City of Joondalup

Draft Iluka–Burns Beach Foreshore Reserve Management Plan

Contents

Acknowledgements

- Eco Logical Australia
- Friends of North Ocean Reef - Iluka Foreshore
- Spineless Wonders

Please formally acknowledge the City of Joondalup if you choose to use any of the content contained within the *Iluka–Burns Beach Foreshore Reserve Management Plan*.

Suggested citation:

City of Joondalup, 2023, *Iluka–Burns Beach Foreshore Reserve Management Plan*, Perth, WA.

Acknowledgement of Country

The City of Joondalup acknowledges the traditional custodians of this land, the Whadjuk people of the Noongar nation. We recognise the culture of the Noongar people and the unique contribution they make to the Joondalup region and Australia. We pay our respects to their Elders past, present and emerging, as well as all Aboriginal and Torres Strait Islander peoples.

Joondalup-ak ngala kaditj Noongar moort nidja Wadjak boodjar-ak kalyakool moondang-ak kaaradj-midi. Ngala Noongar Moort wer baalabang moorditj kaadidjiny koota-djinanginy. Ngala Noongar wer Torres Strait Moort-al dandjoo koorliny kwaba-djinanginy. Koora, yeyi wer kalyakool, ngalak Noongar wer Torres Strait Birdiya wer moort koota-djinanginy.

This plan may include words from the Noongar language and the City recognises that Aboriginal languages are oral in nature and the same word can be spelt in multiple ways.

Aboriginal and Torres Strait Islander people are advised that this plan may contain images or names of people who are deceased.

Acronyms

Acronym / Abbreviation	Definition
AHD	Australian Height Datum
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
BOM	Bureau of Meteorology
the City	City of Joondalup
CoJ	City of Joondalup
CPSM	Centre for Phytophthora Science and Management
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFWA	Department of Agriculture and Food Western Australia
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DEC	Department of Environment and Conservation
DEP	Department of Environmental Protection
DFES	Department of Fire and Emergency Services
DoE	Department of Environment
DoW	Department of Water
DPI	Department of Primary Industries
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
DWG	Dieback Working Group
EDOWA	Environmental Defender's Office Western Australia (Inc)
ELA	Eco Logical Australia
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EWSWA	Environmental Weed Strategy for Western Australia
FCT	Floristic Community Type
FESA	Fire and Emergency Services Authority
GIS	Geographic Information System
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australia Migratory Bird Agreement
LPS3	Local Planning Scheme No. 3
mAHD	Elevation in metres with respect to the Australian Height Datum
MRS	Metropolitan Region Scheme
NACMS	Natural Area Consulting Management Services
NWCPAG	National Wildlife Corridors Plan Advisory Group
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
PUBF	Perth Urban Bushland Fungi project
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SWALSC	South West Aboriginal Land & Sea Council
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
WA	Western Australia
WAH	Western Australia Herbarium
WoNS	Weeds of National Significance

Executive Summary

The *Iluka–Burns Beach Foreshore Reserve Management Plan* outlines a framework for the environmental management of Iluka Foreshore Reserve and Burns Beach Foreshore Reserve (referred to as Iluka-Burns Beach) for the next ten years. Iluka-Burns Beach are classified as Major Conservation Areas due to the high biodiversity values of the area.

As part of the development of the *Iluka-Burns Beach Foreshore Reserve Management Plan*, a flora, fauna and fungi survey was conducted in spring 2020. The results of this survey were combined with previous surveys to develop a comprehensive species list and ecological assessment of the site.

Iluka Foreshore Reserve is located approximately 27km north-west from the Perth Central Business District, with Burns Beach Foreshore Reserve being located adjacent to the north.

Iluka Foreshore Reserve in Iluka contains approximately 31 hectares (ha) of bushland and is bounded by Ocean Parade to the north, Burns Beach Road to the east, ocean to the west and extends just past Shenton Ave to the south.

Iluka Foreshore Reserve contains a significant State listed priority ecological community 'Coastal shrublands on shallow sands' (Priority 3) and is recognised for its regional environmental significance by being designated as a Bush Forever site (325) by the Western Australian Planning Commission in 2000. Iluka Foreshore Reserve contains the Burns Beach Waugal Aboriginal heritage site (ID 22672) and is also located adjacent to the State Heritage Register listed Marmion Marine Park.

The majority of the native vegetation at Iluka Foreshore Reserve is in excellent condition (70%) and the survey conducted in spring 2020 identified 74 native flora species (including one endangered species, two priority species and five significant species of the Perth Metropolitan Region), three native mammals (including one priority species), 25 native birds (including one endangered species), 13 native reptiles and 12 native invertebrates.

A comprehensive macroinvertebrate and herpetofauna survey was conducted at Iluka Foreshore between April 2015 to May 2018 by Spineless Wonders (engaged by Friends of North Ocean Reef – Iluka Foreshore) with over 500 invertebrate species being identified.[1]

A total of 47 weed species, four non-native mammals, two non-native birds and one non-native invertebrate were identified at Iluka Foreshore Reserve in the survey conducted in spring 2020.

Burns Beach Foreshore Reserve in Burns Beach contains approximately 29 ha of bushland and is bounded by Tamala Park Conservation Reserve to the north, Beachside Drive to the east, ocean to the west and Ocean Parade to the south.

Burns Beach Foreshore Reserve contains a significant State listed priority ecological community 'Coastal shrublands on shallow sands' (Priority 3) and the majority of the site is recognised for its regional environmental significance by being designated as a Bush Forever site (322) by the Western Australian Planning Commission in 2000. Burns Beach Foreshore Reserve is also located adjacent to the State Heritage Register listed Marmion Marine Park.

[1] Knowles, D.G. (2018)

The majority of the native vegetation at Burns Beach Foreshore Reserve is in excellent condition (65%) and the survey conducted in spring 2020 identified 63 native flora species (including four significant species of the Perth Metropolitan Region), three native mammals (including one priority species), 22 native birds, seven native reptiles and 12 native invertebrates.

A total of 43 weed species, three non-native mammals, two non-native birds were identified at Burns Beach Foreshore Reserve in the survey conducted in spring 2020.

Environmental threats have the potential to degrade natural areas and reduce biodiversity values. Environmental threats addressed in this Plan include weeds, pathogens and disease, human impacts, access and infrastructure, non-native fauna species and fire.

In order to address the key environmental threats at Iluka-Burns Beach a number of management actions are outlined within the Plan. Recommended management actions for the next five years include weed management, pathogen management, feral animal control, bushfire mitigation, monitoring flora and fauna species through field surveys, endangered flora species management, maintaining infrastructure, environmental education and supporting the Friends Group.

It is also proposed that the City reviews the risk and management of unexploded ordnances (UXO) within Burns Beach Foreshore Reserve and coastal hazard risks such as the limestone cliffs across the Iluka – Burns Beach Foreshore Reserve. Management actions will be implemented in partnership with Friends of North Ocean Reef - Iluka Foreshore and other key stakeholders and community groups, where relevant.

1.0 Introduction

1.1 Background

The City of Joondalup ('the City') is situated along the Swan Coastal Plain, with the Joondalup City Centre being located 30km from the Perth Central Business District. The City covers an area of 96.5km^2 which encompasses a diverse range of natural areas including 17km of coastal foreshore, a chain of wetlands and a variety of bushland ecosystems (as shown in Figure 1).

The City's southern boundary is located approximately 16km from the Perth Central Business District, and is bounded by the City of Wanneroo to the east and north, the City of Stirling to the south, and the Indian Ocean to the west.

There are a number of regionally, nationally and internationally significant natural areas located within the City, including the Yellagonga Regional Park and a number of Bush Forever sites which contain species of high conservation value. Significant natural areas adjacent to the City include the Marmion Marine Park and the Neerabup National Park.

The City of Joondalup is committed to conserving and enhancing the City's natural assets to ensure the long term protection of the environment for future generations.

1.2 Natural Area Management Plans

The City is developing Natural Area Management Plans to provide strategic ongoing management of the City's natural areas and protect native vegetation and ecosystems.

Environmental threats have the potential to degrade natural areas and reduce biodiversity values. Environmental threats addressed in this Plan include weeds, plant diseases, fire, non-native fauna species and human impacts.

Natural Areas Management Plans describe the potential environmental impacts, risks and threats in natural areas and the associated management strategies that will be implemented to minimise potential impacts.

1.3 Study Area

The study area for the Iluka-Burns Beach Foreshore Reserve Management Plan is Iluka Foreshore Reserve in Iluka and Burns Beach Foreshore Reserve in Burns Beach. These sites have been recognised for their regional environmental significance by being designated as Bush Forever sites 322 and 325[2,3]. Marmion Marine Park is located adjacent to the sites and is listed on the State Heritage Register by the Government of Western Australia.

1.3.1 Location

Iluka Foreshore Reserve in Iluka contains approximately 31 ha of bushland and is bounded by Burns Beach Caravan Park and Ocean Parade to the north, Burns Beach Road and residential properties to the east, ocean to the west and extends just past Shenton Ave to the south, adjoining Ocean Reef Foreshore Reserve (as shown in Figure 2).

[2] Government of Western Australia (2000a)
[3] Government of Western Australia (2000b)

Burns Beach Foreshore Reserve in Burns Beach contains approximately 29 ha of bushland and is bounded by Tamala Park Conservation Reserve to the north, Beachside Drive, residential properties and bushland to the east, ocean to the west and Ocean Parade and Burns Beach Caravan Park to the south (as shown in Figure 3).

1.3.2 Aboriginal Heritage

The Iluka-Burns Beach Foreshore Reserve is located within the Traditional Country of the Noongar people. Noongar people have lived in the south-west of Western Australia for more than 45,000 years. Noongar are made up of fourteen different language groups and Whadjuk is the name of the dialectal group from the Perth area.[4]

Noongar people have their own laws and customs and speak their own language. The laws and customs are characterised by a strong spiritual connection to country, caring for the natural environment and for places of significance.[4] The Noongar connection with nature and country includes a close relationship with spiritual beings associated with the land.[5]

Iluka Foreshore Reserve contains the mythological Burns Beach Waugal Aboriginal heritage site (ID 22672). Waugal means soul, spirit or breath and is the snake or rainbow serpent major spirit for Noongar people and central to their beliefs and customs. Noongar people recognise the Waugal as the giver of life, maintaining all fresh water sources and making Noongar people custodians of the land. Noongar people believe that the Waugal dominates the earth and sky and its track shaped the sand dunes as it slithered over the land.[5]

1.3.3 European Heritage

Up until the early 1970's, Iluka-Burns Beach Foreshore Reserve was predominantly native vegetation. In the early 1970s there was a residential development at the south of Burns Beach Foreshore Reserve adjacent to Iluka Foreshore Reserve. Further residential developments adjacent to Iluka-Burns Beach Foreshore Reserve commenced in the 1970s.

The suburb name Iluka was proposed by the City of Wanneroo and approved in 1980. Iluka is an Aboriginal word meaning 'near the sea'.[6]

Burns Beach is located on land originally owned by Midland Railway Company. A request was made by 50 district residents to the Wanneroo Road Board in 1908 and granted for a 50-acre reserve for camping and a health resort at the beach. By the late 1920s the area was referred to by locals as 'Burns Beach' after a farmer who ran sheep in the area.[6]

1.3.4 Land Use Planning

City of Joondalup Local Planning Scheme No. 3

Planning for land use occurs under the City of Joondalup Local Planning Scheme No. 3 (LPS3). LPS3 includes the protection of sites zoned as Environmental Conservation, meaning areas with biodiversity and conservation value.

[4] SWALSC (no date(a))
[5] SWALSC (no date(b))
[6] Landgate (2020)

Neither Iluka Foreshore Reserve or Burns Beach Foreshore Reserve are zoned as Environmental Conservation under LPS3 as they are both under a higher protection order, the MRS – Parks and Recreation.

Metropolitan Region Scheme

The Metropolitan Region Scheme (MRS) was established in 1962 by the then Metropolitan Regional Planning Authority. The MRS sets out the broad pattern of land use for the whole Perth Metropolitan Region.

The coastal foreshore area of Iluka Foreshore Reserve and Burns Beach Foreshore Reserve was zoned as Parks and Recreation when the MRS was established, meaning lands of regional significance for ecological, recreation or landscape purposes.

1.3.5 Land Tenure

Iluka Foreshore Reserve is Crown Land managed by the City of Joondalup and is reserved for the purposes of Parks and Recreation under the Metropolitan Region Scheme (MRS).

Burns Beach Foreshore is partly Crown Land managed by the City of Joondalup and reserved for the purposes of Parks and Recreation under the MRS. The other part of Burns Beach Foreshore Reserve is also reserved for the purposes of Parks and Recreation under the MRS, however it is owned by Burns Beach Management Pty Ltd (as shown in Figure 4). The City has an informal arrangement with Burns Beach Management Pty Ltd to manage the bushland area from Ocean Parade in the south to Burleigh Drive in the north. The remaining bushland on the coast to the north of Burleigh Drive is currently not managed due to restricted access.

1.3.6 Current Land Use

The main uses of Iluka-Burns Beach are for recreational purposes such as walking, cycling, dog exercising, beach activities and use of adjacent playgrounds and Burns Beach Cafe.

Properties adjacent to Iluka Foreshore Reserve are primarily zoned as Low Density Residential with a small area of Commercial Zone (such as Iluka Plaza) and public open space (Pattaya Park and Burns Park). The Iluka Structure Plan applies to the properties to the north of Silver Sands Drive in Iluka.

Properties adjacent to Burns Beach Foreshore Reserve are primarily zoned as Low and Medium Density Residential with a small area of Commercial Zone and public open space (Burns Beach Park and Beachside Park). The Burns Beach Structure Plan applies to the majority of the properties adjacent to the site.

1.3.6 Future Land Use

Tamala Conservation Park

The establishment of a conservation park between Burns Beach and Mindarie as a Class A Reserve is outlined in the DPLH and WAPC *Tamala Conservation Park Establishment Plan*.

Figure 5 identifies the proposed boundaries, with the proposed park comprising of around 380 ha of high quality coastal vegetation bordered in the west by the Indian Ocean and to the east by Marmion Avenue within the Cities of Wanneroo and Joondalup. The subject area is entirely reserved for Parks and Recreation under the MRS. The entire area lies within Bush Forever site 322 and consists of around 234 ha, owned by the Western Australian Planning Commission (WAPC) and 147 hectares of Crown Reserves.

The Cities of Wanneroo and Joondalup are prepared to continue managing these reserves wholly or in part, conditional upon State Government funding and maintaining a dual use path along the coast to connect Burns Beach and Mindarie.

The *Tamala Conservation Park Establishment Plan* notes the Noongar name of Booyeembara be considered by DBCA when developing the Management Plan for the Park. The plan references that the coastal area was referred to as Booyeembara, deriving from the Noongar word for rock (boya or booyee), referring to the prevalence of limestone in the area.

Marmion Marine Park

Marmion Marine Park is currently situated between Trigg Island and Burns Rocks, encompassing approximately 9,500 hectares (Figure 6). It was gazetted in 1987 as Western Australia's first marine park, with management guided by the *Marmion Marine Park Management Plan (1992-2002)*.

A review of the management plan was recommended by the then Marine Parks and Reserves Authority in 2012, and the Office of the Auditor General in its 2016 report *Management of Marine Parks and Reserves*. In 2019, development approval for Ocean Reef Marina required the excision of 143 hectares from Marmion Marine Park enacted through the *Reserves (Marmion Marine Park) Act 2019*. This triggered a review of the management plan to reflect the excision as well as the proposed extension of the marine park, as a commitment under the State Government's *Plan for Our Parks* initiative.

The DBCA commenced the review and proposed extension of Marmion Marine Park in 2021. There has been an extensive community engagement process throughout the review, with the final community reference committee meeting scheduled in the later half of 2023. The Indicative Joint Management Plan is progressing through relevant statutory approvals and once approval from the relevant Ministers has been granted, will be advertised for the public comment period.

An extension to the Marmion Marine Park is being proposed to enhance protection of intertidal and subtidal macroalgae reef communities, sea grass beds, important habitat for the endemic Australia sea lion (*Neophoca cinerea*) and an array of seabirds. An extension to the park will also allow management frameworks to be put in place to manage the expected increase in use of this area into the future. The proposed extension will see Marmion Marine Park covering the entire length of Iluka – Burns Beach Foreshore Reserve coastline and the City's entire 17km length of coastline (Figure 6).

Marmion Marine Park will continue to be managed for multiple-use, with zoning to be determined through the planning process based on community input. The review will include the development of a new management plan to establish a contemporary management framework to conserve the ecological, social, and cultural values of the area, while allowing for sustainable use and planning for the predicted increased use of the area.

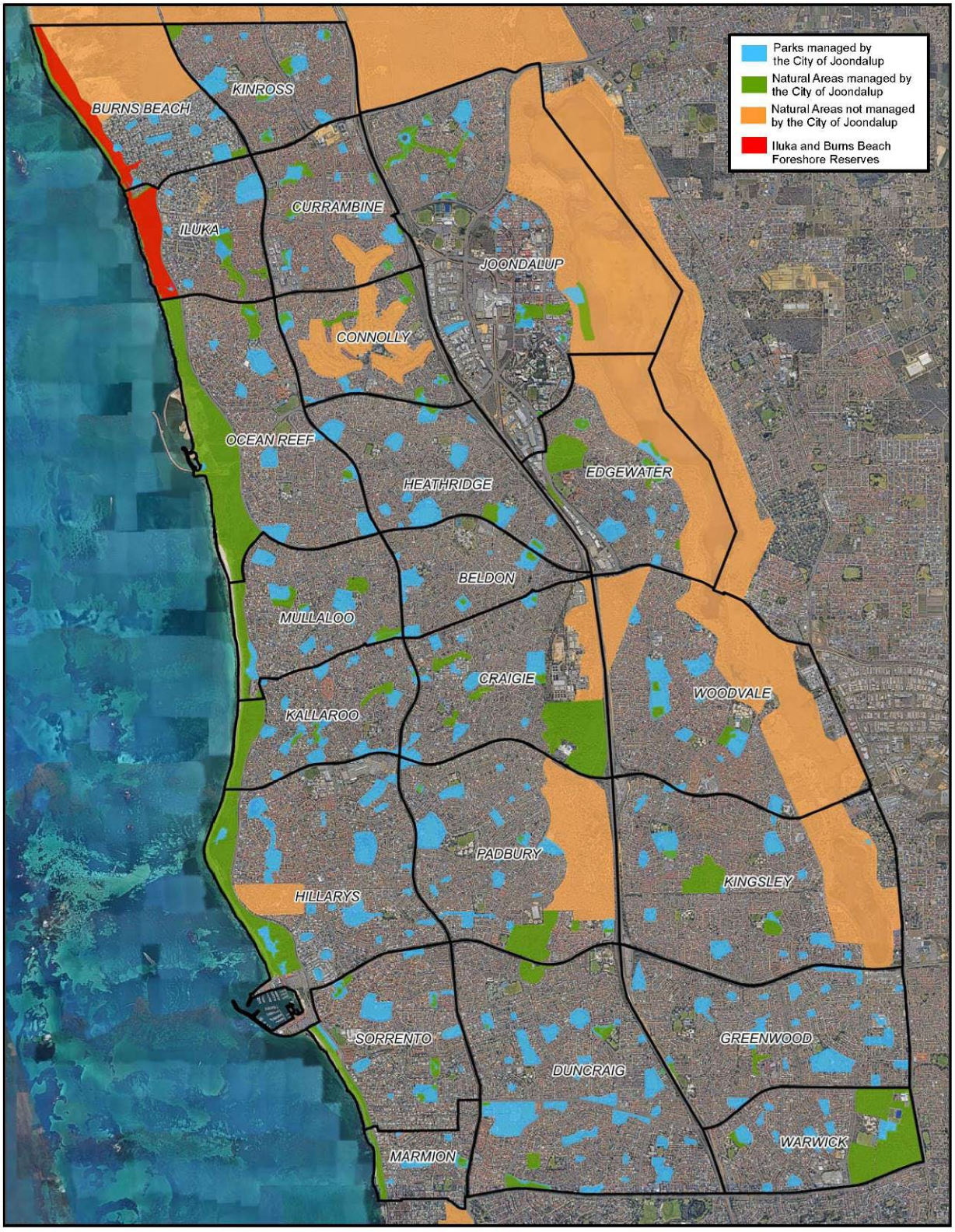


Figure 1: Location of Iluka-Burns Beach Foreshore Reserve in City of Joondalup

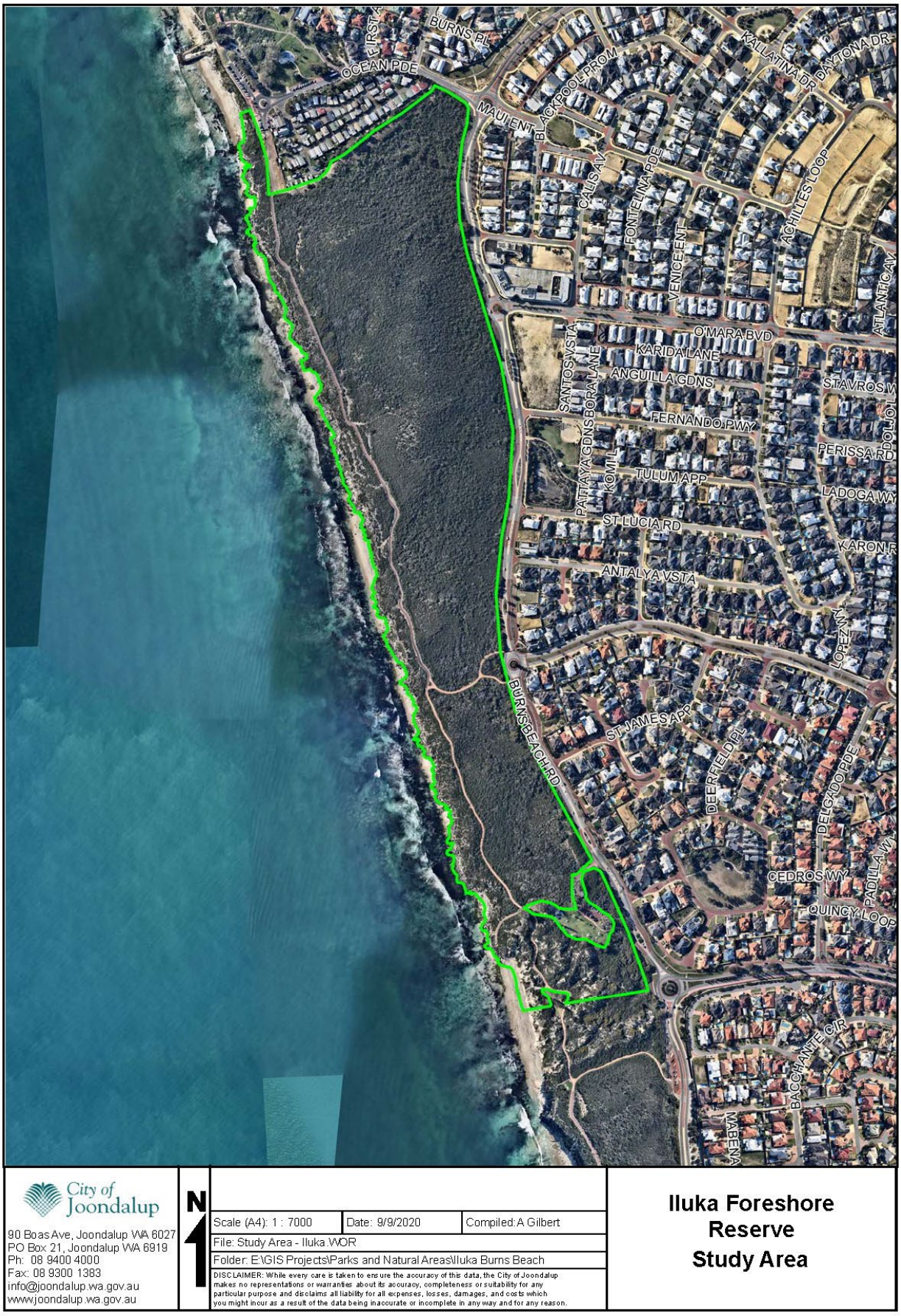


Figure 2: Iluka Foreshore Reserve Study Area (2020)

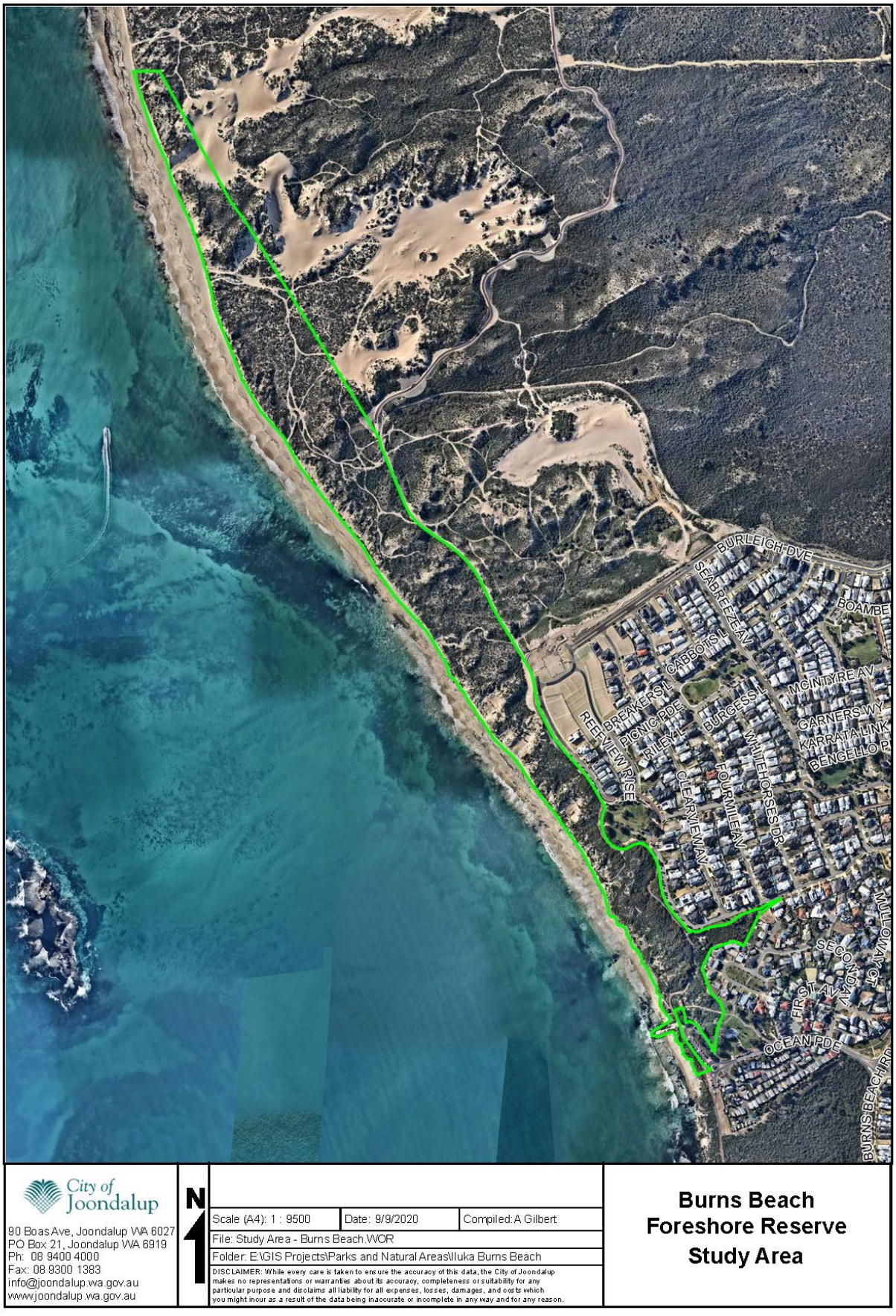


Figure 3: Burns Beach Foreshore Reserve Study Area (2020)

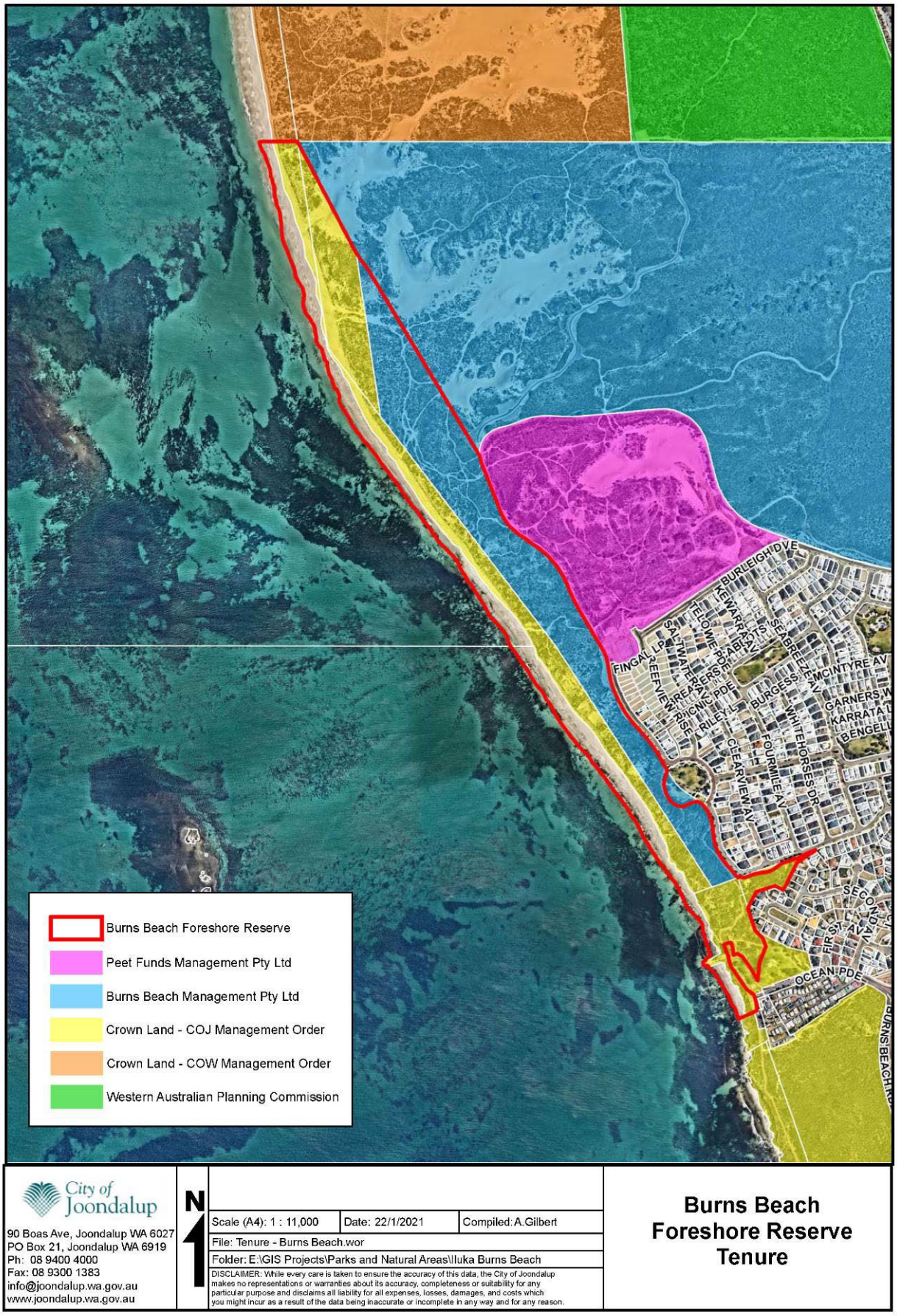


Figure 4: Burns Beach Foreshore Reserve Land Tenure

Figure 5: Aerial photograph showing propose Tamala Conservation Park boundary

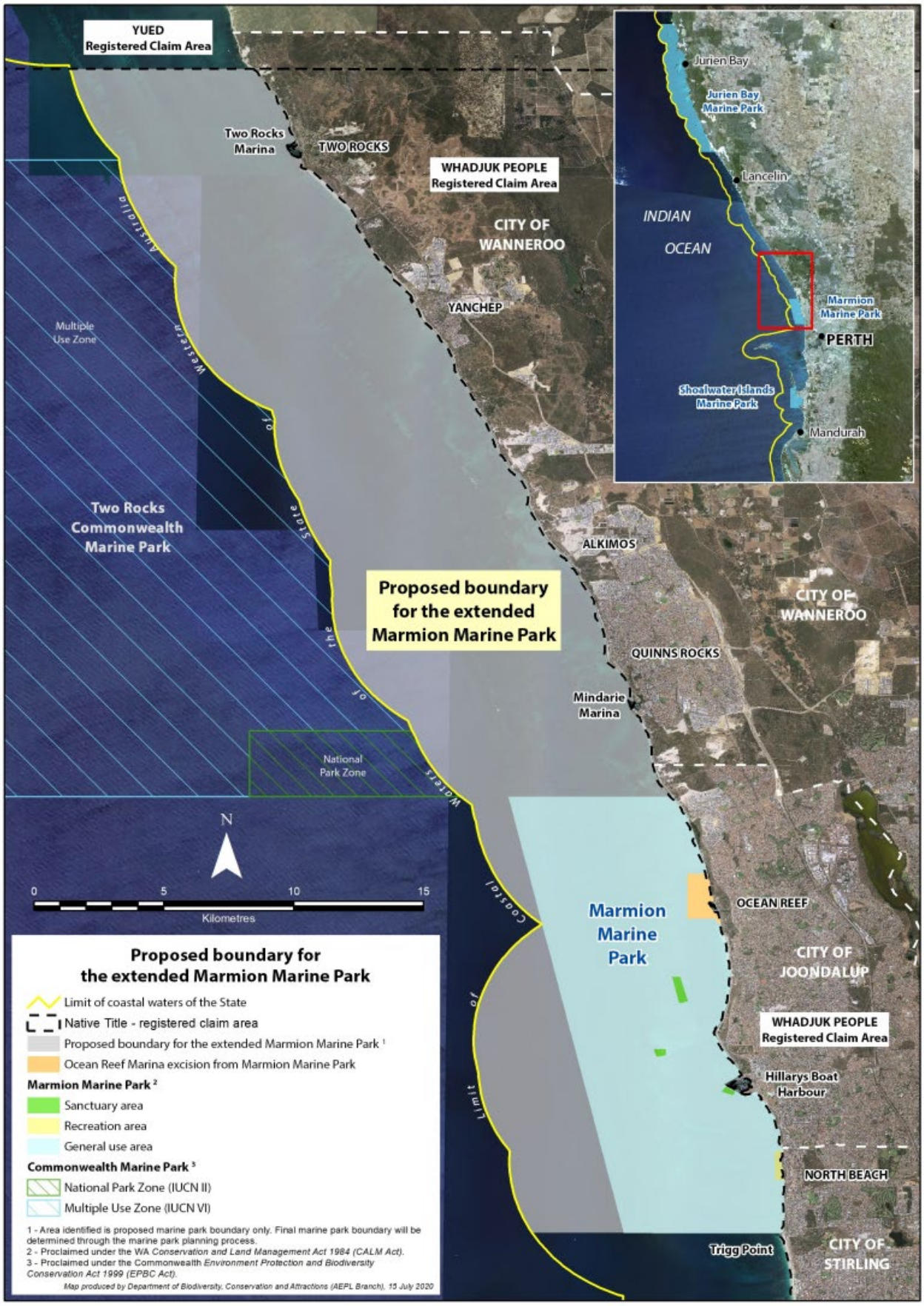


Figure 6: Current and proposed boundary for the extended Marmion Marine Park

1.4 Aim and Objectives

The aim of the *Iluka-Burns Beach Foreshore Reserve Management Plan* is to provide a framework to protect and enhance biodiversity values whilst maintaining appropriate community access and awareness of the natural area.

The objectives of the *Iluka-Burns Beach Foreshore Reserve Management Plan* are to:

- Establish a baseline description of the Iluka-Burns Beach environment to guide future environmental planning and recommended management actions.
- Outline key environmental threats and the impact they have on conservation and recreation values.
- Outline management actions to address key environmental threats including monitoring and reporting.

1.5 Purpose

The purpose of the *Iluka-Burns Beach Foreshore Reserve Management Plan* is to:

- Provide information to assist the City in prioritising maintenance schedules.
- Guide the future development of the City's Conservation Capital Works Program.
- Increase opportunities for grant funding by having a detailed schedule of projects.
- Provide guidance to City employees, contractors and Friends Groups operating within Iluka-Burns Beach Foreshore Reserve.
- Provide mechanisms to raise community awareness of Iluka-Burns Beach Foreshore Reserve whilst protecting and enhancing biodiversity values.

1.6 Strategic Context

The *Iluka-Burns Beach Foreshore Reserve Management Plan* is a Natural Area Management Plan and aligns with the City of Joondalup Strategic Environmental Framework outlined in Figure 7. Details of the relevant local, State and Federal legislation, policies, plans and strategies are outlined in Appendix 1.

Figure 7: City of Joondalup Strategic Environmental Framework

1.7 Stakeholder Consultation

Key external stakeholders to be consulted for the development of the *Iluka-Burns Beach Foreshore Reserve Management Plan* include:

- Friends of North Ocean Reef - Iluka Foreshore
- Department of Biodiversity, Conservation and Attractions (DBCA)
- Department of Fire and Emergency Services (DFES)
- Department of Planning, Lands and Heritage (DPLH)
- Western Australian Local Government Association (WALGA)
- Burns Beach Residents Association (Inc)
- Iluka Homeowners Association
- Local residents.

2.0 Description of the Physical Environment

2.1 Geology, Soils and Landforms

Soils of the Swan Coastal Plain

Iluka-Burns Beach is situated in the City of Joondalup which is located within the Swan Coastal Plain. The majority of the soils of the Swan Coastal Plain are formed by material deposited by rivers and wind. A series of dune systems has been formed with the youngest dunes being the Quindalup Dunes nearest the coast, followed by the Spearwood Dunes and the oldest Bassendean Dunes are farthest from the coast, as shown in Figure 8.[7]

Iluka-Burns Beach is located within the Quindalup and Spearwood Dune System. The Spearwood Dune System comprises of sand derived from Tamala Limestone.[8] The Spearwood Dunes have a core of sandy aeolianite with a capping of secondary limestone (Tamala Limestone, predominantly calcarenite) overlain by yellow brown siliceous sands with weak podzol development.[9,10] The Spearwood Dunes are believed to have formed around 40,000 years ago and comprise of red/brown, yellow and pale yellow/grey sands. The Spearwood Sand Phase is characterised by undulating dunes with rocky crests of Aeolian sand over limestone, as in Figure 9.

The Quindalup System is described as coastal dunes of the Swan Coastal Plain, with calcareous deep sands and yellow sands, dominated by coastal scrub. The Quindalup System formed around 10,000 years ago and exhibits undulating and dramatic landscape features. The Quindalup dunes are underlain by the Safety Bay Sands formation, which comprises calcareous soils also derived from Tamala limestone.[11]

The environmental geological characteristics of Iluka-Burns Beach are limestone and sand, impacting on the types of vegetation communities existing at the site.

The land contours of Iluka Foreshore Reserve range from 0m to 24m and the Burns Beach Foreshore Reserve land contours range from 0m to 27m Australian Height Datum (AHD), as shown in Figure 13 and Figure 14.

Acid Sulfate Soils

Potential Acid Sulfate Soils are naturally occurring soils and sediments that contain iron sulphides. Potential Acid Sulfate Soils are predominantly found in low-lying coastal wetlands and tidal flats and are harmless when left undisturbed. Exposure to air can cause the iron sulfides in Potential Acid Sulfate Soils to react with oxygen and water producing Acid Sulfate Soils with high concentrations of iron and sulfuric acid, which can lead to other contaminants, such as heavy metals and arsenic being released into the surrounding environment.[12]

[7] Bolland (1998)
[8] Gozzard cited in ELA (2016a)
[9] McArthur and Bettenay cited in Syrinx (2012)
[10] DoW (2004)
[11] ELA (2017)
[12] DEC no date (a)

Acid Sulfate Soils are categorised as Potential Acid Sulfate Soils or Actual Acid Sulfate Soils. Potential Acid Sulfate Soils have not been oxidised by exposure to air whilst Actual Acid Sulfate Soils have been disturbed or exposed to oxygen and become acidic.[12]

There is no known risk of Acid Sulfate Soils in Iluka Foreshore Reserve or Burns Beach Foreshore Reserve.[10] The risk of Acid Sulfate Soils is based on the likelihood of Potential Acid Sulfate Soils occurring within soil profiles and has been mapped by the Department of Biodiversity, Conservation and Attractions (DBCA) using available desk-top information and limited ground-truthing, within areas where intensive on-ground soil mapping and soil analysis work has been undertaken. The mapping undertaken has found that Acid Sulfate Soils are not known or expected to occur in the environment of Iluka Foreshore Reserve or Burns Beach Foreshore Reserve on the basis of the geological units present, depth to groundwater and partial "ground truthing" or onsite investigation. Within the City of Joondalup, areas of high to moderate acid sulfate soil risk are predominantly in wetlands or areas adjacent to wetlands, as shown in Figure 10.[12,13]

[13] DWER (no date)

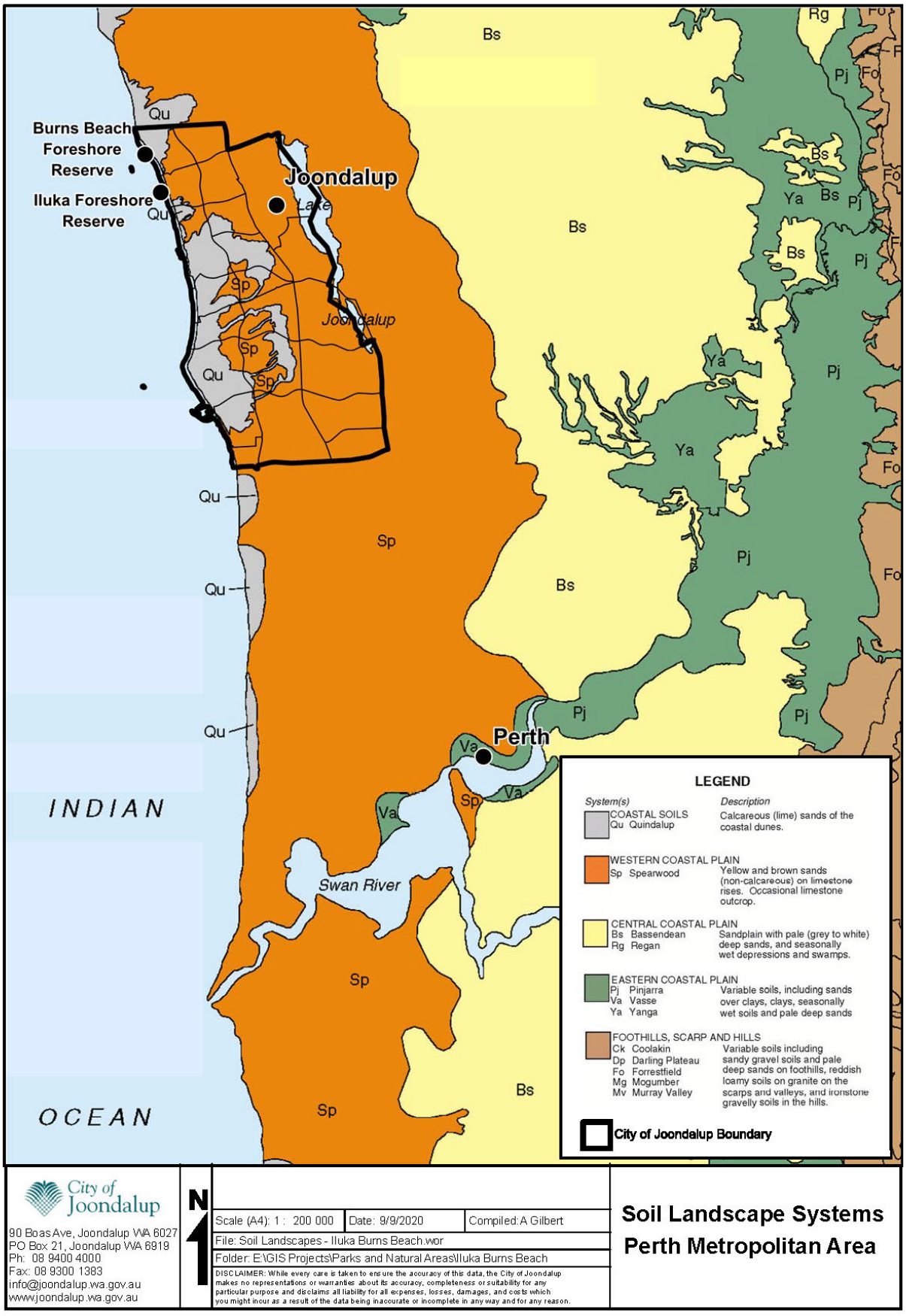


Figure 8: Soils of the Swan Coastal Plain (sourced from Department of Agriculture 2002)

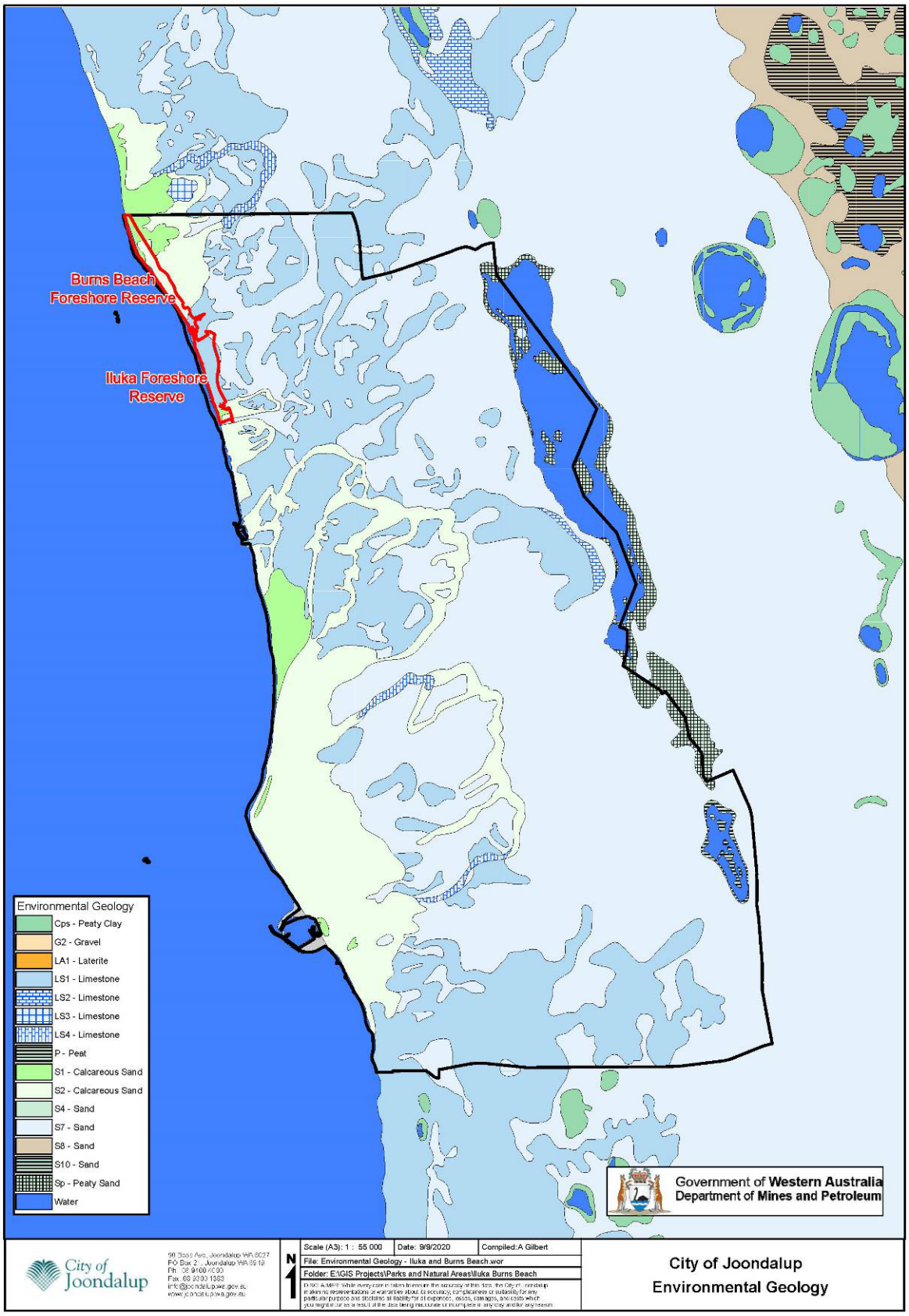


Figure 9: City of Joondalup Environmental Geology (sourced from Department of Mines and Petroleum 2013)

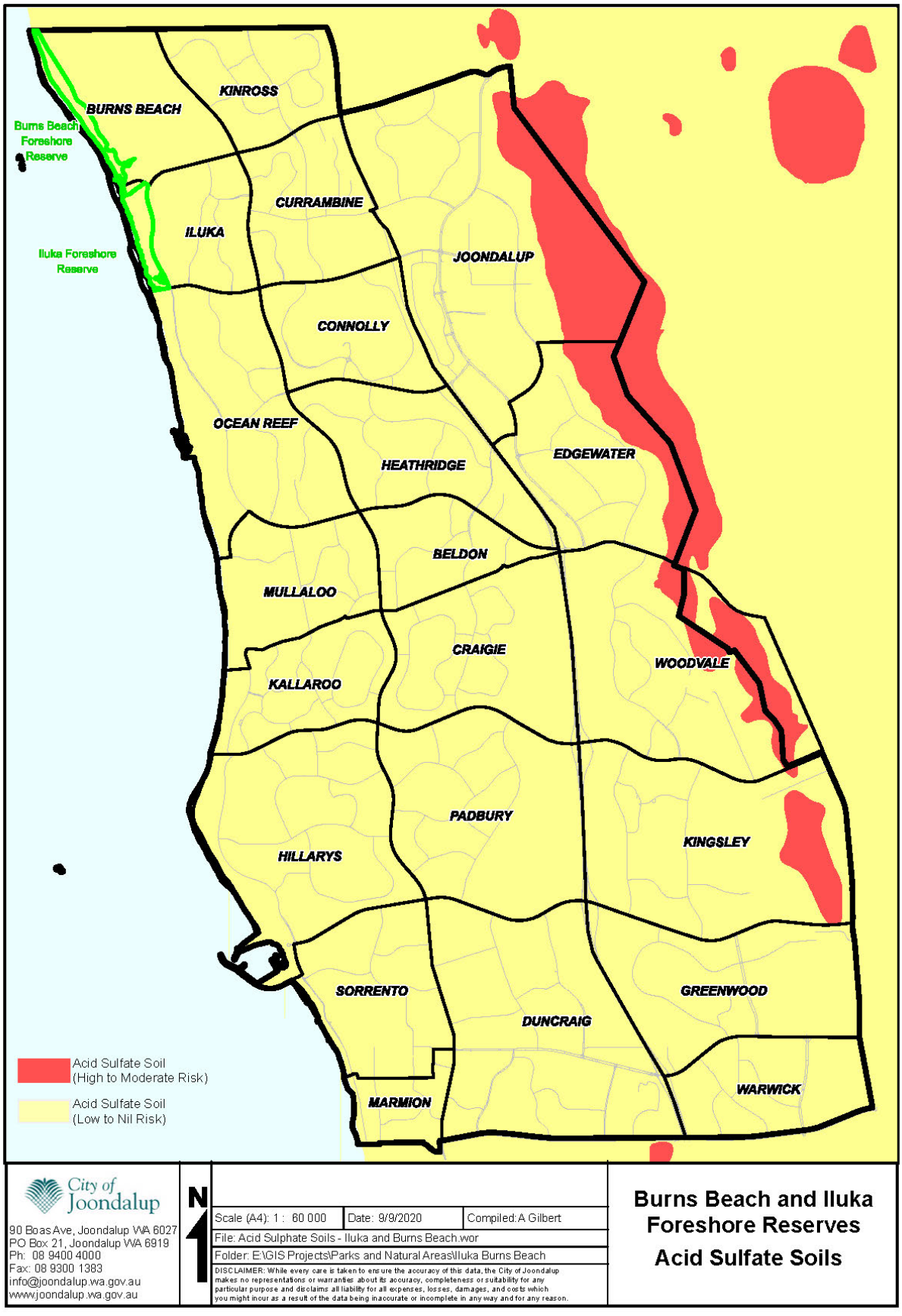


Figure 10: Iluka-Burns Beach Reserve Acid Sulfate Soil Risk

2.2 Hydrology

Groundwater

The City of Joondalup is located on Perth's largest source of groundwater, the Gnangara Groundwater System, comprising four main aquifers: superficial (shallow, unconfined), Mirrabooka (deeper, semi-confined), Leederville (deep, mostly confined) and the Yarragadee (deep, mostly confined). The Gnangara Mound extends across most of the superficial aquifer and refers to the water table creating a mound shape, as shown in Figure 11. Groundwater levels in the superficial aquifer have been declining over recent years due to pressure from extraction and the impacts of climate change, as shown in Figure 12.[14]

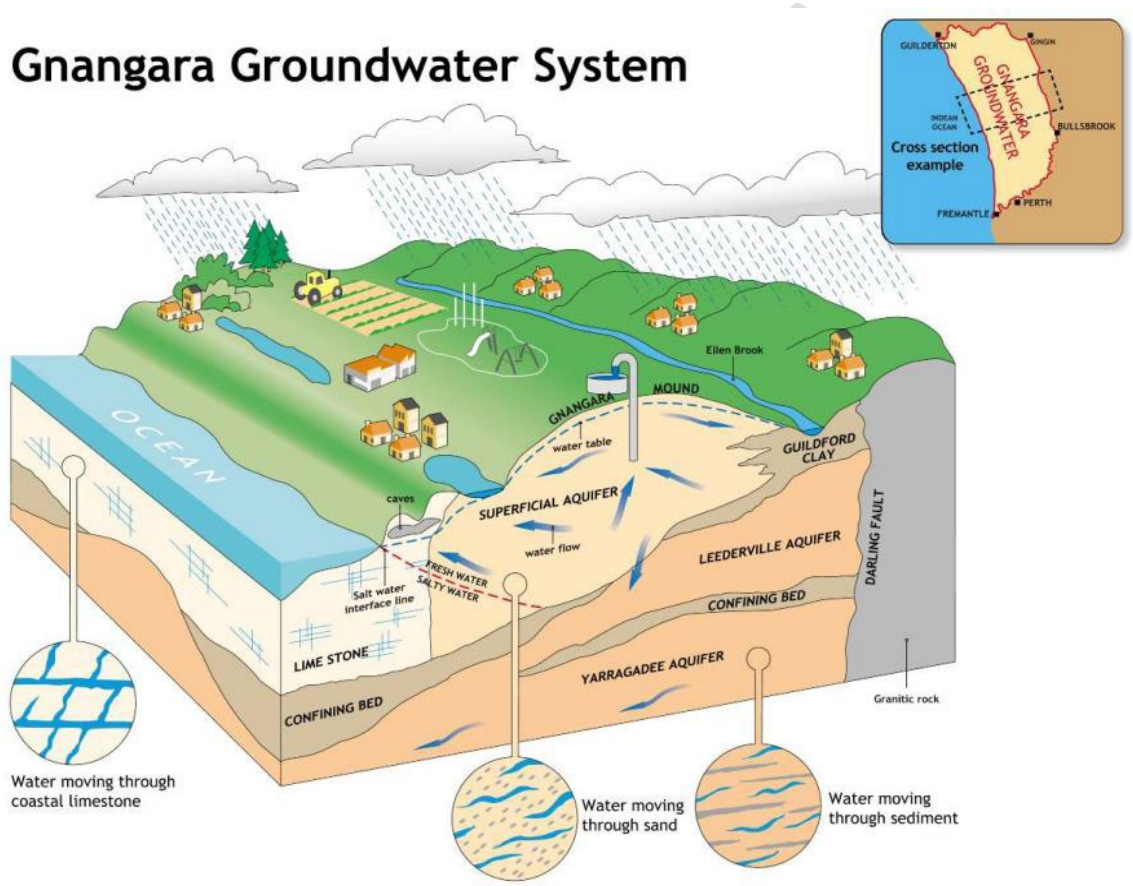


Figure 11: Gnangara Groundwater System (sourced from DWER 2020a)

There is a natural seasonal variance in Perth's groundwater system due to annual rainfall recharge, as shown in Figure 12.

[14] City of Joondalup (2012a)

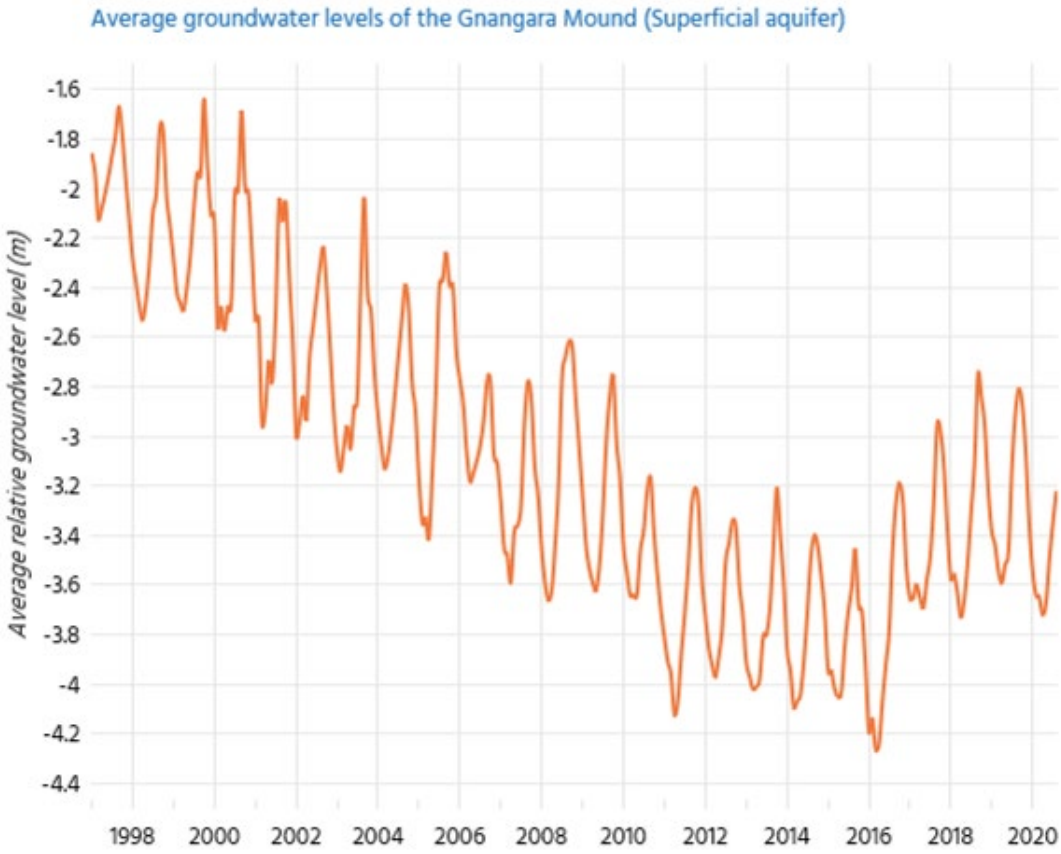


Figure 12: Average Groundwater Levels of the Gnangara Mound Superficial Aquifer (sourced from DWER 2020a)

It is likely that plant species at Iluka-Burns Beach utilise groundwater as the depth to water varies from 0m on the water line up to 21.5m, with a +/- range of 3m seasonal variance.[13] In general, some plant species (usually larger tree species) in the Perth metropolitan area within approximately 10m of groundwater are likely to access the water table. Depth to water is the depth from the natural surface contours to the water table. Groundwater salinity at Iluka-Burns Beach is marginal (500 – 1000 TDS in mg/L).

There is one groundwater monitoring bore located within the north of Iluka Foreshore Reserve with groundwater level measurements having been taken from 1974 until 2020. The water levels taken at this bore indicate that the water table has risen by 0.044 meters AHD from 0.515 meters AHD in 1974 to 0.559 meters AHD in 2020.[15] The water level readings taken at this bore are largely steady and a 0.05m variation is to be expected. The groundwater level near the coast is controlled by sea level and should not change much over time. Most of the groundwater decline in the Perth metropolitan area is recorded further inland such as at the top of the groundwater mound, whilst groundwater levels near the coast have remained stable.

The effect of long-term persistent hydrological change can cause changes in vegetation community composition and structure, with a potential loss of some species and a gradual replacement by more drought-tolerant species. The rate (m/yr) and magnitude (metres) of groundwater level change are also relevant to potential vegetation impact.[16]

[15] DWER (2020b)
[16] Loomes and Froend (no date)

The use of groundwater for domestic irrigation through bores is deemed suitable in the area and is supported in preference to scheme water. The area is low in iron concentration, resulting in a low iron staining risk.[13]

Stormwater Drainage

Stormwater consists of runoff from rainfall and material mobilised and dissolved in its path of flow. Stormwater is channelled and collected in sumps and swales to recharge the superficial aquifer and prevent the spread of weeds, pollutants, pathogens and sediment to vegetation.[17]

Sumps allow some stormwater to infiltrate retention basins, detain the water, collect sediment and over time the water is absorbed back into groundwater. Most sumps are steeply graded rectangular excavations with an inflow at the bottom. Sumps are fenced off in the interest of community safety due to the potential for rapid stormwater inflow.[18]

Iluka Foreshore Reserve does not contain a sump, however there is one located adjacent to the site in Pattaya Park, Iluka (Burns Beach Road Sump), as shown in Figure 13.

Burns Beach Foreshore Reserve does not contain a sump, however there is one located approximately 60 metres away (First Ave Sump) in Burns Beach Park, which adjoins to the site, as shown in Figure 14.

[17] DoE (2004)
[18] Grose and Hedgcock (no date)

Figure 13: Iluka Foreshore Reserve Drainage

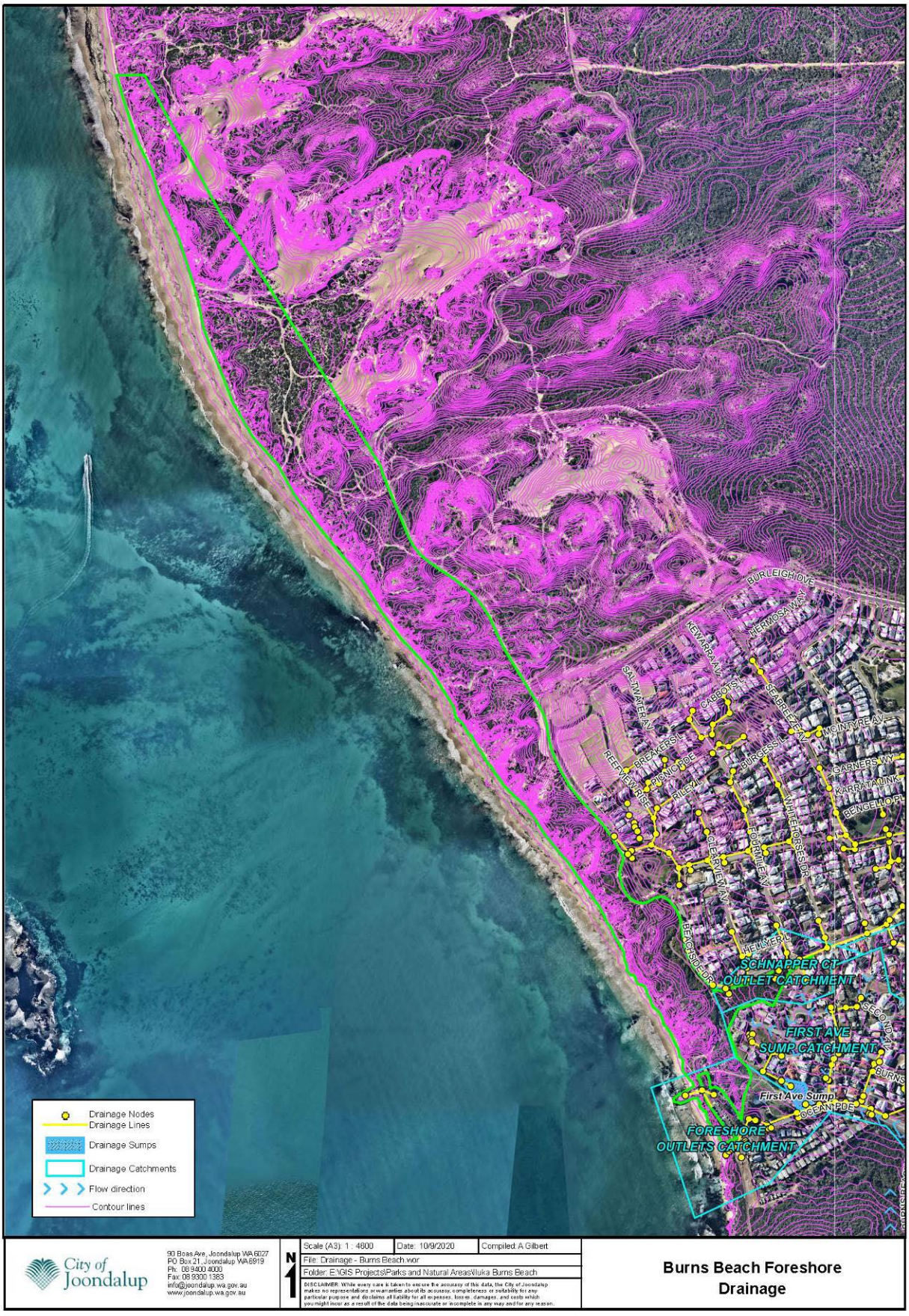


Figure 14: Burns Beach Foreshore Reserve Drainage

2.3 Climate

The City of Joondalup experiences a Mediterranean climate of hot dry summers with an average temperature of 32°C during the day and mild wet winters with an average day time temperature of 18°C.[19]

The average annual rainfall in the City of Joondalup (as recorded at Perth Airport) from 2012 to 2022 was 664.4mm. Approximately 76% of the annual rain falls between the months of May and September, as shown in Figure 15.[20]

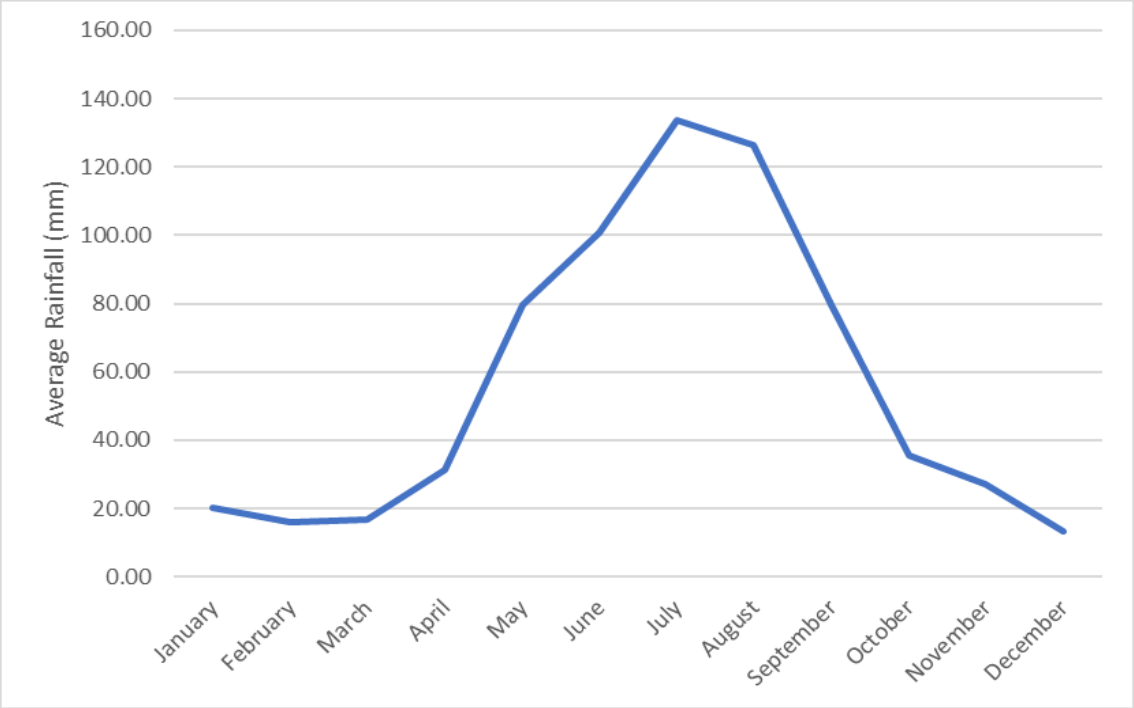


Figure 15: Mean Monthly Rainfall Recorded at Perth Airport Weather Station 2012-2022 (sourced from BoM 2023a)

Current Climate Change

The City of Joondalup is located in the southwest of Western Australia, an area that is already being impacted by the effects of climate change particularly through rising temperatures and decreasing rainfall.

The long-term trend in temperature for south-west Western Australia has been increasing over the past century, with the rate of warming higher since 1960.[21] In 2019 the mean annual temperature for Perth was 1.8°C above the long term average (1961-1990) and was the warmest year on record (since 1944). In 2022 the annual mean maximum temperature was 25.5°C.

There have also been greater temperature extremes. The mean number of days over 35°C between 1944 and 2014, was 27.5 days; between 1981 and 2010 it was 28.5 days; between 1991 and 2021 is was 37 days; and in 2022 there were 40 days.**Error! Bookmark not defined.** In

[19] City of Joondalup (no date)
[20] BoM (2023b)
[21] Hope et al. (2015)

January 2022, Perth Airport recorded six consecutive days over 40°C days and in February 2022, recorded seven consecutive days between 36-40°C.[22]

There is a strong drying trend between May to July over south-west Western Australia, with rainfall since 1970 around 20% less than the average between 1900 and 1969. Since 1999, rainfall is around 26% less than the average between 1900 and 1969.[23] In 2019, Perth Airport recorded 524.6 mm which was its fourth-driest year since records commenced in 1944 and the driest year since 2010.[22] In 2021, Perth Airport recorded 798.8mm and was one of the wettest year on record since 2011.[22] In 2022, Perth Airport recorded 668.6mm of rainfall.

Future Climate Change

Climate change is expected to continue although the extent of change will be dependent on both the amount of greenhouse gases that continue to be emitted and how the environment responds. Future projections have been developed which indicate that for the south-west of Western Australia temperatures will continue to increase while rainfall decreases.[21] Further details on these projections are provided in Table 1.

	2030	**2090**
Temperature	By 2030 temperatures are expected to rise between 0.6 to 1°C.	By 2090 temperatures under an intermediate emissions scenario could rise between 1.1 to 2.1°C and under a high emissions scenario between 2.6 to 4.2°C.
Rainfall	By 2030 winter rainfall is projected to decrease by up to 15%.	By 2090 under an intermediate emissions scenario winter rainfall could decrease by up to 28%, under a high emissions scenario this reduction could as high as 44%.
Extreme Temperatures	Extreme temperatures are projected to increase at a similar rate to mean temperature, with a substantial increase in the temperature reached on hot days, the frequency of hot days, and the duration of warm spells	
Extreme Rainfall and drought	Increased intensity of extreme rainfall events is projected, with *medium confidence*. Time spent in drought is projected (with *high confidence*) to increase over the course of the century.	
Fire Weather	There is *high confidence* that climate change will result in a harsher fire-weather climate in the future.	

Table 1: Future Climate Change Projections for South-West Western Australia (adapted from DWER 2021)

The future changes to the climate are expected to have the following impacts on local bushland areas:

- Overall reduction in biodiversity.
- Increase threats to the natural environment such as incidence of weeds, fire and disease.

[22] BOM (2023b)
[23] BOM & CSIRO (2018)

- Changes to habitats and distribution patterns of species. A drier climate will result in reduced water availability for ecosystems and fauna and flora species.
- Potential extinctions of endemic species.
- Greater occurrence of extreme weather events such as heat-waves and intense storms.

Whilst climate change is difficult to address directly, many of the management actions in this Plan focus on maintaining vegetation resilience and will assist to minimise the effects of climate change.

2.4 Vegetation

Vegetation Complexes

Vegetation complexes are classified by the soil and landforms contained in medium to large areas along the Swan Coastal Plain. Regional scale mapping shows the study area is classified as having Quindalup Complex and Cottesloe Complex - Central and South (see Figure 16).

The Quindalup Complex is described as a coastal dune complex consisting mainly of two alliances – the strand and foredune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* – *Callitris preissii* and the closed scrub of *Acacia rostellifera*. The pre-European extent remaining within the Swan Coastal Plain IBRA region for the Quindalup Complex is 49%. The pre-European extent remaining within the City of Joondalup is 12.55%.[24,25]

The Cottesloe Complex - Central and South is described as a "mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *Eucalyptus gomphocephala* – *Eucalyptus marginata* – *Eucalyptus calophylla* with a closed heath on the limestone outcrops."[26] Approximately 31% (10,606 ha) of the original vegetation complex extent of Cottesloe Complex – Central and South remains within the Perth Metropolitan Region, with 3% (345 ha) of this remaining vegetation existing within the City of Joondalup.

The State Government's Bush Forever Strategy aims to protect 51,000 ha of regionally significant vegetation, or 18% of the original vegetation, within the Swan Coastal Plain portion of the Perth Metropolitan Region. The State Government has established targets under Bush Forever which aim to protect at least 10% of each of the 26 vegetation complexes, to achieve a comprehensive representation of all the ecological communities originally occurring in the region.[1] The Strategy identifies 287 bushland sites. Iluka Foreshore Reserve is included within the Bush Forever Strategy as site 325 and Burns Beach Foreshore Reserve is included within the Bush Forever Strategy as site 322.

Due to the limited extent of the Quindalup Complex and Cottesloe Complex – Central and South vegetation complex remaining within the City of Joondalup, it is important to retain bushland within Iluka-Burns Beach Foreshore Reserve for its conservation value.

[24] ELA (2016b)
[25] NACMS (2016)
[26] Heddle et. al. cited in Syrinx (2014)

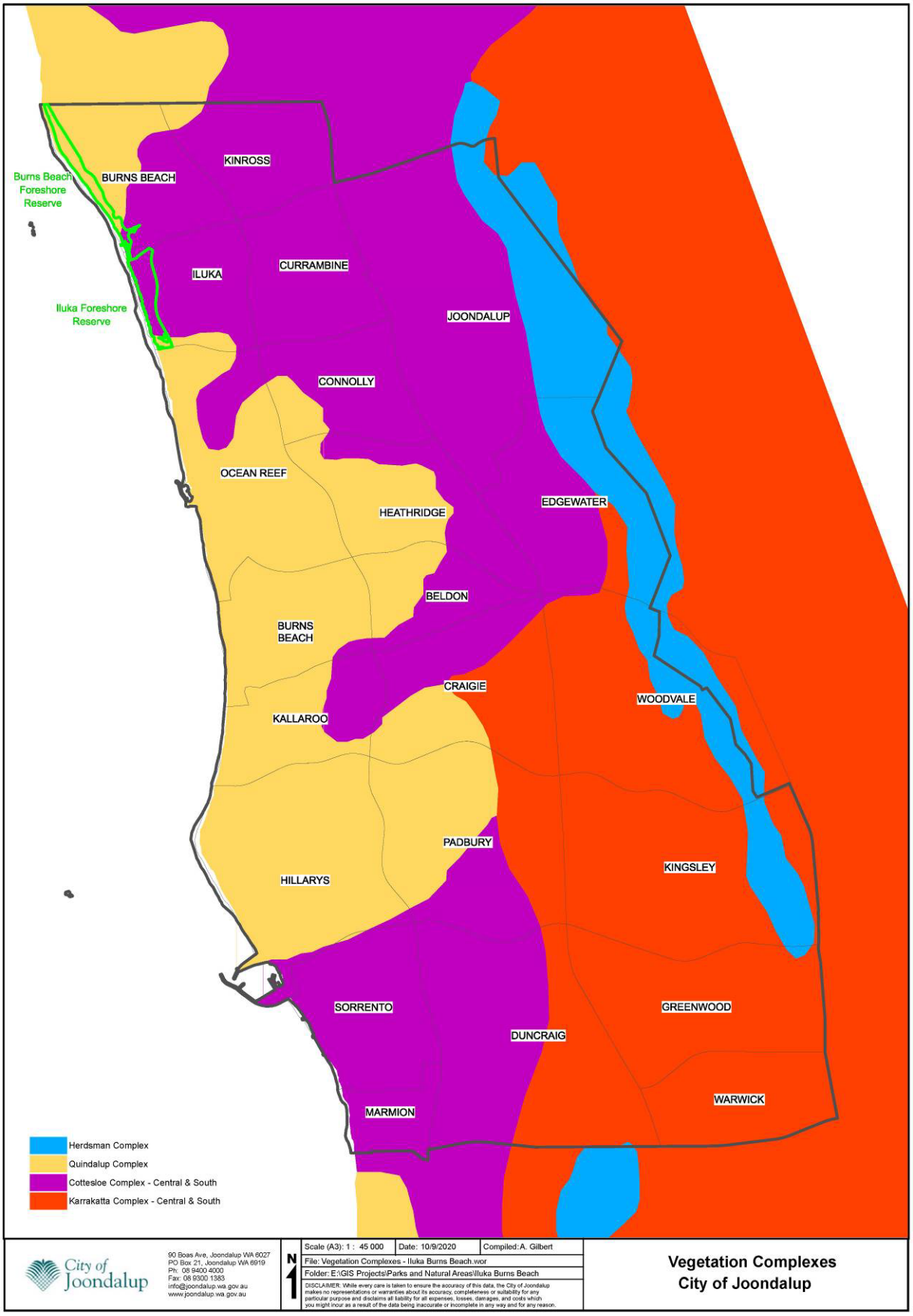


Figure 16: City of Joondalup Vegetation Complexes

Floristic Community Types

The vegetation of the Swan Coastal Plain has been systematically surveyed and defined into Floristic Community Types (FCTs). This floristic analysis defined 30 FCTs with some groups further subdivided, with a total of 43 types and sub-types recognised.[27]

The Spearwood and Quindalup Dune units support FCT 24, FCT 27, FCT 28 and FCT 29. The following FCTs were inferred to occur in the study area through the State Government's Bush Forever assessment in 2000:

- FCT 24: Northern Spearwood shrublands and woodlands
- FCT 27: Species-poor mallees and shrublands on limestone
- FCT 28: Spearwood *Banksia attenuata* or *B. attenuata* — *Eucalyptus* Woodlands
- FCT 29a: Coastal shrublands on shallow sands
- FCT 29b: Acacia shrublands on taller dunes.

Only FCT 24 and FCT 29a were identified in Iluka-Burns Beach Foreshore Reserve during the September 2020 field survey conducted by Eco Logical Australia.[28]

FCT 24 – Northern Spearwood shrublands and woodlands

FCT 24 is described as heaths or heaths with scattered *Eucalyptus gomphocephala* (Tuart), with heathlands in this group typically including *Banksia sessilis*, *Calothamnus quadrifidus*, and *Schoenus grandifloras*. The BsArSg vegetation community, comprising a total of 4.6ha (14.7%) of the Iluka survey area and 0.4ha (1.4%) of the Burns Beach survey area, has components analogous to the 'Northern Spearwood shrublands and woodlands' Priority Ecological Community, including the presence of *Banksia sessilis* and *Calothamnus quadrifidus* heathland, and is considered as likely representing this Priority Ecological Community. The inferred presence of FCT 24 is also noted in Bush Forever for Burns Beach Foreshore Reserve.

FCT 24 is currently listed as a Priority 3 (i), Priority Ecological Community (PEC)[29] which means that it is poorly known from several to many occurrences but does not appear to be under threat of habitat destruction or degradation.[30]

FCT 24 can be a component of the Endangered Banksia Woodlands of the Swan Coastal Plain EPBC Act listed TEC.

FCT 29a – Coastal shrublands on shallow sands

FCT 29a is described as mostly heaths on shallow sands over limestone close to the coast. Important species include *Spyridium globulosum*, *Rhagodia baccata*, and *Olearia axillaris*. Quadrats within the remaining vegetation communities showed close affiliation with FCT 29a. Vegetation communities ArAcSg, FpApSc, McAr, SgEsOa, SgMhAr, SgSa, comprising a total of 24.4 ha (77.91%) of the Iluka survey area and 26.2 ha (89.4%) of the Burns Beach survey area, have components analogous to the 'Coastal shrublands on shallow sands' PEC, including the presence of heaths on shallow sands over limestone close to the coast,

[27] Gibson et al cited in ELA (2016)
[28] ELA (2021)
[29] DPaW (2015b)
[30] DEC (2010a)

Spyridium globulosum, *Rhagodia baccata*, and *Olearia axillaris* and is considered as likely representing this community. The inferred presence of FCT 29a is also noted in Bush Forever for Burns Beach Foreshore Reserve and Coastal Strip from Burns Beach to Hillarys.

FCT 29a: 'Coastal shrublands on shallow sands' is listed by DBCA as a Priority 3 ecological community which means that it is poorly known from several to many occurrences but does not appear to be under threat of habitat destruction or degradation.[31]

FCT 29a is listed within the Approved Conservation Advice (incorporating listing advice) for the Tuart *(Eucalyptus gomphocephala)* woodlands and forests of the Swan Coastal Plain TEC as a FCT that includes Tuart, indicating the potential presence of these TECs within the survey areas.

Whilst FCTs can be a useful way of describing groups of flora species, or defining Threatened or Priority Ecological Communities on the Swan Coastal Plain, vegetation communities are more commonly used to define plant communities.

Vegetation Communities

Field sampling confirmed seven vegetation communities occurring within Iluka-Burns Beach Foreshore Reserve. Although only two main vegetation communities exists within the Iluka – Burns Beach Foreshore Reserve area, SgMhAr (25.0%) and SgEsOa (24.1%), and described in full in Table 2 and shown in Figure 17 and Figure 18.

Table 2: Vegetation Communities at Iluka-Burns Beach Foreshore Reserve

Vegetation Community Reference	Vegetation Community Description	Burns Beach survey area	Iluka survey area	Total Site Coverage
McAr	*Melaleuca cardiophylla, Acacia rostellifera* mid shrubland over *Rhagodia baccata, Threlkeldia diffusa* low sparse chenopod shrubland and **Ehrharta calycina* low sparse tussock grassland.	N/A	3.3 ha (10.5%)	3.3 ha (5.4%)
FpApSc	*Frankenia pauciflora, Acanthocarpus preissii, Scaevola crassifolia* low open shrubland.	0.1 ha (0.3%)	3.6 ha (11.5%)	3.7 ha (6.1%)
SgMhAr	*Spyridium globulosum, Melaleuca huegelii, Acacia rostellifera* tall open shrubland over *Grevillea preissii subsp. preissii* mid sparse shrubland and *Rhagodia baccata, Threlkeldia diffusa* mid open chenopod shrubland over **Briza maxima, *Ehrharta calycina low* open tussock grassland and *Lomandra* maritima low sparse forbland.	N/A	15.2 ha (48.6%)	15.2 ha (25.0%)
BsArSg	*Banksia sessilis, Acacia rostellifera, Spyridium globulosum* mid open shrubland over *Hibbertia hypericoides, Banksia dallanneyi* low open shrubland and *Lomandra maritima* low sparse forbland.	0.4 ha (1.4%)	4.6 ha (14.7%)	5 ha (8.2%)
SgEsOa	*Spyridium globulosum, Exocarpos sparteus, Olearia axillaris* tall sparse shrubland over *Acrotriche cordata, Scaevola crassifolia, Leucopogon parviflorus* mid sparse shrubland over *Acanthocarpus preissii* low sparse shrubland and **Trachyandra divaricata, Conostylis candicans subsp. calicola* low	13.4 ha (46.1%)	1.2 ha (3.8%)	14.6 ha (24.1%)

[31] DEC (2010a)

Vegetation Community Reference	Vegetation Community Description	Burns Beach survey area	Iluka survey area	Total Site Coverage
	sparse forbland.			
ArAcSg	*Acacia rostellifera, Acacia cyclops, Spyridium globulosum* tall shrubland over *Rhagodia baccata, Threlkeldia diffusa* low sparse chenopod shrubland and *Acanthocarpus preissii* low sparse shrubland.	1.9 ha (6.5%)	0.7 ha (2.2%)	2.6 ha (4.3%)
SgSa	*Spyridium globulosum, Santalum acuminatum* tall sparse shrubland over *Olearia axillaris, Myoporum insulare* mid sparse shrubland and *Rhagodia baccata* mid sparse chenopod shrubland over **Tetragona decumbens, Scaevola crassifolia* low open shrubland and *Lepidosperma gladiatum* low open sedgeland.	10.7ha (36.5%)	0.4 ha (14.7%)	11.1 ha (18.3%)

*indicates weed species.
Note: The remaining vegetation on site has been cleared and/or identified as open beach / rocks, dunal blow out and tracks (5.2 ha or 8.6%).

No Threatened Ecological Communities were identified within Iluka – Burns Beach Foreshore Reserve .[35]

Vegetation Condition

The Keighery Scale is a tool used to rate the condition of vegetation from pristine to completely degraded, as detailed in Appendix 5. Infrastructure, formalised limestone or asphalt paths and areas of bare ground not containing vegetation (e.g. sandy or rocky beaches) were not assigned a vegetation condition category.

Vegetation condition assessments include observations regarding the numbers of native species, weed cover, vegetation structure, species diversity, amount of understorey, health condition of most species' populations and physical disturbance.

Changes in the vegetation condition can also be attributed to differing interpretations of Keighery Scale definitions by assessors as well as external factors such as different seasonal timings of vegetation assessments, frequency and intensity of recent fire occurrences and other disturbances such as the incidence of weeds can also result in variance in vegetation assessments.

A vegetation condition assessment was conducted in 2012 for the entire coastal foreshore area but has not been broken down into vegetation condition categories for the specific sites of Iluka Foreshore Reserve and Burns Beach Foreshore Reserve. Eco Logical undertook a vegetation condition assessment in September 2020 for the Iluka-Burns Beach Foreshore Reserve.

The vegetation condition at Iluka-Burns Beach Foreshore Reserve ranges from excellent to completely degraded. The majority of Iluka and Burns Beach survey areas were classed as being in excellent condition. Iluka-Burns Beach Foreshore Reserve contains various formal paths and informal tracks and these have been categorised as completely degraded. The majority of the remnant vegetation within Burns Beach Foreshore Reserve is in excellent condition, with the condition reducing to completely degraded in areas directly surrounding pathways, known as 'edge effects'.

The good condition areas surrounding pathways reflects the reduction in vegetation condition caused by disturbances, through the construction of formal and informal paths. Reduction in vegetation condition also commonly exists on the boundary edges of bushland areas, due to various factors including the introduction of invasive species from surrounding areas, informal access and rubbish dumping.

Completely degraded areas in the northern sections of Burns Beach Foreshore Reserve generally surround the illegal vehicle tracks, fragmenting the vegetation throughout the area and preventing these areas from naturally revegetating. There is also a dunal blowout in the north of Burns Beach Foreshore Reserve. Vegetation condition is shown in Table 3, Figure 19 and Figure 20.

Table 3: Iluka-Burns Beach Foreshore Reserve Vegetation Condition Assessment using Keighery Scale

Site / Year	Burns Beach Foreshore Sept 2020	Iluka Foreshore Sept 2020
Pristine	N/A	N/A
Excellent	19.1 ha (65.2%)	21.9 ha (70%)
Very Good	2 ha (6.8%)	3.4 ha (10.9%)
Good	4.2 ha (14.3%)	3.7 ha (11.8%)
Degraded	N/A	N/A
Completely Degraded	1.9 ha (6.5%)	N/A
Open beach / rocks	1 ha (3.4%)	1.2 ha (3.8%)
Tracks	1.1 ha (3.8%)	1.1 ha (3.5%)
Total	**29.3 ha**	**31.3 ha**

Additionally the State Government's Bush Forever Strategy rated the vegetation condition of Burns Bush bushland as more than 70% excellent to pristine, less than 30% very good to good, with localised disturbance areas to the north of Burns Beach. The coastal strip from Burns Beach to Hillarys was rated as excellent to degraded, with areas of severe localised disturbance.[32]

High resolution multi-spectral imagery has been obtained for the City of Joondalup in November 2015 and November 2019 and analysed to measure canopy cover and change in vigour of vegetation in key City conservation areas. The vegetation vigour change in Iluka-Burns Beach Foreshore Reserve over a two year period is shown in Figure 21 and Figure 22. The majority of the site has increased in vegetation vigour with some minor areas showing decline.

Vegetation Cover

The height of the majority of vegetation cover at Iluka-Burns Beach Foreshore Reserve is 0-3m, with a minor amount of vegetation with a height of 3-10m and a very minor amount of vegetation with a height of 10m or more, as shown in Figure 23 and Figure 24.

[32] Government of Western Australia (2000b)

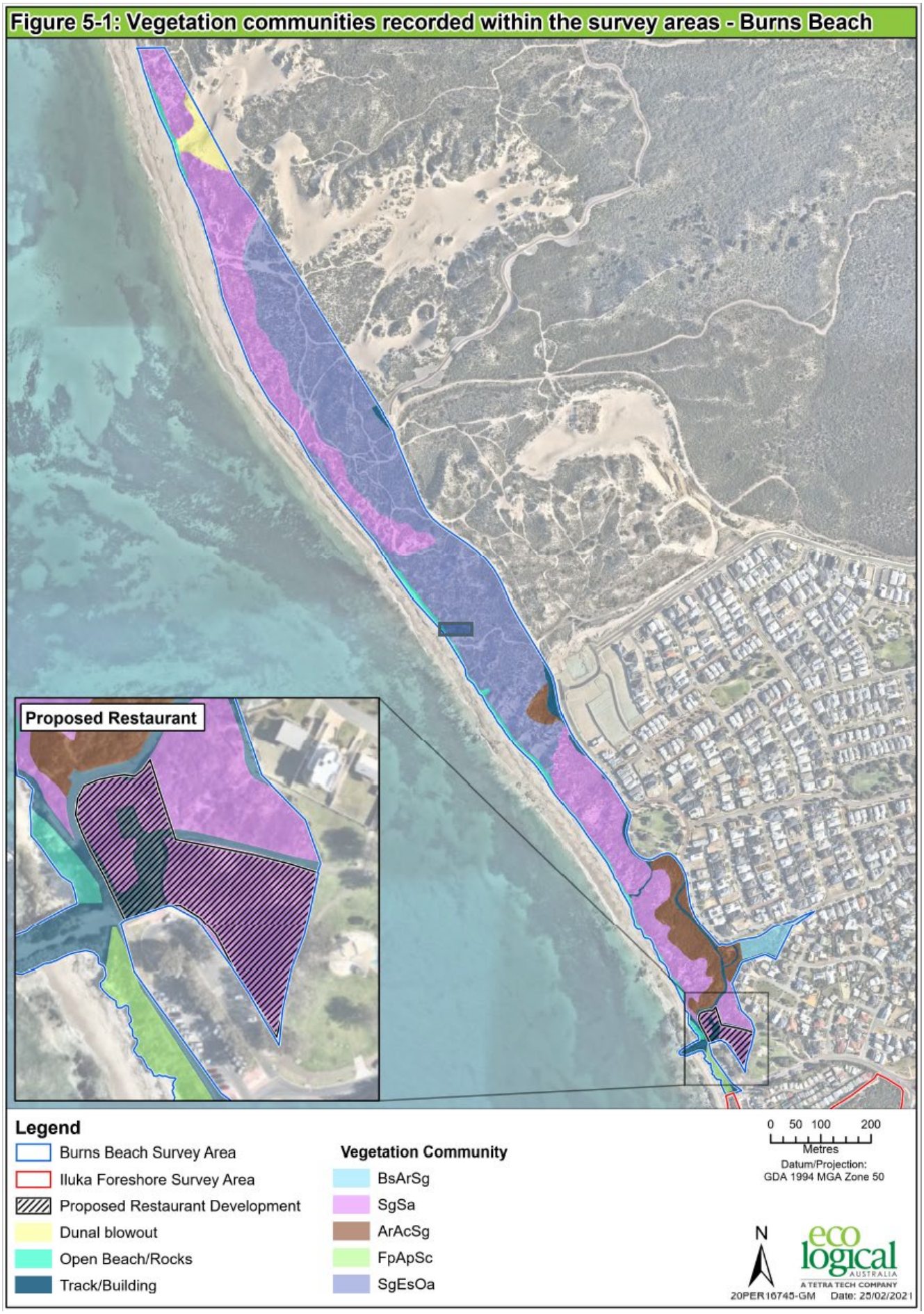


Figure 17: Burns Beach Foreshore Reserve Vegetation Communities (sourced from ELA 2021)

Figure 18: Iluka Foreshore Reserve Vegetation Communities (sourced from ELA 2021)

Figure 19: Burns Beach Foreshore Reserve Vegetation Condition – September 2020 (sourced from ELA 2021)

Figure 20: Iluka Foreshore Reserve Vegetation Condition – September 2020 (sourced from ELA 2021)

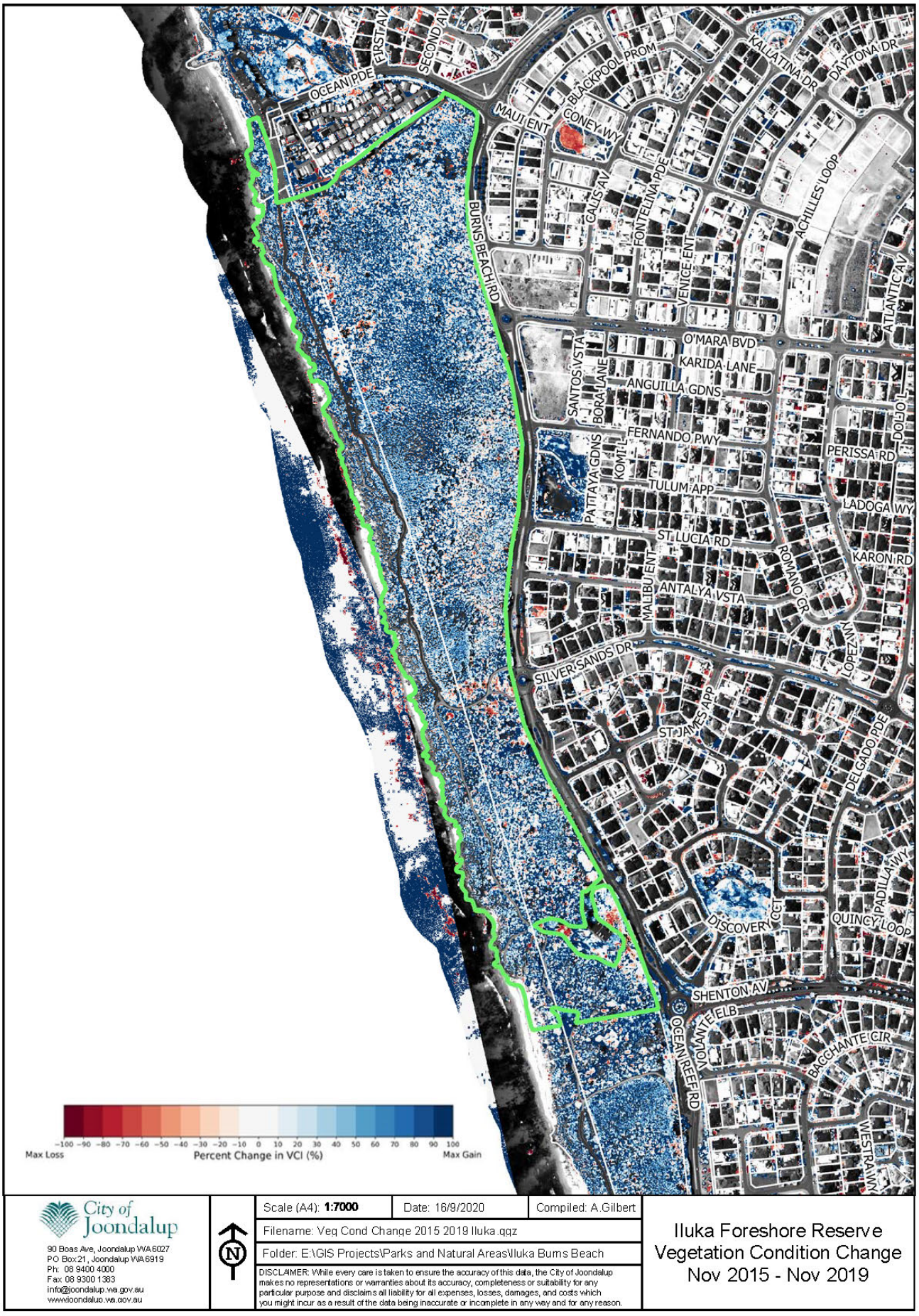


Figure 21: Iluka Foreshore Reserve Vegetation Condition Change 2015 – Oct 2019 (Arbor Carbon 2019)

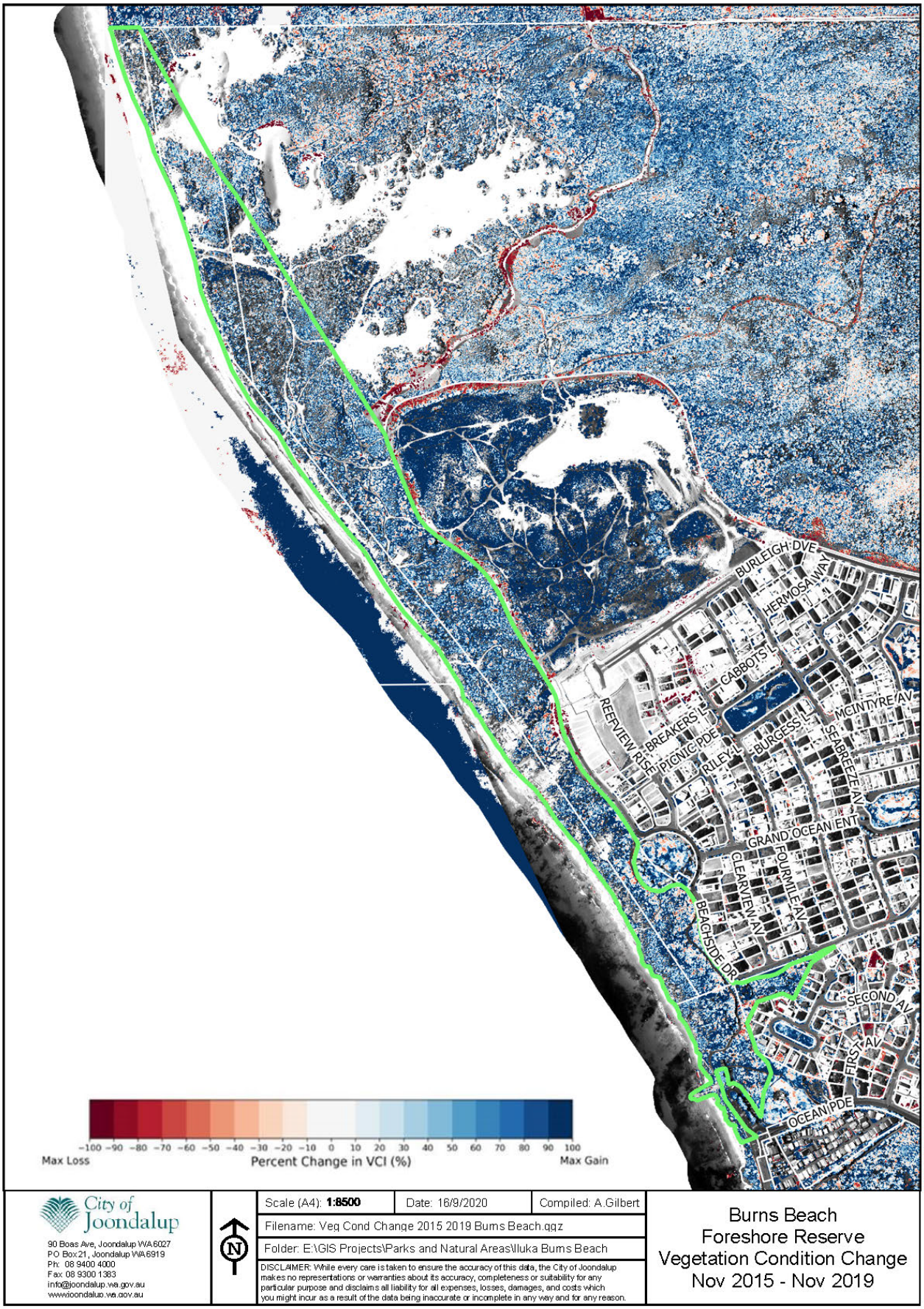


Figure 22: Burns Beach Foreshore Reserve Vegetation Condition Change 2015 – 2019 (Arbor Carbon 2019)

Figure 23: Iluka Foreshore Reserve Vegetation Heights (2017)

Figure 24: Burns Beach Foreshore Reserve Vegetation Heights (2017)

3.0 Biodiversity Management

Iluka-Burns Beach Foreshore Reserve supports an abundance of plant and animal species, including species listed as priority based on their endangered, threatened and migratory status. The long term protection of biodiversity values within Iluka-Burns Beach Foreshore Reserve is critical to ensure the conservation of this important bushland habitat. The protection and enhancement of biodiversity within Iluka-Burns Beach Foreshore Reserve also benefits the community through the provision of ecosystem services such as:

- the production of oxygen and capture of carbon dioxide
- noise and air quality regulation
- cooling of urban environments
- regulation of freshwater supplies
- generation and maintenance of topsoil
- generation and recycling of nutrients[33]
- control of pests and diseases
- supporting seed dispersal and pollination
- providing a genetic store[34]
- a number of cultural services such as recreational, aethetic values and heritage values.[35]

There are a number of environmental threats that pose a risk to the biodiversity of Iluka-Burns Beach Foreshore Reserve. The key environmental threats at Iluka-Burns Beach Foreshore Reserve addressed in this Section include:

- Weeds
- Pathogens and disease
- Non-native fauna species
- Human impacts
- Access and infrastructure
- Fire.

Management actions to address the key environmental threats are outlined in the following sections. There are other additional environmental threats that are out of the scope of this Plan and therefore not addressed such as climate change and habitat fragmentation.

3.1 Flora

Iluka-Burns Beach Foreshore Reserve is located within the Southwest Australia biodiversity hotspot. Southwest Australia, from Shark Bay in the north to Israelite Bay in the south, is one of 36 biodiversity hotspots in the world with over 3,600 endemic plant species occurring in this region. Approximately 30% of the original vegetation extent of this area remains in more or less pristine condition, with habitat loss being primarily due to agricultural and urban expansion and biological factors such as feral animals, weeds and the plant pathogen *Phytophthora cinnamomi*.[36,37]

[33] Burbidge (2004)
[34] Millennium Ecosystem Assessment (2005)
[35] City of Joondalup (2012b)
[36] Conservation International (2020)
[37] WWF (no date)

Flora surveys enable collection of scientific data related to the occurrence and distribution of flora species and vegetation communities. Information obtained from flora surveys is used as a baseline to monitor the ecological health of flora populations and vegetation communities.[36]

The City engaged consultants, Eco Logical Australia (ELA), to undertake a field flora survey of Iluka-Burns Beach Foreshore Reserve in September 2020.

The design of the flora survey was aligned with methodology outlined in the EPA *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (2016). The survey was undertaken in accordance with the requirements of the State *Biodiversity Conservation Act 2016* (BC Act), *Environmental Protection Act 1986* (EP Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The survey methodology included the use of 10m x 10m quadrats with at least 3 per vegetation community. It also included opportunistic sampling of species not recorded within the quadrats, to inform a species inventory of the study area. A total of 28 quadrats (14 in each Iluka and Burns Beach survey area) were installed within the study area, following analysis of aerial imagery, review of previous City of Joondalup field survey reports and ground-truthing.

ELA recorded a total of 149 flora species at the Iluka-Burns Beach Foreshore Reserve during their survey. This total included 92 native (62%) and 57 (38%) introduced taxa. The taxa comprised 52 families and 120 genera. The most commonly occurring family was Poaceae (19 taxa) and Fabaceae (17 taxa). Acacia (with 5 taxa), Conostylis (with 4 taxa), Hibbertia (with 4 taxa) and Melaleuca (with 3 taxa) were the most common genus.

ELA recorded a total of 121 flora species within the Iluka survey area (74 native and 47 introduced). Families with the highest number of species included Poaceae (15 species), Fabaceae (14 species) and Asteraceae (10 species). Acacia (with 4 taxa), Conostylis (with 4 taxa), Hibbertia (with 4 taxa) and Melaleuca (with 3 taxa) were the best represented genera throughout the Iluka survey area.

ELA recorded a total of 106 flora species within the Burns Beach survey area (63 native and 43 introduced). Families with the highest number of species included Poaceae (16 species), Fabaceae (14 species) and Asteraceae (6 species). Acacia (with 4 taxa), Conostylis (with 4 taxa), and Melaleuca (with 3 taxa) were the best represented genera throughout the Iluka survey area.

Previous flora surveys conducted in Iluka-Burns Beach Foreshore Reserve include:

- ATA Environmental (2001) *Iluka Flora & Vegetation Survey & Fauna Habitat Assessment*
- Dr. W. Foulds (1982) *Conservation Area Ocean Reef / Burn's Beach South*
- Cardno BSD Pty Ltd (2006) *Foreshore Management Plan Burns Beach,* prepared for Burns Beach Property Trust
- Keighery G.J. and B.J. (1992) *Flora of Burns Beach Coastal Reserve*
- City of Joondalup (2014) *Burns Beach Structure Plan No. 10*
- City of Joondalup (2009) *Burns Beach Park Natural Area Initial Field Assessment*
- AECOM (2018) *Tamala Park Reserve – Biological Report*, prepared for City of Wanneroo
- NACMS (2017) *Targeted Flora and Vegetation Survey – Part Lot 11485, 44 Ocean Parade, Burns Beach*, prepared for City of Joondalup

- GHD (2013) *Proposed Dual Use Coastal Path between Mindarie and Burns Beach: Environmental Study and Topographical Survey Report*, prepared for Department of Planning
- Government of WA (2000b) *Bush Forever Site Description: Burns Beach Bushland*.

The combination of results from all the surveys undertaken within Iluka – Burns Beach Foreshore Reserve indicates that there are 402 species, including 298 native species (76%) and 104 introduced species (26%).

The optimal time for surveying is spring for native flora and winter for weeds. Rainfall (4 mm) was recorded during the five day survey conducted by ELA, and a total of 322.1 mm of rainfall was received in the three months prior to the survey.[38] This is below the long-term average for the period June – August (446 mm), however it is still considered suitable for flora survey timing.[9]

Native Flora

Native flora is an important part of the Iluka-Burns Beach Foreshore Reserve ecosystem. The loss of native plant species can lead to a loss of fauna that depend on flora for food and shelter.

A total of 92 native flora species have been recorded at Iluka-Burns Beach Foreshore Reserve (see Appendix 2). There were 75 native flora species identified in the Iluka survey area and 63 native flora species identified in the Burns Beach survey area.

The number of native flora species recorded at Iluka-Burns Beach Foreshore Reserve is comparable to the number of species recorded in similar bushland areas nearby.[38] The diversity is also considered to be very good for remnant vegetation in a built-up urbanised area.[9]

One flora species listed as Endangered under the EPBC Act and BC Act was recorded within the Iluka survey area, namely *Marianthus paralius* (WA Herbarium ACC/8941/E). No Threatened flora species listed under the EPBC Act or BC Act were recorded within the Burns Beach survey area.

Two naturally occurring priority species rated by the Department of Biodiversity, Conservation and Attractions (DBCA) listed under the *Biodiversity Conservation Act 2016* has been recorded at Iluka Foreshore Reserve, *Hibbertia leptotheca* (Priority Three - Poorly-known species) and *Jacksonia sericea* (Priority Four - Rare, Near Threatened and other species in need of monitoring). Both species are also listed as Significant Flora of the Perth Metropolitan Region, under the State Governments' Bush Forever Strategy (2000). A further eight Bush Forever significant flora species were recorded within Iluka-Burns Beach Foreshore Reserve, including *Agonis flexuosa, Callitris preissii, Grevillea preissii* subsp. *preissii, Lechenaultia linarioides, Trymalium ledifolium, Diplopeltis huegelii, Melaleuca cardiophylla and Melaleuca lanceolata,* see Appendix 3.

Weeds

Weeds are exotic or native species that grow in ecosystems where they did not originally belong. Weeds are commonly introduced and distributed within bushland areas through the

[38] ELA 2021

dispersal of seed by water, wind and animals such as birds, fire, through dumping of garden refuse, and by human or vehicle movement in natural areas.[39]

Weeds have major economic, environmental and social impacts in Australia and can:

- displace native plant species
- alter ecosystems, nutrient recycling and soil quality
- harbour pests and diseases
- increase fuel loads for fires
- impact negatively on fauna and flora and their habitats
- compete with native species for space, water and nutrients.[40]

Approximately 3,200 species of introduced plants have naturalised within Australia, with 500 of these being declared noxious or under legislative control. Garden plants are the main source of Australia's weeds, accounting for between 50% and 70% of recognised weed species. An estimated average of 20 plant species become naturalised in Australia each year.[40]

A combined total of 57 weed species have been recorded at Iluka-Burns Beach Foreshore Reserve (see Appendix 2), from the flora surveys undertaken by Eco Logical (2020). From these 57 weed species, 24 have been identified as priority weed species for management (see Appendix 7). A total of 47 introduced (weed) species were recorded within the Iluka survey area, representing 38.8% of the total flora species recorded. A total of 43 introduced (weed) species were recorded within the Burns Beach survey area, representing 40.6% of the total flora species recorded.

Environmental weeds are classified as priority if they meet any of the following criteria:

- Weed species listed as a Weed of National Significance (WoNS) by the Australian Government.
- The weed species is listed as a Declared Pest Plant according to the *Biosecurity and Agriculture Management Act 2007*.
- The weed species is listed as a Pest Plant under the City's *Pest Plant Local Law 2012*.
- The City of Joondalup has determined that the weed species; poses a major threat to vegetation or the structure of vegetation communities; is likely to lead to a significant outbreak of individual weed species; and/or contribute to a high fuel load (e.g. grasses). These species are classed as priority weeds in the City of Joondalup.

The majority of the weed species recorded are daisies from the Asteraceae family and grasses from the Poaceae family. Many of the weed species adjoin disturbed areas, particularly pathways and informal tracks. Areas surrounding the boundary of Iluka-Burns Beach Foreshore Reserve, where the bushland meets the road, particularly in the northern section of the Burns Beach reserve, contain a high weed presence. The most common species observed in the 2020 survey at Iluka-Burns Beach Foreshore Reserve were *Ehrharta calycina* (Perennial Veldt Grass), *Ehrhata longiflora* (Annual Veldt Grass), *Tetragonia decumbens* (Sea Spinach), and *Pelargonium capitatum* (Rose Pelargonium).[9]

A total of 24 weed species have been recorded in Iluka-Burns Beach Foreshore Reserve and are rated as priority weed species in the City of Joondalup, none of which is ranked as a Pest Plant under the City of Joondalup Local Law.

[39] Australian Government, no date
[40] Invasive Plants and Animals Committee (2016)

The City of Joondalup has a Pest Plant Local Law (2012) for the management of Caltrop *(Tribulus terrestris*). This species was not recorded in the 2020 survey undertaken by ELA.

Two species recorded are listed as Declared Pests under the *Biosecurity and Agriculture Management (BAM) Act 2007* (both of which are also listed on the City's priority weed list). Within the Iluka survey, *Asparagus asparagoides* (Bridal Creeper) and *Moraea flaccida* (One-leaf Cape Tulip) were recorded and are listed as Declared Pests s22(2) under the BAM Act. *Asparagus asparagoides* (Bridal Creeper) was recorded and is also listed as a WoNS. Within the Burns Beach survey area, *Asparagus asparagoides* (Bridal Creeper) is listed as a Declared Pest under the BAM Act and as a WoNS.

Examples of Identified priority weeds are illustrated in Appendix 6 and their recommended weed treatment methodology is detailed in Appendix 7, which is used for City of Joondalup on ground management of priority weeds.

Current Management Approach

The City's current approach to monitoring, conserving and protecting native flora in Iluka-Burns Beach Foreshore Reserve is outlined below.

Site Assessments

Flora surveys are conducted approximately every 5-10 years in Iluka-Burns Beach Foreshore Reserve to record the occurrence and distribution of flora species and vegetation communities. Information obtained from flora surveys is used to monitor the ecological health of flora populations and vegetation communities on site.

Natural Area Initial Assessments are conducted approximately every 5-10 years in sites without Council endorsed management plans to assess site-specific ecological values, biodiversity significance and threatening processes, at a level that is consistent with regional scientific standards.[41]

Weed Management

The City undertakes an integrated approach to weed management, including:

- Preventing weed introduction through weed hygiene and other measures.
- Regular monitoring and reporting of weed populations.
- On ground weed control, including prioritisation of natural areas and priority weeds to target.
- Community education initiatives.
- Partnerships and research with external stakeholders.

Weed Monitoring

The following table outlines the various weed monitoring methods undertaken by the City in Iluka-Burns Beach Foreshore Reserve.

[41] WALGA (2004)

Weed Monitoring Method	Detail
Bi-monthly weed inspections	Weed inspections are conducted at Iluka-Burns Beach Foreshore Reserve every two months to establish the extent and distribution of weed species and to identify priority weeds. Weed inspections are used to inform on ground weed management programs.
Annual weed percentage cover monitoring	The City monitors the percentage cover of environmental weeds in Iluka-Burns Beach Foreshore Reserve on an annual basis, measured by three transects within the reserve.
Flora surveys	Flora surveys are conducted every 5-10 years in Iluka-Burns Beach Foreshore Reserve. Flora surveys include mapping of priority weeds and a vegetation condition assessment. The vegetation condition assessment also informs weed management as the vegetation in the best condition can be prioritised for weed control. Comparisons will be made between flora surveys to assess site changes every 5-10 years.

Annual weed percentage cover monitoring is conducted in Iluka Foreshore Reserve, measured by three transects within the reserve. A significant increase in the percentage cover of weeds was recorded in 2019/20, as compared to 2018/19 due to an earlier winter rainfall in 2019/20 and a focus on hand weeding rather than herbicide use, as requested by the Friends of North Ocean Reef – Iluka Foreshore. In 2021/22 there was a significant reduction in weeds at Iluka Foreshore from 2019/20 and 2020/21 levels, as shown in Figure 25. This was most likely due to increased Friends Group funding to undertake contractor hand weeding and grass-selective sprays which may have reduced the percentage of weed cover.

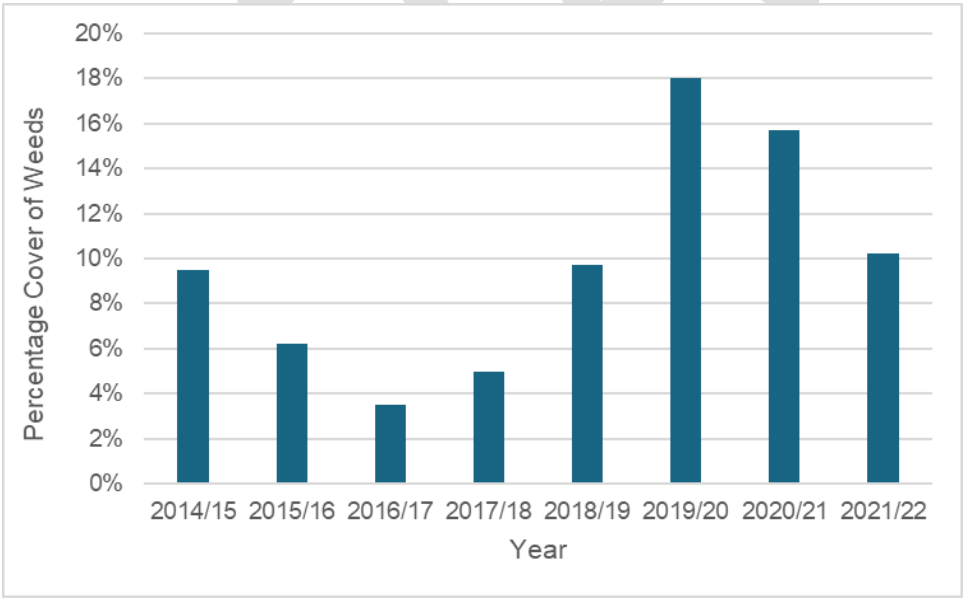


Figure 25: Percentage Cover of Weeds in Iluka Foreshore Reserve 2014–2022

Weed Control

In accordance with the City's Annual Bushland Schedule, on ground weed management in Iluka-Burns Beach Foreshore Reserve occurs through weed spraying and hand weeding methods. In addition to this, contractors are engaged to spray weeds and hand weed. City of

Joondalup staff use a weed spraying procedure and conduct weed control trials periodically to evaluate the most effective weed management methods.

The Friends of North Ocean Reef - Iluka Foreshore also conduct hand weeding within Iluka Foreshore Reserve.

Resources such as the DPaW's Florabase website, the *Western Weeds, A guide to the Weeds of Western Australia* book or *Southern Weeds and their Control* (DAFWA Bulletin 4744) are consulted in regards to weed control. Weeds on verges surrounding Iluka-Burns Beach Foreshore Reserve are managed by mowing and brush cutting to reduce seed spread, chemical weed control and spreading certified pathogen free mulch, where required.

The City's *Weed Management Plan 2023 - 2033* provides an integrated approach to the management of weeds in the City. The *Weed Management Plan 2023 - 2033* details actions to prevent, monitor, prioritise and control the introduction and spread of weeds in the City.

Pest Plant Local Law 2012

The purpose of the *Pest Plant Local Law 2012* is to prescribe pest plants within the City of Joondalup that are likely to adversely affect the value of property in the district or the health, comfort or convenience of the inhabitants of the district.

Pest plants are generally highly adaptable, out compete native species and spread easily, leading to quick establishment, particularly after a disturbance event such as fire, or through unrestricted access. If pest plants are allowed to establish they have the potential to decrease the City's unique floristic diversity.

The *Pest Plant Local Law 2012* requires the owner or occupier of private land within the City of Joondalup district to destroy, eradicate or otherwise control scheduled pest plants on notice by the City. Currently one weed species is scheduled under the Local Law – Caltrop (*Tribulus terrestris*). Caltrop has previously been identified on private property adjacent to Burns Beach Foreshore Reserve in 2015 and the owner notified.

An amendment to the *Pest Plant Local Law 2012* was proposed in 2023 to include Golden Crownbeard (*Verbesina encelioides*) as a pest plant.

Community Education

A number of education initiatives are undertaken to raise the awareness of weeds in the community, these include:

- Delivery of Gardening Workshops, promoting the use of native species in residential gardens
- Development and distribution of brochures including *Environmental Weeds*, *Garden Escapees, Protecting our Natural Areas and Parks* and a series of *Growing Locals* brochures (available in hard copy and on the City's website)
- Weed Education Workshops for Local Friends Groups.

Revegetation

The City of Joondalup encourages natural bushland regeneration through weed management and conservation fencing, to allow natural regeneration to occur and vegetation to re-establish itself. This is important in maintaining species diversity and populations.

The City supports revegetation in degraded or completely degraded areas using direct seeding techniques with local provenance seeds and seedlings, as required.

Recommended Flora Management Actions

To monitor, conserve and protect native flora in Iluka-Burns Beach Foreshore Reserve, the following management actions are proposed:

Action	Details
Flora survey	Undertake a follow up flora survey in spring to supplement previous flora surveys, within 5-10 years. Make comparisons between flora surveys to assess site changes every 5-10 years.
Weed survey	Undertake a follow up weed survey in winter to supplement previous weed surveys, within 5-10 years.
Endangered flora conservation	Investigate the planting of the identified endangered flora species to maintain or enhance the population/s to ensure the species long-term preservation within Iluka-Burns Beach Foreshore Reserve.
Investigate planting trees (and vegetation) for habitat	Investigate planting other species of local trees and shrubs (such as Banksia and Hakea species) to provide opportunities for nesting sites and shelter for fauna.
Revegetation	Support revegetation being conducted in degraded or completely degraded areas using local provenance species, as required.
Restrict unauthorised access	Consider the installation of fencing or formal signage to prevent habitat degradation and weed spread from unauthorised walking/vehicle tracks.
Bi-monthly weed inspections	Conduct weed inspections every two months to establish the extent of weeds and to identify priority weed species.
Weed control	Undertake a coordinated approach to regular weed control by implementing the Annual Bushland Schedule.
Weed Control	Undertake a targeted approach to weed control of **Asparagus asparagoides* (Bridal Creeper) within Iluka – Burns Beach Foreshore Reserve.
Weed Control	Undertake a targeted approach to weed control of **Moraea flaccida* (One-leaf Cape Tulip) within Iluka reserve, to prevent its spread into surrounding reserves.
Weed Control	Undertake a targeted approach to weed control of **Ricinus communis* (Castor Oil Plant) within Iluka Foreshore Reserve.
Weed control on verges	Conduct weed management of weeds on verges within and surrounding Iluka – Burns Beach Reserves including mowing of verges to reduce seed spread, spraying of weeds and spreading of certified mulch, where required.
Weed Management Plan	Implement the *City of Joondalup Weed Management Plan* to provide an ongoing strategic approach to the management of natural areas in order to reduce the incidence of weeds.

3.2 Fungi

It is estimated that there are 10 times more species of fungi than plants in the world, equating to approximately 140,000 fungi and 14,000 plant species in Western Australia.[42] Many fungi are yet to be discovered and most are microscopic. Fungi is an important part of an ecosystem as they recycle and break down organic matter and debris to provide nutrients for plants. Many plants can thrive in poor soils because they have beneficial connections with fungi. The amount of species of fungi present in bushland can be an indicator of ecosystem health.[43] Fungi also provide food and habitat for mammals such as bandicoots and other fauna including invertebrates. [44]

Research into the importance of fungi is leading to the discovery of how fungi can help reduce the likelihood of extinction of plants, animals and the loss of ecological communities.[44]

Fungi surveys are important in providing baseline information and to highlight changes in fungi occurrence over time. Undertaking fungi surveys also enables the comparison of ecological data with other natural areas within the City of Joondalup.

Fungi Survey (2020)

Whilst undertaking the flora and fauna survey in September 2020, consultants Eco Logical Australia were also engaged to undertake an opportunistic fungi survey of the Iluka – Burns Beach Foreshore Reserve and record all incidental sightings of fungi.[35] The optimum time for fungi surveys is in autumn or winter after substantial rainfall.[42] Due to time limitations, the incidental fungi survey was conducted in spring (dry conditions) and no fungi were recorded by the consultant.

In spring 2018 and 2019, the City engaged Natural Area Consulting to undertake a fungi survey at Ocean Reef Foreshore, located 1.8 kms from Iluka Foreshore Reserve. No species of fungi were recorded during this survey.

In spring 2013, the City engaged consultants, Natural Area Consulting, to undertake a fungi survey at Marmion Coastal Foreshore Reserve, located approximately 12 kms from Iluka Foreshore Reserve. Four species of fungi were recorded during this survey.

Fungi species recorded in the nearby natural areas of Marmion Foreshore Reserve are potentially likely to be present in Iluka – Burns Beach Foreshore Reserve. A list of fungi likely to occur in Iluka – Burns Beach Foreshore Reserves and photographic examples is provided in Appendix 11.

Current Management Approach

The City of Joondalup currently monitor fungi in Iluka – Burns Beach Foreshore Reserve through recording incidental sightings of fungi species during the City's 5-10 yearly flora and fauna surveys.

Recommended Fungi Management Action:

[42] Bougher (2009)
[43] Robinson (no date)
[44] DPaW (no date a)

To monitor fungi health in Iluka – Burns Beach Foreshore Reserve, the following management action is proposed:

Action	Details
Fungi survey	Undertake a comprehensive fungi survey in autumn or winter after substantial rain, to supplement previous incidental fungi surveys, within 5-10 years.

3.3 Plant Diseases

Organisms such as fungi, bacteria and viruses that cause plant diseases are known as pathogens. Whilst some pathogens are naturally occurring within the soil, others have been introduced to the environment through the movement of plant materials and soils.[45]

The symptoms produced by plants that are affected by pathogens vary depending upon the species of pathogen, host species, environment and climatic conditions. Some pathogens can live in the soil for a long period without impacting the health of plants, whilst others can cause rapid death or result in a slow, perennial decline in health.[45]

Phytophthora dieback refers to the disease caused by the introduced plant pathogen *Phytophthora cinnamomi*. While there are numerous species of *Phytophthora*, the most widespread and destructive species affecting native plants throughout South-western Western Australia is *P. cinnamomi*.[46] Previously *Phytophthora* dieback was commonly referred to as 'Jarrah dieback' due to Jarrah (*Eucalyptus marginata*) trees being one of the first plant species observed to be impacted by *P. cinnamomi*.[47] However as the pathogen has become more widespread, up to 22% of native plant species in the south-west of Western Australia are likely to be susceptible to the pathogen.[48]

Whilst *P. cinnamomi* is the most common species of *Phytophthora* dieback within Western Australia, other species of *Phytophthora* are common in urban areas of Perth.

Pathogen sampling of the City's parks, natural areas and coastal sites in accordance with the *City of Joondalup Pathogen Management Plan 2013-2016* has recovered a number of *Phytophthora* species, which include *P. alticola, P. arenaria, P. asparagi, P. boodjera, P. multivora, P. nicotianae* and *P. palmivora*. Of these *Phytophthora* species identified within the City, *P. multivora* and *P. nicotianae* are the most prevalent.

Phytophthora multivora is a common pathogen in urban areas of Perth, particularly along the inland dune systems. It is widespread throughout the south-west of Western Australia with a similar distribution to *P. cinnamomi*. *P. multivora* is named due to its wide host range, including *Banksia* and *Eucalyptus* species. *P. multivora* can cause rapid death of plants, or a slow, perennial decline in the health of the tree crown and is commonly associated with individual spot deaths and areas of tree decline.[49]

Phytophthora nicotianae has been identified in herbaceous and woody plants used in agriculture and horticulture, although it is now considered established within natural ecosystems in Western Australia. The pathogen is widely found within nursery stock and therefore has a higher probability of infecting parks and reserves, rather than natural areas

[45] City of Joondalup (2013)
[46] DBCA (no date a)
[47] DWG (2020)
[48] CPSM (2012)
[49] Barber (2012)

due to the introduction of nursery stock and soil through planting programs and the regular use of machinery and vehicles. *P. nicotianae* is associated with large lesions at the base of *Eucalyptus* trees and causes collar rot of *Grevillea* species. *P. nicotianae* has also been identified as causing fine root death of numerous other native plant species.[49]

Armillaria luteobubalina has also been identified within a number of parks within the City of Joondalup. *Armillaria* is a fungus that causes root rot and wood decay of a wide variety of plants including many species of native flora. The fungus is native to Australia and can also cause major damage to natural ecosystems. *Armillaria luteobubalina* is commonly known as the "Honey Fungus" due to the colour of the fruiting body seen above the ground during certain times of the year, as shown in Figure 26. Fruiting bodies (mushrooms) are not evident at all infected sites.[49]

Figure 26: Fruiting Bodies of *Armillaria luteobubalina* (sourced from City of Joondalup, 2013)

At present there is no reliable mechanism for the complete eradication of *Phytophthora* species and the control of *Armillaria luteobubalina* is both expensive and labour intensive.[49]

Current Management Approach

The City has developed a *Pathogen Management Plan 2018-2028* to provide guidance on the management of pathogens within the City to protect biodiversity values and minimise the risk of pathogen introduction and spread within landscaped and natural areas. Strategies to engage the community and key stakeholders in order to raise the awareness of pathogens within the City are also identified within the Plan.

The City has further developed *Pathogen Hygiene Procedure for City staff and Contractors, Pathogen and Weed Hygiene Guidelines* and *Purchasing of Landscaping Materials Guidelines* to minimise the spread of pathogens.

Pathogen sampling was undertaken in Iluka Foreshore Reserve in March to April 2016 and December 2016 to January 2017 and in Burns Beach Park in May 2014. The only pathogen

to have been identified in the pathogen mapping and sampling program is *Armillaria* which is suspected in Iluka Foreshore Reserve.

Although no pathogens have been confirmed through the pathogen mapping and sampling program at Iluka-Burns Beach Foreshore Reserve, a limited amount of pathogen sampling has been undertaken several years ago. The City applies the precautionary approach and implements and encourages pathogen hygiene to prevent the introduction or spread of pathogens.

Recommended Pathogen Management Actions:

To prevent pathogen and weed spread and protect biodiversity values at Iluka-Burns Beach Foreshore Reserve, the following management actions are proposed:

Action	Details
Pathogen Management	Implement recommendations from the Pathogen Management Plan that are applicable to the management of Iluka-Burns Beach Foreshore Reserve.
Hygiene Guidelines	Implement *Pathogen Hygiene Procedure for City staff and Contractors, Pathogen and Weed Hygiene Guidelines* and *Purchasing of Landscaping Materials Guidelines* to prevent the introduction or spread of weed or pathogens into Iluka-Burns Beach Foreshore Reserve.

3.4 Fauna

Fauna surveys document the occurrence, distribution and population of fauna species. Information from fauna surveys is used as a baseline to monitor the health of fauna species.

The City engaged consultants, Eco Logical Australia (ELA), to undertake a fauna survey of Iluka-Burns Beach Foreshore Reserve in November 2020. As part of the fauna survey, ELA reviewed data from previous surveys provided by City of Joondalup to compile a comprehensive data set to be used in the development of this Plan.

The fauna survey design was aligned with *EPA Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (2020), except there were three trapping nights rather than seven trapping nights.

Two conservation listed fauna species were recorded during the survey, including Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris)* and Quenda (*Isoodon fusciventer*).

The fauna survey method included a variety of sampling techniques, both systematic and opportunistic. Systematic trapping was conducted over four nights; two in the Iluka area and two in the Burns Beach area; in October 2020 using a combination of pitfall traps, Elliot box traps, cage traps and funnel traps in six trapping transects. Other fauna survey methods included a bird survey during peak activity periods (e.g. after dawn), an acoustic survey using SM2 ultrasonic recorder for bat echolocation calls, hand searches, installation of motion sensor cameras (over four nights) and a nocturnal search (over one night), in addition to opportunistic sampling and sightings.

The optimum season for fauna detectability in the south west bioregions is spring. Trapping periods of at least 7 nights are recommended to reduce the potential for adverse weather conditions to impact upon survey results and therefore show species diversity, richness trends and provide reliable indications of species composition and abundance data.

Previous fauna surveys at Iluka-Burns Beach Foreshore Reserve include:

- *Iluka Foreshore Macroinvertebrate and Herpetofauna Inventory Surveys – all samples from April 2015 to May 2018*, prepared for Friends of North Ocean Reef – Iluka Foreshore.
- ATA Environmental (2001) *Iluka Flora & Vegetation Survey & Fauna Habitat Assessment.*
- City of Joondalup (CoJ) *Natural Area Initial Field Assessment – Burns Beach Park* (2009).
- AECOM (2018) *Tamala Park Reserve – Biological Report*, prepared for City of Wanneroo.
- GHD (2013) *Proposed Dual Use Coastal Path between Mindarie and Burns Beach: Environmental Study and Topographical Survey Report*, prepared for Department of Planning.
- Cardno BSD Pty Ltd (2006) *Foreshore Management Plan Burns Beach,* prepared for Burns Beach Property Trust.
- City of Joondalup (2014) *Burns Beach Structure Plan No. 10.*
- Government of WA (2000b) *Bush Forever Site Description: Burns Beach Bushland*.

The combination of results from the fauna survey in 2020 and the previous fauna assessments undertaken indicate the following species inhabit Iluka – Burns Beach Foreshore Reserves:

- Six native mammals
- 62 native birds (including two species of conservation significance)
- 30 native reptile species
- Over 500 native invertebrates.

In addition, the following non-native fauna have been identified at Iluka – Burns Beach Foreshore Reserves:

- Four mammals (including the domestic/feral cat)
- Two birds.

The full fauna species list incorporating all the above assessments is provided in Appendix 8.

The results from the fauna survey in 2020 recorded the following species:

- Seven mammals (three native and four introduced species)
- 28 birds (26 native and two introduced species)
- 15 reptiles (all native species)
- No amphibians
- 14 invertebrates (13 native and one introduced species).

Fauna Habitat

The bushland at Iluka – Burns Beach Foreshore Reserve provides an important area of remnant fauna habitat within the City of Joondalup. The vegetation community and habitat resources it contains support a relatively diverse and species-rich assemblage of native birds, mammals and reptiles and the bushland is considered to have high local conservation value.[9] The Iluka – Burns Beach Foreshore Reserve provides a valuable ecological linkage to adjacent bushland to the north, south and east (e.g. Burns Beach Bushland and Neerabup National Park).[35]

The vegetation condition at Iluka Foreshore ranges from excellent to good and at Burns Beach Foreshore ranges from excellent to completely degraded. There are areas of localised disturbance due to the dunal blow-outs, unauthorised access tracks (walk trails and vehicle tracks) and minor rubbish dumping. Vegetation, trees, leaf litter, soil, fungi, sticks, logs and dead trees at Iluka – Burns Beach Foreshore Reserve provide habitat for fauna to nest, shelter, forage and roost.

A total of five fauna habitats are present within the Iluka – Burns Beach Foreshore Reserve. The Iluka study area contains five broad vegetation community types and the Burns Beach study area contains four broad vegetation community types; described in Table 4. The most commonly occurring fauna habitat in the Burns Beach survey area was dunes and swales and in the Iluka survey area was *Melaleuca* shrubland over heath. In respect to coverage of the habitats, in the Burns Beach survey area the habitats covered a total of 26.5 ha (90.8%) and in the Iluka survey area the habitats covered a total of 29 ha (92.5%), with the remaining areas comprising of tracks and open beach/rock in both survey areas. The vegetation communities provide foraging and nesting habitat for a diversity of nectar and seed eating birds, as well as habitat for a range of mammals, reptiles and invertebrates.[9]

The fauna survey in 2020 highlighted the invertebrate species diversity within Iluka – Burns Beach Foreshore Reserve is expected to be higher than what was recorded, given the extent of good quality remnant native bushland habitat present and the diversity of flora species at the site.[35] This is supported by the results of the Friends of North Ocean Reef – Iluka Foreshore Macroinvertebrate and Herpetofauna Inventory Surveys from 2015 to 2018.[1]

Table 4: Fauna habitats at Iluka-Burns Beach Foreshore Reserve

Fauna habitats	Burns Beach extents	Iluka extents
Dunes and swales	24.1ha (82.3%)	1.6ha (5.2%)
Tall Acacia shrubland	1.9ha (6.7%)	0.6ha (2%)
Low Banksia shrubland over low heath	0.4ha (1.4%)	4.6ha (14.7%)
Low limestone coastal heath	0.1ha (0.5%)	3.6ha (11.5%)
Melaleuca shrubland over heath	N/A	18.5ha (59.1%)
Open beach / rocks	1.6ha (5.4%)	1.2ha (3.8%)
Tracks	1.1ha (3.8%)	1.1ha (3.7%)
Total	**29.3 ha**	**31.3 ha**

Carnaby's Black-Cockatoo habitat

The *Banksia sessilis, Acacia rostellifera, Spyridium globulosum* mid open shrubland (BsArSg) vegetation community within the Iluka – Burns Beach Foreshore Reserve provides potential foraging habitat for the Carnaby's Black-Cockatoo. This includes Banksia and Hakea species, which are known foraging species for Carnaby's Black-Cockatoo.[73] Carnaby's Black-Cockatoos nest in hollows of smooth-barked eucalypts, including Tuarts (*Eucalyptus gomphocephala*) and Marris (*Corymbia calophylla*), which are not found on site.[50]

[50] DEC (2011a)

Due to the endangered status of the Carnaby's Black-Cockatoo and the limited remaning vegetation within the Perth Metropolitan Area, it is important that good quality vegetation and a diversity of flora species known to be used by the endangered Carnaby's Black-Cockatoo is maintained for potential foraging habitat at Iluka – Burns Beach Foreshore Reserve.

Quenda habitat

Quenda are one of the few remaining native mammals that still persist within remnant habitat on the Swan Coastal Plain.[51] They are considered ecosystem engineers capable of turning over nearly four tonnes of soil per individual per year and their continued persistence in landscapes may be important for maintaining ecosystem processes.[52]

Quenda are omnivores and forage for subterranean food such as fungi and invertebrates.[53] The Iluka-Burns Beach Foreshore Reserve with its dense understorey provides plenty of foraging habitat for Quenda which were recorded on site in the 2020 fauna survey.

Native Fauna

Fauna and flora are interconnected in complex relationships with each other and with factors such as soil, water, climate and landscape. The decline of native fauna can cause loss of plant species and changes to ecological communities. Alternatively, the decline of native flora can cause loss of fauna species.

Mammals

Three native mammals were recorded at Iluka – Burns Beach Foreshore Reserve, the Quenda (*Isoodon fusciventer*), White-striped Free-tailed Bat (*Austronomus australis*) and the Gould's Wattled Bat (*Chalinolobus gouldii*).[35] In previous surveys the Western Grey Kangaroo (*Macropus fuliginosus*), Western Brush Wallaby (*Notamacropus irma*) and the Short-beaked Echidna (*Tachyglossus aculeatus*) have also been recorded.[54, 55]

Quenda

The DBCA have listed the Quenda (*Isoodon fusciventer*) as a Priority 4 species (Rare, Near Threatened and other species in need of monitoring). Threats to Quenda include loss of habitat, predation by introduced predators (e.g. European Red Fox and cats) and fire in fragmented habitat.[64] In addition, they appear to be vulnerable to spatial isolation.[56] Although Quenda were once common throughout south-west Western Australia, due to a combination of habitat loss and predation by introduced predators, they are now absent from many areas, or persist in low numbers.[62]

Home range estimates for species in the genus *Isoodon* vary from 0.5 – 6.0ha and although these animals are typically solitary, they often have overlapping home ranges.[53] While searching for underground food Quenda create small scale disturbances in the form of foraging pits in the soil and have been identified as one of Australia's persisting digging mammals; with its digging activities implicated in a range of potential ecosystem services.[63]

[51] Wilson et al. (2012)
[52] Valentine et al. (2013); Valentine et al. (2017)
[53] VanDyck and Strahan (2008)
[54] AECOM (2018)
[55] Beaumaris Land Sales (2001)
[56] Ramalho et al. (2018)

Quenda have a backward opening pouch which assists with reducing soil falling onto their pouch young during digging activities. Eight teats are arranged in an incomplete circle and the pouch can accommodate one to six (usually two to four) young in a litter. [64] [70]

During the 2020 fauna survey, Quenda (*Isoodon fusciventer*) were recorded in both survey areas. Within the Burns Beach survey area, six individuals were trapped in cage traps over four trapping nights. An individual was also recorded on motion camera. Within the Iluka survey area one individual was recorded at each of the two trapping locations. Of the eight trapped individuals, all but one were males, with the female having one unfurred pouch young. The majority of the Quenda observed appeared to be in good condition. Two males were missing the majority of their tail, an injury most likely the result of mating.

Insectivorous Bats (microbats)

Gould's Wattled Bat (*Chalinolobus gouldii*) and White-striped Free-tailed Bat (*Austronomus australis*) are two of approximately 75 species of bat in Australia. These native mammals fall into two main groups: the megabats and the microbats. Two groups of bat occur in Western Australia, flying-foxes (megabats) and insectivorous bats (microbats). Both recorded species are insectivorous bats (microbats). Bats can be useful for pest control, feeding on moths, beetles, mosquitoes, invertebrate larvae, flying ants and other invertebrates.[57] A comprehensive bat survey would require a one week remote monitoring bat survey during summer. Bats can be encouraged to roost in the area by installing bat boxes.

Reptiles

Fifteen native reptile species have been recorded at Iluka – Burns Beach Foreshore Reserve, with 13 reptiles (four snakes, one gecko, seven skinks and one blind snake) in the Iluka survey area and seven reptiles (one dragon, three snakes, and three skinks) in the Burns Beach survey area. The most commonly occurring species trapped across the survey areas was West-coast Laterite Ctenotus (*Ctenotus fallens*). This species favours low coastal vegetation on sandy soils. Scincidae family (skinks) were the most commonly observed reptiles across both survey areas. All species recorded are considered common and widespread throughout the Perth region and wider South-west WA. None are considered conservation significant. [9,58,59]

The 2020 fauna survey noted that the majority of reptile specimens trapped were considered to be in good physical condition.[35]

In a previous study in 2018 the species *Lialis burtonis* (Burton's Legless Lizard) was recorded and is a specialist predator of skink lizards. Its occurrence indicates adequate abundance of skinks to support a population of this species.[9]

Amphibians

No amphibians have been recorded at Iluka – Burns Beach Foreshore Reserve.

Birds

[57] DEC (2007)
[58] Australian Government, Atlas of Living Australia (no date a)
[59] Australian Government, Atlas of Living Australia (no date b)

A total of 26 native birds have been recorded at Iluka-Burns Beach Foreshore Reserves, with 25 native species recorded in the Iluka Foreshore Reserve and 22 native species in the Burns Beach Foreshore Reserve.

Carnaby's Black-Cockatoos

One conservation listed species was recorded in the Iluka survey area, the endangered Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) (see Appendix 9). This species was observed flying over the survey area during the flora survey.

Carnaby's Black-Cockatoos (Carnaby's) are endemic to the South-west of Western Australia and are listed on state, national and international threatened species lists.

Common Native Birds

The most common bird species recorded at Iluka – Burns Beach Foreshore Reserve were the honeyeaters. Across the Iluka and Burns Beach Foreshore Reserves there were a range of seasonal and resident nectar feeders such as honey eaters and wattle birds, opportunistic insectivores such as the *Malurus lamberti* (Variegated Fairywren) and larger omnivorous species such as *Cracticus tibicen* (Australian Magpie), *Coracina novaehollandiae* (Black-faced Cuckoo-shrike) and *Cracticus nigrogularis* (Pied Butcherbird). All species observed at Iluka – Burns Beach Foreshore Reserve are known to be widespread throughout the south-west of WA and considered as common on the northern Swan Coastal Plain.[9]

Invertebrates

Invertebrates are animals without backbones such as insects, worms and molluscs. Invertebrates constitute more than 95% of all living animal species, with Australia having documented 100,000 species and an estimated 200,000 undescribed invertebrate species.[60] Some invertebrates are important indicators of ecosystem health, such as ants (seed dispersers), bees (pollinators) or spiders (top invertebrate predators).[61]

Invertebrates recycle organic matter, putting it back into circulation for use by other parts of the ecosystem and are instrumental in controlling the numbers of other species.[60]

During the 2020 fauna survey, invertebrates were recorded opportunistically by observations, during hand searching for vertebrates, or as bycatch within vertebrate pitfall traps.

A total of 13 native invertebrates were recorded during the 2020 survey across the Iluka-Burns Beach Foreshore Reserve. The majority of invertebrate species recorded in the 2020 fauna survey were spiders. The Iluka-Burns Beach Foreshore Reserve supports a rich invertebrate diversity, which is reflected by the fairly diverse reptile assemblage present.[62]

Over 500 invertebrate species were identified in the 2015-2018 an invertebrate study that was undertaken by Spineless Wonders in collaboration with the Friends of North Ocean Reef Iluka Foreshore.[1] A macroinvertebrate inventory survey conducted between 2015 and 2018 within the bounds of the Iluka Coastal Foreshore Reserve, between St. Lucia Road in the north and Resolute Way in the south, recorded over 500 macroinvertebrate species over

[60] DBCA (no date b)
[61] V Framenau (2012), email, 9 July
[62] ELA (2021)

this four-year period in one of the most comprehensive macrofaunal biodiversity inventories for any coastal habitat mosaic ever assembled in Western Australia.[1]

The invertebrates recorded during the 2020 survey, in most cases, were only able to be identified to the taxonomic order level. It is likely that a targeted invertebrate survey would uncover a much higher number of invertebrate taxa within the Iluka-Burns Beach Foreshore Reserve, as demonstrated by the 2015 – 2018 survey.

Non-native Fauna

Non-native fauna impact native fauna and flora through predation, competition for food and shelter, spreading diseases and destroying habitat. These impacts can result in the diminishing or extinction of native species.[63]

Non-native animals such as cats, foxes, rabbits, rats, mice, birds, millipedes, ants and bees inhabit the City's bushland, wetland and coastal areas.

Mammals

Australia is home to some of the world's most unique animals. More than 80 per cent of our mammals occur nowhere else on earth,[64] however Australian mammals are becoming extinct at an alarming rate, primarily due to non-native (feral animal) predation.[65]

Four non-native mammals were recorded in the 2020 fauna survey. This included the house mouse (*Mus musculus*), fox (*Vulpes vulpes*), cat (*Felis catus*) and rabbit (*Oryctolagus cuniculus*). The Red Fox and Cat are direct predators to native mammals and reptiles. The survey also recorded free roaming pet cats (*Felis catus*) on a motion camera, indicating the use of the reserve by domestic animals. The House Mouse and European Rabbit have the potential to introduce and spread disease to native mammal populations and likely compete for food resources with other native fauna species.

The lack of small native mammals recorded (other than the Quenda and microbats) is expected due to the size, fragmented nature and location of Iluka-Burns Beach Foreshore Reserve, however the likely presence of feral predators could also be having an impact on the microbat and Quenda populations.

Foxes are common within the City's bushland areas and have caused the decline of many native birds, reptiles and small mammals.[66]

Domestic animals such as dogs (*Canis lupus*) can also cause damage to the City's natural environment, particularly when exercised unleashed within natural areas. Iluka-Burns Beach Foreshore Reserve is a dog on lead area. Dogs can harass native fauna, including mammals such as Quenda, resulting in stress and harm to the animals. Dogs can also spread pathogens if they disturb the soil, particularly around trees which may contain soil-based diseases. Dog droppings, if not removed, contribute a significant amount of nutrients to the site, encouraging weed growth and potentially polluting groundwater. Some dog droppings contain harmful bacteria and nutrients.[67]

[63] Australian Government, DAWE (no date)
[64] Australian Government, DoE (2015a)
[65] Australian Wildlife Conservancy (no date)
[66] DPI (2012)
[67] KABWA (no date)

The City Field Officers patrol Iluka-Burns Beach Foreshore Reserve on an adhoc basis (responding to requests) to ensure dogs are kept on leads and their droppings are collected.

Domestic and feral cats (*Felis catus*) have the potential to cause significant environmental harm when allowed to roam within urban natural areas.[68] Feral cats are attributed to be the major threat to mammalian fauna extinction in Australia.[65] The Federal Government Environment Minister endorsed the *National Declaration of Feral Cats as Pests* in 2015 to recognise feral cats as a nationally significant pest that threatens native fauna.

Under the *Cat Act 2011* the City of Joondalup may seize cats if they are reported to be in public areas or on private property without the consent of the owner/occupier. The *Cat Act 2011* encourages responsible pet ownership by ensuring cats are registered, sterilised and microchipped.

Birds

A total of two non-native species of birds have been recorded at Iluka – Burns Beach Foreshore Reserve including *Dacelo novaeguineae* (Laughing Kookaburra) and *Spilopelia senegalensis* (Laughing Dove).

The Laughing Kookaburra has been widely introduced into Western Australia where they breed in tree hollows that would usually be used by parrots and owls. Laughing Kookaburras also prey on small reptiles, mammals and nestlings, placing undue pressure on these native species.[69]

The Laughing Dove are widespread throughout much of south-western Western Australia, the natural range of the Laughing Dove extends from Africa, through the Middle East to the Indian subcontinent. Laughing Doves breed in an array of locations, often suburban environments. Laughing Doves typically feed on the ground eating grain, seeds and weeds.

Although no Rainbow Lorikeets were sighted in the 2020 fauna survey, they were recorded in a previous survey in 2013.

Invertebrates

One non-native invertebrate species was recorded in Iluka – Burns Beach Foreshore Reserve in the 2020 survey, the Portuguese millipede (*Ommatoiulus moreletii*). In the 2015-2018 survey within the Iluka Foreshore Reserve, two non-native invertebrate species were recorded in Iluka – Burns Beach Foreshore Reserve the European Honey Bee (*Apis mellifera*) and Portuguese millipede (*Ommatoiulus moreletii*).[1]

Portuguese millipedes were first recorded in Western Australia in 1986 and are now widespread in the south-west of the State. They feed on organic matter such as leaf litter and are not known to impact native flora or fauna. Portuguese millipedes can reach high population levels and be a domestic nuisance when they invade homes and gardens. This species is known to be distasteful and therefore avoided by many predators. It plays a useful role in breaking down organic matter in the soil, however is considered a pest when it reaches high population levels.[70] This species has become widespread across the Perth metropolitan area in both bushland and suburban areas. The Portuguese Millipede

[68] Australian Government, Department of the Environment (2015b)
[69] Birdlife Australia (no date b)
[70] DPIRD (2020)

(*Ommatoiulus moreletii*) is listed as Permitted – s11 under the Western Australian organism List.

European honey bees are frequently observed at the site. The European honey bee (*Apis mellifera*) is common within the City's natural areas and may impact upon native flora and fauna through competing with native fauna (including native bees) for floral resources, disrupting natural pollination processes and displacing endemic wildlife from tree hollows. European honey bees are feral animals, however, European honey bees are important to Australian horticulture and agricultural industries with approximately 65% of agricultural production in Australia being dependent on pollination by European honey bees.[71]

Ecological Linkages

Naturally connected landscapes and ecosystems are generally healthier, protect a diversity of species, provide pathways for species movement and can store carbon more effectively than degraded landscapes.[72] In urban areas where there is engineered infrastructure dividing the landscape, it may be beneficial to provide wildlife crossings such as underpasses, tunnels, viaducts or overpasses to enable wildlife movement.

Iluka-Burns Beach Foreshore Reserve forms an important coastal ecological linkage from Mindarie in the north to North Fremantle in the south. It also forms an ecological linkage to Neerabup National Park and Yellagonga Regional Park in the east, as shown in Figure 27. The ecological linkage from Burns Beach Foreshore Reserve to Neerabup National Park and Yellagonga Regional Park is divided by Marmion Avenue, Connolly Drive, Mitchell Freeway and Burns Beach Road.

Future development to the north of Iluka-Burns Beach Foreshore Reserve, may result in further isolation from other bushland remnants. The Iluka-Burns Beach Foreshore Reserve provides a valuable linkage to adjacent bushland to the north, south and east. It provides habitat connectivity for many species, particularly birds and this is important for the continued presence of a range of local bird species, including Carnaby's Black-Cockatoo. The occurrence of Carnaby's Black-Cockatoo highlights the foraging value of the study area.[9]

Current Management Approach

The City of Joondalup is implementing a number of management actions to monitor native fauna and address the environmental impacts of domestic and pest animals within the City's natural areas. Monitoring of native fauna occurs through fauna surveys. Control of non-native fauna such as foxes, cats and rabbits is undertaken annually within selected bushland, wetland and coastal areas, as required. Fox, cat and rabbit control methods employed include biological and chemical control, trapping, baiting and exclusion methods such as fencing. Fox, cat and rabbit control is conducted when foxes, cats or rabbits are observed or rabbit or fox warrens are identified on site. Three separate fox and cat trapping events were conducted in Iluka Foreshore Reserve during 2020, resulting in the trapping of seven cats and two foxes. Further fox and cat trapping events were conducted in Iluka – Burns Beach Foreshore Reserve in 2021 and summer of 2022 as well as the release of Rabbit Hemorrhagic Disease (RHD) virus for rabbit control.

The City liaises with City of Wanneroo around feral animal control programs within in its connected reserves, and where possible aligns its programs to address any feral animals

[71] Rural Industries Research and Development Corporation (no date)
[72] NWCPAG (2012)

that move between the Cities coastal foreshore reserves. In addition, Friends Groups often report any feral animal observations within reserves to the City.

The City's current management practices have greatly reduced the incidence of pest animal populations within the City. However, continued and coordinated action is required to ensure that populations remain at controllable numbers and that the impacts on natural areas remain acceptably low.

The City also promotes responsible pet ownership and encourages the community to ensure that domestic pets do not have a negative impact on the natural environment. Iluka-Burns Beach Foreshore Reserve is designated as a place where dogs must be on a lead at all times by Council resolution in accordance with the *Dog Act 1976*. Cats may be seized where they are found wandering in public areas, such as Iluka-Burns Beach Foreshore Reserve, in accordance with the *Cat Act 2011*.

Recommended Fauna Management Actions:

To monitor and protect native fauna in Iluka-Burns Beach Foreshore Reserve, the following management actions are proposed:

Action	**Details**
Fauna survey	Undertake a follow up fauna survey, in mid-late spring to supplement previous fauna survey, within 10 years.
Fauna / Ecological Linkages investigations	During on ground maintenance tasks, investigate the access points utilised by native fauna, in order to guide suitable management of native fauna within the reserve. Based on the findings, undertake an in house study aiming to improve ecological linkages between the Iluka-Burns Beach Foreshore Reserve to the Burns Beach Bushland and Neerabup National Park; and to Yellagonga Regional Park.
Quenda monitoring	Commence discussions with WA Universities on research and monitoring opportunities of the Quenda population.
Bat survey	Undertake a one week remote monitoring bat survey in summer to supplement previous one night bat survey undertaken in spring.
Installation of bat boxes	If bat survey indicates presence of bats, consider installing bat boxes to encourage bats to roost.
Feral animal control	Monitor feral animal populations and implement regular control to reduce pressures on native fauna and flora. This is inclusive of rabbit, cat and fox control. Remove feral beehives if they are identified on site and are accessible.
Patrols undertaken by City Field Officers	Continue targeted patrols by City Field Officers to ensure dogs are kept on leads and their droppings are collected.

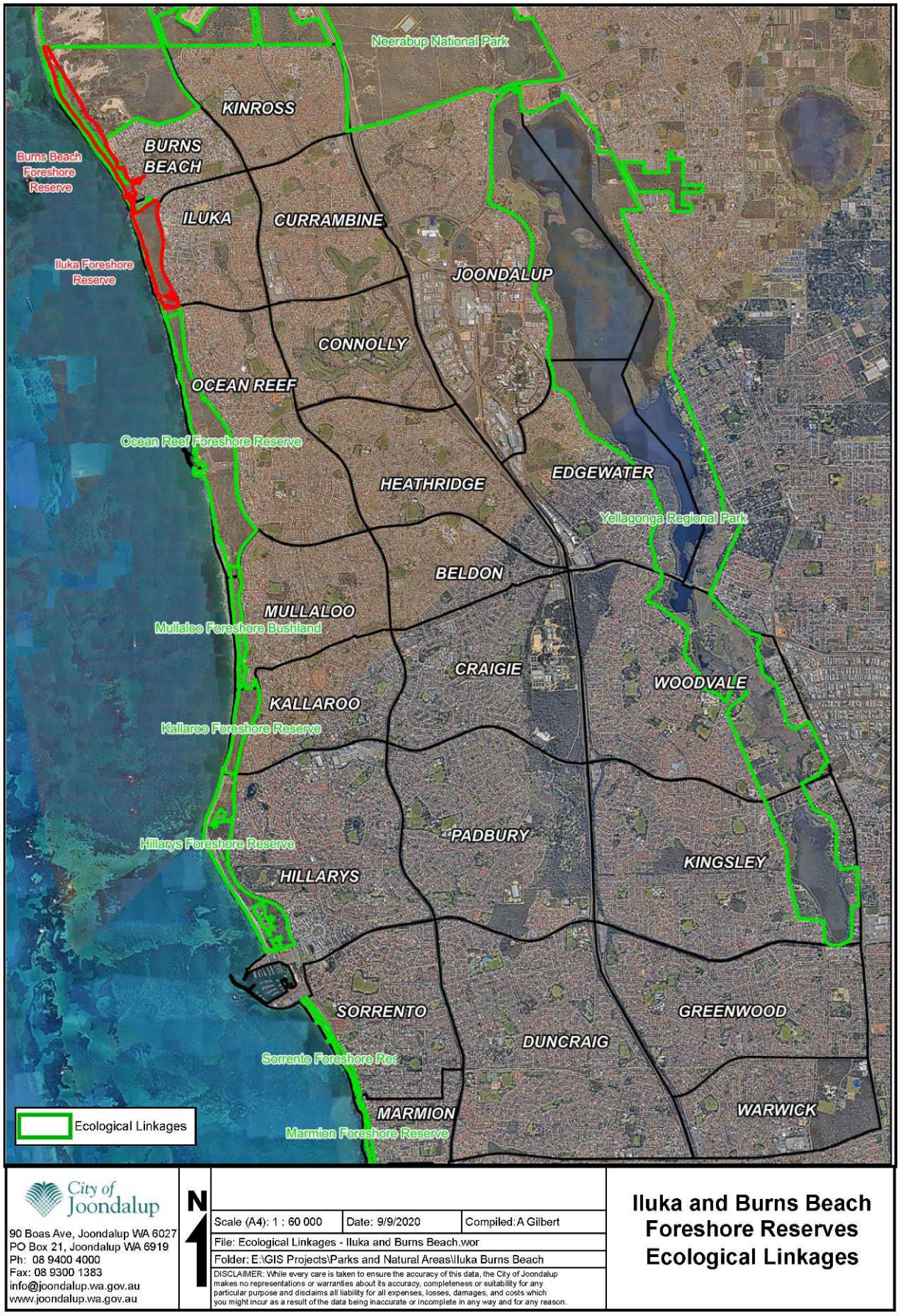


Figure 27: Ecological Linkages adjacent to Iluka-Burns Beach Foreshore Reserve

3.5 Social and Built Environment

History and Heritage

Iluka-Burns Beach Foreshore Reserve is not listed on the State Heritage Register, however Marmion Marine Park is located adjacent to the site and is listed on the State Heritage Register due to the social and ecological significance of the islands, lagoons and reefs forming the marine park.

The Burns Beach Waugal Aboriginal Heritage site (ID 22672) is located within Iluka Foreshore Reserve (see Section 1.3.2) and is listed on the State Aboriginal Heritage Inquiry System.

An unexploded ordnance (UXO) investigation was undertaken in Burns Beach Foreshore for the development of the Burns Beach to Mindarie dual use path in July 2019. No items of live UXO or explosive ordnance were located during the investigation, however a few fragments of explosive ordnance waste were uncovered. The investigation only surveyed the area designated for the Burns Beach to Mindarie dual use path and not the surrounding areas. The majority of Burns Beach Foreshore Reserve is located within an UXO area ID 1041 with a slight occurrence category and was a field firing demonstration range in 1943 where armour artillery and infantry conducted live firing.[73]

Social Value

Australians have reported they would be willing to pay an average of $35,000 more (approximately 7%, assuming a base value of $500,000) to live in a home in a 'green' neighbourhood, with a third of Australians willing to pay an extra $100,000 or more to live in a 'green' area. Approximately two thirds of Australians would prefer to buy a home in a nature-filled neighbourhood to reduce their stress levels. Living in a home with a 'green' neighbourhood is important to Australians, even more important than proximity to work, shops and public transport.[74]

Urban natural areas can provide social, psychological, physical and spiritual benefits and play a role in community health, wellbeing and quality of life. Some of the benefits of urban natural areas for the community include:

- Reduction of mental fatigue and stress
- Provide opportunities for reflective thought, peace and quiet
- Create opportunities for informal social interactions
- Provide opportunities for activities that can increase physical health
- Assists to reduce the crime rate by relaxing people and encouraging people to be outdoors.[75]

The main uses of Iluka-Burns Beach are for recreational purposes such as walking, cycling, dog exercising, beach activities and use of adjacent playgrounds and Burns Beach Cafe.

The Friends of North Ocean Reef – Iluka Foreshore have been operational since 2006 and assist in maintaining the conservation values of Iluka Foreshore Reserve through actions

[73] Department of Defence (2020)
[74] Planet Ark (2014)
[75] Tarran (2006)

such as manual weed control, revegetation and conducting ecological surveys. There is currently no Friends Group operating in Burns Beach Foreshore Reserve.

Access and Infrastructure

Iluka Foreshore Reserve contains infrastructure such as playgrounds, board walk and lookout, toilets and showers, BBQs, bike racks, gazebo, shelters, seating, drink fountain and bins, as shown in Figure 35.

Burns Beach Foreshore Reserve contains infrastructure such as playgrounds, board walks, BBQs, toilets and showers, bike racks, seating, shelters, bins and a drinking fountain, as shown in Figure 37. The Sistas Burns Beach Café and Restaurant and Burns Beach Sunsets Village caravan park are also located on site.

A development is proposed for Burns Beach in the predominantly cleared area near the northern car park including a new café / restaurant space, car park, playground, picnic facilities and landscaping. The development is subject to approvals, community consultation and Council endorsement prior to commencement.

Utilities

Several public utilities operate within or adjacent to Iluka-Burns Beach Foreshore Reserve, as shown in Figure 28 and Figure 29.

The public hydrants are owned, serviced and maintained by the DFES in conjunction with the Water Corporation. The Water Corporation also maintain the sewerage infrastructure on an as required basis.

Lighting

Whilst artificial lighting benefits humans by providing for safety, amenity and increased productivity, it also has the potential to affect wildlife.[76]

Any new infrastructure projects should consider the conservation of natural darkness through good-quality lighting design and management. Appropriate risk assessment, management plans and monitoring procedures of artificial lighting will be able to reduce the overall effect on wildlife.[76]

Light-emitting diodes (LEDs) provide the ability to control and manage the parameters of lighting, thereby incorporating best practice lighting design principles. The City is investigating options to transition the City's street lighting to LED smart-monitor lighting.

Security lighting has only been added in Iluka Foreshore Reserve and Burns Beach Foreshore Reserve where necessary, see Figure 28 and Figure 29. The City endeavours to install lighting using best practice design lighting principles.[76]

[76] DCCEEW (2023)

Figure 28: Iluka Foreshore Reserve Power, Lighting, Water & Sewage Utilities

Figure 29: Burns Beach Foreshore Reserve Power, Lighting Water & Sewage Utilities

Conservation Fencing

Conservation fencing is used to restrict access and protect areas of the foreshore reserve. Timber post and plastic coated galvanised chain mesh fencing surrounds the outer perimeter of the bushland (adjacent to Burns Beach Road) at Iluka Foreshore Reserve and along the sides of the pathway, as shown in Figure 30. There are also several small sections of the previous ring lock conservation fencing that require upgrading to the plastic coated galvanised chain mesh fencing.

Conservation fencing is also installed along the sides of the pathway at Burns Beach Foreshore Reserve extending to the north until the development on Beachside Drive.

Fencing is inspected every two months and repairs are conducted as required.

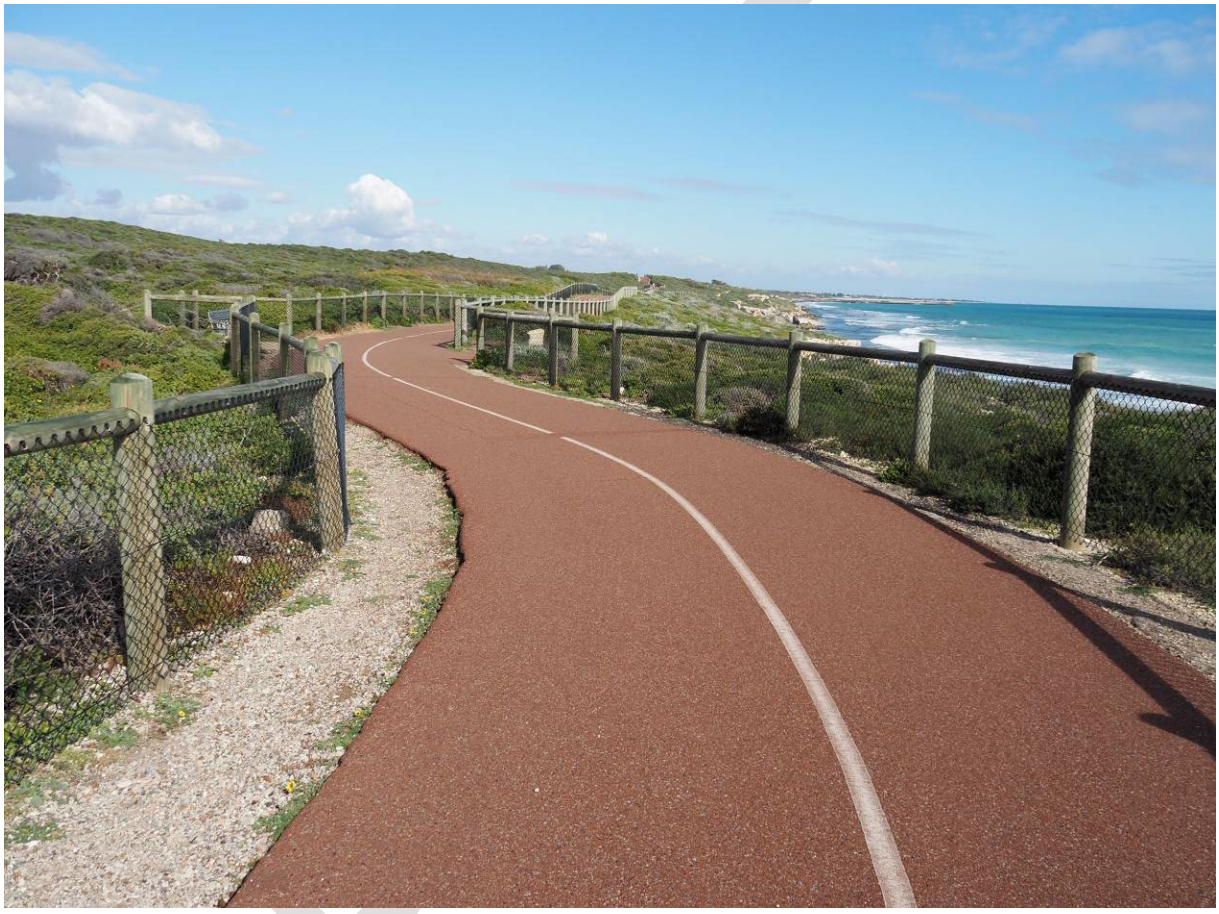


Figure 30: Conservation Fencing on the perimeter of Iluka-Burns Beach Foreshore Reserve

Access Points

Access points allow people to enter the foreshore reserve areas that are fenced off and often give access to paths and provide pedestrian access to the beach. All formal access points have fencing or railing to prevent unauthorised vehicle and motorbike access. There are numerous access points in Iluka-Burns Beach Foreshore Reserve, as shown in Figure 34 and Figure 36. The access ways provide access from recreational areas, car parks and at several intervals along the dual use path.

Where informal access points are established within Iluka – Burns Beach Foreshore Reserve, the City addresses this through installing temporary fencing and repairing any damage to fencing.

Paths and Trails

Paths in Iluka-Burns Beach Foreshore Reserve are used for pedestrian and cyclist access, fire access ways and bushland management and maintenance purposes. The paths in Iluka-Burns Beach Foreshore Reserve are mostly used by pedestrians, dog walkers and cyclists. The primary path within Iluka-Burns Beach Foreshore Reserve is a coastal dual use path. This primary dual use path also forms part of the Sunset Coast Trail which runs along the entire stretch of coastline.

Construction of the northern section of the coastal path between Mindarie and Burns Beach was completed in October 2020. In early 2022, developer PEET has completed the final 650 metre section of the Burns Beach-Mindarie shared coastal path, which links the cities of Joondalup and Wanneroo from Burns Beach estate in the south to Catalina estate in the north. The coastal path route was designed to ensure the region's biodiversity and Aboriginal cultural heritage would be protected before construction began. The works have created a continuous route from North Fremantle to Mindarie.

An existing fire access way was formalised to create a pathway in the north of Iluka Foreshore Reserve adjacent to Burns Beach Caravan Park in 2021.

A number of informal tracks also exist within the bushland. The use of informal tracks and the disturbance of soil through the establishment of informal 4WD, BMX and walking tracks, has the potential to spread and establish weeds and reduce healthy vegetation condition.

The current gates are easy for cyclists or people with prams or wheelchairs to use, however gates that allow easy access on site also allow motorbikes to enter.

Access and Inclusion

The Australian Bureau of Statistics 2021 Census indicates that 6,224 (3.9%) of City residents have a need for assistance with core activities due to a severe or profound disability.

The City of Joondalup has an *Access and Inclusion Plan 2021/22 -2023/24* stating that 'the City is committed to ensuring that its activities and services are inclusive of all members of the community, including people with disability and their families or carers, and people from culturally and linguistically diverse backgrounds.'

The formal paths in Iluka-Burns Beach Foreshore Reserve allow wheelchair access. The paths can be accessed from entries in the north and south of the reserve. The City's *Access and Inclusion Plan 2021/22 – 2023/24* also has an action to 'investigate improving the accessibility of beaches and foreshore environments' and implement accessibility upgrades in approved locations.

Signage

Signage is important to encourage appropriate use of the site and inform the community about the ecological and cultural values of Iluka-Burns Beach Foreshore Reserve. There are numerous signs at Iluka-Burns Beach Foreshore Reserve on the periphery of the site and near the main entrances, detailing information such as the name of the site and that the site is managed by City of Joondalup.

Signage at the reserve also informs park users about the danger associated with the limestone cliff risk areas and encourages the protection of the natural areas and dunes. There is also a series of ecological interpretative signage installed along the coastal walk from Iluka Foreshore Reserve in the south to Burns Beach Foreshore Reserve in the north. The signage focuses on highlighting the unique flora and fauna of the area. As well as signage of the Marmion Marine Park site and its management.

There are also 'dogs must be on a lead' signs, at the main entrance points.

Directional signage uses maps to indicate trails, entrances and infrastructure. Interpretive signage increases awareness of the ecological values of the bushland. The City has developed a *Wayfinding Signage Strategy* to guide the provision of information and interpretive messages within the City's natural areas.

Signage is reviewed and inspected as required in alignment with the *Wayfinding Signage Strategy* and the City's legal requirements.

Figure 31: Examples of the interpretative ecological signage along the coastal walk through Iluka-Burns Beach Foreshore Reserve

Toilets

There are toilets and showers located adjacent to the car park at Iluka Foreshore Reserve, as shown in Figure 35. Toilets and showers are also located at Burns Beach Foreshore Reserve to the north of the car parks, as shown in Figure 37.

Parking

There is a car park located at Iluka Foreshore Reserve with the entrance being close to the corner of Burns Beach Road and Discovery Circuit, as shown in Figure 35. There are two car parks located at Burns Beach Foreshore Reserve at the end of Ocean Parade by the coast (north and south of the roundabout), as shown in Figure 37. Some street parking is also available along Ocean Parade.

Seating

Numerous park bench seats and picnic shelter seats are located at Iluka Foreshore Reserve in the park area and along the dual use path, as shown in Figure 34 and Figure 35.

Numerous park bench seats and picnic shelter seats are also located at Burns Beach Foreshore Reserve, predominantly in the park areas, as shown in Figure 36 and Figure 37.

Figure 32: Seating at Iluka – Burns Beach Foreshore Reserve

Antisocial Behaviour

There is a history of dumping of garden refuse and rubbish, cubby houses, graffiti on signage, theft of plant tags and homeless person activities in Iluka Foreshore Reserve. There is a history of dumping of garden refuse within Burns Beach Foreshore Reserve, particularly in the fire access ways adjacent to houses. Inspections are conducted every 2 months and actions are undertaken to address any issues identified.

Rubbish

Rubbish bins are generally installed in locations where people gather to socialise or undertake recreational activities. Dog poo bins are generally installed in locations where people walk their dogs. There are dog poo bins located in the south-east corner and the south-west corner near paths and access points to the site (see Figure 35 and Figure 37). These dog poo bins can also be used to dispose of general rubbish.

Litter can have negative impacts on flora and fauna. Litter is collected by the City or Friends Group on an as needed basis, sometimes in conjunction with hand weeding activities.

The City monitors the amount of litter present in Iluka Foreshore Reserve on an annual basis, measured on three transects within the reserve. The amount of litter present in Iluka Foreshore Reserve has decreased from 18 items per hectare in 2019/20 to 0 items per hectare in 2020/21 and 2021/22 (see Figure 33).

The amount of litter per hectare has not been measured at Burns Beach Foreshore Reserve to date.

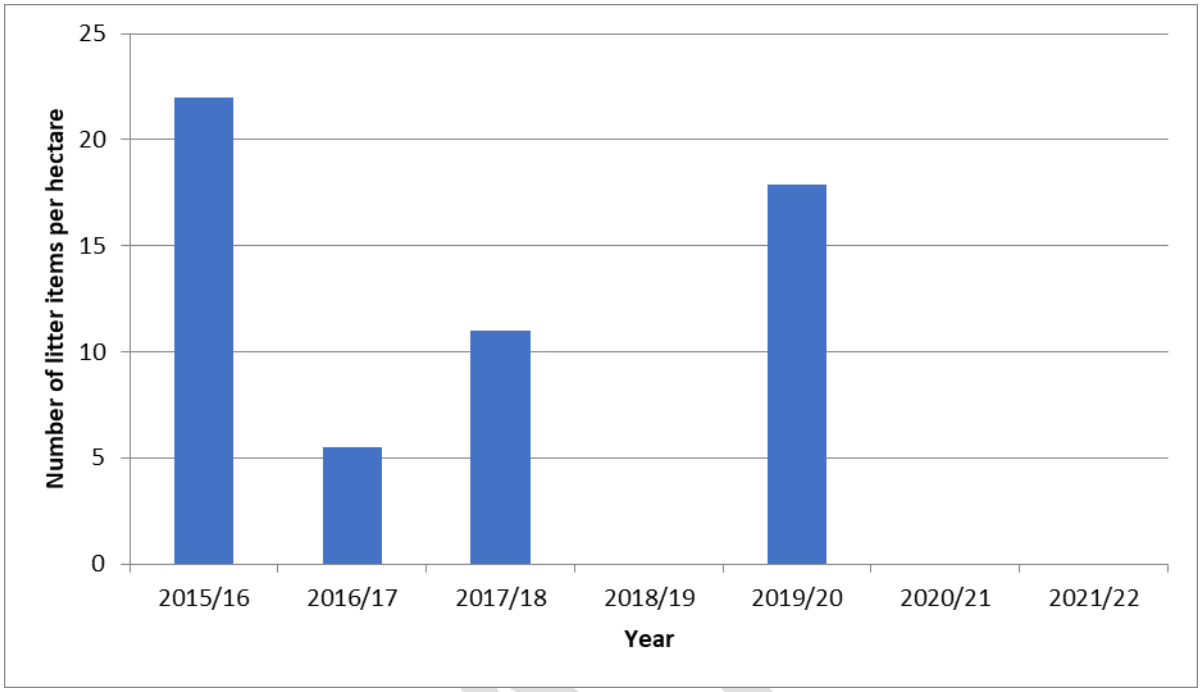


Figure 33: Amount of Litter Present in Iluka Foreshore Reserve

Water Sensitive Urban Design

A fenced off sump is located adjacent to Iluka Foreshore Reserve on the corner of Burns Beach Road and St Lucia Road, as shown in Figure 13. A fenced off sump is also located close to Burns Beach Foreshore Reserve at Burns Beach Park on Ocean Parade, as shown in Figure 14. Both sumps contain vegetation and there are currently no plans for changes to these sites.

Recommended Social and Built Environment Management Actions:

To enhance the social and built environment in Iluka-Burns Beach Foreshore Reserve, the following management actions are proposed:

Action	Details
Maintain conservation fencing	Maintain conservation fencing on an as needed basis (informed by inspections every 2 months) to protect the native vegetation, flora and fauna from informal access.
Upgrade conservation fencing	Upgrade sections of old ring-lock conservation fencing to the newer plastic coated galvanised chain mesh fencing.
Investigate closure and rehabilitation of informal tracks	Investigate closure and rehabilitation of informal tracks that are used infrequently to protect vegetation.
Implement *Wayfinding Signage Strategy*	Implement recommendations from the City's *Wayfinding Signage Strategy* that are applicable to the management of Iluka-Burns Beach Foreshore Reserve.

Action	Details
Investigate additional signage requirements	Investigate any additional signage requirements, such as Aboriginal cultural heritage interpretative signage (e.g. mythological Burns Beach Waugal Aboriginal heritage site), limestone cliff danger signage and Unexploded Ordnance signage as required.
Patrols undertaken by City Field Officers	The City will continue to visit Iluka-Burns Beach Foreshore Reserve as part of the City Field Officers patrol regime, as a form of active surveillance of the bushland and adjoining recreational parkland.
Investigate the provision of additional waste services	Monitor and investigate the provision of additional waste services to mitigate litter, as a result of increased public use and infrastructure upgrades in the active reserve.
Dismantle cubby houses, BMX tracks and informal tracks	Dismantle cubby houses, BMX tracks and informal tracks as required to discourage vegetation degradation and littering in the surrounding area.

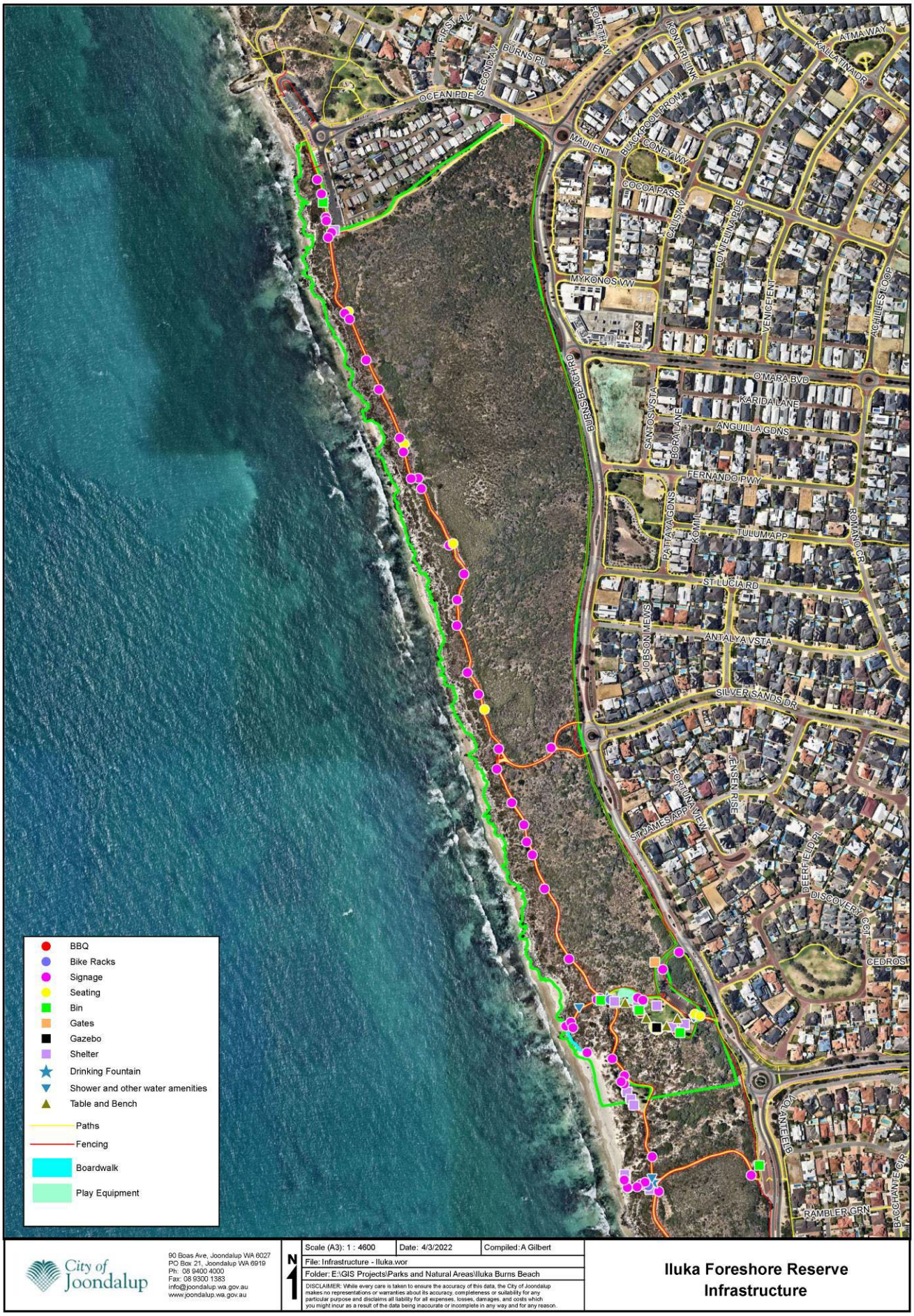
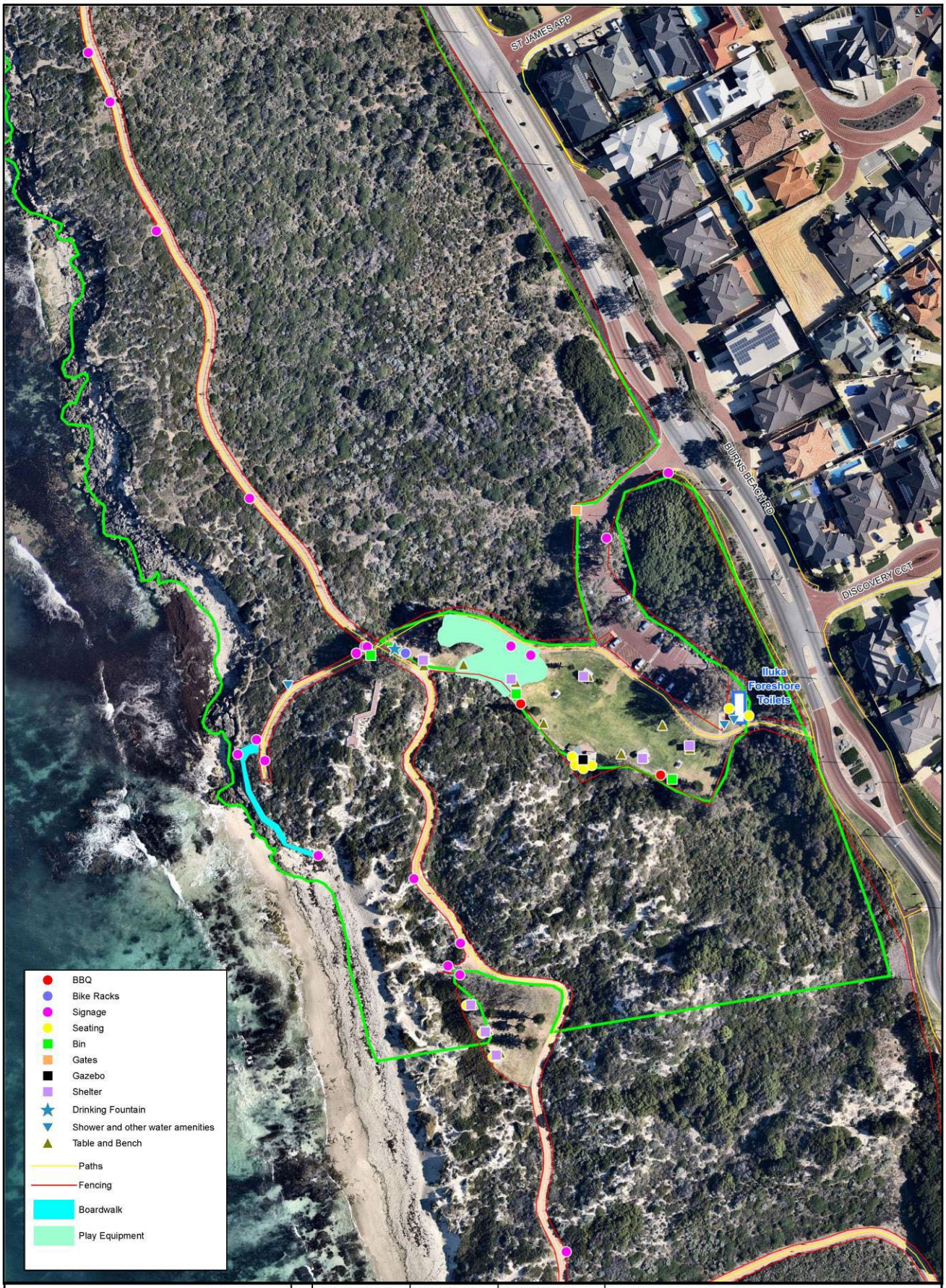


Figure 34: Iluka Foreshore Reserve Infrastructure



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N

Scale (A3): 1 : 1250 | Date: 10/9/2020 | Compiled: A Gilbert

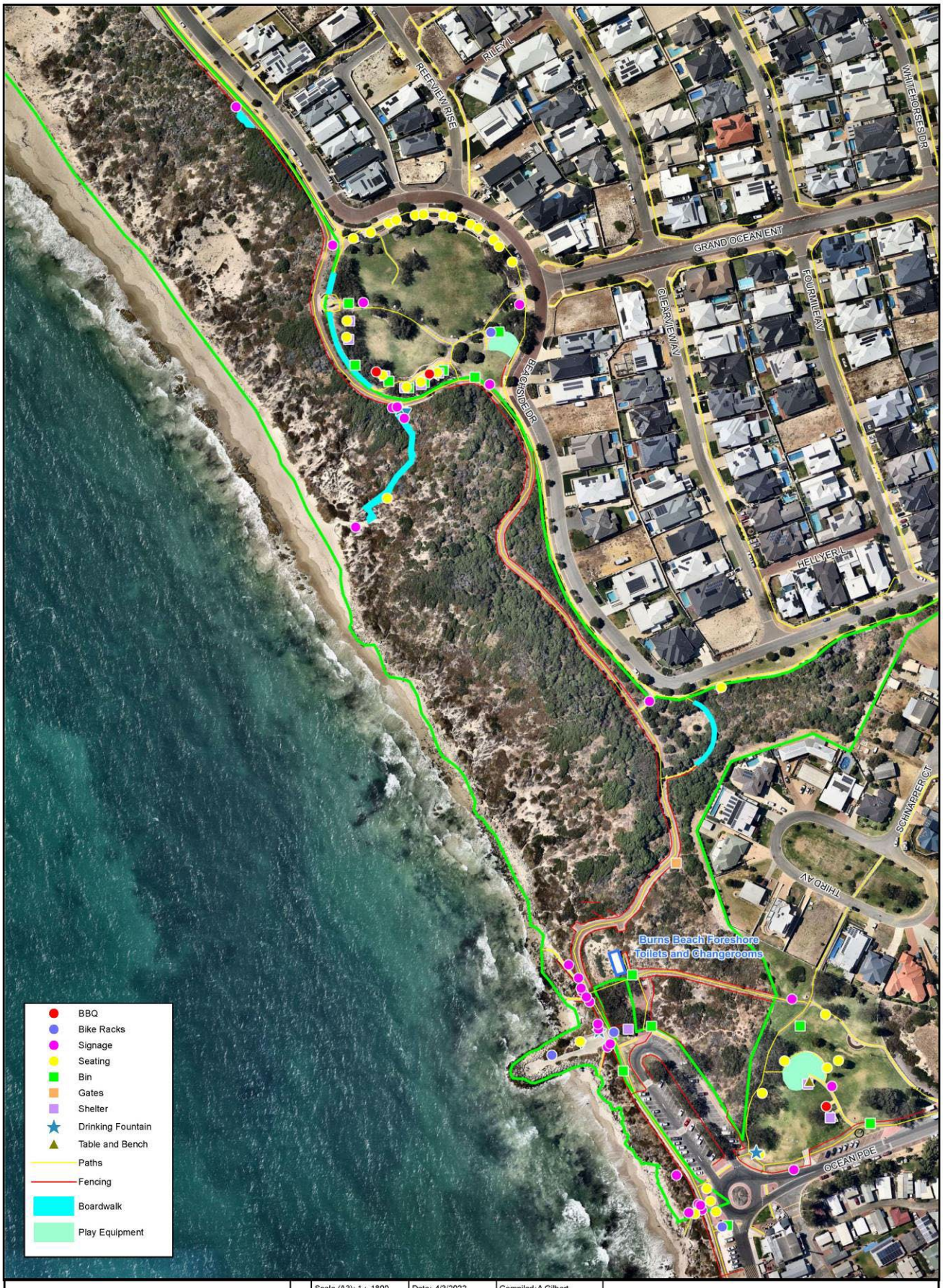
File: Infrastructure - Iluka.wor

Folder: E:\GIS Projects\Parks and Natural Areas\Iluka Burns Beach

Iluka Foreshore Reserve Infrastructure

Figure 35: Iluka Foreshore Reserve Detailed Infrastructure

Figure 36: Burns Beach Foreshore Reserve Infrastructure



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Burns Beach Foreshore Reserve Infrastructure

Figure 37: Burns Beach Foreshore Reserve Detailed Infrastructure

3.6 Fire Management

Fire is an important natural feature of the Western Australian landscape. Fire helps to shape the diversity of plant communities with many native plants having developed fire-related adaptations over time, for example fire expedites many species to flower or germinate.

Before Aboriginal people populated the Australian continent approximately 40,000 to 60,000 years ago, the major cause of fires would have been lightning. Aboriginal people learnt to harness the naturally recurring fire caused by lightning and other sources to their advantage, which resulted in skilful burning of landscapes for many different purposes. Fire was used to gain access to difficult areas, promote the development of food plants, for cooking, warmth and signalling and attracting animals for hunting.[77]

Although there are benefits to fire, an increase of fire occurrences particularly in the same area over a short period of time, referred to as fire intervals or measured as time since last fire, has the potential to adversely impact flora and fauna populations.

Human activity such as accidents and arson have resulted in increased incidences of fire within many urban bushland reserves, which can encourage growth of highly flammable and invasive weeds.

The climate in the south-west of Western Australia has become warmer and drier and is likely to continue to dry, with lower winter rainfall and increased average temperatures resulting in a longer 'fire season' and a greater proportion of the landscape that is sufficiently dry enough to burn.[78,79]

Bushfires are unplanned fires that can be caused by events such as lightning, unplanned effects from controlled burning operations, escape from industrial activities, damaged power transmission lines, discarded cigarette butts or deliberate arson. Bushfires can cause significant damage to people, property and the environment.[80] In 2015 the State Government released *State Planning Policy 3.7, Planning in Bushfire Prone Areas* and corresponding guidelines in response to several extreme fire events in Australia.

Under the *Bush Fires Act 1954*, local government have the responsibility of prevention, preparedness and recovery to bushfires, hence fire management of Iluka-Burns Beach Foreshore Reserve is the responsibility of the City of Joondalup. The City of Joondalup has a "duty of care" to take all reasonable precautions to prevent any bushfire from spreading onto neighbouring properties. The City of Joondalup does not currently have a hazard reduction burn management regime for the area.

The Department of Fire and Emergency Services (DFES) has the primary responsibility of emergency response in the event of a bushfire. DFES work with the community and local government to provide education on hazard risk management and to prevent, prepare for, respond to and recover from a diverse range of emergencies.[81]

DFES have developed an Urban Bushland Response Plan (UBRP) for Iluka Foreshore Reserve (Ocean Reef Foreshore Resolute Way to Burns Beach) and also a UBRP for Burns

[77] DPaW (2013a)
[78] DPaW (2013b)
[79] City of Joondalup (2014)
[80] EDOWA (2011)
[81] DFES (no date a)

Beach Foreshore Reserve (Burns Beach Foreshore and dunes to Marmion Avenue) including site specific information on ecologically sensitive areas, hazard advice, high risk areas and communications plan. The UBRP's are updated by DFES annually and identify key stakeholders including the City of Joondalup.

There are numerous public water hydrants located around Iluka-Burns Beach Foreshore Reserve which are installed and maintained by the Water Corporation and DFES, as shown in Figure 28 and Figure 29.

Undertaking fire management within Iluka-Burns Beach Foreshore Reserve will help to:

- Protect life, property and environment in Iluka-Burns Beach Foreshore Reserve and adjacent residential areas and privately owned buildings.
- Fulfil obligations under the *Bush Fires Act 1954*.
- Protect the ecological and amenity values of Iluka-Burns Beach Foreshore Reserve bushland.
- Protect landscape values (including flora and fauna) from uncontrolled fire and inappropriate suppression techniques.
- Reduce the frequency, impact and area of unplanned fires.
- Minimise the spread of disease and weeds during fire fighting operations and when establishing firebreaks.
- Minimise impacts on air quality.

Fire Risk

The most recent fuel load assessment was conducted at Iluka-Burns Beach Foreshore Reserve in 2016-17 by the City of Joondalup which indicated the site had a fuel load ranging from 5.4 to 17.5 tonnes / ha. The fuel load assessment was undertaken according to the methodology from the Fire and Emergency Services Australia (FESA) *Visual Fuel Load Guide for the Scrub Vegetation of the Swan Coastal Plain*.[82] The results of fuel load assessments are used to inform fire management of the site.

Fire Occurrences

There have been a small amount of fires at Iluka-Burns Beach Foreshore Reserve, the majority of which are believed to have been deliberately lit. Most of the fires occurred within Iluka Foreshore Reserve. Records of fire occurrences at Iluka Foreshore Reserve and Burns Beach Foreshore Reserve are detailed in Table 5 and Table 6.

Dates	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2012**	**2011**	**2010**
Fire Occurrences	0	1	0	0	1	0	1	1	1	2	0	0	1

Table 5: Fire Occurrences at Iluka Foreshore Reserve (DFES 2023)

[82] FESA (2007)

Dates	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
Fire Occurrences	0	0	0	0	0	0	0	2	0	0	0	0	0

Table 6: Fire Occurrences at Burns Beach Foreshore Reserve (DFES 2023)

Monitoring of fire occurrences and detailing fire incidents and frequency through mapping and updating the City's Geographic Information System (GIS) layer could inform fire prevention actions.

Fire Response

The closest Fire and Rescue Service Station is Joondalup Fire Station located on Drovers Place in Wanneroo and they are responsible for suppressing fires within Iluka-Burns Beach Foreshore Reserve. The Western Australia Police are responsible for the evacuation of residents and visitors, if required.

Fire Recovery

Weed control is revised after fire incidents to aid regrowth by selecting appropriate chemicals, targeting weeds if safe to do so for new seedlings, and spraying weedy grasses using targeted approaches.

Current Management Approach

The City of Joondalup implements a number of on ground measures to reduce the risk of fire, including undertaking:

- Controlled access;
- Weed (invasive) species management;
- Ad-hoc fuel load assessment and management; and
- Maintenance and installation of fire access tracks (fire access ways and strategic firebreaks).

Fuel load assessments are conducted on an as required basis and the results used to inform bushfire mitigation works on the site.

Weed control and maintenance of fire access tracks are conducted in accordance with the City's Annual Bushland Schedule.

A *Bushfire Risk Management Plan 2018 - 2023* has been developed by the City of Joondalup to identify the level of risk for fire occurrences within the City of Joondalup and proposes management strategies to be employed to reduce and mitigate the risk. Iluka Foreshore Reserve has the risk rating of extreme and Burns Beach Foreshore Reserve has the risk rating of medium within the Plan. The majority of Iluka-Burns Beach Foreshore Reserve has been rated as a bushfire prone area by the Fire and Emergency Services Commissioner, meaning that it is subject, or likely to be subject, to bushfire attack. Additional planning and building requirements may apply to development within these areas.

The City has also developed Fire Weed Management Guidelines to mitigate the impact of weeds within the post fire environment of the City's natural areas. These Guidelines are implemented within the City's natural areas after a fire event.

Recommended Fire Management Actions:

To prevent fire occurrences and minimise the environmental impact of fire occurrences in Iluka-Burns Beach Foreshore Reserve, the following management actions are proposed:

Action	Details
Maintain fire access tracks and footpaths	Maintain fire access tracks and footpaths, including weed control and pruning of vegetation, by implementing the Annual Bushland Schedule.
Implement Bushfire Risk Management Plan	Implement the City's *Bushfire Risk Management Plan* in relation to Iluka-Burns Beach Foreshore Reserve.
Monitor fire occurrences	Monitor fire occurrences through mapping and updating Geographic Information System (GIS) layers detailing fire incidents and frequency to inform fire prevention actions.
Revise weed control after fire incidents	Revise weed control after fire incidents to aid regrowth by selecting appropriate chemicals, targeting weeds if safe to do so for new seedlings, and spraying weedy grasses using backpacks.
Implement Fire Weed Management Guidelines	Implement the Fire Weed Management Guidelines, when required, to reduce the infestation of weeds in natural areas after a fire.

3.7 Education and Training

An important objective of this Plan is to ensure that the local community, visitors to the City's natural areas and those that manage the City's natural areas have the necessary awareness, knowledge, motivation and behaviour to assist in protecting the City's natural areas.

Environmental objectives cannot be achieved through the actions of the City alone; the community can also affect the local environment in both positive and negative ways. Environmental outcomes require the support of an engaged community that is aware and participating in environmental activities.

The local community can protect and enhance Iluka-Burns Beach Foreshore Reserve through the following actions:

- Contact the City if they are interested in initiating an environmental volunteer group such as the Friends of Burns Beach Foreshore Reserve to assist with bushland restoration and maintenance activities.
- Contact the City if they are interested in participating in an environmental volunteer group such as the Friends of North Ocean Reef – Iluka Foreshore to assist with bushland restoration and maintenance activities.
- Minimising access and disturbance to the site by staying on paths, not taking vehicles into natural areas, and not allowing dogs to run off-leads.
- Contain cats, particularly at night, and ensure they stay out of Iluka-Burns Beach Foreshore Reserve.
- Planting local, native species in gardens where possible.
- Avoid touching or feeding wildlife and picking wildflowers or native plants.

- Undertaking appropriate hygiene practices such as cleaning footwear when entering and leaving the site, removing any weed seeds attached to clothing and removing and disposing appropriately of dog excrement (may contain weed seed).
- Not dumping garden rubbish or littering on site. Litter could be collected from site when spotted, or people could organise or get involved with a Clean Up Australia Day event.

Schools are also an important avenue for raising awareness and interest in environmental issues and creating future community members that are aware of, appreciate and actively participate in local environmental management. There are a number of schools (e.g. Beaumaris Primary School, Burns Beach Primary School, St Simon Peter Catholic Primary School and Prendiville Catholic College) within close proximity to Iluka-Burns Beach Foreshore Reserve which creates possible bushland learning opportunities for students.

Current Management Approach

The City implements an annual Environmental Education Program to address key environmental issues and encourage greater environmental stewardship by the community. The Environmental Education Program includes a Think Green Biodiversity campaign, focussed on raising awareness of key environmental issues within the City and encouraging community participation in protecting the natural environment.

As part of the Environmental Education Program, the City has developed an Adopt a Bushland Program for students from years 4 to 6 to provide an interactive educational bushland management program. The Adopt a Bushland program could be implemented with students from years 4 to 6 at the abovementioned primary schools.

In order to educate the community about how they can protect natural areas, the City has developed a number of key brochures titled '*Being WEEDwise: Garden Escapees in the City of Joondalup*', '*Being WEEDwise: Environmental Weeds in the City of Joondalup*' and '*Protecting our Natural Areas and Parks'*.

The City of Joondalup Natural Environment Team currently conduct regular plant identification training, including weed management. New members in the Natural Environment Team undertake training for the management of pathogens.

The City's Friends Groups are instrumental in assisting to protect, preserve and enhance significant bushland areas within the City and may also benefit from training.

Recommended Education and Training Management Actions:

To increase community awareness and training opportunities regarding natural areas management, the following actions are proposed:

Action	Details
Environmental Education Program	Implement initiatives of a 'Think Green Biodiversity' campaign (part of the Environmental Education Program) targeting environmental issues such as: • pathogens • weeds • litter • fire • flora, fungi and fauna awareness • preventing hand feeding of wildlife • responsible pet ownership.
Support 'Friends of North Ocean Reef – Iluka Foreshore'	Support the 'Friends of North Ocean Reef – Iluka Foreshore' group and encourage community participation in the management of this natural area.
School Programs	Implement an Adopt a Bushland/Coastline program for students to provide an interactive bushland management program; and liaise with nearby schools such as Kinross Primary School, Francis Jordan Catholic School, Currambine Primary School, Burns Beach Primary School and Beaumaris Primary School to increase awareness of the bushland ecological values.
Natural Environment Team training	Conduct regular Natural Environment Team plant identification training, including weed management, to increase the effectiveness of weed control activities, as required.
Friends Groups training	Provide training including pathogen management and weed identification to community members involved in Friends of North Ocean Reef – Iluka Foreshore.

4.0 Implementation Plan

To ensure the Iluka-Burns Beach Foreshore Reserve Management Plan is being implemented in an effective and timely manner the following steps will be undertaken:

- Regular inspections
- Natural Area Key Performance Indicators reported on in Annual Report
- Scientific research
- Annual progress report against the actions in the Management Plan.

4.1 Inspections

Inspections of Iluka-Burns Beach Foreshore Reserve are conducted by the City of Joondalup once every 2 months and include weed monitoring, pest species monitoring and assessment of infrastructure maintenance requirements.

4.2 Monitoring and Reporting

A review of the Iluka-Burns Beach Foreshore Reserve Management Plan will be undertaken annually by reporting against progress made in implementing recommended management actions through the State of the Environment Report, as relevant.

Ongoing reporting against Council endorsed Natural Key Performance Indicators will also be undertaken to ascertain whether current management practices are leading to positive environmental outcomes. The key indicator will be measured and reported on a five yearly basis, as shown in Table 7.

Key Performance Indicator	Source	Reporting Period
Vegetation condition per area (using the Keighery Scale of vegetation condition) expressed as a percentage for each classification (pristine to completely degraded).	Data obtained through on site floristic survey undertaken to inform the review of the Management Plan with the service provided by specialised consultants.	Five Yearly 2026/27

Table 7: Natural Area Key Performance Indicator

4.3 Scientific Research and Monitoring

A flora survey and vegetation condition assessment will be conducted at Iluka-Burns Beach Foreshore Reserve in 2026/27, to inform the update of the Management Plan. Comparisons to previous surveys will be made to assess site changes over time.

4.4 Management Plan Review

The Implementation Plan for the Iluka-Burns Beach Foreshore Reserve Management Plan is to be reviewed 5 years after the initial ecological survey in 2026/27 with a major update of the Plan to be conducted 10 years after the initial ecological survey in 2031/32.

4.5 Summary of Recommended Management Actions

Biodiversity Conservation Area	Recommended Management Action	Detail	Timeframe
Flora	Flora survey	Undertake a follow up flora survey in spring to supplement previous flora surveys, within 5-10 years. Make comparisons between flora surveys to assess site changes every 5-10 years.	Within 5-10 years
	Weed survey	Undertake a follow up weed survey in winter to supplement previous weed surveys, within 5-10 years.	Within 5-10 years
	Endangered flora conservation	Investigate the planting of the identified endangered flora species to maintain or enhance the population/s to ensure the species long-term preservation within Iluka-Burns Beach Foreshore Reserve.	Within 4-5 years
	Investigate planting trees (and vegetation) for habitat	Investigate planting other species of local trees and shrubs (such as Banksia and Hakea species) to provide opportunities for nesting sites and shelter for fauna.	Within 4-5 years
	Revegetation	Support revegetation being conducted in degraded or completely degraded areas using local provenance species, as required.	Ongoing
	Restrict unauthorised access	Consider the installation of fencing or formal signage to prevent habitat degradation and weed spread from unauthorised walking/vehicle tracks.	As required
	Bi-monthly weed inspections	Conduct weed inspections every two months to establish the extent of weeds and to identify priority weed species.	Ongoing
	Weed control	Undertake a coordinated approach to regular weed control by implementing the Annual Bushland Schedule.	Ongoing
	Weed Control	Undertake a targeted approach to weed control of **Asparagus asparagoides* (Bridal Creeper) within Iluka – Burns Beach Foreshore Reserve.	Ongoing
	Weed Control	Undertake a targeted approach to weed control of **Moraea flaccida* (One-leaf Cape Tulip) within Iluka reserve, to prevent its spread into surrounding reserves.	Ongoing
	Weed Control	Undertake a targeted approach to weed control of **Ricinus communis* (Castor Oil Plant) within Iluka Foreshore Reserve.	Ongoing
	Weed control on verges	Conduct weed management of weeds on verges within and surrounding Iluka – Burns Beach Reserves including mowing of verges to reduce seed spread, spraying of weeds and spreading of certified mulch, where required.	Ongoing
	Weed Management Plan	Implement the City of Joondalup Weed Management Plan to provide an ongoing strategic approach to the management of natural areas in order to reduce the incidence of weeds.	Ongoing
Fungi	Fungi Survey	Undertake a comprehensive fungi survey in autumn or winter after substantial rain, to supplement previous incidental fungi surveys, within 5-10 years.	Within 5-10 years

Biodiversity Conservation Area	Recommended Management Action	Detail	Timeframe
Pathogens	Pathogen Management	Implement recommendations from the Pathogen Management Plan that are applicable to the management of Iluka-Burns Beach Foreshore Reserve.	Ongoing
	Hygiene Guidelines	Implement Pathogen Hygiene Procedure for City staff and Contractors, Pathogen and Weed Hygiene Guidelines and Purchasing of Landscaping Materials Guidelines to prevent the introduction or spread of weed or pathogens into Iluka-Burns Beach Foreshore Reserve.	Ongoing
Fauna	Fauna survey	Undertake a follow up fauna survey, in mid-late spring to supplement previous fauna survey, within 10 years.	Within 9-10 years
	Fauna / Ecological Linkages investigations	During on ground maintenance tasks, investigate the access points utilised by native fauna, in order to guide suitable management of native fauna within the reserve. Based on the findings, undertake an in house study aiming to improve ecological linkages between the Iluka-Burns Beach Foreshore Reserve to the Burns Beach Bushland and Neerabup National Park; and to Yellagonga Regional Park.	Within 1-2 years
	Quenda monitoring	Commence discussions with WA Universities on research and monitoring opportunities of the Quenda population.	Within 4-5 years
	Bat survey	Undertake a one week remote monitoring bat survey in summer to supplement previous one night bat survey undertaken in spring.	Within 9-10 years
	Installation of bat boxes	If bat survey indicates presence of bats, consider installing bat boxes to encourage bats to roost.	Within 9-10 years
	Feral animal control	Monitor feral animal populations and implement regular control to reduce pressures on native fauna and flora. This is inclusive of rabbit, cat and fox control. Remove feral beehives if they are identified on site and are accessible.	Ongoing
	Patrols undertaken by City Field Officers	Continue targeted patrols by City Field Officers to ensure dogs are kept on leads and their droppings are collected.	Ongoing
Social and Built Environment	Maintain conservation fencing	Maintain conservation fencing on an as needed basis (informed by inspections every 2 months) to protect the native vegetation, flora and fauna from informal access.	Ongoing
	Upgrade conservation fencing	Upgrade sections of old ring-lock conservation fencing to the newer plastic coated galvanised chain mesh fencing.	Within 4-5 years
	Investigate closure and rehabilitation of informal tracks	Investigate closure and rehabilitation of informal tracks that are used infrequently to protect vegetation.	Ongoing
	Implement Wayfinding Signage Strategy	Implement recommendations from the City's Wayfinding Signage Strategy that are applicable to the management of Iluka-Burns Beach Foreshore Reserve.	Ongoing

Biodiversity Conservation Area	Recommended Management Action	Detail	Timeframe
	Investigate additional signage requirements	Investigate any additional signage requirements, such as Aboriginal cultural heritage interpretative signage (e.g. mythological Burns Beach Waugal Aboriginal heritage site), limestone cliff danger signage and Unexploded Ordnance signage as required.	Within 4-5 years
	Patrols undertaken by City Field Officers	The City will continue to visit Iluka-Burns Beach Foreshore Reserve as part of the City Field Officers patrol regime, as a form of active surveillance of the bushland and adjoining recreational parkland.	Ongoing
	Investigate the provision of additional waste services	Monitor and investigate the provision of additional waste services to mitigate litter, as a result of increased public use and infrastructure upgrades in the active reserve.	Ongoing
	Dismantle cubby houses, BMX tracks and informal tracks	Dismantle cubby houses, BMX tracks and informal tracks as required to discourage vegetation degradation and littering in the surrounding area.	Ongoing
Fire Management	Maintain fire access tracks and footpaths	Maintain fire access tracks and footpaths, including weed control and pruning of vegetation, by implementing the Annual Bushland Schedule.	Ongoing
	Implement Bushfire Risk Management Plan	Implement the City's Bushfire Risk Management Plan in relation to Iluka-Burns Beach Foreshore Reserve.	Ongoing
	Monitor fire occurrences	Monitor fire occurrences through mapping and updating Geographic Information System (GIS) layers detailing fire incidents and frequency to inform fire prevention actions.	Ongoing
	Revise weed control after fire incidents	Revise weed control after fire incidents to aid regrowth by selecting appropriate chemicals, targeting weeds if safe to do so for new seedlings, and spraying weedy grasses using backpacks.	Ongoing
	Implement Fire Weed Management Guidelines	Implement the Fire Weed Management Guidelines, when required, to reduce the infestation of weeds in natural areas after a fire.	Ongoing

Biodiversity Conservation Area	Recommended Management Action	Detail	Timeframe
Education and Training	Environmental Education Program	Implement initiatives of a 'Think Green Biodiversity' campaign (part of the Environmental Education Program) targeting environmental issues such as: • pathogens • weeds • litter • fire • flora, fungi and fauna awareness • preventing hand feeding of wildlife • responsible pet ownership.	Ongoing
	Support 'Friends of North Ocean Reef – Iluka Foreshore'	Support the 'Friends of North Ocean Reef – Iluka Foreshore' group and encourage community participation in the management of this natural area.	Ongoing
	School Programs	Implement an Adopt a Bushland/Coastline program for students to provide an interactive bushland management program; and liaise with nearby schools such as Kinross Primary School, Francis Jordan Catholic School, Currambine Primary School, Burns Beach Primary School and Beaumaris Primary School to increase awareness of the bushland ecological values.	Ongoing
	Natural Environment Team training	Conduct regular Natural Environment Team plant identification training, including weed management, to increase the effectiveness of weed control activities, as required.	Ongoing
	Friends Groups training	Provide training including pathogen management and weed identification to community members involved in Friends of North Ocean Reef – Iluka Foreshore	Ongoing

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6.0 Appendices

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Appendix 1: Relevant Local, State and Federal Legislation, Plans and Strategies

The purpose of the Iluka-Burns Beach Foreshore Reserve Management Plan aligns with the environmental aims and objectives of the following City of Joondalup, State and Federal Government strategic plans and legislation.

Local Government

Strategic Community Plan

The City of Joondalup *Strategic Community Plan 2022-2032* highlights the focus on preservation, conservation and accessibility of the City's natural assets and the importance of engaging with the community and regional stakeholders.

Environment Plan

The City of Joondalup *Environment Plan 2014-2019* provides strategic direction in the delivery of environmental initiatives within the City of Joondalup.

Biodiversity Action Plan

The *City of Joondalup Biodiversity Action Plan 2009 – 2019* provides direction for the City's biodiversity management activities and details the development of individual Natural Areas Management Plans as an action.

Local Planning Scheme No. 3

The City's Local Planning Scheme No. 3 (LPS3) classifies land into zones and outlines how land within those zones may be used and developed. Significant natural areas that are not otherwise protected can be zoned as environmental conservation reserves to identify areas with biodiversity and conservation value and to protect those areas from development and subdivision.

Neither Iluka Foreshore Reserve or Burns Beach Foreshore Reserve are zoned as Environmental Conservation under LPS3 as they are both under a higher protection order, the MRS – Parks and Recreation.

City of Joondalup Pest Plant Local Law 2012

Under the *Agriculture and Related Resources Protection Act 1976* and the *Local Government Act 1995*, the Council of the City of Joondalup made the *Pest Plant Local Law 2012* to require the owner or occupier of private land within the City of Joondalup district to destroy, eradicate or otherwise control pest plants within a specified time. Caltrop (*Tribulus terrestis*) is designated as a pest plant.

Caltrop has not been identified in Iluka – Burns Beach Foreshore Reserve by the City of Joondalup.

Local Biodiversity Program (formerly Perth Biodiversity Project)

The City of Joondalup is one of 32 local governments participating in the Western Australian Local Government Association's (WALGA's) Local Biodiversity Program. The aim of the Local Biodiversity Program is to support local governments to effectively integrate biodiversity conservation into land use planning to protect and manage local natural areas.

As part of the Local Biodiversity Program, the City of Joondalup assessed all natural areas from 2004 onwards using the ecological criteria of the Natural Area Assessment process, resulting in a priority ranking of natural areas. The City of Joondalup assesses major conservation (without management plans), high priority and medium priority natural areas approximately every 5-7 years using this assessment tool.

Natural Area Assessments include a desktop assessment and field survey and document information such as:

- vegetation complexes
- threatened or significant flora or ecological communities
- structural plant communities
- weed species
- vegetation condition assessment
- ecological criteria rankings
- a viability estimate
- fauna species observed.

A Natural Areas Initial Field Assessment was conducted at Burns Beach Park in 2009.

State Government

Relevant Legislation, Policies and Plans

Aboriginal Heritage Act 1972

The Act provides a framework for protection of Aboriginal cultural sites in Western Australia.

Iluka Foreshore Reserve contains the mythological Burns Beach Waugal Aboriginal heritage site (ID 22672) which is registered with the Department of Planning, Lands and Heritage as a State protected Aboriginal heritage site.

Biodiversity Conservation Act 2016

The Act provides for the conservation and protection of biodiversity, particularly threatened species and threatened ecological communities.

One flora species listed as Endangered under the EPBC Act and the BC Act was recorded within the Iluka survey area, namely *Marianthus paralius* (WA Herbarium ACC/8941/E). No Threatened flora species listed under the EPBC Act or BC Act were recorded within the Burns Beach survey area.

One conservation significant fauna species was observed during the Iluka field survey, the Carnaby's Cockatoo (*Calyptorhynchus latirostris);* listed as Endangered under the EPBC Act and BC Act.

Biosecurity and Agriculture Management Act 2007

The Act gives provision to control the entry, establishment, spread and impact of certain organisms that have or may have an adverse effect on other organisms, human beings, the environment, agricultural activities or related commercial activities. Pests, including plants, are declared under the Act as prohibited organisms.
One the Declared Pest species **Moraea flaccida* (One-leaf Cape Tulip), was recorded during the Iluka – Burns Beach Foreshore Reserve survey.

Bush Fires Act 1954

The Act makes provision for diminishing the dangers resulting from bush fires and for the prevention, control and extinguishment of bush fires.

Cat Act 2011

The Act makes provision for the control and management of cats and promotes and encourages the responsible ownership of cats.

Cats may be seized if they are found wandering in public areas, such as Iluka-Burns Beach Foreshore Reserve, in accordance with the *Cat Act 2011*.

Dog Act 1976

The Act makes provisions for the control of dogs in public and private spaces and promotes the responsible ownership of dogs.

Iluka-Burns Beach Foreshore Reserve is designated as a place where dogs must be on a leash at all times by Council resolution in accordance with the *Dog Act 1976*.

Environmental Protection Act 1986

The Act provides authority to the Environmental Protection Authority (EPA) for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment in Western Australia.

Heritage of Western Australia Act 1990

The Act provides for and encourages the conservation of places which have significance to the cultural heritage in the State.

Government of Western Australia "Bush Forever" Strategy 2000

The Strategy identifies regionally significant bushland in the Perth Metropolitan Region to be retained, managed and protected forever.

Iluka Foreshore Reserve is designated as Bush Forever site 325 and the majority of Burns Beach Foreshore Reserve is designated as Bush Forever site 322.

Two DBCA listed flora species were recorded in the Iluka survey area; *Hibbertia leptotheca* (P3) and *Jacksonia sericea* (P4).

A further eight Bush Forever significant species were recorded within the survey areas; *Agonis flexuosa, Callitris preissii, Grevillea preissii* subsp*. preissii* and *Melaleuca lanceolata* within Burns Beach and *Diplopeltis huegelii*, *Grevillea preissii* subsp*. preissii*, *Lechenaultia linarioides*, *Melaleuca cardiophylla,* and *Trymalium ledifolium* within Iluka Foreshore. These species are listed as Bush Forever significant species of the Perth Metropolitan Region due to their being endemic to the Swan Coastal Plain.

Draft Perth and Peel Green Growth Plan for 3.5 million (Green Growth Plan)

The *Green Growth Plan* delivers a comprehensive environmental program for the protection of both Commonwealth matters of national environmental significance and State environmental values. The draft *Green Growth Plan* provides a comprehensive approach to the avoidance and mitigation of environmental impacts and a committed Conservation Program that will deliver significant improvements to the protection and management of the environment as the Perth and Peel regions grow to a population of 3.5 million people.

State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region

The *State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region* aims to provide direction and an implementation framework that will ensure bushland protection and management issues in the Perth Metropolitan Region are appropriately addressed and integrated with broader land use planning and decision-making.

State Planning Policy 3.7 - Planning in Bushfire Prone Areas
The *State Planning Policy 3.7 – Planning in Bushfire Prone Areas* (SPP 3.7) seeks to guide the implementation of effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on new property and infrastructure. SPP 3.7 applies to all higher order strategic planning documents, strategic planning proposals, subdivision and development applications located in designated bushfire prone areas.

Federal Government

Relevant Legislation and Strategies

Environment Protection and Biodiversity Conservation Act 1999

The Act provides for the protection of the environment and the conservation of biodiversity, and for related purposes.

One *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* listed fauna species have been recorded in Iluka Foreshore Reserve, the endangered Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*). In addition, one flora species listed as Endangered under the EPBC Act was recorded within the Iluka survey area, namely *Marianthus paralius*.

Australia's Biodiversity Conservation Strategy 2010-2030

The Strategy aims to protect biological diversity and maintain ecological processes and systems.

Australia's Strategy for Nature 2019-2030

The Strategy is the overarching framework for all national, state and territory and local strategies, legislation, policies and actions that target nature. The strategy moves away from a purely protection-based approach and strives to incorporate adaptation, resilience and natural resource management in cities, rural and natural environments, on land and at sea.

Australian Pest Animal Strategy 2017-2027

The strategy provides national guidance on best practice vertebrate pest animal management, in striving towards the national vision of protecting Australia's economy, environment and social wellbeing from the impact of pest animals. It reaffirms agreed national pest animal management principles, and sets national goals and priorities that will help improve Australia's overall ability to prevent and respond to new pest animal incursions and manage the negative impacts of established pest animals.

Australian Weeds Strategy 2017-2027

The strategy provides national guidance on best practice weed management. It aims to guide coordination of effort across all jurisdictions and affected stakeholders and to inform plans and actions by state and territory governments, local governments, regional natural resource management (NRM) agencies, as well as by industry, landholders and the wider community.

Threatened Species Strategy 2021-2031

The Australian Government's Threatened Species Strategy delivers a framework for action to protect and recover our nation's threatened plants and animals across Australia, spanning terrestrial, marine and freshwater environments. It sets a clear vision to drive practical on-ground action; identifies key action areas that are fundamental to the recovery of threatened species and ecological communities; and establishes principles for identifying priority threatened species and places to focus Australian Government effort. The Strategy provides guidance into how the Australian community can work together to protect threatened animals and plants, both now and into the future and is underpinned by consecutive 5 year Action Plans.

The Australian Government endorsed a list of 20 Weeds of National Significance (WoNS) in 1999 and a further 12 species were added in 2012. The 32 WoNS are identified as nationally agreed priority plant species for control and management based on the criteria of invasiveness and impact characteristics, potential and current area of spread and economic, environmental and social impacts.

Iluka – Burns Beach Foreshore Reserve contains one known WoNS, namely *Asparagus asparagoides* (Bridal Creeper).

International Conventions or Listings

International Union for Conservation of Nature (IUCN) Red List of Threatened Species

The IUCN Red List of Threatened Species™ provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria.

One endangered IUCN Red List species has been recorded in Iluka-Burns Beach Foreshore Reserve, Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*).

United Nations Convention on Biological Diversity (CBD)

The *Convention on Biological Diversity* (CBD) is one of three international environment agreements that emerged from the Rio Earth Summit held in 1992. The CBD is the overarching global framework on biodiversity conservation for the United Nations system and links all related biodiversity-related conventions and cascading treaties.

United Nations Convention on Migratory Species

The Convention on Migratory Species (CMS) aims to build and strengthen global conservation efforts for migratory species in the air, on land, and in the seas.

Appendix 2: Iluka – Burns Beach Foreshore Reserve Flora Species List

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
Asparagaceae	**Agave americana*									X					
Poaceae	**Aira caryophyllea subsp. caryophyllea*	Silvery Hairgrass													X
Poaceae	**Aira caryophyllea*	Silvery Hairgrass						X					X		
Aizoaceae	**Aizoon pubescens*									X					
Poaceae	**Ammophila arenaria*									X					
Rosaceae	**Aphanes arvensis*									X					
Asteraceae	**Arctotheca calendula*	Cape Weed			X			X		X		X	X		X
Asteraceae	**Arctotheca populifolia*									X					
Asteraceae	**Arctotis stoechadifolia*	African daisy							X			X		X	
Asparagaceae	**Asparagus asparagoides*	Bridal Creeper											X	X	
Poaceae	**Avena barbata*	Bearded Oat								X		X	X	X	X
Poaceae	**Avena fatua*	Wild Oat										X		X	X
Orobanchaceae	**Bellardia trixago*	Mediterranean Lineseed			X					X					
Brassicaceae	**Brassica barrelieri*									X					
Brassicaceae	**Brassica tournefortii*	Mediterranean Turnip								X		X	X	X	X

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
Poaceae	**Briza maxima*	Blowfly Grass						X					X	X	X
Poaceae	**Briza minor*	Shivery Grass			X					X			X		X
Poaceae	**Bromus catharticus*									X					
Poaceae	**Bromus diandrus*	Great Brome						X		X		X	X	X	X
Poaceae	**Bromus rubens*	Red Brome			X										
Brassicaceae	**Cakile maritima*	Sea Rocket								X		X	X	X	X
Asteraceae	**Carduus pycnocephalus*	Slender Thistle											X		
Aizoaceae	**Carpobrotus aequilaterus*									X					
Aizoaceae	**Carpobrotus edulis*	Hottentot Fig			X	X		X	X	X		X	X	X	X
Poaceae	**Catapodium rigidum*	Rigid Fescue			X	X								X	X
Poaceae	**Cenchrus clandestinus*	Kikuyu Grass							X			X		X	X
Asteraceae	**Centaurea melitensis*	Maltese Cockspur								X			X		
Caryophyllaceae	**Cerastium glomeratum*	Sticky Mouse-ear Chickweed			X										
Myrtaceae	**Chamelaucium uncinatum*	Geraldton Wax								X					X
Crassulaceae	**Crassula glomerata*					X			X			X		X	X
Convolvulaceae	**Cuscuta epithymum*	Lesser Dodder												X	
Convolvulaceae	**Cuscuta planiflora*	Small-seeded Dodder											X		

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
Poaceae	**Cynodon dactylon*	Couch										X		X	
Poaceae	**Digitaria ciliaris*									X					
Scrophulariaceae	**Dischisma arenarium*													X	
Poaceae	**Ehrharta calycina*	Perennial Veldt Grass								X			X	X	X
Poaceae	**Ehrharta longiflora*	Annual Veldt Grass				X		X	X			X	X	X	X
Poaceae	**Eragrostis curvula*									X					
Asteraceae	**Erigeron bonariensis*									X					
Asteraceae	**Erigeron sumatrensis*									X					
Geraniaceae	**Erodium botrys*	Long Storksbill								X			X		
Geraniaceae	**Erodium cicutarium*	Common Stork's-bill			X										
Euphorbiaceae	**Euphorbia paralias*	Sea Splurge								X			X	X	
Euphorbiaceae	**Euphorbia peplus*	Petty Spurge											X		X
Euphorbiaceae	**Euphorbia sp.*							X							
Euphorbiaceae	**Euphorbia terracina*	Geraldton Carnation Weed								X			X	X	X
Papaveraceae	**Fumaria bastardii*									X					
Papaveraceae	**Fumaria capreolata*	Whiteflower Fumitory								X			X	X	X
Papaveraceae	**Fumaria muralis*									X					

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
Rubiaceae	**Galium murale*	Small Goosegrass													X
Asteraceae	**Gazania linearis*	Gazania							X			X		X	
Geraniaceae	**Geranium molle*	Dove's-foot Crane's-bill			X										
Iridaceae	**Gladiolus caryophyllaceus*	Wild Gladiolus			X			X					X		X
Brassicaceae	**Heliophila pusilla*				X	X		X					X		
Poaceae	**Hordeum leporinum*	Barley Grass								X				X	X
Asteraceae	**Hypochaeris glabra*	Smooth Cats Ear			X			X					X		X
Asparagaceae	**Lachenalia reflexa*	Cape Cowslip /Yellow Soldier													X
Asteraceae	**Lactuca saligna*									X					
Asteraceae	**Lactuca serriola*	Prickly Lettuce										X		X	X
Poaceae	**Lagurus ovatus*	Hare's Tail Grass				X				X		X	X	X	X
Cyperaceae	**Leptospermum laevigatum*									X					
Poaceae	**Lolium perenne*	Perennial Ryegrass											X		
Poaceae	**Lolium rigidum*	Rigid Ryegrass										X			
Primulaceae	**Lysimachia arvensis*	Pimpernel			X			X		X			X	X	X
Fabaceae	**Medicago polymorpha*	Burr Medic				X			X	X		X		X	X
Fabaceae	**Melilotus indicus*	Annual			X									X	X

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
		Yellow Sweetclover													
Iridaceae	**Moraea flaccida*	One-leaf Cape Tulip			X								X		X
Onagraceae	**Oenothera drummondii*	Beach Evening Primrose								X		X		X	
Onagraceae	**Oenothera stricta*									X					
Asteraceae	**Osteospermum ecklonis*	Cape Marguerite												X	X
Oxalidaceae	**Oxalis pes-caprae*	Soursob												X	X
Orobanchaceae	**Parentucellia latifolia*				X										
Geraniaceae	**Pelargonium capitatum*	Rose Pelargonium			X	X	X	X	X	X	X	X	X	X	X
Poaceae	**Pentameris airoides*	False Hairgrass								X			X		
Caryophyllaceae	**Petrorhagia dubia*	Hairy Pink			X			X					X	X	X
Plantaginaceae	**Plantago lanceolata*									X					
Caryophyllaceae	**Polycarpon tetraphyllum*	Fourleaf Allseed													X
Brassicaceae	**Raphanus raphanistrum*	Wild Radish												X	X
Euphorbiaceae	**Ricinus communis*	Castor Oil Plant						X						X	X
Iridaceae	**Romulea rosea*	Guildford Grass			X	X							X		X
Poaceae	**Rostraria cristata*	Mediterranean			X										

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
		Hairgrass													
Anacardiaceae	**Schinus terebinthifolia*	Japanese Pepper												X	X
Caryophyllaceae	**Silene gallica*	Windmill Pink				X									
Solanaceae	**Solanum linnaeanum*									X					
Solanaceae	**Solanum nigrum*	Black Berry Nightshade				X		X					X	X	
Asteraceae	**Sonchus asper*	Rough Sowthistle								X			X		
Asteraceae	**Sonchus oleraceus*	Common Sowthistle			X	X							X	X	X
Asteraceae	**Sonchus sp.*								X						
Caryophyllaceae	**Stellaria media*	Chickweed			X									X	X
Aizoaceae	**Tetragonia decumbens*	Sea Spinach				X			X	X				X	X
Poaceae	**Thinopyrum distichum*									X					
Asphodelaceae	**Trachyandra divaricata*	Dune Onion Weed						X	X				X	X	X
Fabaceae	**Trifolium campestre*	Hop Clover			X									X	
Fabaceae	**Trifolium dubium*	Suckling Clover								X			X		
Fabaceae	**Trifolium tomentosum*									X					
Tropaeolaceae	**Tropaeolum sp.*														X
Asteraceae	**Urospermum picroides*									X					
Asteraceae	**Ursinia anthemoides*	Ursinia			X			X							X

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Asteraceae	**Vellereophyton dealbatum*	White Cudweed											X		
Fabaceae	**Vicia sativa*	Common Vetch													X
Poaceae	**Vulpia bromoides*	Squirrel-tail Fescue				X									
Poaceae	**Vulpia myuros*	Rat's Tail Fescue				X				X				X	X
Arecaceae	**Washingtonia filifera*									X					
Iridaceae	**Watsonia meriana var. bulbillifera*	Bugle Lily											X		
Fabaceae	*Acacia cochlearis*	Rigid Wattle				X				X			X	X	
Fabaceae	*Acacia cyclops*	Coastal Wattle			X	X	X			X		X	X	X	X
Fabaceae	*Acacia lasiocarpa var. lasiocarpa*				X		X							X	
Fabaceae	*Acacia rostellifera*	Summer-scented Wattle				X	X	X		X	X	X	X	X	X
Fabaceae	*Acacia saligna*	Orange Wattle				X		X		X		X	X	X	X
Fabaceae	*Acacia truncata*				X	X									X
Fabaceae	*Acacia pulchella*	Prickly Moses			X	X		X		X			X		
Fabaceae	*Acacia xanthina*						X			X					
Asparagaceae	*Acanthocarpus preissii*				X	X			X	X		X	X	X	X
Ericaceae	*Acrotriche cordata*	Coast Ground Berry				X				X			X	X	X
Asteraceae	*Actitis megalocarpa*						X								

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Proteaceae	*Adenanthos sp.*				X										
Myrtaceae	*Agonis flexuosa*	Peppermint												X	
Restionaceae	*Alexgeorgea nitens*							X							
Casuarinaceae	*Allocasuarina lehmanniana*						X			X					
Casuarinaceae	*Allocasuarina fraseriana*	Sheoak						X		X	X				
Casuarinaceae	*Allocasuarina humilis*	Dwarf Sheoak			X	X		X		X					
Malvaceae	*Alyogyne huegelii*					X									
Poaceae	*Amphipogon turbinatus*									X			X		
Haemodoraceae	*Anigozanthos humilis*	Catspaw			X			X							X
Solanaceae	*Anthocercis ilicifolia*									X					
Asteraceae	*Asteraceae sp.*				X								X		
Asteraceae	*Asteridea pulverulenta*				X					X					
Chenopodiaceae	*Atriplex cinerea*	Grey Saltbush										X		X	
Chenopodiaceae	*Atriplex isatidea*	Coast Saltbush								X			X		
Poaceae	*Austrostipa elegantisssima*												X		
Poaceae	*Austrostipa flavescens*					X		X		X					X
Poaceae	*Austrostipa variabilis*									X					
Proteaceae	*Banksia attenuata*	Slender Banksia					X	X		X	X		X		X
Proteaceae	*Banksia dallanneyi*	Couch Honeypot									X			X	X

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Proteaceae	*Banksia lindleyana*									X					
Proteaceae	*Banksia menziesii*	Firewood Banksia				X	X	X		X			X		
Proteaceae	*Banksia nivea*				X	X									
Proteaceae	*Banksia sessilis*	Parrot Bush			X	X		X			X			X	X
Proteaceae	*Banksia sessilis var. cygnorum*						X			X			X		
Proteaceae	*Banksia dallanneyi subsp. agricola*							X							
Fabaceae	*Bossiaea eriocarpa*	Common Brown Pea			X	X		X		X				X	X
Asteraceae	*Brachyscome sp.*					X									
Poaceae	*Bromus arenarius*				X	X				X					
Colchicaceae	*Burchardia congesta*							X		X			X		
Hemerocallidaceae	*Caesia micrantha*	Pale Grass-lily						X							
Orchidaceae	*Caladenia flava*				X					X					
Orchidaceae	*Caladenia latifolia*				X					X					
Orchidaceae	*Caladenia longicauda*	Common White Spider Orchid						X							
Montiaceae	*Calandrinia brevipedata*	Short-stalked Purslane												X	X
Montiaceae	*Calandrinia calyptrata*				X										
Montiaceae	*Calandrinia granulifera*					X									

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Montiaceae	*Calandrinia liniflora*				X								X		
Montiaceae	*Calandrinia tholiformis*													X	X
Montiaceae	*Calandrinia corrigioloides*	Strap Purslane						X							
Dasypogonaceae	*Calectasia narragara*									X					
Cupressaceae	*Callitris preissii*	Rottnest Island Pine								X				X	
Myrtaceae	*Calothamnus quadrifidus*	One-sided Bottlebrush				X	X	X		X			X	X	X
Myrtaceae	*Calothamnus sanguineus*				X										
Myrtaceae	*Calytrix fraseri*	Pink Summer Calytrix						X							
Aizoaceae	*Carpobrotus sp.*					X									
Aizoaceae	*Carpobrotus virescens*	Coastal Pigface				X				X		X	X		
Lauraceae	*Cassytha flava*	Dodder Laurel								X				X	X
Lauraceae	*Cassytha pomiformis*									X					
Lauraceae	*Cassytha sp.*														X
Lauraceae	*Cassytha racemosa*	Dodder Laurel			X	X		X		X			X		
Cyperaceae	*Chaetospora curvifolia*							X							
Fabaceae	*Chorizema aciculare*				X										
Ranunculaceae	*Clematis linearifolia*				X					X			X		X
Gyrostemonaceae	*Codonocarpus cotinifolius*												X		

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Polygalaceae	*Comesperma confertum*				X					X					
Polygalaceae	*Comesperma integerrimum*												X		X
Polygalaceae	*Comesperma virgatum*									X					
Proteaceae	*Conospermum triplinervium*						X								
Ericaceae	*Conostephium pendulum*	Pearl Flower				X		X		X			X		
Haemodoraceae	*Conostylis aculeata*	Prickly Conostylis			X	X		X		X			X		
Haemodoraceae	*Conostylis aculeata subsp. preissii*													X	X
Haemodoraceae	*Conostylis aurea*												X		
Haemodoraceae	*Conostylis candicans subsp. calcicola*													X	
Haemodoraceae	*Conostylis candicans subsp. candicans*									X					X
Haemodoraceae	*Conostylis pauciflora subsp. euryrhipis*			P4			X								
Haemodoraceae	*Conostylis setigera*	Bristly Cottonhead						X		X			X	X	X
Hemerocallidaceae	*Corynotheca micrantha*	Sand Lily			X			X					X		X
Asteraceae	*Cotula turbinata*									X					
Crassulaceae	*Crassula colorata*	Dense Stonecrop			X	X		X					X	X	X
Crassulaceae	*Crassula extrorsa*									X					
Rhamnaceae	*Cryptandra arbutiflora*									X					
Rhamnaceae	*Cryptandra mutila*				X					X					

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Goodeniaceae	*Dampiera linearis*	Common Dampiera			X			X							
Apiaceae	*Daucus glochidiatus*	Australian Carrot			X	X							X	X	X
Fabaceae	*Daviesia capitatum*									X					
Fabaceae	*Daviesia decurrens*									X					
Fabaceae	*Daviesia divaricata*	Marno			X			X							
Fabaceae	*Daviesia incrassata*				X										
Fabaceae	*Daviesia triflora*							X							
Restionaceae	*Desmocladus asper*									X			X		
Restionaceae	*Desmocladus flexuosus*				X	X		X		X				X	X
Hemerocallidaceae	*Dianella revoluta*	Blueberry Lily				X				X			X		X
Hemerocallidaceae	*Dianella revoluta var. divaricata*	Flax Lily						X							
Asparagaceae	*Dichopogon capillipes*									X					
Rutaceae	*Diplolaena dampieri*									X					
Sapindaceae	*Diplopeltis huegelii*				X										X
Sapindaceae	*Diplopeltis huegelii subsp. huegelii*						X								
Droseraceae	*Drosera pallida*									X			X		
Droseraceae	*Drosera erythrorhiza*	Red Ink Sundew						X		X					
Droseraceae	*Drosera macrantha*				X					X					

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Orchidaceae	*Elythranthera brunonis*									X					
Chenopodiaceae	*Enchylaena tomentosa*	Barrier Saltbush				X				X			X		
Myrtaceae	*Eremaea pauciflora*							X							
Scrophulariaceae	*Eremophila glabra*				X	X									
Scrophulariaceae	*Eremophila glabra subsp. albicans*														X
Orchidaceae	*Eriochilus dilatatus*				X										
Myrtaceae	*Eucalyptus utilis*	Coastal Moort												X	
Myrtaceae	*Eucalyptus decipiens*	Redheart			X			X		X	X				
Myrtaceae	*Eucalyptus foecunda*	Narrow-leaved Red Mallee			X			X		X					
Myrtaceae	*Eucalyptus gomphocephala*						X			X	X		X		
Myrtaceae	*Eucalyptus marginata*										X				
Myrtaceae	*Eucalyptus todtiana*	Pricklybark						X					X		
Santalaceae	*Exocarpos sp.*				X								X		
Santalaceae	*Exocarpos sparteus*	Broom Ballart				X				X				X	
Fabroniaceae	*Fabronia hampeana*			P2						X					
Cyperaceae	*Ficinia nodosa*	Knotted Club Rush				X			X	X		X	X	X	X
Frankeniaceae	*Frankenia pauciflora*	Seaheath				X			X						X
Fabaceae	*Gastrolobium capitatum*				X										

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Fabaceae	*Gastrolobium nervosum*					X	X	X		X				X	X
Fabaceae	*Gastrolobium tomentosum*			P4						X					
Asteraceae	*Gnephosis angianthoides*									X					
Fabaceae	*Gompholobium aristatum*					X									
Fabaceae	*Gompholobium tomentosum*	Hairy Yellow Pea			X			X					X	X	X
Proteaceae	*Grevillea crithmifolia*													X	X
Proteaceae	*Grevillea preissii subsp. preissii*						X			X				X	X
Proteaceae	*Grevillea thelemanniana*	Spider Net Grevillea	CR	CR	X	X		X							
Proteaceae	*Grevillea vestita*							X							
Proteaceae	*Hakea costata*	Ribbed Hakea			X			X							
Proteaceae	*Hakea lissocarpha*	Honey Bush				X		X		X			X		
Proteaceae	*Hakea prostrata*	Harsh Hakea			X	X		X							
Proteaceae	*Hakea ruscifolia*	Candle Hakea						X							
Proteaceae	*Hakea trifurcata*	Two-leaf Hakea			X		X	X		X					
Fabaceae	*Hardenbergia comptoniana*	Native Wisteria			X	X		X	X	X		X	X	X	X
Lamiaceae	*Hemiandra glabra*									X				X	
Lamiaceae	*Hemiandra pungens*					X			X	X			X		
Dilleniaceae	*Hibbertia cuneiformis*	Cutleaf Hibbertia												X	X

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Dilleniaceae	*Hibbertia huegelii*									X					
Dilleniaceae	*Hibbertia hypericoides*	Yellow Buttercups			X	X	X	X		X			X	X	X
Dilleniaceae	*Hibbertia leptotheca*			P3		X	X								X
Dilleniaceae	*Hibbertia polystachya*				X										
Dilleniaceae	*Hibbertia racemosa*	Stalked Guinea Flower			X	X	X								X
Dilleniaceae	*Hibbertia subvaginata*									X					
Fabaceae	*Hovea pungens*	Devil's Pins			X			X							
Fabaceae	*Hovea stricta*				X										
Fabaceae	*Hovea trisperma*	Common Hovea						X							
Asteraceae	*Hyalosperma cotula*									X					
Violaceae	*Hybanthus angustifolium*									X					
Violaceae	*Hybanthus calycinus*	Wild Violet			X			X		X			X	X	X
Araliaceae	*Hydrocotyle diantha*				X										
Araliaceae	*Hydrocotyle intertexta*				X										
Cyperaceae	*Isolepis marginata*	Coarse Club-rush			X			X					X	X	
Fabaceae	*Isotropis cuneifolia*	Granny Bonnets						X		X					
Fabaceae	*Jacksonia calcicola*						X								
Fabaceae	*Jacksonia sericea*	Waldjumi		P4		X				X					X

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Fabaceae	*Jacksonia furcellata*	Grey Stinkwood			X			X		X					
Fabaceae	*Jacksonia sternbergiana*	Stinkwood						X		X					
Fabaceae	*Kennedia coccinea*					X									
Fabaceae	*Kennedia prostrata*	Scarlet Runner			X	X				X			X	X	X
Myrtaceae	*Kunzea glabrescens*	Spearwood												X	
Asteraceae	*Lagenophora huegelii*				X			X		X					
Goodeniaceae	*Lechenaultia linarioides*	Yellow Leschenaultia			X		X								X
Cyperaceae	*Lepidosperma angustatum*					X				X					
Cyperaceae	*Lepidosperma calcicola*													X	X
Cyperaceae	*Lepidosperma costale*									X					
Cyperaceae	*Lepidosperma empetriformis*									X					
Cyperaceae	*Lepidosperma gladiatum*	Coast Sword-sedge				X			X	X		X	X	X	X
Cyperaceae	*Lepidosperma longitudinale*	Pithy Sword-sedge											X		
Cyperaceae	*Lepidosperma squamatum*												X		
Cyperaceae	*Lepidosperma angustatum*							X							
Santalaceae	*Leptomeria empetriformis*						X								
Asteraceae	*Leucophyta brownii*						X		X	X					
Ericaceae	*Leucopogon insularis*												X		

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Ericaceae	*Leucopogon parviflorus*	Coast Beard-heath			X	X				X			X	X	X
Ericaceae	*Leucopogon polymorphus*									X					
Ericaceae	*Leucopogon sprengelioides*							X							
Stylidiaceae	*Levenhookia pusilla*												X		
Campanulaceae	*Lobelia heterophylla*	Wing-seeded Lobelia											X		
Asparagaceae	*Lomandra hermaphrodita*									X					
Asparagaceae	*Lomandra maritima*					X	X			X	X		X	X	X
Asparagaceae	*Lomandra preissii*												X		
Asparagaceae	*Lomandra caespitosa*	Tufted Mat Rush						X							
Restionaceae	*Loxocarya cinerea*					X									
Anarthriaceae	*Lyginia barbata*							X							
Ericaceae	*Lysinema ciliatum*	Curry Flower			X			X							
Zamiaceae	*Macrozamia fraseri*							X		X			X		
Zamiaceae	*Macrozamia riedlei*												X		
Pittosporaceae	*Marianthus paralius*		EN	EN							X				X
Myrtaceae	*Melaleuca cardiophylla*	Tangling Melaleuca				X	X			X			X		X
Myrtaceae	*Melaleuca huegelii*	Chenille Honeymyrtle			X	X	X		X	X	X		X	X	X
Myrtaceae	*Melaleuca lanceolata*	Rottnest Teatree												X	X

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Myrtaceae	*Melaleuca systena*				X	X	X	X		X	X		X	X	X
Cyperaceae	*Mesomelaena pseudostygia*							X					X		
Asteraceae	*Millotia myosotidifolia*				X					X					
Scrophulariaceae	*Myoporum insulare*	Blueberry Tree				X	X		X	X		X	X	X	
Nitrariaceae	*Nitraria billardierei*					X			X						
Loranthaceae	*Nuytsia floribunda*	Christmas Tree						X		X			X		
Olacaceae	*Olax benthamiana*					X									X
Asteraceae	*Olearia axillaris*	Coastal Daisybush			X	X	X	X	X	X	X	X	X	X	X
Rubiaceae	*Opercularia vaginata*	Dog Weed			X			X							
Iridaceae	*Orthrosanthus laxus*	Morning Iris						X		X					
Urticaceae	*Parietaria cardiostegia*														X
Urticaceae	*Parietaria debilis*	Pellitory			X									X	
Geraniaceae	*Pelargonium littorale*				X										
Proteaceae	*Persoonia saccata*	Snottygobble						X							
Proteaceae	*Petrophile sp.*									X					
Proteaceae	*Petrophile brevifolia*					X				X					
Proteaceae	*Petrophile linearis*	Pixie Mops						X							
Proteaceae	*Petrophile macrostachya*					X		X							
Proteaceae	*Petrophile media*							X							

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Proteaceae	*Petrophile serruriae*				X		X	X							
Orchidaceae	*Pheladenia deformis*				X										
Rutaceae	*Philotheca spicata*				X										
Phyllanthaceae	*Phyllanthus calycinus*	False Boronia			X	X		X		X			X	X	X
Thymelaeaceae	*Pimelea argentea*									X			X		
Thymelaeaceae	*Pimelea calcicola*			P3			X								
Thymelaeaceae	*Pimelea ferruginea*				X										
Thymelaeaceae	*Pimelea leucantha*									X			X		
Thymelaeaceae	*Pimelea sulphurea*	Yellow Banjine				X		X							
Thymelaeaceae	*Pimelea sylvestris*				X										
Thymelaeaceae	*Pimelea villifera*						X								
Asteraceae	*Pithocarpa cordata*									X			X		
Plantaginaceae	*Plantago exilis*					X									X
Poaceae	*Poa drummondiana*				X										
Poaceae	*Poa porphyroclados*							X							
Poaceae	*Poaceae sp.*													X	X
Asteraceae	*Podolepis gracilis*									X					
Asteraceae	*Podotheca gnaphalioides*	Golden Longheads								X			X		X
Phyllanthaceae	*Poranthera microphylla*				X										

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Orchidaceae	*Pterostylis aspera*									X					
Orchidaceae	*Pterostylis sp. (nana complex)*													X	
Amaranthaceae	*Ptilotus sp.*									X					
Amaranthaceae	*Ptilotus polystachyus*	Prince of Wales Feather						X		X					
Asteraceae	*Quinetia urvillei*							X							
Chenopodiaceae	*Rhagodia baccata*	Berry Saltbush			X	X			X	X		X	X	X	X
Asteraceae	*Rhodanthe citrina*									X			X		
Asteraceae	*Rhodanthe corymbosa*					X									X
Poaceae	*Rytidosperma occidentale*									X					
Chenopodiaceae	*Salicornia quinqueflora*					X									
Santalaceae	*Santalum acuminatum*	Quandong				X				X				X	X
Aizoaceae	*Sarcozona bicarinata*			P3											
Goodeniaceae	*Scaevola anchusifolia*									X					
Goodeniaceae	*Scaevola canescens*					X				X					
Goodeniaceae	*Scaevola crassifolia*	Thick-leaved Fan-flower				X	X		X	X	X	X	X	X	X
Goodeniaceae	*Scaevola nitida*				X		X			X			X		
Goodeniaceae	*Scaevola repens*														X
Goodeniaceae	*Scaevola thesioides*												X		

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
Cyperaceae	*Schoenoplectiella lateriflora*							X							
Cyperaceae	*Schoenus clandestinus*												X		
Cyperaceae	*Schoenus grandiflorus*	Large Flowered Bogrush				X									X
Cyperaceae	*Schoenus lanatus*				X										
Asteraceae	*Senecio hispidulus*	Hispid Fireweed								X			X		
Asteraceae	*Senecio pinnatifolius*									X			X		
Asteraceae	*Senecio pinnatifolius var. latilobus*													X	X
Asteraceae	*Senecio sp.*								X						
Asparagaceae	*Sowerbaea laxiflora*									X					
Fabaceae	*Sphaerolobium medium*				X										
Fabaceae	*Sphaerolobium sp.*							X							
Poaceae	*Spinifex hirsutus*	Hairy Spinifex					X			X				X	
Poaceae	*Spinifex longifolius*	Beach Spinifex					X		X	X		X		X	
Poaceae	*Sporobolus virginicus*					X			X						
Rhamnaceae	*Spyridium globulosum*	Basket Bush			X	X	X	X	X	X	X	X	X	X	X
Brassicaceae	*Stenopetalum gracile*									X					
Proteaceae	*Stirlingia latifolia*	Blueboy						X							
Stylidiaceae	*Stylidium brunonianum*	Pink Fountain			X			X							

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
		Triggerplant													
Stylidiaceae	*Stylidium guttatum*				X										
Stylidiaceae	*Stylidium junceum*	Reed Triggerplant			X			X							
Stylidiaceae	*Stylidium maritimum*			P3			X								
Stylidiaceae	*Stylidium repens*	Matted Triggerplant						X							
Stylidiaceae	*Stylidium schoenoides*	Cow Kicks						X							
Ericaceae	*Styphelia pallida*				X	X									
Ericaceae	*Styphelia racemulosa*				X										
Ericaceae	*Styphelia xerophylla*									X					
Proteaceae	*Synaphea petiolaris*	Synaphea						X							
Fabaceae	*Templetonia retusa*	Cockies Tongues			X	X				X			X	X	X
Poaceae	*Tetrarrhena laevis*	Forest Ricegrass												X	
Orchidaceae	*Thelymitra campanulata*									X					
Malvaceae	*Thomasia cognata*				X	X									
Malvaceae	*Thomasia triphylla*														X
Chenopodiaceae	*Threlkeldia diffusa*	Coast Bonefruit				X			X	X		X		X	X
Asparagaceae	*Thysanotus dichotomus*	Branching Fringe Lily											X		

Family	Species name / Latin name	Common name	Conservation status		Previous studies									2020 Survey	
			EPBC Act	BC Act / DBCA	Foulds 1982	Keighery 1992	Government of Western Australia 2000	Beaumaris Land Sales 2001	City of Joondalup 2009	GHD 2013	City of Joondalup 2014	Natural Area 2017	AECOM 2018	ELA 2021 Burns Beach	ELA 2021 Iluka
Asparagaceae	*Thysanotus manglesianus*	Fringed Lily								X			X		X
Asparagaceae	*Thysanotus patersonii*				X	X		X					X		
Asparagaceae	*Thysanotus multiflorus*	Many-flowered Fringe Lily						X							
Araliaceae	*Trachymene pilosa*	Native Parsnip			X	X				X			X	X	X
Hemerocallidaceae	*Tricoryne elatior*	Yellow Autumn Lily			X	X								X	X
Rhamnaceae	*Trymalium ledifolium*				X					X					X
Rhamnaceae	*Trymalium ledifolium subsp. ledifolium*						X								
Campanulaceae	*Wahlenbergia capensis*	Cape Bluebell											X		
Campanulaceae	*Wahlenbergia gracilenta*				X										
Campanulaceae	*Wahlenbergia preissii*							X		X					
Asteraceae	*Waitzia nitida*									X					
Asteraceae	*Waitzia suaveolens*	Fragrant Waitzia						X							
Lamiaceae	*Westringia dampieri*											X			
Colchicaceae	*Wurmbea dioica*				X										
Xanthorrhoeaceae	*Xanthorrhoea preissii*	Grass Tree				X		X		X			X		
Apiaceae	*Xanthosia huegelii*							X							

+ = recorded during survey.

• = listed within database search for respective survey but not recorded during that survey.

* = introduced species.

^ = species recorded as an opportunistic collection

CR = listed as Critically Endangered under the EPBC Act, WC Act and the IUCN red list.

EN = listed as Endangered under the EPBC Act, WC Act and the IUCN red list.

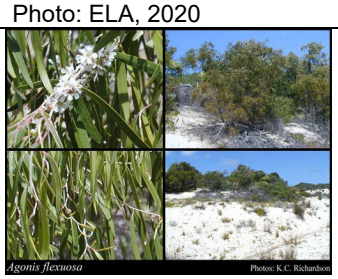
VU = listed as Vulnerable under the EPBC Act, WC Act and the IUCN red list.

P1, P2, P3 = Taxa that may be threatened or near threatened, but are data deficient or have not yet been adequately surveyed to be listed under the Wildlife Conservation (Rare Flora) Notice

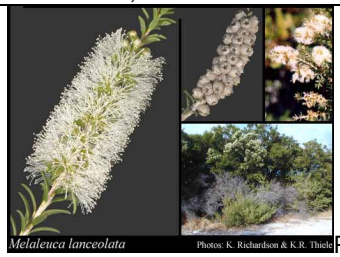
P4 = Taxa that are not currently threatened but could if present circumstances change. These taxa are usually represented on conservation lands.

Appendix 3: Iluka – Burns Beach Foreshore Reserve Key Flora Species

Priority and Significant Flora at Iluka – Burns Beach Foreshore Reserve

Name	Common Name	Conservation Code	Image
Marianthus paralius		Endangered under EPBC Act and *Biodiversity Conservation Act 2016*	 Photo: ELA, 2020
Hibbertia leptotheca		Priority 3 / Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: ELA, 2020
Jacksonia sericea	Waldjumi	Priority Four, DBCA, *Biodiversity Conservation Act 2016*; Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: ELA, 2020
Agonis flexuosa		Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: DBCA & WAH, no date
Callitris preissii		Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: DBCA & WAH, no date

Name	Common Name	Conservation Code	Image
Lechenaultia linarioides		Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: ELA, 2020
Grevillea preissii subsp. *preissii*		Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: ELA, 2020
Trymalium ledifolium		Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: ELA, 2020
Diplopeltis huegelii		Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: ELA, 2020

Name	Common Name	Conservation Code	Image
Melaleuca cardiophylla		Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: ELA, 2020
Melaleuca lanceolata		Significant Flora of the Perth Metropolitan Region, Bush Forever Strategy (2000)	 Photo: DBCA & WAH, no date

Note: For further explanations on Conservation Codes, refer to Appendix 4.

Appendix 4: Conservation Codes for WA Flora and Fauna

Conservation Codes for WA Flora and Fauna under the *Biodiversity Conservation Act 2016*

Category	Definition
Threatened (T)	Listed in the category of critically endangered, endangered or vulnerable, as outlined below.
Critically Endangered (CR)	Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
Vulnerable (VU)	Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Migratory (MI)	Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: • the Bonn Convention (*Convention on the Conservation of Migratory Species of Wild Animals*) for which Australia is a range state. • the agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA). • the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA). • the agreement between Australia and the Republic of Korea to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA in respect to migratory birds (ROKAMBA). • Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
Conservation Dependent (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention.
Other specially protected species (OS)	Fauna otherwise in need of special protection to ensure their conservation.

The City of Joondalup has added a category listed as Locally Significant to reflect locally significant native species within the City of Joondalup. Locally Significant species are defined below.

Category	Definition
Locally Significant (LS) - City of Joondalup	Taxa within the City of Joondalup who are at risk of predation or extinction from within the City due to a variety of environmental and external factors. These populations are in need of conservation and monitoring, thus are classed as Locally Significant species within the City of Joondalup.

Priority flora and fauna categories used by the Department of Biodiversity, Conservation and Attractions (2019)

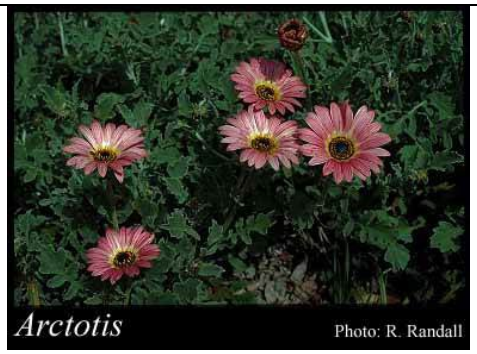
Category	Code	Definition
Priority 1	P1	*Poorly-known species* Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2	P2	*Poorly-known species* Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3	P3	*Poorly-known species* Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	P4	*Rare, Near Threatened and other species in need of monitoring* (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix 5: Keighery Vegetation Condition Scale Definitions

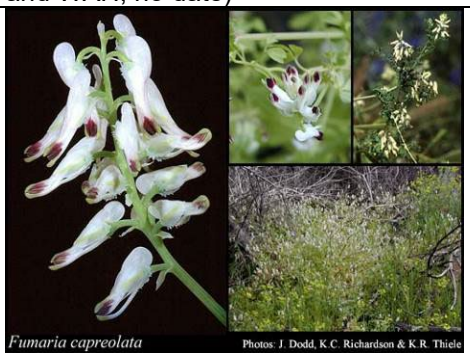
Vegetation Condition	Description
Pristine	Pristine or nearly so, with no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered with obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and 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 and 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 some very aggressive weeds at high density, partial clearing, dieback and 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.

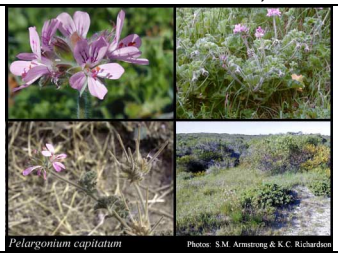
Source: Keighery 1994

Appendix 6: Examples of Priority Weed Species at Iluka – Burns Beach Foreshore Reserve

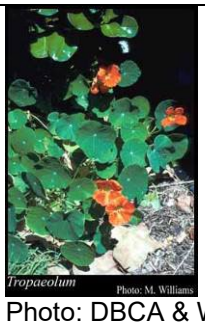
Name	Common Name	Conservation Code	Image
Arctotis sp.	Arctotis	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Asparagus asparagoides	Bridal creeper	WoNS and Declared Pest - s22(2), City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Avena fatua	Wild Oats	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Carpobrotus edulis	Pigface	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.

Name	Common Name	Conservation Code	Image
Chamelaucium uncinatum	Geraldton Wax	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Cynodon dactylon	Couch grass	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Dimorphotheca ecklonis (more recently known as *Osteospermum ecklonis (D C.) Norl.*)	Veldt Daisy	City of Joondalup Priority weed	 Photo: Urban Bushland Council, no date.
Ehrharta calycina	Perennial Veldt Grass	City of Joondalup Priority weed	 Photos: S.M. Armstrong (DBCA and WAH, no date)

Name	Common Name	Conservation Code	Image
Ehrharta longiflora	Annual Veldt Grass	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Euphorbia paralias	Sea Spurge	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Euphorbia terracina	Geraldton Carnation Weed	City of Joondalup Priority weed	 Photos: J.Dodd and K.R. Thiele (DBCA and WAH, no date)
Fumaria capreolata	Fumitory	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.

Name	Common Name	Conservation Code	Image
Gazania linearis	Gazania	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Lactuca serriola	Prickle Lettuce	City of Joondalup Priority weed)	 Photo: DBCA & WAH, no date.
Moraea flaccida	One-leaf Cape Tulip	WoNS and Declared Pest, City of Joondalup Priority weed	 Photos: R. Knox and K.C. Richardson (DBCA & WAH, no date)
Oxalis pes-caprae	Soursob	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Pelargonium capitatum	Rose Pelargonium	City of Joondalup Priority weed	

Name	Common Name	Conservation Code	Image
			Photos: S.M Armstrong and K.C. Richardson (DBCA and WAH, no date)
Pennisetum clandestinum	Kikuyu grass	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Raphanus raphanistrum	Wild Radish	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Ricinus communis	Castor Oil Plant	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Schinus terebinthifolia	Japanese Pepper	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.

Name	Common Name	Conservation Code	Image
Tetragonia decumbens	Sea Spinach	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Trachyandra divaricata	Dune Onion Weed	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.
Tropaeolum sp.	Nasturtium	City of Joondalup Priority weed	 Photo: DBCA & WAH, no date.

Appendix 7 - Iluka – Burns Beach Foreshore Reserve High Priority Weed Species Management

Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing (WA Herbarium)
Arctotis sp.	Arctotis	Herbs	Priority (CoJ)	Hand weeding, Glyphosate	September to January
Asparagus asparagoides	Bridal Creeper	Herbs and Creepers	WONS, P1 (whole state), highest priority (DPaW Swan Region), Priority (CoJ)	Metsulfuron, hand weeding	August to September
Avena fatua	Wild Oats	Grasses	High priority (DPaW Swan Region), Priority (CoJ)	Quizalofop	July to October
Carpobrotus edulis	Pigface	Herbs	High priority (DPaW Swan Region)	Hand weeding, Glyphosate	All year
Chamelaucium uncinatum	Geraldton Wax	Trees and Shrubs	Priority (CoJ)	Cut and paint with Glyphosate, hand weed	June to November / All year
Conyza sp.	Fleabane		Priority (CoJ)	Hand weeding, Glyphosate *Resistant to herbicide treatment.	All year
Cynodon dactylon	Couch grass	Grasses	High priority (DPaW Swan Region), Priority (CoJ)	Glyphosate, Quizalofop	November to February
Dimorphotheca ecklonis (more recently known as *Osteospermum ecklonis (DC.) Norl.)*	Veldt Daisy	Herbs	Priority (CoJ)	Hand weeding, Glyphosate	September to January
Ehrharta calycina	Perennial Veldt Grass	Grasses	High priority (DPaW Swan Region), Priority (CoJ)	Quizalofop	June to August
Ehrharta longiflora	Annual Veldt Grass	Grasses	Priority (CoJ)	Quizalofop	July to November
Euphorbia paralias	Sea Spurge	Herbs	Priority (CoJ)	Glyphosate, Metsulfuron	October to June
Euphorbia terracina	Geraldton Carnation	Herbs	High priority (DPaW	Triasulfuron, Hand	June to August spray,

Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing (WA Herbarium)
	Weed		Swan Region), Priority (CoJ)	weeding	June to November hand weeding
Fumaria sp.	Fumitory	Herbs	Priority (CoJ)	Metsulfuron	August to November
Gazania linearis	Gazania	Herbs	High priority (DPaW Swan Region), Priority (CoJ)	Glyphosate, Hand weeding	June to December spray, All year hand weeding
Ipomoea indica	Morning Glory	Herbs and Climbers	Priority (CoJ)	Metsulfuron	November to May
Lactuca serriola	Prickle Lettuce	Herbs	Priority (CoJ)	Hand weeding	October to February
Moraea flaccida	One-leaf Cape Tulip	Herbs	Declared pest (BAM Act), High priority (DPaW Swan Region), Priority (CoJ)	Metsulfuron	July to August
Oxalis pes-caprae	Soursob	Herbs	High priority (DPaW Swan Region), Priority (CoJ)	Glyphosate, Metsulfuron	June to July
Pennisetum clandestinium	Kikuyu grass	Grasses	High priority (DPaW Swan Region), Priority (CoJ)	Quizalofop, Glyphosate	June to August
Pelargonium capitatum	Rose Pelargonium	Herbs	High priority (DPaW Swan Region), Priority (CoJ)	Glyphosate, Metsulfuron, Hand weeding	June to October
Raphanus sp.	Wild Radish	Herbs	Priority (CoJ)	Hand weeding	April to May or July to November
Ricinus communis	Castor Oil Plant	Trees and Shrubs	Priority (CoJ)	Hand weeding	June to September
Schinus terebinthifolia	Japanese Pepper, Brazilian Pepper	Trees and Shrubs	High priority (DPaW Swan Region), Priority (CoJ)	Cut & paint with Glyphosate, hand weeding	All year
Tetragonia decumbens	Sea Spinach	Herbs	Priority (CoJ)	Hand weeding, Glyphosate	March to November
Thinopyrum distichum	Sea Wheatgrass	Herbs	Priority (CoJ)	Metsulfuron (wiping)	October to November
Trachyandra divaricata	Onion Weed	Herbs	Priority (CoJ)	Hand weeding, Metsulfuron, Glyphosate	June to October
Tropaeolum sp.	Nasturtium	Herbs	Priority (CoJ)	Glyphosate, hand weeding	July to November

Name	Common Name	Type of Weed	Status/Notes	Treatment Type	Optimal Treatment Timing (WA Herbarium)
Urospermum picroides	False Hawkbit	Herbs	Priority (CoJ)	Hand weeding	August to December
Yucca sp.	Yucca	Herbs	Priority (CoJ)	Hand weeding	July

Note: The Iluka – Burns Beach High Priority Weed Species Management table was created using the following criteria:

- Weed species listed as a Weed of National Significance (WoNS) in 1999 and 2012 by the Australian Government;
- The weed species is listed as a Declared Plant according to the *Biosecurity and Agriculture Management Act 2007*;
- The weed species is listed as High Priority in regards to its ecological impact according to the DPaW Draft Weed Prioritisation Process for the Swan Region (2013);
- The weed species is listed as a Pest Plant under the City's *Pest Plant Local Law 2012*;
- The City of Joondalup has determined that the weed species poses: a major threat to vegetation and the structure of vegetation communities or is likely to contribute to a high fuel load (e.g. grasses). These species are classed as High Priority weeds in the City of Joondalup.

Appendix 8: Iluka – Burns Beach Foreshore Reserve Fauna Species List

Family	Species	Common name	Conservation status		Previous studies								2020 survey	
			EPBC Act	BC Act / DBCA	Beaumaris Land Sales 2001	Cardno 2006	CoJ 2009	GHD 2013	CoJ 2014	Knowles 2015-2018	AECOM 2018	Spineless Wonders 2018	Burns Beach (ELA 2021)	Iluka (ELA 2021)
BIRDS														
Acanthizidae	*Acanthiza apicalis*	Inland Thornbill			X									
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill			X									
Acanthizidae	*Acanthiza inornata*	Western Thornbill			X									
Acanthizidae	*Acanthiza sp.*	Thornbill						X						
Acanthizidae	*Gerygone fusca*	Western Gerygone			X									
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren			X		X							
Accipitridae	*Accipiter cirrocephalus*	Collard Sparrowhawk						X						
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk			X									
Accipitridae	*Accipiter fasciatus*	Brown Goshawk			X									
Accipitridae	*Hieraaetus morphnoides*	Little Eagle			X						X			
Alcedinidae	**Dacelo novaeguineae*	Laughing Kookaburra						X					X	X
Artamidae	*Artamus cinereus*	Black-faced Woodswallow			X								X	X
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow			X									
Cacatuidae	*Cacatua galerita*	Sulpher-crested Cockatoo						X						
Cacatuidae	*Cacatua sanguinea*	Little Corella						X					X	X
Cacatuidae	*Calyptorhynchus latirostris*	Carnaby's Cockatoo	EN	EN	X	X			X		X			X

Family	Species	Common name	Conservation status		Previous studies								2020 survey	
			EPBC Act	BC Act / DBCA	Beaumaris Land Sales 2001	Cardno 2006	CoJ 2009	GHD 2013	CoJ 2014	Knowles 2015-2018	AECOM 2018	Spineless Wonders 2018	Burns Beach (ELA 2021)	Iluka (ELA 2021)
Cacatuidae	*Eolophus roseicapilla*	Galah			X						X		X	X
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckooshrike			X			X					X	X
Campephagidae	*Lalage tricolor*	White-winged Triller			X									
Columbidae	**Spilopelia senegalensis*	Laughing Dove			X								X	X
Columbidae	*Ocyphaps lophotes*	Crested Pigeon											X	
Columbidae	*Phaps chalcoptera*	Common Bronzewing			X									
Corvidae	*Barnardius zonarius*	Australian Ringneck			X								X	X
Corvidae	*Corvus bennetti*	Little Crow											X	X
Corvidae	*Corvus coronoides*	Australian Raven			X			X			X		X	X
Cracticidae	*Cracticus nigrogularis*	Pied Butcherbird						X					X	X
Cracticidae	*Cracticus tibicen*	Australian Magpie			X			X					X	X
Cracticidae	*Cracticus torquatus*	Grey Butcherbird			X									
Cuculidae	*Chrysococcyx basalis*	Horsfield's Bronze Cuckoo			X									
Falconidae	*Falco cenchroides*	Nankeen Kestrel			X									
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow			X									
Hirundinidae	*Hirundo neoxena*	Welcome Swallow			X									X
Hirundinidae	*Petrochelidon nigricans*	Tree Martin			X									
Laridae	*Larus novaehollandiae*	Silver Gull											X	X

Family	Species	Common name	Conservation status		Previous studies								2020 survey	
			EPBC Act	BC Act / DBCA	Beaumaris Land Sales 2001	Cardno 2006	CoJ 2009	GHD 2013	CoJ 2014	Knowles 2015-2018	AECOM 2018	Spineless Wonders 2018	Burns Beach (ELA 2021)	Iluka (ELA 2021)
Maluridae	*Malurus lamberti*	Variegated Fairywren											X	X
Maluridae	*Malurus leucopterus*	White-winged Fairywren			X		X						X	X
Maluridae	*Malurus sp.*	Fairywren						X						
Maluridae	*Malurus splendens*	Splendid Fairywren			X		X	X			X			
Meliphagidae	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater						X						
Meliphagidae	*Acanthorhynchus superciliosus*	Western Spinebill			X			X						
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird			X			X					X	X
Meliphagidae	*Anthochaera lunulata*	Western Little Wattlebird			X									
Meliphagidae	*Gliciphila melanops*	Tawny-crowned Honeyeater			X									
Meliphagidae	*Lichenostomus virescens*	Singing Honeyeater			X								X	X
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater			X								X	X
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner			X									
Meliphagidae	*Phylidonyris niger*	White-cheeked Honeyeater			X								X	X
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater			X			X			X		X	X
Meropidae	*Merops ornatus*	Rainbow Bee-eater			X									
Monarchidae	*Grallina cyanoleuca*	Magpie-lark						X					X	X
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush			X			X						
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler			X									

Family	Species	Common name	Conservation status		Previous studies								2020 survey	
			EPBC Act	BC Act / DBCA	Beaumaris Land Sales 2001	Cardno 2006	CoJ 2009	GHD 2013	CoJ 2014	Knowles 2015-2018	AECOM 2018	Spineless Wonders 2018	Burns Beach (ELA 2021)	Iluka (ELA 2021)
Pandionidae	*Pandion haliaetus*	Eastern Osprey												X
Pardalotidae	*Pardalotus striatus*	Striated Pardalote						X						
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant											X	X
Podargidae	*Podargus strigoides*	Tawny Frogmouth												X
Psittacidae	*Glossopsitta sp.*	Lorikeet						X						
Psittacidae	*Neophema elegans*	Elegant Parrot			X									
Psittacidae	*Platycercus spurius*	Red-capped Parrot			X									
Psittaculidae	*Barnardius zonarius*	Australian Ringneck						X						
Rhipiduridae	*Rhipidura albiscapa*	Grey Wagtail			X									
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail			X			X					X	X
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis											X	X
Zosteropidae	*Zosterops lateralis*	Silvereye			X						X			
MAMMALS														
Canidae	**Vulpes vulpes*	Red Fox			X			X			X		X	X
Felidae	**Felis catus*	Cat			X						X		X	X
Leporidae	**Oryctolagus cuniculus*	European Rabbit			X		X	X			X			X
Macropodidae	*Macropus fuliginosus subsp. melanops*	Western Grey Kangaroo			X			X			X			
Macropodidae	*Notamacropus irma*	Western Brush Wallaby		P4							X			

Family	Species	Common name	Conservation status		Previous studies								2020 survey	
			EPBC Act	BC Act / DBCA	Beaumaris Land Sales 2001	Cardno 2006	CoJ 2009	GHD 2013	CoJ 2014	Knowles 2015-2018	AECOM 2018	Spineless Wonders 2018	Burns Beach (ELA 2021)	Iluka (ELA 2021)
Molossidae	*Austronomus australis*	White-striped Free-tailed Bat											X	X
Muridae	**Mus musculus*	House Mouse			X								X	X
Peramelidae	*Isoodon fusciventer*	Quenda		P4	X						X		X	X
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna			X									
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat											X	X
REPTILES														
Agamidae	*Pogona minor subsp. minor*	Western Bearded Dragon			X			X		X	X	X	X	
Carphodactylidae	*Underwoodisaurus milii*	Southern Barking Gecko								X		X		
Elapidae	*Demansia psammophis*	Reticulated Whipsnake			X									
Elapidae	*Echiopsis curta*	Bardick								X		X		X
Elapidae	*Notechis scutatus*	Tiger snake											X	X
Elapidae	*Pseudonaja affinis subsp. affinis*	Dugite			X			X		X	X	X	X	X
Elapidae	*Simoselaps bertholdi*	Jan's Banded Snake								X		X		X
Elapidae	*Simoselaps calonotus*	Black-striped Snake											X	
Gekkonidae	*Christinus marmoratus*	Marbled Gecko								X		X		
Gekkonidae	*Strophurus spinigerus*	Southwest Spiny-tailed Gecko			X					X		X		X
Pygopodidae	*Delma concinna*	Javelin Legless Lizard			X									
Pygopodidae	*Lialis burtonis*	Burton's Legless Lizard			X					X		X		

Family	Species	Common name	Conservation status		Previous studies								2020 survey	
			EPBC Act	BC Act / DBCA	Beaumaris Land Sales 2001	Cardno 2006	CoJ 2009	GHD 2013	CoJ 2014	Knowles 2015-2018	AECOM 2018	Spineless Wonders 2018	Burns Beach (ELA 2021)	Iluka (ELA 2021)
Scincidae	*Cryptoblepharus buchananii*	Fence Skink								X		X	X	X
Scincidae	*Cryptoblepharus plagiocephalus*	Fence Skink			X									
Scincidae	*Crytoblepharus buchananii*	Buchanan's Snake-eyed Skink									X			
Scincidae	*Ctenotus australis*	West-coast Long-tailed Ctenotus									X			
Scincidae	*Ctenotus fallens*	West-coast Laterite Ctenotus			X					X		X	X	X
Scincidae	*Cyclodomorphus celatus*	Slender Blue-tongue Lizard			X									X
Scincidae	*Egernia kingii*	King's Skink								X		X		
Scincidae	*Egernia napoleonis*	South-western Crevice Egernia			X									
Scincidae	*Hemiergis quadrilineata*	Two-toed Earless Skink			X									X
Scincidae	*Lerista elegans*	Elegant Slider			X					X		X	X	X
Scincidae	*Lerista lineopunctulata*	West Coast Line-spotted Lerista			X									
Scincidae	*Lerista praepedita*	Western Worm Lerista												
Scincidae	*Menetia greyii*	Common Dwarf Skink			X					X		X		
Scincidae	*Morethia obscura*	Shrubland Morethia Skink			X									X
Scincidae	*Tiliqua occipitalis*	Western Bluetongue			X									

Family	Species	Common name	Conservation status		Previous studies								2020 survey	
			EPBC Act	BC Act / DBCA	Beaumaris Land Sales 2001	Cardno 2006	CoJ 2009	GHD 2013	CoJ 2014	Knowles 2015-2018	AECOM 2018	Spineless Wonders 2018	Burns Beach (ELA 2021)	Iluka (ELA 2021)
Scincidae	*Tiliqua rugosa subsp. rugosa*	Bobtail			X			X		X	X	X		X
Typhlopidae	*Anilos australis*	Southern Blind Snake												X
Varanidae	*Varanus gouldii*	Gould's Sand Goanna						X						

Notes: Invertebrates have not been included within this Appendices due to the high diversity of invertebrate species (exceeding 500 species) found in the invertebrate inventory surveys undertaken by Spineless Wonders between 2015 and 2018.[1]

Key:

X = recorded during survey.

• = listed within database search for respective survey but not recorded during that survey.

* = introduced species.

EN = listed as Endangered under the EPBC Act, WC Act and/or the IUCN red list.

VU = listed as Vulnerable under the EPBC Act, WC Act and/or the IUCN red list.

LC = Least Concern under the IUCN red list.

M = listed as Migratory species under the EPBC Act.

IA = listed as Migratory under the WC Act.

P1 = Priority 1: poorly known species occurring on threatened land (land not managed for conservation)

P2 = Priority 2: poorly knows species occurring on some conservation lands

P3 = Priority 3: known from few specimens or records and need urgent survey and evaluation of conservation status.

P4 = Priority 4: not currently threatened but could if present circumstances change. Usually found on conservation lands.

Appendix 9: Iluka – Burns Beach Foreshore Reserve Key Fauna Species

Name	Common Name	Conservation Code	Image
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	Schedule 2 (*Wildlife Conservation Act*), Endangered (IUCN, DPaW and EPBC)	 Photo: Gary Tate, Yellagonga Regional Park, 2012
Isoodon fusciventer	Quenda	Priority 4 (Department of Biodiversity, Conservation and Attractions)	 Photo: Gary Tate, 2017

Note: For further explanations on Conservation Codes, refer to Appendix 4.

Appendix 10: Iluka – Burns Beach Foreshore Reserve Introduced Fauna Species

Name	Common Name	Image
Dacelo novaeguineae	Laughing Kookaburra	 Photo: Chris Kershaw, Shepherds Bush, 2016
Felis catus	Feral cat	 Photo: Gary Tate, Yellagonga Regional Park, 2016
Mus musculus	House Mouse	 Photo: Roar Solheim (IUCN 2012)
Ommatoiulus moreleti	Portuguese Millipede	 Photo: Robert Mesibov (Australian Government no date)

Name	Common Name	Image
Vulpes vulpes	European Red Fox	 Photo: Centre for Fortean Zoology Australia (2010)

Appendix 11 – Iluka – Burns Beach Foreshore Reserve Fungi Species - Likely to Occur

Examples of potential fungi species occurring at Iluka – Burns Beach Foreshore Reserves.

Name	Common Name	Image
Colus pusillus	Red Fingers	 Photo: Natural Area Consulting, 2014.
Phlebia subceracea	Golden Splash Tooth	 Photo: Natural Area Consulting, 2014.
Scleroderma sp.	Earthball	 Photo: Natural Area Consulting, 2014.
Volvariella speciosa	Common Rosegill	 Photo: Natural Area Consulting, 2014.