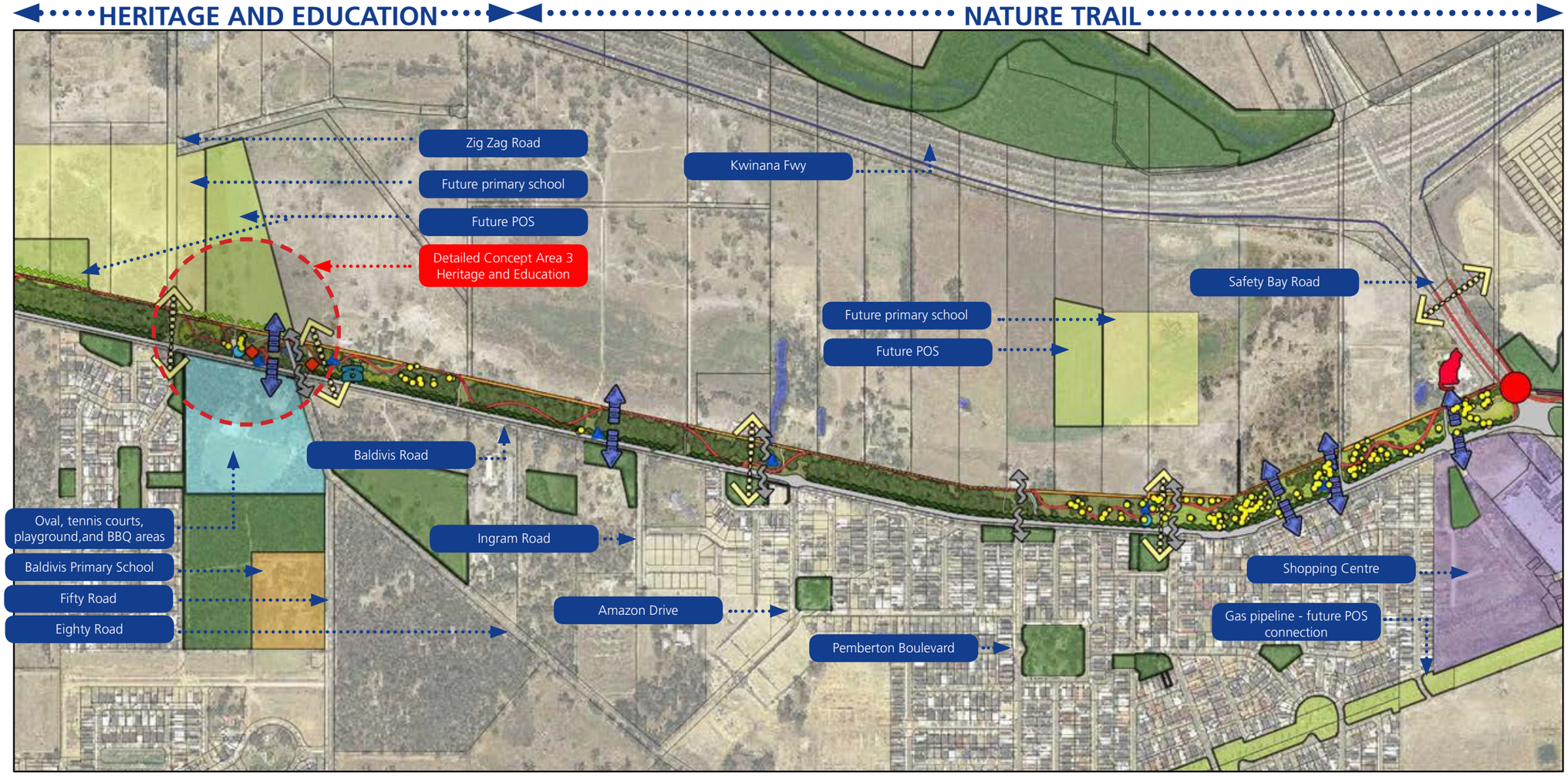
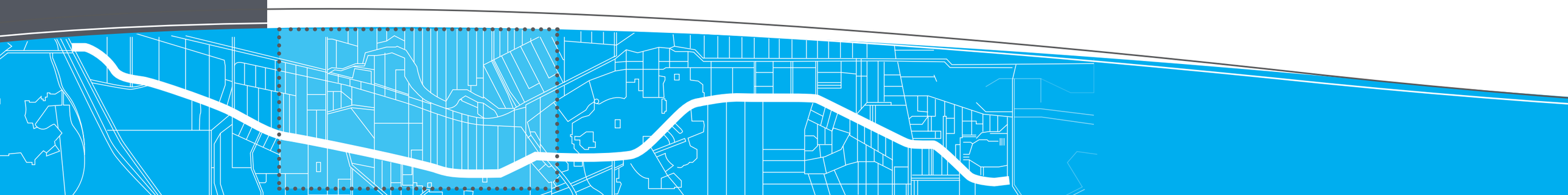


FIGURE 4.1.4

Management Objectives:

- Maintain and protect all existing vegetation, utilising firebreak for DUP where possible to minimise fragmentation
- Manage priority weed species
- Focus revegetation of native species in key feature nodes and primary access points
- Utilise designated offset areas for future revegetation of native species to improve landscape connectivity
- Provide potential solutions to manage the interface between the Tramway and residential development
- Ensure adequate fire safety measures, such as breaks and slashing
- Establish an integrated DUP network
- Provide a safe pedestrian detour around the Safety Bay Road intersection
- Create a Heritage Concept Area adjacent to old Baldivis School site with unique interactive and interpretive playscapes based on settlement era period



4. PRECINCT TWO

Legend

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- Existing Telstra Building
- Black Cockatoo Breeding Tree Locations

4.2 GOAL FOUR – Managing the interface between the Tramway and neighbouring residential development (working towards overarching objective 3)

Areas surrounding Precinct One and Two are currently undergoing extensive residential development as depicted in the Social Context Mapping (figure 1.6.1). Accordingly, any residential development that abuts the Tramway should strive for an interface that optimises aesthetic amenity, landscape continuity and user safety.

This is particularly important for the interface between the Tramway and any POS in the adjoining subdivision. These areas should be managed to enhance recreational experiences and landscape usability. An example of preferred interface treatments to maximise these objectives can be seen in figures 4.2.1, 4.2.2, 4.2.3, 4.2.4 and 4.2.5.

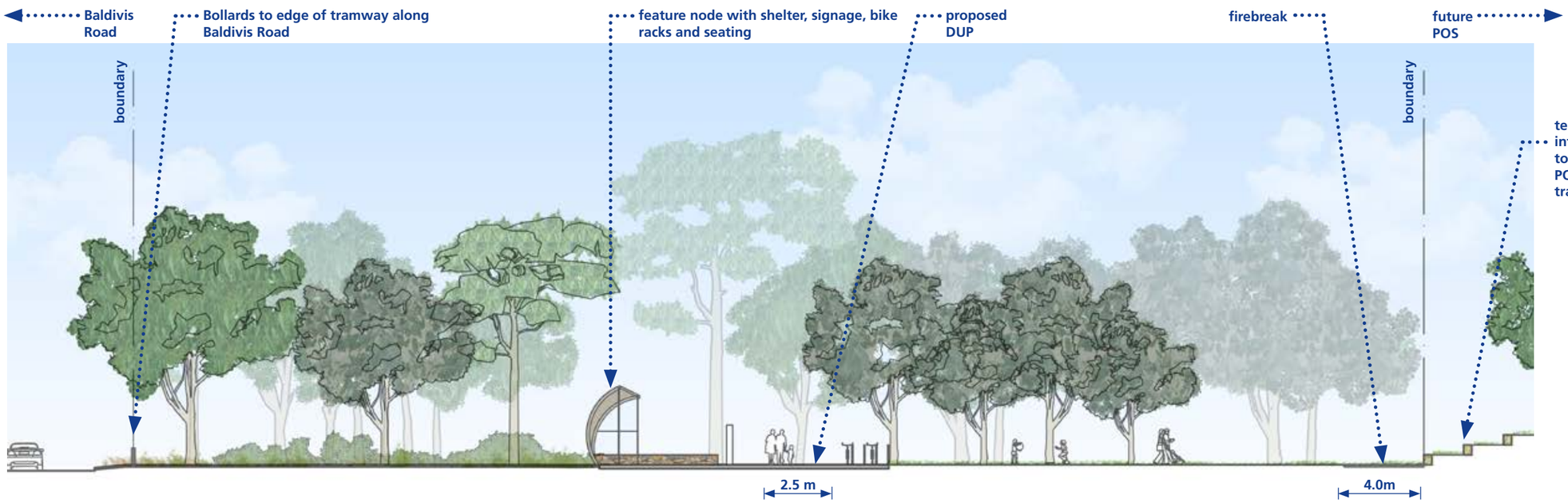


FIGURE 4.2.1 INDICATIVE SECTION A - SOFT INTERFACE WITH ADJACENT DEVELOPMENT - TERRACING DOWN POS

NOTE: Sections indicate mature tree planting 5-10 years following installation

4. PRECINCT TWO

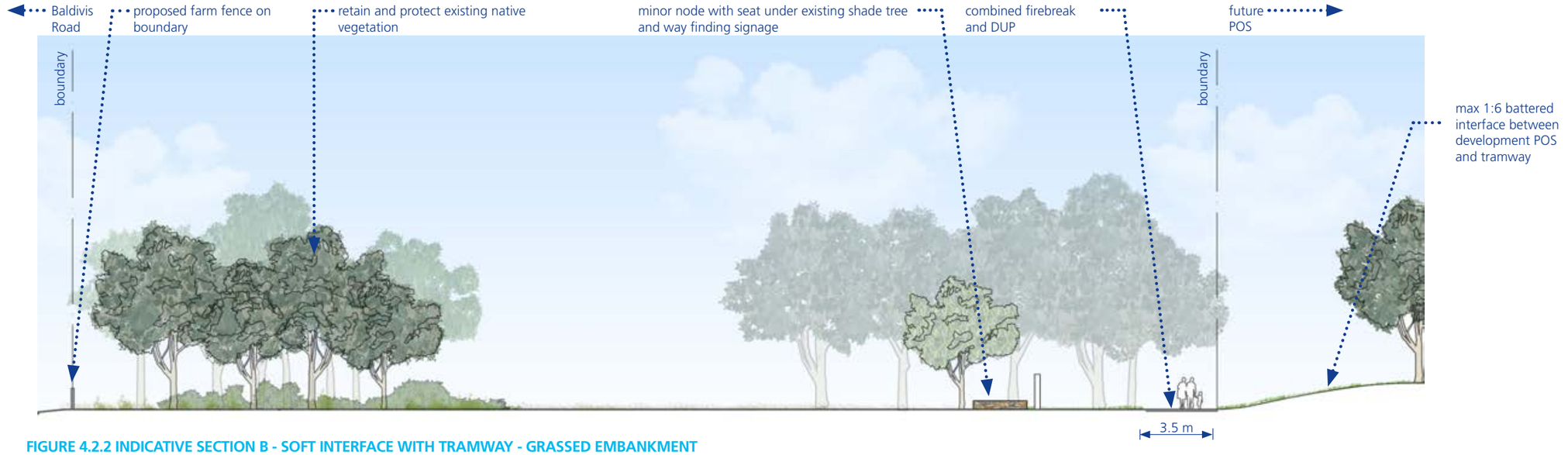


FIGURE 4.2.2 INDICATIVE SECTION B - SOFT INTERFACE WITH TRAMWAY - GRASSED EMBANKMENT

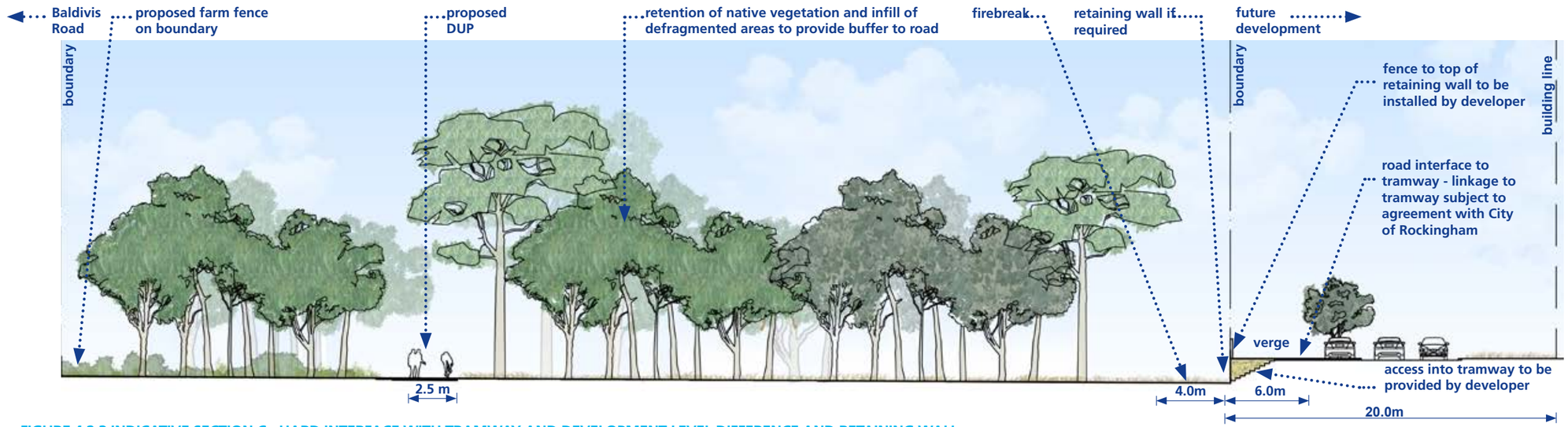
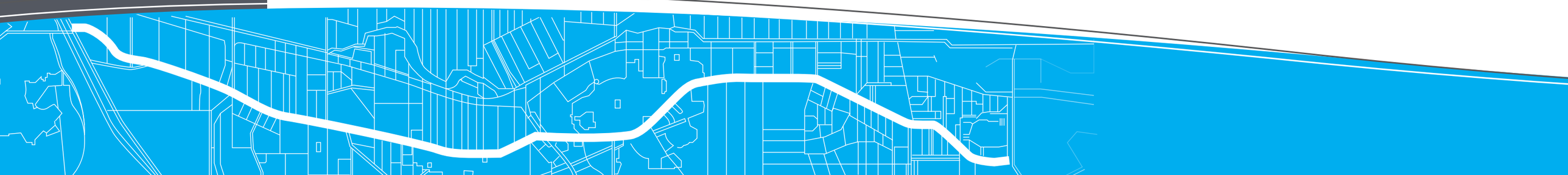


FIGURE 4.2.3 INDICATIVE SECTION C - HARD INTERFACE WITH TRAMWAY AND DEVELOPMENT LEVEL DIFFERENCE AND RETAINING WALL



4. PRECINCT TWO

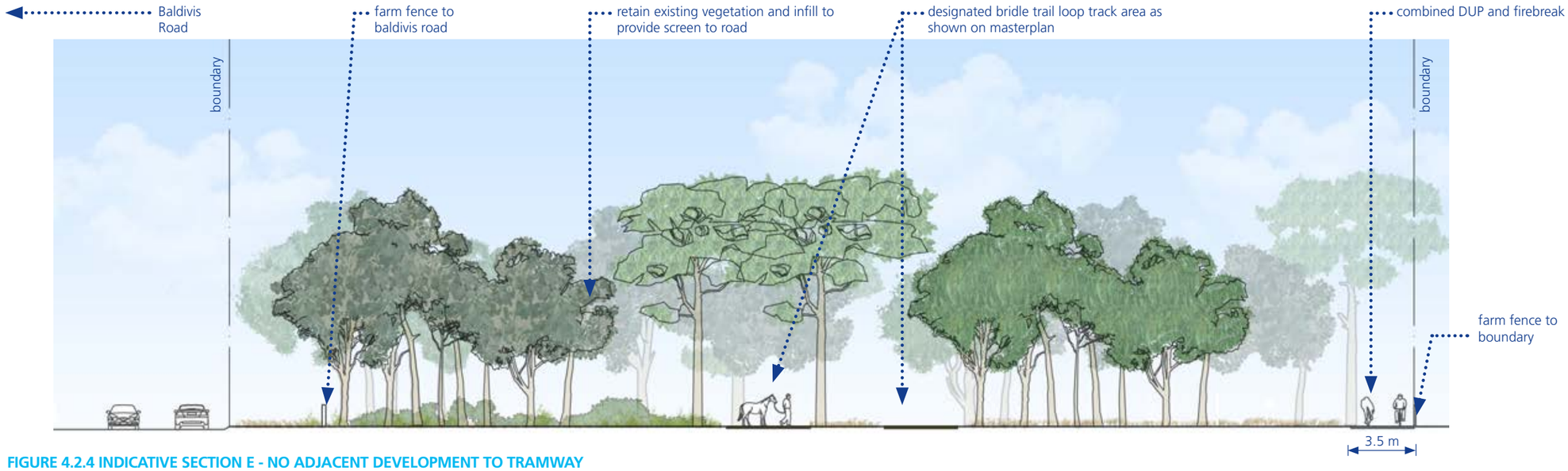


FIGURE 4.2.4 INDICATIVE SECTION E - NO ADJACENT DEVELOPMENT TO TRAMWAY

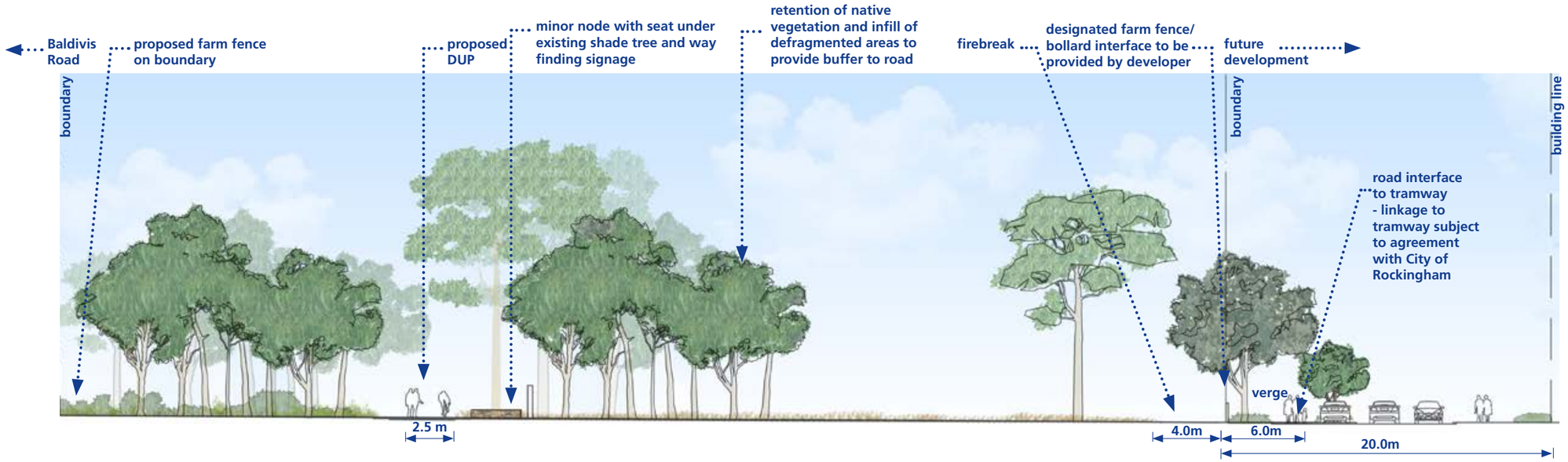


FIGURE 4.2.5 INDICATIVE SECTION D - NO LEVEL DIFFERENCE BETWEEN TRAMWAY AND ADJACENT DEVELOPMENT

NOTE: Sections indicate mature tree planting 5-10 years following installation

PRECINCT TWO

DETAILED CONCEPT PLAN TWO - POTENTIAL CONNECTION NODE

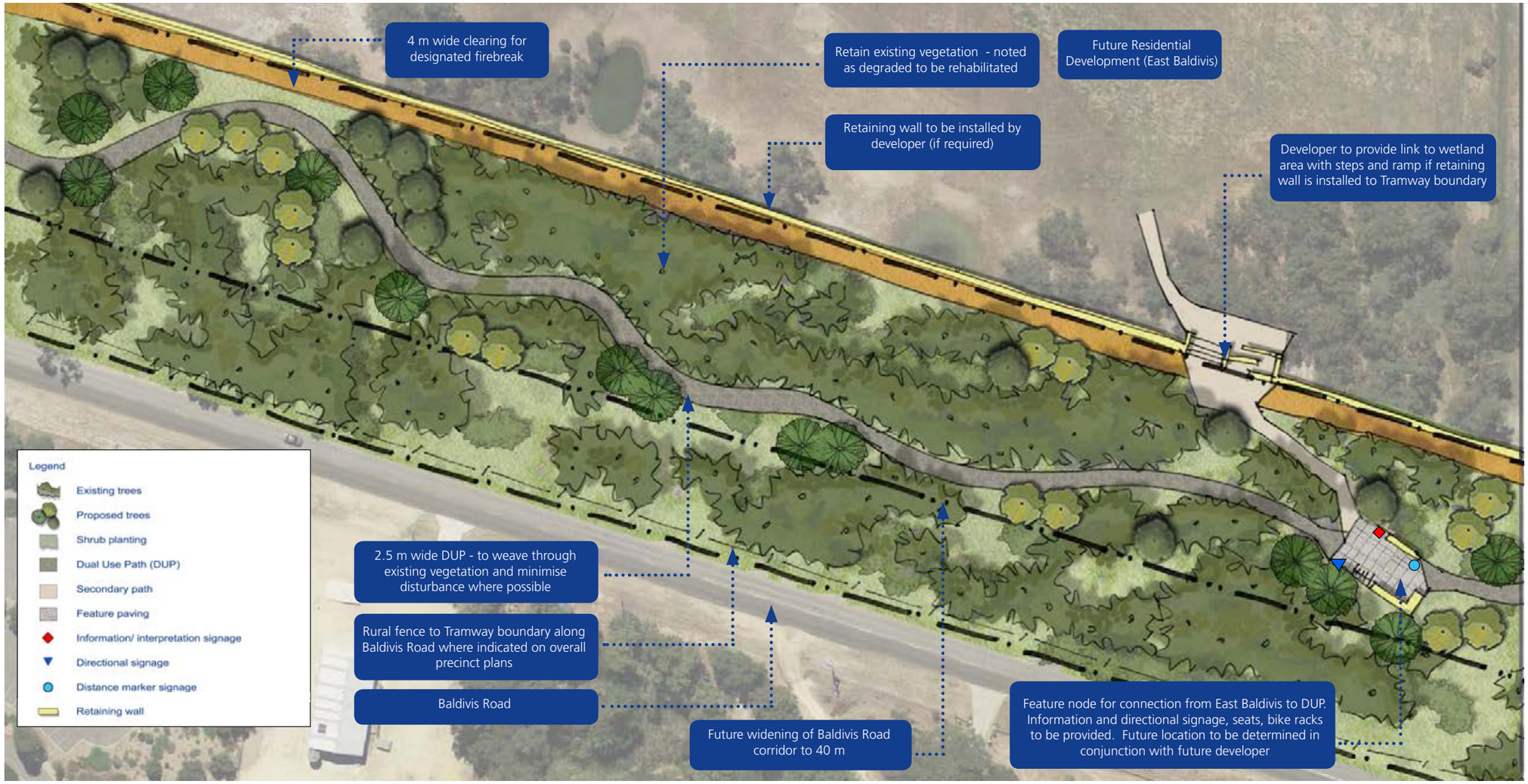
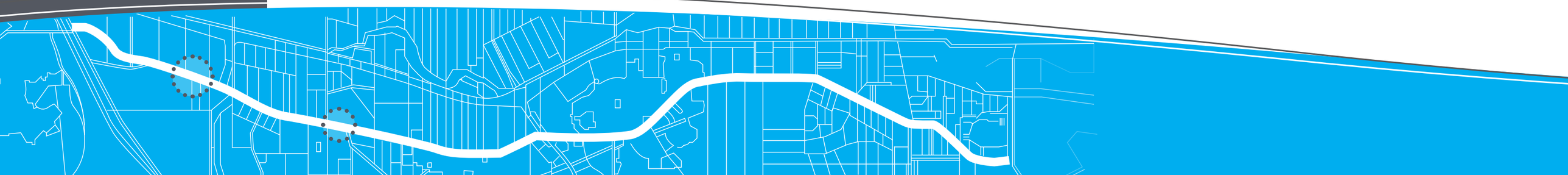


FIGURE 4.2.6

The City recognises that in some instances it is necessary for developers to raise their landholdings using imported fill to improve stormwater drainage and enable residential development. This may result in a vertical separation of up to 2 m between the edge of the Tramway and the adjoining landholding. Management of this may require soil retention, either by hard wall edge or graded separation.

A hard wall edge does not support the desirable objective of a soft interface between the reserve and residential development, nor does it support the recreational objectives of the reserve. As such, the City strongly discourages developers from using hard interface elements such as retaining walls.
Raising and retaining the level of adjoining development not only causes concern for reserve frontage but has the potential to create an artificial low in the Tramway resulting in drainage issues. Alternatively, the City proposes buffer areas between the reserve and neighbouring subdivisions, with the inclusion of terraced steps to overcome raised lots. These buffers can be vegetated to act as an aesthetic and usable landscape feature. The inclusion of a buffer also ensures that runoff, discharge or other pollutants into the reserve from the subdivision is minimised. An example of this treatment can be seen in indicative section B in figure 4.2.2.

Such interface treatments to overcome raised lots are the responsibility of the developer and should be incorporated into the residential subdivision landscape plan. They should not be situated within the Tramway reserve. It is the City's expectation that the developer will also be responsible for the mitigation of



drainage issues within the Tramway, should the developer's raised landholdings create an artificial low in the reserve. Furthermore, the City expects that any stormwater generated in adjoining subdivisions will be retained within developer's landholdings as per the Planning and Development Act (2005).

It is also expected that the developer include appropriate areas of road reserve and grassed POS abutting the Tramway with due consideration for fire safety requirements, in accordance with the Fire and Emergency Services Act (1998) and the *Planning for Bushfire Protection Guidelines* (2010). For more information regarding fire safety and preferred treatment scenarios for future developments adjoining the Tramway, please refer to Goal Ten (section 6.3).

4.3 GOAL FIVE – Increase community involvement and educational opportunities through provision of a heritage precinct (working towards overarching objectives 1 and 2)

The Tramway has strong links to European heritage and early settlement in Baldivis, consequently 'Heritage and Nature Based Play' was chosen as the theme to encompass the recreational experience proposed in Precinct Two. An important focal point for the interpretation of heritage in the area is the old Baldivis School building, which is located close to the Tramway. The building has been registered on the City's Municipal Heritage Register and is dated from the interwar period. It was built as part of the Group Settlement Scheme that helped populate Baldivis in this era. The heritage building can be seen in figure 4.3.2.

DETAILED CONCEPT PLAN THREE - HERITAGE, EDUCATION AND NATURE BASED PLAY

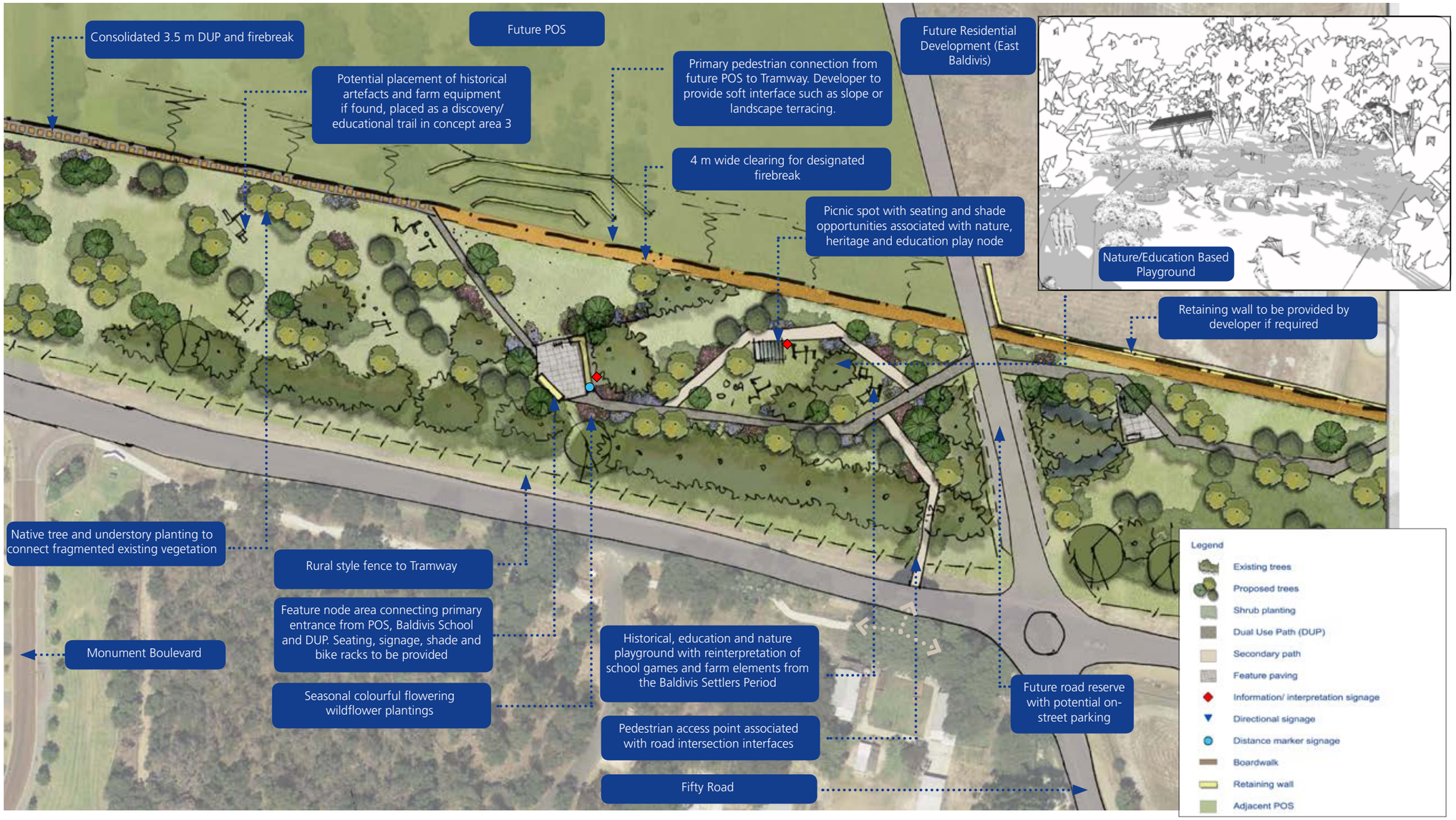


FIGURE 4.3.1

PRECINCT TWO

FIGURE 4.3.2

The location of the Heritage and Nature Based Play Concept Area within the Tramway can be seen in figure 4.1.4 and a detailed design of the concept area can be seen in figure 4.3.1. The Heritage Precinct will incorporate a number of nature based play elements, designed to allow children to interact with the natural environment by using materials such as timber, stone and sand. The nature based play area will be accompanied by interpretive signage to enhance the educational potential of the area. If any historical artefacts or pieces of old farm equipment are found within the reserve, they will be placed in this precinct as an additional educational heritage feature.

Situated adjacent to the proposed play area will be an assortment of native flowering species. This native flowering display area will not only provide an aesthetic landscape feature but, with the support of interpretive signage, may also encourage individuals to plant native species in their own gardens. This has positive flow-on effects by helping reduce habitat fragmentation, providing small ecological links for birds and other species in an urban environment. Furthermore, native plants are generally lower maintenance and more water wise than many introduced garden species. As the vegetation in this node is significantly denuded, revegetation of native trees and shrubs will also occur. This will be complemented with weed management. Water may be required for ongoing maintenance. Any remnant native vegetation will be retained and incorporated into landscape designs for the area. Please refer to the Baldivis Tramway Environmental Management Plan that accompanies this Master Plan for more information.

The location of this concept area not only provides strong links to the Baldivis Heritage buildings, but also to current and future community facilities and a district sporting POS. This is indicated in figure 1.6.1 and 4.1.4. A significant focus of this concept area is to provide appropriate connection points to the POS and facilities on either side of the Tramway to support recreational and community involvement objectives of the precinct. This will be achieved through a specific connection node within the precinct containing seating and interpretive signage acting as a central meeting point with connecting pathways to the north, south, east and west. A designated crossing point and signage will be employed to ensure a safe connection for users crossing Baldivis Road. The location of this crossing point is depicted in Figure 4.3.1. The developer to the east of the Tramway is encouraged to retain a soft interface with the Tramway to maintain landscape connectivity and recreational capacity of the area.

4.4 GOAL SIX – Ensuring a continuous path network throughout the reserve that allows for a trail-based sustainable recreation experience (working towards overarching objectives 2 and 4)

As with Precinct One, recreational opportunities for Precinct Two are predominately informal recreational activities such as walking and cycling, based around the DUP. Currently, approximately 2.4 km of formalised concrete pathway is already constructed in Precinct Three. The location of the proposed DUP in Precinct Two can also be seen in figure 4.1.4. The pathways in this precinct will connect to those in other precincts in order to establish a continuous path network throughout the Tramway. This is critical to ensure the provision of a sustainable trail-based recreation experience for users.

Similar to Precinct One, Precinct Two requires pedestrian traffic management solutions for the provision of a safe crossing and continuous path network at Safety Bay Road, where a busy dual carriage roundabout exists. It is proposed that the DUP will connect to the current PSP that exists along Safety Bay Road, directing pedestrians to the underpass near the Kwinana freeway, with a DUP on the other side of Safety Bay Road to connect back into the Tramway. Although this is a relatively lengthy detour, it offers a low risk option for pedestrians who do not feel comfortable crossing the busy road, such as those travelling with children. There is currently a median refuge on Safety Bay Road offering a more direct crossing point for confident users. Signage will be used to caution motorists and pedestrians of the crossing. The detour of the DUP and proposed crossing points can be seen in figure 4.1.4.

In addition to the intersection of major roads, there are a number of smaller roads and driveways that traverse the Tramway. At these locations, subtle yet informative signs with small arrows will direct pedestrians and cyclists to the continuation of the DUP. These directional signs will also serve to notify users of a break in the DUP, prompting the user to exercise caution when traversing the road or driveway.

The City will liaise with property owners whose driveways pass through the Tramway regarding the installation of a DUP within the reserve. Property owners will be reminded to exercise caution and drive slowly along driveways to ensure pedestrian safety. Furthermore, the development of a continuous path network may require the removal of some personal property from the reserve.

While the DUP will connect the proposed concept areas within the Tramway, it is important that the concept areas do not obstruct the continuity of the pathway. At Kulija Road and Safety Bay Road the DUP will connect to the existing PSP along the Kwinana Freeway, forming an integrated cycle network. Furthermore, the existing gas pipeline in Precinct One will become future POS and will provide an aesthetic and functional link from the Tramway to the PSP. In Precinct 3 the DUP will connect to the Parmelia Gas Pipeline Corridor, which has been developed as POS. This offers an alternate route for pedestrians and cyclists to access the Stocklands Shopping Centre community hub.

Major ingress and egress points along the proposed DUP network within the Tramway can be seen on the overall concept plans for all four precincts (figures 3.1.4, 4.1.4, 5.1.1 and 6.1.1).

4.5 Management Actions for Precinct Two

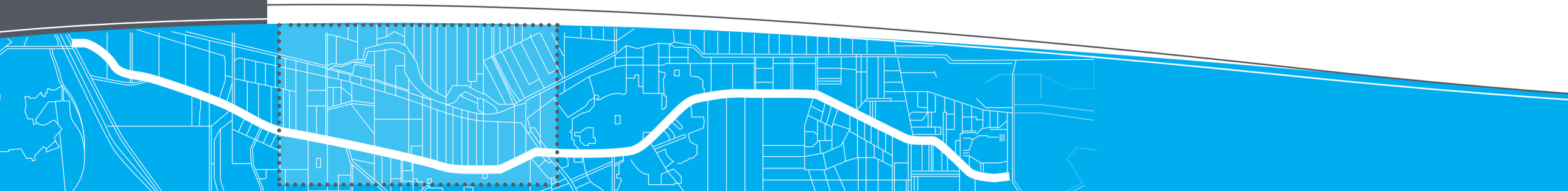
TABLE 4.5

	Precinct Two Management Actions	Priority
12	Construct 2.5 m wide concrete DUP	High
13	Install directional, regulatory and interpretive signage	Medium
14	Liaise with future developers adjoining the Tramway regarding appropriate interface treatments	Ongoing
15	Maintain and protect all existing vegetation	High
16	Manage priority weed species	High
17	Focus revegetation of native species in key concept area nodes and primary access points	High
18	Utilise designated offset areas for future revegetation of native species to improve landscape connectivity	Ongoing
19	Ensure adequate fire safety measures, such as breaks and slashing	High
20	Establish an integrated DUP network with the Kwinana Fwy PSP	Medium
21	Provide a safe pedestrian detour around the Safety Bay Rd intersection	High
22	Create a Heritage and Nature Based Play Concept Area adjacent to old Baldivis School site with unique interactive and interpretive playscapes	Medium

5. Precinct Three

5.1 Site Characteristics

Precinct Three contains good quality remnant vegetation, primarily Karrakatta vegetation complex and a number of different plant communities. The soil comprises both the Bassendean and Spearwood soil classifications. While a Multiple Use Category Wetland and localised water bodies are located near the Tramway, no wetlands occur within the reserve in this precinct. Mapping of these site characteristics can be found in Section 2 of the Environmental Management Plan.



OVERALL PRECINCT PLAN PRECINCT THREE

NATURE TRAIL

BRIDLE TRAIL

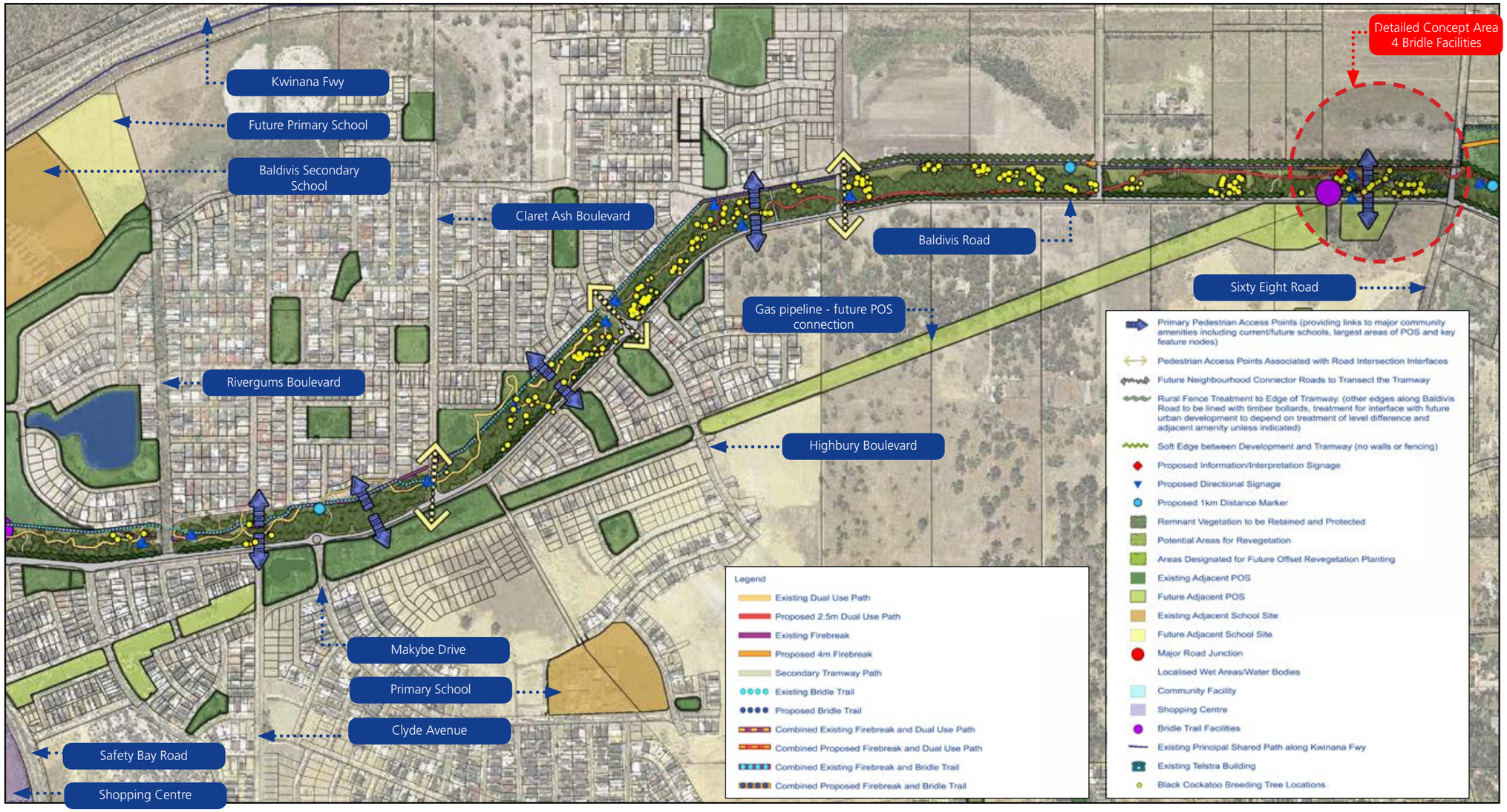


FIGURE 5.1.1

Management Objectives:

- Maintain and protect all existing vegetation, utilising firebreak for bridle trail where possible to minimise fragmentation
- Manage priority weed species
- Rehabilitation of remnant bushland to improve vegetation condition
- Maintain existing network of pathways along the Rivergums estate and provide connection to wider path network
- Ensure adequate fire safety measures, such as breaks and slashing
- Provide designated bridle trail area with horse float and horse tie up facilities
- Connect bridle node with existing bridle trails to provide a continuous trail network from Baldivis Equestrian and Pony Club to Rivergums estate
- Separate bridle tail from DUP to prevent conflict of use and ensure user safety

5. PRECINCT THREE

DETAILED CONCEPT PLAN FOUR - BRIDLE FACILITIES

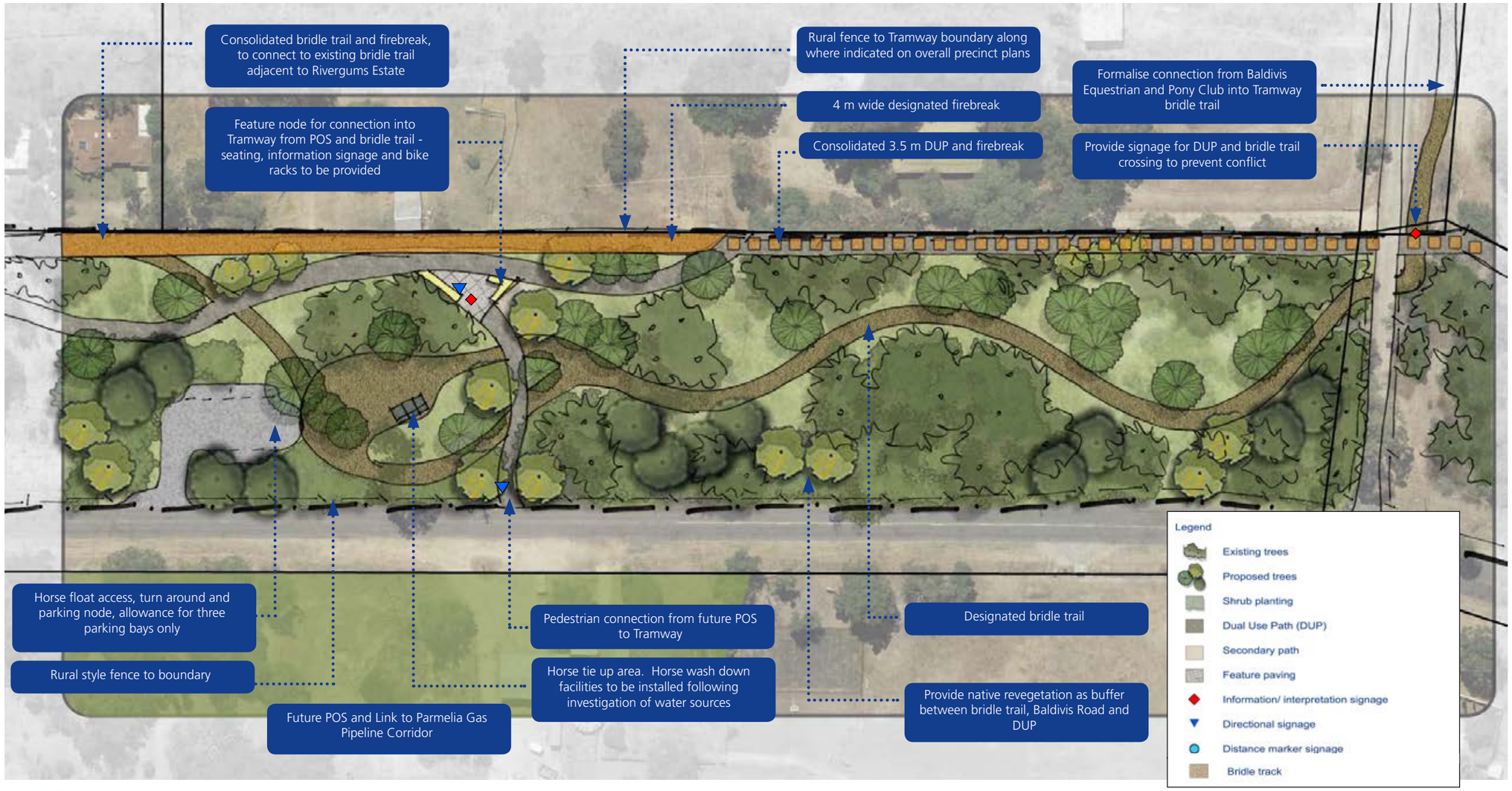


FIGURE 5.2.1

5. PRECINCT THREE

5.2 GOAL SEVEN - Improving horse riding facilities without impacting on other management objectives (working towards overarching objectives 2, 4 and 5)

Horse riding has been identified as an important component of the Baldivis Tramway path network. It is proposed that the bridle trail be extended from the Baldivis Equestrian and Pony Club to connect with the existing bridle trail adjacent to the Rivergums estate. The proposed bridle trail extension will not continue into Precinct Two north of Safety Bay Road. The proposed trail will be 3 m - 4 m wide with a crushed limestone surface (or similar), allowing the bridle trail to double as a firebreak where possible.

The provision of sustainable horse riding trails has to be balanced with environmental conservation objectives and the safety and access concerns of all trail users. Horse riders will not be permitted to enter bushland areas and, through the use of signage, will be encouraged to stay on established bridle trails. Enabling the bridle trail to act as a firebreak where possible will minimise habitat fragmentation through good quality remnant bushland. Maintaining conservation objectives is particularly important in Precinct Three as bushland rehabilitation measures are to be implemented in the area, as detailed in the Baldivis Tramway Environmental Management Plan.

5.2.1 Proposed Bridle Facilities Concept Area

The extension of existing bridle trails is expected to increase the frequency of horse riding within the reserve. Detailed Concept Plan Four outlines a proposed Bridle Facilities Concept Area to provide horse owners with a designated area to access the bridle trail and tie up their horses. The creation of specific bridle facilities minimises the risk of conflict between horse riders and other reserve users. The bridle facilities concept area will contain seating, interpretive signage, shade and tie up facilities. There is also the potential for a small number of car and horse float parking bays within the concept area, the development of which will be subject to future approval.

5.3 GOAL EIGHT – Managing conflicting uses of the reserve and conflicting objectives of trail users (working towards overarching objectives 1 and 5)

The DUP will be used for a variety of different recreational activities. These conflicting uses must be effectively managed to ensure equity and safety of all reserve uses. As Section Three is currently the most frequented section of the Tramway, interpretive, directional and regulatory signage should be installed in this area as a priority. An example of interpretive signage design for this section can be seen in Section 7 of this Master Plan.

To support the overarching objective to conserve the natural environment of the Tramway, it should be classified as a 'dog on lead only' reserve. To ensure responsible dog ownership, 'dog on lead' and 'pick up faeces' signs will be situated at major pedestrian access points, to be complemented with the provision of dog bins and bags where practical.

Where horses are present in Precinct Three and Four, the DUP will be kept separate from the bridle trail where possible. In areas where the DUP must intersect with the bridle trail, signage will be used to caution users. The provision of a specific bridle facilities node in Precinct Three will offer a safe area for horses to be tied up where they are separated from the DUP, minimising the risk of conflict between horses and other reserve users.

The variety of recreational experiences available to users in each precinct allows the Tramway reserve to cater to the varying objectives of trail users. Throughout the reserve, opportunities for walking, cycling, horse riding, play, interpretation, education, conservation and nature appreciation exist. The establishment of key concept areas and a designated DUP and bridle trail helps to manage conflict between users and their objectives.

5.4 Management Actions for Precinct Three

TABLE 5.4.1

	Precinct Three Management Actions	Priority
23	Maintain existing network of pathways along the Rivergums estate and provide connection to wider path network	High
24	Install directional, regulatory and interpretive signage	Medium
25	Maintain and protect all existing vegetation	High
26	Manage priority weed species	High
27	Rehabilitation of remnant bushland to improve vegetation condition	High
28	Ensure adequate fire safety measures, such as breaks and slashing	High
29	Establish an integrated DUP network with the Parmelia Gas Pipeline POS	Medium
30	Utilise firebreak for bridle trail where possible to minimise fragmentation	High
31	Create a Bridle Facilities Concept Area with horse float and horse tie up facilities	Medium
32	Connect Bridle Facilities Concept Area with existing bridle trails to provide a continuous trail network from Baldivis Equestrian and Pony Club to Rivergums estate	High

PRECINCT FOUR

6.

OVERALL PRECINCT PLAN PRECINCT FOUR

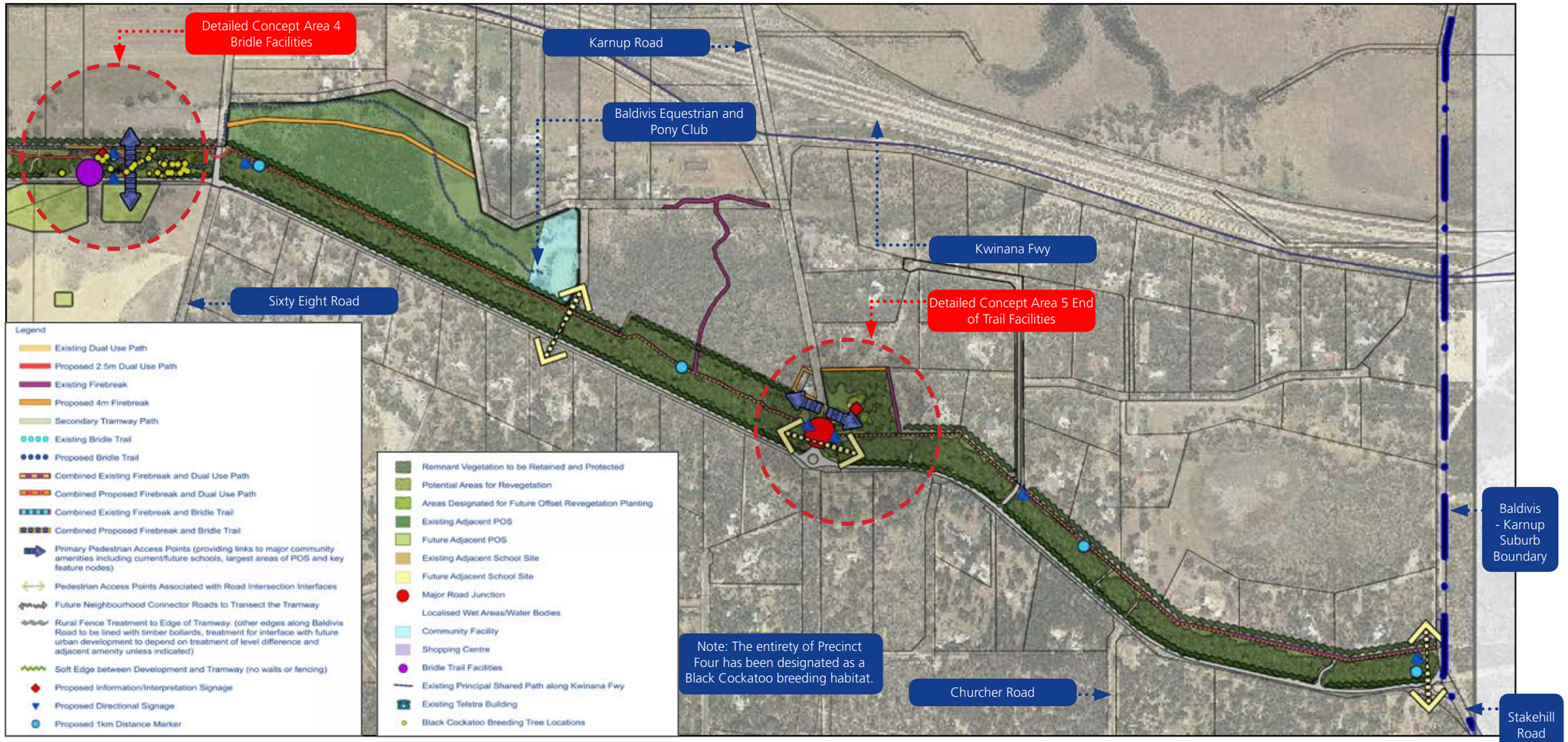


FIGURE 6.1.1

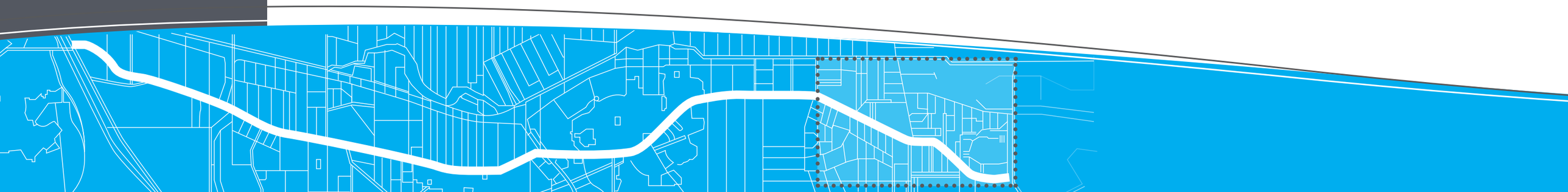
Management Objectives

- Maintain and protect all existing vegetation, utilising firebreak for DUP where possible to minimise fragmentation
- Rehabilitation of remnant bushland to improve vegetation condition
- Manage priority weed species
- Ensure adequate firebreaks
- Upgrade facilities to Karnup Nature Reserve concept area to include new shade structures, BBQs and updated signage
- Formalise entrance into the Tramway from Karnup Nature Reserve to provide link away from road verge to increase pedestrian safety

6. Precinct Four

6.1 Site Characteristics

Precinct Four contains very good condition vegetation, with sections of Serpentine River Complex, Karrakatta Complex and a Jarrah-Marri-Banksia plant community. As in Precinct Three, both Bassendean and Spearwood soil systems are present. Mapping of these site characteristics can be found in Section 2 of the Environmental Management Plan.



DETAILED CONCEPT PLAN FIVE - END OF TRIP FACILITIES

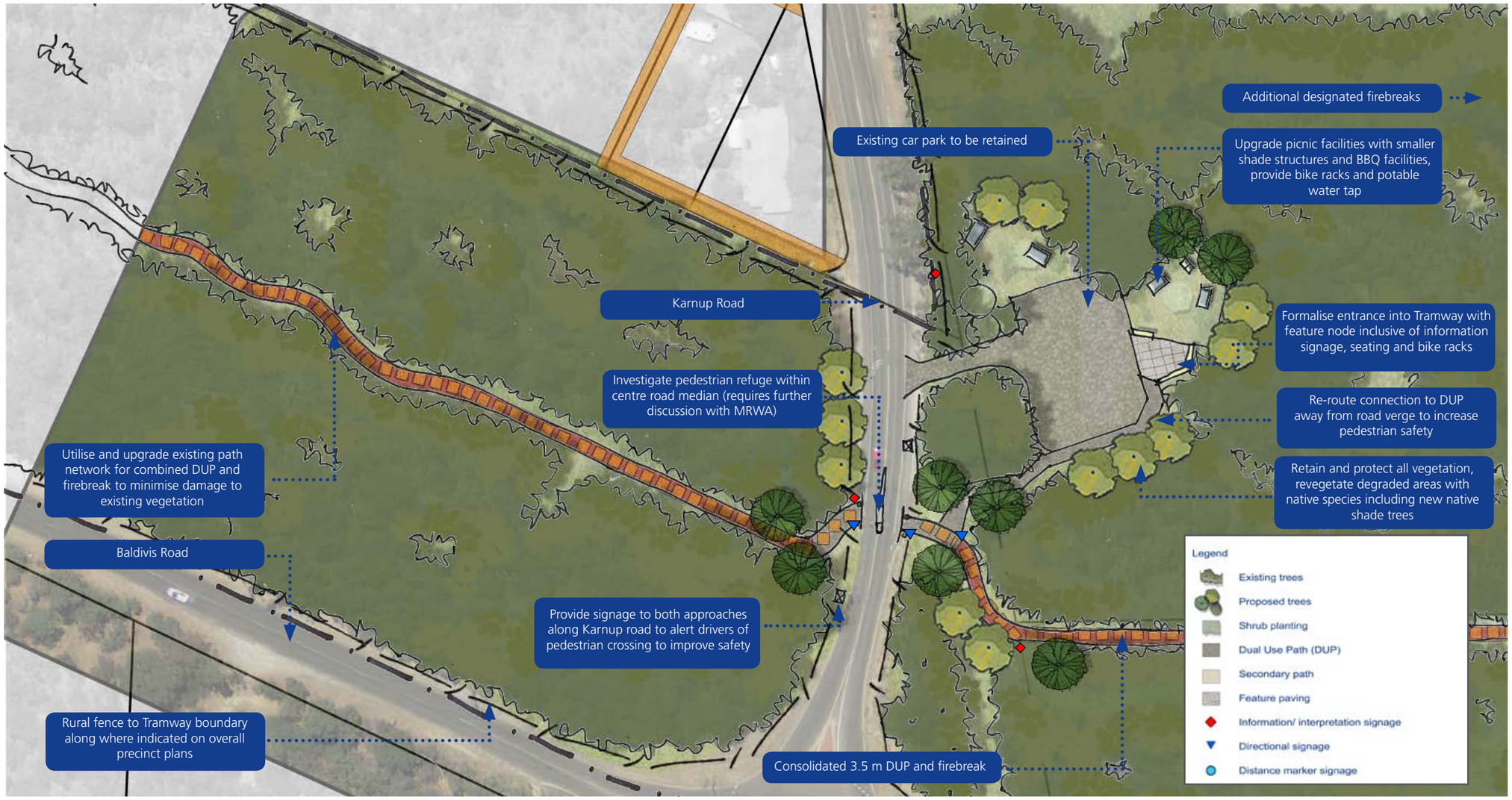


FIGURE 6.2.1

6.2 GOAL NINE – Restricting unauthorised access and controlling recreational use to preserve the natural environment (working towards overarching objective 1)

An ecological survey of the Tramway reserve determined that the remnant bushland in Precinct Four was in a very good condition. It is important to protect the ecological value of this precinct by prohibiting horse riding, mountain bike riding and off-road vehicles from entering bushland areas. Low impact recreational activities such as bush walking and nature observing will be encouraged in this precinct, with activities to be limited to the existing mulched pathway. This pathway also acts as a firebreak. The location of this path can be found on the overall concept plan for Precinct Four (figure 6.1.1).

In terms of conservation, the City advocates the Bradley Method of bushland regeneration, whereby efforts are focused in areas that are relatively undisturbed and not completely invaded by weeds. By focusing efforts in areas that are not completely degraded, bushland condition can be successfully improved with relatively little effort. As Precinct Three and Four contain good and very good quality remnant vegetation respectively, bushland revegetation and rehabilitation will be concentrated in these precincts. Due to the heavily denuded nature of Precincts One and Two, revegetation in these precincts will only occur around the proposed concept areas, primarily for aesthetic and shade purposes, with the hope of providing some ecological benefit.

To support bushland revegetation and weed control measures in the Tramway, there is a critical need to maintain appropriate access to the reserve from surrounding residential communities. This is particularly important for the good quality remnant bushland in precincts Three and Four. Informal entry points will result in trampling and further degradation of vegetation. A combination of bollards, u-rails and fencing will be installed at reserve access points to discourage inappropriate access.

6. PRECINCT FOUR

FIGURE 6.2.1

FIGURE 6.2.2

There are currently small sections along the western side of the Tramway with good condition fencing. It is recommended that fencing be installed along the entire length of the Tramway to prevent inappropriate access and rubbish dumping in the reserve. This is particularly important as the residential population in Baldivis increases. Precinct Four should be prioritised for fencing to protect the very good condition vegetation, followed by Precinct Three. Fencing of Precinct One and Two should be aimed for, but is of a lower priority due to the already degraded state of vegetation. Fencing may not be required along the eastern boundary of proposed concept areas to ensure landscape continuity of POS in adjoining residential development in these instances. The extent and quality of current fencing in the reserve can be seen in the Environmental Management Plan that accompanies this Master Plan.

6.2.1 Proposed 'End of Trip' Concept Area

It is proposed that an End of Trip Concept Area be provided in the existing Karnup Town Site Nature Reserve, the location of which can be seen in figure 6.1.1. There is currently sufficient parking in this reserve to allow people to end or start the trail from this point. The reserve also contains a number of facilities including a gazebo, BBQ and bins, these can be seen in figure 6.2.1 and 6.2.2. Detailed Concept Plan Five (figure 6.2.1) outlines the proposed upgrade of the current facilities to improve the area. This will include new picnic tables with smaller shade structures, bike racks and interpretive signage. The installation of a potable water tap should also be investigated for this concept area.

It is to be noted that the location of this concept area, although in close proximity to the Tramway, is significantly separated by Karnup Road (see figure 6.1.1). Signage is to be installed to caution pedestrians and motorists of the crossing. The installation of a pedestrian refuge in the road median is also a possibility to improve pedestrian safety, and will be investigated in conjunction with Main Roads WA. Interpretive signage within the End of Trip Concept Area is to be located away from the road to ensure user safety.

Currently there is a fire break/trail that continues in the Tramway from the End of Trip Concept Area to Stakehill Road, the suburb boundary between Baldivis and Karnup where the scope of this Master Plan ends. The continuation of the trail beyond the proposed concept area to the suburb boundary can be seen in figure 6.1.1. From this point there will be also be future connections to the Kwinana Freeway via the regional sporting ground proposed for development south of Stakehill Road.

6.3 GOAL TEN – Ensure adequate fire safety throughout the reserve (working towards overarching objectives 1, 3 and 5)

For the protection of users, residents and the reserve itself, appropriate fire safety measures are critical management considerations within the reserve and adjoining development. Proposed residential development in Precinct One and Two of the Tramway highlights the need for proactive fire management strategies. There are a number of firebreaks within the Tramway reserve that are currently managed by the City. These occur in Precincts Three and Four and are depicted in figures 5.1.1 and 6.1.1.

In Precinct One and Two it is proposed that a 4 m wide crushed limestone firebreak be created along the entire eastern boundary of the reserve. It is expected that future residential development abutting the eastern side of the Tramway will include a minimum 20 m wide Building Protection Zone (BPZ). This may consist of a road reserve, open grassed areas of POS and/or on street parking. A number of preferred road reserve and POS treatment scenarios for future developments adjoining the Tramway can be seen in figure 4.2.1, 4.2.2, 4.2.3, 4.2.4 and 4.2.5.

Developers should be mindful that revegetation of designated offset areas and around key concept areas in Precincts One and Two may lead to increased fuel loads. At the time of construction developers should undertake a Bushfire Hazard Assessment for the section of the Tramway adjoining their landholding.

Based on potential vegetation changes the developer may be required to adhere to AS 3959 construction standards. Similarly, in instances where revegetation may occur after development, the potential increase in fuel loads and subsequent impacts on neighbouring development must be considered when selecting species and planting densities, as it is likely existing homes would not comply with AS 3959 construction standards due to low fire hazard at the time of building.

In Precinct Three the current firebreak adjoining Rivergums estate will be continued south to the Baldivis Equestrian and Pony Club. This break will double as the bridle trail extension. In Precinct Four the current pathway through the Karnup Nature Reserve acts as a firebreak and will be maintained. In this precinct additional strategic fire breaks and access points are required in areas directly adjoining the Tramway, such as surrounding the Baldivis Equestrian and Pony Club and around the End of Trip Concept Area. The proposed firebreaks within and adjoining the entire reserve can be seen in figure 6.1.1.

In addition to the north-south firebreaks, a number of east-west breaks traversing the Tramway are necessary to act as strategic fire access points to compartmentalise vegetation. The roads that intersect the Tramway currently assist with this. Pedestrian access pathways in proposed concept areas that traverse the Tramway are to be constructed of materials that could be trafficked by emergency service vehicles if necessary (i.e. no steps, no weak pavers). These pathways will also provide additional east-west breaks.

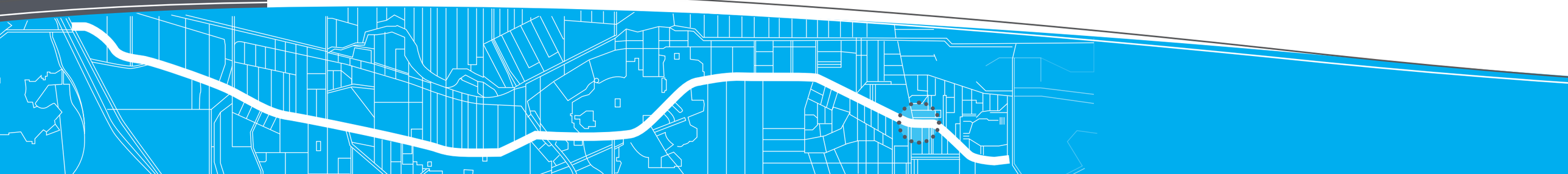
The firebreaks throughout the reserve should be formalised to consist of a 4 m wide crushed limestone track with 4 m vertical clearance. Any new development of the firebreak within the Tramway should be undertaken along a route that minimises earthworks and native vegetation removal by utilising cleared areas and existing paths as far as practical. The firebreak must include multiple access points, be trafficable and contain a number of areas where emergency services vehicles are able to pass one another.

For more information regarding fuel loads, bushfire risk, and fire management strategies and responsibilities please refer to the Baldivis Tramway Environmental Management Plan that accompanies this Master Plan.

6.4 Management Actions for Precinct Four

TABLE 6.4.1

	Precinct Four Management Actions	Priority
33	Maintain and protect all existing vegetation, utilising firebreak for DUP where possible to minimise fragmentation	High
34	Install directional, regulatory and interpretive signage	
35	Manage priority weed species	High
36	Rehabilitation of remnant bushland to improve vegetation condition	High
37	Ensure adequate fire breaks	High
38	Upgrade facilities to Karnup Nature Reserve End of Trip Concept Area to include new shade structures, BBQs and updated signage	Medium
39	Formalise entrance into the Tramway from Karnup Nature Reserve to provide link away from road verge to increase pedestrian safety	Medium
40	Investigate median refuge for pedestrians with Main Roads	Medium



7. SIGNAGE STRATEGY

7. Signage strategy
Clear and consistent signs are to fulfil a number of management objectives including behaviour modification, the provision of way finding, hazard warning and interpretive information. A basic signage strategy has been devised for the Tramway.

The signage strategy for the Tramway will consist of the following components:
- Directional and regulatory signage at selected pedestrian access points, for wayfinding and to provide information on dog controls, horse riding and bike riding regulations
- Interpretive and educational signage at key concept areas and feature nodes
- Warning signs depicting major road crossings to ensure pedestrian safety

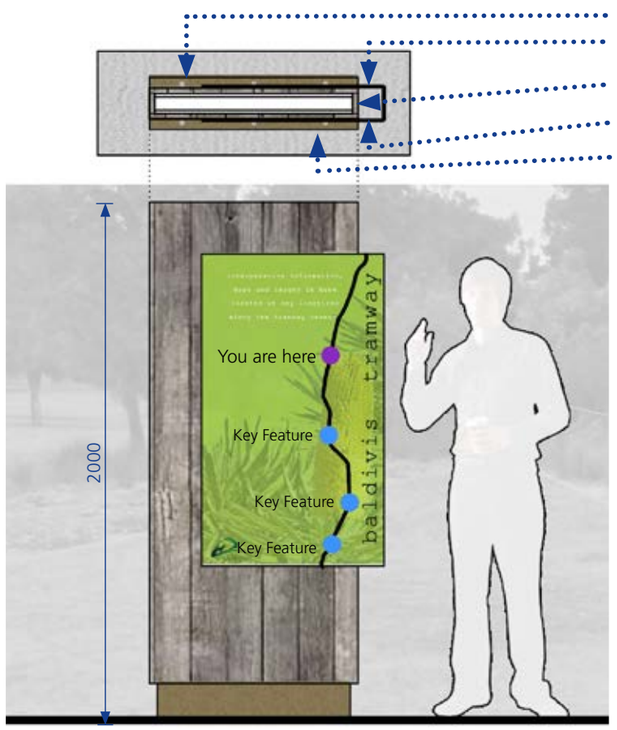
Behavioural modification signage should be erected at primary pedestrian access points to the reserve. The primary pedestrian access points are indicated in the overall concept plans for each precinct. General 'share the path' and 'blind corner' messages should be incorporated into signage along the DUP to notify users to be mindful of one another, particularly where views of oncoming horse riders and cyclists may be obscured.

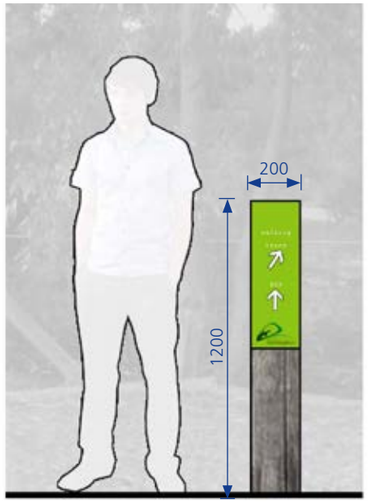
The location of additional signage in areas other than primary pedestrian access points can also be seen in the overall concept plans for each precinct (figures 3.1.4, 4.1.4, 5.1.1 and 6.1.1).

It is important that any signage used in the Tramway complements the natural character of the reserve and does not clutter the landscape. With this in mind, the City has designed a proposed preliminary signage palette for all new signs along the Tramway which can be seen in figure 7.1. The signage palette includes a primary interpretive sign, primary wayfinding sign, as well as a secondary wayfinding distance marker. The digital vinyl print on an aluminium plate will be riveted to weathered timber. The weathered timber will reflect the history of the Tramway Reserve. This timber may then be mounted into a steel bracket with a concrete footing to ensure stability and longevity of the sign. Colour variation of the signage in different precincts will allow the user to differentiate between the themes of each precinct and the recreational experiences they offer. The colour palette for each theme can be seen in figure 7.1.

INDICATIVE SIGNAGE TYPOLOGY

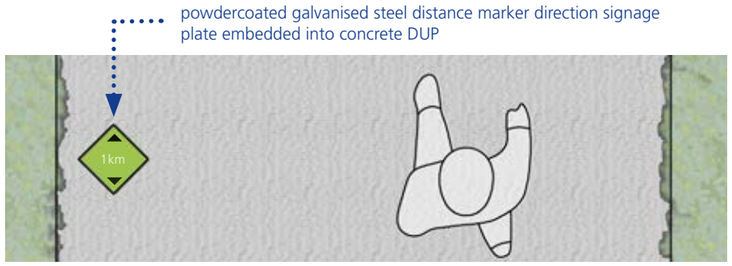
PROPOSED INFORMATION INTERPRETATION SIGN





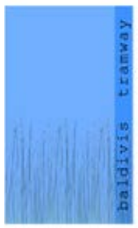
PRIMARY DIRECTIONAL/ WAYFINDING SIGN

marker enlargement
not to scale



WAYFINDING/DISTANCE MARKER

PRECINCT SIGNAGE INSERT THEMES:



EPHEMERAL WETLAND

HERITAGE AND EDUCATION

BRIDLE TRAIL

NATURE TRAIL

CONSERVATION

PRECEDENT IMAGERY

WEATHERED TIMBER

BOLD AND SIMPLISTIC

8.

9.

REFERENCES

360 Environmental Pty Ltd (2014) Level 2 Vegetation and Flora Assessment, Baldivis Tramway Reserve

360 Environmental Pty Ltd (2014) Level 1 Fauna and Black Cockatoo Assessment, Baldivis Tramway Reserve

City of Rockingham, Baldivis Tramway Reserve Environmental Management Plan, Environmental Resources Management Australia Pty Ltd (2000)

City of Rockingham, Trails Master Plan, Transplan Planning and Design (2010)

Department of Planning (2010), Planning for Bushfire Protection Guidelines

Department of Planning (2005), Planning and Development Act

Department of Fire and Emergency Services (1998), Fire and Emergency Services Act

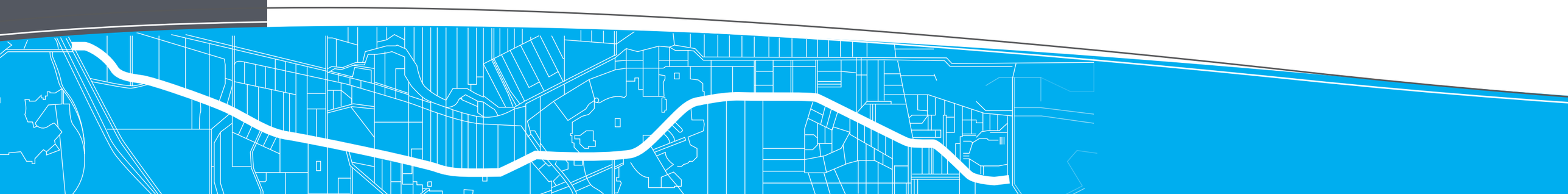
IMPLEMENTATION TABLE OF MANAGEMENT ACTIONS, PRIORITIES AND SUCCESS CRITERIA

The term of this Management Plan will be for 10 years, with the management actions prioritised as follows:

- Priority 1 – Year 1
- Priority 2 – Year 2/3
- Priority 3 – Year 4/5
- Priority 4 – Year 5 onwards

Indicative implementation costs for the management actions associated with this plan are listed in table 9.1.

To evaluate the progress and success of implementation, it is recommended that this plan is subject to:
- An annual review by relevant City of Rockingham officers
- An interim review and report (5 years)
- A final review at the end of the term of the Plan (10 years)

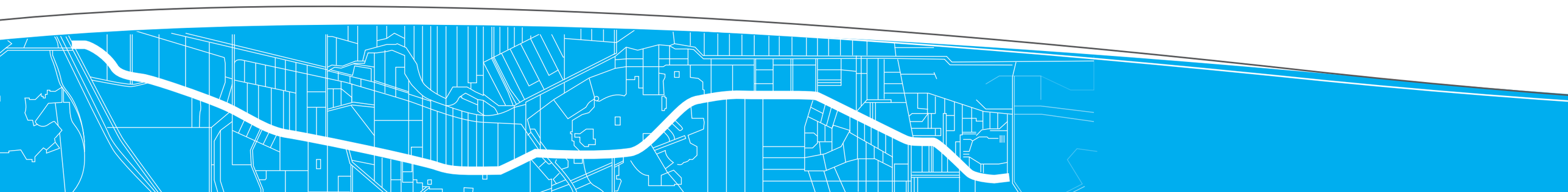


IMPLEMENTATION TABLE 9.1

Category	Planning Precinct	Management Consideration	Priority	Team Plan	Approx Costing	Criteria for Success
LANDSCAPE DESIGN	Precinct 1	Construct 2.5 m wide concrete DUP	4	Capital	373,000	• Pathway constructed • Signage present • Trafficable pedestrian and cycling routes to the PSP • Pedestrians safely able to cross Kulija Rd • Property owners aware of upgrades • Personal property removed from reserve
		Install directional, regulatory and interpretive signage (see overall concept plans for locations and Section 7 for designs)	4	Capital	1,310	
		Establish an integrated DUP network with 2.5 m wide concrete path to connect to Kwinana Fwy PSP at Kulija Rd	4	Capital	20,750	
		Provide a safe pedestrian detour around the Kulija Road intersection with 2.5 m wide concrete DUP	4	Capital	76,625	
		Investigate future pedestrian median strip in conjunction with Main Roads	4	Officer time		
		Liaise with developers adjoining the Tramway to ensure appropriate interface treatments	4	Officer time		
		Liaise with adjoining property owners regarding personal property within the reserve	4	Officer time		
		Inform property owners with driveways through the reserve to beware of pedestrians	4	Officer time		
	Precinct 1 Total				**471,685**	
	Concept Area 1: Ephemeral Wetland	Boardwalk installation and design	4	Capital	10,000	• Pathway constructed • Boardwalk constructed • Signage present • Seating and bike racks present
		Interpretive and directional signage for passive recreation and education	4	Capital	800	
		Install seating	4	Capital	3,200	
		Secondary 2.5 m wide pathways surrounding the wetland and leading to the wetland from the DUP	4	Capital	26,375	
	Concept Area 1 Total				**40,375**	
	Concept Area 2: Potential Connection Node	Additional 2.5 m wide concrete DUP	4	Capital	2,500	• Pathway constructed • Seating and bike racks present • Signage present
		Bike rack	4	Capital	400	
		Seating	4	Capital	1,600	
		Interpretive and directional signage for passive recreation and education	4	Capital	800	
	Concept Area 2 Total				**5,300**	
	Precinct 1 Overall Total				**517,360**	
	Precinct 2	Construct 2.5 m wide concrete DUP	4	Capital	435,000	• Pathway constructed • Seating and bike racks present • Signage present
		Install directional, regulatory and interpretive signage (see overall concept plans for locations and Section 7 for designs)	4	Capital	1,400	
		Provide a safe pedestrian detour around the Safety Bay Road intersection with a 2.5 m wide concrete DUP	4	Capital	103,875	
		Liaise with future developers adjoining the Tramway regarding appropriate interface treatments	4	Officer time		
		Liaise with adjoining property owners regarding personal property within the reserve	4	Officer time		
		Inform property owners with driveways through the reserve to beware of pedestrians	4	Officer time		
	Precinct 2 Total				**540,275**	
	Concept Area 3: Heritage, Education and Nature Based Play	Interpretive/directional signage for passive recreation and education	4	Capital	3,200	• Signage present • Play area constructed • East-west pathway constructed • Connection node with seating and bike racks installed • Pedestrians easily able to move between Tramway and adjoining POS
		Construction and design of play area using natural materials such as timber, stone and sand	4	Capital	50,000	
		Placement of historical artefacts and farm equipment if found in the reserve	4	Capital		
		Connection node to adjoining POS and community facilities with seating, bike racks and signage	4	Capital	19,600	
		East-west 2.5 m wide concrete pathway connecting the Tramway to adjoining POS (should have 3 m wide clearance to allow for emergency services strategic access in the event of fire)	4	Capital	8,250	
		Designated crossing point to across Baldivis Road with safety signage	4	Capital	160	
	Concept Area 3 Total				**81,210**	
	Precinct 2 Overall Total				**621,485**	

TABLE 9.1 - CONTINUED

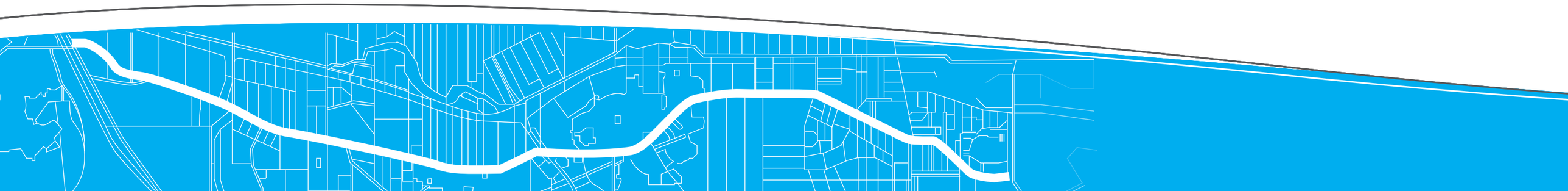
	Precinct 3	Install directional, regulatory and interpretive signage (see overall concept plans for locations and Section 7 for designs), prioritise Precinct Three over other precincts	1	Capital	2,350	• Trafficable connections present to PSP and via Parmelia Pipeline POS • Signage present • Bridle trail constructed and connected to existing trail • Property owners aware of upgrades • Personal property removed from reserve
		Construct 2.5 m wide concrete DUP and connect to existing DUP network adjoining Rivergums estate	1	Capital	183,250	
		Extend existing bridle trail (3 m wide crushed limestone) from Equestrian Club and connect to existing trails adjoining Rivergums estate	3	Capital	46,068	
		Liaise with adjoining property owners regarding personal property within the reserve	1	Officer time		
		Inform property owners with driveways through the reserve to beware of pedestrians	1	Officer time		
	Precinct 3 Total				**231,668**	
	Concept Area 4: Bridle Facilities	Interpretive and regulatory signage to prevent conflict between horses and other reserve users	3	Capital	900	• Signage present • Seating, shade structures, tie up posts installed • Design and construction of parking bays
		Installation of crushed limestone as ground cover	3	Capital	70,554	
		Installation of a bench seat	4	Capital	1,600	
		Installation of shade structure	4	Capital	10,000	
		Installation of tie up posts	3	Capital	195	
		Further investigation into design and construction of car float parking bays	3	Officer time		
	Concept Area Total				**83,249**	
	Precinct 3 Overall Total				**314,917**	
	Precinct 4	Install directional, regulatory and interpretive signage (see overall concept plans for locations and Section 7 for designs)	2	Capital	1,150	• Pathway constructed and connected to existing pathway in Karnup NR • Existing pathway formalised • Signage present
		Construction of 3 m wide crushed limestone pathway from Sixty Eight Rd to Karnup Rd, will include the formalisation of an existing section of path in the Karnup NR (will double as firebreak)	2	Capital	45,639	
	Precinct 4 Total				**46,789**	
	Concept Area 5: End of Trip Facilities	Upgrade facilities to Karnup Nature to include new shade structures and picnic tables	1	Capital	18,000	• Signage present, with formalised entrance to the Tramway trail • Seating, shade structures and BBQs • Installation of potable water tap
		BBQ upgrade if required	1	Capital	10,000	
		Installation of a bench seat	1	Capital	1,600	
		Installation of bike rack	1	Capital	400	
		Formalise entrance into the Tramway from Karnup Nature Reserve by construction of additional 2.5 m wide DUP to provide link away from road verge to increase pedestrian safety	1	Capital	6,250	
		Investigate installation of potable water tap	4	Officer time		
	Concept Area Total				**36,250**	
	Precinct 4 Overall Total				**83,039**	
LANDSCAPE DESIGN TOTAL						**1,536,801**



For details refer to Environmental Management Plan						
ENVIRONMENTAL MANAGEMENT	**Precinct 1**	Targeted spraying of priority weed species as per Section 4.1 of Environmental Management Plan (EMP)	4	Operational	360	• No increase in weed presence
		Upgrade poor condition/absent fencing to discourage inappropriate access	4	Capital	59,200	• Fencing upgraded
		Installation of bollards and u-rails at primary pedestrian access points	4	Capital	1,620	• Bollards and gates installed
		Installation of vehicle access gates at major road access points to ensure authorised vehicle access only, with adjoining pedestrian access gates	4	Capital	3,300	• Firebreaks and strategic access points constructed and maintained
		Construction of a 4 m wide crushed limestone firebreak with 4 m high vertical clearance along the eastern border of the Tramway	4	Capital	128,172	• Open grassed area fuel loads maintained at <2t/ha
		Minimising fuel loads through slashing/spraying of open grassed areas	1	Operational	16,800	
		Liaise with adjoining developers to ensure appropriate interface treatments to maintain HSZ and BPZ	1	Officer time		• Developer maintenance of BPZ and HSZ
	Precinct 1 Total				**209,452**	
	Concept Area 1: Ephemeral Wetland	Weed spraying prior to revegetation	4	Operational	5,698	• Overall reduction in weed presence prior to planting
		Revegetate with seedlings, as per the suggested planting palette (see Section 4.4 of EMP)	4	Operational	70,000	• Minimum 80% seedling survival
		Ongoing monitoring to ensure seedling survival and establishment	4	Officer time		
	Concept Area 1 Total				**75,698**	
	Concept Area 2: Potential Connection Node	Weed spraying prior to revegetation	4	Operational	3,904	• Overall reduction in weed presence prior to planting
		Revegetate with seedlings, as per the suggested planting palette (see Section 4.4 of EMP)	4	Operational	47,500	• Minimum 80% seedling survival
		Ongoing monitoring to ensure seedling survival and establishment	4	Officer time		
	Concept Area 2 Total				**51,404**	
	Precinct 1 Overall Total				**336,554**	
	Precinct 2	Targeted spraying of priority weed species	4	Operational	240	• No increase in weed presence
		Upgrade poor condition/absent fencing to discourage inappropriate access	4	Capital	72,000	• Fencing upgraded
		Installation of bollards and u-rails at primary pedestrian access points	4	Capital	2,160	• Bollards and gates installed
		Installation of vehicle access gates at major road access points to ensure authorised vehicle access only, with adjoining pedestrian access gates	4	Capital	2,200	• Firebreaks and strategic access points constructed and maintained
		Construction of a 4 m wide crushed limestone firebreak with 4 m high vertical clearance along the eastern border of the Tramway	4	Capital	74,844	• Open grassed area fuel loads maintained at <2t/ha
		Minimising fuel loads through slashing/spraying of open grassed areas	1	Operational	3,783	
		Liaise with adjoining developers to ensure appropriate interface treatments to maintain HSZ and BPZ	4	Officer time		• Developer maintenance of BPZ and HSZ
	Precinct 2 Total				**155,227**	
	Concept Area 3: Heritage, Education and Nature Based Play	Weed spraying prior to revegetation	4	Operational	3,032	• Overall reduction in weed presence prior to planting
		Plant native flowering species in feature garden bed adjoining play area	4	Operational	1,290	• Minimum 80% seedling survival
		Revegetate with seedlings, as per the suggested planting palette (see Section 4.4 of EMP)	4	Operational	37,500	• Flowering garden forms an attractive landscape feature
		Ongoing monitoring to ensure seedling survival and establishment	4	Officer time		
	Concept Area Total				**41,822**	
	Precinct 2 Overall Total				**197,049**	
	Precinct 3	Targeted spraying of priority weed species	1	Operational	420	• No increase in weed presence
		Upgrade poor condition/absent fencing to discourage inappropriate access	2	Capital	72,000	• Fencing upgraded
		Installation of bollards and u-rails at primary pedestrian access points	2	Capital	2,430	• Bollards and gates installed
		Installation of vehicle access gates at major road access points to ensure authorised vehicle access only, with adjoining pedestrian access gates	2	Capital	2,000	• Firebreaks and strategic access points constructed and maintained
		Construction of a 4 m wide crushed limestone (or similar) firebreak with 4 m high vertical clearance along the eastern border of the Tramway, connecting to existing breaks adjoining Rivergums	2	Capital	8,800	
	Precinct 3 Total				**85,650**	

TABLE 9.1- CONTINUED

	Concept Area 4: Bridle Facilities	Weed control prior to revegetation	3	Operational	3,863	• Overall reduction in weed presence prior to planting • Minimum 80% seedling survival • Fence constructed, no further degradation of surrounding vegetation
		Revegetate concept area with trees and shrubs, based on planting palette (see Section 4.4 of EMP)	3	Operational	47,500	
		Fencing marking perimeter of node to prevent degradation of surrounding vegetation	3	Capital	960	
	Concept Area Total				**52,323**	
	Precinct 3 Overall Total				**137,973**	
	Precinct 4	Targeted spraying of priority weed species	1	Operational	120	• No increase in weed presence • Fencing upgraded • Firebreaks and strategic access points constructed and maintained
		Upgrade poor condition/absent fencing to discourage inappropriate access	1	Capital	34	
		Construction of additional 4 m wide crushed limestone firebreaks with 4 m high vertical clearance in selected adjoining areas	3	Capital	36,960	
	Precinct 4 Total				**37,114**	
	Concept Area 5: End of Trip Facilities	Weed control prior to revegetation	4	Operational	420	• Overall reduction in weed presence prior to planting • Minimum 80% seedling survival after 2 years • Fence constructed, no further degradation of surrounding vegetation
		Revegetate with seedlings, as per the suggested planting palette (see Section 4.4 of EMP)	4	Operational	5,000	
		Fencing marking perimeter of node to prevent degradation of surrounding vegetation	1	Capital	2,400	
	Concept Area Total				**7,820**	
	Precinct 4 Overall Total				**44,934**	
	Revegetation and Rehabilitation Outside Proposed Concept Areas	Plant seedlings in areas of good condition vegetation	2/3	Operational	557,500	• Minimum 80% seedling survival after 2 years
		Direct seeding in areas of very good condition vegetation	2/3	Operational	245	
	Revegetation and Rehabilitation Total				**557,745**	
	Ongoing Review and Assessment	Interim report including ecological assessment of flora and fauna	3	Public works overheads	41,000	• Vegetation and weed survey repeated every 5 years • Survey should indicate an overall improvement in vegetation condition and no increase in weed presence • Before and after fauna assessments should indicate an overall reduction in population numbers • Fire management plan developed
		10 year review to determine overall success or failure of Plan	4	Public works overheads	44,040	
		Feral fauna assessment	4	Public works overheads	12,000	
		Development of fire management plan	2	Public works overheads	10,000	
		Annual review of implementation progress by relevant City of Rockingham Officers	1	Officer time		
	Ongoing Review and Assessment Total				**107,040**	
ENVIRONMENTAL MANAGEMENT TOTAL						**1,381,295**
BALDIVIS TRAMWAY MASTERPLAN GRAND TOTAL						**2,918,096**



Baldivis Tramway
ENVIRONMENTAL MANAGEMENT PLAN

1. INTRODUCTION

2. SITE CHARACTERISTICS

1. Introduction

This report supplements the Baldivis Tramway Master Plan (Master Plan) and aims to provide directions and recommendations for the management of the natural environment within the Baldivis Tramway Reserve. In particular, the recommendations are concerned with the protection and enhancement of native vegetation through the removal of threatening processes. As per the Master Plan, the Environmental Management Plan will refer the four Planning Precincts for ease of identification and prioritisation of management actions.

1.1 Project goals for environmental management

- Determine the extent, condition and type of remnant vegetation within the Tramway
- Determine the type, severity and extent of threats present
- Develop management actions designed to mitigate threats, protect remnant vegetation, enhance ecological value and improve vegetation condition within the reserve
- Establish rehabilitation and revegetation targets.

2. Site Characteristics

2.1 Climate

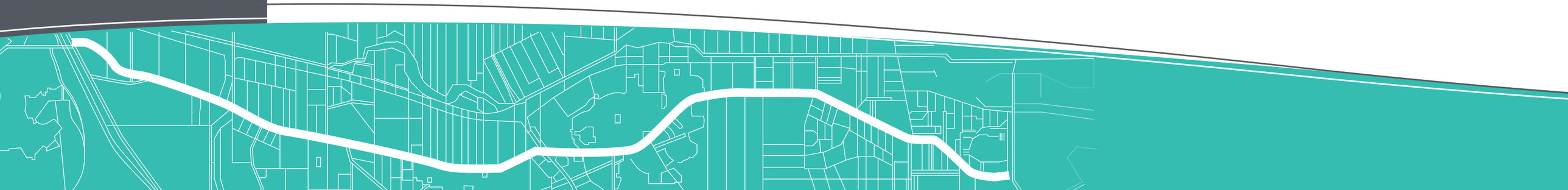
The Rockingham area experiences a Mediterranean climate, comprised of hot, dry summers and mild wet winters. Mean daily maximum temperatures vary from 30°C in summer to 18°C in winter. The mean annual rainfall in Rockingham is 824 mm.

2.2 Hydrology

The area to the east of Kwinana Freeway forms part of the Serpentine River Floodplain, with large sections of Multiple Use Category wetlands situated between the Tramway reserve and the Kwinana Freeway. While historically a large wetland area, the Multiple Use Category classification describes these wetlands as having few important ecological attributes and functions remaining. Abutting the Tramway in Precinct One are a number of Planned Resource Enhancement Wetlands, that despite being partially modified still support substantial ecological attributes and functions. The hydrology within and surrounding the Tramway Reserve can be seen in figures 2.2.1, 2.2.2, 2.2.3 and 2.2.4.

FIGURE 2.2.1 HYDROLOGY PRECINCT ONE

FIGURE 2.2.2 HYDROLOGY PRECINCT TWO



2.

LEGEND

- EXTENT OF TRAMWAY
- DEGRADED CLEARED PASTURE - REMAINING EXTENT OF TRAMWAY VEGETATION
- MULTIPLE USE CATEGORY WETLAND - Few important ecological attributes and functions remaining
- SERPENTINE RIVER FLOODPLAIN
- CONSERVATION CATEGORY WETLAND - Supports a high level of ecological attributes and functions
- ENVIRONMENTAL PROTECTION POLICY WETLAND
- LOCALISED WET AREAS/WATER BODIES IN OR AROUND THE TRAMWAY

FIGURE 2.2.3 HYDROLOGY PRECINCT THREE

FIGURE 2.2.4 HYDROLOGY PRECINCT FOUR

SITE CHARACTERISTICS 2.

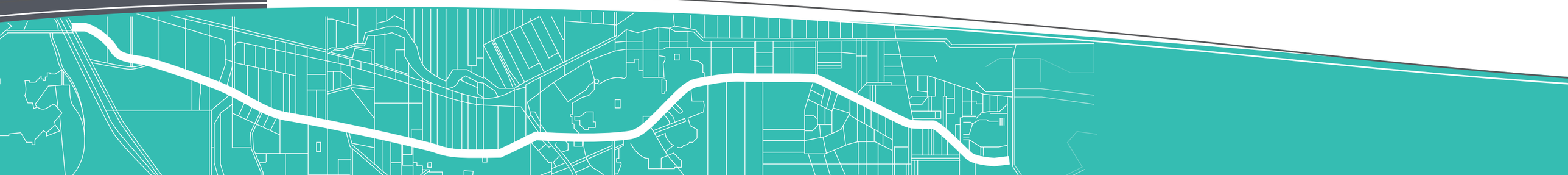
2.3 Soils and geology

The geology within the Tramway consists of three different units. The distribution of these units across the four precincts can be seen in figures 2.3.1, 2.3.2, 2.3.3 and 2.3.4.

- **Bassendean system**
  Gently undulating sandplains, which consist of pale deep sands and well-drained deep bleached grey sands. This geology type typically supports *Banksia-Melaleuca rhaphiophylla* woodlands and mixed heath. Soils are permeable with low nutrient retention.
- **Pinjarra system**
  This poorly drained coastal plain consists of semi-wet soils, grey sandy duplexes, brown loamy earths, pale sands and clays. The soil in this area has low permeability with high water logging risk and the geology type typically supports *Jarrah-Marri-Wandoo* woodlands.
- **Spearwood system**
  Sand dunes and plains with soils consisting of yellow deep sands, pale deep sands and yellow/brown shallow sands. Vegetation is typically *Tuart-Marri* woodlands. Soil has a low nutrient export, water logging and erosion risk.

FIGURE 2.3.1 SOIL CHARACTERISTICS AND LAND CAPABILITY PRECINCT ONE

FIGURE 2.3.2 SOIL CHARACTERISTICS AND LAND CAPABILITY PRECINCT TWO



2.

LEGEND

EXTENT OF TRAMWAY

PINJARRA SYSTEM
Poorly drained coastal plain. Semi-wet soils, grey sandy duplexes, brown loamy earths, pale sands and clays. Vegetation typically J*arrah-Marri-Wandoo* woodland. Soil has low permeablity, absorption rates with high water logging risk

BASSENDEAN SYSTEM
Gently undulating sandplains. Soils are typically pale deep sands and well-drained deep bleached grey sands. Vegetation consists of *Banksia*-paperbark woodlands and mixed heath. Soils are permeable with low nutrient retention

SPEARWOOD SYSTEM
Sand dunes and plains with soils consisting of yellow deep sands and yellow/brown shallow sands. Vegetation is typically *Tuart-Marri* woodland. Soil has a low nutrient export risk, low water logging and erosion risk

FIGURE 2.3.3 SOIL CHARACTERISTICS AND LAND CAPABILITY PRECINCT THREE

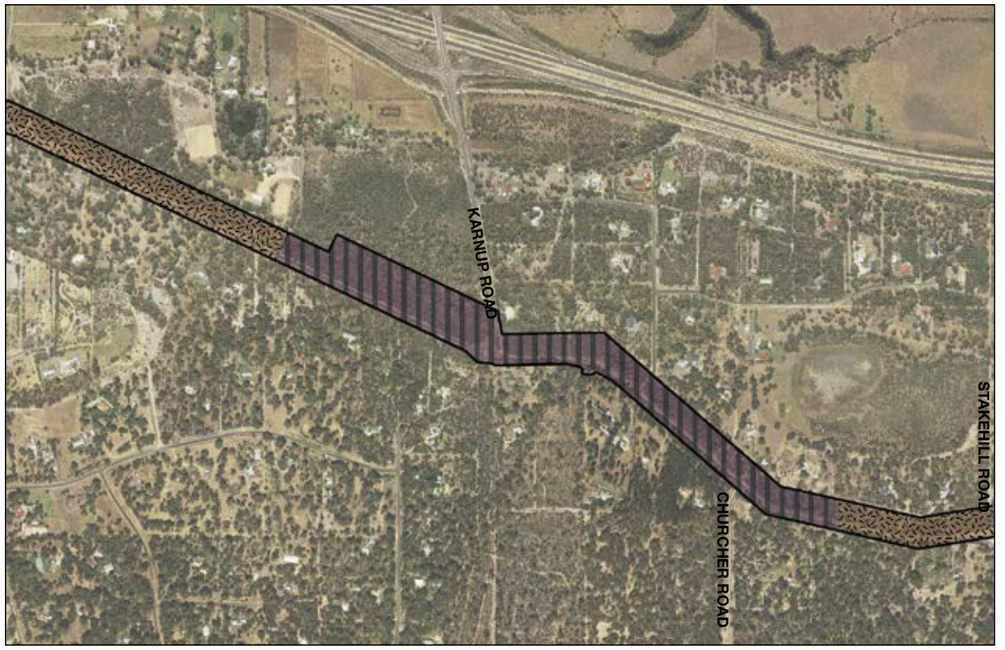


FIGURE 2.3.4 SOIL CHARACTERISTICS AND LAND CAPABILITY PRECINCT FOUR

2. SITE CHARACTERISTICS

2.4 Vegetation complexes

The Tramway Reserve straddles the boundary of two vegetation complexes as identified by (Heddle et al. 1980), see table 2.4.1 and figures 2.4.3 and 2.4.4. These complexes are broadly defined and include a range of vegetation communities. Both complexes have been extensively cleared within the metropolitan area (Bushforever 2000). The Serpentine River vegetation complex which is present within the Tramway has <10% left of the pre-European extent in secure conservation reserves, therefore it is considered regionally significant.

TABLE 2.4.1

Vegetation Complex	Description	Original Area (Ha)	Remnant Area (Ha)
Karrakatta Complex-Central and South	Open forest of *Eucalyptus gomphocephala*, *E. marginata* and *Corymbia calophylla* in varying admixtures. Understorey species vary depending upon the proportion of sand and gravel, depth of sand and moisture levels.	34,532	6275 (18%)
Serpentine River Complex	Closed scrub of *Melaleuca* and fringing woodlands of Eucalyptus rudis and *Melaleuca rhaphiophylla* along streams. *Marri-Jarrah-Banksia* woodlands occur upland.	4445	398 (9%)

FIGURE 2.4.1 EXISTING VEGETATION COMPLEXES AND COMMUNITIES PRECINCT ONE

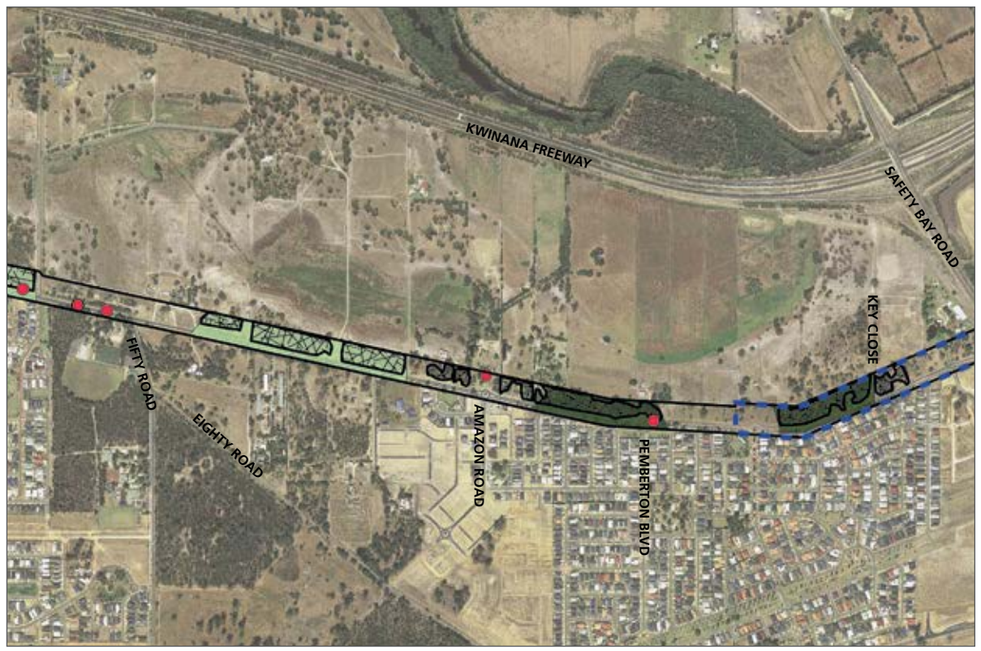
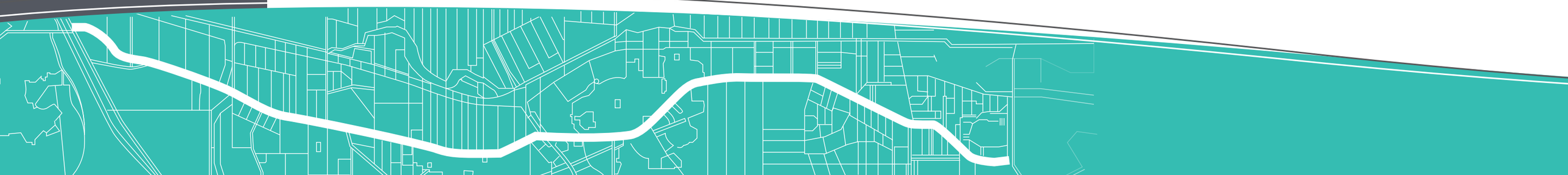


FIGURE 2.4.2 EXISTING VEGETATION COMPLEXES AND COMMUNITIES PRECINCT TWO



2.

LEGEND

EXTENT OF TRAMWAY

PRIORITY WEEDS

SERPENTINE RIVER COMPLEX
Closed shrub of *Melaleuca* species and fringing woodlands of *E.rudis - M.raphiophylla*

KARRAKATTA COMPLEX
Predominantly open forest of *E.gomphocephala-E.marginata-E.calophylla*. and woodland *E.marginata-Banksia spp.*

RECENT REVEGETATION BY COR

PLANT COMMUNITY
TUART - SHEOAK - BANKSIA
B. attenuata, *B. menziesii*, *E. gomphocephala*, *A. fraseriana* woodland to 12 m in height

PLANT COMMUNITY
JARRAH - MARRI - BANKSIA
B. attenuata, *B. menziesii*, *E.marginata*, *C.calophyllya* woodland to 8 m in height

DEGRADED CLEARED PASTURE - REMAINING EXTENT OF TRAMWAY VEGETATION

2.5 Vegetation communities

A botanical survey was undertaken in October 2013 to determine the composition and condition of vegetation communities within the reserve. The composition of the native species flora within the study area is consistent with the descriptions of the Heddle et al. (1980) vegetation complexes noted above.

There were 144 native species recorded for the Reserve (see Appendix B: Native Species Recorded in the Reserve, page 58). These vegetation species were further classified according to vegetation communities, which were closely related to their position in the reserve and the associated soil and geology types.

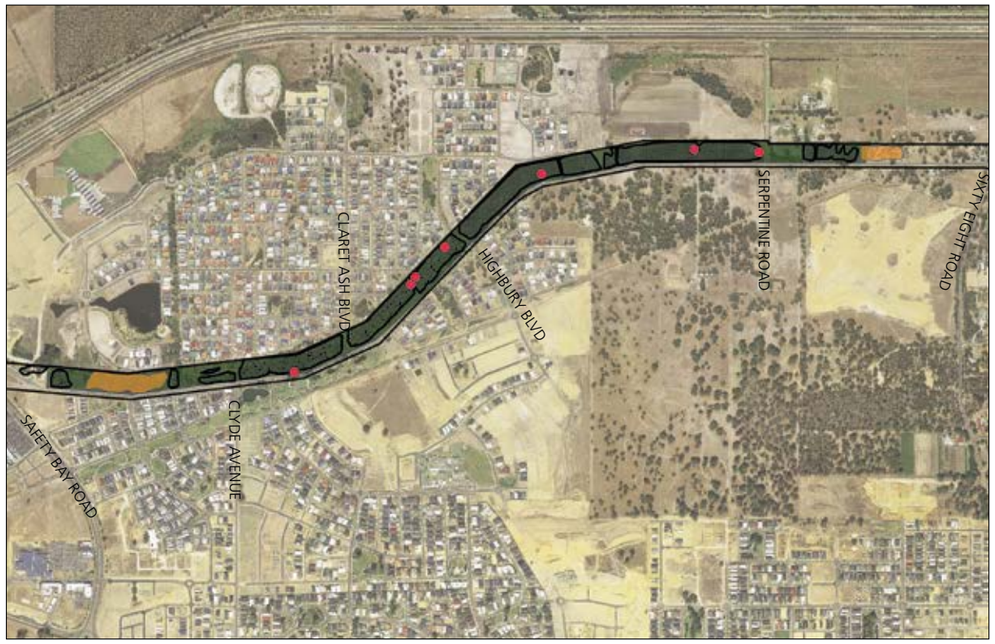


FIGURE 2.4.3 EXISTING VEGETATION COMPLEXES AND COMMUNITIES PRECINCT THREE

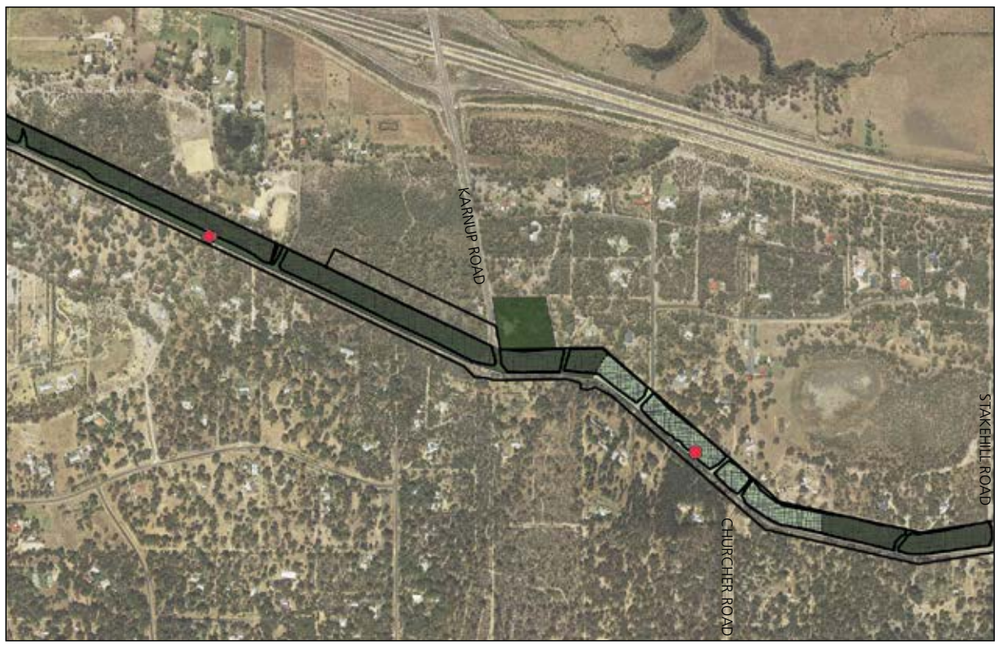


FIGURE 2.4.4 EXISTING VEGETATION COMPLEXES AND COMMUNITIES PRECINCT FOUR

2. SITE CHARACTERISTICS


COMMUNITY 1


COMMUNITY 2


COMMUNITY 3


COMMUNITY 4


COMMUNITY 5

- **Community 1: Pasture dominated, *Eucalyptus rudis–Melaleuca–Kunzea* woodland**

Pasture areas dominate the northern half of the tramway reserve. These areas consist of parkland cleared trees (mostly *Eucalyptus gomphocephala* and *Allocasuarina fraseriana*) over an understorey of mostly exotic grasses and herbs. Pastures occupy approximately 55 ha of the reserve. These areas are completely degraded.

- **Community 2: Wet shrub - closed low heath (to 2 m) (not mapped)**

This community consists of *Taxandria linearifolia*, *Hypocalymma angustifolium* and *Kunzea glabrescens* with an emergent low woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* to 5 m over a low shrubland/ herbland of rushes, sedges (e.g. *Juncus pallidus*, *Lepidosperma spp*) and annual herbs.

The community occurs on low-lying damplands and seasonally inundated areas in the northern part of the reserve. Most of this plant community is in degraded ecological condition, with weed invasion being the main disturbance (e.g. Arum Lilies in the picture). This community occupies approximately 1 ha of the reserve.

- **Community 3: *Banksia attenuata*, *B. menziesii*, *Eucalyptus gomphocephala* and *Allocasuarina fraseriana* woodland to 12 m in height**

The understorey of this community consists of shrubs (*Hypocalymma angustifolium*, *Xanthorrhoea preissii*, *Bossiaea eriocarpa*, *Hibbertia hypericoides* and *Phyllanthus calycinus*) over a species rich ground layer of low shrubs, herbs, lilies and sedge-like species (*Arthropodium capillipes*, *Conostylis aculeata*, *Dasypogon bromelliformis*, *Hardenbergia comptoniana*, *Lepidosperma spp* and *Opercularia spp*) as well as numerous exotic species (e.g. Galdiolus and grasses). The northern sections of this community are mostly in poor ecological condition due to clearing and weed invasion. Areas south of Safety Bay Road are generally in good condition with only peripheral disturbances and weed invasion. These woodlands occupy approximately 16 ha of the Tramway Reserve.

- **Community 4: *Banksia attenuata*, *B. menziesii*, *Eucalyptus marginata* and *Corymbia calophylla* woodland to 8 m in height.**

The understorey of this community consists of shrubs (*Hypocalymma angustifolium*, *Xanthorrhoea preissii*, *Bossiaea eriocarpa*, *Daviesia divaricata*, *Hibbertia hypericoides* and *Jacksonia spp*) over a species rich ground layer of low shrubs, herbs, lilies and sedge-like species (e.g. Arthropodium capillipes, Conostylis aculeata, *Dasypogon bromelliformis*, *Hardenbergia comptoniana*, *Lepidosperma angustatum* and *L. squamatum*) as well as numerous exotic species (e.g. Galdiolus and grasses). The community is mostly in good to very good ecological condition though the boundary areas are degraded through edge effects and weed invasion. This community occupies approximately 22 ha.

- **Community 5: Rehabilitation planting**

Approximately 3 ha of the Tramway Reserve have been rehabilitated at various times. Rehabilitation typically involves earth ripping, followed by weed control and planting of native seedlings or cuttings. Some of these areas now support mature plants with natural recruitment occurring. The species composition of these areas includes both local and non-local native species. Examples of the latter include *Eucalyptus conferruminata*, *Melaleuca nesophila* and *Hakea petiolaris*.

The location of these vegetation communities can be found in figures 2.4.1, 2.4.2, 2.4.3 and 2.4.4.

2.6 Vegetation condition

Vegetation condition within the reserve ranges from degraded in the northern section to very good in the southern section. The condition of vegetation throughout the Tramway can be seen in figures 2.6.1 and 2.6.2. Vegetation condition was assessed according to Keighery (1994). The criteria for vegetation condition classification can be seen in Appendix C.

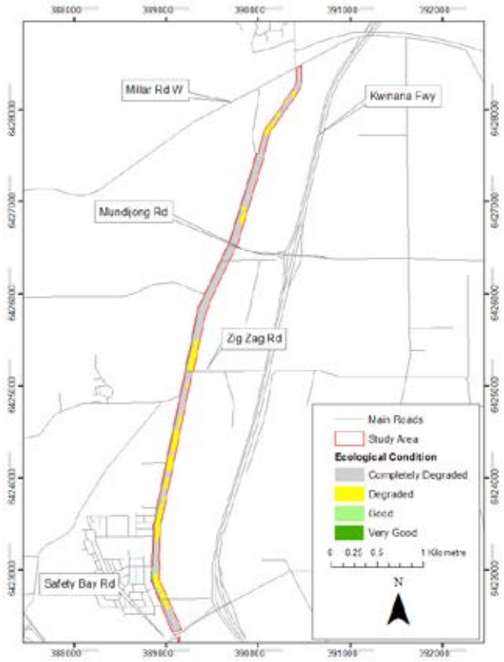


FIGURE 2.6.1

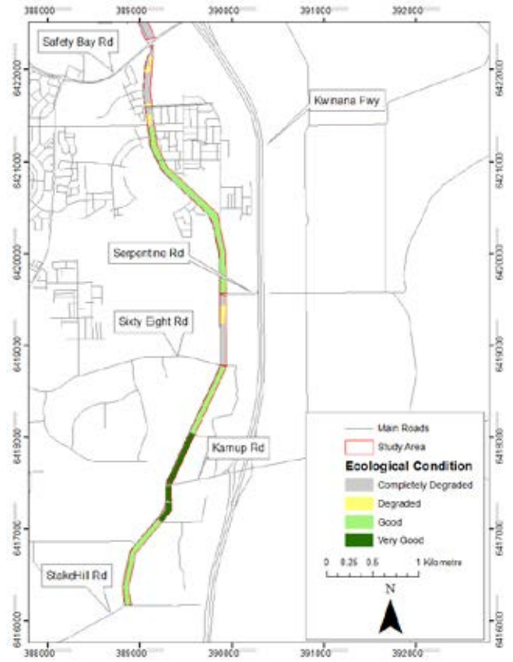


FIGURE 2.6.2

2.7 Conservation significant flora

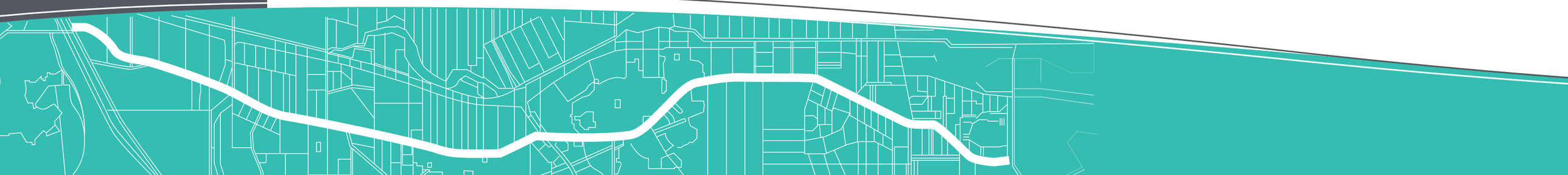
Two populations of the priority species, *Dodonaea hackettiana* (P4) were recorded in the Reserve (figure 2.7.1). This species is a medium sized shrub to 2.5 m. It is limited to the Perth metropolitan area and is mostly found in near coastal situations. The southern population (15 plants) would appear to be associated with rehabilitation planting and may be the result of a deliberate introduction. The northern population is in close proximity to a constructed pathway and could potentially be an introduction. It consists of four plants found within the *Tuart-Sheoak-Banksia* community. Though small, both populations appear healthy and were in flower at the time of field visits. Both populations show evidence of seedling recruitment.

2.8 Conservation significant fauna

Two of the conservation significant Black Cockatoos, Forest Red-tailed Black-Cockatoo and Carnaby's Cockatoo were recorded foraging in the Tramway Reserve during the field assessment. The Forest Red-tailed Black Cockatoo is distributed through the humid and sub-humid south-west of Western Australia from Gingin through the Darling Ranges to the south-west from approximately Bunbury to Albany (Johnstone & Storr 1998). The Forest Red-tailed Black Cockatoo was recorded foraging on Marri nuts in the project area during the assessment.

The Carnaby's Cockatoo is endemic to south-west Western Australia, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale 2003). The species was once common, but the population has declined significantly in the last half century (Johnstone and Storr 1998). Carnaby's Cockatoo was recorded foraging on *Banksia spp.* in the Tramway Reserve during the assessment.

Although not observed during the survey, three species were identified during a desktop review were considered likely to occur within the Tramway Reserve.



The Quenda occurs in forest, heath and coastal scrubs along the coast of south-western WA from Moore River to Israelite Bay (Menkhorst & Knight 2001). They typically seek daytime refuge from predators in very thick ground-storey vegetation, often associated with swamps or damplands (Long 2009). They forage by night in open areas, leaving distinctive conical feeding holes in the ground (Long 2009). The Quenda is threatened by clearing and fragmentation of its preferred habitat (Van Dyck & Strahan 2008). The denser ground-storey vegetation in the southern section of the Tramway Reserve provides ideal habitat for this species.

The Rainbow Bee-eater is listed as migratory under the EPBC Act. This species is one of the most common and widespread birds in Australia with a distribution that covers the majority of Australia (Barrett et al. 2003). In Western Australia this bird can occur as a resident, breeding visitor, postnuptial nomad, passage migrant and winter visitor (Johnstone & Storr 1998). The Tramway Reserve contains potential foraging and nesting habitat for this species.

The Black-striped Snake is restricted to sandy coastal strip near Perth and occurs on dunes and sandplains vegetated with heaths and *Eucalypt-Banksia* woodlands (Wilson & Swan 2010). The Tramway Reserve includes suitable habitat for this species.

2.9 Fauna habitat

Three broad fauna habitat types were present in the project area, *Eucalyptus* and *Melaleuca* woodland, *Eucalyptus-Corymbia-Banksia* woodland and scattered native trees. The Eucalyptus and *Melaleuca* woodland and scattered native trees were generally in a degraded condition and provided limited value to fauna due to the absence of midstorey species and ground cover. The *Eucalyptus-Corymbia-Banksia* woodland typically was in better condition especially in the southern section. This habitat included a more intact shrub and ground layer and consequently was considered to have a higher habitat value.

TABLE 2.9.1

Habitat Type	Description	Area (ha)
Eucalyptus and *Melaleuca* woodland	*Eucalyptus rudis* and *Melaleuca preissiana* low open woodlands over grasses and weeds	4.80
Eucalyptus-Corymbia-Banksia woodland	*Eucalyptus gomphocephala*, *E. marginata* and *Corymbia calophylla* woodlands over *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana* low woodlands over mixed shrubs over grasses and weeds.	30.01
Scattered native trees	Scattered remnant trees (*Corymbia calophylla* and *Eucalyptus spp.*) over grasses and weeds.	28.90

- ***Eucalyptus* and *Melaleuca* woodland**

The *Eucalyptus* and *Melaleuca* woodland typically occupied the lower lying areas and was generally in a more degraded condition. The *Eucalyptus rudis* and *Melaleuca preissiana* provide foraging opportunities for a variety of native birds, particularly Honeyeaters when flowering. The undergrowth in this habitat consists mainly of introduced species thereby restricting the level of habitat potential for ground dwelling species.

- ***Eucalyptus-Corymbia-Banksia* woodland**

The soft white sand of the *Eucalyptus-Corymbia-Banksia* woodland provides suitable habitat for burrowing reptiles including the conservation significant Black-striped Snake (*Neelaps calonoto*). The *Eucalyptus*, *Corymbia* and *Banksia spp.* found in this habitat type provides foraging opportunities for a variety of native birds when flowering and both the flowers and seeds provide foraging opportunities for Black Cockatoos. The undergrowth in this habitat was typically more intact and included species such as *Xanthorrhoea spp.* and *Macrozamia spp.* that provide habitat for ground dwelling species.

- **Scattered Native Trees**

These areas have a severely altered natural vegetation structure and offer limited habitat for fauna. They generally consist of cleared areas with isolated remnant trees. Despite being highly degraded they may still provide potential breeding habitat and limited foraging habitat for threatened Black Cockatoo species. The absence of undergrowth in this habitat restricts the use for ground dwelling species that require cover.

2.9.1 Black Cockatoo habitat

Suitable foraging and breeding habitat for all three species of Black Cockatoos was recorded in the Tramway Reserve, which can be seen in the overall concept plans in the Master Plan. The Forest Red-tailed Black-Cockatoo and Carnaby's Cockatoo were directly observed foraging in the Tramway during the field assessment.

Suitable foraging habitat was located in all three of the fauna habitats described in the Tramway, particularly in the *Eucalyptus-Corymbia-Banksia* woodland and scattered native trees broad habitat types. These habitat types featured known Black Cockatoo foraging species such as Jarrah (*Eucalyptus marginata*), Tuart (*E. gomphocephala*), Marri (*Corymbia calophylla*), *Banksia spp.* and *Allocasuarina fraseriana*.

In order to assess potential Black Cockatoo breeding habitat 273 trees that had a diameter at breast height (DBH) ≥ 500 mm were recorded (Appendix D, page 59). Of these 273, 136 were Marri, 38 were Tuart, 34 were Jarrah, 30 were Flooded gum (*Eucalyptus rudis*) and 35 were dead trees. Twenty seven trees had obvious hollows with suitable dimensions for breeding, however, no signs such as feathers or bespatter were recorded beneath them. Of the 266 trees measured the mean size was 793 mm ± 300 mm (one standard deviation).

Potential breeding trees in Precinct Four of the Tramway Reserve were not recorded. This was due to the high density of mature trees along the length of Precinct Four. This whole section is considered potential breeding habitat for Black Cockatoos.

3. Threatening Process

3.1 Weeds

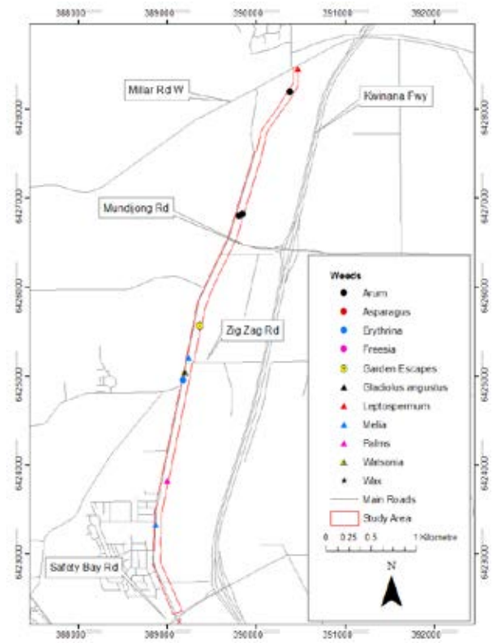


FIGURE 3.1.1

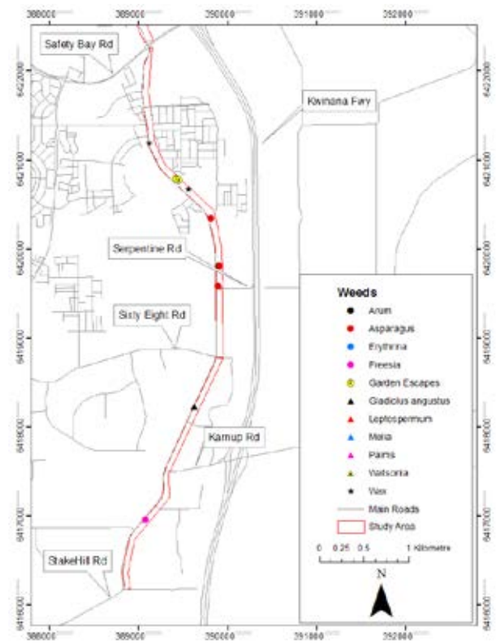


FIGURE 3.1.2

3. THREATENING PROCESSES

FIGURE 2.7.1 - PRIORITY SPECIES *DODONAEA HACKETTIANA* (P4)

CARNABY'S COCKATOO
PHOTO SOURCE: FRANK SPOLC

3. THREATENING PROCESSES

The floristic assessment of the Tramway identified 97 exotic species (see Appendix E, page 62). This number includes garden escapees (e.g. *Dimorphotheca*, *Pelargonium*), annual and perennial grasses and herbs, as well as woody species and geophytes. A number of these species are recognised ecological threats (e.g. Arum Lily - *Zantedeschia aethiopica*, Bridal Creeper - *Asparagus asparagoides*, Freesias). Due to the ubiquitous nature of some weed species, not all weeds are mapped (e.g. *Ursinia anthemoides*, *Arctotheca calendula*). The species mapped are considered to be aggressive ecological threats which should be removed as a priority. The location of these weeds can be seen in figures 3.1.1 and 3.1.2. These weeds restrict the natural succession and regeneration of native species and if not actively managed will also inhibit bushland revegetation and rehabilitation within the Tramway.

3.2 Dieback (*Phytophthora cinnamomi*)

Dieback is a plant disease caused by the pathogen *Phytophthora cinnamomi* that feeds on root tissue causing lesions that reduce the ability of infected plant to transport water and nutrients. The pathogen greatly decreases the biodiversity of infested areas, reducing the ability of bushland areas to provide habitat for native fauna. A variety of human activities spread dieback via vehicles, footwear and revegetation works.

A formal assessment for the presence of dieback (*Phytophthora*) was not undertaken and an informal visual assessment for dieback cannot accurately be undertaken in degraded vegetation. However, in sections of the Tramway with good condition vegetation the presence of dieback-susceptible species can be used an indicator of disease absence. Species of the plant family Proteaceae are known to be very susceptible to dieback. Hence the presence of healthy populations of *Banksia spp.* and *Xylomelum occidentalis* (as well as *Eucalyptus marginata* and *Allocasuarina fraseriana*) within the overstorey of the woodland communities suggests that dieback (if present) is not extensive.

3.3 Introduced fauna

Introduced animals represent a threat to the conservation values provided by the reserve. A desktop review indicated six introduced fauna species that were likely to occur within the Tramway Reserve, including:

- European Red Fox (*Vulpes vulpes*)
- Rabbit (*Oryctolagus cuniculus*)
- House Mouse (*Mus musculus*)
- Domestic Pigeon (*Columba livia*)
- Laughing Turtle-dove (*Streptopelia senegalensis*)
- Spotted Turtle-dove (*Streptopelia chinensis*)
- Eastern Long-billed Corella (*Cacatua tenuirostris*).

A number of introduced fauna species were also sighted during a field survey including:

- European Red Fox (*Vulpes vulpes*)
- Rainbow Lorikeet (*Trichoglossus haematodus*)
- Laughing Kookaburra (*Dacelo novaeguineae*).

Introduced fauna can impact native fauna populations through a number of mechanisms including predation, competition for food, shelter and breeding sites.

The total inventory of fauna from the desktop review and field assessment can be seen in Appendix F page 63.

3.4 Fragmentation of bushland

The Tramway occurs in a highly urbanised environment where many landscape features can lead to bushland fragmentation. While fulfilling recreational objectives, current and proposed path networks have the potential to fragment bushland within the reserve. Driveways and roads that traverse the Tramway also act to isolate pockets of bushland.

The creation of small isolated patches of remnant bushland inhibit landscape connectivity; restricting habitat availability for native species, reducing the long term viability of populations as well as inhibiting the natural dispersal of flora and fauna.

As described in the Master Plan, the overall recreational objective of the Tramway Reserve is to provide a continuous trail for unstructured recreation such as walking, cycling and nature appreciation. Currently, trails exist between Safety Bay Road and Heritage Park Drive, developed as part of the residential subdivisions neighbouring the Tramway in this area. The proposed pathway network is to be developed with due consideration for minimising fragmentation.

3.5 Fuel loads and fire risk

Increased fire frequency threatens biodiversity, reduces the ability of native species to complete their lifecycle and can encourage the growth of invasive weeds. Fire also poses a threat to infrastructure within and surrounding the reserve.

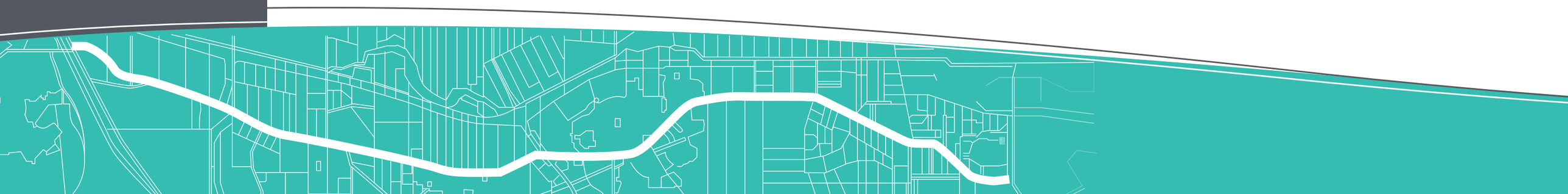
Spatial variation in fuel loads within plant communities can lead to unpredictability in fire behaviour. Bushfire hazard levels can be determined based on the predominant vegetation types as per the *Planning for Bushfire Protection Guidelines* (2010). All forest and woodland areas are classified as an 'extreme' bushfire hazard, while open woodland vegetation areas have a 'moderate' bushfire hazard rating. The vegetation in Precincts Three and Four would therefore be classified as moderate-extreme. Patches of 'extreme' bushfire hazard woodland are also present in Precincts One and Two, while the shrubland present in these precincts is classified as 'moderate'. The grassland which is the dominant vegetation class in the northern section of the Tramway is classified as 'low' bushfire hazard. The vegetation in Precincts One and Two would therefore be classified as low-moderate-extreme.

Fuel loads were assessed in the Tramway Reserve between Safety Bay Road and Serpentine Road (Precinct Three), where large areas of residential development abut the reserve. The available fuel load estimates of sample sites (8-16 tonnes per ha) reflected the heterogeneous nature of fuel distribution within the Tramway as well as the moderate bushfire hazard rating based on vegetation type.

Fuel loads were greater within the *Tuart-Sheoak-Banksia* community than the *Jarrah-Marri-Banksia* community. This reflects the taller stature and larger size of the overstorey and the greater density of the understorey and ground layers of the former community. The estimated fuel loads at each of the four sample sites can be seen in table 3.5.1.

TABLE 3.5.1

Site	Location	Fuel Estimate (t per ha)
F1	389902 E 6419833 N	8.2
F2	389816 E 6420339 N	10.2
F3	389408 E 6420763 N	11.7
F4	389117 E 6421345 N	15.6



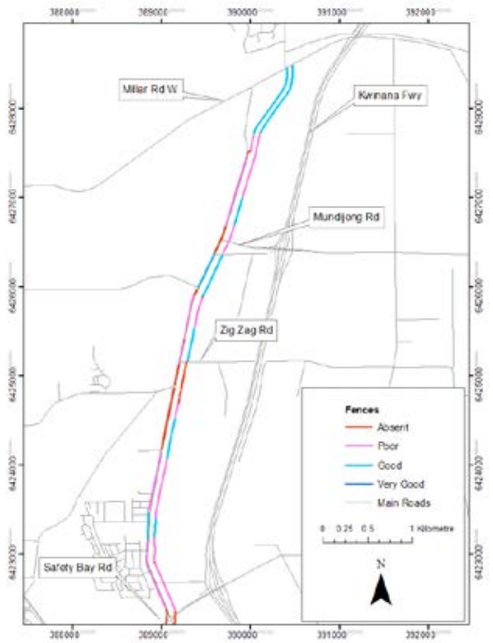


FIGURE 3.6.1

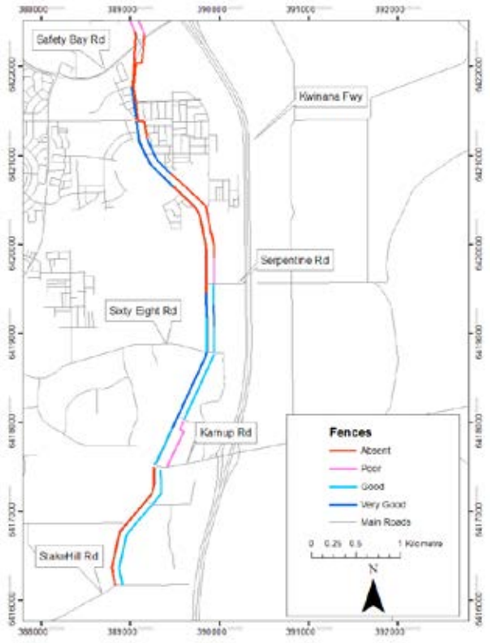


FIGURE 3.6.2

3.6 Inappropriate access

Inappropriate access can pose a threat to conservation of bushland areas as result of trampling, use of off-road vehicles and dumping of rubbish. Inappropriate access is closely linked to the availability, quality and location of fencing. The condition and extent of fencing throughout the Tramway can be seen in figures 3.6.1 and 3.6.2, with approximate fencing distances depicted in table 3.6.1. Precinct 3, from Safety Bay Road to Sixty Eight Road, was deemed to be the most poorly fenced section of the Tramway. This is of particular concern due to the good quality vegetation in this precinct. While the fencing in Precinct Four from Sixty Eight Rd to Stakehill Road, surrounding very good quality vegetation, was the best in the Tramway.

TABLE 3.6.1

Tramway Precinct	Approximate Fence Condition Distances (km)			
	Absent	Poor	Good	Very Good
1	0.4	3.3	3.1	0
2	1.4	3.1	1.1	0
3	4.2	0.3	0	2.2
4	1.5	0.6	2.6	0.9

The majority of fences feature wood posts with simple horizontal plain wire and barb wire. Some areas have ring lock fencing. Generally fences delineating the Tramway Reserve from adjacent properties were in better condition than the fences along Baldivis Road.

Of note is the presence of non-standard fences, including electric fences. These fences are associated with the adjacent land owner extending into the Tramway Reserve. The exact location of non-standard fencing within the reserve is depicted in table 3.6.2.

TABLE 3.6.2

Easting	Northing	Notes
389079	6424485	Looking north, no fence
388894	6423603	Neighbour's fence
388894	6423603	Neighbour's fence
388894	6423603	Neighbour's fence
388852	6423051	Pasture/no fence
388852	6423051	Pasture/no fence

4. MANAGEMENT ACTIONS

4. Management Actions

4.1 Weed management

The objectives for weed management within the Tramway include:

- Preventing the introduction of additional weed species
- Prevent further encroachment of weeds into bushland areas, particularly in Precincts Three and Four
- Ensure weed control actions do not negatively impact native flora and fauna
- Support weed management efforts with bushland revegetation and rehabilitation.

An integrated weed management approach will use a variety of control options to create a sustainable and effective management system. In natural areas integrated weed management involves a combination of mechanical and chemical systems coupled with an appropriate restoration and revegetation process to increase ecosystem resilience and long-term viability.

Due to the large area of the Tramway reserve, weed control efforts should be focused on priority weed species. The location of these weeds can be seen in figures 3.1.1 and 3.1.2. These weeds pose aggressive ecological threats and should be removed as a priority. The proposed methodology and timing of weed control for each weed species can be found in table 4.1.1.

TABLE 4.1.1

Weed	Control Method	Timing
Zantedeschia aethiopica (arum lily)	Spot spray metsulfuron methyl 0.4 g/15 L of water (or 5 g/ha) + 225 mL glyphosate + Pulse®. As glyphosate is non-selective, only apply where there is no chance of off target application on native vegetation. Otherwise, spot spray metsulfuron methyl or chlorsulfuron 0.4 g/15 L of water (or 5 g/ha) + Pulse.	Any time between July and September for a period of five years (spraying can cause dormancy and regrowth)
Asparagus asparagoides (bridal creeper)	Spray 0.2 g metsulfuron methyl + Pulse® in 15 L water (or 2.5–5 g/ha + Pulse®). Best results achieved when flowering. Biological control agents available	August to September
Erythrina	Try stem injection using 100% glyphosate, or apply 250 ml Access® in 15 L of diesel to basal 50 cm of trunk (basal bark)	April to September
Freesia	Spot spray metsulfuron methyl 0.2 g/15 L + Pulse® or 2.5-5 g/ha + Pulse®. Apply just on flowering at corm exhaustion.	July to August
Gladiolus angustus	Spot spray metsulfuron methyl 0.2 g/15 L + glyphosate 1% + Pulse® in degraded sites	July to August
Leptospermum laevigatum (coast tea tree)	Hand pull seedlings. Fell mature plants. Resprouting has been recorded in some areas. Where resprouting has been observed, apply 250 ml Access® in 15 L of diesel to bottom 50 cm of trunk (basal bark).	July to October

4. MANAGEMENT ACTIONS

TABLE 4.1.1 - CONTINUED

Melia azedarach	Hand pull seedlings, ensuring removal of all root material. Stem inject older plants using 50% glyphosate, or basal bark with 250 ml Access® in 15 L of diesel to base 50 cm of trunk. Avoid root disturbance until trees are confirmed dead	December to February
Watsonia	Wipe individual leaves with glyphosate 10% or spray dense infestations 2,2-DPA 10 g/L + Pulse®. Apply just as flower spikes emerge at corm exhaustion. 2,2-DPA at 5 g/L+ Pulse® is also quite effective and is appropriate to use when particularly concerned about off-target damage, for example following fire when Watsonia is growing among germinating native seedlings and re-sprouting native shrubs	August to September
Chamelaucium uncinatum (Geraldton wax)	Cut to base and paint with 50% glyphosate. Control seedlings following fire	All year round

Introduced grass species located in open grassland areas in Precincts One and Two of the Tramway should be controlled through a combination of slashing and spraying, with the most appropriate method to be determined on site with regard to the presence of low hanging branches, fallen branches and other factors that may restrict access of slashing machinery. Weeds should be treated regularly to reduce the amount of seed being transmitted into the bushland areas of the reserve. The biology and preferred method of removal for the priority weed species within the Tramway can be found on the Flora Base website (www.florabase.dpaw.wa.gov.au). As weed treatment methodologies may change or improve, regular checking of this website is recommended.

To support weed control methods, the area should be monitored for expansion of existing weed populations or for new infestations, particularly in areas that are undergoing rehabilitation and revegetation. Future weed control priorities and actions may need to be adjusted according to the results of ongoing monitoring. Weed control should also be prioritised succeeding fire events to prevent invasive weeds from re-establishing.

4.1.1 Recommendations

TABLE 4.1.2

	Weed Management Actions	Priority
1	Use figures 3.1.1 and 3.1.2 to immediately implement appropriate weed control activities as per the relevant timing in table 4.1.1.	High
2	Undertake weed control after disturbance events such as fire	High
3	Interim assessment (after 5 years) of weed populations to inform future management	High

4.2 Dieback (*Phytophthora cinnamomi*) management

The primary objective for dieback management within the Tramway is to prevent the spread of the pathogen to and within the reserve. Dieback infection has a number of consequences for Local Government including the:

- Local extinction of trees and wildflowers
- Diminished recreation and aesthetic values of reserves
- Cost of treatment
- Cost of removing dead trees for public safety
- Cost of rehabilitating areas damaged by the pathogen.

As such a formal assessment of dieback within the Tramway should be considered in order to support bushland rehabilitation objectives of the Master Plan. The reserve should at the very least be monitored for dieback where tree decline is observed. In the event that dieback presence is confirmed, management of dieback can be achieved through appropriate hygiene, eliminating activities that spread the pathogen and the application of phosphite to boost the immune systems of susceptible plants (Dieback Working Group, 2008).

To minimise the risk of dieback being introduced to the Tramway Reserve, particularly during infrastructure upgrades as per the Master Plan, appropriate hygiene standards should be maintained by:

- Ensuring revegetation tubestock are sourced from an accredited nursery
- Ensuring machinery, vehicles, equipment and footwear arrive at the site free of mud and soil
- Ensuring machinery and equipment is not cleaned inside the reserve
- Works involving the movement of soil such as path construction should only be undertaken in dry soil conditions to minimise the risk of dieback being dispersed by machinery
- Disinfecting footwear and equipment with undiluted methylated spirits or similar when entering bushland areas.

The maintenance of these hygiene standards is particularly important when conducting on-ground works in good quality vegetation in Precincts Three and Four.

4.2.1 Recommendations

TABLE 4.2.1

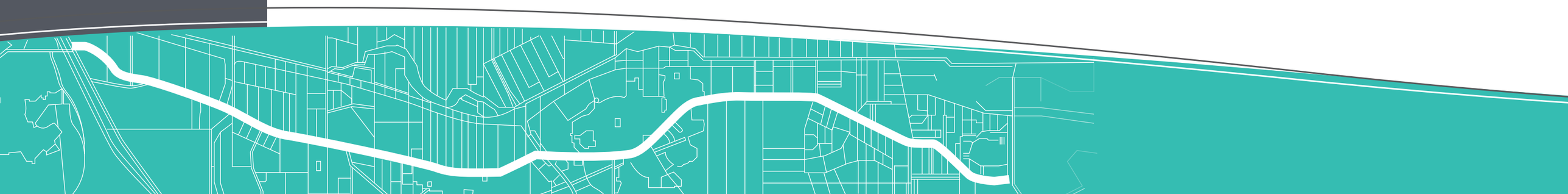
	Dieback Management Actions	Priority
4	Monitor reserve for dieback presence where tree decline is observed	High
5	Tubestock for revegetation sourced from accredited nursery	High
6	Maintain appropriate hygiene practices during on-ground works	High

4.3 Introduced fauna management

The objective of fauna management in the Tramway is to suppress feral animal numbers to minimise predation pressure on native fauna by foxes and cats and to minimise grazing pressure on native plants and seedlings by rabbits.

To minimise the impacts of introduced fauna on the conservation objectives of the reserve, ongoing assessment is required to ascertain the extent of rabbit and fox populations within the Tramway, in addition to other introduced fauna species. Potential development of control programs, including measures such as baiting and trapping, should be investigated following the results of preliminary assessment. An appropriate introduced fauna management plan should be considered to document the most appropriate methods and focus areas (such as in good quality vegetation in Precincts Three and Four) for controlling these introduced species within the Tramway.

In the event that fauna management controls are implemented, an assessment should be conducted following implementation to evaluate the efficacy of controls in managing introduced fauna populations. Such evaluation should inform future introduced fauna management plans for the reserve and elsewhere in the City of Rockingham.



In the short term, the restoration of habitat through understorey planting will help to provide refuge for native fauna. To maximise the success of bushland restoration and revegetation within the Tramway, all seedlings should be planted with tree guards to prevent grazing by rabbits.

TABLE 4.2.2

	Introduced Fauna Management Actions	Priority
7	Assessment to determine extent of feral fauna populations	High
8	Development of control program for specific problem species and areas following results of assessment	Ongoing
9	Use tree guards around seedlings to minimise the impact of rabbits during revegetation works	High
10	Understorey revegetation to provide native fauna with refuge	High

4.4 Bushland fragmentation, revegetation and rehabilitation strategies

In order to minimise bushland fragmentation, the proposed path network should 'skirt' core bushland areas, using degraded and cleared areas for the placement of the path itself as well as the placement of proposed concept areas. Particular caution should be exercised to ensure the protection of significant trees for Black Cockatoo habitat, as described in Section 2.9.1 of this management plan and mapped in the overall precinct plans (figures 3.1.4, 4.1.4, 5.1.1 and 6.1.1 of the Master Plan).

Improving bushland areas enhances both the ecological and recreational capacity of reserves. The primary objectives of revegetation and rehabilitation within the Tramway are to:

- Optimise use of limited resources by prioritising areas for targeted action
- Improve overall condition of bushland areas within the Tramway
- Ensure vegetation communities are self-sustaining and are capable of natural regeneration
- Re-establish native flora and vegetation communities present within the Tramway
- Support native fauna through habitat improvement.

Rehabilitation within the Tramway will serve to complement the natural regeneration processes of the ecosystem. For this reason, the City advocates the Bradley Method of bushland regeneration, whereby efforts are focused in areas that are relatively undisturbed and not completely invaded by weeds. Through the removal of threatening processes such as weeds, conditions favourable for growth are created and native vegetation species can regenerate. While the Bradley Method primarily promotes allowing natural regeneration after weed control, the effectiveness of such a program would be further enhanced by corresponding revegetation efforts. By focusing efforts in areas that are not completely degraded, bushland condition can be successfully improved with relatively little effort. The priority revegetation and rehabilitation areas can be seen in figures 4.4.1, 4.4.2, 4.4.3 and 4.4.4.

As Precinct Three and Four contain good and very good quality remnant vegetation respectively, bushland revegetation and rehabilitation will be concentrated in these precincts. This will include planting of seedlings in good quality vegetation (1 plant per m^2) and direct seeding in areas of very good quality vegetation (0.15 g per m^2). The recommended species list for revegetation can be seen in table 4.4.1. This species list is derived from the existing vegetation communities and complexes within the Tramway and includes foraging and breeding habitat for Carnaby's Black Cockatoo.

Due to the heavily denuded nature of Precincts One and Two, revegetation in these precincts will only occur around the Proposed Concept Areas, primarily for aesthetic and shade purposes, with the hope of providing some ecological benefit. Revegetation in Proposed Concept Areas will consist of tree and shrub seedlings. Planting in these areas should only occur after the construction of proposed infrastructure.

The suggested species list for revegetation in the Proposed Concept Areas can also be seen in table 4.4.1.

The planting density required in each concept area varies with regard to existing vegetation and proposed landscaping treatments. However a general density of 1 plant per m^2 should be maintained. The detailed concept plans for each Proposed Concept Area indicate the number and preferred placement of seedlings. It is important to note that this is only a guide, and the most appropriate density and placement of seedlings should be determined on site with due consideration for environmental conditions and the location of the DUP and firebreaks.

It is recommended that:

- Weed control occur in each revegetation area one year prior to planting and yearly thereafter for a period of three years
- Seedlings should be planted with native fertiliser tablets and plastic tree guards to prevent predation by rabbits
- A general plant density of 1 plant per m^2 be maintained for seedlings
- An application rate of 0.15 g/m^2 for direct seeding be maintained with appropriate germination treatments to be considered prior to direct seeding
- Planting be conducted in late autumn – early winter to utilise the winter rains
- Plants be watered regularly during summer months
- Plants used for revegetation be local provenance and grown by a NIASA accredited nursery
- Plants be healthy and hardened before planting with good root stock, to maximise chance of survival
- Revegetation be conducted according to priority as per table 4.4.1, with Priority 1 being most important
- Ongoing monitoring is conducted to evaluate success of restoration in terms of seedling survival and recruitment
- A seedling survival of 80% should be observed after two years.

The plant requirements for rehabilitation and revegetation is summarised in table 4.4.1. Species suitable for Black Cockatoo foraging and breeding habitat are marked with an asterisk.

4. REVEGETATION AREAS

Revegetation Legend

- Revegetation and Rehabilitation in Very Good Condition Bushland
- Revegetation and Rehabilitation in Good Condition Bushland
- Revegetation in Detailed Concept Areas

Legend

- Existing Dual Use Path
- Proposed 2.5m Dual Use Path
- Existing Firebreak
- Proposed 4m Firebreak
- Secondary Tramway Path
- Existing Bridle Trail
- Proposed Bridle Trail
- Combined Existing Firebreak and Dual Use Path
- Combined Proposed Firebreak and Dual Use Path
- Combined Existing Firebreak and Bridle Trail
- Combined Proposed Firebreak and Bridle Trail
- Soft Edge between Development and Tramway (no walls or fencing)
- Remnant Vegetation to be Retained and Protected
- Potential Areas for Revegetation
- Areas Designated for Future Offset Revegetation Planting
- Localised Wet Areas/Water Bodies
- Bridle Trail Facilities
- Existing Principal Shared Path along Kwinana Fwy
- Existing Telstra Building
- Black Cockatoo Breeding Tree Locations

PRECINCT ONE

EPHEMERAL WETLAND

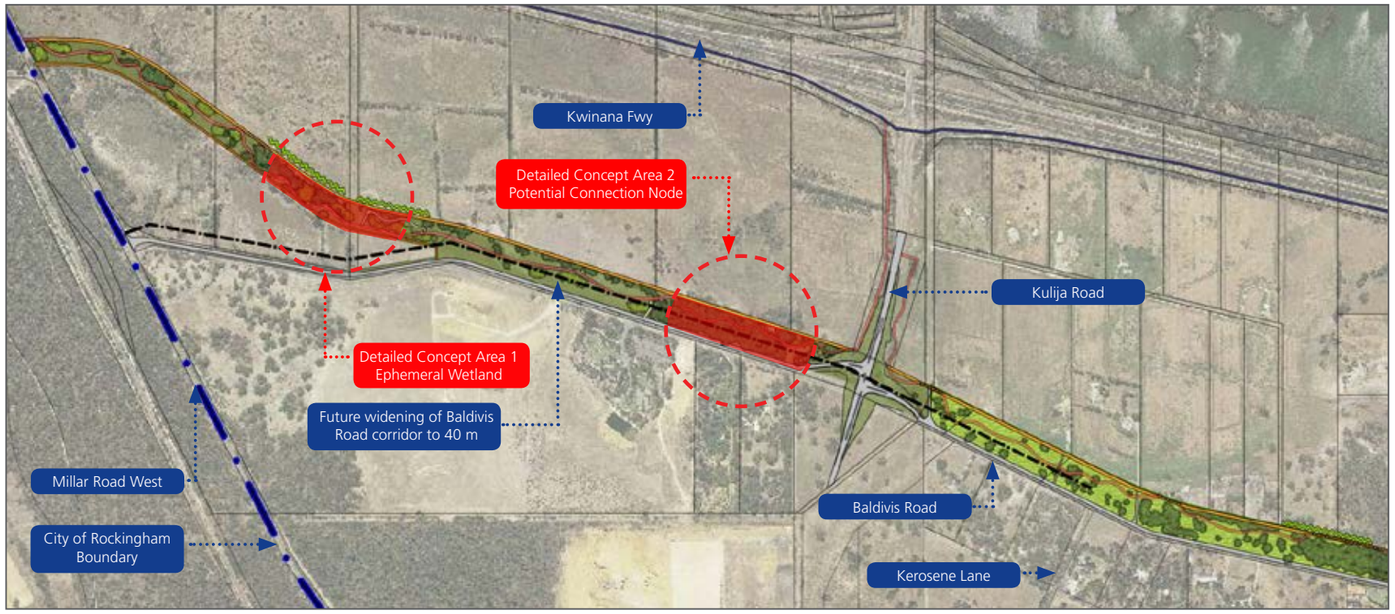


FIGURE 4.4.1 REVEGETATION AREAS MAP

PRECINCT TWO

HERITAGE AND EDUCATION ••• NATURE TRAIL

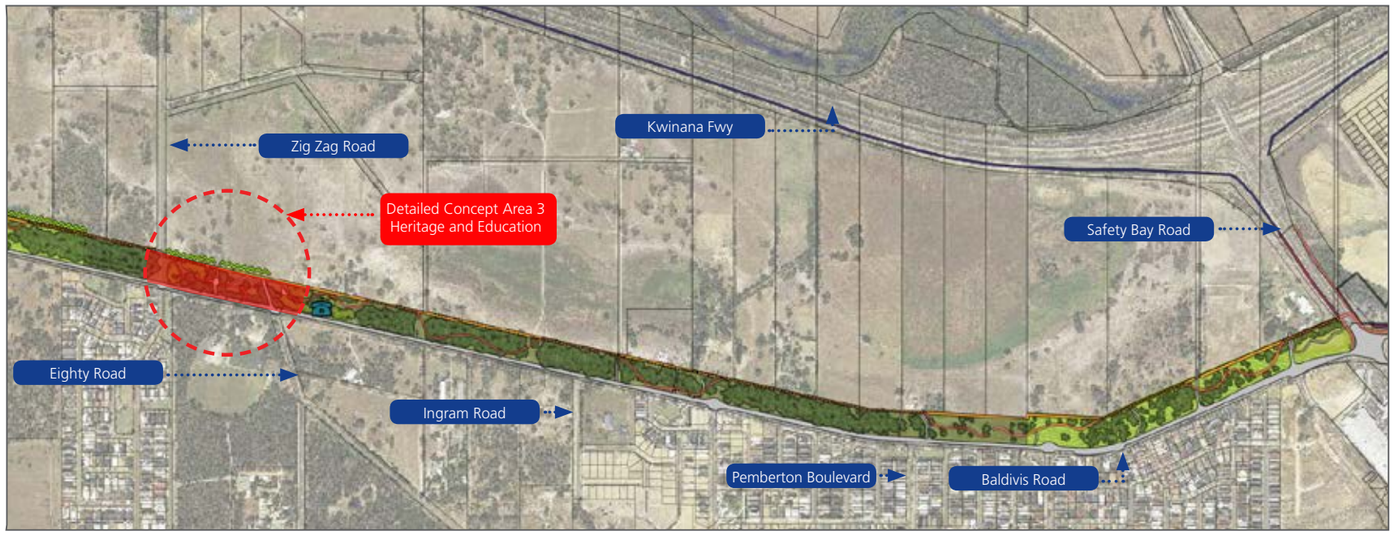
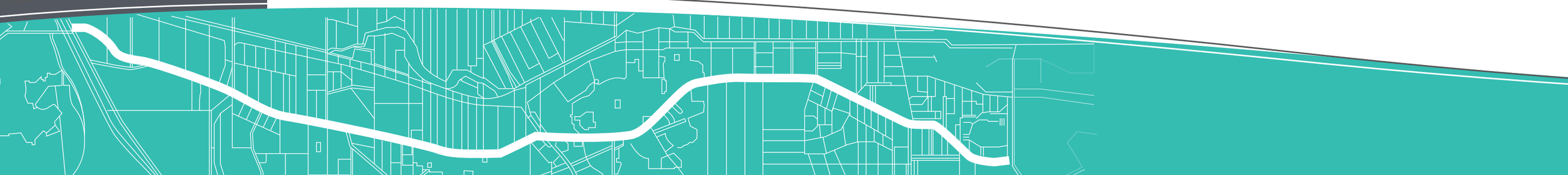


FIGURE 4.4.2 REVEGETATION AREAS MAP



4.

PRECINCT THREE

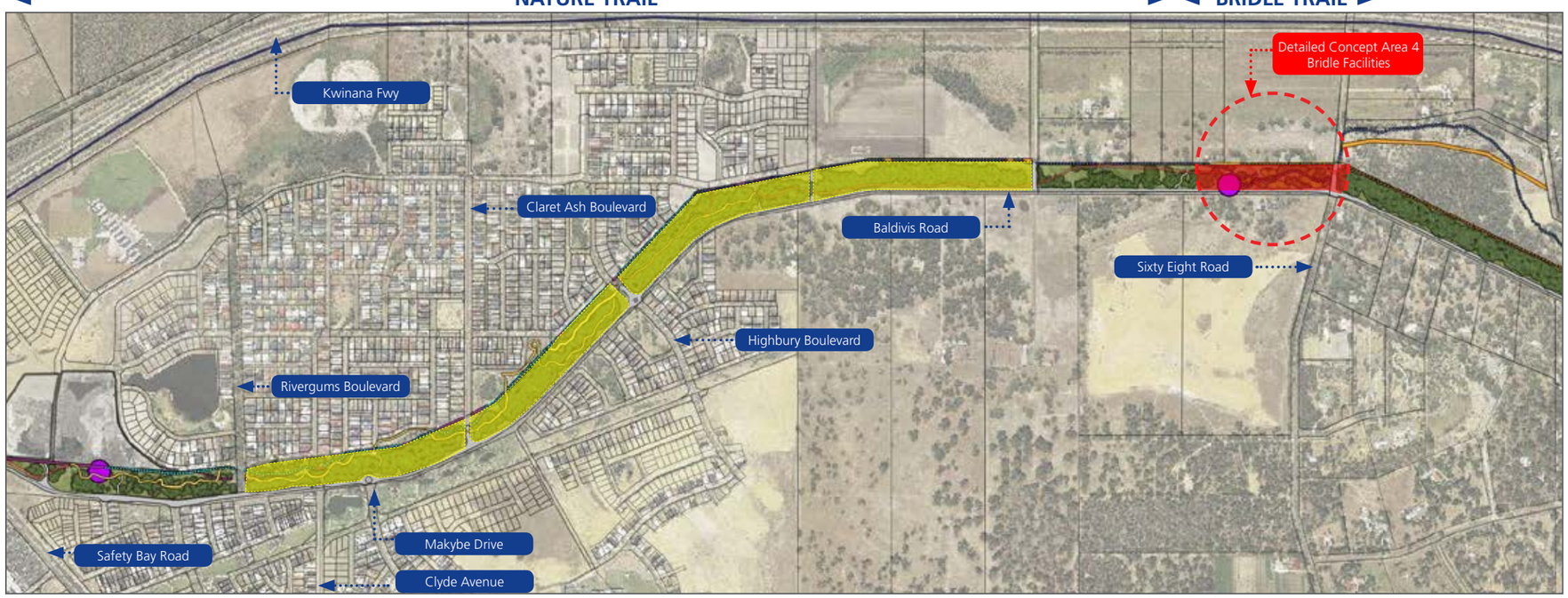


FIGURE 4.4.3 REVEGETATION AREAS MAP

PRECINCT FOUR

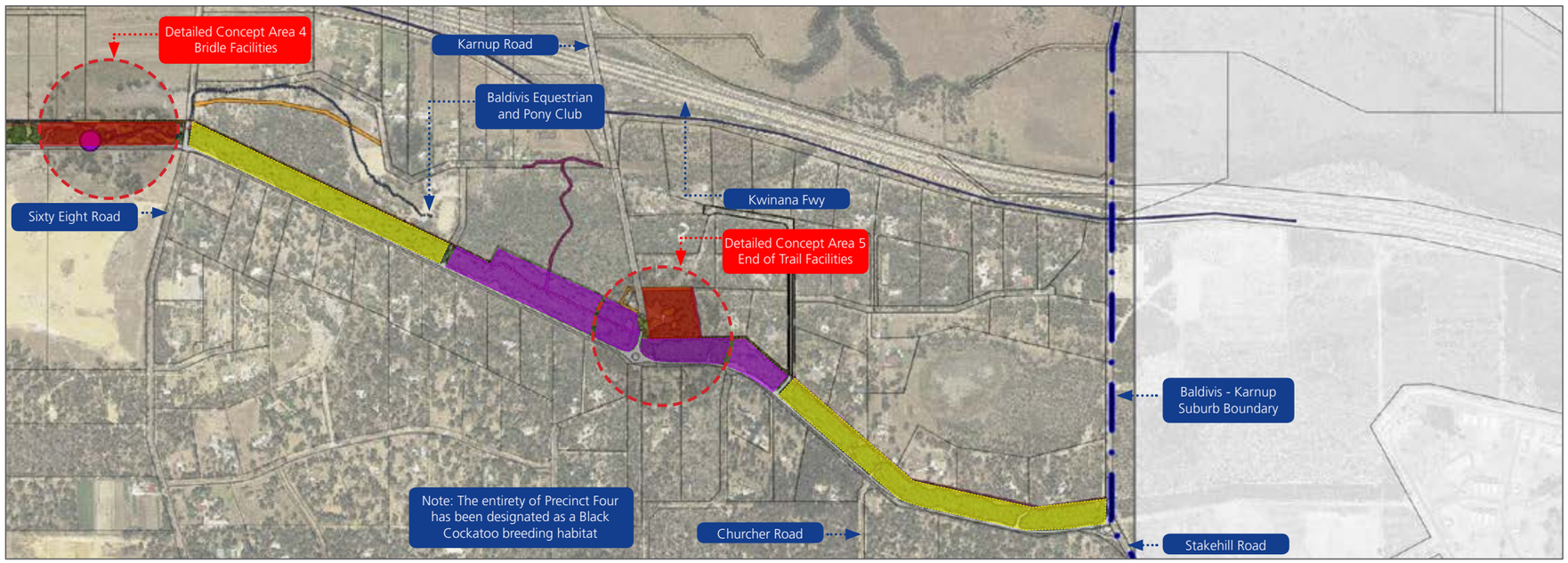
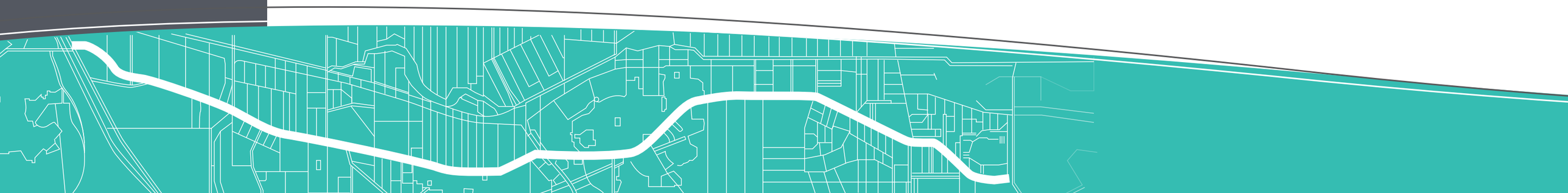


FIGURE 4.4.4 REVEGETATION AREAS MAP

4.1 REVEGETATION PLANT REQUIREMENTS

SUMMARY OF PLANT REQUIREMENTS TABLE 4.4.1

	Suitable Species	Common Name	Form	No. of Seedlings	Total Area (m²)
Good Condition Vegetation Area **Priority 1**	*Eucalyptus marginata**	Jarrah	Tree	223,000	223,310
	*Eucalyptus gomphocephala**	Tuart	Tree		
	Allocasuarina fraseriana	WA Sheoak	Tree		
	*Banksia menziesii**	Firewood Banksia	Tree		
	*Banksia attenuata**	Slender Banksia	Tree		
	*Banksia grandis**	Bull Banksia	Tree		
	Corymbia calophylla	Marri	Tree		
	Acacia alata	Winged Wattle	Understorey		
	Acacia cochlearis	Rigid Wattle	Understorey		
	Acacia extensa	Wiry Wattle	Understorey		
	Acacia huegelii	n/a	Understorey		
	Acacia pulchella	Prickly Moses	Understorey		
	Adenanthos meisneri	Prostrate Woollybush	Understorey		
	Adenanthos obovatus	Basket Flower	Understorey		
	Allocasuarina humilis	Dwarf Sheoak	Understorey		
	Anigozanthos humilis	Cat's Paw	Understorey		
	Anigozanthos manglesii	Mangles Kangaroo Paw	Understorey		
	Astroloma ciliatum	Candle Cranberry	Understorey		
	Astroloma pallidum	Kick Bush	Understorey		
	Baeckea camphorosmae	n/a	Understorey		
	Bossiaea eriocarpa	Common Brown Pea	Understorey		
	Calytrix flavescens	Summer Starflower	Understorey		
	Calytrix fraseri	Pink Summer Calytrix	Understorey		
	Conostephium pendulum	Pearl Flower	Understorey		
	Conostephium preissii	Pearl Flower	Understorey		
	Conostylis juncea	Prickly Conostylis	Understorey		
	Dasypogon bromeliifolius	Pineapple Bush	Understorey		
	Eremaea pauciflora	Orange-fruited Eremaea	Understorey		
	Gastrolobium capitatum	Bacon and Eggs	Understorey		
	Gompholobium tomentosum	Yellow Pea	Understorey		
	*Hakea lissocarpha**	Honey Bush	Understorey		
	Hardenbergia comptoniana	Native Wisteria	Understorey		
	Hemiandra pungens	Snakebush	Understorey		
Good Condition Vegetation Area (direct seeding) **Priority 2** (for suitable understorey species see 'Good Condition Vegetation Area' List)	*Eucalyptus marginata**	Jarrah	Tree	328g of seed	2,185
	*Eucalyptus gomphocephala**	Tuart	Tree		
	Allocasuarina fraseriana	WA Sheoak	Tree		
	*Banksia menziesii**	Firewood Banksia	Tree		
	*Banksia attenuata**	Slender Banksia	Tree		
	*Banksia grandis**	Bull Banksia	Tree		
	Corymbia calophylla	Marri	Tree		
Concept Area 1 **Priority 3**	*Eucalyptus rudis*	Flooded Gum	Tree	28,000	28,486
	Melaleuca raphiophylla	Swamp Paperbark	Tree		
	Taxandra linearifolia	Swamp Peppermint	Tree		
	Hypocalymma angustifolium	Pink-flowered Myrtle	Understorey		
	Juncus pallidus	Pale Rush	Understorey		
	Kunzea glabrescens	Spearwood	Understorey		
Concept Area 2 **Priority 3**	*Allocasuarina fraseriana*	WA Sheoak	Tree	19,000	19,522
	*Banksia attenuata**	Slender Banksia	Tree		
	*Banksia manziesii**	Firewood Banksia	Tree		
	*Eucalyptus gomphocephala**	Tuart	Tree		
	Anthropodium capillipes	Chocolate Lily	Understorey		
	Bossiaea eriocarpa	Common Brown Pea	Understorey		
	Conostylis aculeata/ Conostylis juncea	Prickly Conostylis	Understorey		
	Dasypogon bromeliifolius	Pineapple Bush	Understorey		
	Hardenbergia comptoniana	Native Wisteria	Understorey		
	Hibbertia hypericoides	Yellow Buttercups	Understorey		
	Hypocalymma angustifolium	Pink-flowered Myrtle	Understorey		
	Lepidosperma spp.	n/a	Understorey		
	Opercularia spp.	n/a	Understorey		
	Phyllanthus calycinus	False Boronia	Understorey		
	Xanthorrhoea preissii	Grass Tree	Understorey		



Concept Area 3	*Allocasuarina fraseriana*	WA Sheoak	Tree	15,000	15,157
Priority 3			Tree		
	*Banksia attenuata**	Slender Banksia	Tree		
	*Banksia menziesii**	Firewood Banksia	Tree		
	Corymbia calophylla	Marri	Tree		
	*Eucalyptus gomphocephala**	Tuart	Tree		
	Eucalyptus Rudis	Flooded Gum	Tree		
	Melaleuca raphiophylla	Swamp Paperbark	Tree		
	Anthropodium capillipes	Chocolate Lily	Understorey		
	Bossiaea eriocarpa	Common Brown Pea	Understorey		
	Conostylis aculeata/ Conostylis juncea	Prickly Conostylis	Understorey		
	Dasypogon bromeliifolius	Pineapple Bush	Understorey		
	Hardenbergia comptoniana	Native Wisteria	Understorey		
	Hibbertia hypericoides	Yellow Buttercups	Understorey		
	Hypocalymma angustifolium	Pink-flowered Myrtle	Understorey		
	Lepidosperma spp.	n/a	Understorey		
	Opercularia spp.	n/a	Understorey		
	Phyllanthus calycinus	False Boronia	Understorey		
	Xanthorrhoea preissii	Grass Tree	Understorey		
Concept Area 3 **Wild Flower Garden Bed**					
SPRING	*Conostylis candicans*	Grey Cottonheads	6 months (flowering period)	515	515
	Thysanotus multiflorus	Finge Lily	3 months		
	Anigozanthas manglesii	Red and Green Kangaroo Paw	4 months		
SUMMER	*Calytrix fraseri*	Pink Summer Calytrix	9 months		
	Hemiandra pungens	Snakebush	6 months		
AUTUMN	*Hibbertia cuneiformis*	Cut Leaf Hibbertia	3 months		
	Hakea laurina	Pincushion Hakea	2 months		
	Hibbertia racemosa	Stalked Guinea Flower	6 months		
WINTER	*Banksia ashbyi*	Ashby's Banksia	6 months		
	Banksia menziesii	Firewood Banksia	9 months		
Concept Area 4	*Banksia attenuata**	Slender Banksia	Tree	19,000	19,315
	*Banksia grandis**	Bull Banksia	Tree		
Priority 3	*Banksia menziesii**	Firewood Banksia	Tree		
	Corymbia calophylla	Marri	Tree		
	*Eucalyptus marginata**	Jarrah	Tree		
	*Eucalyptus gomphocephala**	Tuart	Tree		
	Bossiaea eriocarpa	Common Brown Pea	Understorey		
	Conostylis aculeata/ Conostylis juncea	Prickly Conostylis	Understorey		
	Dasypogon bromeliifolius	Pineapple Bush	Understorey		
	Daviesia divaricata	Marno	Understorey		
	*Hakea lissocarpha**	Honey Bush	Understorey		
	Hardenbergia comptoniana	Native Wisteria	Understorey		
	Hibbertia hypericoides	Yellow Buttercups	Understorey		
	Hypocalymma angustifolium	White Myrtle	Understorey		
	Jacksonia furcellata	Grey Stinkwood	Understorey		
	Jacksonia sternbergiana	Stinkwood	Understorey		
	Lepidosperma angustatum	n/a	Understorey		
	Lepidosperma squamatum	n/a	Understorey		
	Xanthorrhoea preisii	Grass Tree	Understorey		
Concept Area 5	*Banksia attenuate**	Slender Banksia	Tree	2,000	2,096
Priority 3	*Banksia menziesii**	Firewood Banksia	Tree		
	*Banksia grandis**	Bull Banksia	Tree		
	Corymbia calophylla	Marri	Tree		
	*Eucalyptus marginate**	Jarrah	Tree		
	*Eucalyptus gomphocephala**	Tuart	Tree		

Total Grams of Seed Required	**328g**
Total Number of Seedlings Required	**306,515**
Total Area for Revegetation	**308,401**

4.4.1 Offset areas

As stated in the Master Plan, the City is amenable to outside parties undertaking revegetation works within the reserve as an offset for external development. Potential future offsetting projects within the Tramway reserve will require a proposal be submitted to the City for approval. Such proposals should be developed with due regard for the Master Plan and include, at the very least, ecological surveys to assess site conditions, appropriate management strategies for threatening process and ongoing monitoring and management goals. In keeping with the Master Plan, the City expects that future offset projects will include the construction of a DUP and firebreak in sections of the Tramway where the proposed DUP and firebreak are not yet constructed. All proposals for the use of the Tramway as an offset site will be assessed by the City on a case by case basis.

4.

4.4.2 Recommendations

TABLE 4.4.2

	Revegetation and Rehabilitation Management Actions	Priority
11	Plant suitable native species seedlings in Proposed Concept Areas following construction of infrastructure	Ongoing
12	Plant suitable native species seedlings in areas of Good Condition Vegetation in Precincts Three and Four	Medium
13	Weed control in revegetation and rehabilitation areas to promote natural regeneration of bushland	High
14	Direct seeding of mixed native seed to enhance natural regeneration of bushland in area of very good condition bushland in Precinct Four	Medium
15	Ongoing monitoring to determine seedling survival and establishment rates	High
16	Observe 80% seedling survival after 2 years	High
17	Interim assessment (after 5 years) of rehabilitation and revegetation areas to inform future management	High

4.5 Fire Management Strategies

Any activities to manage fire risk within the Tramway must be undertaken with reference to the *Planning for Bushfire Protection Guidelines*. There is also the need to consult with the Department of Fire and Emergency Services (DFES), the City of Rockingham Emergency Services department and the community.

Ideally, a fire management plan should be developed for the entire site, however; as a minimum, the following fire risk management actions should be implemented:

- Maintenance of a 4 m wide crushed limestone firebreak along the eastern border of the Tramway
- Maintain emergency access through weed control and pruning of vegetation in the vicinity of fire breaks to ensure a 4 m vertical clearance
- Maintenance of east-west breaks through the Tramway, in the form of existing roads and driveways, to compartmentalise vegetation and provide strategic access points for emergency services
- Active management of fuel loads within the reserve associated with vegetation within the reserve, such as slashing and spraying of open grassed areas or controlled burning
- Ensure the maintenance of Hazard Separation Zones (HSZ) and Building Protection Zones (BPZ) in areas bordering the Tramway, as per the *Planning for Bushfire Protection Guidelines*. An example of how these zones should be maintained can be seen in figure 4.5.1.

Maintenance of appropriate BPZ and HSZ should be factored into the design of future residential development abutting the Tramway. Further examples of desirable landscape interface treatments can be seen in the Master Plan.

Developers should be mindful that revegetation of designated offset areas and around key concept areas in Precincts One and Two may lead to increased fuel loads. At the time of construction developers should undertake a Bushfire Hazard Assessment for the section for the Tramway adjoining their landholding. Based on potential vegetation changes the developer may be required to adhere to AS 3959 construction standards.

Development of new firebreaks within the reserve should be undertaken along a route that minimises earthworks and native vegetation removal by utilising cleared areas and existing paths as far as practical. The firebreak must include multiple access points, be trafficable and contain a number of areas where

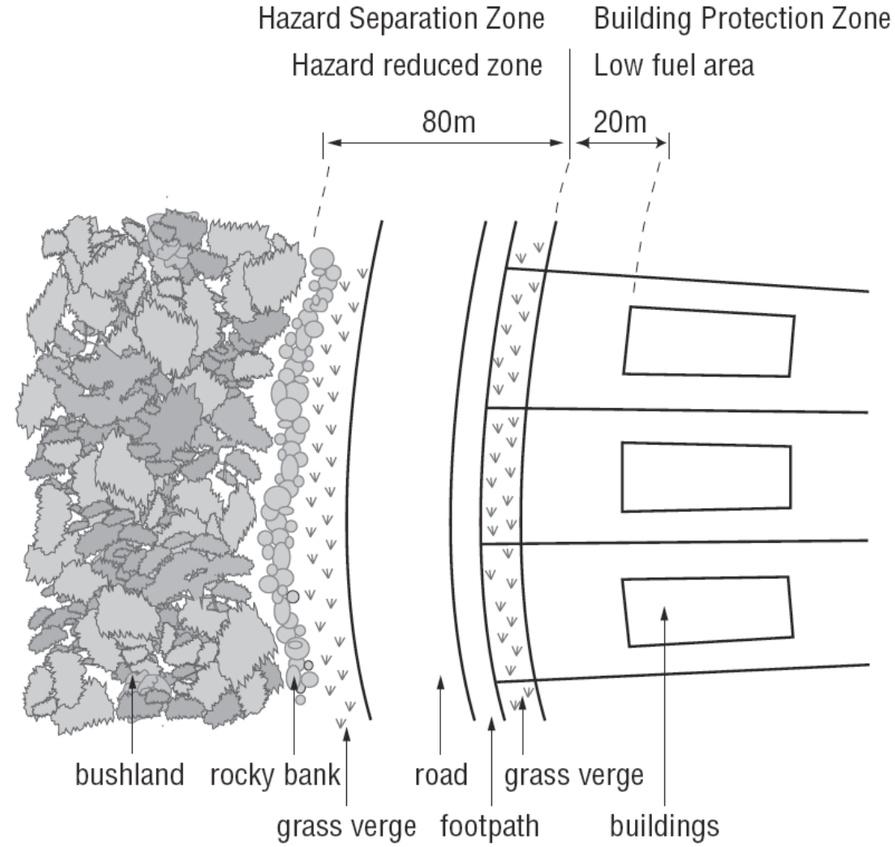
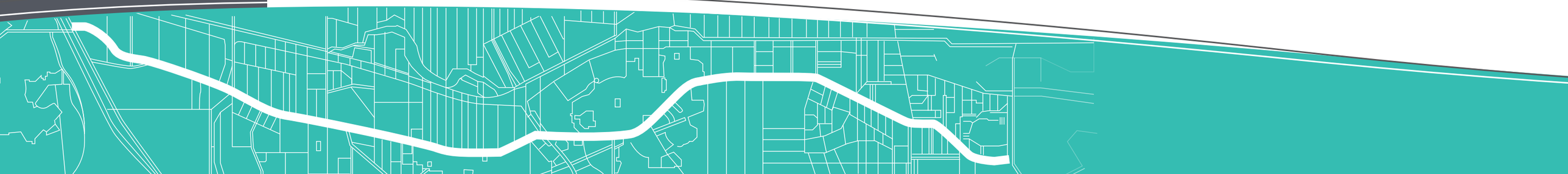


FIGURE 4.5.1

emergency services vehicles are able to pass one another. The location of current and proposed fire breaks within and surrounding the reserve can be seen in the overall concept plan for each precinct. The management of these firebreaks will be the responsibility of the City.

TABLE 4.5.1

	Fire Management Actions	Priority
18	Construction of 4 m firebreak along the Eastern border of the Tramway, with 4 m vertical clearance	High
19	Maintenance of existing east-west breaks as strategic access points and to compartmentalise vegetation	High
20	Active management of fuel loads, i.e. slashing, controlled burns	High
21	Ensure adjoining developments employ appropriate interface treatments to maintain HSZ and BPZ	High



4.

4.6 Inappropriate Access Management

Access to the Tramway should accommodate recreation objectives while protecting the conservation objectives of the reserve. The DUP and proposed concept areas will help to minimise the impact on surrounding bushland, by confining recreational activities to specific areas within the reserve.

Construction and upgrade of fencing will also be required to restrict inappropriate access. Treated pine with galvanised wires would be suitable fencing materials as they are durable, cost-effective and visually unobtrusive. To protect remnant bushland within the Tramway, fencing should be prioritised based on the quality of vegetation in each precinct. As the western side of the Tramway along Baldivis Road is heavily trafficked, it should be fenced as priority over the eastern side of the reserve.

Priorities for fencing include:

- Priority 1: Western edge of Precinct Four (very good quality vegetation)
- Priority 2: Eastern edge of Precinct Four
- Priority 3: Western edge of Precinct Three (good quality vegetation)
- Priority 4: Eastern edge of Precinct Three
- Priority 5: Western edge of Precinct One and Two (degraded vegetation)
- Priority 5: Eastern edge of Precinct One and Two

For more information regarding the condition and extent of current fencing please refer to section 3.6 of this environmental management plan. East-west fencing should also be installed where roads traverse the Tramway in these precincts. In sections of Precinct One and Two where residential development may abut proposed concept areas within the Tramway, the eastern side of the reserve may not require fencing to maximise landscape continuity and recreational capacity of the future POS.

At major pedestrian access points, as indicated in the overall concept plans for each precinct (see Master Plan), bollards should be installed to prevent unauthorised vehicular access. At major road access points, vehicle access gates should be installed with separate pedestrian access gates to inhibit the entry of motorbikes and other off road vehicles into the reserve.

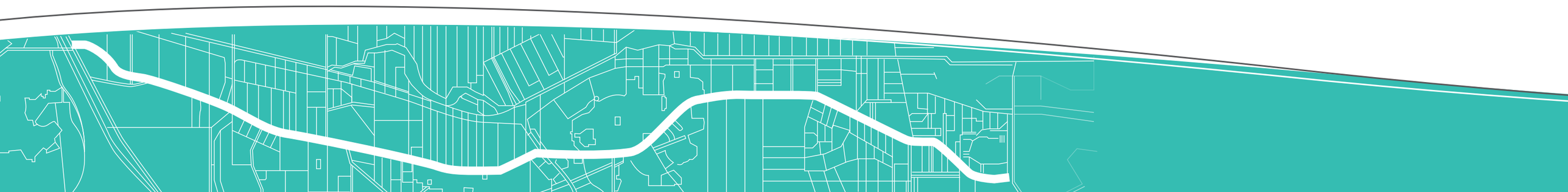
TABLE 4.6.1

	Inappropriate Access Management Actions	Priority
22	Upgrade existing fencing in each precinct as per priorities	High
23	Installation of bollards at primary pedestrian access points	Medium
24	Installation of vehicle access gates at major road access points	High
25	Installation of pedestrian access gates adjacent to vehicle access gates	High

IMPLEMENTATION TABLE 5.1

5.1 Implementation table of management actions, priorities and success criteria

For details refer to Environmental Management Plan						
ENVIRONMENTAL MANAGEMENT	Precinct 1	Targeted spraying of priority weed species as per Section 4.1 of Environmental Management Plan (EMP)	4	Operational	360	• No increase in weed presence
		Upgrade poor condition/absent fencing to discourage inappropriate access	4	Capital	59,200	• Fencing upgraded
		Installation of bollards and u-rails at primary pedestrian access points	4	Capital	1,620	• Bollards and gates installed
		Installation of vehicle access gates at major road access points to ensure authorised vehicle access only, with adjoining pedestrian access gates	4	Capital	3,300	• Firebreaks and strategic access points constructed and maintained
		Construction of a 4 m wide crushed limestone firebreak with 4 m high vertical clearance along the eastern border of the Tramway	4	Capital	128,172	• Open grassed area fuel loads maintained at <2t/ha
		Minimising fuel loads through slashing/spraying of open grassed areas	1	Operational	16,800	
		Liaise with adjoining developers to ensure appropriate interface treatments to maintain HSZ and BPZ	1	Officer time		• Developer maintenance of BPZ and HSZ
	Precinct 1 Total				**209,452**	
	Concept Area 1: Ephemeral Wetland	Weed spraying prior to revegetation	4	Operational	5,698	• Overall reduction in weed presence prior to planting
		Revegetate with seedlings, as per the suggested planting palette (see Section 4.4 of EMP)	4	Operational	70,000	• Minimum 80% seedling survival
		Ongoing monitoring to ensure seedling survival and establishment	4	Officer time		
	Concept Area 1 Total				**75,698**	
	Concept Area 2: Potential Connection Node	Weed spraying prior to revegetation	4	Operational	3,904	• Overall reduction in weed presence prior to planting
		Revegetate with seedlings, as per the suggested planting palette (see Section 4.4 of EMP)	4	Operational	47,500	• Minimum 80% seedling survival
		Ongoing monitoring to ensure seedling survival and establishment	4	Officer time		
	Concept Area 2 Total				**51,404**	
	Precinct 1 Overall Total				**336,554**	
	Precinct 2	Targeted spraying of priority weed species	4	Operational	240	• No increase in weed presence
		Upgrade poor condition/absent fencing to discourage inappropriate access	4	Capital	72,000	• Fencing upgraded
		Installation of bollards and u-rails at primary pedestrian access points	4	Capital	2160	• Bollards and gates installed
		Installation of vehicle access gates at major road access points to ensure authorised vehicle access only, with adjoining pedestrian access gates	4	Capital	2,200	• Firebreaks and strategic access points constructed and maintained
		Construction of a 4 m wide crushed limestone firebreak with 4 m high vertical clearance along the eastern border of the Tramway	4	Capital	74,844	• Open grassed area fuel loads maintained at <2t/ha
		Minimising fuel loads through slashing/spraying of open grassed areas	1	Operational	3,783	
		Liaise with adjoining developers to ensure appropriate interface treatments to maintain HSZ and BPZ	4	Officer time		• Developer maintenance of BPZ and HSZ
	Precinct 2 Total				**155,227**	
	Concept Area 3: Heritage, Education and Nature Based Play	Weed spraying prior to revegetation	4	Operational	3,032	• Overall reduction in weed presence prior to planting
		Plant native flowering species in feature garden bed adjoining play area	4	Operational	1,290	• Minimum 80% seedling survival
		Revegetate with seedlings, as per the suggested planting palette (see Section 4.4 of EMP)	4	Operational	37,500	• Flowering garden forms an attractive landscape feature
		Ongoing monitoring to ensure seedling survival and establishment	4	Officer time		
	Concept Area Total				**41,822**	
	Precinct 2 Overall Total				**197,049**	



	Precinct 3	Targeted spraying of priority weed species	1	Operational	420	• No increase in weed presence • Fencing upgraded • Bollards and gates installed • Firebreaks and strategic access points constructed and maintained
		Upgrade poor condition/absent fencing to discourage inappropriate access	2	Capital	72,000	
		Installation of bollards and u-rails at primary pedestrian access points	2	Capital	2,430	
		Installation of vehicle access gates at major road access points to ensure authorised vehicle access only, with adjoining pedestrian access gates	2	Capital	2,000	
		Construction of a 4 m wide crushed limestone (or similar) firebreak with 4 m high vertical clearance along the eastern border of the Tramway, connecting to existing breaks adjoining Rivergums	2	Capital	8,800	
	Precinct 3 Total				**85,650**	
	Concept Area 4: Bridle Facilities	Weed control prior to revegetation	3	Operational	3,863	• Overall reduction in weed presence prior to planting • Minimum 80% seedling survival • Fence constructed, no further degradation of surrounding vegetation
		Revegetate concept area with trees and shrubs, based on planting palette (see Section 4.4 of EMP)	3	Operational	47,500	
		Fencing marking perimeter of node to prevent degradation of surrounding vegetation	3	Capital	960	
	Concept Area Total				**52,323**	
	Precinct 3 Overall Total				**137,973**	
	Precinct 4	Targeted spraying of priority weed species	1	Operational	120	• No increase in weed presence • Fencing upgraded • Firebreaks and strategic access points constructed and maintained
		Upgrade poor condition/absent fencing to discourage inappropriate access	1	Capital	34	
		Construction of additional 4 m wide crushed limestone firebreaks with 4 m high vertical clearance in selected adjoining areas	3	Capital	36,960	
	Precinct 4 Total				**37,114**	
	Concept Area 5: End of Trip Facilities	Weed control prior to revegetation	4	Operational	420	• Overall reduction in weed presence prior to planting • Minimum 80% seedling survival after 2 years • Fence constructed, no further degradation of surrounding vegetation
		Revegetate with seedlings, as per the suggested planting palette (see Section 4.4 of EMP)	4	Operational	5,000	
		Fencing marking perimeter of node to prevent degradation of surrounding vegetation	1	Capital	2,400	
	Concept Area Total				**7,820**	
	Precinct 4 Overall Total				**44,934**	
	Revegetation and Rehabilitation Outside Proposed Concept Areas	Plant seedlings in areas of good condition vegetation	2/3	Operational	557,500	• Minimum 80% seedling survival after 2 years
		Direct seeding in areas of very good condition vegetation	2/3	Operational	245	
	Revegetation and Rehabilitation Total				**557,745**	
	Ongoing Review and Assessment	Interim report including ecological assessment of flora and fauna	3	Public works overheads	41,000	• Vegetation and weed survey repeated every 5 years • Survey should indicate an overall improvement in vegetation condition and no increase in weed presence • Before and after fauna assessments should indicate an overall reduction in population numbers • Fire management plan developed
		10 year review to determine overall success or failure of Plan	4	Public works overheads	44,040	
		Feral fauna assessment	4	Public works overheads	12,000	
		Development of fire management plan	2	Public works overheads	10,000	
		Annual review of implementation progress by relevant City of Rockingham Officers	1	Officer time		
	Ongoing Review and Assessment Total				**107,040**	
ENVIRONMENTAL MANAGEMENT TOTAL						**1,381,295**
BALDIVIS TRAMWAY MASTERPLAN GRAND TOTAL						**2,918,096**

6.

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APPENDIX A: COST CALCULATIONS

CATEGORY	PLANNING PRECINCT	ACTION	UNIT (M2 OR EA)	COST/UNIT ($)	TOTAL
LANDSCAPE DESIGN	**Precinct 1**	2.5 m wide concrete pathway	7,460	50	373,000
		Additional 2.5 m wide pathway to connect to PSP	415	50	20,750
		Additional 2.5 m wide pathway to detour around Kulija Rd	1,532	50	76,625
		Interpretive signage	1	800	800
		Regulatory/directional signage	2	100	200
		Safety signage to cross Kulija Rd	2	80	160
		Distance markers	3	50	150
					Total: 471,685
	Concept Area 1: Ephemeral Wetland	Additional 2.5 m wide pathway around 'wetland' concept area	527	50	26,375
		Small (~20x5 m) boardwalk construction and design	100	100	10,000
		Seating	2	1,600	3,200
		Interpretive signage	1	800	800
					Total: 40,375
	Concept Area 2: Potential Connection Node	Additional 2.5 m wide pathway	50	50	2,500
		Bike rack	1	400	400
		Seating	1	1,600	1,600
		Interpretive signage	1	800	800
					Total: 5,300
	Precinct 2	2.5 m wide concrete pathway	8,700	50	435,000
		Additional 2.5 m wide pathway to detour around Safety Bay Rd	2,077	50	103,875
		Interpretive signage	1	800	800
		Regulatory/directional signage	5	100	500
		Distance markers	2	50	100
					Total: 540,275
	Concept Area 3: Heritage, Education and Nature Based Play	Interpretive signage	4	800	3,200
		Construction and design of nature based play	1	50,000	50,000
		East-west 2.5 m wide concrete pathway	165	50	8,250
		Seating	2	1,600	3,200
		Shade structure	1	10,000	10,000
		Picnic table with shade	1	6,000	6,000
		Bike Rack	1	400	400
		Safety signage to cross Safety Bay Rd	2	80	160
					Total: 81,210
	Precinct 3	2.5 m wide concrete pathway	3,665	50	183,250
		Interpretive signage	2	800	1,600
		Regulatory/directional signage	6	100	600
		Distance markers	3	50	150
		Extend bridle trail 3 m wide crushed limestone	4,188	11	46,068
					Total: 231,668

APPENDIX A COST CALCULATIONS - CONTINUED

CATEGORY	PLANNING PRECINCT	ACTION	UNIT (M2 OR EA)	COST/UNIT ($)	TOTAL
	Concept Area 4: Bridle Facilities	Crushed limestone ground cover	6,414	11	70,554
		Seating	1	1,600	1,600
		Shade structure	1	10,000	10,000
		Tie up posts with bolt/hook	3	65	195
		Regulatory sign	1	100	100
		Interpretive signage	1	800	800
					Total: 83,249
	Precinct 4	Interpretive signage	1	800	800
		Regulatory signage	2	100	200
		Distance markers	3	50	150
		Formalisation of 3 m wide pathway with crushed limestone	4,149	11	45,639
					Total: 46,789
	Concept Area 5: End of Trip Facilities	New shade structures and benches	3	6,000	18,000
		Formalise entrance by construction of additional 2.5 m wide DUP	125	50	6,250
		Seat	1	1,600	1,600
		BBQ upgrade if needed	1	10,000	10,000
		Bike rack	1	400	400
					Total: 36,250
				MASTERPLAN TOTAL	**1,536,801**
ENVIRONMENTAL	**Precinct 1**	Targeted weed spraying	1,800	0.2	360
		Upgrade of poor/absent fencing	3,700	16	59,200
		4 m wide crushed limestone fire break	11,652	11	128,172
		Spraying/slashing open grassed areas	112,000	0.15	16,800
		Bollards	12	35	420
		Vehicle access farm style gate	3	500	1,500
		U-rails	6	200	1,200
		Pedestrian swing gates	3	600	1,800
					Total: 209,452
	Concept Area 1: Ephemeral Wetland	Seedlings	28,000	2.5	70,000
		Weed spraying	28,490	0.2	5,698
					Total: 75,698
	Concept Area 2: Potential Connection Node	Seedlings	19,000	2.5	47,500
		Weed spraying	19,520	0.2	3,904
					Total: 51,404

	Precinct 2	Targeted weed spraying	1,200	0.2	240
		Upgrade of poor/absent fencing	4,500	16	72,000
		4 m wide crushed limestone fire break	6,804	11	74,844
		Spraying/slashing open grassed areas	25,220	0.15	3,783
		Bollards	16	35	560
		Vehicle access farm style gate	2	500	1,000
		U-rails	8	200	1,600
		Pedestrian swing gates	2	600	1,200
					Total: 155,227
	Concept Area 3: Heritage, Education and Nature Based Play	Seedlings	15,516	2.5	38,790
		Weed spraying	15,160	2.5	3,032
					Total: 41,822
	Precinct 3	Targeted weed spraying	2,100	0.2	420
		Upgrade of poor/absent fencing	4,500	16	72,000
		4 m wide crushed limestone fire break (in addition to bridle trail)	800	11	8,800
		Bollards	18	35	630
		Vehicle access farm style gate	2	500	1,000
		U-rails	9	200	1,800
		Pedestrian swing gates	2	500	1,000
					Total: 85,650
	Concept Area 4: Bridle Facilities	Seedlings	19,000	2.5	47,500
		Fencing	60	16	960
		Weed spraying	19,315	0.2	3,863
					Total: 52,323
	Precinct 4	Weed spraying	600	0.2	120
		Upgrade of poor/absent fencing	2.1	16	33.6
		(round to 34)			
		Additional 4 m wide crushed limestone firebreaks in adjoining areas	3,360	11	36,960
					Total: 37,114
	Concept Area 5: End of Trip Facilities	Fencing around perimeter	150	16	2,400
		Seedlings	2,000	2.5	5,000
		Weed spraying	2,100	0.2	420
					Total: 7,820
	Ongoing consultant reports and assessments	Interim report	1	41,000	41,000
		10 year review	1	44,040	44,040
		Feral fauna assessment	1	12,000	12,000
		Fire management plan	1	10,000	10,000
					Total: 107,040
	Revegetation and rehabilitation	Seedlings in areas of good condition vegetation	223,000	2.5	557,500
		Direct seeding in areas of very good condition vegetation	350	0.7	245
					Total: 557,745
				ENVIRONMENTAL TOTAL	**1,381,295**
				GRAND TOTAL	**2,918,096**

APPENDIX B

B.

APPENDIX B: NATIVE PLANT SPECIES RECORDED IN THE TRAMWAY RESERVE DURING FIELD SURVEY

Family	Taxon
Apiaceae	*Eryngium pinnatifidum*
	Xanthosia huegelii
Araceae	*Lemna disperma*
Araliaceae	*Trachymene pilosa*
Asparagaceae	*Dichopogon capillipes*
	Lomandra nigricans
	Lomandra suaveolens
	Sowerbaea laxiflora
	Thysanotus sparteus
Asteraceae	*Lagenophora huegelii*
	Olearia axillaris
	Podolepis gracilis
Casuarinaceae	*Allocasuarina fraseriana*
	Casuarina obesa
Colchicaceae	*Burchardia congesta*
Commelinaceae	*Cartonema philydroides*
Crassulaceae	*Crassula colorata*
Cupressaceae	*Callitris preissii*
Cyperaceae	*Baumea juncea*
	Ficinia nodosa
	Lepidosperma angustatum
	Lepidosperma squamatum
	Mesomelaena pseudostygia
	Schoenus curvifolius
	Schoenus grandiflorus
	Tetraria octandra
Dasypogonaceae	*Calectasia narragara*
	Dasypogon bromeliifolius
Dilleniaceae	*Hibbertia cuneiformis*
	Hibbertia hypericoides
Droseraceae	*Drosera erythrorhiza*
	Drosera glanduligera
	Drosera macrantha
Ericaceae	*Leucopogon propinquus*
Euphorbiaceae	*Monotaxis grandiflora*
Fabaceae	*Acacia alata*
	Acacia pulchella
	Acacia rostellifera
	Acacia saligna
	Bossiaea eriocarpa
	Daviesia divaricata
	Gompholobium confertum
	Gompholobium tomentosum
	Hardenbergia comptoniana
	Hovea trisperma
	Jacksonia furcellata
	Jacksonia sternbergiana
	Kennedia prostrata
	Labichea punctata
Geraniaceae	*Geranium retrorsum*
Goodeniaceae	*Dampiera linearis*
	Scaevola canescens
Haemodoraceae	*Anigozanthos humilis*
	Anigozanthos manglesii
	Conostylis aculeata
	Conostylis candicans
	Phlebocarya ciliata
Hemerocallidaceae	*Caesia micrantha*
	Agrostocrinum hirsutum
	Corynotheca micrantha
	Dianella revoluta
	Tricoryne elatior
Iridaceae	*Orthrosanthus laxus*
	Patersonia occidentalis
Juncaceae	*Juncus pallidus*
Lamiaceae	*Hemiandra pungens*
Lauraceae	*Cassytha glabella*
Loranthaceae	*Nuytsia floribunda*
Malvaceae	*Guichenotia ledifolia*
Molluginaceae	*Macarthuria australis*
Myrtaceae	*Agonis flexuosa*
	Callistemon phoeniceus
	Calothamnus hirsutus
	Calothamnus quadrifidus
	Chamelaucium uncinatum
	Corymbia calophylla
	Corymbia ficifolia
	Darwinia citriodora
	Eremaea pauciflora
	*Eucalyptus camaldulensis subsp. obtusa**
	*Eucalyptus conferruminata**
	*Eucalyptus foecunda**
	Eucalyptus gomphocephala
	Eucalyptus marginata
	*Eucalyptus platypus var. platypus**
	Eucalyptus rudis
	*Eucalyptus sp (non-local)**
	Kunzea glabrescens
	Melaleuca huegelii
	Melaleuca lanceolata
	*Melaleuca nesophila**
	Melaleuca preissiana
	Melaleuca rhaphiophylla
	Melaleuca seriata
	Melaleuca teretifolia
	Taxandria linearifolia
Orchidaceae	*Caladenia flava*
	Diuris sp (indet.)
	Microtis media
	Pterostylis vittata
	Pyrorchis sp (indet.)
	Thelymitra crinita
Phyllanthaceae	*Phyllanthus calycinus*
Poaceae	*Austrostipa flavescens*
Polygalaceae	*Comesperma virgatum*
Proteaceae	*Adenanthos cygnorum subsp. cygnorum*
	Banksia attenuata
	Banksia grandis
	Banksia ilicifolia
	Banksia littoralis
	Banksia menziesii
	Banksia nivea
	Banksia prionotes
	Banksia sessilis
	*Grevillea olivacea**
	*Grevillea vestita**
	Hakea lissocarpha
	*Hakea petiolaris**
	Hakea prostrata
	Hakea ruscifolia
	Hakea trifurcata
	Hakea varia
	Petrophile linearis
	Stirlingia latifolia
	Xylomelum occidentale
Restionaceae	*Desmocladus fasciculatus*
	Desmocladus flexuosa
	Loxocarya cinerea
Rhamnaceae	*Spyridium globulosum*
Rubiaceae	*Opercularia hispidula*
	Opercularia vaginata
Rutaceae	*Philotheca spicatus*
Sapindaceae	*Dodonaea aptera*
	Dodonaea hackettiana
Scrophulariaceae	*Eremophila glabra subsp. albicans*
Stylidiaceae	*Stylidium brunonianum*
	Stylidium junceum
	Stylidium piliferum
	Stylidium schoenoides
Thymelaeaceae	*Pimelea ferruginea*
	Pimelea rosea
Violaceae	*Hybanthus calycinus*
Xanthorrhoeaceae	*Xanthorrhoea brunonis*
	Xanthorrhoea preissii
Zamiaceae	*Macrozamia riedlei*

APPENDIX C: VEGETATION CONDITION SCALE

Rating	Criteria
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact; disturbance affecting individual species; weeds are non-aggressive species.
Very Good	Vegetation structure altered; obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires; the presence of some more aggressive weeds; dieback; logging; grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires; the presence of some very aggressive weeds at high density; partial clearing; dieback; grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires; the presence of very aggressive weeds; partial clearing; dieback; grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX D: BLACK COCKATOO BREEDING TREE LOCATIONS

Tree No.	Tree Species	DBH (mm)	Hollows	Easting*	Northing*
1	Marri	75		389894	6418869
2	Marri	99		389896	6418875
3	Marri	115		389907	6418873
4	Marri	69		389882	6418878
5	Marri	71		389904	6418887
6	Marri	127		389908	6418900
7	Marri	153	3 x 150 mm	389905	6418912
8	Stag	88	1 x 150 mm	389877	6418908
9	Marri	51		389879	6418901
10	Marri	61		389882	6418935
11	Stag	84	1 x 100 mm	389921	6418935
12	Marri	92		389936	6418925
13	Marri	104		389908	6418951
14	Stag	62	1 x 100 mm	389904	6418957
15	Marri	81		389886	6418971
16	Marri	60		389913	6419011
17	Marri	64		389888	6419014
18	Stag	66	1 x 100 mm	389905	6419029
20	Jarrah	59		389907	6419764
21	Marri	65		389916	6419813
22	Marri	66		389926	6419816
23	Marri	86		389916	6419822
24	Marri	64		389913	6419829
25	Marri	51		389913	6419832
26	Jarrah	64		389927	6419843
27	Marri	83		389925	6419914
28	Marri	69		389929	6419916
29	Jarrah	62		389923	6419929
30	Marri	56		389917	6419927
31	Marri	84		389935	6419940
32	Marri	83		389936	6419944
33	Marri	50		389930	6419952
34	Marri	55		389892	6420067
35	Marri	55		389905	6420075
36	Marri	50		389892	6420076
37	Marri	50		389876	6420064
38	Marri	51		389906	6420091
39	Marri	61		389895	6420092
40	Marri	82		389882	6420112
41	Tuart	51		389510	6420675
42	Tuart	52		389508	6420685
43	Jarrah	61		389492	6420741
44	Marri	128		389458	6420713
45	Tuart	97		389404	6420792
46	Jarrah	80		389397	6420805
47	Stag	92	2 x 200 mm 2 x 300 mm	389382	6420758
48	Jarrah	68		389391	6420835
49	Jarrah	56		389358	6420815
50	Stag	153	1 x 200 mm	389366	6420844
51	Stag	138	1 x 200 mm 3 x 100 mm	389348	6420852
52	Tuart	61		389299	6420867
53	Tuart	52		389297	6420577
54	Jarrah	62		389247	6420990
55	Jarrah	125	1 x 100 mm	389880	6420224
56	Jarrah	60		389875	6420218
57	Stag	111		389819	6420291
58	Stag	57		389824	6420305
59	Stag	104		389815	6420340
60	Stag	160	1 x 100 mm	389831	6420360
61	Stag	105	1 x 150 mm 1 x 200 mm	389848	6420338
62	Marri	104	1 x 100 mm	389812	6420367
63	Marri	68	1 x 150 mm	389795	6420363
64	Tuart	82	1 x 500 mm	389799	6420391
65	Stag	119		389788	6420408
66	Marri	60		389793	6420435
67	Marri	55		389769	6420430
68	Marri	82		389765	6420436
69	Marri	63		389748	6420445
70	Tuart	61		389716	6420468
71	Tuart	94		389699	6420484
72	Tuart	96		389690	6420483
73	Marri	80		389889	6419582
74	Marri	121		389882	6419572
75	Marri	55		389889	6419583
76	Marri	53		389882	6419616
77	Marri	59		389888	6419625
78	Marri	64		389888	6419630
79	Stag	107		389903	6419687
80	Marri	74		389903	6419690
81	Marri	73		389895	6419694
82	Marri	64		389881	6419691
83	Marri	56		389912	6419699

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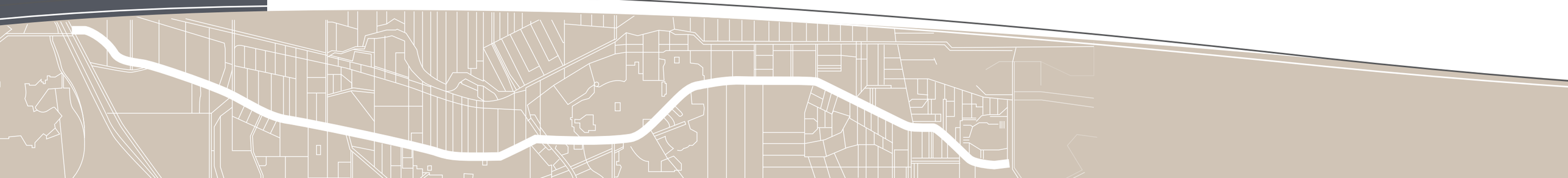
84	Marri	52		389918	6419707
85	Jarrah	91		389923	6419717
86	Stag	99		389921	6419717
87	Stag	71		389922	6419712
88	Marri	74		389895	6419729
89	Marri	84		389890	6419727
90	Marri	61		389911	6419747
91	Marri	65		389919	6419746
92	Marri	98		389912	6419756
93	Tuart	53		389918	6419027
94	Marri	150		389880	6419123
95	Marri	50		389877	6419256
96	Marri	50	1 x 100 mm	389891	6419258
97	Marri	66	1 x 150 mm	389901	6419262
98	Marri	71		389910	6419257
99	Marri	66		389906	6419248
100	Marri	83		389912	6419250
101	Marri	58		389893	6419271
102	Marri	117		389879	6419269
103	Marri	85		389871	6419294
104	Marri	58		389874	6419295
105	Marri	135		389879	6419308
106	Marri	82		389890	6419295
107	Marri	63		389901	6419294
108	Marri	68		389905	6419292
109	Marri	86		389898	6419474
110	Marri	62		389888	6419481
111	Marri	69		389888	6419491
112	Flooded Gum	86		389563	6426220
113	Flooded Gum	87		389466	6426028
114	Flooded Gum	81		389497	6426023
115	Flooded Gum	86		389501	6426017
116	Flooded Gum	83		389506	6426015
117	Flooded Gum	132		389507	6426034
118	Stag	86		389496	6425957
119	Stag	50		389486	6425945
120	Flooded Gum	76		389472	6425918
121	Flooded Gum	127	1 x 100 mm	389459	6425900
122	Flooded Gum	58		389436	6425909
123	Flooded Gum	66		389435	6425912
124	Flooded Gum	101		389417	6425918
125	Flooded Gum	90		389426	6425943
126	Flooded Gum	52		389428	6425863
127	Stag	87		389428	6425863
128	Marri	66	1 x 200 mm	389115	6422380
129	Stag	53	2 x 100 mm	389124	6422371
130	Marri	73		389133	6422382
131	Marri	55		389003	6422619
132	Marri	73		389040	6422629
133	Stag	146		389022	6422635
134	Marri	70		389003	6422641
135	Stag	93		388989	6422635
136	Marri	66		388983	6422646
137	Marri	52	4 x 200 mm	388978	6422636
138	Marri	78		388976	6422703
139	Marri	51		388983	6422703
140	Jarrah	66		388998	6422702
141	Jarrah	149		389005	6422699
142	Marri	57	1 x 200 mm	388975	6422718
143	Marri	60		388959	6422716
144	Marri	57		388949	6422701
145	Marri	56		388954	6422718
146	Marri	62		388943	6422728
147	Marri	62		388961	6422723
148	Marri	50		388962	6422726
149	Marri	75		388939	6422738
150	Flooded Gum	75		389772	6426600
151	Flooded Gum	54		389773	6426637
152	Marri	54		389810	6426698
153	Flooded Gum	83		389813	6426767
154	Flooded Gum	65		389799	6426771
155	Flooded Gum	57		389795	6426778
156	Stag	82		389822	6426840
157	Flooded Gum	58		389825	6426844
158	Flooded Gum	56		389858	6426857
159	Flooded Gum	59		389850	6426867
160	Flooded Gum	55		389837	6426873
161	Flooded Gum	55		389863	6426884
162	Flooded Gum	55	10 x 100 m	389863	6426890
163	Flooded Gum	68		389864	6426894
164	Flooded Gum	52		389872	6426919
165	Flooded Gum	57		389885	6426946
166	Flooded Gum	120		389549	6426106
167	Flooded Gum	75		389575	6426149
168	Flooded Gum	56		389568	6426220
169	Marri	78		389144	6422376
170	Marri	65		389138	6422386
171	Marri	63		389116	6422407
172	Marri	56	1 x 100 mm	389113	6422418
173	Marri	85		389127	6422422
174	Marri	82		389121	6422432
175	Marri	65		389111	6422446
176	Marri	60		389044	6422437
177	Jarrah	57		389096	6422422
178	Marri	124		389088	6422403
179	Jarrah	91		389076	6422385
180	Marri	56		389074	6422372
181	Tuart	170		389064	6422479



APPENDIX D

182	Marri	77		389022	6422514
183	Stag	92		389013	6422537
184	Jarrah	135		389004	6422587
185	Marri	97		389021	6422595
186	Marri	79		389017	6422613
187	Marri	64	2 x 200 mm	389007	6422608
188	Stag	74	2 x 150 mm	389678	6420546
189	Stag	68		389674	6420553
190	Stag	115		389658	6420562
191	Tuart	59		389651	6420546
192	Tuart	69		389647	6420534
193	Tuart	54		389635	6420544
194	Tuart	51	1 x 180 mm	389640	6420545
195	Tuart	53	1 x 110 mm	389631	6420548
196	Tuart	51	1 x 180 mm	389629	6420549
197	Tuart	71	1 x 250 mm	389632	6420553
198	Tuart	52	1 x 100 mm	389617	6420572
199	Tuart	81		389613	6420576
200	Tuart	82		389604	6420564
201	Tuart	114		389592	6420572
202	Tuart	71		389591	6420574
203	Tuart	87		389559	6420610
204	Tuart	68		389538	6420622
205	Jarrah	121		389548	6420652
206	Stag	84		389575	6420661
207	Jarrah	63		389522	6420668
208	Marri	61		389511	6420652
209	Marri	114		389508	6420663
210	jarrah	98		388919	6422771
211	Jarrah	51		388919	6422818
212	stag	70		388931	6422813
213	Marri	75	1 x 120 mm	388927	6422845
214	jarrah	90	1 x 200 mm	388909	6422834
215	jarrah	160	1 x 100 mm	388898	6422837
216	jarrah	70	1 x 120 mm	388895	6422850
217	jarrah	82	1 x 200 mm	388919	6422853
218	Marri	119		388918	6422866
219	Marri	58		388905	6422872
220	jarrah	116		388892	6422868
221	Marri	60		388880	6422811
222	Marri	67		388874	6422881
223	Marri	50		388870	6422885
224	Marri	58		388869	6422885
225	Marri	64		388865	6422887
226	Marri	56		388869	6422902
227	Marri	70		388898	6422904
228	Marri	69		388899	6422904
229	Marri	87		388876	6422926
230	Marri	50		388879	6422928
231	Jarrah	63		388878	6422937
232	Marri	67		388867	6422937
233	Jarrah	69		388857	6422931
234	Jarrah	51		388864	6422946
235	Jarrah	252		388880	6422953
236	Marri	77		388911	6422943
237	Jarrah	142		388910	6422979
238	Jarrah	151		388911	6423016
239	Jarrah	69		388873	6422999
240	Jarrah	53		388882	6423048
241	Tuart	84		388914	6423062
242	Tuart	85		388917	6423060
243	Tuart	74		388918	6423057
244	Tuart	102		388914	6423058
245	Tuart	177		388917	6423069
246	Tuart	69		388891	6423073
247	Stag	95	1 x 200 mm	388909	6423096
248	Jarrah	235		388879	6423094
249	Stag	95		388903	6423134
250	Stag	114		388881	6423148
251	Stag	124		388889	6423172
252	Tuart	117		388881	6423179
253	Stag	128		388890	6423214
254	Tuart	24		388901	6423230
255	Stag	92		388907	6423239
256	Tuart	79		389041	6424295
257	Marri	76		389219	6425046
258	Marri	75		389216	6425008
259	Marri	59		389220	6425009
260	Marri	78		389234	6425005

APPENDIX E

APPENDIX E: EXOTIC PLANT SPECIES RECORDED IN THE TRAMWAY RESERVE DURING FIELD SURVEY (*WEED SPECIES)

Family	Taxon	Comments
Aizoaceae	**Carpobrotus edulis*	Pigface, widespread in disturbed areas, succulent
Anacardiaceae	*Schinus terebinthifolius*	Pepper Tree, localised invasive tree
Apiaceae	**Foeniculum vulgare*	Fennel, localised in disturbed areas
Apocynaceae	**Gomphocarpus fruticosus*	Cotton Bush, localised, invasive soft shrub
Araceae	**Zantedeschia aethiopica*	Arum Lily, localised invasive geophyte, SEW
Arecaceae	**Phoenix sp.*	Date Palm, garden escape, non-invasive palm
	**Washingtonia filifera*	Cotton Palm, localised garden escape, invasive palm
Asparagaceae	**Agave americana*	Century Plant, resistant but not invasive succulent, localised
	**Asparagus asparagoides*	Bridal Creeper, invasive, localised, geophyte, SEW
Asphodelaceae	**Asphodelus fistulosus*	Onion Weed, widespread in disturbed areas, geophyte
Asteraceae	**Arctotheca calendula*	Cape Weed, widespread in disturbed areas, annual herb
	**Carduus pycnocephalus*	Thistle, localised, short-lived perennial herb
	**Conyza bonariensis*	Fleabane, sporadic, short-lived perennial herb
	**Conyza sumatrensis*	Fleabane, sporadic, short-lived perennial herb
	**Dimorphotheca ecklonis*	Veldt Daisy, localised, low shrub
	**Hypochaeris glabra*	Flatweed, widespread in disturbed areas
	**Senecio pinnatifolius*	Ragwort, localised annual herb
	**Sonchus oleraceus*	Milk Thistle, widespread, invasive annual herb
	**Tolpis barbata*	Localised annual herb
	**Ursinia anthemoides*	Ursinia, widespread invasive annual herb
Brassicaceae	**Brassica tournefortii*	Wild Turnip, widespread in disturbed areas, annual herb, invasive
	**Raphanus raphanistrum*	Wild Radish, widespread invasive annual herb
Cactaceae	**Opuntia stricta*	Prickly Pear, localised succulent, garden escape
Campanulaceae	**Wahlenbergia capensis*	Cape Bluebell, common annual herb
Caprifoliaceae	**Lonicera japonica*	Honeysuckle, localised, twining shrub
Caryophyllaceae	**Silene gallica*	Catchfly, widespread in disturbed areas, annual herb
	**Stellaria media*	Chickweed, widespread invasive annual herb
Crassulaceae	**Crassula glomerata*	Stonecrop, widespread in disturbed areas, annual succulent
Cucurbitaceae	**Cucumis myriocarpus*	Paddy Melon, localised, annual ground creeper
Euphorbiaceae	**Euphorbia australis*	Spurge, widespread in disturbed areas
	**Euphorbia peplus*	Spurge, widespread in disturbed areas
	**Euphorbia terracina*	Spurge, widespread in disturbed areas
	**Ricinus communis*	Castor Oil Bush, localised invasive woody shrub
Fabaceae	**Acacia baileyana*	Cootamundra Wattle, localised, tall shrub
	**Chamaecytisus palmensis*	Tagaste, sporadic, woody shrub
	**Erythrina x sykesii*	Coral Tree, localised tree
	**Lathyrus tingitanus*	Tangier Pea, localise creeping herb
	**Lotus angustissimus*	Trefoil, widespread in disturbed areas, annual herb
	**Lupinus cosentinii*	Lupin, widespread in disturbed areas, SEW
	**Lupinus luteus*	Sporadic annual herb
	**Medicago polymorpha*	Medic, common annual herb
	**Melilotus indicus*	Melilot, common annual herb
	**Trifolium angustifolium*	Narrowleaf Clover, localised annual herb
	**Trifolium arvense*	Hare's Foot Clover, localised annual herb
	**Trifolium campestre*	Hop Clover, localised annual herb
	**Trifolium dubium*	Localised annual herb
	**Trifolium hirtum*	Rose Cover, localised annual herb
	**Trifolium tomentosum*	Woolly Clover, localised annual herb
Geraniaceae	**Erodium botrys*	Storksbill, widespread in disturbed areas,
	**Pelargonium (hybrid)*	Pelargonium, localise garden escape, soft shrub
	**Pelargonium capitatum*	Rose Pelargonium, common annual herb
Iridaceae	**Freesia spp.*	Freesia, localised, invasive geophyte, SEW

APPENDIX F: FAUNA SPECIES INVENTORY FROM DESKTOP REVIEW AND FIELD SURVEY

Class	Family	Scientific Name	Common Name	EPBC	WC or Dpaw Code	A	B	C	D
Amphibian	**Limnodynastidae**	*Heleioporus eyre*	Moaning Frog				X		
Reptile	**Elapidae**	*Brachyurophis semifasciatus*	Southern Shovel-nosed Snake				X		
		Hydrophis platurus	Yellow-bellied Seasnake				X		
		Neelaps calonotos	Black-striped Snake		P3	X			
		Notechis scutatus	Tiger Snake				X		
		Pseudonaja affinis subsp. affinis	Dugite				X		
		Pseudonaja mengdeni	Western Brown Snake				X		
		Simoselaps bertholdi	Jan's Banded Snake				X		
	Pygopodidae	*Lialis burtonis*					X		
	Scincidae	*Cryptoblepharus buchananii*					X		
		Cryptoblepharus plagiocephalus					X		
		Ctenotus australis					X		
		Hemiergis quadrilineata					X		
		Lerista elegans					X		
		Menetia greyii					X		
		Morethia lineoocellata					X		
		Ramphotyphlops australis					X		
BIRD	**Acanthizidae**	*Acanthiza apicalis*	Broad-tailed Thornbill, Inland Thornbill				X		
		Acanthiza chrysorrhoa	Yellow-rumped Thornbill				X		
		Acanthiza inornata	Western Thornbill				X		
		Gerygone fusca	Western Gerygone				X		
		Sericornis frontalis	White-browed Scrubwren				X		
		Smicrornis brevirostris	Weebill				X		
	Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk				X		
		Accipiter cirrocephalus subsp. cirrocephalus	Collared Sparrowhawk				X		
		Accipiter fasciatus	Brown Goshawk				X		
		Accipiter fasciatus subsp. fasciatus	Brown Goshawk				X		
		Aquila audax	Wedge-tailed Eagle				X		
		Circus approximans	Swamp Harrier				X		
		Elanus axillaris	Black-Shouldered Kite						X
		Haliaeetus leucogaster	White-bellied Sea-Eagle	Mi, Ma	IA	X	X		
		Pandion cristatus	Eastern Osprey	Ma				X	
		Haliastur sphenurus	Whistling Kite				X		
	Anatidae	*Anas gracilis*	Grey Teal				X		
		Anas rhynchotis	Australasian Shoveler				X		
		Anas superciliosa	Pacific Black Duck				X		X
		Aythya australis	Hardhead				X		
		Biziura lobata	Musk Duck				X		
		Chenonetta jubata	Australian Wood Duck, Wood Duck				X		X
		Cygnus atratus	Black Swan				X		
		Malacorhynchus membranaceus	Pink-eared Duck				X		
		Oxyura australis	Blue-billed Duck				X		
		Tadorna tadornoides	Australian Shelduck, Mountain Duck				X		
	Apodidae	*Apus pacificus*	Fork-tailed Swift	Ma, Mi	IA	X	X		

APPENDIX F

APPENDIX F - CONTINUED

Ardeidae	*Ardea ibis*	Cattle Egret	Mi, Ma	IA	X	X		
	Ardea alba	Great Egret	Mi, Ma				X	
	Ardea modesta	Eastern Great Egret	Ma, Mi	IA	X	X		
	Ardea pacifica	White-necked Heron				X		
	Botaurus poiciloptilus	Australasian Bittern	En				X	
	Ixobrychus minutus	Little Bittern		P4	X			
	Nycticorax caledonicus	Rufous Night Heron				X		
Artamidae	*Artamus cinereus*	Black-faced Woodswallow				X		
	Artamus cyanopterus	Dusky Woodswallow				X		
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew		P4	X	X		
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike				X		X
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover				X		
	Charadrius rubricollis	Hooded Plover	Ma	P4	X			
	Erythrogonys cinctus	Red-kneed Dotterel				X		
Columbidae	*Columba livia*	Domestic Pigeon				X		
	Ocyphaps lophotes	Crested Pigeon				X		X
	Phaps chalcoptera	Common Bronzewing				X		X
	Streptopelia chinensis	Spotted Turtle-Dove				X		
	Streptopelia chinensis subsp. tigrina	Spotted Turtle-Dove				X		
	Streptopelia senegalensis	Laughing Turtle-Dove				X		
Corvidae	*Corvus coronoides*	Australian Raven				X		X
	Corvus bennetti	Little Crow						X
Cracticidae	*Cracticus tibicen*	Australian Magpie				X		X
	Cracticus tibicen subsp. dorsalis	White-backed Magpie				X		
	Cracticus torquatus	Grey Butcherbird				X		
	Strepera versicolor	Grey Currawong				X		
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo				X		
	Cacomantis pallidus	Pallid Cuckoo				X		
	Chrysococcyx basalis	Horsfield's Bronze Cuckoo				X		
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird				X		
Dicruridae	*Grallina cyanoleuca*	Magpie-lark				X		X
	Rhipidura fuliginosa	Grey Fantail						X
	Rhipidura leucophrys	Willie Wagtail				X		X
Falconidae	*Falco cenchroides*	Australian Kestrel				X		
	Falco cenchroides subsp. cenchroides	Australian Kestrel				X		
	Falco longipennis	Australian Hobby				X		
	Falco peregrinus	Peregrine Falcon		S4	X	X		
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra				X		X
	Todiramphus sanctus	Sacred Kingfisher				X		
Hirundinidae	*Hirundo neoxena*	Welcome Swallow				X		
	Hirundo nigricans	Tree Martin						X
Laridae	*Sternula nereis nereis*	Australian Fairy Tern	Vu	S1			X	
Maluridae	*Malurus splendens*	Splendid Fairy-wren				X		X

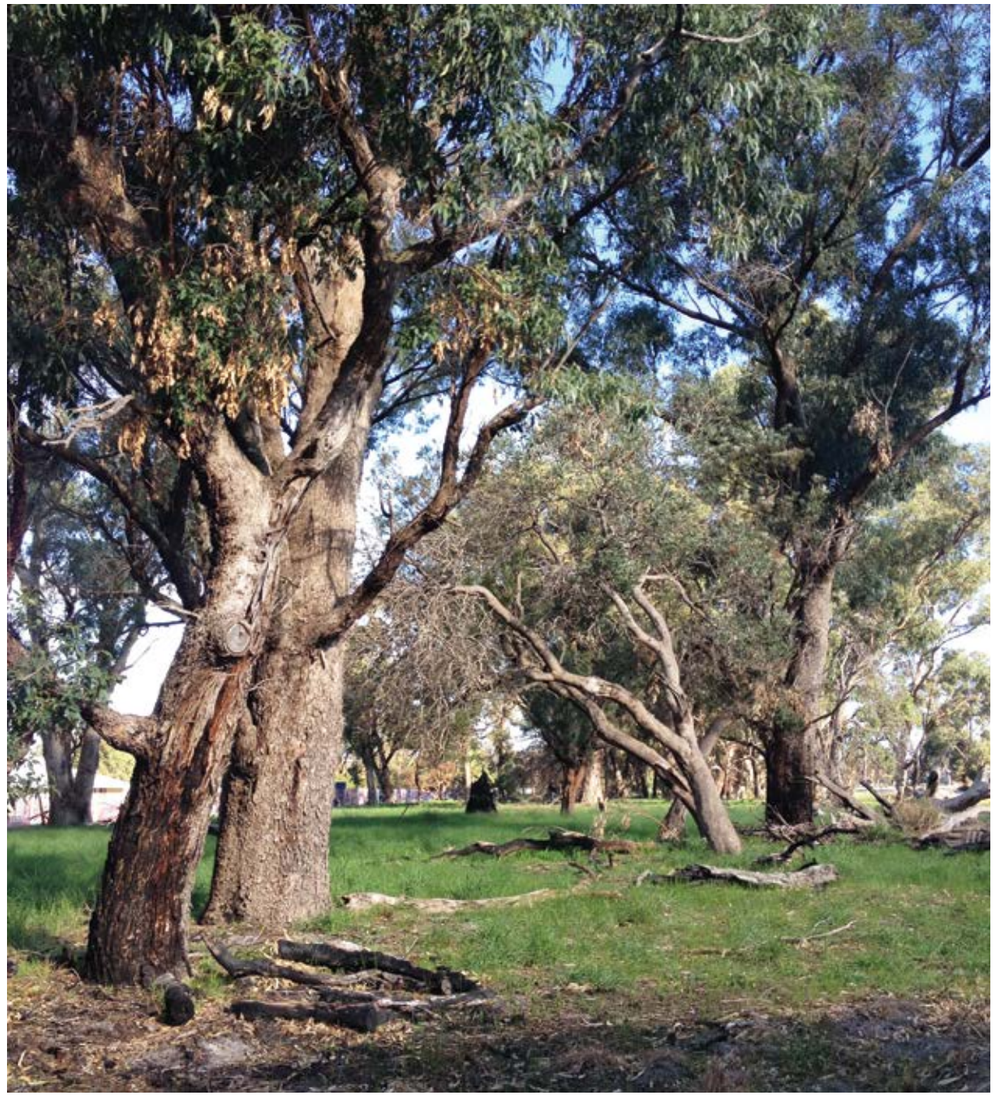
APPENDIX F

	Stipiturus malachurus subsp. westernensis	Southern Emu-wren				X		
Megapodiidae	*Leipoa ocellata*	Malleeefowl	Vu, Mi	S1			X	
Meliphagidae	*Acanthorhynchus superciliosus*	Western Spinebill				X		
	Anthochaera carunculata	Red Wattlebird				X		X
	Anthochaera lunulata	Western Little Wattlebird				X		
	Epthianura albifrons	White-fronted Chat				X		
	Lichmera indistincta	Brown Honeyeater				X		X
	Manorina flavigula	Yellow-throated Miner				X		
	Phylidonyris novaehollandiae	New Holland Honeyeater				X		X
Meropidae	*Merops ornatus*	Rainbow Bee-eater	Mi. Ma	IA	X	X		
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella				X		
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush				X		
	Pachycephala pectoralis	Golden Whistler				X		
	Pachycephala rufiventris	Rufous Whistler				X		X
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote				X		
	Pardalotus striatus	Striated Pardalote				X		X
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican				X		X
Petroicidae	*Petroica goodenovii*	Red-capped Robin				X		
	Petroica multicolor	Scarlet Robin						X
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant				X		
	Phalacrocorax sulcirostris	Little Black Cormorant				X		
	Phalacrocorax varius	Pied Cormorant				X		
Phasianidae	*Coturnix pectoralis*	Stubble Quail				X		
Podargidae	*Podargus strigoides*	Tawny Frogmouth				X		
Podicipedidae	*Podiceps cristatus*	Great Crested Grebe				X		
	Poliocephalus poliocephalus	Hoary-headed Grebe				X		
	Tachybaptus novaehollandiae	Australasian Grebe, Black-throated Grebe				X		
Psittacidae	*Cacatua roseicapilla*	Galah				X		X
	Cacatua sanguinea	Little Corella				X		
	Cacatua tenuirostris	Eastern Long-billed Corella				X		
	Calyptorhynchus banksii	Red-tailed Black-Cockatoo				X		
	Calyptorhynchus banksii subsp. naso	Forest Red-tailed Black-Cockatoo	Vu	S1	X	X	X	X
	Calyptorhynchus latirostris	Carnaby's Cockatoo, short-billed black-cockatoo	En	S1	X	X	X	X
	Calyptorhynchus baudinii	Baudin's Black-Cockatoo	Vu	S1			X	
	Neophema elegans	Elegant Parrot				X		
	Nymphicus hollandicus	Cockatiel						X
	Platycercus zonarius	Australian Ringneck, Ring-necked Parrot				X		X
	Platycercus zonarius subsp. semitorquatus	Twenty-eight Parrot				X		
	Polytelis anthopeplus	Regent Parrot				X		
	Trichoglossus haematodus	Rainbow Lorikeet				X		X
Rallidae	*Fulica atra*	Eurasian Coot				X		
	Gallinula tenebrosa	Dusky Moorhen				X		
	Porphyrio porphyrio	Purple Swamphen				X		
	Porzana pusilla	Baillon's Crake				X		
	Porzana tabuensis	Spotless Crake				X		

APPENDIX F

APPENDIX F - CONTINUED

	Recurvirostridae	*Cladorhynchus leucocephalus*	Banded Stilt				X			
		Himantopus himantopus	Black-winged Stilt				X			
		Recurvirostra novaehollandiae	Red-necked Avocet				X			
	Rostratulidae	*Rostratula australis*	Australian Painted Snipe	En, Ma, Mi	S1			X		
	Scolopacidae	*Actitis hypoleucos*	Common Sandpiper		IA	X	X			
		Calidris acuminata	Sharp-tailed Sandpiper		IA	X	X			
		Calidris ferruginea	Curlew Sandpiper		S1	X				
		Calidris ruficollis	Red-necked Stint		IA	X	X			
		Numenius madagascariensis	Eastern Curlew		S1	X				
		Tringa glareola	Wood Sandpiper		IA	X	X			
		Tringa nebularia	Common Greenshank		IA	X	X			
	Strigidae	*Ninox novaeseelandiae*	Boobook Owl				X			
	Sylviidae	*Acrocephalus australis*	Australian Reed Warbler				X			
		Cincloramphus cruralis	Brown Songlark				X			
		Megalurus gramineus	Little Grassbird				X			
	Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill				X			
		Platalea regia	Royal Spoonbill				X			
		Threskiornis molucca	Australian White Ibis				X			X
		Threskiornis spinicollis	Straw-necked Ibis				X			
	Turnicidae	*Turnix varia subsp. varia*	Painted Button-quail				X			
	Tytonidae	*Tyto alba subsp. delicatula*	Barn Owl				X			
	Zosteropidae	*Zosterops lateralis*	Grey-breasted White-eye, Silvereye				X			
MAMMAL	**Leporidae**	*Oryctolagus cuniculus*	Rabbit				X			
	Canidae	*Vulpes vulpes*	Fox							X
	Dasyuridae	*Phascogale tapoatafa*	Brush-tailed Phascogale		S1	X				
		Dasyurus geoffroii	Chuditch, Western Quoll	Vu	S1			X		
	Macropodidae	*Macropus irma*	Western Brush Wallaby		P4	X				
		Setonix brachyurus	Quokka	Vu	S1			X		
		Macropus fuliginosus	Western Grey Kangaroo				X			
	Molossidae	*Mormopterus planiceps*	Southern Freetail-bat				X			
		Tadarida australis	White-striped Freetail-bat				X			
	Muridae	*Mus musculus*	House Mouse				X			
	Peramelidae	*Isoodon obesulus subsp. fusciventer*	Quenda, Southern Brown Bandicoot		P4	X	X			
	Potoroidae	*Bettongia penicillata ogilbyi*	Woylie	En	S1			X		
	Petauridae	*Pseudocheirus occidentalis*	Western Ringtail Possum	Vu	S1			X		
	Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat				X			
		Nyctophilus geoffroyi	Lesser Long-eared Bat				X			
		Vespadelus regulus	Southern Forest Bat				X			



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