APPENDIX 1

Environmental Assessment Report (JBS&G)

Stockland Development Pty Ltd

Environmental Assessment Report

North East Baldivis District Structure Plan
Mundijong Road, Baldivis WA

16 June 2023

64058/148,438 (Rev D)

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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1. Introduction

1.1 Overview

Stockland Development Pty Ltd (the proponent) is proposing to lodge a District Structure Plan (DSP) (Appendix A), to be followed by a subsequent amendment process to the Metropolitan Region Scheme, across multiple lots on Mundijong Road, Baldivis (the site; Figure 1.1) to enable urban development.

The site has been identified within the *Perth and Peel @ 3.5 million: Planning Investigation Area Update (WAPC 2022)* land use planning and infrastructure framework as "Urban Expansion".

The site is located approximately 45 km south of the Perth CBD within the City of Rockingham and is approximately 757 ha in area. The site is currently zoned "Rural" under the Metropolitan Region Scheme and a combination of "Rural", "Public Use" and "Special Rural" under the City Rockingham Town Planning Scheme (TPS) No. 2.

1.2 Purpose and scope of this document

This Environmental Assessment Report (EAR) has been prepared to inform and support the DSP, identifying the highest value environmental features for retention and establishing high-level management measures across the site. The proposed DSP map (Appendix A) aligns with the findings of this EAR.

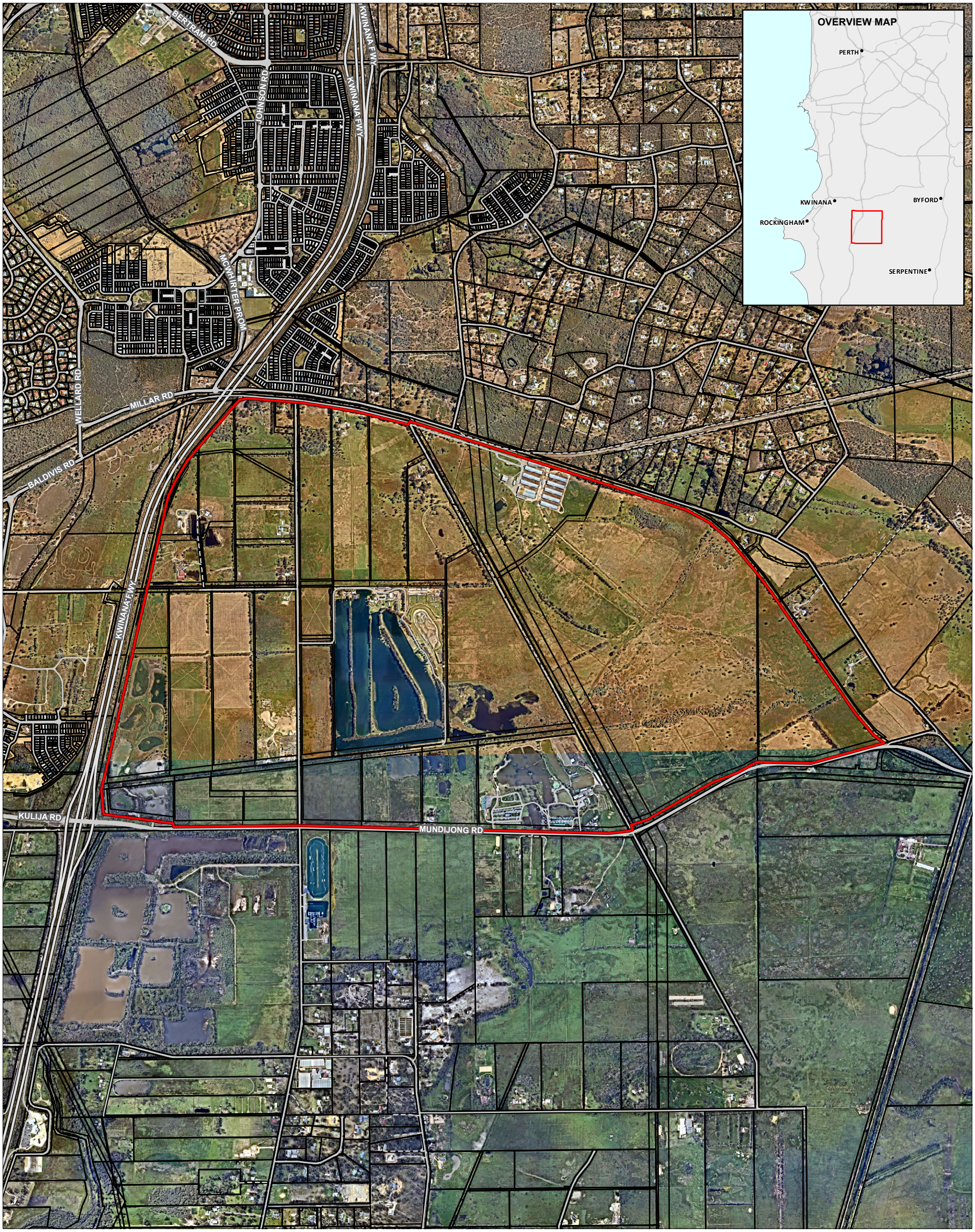
In accordance with Table 3 of the *South Metropolitan Peel Sub-Regional Planning Framework (Department of Planning, Lands and Heritage [DPLH] 2018)*, scheme amendments are required to incorporate details of investigations into 17 key considerations. In addition to the issues typically required to be addressed by environmental reports supporting rezoning applications, this EAR addresses four of the key considerations in Table 3, specifically:

1. Environmental considerations – implications of/for significant on-ground environmental attributes and Peel-Harvey catchment considerations
2. Basic Raw Materials – implications of on-site resources
3. Mosquitoes – nuisance and health considerations
4. Environment and landscape – identify any requirements for additional open space (nature/passive recreation)

The *Perth and Peel@3.5million Planning Investigation Areas Update* (2022) is an addendum to the Sub-Regional Planning Frameworks and should be considered in conjunction with these documents. The key consideration relevant to the EAR is the protection of significant environmental values.

This EAR includes identification of:

- Applicable legislation, policy and guidance.
- The environmental, bushfire and heritage characteristics of the site.
- Potential impacts to the above characteristics associated with urban development as proposed by the DSP.
- Relevant approval requirements.
- The likely spatial and management responses of future development to ensure that any identified potential impacts can be mitigated or managed as to not result in a 'significant' impact.



Legend

- Site boundary
- Cadastral boundary
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

JBS&G

0 580 metres

North East Baldivis, Mundijong Road Baldivis, WA

SITE LOCATION

Job No: 64058		Scale 1:20,000 at A3		
Client: Stockland Development Pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: jcrute	Checked By:	Version: A	Date: 16-Nov-2022	**FIGURE: 1.1**

Document Path: W:\Projects\1)Open\Stockland\64058 EAR Review Wellard\GIS\Maps\R01_Rev_A\64058_01_1_A3P_SiteLocn.mxd

Image Reference: www.nearmap.com© - Imagery Date: 30 September 2022.

2. Legislation, policies and guidelines

Key statutory and policy documents are listed below, and where specifically relevant to the proposed rezoning, are described in detail in the following sections.

2.1 Federal legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW). The EPBC Act aims to protect and manage nine Matters of National Environmental Significance (MNES) throughout Australia including:

- World Heritage Properties
- National Heritage Places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth Marine Areas
- Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

MNES identified as relevant to the site include three species of Black Cockatoos, namely Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*). A referral was made in 2020 to the DoCCEEW under the EPBC Act due to the potential impacts that proposed clearing for residential development may have on these MNES. Details of this referral, including the decision are provided in section 5.3.5.

2.2 State legislation

The environmental assessment has been conducted with reference to the following State legislation which provides for the environmental and heritage values, and bushfire risk addressed within this report:

- *Biodiversity Conservation Act 2016*
- *Environmental Protection Act 1986*
- *Biosecurity and Agriculture Management Act 2007*
- *Rights in Water and Irrigation Act 1914*
- *Metropolitan Water Supply, Sewerage and Drainage Act 1909*
- *Aboriginal Cultural Heritage Act 2021*
- *Contaminated sites Act 2003*
- *Contaminated Sites Regulations 2006*
- *Planning and Development Act 2005*

- *Environmental Protection (Noise) Regulations 1997*

2.2.1 Environmental Protection Act 1986

The *Environmental Protection Act 1986* (EP Act) is administered by the Environmental Protection Authority (EPA) of Western Australia. The Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing.

The EPA uses environmental principles, factors and associated objectives as the basis for assessing whether the environmental impact of a proposal or land use planning scheme is acceptable. While there is no statutory role for the EPA in a DSP, the EPA will be consulted and Section 3.11 includes an assessment against the EPA's Environmental Principles, Factors and Objectives to support the planning process.

2.2.2 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* replaced the *Wildlife Conservation Act 1950*. On 3 December 2016, several parts of the new Act were enacted by the State Governor. The remaining parts of the Act and the associated Regulations came into effect on 1 January 2019.

In addition to providing for the protection of flora and fauna, the *Biodiversity Conservation Act 2016* includes provisions for threatened ecological communities, threatening processes, critical habitats and environmental pests.

2.2.3 State Planning Policies

The Western Australian Planning Commission (WAPC) prepares and adopts state planning policies under statutory procedures set out in part 3 of the *Planning and Development Act 2005.* State planning policies relevant to the project are listed below:

- State Planning Policy 2.1: *Peel-Harvey Coastal Plain Catchment Policy* (SPP 2.1)
- State Planning Policy 2.4: *Basic Raw Materials* (SPP 2.4)
- State Planning Policy 2.5: *Rural Planning* (SPP 2.5)
- State Planning Policy 2.9: *Water Resources* (SPP 2.9)
- *Better Urban Water Management guidelines* (WAPC 2008)
- State Planning Policy 3.7: *Planning in Bushfire Prone Areas* (SPP 3.7)
- State Planning Policy 5.4: *Road and Rail Noise* (SPP 5.4)

2.2.3.1 SPP 2.1 Peel-Harvey Coastal Plain Catchment

State Planning Policy 2.1: Peel-Harvey Coastal Plain Catchment has been developed to ensure that land use changes within the Peel-Harvey estuarine system are controlled, to avoid and minimise environmental damage resulting from excessive nutrient export to the system. Land use changes are required to conform with several provisions outlined within the policy to ensure that environmental harm is avoided or minimised.

2.2.3.2 SPP 2.4 Basic Raw Materials

State Planning Policy 2.4: Basic Raw Materials (SPP 2.4) is designed to facilitate the extraction of Basic Raw Material (BRM) resources close to the major markets within the Perth metropolitan region and to avoid sensitive development near BRM resources which would otherwise inhibit extraction. The policy sets out matters to be considered and given effect to by the WAPC and local governments in considering zoning, subdivision and development applications for extractive industries.

2.2.3.3 SPP 2.5 Rural Planning

Section 5.12.5 of *State Planning Policy 2.5: Rural Planning* (SPP 2.5) was introduced to provide policy guidance for managing land use transitions, such as from rural to urban. The policy is relevant to managing land use transitions between existing operators and new landowners.

2.2.3.4 SPP 2.9 Water Resources and Better Urban Water Management guidelines

State Planning Policy 2.9: Water Resources (SPP 2.9) provides guidance on the planning, protection and management of surface and groundwater catchments, and the implementation of total water cycle management principles in the land use planning system. The *Better Urban Water Management guidelines* facilitates the implementation of SPP 2.9.

In accordance with policy measures set out in SPP 2.9 and the *Better Urban Water Management guidelines*, a Local Water Management Strategy (LWMS) will be prepared for the site to support the Structure Planning process. An Urban Water Management Plan (UWMP) will be subsequently prepared as required at the subdivision stage.

2.2.3.5 SPP 3.7 Planning in Bushfire Prone Areas

State Planning Policy 3.7: Planning in Bushfire Prone Areas (SPP 3.7) requires all land which has been designated as bushfire prone by the Fire and Emergency Services (FES) Commissioner to address bushfire risk management. Developments within a bushfire prone area are required to address the relevant policy provisions, for the stage of the planning process that is relevant to the development.

In accordance with Policy Measure 6.3 of SPP 3.7, a Bushfire Management Plan has been prepared for the site which includes:

- a bushfire hazard level (BHL) assessment
- identification of bushfire hazard issues arising from the above assessment
- assessment against the bushfire protection criteria requirements contained within the Guidelines demonstrating compliance can be achieved in subsequent planning stages.

2.2.3.6 SPP 5.4 Road and Rail Noise

State Planning Policy 5.4: Road and Rail Noise (SPP 5.4) applies to all stages of planning in Western Australia, where a noise-sensitive land use is proposed within the policy's trigger distance of specified transport routes or when new or major upgrades of road and rail are proposed. The transport routes identified are considered of key economic importance due to their high vehicle movements and/or freight handling functions.

The objectives of the policy are to:

- protect the community from unreasonable levels of transport noise
- protect strategic and other significant freight transport corridors from incompatible urban encroachment
- ensure transport infrastructure and land-use can mutually exist within urban corridors
- ensure that noise impacts are addressed as early as possible in the planning process
- encourage best practice noise mitigation design and construction standards.

2.3 Environmental Protection Authority (EPA) guidance

The assessment has considered the recommendations of EPA regulatory guidance as listed below:

- *Environmental Factor Guideline - Social Surroundings*
- *Environmental Factor Guideline - Human Health*
- *Environmental Factor Guideline - Inland Waters*

- *Environmental Factor Guideline - Terrestrial Fauna*
- *Environmental Factor Guideline - Terrestrial Environmental Quality*
- *Environmental Factor Guideline – Landforms*
- *Environmental Factor Guideline - Flora and Vegetation*
- *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*
- *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*
- *EPA Guidance Statement No. 33 Environmental Guidance for Planning and Development*
- *Environmental Protection Bulletin No. 20 Protection of naturally vegetated areas through planning and development.*
- *EPA Guidance Separation Distances between Industrial and Sensitive Land Uses*

2.4 Local government policies, strategies and guidance

The City of Rockingham has developed numerous polices, strategies and guidelines relevant to planning and the environment, as listed below. Reference to these documents has been made throughout the report where applicable to a specific environmental factor.

- Planning Policy 3.4.3 – Urban Water Management
- Planning Policy 7.2 – Local Bushland Strategy
- Planning Procedure 1.23 – Environmental Assessment

3. Overview of existing environment

3.1 Land use

3.1.1 Current land use

The site is currently zoned "Rural" under the Metropolitan Region Scheme and a combination of "Rural", "Public Use", and "Special Rural" under the City Rockingham LPS No. 2.

The site currently has multiple landowners and is characterised by a mixture of land uses including rural living, stock grazing and holding, a water ski facility and caravan park, and aquaculture. Current land uses of significance to future development of the site are described in the following sections.

Table 3.1 details the existing lots within the site boundary.

Table 3.1: Lot details

Current Title (Volume/Folio)	Land Description	Area (ha)	Site Address
n/a	Lot 201 on Plan 36173	38.28	Lot 201 Mundijong Road, Baldivis
2834/498	Lot 1 on Plan 77728	42.27	-
2834/499	Lot 2 on Plan 77728	182.88	-
2834/500	Lot 3 on Plan 77728	1.48	
1128/147	Lot 454 on Plan 202741	47.37	-
1822/35	Lot 100 on Diagram 71358	17.69	222 Telephone Lane, Baldivis
1754/191	Lot 452 on Plan 202741	21.50	-
1754/190	Lot 451 on Plan 202741	21.05	156 Telephone Land, Baldivis
n/a	Lot 2 on Diagram 42118	18.72	-
n/a		5.61	-
n/a	Lot 3 on Diagram 49236	2.02	5 St Albans Road, Baldivis
n/a	Lot 21 on Plan 24998	8.41	108 Telephone Lane, Baldivis
n/a	Lot 22 on Plan 24998	9.13	-
n/a	Lot 23 on Plan 24998	8.24	75 St Albans Road, Baldivis
n/a	Lot 24 on Plan 24998	8.20	Lot 24 St Albans Road, Baldivis
n/a	Lot 2 on Plan 38268	11.94	54 Pug Road, Baldivis
n/a	Lot 1 on Plan 38268	6.61	56 Pug Road, Baldivis
n/a	Lot 3 on Plan 38268	7.20	58 Pug Road, Baldivis
n/a	Lot 4 on Plan 38268	6.01	50 Pug Road, Baldivis
n/a	Lot 458 on Plan 202741	5.56	-
n/a	Lot 1 on Diagram 17410	20.08	-
n/a		7.01	-
n/a	Lot 456 on Plan 202741	23.89	-
n/a	Lot 457 on Plan 202741	24.75	-
n/a	Lot 455 on Plan 202741	23.25	3 Pug Road
n/a	Lot 1 on Diagram 42118	11.79	-
n/a	Lot 101 on Diagram 71216	58.98	136 St Albans Road, Baldivis
n/a	Lot 465 on Plan 152853	8.51	-
n/a	Lot 466 on Plan 152853	7.00	-
n/a	Lot 1261 on Plan 152853	5.09	-
n/a	Lot 467 on Plan 202741	12.04	-
n/a	Lot 468 on Plan 202741	13.64	-
n/a	Lot 469 on Plan 202741	14.29	271 Mundijong Road, Baldivis
n/a	Lot 470 on Plan 202741	37.34	355 Mundijong Road, Baldivis
n/a	Lot 44 on Plan 202741	-<1ha	
n/a	Lot 45 on Plan 202741	-<1ha	
n/a	Lot 46 on Plan 202741	-<1ha	
n/a	Lot 20 on Diagram 95616	-<1ha	

3.1.1.1 Livestock holding facility

The livestock holding facility located on Lot 1 comprises ten holding sheds and an effluent pond. Austvision Rural Services Pty Ltd are licenced to operate the facility (L8338/2009/2), to a capacity of 800,000 sheep per year until March 2033. There do not appear to be any significant licence breaches that have created any legacy issues or would impact materially on the redevelopment of the site. Based on the most recent Department of Water and Environmental Regulation (DWER)licence audit report (2020), the operation was found to be compliant with relevant conditions.

The holding sheds and effluent disposal pond on the subject site are potential sources of odour, noise and dust. The EPA (2005) recommends a generic separation distance of 1000 m to the nearest sensitive areas to act as a buffer zone (Figure 3.1). This currently renders a portion of the site inappropriate for future development should the existing livestock holding facility remain operational on Lot 1.

It is understood the livestock holding facility has been purchased by Stockland and would be decommissioned as part of the development process. Therefore, the facility would not be a constraint for the site. It is recommended that an investigation into potential contamination from historic operations at the site is conducted, so that any required remediation can be undertaken to support future residential development. This is outlined in Section 3.8.

A Western Power high voltage transmission line easement runs through the eastern section of the subject site (Figure 3.1). Residential development is not typically permitted within the easement, and so planning and urban design (i.e., lot placement and Public Open Space allocation) may need to accommodate the easement within the Local Structure Plan and subdivision reporting.

3.1.1.2 Bonney's Water Ski Park and West Coast Jet Sprint

A recreational facility comprising a water ski park (Bonney's WA Water Ski Park), jet sprint park (West Coast Jet Sprint), and accommodation with 2 self-contained units and 15 caravan bays (the facility) is located in the centre of the site (Figure 3.1).

Under the CoR TPS No.2, the water ski park would be classified as Private Recreation which is a Discretionary land use within Rural zoning. These types of land uses are not permitted unless approval is granted by the council (City of Rockingham 2014). The city has identified WA Water Ski Park and Baldivis Water Ski as tourist attractions within the local government area (City of Rockingham 2022).

The facility generates noise emissions associated with powerboating operations which are likely to require spatial and management considerations to ensure future residents are not significantly impacted by noise. There is currently no published planning or environmental guidance specific to separation distances from urban development to such facilities.

The facility is required to comply with the *Environmental Protection (Noise) Regulations 1997*, unless a Noise Management Plan has been prepared to the satisfaction of the Chief Executive Officer of DWER in accordance with regulation 16AA.

It is understood that if development is to proceed, noise generating uses will cease, thereby removing this potential constraint.

3.1.1.3 Golden Pond Fish and Marron Farm

Golden Pond Fish and Marron Farm is located within the southeast of the subject site (Figure 3.1). In addition to aquaculture operations, the facility includes a restaurant and accommodation. Historical aerial photography indicates that the site was present and operational since 2000 (Landgate 2019), *EPA guidance Separation Distances between Industrial and Sensitive Land Uses* recommends a generic separation distance of 100-300 m between residential areas and aquaculture operations to act as a buffer for potential noise and odour emissions (EPA 2015). The EPA recommended setback distance

provides a conservative buffer and is intended to be used in the absence of site-specific assessments and data.

Under the CoR TPS No.2 the Golden Pond Fish and Marron Farm would be classified as Agriculture-Intensive which is a Discretionary land use within Rural zoning. These types of land uses are not permitted unless approval is granted by the council (City of Rockingham 2014). In 2014, the CoR received a Development Application for additions to the existing camping area, 50 Caravan Bays and 12 short stay accommodation units and ablution block. The Council approved the DA in April 2014.

A preliminary dust and odour assessment undertaken for that part of the site (Strategen 2018a) identified a "stock feed" type odour emanating from a large shed within the facility. While this odour was rated as "distinct", the fact that Golden Ponds includes accommodation, and a restaurant/ function centre suggests that any odours emitted from the operations are of low impact.

3.1.2 Adjacent land uses

3.1.2.1 Mundijong freight railway

The Mundijong freight railway runs along the northern boundary of the subject site (Figure 3.1). *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (SPP 5.4) (WAPC 2009) applies to new noise sensitive development (i.e., residential) proposed near existing rail infrastructure that could be significantly affected by transport noise.

To understand the potential implications of noise and vibration associated with the Mundijong freight railway, modelling will be required to be undertaken in accordance with SPP 5.4 to determine the extent of noise and vibration impact, and to inform development design and any required mitigation measures (to ensure compliance with SPP 5.4). If noise and vibration modelling demonstrate exceedances of allowable criteria within the site, noise treatments will be required such as noise walls, and/or quiet house design to mitigate any significant impacts associated with the railway. The noise modelling will be conducted by an acoustic consultant.

A noise assessment was conducted by Lloyd George Acoustics in 2013 to support the Wellard Glen Estate development located on the northern side of Millar Road near the site. This assessment determined that lots interfacing Millar Road and the Mundijong freight railway (northern side) would require noise attenuation treatments to ensure residents were not significantly impacted by the railway. Based on the noise assessment, the predicted noise impacts were considered manageable with either:

- 2.0m high barrier on the residential lot boundary; or
- Quiet house design for the first row of houses.

The Wellard Glen Estate is being constructed with (approximately) a 30 m setback from the railway, a masonry wall, and quiet house design for the first row of lots. It is expected that similar mitigation measures would be required for future lots within the project area that interface the railway.

3.1.2.2 Rosguy Holding Yard

A livestock holding facility (Rosguy Holding Yard) is located approximately 1 km south-east of the subject site (Figure 3.1). The facility is currently licenced under Prescribed Premises Category 55 of the *Environmental Protection Regulations 1987* which is 'Livestock saleyard or holding pen: premises on which live animals are held pending their sale, shipment or slaughter', 10,000 animals or more per year. As of May 2019, the facility was licenced to hold up to 30,000 sheep and the licence expiry date was extended to May 2031 (licence number L8524/2011/1).

EPA guidance Separation Distances between Industrial and Sensitive Land Uses recommends a minimum generic separation distance of 1 km to mitigate risks associated with noise, dust and odour. The south-east portion of the subject site marginally falls within the generic separation distance of 1 km. It is considered unlikely that this facility would limit development on the subject site. Alternatively,

development design could be utilised to exclude sensitive receptors from within the small area affected.

3.1.3 Previous land use

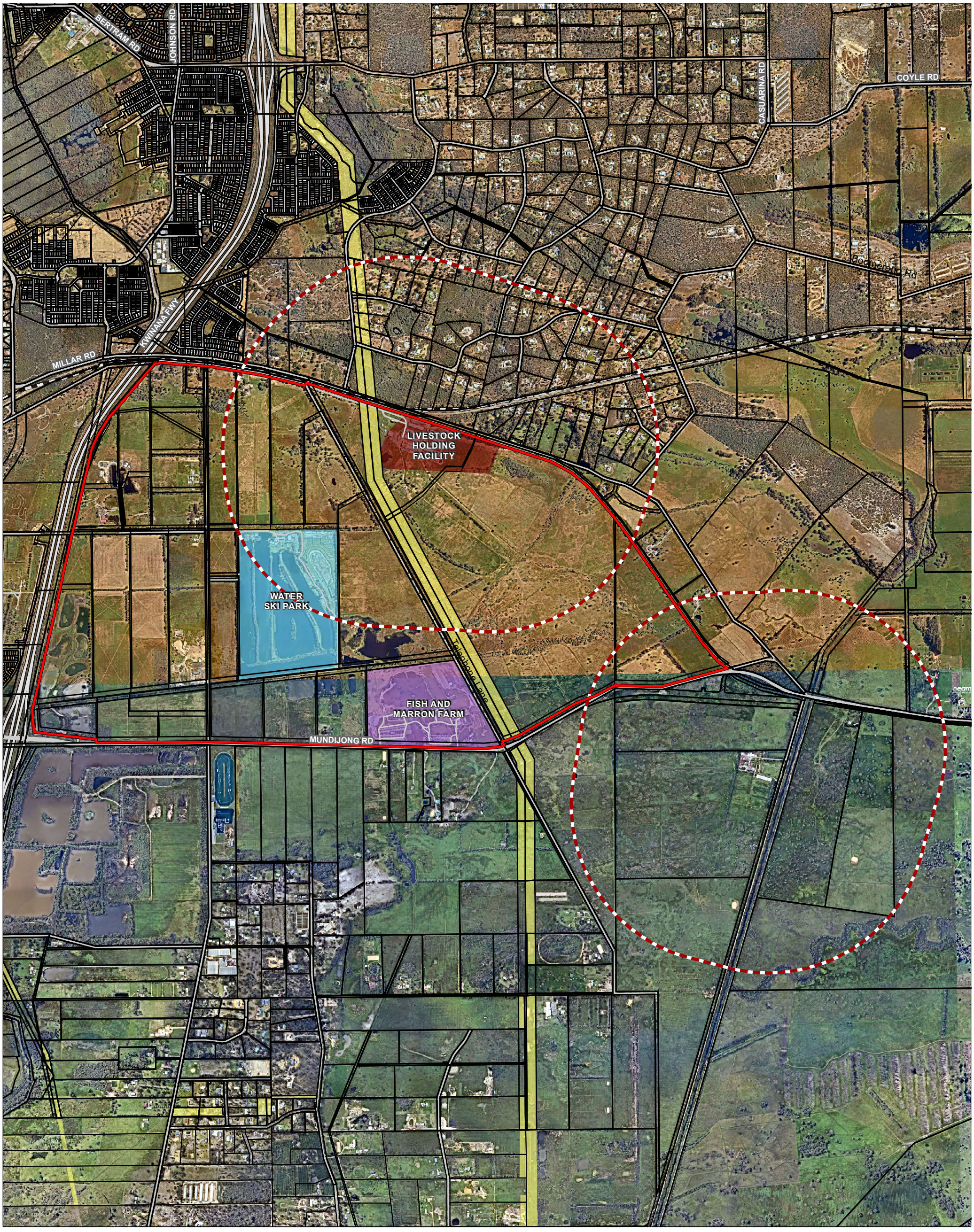
The site has been historically used for a variety of uses, including stock grazing and holding, clay mining, a water ski facility, aquaculture and rural living.

Previous land uses of the site have been determined from a review of historical aerial photography that is available for the site from 1953. Observations made from review of historical aerial photography of the site are outlined in Table 3.2 below.

Table 3.2: Historical land use interpreted from aerial photography

Approx. Year	Site	Detail
Prior to 1953	Lot 21 on Plan 24998	Residence (as evident in present day) visible in Nov 1953 Aerial
Prior to 1953	Lot 1 on Plan 77728	Building (likely shed/workshop) visible in Nov 1953 Aerial
Prior to 1953	Lot 452 on Plan 202741	Building (likely shed/workshop) visible in Nov 1953 Aerial
1965-1974	Lot 452 on Plan 202741	Building (likely shed/workshop) demolished
1965-1974	Lot 451 on Plan 202741	3 buildings developed in northern portion of site
1965-1974	Lot 3 on Diagram 49236	Residence (as evident in present day) developed
1965-1974	Lot 454/468/469/470 on Plan 202741 Lot 101 on Plan 71216	Evidence of shallow, open pit mining (most likely Clay) since the 1965 aerial photograph
1974-1977	Lot 3 on Diagram 49236	Residence developed
1977-1979	Lot 3 on Diagram 49236	Shed/workshop developed
1977-1979	Lot 451 on Plan 202741	New residence (as evident in present day) developed, as well as two additional shed/workshops
1979-1981	Lot 1/2 on Plan 77728	Power lines/corridor developed across the site
1979-1981	Lot 470 on Plan 202741	Building/sheds developed in south-east corner between Sep 1979 and Aug 1981
1979-1981	Lot 100 on Diagram 71358	Circular track (as evident in present day) has been developed
1981-1983	Lot 3 on Diagram 4923	Residence renovated and further developed
1981-1983	Lot 1 on Plan 77728	Building (likely shed/workshop) demolished
1983-1985	Lot 1 on Plan 77728	Residence demolished. Limestone pad evident in June 1983 Main Feedlots and residence (as evident in present day) developed between June 1983 and June 1985 aerials
1983-1985	Lot 2 on Plan 77728	Evidence of clearing, material import/roadbase, possible excavation/tipping
1985	Lot 101 on Diagram 71216	Site facilities, including development of excavated pits and several site buildings between June 1985 and Feb 1995. Additional site facilities built between Feb 1995 and Feb 2000 Water Ski Park was developed in 1985 (Anecdotal, company website)
1979-1981	Lot 100 on Diagram 71358	Residence and sheds (as evident in present day) developed
1985-1995	Lot 1 on Plan 77728	Additional site facilities (additional sheds/workshop, break rooms, administrative building) built between June 1985 and Feb 1995
1985-2001	Lot 1/2/3/4 on Plan 38268	Evidence of shallow excavation (most likely Clay extraction) between the June 1985 and February 1995. Excavation (primarily surficial) continues to occur between February 1995 and January 2001.
1995	Lot 101 on Diagram 71216	Additional site facilities built between Feb 1995 and Feb 2000 Jet Sprint facilities developed in 1995 (Anecdotal, company website).
1995-2000	Lot 470 on Plan 202741	Site facilities, including development of several ponds across the lot and additional sheds, buildings on the south-east corner Golden Ponds Facility opened in 2000 (Anecdotal, company website).
1995-2010	Lot 1 on Plan 17410	Evidence of shallow excavation (most likely Clay extraction) between the Feb 1995 and Feb 2000 aerial photograph on the southern portion of the site and between Jan 2001 and Feb 2010
2003-2004	Lot 470 on Plan 202741	Additional site facilities built between Jan 2003 and Dec 2004

2004	Lot 3 on Plan 38268	Workshop built between 2004 and 2006 aerial, significant vehicle storage from 2004 to present, including concrete pad with tyre marks Baldivis Towing opened 2004 (Anecdotal, company website).
2006	Lot 454 on Plan 202741	South-east portion of site cleared by Mar 2006, shed and laydown area established by Dec 2006 Two small demountable buildings established on site at the same time as shed and laydown area (May 2006-December 2006) Stockpiling of materials continues further north and west, maximum extend reached Apr 2012 Earth and Stone Outdoor Centre opened 2007 (Anecdotal, company website).
2006-2017	Lot 470 on Plan 202741	Gradual infilling of ponds and development of additional site facilities occurring between Jan Dec 2006 and Jan 2017 aerials
2011	Lot 451/452 on Plan 202741	Circle irrigation paddock developed on north of site



Legend

- Site boundary
- Livestock hold facility 1km buffer
- Cadastral boundary

Landuse constraints

- Water ski park
- Fish and marron farm
- Livestock holding facility
- Powerline easement
- Freight railway
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

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0 660 metres

North East Baldivis, Mundijong Road Baldivis, WA

LAND USE CONSIDERATIONS

Job No: 64058		Scale 1:22,500 at A3		
Client: Stockland Development Pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: jcrute	Checked By: CT	Version: A	Date: 16-Nov-2022	**FIGURE: 3.1**

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Image Reference: www.nearmap.com © - Imagery Date: 30 September 2022.

3.2 Topography, geology and soils

The topography of the site is low lying with elevation ranging from approximately 6 m Australian height datum (AHD) to 0 m. The subject site is located between the Peel Main drain to the adjacent west and Birrega Main drain approximately 3 km east. Surface water at the subject site is expected to drain from east to west, toward the Peel Main Drain (DWER 2019).

The bedrock geology of the site is characterised by Warnbro Group (K-WR-ss), interbedded sandstone, siltstone and shale; minor conglomerate (Department of Mines, Industry Regulation and Safety [DMIRS] 2016).

The subject site is located within the Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion) of Western Australia (Mitchell et al. 2002). Beard (1990) describes the Swan Coastal Plain as a low-lying coastal plain, often swampy, with sandhills also containing dissected country rising to the duricrusted Dandaragan plateau on Mesozoic, mainly sandy, yellow soils.

The Swan Coastal Plain comprises five major geomorphologic systems that lie parallel to the coast, the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward & McArthur 1980; Gibson et al. 1994). Each major system is further subdivided into detailed geomorphologic units (Churchward & McArthur 1980; Semeniuk 1990; Gibson et al.1994). The subject site lies on the boundary of the Bassendean system, but is mostly within the Pinjarra Plain system, characterised by poorly drained coastal plain from Perth to Capel, with variable alluvial and aeolian soils (Department of Primary Industries and Regional Development [DPIRD] 2018). As the site covers a large area it comprises a number of identified geomorphological units (DPIRD 2018), these are summarised below in Table 3.3 and displayed in Figure 3.2.

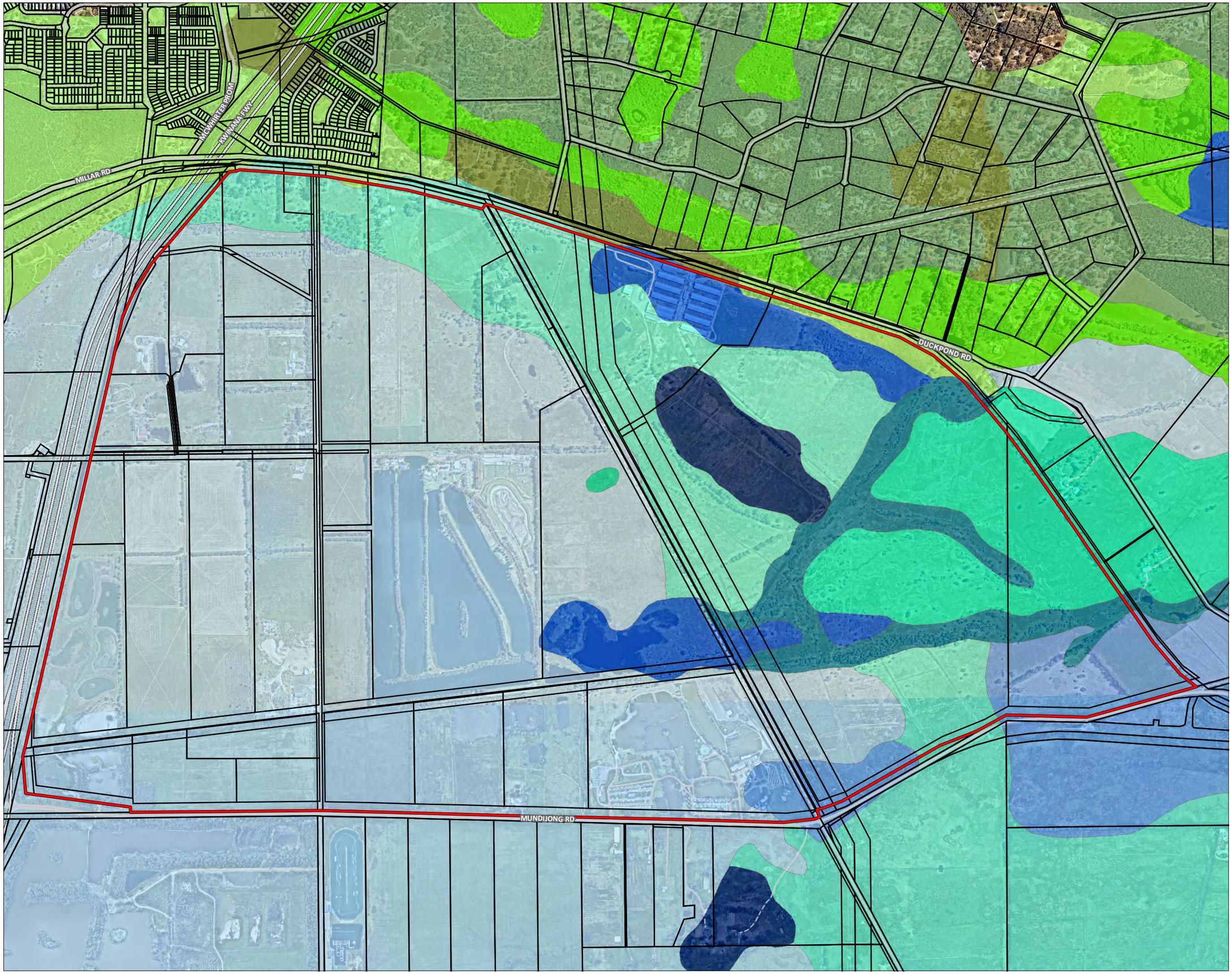
Table 3.3: Landform and soil

Soil Landscape Unit	Unit Description
Bs_B2 (Bassendean B2 Phase)	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale-yellow B horizon or a weak iron-organic hardpan 1-2 m.
Bs_B6 (Bassendean B6 Phase)	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.
PjP1a (Pinjarra P1d Phase)	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or ¿effective duplex¿) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and generally not susceptible to salinity.
PjP1d (Pinjarra P1d Phase)	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or ¿effective duplex¿) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and moderately susceptible to salinity.
PjP3 (Pinjarra P1d Phase)	Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.
PjP4 (Pinjarra P1d Phase)	Poorly drained flats, sometimes with gilgai microrelief and with moderately deep to deep black, olive grey and some yellowish-brown cracking clays and less commonly non-cracking friable clays with generally acidic subsoils.
PjP7 (Pinjarra P7 Phase)	Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and grey sandy duplex and effective duplex soils.
PjP8 (Pinjarra P9 Phase)	Broad poorly drained flats and poorly defined stream channels with moderately deep to deep sands over mottled clays; acidic or less commonly alkaline grey and yellow duplex soils to uniform bleached or pale brown sands over clay.
PjP9 (Pinjarra P9 Phase)	Shallowly incised stream channels of minor creeks and rivers with deep acidic mottled yellow duplex soils.
PjB2 (Pinjarra B2Phase)	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale-yellow B horizon or a weak iron-organic hardpan 1-2 m.

3.2.1 Basic Raw Materials (BRM)

The site is not classified as a Significant Geological Supply or an Extraction Site under *State Planning Policy 2.4 Planning for Basic Raw Materials* (SPP 2.4) (2021) and the associated interactive geological map (GeoVIEW.WA). GeoVIEW does show that the south of the site has a 'Regionally Significant Basic

Raw Materials' zone for clay, however, this is not considered under SPP 2.4, Section 3.1 Supply Categories for Basic Raw Materials.



Legend

- Site boundary
- Cadastral boundary

Landscape unit

- Bassendean B1 phase
- Bassendean B2 phase
- Bassendean B3 phase
- Bassendean B6 phase
- Pinjarra P1a phase
- Pinjarra P1d phase
- Pinjarra P3 phase
- Pinjarra P4 phase
- Pinjarra P7 phase
- Pinjarra P8 phase
- Pinjarra P9 phase
- Pinjarra, B2 phase
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

JBS&G

Job No: 64058

Client: Stockland Development pty Ltd

Version: A	Date: 16-Nov-2022
Drawn By: jcrute	Checked By: CT

Scale 1:13,000 at A3

0 250 500
metres

Coord. Sys. GDA 1994 MGA Zone 50

North East Baldivis, Mundijong Road Baldivis, WA

TOPOGRAPHY, GEOLOGY AND SOILS

FIGURE 3.2

File Name: W:\Projects\1)Open\Stockland\64058 EAR Review Wellard\GIS\Maps\R01_Rev_A\64058_03_2_A3L_TopoGeoSoils.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 September 2022.

3.3 Hydrology

3.3.1 Groundwater

Regional groundwater flow is anticipated to be towards the southwest, it is estimated that depth to groundwater across the site would be shallow, between 8 m AHD in the north-east to 4 m AHD in the west (based upon known groundwater bores information within the Department of Water (DoW) databases) (Figure 3.3).

Five groundwater extraction licenses are registered within the Site. Four licenses to extract from the Superficial Aquifer (62906; 96597; 157696; 206614) and two from the Leederville Aquifer (157699; 206554). Groundwater extraction licenses within the site are displayed below in Table 3.4.

Table 3.4: Groundwater extraction licenses

License Number	Parties	License Address	Aquifer	License Allocation (kL)
62906	Golden Ponds (WA) Pty Ltd	LOT 470 Mundijong Road, Baldivis	Perth - Superficial Swan	200000 kL
96597	Siviour, Mark Brian Siviour, Sally Elizabeth	LOT 101 St Albans Road, Baldivis	Perth - Superficial Swan	200000 kL
157696	Ausvision Rural Services Pty Ltd	LOT 451 Telephone Lane Baldivis 6171; LOT 452 on Plan 202741	Perth - Superficial Swan	67650 kL
157699	Ausvision Rural Services Pty Ltd	LOT 451 Telephone Lane, Baldivis; LOT 452 on Plan 202741	Perth - Leederville	3350 kL
204209	Everlast International Investment Pty Ltd	LOT 468; Mundijong Road, Baldivis (Bore located on LOT 479 Mundijong Road)	Perth – Superficial Swan	60000 kL
206554	Siviour, Mark Brian Siviour, Sally Elizabeth	LOT 101 St Albans Road, Baldivis	Perth - Leederville	10000 kL
206614	Ausvision Rural Services Pty Ltd	LOT 1 on Plan 77728	Perth - Superficial Swan	56180 kL

3.3.2 Surface water

The subject site is located between the Peel Main drain adjacent to the west and Birrega Main drain 1.25 km east. Surface water at the subject site drains from east to west, toward the Peel Main Drain, via several small natural drainage channels that dissect the site, in addition to the Folly River (DoW 2015; Figure 3.3).

In 2012, the WAPC identified the north-east Baldivis area as a potential site for developing a non-heavy industrial estate in the Economic and Employment Land Strategy (WAPC 2012). This prompted the *North-east Baldivis flood modelling and drainage study* (DoW 2015), which assessed the proposed industrial site and surrounds (which included the subject site) to identify constraints associated with flooding in the area, and to provide technical information to support site development. The study found that regular winter inundation from shallow groundwater, limited drainage potential (associated with low landscape position and flat topography), and location between the Birrega and Peel main drains contribute to the flood risk across the area (DoW 2015). The report concluded that the study area (including the subject site) may be flooded via groundwater inundation, direct rainfall, flooding and/or backwater from the Peel Main Drain, and levee overtopping or failure on the Birrega Main Drain (DoW 2015). Land use feasibility, with consideration to potential levee failure, drainage requirements, flood and inundation mitigation, and downstream effects from development have been addressed in a District Water Management Strategy (DWMS).

The subject site is located within the Peel-Harvey Coastal Plain Catchment, and thus the provisions of the Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992 (EPP) and the State Planning

Policy No.2.1 – Peel-Harvey Coastal Plain Catchment (SPP2.1) apply. The Perth and Peel @ 3.5 million Planning Investigation Areas Update (WAPC 2022) shows the land is zoned Urban Expansion.

The EPP provides environmental quality objectives to be achieved and maintained for the total phosphorus loads within the EPP catchment area. The purpose of SPP 2.1 is to improve the social, economic, ecological, aesthetic, and recreational potential of the catchment, whilst balancing land uses changes and economic growth of the catchment as to avoid and minimise environmental damage. The development criteria stipulate that all residential lots, must be connected to reticulated sewerage, unless alternative wastewater treatment and effluent disposal systems are approved by the Western Australian Planning Commission. The policy also specifies that all existing vegetation should be retained, and replanting should be encouraged to help reduce nutrient flow into the Peel Harvey Estuary. Nutrient contamination into the Peel-Harvey Estuary is likely to be significantly reduced with rezoning of the subject site from Rural to Urban, which would be a key factor in favour of a change in zoning.

Development of the site will however be required to demonstrate best practice urban development through reticulated sewerage, water sensitive urban design, and water retention measures. If soils are demonstrated to have a limited ability to retain phosphorous, the inclusion of a soil amendment to imported fill may be required to improve the site's nutrient adsorption capacity. Soil amendments may consist of mining or other by-products that add clay minerals to the soil. Given the current understanding of the subject site's soils, it is unlikely that soil amendments would be required.

3.3.3 Geomorphic wetlands

The nature of the protection and management Swan Coastal Plain wetlands should be afforded is guided by the appropriate management category they have been assigned. These management categories are listed below:

Table 3.5: Wetland management categories and management objectives

Category	Objective
Conservation (C category) Wetlands	To preserve wetland (natural) attributes and functions
Resource Enhancement (R category) wetlands	To restore wetlands through maintenance and enhancement of wetland functions and attributes
Multiple Use (M category) wetlands	To use, develop and manage wetlands in the context of water, town and environmental planning

Regional geomorphic wetland mapping (WALGA 2019) indicates that most of the subject site consists of Palusplain Multiple Use Wetlands (MUW) (UFI 16021) (Figure 3.3). MUW are typically wetlands with few important ecological attributes and function remaining, approved development can progress within MUW and therefore these wetland values do not represent a constraint to development, other than the limitations associated with the site's geology and depth to groundwater / perched surface water as previously discussed.

Several areas of the site are mapped as Resource Enhancement Wetlands (REW) (UFI 14646, 14647, 14665, 14666, 14736) (Figure 3.3). REW are mainly wetlands which may have been partly modified but will support ecological attributes and values, the EPA advise that "reasonable" measures are taken to minimise the potential impacts on REW and their appropriate buffers (WRC 2001; EPA 2008). The DSP proposes to retain three REW (UFI 14646, 14647 and 14736) in a Local Reserve for conservation purposes (Appendix A). The retention of these wetlands recognises the environmental values associated with them, when compared with MUW, and provide an opportunity to strengthen their attributes through the development planning process. However, it is noted that the dataset for the Geomorphic Wetlands of the Swan Coastal Plain is dated, and it is recommended that the site is surveyed to confirm their boundaries and management categories.

It should be noted that, while located outside the site's boundary, one Conservation Category Wetland (CCW) was identified near the site's southeast on the south side of Duckpond Road (UFI 14780; Figure

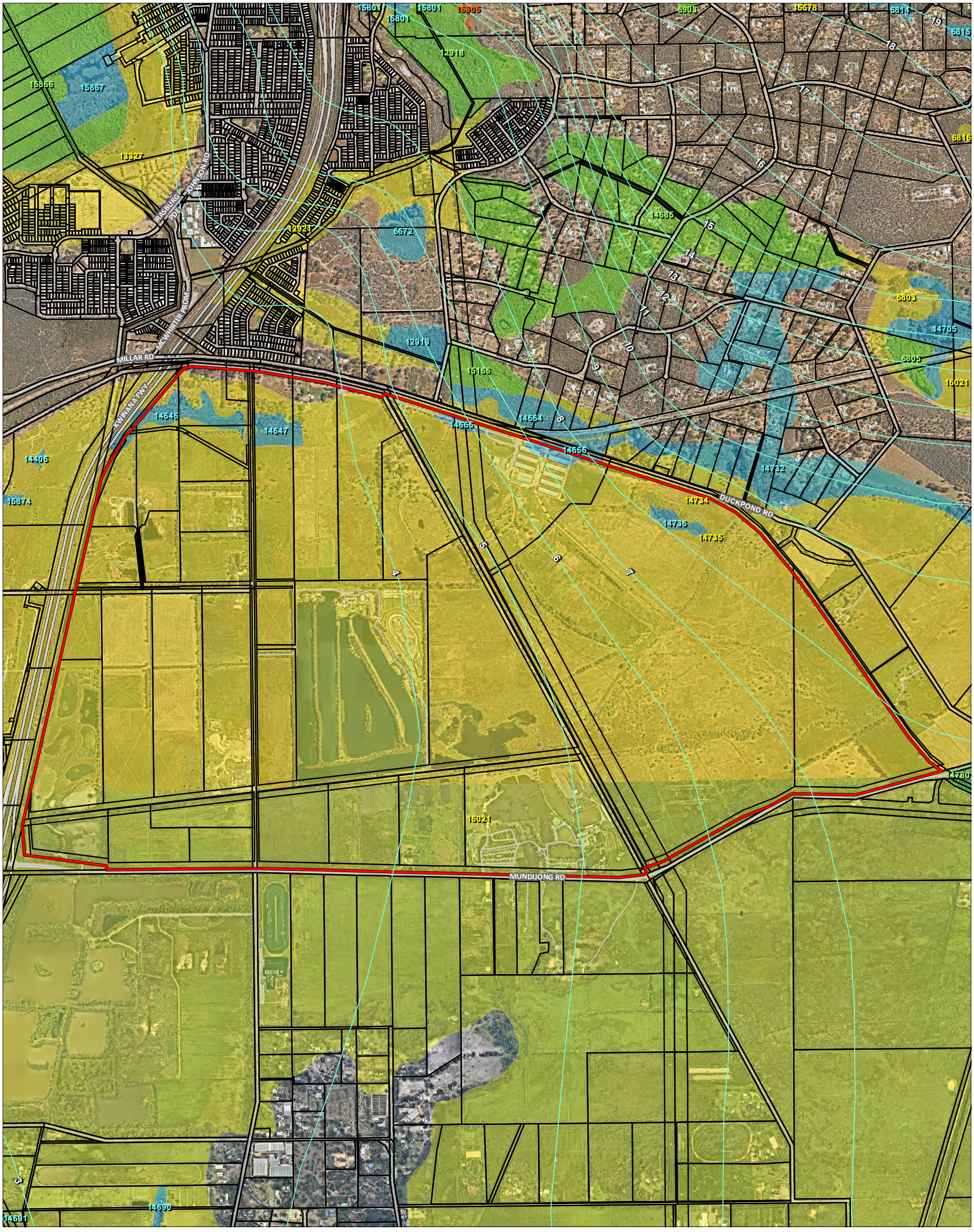
3.3). Land use planning typically requires a buffer of 50 m between the boundary of a CCW and any potential development. This buffer, includes a constructed road reserve, extends into the site, and is reflected in DWER (2019) mapping that classifies the area as an Environmentally Sensitive Area (ESA). ESAs are discussed further in Section 3.7.2.

There are no recorded Ramsar sites or DEE important wetlands within the subject site.

3.3.4 Public drinking water source area

The *Metropolitan Water Supply, Sewerage and Drainage Act 1909* (MWSSD Act) and the *Country Areas Water Supply Act 1947* (CAWS Act) identify and categorise public drinking water source areas as catchment areas, water reserves, or underground water pollution control areas.

A review of the *Perth Groundwater Map* (DWER 2019) indicates that the site is not located within a Public Drinking Water Source Area (PDWSA). The Jandakot PDWSA is located approximately 4 km northeast of the site.



Legend

- Site boundary
- Cadastral boundary

Geomorphic Wetlands

- Conservation
- Resource enhancement
- Multiple use
- Not applicable

- Groundwater contours (mAHD)
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

JBS&G

0 500 metres

North East Baldivis, Mundijong Road Baldivis, WA

HYDROLOGY AND WETLANDS

Job No: 64058		Scale 1:17,000 at A3		
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: jcrute	Checked By: CT	Version: A	Date: 16-Nov-2022	**FIGURE: 3.3**

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Image Reference: www.nearmap.com © - Imagery Date: 30 September 2022.

3.4 Acid sulfate soils

Acid sulfate soils (ASS) are naturally occurring, iron-sulfide rich soils, sediments or organic substrates, formed under waterlogged conditions. If exposed to air, these sulfides can oxidise and release sulfuric acid and heavy metals. This process can occur due to drainage, dewatering or excavation.

The site is identified in the ASS Risk Map, Swan Coastal Plain layer as being within a Moderate to Low ASS risk area. The DWER notes "moderate to low risk of ASS occurring within 3m of natural soil surface but high to moderate risk of ASS beyond 3m of natural soil surface".

RPS conducted a preliminary investigation on the northeast corner of the site in 2017, which confirmed the presence of ASS there. A follow-up investigation was conducted by Strategen (now Strategen-JBS&G) for the entirety of the site in 2018 (Strategen 2018c; Appendix B). This assessment concluded the following:

- Instances of ASS have been identified during the works.
- All materials encountered had net acidities above the DWER (2015b) guidance. Grey Bassendean Sands had net acidities above the detection limit and will require management and lime-neutralisation should these soils be encountered during construction.
- Both above and below water table material is anticipated to require management measures to prevent acidification of soils and groundwater. Management would be based on DWER (2015b) and would include:
    - Lime dosing of excavated soils prior to stockpiling or reuse
    - Treatment of any dewatering effluent to increase pH prior to infiltration
    - Sampling of treated soils and dewatering effluent to ensure that DER guidance is met
    - An ASS Management Plan is anticipated to be required as a condition of subdivision.

Additional ASS delineation work undertaken at a time closer to site development could further delineate the extent of ASS and consequently reduce the extent of treatment required.

3.5 Vegetation and flora

3.5.1 Desktop assessment

3.5.1.1 Vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1:1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981) which led to the delineation of botanical districts as described in Beard (1990); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia, IBRA) for Western Australia (DEE 2019a) and System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980). Vegetation described by Beard (1990) has since been updated by Shepherd *et al*. (2002) to conform to the National Vegetation Information System standards (ESCAVI 2003).

The site occurs within the Swan Coastal Plain IBRA region and Swan Coastal Plain (SWA2) IBRA subregion, which is characterised by vegetation comprising Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plain and paperbark in swampy areas. The outwash plains, once dominated by *C. obesa – Corymbia calophylla* woodlands and *Melaleuca* shrublands, are extensive only in the south (Williams and Mitchell 2002).

At a finer scale, the site falls within one vegetation system association; Pinjarrah 968, which is described by Beard (1990) as a Medium woodland, of Jarrah, Marri and Wandoo.

System 6 mapping refers to vegetation mapping undertaken at a vegetation complex scale by Heddle *et al.* (1980). The site occurs within the following three vegetation complexes, which are displayed in Figure 3.4:

- Serpentine River Complex: described as a closed scrub of *Melaleuca* species and fringing woodland of *Eucalyptus rudis* (Flooded Gum) – *Melaleuca rhaphiophylla* (Swamp Paperbark) along streams.
- Guildford Complex: described as Mixture of open forest to tall open forest of *E. calophylla*, *E. wandoo, E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis* and *M. rhaphiophylla.*
- Bassendean Complex – Central and South: described as vegetation ranging from woodland of *E. marginata* - *Allocasuarina fraseriana* (Sheoak) - *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites. This area includes the transition of *E. marginata* to *E. todtiana* (Pricklybark) in the vicinity of Perth.

Table 3.6 presents the DBCA (2018) Southwest Vegetation Complex Statistics Report and DBCA (2019) 2018 Statewide vegetation Statistics Report for each vegetation system association and complex within the site. In terms of biodiversity conservation targets, the National Objectives and Targets for Biodiversity Conservation 2001 – 2005 aims to (Environment Australia 2001):

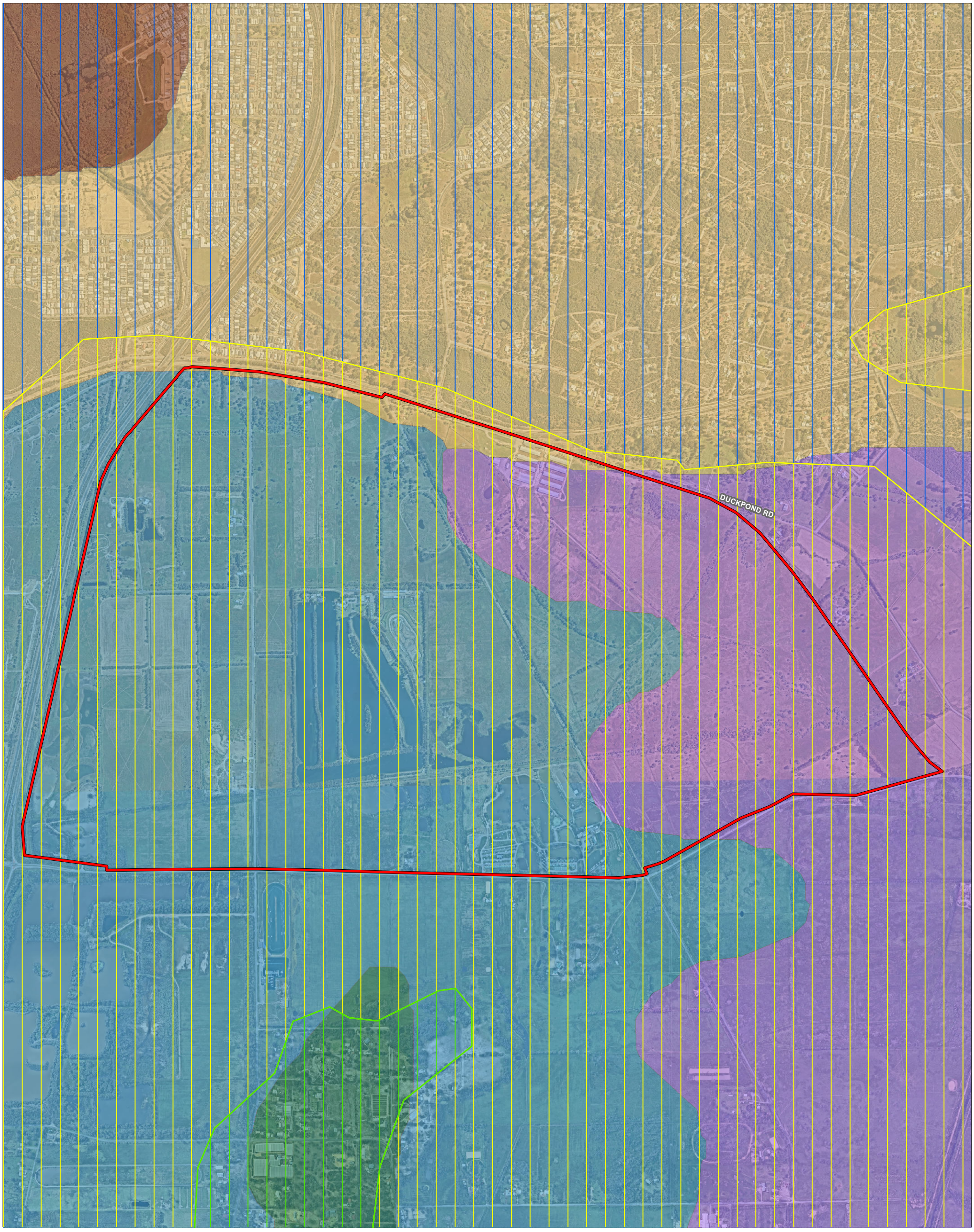
- Prevent clearing of ecological communities with less than 30% of the original extent remaining
- Recover ecological communities with less than 10% of the original extent remaining.

These national targets are reflected in state government policy for Western Australia and generally, are used to guide planning and decision-making (WAPC 2010). However, in relation to bushland conservation within the Perth Metropolitan Region portion of the Swan Coastal Plain, which is recognised as a constrained area, *State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region and Bush Forever* seeks to protect a target of at least 10% of the original extent of each vegetation complex (WAPC 2010).

Table 3.6: Vegetation complex / system association Statistics Report (DBCA 2018; DBCA 2019)

	Swan Coastal Plain			
Vegetation Complex	**Pre-European Extent (ha)**	**Current extent (ha)**	**Percent (%) remaining**	**Current percentage (%) remaining within the State conservation estate**
Serpentine River Complex	19,855	1,940	9.77	2.31
Guildford Complex	90,513	4,608	5.09	0.26
Bassendean Complex – Central and South	87,476	23,509	26.87	1.86
Pinjarrah 968	135,999	8,996	6.61	1.19

The Guildford Complex, Serpentine River Complex and Pinjarrah 968 system association all fall beneath the 10% threshold for retention. However, the majority of vegetation on site has become highly degraded due to agricultural activity and is no longer representative of the vegetation complexes described above (Figure 3.4). Flora and vegetation surveys conducted across the site (Section 3.5.2) have also confirmed that the vegetation does not meet the description of a TEC.



Legend

- Site boundary
- Pre-European vegetation (DPIRD)
  - Bassendean_1001
  - Pinjarra_1001
  - Pinjarra_968 (1098.43 ha within site)
- Vegetation complexes (DBCA)
  - Bassendean complex- Central and South
  - Dardanup complex
  - Guildford complex
  - Herdsman complex
  - Serpentine river complex

JBS&G

0 500 metres

North East Baldivis, Mundijong Road Baldivis, WA

VEGETATION COMPLEXES AND SYSTEM ASSOCIATIONS

Job No: 64058		Scale 1:17,000 at A3	
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: jcrute	Checked By: CT	Version: A	Date: 16-Nov-2022

FIGURE: 3.3

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Image Reference: www.nearmap.com © - Imagery Date: 30 September 2022.

3.5.1.2 Flora

Searches were conducted by Strategen-JBS&G in 2020, using a 5km buffer in NatureMap and the EPBC Protected Matters Search Tool (PMST) to identify flora species of conservation significance potentially occurring in the Survey Area. The desktop assessment identified eleven Threatened flora and seven Priority species that have been recorded in the regional area (Table 3.7). Due to NatureMap since being taken offline indefinitely, another desktop search has been conducted of the publicly available database of DBCA to identify any additional findings. However, the findings of database searches in 2020 remain relevant to the site.

Table 3.7: Threatened and Priority flora identified from Naturemap and PMST database searches

Species	Conservation Status	
	Commonwealth	State
Acacia lasiocarpa var. bracteolata long peduncle variant (G. J. Keighery 5026)	Not listed	Priority 1
Andersonia gracilis	Threatened – Endangered	Threatened
Aponogeton hexatepalus	Not listed	Priority 4
Boronia juncea subsp. *juncea*	Not listed	Priority 1
Caladenia huegelii	Threatened - Endangered	Threatened
Cyathochaeta teretifolia	Not listed	Priority 3
Diuris micrantha	Threatened – Vulnerable	Threatened
Diuris purdiei	Threatened – Endangered	Threatened
Drakaea elastica	Threatened – Endangered	Threatened
Dodonaea hackettiana	Not listed	Priority 4
Eucalyptus x *balanites*	Threatened – Endangered	Threatened
Grevillea curviloba subsp. *incurva*	Threatened - Endangered	Threatened
Jacksonia gracillima	Not listed	Priority 3
Lepidosperma rostratum	Threatened – Endangered	Threatened
Stylidium longitubum	Not listed	Priority 4
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Threatened – Critically Endangered	Threatened
Synaphea sp. Serpentine (G. R. Brand 103)	Threatened – Critically Endangered	Threatened
Tetraria australiensis	Threatened – Vulnerable	Threatened

3.5.2 Site survey

A broad scale vegetation assessment was initially undertaken on 30 May 2018 for those properties within the site owned by Stockland. This assessment was subsequently expanded to cover the remainder of the site on 10 December 2019 (Strategen-JBS&G 2020a,Appendix D). An independent flora, vegetation and fauna survey was also conducted of Lot 201 Mundijong Road on 15 February 2019 (Strategen 2019). Each of the above surveys were conducted by suitably qualified ecologists according to standards set out in the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). A summary of the results of these surveys is provided in the following sections.

3.5.2.1 Threatened and Priority flora

No Threatened flora species as listed under Section 178 of the EPBC Act, or pursuant to the BC Act were recorded within the surveyed area. Additionally, no Priority flora species as listed by the Western Australian Herbarium (1998) were recorded.

Due to the lack of native vegetation and the highly degraded state of what vegetation remains, it is unlikely that any of the Threatened or Priority flora species listed in Table 3.7 occur in the site, based on the habitat requirements of each species.

3.5.2.2 Vegetation type

A total of 10 vegetation types (VTs) were defined and mapped within the survey area (Figure 3.5), which have been summarised in Table 3.8. The survey area comprises predominantly cleared areas on

flat pastural land with scattered native and planted trees. Completely cleared areas, rehabilitated and planted areas have not been counted as unique native VTs but have been included in Table 3.8 and Table 3.9 for area calculation purposes. Total areas occupied within the survey area by each of the identified VTs are set out in Table 3.9.

Table 3.8: Vegetation types

Vegetation type	Description
VT1	*Agonis flexuosa* and *Eucalyptus rudis* scattered trees over weedy grassland
VT2	*Melaleuca rhaphiophylla* scattered trees over isolated occurences of *Xanthorrhoea preissii* over introduced grasses
VT3	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* scattered trees over weedy grassland
VT4	Open woodland of *Corymbia calophylla* over isolated shrubs of *Jacksonia sternbergiana* over weedy grasses
VT5	*Melaleuca viminea* shrubland over mixed native species
VT6	Revegetated woodland of *Corymbia calophylla*, *Melaleuca rhaphiophylla* over open shrubland of local native species and non-endemic species adjacent to artificial lakes
VT7	Shrubland of *Melaleuca teretifolia* over weedy grasses
VT8	*Melaleuca viminea* shrubs over weedy grasses
VT9	Woodland of *Eucalyptus rudis*, ^*Eucalyptus camaldulensis* and ^*Corymbia citriodora* over very open shrubland of *Kunzea glabrescens* and mixed introduced species
VT10	Very open woodland of *Eucalyptus rudis* over weedy grasses
Planted	**Eucalyptus sp., ^Eucalyptus camaldulensis, Casuarina obesa* and / or Casuarina sp. planted trees, over isolated remnant or regrown native shrubs in some locations, over weedy grasses
Cleared	Cleared areas containing hardstand, infrastructure or paddocks with occasional remnant or planted trees or shrubs
Rehabilitation	Revegetation. Shrubland of non-endemic species on road verge
Open Water	Areas of standing water within artificial lakes

The total area mapped within the survey area was 782.4 ha, which includes highly degraded and fully cleared areas, as well as those areas unable to be accessed (Table 3.9). The dominant VT within the survey area was VT3 (33.97 ha) which can be broadly described as *Eucalyptus rudis* and *Melaleuca rhaphiophylla* scattered trees over weedy grassland. A portion of the survey area has been rehabilitated with vegetation surrounding an artificially created wetland (Figure 3.5).

Table 3.9: Area (ha) covered by each VT within the survey area

Vegetation type	Area (ha)	Percentage (%) of the survey area
VT1	3.09	0.39
VT2	13.78	1.76
VT3	33.97	4.34
VT4	1.69	0.22
VT5	9.4	1.20
VT6	4.41	0.56
VT7	0.92	0.12
VT8	0.65	0.08
VT9	1.19	0.15
VT10	3.67	0.47
Planted	31.75	4.06
Cleared	487.81	62.35
Rehabilitation	1.58	0.20
Open Water	3.72	0.48
Unable to access	184.77	23.62
Total	**782.4**	**100**

3.5.2.3 Vegetation condition

Historical aerial photography indicates that since 1953 the survey area has been significantly cleared (Landgate 2019) and is extensively degraded due to historical clearing and grazing by livestock. Tree death of *Melaleuca raphiophylla* was observed in wetland areas of VT2. Vegetation condition within

the site ranged from Completely Degraded to Good, with the majority of vegetation within the survey area was classed as Completely Degraded (Keighery 1994; Figure 3.6; Table 3.10).

Table 3.10: Vegetation condition scale (Keighery 1994)

Condition rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback, grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	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.

Table 3.11 gives a numerical breakdown of the area occupied by each vegetation condition rating within the survey area.

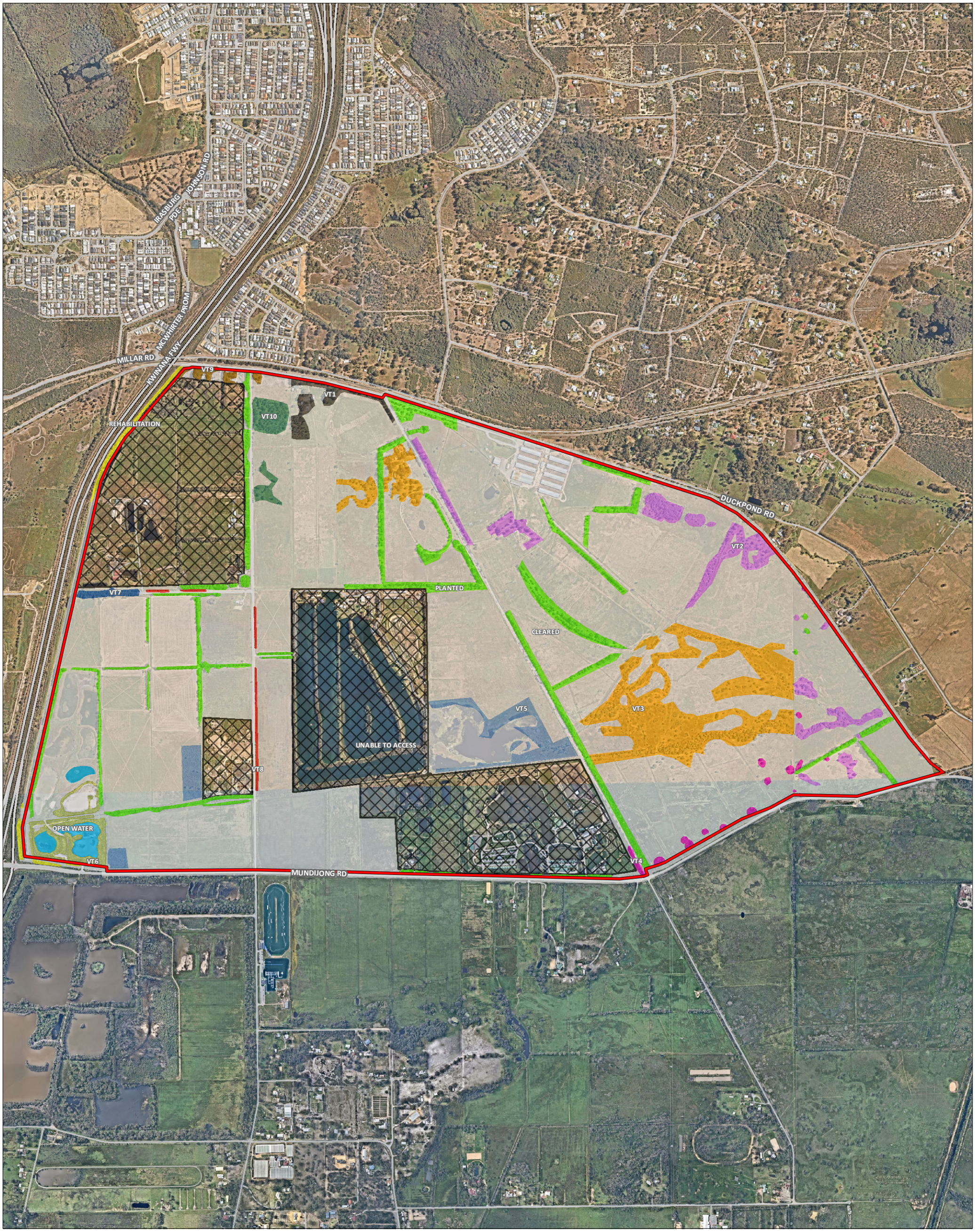
Table 3.11: Area (ha) covered by each vegetation condition category within the survey area

Vegetation Condition	Area (ha)	Percentage (%) of the Survey area
Good	4.41	0.56
Degraded – Good	2.32	0.30
Degraded	12.72	1.63
Completely Degraded – Degraded	29.93	3.83
Completely Degraded	548.25	70.07
Unable to access	184.77	23.62
Total	**782.4**	**100**

3.5.2.4 Threatened and Priority Ecological Communities

None of the vegetation within the surveyed area was considered to be sufficiently in-tact so as to assign a vegetation community type. As such, none of the vegetation was considered to be conservation significant or represent any known Threatened Ecological Community (TEC) or Priority Ecological Community (PEC).

Duckpond Nature Reserve, located to the southeast of the site, contains SCP3c – *Corymbia calophylla* – *Xanthorrhoea preissi* woodlands and shrublands of the Swan Coastal Plain. This is contained within the CCW and has a recommended buffer of 50 m as required under land use planning.



Legend

- Site boundary
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

Vegetation type

- Cleared
- Open water
- Planted
- Rehabilitation
- Unable to access
- VT1
- VT2
- VT3
- VT4
- VT5
- VT6
- VT7
- VT8
- VT9
- VT10

JBS&G

0 500 metres

Job No: 64058		Scale 1:17,000 at A3	
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: jcrute	Checked By: CT	Version: A	Date: 16-Nov-2022

North East Baldivis, Mundijong Road Baldivis, WA

VEGETATION TYPES

FIGURE: 3.5

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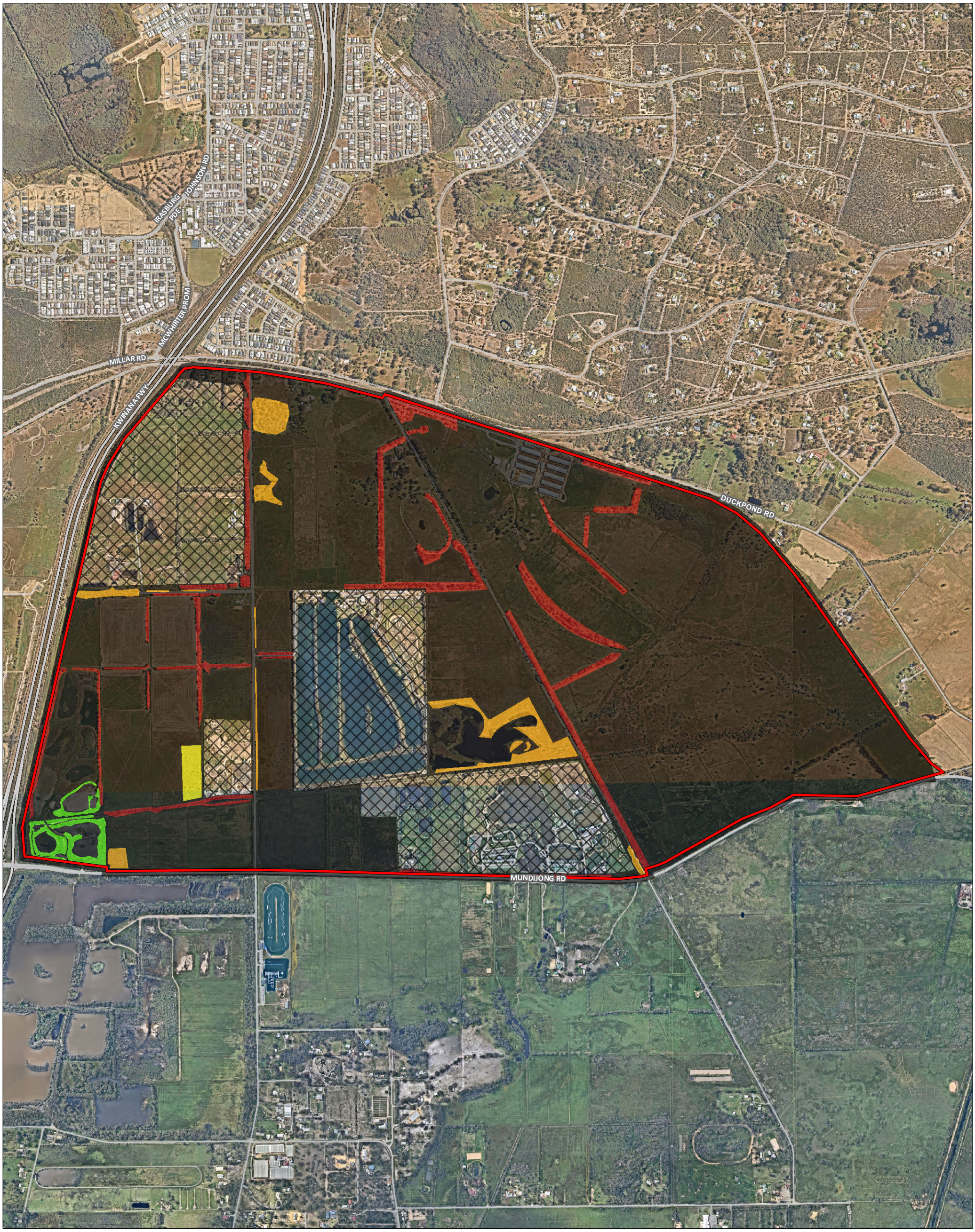
Image Reference: www.nearmap.com© - Imagery Date: 30 September 2022.



Legend

- Site boundary
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

Vegetation condition

- Good
- Degraded to good
- Degraded
- Completely degraded to degraded
- Completely degraded
- Unable to access

JBS&G

0 500 metres

North East Baldivis, Mundijong Road Baldivis, WA

VEGETATION CONDITION

Job No: 64058		Scale 1:17,000 at A3	
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: jcrute	Checked By: CT	Version: A	Date: 16-Nov-2022

FIGURE: 3.6

Document Path: W:\Projects\1)Open\Stockland\64058 EAR Review Wellard\GIS\Maps\R01_Rev_A\64058_03_6_A3P_VegCond.mxd
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3.6 Fauna and habitat

3.6.1 Desktop assessment

Searches were conducted by Strategen-JBS&G in 2020, using a 5km buffer in NatureMap and the EPBC Protected Matters Search Tool (PMST) to identify fauna species of conservation significance potentially occurring in the Survey Area. Due to NatureMap since being taken offline indefinitely, another desktop search has been conducted of the publicly available database of DBCA to identify any additional findings. However, the findings of database searches in 2020 remain relevant to the site.

A total of eight conservation significant species (including Priority species) from the database searches were considered to either be likely, possibly, or unlikely to occur within the site. These eight species comprised seven bird and one mammal species and are listed in Table 3.12. Database reports are provided in Appendix C.

The likelihood of each species is based on the following criteria:

- Recorded: Recorded during a field assessment (as discussed in Section 3.6.2)
- Likely: Suitable habitat is present in the site and the site is in the species' known distribution
- Possible: Limited or no suitable habitat is present in site but is nearby. The species has good dispersal abilities and is known from the general area
- Unlikely: No suitable habitat is present in site but is nearby, the species has poor dispersal abilities, but is known from the general area; or suitable habitat is present, however the site is outside of the species' known distribution.

Table 3.12: Threatened and Priority fauna identified from Naturemap and PMST database searches

Species	Conservation Status		Likelihood of occurrence
	Commonwealth	State	
Birds			
Oxyura australis Blue-billed Duck	Not listed	Priority 4	Unlikely
Tringa nebularia Common Greenshank	Migratory; Marine	Protected under international agreement	Unlikely
Plegadis falcinellus Glossy Ibis	Migratory	Protected under international agreement	Possible
Haliaeetus leucogaster White-bellied Sea Eagle	Marine	Protected under international agreement	Possible
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo	Vulnerable	Threatened	Likely
Calyptorhynchus baudinii Baudin's Black Cockatoo	Vulnerable	Threatened	Likely
Calyptorhynchus latirostris Carnaby's Black Cockatoo	Endangered	Threatened	Likely
Mammals			
Isoodon obesulus fusciventer Quenda (Quenda)	Not listed	Priority 4	Unlikely

3.6.2 Site survey

A level 1 Fauna survey and Black Cockatoo habitat assessment was initially conducted for those portions of the site owned by Stockland on 22 May 2018. This assessment was later expanded to cover the remainder of the site on 10 December 2019 (Strategen-JBS&G 2020b; Appendix E). An independent flora, vegetation and fauna survey was also conducted of Lot 201 Mundijong Road on 15 February 2019 (Strategen 2019). Each survey was conducted by a suitably qualified ecologist

consistent with the standard protocols for the region and relevant EPA Guidance Statements and EPBC Act survey guidelines. A summary of the results of these surveys is provided in the following sections.

3.6.2.1 Threatened and Priority fauna

During the field survey, four conservation significant species pursuant to the EPBC Act or BC Act were recorded: the Glossy Ibis, White-bellied Sea-eagle, Forest Red-tailed Black Cockatoo and the Quenda.

3.6.2.2 Black Cockatoo habitat assessment

3.6.2.3 Foraging habitat

There is a total of 32.63 ha (5.5%) of Black Cockatoo foraging habitat in the survey area. The majority of this is considered to be representative of Poor quality, with some areas identified as being of Poor – Moderate quality. The low overall density of foraging species across this area reflects the poor quality of the habitat. Smaller, isolated areas have denser cover; however, these are limited, and separated by large areas with little or no foraging habitat value.

Two species of Eucalypt (*Corymbia calophylla* [Marr] and *Eucalyptus rudis*) recorded in the survey area are considered Black Cockatoo foraging habitat. One other foraging species was recorded; *Allocasuarina* sp., a known Black Cockatoo dietary item.

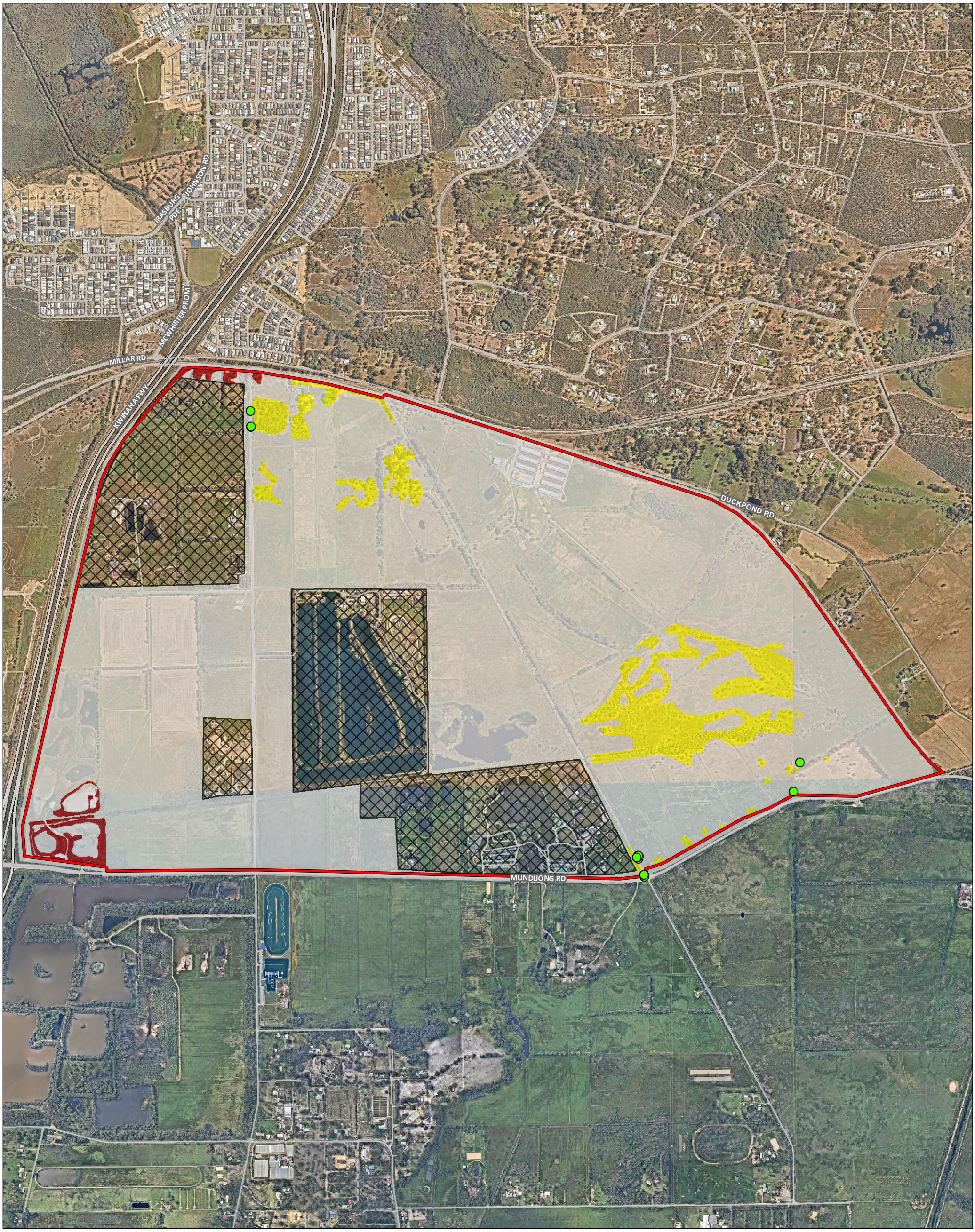
3.6.2.4 Potential breeding trees

Large Marri trees recorded in the site are also considered Black Cockatoo potential breeding habitat. The survey area contains 13 potential breeding trees with a DBH of more than 500 mm. The locations of these potential breeding trees area displayed in Figure 3.7.

No hollows considered to be large enough at their entrances (>120 mm) to be considered as potential breeding hollows in the future were observed in the survey area.

Several Flooded Gum trees were recorded in the survey area, some of which had a DBH of more than 500 mm. However, although their DBH was technically large enough for them to be considered potential breeding habitat, due to their low branching form, they were not considered suitable for Black Cockatoos to breed in.

It should also be noted that six Forest Red-tailed Black Cockatoos were observed foraging in the southeast corner of the site.



Legend

- Site boundary
- Black Cockatoo foraging habitat
  - Poor - moderate
  - Very poor
  - Nil
  - Unable to access
- Black Cockatoo potential breeding trees
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

JBS&G

0 500 metres

North East Baldivis, Mundijong Road Baldivis, WA

BLACK COCKATOO FORAGING HABITAT

Job No: 64058		Scale 1:17,000 at A3		
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: jcrute	Checked By: CT	Version: A	Date: 16-Nov-2022	**FIGURE: 3.7**

Document Path: W:\Projects\1)Open\Stockland\64058 EAR Review Wellard\GIS\Maps\R01_Rev_A\64058_03_7_A3P_BCForagingHab.mxd

Image Reference: www.nearmap.com © - Imagery Date: 30 September 2022.

3.7 Conservation areas

State Planning Policy 2.8: Bushland Policy for the Perth Metropolitan Region (SPP 2.8) aims to provide a policy and implementation framework that ensures bushland protection and management issues throughout the Perth Metropolitan Region are adequately addressed and integrated with broader land use planning and decision-making (WAPC 2010). The policy predominantly deals with two distinct subjects, Bush Forever areas and local bushland areas.

In accordance with SPP 2.8, proposals must recognise regionally significant bushland and outline methods by which it will avoid, minimise and offset any likely adverse impacts it will have on regionally significant bushland.

3.7.1 Bush Forever sites

Bush Forever is a 10-year strategic plan that aims to protect and retain at least 10% of each of the original 26 vegetation complexes that have been identified on the Swan Coastal Plain. Bush Forever sites are the specific localities that have been recognised as containing regionally significant vegetation and are endorsed for protection and retention under Bush Forever.

A search of the Western Australian Local Government Association Administrative Planning Categories mapping tool (WALGA 2018) and of the publicly available database of the DPLH, did not identify any Bush Forever sites within the site. The nearest Bush Forever sites are Site no. 360 and 349, which are located directly to the east of the site and to the northwest on the opposite side of Kwinana Freeway, respectively (Figure 3.8).

3.7.2 Environmentally Sensitive Areas

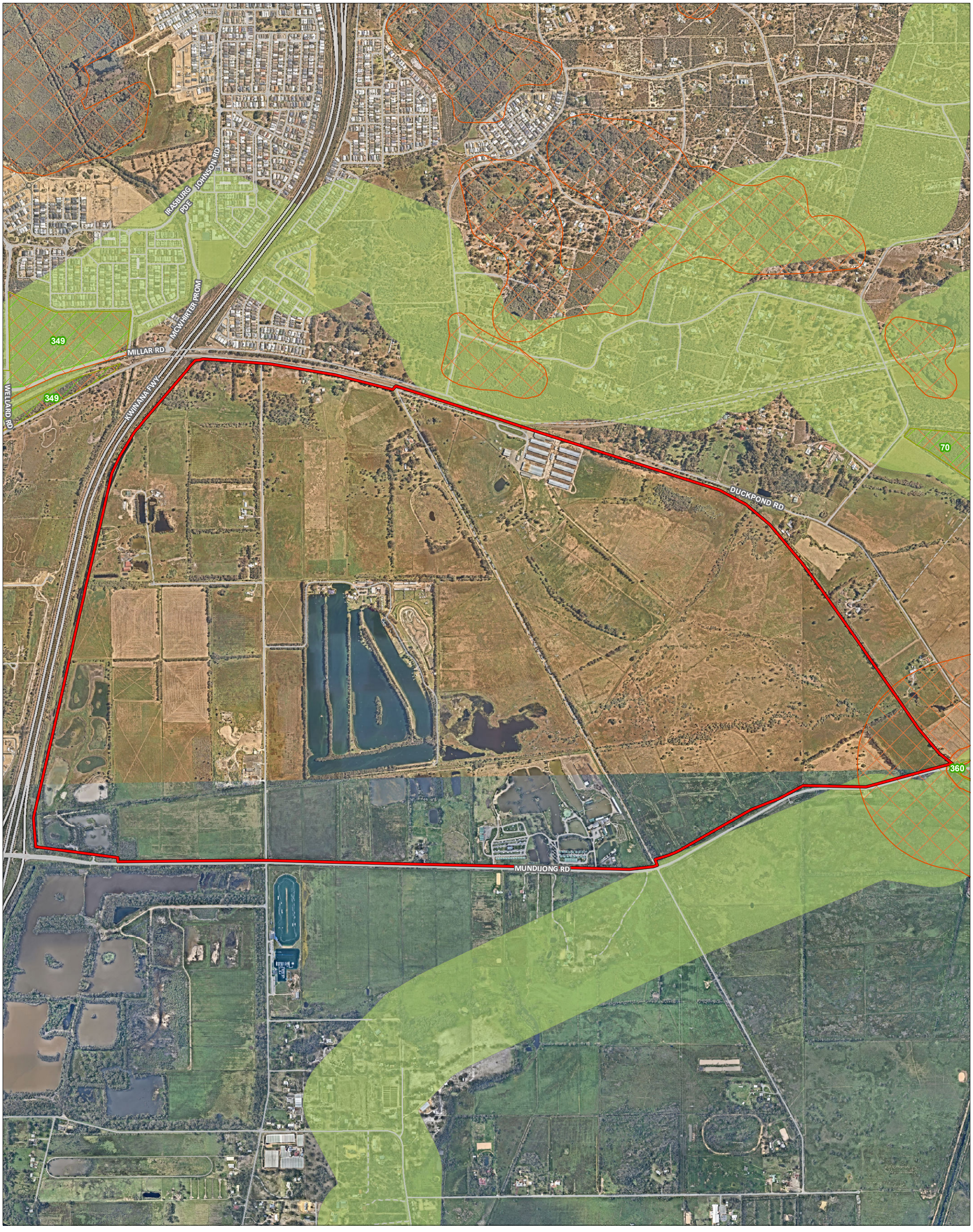
Environmentally sensitive areas (ESAs) are declared by the Minister for the Environment under section 15b of the *Environmental Protection Act 1986*. ESAs are only relevant in the limited context of exemptions in the clearing regulations, which do not apply to ESAs.

The site is mapped as an environmentally sensitive area according to the DWER Environmentally Sensitive Areas Map Viewer (2019b). This ESA is associated with the CCW (UFI 14780; Section 3.3.3) and associated 50 m buffer in the south-eastern corner of the site, as well as a TEC identified within the same area. This broad ESA includes areas that have been significantly degraded to the point where, within the site boundary, little to no native vegetation remains. A flora, vegetation and flora survey conducted across that portion of the site (Strategen 2019a) confirmed the absence of any TEC within that portion of the site.

3.7.3 Regional Ecological Linkages

Regional Ecological Linkages are a network of protected Regionally Significant Natural Areas which act as corridors to maintain habitat connectivity for flora and fauna species. The protection of these linkages is not mandated by legislation, but it is expected that consideration will be given where the linkage may be impacted by an action.

A search of the Western Australian Local Government Association Regional Ecological Linkages for the Perth Metropolitan Region mapping tool (WALGA 2019) identified that the site marginally intersects with one Regional Ecological Linkage (LINK_ID: 73) at the south-eastern boundary (Figure 3.8). This linkage is associated with vegetation occurring to the south of the site and Bush Forever Site 360 to the southeast.



Legend

- Site boundary
- Bush Forever site (DPLH)
- Environmentally sensitive areas (DWER)
- Regional ecological linkages
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

JBS&G

0 500 metres

Job No: 64058

Scale 1:17,000 at A3

Client: Stockland Development pty Ltd

Coord. Sys. GDA 1994 MGA Zone 50

Drawn By: jcrute | Checked By: CT | Version: A | Date: 16-Nov-2022

North East Baldivis, Mundijong Road Baldivis, WA

CONSERVATION AREAS

FIGURE: 3.8

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3.8 Contamination

The *Contaminated Sites Act 2003* (CS Act) defines contamination as having a substance present in land or water above background concentrations that presents a risk of harm to human health or the environment. The act also provides for the identification, recording, management and remediation of contaminated sites. Contamination commonly occurs through accidental leakage and spillage, or poor site management practices.

Strategen-JBS&G has previously undertaken the *Wellard Project Preliminary Site Assessment* (Strategen 2018b). Strategen-JBS&G is not currently aware of any other environmental investigations or remediation on the site.

A standalone report has been produced for the site (Strategen 2018b); findings from the PSI desktop assessment are summarised below in Table 3.13.

Table 3.13: Summary of PSI desktop assessment

Desktop assessment	Summary of outcomes
Current, previous and historic land uses	A number of potentially contaminating land uses were identified during the preliminary site investigation associated with particular land parcels within the site, including intensive agriculture and sheep holding, automotive repair, boat maintenance, market gardens, and uncontrolled fill importations.
Surrounding land uses	Surrounding land uses do not pose a risk of contamination to the site. There are no sites within 1 km of the subject site listed as 'Contamination – remediation required' or 'Remediated for restricted use' under the CS Act.
Freedom of Information requests	No documents within the scope of the request submitted to City of Rockingham on 21 February 2019 were revealed, as advised on 5 March 2019. The site has not been classified 'Contamination – remediation required' or 'Remediated for restricted use' under the CS Act. No sites within 1 km of the subject site have been classified as 'Contamination – remediation required' or 'Remediated for restricted use' under the CS Act. A Basic Summary of Records request submitted to DWER on 21 February 2019 found that the site has not been reported to DWER as a known or suspected contaminated site prior to or after the commencement of the CS Act, as advised on 26 March 2019.
Licences and approvals	No Dangerous Goods Licences are listed for the site as at 11 April 2019.
Disposal locations	No waste disposal locations have been identified on the site.

The PSI identified several potential pathways for contamination within the site, however these are only plausible if the contaminants are identified on site and a pathway exists at the completion of the works to link the source to the receptor. Recommendations from the PSI included a more targeted due diligence assessment on a site-by-site basis, to obtain a more complete picture of the risks to human health and the environment (Strategen 2018b).

3.9 Bushfire risk

A search of the Office of Bushfire Management Bushfire Prone Areas mapping tool indicates that the site is mapped within a bushfire prone area (DFES 2019).

As a result of the bushfire prone status of the site, a Bushfire Management Plan (BMP) is required to address the following requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (SPP 3.7), namely Policy Measure 6.3:

- A bushfire hazard level (BHL) assessment or where lot layout is known, a Bushfire Attack Level (BAL) contour assessment to determine the indicative acceptable BAL ratings across the site.
- Identification of any bushfire hazard issues arising from the above assessment.
- Assessment against the bushfire protection criteria requirements contained within the Guidelines demonstrating compliance can be achieved in subsequent planning stages.

3.10 Heritage

3.10.1 Indigenous heritage

The *Aboriginal Heritage Act 1972* (AHA Act) aims to protect Aboriginal heritage by registering Aboriginal sites (places and/or objects) that are of cultural importance to Aboriginal people. Any proposal to use or alter an area of land, for purposes such as research or development, must first determine if Aboriginal sites occur within the proposed area. If an Aboriginal site is found to occur, permission must be sought from the Minister for Aboriginal Affairs before that land can be used or altered in any way.

A search of the Department of Planning, Lands and Heritage – Aboriginal Heritage Places mapping tool (DPLH 2019) did not identify any registered Aboriginal Heritage Sites, or "other heritage places" within the site. Adjacent to the site however, within the road reserve of Kwinana Freeway to the northwest, is one Aboriginal Heritage Place (Wally's Camp, ID: S02491; 3568). This heritage place is a Registered Site, Camp. Due to the location of this heritage place outside the site boundary, no impacts are anticipated to the site, because of future urban development on the site.

3.10.2 European heritage

European cultural heritage places are recorded in a variety of different heritage listings. Some of these listings give statutory protection to heritage places, through requirements for heritage-related approvals or referrals.

A search of the State Heritage Office *InHerit* search tool did not identify any European cultural heritage places within or adjacent to the site (SHO 2019). The closest European heritage place is Natural Bush Reserve, Rear of Baldivis School (Place No. 03158), which is located approximately 1.8 km southwest of the site.

Legend

- Site boundary
- Regional parks (DBCA)
- Aboriginal heritage places (DAA-001)
- Registered site
- Other heritage place
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

JBS&G

0 580 metres

North East Baldivis, Mundijong Road Baldivis, WA

ABORIGINAL HERITAGE PLACES

Job No: 64058		Scale 1:20,000 at A3		
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: jcrute	Checked By: CT	Version: A	Date: 16-Nov-2022	**FIGURE: 3.9**

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3.11 Mosquitoes

There are almost 100 species of mosquitoes known to occur in Western Australia. Mosquitoes are considered a nuisance and are transmitters of disease-causing viruses and parasites which pose a risk to human health. These diseases include Ross River virus, Barmah Forest virus, Kunjin virus, and the potentially fatal Murray Valley encephalitis virus (Department of Health [DoH] n.d.).

Breeding habitat varies between different species of mosquito; however, they are all generally capable of breeding in natural or man-made standing bodies of fresh, brackish, or saline water. Such waterbodies include lakes, pools, swamps, ground pools, irrigation ditches, tree holes and leaf axils. In urban environments, mosquitoes may breed in pot plant drip trays, septic tanks, roof gutters, ponds, poorly maintained swimming pools, and pet water bowls (DoH n.d.).

Within the Peel-Harvey region, the Peel Harvey Estuary and its associated river systems provide saltmarsh habitat and promotes ideal conditions for saltmarsh mosquitoes to breed. Local Governments within the Peel Region have worked in partnership with DoH since the 1990s to manage mosquitoes through a coordinated mosquito management program, which targets mosquitoes at the larval stage with chemical products to effectively reduce adult populations.

Within the site, there are multiple areas of potential mosquito and midge breeding habitat. Because of this, there is a potential public health risk posed by mosquitoes and their associated nuisance levels, and an impact upon amenity from midges. Known and potential mosquito and midge breeding areas within the site include:

- Bonney's Water Ski Park and West Coast Jet Sprint.
- Golden Pond Fish and Marron Farm.
- Rural Export Holding Yard
- Multiple geomorphic wetlands (Section 3.3.3; Figure 3.3).
- Nine artificial lakes/ clay extraction pits in the southwest of the site
- Multiple small dams in the northwest of the site
- Minor drainage channels that transverse the site

Known and potential mosquito and midge breeding habitat adjacent to the site includes:

- Rosguy holding yard (1 km southeast)
- Peel Main Drain (along the western border of the site)
- one CCW adjacent to the southeast extremity of the site

Several of the potential breeding site identified will be modified by the proposed development and therefore removed as potential breeding sites that may affect future residents. The DWMS will also ensure the creation of mosquito breeding habitat is minimised by appropriate stormwater management.

To manage the public health risk associated with mosquitoes, a Mosquito Management Plan (MMP) may be prepared and implemented by the proponent for the proposed development, if required at later planning stages. The MMP will detail management measures to be implemented on the site for mosquito control, including physical, chemical and cultural measures.

The public health risk of mosquito borne disease is not expected to be worsened by the proposed DSP. The Mosquito Risk Assessment (MRA) for the proposal site identifies the approach to mosquito management that may be implemented for the proposal area (Appendix H). Notwithstanding the potential breeding habitat identified by the MRA, mosquitoes are not a constraint to development and will not present an unreasonable health risk. The risk is no greater than many other urban areas

and no breeding habitat was identified that has the potential to increase the risk beyond acceptable levels.

4. Consideration of the South Metropolitan Sub-Regional Planning Framework

4.1 Environmental and Landscape considerations

4.1.1 Peel-Harvey catchment considerations

The Peel-Harvey Estuarine System is an important regional resource for Western Australia which has experienced significant degradation in recent decades due to increased nutrient pollution from surrounding land uses. Excess phosphorus inputs to the system from the Peel-Harvey coastal catchment have resulted in excessive seasonal growth of algae, causing environmental damage and creating a public nuisance. *State Planning Policy 2.1: Peel-Harvey Coastal Plain Catchment* (SPP 2.1) has been developed to ensure that land use changes within the Peel-Harvey coastal plain do not result in additional nutrient loads entering the Peel-Harvey estuarine system. Land uses are required to meet specific provisions under the policy.

As the site is situated within the Peel-Harvey catchment area, any proposed development will be required to ensure that:

- All lots within the future subdivision area can be connected to a reticulated sewerage system (or alternative system satisfactory to the EPA and Department of Health).
- The proposed change to land use has regard for the net effect that the change is likely to have on the nutrient load discharging from the catchment into the Peel-Harvey estuary.
- Retention and rehabilitation of remnant vegetation occurs where possible, particularly along watercourses, i.e., Folly River within the site.
- Consumption and retention of drainage is maximised within the site, in line with urban water management practices outlined in Better Urban Water Management Guidelines.
- POS soils are treated with nutrient retentive soil amendment if phosphorus retention capability of the soil is low.

The change in land use from Rural to Urban/ Residential provides a stimulus for implementing measures to reduce nutrient inputs from the site into the catchment through:

- Best practice urban water management.
- The management of legacy nutrients associated with past land uses.
- Ensuring the proposed urban development of the site does not result in an increase in nutrients to the system.
- Implementation of measures to reduce nutrient export into the catchment.

4.1.2 Nutrient loads

To support agency engagement on the change in land use within the site, nutrient load modelling was conducted to estimate current and future nutrient loads from the site (Strategen 2019c). The complete Nutrient Load Modelling report is presented in Appendix F.

As nutrient loads vary based on lot size and the average lot size is not yet resolved, two post-development scenarios were run, being:

- Scenario 1 – average lot size of 350 m^2
- Scenario 2 – average lot size of 395 m^2

These land use assumptions have been based on discussions with CLE Town Planning to match land-uses to DoW (2016) categories for nutrient loading.

As presented in Table 4.1, development of the site is anticipated to result in a significant reduction in TN and TP loads from the site, compared to the pre-development scenario. The majority of pre-development TN and TP is sourced from outdoor feedlot sheep. The post development TN loads is approximately 23 to 21% of the pre-development load (reduction of at least 69%). The post development TP load is approximately 14 to 21% of the pre-development load (reduction of at least 79%).

Table 4.1: Total nutrient load

Scenario	TN (kg/yr)	TP (kg/yr)
Pre-development	95,579	28,601
Scenario 1 – average lot area 350 m^2	22,102	4072
Scenario 2 – average lot area 395 m^2	30,505	6064

4.1.3 Landscape considerations

There are no significant landscape/landform features present within the site. Multiple surface water features have been identified within the site which may be incorporated in future development design to ensure that the policy objectives of SPP 2.1 are met. These include five REWs, the buffer area of one CCW, the Folly River and multiple artificial ponds, dams and lakes. Retention of these areas may aid in reducing nutrient export from the site to the wider Peel-Harvey catchment. Several strategies may be implemented to maintain or improve water quality as part of any future development, including:

- Flood retention/ storage devices.
- Soil amendment (which has been demonstrated as effective in reducing phosphorous loads to receiving waterbodies).
- Fertiliser management.
- Water-wise and nutrient-wise landscaping in POS design and management.
- Subsurface drainage with nutrient stripping.
- Swales.
- Bioretention systems including water quality treatment.

The DSP proposes to retain three REW (UFI 14646, 14647 and 14736) in a Local Reserve for conservation purposes (Appendix A). The retention of these wetlands recognises their environmental values, when compared with MUW, and provides an opportunity to strengthen their attributes through the development planning process.

4.2 Basic Raw Materials

Mapping associated with the current SPP 2.4 *Basic Raw Materials* (WAPC 2021) indicates that the site is not classified as a Significant Geological Supply or an Extraction Site under State Planning Policy 2.4 Planning for Basic Raw Materials (SPP 2.4) (2021) and the associated interactive geological map (GeoVIEW.WA). GeoVIEW does show that the south of the site has a 'Regionally Significant Basic Raw Materials' zone for clay, however, this is not considered under SPP 2.4, Section 3.1 Supply Categories for Basic Raw Materials.

4.3 Mosquitoes

There is potential for mosquitoes and midges to breed at multiple locations within the site if not properly managed (Section 3.11). The SPP 2.9 *Water Resources* and the *Better Urban Water Management* guidelines (WAPC 2017) set out specific requirements for disease vector and nuisance insect management, particularly relating to infiltration of stormwater. Additionally, the City of Rockingham may require developers to provide a Mosquito Management Plan as part of the subdivision application.

A Local Water Management Strategy (LWMS) and Urban Water Management Plan (UWMP) will be prepared at future planning stages in accordance with SPP 2.9 *Water Resources* and *Better Urban Water Management* guidelines, to ensure that the design of drainage basins and swales will allow for immobile stormwater to be fully infiltrated within 96 hours between the months of November and May, to mitigate the potential for mosquito breeding.

A Mosquito Management Plan also is likely to be required to be prepared in consultation with, and to the satisfaction of City of Rockingham and the DoH, to support any future subdivision application.

5. Assessment against EPA Environmental Factors

5.1 Key Environmental Factors

Table 5.1 provides a preliminary assessment of the environmental factors established by the EPA for the purposes of environmental impact assessment and is used as a basis for assessing whether the environmental impact of a proposal is acceptable or may be considered significant.

Based on this assessment, the following key environmental factors have been identified:

- Flora and vegetation (Section 5.2).
- Terrestrial fauna (Section 5.3).
- Terrestrial Environmental Quality (Section 5.4).
- Inland waters (Section 5.5).
- Social surroundings (Section 5.6).

Table 5.1: EPA environmental factors – preliminary assessment

Theme	Environmental factor	Environmental objective	Significance of impact
Sea	Benthic Communities and Habitat	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.	The site is not located adjacent or nearby coastal areas.
	Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	The site is not located adjacent or nearby coastal areas.
	Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	The site is not located adjacent or nearby marine areas.
	Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	The site is not located adjacent or nearby marine areas.
Land	Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	Development of the site is not expected to cause significant impacts to flora and vegetation, given the highly degraded nature of the site.
	Landforms	To maintain the variety and integrity of significant physical landforms so that environmental values are protected.	Development of the site is not expected to cause significant impacts to landforms.
	Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	Development of the site may cause potential impacts to terrestrial fauna, through the clearing of habitat to Black Cockatoos. The EPBC referral decision states the proposed clearing on the site is not a controlled action.
	Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected	Development of the site may cause potential impacts to terrestrial environmental quality through the exposure of ASS. The quality of land and soils is expected to be ably managed throughout the development process and is not expected to be a constraint to development.
	Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	Development of the site is not expected to cause impacts to subterranean fauna.
Water	Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	The DSP proposes to retain some REWs as depicted on the Map (Appendix A), impacts are anticipated to be effectively managed through appropriate development design and the DWMS. A LWMS and UWMP will be undertaken at the appropriate stages of the planning process.

Air	Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	Development of the site is not expected to cause significant impacts to air quality.
	Greenhouse Gas Emissions	To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change.	Development of the site is not expected to contribute to an increase in greenhouse gas emissions.
People	Social Surroundings	To protect social surroundings from significant harm.	Development of the site is expected to cause impacts to social surroundings due to noise and vibration levels associated with the Mundijong freight railway, noise levels associated with Kwinana Freeway and Ski Park, odour emissions from adjacent holding yards and the Golden Pond Fish and Marron Farm, as well as high nuisance levels associated with mosquitoes. Dust emissions during construction are not expected to be significant and will be temporary. Impacts to social surroundings are anticipated to be effectively managed and/ or mitigated throughout the development design process.
	Human Health	To protect human health from significant harm.	Development of the site is expected to contribute to public health risk of mosquitoes, due to the known and potential mosquito breeding areas that are within and surrounding the proposal area. Impacts to public health are expected to be effectively managed through the planning and design phases of the development and through implementation of a Mosquito Management Plan for the site utilising standard, accepted practices.

5.2 Key Environmental Factor 1 – Flora and vegetation

5.2.1 Environmental objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016b) identifies the following objective for flora and vegetation:

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

5.2.2 Policy considerations

Flora and vegetation surveys that have informed planning for the site have been conducted in accordance with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a) and the *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016b).

The EPA outlines several key considerations for flora and vegetation within the *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016b), which are discussed below, where relevant, with relation to the site's development.

5.2.3 Receiving environment

Pre-European vegetation within the site comprises one vegetation system association; Pinjarra 968 (medium woodland of Jarrah, Marri and Wandoo), of which 6.61% remains on the Swan Coastal Plain, with 1.19% vested in lands protected for conservation.

Three vegetation complexes were found to be mapped within the site, these being the Serpentine River Complex (9.77% remaining, 2.31% in conservation), Guildford Complex (5.09% remaining, 0.26% in conservation), and Bassendean Complex – Central and South (26.87% remaining, 1.86% in conservation).

The Guildford Complex, Serpentine River Complex and Pinjarra 968 system association all fall beneath the 10% threshold for retention in constrained areas such as the Swan Coastal Plain.

A total of 10 VTs were defined and mapped within the site. The site comprises predominately cleared areas on flat pastural land with scattered native and planted trees.

Vegetation condition within the site ranged from Completely Degraded to Good, with most of the site being classified as Completely Degraded.

Flora and vegetation surveys undertaken across the site have not identified any Threatened or Priority flora or ecological communities (Strategen-JBS&G 2020a; Appendix D).

5.2.4 Potential impacts

Development of the site may result in direct and indirect impacts to vegetation because of:

- Clearing of vegetation mapped within system associations with less than 10% of the original extent remaining on the Swan Coastal Plain.
- Clearing of vegetation within complexes with less than 10% of the original extent remaining on the Swan Coastal Plain.

No conservation significant flora species are anticipated to be impacted through the development of the site.

5.2.5 Management measures

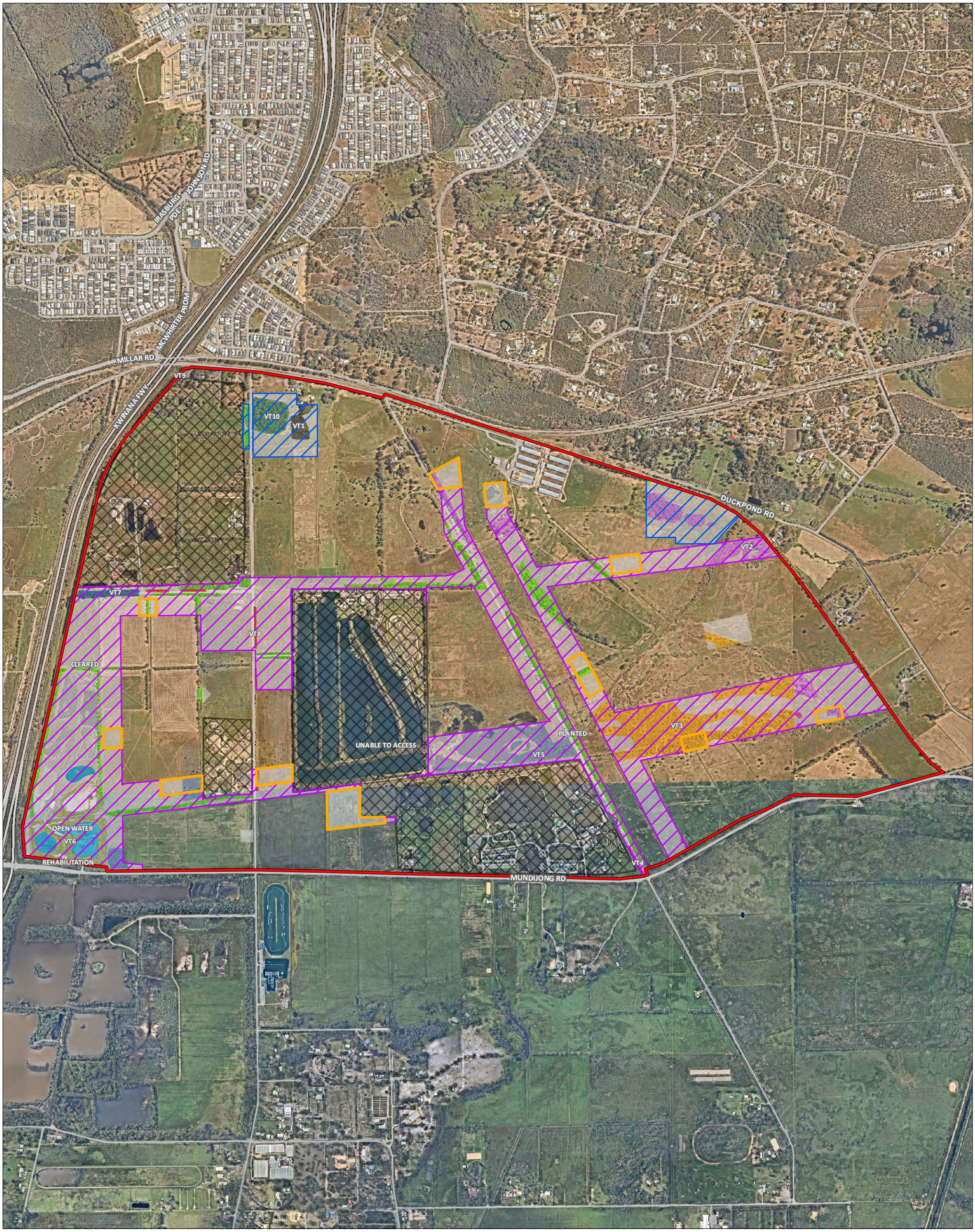
The following potential mitigation and management measures have been identified which may be implemented to ensure impacts to flora and vegetation are appropriately managed as development of the site progresses (Table 5.2).

Table 5.2: Potential mitigation and management measures for flora and vegetation

Parameter	Potential mitigation and management measures
Vegetation	• Retention of remnant vegetation where possible, within wetlands, POS flood storage areas (Figure 5.1) • Implementation of appropriate clearing controls

5.2.6 Predicted outcome

No Threatened or Priority species or ecological communities are anticipated to be impacted as a result of urban development within the site. Considering the highly degraded nature of the landscape, all direct, indirect and cumulative impacts to flora and vegetation are considered minor at a local and regional scale.



Legend

- Site boundary
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

Vegetation type to be retained

- Cleared
- Open water
- Planted
- Rehabilitation
- Unable to access
- VT1
- VT2
- VT3
- VT4
- VT5
- VT6
- VT7
- VT8
- VT9
- VT10

- POS within flood storage
- Wetland
- Flood storage

JBS&G

0 500 metres

North East Baldivis, Mundijong Road Baldivis, WA

NATIVE VEGETATION TO BE RETAINED

Job No: 64058		Scale 1:17,000 at A3	
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: jcrute	Checked By: CT	Version: A	Date: 24-Nov-2022

FIGURE: 5.1

Document Path: W:\Projects\1)Open\Stockland\64058 EAR Review Wellard\GIS\Maps\R01_Rev_A\64058_05_1_A3P_NativeVegToBeRetained.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 September 2022.

5.3 Key Environmental Factor 2 – Terrestrial fauna

5.3.1 Environmental objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2020) identifies the following objective for terrestrial fauna:

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

5.3.2 Policy considerations

Terrestrial fauna surveys that have informed planning for the site have been conducted in accordance with the *Technical Guidance – Terrestrial Fauna Surveys for Environmental Impact Assessment* and the Environmental Factor Guideline: Terrestrial Fauna (EPA 2016d).

The EPA outlines a number of key considerations for terrestrial fauna within the *Environmental Factor Guideline: Terrestrial Fauna* which are discussed below, where relevant, with relation to development of the site.

5.3.3 Receiving environment

Based on searches of the EPBC *Protected Matters Search Tool* and the DBCA's *Naturemap* databases conducted by Strategen-JBS&G in 2020, the desktop assessment identified a total of eight conservation significant species (including Priority species) that may potentially occur within the vicinity of the site. Of these, three species were considered likely to use the site based on their respective habitat requirements, namely the Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo, and Carnaby's Black Cockatoo, all of which are listed under the EPBC Act and BC Act. The remaining species identified in the database searches are considered unlikely to occur within the site due to the lack of suitable habitat and the degraded state of remnant vegetation. Due to NatureMap since being taken offline indefinitely, another desktop search has been conducted of the publicly available database of DBCA to identify any additional findings. However, the findings of database searches in 2020 remain relevant to the site.

During the field survey, four conservation significant species pursuant to the EPBC Act or BC Act were recorded: the Glossy Ibis, White-bellied Sea-eagle, Forest Red-tailed Black Cockatoo and the Quenda.

There was a total of 32.63 ha (5.5%) of Black Cockatoo foraging habitat found in the survey area. The majority of this was considered to be representative of Poor quality, with some areas identified as being of Poor – Moderate quality. The low overall density of foraging species across the area reflects the poor quality of the habitat. Smaller, isolated areas have denser cover; however, these are limited, and separated by large areas with little or no foraging habitat value. 13 potential breeding trees were also identified, none of which contain hollows suitable for breeding.

Black cockatoos range out from their roosting sites to forage before returning at night. The continuity of these foraging habitats within a buffered area surrounding a roosting site, is necessary to maintain a healthy population and widens consideration of the proposal to the broader landcape. Within the regional area, there are several legislated DBCA managed nature reserves occurring within a 12 km radius of the site, which are identified to contain potential Black Cockatoo foraging habitat (Figure 3.8). These include:

- Modong Nature Reserve
- Wadi Nature Reserve
- Leda Nature Reserve
- Banksia Nature Reserve

Furthermore, Jarrahdale State Forest occurs 20 km to the east of the site and has been mapped to contain potential foraging and breeding habitat for Black Cockatoos (DBCA 2011).

5.3.4 Potential impacts

Development of the site will result in direct and indirect impacts to terrestrial fauna as a result of:

- clearing of foraging and potential breeding habitat for all three species of Black Cockatoo, which ranges in quality from Very Poor to Poor-Moderate.

No other conservation significant species are considered likely to be significantly impacted through the development of the site.

5.3.5 EPBC Approval

Development of a portion of the site (namely those properties currently owned by Stockland) was referred to the Department of Environment and Energy (now the Department of Climate Change, Energy, the Environment and Water [DoCCEEW]) under the EPBC Act in 2020 for potential impacts of development on Black Cockatoos. The decision of the DoCCEEW was that the proposed action of clearing vegetation for the construction of residential lots, commercial and educational facilities, POS and associated roads and accessways, between Mundijong and Millar Roads in Baldivis, is not a 'controlled action' (Department of Agriculture, Water and the Environment 2020; Appendix G). This decision means that significant environmental impacts were not considered to be likely as a result of the proposed development, and therefore the proposal does not require approval under the EPBC Act. There is limited and low-quality Black Cockatoo foraging habitat available within the site, in addition to an absence of trees with hollows suitable for breeding.

5.3.6 Management measures

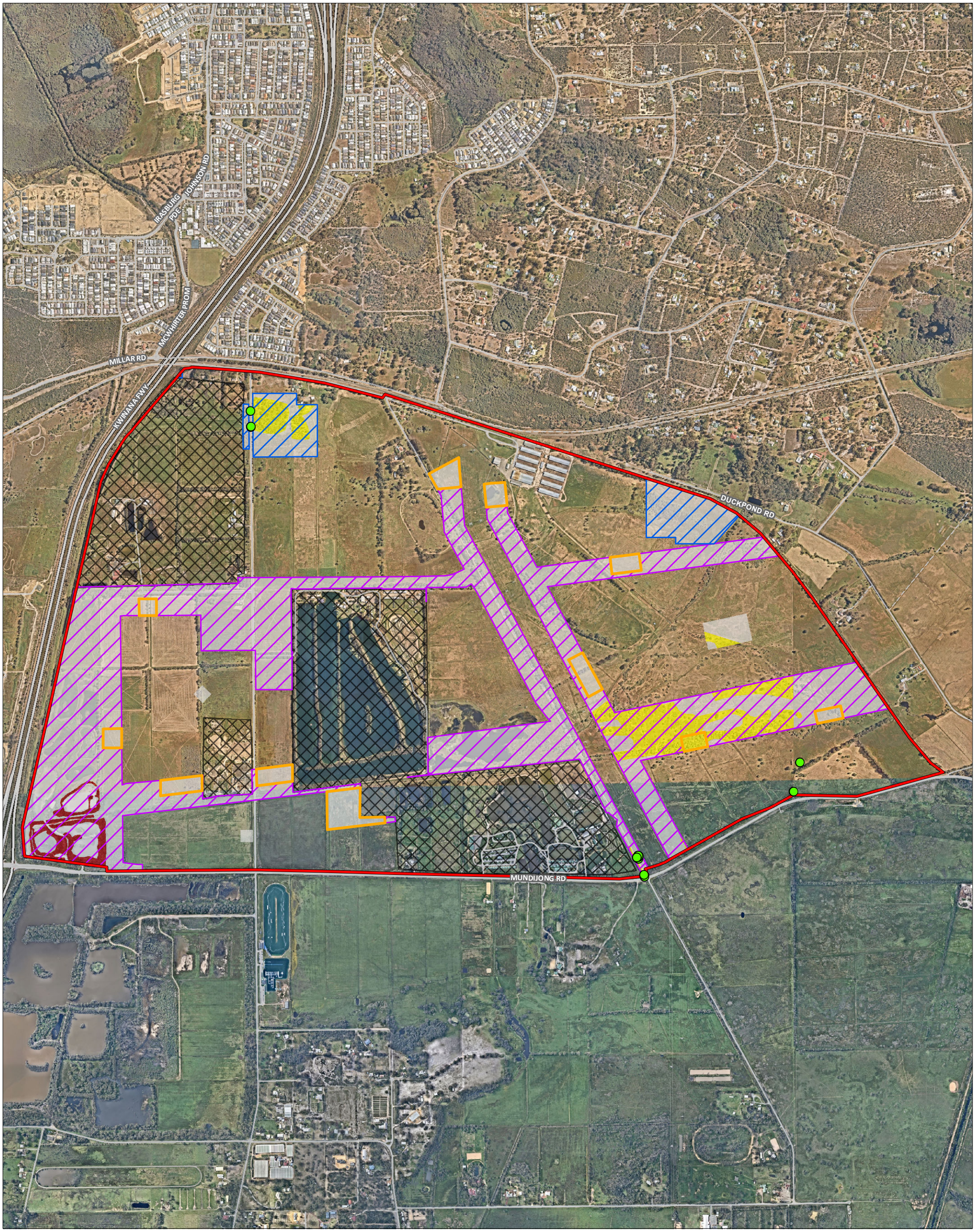
The following potential mitigation and management measures have been identified which may be implemented to ensure impacts to terrestrial fauna are appropriately managed as development of the site progresses (Table 5.3).

Table 5.3: Potential mitigation and management actions for terrestrial fauna

Parameter	Potential mitigation and management measures
Black Cockatoos	• Retention of foraging and breeding habitat for Black Cockatoos has been provided for within three Resource Enhancement Wetlands that are to be retained within Local Reserve (Conservation) as marked (Appendix A). Other POS and flood storage areas may provide other habitat (Figure 5.2). • Landscaping throughout POS and streetscapes utilising native species where possible, which will result in a net gain in trees throughout the project area as a result of the proposed development

5.3.7 Predicted outcome

Considering the above and the 'not a controlled action' decision from DCCEEW under the EPBC Act in 2020, it may be concluded that there will be no significant direct, indirect, or cumulative impacts to Black Cockatoos resulting from the site's development.



Legend

- Site boundary
- Black Cockatoo foraging habitat to be retained
- Poor - moderate
- Very poor
- Nil
- Unable to access
- POS within flood storage
- Wetland
- Flood storage
- Highways
- Main road
- Minor road
- Pedestrian way
- Track
- Black Cockatoo potential breeding trees

JBS&G

0 500 metres

North East Baldivis, Mundijong Road Baldivis, WA

BLACK COCKATOO FORAGING HABITAT

Job No: 64058		Scale 1:17,000 at A3	
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50	
Drawn By: jcrute	Checked By: CT	Version: A	Date: 24-Nov-2022

FIGURE: 5.2

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Image Reference: www.nearmap.com © - Imagery Date: 30 September 2022.

PIARA NATURE RESERVE
THOMSONS LAKE NATURE RESERVE
GIBBS ROAD NATURE RESERVE
FORRESTDALE LAKE NATURE RESERVE
HARRY WARING MARSUPIAL RESERVE
COASTAL PARK
WANDI NATURE RESERVE
MODONG NATURE RESERVE
CARDUP NATURE RESERVE
BANKSIA NATURE RESERVE
LEDA NATURE RESERVE
DUCKPOND RD
SHOALWATER ISLANDS MARINE PARK
LAMBKIN RESERVE
PORT KENNEDY SCIENTIFIC PARK

Legend

- Site boundary
- Project area 5km buffer
- Project area 10km buffer
- Bush Forever site (DPLH)
- Black Cockatoo habitat (Potential feeding areas)

Legislated lands and waters (DBCA)
- Crown Freehold - Dept Managed
- Section 5(1)(h) Reserve
- Nature reserve
- Other Reserves

Geomorphic Wetlands
- Conservation
- Resource enhancement

JBS&G

0 2,600 metres

North East Baldivis, Mundijong Road Baldivis, WA

REGIONAL CONSERVATION AREAS

Job No: 64058		Scale 1:92,500 at A3		
Client: Stockland Development pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: jcrute	Checked By: CT	Version: A	Date: 16-Nov-2022	**FIGURE: 5.3**

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Image Reference: www.nearmap.com© - Imagery Date: 30 September 2022.

5.4 Key Environmental Factor 3 – Terrestrial environmental quality

5.4.1 Environmental objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016c) identifies the following objective for terrestrial environmental quality:

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

5.4.2 Policy considerations

The EPA outlines several key considerations for terrestrial environmental quality within the *Environmental Factor Guideline: Terrestrial Environmental Quality* (EPA 2016c), which are discussed below, where relevant, with relation to development of the site.

The subdivision and development of that part of the site containing ASS is to be planned and undertaken in accordance with the DER (2015) *Treatment and management of soils and water in acid sulfate soil landscapes.*

5.4.3 Receiving environment

5.4.3.1 Acid sulfate soils

A desktop analysis indicates that most of the site is mapped as having a Moderate to Low Risk of ASS occurring within 3 m of the soil surface. Following on-site investigations by Strategen (2018b) and RPS (2017), ASS was confirmed throughout the site. Additional delineation work could further map the extent of ASS across the site, at a time closer to the site's development.

5.4.3.2 Contamination

A review of the contaminated Sites Database showed no sites within 1 km if of the site listed as "Contaminated – remediation required" or "Remediated for restricted use" under the Contaminated Sites Act. A PSI conducted across the site identified several potential pathways for contamination, however further due diligence assessments on a site-by-site basis are required to confirm the risks to human health and the environment (Strategen 2018b). Any constraints arising should be able to be managed via standard, accepted processes.

5.4.4 Potential impacts

To prevent acidification of the soils and groundwater, both above and below water table material is anticipated to require management measures. Grey Bassendean Sands, which had net acidities above the detection limit, will require management and lime-neutralisation should these soils be encountered during the construction phase of development.

The following potentially human health and environmental risks were identified for the site:

- Potential current and future site uses, occupants, workers may be potentially affected by direct contact with contaminated soil and groundwater (if present).
- During construction and/or site excavation works, site users may be potentially affected by direct contact with contaminated soil and groundwater (if present).
- Plant uptake of contaminants in soils and groundwater (if present).
- Leaching of potential contaminants (if present) into groundwater beneath the site.
- Transport of potentially contaminated groundwater (if present) beyond the site boundaries to nearby surface water receptors where human or ecological exposure could occur.
- Abstraction of potentially contaminated groundwater (if present) where Site users, occupants, workers may come into direct contact.

- Volatilisation of potential contaminants from soil and groundwater (if present) where Site users, occupants, workers may inhale.

5.4.5 Management measures

The following potential mitigation and management measures have been identified which may be implemented to ensure impacts to terrestrial environmental quality are appropriately managed as development of the site progresses (Table 5.4). Management for acid sulfate soils would be based on DER (2015) guidelines.

Table 5.4: Potential mitigation and management measures for terrestrial environmental quality

Parameter	Proposed mitigation and management measures
Acid sulfate soils	Management measures to be implemented during the construction phase of development, including: • Lime dosing of excavated soils prior to stockpiling or reuse. • Treatment of any dewatering effluent to increase pH prior to infiltration. • Sampling of treated soils and dewatering effluent to ensure that DER guidance is met. • Development and implementation of an ASS Management Plan, if required.
Contamination	Further due diligence assessments are required to be carried out on a site-by-site basis, including sampling of soil and groundwater, in order to obtain a more complete picture of the risks to human health and the environment.

5.4.6 Predicted outcome

The quality of land and soils is expected to be ably managed throughout the development process and is not expected to be a constraint to development.

5.5 Key Environmental Factor 4 – Inland waters

5.5.1 Environmental objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2018) identifies the following objective for inland waters:

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

5.5.2 Policy considerations

The EPA outlines a number of key considerations for inland waters within the *Environmental Factor Guideline: Inland Waters* (EPA 2018), which are discussed below, where relevant, with relation to development of the site.

The key principles and objectives for sustainable water management is provided in the following:

- Liveable Neighbourhoods (WAPC 2015).
- Stormwater Management Manual for WA (DWER 2022).
- Decision Making Process for Stormwater in Western Australia (DWER 2017).
- Better Urban Water Management (WAPC 2008).
- Interim: Developing a Local Water Management Strategy (DoW 2008).

5.5.3 Receiving environment

Regional groundwater flow is anticipated to be towards the southwest, it is estimated that depth to groundwater across the site would be shallow, between 2.5 m AHD in the north-west to 1 m AHD in the south (based upon known groundwater bores information within the Department of Water (DoW) databases). This indicates that superficial groundwater is shallow at the site, being between 0 m and

1.5 m at maximum levels. Surface water at the site drains from east to west toward the Peel Main Drain via several small natural drainage channels that dissect the site, in addition to the Folly River.

The majority of the site consists of Palusplain Multiple Use Wetlands; however, five Resource Enhancement Wetlands are also situated within the site. It should also be noted that the buffer of one Conservation Category Wetland located to the southeast also overlaps the site.

5.5.4 Potential impacts

Urban development of the site may potentially increase recharge of rainfall into groundwater through increased surface area of residential roofs, driveways, carparks and roads.

While the creation of residential gardens and POS areas may lead to a minor increase in the volume of nitrates and phosphates being discharged into the groundwater, nutrient modelling predicts a significant decrease in the levels of TN and TP loads from the site, compared to pre-development. This is primarily due to the decommissioning of the Rural Exports Pty Ltd holding yard.

Potential impacts will be managed by the measures contained within the DWMS that has been prepared for the site.

5.5.5 Management measures

The following potential mitigation and management measures have been identified which may be implemented to ensure impacts to inland waters are appropriately managed as development of the site progresses (Table 5.5).

Table 5.5: Potential mitigation and management measures for inland waters

Parameter	Proposed mitigation and management measures
Hydrology	Additional hydrological engineering investigations will be undertaken to enable the preparation of a Local Water Management Strategy and Urban Water Management Plan.
Geomorphic wetlands	The site is surveyed to confirm the boundaries and management categories of the wetlands onsite.
	Three Geomorphic Wetlands within the site are retained on the District Structure Plan Map (Appendix A) within Local Reserves retained for conservation purposes.

5.5.6 Predicted outcome

Considering the above, it is not expected that development of the site will result in significant direct, indirect, or cumulative impacts to hydrology. Potential impacts to hydrology will be addressed at the Local Structure Plan and Subdivision stages of development through the preparation of an LWMS and UWMP respectively and mitigated through the implementation of best urban water management.

5.6 Key Environmental Factor 5 – Social surroundings

5.6.1 Environmental objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2018) identifies the following objective for social surroundings:

- To protect social surroundings from significant harm

5.6.2 Policy considerations

The EPA outlines several key considerations for social surroundings within the *Environmental Factor Guideline: Flora and Vegetation* (EPA 2016b), which are discussed below, where relevant, with relation to development of the site.

Regarding noise, future development will be subject to the requirements of *State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (SPP 5.4).

Regarding mosquitoes and midges, the following DoH guidelines will be used to guide future management of the site:

- A guide to developing management for Local Government – Part A Template and guidance notes.
- A guide to developing management for Local Government – Part B Case study examples.

5.6.3 Receiving environment

5.6.3.1 Noise and vibration

The site is located immediately adjacent to a major transport corridor (Kwinana Freeway) to the west, as well as the Mundijong freight railway which runs along the site's northern boundary. Both transport routes are major sources of noise, and in the case of the Mundijong freight railway line, a source of vibration.

Within the site boundary, Bonney's Water Ski Park and West Coast Jet Sprint facility generates noise emissions associated with powerboating operations.

5.6.3.2 Odour

Within the site, both the Golden Ponds Fish and Marron Farm and Austvision Rural Services Pty Ltd stockyards are sources of unpleasant odours. However, given the presence of accommodation facilities within Golden Ponds, as well as a restaurant function centre, it is assumed that any odours emitted from this facility are of low impact.

Another potential source of odours is the Rosguy holdings yards located to the southeast of the site. While no odours were detected during the preliminary site assessment (Strategen 2018a), this may be due to the cool conditions and a small number of animals being held on the date of the assessment.

5.6.3.3 Mosquitoes and midges

Peel Harvey Estuary and its associated river systems provide saltmarsh habitat and promotes ideal conditions for saltmarsh mosquitoes to breed. Local Governments within the Peel Region have worked in partnership with DoH since the 1990s to manage mosquitoes through a coordinated mosquito management program, which targets mosquitoes at the larval stage with chemical products to effectively reduce adult populations.

Within the site, there are multiple areas of potential mosquito and midge breeding habitat. Known and potential mosquito and midge breeding areas within the site include:

- Bonney's Water Ski Park and West Coast Jet Sprint.
- Golden Pond Fish and Marron Farm.
- Austvision Rural Services Pty Ltd holding yard
- Multiple geomorphic wetlands (Section 3.3.3; Figure 3.3).
- Nine artificial lakes/ clay extraction pits in the southwest of the site
- Multiple small dams in the northwest of the site
- Minor drainage channels that transverse the site

Known and potential mosquito and midge breeding habitat adjacent to the site includes:

- Rosguy holding yard (1 km southeast)
- Peel Main Drain (along the western border of the site)
- one CCW adjacent to the southeast extremity of the site

5.6.4 Potential impacts

A noise assessment was conducted by Lloyd George Acoustics in 2013 to support the Wellard Glen Estate development located on the northern side of Millar Road near the site. This assessment determined that lots interfacing Millar Road and the Mundijong freight railway (northern side) would require noise attenuation treatments to ensure residents were not significantly impacted by the railway. Based on the noise assessment, the predicted noise impacts were considered manageable with either:

- 2.0m high barrier on the residential lot boundary; or
- Quiet house design for the first row of houses.

The Wellard Glen Estate is being constructed with an (approximately) 30 m setback from the railway, a masonry wall, and quiet house design for the first row of lots. It is expected that similar mitigation measures would be required for future lots within the site that interface the railway.

Both the Ski Park and Austvision Rural Services Pty Ltd holding yard are to be decommissioned prior to the site's urban development, and so no impacts associated with noise or odours are anticipated from these facilities.

While odours emissions from Golden Ponds are not anticipated to be significant, further odour assessments may be required to assess the impact associated with the Rosguy holding yards to the southeast.

Due to the prevalence of both seasonal and permanent water bodies within the site, there is a potential public health risk posed by mosquitoes and their associated nuisance levels, and an impact upon amenity from midges. However, it is not a constraint to development and can be managed via standard, accepted processes.

5.6.5 Management measures

The following potential management and mitigation measures have been identified which may be implemented to ensure impacts to social surroundings are appropriately managed as development of the site progresses (Table 5.6).

Table 5.6: Potential management and mitigation measures for social surroundings

Parameter	Potential management and mitigation measures
Noise	• Installation of a 2.0 m high noise barrier on the residential lot boundary • Quiet house design for the first row of houses
Odour	• Establishment of a 1000 m separation distance from the Rosguy holding yards and Urban development, as per EPA guidance
Mosquitoes and midges	• Preparation of a Local Water Management Strategy and Urban Water Management Plan to manage stormwater runoff • Development of a Mosquito and Midge Management Plan, if required

Additionally, there are specific requirements set out within the Better Urban Water Management Guidelines for managing stormwater infiltration rates to prevent mosquito breeding. These requirements will be addressed through the preparation of a LWMS and UWMP at the Local Structure Plan and subdivision stages of development, respectively. The Mosquito and Midge Management Plan will be developed in consultation with the City of Rockingham and the Department of Health to ensure that the plan meets their public health requirements.

5.6.6 Predicted outcome

Residual impacts to social surrounds from noise and odour are anticipated to be effectively mitigated through an appropriate design response in accordance with SPP 5.4. Impacts associated with

mosquitoes and midges will be managed through the development of a UWMP and LWMS at subsequent planning stages, and an MMP if required.

6. Other environmental issues

6.1 Bushfire Management

As a result of the bushfire prone status of the site, a Bushfire Management Plan (BMP) is required to accompany the scheme amendment application to address the following requirements of *State Planning Policy 3.7 Planning in Bushfire prone areas* (SPP 3.7), namely, Policy measure 6.3:

- A bushfire hazard level (BHL) assessment or where lot layout is known, a Bushfire Attack Level (BAL) contour assessment to determine the indicative acceptable BAL ratings across the site
- Identification of any bushfire hazard issues arising from the above assessment.
- Assessment against the bushfire protection criteria requirements contained within the Guidelines demonstrating compliance can be achieved in subsequent planning stages.

A bushfire assessment has been undertaken, and a Bushfire Management Plan has been prepared to support future MRS rezoning of the site.

7. Conclusion

This EAR has addressed several of the key considerations outlined within the *South Metropolitan Peel Sub-Regional Planning Framework* and determined that, assuming sufficient management and mitigation practices are implemented, the site is suitable for urban development based on the assessment of existing environmental conditions.

Potentially conflicting land uses were identified within and around the site boundary, namely feedlot operations at Rosguy Feedlot and Austvision Rural Services Pty Ltd, Bonney's Water Ski Park and West Coast Jet Sprint, and Golden Pond Fish and Marron Farm.

Topography, geology and soils within the site do not represent a constraint to development. Based on the available mapping accompanying SPP 2.4, development of the site will not have implications for basic raw materials.

Additional hydrological investigations have been undertaken across the site to inform a DWMS. This will inform the preparation of an LWMS and UWMP, both of which will be required at subsequent stages of planning.

Multiple Resource Enhancement Wetlands (REWs) and the buffer of one Conservation Category Wetland (also an environmentally sensitive area) are present within the site. While the vegetation present within these wetland boundaries is generally degraded, three REWs will be retained in Local Reserves (Conservation) which recognises their environmental values and provides an opportunity to strengthen their attributes through the development planning process. It is recommended that the site is surveyed to confirm the boundaries and categories of the wetlands thereon.

Instances of ASS have been confirmed within 3 m of the soil surface across the site following on-site investigations. While the full extent of ASS could be further delineated following additional ASS works closer to site development, it is anticipated that both above and below water table material will require management measures to prevent acidification of soils and groundwater. These management measures will be developed and contextualised through the preparation of an Acid Sulfate Soils Management Plan if required.

The site contains limited flora or vegetation values. Black Cockatoos appear to be the only fauna of conservation significant within the site, however foraging habitat is of generally low quality (Very Poor: 5.6 ha, Poor: 14.2 ha, Poor to Moderate: 12.83 ha), and any impacts to these have been effectively managed through the EPBC referral process and decision. The proposed development was determined to not be a controlled action, and therefore the clearing of vegetation for the development will not be required approval under the EPBC Act.

A PSI undertaken for the site identified several potential pathways for contamination. Recommendations from the PSI included a more targeted due diligence assessment on a site-by-site basis, in order to obtain a more complete picture of the risks to human health and the environment (Strategen 2018b).

Impacts from noise and odour associated with adjacent land uses including the Rosguy holding yards and Mundijong freeway are anticipated be effectively mitigated through an appropriate design response.

The potential public health risk posed by mosquitoes and midges will be managed through future planning and design stages of the development and implementation of a Mosquito and Midge Management Plan which will be prepared for the site at future stages of planning if required.

There are no Indigenous or European heritage values present within the site.

Bushfire risk will be managed through the implementation of a Bushfire Management Plan, which has been prepared for the site in accordance with the requirement of *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (SPP 3.7), namely Policy Measure 6.3.

In summary, the findings of this EAR, with the appropriate management, aligns with the proposed DSP (Appendix A).

8. Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen-JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen-JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen-JBS&G has also not attempted to determine whether any material matter has been omitted from the data. Strategen-JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen-JBS&G. The making of any assumption does not imply that Strategen-JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen-JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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9. References

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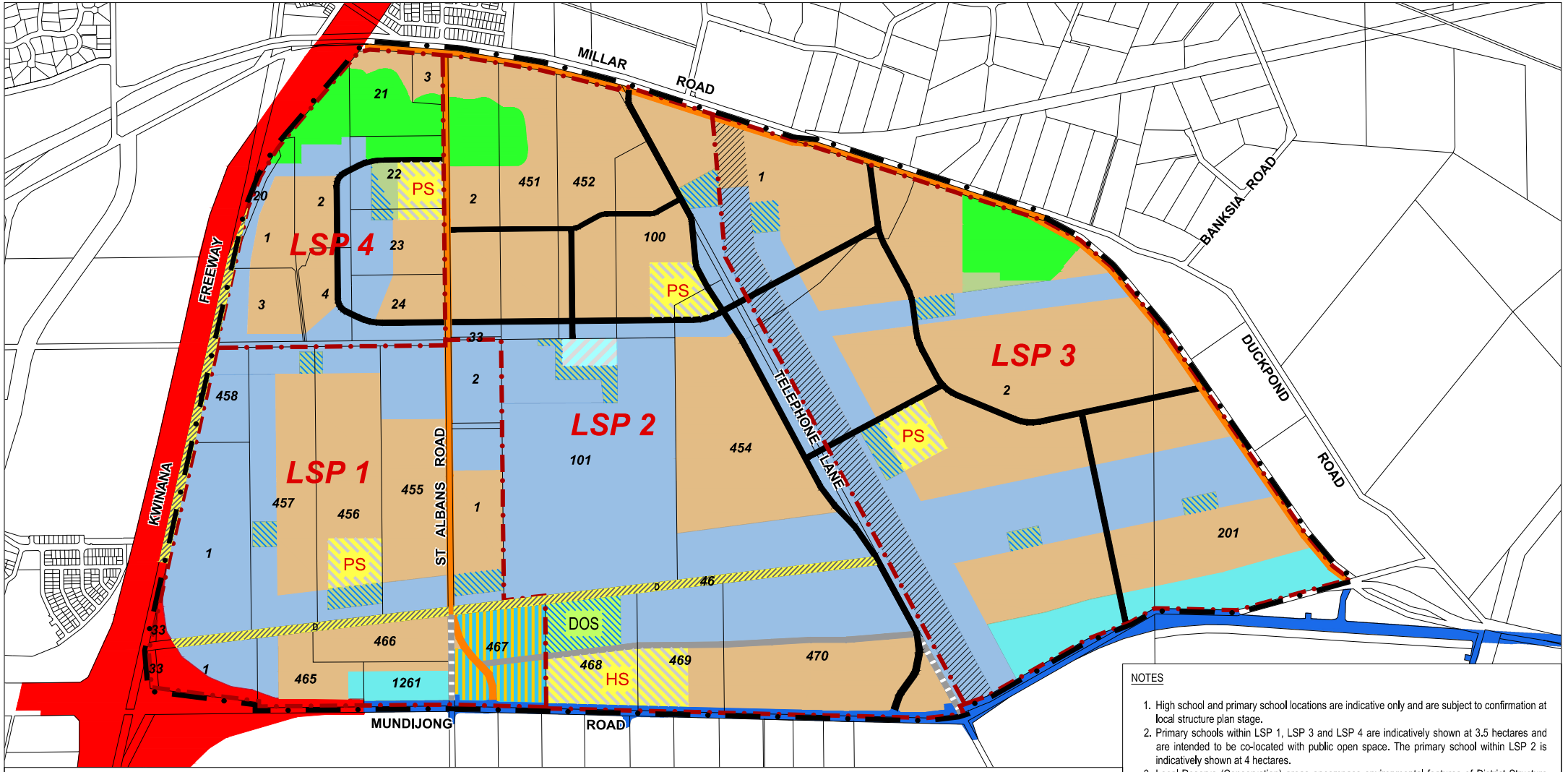
Appendix A District Structure Plan (CLE Planning & Design 2022)



LEGEND

- District Structure Plan Boundary
- Indicative Local Structure Plan Boundary
- Residential
- Employment
- Neighbourhood Centre
- Local Centre
- Multiple Use (Flood Storage)
- PS — Indicative Primary School
- HS — Indicative High School
- DOS — District Open Space (within Multiple Use)
- Local Reserve (Conservation)
- Local Reserve (Public Open Space)
- Local Reserve (Public Open Space - within Multiple Use)
- D — Public Purpose : Drain
- Powerline Easement
- Primary Regional Road Reserve
- Other Regional Road Reserve
- Integrator Arterial B Road
- Neighbourhood Connector Road
- Local Road
- Interim Road

NOTES

1. High school and primary school locations are indicative only and are subject to confirmation at local structure plan stage.
2. Primary schools within LSP 1, LSP 3 and LSP 4 are indicatively shown at 3.5 hectares and are intended to be co-located with public open space. The primary school within LSP 2 is indicatively shown at 4 hectares.
3. Local Reserve (Conservation) areas encompass environmental features of District Structure Plan-level significance. The refinement and reservation of these areas, as well as other localised areas of open space, as restricted open space, unrestricted open space or other will be determined following environmental reporting at the local structure plan stage.
4. An area of District Open Space (DOS) is identified and will accommodate future active district recreation needs of the community. Opportunities to co-locate the DOS with the High School may be considered at the local structure plan stage. The acquisition and development of the DOS is to be provided for within the relevant Development Contribution Plan for the DSP area to ensure the equitable provision of open space.
5. Road hierarchies are subject to review and refinement at local structure plan stage based on the outcomes of subsequent traffic modelling incorporated into revisions to the DSP Traffic Impact Statement or subsequent Traffic Impact Assessments prepared in support of local structure plans.
6. Primary Regional Road and Other Regional Road reserves are shown as per the Metropolitan Region Scheme.

0 200 400 600 800 1km

CLE Town Planning + Design

DISTRICT STRUCTURE PLAN MAP

Mundijong Road, Baldivis

DRAFT

plan no: **3097-142-01**
date: 14 December 2022
scale: 1:20,000 @ A4

N

Appendix B Preliminary Acid Sulfate Soils Assessment (Strategen 2018)

Level 1, 50 Subiaco Square Road Subiaco WA 6008 PO Box 243 Subiaco WA 6904
Phone (08) 9380 3100 Fax (08) 9380 4606
177 Spencer Street Bunbury WA 6230 PO Box 287 Bunbury WA 6231
Phone (08) 9792 4797 Fax (08) 9792 4708

To: Andrew Wallis

Company: Stockland

Fax/email: andrew.wallis@stockland.com.au

Date: 4 October 2018

Project No: STO18278.01

Inquiries: Dale Newsome

Wellard Farms
Preliminary Acid Sulfate Soils Assessment

Strategen was engaged by Stockland to undertake a preliminary Acid Sulfate Soils (ASS) assessment to determine potential constraints to urban development within the proposed Wellard Project Area. The proposed Wellard Project development area (the Site) comprises approximately 760 ha of land, incorporating a number of existing cadastral lots within the locality of Baldivis, approximately 40 kilometres south of the Perth CBD. The Site is generally bounded by Telephone Lane, Freight Railway Line 13 and Duckpond Road to the north; Duckpond Road to the east; Mundijong Road to the south and Kwinana Freeway to the west. The Site locality is shown on Figure 1.

Objectives

The objective was to:

- determine the presence and extent of AASS and PASS in the context of the site geology and hydrogeology
- determine what likely site-specific liming rates are required for future works at the site that disturb natural soils
- provide advice on the likely requirements for ASS management on the site.

Scope

The scope of work included:

1. Opportunistic collection and geological logging of soil samples by Strategen at 0.5 m intervals during geotechnical test pitting by CMW Geosciences to a depth of 3 m. Samples taken by Strategen during sampling with CMW as part of the geotechnical work on 17-18 May 2017. These samples were taken from 30 test pits (TP1 to TP30) at generally 0.5 m intervals to a maximum depth of 3 m below ground level (mbgl) (177 samples plus eight duplicates). Samples were labelled by Strategen based on the lower end of the depth range sampled in cm (e.g. TP1-200 represents the sample from approximately 190-210 cm at TP1). Strategen noted of any other indicators of ASS as outlined by the Identification and investigation of acid sulfate soils and acidic landscapes guideline (DER 2015a) including:
    - the presence of waterlogged soils and peaty soils
    - evidence of sulfurous smells
    - jarosite or extensive iron staining of the soil
    - salt tolerant, dead, dying or stunted vegetation
    - scalded or bare low-lying areas of vegetation.

2. Obtaining samples taken by Cardno during installation of nine monitoring wells on 7 June 2017 (MW3, MW4, MW7-13) at 0.5 m intervals from depths between 0.5 m and 11 m. The depths of bores installed by Cardno varied from 7 to 11 mbgl (86 samples plus one duplicate). Samples were labelled by Cardno were not labelled consistently but include the lower end of the depth range sampled in metres. MW3-8.5 represents the sample from 800-850 cm at MW3. MW11-3.5-4.0 represents the sample from 350 cm to 400 cm at MW11.
3. Analysis of 263 primary soil samples (plus 9 quality assurance/quality control [QA/QC] samples) from the 39 locations for initial screening analysis of field pH (pH_F) and field pH after oxidation with hydrogen peroxide (pH_{FOX}) by a National Association of Testing Authority (NATA) registered laboratory.
4. Analysis of 20 soil samples (including one QA/QC samples) from the samples taken during the geotechnical test pitting for Suspension Peroxide Oxidation Combined Acidity and Sulfur (SPOCAS) suite analysis based on initial field screening results and lithology at a NATA accredited laboratory.
5. Assessment of ASS investigation results and provision of advice on ASS management.

Sampling locations are presented in Figure 2.

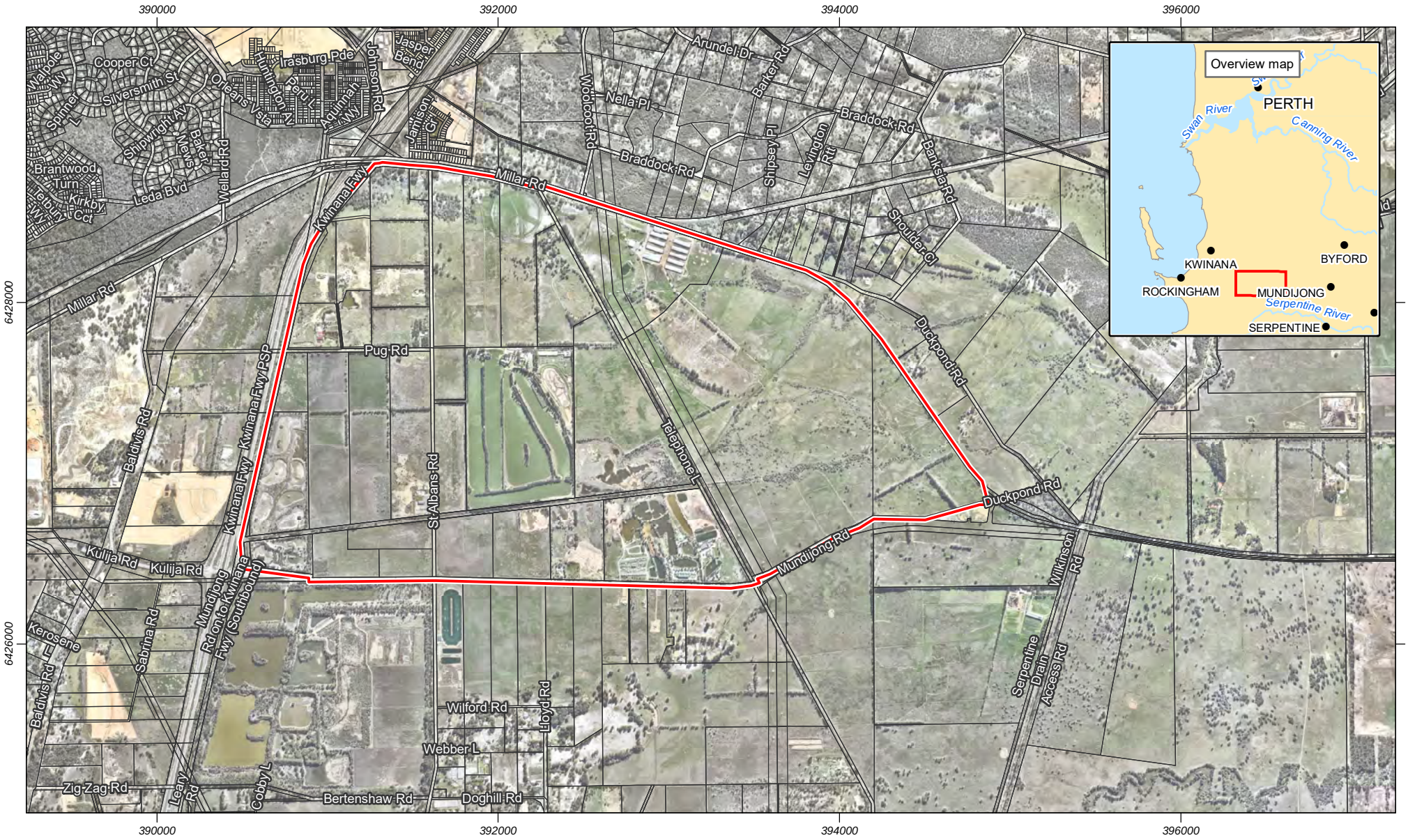


Figure 1: Site Locality

Scale 1:30,930 at A4

0 200 400 600 Metres

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 17/07/2018
Author: JCrute
Source:

Legend

- Site boundary
- Cadastre

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

Path: Q:\Consult\2018\STO\STO18278\01_GIS_documents\ArcMap_documents\STO18278_G003_RevA.mxd

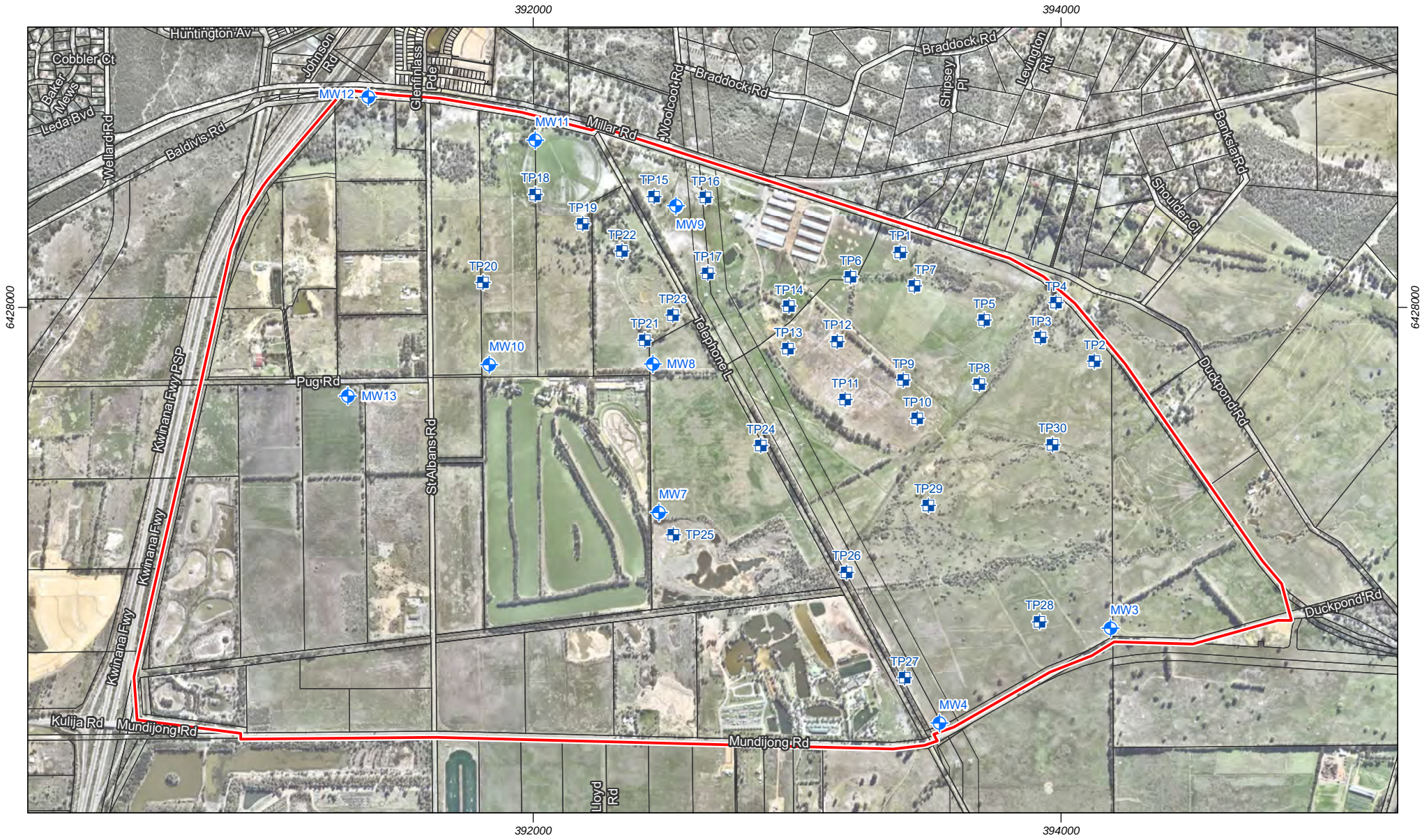


Figure 2: Investigation Location

Scale 1:20,000 at A4

0 200 400 600 Metres

N

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 17/07/2018
Author: vd
Source: Nearmap - 07/06/2017.

Legend

- Test Pit (Strategen May 2018)
- Soil Bore (Cardno June 2018)
- Site boundary
- Cadastre

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

Path: Q:\Consult\2018\STO\STO18278\01_GIS_documents\ArcMap_documents\STO18278_G005_RevB.mxd

Results

Acid sulfate soils mapping

The site is mapped by DWER as having a moderate to low risk of ASS occurring within the top 3 m of the natural soil surface but high to moderate risk of ASS beyond this depth (Figure 3).

Soils

Geotechnical investigations were undertaken concurrently by CMW Geosciences (2018), the results of which are presented in this section with environmental soil logging by Strategen. Strategen environmental soil logs and Cardno environmental groundwater logs are presented as Appendix 1.

Topsoil

The topsoil consists of either sand or clay material depending on the location. These can be described as:

1. SAND/SILTY SAND to CLAYEY SAND: fine to coarse grained, sub-angular to sub-rounded, dark grey to dark brown, trace roots/rootlets, trace organics, trace fines. Typically encountered within the northern half of the site up to 300 mm thick. Variable fines content, locally encountered to comprise CLAYEY SAND.
2. CLAY: medium to high plasticity, brown to dark brown, trace to with sand, trace roots/rootlets, trace organics. Typically encountered within the southern half of the site up to 200 mm thick.

Bassendean Sand

Present in the northern portion of the site, this layer is on average approximately 0.8 m deep and consists of:

1. SAND: loose to medium dense, fine to coarse grained, subangular to sub-rounded grey to grey-white, trace to with fines, predominantly quartz sand, of aeolian origin. Iron stained cemented sandy soils (coffee rock/or coffee sand) were present at TP1, TP15, TP16, TP19, MW8, MW9, MW11 and MW12 at depths below 1.5m.

Guildford Unit

The Guildford Unit is heterogenous and consists of layers of predominantly Clayey Sand to Sandy Clay material with occasional sand lenses:

1. CLAY/Sandy CLAY: brown to grey-brown, sand is of fine to coarse grained, sub-angular to sub-rounded, trace organics, of alluvial origin.
2. CLAYEY SAND: loose to dense, fine to coarse grained, sub-angular to sub-rounded, grey to grey-brown and grey mottled material.
3. Occasional SAND: medium dense to dense, medium to coarse grained, subangular to sub-rounded, brown to grey, trace fines, trace clayey sand lenses. More extensive sand layers (greater than 1 m thickness) were found at depths below 300 cm in MW3, MW7, MW8 and MW9.

Groundwater was typically encountered between 2 to 3 m below ground level (mbgl) during test pitting.

ASS parameters for soils

The *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes* guideline (DER 2015a) established action criteria for the assessment of environmental risk of ASS. The action criteria are based on the net acidity excluding ANC which is the sum of existing and potential acidity calculated as equivalent sulfur (e.g. s-TAA + S_{POS} in %S units).

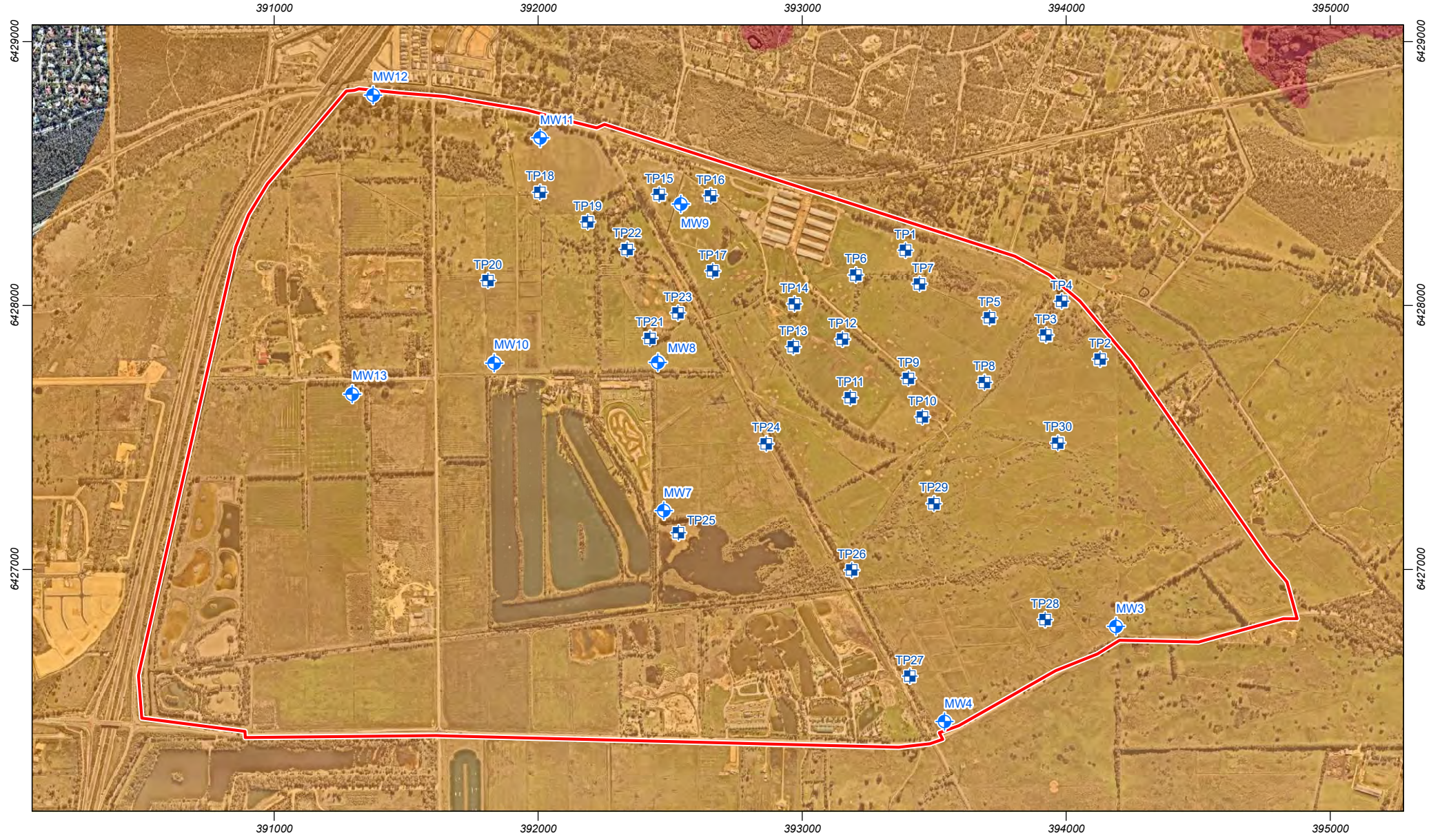


Figure 3: Acid Sulfate Soils Mapping

Scale 1:19,739 at A4

0 200 400 600 Metres

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 4/10/2018
Author: CJT
Source: Nearmap - 28/06/2018.

Legend

- Test Pit (Strategen May 2018)
- Soil Bore (Cardno June 2018)
- Site boundary
- Cadastre

Acid sulfate soil
- High to moderate risk
- Moderate to low risk

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

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As clay content tends to influence the soil's natural buffering capacity, the action criteria are grouped by three broad categories – coarse, medium, and fine. The criteria are used to determine when disturbance of ASS will require treatment and management. If the proposed construction requires disturbance of less than 1000 t of material, the guidelines (DER 2015a) define the following equivalent acidities for the three broad soil categories to be used as the action criteria in this assessment:

- 0.03 %S for coarse texture sands to loamy sands
- 0.06 %S for medium texture sandy loams to light clays
- 0.1 %S for fine texture medium to heavy clays and silty clays.

If the proposed construction requires the disturbance of greater than 1000 t of material, the guidelines (DER 2015a) define an equivalent acidity of 0.03 %S to be used as the action criteria in this assessment. Based on the size of the site, the development of the site will result in disturbance of greater than 1000 t of material for service installation.

In addition to the action criteria, the guidelines (DER 2015a) define indicator pH values for pH_F and pH_{FOX} to assist in characterising likely acid generating soils. The pH indicator values are defined as:

- pH_F <4 pH units oxidation of sulfides probably occurred in the past, indicates presence of AASS
- pH_{FOX} <3 pH units and a significant reaction rate – strongly indicates PASS
- a significantly lower pH_{FOX} value than the pH_F value is used as an indicative trigger value in this assessment, i.e. $pH_F - pH_{FOX}$ >1.0 pH unit.

Soil sample results

Tables of the soil results are presented in Appendix 2. Corresponding Chains of Custody (CoCs), laboratory Certificates of Analysis (CoAs) and Quality Control Interpretive Reports for soil analyses are provided in Appendix 3.

Soil field test results

Conditions indicative of acid sulfate soils

Conditions indicative of ASS were noted in the majority of the 39 bore logs on the site. These conditions were:

1. Blueish and greenish colours or mottling indicative of seasonal or fully waterlogged conditions were found at various depths in TP7, TP10-TP16, TP20, TP22 and TP23-50.
2. Thick (>0.2 m) silty sand or silt topsoils with high organic contents that may be indicative of wetland (and consequently ASS) conditions were noted at.
    - TP1 from 0 to 0.4 mbgl
    - TP3 from 0 to 0.4 mbgl
    - TP7 from 0 to 0.3 mbgl
    - TP17 from 0 to 0.3 mbgl
    - TP18 from 0 to 1.1 mbgl.
3. Organic or sulfurous odours were noted at depth in TP6, TP7, TP18, MW8,
4. Iron stained cemented soils (coffee rock and/or coffee sand) were present at TP1, TP15, TP16, TP19, MW8, MW9, MW11 and MW12. These materials were typically found between depths of 1 mbgl and 2 mbgl, with the exception of MW11 and MW12 where the material was encountered between 3.4 and 8mbgl and 2.5 to 4 mbgl respectively.
5. Salt tolerant, dead, dying or stunted vegetation and/or scalded or bare low-lying areas of vegetation that may be attributed to acidification of ASS were not noted during test pitting.

pH_F and pH_{FOX} results

A review of the pH_F and pH_{FOX} results for all 263 samples (plus 8 duplicates) against the adopted assessment criteria allow the following conclusions to be made:

1. One sample recorded a pH_F <4 pH units, being TP15 at 0.5 m depth (above water table). This result is indicative of AASS at these locations. The average pH_F of the samples tested was 6.7 pH units.
2. 32 samples out of 271 (including duplicates) recorded a pH_{FOX} <3 pH units indicating that there are PASS present on the site. This included both above and below water table samples. The following key observations were made:
    - pH_{FOX} <3 pH units were generally associated with depths greater than 1.5 m to 11 m and across the full range of soil types present
    - soils exhibiting these conditions were identified in TP1 to TP7, TP16, TP23, TP28, MW3, MW4 and MW7 to MW11
    - sites associated with the presence of PASS were typically located near the northern and southern boundaries of the site, close to Millar Road or Mundijong Road
    - the pH_{FOX} varied from 1.5 to 8.9 with an average of 5.0.
3. There was a total of 171 out of 271 samples (63% of samples) where the difference between pH_F and the corresponding pH_{FOX} result was greater than 1.0 pH unit indicating soils with potential presence of sulfides and acid generating potential are common across the site. This included both above and below water table samples. The following key observations were made:
    - the average pH_F-pH_{FOX} was 1.7
    - the largest pH_F-pH_{FOX} value was 7.2 pH units observed at TP7-200
    - all locations except TP30 had at least one sample where pH_F-pH_{FOX} > 1
    - all samples in TP1, TP2, TP3, TP6, TP7, TP8, TP20 and MW8 exhibited pH_F-pH_{FOX} > 1.
4. A total of 30 samples out of 271 had a high reaction level (denoted as XXX or XXXX on the laboratory report) during the pH_{FOX} test across 14 of the 39 locations. This included both above and below water table samples. The following key observations were made:
    - the tests which exhibited a high reaction level were associated with clayey sand, sandy clay or clay material
    - all except one of the samples were from depths greater than 150 cm.

SPOCAS Suite

The SPOCAS suite includes the following analyses and calculated parameters:

- Titratable Actual Acidity (TAA)
- Titratable Peroxide Acidity (TPA)
- Titratable Sulfidic Acidity (TSA)
- Peroxide Oxidisable Sulfur (S_{POS})
- Sulfidic Excess Acid Neutralising Capacity (ANC)
- Net Acidity
- Net Acidity excluding ANC.

On the basis of the field results, a subset of 19 samples (plus one duplicate) were analysed for SPOCAS, based on one of the following observations and/or field results:

- pH_{FOX} was < 3.0 pH units
- pH_F-pH_{FOX} was > 1.0 pH unit
- representation of the soil lithology present during test pitting.

SPOCAS testing included 12 samples from above the watertable and 8 below the watertable. Soil samples below 3m depth were not tested for SPOCAS[1].

Soil laboratory results

Table 1 presents the SPOCAS results. A total 12 out of 20 samples were at or above the DWER (2015a) guideline for Net Acidity (TAA + S_{POS}) of 0.03 %S, including:

- one coffee rock sample
- one clay sample from 3 m depth
- clayey sands from 1 m depth to 3 m depth (six out of twelve samples)
- sands from 0.5 to 3 m depth (five samples)
- one clay sample from 3 m depth.

The maximum liming rate required was calculated at 21 kg $CaCO_3$/tonne for the coffee rock material encountered at TP4 at 150 cm depth. For the remainder of the soil types, the maximum liming rate was calculated at 13kg $CaCO_3$/tonne. Both above and below water table material will require liming.

The DER (2015a) guideline provides the following comments regarding Bassendean Sands and coffee rock formations:

- in some ASS, S_{CR} or S_{POS} may be below the action limit but soils may still have an appreciable TPA. Sometimes this may reflect organic acidity, but it may also reflect acidity from oxidation and/or titration of iron-containing or manganese-containing compounds. This is particularly the case in Western Australia for Bassendean Sands and coffee rock formations. Various aluminium-containing compounds, or complexes, may also contribute to this acidity. This acidity may be present whether or not there is any appreciable potential sulfidic acidity (i.e. any significant S_{CR} or S_{POS} result). While this acidity is commonly not rapidly released into the environment in the short term, it is often released over a slower time-frame and so should not be dismissed as being of no consequence.

High values for TPA are reflective of organic acidity that is released following long term exposure of the soils. Bassendean Sands are considered to be present at the surface to depths of up to 150 cm in the north of the site (north of TP21 and TP29).

Quality analysis and quality control results

The RPD between the primary and duplicate sample was calculated for 8 pH_F / pH_{FOX} samples and 1 SPOCAS laboratory analysis sample.

The QA/QC results for soils are presented in Table 3 of Appendix 3.

For the pH_F and pH_{FOX} to indicate the presence or absence of ASS, all RPD values were below 30%, indicating suitable QA/QC measures were undertaken.

For the SPOCAS results, the RPDs exceeded 30% for TAA, TPA, TSA, KCl and Peroxide Extractable Calcium. These RPD exceedances were likely due to sample heterogeneity and not indicative of inadequate field QA/QC measures.

[1] It is recommended that a selection of these deeper samples, which are currently in frozen storage at the laboratory are tested for SPOCAS or the Chromium reducible sulfate (CRS) suite.

Summary

1. Instances of ASS have been identified during the works.
2. All materials encountered had net acidities above the DER (2015b) guidance. Grey Bassendean Sands had net acidities above the detection limit and will require management and lime-neutralisation should these soils be encountered during construction.
3. Both above and below water table material is anticipated to require management measures to prevent acidification of soils and groundwater. Management would be based on DER (2015b) and would include:
    - lime dosing of excavated soils prior to stockpiling or reuse
    - treatment of any dewatering effluent to increase pH prior to infiltration
    - sampling of treated soils and dewatering effluent to ensure that DER guidance is met
    - An ASS Dewatering Management Plan is anticipated to be required as a condition of subdivision.

Additional ASS delineation work undertaken at a time closer to site development could further delineate the extent of ASS and consequently reduce the extent of treatment required.

Table 1: Laboratory results

Field ID	Sample Date	Location ID	Depth (cm)	Soil Texture	Abover or below ater table	pH_f	pH_{ox}	pH_f - pH_{ox}	Rate of Reaction	pH_{KCl}	pH_{ox}	Sulphidic - TAA	Sulphidic - TPA	Sulphidic - TSA	Peroxide Oxidisable Sulphur	Net Acidity excluding ANC	Net Acidity excluding ANC	Liming Rate excluding ANC	Net Acidity	Net Acidity	Liming Rate
						pH units	pH units	pH units		pH Units	pH Units	% PS	% PS	% PS	% S	% S	mole H^+/t	kg $CaCO_3$/t	% S	mole H^+/t	kg $CaCO_3$/t
						0.1	0.1	0.1	X|XX|XXX|XXXX	0.1	0.1	0.005	0.005	0.005	0.005	0.005	5	1	0.005	5	1
S Action Criteria - >1000 tonnes disturbed (DWER 2015, Table 10)						4	3	1				0.03	0.03	0.03					0.03	18	
TP1_200	17/05/2018	TP1	200	SAND	A	6.4	2	4.4	XX	5.9	2.9	<0.005	0.03	0.03	0.051	0.051	32	4	0.051	32	4
TP3-50	17/05/2018	TP3	50	SAND	A	4.7	2.2	2.5	X	4.9	4.9	0.008	0.008	<0.005	<0.005	0.008	5	1	0.008	5	1
TP4-150	17/05/2018	TP4	150	Silty SAND - Coffee Rock	A	4.5	3.3	1.2	XXX	4.4	4.3	0.13	0.31	0.18	0.058	0.24	150	21	0.24	150	21
TP4-200	17/05/2018	TP4	200	SAND	A	5.6	2.2	3.4	XX	5.3	3.4	0.005	0.005	<0.005	0.023	0.028	17	2	0.028	17	2
TP5-300	17/05/2018	TP5	300	Clayey SAND	B	6.9	1.7	5.2	XXXX	7.4	2.4	<0.005	0.16	0.16	0.15	0.15	92	13	0.15	92	13
TP6-300	17/05/2018	TP6	300	SAND	B	6.7	1.6	5.1	X	6.2	2.9	<0.005	0.061	0.061	0.085	0.085	53	7	0.085	53	7
DUP2	17/05/2018	TP6	300	SAND	B	6.7	1.4	5.3	XX	8.2	2.8	<0.005	0.099	0.099	0.11	0.11	66	9	0.11	66	9
TP7-200	17/05/2018	TP7	200	Clayey SAND	A	9.3	2.1	7.2	XXXX	6.3	2.6	<0.005	0.13	0.13	0.14	0.14	87	12	0.14	87	12
TP7-300	17/05/2018	TP7	300	Clayey SAND	B	7.8	1.6	6.2	XX	4.6	5.4	0.019	0.027	0.008	<0.005	0.019	12	2	0.019	12	2
TP10-250	17/05/2018	TP10	250	Clayey SAND	A	5.8	3.7	2.1	XX	4.4	4.8	0.035	0.042	0.006	0.005	0.058	36	5	0.058	36	5
TP11-200	17/05/2018	TP11	200	Clayey SAND	A	5.8	3.5	2.3	XXXX	5.1	4.9	0.01	0.011	<0.005	<0.005	0.01	6	1	0.01	6	1
TP12-225	17/05/2018	TP12	225	Clayey SAND	B	6.4	4.8	1.6	XX	6.7	6.9	<0.005	0.022	0.022	<0.005	<0.005	<5	<1	<0.005	<5	<1
TP13-300	17/05/2018	TP13	300	Clayey SAND	A	8.4	6.8	1.6	XXX	4.8	3.6	<0.005	<0.005	<0.005	<0.005	<0.005	<5	<1	<0.005	<5	<1
TP15-50	17/05/2018	TP15	50	SAND	A	3.9	3.5	0.4	X	5.3	3	0.008	0.14	0.13	0.1	0.11	68	9	0.11	68	9
TP16-200	17/05/2018	TP16	200	Clayey SAND	B	6.9	1.9	5	XX	6.2	2.6	<0.005	0.1	0.1	0.11	0.11	67	9	0.11	67	9
TP21-250	18/05/2018	TP21	250	Clayey SAND	A	6.2	3.3	2.9	XX	5.5	5.3	<0.005	0.006	0.006	<0.005	<0.005	<5	<1	<0.005	<5	<1
TP23-200	18/05/2018	TP23	200	Clayey SAND	A	7.7	2	5.7	XXXX	4.4	4.2	0.024	0.038	0.014	0.017	0.064	40	6	0.064	40	6
TP23-250	18/05/2018	TP23	250	SAND	B	7.2	2.7	4.5	XX	3.9	4.7	0.04	0.05	0.01	0.056	0.15	94	13	0.15	94	13
TP28-300	18/05/2018	TP28	300	CLAY	B	4.5	2	2.5	XX	6.2	2.7	<0.005	0.16	0.16	0.15	0.15	94	13	0.15	94	13
TP29-100	18/05/2018	TP29	100	Clayey SAND	A	4.8	3.9	0.9	X	6.1	3.3	<0.005	0.024	0.024	0.03	0.03	19	3	0.03	19	3

References

Department of Environment Regulation (DER) 2015a, *Identification and investigation of acid sulfate soils and acidic landscapes – Acid Sulfate Soils Guideline Series*, Department of Environment Regulation, Government of Western Australia, Perth, June 2015.

Department of Environment Regulation (DER) 2015b, *Treatment and management of soil and water in acid sulfate soil landscapes– Acid Sulfate Soils Guideline Series*, Department of Environment Regulation, Government of Western Australia, Perth, June 2015.

Appendix 1
Geological logs

TESTPIT LOG TP1

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE Grass

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SM	Silty SAND, fine grained, well sorted sand, ~25% low-non plastic, dark brown-black, organic fines. Trace root mass.	Moist	TP1_25	5.1	3	XX	
	0.4		SW	SAND, fine-medium grained, well sorted, brown sand. With fines.		TP1_50	5.4	3.2	X	
	0.6									
	0.8									
	1					TP1_100	6.2	4.1	X	
	1.2									
	1.4					TP1_150	5.4	3.2	X	
	1.6									
	1.8									
▽	2			increasing fines at/below waterstrike	Wet	TP1_200	6.4	2	XX	0.051
	2.2			Excavation terminated - Cave-in to 1.8 m bgl						
	2.4									
	2.6									
	2.8									
	3									
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP2

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018
TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE Bare/Sand
LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0		SW	SAND, fine-medium grained, well sorted sand. With low-non plastic, brown fines.	Dry					
	0.2		CL	Sandy CLAY, brown-orange, med-high plasticity, clay, ~50% fine-medium grained sand.	Moist					
	0.4					TP2_50	6.4	4.7	XX	
	0.6		SC	Clayey SAND, brown-orange mottled orange, medium-coarse, well sorted sand. ~25% med plasticity fines.						
	0.8									
	1					TP2_100	7.8	5.8	XX	
	1.2					/DUP1	7.8	6.4	X	
	1.4									
	1.6					TP2_150	7.5	6	XX	
	1.8									
	2					TP2_200	7.7	5.9	XX	
	2.2									
	2.4					TP2_250	7.6	6.1	XX	
▽	2.6									
	2.8			Clayey SAND, grey, medium-coarse, well sorted sand. ~25% med plasticity fines.	Wet					
	3					TP2_300	7.2	5.9	X	
				Excavation terminated - 3 m bgl						
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP3

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 2.6 m bgl
SURFACE Pastural grasses

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SM	Silty SAND, fine grained, well sorted sand, ~15% low-non plastic, brown, organic fines.	Dry	TP3_25	4.5	2.6	XX	
	0.4		SW	SAND, brown-orange, fine-medium grained, well sorted sand.		TP3_50	4.7	2.2	XX	0.008
	0.6				Moist					
	0.8		CL	Sandy CLAY, brown to orange mottled, med-high plasticity, clay, ~30% fine-medium grained sand.		TP3_100	7.3	5.3	XX	
	1									
	1.2		SC	Clayey SAND, brown to orange mottled, medium-coarse, well sorted sand. 25-50% med plasticity fines.						
	1.4					TP3_150	7.3	5.8	XX	
	1.6									
	1.8									
	2					TP3_200	7.4	5.6	XX	
	2.2									
	2.4									
	2.6					TP3_250	7.4	5.7	XX	
	2.8			Excavation terminated - Cave-in to 2.2 m bgl						
	3									
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP4

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare/sand

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SM	Silty SAND, fine grained, well sorted grey sand, ~15% low-non plastic, brown, organic fines.	Dry					
			SW		Moist					
	0.4			SAND, grey, fine-medium grained, well sorted sand.		TP4_50	4.1	3.6	X	
	0.6									
	0.8									
	1					TP4_100	4.4	2.5	X	
	1.2									
	1.4		SM	Cemented Silty SAND "Coffee Rock", dark brown, fine-coarse, sand. ~20% non plastic fines/cemented.		TP4_150	4.5	3.3	XXX	0.24
	1.6		SW	SAND, brown, medium-coarse, well sorted sand. With fines.						
	1.8									
	2					TP4_200	5.6	2.2	XX	
	2.2									
	2.4									
▽	2.6				Wet	TP4_250	4.9	3.5	X	0.028
	2.8									
	3					TP4_300	6	2.5	XX	
				Excavation terminated - 3 m bgl						
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP5

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE Grass

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SM	Silty SAND, fine-medium grained, well sorted, grey sand, ~20% low-non plastic, dark brown organic fines. Trace roots.	Dry					
	0.4		CH	CLAY, grey, high plasticity fines.	Moist	TP5_50	7.5	6.2	X	
	0.6									
	0.8		CL	Sandy CLAY, yellow/brown - orange, med-high plasticity fines, ~15% fine-medium grained orange sand		TP5_100	7.4	8.1	XXXX	
	1									
	1.2									
	1.4					TP5_150	7.4	6	X	
	1.6									
	1.8		SC	Clayey SAND, light brown, medium, well sorted sand. 20% med-high plasticity fines.		TP5_200	7.1	5.3	XX	
	2									
	2.2									
	2.4					TP5_250	7.6	4	X	
	2.6				Wet					
	2.8									
	3					TP5_300	6.9	1.7	XXXX	0.15
	3.2			Excavation terminated - Cave-in to 2.2 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP6

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018
TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare
LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS Water seeping into base of testpit

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SC	Clayey SAND, brown, fine-medium grained, well sorted sand, 30-40% med plastic fines.	Dry	TP6_25	7.7	6.1	X	
	0.4									
	0.6					TP6_50	8.2	6	XX	
	0.8			Clayey SAND, brown-orange, fine-medium grained, well sorted grey sand, 15% med plastic fines.	Moist					
	1					TP6_100	8.3	6.4	XX	
	1.2									
	1.4					TP6_150	7.8	6	XX	
	1.6									
	1.8		SW	SAND, brown, medium-coarse, well sorted sand. With fines.						
	2					TP6_200	7	2.2	X	
	2.2									
	2.4			with dark brown fines from 2.3						
▽	2.6			organic odour from 2.5 m bgl	Wet	TP6_250	6.8	1.7	XX	
	2.8									
	3					DUP2/ TP6_300	6.7	1.6	X	
	3.2			Excavation terminated - 3 m bgl			6.7	1.64	XX	0.085
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP7

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE Grass

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS Water seeping into base of testpit

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SM	Silty SAND, fine, well sorted grey sand, 30% dark brown-black, organic, non-plastic fines.	Dry	TP7_25	8.7	6.4	XX	
	0.4		SC	Clayey SAND, grey, fine, well sorted sand. 20% med plastic fines.		TP7_50	8.9	6.9	X	
	0.6									
	0.8									
	1					TP7_100	9	6.7	X	
	1.2									
	1.4									
	1.6				Moist	TP7_150	8.7	6.7	X	
	1.8			Clayey SAND, yellow-brown to orange, fine grained, well sorted sand, 20% med plastic fines.						
	2			Clayey SAND, blue-green, fine-medium grained, well sorted sand, 30% med-high plasticity fines.		TP7_200	9.3	2.1	XXXX	0.11
	2.2									
	2.4			Clayey SAND, brown, medium grained, well sorted sand, 30% med plastic fines.						
	2.6			organic odour		TP7_250	8.6	5.3	X	
▽	2.8				Wet					
	3					TP7_300	7.8	1.6	XX	0.14
	3.2			Excavation terminated - 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP8

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		CL	Sandy CLAY, brown, med plasticity clay, ~15% fine-medium grained sand	Dry					
	0.4					TP8_50	7.3	5.8	XX	
	0.6									
	0.8				Moist					
	1		SC	Clayey SAND, orange, fine-medium, well sorted sand. 20% med-high plasticity fines.		TP8_100	7.8	6	X X	
	1.2									
	1.4					TP8_150	7.7	6	X	
	1.6									
	1.8									
	2		CL	Sandy CLAY, brown-orange, med-high plasticity fines, ~20% medium grained sand.		TP8_200	7.1	5.9	XX	
	2.2		SW	SAND, medium grained, well sorted grey sand. With medium plasticity fines.						
	2.4									
	2.6					TP8_250	7.1	5.8	X	
	2.8									
	3						7.6	6.2	XX	
	3.2			Excavation terminated 3 m bgl		TP8_300				
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP9

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE Limestone track

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0		FILL	FILL, limestone roadbase	Dry					
	0.2		SC	Clayey SAND, orange-brown, fine-medium, well sorted sand. 15% med-high plasticity fines.	Moist					
	0.4					TP9_50	7.4	5.4	X	
	0.6									
	0.8									
	1		CL	Sandy CLAY, grey/red mottled, very high plasticity clay, ~15% med-coarse grained sand. Trace roots.		TP9_100 /DUP3	4.7 4.8	3.9 4	X X	
	1.2									
	1.4									
	1.6			Sandy CLAY, grey/orange mottled, very high plasticity clay, ~15% fine-med grained sand.		TP9_150	4.4	3.7	X	
	1.8		SC	Clayey SAND, grey, fine-medium, well sorted sand, ~15% med plasticity fines, slightly cemented.						
	2					TP9_200	4.6	3.8	X	
	2.2			Clayey SAND, orange-brown, fine-medium, well sorted sand. 15% med-high plasticity fines.						
	2.4									
	2.6					TP9_250	6.1	5.6	X	
	2.8									
	3					TP9_300	6.3	5.6	X	
	3.2			Excavation terminated 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP10

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS some water seeping in from above clayey sand layer ~1.5mgbl

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SW	SAND, brown, fine-medium, well sorted sand. With low plasticity fines.	Dry					
	0.4				Moist	TP10_50	7.9	6.4	X	
	0.6			SAND, orange, fine-medium, well sorted sand. With low plasticity fines.						
	0.8									
	1					TP10_100	7.7	6.4	X	
	1.2				Wet					
	1.4					TP10_150	7	6.1	X	
	1.6		SC	CLAYEY SAND, grey/orange mottled, fine-med grained, well sorted sand. ~15% med plasticity clay	Moist					
	1.8									
	2					TP10_200	5.3	4.4	X	
	2.2									
	2.4					TP10_250	5.8	3.7	XX	0.019
	2.6									
	2.8									
	3					TP10_300	4.9	4	XX	
	3.2			Excavation terminated 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP11

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS some water seeping in from above clayey sand layer ~1.4 m gbl and from ~2.6 m bgl.

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SW	SAND, grey, medium, well sorted sand. Trace fines	Moist					
	0.4					TP11_50	6.4	5.4	X	
	0.6									
	0.8									
	1			SAND, grey, fine-medium, well sorted sand. With medium plasticity fines.		TP11_100	7	6.1	X	
	1.2				Wet					
	1.4					TP11_150	6.1	5.2	X	
	1.6									
	1.8									
	2		SC	CLAYEY SAND, grey/red mottled, med-coarse grained, well sorted sand, ~30% med plasticity clay	Moist	TP11_200	5.8	3.5	XXXX	0.058
	2.2									
	2.4			CLAYEY SAND, brown/orange mottled grey, fine-med grained, well sorted sand, ~15% med-high plasticity clay		TP11_250	4.9	3.9	X	
▽	2.6				Wet					
	2.8									
	3					TP11_300	5.2	3.7	X	
	3.2			Excavation terminated 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP12

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE pastural grass

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS some water seeping in from above clayey sand layer ~2 m bgl

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SW	SAND, grey, fine, well sorted sand. Trace organic fines and roots in top 0.2m.	Dry					
	0.4					TP12_50	5	4.9	X	
	0.6				Moist					
	0.8									
	1					TP12_100	5.4	5.2	X	
	1.2									
	1.4					TP12_150	6.3	5.6	X	
	1.6									
	1.8									
	2			SAND, brown, fine-medium, well sorted sand. With fines.	Wet	TP12_200	6.8	5.9	X	
	2.2		SC	CLAYEY SAND, grey/yellow mottled, fine-med grained, well sorted sand, ~15% med plasticity clay		TP12_225	6.4	4.8	XX	0.01
	2.4			Excavation terminated 2.3 m bgl, pit collapsed.						
	2.6									
	2.8									
	3									
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP13

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018
TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE pastural grass
LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS water seeping in from ~1.5 m bgl

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SW	SAND, grey, fine-med, well sorted sand. Trace organic fines and roots in top 0.2m.	Moist					
	0.4					TP9_50	7.8	6.1	X	
	0.6			SAND, brown, fine-med, well sorted sand. With non-plastic fines.						
	0.8									
	1					TP9_100 /DUP3	7.5	6	X	
	1.2									
	1.4				Wet					
	1.6					TP9_150	7.1	6	X	
	1.8		SC	Clayey SAND, grey mottled yellow, fine-med grained sand, ~15% med plasticity fines						
	2				Moist	TP13_200	6.5	5	XX	
	2.2									
	2.4									
	2.6		CL	Sandy CLAY, blue/grey, very high plasticity clay, ~50% fine-med grained sand.		TP13_250	8	7.5	XXX	
	2.8		SC	Clayey SAND, blue/green, fine-medium, well sorted sand. 20% med-high plasticity fines.		TP13_300	8.4	6.8	XXX	<0.005
	3			Excavation terminated 3 m bgl						
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP14

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018
TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE pastural grass
LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS water seeping in from ~1.7 m bgl

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SW	SAND, brown, fine-med, well sorted sand. Trace organic fines and roots in top 0.3m.		TP14_50	6	5.2	X	
	0.4									
	0.6									
	0.8				Moist					
	1					TP14_100	5.8	4.4	X	
	1.2									
	1.4				Wet	TP14_150	5.2	4.3	X	
	1.6									
	1.8		SC	Clayey SAND, grey mottled orange, fine-med grained sand, ~15-30% med plasticity fines.	Moist					
	2			Some lenses (10-30cm) with higher clay content.		TP14_200	5.6	4.7	X	
	2.2									
	2.4					TP14_250	6.3	5.1	X	
	2.6									
	2.8									
	3					TP14_300	6.2	4.9	XX	
	3.2			Excavation terminated 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP15

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE grass

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SM	Silty SAND, fine grained, well sorted grey sand, ~15% low-non plastic, brown, organic fines.	Moist					
	0.4		SW	SAND, grey, fine-medium grained, well sorted sand.		TP15_50	3.9	3.5	X	<0.005
	0.6									
	0.8									
	1					TP15_100	6.4	4.6	XX	
	1.2		SM	Cemented Silty SAND "Coffee Rock", dark brown, fine-medium, sand. ~20% non plastic fines/cemented.						
	1.4				Wet					
	1.6					TP15_150	6.9	4.9	XX	
	1.8		SC	Clayey SAND, green/grey, medium-coarse, well sorted sand. ~20-30% med-high plasticity fines.						
	2					TP15_200	8.8	8	XX	
	2.2									
	2.4									
	2.6					TP15_250	9	8.4	X	
	2.8									
	3					TP15_300 /DUP4	9.3	8.6	XXXX	
				Excavation terminated - 3 m bgl			9	8.5	XXXX	
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP16

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SW	SAND, grey, fine-medium grained, well sorted sand.	Moist					
	0.4					TP16_50	4.3	3.6	X	
	0.6									
	0.8									
	1					TP16_100	6.2	5.3	X	
	1.2									
	1.4					TP16_150	6.9	1.9	X	
	1.6				Wet					
	1.8			Cemented Silty SAND "Coffee Rock", dark brown,						
			SM	fine-medium, sand. ~20% non plastic fines/cemented.		TP16_180	6.7	5.2	XX	0.11
	2		SC	Clayey SAND, green/grey, medium-coarse, well sorted sand. ~20% med-high plasticity fines.						
	2.2									
	2.4					TP16_250	4.9	4	XX	
	2.6			Excavation terminated - 2.6 m bgl, pit cave-in						
	2.8									
	3									
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP17

PROJECT NUMBER STO1780.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 17/05/2018
TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare
LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SM	Silty SAND, dark brown, find sand ~50% non plastic, organic fines	Dry	TP17_25	4.9	4	XX	
	0.4		SW	SAND, grey, fine grained, well sorted sand.		TP17_50	4.5	3.8	X	
	0.6									
	0.8									
	1					TP17_100	4.3	4.1	X	
	1.2				Moist					
	1.4					TP17_150	5.9	5	X	
	1.6									
	1.8									
	2			SAND, grey-brown, medium grained, well sorted sand.	Wet	TP16_200	6.7	4.6	XX	
	2.2			Excavation terminated - 2.1 m bgl, pit cave-in						
	2.4									
	2.6									
	2.8									
	3									
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP18

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE Lupins/Irrigated Pasture

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0		SM	Silty SAND, dark brown, fine sand ~30% non plastic, organic fines	Moist					
	0.2									
	0.4					TP18_50	5.6	4.7	X	
	0.6									
	0.8									
	1					TP18_100	7	5.8	X	
	1.2		SW	SAND, grey, fine-medium grained, well sorted sand.						
▽	1.4					TP18_150	8.1	6	X	
	1.6									
	1.8		SM	SAND, dark brown, fine-medium grained, well sorted sand, ~15% non plastic, fines, medium cemented.	Wet					
	2					TP18_200	5.7	4.4	XX	
	2.2			Organic Odour from waterstrike						
	2.4									
	2.6					TP18_250	6	4.9	X	
	2.8									
	3					TP18_300	6.1	5.1	X	
	3.2			Excavation terminated - 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP19

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE grass

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SM	Silty SAND, dark brown, fine sand ~20% non plastic, organic fines	Moist					
			SW	SAND, grey, fine-medium grained, well sorted sand.		TP19_50				
	0.4									
	0.6									
	0.8									
	1					TP19_100				
	1.2									
▽	1.4			Silty SAND (Coffee Rock), dark brown, fine-medium grained, well sorted sand, ~20% highly cemented, non plastic fines.	Wet	TP19_150				
	1.6					TP19_170				
	1.8			SAND, dark brown, fine-medium grained, well sorted sand, Strong organic odour from waterstrike						
	2									
	2.2									
	2.4					TP19_250				
	2.6									
	2.8									
	3					TP19_300				
	3.2			Excavation terminated - 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP20

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE grass

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SC	Clayey SAND, brown, fine sand ~30% plastic,fines, medium cemented	Dry					
	0.4					TP20_50				
	0.6		SW	SAND, brown, fine-medium grained, well sorted sand.	Moist					
	0.8									
	1					TP20_100				
	1.2									
▽	1.4					TP20_150				
	1.6		SC	Clayey SAND, yellow, fine sand ~15% medium plasticity fines						
	1.8									
	2					TP20_200				
	2.2			Clayey SAND, green/grey, fine sand ~25% medium plasticity fines						
	2.4									
	2.6					TP20_250				
	2.8									
	3					TP20_300				
	3.2			Excavation terminated - 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP21

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SW	SAND, grey, fine-medium grained, well sorted sand.	Moist					
	0.4			Becoming yellow/orange from 0.5m bgl		TP21_50				
	0.6		CL	Sandy CLAY, brown mottled orange, medium-high plasticity, ~15% medium sand						
	0.8									
	1					TP21_100				
	1.2									
	1.4					TP21_150				
	1.6									
	1.8									
	2					TP21_200				
	2.2			Decreasing Clay content from ~2.2 m bgl						
	2.4		SC	Clayey SAND, grey, medium-coarse sand ~20% medium plasticity fines		TP21_250				
	2.6									
	2.8									
	3					TP21_300				
	3.2			Excavation terminated - 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP22

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 2.6 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0		SW	SAND, grey, fine grained, well sorted sand.	Dry					
	0.2					TP22_50				
	0.4									
	0.6									
	0.8									
	1				Moist	TP22_100				
	1.2									
	1.4					TP22_150				
	1.6		SM	Silty SAND, grey fine-medium sand, ~15% brown non plastic, organic fines						
	1.8									
	2					TP22_200				
	2.2									
	2.4				Wet					
	2.6					TP22_250				
	2.8			Excavation terminated - 2.6 m bgl, cave-in						
	3									
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP23

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 2.6 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0		SW	SAND, grey, fine grained, well sorted sand.	Moist					
	0.2					TP23_50				
	0.4									
	0.6									
	0.8					TP23_100				
	1									
	1.2									
▽1	1.4			Brown from 1.4 mbgl	Wet	TP23_150/ DUP 5				
	1.6		SC	Clayey SAND, grey fine-medium sand, ~20% green/grey medium-plastic, fines	Moist					
	1.8									
▽2	2					TP23_200				
	2.2		SW	SAND, brown, fine-medium sand with fines	Wet					
	2.4									
	2.6					TP23_250				
	2.8			Excavation terminated - 2.6 m bgl, cave-in						
	3									
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP24

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		SW	SAND, brown, fine-medium grained, well sorted sand.	Moist	TP24_50/ DUP6				
	0.4									
	0.6									
	0.8		CL	Clayey SAND, brown mottled orange, fine-medium sand, ~15% medium-plastic, fines		TP24_100				
	1									
	1.2									
	1.4					TP24_150				
	1.6									
	1.8									
▽	2					TP24_200				
	2.2		SC	Sandy CLAY, brown, medium-high plasticity clay, ~40% medium-coarse sand	Wet					
	2.4									
	2.6					TP24_250				
	2.8		CL	Clayey SAND, orange mottled brown, fine sand, ~25% medium plasticity fines						
	3					TP24_300				
	3.2			Excavation terminated - 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP25

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0		ML	SILT, cream, non-plastic, inorganic silt	Dry					
	0.2					TP25_25				
	0.4				Moist					
			CH	CLAY, brown/orange, high plasticity clay		TP25_50				
	0.6									
	0.8									
	1					TP25_100				
	1.2									
	1.4					TP25_150				
	1.6									
	1.8									
	2			CLAY, green/brown, high plasticity clay. Trace fine - coarse gravels.		TP25_200				
	2.2									
	2.4			CLAY, green, medium plasticity. Trace medium sand.		TP25_250				
	2.6									
▽	2.8		CL	Clayey SAND, green, medium-coarse sand, ~15% medium plasticity fines	Wet					
	3			Excavation terminated - 3 m bgl		TP25_300				
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP26

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0		CL	Sandy CLAY, brown/orange mottled orange, medium-high plasticity clay lenses with 20-30% fine-medium sand.	Dry					
	0.2					TP26_50				
	0.4									
	0.6									
	0.8				Moist					
	1					TP26_100				
	1.2									
	1.4					TP26_150				
	1.6									
	1.8									
	2					TP26_200				
	2.2									
	2.4					TP26_250				
	2.6		CH	CLAY, brown/orange mottled red, high plasticity clay						
	2.8									
	3			Excavation terminated - 3 m bgl		TP26_300				
	3.2									
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP27

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE pastural grasses

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8 3		CL	Sandy CLAY, brown/orange mottled orange, medium-high plasticity clay lenses with 20-30% fine-medium sand.	Dry Moist	TP27_50 TP27_100 TP27_150 TP27_200 TP27_250 TP27_300				
	3.2 3.4 3.6 3.8 4 4.2 4.4 4.6 4.8			Excavation terminated - 3 m bgl						

TESTPIT LOG TP28

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8 3		SC	Clayey SAND, brown/orange mottled orange, medium-coarse sand.~15% medium plasticity clay with some high plasticity lenses. Orange from 0.8 m bgl CLAY, grey mottled red, medium grained sand, 25% very high plasticity fines. Trace visible kaolinite from 1.9 m bgl	Dry Moist	TP28_50 TP28_100 TP28_150 TP28_200 TP28_250 TP28_300				
	3.2 3.4 3.6 3.8 4 4.2 4.4 4.6 4.8			Excavation terminated - 3 m bgl						

TESTPIT LOG TP29

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE pastural/grasses

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0.2		CL	Sandy CLAY, brown/orange, medium plasticity clay, ~10% fine grained sand. Trace roots	Dry	TP29_50				
	0.4									
	0.6				Moist					
	0.8		SC	Clayey SAND, brown/orange mottled red, medium-coarse grained sand, 20% very high plasticity fines.		TP29_100				
	1									
	1.2									
	1.4					TP29_150				
	1.6									
	1.8									
	2					TP29_200				
	2.2			Trace gravels (ironstone) from 2.2m bgl						
	2.4									
	2.6					TP29_250				
	2.8				Wet					
	3					TP29_300/ DUP7				
	3.2			Excavation terminated - 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

TESTPIT LOG TP30

PROJECT NUMBER STO17280.01
PROJECT NAME Wellard Farm, ASS
CLIENT Stockland
ADDRESS Telephone Lane, Wellard
DRILLING DATE 18/05/2018

TESTPIT METHOD Backhoe
END of EXCAVATION 3 m bgl
SURFACE bare

LOGGED BY M. Doyle
CHECKED BY D. Jarvis

COMMENTS

Water	Depth (m)	Graphic Log	USCS	Material Description	Moisture	Samples	pHf	pHfox	Reaction	Scr (%)
	0		CL	Sandy CLAY, brown/orange, medium plasticity clay, ~30-40% fine grained sand.	Dry					
	0.2									
	0.4				Moist	TP30_50/ DUP8				
	0.6									
	0.8									
	1					TP30_100				
	1.2									
	1.4					TP30_150				
	1.6									
	1.8									
	2					TP30_200				
	2.2		SC	Clayey SAND, green/grey mottled orange, medium-coarse grained sand, 25% medium plasticity fines						
	2.4									
	2.6					TP30_250				
	2.8									
	3					TP30_300				
	3.2			Excavation terminated - 3 m bgl						
	3.4									
	3.6									
	3.8									
	4									
	4.2									
	4.4									
	4.6									
	4.8									

YOUR LOGO

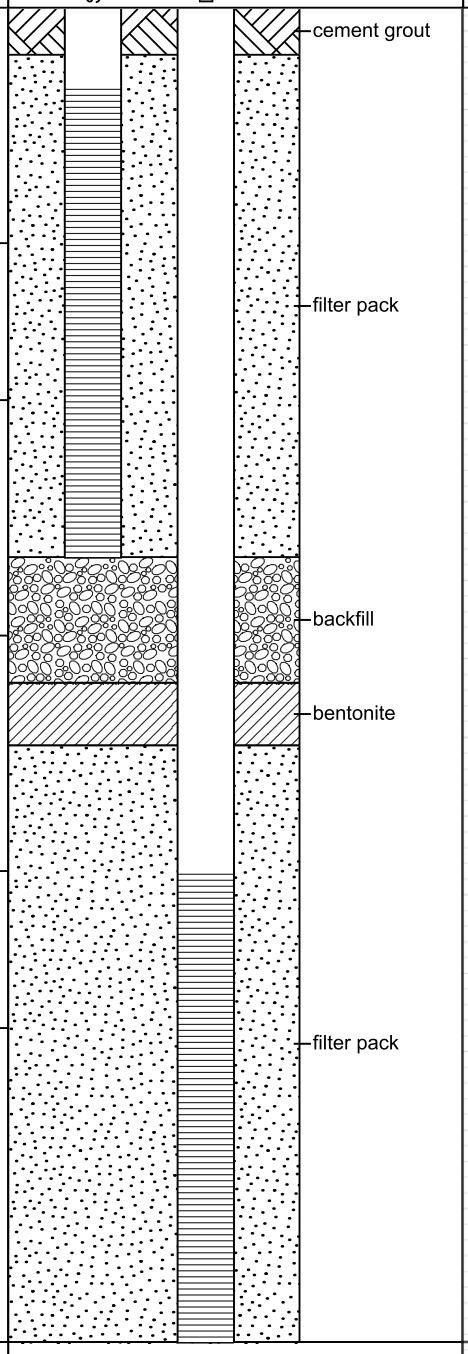
GROUNDWATER LOG MW3

PROJECT NUMBER CW1008000	**DRILLING DATE** 18/06/18	**COORDINATES**
PROJECT NAME	**TOTAL DEPTH** 8.5 m	**COORD SYS**
CLIENT	**DIAMETER** 100 mm	**COMPLETION**
ADDRESS	**CASING** uPVC	**SURFACE ELEVATION**
LICENCE NO.	**SCREEN** uPVC Factory Slotted	**WELL TOC**

COMMENTS

LOGGED BY MB
CHECKED BY

Water	Depth (m)	Graphic Log	Moisture	Material Description	Elevation (m)
	0		D	SAND: dark grey, fine, well sorted	45
	1.5			SAND: grey, fine to medium grained, sub-rounded, moderately sorted	43.5
▽	2.5		W	CLAYEY SAND: red, fine to medium grained, sub-rounded, well sorted	42.5
	4			CLAYEY SAND: light brown, medium grained	41
	5.5			SAND: grey, medium grained, well sorted, high plasticity	39.5
	6.5			CLAYEY SAND: light brown, fine to medium grained, well sorted	38.5
	8.5			Termination depth at 8.5m	36.5



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YOUR LOGO

GROUNDWATER LOG MW4

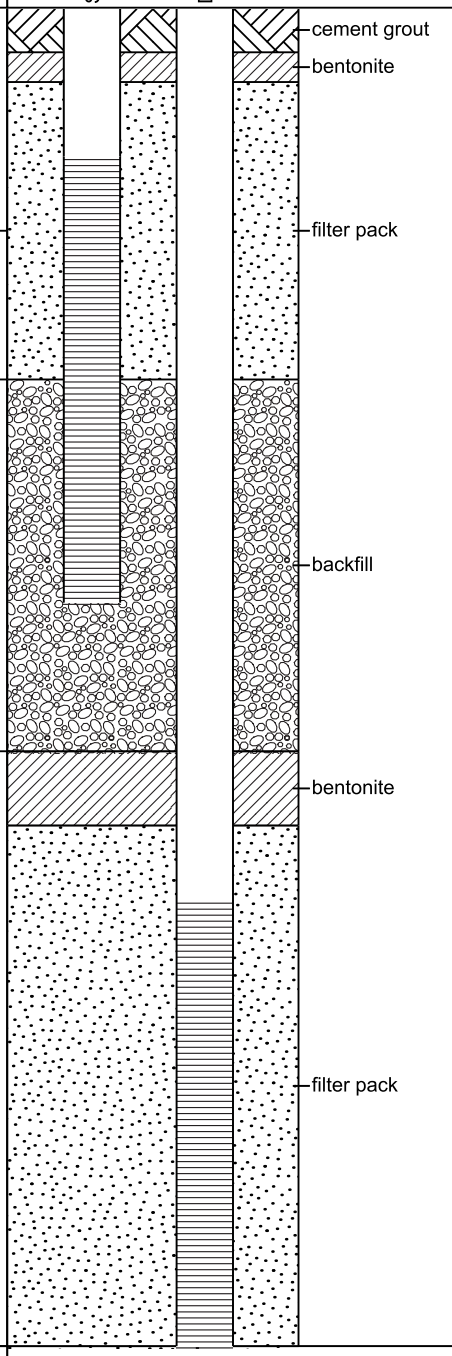
PROJECT NUMBER CW1008000	**DRILLING DATE** 18/06/18	**COORDINATES**
PROJECT NAME	**TOTAL DEPTH** 9 m	**COORD SYS**
CLIENT	**DIAMETER** 100 mm	**COMPLETION**
ADDRESS	**CASING** uPVC	**SURFACE ELEVATION**
LICENCE NO.	**SCREEN** uPVC Factory Slotted	**WELL TOC**

COMMENTS

LOGGED BY MB
CHECKED BY

Water	Depth (m)	Graphic Log	Moisture	Material Description	Elevation (m)
	0		D	SANDY CLAY: dark brown, fine to medium grain, moderately sorted	45
	0.5				44.5
	1				44
	1.5			SANDY CLAY: grey, fine to medium grain, moderately sorted	43.5
	2				43
▽	2.5		W	CLAY: red, high strength, high plasticity, fine grain	42.5
	3				42
	3.5				41.5
	4				41
	4.5				40.5
	5			CLAYEY SAND: grey, fine to medium grain, well sorted	40
	5.5				39.5
	6				39
	6.5				38.5
	7				38
	7.5				37.5
	8				37
	8.5				36.5
	9			Termination depth at 9m	36

Well Diagram



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YOUR LOGO

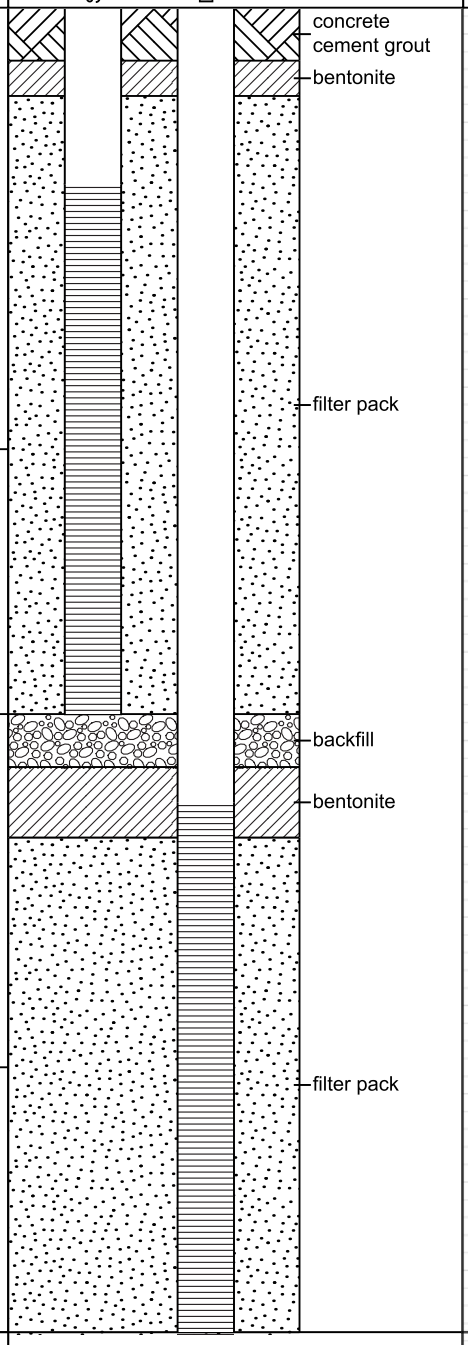
GROUNDWATER LOG MW7

PROJECT NUMBER CW1008000	**DRILLING DATE** 18/06/18	**COORDINATES**
PROJECT NAME	**TOTAL DEPTH** 7.5 m	**COORD SYS**
CLIENT	**DIAMETER** 100 mm	**COMPLETION**
ADDRESS	**CASING** uPVC	**SURFACE ELEVATION**
LICENCE NO.	**SCREEN** uPVC Factory Slotted	**WELL TOC**

COMMENTS

LOGGED BY MB
CHECKED BY

Water	Depth (m)	Graphic Log	Moisture	Material Description	Elevation (m)
	0		W	SANDY CLAY: Dark brown, fine grain, low plasticity, well sorted	45
	0.5				44.5
	1				44
	1.5				43.5
	2				43
▽	2.5		D	SANDY CLAY: brown/grey, fine to medium grain, sub rounded, moderately sorted	42.5
	3				42
	3.5				41.5
	4			SAND: grey, lower amount of fine, medium grained, sub rounded, well sorted	41
	4.5				40.5
	5				40
	5.5				39.5
	6			CLAYEY SAND: grey, fine to medium grained	39
	6.5				38.5
	7				38
	7.5			Termination depth at 7.5m	37.5



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GROUNDWATER LOG MW8

PROJECT NUMBER CW1008000	**DRILLING DATE** 7/06/2018	**COORDINATES** 4581.8, 6021
PROJECT NAME Wellard Farms Investigations	**TOTAL DEPTH** 9	**COORD SYS** GDA Zone 50
CLIENT Stockland	**DIAMETER** 100mm	
ADDRESS Mundijong Road, Wellard	**CASING** uPVC	**SURFACE ELEVATION** x mAHD
	SCREEN uPVC Factory Slotted	**WELL TOC** S=x; M=x; D=x

COMMENTS

LOGGED BY RD

Water	Depth (m)	Graphic Log	Moisture	Material Description	Well Diagram
	0		D	SAND: Light brown, fine to medium grained, sub-rounded, well sorted	S D cement grout
	0.5				
	1			COFFEE SANDS: Brown, minimal cementing, fine to medium grained, sub-rounded, well sorted	backfill
	1.5			CLAYEY SAND: Dark yellow, fine to medium grained, sub-rounded, well sorted	
	2			CLAYEY SAND: Light yellow, fine to medium grained, sub-rounded, well sorted	
▽ 1	2.5		W	CLAYEY SAND: Light yellow/grey, fine to medium grained, sub-rounded, well sorted	bentonite
	3			CLAYEY SAND: Pale grey, fine to medium grained, sub-rounded, well sorted	
	3.5			CLAYEY SAND: Grey, fine to medium grained, sub-rounded, well sorted	
	4				filter pack
	4.5				
	5				bentonite
	5.5			SAND: Minor clay content, grey, fine to medium grain, well sorted, sub-rounded	
	6				
	6.5				
	7				filter pack
	7.5				
	8				
	8.5			SAND: Minor clay content, grey becoming stained with light brown, fine to medium grain, well sorted, sub-rounded	
	9			Termination Depth at 9	
	9.5				
	10				
	10.5				
	11				
	11.5				

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GROUNDWATER LOG MW9

PROJECT NUMBER CW1008000
PROJECT NAME Wellard Farms Investigations
CLIENT Stockland
ADDRESS Mundijong Road, Wellard

DRILLING DATE 7/06/2018
TOTAL DEPTH 11
DIAMETER 100mm
CASING uPVC
SCREEN uPVC Factory Slotted

COORDINATES 4581.8, 6021
COORD SYS GDA Zone 50

SURFACE ELEVATION x mAHD
WELL TOC S=x; M=x; D=x

COMMENTS

LOGGED BY RD

Water	Depth (m)	Graphic Log	Moisture	Material Description	Well Diagram
	0		D	SAND: White, fine to medium grained, well sorted, sub-rounded	S M D cement grout
	0.5			SAND: Yellow , fine to medium grained, well sorted, sub-rounded	filter pack
	1			COFFEE ROCK: Dark brown, , fine to medium grained, well sorted, sub-rounded, very cemented at 1.4-1.5mBGL	
	1.5			SAND: Yellow , fine to medium grained, well sorted, sub-rounded	bentonite
	2			SANDY CLAY: grey, fine grained, well sorted, sub-rounded, low plasticity	
▽ 1	2.5		W		
	3				filter pack
	3.5				
	4			CLAY: grey, very stiff	backfill
	4.5			SANDY CLAY: grey, fine grained, well sorted, sub-rounded, low plasticity	
	5			SAND: dark brown, silt, fine grained, sub-rounded, well sorted, sulphur smell	
	5.5				
	6				
	6.5				
	7				bentonite
	7.5			SAND: dark brown, minor silt, fine grained, sub-rounded, well sorted, sulphur smell	
	8				
	8.5				
	9				filter pack
	9.5				
	10				
	10.5			CLAY: black, extremely stiff	
	11			Termination Depth at:11 m	
	11.5				

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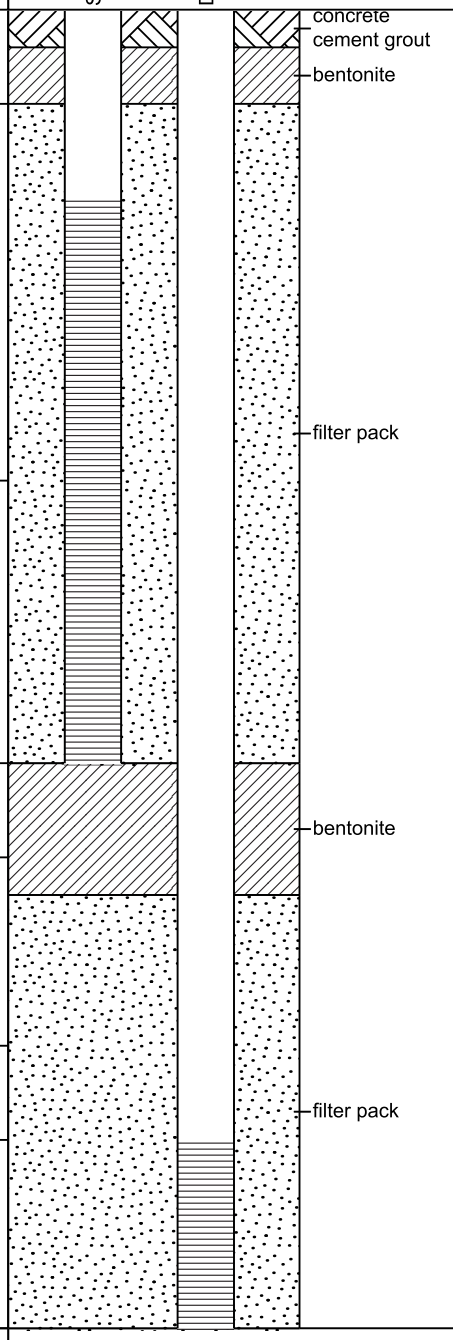
GROUNDWATER LOG MW10

PROJECT NUMBER CW1008000	**DRILLING DATE** 19/06/18	**COORDINATES**
PROJECT NAME	**TOTAL DEPTH** 7 m	**COORD SYS**
CLIENT	**DIAMETER** 100 mm	**COMPLETION**
ADDRESS	**CASING** uPVC	**SURFACE ELEVATION**
LICENCE NO.	**SCREEN** uPVC Factory Slotted	**WELL TOC**

COMMENTS

LOGGED BY MB
CHECKED BY

Water	Depth (m)	Graphic Log	Moisture	Material Description	Elevation (m)
	0		D	SANDY CLAY: dark grey, high strength, fine grain	45
	0.5			SAND: white, fine to medium grained, well sorted, sub-rounded, strength increase with depth	44.5
	1				44
	1.5				43.5
	2				43
▽	2.5		W	SANDY CLAY: grey, fine to medium grained, poorly sorted, low plasticity	42.5
	3				42
	3.5				41.5
	4			SANDY CLAY: fine grain, brown, well sorted, low plasticity	41
	4.5			CLAY: dark grey, very stiff	40.5
	5				40
	5.5			SANDY CLAY: brown, fine grain, low plasticity	39.5
	6			LIMESTONE: very hard	39
	6.5				38.5
	7			Termination depth at 7m	38



GROUNDWATER LOG MW11

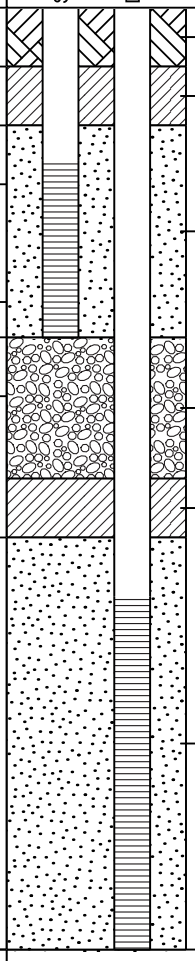
PROJECT NUMBER CW1008000	**DRILLING DATE** 7/06/2018	**COORDINATES** 4581.8, 6021
PROJECT NAME Wellard Farms Investigations	**TOTAL DEPTH** 8	**COORD SYS** GDA Zone 50
CLIENT Stockland	**DIAMETER** 100mm	
ADDRESS Mundijong Road, Wellard	**CASING** uPVC	**SURFACE ELEVATION** x mAHD
	SCREEN uPVC Factory Slotted	**WELL TOC** S=x; M=x; D=x

COMMENTS

LOGGED BY RD

Water	Depth (m)	Graphic Log	Moisture	Material Description
	0.5		D	SAND: Dark grey, fine, sub-rounded, well sorted
	1			SAND: Grey, fine to medium, sub-rounded, moderately sorted
	1.5			SAND: Pale grey, fine to medium, sub-rounded, moderately sorted
	2			SAND: Grey, fine to medium, sub-rounded, moderately sorted
▽ 1	2.5		W	SAND: Dark grey, fine to medium, sub-rounded, moderately sorted
	3			COFFEE ROCK: Well cemented, fine grained, moderately sorted, sub-rounded
	3.5			COFFEE SANDS: Dark brown, no cementing, sulphur smell to end of hole, fine to medium grain moderately sorted, sub-rounded
	4			
	4.5			COFFEE SANDS: Brown becoming lighter, no cementing, sulphur smell to end of hole, fine to medium grain moderately sorted, sub-rounded
	5			
	5.5			
	6			
	6.5			
	7			
	7.5			
	8			Termination Depth at 8
	8.5			
	9			
	9.5			
	10			
	10.5			
	11			
	11.5			

Well Diagram



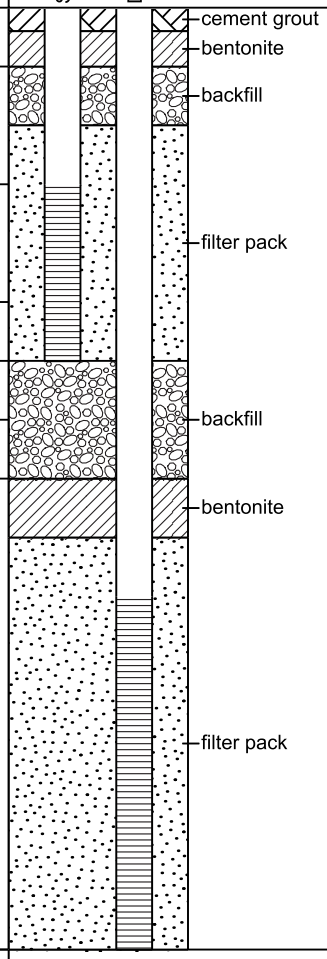
GROUNDWATER LOG MW12

PROJECT NUMBER CW1008000	**DRILLING DATE** 7/06/2018	**COORDINATES** 4581.8, 6021
PROJECT NAME Wellard Farms Investigations	**TOTAL DEPTH** 8	**COORD SYS** GDA Zone 50
CLIENT Stockland	**DIAMETER** 100mm	
ADDRESS Mundijong Road, Wellard	**CASING** uPVC	**SURFACE ELEVATION** x mAHD
	SCREEN uPVC Factory Slotted	**WELL TOC** S=x; M=x; D=x

COMMENTS

LOGGED BY RD

Water	Depth (m)	Graphic Log	Moisture	Material Description
	0		D	FILL: Yellow / grey, fine to coarse with limestone pieces
	0.5			SAND: Grey, fine to medium, moderately sorted, sub-rounded
	1			
	1.5			SAND: White, fine to medium, moderately sorted, sub-rounded
	2			
▽ 1	2.5		W	COFFEE SANDS: No cementing, fine to medium grained, poorly sorted, sub-rounded
	3			COFFEE ROCK: Cemented, fine to medium grained, poorly sorted, sub-rounded
	3.5			COFFEE SANDS: No cementing, fine to medium grained, poorly sorted, sub-rounded
	4			SAND: Dark brown becoming lighted, fine to medium grain, sub-rounded, poorly sorted
	4.5			
	5			
	5.5			
	6			
	6.5			
	7			
	7.5			
	8			Termination Depth at 8
	8.5			
	9			
	9.5			
	10			
	10.5			
	11			
	11.5			



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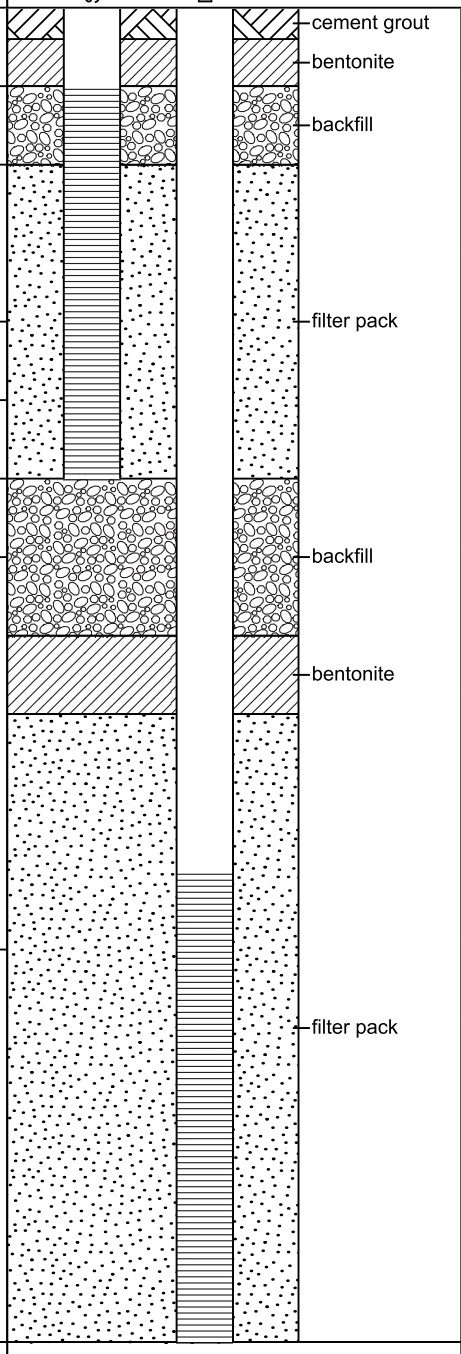
GROUNDWATER LOG MW13

PROJECT NUMBER CW1008000	**DRILLING DATE** 19/06/18	**COORDINATES**
PROJECT NAME Wellard Farm Investigations	**TOTAL DEPTH** 8.5 m	**COORD SYS**
CLIENT Stockland	**DIAMETER** 100 mm	
ADDRESS Mundijong Road, Wellard	**CASING** uPVC	**SURFACE ELEVATION** x mAHD
	SCREEN uPVC Factory Slotted	**WELL TOC** S=z, D=x

COMMENTS

LOGGED BY MB
CHECKED BY

Water	Depth (m)	Graphic Log	Moisture	Material Description	Elevation (m)
	0		D	FILL - SAND: brown, medium grained, moderately sorted	45
	0.5			FILL - SAND: black, medium grained, moderately sorted	44.5
	1			FILL - SAND: yellow, fine to medium grained, sub rounded, well sorted	44
	1.5				43.5
	2			SAND: grey, medium grained, well sorted, high plasticity	43
▽	2.5		W	SAND: orange, medium grained, well sorted, sub rounded	42.5
	3			CLAY: grey, fine grain, very low plasticity	42
	3.5			SANDY CLAY: grey, fine grained, well sorted, low plasticity	41.5
	4				41
	4.5				40.5
	5				40
	5.5				39.5
	6			SAND: grey, medium grained, sub rounded, well sorted	39
	6.5				38.5
	7				38
	7.5				37.5
	8				37
	8.5			Termination depth at 8.5m	36.5



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Appendix 2
Results tables

Table 1 - Field pH

						pH_f	pH_{fox}	pH_f - pH_{fox}	Rate of Reaction
						pH units	pH units	pH units	
						0.1	0.1	0.1	X|XX|XXX|XXXX
Indicators of PASS (DWER 2015, Table 4)							<3	1	XXX
Indicators of AASS (DWER 2015, Table 4)						<4			
Field ID	Soil type	Sample Date	Location ID	Depth (cm)	Above or Below				
TP1-25	Silty SAND	17/05/2018	TP1	25	A	5.1	3	2.1	XX
TP1-50	SAND	17/05/2018	TP1	50	A	5.4	3.2	2.2	X
TP1-100	SAND	17/05/2018	TP1	100	A	6.2	4.1	2.1	X
TP1-150	SAND	17/05/2018	TP1	150	A	6.6	4.7	1.9	X
TP1-200	SAND	17/05/2018	TP1	200	B	6.4	2	4.4	XX
TP2-50	Sandy CLAY	17/05/2018	TP2	50	A	6.4	4.7	1.7	XX
TP2-100	Clayey SAND	17/05/2018	TP2	100	A	7.8	5.8	2	XX
TP2-150	Clayey SAND	17/05/2018	TP2	150	A	7.5	6	1.5	XX
TP2-200	Clayey SAND	17/05/2018	TP2	200	A	7.7	5.9	1.8	XX
TP2-250	Clayey SAND	17/05/2018	TP2	250	A	7.6	6.1	1.5	XX
TP2-300	Clayey SAND	17/05/2018	TP2	300	B	7.2	5.9	1.3	X
TP3-25	SAND	17/05/2018	TP3	25	A	4.5	2.6	1.9	XX
TP3-50	SAND	17/05/2018	TP3	50	A	4.7	2.2	2.5	X
TP3-100	Sandy CLAY	17/05/2018	TP3	100	A	7.3	5.3	2	XX
TP3-150	Clayey SAND	17/05/2018	TP3	150	A	7.3	5.8	1.5	XX
TP3-200	Clayey SAND	17/05/2018	TP3	200	A	7.4	5.6	1.8	XX
TP3-250	Clayey SAND	17/05/2018	TP3	250	A	7.4	5.7	1.7	XX
TP4-50	SAND	17/05/2018	TP4	50	A	4.1	3.6	0.5	X
TP4-100	SAND	17/05/2018	TP4	100	A	4.4	2.5	1.9	X
TP4-150	Silty SAND (Coffee Rock)	17/05/2018	TP4	150	A	4.5	3.3	1.2	XXX
TP4-200	SAND	17/05/2018	TP4	200	A	5.6	2.2	3.4	XX
TP4-250	SAND	17/05/2018	TP4	250	A	4.9	3.5	1.4	X
TP4-300	SAND	17/05/2018	TP4	300	B	6	2.5	3.5	XX
TP5-50	CLAY	17/05/2018	TP5	50	A	7.5	6.2	1.3	X
TP5-100	Sandy CLAY	17/05/2018	TP5	100	A	7.4	8.1	-0.7	XXXX
TP5-150	Sandy CLAY	17/05/2018	TP5	150	A	7.4	6	1.4	X
TP5-200	Clayey SAND	17/05/2018	TP5	200	A	7.1	5.3	1.8	XX
TP5-250	Clayey SAND	17/05/2018	TP5	250	A	7.6	4	3.6	X
TP5-300	Clayey SAND	17/05/2018	TP5	300	B	6.9	1.7	5.2	XXXX
TP6-25	Clayey SAND	17/05/2018	TP6	25	A	7.7	6.1	1.6	X
TP6-50	Clayey SAND	17/05/2018	TP6	50	A	8.2	6	2.2	XX
TP6-100	Clayey SAND	17/05/2018	TP6	100	A	8.3	6.4	1.9	XX
TP6-150	Clayey SAND	17/05/2018	TP6	150	A	7.8	6	1.8	XX
TP6-200	SAND	17/05/2018	TP6	200	A	7	2.2	4.8	X
TP6-250	SAND	17/05/2018	TP6	250	B	6.8	1.7	5.1	XX
TP6-300	SAND	17/05/2018	TP6	300	B	6.7	1.6	5.1	X
TP7-25	Silty SAND	17/05/2018	TP7	25	A	8.7	6.4	2.3	XX
TP7-50	Clayey SAND	17/05/2018	TP7	50	A	8.9	6.9	2	X
TP7-100	Clayey SAND	17/05/2018	TP7	100	A	9	6.7	2.3	X
TP7-150	Clayey SAND	17/05/2018	TP7	150	A	8.7	6.7	2	X
TP7-200	Clayey SAND	17/05/2018	TP7	200	A	9.3	2.1	7.2	XXXX
TP7-250	Clayey SAND	17/05/2018	TP7	250	A	8.6	5.3	3.3	X
TP7-300	Clayey SAND	17/05/2018	TP7	300	B	7.8	1.6	6.2	XX
TP8-50	Sandy CLAY	17/05/2018	TP8	50	A	7.3	5.8	1.5	XX
TP8-100	Clayey SAND	17/05/2018	TP8	100	A	7.8	6	1.8	XX
TP8-150	Clayey SAND	17/05/2018	TP8	150	A	7.7	6	1.7	X
TP8-200	Sandy CLAY	17/05/2018	TP8	200	A	7.1	5.9	1.2	XX
TP8-250	SAND	17/05/2018	TP8	250	A	7.1	5.8	1.3	X
TP8-300	SAND	17/05/2018	TP8	300	A	7.6	6.2	1.4	XX
TP9-50	Clayey SAND	17/05/2018	TP9	50	A	7.4	5.4	2	X
TP9-100	Sandy CLAY	17/05/2018	TP9	100	A	4.7	3.9	0.8	X
TP9-150	Sandy CLAY	17/05/2018	TP9	150	A	4.4	3.7	0.7	X
TP9-200	Clayey SAND	17/05/2018	TP9	200	A	4.6	3.8	0.8	X
TP9-250	Clayey SAND	17/05/2018	TP9	250	A	6.1	5.6	0.5	X
TP9-300	Clayey SAND	17/05/2018	TP9	300	A	6.3	5.6	0.7	X
TP10-50	SAND	17/05/2018	TP10	50	A	7.9	6.4	1.5	X
TP10-100	SAND	17/05/2018	TP10	100	A	7.7	6.4	1.3	X
TP10-150	SAND	17/05/2018	TP10	150	A	7	6.1	0.9	X
TP10-200	Clayey SAND	17/05/2018	TP10	200	A	5.3	4.4	0.9	X
TP10-250	Clayey SAND	17/05/2018	TP10	250	A	5.8	3.7	2.1	XX
TP10-300	Clayey SAND	17/05/2018	TP10	300	A	4.9	4	0.9	XX

Table 1 - Field pH

						pH_f	pH_{fox}	pH_f - pH_{fox}	Rate of Reaction
						pH units	pH units	pH units	
						0.1	0.1	0.1	X|XX|XXX|XXXX
Indicators of PASS (DWER 2015, Table 4)							<3	1	XXX
Indicators of AASS (DWER 2015, Table 4)						<4			
Field ID	Soil type	Sample Date	Location ID	Depth (cm)	Above or Below				
TP11-50	SAND	17/05/2018	TP11	50	A	6.4	5.4	1	X
TP11-100	SAND	17/05/2018	TP11	100	A	7	6.1	0.9	X
TP11-150	SAND	17/05/2018	TP11	150	A	6.1	5.2	0.9	X
TP11-200	Clayey SAND	17/05/2018	TP11	200	A	5.8	3.5	2.3	XXXX
TP11-250	Clayey SAND	17/05/2018	TP11	250	A	4.9	3.9	1	X
TP11-300	Clayey SAND	17/05/2018	TP11	300	B	5.2	3.7	1.5	X
TP12-50	SAND	17/05/2018	TP12	50	A	5	4.9	0.1	X
TP12-100	SAND	17/05/2018	TP12	100	A	5.4	5.2	0.2	X
TP12-150	SAND	17/05/2018	TP12	150	A	6.3	5.6	0.7	X
TP12-200	SAND	17/05/2018	TP12	200	B	6.8	5.9	0.9	X
TP12-225	Clayey SAND	17/05/2018	TP12	225	B	6.4	4.8	1.6	XX
TP13-50	SAND	17/05/2018	TP13	50	A	7.8	6.1	1.7	X
TP13-100	SAND	17/05/2018	TP13	100	A	7.5	6	1.5	X
TP13-150	SAND	17/05/2018	TP13	150	A	7.1	6	1.1	X
TP13-200	Clayey SAND	17/05/2018	TP13	200	A	6.5	5	1.5	XX
TP13-250	Clayey SAND	17/05/2018	TP13	250	A	8	7.5	0.5	XXX
TP13-300	Clayey SAND	17/05/2018	TP13	300	A	8.4	6.8	1.6	XXX
TP14-50	SAND	17/05/2018	TP14	50	A	6	5.2	0.8	X
TP14-100	SAND	17/05/2018	TP14	100	A	5.8	4.4	1.4	X
TP14-150	SAND	17/05/2018	TP14	150	A	5.2	4.3	0.9	X
TP14-200	Clayey SAND	17/05/2018	TP14	200	A	5.6	4.7	0.9	X
TP14-250	Clayey SAND	17/05/2018	TP14	250	A	6.3	5.1	1.2	X
TP14-300	Clayey SAND	17/05/2018	TP14	300	A	6.2	4.9	1.3	XX
TP15-50	SAND	17/05/2018	TP15	50	A	3.9	3.5	0.4	X
TP15-100	SAND	17/05/2018	TP15	100	A	6.4	4.6	1.8	XX
TP15-150	Silty SAND (Coffee Rock)	17/05/2018	TP15	150	A	6.9	4.9	2	XX
TP15-200	Clayey SAND	17/05/2018	TP15	200	B	8.8	8	0.8	XX
TP15-250	Clayey SAND	17/05/2018	TP15	250	B	9	8.4	0.6	X
TP15-300	Clayey SAND	17/05/2018	TP15	300	B	9.3	8.6	0.7	XXXX
TP16-50	SAND	17/05/2018	TP16	50	A	4.4	3.5	0.9	X
TP16-100	SAND	17/05/2018	TP16	100	A	4.3	3.6	0.7	X
TP16-150	SAND	17/05/2018	TP16	150	A	6.2	5.3	0.9	X
TP16-200	Clayey SAND	17/05/2018	TP16	200	B	6.9	1.9	5	XX
TP16-250	Clayey SAND	17/05/2018	TP16	250	B	6.7	5.2	1.5	XX
TP17-25	Silty SAND	17/05/2018	TP17	25	A	4.9	4	0.9	XX
TP17-50	SAND	17/05/2018	TP17	50	A	4.5	3.8	0.7	X
TP17-100	SAND	17/05/2018	TP17	100	A	4.3	4.1	0.2	X
TP17-150	SAND	17/05/2018	TP17	150	A	5.9	5	0.9	X
TP17-200	SAND	17/05/2018	TP17	200	B	6.7	4.6	2.1	XX
TP18-50	Silty SAND	18/05/2018	TP18	50	A	5.6	4.7	0.9	X
TP18-100	Silty SAND	18/05/2018	TP18	100	A	7	5.8	1.2	X
TP18-150	SAND	18/05/2018	TP18	150	A	8.1	6	2.1	X
TP18-200	SAND	18/05/2018	TP18	200	B	5.7	4.4	1.3	XX
TP18-250	SAND	18/05/2018	TP18	250	B	6	4.9	1.1	X
TP18-300	SAND	18/05/2018	TP18	300	B	6.1	5.1	1	X
TP19-50	SAND	18/05/2018	TP19	50	A	4.4	4.2	0.2	X
TP19-100	SAND	18/05/2018	TP19	100	A	6.4	5.2	1.2	X
TP19-150	SAND	18/05/2018	TP19	150	A	6.3	5.4	0.9	X
TP19-170	Silty SAND (Coffee Rock)	18/05/2018	TP19	170	B	6.2	4.8	1.4	X
TP19-250	SAND	18/05/2018	TP19	250	B	6.8	5.3	1.5	XX
TP19-300	SAND	18/05/2018	TP19	300	B	6.8	5	1.8	X
TP20-50	Clayey SAND	18/05/2018	TP20	50	A	7.6	6.2	1.4	X
TP20-100	SAND	18/05/2018	TP20	100	A	8.3	6.4	1.9	X
TP20-150	SAND	18/05/2018	TP20	150	A	7.8	6.3	1.5	XX
TP20-200	Clayey SAND	18/05/2018	TP20	200	B	7.8	6.4	1.4	XX
TP20-250	Clayey SAND	18/05/2018	TP20	250	B	8.7	7.1	1.6	XX
TP20-300	Clayey SAND	18/05/2018	TP20	300	B	9.1	7	2.1	XX
TP21-50	SAND	18/05/2018	TP21	50	A	5.5	4.5	1	XX
TP21-100	Sandy CLAY	18/05/2018	TP21	100	A	8.6	6.3	2.3	XX
TP21-150	Sandy CLAY	18/05/2018	TP21	150	A	8.6	6.3	2.3	XX
TP21-200	Sandy CLAY	18/05/2018	TP21	200	A	8	4.8	3.2	XX
TP21-250	Clayey SAND	18/05/2018	TP21	250	A	6.2	3.3	2.9	XX
TP21-300	Clayey SAND	18/05/2018	TP21	300	A	5.6	4.1	1.5	XX

Table 1 - Field pH

						pH_f	pH_{fox}	pH_f - pH_{fox}	Rate of Reaction
						pH units	pH units	pH units	
						0.1	0.1	0.1	X|XX|XXX|XXXX
Indicators of PASS (DWER 2015, Table 4)							<3	1	XXX
Indicators of AASS (DWER 2015, Table 4)						<4			
Field ID	Soil type	Sample Date	Location ID	Depth (cm)	Above or Below				
TP22-50	SAND	18/05/2018	TP22	50	A	5.8	4.9	0.9	X
TP22-100	SAND	18/05/2018	TP22	100	A	6.5	5.4	1.1	X
TP22-150	SAND	18/05/2018	TP22	150	A	6.5	5.4	1.1	X
TP22-200	Silty SAND	18/05/2018	TP22	200	A	6.2	4.8	1.4	X
TP22-250	Silty SAND	18/05/2018	TP22	250	B	6.4	4.8	1.6	X
TP23-50	SAND	18/05/2018	TP23	50	A	4.6	4.5	0.1	X
TP23-100	SAND	18/05/2018	TP23	100	A	4.8	4.6	0.2	X
TP23-150	SAND	18/05/2018	TP23	150	A	6.1	4.9	1.2	X
TP23-200	Clayey SAND	18/05/2018	TP23	200	A	7.7	2	5.7	XXXX
TP23-250	SAND	18/05/2018	TP23	250	B	7.2	2.7	4.5	XX
TP24-50	SAND	18/05/2018	TP24	50	A	5.9	5.6	0.3	XX
TP24-100	Clayey SAND	18/05/2018	TP24	100	A	7	5.4	1.6	X
TP24-150	Clayey SAND	18/05/2018	TP24	150	A	7	5.7	1.3	X
TP24-200	Clayey SAND	18/05/2018	TP24	200	A	6.7	5.3	1.4	X
TP24-250	Sandy CLAY	18/05/2018	TP24	250	B	6.5	5.3	1.2	X
TP24-300	Clayey SAND	18/05/2018	TP24	300	B	6.5	5.3	1.2	X
TP25-25	SILT	18/05/2018	TP25	25	A	4.6	4.2	0.4	X
TP25-50	CLAY	18/05/2018	TP25	50	A	6.9	5.8	1.1	XX
TP25-100	CLAY	18/05/2018	TP25	100	A	7.7	6.4	1.3	XX
TP25-150	CLAY	18/05/2018	TP25	150	A	7.9	6.9	1	XX
TP25-200	CLAY	18/05/2018	TP25	200	A	7.7	7.3	0.4	XX
TP25-250	CLAY	18/05/2018	TP25	250	A	8.3	8.8	-0.5	XXXX
TP25-300	Clayey SAND	18/05/2018	TP25	300	B	8.4	8.5	-0.1	XXXX
TP26-50	Sandy CLAY	18/05/2018	TP26	50	A	6.6	5.3	1.3	XX
TP26-100	CLAY	18/05/2018	TP26	100	A	6.4	5.4	1	XX
TP26-150	CLAY	18/05/2018	TP26	150	A	5.9	4.9	1	XX
TP26-200	CLAY	18/05/2018	TP26	200	A	5.7	4.7	1	XX
TP26-250	CLAY	18/05/2018	TP26	250	A	5.2	4.3	0.9	XX
TP26-300	CLAY	18/05/2018	TP26	300	A	5.3	4.4	0.9	XX
TP27-50	Sandy CLAY	18/05/2018	TP27	50	A	7.5	6.4	1.1	XX
TP27-100	Sandy CLAY	18/05/2018	TP27	100	A	7.3	6	1.3	XX
TP27-150	Sandy CLAY	18/05/2018	TP27	150	A	6.3	5.6	0.7	X
TP27-200	Sandy CLAY	18/05/2018	TP27	200	A	6.2	5.8	0.4	XX
TP27-250	Sandy CLAY	18/05/2018	TP27	250	A	5.6	5	0.6	XX
TP27-300	Sandy CLAY	18/05/2018	TP27	300	A	5.9	5.3	0.6	XX
TP28-50	Clayey SAND	18/05/2018	TP28	50	A	4.8	4	0.8	X
TP28-100	Clayey SAND	18/05/2018	TP28	100	A	5.1	4.4	0.7	XX
TP28-150	CLAY	18/05/2018	TP28	150	A	4.4	3.7	0.7	XX
TP28-200	CLAY	18/05/2018	TP28	200	A	4.3	3.7	0.6	X
TP28-250	CLAY	18/05/2018	TP28	250	A	4.3	3.6	0.7	XX
TP28-300	CLAY	18/05/2018	TP28	300	A	4.5	2	2.5	XX
TP29-50	Sandy CLAY	18/05/2018	TP29	50	A	6.5	6.9	-0.4	XXXX
TP29-100	Clayey SAND	18/05/2018	TP29	100	A	4.8	3.9	0.9	X
TP29-150	Clayey SAND	18/05/2018	TP29	150	A	5.3	4.6	0.7	X
TP29-200	Clayey SAND	18/05/2018	TP29	200	A	8.7	7.3	1.4	XX
TP29-250	Clayey SAND	18/05/2018	TP29	250	A	8.5	7	1.5	XX
TP29-300	Clayey SAND	18/05/2018	TP29	300	B	8.1	6.8	1.3	XX
TP30-50	Sandy CLAY	18/05/2018	TP30	50	A	6.8	6.4	0.4	XX
TP30-100	Sandy CLAY	18/05/2018	TP30	100	A	7.1	6.3	0.8	X
TP30-150	Clayey SAND	18/05/2018	TP30	150	A	7.3	8.1	-0.8	XXXX
TP30-200	Clayey SAND	18/05/2018	TP30	200	A	7.2	6.6	0.6	X
TP30-250	Clayey SAND	18/05/2018	TP30	250	A	8.5	8.9	-0.4	XXXX
TP30-300	Clayey SAND	18/05/2018	TP30	300	A	7.7	7.2	0.5	X

Table 1 - Field pH

						pH_f	pH_{fox}	pH_f - pH_{fox}	Rate of Reaction
						pH units	pH units	pH units	
						0.1	0.1	0.1	X|XX|XXX|XXXX
Indicators of PASS (DWER 2015, Table 4)							<3	1	XXX
Indicators of AASS (DWER 2015, Table 4)						<4			
Field ID	Soil type	Sample Date	Location ID	Depth (cm)	Above or Below				
MW3-3.0	Clayey SAND	7/06/2018	MW3	300	B	5.4	4.2	1.2	XX
MW3-3.5	Clayey SAND	7/06/2018	MW3	350	B	5.3	4	1.3	XX
MW3-4.0	Clayey SAND	7/06/2018	MW3	400	B	5	4.2	0.8	XX
MW3-4.5	Clayey SAND	7/06/2018	MW3	450	B	5	4	1	XX
MW3-5.0	Clayey SAND	7/06/2018	MW3	500	B	5	3.9	1.1	XX
MW3-5.5	SAND	7/06/2018	MW3	550	B	5.4	2.5	2.9	X
MW3-6.5	SAND	7/06/2018	MW3	650	B	5.2	3.5	1.7	XX
MW3-7.0	Clayey SAND	7/06/2018	MW3	700	B	5.2	3.4	1.8	XX
MW3-7.5	Clayey SAND	7/06/2018	MW3	750	B	5.4	4.1	1.3	XX
MW3-8.0	Clayey SAND	7/06/2018	MW3	800	B	5.6	3.5	2.1	XX
MW3-8.5	Clayey SAND	7/06/2018	MW3	850	B	6.1	4	2.1	X
MW4-3.0	CLAY	7/06/2018	MW4	300	B	5.4	3.4	2	XX
MW4-3.5	CLAY	7/06/2018	MW4	350	B	5.6	3.5	2.1	XX
MW4-4.0	CLAY	7/06/2018	MW4	400	B	5.7	3.7	2	XX
MW4-4.5	CLAY	7/06/2018	MW4	450	B	5.9	4.1	1.8	XX
MW4-5.0	Clayey SAND	7/06/2018	MW4	500	B	5.7	4	1.7	XX
MW4-5.5	Clayey SAND	7/06/2018	MW4	550	B	6.6	6	0.6	XX
MW4-6.0	Clayey SAND	7/06/2018	MW4	600	B	6.8	5.8	1	XX
MW4-6.5	Clayey SAND	7/06/2018	MW4	650	B	6.4	6	0.4	XX
MW4-7.0	Clayey SAND	7/06/2018	MW4	700	B	5.7	3.2	2.5	X
MW4-7.5	Clayey SAND	7/06/2018	MW4	750	B	5.9	3.4	2.5	X
MW4-8.0	Clayey SAND	7/06/2018	MW4	800	B	5.4	3.1	2.3	X
MW4-8.5	Clayey SAND	7/06/2018	MW4	850	B	5.7	2.8	2.9	X
MW7-3.5	Clayey SAND	7/06/2018	MW7	350	B	6.6	5.9	0.7	XX
MW7-4.0	Clayey SAND	7/06/2018	MW7	400	B	6.8	5.7	1.1	XX
MW7-4.5	Clayey SAND	7/06/2018	MW7	450	B	7.3	6.7	0.6	X
MW7-5.0	Clayey SAND	7/06/2018	MW7	500	B	7.3	5.4	1.9	X
MW7-5.5	Clayey SAND	7/06/2018	MW7	550	B	7.6	2.6	5	X
MW7-6.0	SAND	7/06/2018	MW7	600	B	7.7	2.5	5.2	X
MW7-6.5	SAND	7/06/2018	MW7	650	B	7.5	3.8	3.7	X
MW7-7.0	Clayey SAND	7/06/2018	MW7	700	B	6.3	3	3.3	X
MW7-7.5	Clayey SAND	7/06/2018	MW7	750	B	6.7	3.3	3.4	X
MW7-8.0	Clayey SAND	7/06/2018	MW7	800	B	6.9	3.5	3.4	XX
MW8-3.5-4.0	Clayey SAND	7/06/2018	MW8	350-400	B	7.2	5.7	1.5	X
MW8-4.0-4.5	Clayey SAND	7/06/2018	MW8	400-450	B	7.6	5.6	2	X
MW8-4.5-5.0	Clayey SAND	7/06/2018	MW8	450-500	B	7.2	4.9	2.3	XX
MW8-5.0-5.5	Clayey SAND	7/06/2018	MW8	500-550	B	7.4	5.1	2.3	XX
MW8-5.5-6.5	SAND	7/06/2018	MW8	550-650	B	7.1	3.7	3.4	XX
MW8-6.0-6.5	SAND	7/06/2018	MW8	600-650	B	7.1	1.7	5.4	XX
MW8-6.5-7.0	SAND	7/06/2018	MW8	650-700	B	7	1.5	5.5	XX
MW8-7.0-7.5	SAND	7/06/2018	MW8	700-750	B	7	1.7	5.3	XX
MW8-7.5-8.0	SAND	7/06/2018	MW8	750-800	B	6.9	2.1	4.8	XX
MW8-8.0-8.5	SAND	7/06/2018	MW8	800-850	B	7.1	1.6	5.5	XX
MW8-8.5-9.0	SAND	7/06/2018	MW8	850-900	B	6.8	1.7	5.1	XX
MW9-3.5-4.0	Sandy CLAY	7/06/2018	MW9	350-400	B	7.9	7.7	0.2	X
MW9-4.0-4.5	CLAY	7/06/2018	MW9	400-450	B	8.7	7.1	1.6	X
MW9-4.5-5.0	Sandy CLAY	7/06/2018	MW9	450-500	B	8.1	7	1.1	X
MW9-5.0-8.5	SAND	7/06/2018	MW9	500-850	B	6.9	5.9	1	X
MW9-9.0-9.5	SAND	7/06/2018	MW9	900-950	B	6.8	5.5	1.3	X
MW9-9.5-10.5	SAND	7/06/2018	MW9	950-1050	B	6.8	6	0.8	X
MW9-10.5-11.0	CLAY	7/06/2018	MW9	1050-1100	B	8.7	2.2	6.5	XXXX
MW10-3.0	Sandy CLAY	7/06/2018	MW10	300	B	9.2	8.4	0.8	XXXX
MW10-3.5	Sandy CLAY	7/06/2018	MW10	350	B	8.7	7.7	1	XXXX
MW10-4.0	Sandy CLAY	7/06/2018	MW10	400	B	8.2	7.3	0.9	XXXX
MW10-4.5	Sandy CLAY	7/06/2018	MW10	450	B	8.9	7.2	1.7	XXXX
MW10-5.0	CLAY	7/06/2018	MW10	500	B	8.1	7	1.1	XXXX
MW10-7.0	LIMESTONE	7/06/2018	MW10	700	B	8.3	7.8	0.5	XXXX
MW11-3.5-4.0	SAND	7/06/2018	MW11	350-400	B	6.6	4.4	2.2	XX
MW11-4.0-4.5	Coffee SAND	7/06/2018	MW11	400-450	B	6.4	3.8	2.6	XX
MW11-4.5-5.0	Coffee SAND	7/06/2018	MW11	450-500	B	6.5	3.2	3.3	XX
MW11-5.5-6.5	Coffee SAND	7/06/2018	MW11	550-650	B	6.4	2.7	3.7	XX
MW11-6.5-7.5	Coffee SAND	7/06/2018	MW11	650-750	B	6.3	1.9	4.4	XXX

Table 1 - Field pH

						pH_f	pH_{fox}	pH_f - pH_{fox}	Rate of Reaction
						pH units	pH units	pH units	
						0.1	0.1	0.1	X|XX|XXX|XXXX
Indicators of PASS (DWER 2015, Table 4)							<3	1	XXX
Indicators of AASS (DWER 2015, Table 4)						<4			
Field ID	Soil type	Sample Date	Location ID	Depth (cm)	Above or Below				
MW12-0-0.5	FILL	7/06/2018	MW12	0-50	A	8.2	6.5	1.7	XX
MW12-1.0-1.5	SAND	7/06/2018	MW12	100-150	A	8.3	6.2	2.1	X
MW12-1.5-2.0	SAND	7/06/2018	MW12	150-200	A	8.2	6	2.2	X
MW12-2.0-2.5	SAND	7/06/2018	MW12	200-250	B	8.3	5.8	2.5	X
MW12-2.5-3.0	Coffee SAND	7/06/2018	MW12	250-300	B	6.7	5.3	1.4	X
MW12-3.0-3.5	COFFEE ROCK	7/06/2018	MW12	300-350	B	5.4	4.7	0.7	X
MW12-3.5-4.0	Coffee SAND	7/06/2018	MW12	350-400	B	5.3	4.1	1.2	X
MW12-4.0-4.5	SAND	7/06/2018	MW12	400-450	B	5.1	4.4	0.7	X
MW12-4.5-5.0	SAND	7/06/2018	MW12	450-500	B	4.8	4.1	0.7	X
MW12-5.0-5.5	SAND	7/06/2018	MW12	500-550	B	4.8	4.4	0.4	X
MW12-0.5-1.0	SAND	7/06/2018	MW12	50-100	B	8	5.8	2.2	X
MW12-5.5-6.0	SAND	7/06/2018	MW12	550-600	B	5.4	4.6	0.8	X
MW12-6.0-6.5	SAND	7/06/2018	MW12	600-650	B	5.6	4.8	0.8	X
MW12-6.5-7.0	SAND	7/06/2018	MW12	650-700	B	5.5	4.5	1	X
MW12-7.0-7.5	SAND	7/06/2018	MW12	700-750	B	6.1	4	2.1	XX
MW13-3.5	Sandy CLAY	7/06/2018	MW13	350	B	7.8	7.9	-0.1	XXXX
MW13-4.0	Sandy CLAY	7/06/2018	MW13	400	B	8.3	8.6	-0.3	XXXX
MW13-4.5	Sandy CLAY	7/06/2018	MW13	450	B	7.4	7.4	0	XXXX
MW13-5.0	Sandy CLAY	7/06/2018	MW13	500	B	7.6	8.5	-0.9	XXXX
MW13-5.5	Sandy CLAY	7/06/2018	MW13	550	B	8.4	8	0.4	XXXX
MW13-6.0	SAND	7/06/2018	MW13	600	B	9.2	7.4	1.8	XXXX
MW13-6.5	SAND	7/06/2018	MW13	650	B	8.8	6.7	2.1	X
MW13-7.0	SAND	7/06/2018	MW13	700	B	8.8	8.1	0.7	X
MW13-7.5	SAND	7/06/2018	MW13	750	B	8.7	6.5	2.2	X

Table 2 - SPOCAS

Field ID	Sample Date	Location ID	Depth (cm)	Soil Texture	Above or below water table	pH_f	pH_{fox}	pH_f - pH_{fox}	Rate of Reaction	Moisture	pH_{KCl}	pH_{ox}	Titratable Actual Acidity	Titratable Peroxide Acidity	Titratable Sulphidic Acidity	Sulphidic - TAA	Sulphidic - TPA	Sulphidic - TSA	KCl Extractable Sulphur	Peroxide Extractable Sulphur	Peroxide Oxidisable Sulphur	Acidic S_{pos}	Residual Acid Soluble Sulphur	S_{ras} - Pyrite S	S_{ras} - Acidic
						pH units	pH units	pH units		%w/w	pH Units	pH Units	mol H^+/t	mol H^+/t	mol H^+/t	% PS	% PS	% PS	% S	% S	% S	mol H^+/t	% S	% PS	mol H^+/t
						0.1	0.1	0.1	X|XX|XXX|XXXX	0.1	0.1	0.1	2	2	2	0.005	0.005	0.005	0.005	0.005	0.005	4	0.005	0.005	4
ASS Action Criteria - >1000 tonnes disturbed (DWER 2015, Table 10)						4	3	1								0.03	0.03	0.03							
TP1_200	17/05/2018	TP1	200	SAND	A	6.4	2	4.4	XX	13.5	5.9	2.9	<2	19	19	<0.005	0.03	0.03	0.008	0.059	0.051	32	NR	NR	NR
TP3-50	17/05/2018	TP3	50	SAND	A	4.7	2.2	2.5	X	2.2	4.9	4.9	5	5	<2	0.008	0.008	<0.005	0.017	0.017	<0.005	<4	NR	NR	NR
TP4-150	17/05/2018	TP4	150	Silty SAND - Coffee R	A	4.5	3.3	1.2	XXX	17.8	4.4	4.3	81	190	110	0.13	0.31	0.18	0.008	0.066	0.058	36	0.066	0.05	31
TP4-200	17/05/2018	TP4	200	SAND	A	5.6	2.2	3.4	XX	8.6	5.3	3.4	3	3	<2	0.005	0.005	<0.005	0.006	0.029	0.023	14	NR	NR	NR
TP5-300	17/05/2018	TP5	300	Clayey SAND	B	6.9	1.7	5.2	XXXX	16.5	7.4	2.4	<2	97	97	<0.005	0.16	0.16	0.013	0.16	0.15	92	NR	NR	NR
TP6-300	17/05/2018	TP6	300	SAND	B	6.7	1.6	5.1	X	16.6	6.2	2.9	<2	38	38	<0.005	0.061	0.061	0.008	0.093	0.085	53	NR	NR	NR
DUP2	17/05/2018	TP6	300	SAND	B	6.7	1.4	5.3	XX	16.3	8.2	2.8	<2	62	62	<0.005	0.099	0.099	0.014	0.12	0.11	66	NR	NR	NR
TP7-200	17/05/2018	TP7	200	Clayey SAND	A	9.3	2.1	7.2	XXXX	16.1	6.3	2.6	<2	83	83	<0.005	0.13	0.13	0.01	0.15	0.14	87	NR	NR	NR
TP7-300	17/05/2018	TP7	300	Clayey SAND	B	7.8	1.6	6.2	XX	10.9	4.6	5.4	12	17	5	0.019	0.027	0.008	0.015	0.016	<0.005	<4	NR	NR	NR
TP10-250	17/05/2018	TP10	250	Clayey SAND	A	5.8	3.7	2.1	XX	11.5	4.4	4.8	22	26	4	0.035	0.042	0.006	0.019	0.024	0.005	<4	0.024	0.018	11
TP11-200	17/05/2018	TP11	200	Clayey SAND	A	5.8	3.5	2.3	XXXX	14.8	5.1	4.9	6	7	<2	0.01	0.011	<0.005	0.012	0.016	<0.005	<4	NR	NR	NR
TP12-225	17/05/2018	TP12	225	Clayey SAND	B	6.4	4.8	1.6	XX	12.1	6.7	6.9	<2	14	14	<0.005	0.022	0.022	0.01	0.011	<0.005	<4	NR	NR	NR
TP13-300	17/05/2018	TP13	300	Clayey SAND	A	8.4	6.8	1.6	XXX	2.1	4.8	3.6	<2	<2	<2	<0.005	<0.005	<0.005	0.007	0.008	<0.005	<4	NR	NR	NR
TP15-50	17/05/2018	TP15	50	SAND	A	3.9	3.5	0.4	X	18	5.3	3	5	86	81	0.008	0.14	0.13	0.009	0.11	0.1	63	NR	NR	NR
TP16-200	17/05/2018	TP16	200	Clayey SAND	B	6.9	1.9	5	XX	16	6.2	2.6	<2	65	65	<0.005	0.1	0.1	0.013	0.12	0.11	67	NR	NR	NR
TP21-250	18/05/2018	TP21	250	Clayey SAND	A	6.2	3.3	2.9	XX	8.7	5.5	5.3	<2	4	4	<0.005	0.006	0.006	0.016	0.019	<0.005	<4	NR	NR	NR
TP23-200	18/05/2018	TP23	200	Clayey SAND	A	7.7	2	5.7	XXXX	14.7	4.4	4.2	15	24	9	0.024	0.038	0.014	0.014	0.031	0.017	11	0.031	0.023	14
TP23-250	18/05/2018	TP23	250	SAND	B	7.2	2.7	4.5	XX	14.6	3.9	4.7	25	31	6	0.04	0.05	0.01	0.017	0.073	0.056	35	0.073	0.055	34
TP28-300	18/05/2018	TP28	300	CLAY	B	4.5	2	2.5	XX	14.8	6.2	2.7	<2	100	100	<0.005	0.16	0.16	0.009	0.16	0.15	94	NR	NR	NR
TP29-100	18/05/2018	TP29	100	Clayey SAND	A	4.8	3.9	0.9	X	15.1	6.1	3.3	<2	15	15	<0.005	0.024	0.024	0.01	0.04	0.03	19	NR	NR	NR

NR = Not Required (ARL)

Table 2 - SPOCAS

Field ID	Sample Date	Location ID	Depth (cm)	Soil Texture	KCl Extractable Calcium	Peroxide Extractable Calcium	Acid Reacted Calcium	Acidity - Ca	Sulphidic - Ca	KCl Extractable Magnesium	Peroxide Extractable Magnesium	Acid Reacted Magnesium	Acidity - Mg	Sulphidic - Mg	Excess Acid Neutral. Capacity	Excess ANC - Acidity	Excess ANC - Sulphidic	ANC Fineness Factor	Net Acidity excluding ANC	Net Acidity excluding ANC	Liming Rate excluding ANC	Net Acidity	Net Acidity	Liming Rate
					% Ca	% Ca	% Ca	mol H^+/t	% PS	% Mg	% Mg	% Mg	mol H^+/t	% PS	% $CaCO_3$	mole H^+/t	% PS	-	% S	mole H^+/t	kg $CaCO_3$/t	% S	mole H^+/t	kg $CaCO_3$/t
					0.005	0.005	0.005	4	0.005	0.005	0.005	0.005	4	0.005	0.02	4	0.005	0.5	0.005	5	1	0.005	5	1
ASS Action Criteria - >1000 tonnes disturbed (DWER 2015, Table 10)																						0.03	18	
TP1_200	17/05/2018	TP1	200	SAND	0.018	0.018	<0.005	<4	<0.005	0.011	0.028	0.017	14	0.022	NR	NR	NR	1.5	0.051	32	4	0.051	32	4
TP3-50	17/05/2018	TP3	50	SAND	0.006	0.007	<0.005	<4	<0.005	0.031	0.031	<0.005	<4	<0.005	NR	NR	NR	1.5	0.008	5	1	0.008	5	1
TP4-150	17/05/2018	TP4	150	Silty SAND - Coffee R	0.016	0.019	<0.005	<4	<0.005	0.049	0.049	<0.005	<4	<0.005	NR	NR	NR	1.5	0.24	150	21	0.24	150	21
TP4-200	17/05/2018	TP4	200	SAND	0.013	0.016	<0.005	<4	<0.005	0.083	0.083	<0.005	<4	<0.005	NR	NR	NR	1.5	0.028	17	2	0.028	17	2
TP5-300	17/05/2018	TP5	300	Clayey SAND	0.018	0.021	<0.005	<4	<0.005	0.1	0.1	<0.005	<4	<0.005	NR	NR	NR	1.5	0.15	92	13	0.15	92	13
TP6-300	17/05/2018	TP6	300	SAND	0.005	0.006	<0.005	<4	<0.005	0.1	0.1	<0.005	<4	<0.005	NR	NR	NR	1.5	0.085	53	7	0.085	53	7
DUP2	17/05/2018	TP6	300	SAND	0.019	0.021	<0.005	<4	<0.005	0.13	0.13	<0.005	<4	<0.005	NR	NR	NR	1.5	0.11	66	9	0.11	66	9
TP7-200	17/05/2018	TP7	200	Clayey SAND	0.028	0.028	<0.005	<4	<0.005	0.15	0.15	<0.005	<4	<0.005	NR	NR	NR	1.5	0.14	87	12	0.14	87	12
TP7-300	17/05/2018	TP7	300	Clayey SAND	<0.005	<0.005	<0.005	<4	<0.005	0.19	0.19	<0.005	<4	<0.005	NR	NR	NR	1.5	0.019	12	2	0.019	12	2
TP10-250	17/05/2018	TP10	250	Clayey SAND	<0.005	<0.005	<0.005	<4	<0.005	0.23	0.23	<0.005	<4	<0.005	NR	NR	NR	1.5	0.058	36	5	0.058	36	5
TP11-200	17/05/2018	TP11	200	Clayey SAND	0.025	0.026	<0.005	<4	<0.005	0.22	0.22	<0.005	<4	<0.005	NR	NR	NR	1.5	0.01	6	1	0.01	6	1
TP12-225	17/05/2018	TP12	225	Clayey SAND	0.021	0.022	<0.005	<4	<0.005	0.26	0.26	<0.005	<4	<0.005	0.07	14	0.022	1.5	<0.005	<5	<1	<0.005	<5	<1
TP13-300	17/05/2018	TP13	300	Clayey SAND	0.006	0.006	<0.005	<4	<0.005	0.24	0.24	<0.005	<4	<0.005	NR	NR	NR	1.5	<0.005	<5	<1	<0.005	<5	<1
TP15-50	17/05/2018	TP15	50	SAND	0.043	0.051	0.008	4	0.006	0.35	0.35	<0.005	<4	<0.005	NR	NR	NR	1.5	0.11	68	9	0.11	68	9
TP16-200	17/05/2018	TP16	200	Clayey SAND	0.007	0.009	<0.005	<4	<0.005	0.25	0.25	<0.005	<4	<0.005	NR	NR	NR	1.5	0.11	67	9	0.11	67	9
TP21-250	18/05/2018	TP21	250	Clayey SAND	0.011	0.015	<0.005	<4	<0.005	0.28	0.28	<0.005	<4	<0.005	NR	NR	NR	1.5	<0.005	<5	<1	<0.005	<5	<1
TP23-200	18/05/2018	TP23	200	Clayey SAND	0.007	0.009	<0.005	<4	<0.005	0.044	0.044	<0.005	<4	<0.005	NR	NR	NR	1.5	0.064	40	6	0.064	40	6
TP23-250	18/05/2018	TP23	250	SAND	0.075	0.081	0.006	<4	0.005	0.11	0.13	0.02	17	0.026	NR	NR	NR	1.5	0.15	94	13	0.15	94	13
TP28-300	18/05/2018	TP28	300	CLAY	0.017	0.022	0.005	<4	<0.005	0.071	0.071	<0.005	<4	<0.005	NR	NR	NR	1.5	0.15	94	13	0.15	94	13
TP29-100	18/05/2018	TP29	100	Clayey SAND	0.007	0.007	<0.005	<4	<0.005	0.024	0.024	<0.005	<4	<0.005	NR	NR	NR	1.5	0.03	19	3	0.03	19	3

NR = Not Required (ARL)

Table 3 - QAQC Results

		Field ID	TP2-100	DUP1	RPD	TP6-300	DUP2	RPD	TP9-100	DUP3	RPD	TP15-300	DUP4	RPD	TP23-150	DUP5	RPD	TP24-50	DUP6	RPD	TP29-300	DUP7	RPD	TP30-50	DUP8	RPD
		Sample Date	17/05/2018			17/05/2018			17/05/2018			17/05/2018			18/05/2018			18/05/2018			18/05/2018			18/05/2018		
		Location ID	TP2			TP6			TP9			TP15			TP23			TP24			TP29			TP30		
		Depth (mm)	100			300			100			300			150			50			300			50		
pH_f	pH units	0.1	7.8	7.8	0	6.7	6.7	0	4.7	4.8	2	9.3	9	3	6.1	6.1	0	5.9	5.9	0	8.1	8	1	6.8	6.8	0
pH_{fox}	pH units	0.1	5.8	6.4	10	1.6	1.4	13	3.9	4	3	8.6	8.5	1	4.9	4.3	13	5.6	4.6	20	6.8	6.5	5	6.4	6.4	0
pH_f - pH_{fox}	pH units	0.1	2	1.4		5.1	5.3		0.8	0.8	0	0.7	0.5		1.2	1.8		0.3	1.3		1.3	1.5		0.4	0.4	0
Rate of Reaction		X|XX|XXX|XXXX	XX	X		X	XX		X	X		XXXX	XXXX		X	XX		XX	X		XX	XX		XX	X	
Moisture	%w/w	0.1				16.6	16.3	2																		
pH_{KCl}	pH Units	0.1				6.2	8.2	28																		
pH_{ox}	pH Units	0.1				2.9	2.8	4																		
Titratable Actual Acidity	mol H^+/t	2				<2	<2																			
Titratable Peroxide Acidity	mol H^+/t	2				38	62	48																		
Titratable Sulphidic Acidity	mol H^+/t	2				38	62	48																		
Sulphidic - TAA	% PS	0.005				<0.005	<0.005																			
Sulphidic - TPA	% PS	0.005				0.061	0.099	48																		
Sulphidic - TSA	% PS	0.005				0.061	0.099	48																		
KCl Extractable Sulphur	% S	0.005				0.008	0.014	55																		
Peroxide Extractable Sulphur	% S	0.005				0.093	0.12	25																		
Peroxide Oxidisable Sulphur	% S	0.005				0.085	0.11	26																		
Acidic S_{pos}	mol H^+/t	4				53	66	22																		
Residual Acid Soluble Sulphur	% S	0.005				NR	NR																			
S_{ras} - Pyrite S	% PS	0.005				NR	NR																			
S_{ras} - Acidic	mol H^+/t	4				NR	NR																			
KCl Extractable Calcium	% Ca	0.005				0.005	0.019	117																		
Peroxide Extractable Calcium	% Ca	0.005				0.006	0.021	111																		
Acid Reacted Calcium	% Ca	0.005				<0.005	<0.005																			
Acidity - Ca	mol H^+/t	4				<4	<4																			
Sulphidic - Ca	% PS	0.005				<0.005	<0.005																			
KCl Extractable Magnesium	% Mg	0.005				0.1	0.13	26																		
Peroxide Extractable Magnesium	% Mg	0.005				0.1	0.13	26																		
Acid Reacted Magnesium	% Mg	0.005				<0.005	<0.005																			
Acidity - Mg	mol H^+/t	4				<4	<4																			
Sulphidic - Mg	% PS	0.005				<0.005	<0.005																			
Excess Acid Neutral. Capacity	% $CaCO_3$	0.02				NR	NR																			
Excess ANC - Acidity	mole H^+/t	4				NR	NR																			
Excess ANC - Sulphidic	% PS	0.005				NR	NR																			
ANC Fineness Factor	-	0.5				1.5	1.5	0																		
Net Acidity excluding ANC	% S	0.005				0.085	0.11	26																		
Net Acidity excluding ANC	mole H^+/t	5				53	66	22																		
Liming Rate excluding ANC	kg $CaCO_3$/t	1				7	9	25																		
Net Acidity	% S	0.005				0.085	0.11	26																		
Net Acidity	mole H^+/t	5				53	66	22																		
Liming Rate	kg $CaCO_3$/t	1				7	9	25																		

NR = Not Required (ARL)

Appendix 3
Laboratory results

ARL
Analytical Reference Laboratory

CHAIN OF CUSTODY

46-48 Banksia Road WELSHPOOL WA 6106
Ph: +61 8 6253 4444 www.arlwa.com.au

Client: Stockland	**Date Results Required By:**	Purchase Order No: STO17280.01
Contact: Maree Doyle 0401 841 112	(Please specify a time frame/number of working days)	ARL Quote No: Standard Strategen
Address: Strategen Level 1 50 Subiaco Square SUBIACO WA 6008	**Email Reports To:** p.bourgault@strategen.com.au m.doyle@strategen.com.au	LABORATORY USE ONLY
Phone No: 9380 3100	**Email Invoices To:**	Payment Method:
Fax No:	accounts@strategen.com.au	Invoice No.:

Project Reference: Wellard Project ASS

Comments:

ARL Job Number: 18-0749B

Condition of Samples: 8 c

Lab #	Field Sample ID	Date Sampled	Sample Type	Total Containers	pHf	Phfox
1	TP1-50	17/5/18	S	1	X	X
2	TP1-100		S	1	X	X
3	TP1-150		S	1	X	X
4	TP1-200		S	1	X	X
5	TP1-~~250~~ 225		S	1	X	X
	~~TP1-300~~		S	1	X	X
6	TP2-50	17/5/18	S	1	X	X
7	TP2-100		S	1	X	X
8	TP2-150		S	1	X	X
9	TP2-200		S	1	X	X
10	TP2-250		S	1	X	X
11	TP2-~~300~~ 300		S	1	X	X
12	TP3-50		S	1	X	X
13	TP3-100		S	1	X	X
14	TP3-150		S	1	X	X
15	TP3-200		S	1	X	X
16	TP3-250		S	1	X	X
17	TP3-~~300~~ 275		S	1	X	X
18	TP4-50		S	1	X	X
19	TP4-100		S	1	X	X
20	TP4-150		S	1	X	X
21	TP4-200		S	1	X	X
22	TP4-250		S	1	X	X
23	TP4-300		S	1	X	X
24	TP5-50		S	1	X	X
25	TP5-100		S	1	X	X
26	TP5-150		S	1	X	X
27	TP5-200		S	1	X	X
28	TP5-250		S	1	X	X
29	TP5-300		S	1	X	X
30	TP6-50		S	1	X	X
31	TP6-100		S	1	X	X
32	TP6-150		S	1	X	X
33	TP6-200		S	1	X	X
34	TP6-250		S	1	X	X
35	TP6-300		S	1	X	X

Samples Relinquished By: ..... On: ..... At: ..... Signed: .....

Samples Received By: Ryan Seaton On: 17/05/18 At: 17:30 Signed: .....

ARL
Analytical Reference Laboratory

CHAIN OF CUSTODY

46-48 Banksia Road WELSHPOOL WA 6106
Ph: +61 8 6253 4444 www.arlwa.com.au

Client: Stockland	**Date Results Required By:**	Purchase Order No: STO17280.01
Contact: Maree Doyle 0401 841 112	(Please specify a time frame/number of working days)	ARL Quote No: Standard Strategen
Address: Strategen Level 1 50 Subiaco Square SUBIACO WA 6008	**Email Reports To:** p.bourgault@strategen.com.au m.doyle@strategen.com.au	LABORATORY USE ONLY
Phone No: 9380 3100	**Email Invoices To:**	Payment Method:
Fax No:	accounts@strategen.com.au	Invoice No.:
Project Reference: Wellard Project ASS		ANALYSIS REQUIRED
Comments:		
ARL Job Number: 18-07493	Condition of Samples: 0°c	

Lab #	Field Sample ID	Date Sampled	Sample Type	Total Containers	pHf	Phfox
36	TP7-50	17/5/18	S	1	X	X
37	TP7-100		S	1	X	X
38	TP7-150		S	1	X	X
39	TP7-200		S	1	X	X
40	TP7-250		S	1	X	X
41	TP7-300		S	1	X	X
42	TP8-50		S	1	X	X
43	TP8-100		S	1	X	X
44	TP8-150		S	1	X	X
45	TP8-200		S	1	X	X
46	TP8-250		S	1	X	X
47	TP8-300		S	1	X	X
48	TP9-50		S	1	X	X
49	TP9-100		S	1	X	X
50	TP9-150		S	1	X	X
51	TP9-200		S	1	X	X
52	TP9-250		S	1	X	X
53	TP9-300		S	1	X	X
54	TP10-50		S	1	X	X
55	TP10-100		S	1	X	X
56	TP10-150		S	1	X	X
57	TP10-200		S	1	X	X
58	TP10-250		S	1	X	X
59	TP10-300		S	1	X	X
60	TP11-50		S	1	X	X
61	TP11-100		S	1	X	X
62	TP11-150		S	1	X	X
63	TP11-200		S	1	X	X
64	TP11-250		S	1	X	X
65	TP11-300		S	1	X	X
66	TP12-50		S	1	X	X
67	TP12-100		S	1	X	X
68	TP12-150		S	1	X	X
69	TP12-200		S	1	X	X
70	TP12-~~250~~ 225		S	1	X	X
	~~TP12-300~~		S	1	X	X

Samples Relinquished By: M-DSL On: 17/5/18 At: 1730 Signed: M

Samples Received By: Ryan Seah On: 17/05/18 At: 17:30 Signed:

ARL
Analytical Reference Laboratory

CHAIN OF CUSTODY

46-48 Banksia Road WELSHPOOL WA 6106
Ph: +61 8 6253 4444 www.arlwa.com.au

Client: Stockland	**Date Results Required By:**	Purchase Order No: STO17280.01
Contact: Maree Doyle 0401 841 112	(Please specify a time frame/number of working days)	ARL Quote No: Standard Strategen
Address: Strategen Level 1 50 Subiaco Square SUBIACO WA 6008	**Email Reports To:** p.bourgault@strategen.com.au m.doyle@strategen.com.au	LABORATORY USE ONLY
Phone No: 9380 3100	**Email Invoices To:**	Payment Method:
Fax No:	accounts@strategen.com.au	Invoice No.:
Project Reference: Wellard Project ASS		ANALYSIS REQUIRED
Comments:		

ARL Job Number: 18-07493 Condition of Samples: 8 C

Lab #	Field Sample ID	Date Sampled	Sample Type	Total Containers	pHf	Phfox									
71	TP13-50	17/5/18	S	1	X	X									
72	TP13-100		S	1	X	X									
73	TP13-150		S	1	X	X									
74	TP13-200		S	1	X	X									
75	TP13-250		S	1	X	X									
76	TP13-300		S	1	X	X									
77	TP14-50		S	1	X	X									
78	TP14-100		S	1	X	X									
79	TP14-150		S	1	X	X									
80	TP14-200		S	1	X	X									
81	TP14-250		S	1	X	X									
82	TP14-300		S	1	X	X									
83	TP15-50		S	1	X	X									
84	TP15-100		S	1	X	X									
85	TP15-150		S	1	X	X									
86	TP15-200		S	1	X	X									
87	TP15-250		S	1	X	X									
88	TP15-300		S	1	X	X									
89	TP16-50		S	1	X	X									
90	TP16-100		S	1	X	X									
91	TP16-150		S	1	X	X									
92	TP16-200		S	1	X	X									
93	TP16-250		S	1	X	X									
94	~~TP16-300~~ TP17-25		S	1	X	X									
95	TP17-50		S	1	X	X									
96	TP17-100		S	1	X	X									
97	TP17-150		S	1	X	X									
98	TP17-200		S	1	X	X									
	~~TP17-250~~		S	1	X	X									
	~~TP17-300~~		S	1	X	X									
	~~TP18-50~~		S	1	X	X									
99	~~TP18-100~~ DUP1	17/5/18	S	1	X	X									
100	~~TP18-150~~ DUP2		S	1	X	X									
101	~~TP18-200~~ DUP3		S	1	X	X									
102	~~TP18-250~~ DUP4		S	1	X	X									
	~~TP18-300~~ TP17-25		S	1	X	X									

Samples Relinquished By: ..... On: ..... At: ..... Signed: .....

Samples Received By: Ryan Seaton On: 17/05/18 At: 17:30 Signed: .....

103 TP6-25
104 TP7-25

ARL
Analytical Reference Laboratory

ARL GROUP

ProMicro
Science with Ethics

LABORATORY REPORT

Job Number: 18-07493
Revision: 00
Date: 22 May 2018

ADDRESS: **Strategen Environmental Consultants Pty Ltd**
Level 1, 50 Subiaco Square Road
Subiaco WA 6008

ATTENTION: Phil Bourgault

DATE RECEIVED: 18/05/2018

YOUR REFERENCE: Wellard Project ASS

PURCHASE ORDER: STO17280.01

APPROVALS:

Douglas Todd
Laboratory Manager

REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd
Samples are analysed on an as received basis unless otherwise noted.
Rates of Reaction are determined by visual observation and are based on
Acid Sulphate Soils Laboratory Methods Guidelines: Section H - Table H1.1

RATES OF REACTION
Slight Reaction = X
Moderate Reaction = XX
Vigorous Reaction = XXX
Very Vigorous Reaction = XXXX

METHOD REFERENCES:

ARL No. 208	"Field" pH measurements
23A and 23B	QASSIT et al Method Code

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493 Revision: 00 *Date:* 22 May 2018

RESULTS:

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-1** / **TP1-50** / **17/05/2018**	**18-07493-2** / **TP1-100** / **17/05/2018**	**18-07493-3** / **TP1-150** / **17/05/2018**	**18-07493-4** / **TP1-200** / **17/05/2018**	**18-07493-5** / **TP1-25** / **17/05/2018**
pH_f (23Af)	0.1	pH units	5.4	6.2	6.6	6.4	5.1
pH_{fox} (23Bf)	0.1	pH units	3.2	4.1	4.7	2.0	3.0
Rate of Reaction			X	X	X	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-6** / **TP2-50** / **17/05/2018**	**18-07493-7** / **TP2-100** / **17/05/2018**	**18-07493-8** / **TP2-150** / **17/05/2018**	**18-07493-9** / **TP2-200** / **17/05/2018**	**18-07493-10** / **TP2-250** / **17/05/2018**
pH_f (23Af)	0.1	pH units	6.4	7.8	7.5	7.7	7.6
pH_{fox} (23Bf)	0.1	pH units	4.7	5.8	6.0	5.9	6.1
Rate of Reaction			XX	XX	XX	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-11** / **TP2-300** / **17/05/2018**	**18-07493-12** / **TP3-50** / **17/05/2018**	**18-07493-13** / **TP3-100** / **17/05/2018**	**18-07493-14** / **TP3-150** / **17/05/2018**	**18-07493-15** / **TP3-200** / **17/05/2018**
pH_f (23Af)	0.1	pH units	7.2	4.7	7.3	7.3	7.4
pH_{fox} (23Bf)	0.1	pH units	5.9	2.2	5.3	5.8	5.6
Rate of Reaction			X	X	XX	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-16** / **TP3-250** / **17/05/2018**	**18-07493-17** / **TP3-25** / **17/05/2018**	**18-07493-18** / **TP4-50** / **17/05/2018**	**18-07493-19** / **TP4-100** / **17/05/2018**	**18-07493-20** / **TP4-150** / **17/05/2018**
pH_f (23Af)	0.1	pH units	7.4	4.5	4.1	4.4	4.5
pH_{fox} (23Bf)	0.1	pH units	5.7	2.6	3.6	2.5	3.3
Rate of Reaction			XX	XX	X	X	XXX

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493 Revision: 00 Date: 22 May 2018

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-21 TP4-200 17/05/2018**	**18-07493-22 TP4-250 17/05/2018**	**18-07493-23 TP4-300 17/05/2018**	**18-07493-24 TP5-50 17/05/2018**	**18-07493-25 TP5-100 17/05/2018**
pH_f (23Af)	0.1	pH units	5.6	4.9	6.0	7.5	7.4
pH_{fox} (23Bf)	0.1	pH units	2.2	3.5	2.5	6.2	8.1
Rate of Reaction			XX	X	XX	X	XXXX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-26 TP5-150 17/05/2018**	**18-07493-27 TP5-200 17/05/2018**	**18-07493-28 TP5-250 17/05/2018**	**18-07493-29 TP5-300 17/05/2018**	**18-07493-30 TP6-50 17/05/2018**
pH_f (23Af)	0.1	pH units	7.4	7.1	7.6	6.9	8.2
pH_{fox} (23Bf)	0.1	pH units	6.0	5.3	4.0	1.7	6.0
Rate of Reaction			X	XX	X	XXXX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-31 TP6-100 17/05/2018**	**18-07493-32 TP6-150 17/05/2018**	**18-07493-33 TP6-200 17/05/2018**	**18-07493-34 TP6-250 17/05/2018**	**18-07493-35 TP6-300 17/05/2018**
pH_f (23Af)	0.1	pH units	8.3	7.8	7.0	6.8	6.7
pH_{fox} (23Bf)	0.1	pH units	6.4	6.0	2.2	1.7	1.6
Rate of Reaction			XX	XX	X	XX	X

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-36 TP7-50 17/05/2018**	**18-07493-37 TP7-100 17/05/2018**	**18-07493-38 TP7-150 17/05/2018**	**18-07493-39 TP7-200 17/05/2018**	**18-07493-40 TP7-250 17/05/2018**
pH_f (23Af)	0.1	pH units	8.9	9.0	8.7	9.3	8.6
pH_{fox} (23Bf)	0.1	pH units	6.9	6.7	6.7	2.1	5.3
Rate of Reaction			X	X	X	XXXX	X

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-41 TP7-300 17/05/2018**	**18-07493-42 TP8-50 17/05/2018**	**18-07493-43 TP8-100 17/05/2018**	**18-07493-44 TP8-150 17/05/2018**	**18-07493-45 TP8-200 17/05/2018**
pH_f (23Af)	0.1	pH units	7.8	7.3	7.8	7.7	7.1
pH_{fox} (23Bf)	0.1	pH units	1.6	5.8	6.0	6.0	5.9
Rate of Reaction			XX	XX	XX	X	XX

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493 Revision: 00 Date: 22 May 2018

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-46 TP8-250 17/05/2018**	**18-07493-47 TP8-300 17/05/2018**	**18-07493-48 TP9-50 17/05/2018**	**18-07493-49 TP9-100 17/05/2018**	**18-07493-50 TP9-150 17/05/2018**
pH_f (23Af)	0.1	pH units	7.1	7.6	7.4	4.7	4.4
pH_{fox} (23Bf)	0.1	pH units	5.8	6.2	5.4	3.9	3.7
Rate of Reaction			X	XX	X	X	X

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-51 TP9-200 17/05/2018**	**18-07493-52 TP9-250 17/05/2018**	**18-07493-53 TP9-300 17/05/2018**	**18-07493-54 TP10-50 17/05/2018**	**18-07493-55 TP10-100 17/05/2018**
pH_f (23Af)	0.1	pH units	4.6	6.1	6.3	7.9	7.7
pH_{fox} (23Bf)	0.1	pH units	3.8	5.6	5.6	6.4	6.4
Rate of Reaction			X	X	X	X	X

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-56 TP10-150 17/05/2018**	**18-07493-57 TP10-200 17/05/2018**	**18-07493-58 TP10-250 17/05/2018**	**18-07493-59 TP10-300 17/05/2018**	**18-07493-60 TP11-50 17/05/2018**
pH_f (23Af)	0.1	pH units	7.0	5.3	5.8	4.9	6.4
pH_{fox} (23Bf)	0.1	pH units	6.1	4.4	3.7	4.0	5.4
Rate of Reaction			X	X	XX	XX	X

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-61 TP11-100 17/05/2018**	**18-07493-62 TP11-150 17/05/2018**	**18-07493-63 TP11-200 17/05/2018**	**18-07493-64 TP11-250 17/05/2018**	**18-07493-65 TP11-300 17/05/2018**
pH_f (23Af)	0.1	pH units	7.0	6.1	5.8	4.9	5.2
pH_{fox} (23Bf)	0.1	pH units	6.1	5.2	3.5	3.9	3.7
Rate of Reaction			X	X	XXXX	X	X

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07493-66 TP12-50 17/05/2018**	**18-07493-67 TP12-100 17/05/2018**	**18-07493-68 TP12-150 17/05/2018**	**18-07493-69 TP12-200 17/05/2018**	**18-07493-70 TP12-225 17/05/2018**
pH_f (23Af)	0.1	pH units	5.0	5.4	6.3	6.8	6.4
pH_{fox} (23Bf)	0.1	pH units	4.9	5.2	5.6	5.9	4.8
Rate of Reaction			X	X	X	X	XX

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493 Revision: 00 Date: 22 May 2018

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07493-71** **TP13-50** **17/05/2018**	**18-07493-72** **TP13-100** **17/05/2018**	**18-07493-73** **TP13-150** **17/05/2018**	**18-07493-74** **TP13-200** **17/05/2018**	**18-07493-75** **TP13-250** **17/05/2018**
pH_f (23Af)	0.1	pH units	7.8	7.5	7.1	6.5	8.0
pH_{fox} (23Bf)	0.1	pH units	6.1	6.0	6.0	5.0	7.5
Rate of Reaction			X	X	X	XX	XXX

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07493-76** **TP13-300** **17/05/2018**	**18-07493-77** **TP14-50** **17/05/2018**	**18-07493-78** **TP14-100** **17/05/2018**	**18-07493-79** **TP14-150** **17/05/2018**	**18-07493-80** **TP14-200** **17/05/2018**
pH_f (23Af)	0.1	pH units	8.4	6.0	5.8	5.2	5.6
pH_{fox} (23Bf)	0.1	pH units	6.8	5.2	4.4	4.3	4.7
Rate of Reaction			XXX	X	X	X	X

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07493-81** **TP14-250** **17/05/2018**	**18-07493-82** **TP14-300** **17/05/2018**	**18-07493-83** **TP15-50** **17/05/2018**	**18-07493-84** **TP15-100** **17/05/2018**	**18-07493-85** **TP15-150** **17/05/2018**
pH_f (23Af)	0.1	pH units	6.3	6.2	3.9	6.4	6.9
pH_{fox} (23Bf)	0.1	pH units	5.1	4.9	3.5	4.6	4.9
Rate of Reaction			X	XX	X	XX	XX

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07493-86** **TP15-200** **17/05/2018**	**18-07493-87** **TP15-250** **17/05/2018**	**18-07493-88** **TP15-300** **17/05/2018**	**18-07493-89** **TP16-50** **17/05/2018**	**18-07493-90** **TP16-100** **17/05/2018**
pH_f (23Af)	0.1	pH units	8.8	9.0	9.3	4.4	4.3
pH_{fox} (23Bf)	0.1	pH units	8.0	8.4	8.6	3.5	3.6
Rate of Reaction			XX	X	XXXX	X	X

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07493-91** **TP16-150** **17/05/2018**	**18-07493-92** **TP16-200** **17/05/2018**	**18-07493-93** **TP16-250** **17/05/2018**	**18-07493-94** **TP17-25** **17/05/2018**	**18-07493-95** **TP17-50** **17/05/2018**
pH_f (23Af)	0.1	pH units	6.2	6.9	6.7	4.9	4.5
pH_{fox} (23Bf)	0.1	pH units	5.3	1.9	5.2	4.0	3.8
Rate of Reaction			X	XX	XX	XX	X

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493 Revision: 00 Date: 22 May 2018

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07493-96** **TP17-100** **17/05/2018**	**18-07493-97** **TP17-150** **17/05/2018**	**18-07493-98** **TP17-200** **17/05/2018**	**18-07493-99** **DUP1** **17/05/2018**	**18-07493-100** **DUP2** **17/05/2018**
pH_f (23Af)	0.1	pH units	4.3	5.9	6.7	7.8	6.7
pH_{fox} (23Bf)	0.1	pH units	4.1	5.0	4.6	6.4	1.4
Rate of Reaction			X	X	XX	X	XX

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07493-101** **DUP3** **17/05/2018**	**18-07493-102** **DUP4** **17/05/2018**	**18-07493-103** **TP6-25** **17/05/2018**	**18-07493-104** **TP7-25** **17/05/2018**
pH_f (23Af)	0.1	pH units	4.8	9.0	7.7	8.7
pH_{fox} (23Bf)	0.1	pH units	4.0	8.5	6.1	6.4
Rate of Reaction			X	XXXX	X	XX

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting

* Denotes test conducted by in-house methodology

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

ARL
Analytical Reference Laboratory

ARL GROUP

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Science with Ethics

LABORATORY REPORT

Job Number: 18-07493-A
Revision: 00
Date: 6 June 2018

ADDRESS: **Strategen Environmental Consultants Pty Ltd**
Level 1, 50 Subiaco Square Road
Subiaco WA 6008

ATTENTION: Phil Bourgault

DATE RECEIVED: 18/05/2018

YOUR REFERENCE: Wellard Project ASS

PURCHASE ORDER:

APPROVALS:

Douglas Todd
Laboratory Manager

REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd
Samples are analysed on an as received basis unless otherwise noted.
SPOCAS ananlysis was conducted on a dried and ground sample.

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561

ARL No. 135	Moisture
ARL No. 201	KCL Extractable pH and TAA
ARL No. 202	Peroxide Extractable pH, TPA and ANCe
ARL No. 204	Sulphur, Calcium and Magnesium by KCl Extraction
ARL No. 203	Sulphur, Calcium and Magnesium by Peroxide Extraction
ARL No. 205	Sulphur, Calcium and Magnesium by 4M HCl Extraction
ARL No. 210	Acid Sulphate Soils Method Codes and Further Calculations

NATA
WORLD RECOGNISED
ACCREDITATION
Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493-A Revision: 00 Date: 6 June 2018

SPOCAS Suite Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07493-A-4 TP1-200 17/05/2018	18-07493-A-12 TP3-50 17/05/2018	18-07493-A-20 TP4-150 17/05/2018	18-07493-A-21 TP4-200 17/05/2018	18-07493-A-29 TP5-300 17/05/2018
Moisture	0.1	%w/w	13.5	2.2	17.8	8.6	16.5
pH_{KCl} (23A)	0.1	pH Units	5.9	4.9	4.4	5.3	7.4
pH_{ox} (23B)	0.1	pH Units	2.9	4.9	4.3	3.4	2.4
Titratable Actual Acidity (23F)	2	molH^+/t	<2	5	81	3	<2
Titratable Peroxide Acidity (23G)	2	molH^+/t	19	5	190	3	97
Titratable Sulphidic Acidity (23H)	2	molH^+/t	19	<2	110	<2	97
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulphur	<0.005	0.008	0.13	0.005	<0.005
Sulphidic - TPA (s-23G)	0.005	% Pyrite Sulphur	0.030	0.008	0.31	0.005	0.16
Sulphidic - TSA (s-23H)	0.005	% Pyrite Sulphur	0.030	<0.005	0.18	<0.005	0.16
KCl Extractable Sulphur (23Ce)	0.005	% S	0.008	0.017	0.008	0.006	0.013
Peroxide Extractable Sulphur (23De)	0.005	% S	0.059	0.017	0.066	0.029	0.16
Peroxide Oxidisable Sulphur (23Ee)	0.005	% S	0.051	<0.005	0.058	0.023	0.15
Acidic S_{pos} (a-23Ee)	4	molH^+/t	32	<4	36	14	92
Residual Acid Soluble Sulphur (23Re)	0.005	% S	NOTREQUIRED	NOTREQUIRED	0.066	NOTREQUIRED	NOTREQUIRED
S_{ras} - Pyrite S (s-23Re)	0.005	% Pyrite S	NOTREQUIRED	NOTREQUIRED	0.050	NOTREQUIRED	NOTREQUIRED
S_{ras} - Acidic (a-23Re)	4	molH^+/t	NOTREQUIRED	NOTREQUIRED	31	NOTREQUIRED	NOTREQUIRED
KCl Extractable Calcium (23Vh)	0.005	% Ca	0.018	0.006	0.016	0.013	0.018
Peroxide Extractable Calcium (23Wh)	0.005	% Ca	0.018	0.007	0.019	0.016	0.021
Acid Reacted Calcium (23Xh)	0.005	% Ca	<0.005	<0.005	<0.005	<0.005	<0.005
Acidity - Ca (a-23Xh)	4	molH^+/t	<4	<4	<4	<4	<4
Sulphidic - Ca (s-23Xh)	0.005	% Pyrite S	<0.005	<0.005	<0.005	<0.005	<0.005
KCl Extractable Magnesium (23Sm)	0.005	% Mg	0.011	0.031	0.049	0.083	0.10
Peroxide Extractable Magnesium (23Tm)	0.005	% Mg	0.028	0.031	0.049	0.083	0.10
Acid Reacted Magnesium (23Um)	0.005	% Mg	0.017	<0.005	<0.005	<0.005	<0.005
Acidity - Mg (a-23Um)	4	molH^+/t	14	<4	<4	<4	<4
Sulphidic - Mg (s-23Um)	0.005	% Pyrite S	0.022	<0.005	<0.005	<0.005	<0.005
Excess Acid Neutral. Capacity (23Q)	0.02	%$CaCO_3$	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
Excess ANC - Acidity (a-23Q)	4	moleH^+/t	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493-A Revision: 00 Date: 6 June 2018

SPOCAS Suite Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07493-A-4 TP1-200 17/05/2018	18-07493-A-12 TP3-50 17/05/2018	18-07493-A-20 TP4-150 17/05/2018	18-07493-A-21 TP4-200 17/05/2018	18-07493-A-29 TP5-300 17/05/2018
Excess ANC - Sulphidic (s-23Q)	0.005	% Pyrite S	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
ANC Fineness Factor	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity excluding ANC	0.005	% S	0.051	0.008	0.24	0.028	0.15
Net Acidity excluding ANC	5	mole H^+/t	32	5	150	17	92
Liming Rate excluding ANC	1	kg $CaCO_3$/t	4	1	21	2	13
Net Acidity	0.005	% S	0.051	0.008	0.24	0.028	0.15
Net Acidity	5	mole H^+/t	32	5	150	17	92
Liming Rate	1	kg $CaCO_3$/t	4	1	21	2	13

SPOCAS Suite Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07493-A-35 TP6-300 17/05/2018	18-07493-A-39 TP7-200 17/05/2018	18-07493-A-41 TP7-300 17/05/2018	18-07493-A-58 TP10-250 17/05/2018	18-07493-A-63 TP11-200 17/05/2018
Moisture	0.1	%w/w	16.6	16.3	16.1	10.9	11.5
pH_{KCl} (23A)	0.1	pH Units	6.2	8.2	6.3	4.6	4.4
pH_{ox} (23B)	0.1	pH Units	2.9	2.8	2.6	5.4	4.8
Titratable Actual Acidity (23F)	2	mol H^+/t	<2	<2	<2	12	22
Titratable Peroxide Acidity (23G)	2	mol H^+/t	38	62	83	17	26
Titratable Sulphidic Acidity (23H)	2	mol H^+/t	38	62	83	5	4
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulphur	<0.005	<0.005	<0.005	0.019	0.035
Sulphidic - TPA (s-23G)	0.005	% Pyrite Sulphur	0.061	0.099	0.13	0.027	0.042
Sulphidic - TSA (s-23H)	0.005	% Pyrite Sulphur	0.061	0.099	0.13	0.008	0.006
KCl Extractable Sulphur (23Ce)	0.005	% S	0.008	0.014	0.010	0.015	0.019
Peroxide Extractable Sulphur (23De)	0.005	% S	0.093	0.12	0.15	0.016	0.024
Peroxide Oxidisable Sulphur (23Ee)	0.005	% S	0.085	0.11	0.14	<0.005	0.005
Acidic S_{pos} (a-23Ee)	4	mol H^+/t	53	66	87	<4	<4
Residual Acid Soluble Sulphur (23Re)	0.005	% S	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	0.024
S_{ras} - Pyrite S (s-23Re)	0.005	% Pyrite S	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	0.018
S_{ras} - Acidic (a-23Re)	4	mol H^+/t	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	11
KCl Extractable Calcium (23Vh)	0.005	% Ca	0.005	0.019	0.028	<0.005	<0.005
Peroxide Extractable Calcium (23Wh)	0.005	% Ca	0.006	0.021	0.028	<0.005	<0.005
Acid Reacted Calcium (23Xh)	0.005	% Ca	<0.005	<0.005	<0.005	<0.005	<0.005

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493-A Revision: 00 Date: 6 June 2018

SPOCAS Suite Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07493-A-35 TP6-300 17/05/2018	18-07493-A-39 TP7-200 17/05/2018	18-07493-A-41 TP7-300 17/05/2018	18-07493-A-58 TP10-250 17/05/2018	18-07493-A-63 TP11-200 17/05/2018
Acidity - Ca (a-23Xh)	4	mol H^+/t	<4	<4	<4	<4	<4
Sulphidic - Ca (s-23Xh)	0.005	% Pyrite S	<0.005	<0.005	<0.005	<0.005	<0.005
KCl Extractable Magnesium (23Sm)	0.005	% Mg	0.10	0.13	0.15	0.19	0.23
Peroxide Extractable Magnesium (23Tm)	0.005	% Mg	0.10	0.13	0.15	0.19	0.23
Acid Reacted Magnesium (23Um)	0.005	% Mg	<0.005	<0.005	<0.005	<0.005	<0.005
Acidity - Mg (a-23Um)	4	mol H^+/t	<4	<4	<4	<4	<4
Sulphidic - Mg (s-23Um)	0.005	% Pyrite S	<0.005	<0.005	<0.005	<0.005	<0.005
Excess Acid Neutral. Capacity (23Q)	0.02	% $CaCO_3$	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
Excess ANC - Acidity (a-23Q)	4	mole H^+/t	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
Excess ANC - Sulphidic (s-23Q)	0.005	% Pyrite S	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
ANC Fineness Factor	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity excluding ANC	0.005	% S	0.085	0.11	0.14	0.019	0.058
Net Acidity excluding ANC	5	mole H^+/t	53	66	87	12	36
Liming Rate excluding ANC	1	kg $CaCO_3$/t	7	9	12	2	5
Net Acidity	0.005	% S	0.085	0.11	0.14	0.019	0.058
Net Acidity	5	mole H^+/t	53	66	87	12	36
Liming Rate	1	kg $CaCO_3$/t	7	9	12	2	5

SPOCAS Suite Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07493-A-70 TP12-225 17/05/2018	18-07493-A-76 TP13-300 17/05/2018	18-07493-A-83 TP15-50 17/05/2018	18-07493-A-92 TP16-200 17/05/2018	18-07493-A-100 DUP2 17/05/2018
Moisture	0.1	%w/w	14.8	12.1	2.1	18.0	16.0
pH_{KCl} (23A)	0.1	pH Units	5.1	6.7	4.8	5.3	6.2
pH_{ox} (23B)	0.1	pH Units	4.9	6.9	3.6	3.0	2.6
Titratable Actual Acidity (23F)	2	mol H^+/t	6	<2	<2	5	<2
Titratable Peroxide Acidity (23G)	2	mol H^+/t	7	14	<2	86	65
Titratable Sulphidic Acidity (23H)	2	mol H^+/t	<2	14	<2	81	65
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulphur	0.010	<0.005	<0.005	0.008	<0.005
Sulphidic - TPA (s-23G)	0.005	% Pyrite Sulphur	0.011	0.022	<0.005	0.14	0.10
Sulphidic - TSA (s-23H)	0.005	% Pyrite Sulphur	<0.005	0.022	<0.005	0.13	0.10
KCl Extractable Sulphur (23Ce)	0.005	% S	0.012	0.010	0.007	0.009	0.013

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07493-A Revision: 00 *Date:* 6 June 2018

SPOCAS Suite Sample No: / Sample Description: / Sample Date:	LOR	UNITS	18-07493-A-70 TP12-225 17/05/2018	18-07493-A-76 TP13-300 17/05/2018	18-07493-A-83 TP15-50 17/05/2018	18-07493-A-92 TP16-200 17/05/2018	18-07493-A-100 DUP2 17/05/2018
Peroxide Extractable Sulphur (23De)	0.005	% S	0.016	0.011	0.008	0.11	0.12
Peroxide Oxidisable Sulphur (23Ee)	0.005	% S	<0.005	<0.005	<0.005	0.10	0.11
Acidic S_{pos} (a-23Ee)	4	mol H^+/t	<4	<4	<4	63	67
Residual Acid Soluble Sulphur (23Re)	0.005	% S	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
S_{ras} - Pyrite S (s-23Re)	0.005	% Pyrite S	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
S_{ras} - Acidic (a-23Re)	4	mol H^+/t	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
KCl Extractable Calcium (23Vh)	0.005	% Ca	0.025	0.021	0.006	0.043	0.007
Peroxide Extractable Calcium (23Wh)	0.005	% Ca	0.026	0.022	0.006	0.051	0.009
Acid Reacted Calcium (23Xh)	0.005	% Ca	<0.005	<0.005	<0.005	0.008	<0.005
Acidity - Ca (a-23Xh)	4	mol H^+/t	<4	<4	<4	4	<4
Sulphidic - Ca (s-23Xh)	0.005	% Pyrite S	<0.005	<0.005	<0.005	0.006	<0.005
KCl Extractable Magnesium (23Sm)	0.005	% Mg	0.22	0.26	0.24	0.35	0.25
Peroxide Extractable Magnesium (23Tm)	0.005	% Mg	0.22	0.26	0.24	0.35	0.25
Acid Reacted Magnesium (23Um)	0.005	% Mg	<0.005	<0.005	<0.005	<0.005	<0.005
Acidity - Mg (a-23Um)	4	mol H^+/t	<4	<4	<4	<4	<4
Sulphidic - Mg (s-23Um)	0.005	% Pyrite S	<0.005	<0.005	<0.005	<0.005	<0.005
Excess Acid Neutral. Capacity (23Q)	0.02	% $CaCO_3$	NOTREQUIRED	0.07	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
Excess ANC - Acidity (a-23Q)	4	mole H^+/t	NOTREQUIRED	14	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
Excess ANC - Sulphidic (s-23Q)	0.005	% Pyrite S	NOTREQUIRED	0.022	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
ANC Fineness Factor	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity excluding ANC	0.005	% S	0.010	<0.005	<0.005	0.11	0.11
Net Acidity excluding ANC	5	mole H^+/t	6	<5	<5	68	67
Liming Rate excluding ANC	1	kg $CaCO_3$/t	1	<1	<1	9	9
Net Acidity	0.005	% S	0.010	<0.005	<0.005	0.11	0.11
Net Acidity	5	mole H^+/t	6	<5	<5	68	67
Liming Rate	1	kg $CaCO_3$/t	1	<1	<1	9	9

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting

* Denotes test not covered by NATA Accreditation

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd
ARL Job No: 18-07493-A Revision: 00 Date: 6 June 2018

Quality Control Report

Job Number: 18-07493
Date: 22/05/2018

This Quality Control Report is issued in accordance with Section 18 of the ARL Quality Management Manual. All QC parameters are contained within the relevant ARL Method as indicated by the method reference, either on this report or the Laboratory Report.

Acceptance of Holding Times, Duplicate RPD, Spike, LCS and CRM Recoveries are determined at the time of analysis by the Signatory indicated on the Laboratory Report.

DEFINITIONS

Duplicate Analysis
A sample, chosen randomly by the analyst at the time of sample preparation, analysed in duplicate.

RPD
Relative Percent Difference is the absolute difference between the sample and a duplicate analysis compared to the average of the two analytical results. Acceptance Limits can be exceeded by matrix interference or when the result is less than 5 times the LOR.

Matrix Spike
An additional portion of sample to which known amounts of the target analytes are added before sample preparation. Acceptance Limits can be exceeded by matrix interference or when the target analytes are present in the sample.

Certified Reference Material (CRM)
A commercially available certified solution/mixture of the target analyte of known concentration.

Laboratory Control Sample (LCS)
An in-house certified solution/mixture of the target analyte of known concentration.

Analytical Reference Laboratory (WA) PTY. Ltd
46-48 Banksia Road, Welshpool, Western Australia 6106 Telephone: 08 6253 4444 Facsmile 08 6253 4440
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Quality Control Report

Job Number: 18-07493

Date: 22/05/2018

ARL Environmental and Analytical Laboratory

'Field' pH in Acid Sulphate Soils

Holding Time Criteria	Date	
Analysed	21/05/2018	
Duplicate Analysis (18-07493-1)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-07493-11)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-07493-21)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-07493-31)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	1	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-07493-41)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	6	25
Duplicate Analysis (18-07493-50)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	2	25
pH_{fox} (23Bf)	0	25
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.4	0.1
pH_{fox} (23Bf)	5.5	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.0	0.1
pH_{fox} (23Bf)	5.5	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	4.8	0.1
pH_{fox} (23Bf)	5.5	0.1
Certified Reference Material	**Recovery (%)**	**Limits (%)**
pH_f (23Af)	98	95 - 105
pH_{fox} (23Bf)	98	95 - 105
pH_f (23Af)	98	95 - 105
pH_{fox} (23Bf)	98	95 - 105
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105
Duplicate Analysis (18-07493-55)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-07493-61)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-07493-71)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	3	25
pH_{fox} (23Bf)	2	25

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Quality Control Report

Job Number: 18-07493

Date: 22/05/2018

Environmental and Analytical Laboratory

Duplicate Analysis (18-07493-83)	RPD (%)	Limits (%)
pH_f (23Af)	3	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-07493-91)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	6	25
Duplicate Analysis (18-07493-99)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	2	25
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.2	0.1
pH_{fox} (23Bf)	5.5	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.3	0.1
pH_{fox} (23Bf)	5.5	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.2	0.1
pH_{fox} (23Bf)	5.5	0.1
Certified Reference Material	**Recovery (%)**	**Limits (%)**
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105

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Quality Control Report

Job Number: 18-07493-A
Date: 6/06/2018

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A commercially available certified solution/mixture of the target analyte of known concentration.

Laboratory Control Sample (LCS)
An in-house certified solution/mixture of the target analyte of known concentration.

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Quality Control Report

Job Number: 18-07493-A

Date: 6/06/2018

Environmental and Analytical Laboratory

Sulphur in TAA and TPA ASS

Holding Time Criteria	Date	
Extracted	5/06/2018	
Analysed	6/06/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	0	200
Peroxide Extractable Sulphur (23De)	37	25
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	6	200
Peroxide Extractable Sulphur (23De)	11	25
Duplicate Analysis (18-08184-1)	**RPD (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	0	200
Peroxide Extractable Sulphur (23De)	8	25
Blank Analysis	**Result (% S)**	**Limit (% S)**
KCl Extractable Sulphur (23Ce)	<0.005	0.005
Peroxide Extractable Sulphur (23De)	<0.005	0.005
Blank Analysis	**Result (% S)**	**Limit (% S)**
KCl Extractable Sulphur (23Ce)	<0.005	0.005
Peroxide Extractable Sulphur (23De)	<0.005	0.005
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	82	80 - 120
Peroxide Extractable Sulphur (23De)	96	80 - 120
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	84	80 - 120
Peroxide Extractable Sulphur (23De)	99	80 - 120

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Quality Control Report

Job Number: 18-07493-A

Date: 6/06/2018

Environmental and Analytical Laboratory

Ca and Mg in TAA and TPA ASS

Holding Time Criteria	Date	
Extracted	1/06/2018	
Analysed	6/06/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	6	200
Peroxide Extractable Calcium (23Wh)	40	200
KCl Extractable Magnesium (23Sm)	74	200
Peroxide Extractable Magnesium (23Tm)	35	50
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	0	200
Peroxide Extractable Calcium (23Wh)	14	200
KCl Extractable Magnesium (23Sm)	4	25
Peroxide Extractable Magnesium (23Tm)	4	25
Duplicate Analysis (18-08184-1)	**RPD (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	14	25
Peroxide Extractable Calcium (23Wh)	13	25
KCl Extractable Magnesium (23Sm)	44	50
Peroxide Extractable Magnesium (23Tm)	44	50
Blank Analysis	**Result (% Ca)**	**Limit (% Ca)**
KCl Extractable Calcium (23Vh)	<0.005	0.005
Peroxide Extractable Calcium (23Wh)	<0.005	0.005
KCl Extractable Magnesium (23Sm)	<0.005	0.005
Peroxide Extractable Magnesium (23Tm)	<0.005	0.005
Blank Analysis	**Result (% Ca)**	**Limit (% Ca)**
KCl Extractable Calcium (23Vh)	<0.005	0.005
Peroxide Extractable Calcium (23Wh)	<0.005	0.005
KCl Extractable Magnesium (23Sm)	<0.005	0.005
Peroxide Extractable Magnesium (23Tm)	<0.005	0.005
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	91	80 - 120
Peroxide Extractable Calcium (23Wh)	84	80 - 120
KCl Extractable Magnesium (23Sm)	67	80 - 120
Peroxide Extractable Magnesium (23Tm)	104	80 - 120
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	85	80 - 120
Peroxide Extractable Calcium (23Wh)	97	80 - 120
KCl Extractable Magnesium (23Sm)	83	80 - 120
Peroxide Extractable Magnesium (23Tm)	84	80 - 120

Analytical Reference Laboratory (WA) PTY. Ltd
46-48 Banksia Road, Welshpool, Western Australia 6106 Telephone: 08 6253 4444 Facsimile 08 6253 4440
www.arlwa.com.au ABN: 91 050 159 898

Quality Control Report

Job Number: 18-07493-A

Date: 6/06/2018

Environmental and Analytical Laboratory

pHox and TPA in Soil

Holding Time Criteria	Date	
Extracted	5/06/2018	
Analysed	6/06/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
pH_{ox} (23B)	10	25
Titratable Peroxide Acidity (23G)	51	25
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
pH_{ox} (23B)	11	25
Titratable Peroxide Acidity (23G)	67	25
Duplicate Analysis (18-08184-1)	**RPD (%)**	**Limits (%)**
pH_{ox} (23B)	0	25
Titratable Peroxide Acidity (23G)	0	25
Blank Analysis	**Result (pH Units)**	**Limit (pH Units)**
pH_{ox} (23B)	5.6	0.1
Titratable Peroxide Acidity (23G)	<2	2
Blank Analysis	**Result (pH Units)**	**Limit (pH Units)**
pH_{ox} (23B)	5.5	0.1
Titratable Peroxide Acidity (23G)	<2	2
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
pH_{ox} (23B)	91	80 - 120
Titratable Peroxide Acidity (23G)	95	80 - 120
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
pH_{ox} (23B)	90	80 - 120
Titratable Peroxide Acidity (23G)	92	80 - 120

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Quality Control Report

Job Number: 18-07493-A

Date: 6/06/2018

Environmental and Analytical Laboratory

pH KCL and TAA in Soil

Holding Time Criteria	Date	
Extracted	1/06/2018	
Analysed	5/06/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
pH_{KCl} (23A)	0	25
Titratable Actual Acidity (23F)	0	25
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
pH_{KCl} (23A)	2	25
Titratable Actual Acidity (23F)	0	25
Duplicate Analysis (18-08184-1)	**RPD (%)**	**Limits (%)**
pH_{KCl} (23A)	0	25
Titratable Actual Acidity (23F)	0	25
Blank Analysis	**Result (pH Units)**	**Limit (pH Units)**
pH_{KCl} (23A)	5.8	0.1
Titratable Actual Acidity (23F)	<2	2
Blank Analysis	**Result (pH Units)**	**Limit (pH Units)**
pH_{KCl} (23A)	6.1	0.1
Titratable Actual Acidity (23F)	<2	2
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
pH_{KCl} (23A)	98	80 - 120
Titratable Actual Acidity (23F)	81	80 - 120
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
pH_{KCl} (23A)	97	80 - 120
Titratable Actual Acidity (23F)	84	80 - 120

Moisture in ASS

Holding Time Criteria	Date	
Extracted	28/05/2018	
Analysed	29/05/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
Blank Analysis	**Result (%w/w)**	**Limit (%w/w)**
Moisture	<0.1	0.1

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ARL
Analytical Reference Laboratory

CHAIN OF CUSTODY

46-48 Banksia Road WELSHPOOL WA 6106
Ph: +61 8 6253 4444 www.arlwa.com.au

Client: Stockland	**Date Results Required By:** Standard TAT (Please specify a time frame/number of working days)	Purchase Order No: STO17280.01
Contact: Maree Doyle 0401 841 112		ARL Quote No: Standard Strategen
Address: Strategen Level 1, 50 Subiaco Square, SUBIACO WA 6008	**Email Reports To:** p.bourgault@strategen.com.au m.doyle@strategen.com.au	LABORATORY USE ONLY
Phone No: 9380 3100	**Email Invoices To:** accounts@strategen.com.au	Payment Method:
Fax No:		Invoice No.:
Project Reference: Wellard Project ASS		ANALYSIS REQUIRED
Comments:		
ARL Job Number: 18-07558	Condition of Samples: 18°c	

Lab #	Field Sample ID	Date Sampled	Sample Type	Total Containers	pHf	Phfox									
1	TP19-50	18/5/18	S	1	X	X									
2	TP19-100		S	1	X	X									
3	TP19-150		S	1	X	X									
4	TP19-~~200~~ 170		S	1	X	X									
5	TP19-250		S	1	X	X									
6	TP19-300		S	1	X	X									
7	TP20-50		S	1	X	X									
8	TP20-100		S	1	X	X									
9	TP20-150		S	1	X	X									
10	TP20-200		S	1	X	X									
11	TP20-250		S	1	X	X									
12	TP20-300		S	1	X	X									
13	TP21-50		S	1	X	X									
14	TP21-100		S	1	X	X									
15	TP21-150		S	1	X	X									
16	TP21-200		S	1	X	X									
17	TP21-250		S	1	X	X									
18	TP21-300		S	1	X	X									
19	TP24-50		S	1	X	X									
20	TP24-100		S	1	X	X									
21	TP24-150		S	1	X	X									
22	TP24-200		S	1	X	X									
23	TP24-250		S	1	X	X									
24	TP24-300		S	1	X	X									
25	TP25-50		S	1	X	X									
26	TP25-100		S	1	X	X									
27	TP25-150		S	1	X	X									
28	TP25-200		S	1	X	X									
29	TP25-250		S	1	X	X									
30	TP25-300		S	1	X	X									
31	TP26-50		S	1	X	X									
32	TP26-100		S	1	X	X									
33	TP26-150		S	1	X	X									
34	TP26-200		S	1	X	X									
35	TP26-250		S	1	X	X									
36	TP26-300		S	1	X	X									

Samples Relinquished By: M. Doyle On: 18/5/18 At: 1700 Signed:

Samples Received By: Ryan Seator On: 18/05/18 At: 17:30 Signed:

Date COC cont. (All soil samples to be analysed for pHf + pHfox.)

18/5/18	TP22-50	-72
	TP22-100	-73
	TP22-150	-74
	TP22-200	-75
	TP22-250	-76
	TP23-50	-77
	TP23-100	-78
	TP23-150	-79
	TP23-200	-80
	TP23-250	-81

ARL
Analytical Reference Laboratory

CHAIN OF CUSTODY

46-48 Banksia Road WELSHPOOL WA 6106
Ph: +61 8 6253 4444 www.arlwa.com.au

Client: Stockland	**Date Results Required By:** Standard TAT (Please specify a time frame/number of working days)	Purchase Order No: STO17280.01
Contact: Maree Doyle 0401 841 112		ARL Quote No: Standard Strategen
Address: Strategen Level 1, 50 Subiaco Square, SUBIACO WA 6008	**Email Reports To:** p.bourgault@strategen.com.au, m.doyle@strategen.com.au	LABORATORY USE ONLY
Phone No: 9380 3100	**Email Invoices To:** accounts@strategen.com.au	Payment Method:
Fax No:		Invoice No.:
Project Reference: Wellard Project ASS		ANALYSIS REQUIRED
Comments:		

ARL Job Number: 18-0758 Condition of Samples:

Lab #	Field Sample ID	Date Sampled	Sample Type	Total Containers	pHf	Phfox									
37	TP27-50		S	1	X	X									
38	TP27-100		S	1	X	X									
39	TP27-150		S	1	X	X									
40	TP27-200		S	1	X	X									
41	TP27-250		S	1	X	X									
42	TP27-300		S	1	X	X									
43	TP28-50		S	1	X	X									
44	TP28-100		S	1	X	X									
45	TP28-150		S	1	X	X									
46	TP28-200		S	1	X	X									
47	TP28-250		S	1	X	X									
48	TP28-300		S	1	X	X									
49	TP29-50		S	1	X	X									
50	TP29-100		S	1	X	X									
51	TP29-150		S	1	X	X									
52	TP29-200		S	1	X	X									
53	TP29-250		S	1	X	X									
54	TP29-300		S	1	X	X									
55	TP30-50		S	1	X	X									
56	TP30-100		S	1	X	X									
57	TP30-150		S	1	X	X									
58	TP30-200		S	1	X	X									
59	TP30-250		S	1	X	X									
60	TP30-300		S	1	X	X									
61	~~DUP1~~ TP18-50		S	1	X	✓									
62	~~DUP2~~ TP18-100		S	1	X	X									
63	~~DUP3~~ TP18-150		S	1	X	X									
64	~~DUP4~~ TP18-200		S	1	X	X									
65	DUP5		S	1	X	X									
66	DUP6		S	1	X	X									
67	DUP7		S	1	X	X									
68	DUP8		S	1	X	X									
69	~~DUP9~~ TP18-250		S	1	X	X									
70	~~DUP10~~ TP18-300		S	1	X	X									
71	TP25-25		S	1	X	X									

Samples Relinquished By: M-Dg/h On: 18/5/18 At: 1400 Signed:

Samples Received By: Ryan Heath On: 18/05/18 At: 17:30 Signed:

2 of 3

ARL
Analytical Reference Laboratory

ARL GROUP

ProMicro
Science with Ethics

LABORATORY REPORT

Job Number: 18-07558
Revision: 00
Date: 25 May 2018

ADDRESS: **Strategen Environmental Consultants Pty Ltd**
Level 1, 50 Subiaco Square Road
Subiaco WA 6008

ATTENTION: Phil Bourgault

DATE RECEIVED: 21/05/2018

YOUR REFERENCE: Wellard Project ASS

PURCHASE ORDER: STO17280.01

APPROVALS:

Leigh Bermingham
Applications Chemist

REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd
Samples are analysed on an as received basis unless otherwise noted.
Rates of Reaction are determined by visual observation and are based on
Acid Sulphate Soils Laboratory Methods Guidelines: Section H - Table H1.1

RATES OF REACTION
Slight Reaction = X
Moderate Reaction = XX
Vigorous Reaction = XXX
Very Vigorous Reaction = XXXX

METHOD REFERENCES:

ARL No. 208	"Field" pH measurements
23A and 23B	QASSIT et al Method Code

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07558 Revision: 00 *Date:* 25 May 2018

RESULTS:

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-1 TP19-50 18/05/2018**	**18-07558-2 TP19-100 18/05/2018**	**18-07558-3 TP19-150 18/05/2018**	**18-07558-4 TP19-170 18/05/2018**	**18-07558-5 TP19-250 18/05/2018**
pH_f (23Af)	0.1	pH units	4.4	6.4	6.3	6.2	6.8
pH_{fox} (23Bf)	0.1	pH units	4.2	5.2	5.4	4.8	5.3
Rate of Reaction			X	X	X	X	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-6 TP19-300 18/05/2018**	**18-07558-7 TP20-50 18/05/2018**	**18-07558-8 TP20-100 18/05/2018**	**18-07558-9 TP20-150 18/05/2018**	**18-07558-10 TP20-200 18/05/2018**
pH_f (23Af)	0.1	pH units	6.8	7.6	8.3	7.8	7.8
pH_{fox} (23Bf)	0.1	pH units	5.0	6.2	6.4	6.3	6.4
Rate of Reaction			X	X	X	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-11 TP20-250 18/05/2018**	**18-07558-12 TP20-300 18/05/2018**	**18-07558-13 TP21-50 18/05/2018**	**18-07558-14 TP21-100 18/05/2018**	**18-07558-15 TP21-150 18/05/2018**
pH_f (23Af)	0.1	pH units	8.7	9.1	5.5	8.6	8.6
pH_{fox} (23Bf)	0.1	pH units	7.1	7.0	4.5	6.3	6.3
Rate of Reaction			XX	XX	XX	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-16 TP21-200 18/05/2018**	**18-07558-17 TP21-250 18/05/2018**	**18-07558-18 TP21-300 18/05/2018**	**18-07558-19 TP24-50 18/05/2018**	**18-07558-20 TP24-100 18/05/2018**
pH_f (23Af)	0.1	pH units	8.0	6.2	5.6	5.9	7.0
pH_{fox} (23Bf)	0.1	pH units	4.8	3.3	4.1	5.6	5.4
Rate of Reaction			XX	XX	XX	XX	X

Strategen Environmental Consultants Pty Ltd

ARL Job No: *18-07558* *Revision:* *00* *Date:* 25 May 2018

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07558-21 TP24-150 18/05/2018	18-07558-22 TP24-200 18/05/2018	18-07558-23 TP24-250 18/05/2018	18-07558-24 TP24-300 18/05/2018	18-07558-25 TP25-50 18/05/2018
pH_f (23Af)	0.1	pH units	7.0	6.7	6.5	6.5	6.9
pH_{fox} (23Bf)	0.1	pH units	5.7	5.3	5.3	5.3	5.8
Rate of Reaction			X	X	X	X	XX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07558-26 TP25-100 18/05/2018	18-07558-27 TP25-150 18/05/2018	18-07558-28 TP25-200 18/05/2018	18-07558-29 TP25-250 18/05/2018	18-07558-30 TP25-300 18/05/2018
pH_f (23Af)	0.1	pH units	7.7	7.9	7.7	8.3	8.4
pH_{fox} (23Bf)	0.1	pH units	6.4	6.9	7.3	8.8	8.5
Rate of Reaction			XX	XX	XX	XXXX	XXXX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07558-31 TP26-50 18/05/2018	18-07558-32 TP26-100 18/05/2018	18-07558-33 TP26-150 18/05/2018	18-07558-34 TP26-200 18/05/2018	18-07558-35 TP26-250 18/05/2018
pH_f (23Af)	0.1	pH units	6.6	6.4	5.9	5.7	5.2
pH_{fox} (23Bf)	0.1	pH units	5.3	5.4	4.9	4.7	4.3
Rate of Reaction			XX	XX	XX	XX	XX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07558-36 TP26-300 18/05/2018	18-07558-37 TP27-50 18/05/2018	18-07558-38 TP27-100 18/05/2018	18-07558-39 TP27-150 18/05/2018	18-07558-40 TP27-200 18/05/2018
pH_f (23Af)	0.1	pH units	5.3	7.5	7.3	6.3	6.2
pH_{fox} (23Bf)	0.1	pH units	4.4	6.4	6.0	5.6	5.8
Rate of Reaction			XX	XX	XX	X	XX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07558-41 TP27-250 18/05/2018	18-07558-42 TP27-300 18/05/2018	18-07558-43 TP28-50 18/05/2018	18-07558-44 TP28-100 18/05/2018	18-07558-45 TP28-150 18/05/2018
pH_f (23Af)	0.1	pH units	5.6	5.9	4.8	5.1	4.4
pH_{fox} (23Bf)	0.1	pH units	5.0	5.3	4.0	4.4	3.7
Rate of Reaction			XX	XX	X	XX	XX

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07558 Revision: 00 Date: 25 May 2018

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-46 TP28-200 18/05/2018**	**18-07558-47 TP28-250 18/05/2018**	**18-07558-48 TP28-300 18/05/2018**	**18-07558-49 TP29-50 18/05/2018**	**18-07558-50 TP29-100 18/05/2018**
pH_f (23Af)	0.1	pH units	4.3	4.3	4.5	6.5	4.8
pH_{fox} (23Bf)	0.1	pH units	3.7	3.6	2.0	6.9	3.9
Rate of Reaction			X	XX	XX	XXXX	X

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-51 TP29-150 18/05/2018**	**18-07558-52 TP29-200 18/05/2018**	**18-07558-53 TP29-250 18/05/2018**	**18-07558-54 TP29-300 18/05/2018**	**18-07558-55 TP30-50 18/05/2018**
pH_f (23Af)	0.1	pH units	5.3	8.7	8.5	8.1	6.8
pH_{fox} (23Bf)	0.1	pH units	4.6	7.3	7.0	6.8	6.4
Rate of Reaction			X	XX	XX	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-56 TP30-100 18/05/2018**	**18-07558-57 TP30-150 18/05/2018**	**18-07558-58 TP30-200 18/05/2018**	**18-07558-59 TP30-250 18/05/2018**	**18-07558-60 TP30-300 18/05/2018**
pH_f (23Af)	0.1	pH units	7.1	7.3	7.2	8.5	7.7
pH_{fox} (23Bf)	0.1	pH units	6.3	8.1	6.6	8.9	7.2
Rate of Reaction			X	XXXX	X	XXXX	X

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-61 TP18-50 18/05/2018**	**18-07558-62 TP18-100 18/05/2018**	**18-07558-63 TP18-150 18/05/2018**	**18-07558-64 TP18-200 18/05/2018**	**18-07558-65 DUP5 18/05/2018**
pH_f (23Af)	0.1	pH units	5.6	7.0	8.1	5.7	6.1
pH_{fox} (23Bf)	0.1	pH units	4.7	5.8	6.0	4.4	4.3
Rate of Reaction			X	X	X	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-07558-66 DUP6 18/05/2018**	**18-07558-67 DUP7 18/05/2018**	**18-07558-68 DUP8 18/05/2018**	**18-07558-69 TP18-250 18/05/2018**	**18-07558-70 TP18-300 18/05/2018**
pH_f (23Af)	0.1	pH units	5.9	8.0	6.8	6.0	6.1
pH_{fox} (23Bf)	0.1	pH units	4.6	6.5	6.4	4.9	5.1
Rate of Reaction			X	XX	X	X	X

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07558 Revision: 00 *Date:* 25 May 2018

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07558-71** **TP25-25** **18/05/2018**	**18-07558-72** **TP22-50** **18/05/2018**	**18-07558-73** **TP22-100** **18/05/2018**	**18-07558-74** **TP22-150** **18/05/2018**	**18-07558-75** **TP22-200** **18/05/2018**
pH_f (23Af)	0.1	pH units	4.6	5.8	6.5	6.5	6.2
pH_{fox} (23Bf)	0.1	pH units	4.2	4.9	5.4	5.4	4.8
Rate of Reaction			X	X	X	X	X

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07558-76** **TP22-250** **18/05/2018**	**18-07558-77** **TP23-50** **18/05/2018**	**18-07558-78** **TP23-100** **18/05/2018**	**18-07558-79** **TP23-150** **18/05/2018**	**18-07558-80** **TP23-200** **18/05/2018**
pH_f (23Af)	0.1	pH units	6.4	4.6	4.8	6.1	7.7
pH_{fox} (23Bf)	0.1	pH units	4.8	4.5	4.6	4.9	2.0
Rate of Reaction			X	X	X	X	XXXX

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-07558-81** **TP23-250** **18/05/2018**
pH_f (23Af)	0.1	pH units	7.2
pH_{fox} (23Bf)	0.1	pH units	2.7
Rate of Reaction			XX

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting

* Denotes test conducted by in-house methodology

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

ARL GROUP

LABORATORY REPORT

Job Number: 18-07558-A
Revision: 00
Date: 6 June 2018

ADDRESS: **Strategen Environmental Consultants Pty Ltd**
Level 1, 50 Subiaco Square Road
Subiaco WA 6008

ATTENTION: Phil Bourgault

DATE RECEIVED: 21/05/2018

YOUR REFERENCE: Wellard Project ASS

PURCHASE ORDER:

APPROVALS:

Douglas Todd
Laboratory Manager

REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd
Samples are analysed on an as received basis unless otherwise noted.
SPOCAS analysis is conducted on a dried and ground basis.

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561

ARL No. 135	Moisture
ARL No. 201	KCL Extractable pH and TAA
ARL No. 202	Peroxide Extractable pH, TPA and ANCe
ARL No. 204	Sulphur, Calcium and Magnesium by KCl Extraction
ARL No. 203	Sulphur, Calcium and Magnesium by Peroxide Extraction
ARL No. 205	Sulphur, Calcium and Magnesium by 4M HCl Extraction
ARL No. 210	Acid Sulphate Soils Method Codes and Further Calculations

NATA
WORLD RECOGNISED ACCREDITATION
Accredited for compliance with ISO/IEC 17025 - Testing

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07558-A Revision: 00 Date: 6 June 2018

SPOCAS Suite Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07558-A-17 TP21-250 18/05/2018	18-07558-A-48 TP28-300 18/05/2018	18-07558-A-50 TP29-100 18/05/2018	18-07558-A-80 TP23-200 18/05/2018	18-07558-A-81 TP23-250 18/05/2018
Moisture	0.1	%w/w	8.7	14.7	14.6	14.8	15.1
pH_{KCl} (23A)	0.1	pH Units	5.5	4.4	3.9	6.2	6.1
pH_{ox} (23B)	0.1	pH Units	5.3	4.2	4.7	2.7	3.3
Titratable Actual Acidity (23F)	2	mol H^+/t	<2	15	25	<2	<2
Titratable Peroxide Acidity (23G)	2	mol H^+/t	4	24	31	100	15
Titratable Sulphidic Acidity (23H)	2	mol H^+/t	4	9	6	100	15
Sulphidic - TAA (s-23F)	0.005	% Pyrite Sulphur	<0.005	0.024	0.040	<0.005	<0.005
Sulphidic - TPA (s-23G)	0.005	% Pyrite Sulphur	0.006	0.038	0.050	0.16	0.024
Sulphidic - TSA (s-23H)	0.005	% Pyrite Sulphur	0.006	0.014	0.010	0.16	0.024
KCl Extractable Sulphur (23Ce)	0.005	% S	0.016	0.014	0.017	0.009	0.010
Peroxide Extractable Sulphur (23De)	0.005	% S	0.019	0.031	0.073	0.16	0.040
Peroxide Oxidisable Sulphur (23Ee)	0.005	% S	<0.005	0.017	0.056	0.15	0.030
Acidic S_{pos} (a-23Ee)	4	mol H^+/t	<4	11	35	94	19
Residual Acid Soluble Sulphur (23Re)	0.005	% S	NOTREQUIRED	0.031	0.073	NOTREQUIRED	NOTREQUIRED
S_{ras} - Pyrite S (s-23Re)	0.005	% Pyrite S	NOTREQUIRED	0.023	0.055	NOTREQUIRED	NOTREQUIRED
S_{ras} - Acidic (a-23Re)	4	mol H^+/t	NOTREQUIRED	14	34	NOTREQUIRED	NOTREQUIRED
KCl Extractable Calcium (23Vh)	0.005	% Ca	0.011	0.007	0.075	0.017	0.007
Peroxide Extractable Calcium (23Wh)	0.005	% Ca	0.015	0.009	0.081	0.022	0.007
Acid Reacted Calcium (23Xh)	0.005	% Ca	<0.005	<0.005	0.006	0.005	<0.005
Acidity - Ca (a-23Xh)	4	mol H^+/t	<4	<4	<4	<4	<4
Sulphidic - Ca (s-23Xh)	0.005	% Pyrite S	<0.005	<0.005	0.005	<0.005	<0.005
KCl Extractable Magnesium (23Sm)	0.005	% Mg	0.28	0.044	0.11	0.071	0.024
Peroxide Extractable Magnesium (23Tm)	0.005	% Mg	0.28	0.044	0.13	0.071	0.024
Acid Reacted Magnesium (23Um)	0.005	% Mg	<0.005	<0.005	0.020	<0.005	<0.005
Acidity - Mg (a-23Um)	4	mol H^+/t	<4	<4	17	<4	<4
Sulphidic - Mg (s-23Um)	0.005	% Pyrite S	<0.005	<0.005	0.026	<0.005	<0.005
Excess Acid Neutral. Capacity (23Q)	0.02	% $CaCO_3$	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
Excess ANC - Acidity (a-23Q)	4	mole H^+/t	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-07558-A Revision: 00 *Date:* 6 June 2018

SPOCAS Suite Sample No: Sample Description: Sample Date:	LOR	UNITS	18-07558-A-17 TP21-250 18/05/2018	18-07558-A-48 TP28-300 18/05/2018	18-07558-A-50 TP29-100 18/05/2018	18-07558-A-80 TP23-200 18/05/2018	18-07558-A-81 TP23-250 18/05/2018
Excess ANC - Sulphidic (s-23Q)	0.005	% Pyrite S	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED	NOTREQUIRED
ANC Fineness Factor	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity excluding ANC	0.005	% S	<0.005	0.064	0.15	0.15	0.030
Net Acidity excluding ANC	5	mole H^+/t	<5	40	94	94	19
Liming Rate excluding ANC	1	kg $CaCO_3$/t	<1	6	13	13	3
Net Acidity	0.005	% S	<0.005	0.064	0.15	0.15	0.030
Net Acidity	5	mole H^+/t	<5	40	94	94	19
Liming Rate	1	kg $CaCO_3$/t	<1	6	13	13	3

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting

* Denotes test not covered by NATA Accreditation

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

Quality Control Report

Job Number: 18-07558
Date: 25/05/2018

This Quality Control Report is issued in accordance with Section 18 of the ARL Quality Management Manual. All QC parameters are contained within the relevant ARL Method as indicated by the method reference, either on this report or the Laboratory Report.

Acceptance of Holding Times, Duplicate RPD, Spike, LCS and CRM Recoveries are determined at the time of analysis by the Signatory indicated on the Laboratory Report.

DEFINITIONS

Duplicate Analysis
A sample, chosen randomly by the analyst at the time of sample preparation, analysed in duplicate.

RPD
Relative Percent Difference is the absolute difference between the sample and a duplicate analysis compared to the average of the two analytical results. Acceptance Limits can be exceeded by matrix interference or when the result is less than 5 times the LOR.

Matrix Spike
An additional portion of sample to which known amounts of the target analytes are added before sample preparation. Acceptance Limits can be exceeded by matrix interference or when the target analytes are present in the sample.

Certified Reference Material (CRM)
A commercially available certified solution/mixture of the target analyte of known concentration.

Laboratory Control Sample (LCS)
An in-house certified solution/mixture of the target analyte of known concentration.

Analytical Reference Laboratory (WA) PTY. Ltd
46-48 Banksia Road, Welshpool, Western Australia 6106 Telephone: 08 6253 4444 Facsmile 08 6253 4440
www.arlwa.com.au ABN: 91 050 159 898

Quality Control Report

Job Number: 18-07558

Date: 25/05/2018

Environmental and Analytical Laboratory

'Field' pH in Acid Sulphate Soils

Holding Time Criteria	Date	
Analysed	23/05/2018	
Duplicate Analysis (18-07558-3)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	2	25
pH_{fox} (23Bf)	2	25
Duplicate Analysis (18-07558-13)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	2	25
pH_{fox} (23Bf)	7	25
Duplicate Analysis (18-07558-24)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	2	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-07558-34)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	2	25
pH_{fox} (23Bf)	6	25
Duplicate Analysis (18-07558-44)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	6	25
pH_{fox} (23Bf)	0	25
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.3	0.1
pH_{fox} (23Bf)	5.5	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.1	0.1
pH_{fox} (23Bf)	5.5	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.1	0.1
pH_{fox} (23Bf)	5.5	0.1
Certified Reference Material	**Recovery (%)**	**Limits (%)**
pH_f (23Af)	100	95 - 105
pH_{fox} (23Bf)	100	95 - 105
pH_f (23Af)	100	95 - 105
pH_{fox} (23Bf)	100	95 - 105
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105
Duplicate Analysis (18-07558-51)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	4	25
pH_{fox} (23Bf)	2	25
Duplicate Analysis (18-07558-61)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	6	25
Duplicate Analysis (18-07558-72)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	4	25
pH_{fox} (23Bf)	4	25
Duplicate Analysis (18-07558-81)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	3	25
pH_{fox} (23Bf)	4	25

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Quality Control Report

Job Number: 18-07558

Date: 25/05/2018

Environmental and Analytical Laboratory

Blank Analysis	Result (pH units)	Limit (pH units)
pH_f (23Af)	5.1	0.1
pH_{fox} (23Bf)	5.5	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.0	0.1
pH_{fox} (23Bf)	5.7	0.1
Certified Reference Material	**Recovery (%)**	**Limits (%)**
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105

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Quality Control Report

Job Number: 18-07558-A
Date: 6/06/2018

This Quality Control Report is issued in accordance with Section 18 of the ARL Quality Management Manual. All QC parameters are contained within the relevant ARL Method as indicated by the method reference, either on this report or the Laboratory Report.

Acceptance of Holding Times, Duplicate RPD, Spike, LCS and CRM Recoveries are determined at the time of analysis by the Signatory indicated on the Laboratory Report.

DEFINITIONS

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Quality Control Report

Job Number: 18-07558-A

Date: 6/06/2018

Environmental and Analytical Laboratory

Sulphur in TAA and TPA ASS

Holding Time Criteria	Date	
Extracted	5/06/2018	
Analysed	6/06/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	0	200
Peroxide Extractable Sulphur (23De)	37	25
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	6	200
Peroxide Extractable Sulphur (23De)	11	25
Duplicate Analysis (18-08184-1)	**RPD (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	0	200
Peroxide Extractable Sulphur (23De)	8	25
Blank Analysis	**Result (% S)**	**Limit (% S)**
KCl Extractable Sulphur (23Ce)	<0.005	0.005
Peroxide Extractable Sulphur (23De)	<0.005	0.005
Blank Analysis	**Result (% S)**	**Limit (% S)**
KCl Extractable Sulphur (23Ce)	<0.005	0.005
Peroxide Extractable Sulphur (23De)	<0.005	0.005
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	82	80 - 120
Peroxide Extractable Sulphur (23De)	96	80 - 120
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
KCl Extractable Sulphur (23Ce)	84	80 - 120
Peroxide Extractable Sulphur (23De)	99	80 - 120

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Quality Control Report

Job Number: 18-07558-A

Date: 6/06/2018

Environmental and Analytical Laboratory

Ca and Mg in TAA and TPA ASS

Holding Time Criteria	Date	
Extracted	1/06/2018	
Analysed	6/06/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	6	200
Peroxide Extractable Calcium (23Wh)	40	200
KCl Extractable Magnesium (23Sm)	74	200
Peroxide Extractable Magnesium (23Tm)	35	50
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	0	200
Peroxide Extractable Calcium (23Wh)	14	200
KCl Extractable Magnesium (23Sm)	4	25
Peroxide Extractable Magnesium (23Tm)	4	25
Duplicate Analysis (18-08184-1)	**RPD (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	14	25
Peroxide Extractable Calcium (23Wh)	13	25
KCl Extractable Magnesium (23Sm)	44	50
Peroxide Extractable Magnesium (23Tm)	44	50
Blank Analysis	**Result (% Ca)**	**Limit (% Ca)**
KCl Extractable Calcium (23Vh)	<0.005	0.005
Peroxide Extractable Calcium (23Wh)	<0.005	0.005
KCl Extractable Magnesium (23Sm)	<0.005	0.005
Peroxide Extractable Magnesium (23Tm)	<0.005	0.005
Blank Analysis	**Result (% Ca)**	**Limit (% Ca)**
KCl Extractable Calcium (23Vh)	<0.005	0.005
Peroxide Extractable Calcium (23Wh)	<0.005	0.005
KCl Extractable Magnesium (23Sm)	<0.005	0.005
Peroxide Extractable Magnesium (23Tm)	<0.005	0.005
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	91	80 - 120
Peroxide Extractable Calcium (23Wh)	84	80 - 120
KCl Extractable Magnesium (23Sm)	67	80 - 120
Peroxide Extractable Magnesium (23Tm)	104	80 - 120
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
KCl Extractable Calcium (23Vh)	85	80 - 120
Peroxide Extractable Calcium (23Wh)	97	80 - 120
KCl Extractable Magnesium (23Sm)	83	80 - 120
Peroxide Extractable Magnesium (23Tm)	84	80 - 120

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Quality Control Report

Job Number: 18-07558-A

Date: 6/06/2018

Environmental and Analytical Laboratory

pHox and TPA in Soil

Holding Time Criteria	**Date**	
Extracted	5/06/2018	
Analysed	6/06/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
pH_{ox} (23B)	10	25
Titratable Peroxide Acidity (23G)	51	25
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
pH_{ox} (23B)	11	25
Titratable Peroxide Acidity (23G)	67	25
Duplicate Analysis (18-08184-1)	**RPD (%)**	**Limits (%)**
pH_{ox} (23B)	0	25
Titratable Peroxide Acidity (23G)	0	25
Blank Analysis	**Result (pH Units)**	**Limit (pH Units)**
pH_{ox} (23B)	5.6	0.1
Titratable Peroxide Acidity (23G)	<2	2
Blank Analysis	**Result (pH Units)**	**Limit (pH Units)**
pH_{ox} (23B)	5.5	0.1
Titratable Peroxide Acidity (23G)	<2	2
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
pH_{ox} (23B)	91	80 - 120
Titratable Peroxide Acidity (23G)	95	80 - 120
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
pH_{ox} (23B)	90	80 - 120
Titratable Peroxide Acidity (23G)	92	80 - 120

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Quality Control Report

Job Number: 18-07558-A

Date: 6/06/2018

Environmental and Analytical Laboratory

pH KCL and TAA in Soil

Holding Time Criteria	Date	
Extracted	1/06/2018	
Analysed	5/06/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
pH_{KCl} (23A)	0	25
Titratable Actual Acidity (23F)	0	25
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
pH_{KCl} (23A)	2	25
Titratable Actual Acidity (23F)	0	25
Duplicate Analysis (18-08184-1)	**RPD (%)**	**Limits (%)**
pH_{KCl} (23A)	0	25
Titratable Actual Acidity (23F)	0	25
Blank Analysis	**Result (pH Units)**	**Limit (pH Units)**
pH_{KCl} (23A)	5.8	0.1
Titratable Actual Acidity (23F)	<2	2
Blank Analysis	**Result (pH Units)**	**Limit (pH Units)**
pH_{KCl} (23A)	6.1	0.1
Titratable Actual Acidity (23F)	<2	2
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
pH_{KCl} (23A)	98	80 - 120
Titratable Actual Acidity (23F)	81	80 - 120
Laboratory Control Sample	**Recovery (%)**	**Limits (%)**
pH_{KCl} (23A)	97	80 - 120
Titratable Actual Acidity (23F)	84	80 - 120

Moisture in ASS

Holding Time Criteria	Date	
Extracted	28/05/2018	
Analysed	29/05/2018	
Duplicate Analysis (18-07493-A-4)	**RPD (%)**	**Limits (%)**
Duplicate Analysis (18-07558-A-17)	**RPD (%)**	**Limits (%)**
Blank Analysis	**Result (%w/w)**	**Limit (%w/w)**
Moisture	<0.1	0.1

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CHAIN OF CUSTODY DOCUMENTATION

STO WELLARD

stategen ENVIRONMENTAL

Level 1,
50 Subiaco Square Road
Subiaco WA 6008
PO Box 243
Subiaco WA 6904
Ph: (08) 9380 3100

Client: ~~Satterley~~ Stockland

Site: ~~Upper Swan - Stage 1~~ Welland farms

Project Manager: Phil Bourgault

Project No.: ~~SPG15258.13~~

Report To: p.bourgault@strategen.com

Sampled By: Phil Bourgault

Page: 1 of 3

Date requested:

Phone: 93803100

Quote No.: Strategen Prices

Invoice To: accounts@strategen.com.au

LAB No.	SAMPLE ID. (18-08917)	DATE	SOIL/WATER (S/W)	NO. SAMPLE CONTAINERS	ANALYSIS: ~~TRH-BTEX~~	~~Aliphatic/Aromatic Split~~	~~As, Cd, Co, Cr, Cu, Hg, Ni, Pb, Se, Zn~~	~~OC/OPs~~	pH ~~f+ fox~~				Hold	COMMENTS
1	MW12 0-0.5	12/06/2018	S						X					
2	0.5-1.0								X					
3	1.0-1.5								X					
4	1.5-2.0								X					
5	2.0-2.5								X					
6	2.5-3.0								X					
7	3.0-3.5								X					
8	3.5-4.0								X					
9	4.5-5.0								X					
10	5.5-6.0								X					
11	6.0-6.5								X					
12	6.5-7.0								X					
13	7.0-7.5								X					
87	4.0-4.5													-6?

Strategen Environmental

RELINQUISHED BY

Name:

Signature:

Date: 12/06/2018

Time:

Laboratory

RECEIVED BY

Name:

Signature:

Date: 12/06/18

Time: 17:00

CHAIN OF CUSTODY DOCUMENTATION

STO WELLARD

strategen ENVIRONMENTAL

Level 1,
50 Subiaco Square Road
Subiaco WA 6008
PO Box 243
Subiaco WA 6904
Ph: (08) 9380 3100

Client: ~~Satterley~~ Stockland
Site: ~~Upper Swan Stage 1~~ Wellard Farms
Project Manager: Phil Bourgault

Project No.: ~~SPG15258.13~~
Report To: p.bourgault@strategen.com
Sampled By: Phil Bourgault

Page: 2 of 3
Date requested:
Phone: 93803100
Quote No.: Strategen Prices
Invoice To: accounts@strategen.com.au

18-08817

LAB No.	SAMPLE ID.	DATE	SOIL/WATER (S/W)	NO. SAMPLE CONTAINERS	ANALYSIS: TRH-BTEX	Aliphatic/Aromatic Split	As, Cd, Co, Cr, Cu, Hg, Ni, Pb, Se, Zn	OC/OPs	pH, rHg				Hold	COMMENTS
14	MW11 3.5-4.0	12/06/2018							X					
15	4.0-4.5	"							X					
16	4.5-5.0	"							X					
17	5.5-6.5	"							X					
18	6.5-7.5	"							X					
		"												
19	MW9 3.5-4.0	"							X					
20	4.0-4.5	"							X					
21	4.5-5.0	"							X					
22	5.0-8.5	"							X					
23	9.0-9.5	"							X					
24	9.5-10.5													
25	10.5-11.0													

Strategen Environmental

RELINQUISHED BY	Date:	Time:
Name:	12/06/2018	
Signature:		

Laboratory

RECEIVED BY	Date:	Time:
Name: Jon Seth	12/06/18	17:00
Signature:		

CHAIN OF CUSTODY DOCUMENTATION

STO WELLARD

strategen ENVIRONMENTAL	Level 1, 50 Subiaco Square Road Subiaco WA 6008 PO Box 243 Subiaco WA 6904 Ph: (08) 9380 3100	Client: ~~Satterley~~ STOCKLAND Site: ~~Upper Swan - Stage 1~~ WELLARD FARM Project Manager: Phil Bourgault	Project No.: ~~SPG15258.13~~ Report To: p.bourgault@strategen.com Sampled By: Phil Bourgault	Page: ~~1~~ 3 of 3 Date requested: Phone: 93803100 Quote No.: Strategen Prices Invoice To: accounts@strategen.com.au

LAB No.	SAMPLE ID. (18-08817)	DATE	SOIL/WATER (S/W)	NO. SAMPLE CONTAINERS	ANALYSIS: TRH-BTEX	Aliphatic/Aromatic Split	As, Cd, Co, Cr, Cu, Hg, Ni, Pb, Se, Zn	OC/OPs	pH + pH 6x				Hold	COMMENTS
26	MW8 3.5 – 4.0	12/06/2018							X					
27	4.0 – 4.5								X					
28	4.5 – 5.0								X					
29	5.0 – 5.5								X					
30	5.5 – 6.5								X					
31	6.0 – 6.5								X					
32	6.5 – 7.0								X					
33	7.0 – 7.5								X					
34	7.5 – 8.0								X					
35	8.0 – 8.5								X					
36	8.5 – 9.0								X					

Strategen Environmental			Laboratory		
RELINQUISHED BY Name: Signature:	Date: 12/06/2018	Time:	RECEIVED BY Name Ryan Lewis Signature:	Date: 12/06/18	Time: 17:00

LABORATORY REPORT

Job Number: 18-08817
Revision: 00
Date: 20 June 2018

ADDRESS: **Strategen Environmental Consultants Pty Ltd**
Level 1, 50 Subiaco Square Road
Subiaco WA 6008

ATTENTION: Phil Bourgault

DATE RECEIVED: 13/06/2018

YOUR REFERENCE: STO Wellard

PURCHASE ORDER:

APPROVALS:

Sam Becker
Inorganics Manager

REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd
Samples are analysed on an as received basis unless otherwise noted.
Rates of Reaction are determined by visual observation and are based on
Acid Sulphate Soils Laboratory Methods Guidelines: Section H - Table H1.1

RATES OF REACTION
Slight Reaction = X
Moderate Reaction = XX
Vigorous Reaction = XXX
Very Vigorous Reaction = XXXX

METHOD REFERENCES:

ARL No. 208	"Field" pH measurements
23A and 23B	QASSIT et al Method Code

ARL Analytical Reference Laboratory

ARL Group
Proudly Western Australian

ProMicro
Science with Ethics

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd
ARL Job No: 18-08817 Revision: 00 *Date:* 20 June 2018

RESULTS:

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-08817-1** **MW12-0-0.5** **12/06/2018**	**18-08817-2** **MW12-0.5-1.0** **12/06/2018**	**18-08817-3** **MW12-1.0-1.5** **12/06/2018**	**18-08817-4** **MW12-1.5-2.0** **12/06/2018**	**18-08817-5** **MW12-2.0-2.5** **12/06/2018**
pH_f (23Af)	0.1	pH units	8.2	8.0	8.3	8.2	8.3
pH_{fox} (23Bf)	0.1	pH units	6.5	5.8	6.2	6.0	5.8
Rate of Reaction			XX	X	X	X	X

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-08817-6** **MW12-2.5-3.0** **12/06/2018**	**18-08817-7** **MW12-3.0-3.5** **12/06/2018**	**18-08817-8** **MW12-3.5-4.0** **12/06/2018**	**18-08817-9** **MW12-4.5-5.0** **12/06/2018**	**18-08817-10** **MW12-5.5-6.0** **12/06/2018**
pH_f (23Af)	0.1	pH units	6.7	5.4	5.3	5.1	5.4
pH_{fox} (23Bf)	0.1	pH units	5.3	4.7	4.1	4.4	4.6
Rate of Reaction			X	X	X	X	X

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-08817-11** **MW12-6.0-6.5** **12/06/2018**	**18-08817-12** **MW12-6.5-7.0** **12/06/2018**	**18-08817-13** **MW12-7.0-7.5** **12/06/2018**	**18-08817-14** **MW11-3.5-4.0** **12/06/2018**	**18-08817-15** **MW11-4.0-4.5** **12/06/2018**
pH_f (23Af)	0.1	pH units	5.6	5.5	6.1	6.6	6.4
pH_{fox} (23Bf)	0.1	pH units	4.8	4.5	4.0	4.4	3.8
Rate of Reaction			X	X	XX	XX	XX

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-08817-16** **MW11-4.5-5.0** **12/06/2018**	**18-08817-17** **MW11-5.5-6.5** **12/06/2018**	**18-08817-18** **MW11-6.5-7.5** **12/06/2018**	**18-08817-19** **MW9-3.5-4.0** **12/06/2018**	**18-08817-20** **MW9-4.0-4.5** **12/06/2018**
pH_f (23Af)	0.1	pH units	6.5	6.4	6.3	7.9	8.7
pH_{fox} (23Bf)	0.1	pH units	3.2	2.7	1.9	7.7	7.1
Rate of Reaction			XX	XX	XXX	X	X

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-08817 *Revision: 00* *Date:* 20 June 2018

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-08817-21 MW9-4.5-5.0 12/06/2018	18-08817-22 MW9-5.0-8.5 12/06/2018	18-08817-23 MW9-9.0-9.5 12/06/2018	18-08817-24 MW9-9.5-10.5 12/06/2018	18-08817-25 MW9-10.5-11.0 12/06/2018
pHf (23Af)	0.1	pH units	8.1	6.9	6.8	6.8	8.7
pHfox (23Bf)	0.1	pH units	7.0	5.9	5.5	6.0	2.2
Rate of Reaction			X	X	X	X	XXXX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-08817-26 MW8-3.5-4.0 12/06/2018	18-08817-27 MW8-4.0-4.5 12/06/2018	18-08817-28 MW8-4.5-5.0 12/06/2018	18-08817-29 MW8-5.0-5.5 12/06/2018	18-08817-30 MW8-5.5-6.5 12/06/2018
pHf (23Af)	0.1	pH units	7.2	7.6	7.2	7.4	7.1
pHfox (23Bf)	0.1	pH units	5.7	5.6	4.9	5.1	3.7
Rate of Reaction			X	X	XX	XX	XX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-08817-31 MW8-6.0-6.5 12/06/2018	18-08817-32 MW8-6.5-7.0 12/06/2018	18-08817-33 MW8-7.0-7.5 12/06/2018	18-08817-34 MW8-7.5-8.0 12/06/2018	18-08817-35 MW8-8.0-8.5 12/06/2018
pHf (23Af)	0.1	pH units	7.1	7.0	7.0	6.9	7.1
pHfox (23Bf)	0.1	pH units	1.7	1.5	1.7	2.1	1.6
Rate of Reaction			XX	XX	XX	XX	XX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-08817-36 MW8-8.5-9.0 12/06/2018	18-08817-37 MW12-4.0-4.5 12/06/2018	18-08817-38 MW12-5.0-5.5 12/06/2018
pHf (23Af)	0.1	pH units	6.8	4.8	4.8
pHfox (23Bf)	0.1	pH units	1.7	4.1	4.4
Rate of Reaction			XX	X	X

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting

* Denotes test conducted by in-house methodology

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: *18-08817* *Revision:* *00* *Date:* 20 June 2018

Quality Control Report

Job Number: 18-08817
Date: 20/06/2018

This Quality Control Report is issued in accordance with Section 18 of the ARL Quality Management Manual. All QC parameters are contained within the relevant ARL Method as indicated by the method reference, either on this report or the Laboratory Report.

Acceptance of Holding Times, Duplicate RPD, Spike, LCS and CRM Recoveries are determined at the time of analysis by the Signatory indicated on the Laboratory Report.

DEFINITIONS

Duplicate Analysis
A sample, chosen randomly by the analyst at the time of sample preparation, analysed in duplicate.

RPD
Relative Percent Difference is the absolute difference between the sample and a duplicate analysis compared to the average of the two analytical results. Acceptance Limits can be exceeded by matrix interference or when the result is less than 5 times the LOR.

Matrix Spike
An additional portion of sample to which known amounts of the target analytes are added before sample preparation. Acceptance Limits can be exceeded by matrix interference or when the target analytes are present in the sample.

Certified Reference Material (CRM)
A commercially available certified solution/mixture of the target analyte of known concentration.

Laboratory Control Sample (LCS)
An in-house certified solution/mixture of the target analyte of known concentration.

Analytical Reference Laboratory (WA) PTY. Ltd
46-48 Banksia Road, Welshpool, Western Australia 6106 Telephone: 08 6253 4444 Facsmile 08 6253 4440
www.arlwa.com.au ABN: 91 050 159 898

Quality Control Report

Job Number: 18-08817

Date: 20/06/2018

Environmental and Analytical Laboratory

'Field' pH in Acid Sulphate Soils

Holding Time Criteria	Date	
Analysed	20/06/2018	
Duplicate Analysis (18-08817-1)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-08817-11)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	2	25
pH_{fox} (23Bf)	2	25
Duplicate Analysis (18-08817-21)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	3	25
Duplicate Analysis (18-08817-31)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	6	25
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	4.7	0.1
pH_{fox} (23Bf)	5.0	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	4.7	0.1
pH_{fox} (23Bf)	5.0	0.1
Certified Reference Material	**Recovery (%)**	**Limits (%)**
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105

Analytical Reference Laboratory (WA) PTY. Ltd
46-48 Banksia Road, Welshpool, Western Australia 6106 Telephone: 08 6253 4444 Facsmile 08 6253 4440
www.arlwa.com.au ABN: 91 050 159 898

CHAIN OF CUSTODY DOCUMENTATION

stategen

Level 1,
50 Subiaco Square Road
Subiaco WA 6008
PO Box 243
Subiaco WA 6904
Ph: (08) 9380 3100

Client: Stockland
Site: Wellard Farm
Project Manager: Phil Bourgault

Project No.: STO18278.01
Report To: .bourgault@strategen.com.a
Sampled By: cardno

Page: 1 of 3
Date requested:
Phone: 93803100
Quote No.: Strategen Prices

Invoice To: accounts@strategen.com.au
COMMENTS

LAB No.	SAMPLE ID.	DATE	SOIL/WATER (S/W)	NO. SAMPLE CONTAINERS	ANALYSIS: pHf & pHfox								Hold
1	MW10 3.0	19.6.18			X								
2	MW10 3.5	"											
3	MW10 4.0	"											
4	MW10 4.5	"											
5	MW10 5.0												
6	MW10 7.0	"											
7	MW3 3.0												
8	MW3 3.5												
9	MW3 4.0												
10	MW3 4.5												
11	MW3 5.0												
12	MW3 5.5												
13	MW3 6.5												
14	MW3 7.0												
15	MW3 7.5												
16	MW3 8.0												
17	MW3 8.5												

Strategen Environmental

RELINQUISHED BY
Name:
Signature:
Date: 21/6/18
Time: 4:45

Laboratory

RECEIVED BY
Name: N: HJH
Signature:
Date: 21/6/18
Time: 4:45

CHAIN OF CUSTODY DOCUMENTATION

stategen

Level 1,
50 Subiaco Square Road
Subiaco WA 6008
PO Box 243
Subiaco WA 6904
Ph: (08) 9380 3100

Client: Stockland

Site: Wellard Farm

Project Manager: Phil Bourgault

Project No.: STO18278.01

Report To: .bourgault@strategen.com.a

Sampled By: cardno

Page: 1 of 3

Date requested:

Phone: 93803100

Quote No.: Strategen Prices

Invoice To: accounts@strategen.com.au

COMMENTS

18-09371

LAB No.	SAMPLE ID.	DATE	SOIL/WATER (S/W)	NO. SAMPLE CONTAINERS	ANALYSIS: pHf & pHfox								Hold
18	MW13 - 3.5	19.6.18			X								
19	" 4.0												
20	" 4.5												
21	" 5.0												
22	" 5.5												
23	" 6.0												
24	" 6.5												
25	" 7.0												
26	" 7.5												
27	MW4 3.0												
28	" 3.5												
29	" 4.0												
30	" 4.5												
31	" 5.0												
32	" 5.5												
33	" 6.0												
34	" 6.5												

Strategen Environmental

RELINQUISHED BY

Name:

Signature:

Date: 21.6.18

Time: 4:45

Laboratory

RECEIVED BY

Name N.Hill

Signature:

Date: 21/6/18

Time: 4:45

CHAIN OF CUSTODY DOCUMENTATION

strategen	Level 1, 50 Subiaco Square Road Subiaco WA 6008 PO Box 243 Subiaco WA 6904 Ph: (08) 9380 3100	**Client:** Stockland **Site:** Wellard Farm **Project Manager:** Phil Bourgault	**Project No.:** STO18278.01 **Report To:** .bourgault@strategen.com.a **Sampled By:** cardno	**Page:** 3 of 3 **Date requested:** **Phone:** 93803100 **Quote No.:** Strategen Prices

18-09371

LAB No.	SAMPLE ID.	DATE	SOIL/WATER (S/W)	NO. SAMPLE CONTAINERS	ANALYSIS: pHf & pHfox								Hold	Invoice To: accounts@strategen.com.au COMMENTS
35	MW4 7.0	19.6.18			X									
36	" 7.5													
37	" 8.0													
38	" 8.5													
39	MW7 3.5													
40	" 4.0													
41	" 4.5													
42	" 5.0													
43	" 5.5													
44	" 6.0													
45	" 6.5													
46	" 7.0													
47	" 7.5													
48	" 8.0													
49	Dup													

Strategen Environmental			Laboratory		
RELINQUISHED BY	Date:	Time:	RECEIVED BY	Date:	Time:
Name: Signature:	21.6.18	4:45	Name N Signature:	4.45 → 21/6/18	

LABORATORY REPORT

Job Number: 18-09371
Revision: 00
Date: 27 June 2018

ADDRESS: **Strategen Environmental Consultants Pty Ltd**
Level 1, 50 Subiaco Square Road
Subiaco WA 6008

ATTENTION: Phil Bourgault

DATE RECEIVED: 21/06/2018

YOUR REFERENCE: STO18278.01

PURCHASE ORDER:

APPROVALS:

Sean Sangster
Inorganics Supervisor

REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd
Samples are analysed on an as received basis unless otherwise noted.
Rates of Reaction are determined by visual observation and are based on
Acid Sulphate Soils Laboratory Methods Guidelines: Section H - Table H1.1

RATES OF REACTION
Slight Reaction = X
Moderate Reaction = XX
Vigorous Reaction = XXX
Very Vigorous Reaction = XXXX

METHOD REFERENCES:

ARL No. 208	"Field" pH measurements
23A and 23B	QASSIT et al Method Code

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd
ARL Job No: 18-09371 Revision: 00 *Date:* 27 June 2018

RESULTS:

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-09371-1 MW10-3.0 19/03/2018**	**18-09371-2 MW10-3.5 19/03/2018**	**18-09371-3 MW10-4.0 19/03/2018**	**18-09371-4 MW10-4.5 19/03/2018**	**18-09371-5 MW10-5.0 19/03/2018**
pH_f (23Af)	0.1	pH units	9.2	8.7	8.2	8.9	8.1
pH_{fox} (23Bf)	0.1	pH units	8.4	7.7	7.3	7.2	7.0
Rate of Reaction			XXXX	XXXX	XXXX	XXXX	XXXX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-09371-6 MW10-7.0 19/03/2018**	**18-09371-7 MW3-3.0 19/03/2018**	**18-09371-8 MW3-3.5 19/03/2018**	**18-09371-9 MW3-4.0 19/03/2018**	**18-09371-10 MW3-4.5 19/03/2018**
pH_f (23Af)	0.1	pH units	8.3	5.4	5.3	5.0	5.0
pH_{fox} (23Bf)	0.1	pH units	7.8	4.2	4.0	4.2	4.0
Rate of Reaction			XXXX	XX	XX	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-09371-11 MW3-5.0 19/03/2018**	**18-09371-12 MW3-5.5 19/03/2018**	**18-09371-13 MW3-6.5 19/03/2018**	**18-09371-14 MW3-7.0 19/03/2018**	**18-09371-15 MW3-7.5 19/03/2018**
pH_f (23Af)	0.1	pH units	5.0	5.4	5.2	5.2	5.4
pH_{fox} (23Bf)	0.1	pH units	3.9	2.5	3.5	3.4	4.1
Rate of Reaction			XX	X	XX	XX	XX

Acid Sulphate Soils Sample No: / **Sample Description:** / **Sample Date:**	**LOR**	**UNITS**	**18-09371-16 MW3-8.0 19/03/2018**	**18-09371-17 MW3-8..5 19/03/2018**	**18-09371-18 MW13-3.5 19/03/2018**	**18-09371-19 MW13-4.0 19/03/2018**	**18-09371-20 MW13-4.5 19/03/2018**
pH_f (23Af)	0.1	pH units	5.6	6.1	7.8	8.3	7.4
pH_{fox} (23Bf)	0.1	pH units	3.5	4.0	7.9	8.6	7.4
Rate of Reaction			XX	X	XXXX	XXXX	XXXX

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-09371 Revision: 00 Date: 27 June 2018

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-09371-21 MW13-5.0 19/03/2018	18-09371-22 MW13-5.5 19/03/2018	18-09371-23 MW13-6.0 19/03/2018	18-09371-24 MW13-6.5 19/03/2018	18-09371-25 MW13-7.0 19/03/2018
pH_f (23Af)	0.1	pH units	7.6	8.4	9.2	8.8	8.8
pH_{fox} (23Bf)	0.1	pH units	8.5	8.0	7.4	6.7	8.1
Rate of Reaction			XXXX	XXXX	XXXX	X	X

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-09371-26 MW13-7.5 19/03/2018	18-09371-27 MW4-3.0 19/03/2018	18-09371-28 MW4-3.5 19/03/2018	18-09371-29 MW4-4.0 19/03/2018	18-09371-30 MW4-4.5 19/03/2018
pH_f (23Af)	0.1	pH units	8.7	5.4	5.6	5.7	5.9
pH_{fox} (23Bf)	0.1	pH units	6.5	3.4	3.5	3.7	4.1
Rate of Reaction			X	XX	XX	XX	XX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-09371-31 MW4-5.0 19/03/2018	18-09371-32 MW4-5.5 19/03/2018	18-09371-33 MW4-6.0 19/03/2018	18-09371-34 MW4-6.5 19/03/2018	18-09371-35 MW4-7.0 19/03/2018
pH_f (23Af)	0.1	pH units	5.7	6.6	6.8	6.4	5.7
pH_{fox} (23Bf)	0.1	pH units	4.0	6.0	5.8	6.0	3.2
Rate of Reaction			XX	XX	XX	XX	X

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-09371-36 MW4-7.5 19/03/2018	18-09371-37 MW4-8.0 19/03/2018	18-09371-38 MW4-8.5 19/03/2018	18-09371-39 MW7-3.5 19/03/2018	18-09371-40 MW7-4.0 19/03/2018
pH_f (23Af)	0.1	pH units	5.9	5.4	5.7	6.6	6.8
pH_{fox} (23Bf)	0.1	pH units	3.4	3.1	2.8	5.9	5.7
Rate of Reaction			X	X	X	XX	XX

Acid Sulphate Soils Sample No: Sample Description: Sample Date:	LOR	UNITS	18-09371-41 MW7-4.5 19/03/2018	18-09371-42 MW7-5.0 19/03/2018	18-09371-43 MW7-5.5 19/03/2018	18-09371-44 MW7-6.0 19/03/2018	18-09371-45 MW7-6.5 19/03/2018
pH_f (23Af)	0.1	pH units	7.3	7.3	7.6	7.7	7.5
pH_{fox} (23Bf)	0.1	pH units	6.7	5.4	2.6	2.5	3.8
Rate of Reaction			X	X	X	X	X

LABORATORY REPORT

Strategen Environmental Consultants Pty Ltd

ARL Job No: 18-09371 *Revision: 00* *Date:* 27 June 2018

Acid Sulphate Soils **Sample No:** **Sample Description:** **Sample Date:**	**LOR**	**UNITS**	**18-09371-46** **MW7-7.0** **19/03/2018**	**18-09371-47** **MW7-7.5** **19/03/2018**	**18-09371-48** **MW7-8.0** **19/03/2018**	**18-09371-49** **Dup** **19/03/2018**
pH_f (23Af)	0.1	pH units	6.3	6.7	6.9	7.9
pH_{fox} (23Bf)	0.1	pH units	3.0	3.3	3.5	6.6
Rate of Reaction			X	X	XX	X

Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting

* Denotes test conducted by in-house methodology

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

Quality Control Report

Job Number: 18-09371
Date: 27/06/2018

This Quality Control Report is issued in accordance with Section 18 of the ARL Quality Management Manual. All QC parameters are contained within the relevant ARL Method as indicated by the method reference, either on this report or the Laboratory Report.

Acceptance of Holding Times, Duplicate RPD, Spike, LCS and CRM Recoveries are determined at the time of analysis by the Signatory indicated on the Laboratory Report.

DEFINITIONS

Duplicate Analysis
A sample, chosen randomly by the analyst at the time of sample preparation, analysed in duplicate.

RPD
Relative Percent Difference is the absolute difference between the sample and a duplicate analysis compared to the average of the two analytical results. Acceptance Limits can be exceeded by matrix interference or when the result is less than 5 times the LOR.

Matrix Spike
An additional portion of sample to which known amounts of the target analytes are added before sample preparation. Acceptance Limits can be exceeded by matrix interference or when the target analytes are present in the sample.

Certified Reference Material (CRM)
A commercially available certified solution/mixture of the target analyte of known concentration.

Laboratory Control Sample (LCS)
An in-house certified solution/mixture of the target analyte of known concentration.

Analytical Reference Laboratory (WA) PTY. Ltd
46-48 Banksia Road, Welshpool, Western Australia 6106 Telephone: 08 6253 4444 Facsmile 08 6253 4440
www.arlwa.com.au ABN: 91 050 159 898

Quality Control Report

Job Number: 18-09371

Date: 27/06/2018

ARL Environmental and Analytical Laboratory

'Field' pH in Acid Sulphate Soils

Holding Time Criteria	Date	
Analysed	26/06/2018	
Duplicate Analysis (18-09371-1)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	1	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-09371-11)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-09371-21)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	3	25
pH_{fox} (23Bf)	2	25
Duplicate Analysis (18-09371-31)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	0	25
pH_{fox} (23Bf)	0	25
Duplicate Analysis (18-09371-41)	**RPD (%)**	**Limits (%)**
pH_f (23Af)	1	25
pH_{fox} (23Bf)	0	25
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.7	0.1
pH_{fox} (23Bf)	5.5	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.6	0.1
pH_{fox} (23Bf)	5.4	0.1
Blank Analysis	**Result (pH units)**	**Limit (pH units)**
pH_f (23Af)	5.8	0.1
pH_{fox} (23Bf)	5.5	0.1
Certified Reference Material	**Recovery (%)**	**Limits (%)**
pH_f (23Af)	98	95 - 105
pH_{fox} (23Bf)	98	95 - 105
pH_f (23Af)	98	95 - 105
pH_{fox} (23Bf)	98	95 - 105
pH_f (23Af)	99	95 - 105
pH_{fox} (23Bf)	99	95 - 105

Analytical Reference Laboratory (WA) PTY. Ltd
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Appendix C Naturemap and Protected Matters Search Tool results

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 04/02/2019

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 52' 26" E,32° 17' 03" S
Buffer 5km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
2.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
3.	24262	*Acanthiza inornata (Western Thornbill)*			
4.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
5.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
6.	24281	*Accipiter cirrocephalus subsp. cirrocephalus (Collared Sparrowhawk)*			
7.	25536	*Accipiter fasciatus (Brown Goshawk)*			
8.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
9.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
10.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
11.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
12.		*Aname mainae*			
13.		*Aname tepperi*			
14.	24310	*Anas castanea (Chestnut Teal)*			
15.	24312	*Anas gracilis (Grey Teal)*			
16.	24315	*Anas rhynchotis (Australasian Shoveler)*			
17.	24316	*Anas superciliosa (Pacific Black Duck)*			
18.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
19.		*Anser anser*			
20.	24561	*Anthochaera carunculata (Red Wattlebird)*			
21.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
22.	25554	*Apus pacificus (Fork-tailed Swift, Pacific Swift)*		IA	
23.	24285	*Aquila audax (Wedge-tailed Eagle)*			
24.	24337	*Ardea garzetta subsp. nigripes (Little Egret)*			
25.	25558	*Ardea ibis (Cattle Egret)*			
26.	41324	*Ardea modesta (great egret, white egret)*			
27.	24340	*Ardea novaehollandiae (White-faced Heron)*			
28.	24341	*Ardea pacifica (White-necked Heron)*			
29.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
30.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
31.	24318	*Aythya australis (Hardhead)*			
32.		*Barnardius zonarius*			
33.	24319	*Biziura lobata (Musk Duck)*			
34.	25715	*Cacatua roseicapilla (Galah)*			
35.	25716	*Cacatua sanguinea (Little Corella)*			
36.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
37.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
38.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
39.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
40.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
41.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
42.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
43.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
44.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
45.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
46.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
47.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
48.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
49.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
50.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
51.		*Chroicocephalus novaehollandiae*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
52.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
53.	24288	*Circus approximans (Swamp Harrier)*			
54.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
55.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
56.	24399	*Columba livia (Domestic Pigeon)*	Y		
57.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
58.	25592	*Corvus coronoides (Australian Raven)*			
59.	24671	*Coturnix pectoralis (Stubble Quail)*			
60.	25595	*Cracticus tibicen (Australian Magpie)*			
61.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
62.	25596	*Cracticus torquatus (Grey Butcherbird)*			
63.	25399	*Crinia glauerti (Clicking Frog)*			
64.	25400	*Crinia insignifera (Squelching Froglet)*			
65.	30893	*Cryptoblepharus buchananii*			
66.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
67.	25027	*Ctenotus australis*			
68.	25039	*Ctenotus fallens*			
69.	24322	*Cygnus atratus (Black Swan)*			
70.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
71.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
72.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
73.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
74.	24999	*Delma grayii*			
75.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
76.		*Dingosa serrata*			
77.	25100	*Egernia napoleonis*			
78.		*Egretta garzetta*			
79.		*Egretta novaehollandiae*			
80.		*Elanus axillaris*			
81.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
82.		*Eolophus roseicapillus*			
83.	24567	*Epthianura albifrons (White-fronted Chat)*			
84.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
85.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
86.	24472	*Falco cenchroides subsp. cenchroides (Australian Kestrel, Nankeen Kestrel)*			
87.	25623	*Falco longipennis (Australian Hobby)*			
88.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
89.	25727	*Fulica atra (Eurasian Coot)*			
90.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
91.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
92.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
93.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
94.	25530	*Gerygone fusca (Western Gerygone)*			
95.	24443	*Grallina cyanoleuca (Magpie-lark)*			
96.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
97.	25541	*Haliastur indus (Brahminy Kite)*			
98.	24295	*Haliastur sphenurus (Whistling Kite)*			
99.	24296	*Hamirostra isura (Square-tailed Kite)*			
100.	25410	*Heleioporus eyrei (Moaning Frog)*			
101.	25119	*Hemiergis quadrilineata*			
102.	47965	*Hieraaetus morphnoides (Little Eagle)*			
103.	25734	*Himantopus himantopus (Black-winged Stilt)*			
104.	24491	*Hirundo neoxena (Welcome Swallow)*			
105.		*Holconia westralia*			
106.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
107.		*Isopeda leishmanni*			
108.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
109.	25131	*Lerista distinguenda*			
110.	25133	*Lerista elegans*			
111.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
112.	25005	*Lialis burtonis*			
113.	25661	*Lichmera indistincta (Brown Honeyeater)*			
114.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
115.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
116.	25388	*Litoria moorei (Motorbike Frog)*			
117.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
118.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
119.	25654	*Malurus splendens (Splendid Fairy-wren)*			
120.	24583	*Manorina flavigula (Yellow-throated Miner)*			
121.	25758	*Megalurus gramineus (Little Grassbird)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
122.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
123.	25184	*Menetia greyii*			
124.	24598	*Merops ornatus (Rainbow Bee-eater)*			
125.		*Microcarbo melanoleucos*			
126.	25693	*Microeca fascinans (Jacky Winter)*			
127.	48008	*Morus serrator (Australasian Gannet)*			
128.	24223	*Mus musculus (House Mouse)*	Y		
129.	25420	*Myobatrachus gouldii (Turtle Frog)*			
130.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	
131.	24738	*Neophema elegans (Elegant Parrot)*			
132.	48024	*Notamacropus eugenii subsp. derbianus (Tammar Wallaby, Tammar)*		P4	
133.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
134.	25252	*Notechis scutatus (Tiger Snake)*			
135.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
136.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
137.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
138.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
139.	24693	*Pachyptila desolata (Antarctic Prion)*			
140.	48591	*Pandion cristatus (Osprey, Eastern Osprey)*		IA	
141.	25253	*Parasuta gouldii*			
142.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
143.	25682	*Pardalotus striatus (Striated Pardalote)*			
144.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
145.	48060	*Petrochelidon ariel (Fairy Martin)*			
146.	48061	*Petrochelidon nigricans (Tree Martin)*			
147.	48066	*Petroica boodang (Scarlet Robin)*			
148.	25697	*Phalacrocorax carbo (Great Cormorant)*			
149.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
150.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
151.	25699	*Phalacrocorax varius (Pied Cormorant)*			
152.	24409	*Phaps chalcoptera (Common Bronzewing)*			
153.	25587	*Phaps elegans (Brush Bronzewing)*			
154.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		S	
155.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
156.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
157.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
158.	24842	*Platalea regia (Royal Spoonbill)*			
159.	25720	*Platycercus icterotis (Western Rosella)*			
160.	24747	*Platycercus spurius (Red-capped Parrot)*			
161.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
162.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
163.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
164.	25703	*Podargus strigoides (Tawny Frogmouth)*			
165.	25704	*Podiceps cristatus (Great Crested Grebe)*			
166.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
167.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
168.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
169.	25722	*Polytelis anthopeplus (Regent Parrot)*			
170.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
171.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
172.	25732	*Porzana pusilla (Baillon's Crake)*			
173.	24771	*Porzana tabuensis (Spotless Crake)*			
174.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
175.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
176.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
177.		*Purpureicephalus spurius*			
178.	24245	*Rattus rattus (Black Rat)*	Y		
179.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
180.	48096	*Rhipidura albiscapa (Grey Fantail)*			
181.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
182.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
183.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
184.	30948	*Smicrornis brevirostris (Weebill)*			
185.	25643	*Sterna hybrida (Whiskered Tern)*			
186.	24329	*Stictonetta naevosa (Freckled Duck)*			
187.	25597	*Strepera versicolor (Grey Currawong)*			
188.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
189.	30951	*Streptopelia chinensis subsp. tigrina (Spotted Turtle-Dove)*	Y		
190.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
191.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
192.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
193.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
194.	48597	*Thalasseus bergii (Crested Tern)*		IA	
195.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
196.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
197.	25207	*Tiliqua rugosa subsp. rugosa*			
198.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
199.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
200.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
201.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
202.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
203.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
204.	48147	*Turnix varius (Painted Button-quail)*			
205.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
206.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
207.	24040	*Vulpes vulpes (Red Fox)*	Y		
208.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
209.		*Zebraplatys fractivittata*			
210.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 04/02/2019

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 52' 26" E,32° 17' 03" S
Buffer 5km
Group By Family

Family	Species	Records
Amaranthaceae	1	1
Anarthriaceae	1	3
Apiaceae	6	10
Aponogetonaceae	1	4
Araceae	2	2
Araliaceae	1	4
Asparagaceae	16	42
Asphodelaceae	1	1
Asteraceae	11	25
Boryaceae	1	2
Brassicaceae	1	2
Campanulaceae	5	6
Caryophyllaceae	2	2
Casuarinaceae	1	5
Centrolepidaceae	4	6
Colchicaceae	2	2
Commelinaceae	1	1
Crassulaceae	1	2
Cyperaceae	22	36
Dasypogonaceae	1	4
Dilleniaceae	7	12
Droseraceae	9	21
Ericaceae	4	9
Euphorbiaceae	4	6
Fabaceae	26	53
Goodeniaceae	10	17
Gyrostemonaceae	1	3
Haemodoraceae	12	26
Haloragaceae	3	4
Hemerocallidaceae	10	20
Iridaceae	4	7
Juncaceae	2	3
Lamiaceae	1	3
Lauraceae	2	2
Macarthuriaceae	1	3
Malvaceae	1	1
Marsileaceae	1	1
Montiaceae	1	2
Myrtaceae	27	44
Orchidaceae	15	20
Philydraceae	1	1
Phyllanthaceae	2	4
Poaceae	34	54
Polygalaceae	2	4
Polygonaceae	2	2
Potamogetonaceae	1	1
Proteaceae	18	37
Ranunculaceae	1	1
Restionaceae	10	18
Rutaceae	6	8
Sapindaceae	1	2
Solanaceae	1	1
Stylidiaceae	12	24
Thymelaeaceae	3	3
Xanthorrhoeaceae	2	8
Zamiaceae	1	2
Zygophyllaceae	1	1
TOTAL	**320**	**588**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Amaranthaceae					
1.	2718	*Ptilotus drummondii (Narrowleaf Mulla Mulla)*			
Anarthriaceae					
2.	1097	*Lyginia barbata*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Apiaceae					
3.	6203	*Actinotus glomeratus*			
4.	6214	*Centella asiatica*			
5.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
6.	6222	*Homalosciadium homalocarpum*			
7.	6263	*Schoenolaena juncea*			
8.	6289	*Xanthosia huegelii*			
Aponogetonaceae					
9.	141	*Aponogeton hexatepalus (Stalked Water Ribbons)*		P4	
Araceae					
10.	28342	*Landoltia punctata (Thin Duckweed)*			
11.	1049	*Zantedeschia aethiopica (Arum Lily)*	Y		
Araliaceae					
12.	6280	*Trachymene pilosa (Native Parsnip)*			
Asparagaceae					
13.	1287	*Dichopogon capillipes*			
14.	1307	*Laxmannia ramosa (Branching Lily)*			
15.	1309	*Laxmannia squarrosa*			
16.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
17.	1228	*Lomandra hermaphrodita*			
18.	1232	*Lomandra micrantha (Small-flower Mat-rush)*			
19.	1234	*Lomandra nigricans*			
20.	1239	*Lomandra preissii*			
21.	1243	*Lomandra sericea (Silky Mat Rush)*			
22.	1246	*Lomandra suaveolens*			
23.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
24.	1319	*Thysanotus arenarius*			
25.	1339	*Thysanotus multiflorus (Many-flowered Fringe Lily)*			
26.	1343	*Thysanotus patersonii*			
27.	1351	*Thysanotus sparteus*			
28.	1357	*Thysanotus thyrsoideus*			
Asphodelaceae					
29.	1366	*Bulbine semibarbata (Leek Lily)*			
Asteraceae					
30.	7878	*Brachyscome iberidifolia*			
31.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
32.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
33.	8175	*Podolepis gracilis (Slender Podolepis)*			
34.	8182	*Podotheca angustifolia (Sticky Longheads)*			
35.	13255	*Pterochaeta paniculata*			
36.	8225	*Siloxerus humifusus (Procumbent Siloxerus)*			
37.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
38.	8251	*Trichocline spathulata (Native Gerbera)*			
39.	8255	*Ursinia anthemoides (Ursinia)*	Y		
40.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
Boryaceae					
41.	1272	*Borya scirpoidea*			
Brassicaceae					
42.	3016	*Heliophila pusilla*	Y		
Campanulaceae					
43.	37500	*Grammatotheca bergiana var. bergiana*	Y		
44.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
45.	7407	*Lobelia rhytidosperma (Wrinkled-seeded Lobelia)*			
46.	7408	*Lobelia tenuior (Slender Lobelia)*			
47.	37440	*Monopsis debilis var. depressa*	Y		
Caryophyllaceae					
48.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
49.	2909	*Silene gallica (French Catchfly)*	Y		
Casuarinaceae					
50.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
Centrolepidaceae					
51.	1117	*Aphelia cyperoides*			
52.	1125	*Centrolepis drummondiana*			
53.	1131	*Centrolepis inconspicua*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
54.	1132	*Centrolepis mutica*			
Colchicaceae					
55.	12770	*Burchardia congesta*			
56.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
Commelinaceae					
57.	1162	*Cartonema philydroides*			
Crassulaceae					
58.	3137	*Crassula colorata (Dense Stonecrop)*			
Cyperaceae					
59.	739	*Baumea acuta (Pale Twig-rush)*			
60.	748	*Baumea vaginalis (Sheath Twigrush)*			
61.	763	*Chorizandra enodis (Black Bristlerush)*			
62.	768	*Cyathochaeta avenacea*			
63.	16245	*Cyathochaeta teretifolia*		P3	
64.	815	*Cyperus tenellus (Tiny Flatsedge)*	Y		
65.	910	*Isolepis cernua (Nodding Club-rush)*			
66.	912	*Isolepis cyperoides*			
67.	919	*Isolepis oldfieldiana*			
68.	925	*Lepidosperma angustatum*			
69.	944	*Lepidosperma scabrum*			
70.		*Lepidosperma sp.*			
71.	955	*Mesomelaena pseudostygia*			
72.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
73.	982	*Schoenus clandestinus*			
74.	984	*Schoenus curvifolius*			
75.	986	*Schoenus efoliatus*			
76.	994	*Schoenus humilis*			
77.	1007	*Schoenus pedicellatus*			
78.	1017	*Schoenus subbulbosus*			
79.	1023	*Schoenus tenellus*			
80.	1036	*Tetraria octandra*			
Dasypogonaceae					
81.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
Dilleniaceae					
82.	5108	*Hibbertia acerosa (Needle Leaved Guinea Flower)*			
83.	5114	*Hibbertia commutata*			
84.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
85.	45534	*Hibbertia hypericoides subsp. hypericoides*			
86.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
87.	5173	*Hibbertia subvaginata*			
88.	5176	*Hibbertia vaginata*			
Droseraceae					
89.	3092	*Drosera bulbosa (Red-leaved Sundew)*			
90.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			
91.	3097	*Drosera gigantea (Giant Sundew)*			
92.	3101	*Drosera heterophylla (Swamp Rainbow)*			
93.	3106	*Drosera macrantha (Bridal Rainbow)*			
94.	3109	*Drosera menziesii (Pink Rainbow)*			
95.	13189	*Drosera oreopodion*			
96.	3124	*Drosera pulchella (Pretty Sundew)*			
97.	3131	*Drosera stolonifera (Leafy Sundew)*			
Ericaceae					
98.	6323	*Astroloma ciliatum (Candle Cranberry)*			
99.	6348	*Conostephium pendulum (Pearl Flower)*			
100.	6349	*Conostephium preissii*			
101.	6374	*Leucopogon conostephioides*			
Euphorbiaceae					
102.	4585	*Amperea ericoides*			
103.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
104.	4662	*Monotaxis grandiflora (Diamond of the Desert)*			
105.	4666	*Monotaxis occidentalis*			
Fabaceae					
106.	15466	*Acacia applanata*			
107.	3374	*Acacia huegelii*			
108.	14932	*Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)*		P1	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
109.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
110.	3602	*Acacia willdenowiana (Grass Wattle)*			
111.	3692	*Aotus procumbens*			
112.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
113.	3793	*Daviesia angulata*			
114.	3832	*Daviesia physodes*			
115.	3872	*Euchilopsis linearis (Swamp Pea)*			
116.	3880	*Eutaxia virgata*			
117.	20473	*Gastrolobium ebracteolatum*			
118.	3951	*Gompholobium marginatum*			
119.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
120.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
121.	3968	*Hovea trisperma (Common Hovea)*			
122.	12859	*Hovea trisperma var. trisperma*			
123.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
124.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
125.	20462	*Jacksonia gracillima*		P3	
126.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
127.	4044	*Kennedia prostrata (Scarlet Runner)*			
128.	4045	*Kennedia stirlingii (Bushy Kennedia)*			
129.	4181	*Pultenaea reticulata*			
130.	4292	*Trifolium campestre (Hop Clover)*	Y		
131.	4313	*Trifolium subterraneum (Subterranean Clover)*	Y		
Goodeniaceae					
132.	7420	*Dampiera alata (Winged-stem Dampiera)*			
133.	7454	*Dampiera linearis (Common Dampiera)*			
134.	7538	*Goodenia pulchella*			
135.	7568	*Lechenaultia biloba (Blue Leschenaultia)*			
136.	7572	*Lechenaultia expansa*			
137.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
138.	7603	*Scaevola canescens (Grey Scaevola)*			
139.	7619	*Scaevola lanceolata (Long-leaved Scaevola)*			
140.	7634	*Scaevola phlebopetala (Velvet Fanflower)*			
141.	7635	*Scaevola pilosa (Hairy Fan-flower)*			
Gyrostemonaceae					
142.	2788	*Gyrostemon subnudus*			
Haemodoraceae					
143.	11434	*Anigozanthos humilis subsp. humilis*			
144.	11261	*Anigozanthos manglesii subsp. manglesii*			
145.	29487	*Anigozanthos manglesii var. x angustifolius*			
146.	1416	*Anigozanthos viridis (Green Kangaroo Paw, Kurulbardang)*			
147.	1418	*Conostylis aculeata (Prickly Conostylis)*			
148.	1436	*Conostylis juncea*			
149.	1455	*Conostylis setosa (White Cottonhead)*			
150.	1468	*Haemodorum laxum*			
151.	1474	*Haemodorum sparsiflorum*			
152.	1475	*Haemodorum spicatum (Mardja)*			
153.	1478	*Phlebocarya ciliata*			
154.	1481	*Tribonanthes australis*			
Haloragaceae					
155.	6161	*Gonocarpus pithyoides*			
156.	34676	*Meionectes brownii (Swamp Raspwort)*			
157.	6192	*Myriophyllum drummondii*			
Hemerocallidaceae					
158.	1261	*Agrostocrinum scabrum (Blue Grass Lily)*			
159.	1264	*Arnocrinum preissii*			
160.	1276	*Caesia micrantha (Pale Grass Lily)*			
161.	1277	*Caesia occidentalis*			
162.	1285	*Corynotheca micrantha (Sand Lily)*			
163.	1259	*Dianella revoluta (Blueberry Lily)*			
164.	11636	*Dianella revoluta var. divaricata*			
165.	1260	*Stypandra glauca (Blind Grass)*			
166.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
167.	1363	*Tricoryne tenella*			
Iridaceae					
168.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
169.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
170.	30471	*Patersonia occidentalis var. angustifolia*			
171.	1556	*Romulea rosea (Guildford Grass)*	Y		
Juncaceae					
172.	1189	*Juncus pauciflorus (Loose Flower Rush)*			
173.	1198	*Luzula meridionalis (Field Woodrush)*			
Lamiaceae					
174.	6839	*Hemiandra pungens (Snakebush)*			
Lauraceae					
175.	2957	*Cassytha racemosa (Dodder Laurel)*			
176.	11242	*Cassytha racemosa forma pilosa*			
Macarthuriaceae					
177.	2839	*Macarthuria australis*			
Malvaceae					
178.	45082	*Lasiopetalum glutinosum subsp. latifolium*			
Marsileaceae					
179.	78	*Pilularia novae-hollandiae (Austral Pillwort)*			
Montiaceae					
180.	2854	*Calandrinia granulifera (Pygmy Purslane)*			
Myrtaceae					
181.	20350	*Astartea affinis (West-coast Astartea)*			
182.	20283	*Astartea scoparia (Common Astartea)*			
183.	5415	*Calothamnus lateralis*			
184.	5458	*Calytrix flavescens (Summer Starflower)*			
185.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
186.	13950	*Eremaea asterocarpa subsp. asterocarpa*			
187.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
188.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
189.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
190.	35070	*Hypocalymma angustifolium subsp. Swan Coastal Plain (G.J. Keighery 16777)*			
191.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
192.	5832	*Kunzea ericifolia (Spearwood, Pondil)*			
193.	15498	*Kunzea glabrescens (Spearwood)*			
194.	17461	*Kunzea micrantha subsp. micrantha*			
195.	37580	*Melaleuca acutifolia*			
196.	5926	*Melaleuca lateritia (Robin Redbreast Bush)*			
197.	5952	*Melaleuca preissiana (Moonah)*			
198.	5959	*Melaleuca rhaphiophylla (Swamp Paperbark)*			
199.	5978	*Melaleuca teretifolia (Banbar)*			
200.	5980	*Melaleuca thymoides*			
201.	5987	*Melaleuca viminea (Mohan)*			
202.	13280	*Melaleuca viminea subsp. viminea*			
203.	6006	*Pericalymma ellipticum (Swamp Teatree)*			
204.	16477	*Pericalymma ellipticum var. ellipticum*			
205.	16478	*Pericalymma ellipticum var. floridum*			
206.	6033	*Scholtzia involucrata (Spiked Scholtzia)*			
207.	20135	*Taxandria linearifolia*			
Orchidaceae					
208.	11136	*Caladenia denticulata*			
209.	1586	*Caladenia discoidea (Dancing Orchid)*			
210.	1592	*Caladenia flava (Cowslip Orchid)*			
211.	15348	*Caladenia flava subsp. flava*			
212.	12939	*Diuris magnifica*			
213.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
214.	1653	*Leporella fimbriata (Hare Orchid)*			
215.	15419	*Microtis media subsp. media*			
216.	1667	*Paracaleana nigrita (Flying Duck Orchid)*			
217.	1670	*Prasophyllum drummondii (Swamp Leek Orchid)*			
218.	10853	*Prasophyllum plumiforme*			
219.	1698	*Pterostylis vittata (Banded Greenhood)*			
220.		*Thelymitra aff. pauciflora*			
221.	11053	*Thelymitra macrophylla*			
222.	1710	*Thelymitra mucida (Plum Orchid)*			
Philydraceae					
223.	1173	*Philydrella pygmaea (Butterfly Flowers)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Phyllanthaceae					
224.	4675	*Phyllanthus calycinus (False Boronia)*			
225.	4691	*Poranthera microphylla (Small Poranthera)*			
Poaceae					
226.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
227.	13380	*Amphibromus nervosus*			
228.	200	*Amphipogon turbinatus*			
229.	17233	*Austrostipa campylachne*			
230.	17234	*Austrostipa compressa*			
231.	17257	*Austrostipa variabilis*			
232.	234	*Avena fatua (Wild Oat)*	Y		
233.	244	*Briza maxima (Blowfly Grass)*	Y		
234.	245	*Briza minor (Shivery Grass)*	Y		
235.	249	*Bromus diandrus (Great Brome)*	Y		
236.	250	*Bromus hordeaceus (Soft Brome)*	Y		
237.	283	*Cynodon dactylon (Couch)*	Y		
238.	299	*Deyeuxia quadriseta (Reed Bentgrass)*			
239.	306	*Dichelachne crinita (Longhair Plumegrass)*			
240.	11485	*Ehrharta brevifolia var. cuspidata*	Y		
241.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
242.	379	*Eragrostis elongata (Clustered Lovegrass)*			
243.	445	*Holcus setiger (Annual Fog)*	Y		
244.	20019	*Lachnagrostis filiformis*			
245.	19955	*Lachnagrostis plebeia*			
246.	485	*Microlaena stipoides (Weeping Grass)*			
247.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
248.	516	*Parapholis incurva (Coast Barbgrass)*	Y		
249.	528	*Paspalum distichum (Water Couch)*	Y		
250.	547	*Phalaris angusta*	Y		
251.	552	*Phalaris paradoxa (Paradoxa Grass)*	Y		
252.	573	*Poa drummondiana (Knotted Poa)*			
253.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
254.	583	*Polypogon tenellus*			
255.	40431	*Rytidosperma acerosum*			
256.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		
257.	724	*Vulpia myuros (Rat's Tail Fescue)*	Y		
258.	12052	*Vulpia myuros forma megalura*	Y		
259.	33101	*Vulpia myuros forma myuros*	Y		
Polygalaceae					
260.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
261.	4564	*Comesperma virgatum (Milkwort)*			
Polygonaceae					
262.	2430	*Rumex brownii (Swamp Dock)*	Y		
263.	2433	*Rumex crispus (Curled Dock)*	Y		
Potamogetonaceae					
264.	110	*Potamogeton drummondii*			
Proteaceae					
265.	1775	*Adenanthos cygnorum (Common Woollybush)*			
266.	1791	*Adenanthos obovatus (Basket Flower)*			
267.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
268.	1819	*Banksia grandis (Bull Banksia, Pulgarla)*			
269.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
270.	1834	*Banksia menziesii (Firewood Banksia)*			
271.	2066	*Grevillea pilulifera (Woolly-flowered Grevillea)*			
272.	2179	*Hakea marginata*			
273.	2197	*Hakea prostrata (Harsh Hakea)*			
274.	2216	*Hakea varia (Variable-leaved Hakea)*			
275.	2273	*Persoonia saccata (Snottygobble)*			
276.	2299	*Petrophile linearis (Pixie Mops)*			
277.	2316	*Stirlingia latifolia (Blueboy)*			
278.	2326	*Synaphea polymorpha (Albany Synaphea, Pinda)*			
279.	28354	*Synaphea sp. Serpentine (G.R. Brand 103)*		T	
280.	2329	*Synaphea spinulosa*			
281.	15532	*Synaphea spinulosa subsp. spinulosa*			
282.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
Ranunculaceae					
283.	2938	*Ranunculus trilobus (Buttercup)*	Y		

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Restionaceae					
284.	16595	*Desmocladus flexuosus*			
285.	17838	*Dielsia stenostachya*			
286.	1070	*Hypolaena exsulca*			
287.	1077	*Leptocarpus canus (Hoary Twine-rush)*			
288.	1078	*Leptocarpus coangustatus*			
289.	46375	*Leptocarpus decipiens*			
290.	19833	*Leptocarpus laxus*			
291.	1080	*Leptocarpus scariosus*			
292.	1085	*Lepyrodia glauca*			
293.	1090	*Lepyrodia muirii*			
Rutaceae					
294.	4413	*Boronia crenulata (Aniseed Boronia)*			
295.	16636	*Boronia crenulata subsp. viminea*			
296.	4417	*Boronia dichotoma*			
297.	16633	*Boronia juncea subsp. juncea*		P1	
298.	11381	*Boronia ramosa subsp. anethifolia*			
299.	18529	*Philotheca spicata (Pepper and Salt)*			
Sapindaceae					
300.	4763	*Dodonaea hackettiana (Hackett's Hopbush)*		P4	
Solanaceae					
301.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
Stylidiaceae					
302.	7676	*Levenhookia pusilla (Midget Stylewort)*			
303.	7677	*Levenhookia stipitata (Common Stylewort)*			
304.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
305.	7696	*Stylidium calcaratum (Book Triggerplant)*			
306.	7699	*Stylidium carnosum (Fleshy-leaved Triggerplant)*			
307.	7717	*Stylidium divaricatum (Daddy-long-legs)*			
308.	7756	*Stylidium longitubum (Jumping Jacks)*		P4	
309.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
310.	7785	*Stylidium repens (Matted Triggerplant)*			
311.	7790	*Stylidium roseoalatum (Pink-wing Triggerplant)*			
312.	7798	*Stylidium schoenoides (Cow Kicks)*			
313.	7806	*Stylidium utricularioides (Pink Fan Triggerplant)*			
Thymelaeaceae					
314.	11404	*Pimelea imbricata var. major*			
315.	5252	*Pimelea lanata*			
316.	5254	*Pimelea leucantha*			
Xanthorrhoeaceae					
317.	1280	*Chamaescilla corymbosa (Blue Squill)*			
318.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
Zamiaceae					
319.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
Zygophyllaceae					
320.	4383	*Tribulus terrestris (Caltrop)*	Y		

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

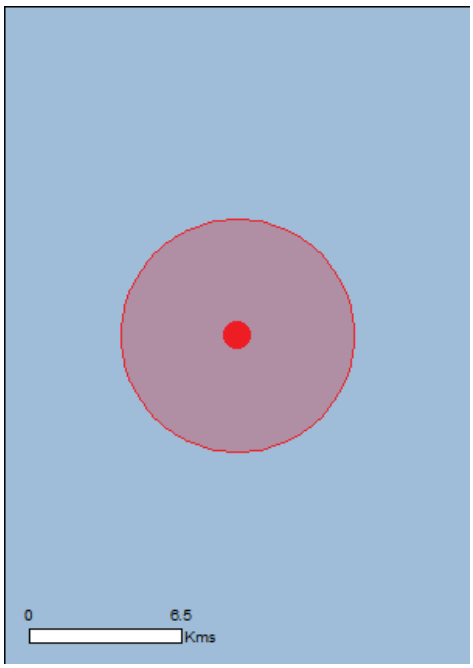
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/02/19 15:08:03



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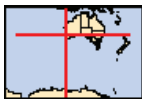

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	26
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Forrestdale and thomsons lakes	Within 10km of Ramsar
Peel-yalgorup system	20 - 30km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	Community known to occur within area
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Banksia	WA
Leda	WA
Unnamed WA51784	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.28417 115.87389

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D Flora and vegetation assessment (Strategen-JBS&G 2020a)

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Email:	rachel.ezzard@stockland.com.au	Inquiries:	Dale Newsome

Wellard Project: Broadscale vegetation mapping

1. Background

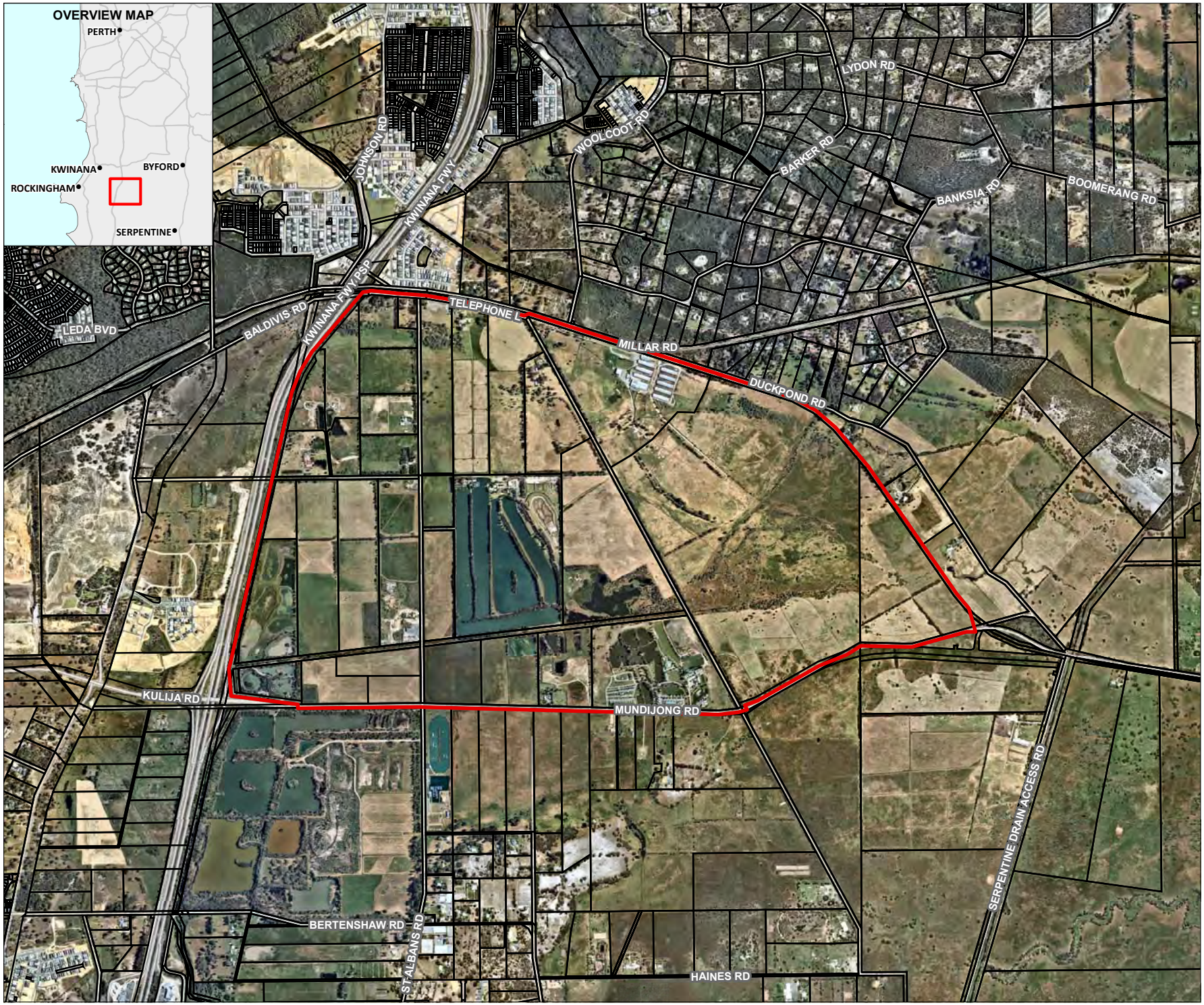
Strategen-JBS&G was engaged by Stockland to determine the environmental values of the Wellard Project proposed development (the survey area; Figure 2.1) to support consultation with stakeholders and the lodgement of a District Structure Plan and the Metropolitan Region Scheme (MRS) amendment for the proposed re-development. The survey area is currently zoned Rural under both the MRS and the City of Rockingham Local Planning Scheme (LPS) No. 2.

A broad vegetation assessment was undertaken by Strategen-JBS&G to define and map the broad scale vegetation types in the survey area. This report represents the findings of the assessment.

2. Scope

The objectives of this assessment were to:

- undertake a preliminary vegetation assessment within the survey area
- determine vegetation types and vegetation condition within the survey area
- map the broad scale vegetation in the survey area
- prepare a report summarising the findings.



Legend:

- Site boundary (782.38 ha)
- Cadastral boundary
- Roads (MRWA)

strategen JBS&G

Job No: 572265	
Client: Stockland	
Version: A	Date 16/12/2019
Drawn By: cthatcher	Checked By: WO
Scale 1:30,000	

0 0.5 1
Kilometres

Wellard Farms
Perth, WA

Survey area

FIGURE 2.1

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Stockland\57226 Stockland Wellard Farms EPBC\GIS\Maps\R001_RevA\57226_01_1_SiteLocn.mxd
Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019

3. Overview of existing environment

3.1 Geology, landforms and soils

The survey area is located in the Swan Coastal Plain 2 bioregion, composed of colluvial and aeolian sands, alluvial river flats and coastal limestone. The climate is warm Mediterranean, with rainfall ranging from 600 and 1000 mm annual (Mitchell et al. 2002).

The Guildford formation and Bassendean sands overlie the survey area. The Guildford formation is described as alluvial sand and clay with shallow-marine and estuarine lenses and local basal conglomerate. The Bassendean sands formation is described as basal conglomerate overlain by dune quartz sand with heavy mineral concentrations (GSWA 2008).

3.2 Wetlands

There are five Palusplain Resource enhancement Wetlands mapped over the survey area. These are:

- UFI 14646
- UFI 14647
- UFI 14665
- UFI 14666
- UFI 14736

There are also three Palusplain Multiple Use Wetlands mapped over the survey area. These are:

- UFI 16021
- UFI 14735
- UFI 14734

3.3 Regional vegetation

3.3.1 Beard 1990 Botanical subdistrict

The survey area occurs within the Dale Botanical Subdistrict which is characterised by jarrah (*Eucalyptus marginata*) forest on ironstone gravels, marri-wandoo (*Corymbia calophylla – E. wandoo*) woodlands on loamy soils, with sclerophyll understoreys (Beard 1990).

3.3.2 IBRA subregion

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Western Australia into 26 biogeographic regions and 53 subregions based on dominant landscape characteristics of climate, lithology, geology, landform and vegetation (McKenzie et al. 2003). The survey area is located within the Swan Coastal Plain 2 bioregion, which is characterised as a low lying coastal plain, mainly covered with woodlands. It is dominated by *Banksia* spp. or *Eucalyptus gomphocephala* (Tuart) on sandy soils, *Casuarina obesa* on outwash plains, and *Melaleuca* spp. in swampy areas. The climate is warm Mediterranean (Williams & Mitchell 2001).

3.3.3 System 6 and vegetation association mapping

Vegetation occurring within the region was initially mapped at a broad scale (1: 1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981); System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia) for Western Australia (DoEE 2018).

Based on regional vegetation complex mapping (Heddle et al. 1980), there are three vegetation complexes mapped across the survey area as described in Table 3.1.

Table 3.1: Vegetation complexes occurring within the survey area (Heddle et al. 1980)

Vegetation complex	Description
Serpentine River Complex	Closed scrub of Melaleuca spp. and fringing woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* along streams.
Guildford River Complex	Mixture of open forest to tall open forest of *Eucalyptus calophylla*, *E. wandoo, E. marginata* and woodland of E. wandoo (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis* and M. rhaphiophylla.
Bassendean Complex – Central and South	Vegetation ranging from woodlands *of E. marginata*, *C. fraseriana* and *Banksia* spp. to low woodlands of *Melaleuca* spp. and sedgelands on the moister sites. This area includes the transition of *E. marginata* to *E. todtiana* in the vicinity of Perth.

3.4 Environmentally sensitive areas

The survey area is mapped as containing an environmentally sensitive area according to the DWER Environmentally Sensitive Areas Map Viewer (2019b). This ESA is associated with a Conservation Category Wetland (UFI 14780;) and associated 50 m buffer, as well as a TEC identified within the same area, to the south east of the survey area.

4. Methods

The broad scale vegetation assessment was undertaken by a qualified botanist from Strategen-JBS&G on 30 May 2018 and 10 December 2019. Surveying undertaken in 2018 involved a detailed floristic and vegetation assessment of those properties owned by Stockland located east of St Albans Road (Figure 2.1). Surveying conducted in 2019 involved a floristic and vegetation assessment of those properties owned by Stockland located west of St Albans Road, and a broadscale assessment of roadside vegetation within the remainder of the survey area.

The assessment was conducted according to standards set out in the EPA '*Technical Guidance – Flora and vegetation surveys for Environmental Impact Assessment*' (EPA 2016). The survey area was traversed on foot to delineate broad vegetation types within the survey area at a number of mapping points. Flora and vegetation was described and sampled systematically at each mapping point and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed.

4.1 Survey methodology limitations and constraints

Table 4.1 displays the evaluation of the survey against a range of potential limitations that may have an effect on that survey. Based on this evaluation, the only potentially constraining factors on the survey are access problems and timing. However, given the highly degraded nature of the survey area, it is considered that these potentially constraining factors are minor in nature.

Table 4.1: Flora and vegetation survey potential limitations and constraints

Potential limitation	Impact on assessment	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint.**	The survey has been undertaken in the Dale Botanical Subdistrict on the Swan Coastal Plain which has been well studied and documented with ample literature available (Beard 1990).
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint.**	Number of species recorded, number of quadrats sampled and timing of the survey (i.e. ate autumn and early summer) were adequate for this level of survey.

Proportion of flora/fauna collected and identified (based on sampling, timing and intensity).	**Not a constraint.**	The proportion of flora surveyed was adequate. Given the highly degraded nature of the survey area it is considered that the areas surveyed in detail are representative of the wider survey area.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a constraint.**	The information collected during the survey was sufficient to assess the vegetation that was present during the time of the survey.
Mapping reliability.	**Not a constraint.**	Aerial photography of a suitable scale was used to map the survey area. Vegetation types were assigned to each vegetation remnant based on topography, species presence/absence and vegetation density and diversity.
Timing, weather, season, cycle.	**Potentially a constraint.**	Flora and vegetation surveys are normally conducted following winter rainfall in the South-West Province, ideally during spring (EPA 2016). The field assessments were conducted in May and December (Autumn and December) in fine weather conditions. Given the highly degraded nature of the survey area it is not considered that a Spring survey would reveal any further detail in the assessment.
Disturbances (fire flood, accidental human intervention, etc.).	**Not a constraint.**	The survey area and regional surrounds have been subject to disturbance over a significant period of time. Given the wide range of this disturbance, this is not considered to be a limitation within the survey area.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint.**	The survey area was traversed on foot and by car and all differences in vegetation structure were recorded appropriately.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint.**	The available resources were adequate to complete the survey.
Access problems (i.e. ability to access survey area).	**Potentially a constraint.**	Existing road networks and tracks enabled adequate access to survey the vegetation within the survey area. While land access permissions were not given for the entirety of the survey area, given the highly degraded nature of the survey area, it is considered that assessments made of roadside vegetation were sufficient to enable an assessment of the entire survey area.
Experience levels (e.g. degree of expertise in species identification to taxon level).	**Not a constraint.**	All survey personnel have the appropriate training in sampling and identifying the flora of the region.

5. Results

5.1 Native flora

Within Stocklands landholdings (Figure 2.1), a total of six native vascular plant taxa from three four genera and two plant families were recorded. The low number of plant genera recorded reflects the extremely disturbed nature of the survey area.

Table 5.1: Native flora taxa recorded

Family	Species
Casuarinaceae	*Casuarina obesa*
Fabaceae	*Jacksonia sternbergiana*
Myrtaceae	*Agonis flexuosa*
	Corymbia calophylla
	Eucalyptus rudis
	^Eucalyptus camaldulensis

	Kunzea glabrescens
	Melaleuca rhaphiophylla
	Melaleuca sp.
	Melaleuca teretifolia
	Melaleuca viminea
Xanthorrhoeaceae	*Xanthorrhoea preissii*

5.2 Threatened and Priority flora

No Threatened or Priority flora species were identified during the field assessment.

A desktop assessment using a 5 km radius from the NatureMap database search indicated that the following Threatened flora (two species) and Priority Flora (six species) have the potential to occur in the survey area:

- *Aponogeton hexatepalus* (P4)
- *Boronia juncea* subsp. *juncea (*P1)
- *Cyathochaeta teretifolia* (P3)
- *Diuris micrantha* (Vulnerable / Threatened)
- *Dodonaea hackettiana* (P4)
- *Jacksonia gracillima* (P3)
- *Stylidium longitubum* (P4)
- *Synaphea* sp. *Serpentine* (G.R. Brand 103) (Critically Endangered / Threatened).

Due to the lack of native vegetation and the highly degraded state of the remaining vegetation, it is unlikely that any Threatened or Priority flora species occur in the survey area.

5.3 Declared species

Two introduced species recorded, **Zantedeschia aethiopica* (Arum Lily) and **Gomphocarpus fruticosus* (Cotton Bush) are Declared species pursuant to section 22 of the Biosecurity and Agriculture Management Act 2007 (BAM Act), according to the Western Australian Department of Agriculture and Food (DAFWA 2016). These species were recorded throughout the survey area.

5.4 Vegetation types

A total of 10 vegetation types (VTs) were defined and mapped within the survey area (Figure 5.1) and are summarised in Table 5.2. The survey area comprises predominantly cleared areas on flat pastural land with scattered native and planted trees. Completely cleared areas, rehabilitated and planted areas have not been counted as unique native VTs but have been included in Table 5.2 and Table 5.3 for area calculation purposes. Total areas occupied within the survey area by each of the identified VTs are set out in Table 5.3.

Table 5.2: Vegetation types

Vegetation type	Description
VT1	*Agonis flexuosa* and *Eucalyptus rudis* scattered trees over weedy grassland
VT2	*Melaleuca rhaphiophylla* scattered trees over isolated occurences of *Xanthorrhoea preissii* over introduced grasses
VT3	*Eucalyptus rudis* and *Melaleuca rhaphiophylla* scattered trees over weedy grassland
VT4	Open woodland of *Corymbia calophylla* over isolated shrubs of *Jacksonia sternbergiana* over weedy grasses
VT5	*Melaleuca viminea* shrubland over mixed native species
VT6	Revegetated woodland of *Corymbia calophylla*, *Melaleuca rhaphiophylla* over open shrubland of local native species and non-endemic species adjacent to artificial lakes
VT7	Shrubland of *Melaleuca teretifolia* over weedy grasses

Vegetation type	Description
VT8	*Melaleuca viminea* shrubs over weedy grasses
VT9	Woodland of *Eucalyptus rudis*, ^*Eucalyptus camaldulensis* and ^*Corymbia citriodora* over very open shrubland of *Kunzea glabrescens* and mixed introduced species
VT10	Very open woodland of *Eucalyptus rudis* over weedy grasses
Planted	**Eucalyptus sp., ^Eucalyptus camaldulensis, Casuarina obesa* and / or *Casuarina* sp. planted trees, over isolated remnant or regrown native shrubs in some locations, over weedy grasses
Cleared	Cleared areas containing hardstand, infrastructure or paddocks with occasional remnant or planted trees or shrubs
Rehabilitation	Revegetation. Shrubland of non-endemic species on road verge
Open Water	Areas of standing water within artificial lakes

The total area mapped within the survey area was 782.4 ha, which includes highly degraded and fully cleared areas, as well as those areas unable to be accessed (Table 5.3). The dominant VT within the survey area was VT3 (33.97 ha) which can be broadly described as *Eucalyptus rudis* and *Melaleuca rhaphiophylla* scattered trees over weedy grassland. A portion of the survey area has been rehabilitated with vegetation surrounding an artificially created wetland (Figure 5.1).

Table 5.3: Area (ha) covered by each VT within the survey area

Vegetation type	Area (ha)	Percentage (%) of the survey area
VT1	3.09	0.39
VT2	13.78	1.76
VT3	33.97	4.34
VT4	1.69	0.22
VT5	9.4	1.20
VT6	4.41	0.56
VT7	0.92	0.12
VT8	0.65	0.08
VT9	1.19	0.15
VT10	3.67	0.47
Planted	31.75	4.06
Cleared	487.81	62.35
Rehabilitation	1.58	0.20
Open Water	3.72	0.48
Unable to access	184.77	23.62
Total	**782.4**	**100**

5.5 Vegetation condition

Historical aerial photography indicates that since 1953 the survey area has been significantly cleared (Landgate 2019) and is extensively degraded due to historical clearing and grazing by livestock, with part of the survey area currently in use as a livestock holding yard (Plate 1). Tree death of *Melaleuca rhaphiophylla* was observed in wetland areas of VT2 (Plate 2). The majority of vegetation within the survey area was classed as Completely Degraded (Keighery 1994; Figure 5.2; Table 5.4).

Table 5.5 gives a numerical breakdown of the area occupied by each vegetation condition rating within the survey area.

Table 5.4: Vegetation condition scale (Keighery 1994)

Condition rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

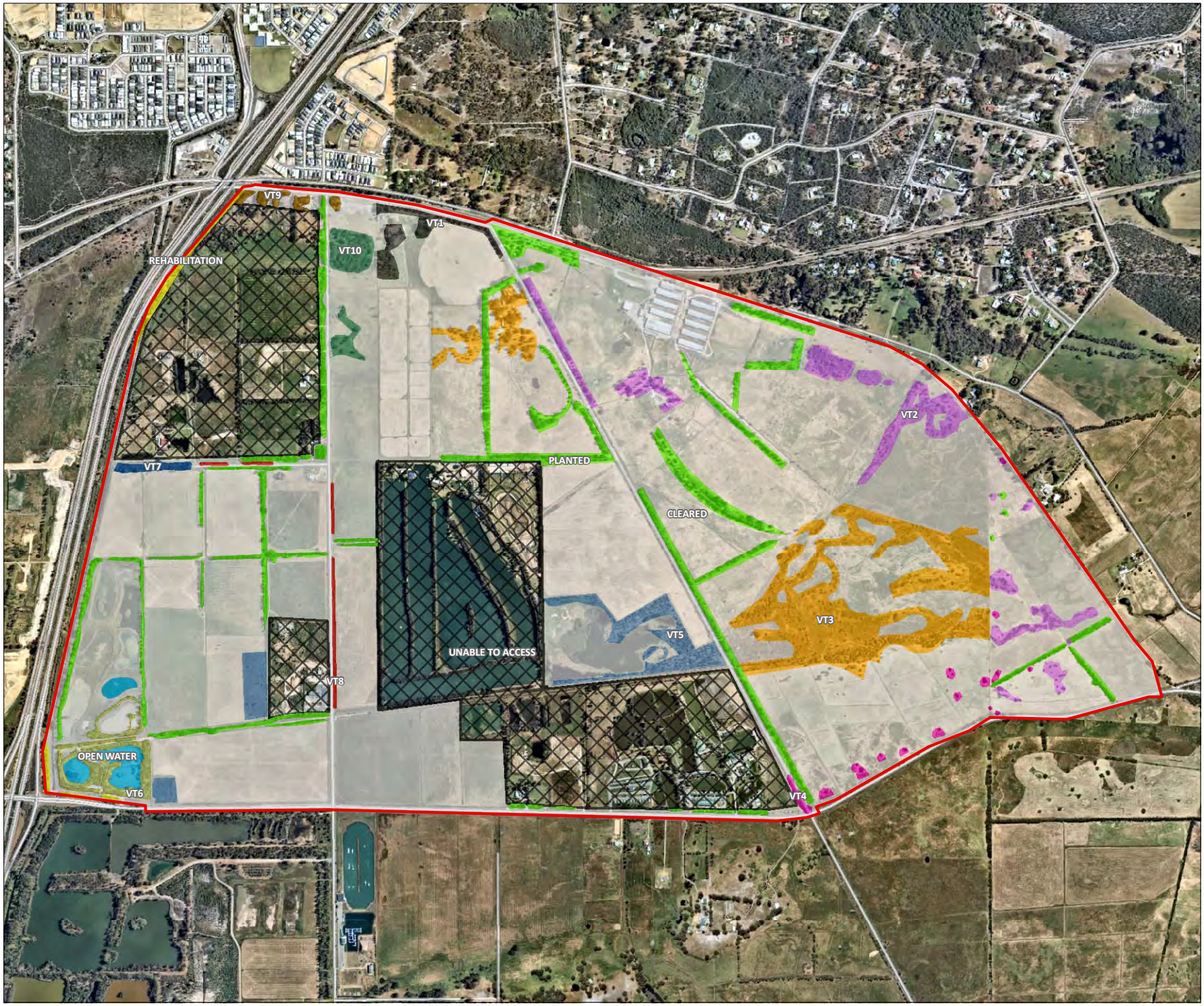
Good (4)	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback, grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	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.

Table 5.5: Area (ha) covered by each vegetation condition category within the survey area

Vegetation Condition	Area (ha)	Percentage (%) of the survey area
Good	4.41	0.56
Degraded – Good	2.32	0.30
Degraded	12.72	1.63
Completely Degraded – Degraded	29.93	3.83
Completely Degraded	548.25	70.07
Unable to access	184.77	23.62
Total	**782.4**	**100**

5.6 Threatened Ecological Communities

Due to the highly degraded state of the vegetation, none of the vegetation types within the survey area are likely to represent any Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs).



Legend:

- Site boundary

Vegetation type

- Cleared (487.81 ha)
- Open water (3.72 ha)
- Planted (31.75 ha)
- Rehabilitation 1.58 ha)
- Unable to access (184.77 ha)
- VT1 (3.09 ha)
- VT2 (13.78 ha)
- VT3 (33.97 ha)
- VT4 (1.69 ha)
- VT5 (9.4 ha)
- VT6 (4.41 ha)
- VT7 (0.92 ha)
- VT8 (0.65 ha)
- VT9 (1.19 ha)
- VT10 (3.67 ha)
- Roads (MRWA)

strategen JBS&G

Job No: 572265

Client: Stockland

Version: A	Date 19/12/2019
Drawn By: cthatcher	Checked By: WO

Scale 1:20,000

0 250 500
Metres

Wellard Farms
Perth, WA

VEGETATION TYPES

FIGURE 5.1

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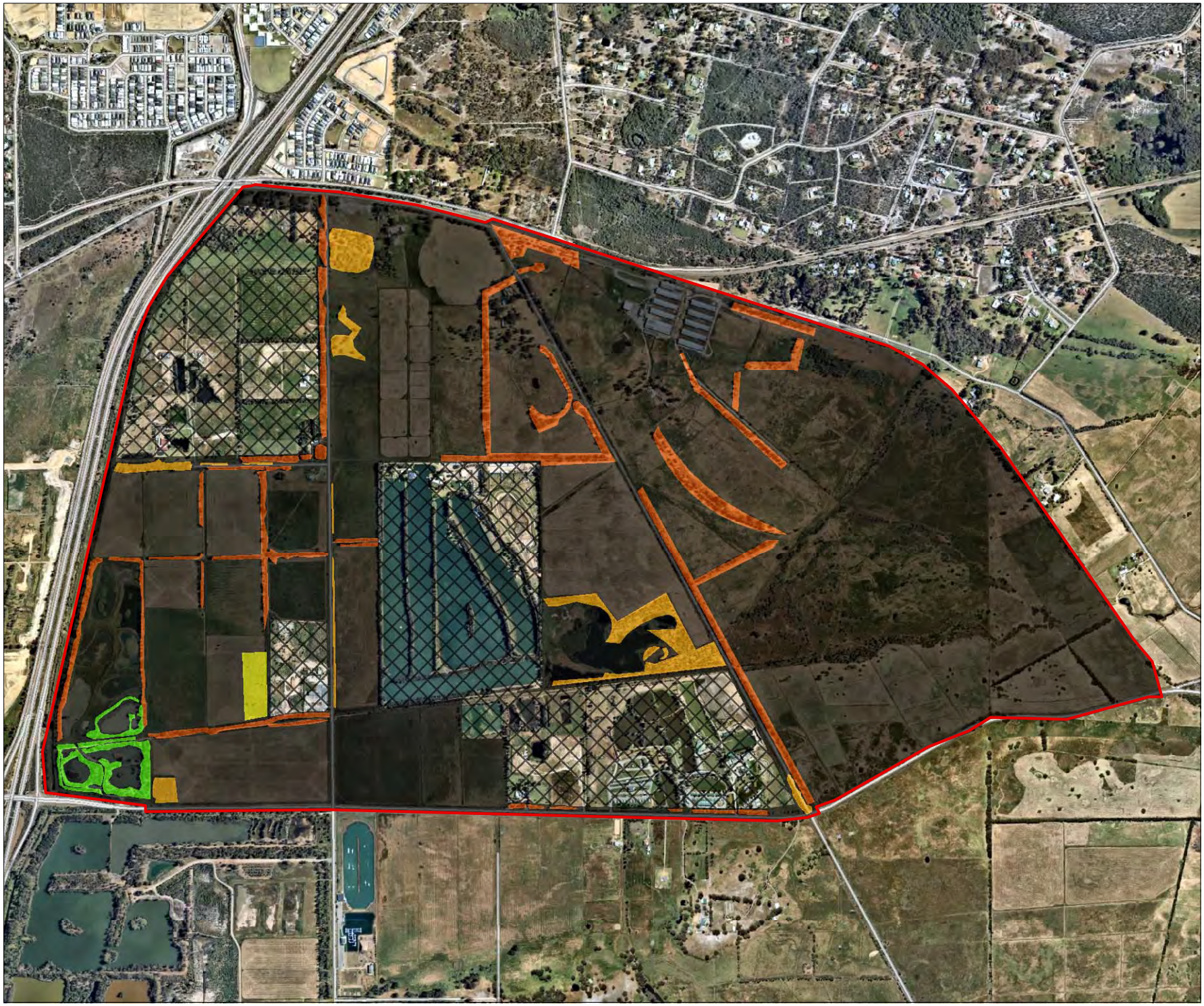
Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019



Legend:

- Site boundary

Vegetation condition

- Good (4.41 ha)
- Degraded to good (2.32 ha)
- Degraded (12.72 ha)
- Completely degraded to degraded (29.93 ha)
- Completely degraded (548.25 ha)
- Unable to access (184.77 ha)
- Roads (MRWA)

strategen JBS&G

Job No: 572265

Client: Stockland

Version: A	Date 18/12/2019
Drawn By: cthatcher	Checked By: WO

Scale 1:20,000

0 250 500
Metres

Wellard Farms
Perth, WA

VEGETATION CONDITION

FIGURE 5.2

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Stockland\57226 Stockland Wellard Farms EPBC\GIS\Maps\R001_RevA\57226_03_6_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019

6. Discussion

Vegetation within the survey area comprises 11 VTs as well as revegetated, planted, and completely cleared areas.

Two Declared Plant species pursuant to section 22 of the BAM Act (**Zantedeschia aethiopica* [Arum Lily] and **Gomphocarpus fruticosus* [Cotton Bush]) were recorded across the survey area.

The survey area has experienced significant modification due to historical clearing and pastoral land uses for livestock. The vegetation recorded within the survey area was highly degraded and did not resemble any TECs or PECs. No conservation significant species were recorded within the survey area.

The majority of vegetation in the survey area was mapped as Completely Degraded (Keighery 1994). Remnant native vegetation mostly consisted of isolated trees over weeds. Some parts of the survey area have been planted with garden species and non-endemic trees, and a portion of the survey area (Figure 5.1) has been rehabilitated / revegetated with vegetation surrounding an artificial wetland. Other wetland areas in the survey area consisted mainly of native *Melaleuca rhaphiophylla* and *Eucalyptus rudis* trees over weeds including Declared weed species **Zantedeschia aethiopica.*

Adequate data has been collected to define and assess the broad scale vegetation communities in the survey area, which contains at minimum approximately 19.45 ha (2.48%) of remnant native vegetation in Degraded to Good condition. The overall vegetation within the survey area is highly degraded and is not considered of high conservation significance.

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Attachment A: Plates

Plate 1: Part of the survey area which is currently being utilised as a livestock holding yard

Plate 2: *Melaleuca rhaphiophylla* tree death in VT2

Appendix E Black Cockatoo habitat assessment (Strategen-JBS&G 2020b)

Stockland

Wellard Farms

Level 1 Fauna Survey and Black Cockatoo Habitat Assessment

20 February 2020

57226-126527 (Rev D)

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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Appendices

1. Introduction

1.1 Project background and location

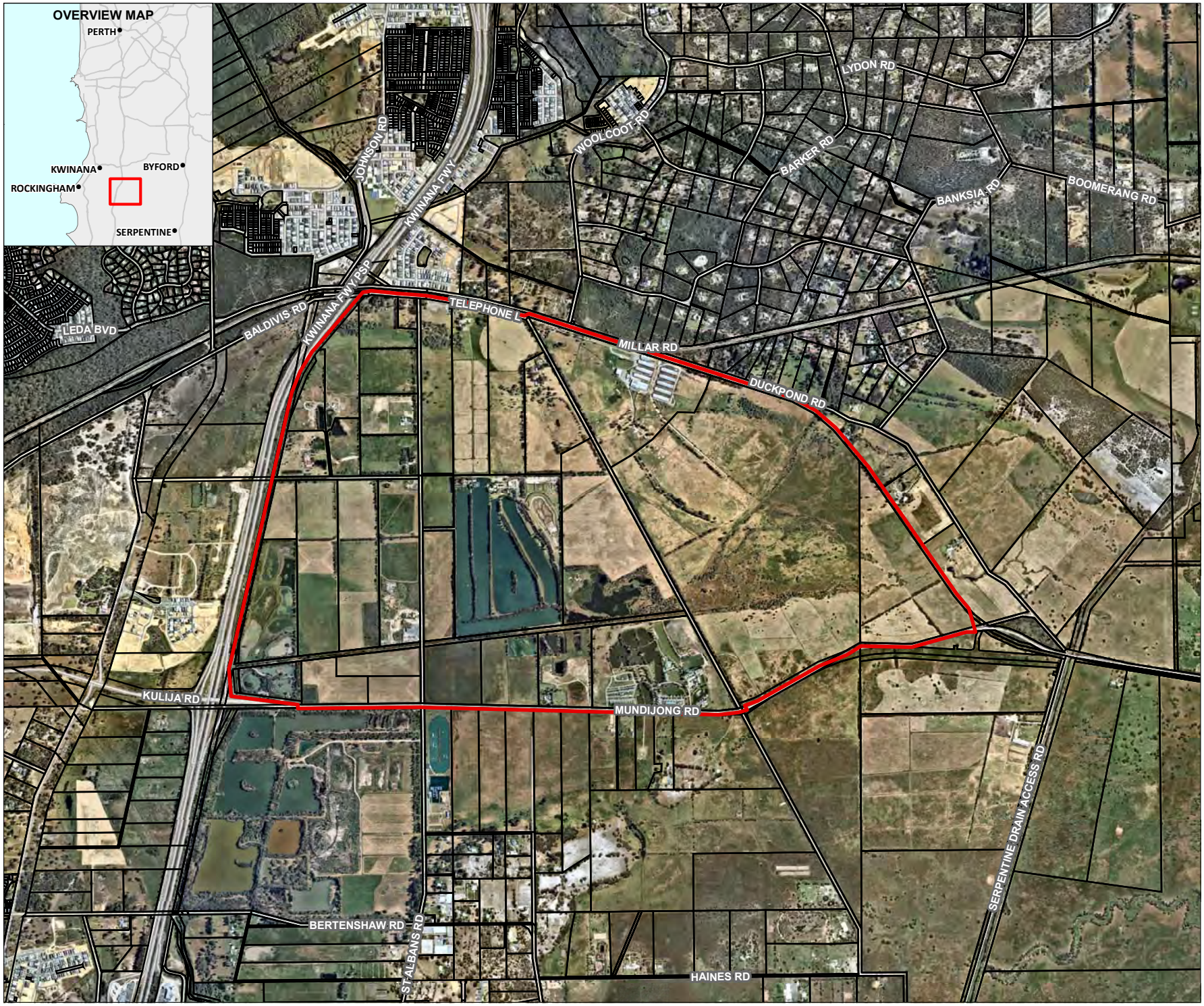
Strategen-JBS&G was engaged by Stockland to determine the environment values of the Wellard Project (survey area; Figure 1.1) to support engagement with stakeholders and the lodgements of a District Structure Plan and the Metropolitan Region Scheme amendment for the proposed development.

A Level 1 Fauna survey and Black Cockatoo habitat assessment were undertaken by Strategen-JBS&G to define and map the fauna habitat in the survey area. This report represents the findings of the assessment.

1.2 Scope

The scope of the assessments was to:

- undertake a Level 1 Fauna Survey
- undertake a Black Cockatoo habitat assessment across the entire survey area
- prepare a concise, technical report representing the results of the desktop review and field survey.



Legend:

- Site boundary (782.38 ha)
- Cadastral boundary
- Roads (MRWA)

strategen JBS&G

Job No: 572265	
Client: Stockland	
Version: A	Date 16/12/2019
Drawn By: cthatcher	Checked By: WO
Scale 1:30,000	

0 0.5 1
Kilometres

Wellard Farms
Perth, WA

Survey area

FIGURE 1.1

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Stockland\57226 Stockland Wellard Farms EPBC\GIS\Maps\R001_RevA\57226_01_1_SiteLocn.mxd
Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019

2. Context

2.1 Legislative context

Fauna in WA is protected formally and informally by various legislative and non-legislative measures, which are as follows:

- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* – Australian Government
- *Biodiversity Conservation Act 2016* (BC Act) – State
- *Environmental Protection Act 1986* (EP Act) – State

Non-legislative measures:

- WA Department of Biodiversity, Conservation and Attractions (DBCA) Priority lists for flora, ecological communities and fauna
- recognition of locally significant populations by the DBCA

A short description of each is provided below. Other definitions, including species conservation categories, are provided in Appendix A.

2.1.1 EPBC Act

The EPBC Act aims to protect matters of national environmental significance, which are detailed in Appendix 1. Under the EPBC Act, the Commonwealth Department of the Environment and Energy (DEE) lists protected species and Threatened Ecological Communities (TECs) by criteria set out in the Act. Species are conservation significant if they are listed as Threatened (i.e. Critically Endangered, Endangered and Vulnerable) or Migratory.

Bird species protected as Migratory under the EPBC Act include those listed under international migratory bird agreements relating to the protection of birds which migrate between Australia and other countries, for which Australia has agreed. This includes the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Some marine fauna or terrestrial fauna that use marine habitats are listed as Marine under the EPBC Act. These species are only considered conservation significant when a proposed development occurs in a Commonwealth marine area (i.e. any Commonwealth Waters or Commonwealth Marine Protected Area). Outside of such areas, the EPBC Act does not consider these species to be matters of national environmental significance so are not protected under the Act.

2.1.2 BC Act

The *Biodiversity Conservation Act 2016* has now replaced the *Wildlife Conservation Act 1950* (WC Act). On 3 December 2016, several parts of the new Act were enacted by the State Governor. The remaining parts of the Act and the associated Regulations came into effect on 1 January 2019.

In addition to providing for the protection of flora and fauna, the *Biodiversity Conservation Act 2016* includes provisions for threatened ecological communities, threatening processes, critical habitats and environmental pests.

2.1.3 EP Act

Threatened flora, fauna (and significant habitat necessary for the maintenance of indigenous fauna) and Threatened Ecological Communities (TECs) are given special consideration in environmental impact assessments and have special status as Environmentally Sensitive Areas

(ESAs) under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Exemptions for a clearing permit do not apply in an ESA.

3. Methods

3.1 Database review

A 5 km DBCA Threatened Fauna Database, NatureMap search and EPBC Protected Matters Search Tool (PMST) search was undertaken (Appendix B). The searches were undertaken to identify fauna species of conservation significance potentially occurring in the survey area (DBCA 2018a, DBCA 2018b, DEE 2018).

Collectively, these sources were used to compile a list of species that have been previously recorded in the vicinity of the survey area (Appendix C). This list invariably includes some species that do not occur in the survey Area, as some fauna have a limited or patchy distribution or a high level of habitat specificity for habitats which are not located in the survey area e.g. marine species that require ocean for habitat. Some fauna may also have become locally extinct or were erroneously identified in previous surveys. These fauna were examined and then excluded from the list where relevant.

3.2 Field survey

The field survey was undertaken on 22nd May 2018 and 10th December 2019. It was consistent with standard protocols for the region and relevant EPA Guidance Statements and EPBC Act Survey Guidelines as outlined above in section 1.2 (where relevant and practical).

The purpose of the field assessment was to verify the accuracy of the desktop assessment and to further delineate and characterise the fauna assemblages and fauna habitat in the survey area. The assessment consisted primarily of a fauna habitat assessment and opportunistic observations.

3.2.1 Habitat assessment

Vegetation communities and landforms were used to identify the broad fauna habitats in the survey area. Habitat assessments were undertaken across the survey area (Appendix D). These fauna habitats were then assessed for their potential to support species of conservation significance and the quality of habitat they provide to a wider suite of fauna. The habitat assessments were documented systematically for each habitat type on standardised field sheets.

Each broad habitat type description includes information on:

- location of the broad habitat type within the survey area (GPS co-ordinate) and its relative percentage.
- habitat condition was assessed at each trap site as “completely degraded through to pristine”, based on the scale given in Keighery (1994).
- landscape position.
- dominant vegetation and structure (e.g. number of vegetation strata).
- hollow-bearing trees and dead stags (e.g. average size and abundance of hollows).
- description of any rock and rocky outcrops.
- logs (e.g. abundance and size).
- substrate (e.g. leaf litter).
- wetlands, creeks, rivers, dams and other water bodies.
- description of any observed nests and roosts (if present).
- subterranean roosts (e.g. caves, disused mineshafts and/or adits).
- associated fauna species observed using the habitat.

- disturbance (e.g. cattle grazing, fire).
- photo showing a typical example of the broad habitat type.

The location of the habitat assessments can be seen in Figure 4.1.

3.2.2 Opportunistic observation

Fauna were opportunistically observed and recorded during the assessment. The assessment included looking through leaf litter, overturning rocks, looking under decorticating bark and searches for scats, tracks, burrows and other traces of animals throughout the survey area. If conservation significant species were located, the coordinates were recorded with a GPS.

3.2.3 Black Cockatoo habitat assessment

The Black Cockatoo habitat assessment involved traversing the survey Area by foot. Any trees meeting each of the following criteria for potential breeding were recorded and electronically logged using a hand-held Global Positioning System (GPS) unit:

- Native trees (e.g. Jarrah, Tuart, Marri etc.).
- Diameter at breast height (DBH) > 500 mm (300 mm for Wandoo and Salmon Gum) regardless of the presence or absence of hollows.

Trees were placed in the following size class categories:

- A = 500 – 1000 mm DBH
- B = 1000 – 2000 mm DBH
- C = >2000 mm DBH

The Black Cockatoo habitat assessment involved assessing the habitat for tree and shrub species known to be important dietary items e.g. Marri and Banksia sp. It also included looking for:

- Evidence of feeding (chewed cones, seed and nut material).
- Opportunistic observations of Black Cockatoos in the survey area.

Areas if potential Black Cockatoo habitat were then given a foraging quality score, based on the definitions provided in Table 3.1.

Table 3.1: Definitions of black cockatoo foraging habitat quality

Foraging quality	Justification
Excellent	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) and presence of food sources at several strata (i.e. canopy, midstorey and understorey).
Good	High density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species >60%) but food sources only present at one or two strata (i.e. canopy and midstorey).
Moderate	Moderate foraging value density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 20-40%) and food sources only present at one or two strata (i.e. canopy and midstorey).
Poor	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy).
Very poor	Very low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species <10%) and presence of food sources at only one stratum (i.e. canopy).
Nil	Cleared areas - no suitable vegetation present.

3.2.4 Taxonomy

For species identified in the desktop assessment, where there is doubt to their true taxonomy (through subsequent name changes or taxonomic reviews), an effort was made to determine the current scientific name for each taxon. In some cases, old scientific names may be presented where correct nomenclature could not be determined due to name changes. Some taxon names may be followed by 'sp.', meaning that the species name was not given in the data source or the identification is in doubt. Where there are previously recorded taxa such as this that have the potential to be a conservation significant species, they are discussed specifically in the results and discussion section.

Taxonomy and nomenclature in this report follows the accepted listing of published terrestrial vertebrate species. The listing for amphibians and reptiles follows Cogger (2014); birds follow Christidis & Boles (2008) and mammals follow Van Dyck & Strahan (2008).

3.3 Survey limitations and constraints

Table 3.2 displays the evaluation of the fauna assessment against a range of potential limitations that may have an effect on that assessment. Based on this evaluation, the only potentially constraining factor on the survey are land access problems. However, given the highly degraded nature of the survey area, it is considered that this potentially constraining factor is minor in nature.

Table 3.2: Fauna survey methodology: potential limitations and constraints.

Potential limitation	Impact on assessment	Comment
Competency/ experience of the consultant carrying out the survey	**Not a constraint**	All survey personnel have the appropriate training and experience in surveying for the fauna of the region
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions)	**Not a constraint**	Surveying was conducted through habitat assessments and opportunistic observations. Through these methods all fauna groups were able to be surveyed.
Proportion of fauna identified, recorded and/ or collected	**Not a constraint**	No fauna were collected. Opportunistic observations are sufficient for the required scope of works.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	**Not a constraint**	DBCA and DoEE databases were searched for information on the potential fauna present within the survey area.
The proportion of the task achieved and further work which might be needed	**Not a constraint**	The entire task was achieved. No further work is anticipated to be required.
Timing, weather, season, cycle	**Not a constraint**	The survey was conducted during the breeding seasons for Carnaby's and Red-tailed Black Cockatoos.
Disturbances (e.g. fire, flood, accidental human intervention etc) which affected the results of the survey	**Not a constraint**	The survey area has not been subject to fire or other significant disturbance in the recent past. The majority of the survey area has been highly degraded as a result of agricultural activities.
Intensity (in retrospect, was the intensity adequate)	**Not a constraint**	The survey area was traversed on foot where land access allowed.
Completeness (e.g. was relevant area fully surveyed)	**Potentially a constraint**	While land access permissions were not given for the entirety of the survey area, given the highly degraded nature of the survey area, it is considered that assessments made of roadside vegetation were sufficient to enable an assessment of the entire survey area.
Resources (e.g. degree of expertise available in animal identification to taxon level)	**Not a constraint**	All survey personnel have the appropriate training and experience in surveying for the fauna of the region.
Remoteness and/or access problems	**Potentially a constraint**	While land access permissions were not given for the entirety of the survey area, given the highly degraded

		nature of the survey area, it is considered that assessments made of roadside vegetation were sufficient to enable an assessment of the entire survey area.
Availability of contextual (biogeographic) information on the region	**Not a constraint**	The survey has been undertaken on the Swan Coastal Plain which has been well studies and documented with ample literature available.

4. Fauna survey results

4.1 Database results

Database searches returned 180 vertebrate species from 72 families as potentially occurring in the vicinity of the survey area. Of these, seven species were amphibians from three families, 28 were reptiles from six families, 153 were bird species from 51 families and 18 were mammals from 12 families.

A total of 41 conservation significant vertebrate species (including Priority species) from 22 families were identified during the desktop review of the database searches (Appendix B). These were comprised of four reptile species from three families, 30 bird species from 15 families and seven mammals from four families.

4.1.1 Waterbirds

The 5 km DBCA Threatened Fauna Database, NatureMap database and EPBC PMST search returned a number of wetland species in particular wading birds. Wetland avifauna such as wading birds, including Plovers, Stilts and Sandpipers inhabit estuaries, mudflats, saltmarshes, sandflats and beaches, where they feed on invertebrates such as worms, molluscs, insects and crustaceans (Garnett *et al.* 2011). This habitat is not present in the survey area and as such, these species have been omitted from any further discussion. There are multiple areas of artificial wetland in the survey area, which provides habitat for other waterbirds which will be discussed in section 5.2.3.

4.1.2 Extinct and Regionally Extinct

A number of species returned were also known to be historical records of species now extinct in the local area (e.g. Malleefowl (*Leipoa ocellate*), Western Quoll (*Dasyurus geoffroii*) and Western Ringtail Possum (*Pseudocheirus occidentalis*) and more broadly in the region. These species have been omitted from any further discussion.

4.1.3 Database errors

Occasionally there are obvious errors in the database searches that are sourced from the various government departments. For example, the Grey Wagtail has only two confirmed sightings in north-west WA (Johnstone & Storr 2004) yet it was present in the EPBC PMST. Also, the Keeled Legless Lizard (*Pletholax gracilis edelensis*) was returned from NatureMap, however the subspecies returned is restricted to Edel Land Peninsular and Dirk Hartog Island, Shark Bay, on dunes with Beach spinifex (*Spinifex longifolius*) (Wilson & Swan 2017). These species have therefore been omitted from any further discussion.

In addition, those species that were returned from the DBCA Threatened Fauna Database, that had three or fewer records and those with limited records and classed as less than certain in their identification, have also been omitted from further discussion.

It is important to note, that the EPBC PMST is not entirely based on point records, but also on broader information, for example bioclimatic distribution models. Whereas DBCAs threatened fauna database and NatureMap is, consequently, the results of the EPBC PMST are in some cases less accurate, particularly at a local scale (e.g. the Yellow Wagtail [*Motacilla flava*]). Consequently, the EPBC PMST will include species that do not occur in the search area because for example there is no habitat or they are now known to be locally extinct.

In addition, many fauna are not distributed evenly across the landscape, are more abundant in some places than others are, and consequently more detectable (Currie 2007). Furthermore, some small, common ground-dwelling reptile and mammal species tend to be habitat specific, and many bird

species can occur as regular migrants, occasional visitors or vagrants. Therefore, all these species have been omitted from any further discussion regarding fauna results.

4.1.4 Conservation Significant Fauna

With the afore mentioned species removed, a total of eight conservation significant species (including Priority species) from the database searches are potentially considered to either be likely, possibly or unlikely to occur in the survey area. These eight species comprise of seven bird and one mammal species.

Of these eight conservation significant species, four species were recorded during the field assessment, three species are considered as 'Likely' to occur, no species are considered 'Possible' and one species is considered 'Unlikely' to occur within the survey area (Table 4.1).

The likelihood of each species is based on the following criteria:

- Recorded: Recorded during the field assessment
- Likely: Suitable habitat is present in the survey area and the survey area is in the species' known distribution
- Possible: Limited or no suitable habitat is present in survey area, but is nearby. The species has good dispersal abilities and is known from the general area
- Unlikely: No suitable habitat is present in survey area but is nearby, the species has poor dispersal abilities, but is known from the general area; or suitable habitat is present, however the survey area is outside of the species' known distribution.

Table 4.1: Conservation significant fauna potentially occurring within the survey area

Species	Common name	Conservation Status	Likelihood
Birds			
Oxyura australis	Blue-billed duck	P4	Unlikely
Tringa nebularis	Common greenshank	Mi, Ma	Unlikely
Plegadis falcinenellus	Glossy Ibis	Mi	Recorded
Haliaeetus leucogaster	White-bellied Sea Eagle	Mi, Ma	Recorded
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Vu	Recorded
Calyptorhynchus baudinii	Baudin's Black Cockatoo	En	Likely
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	En	Likely
Mammals			
Isoodon fusciventer	Southern Brown Bandicoot	P4	Recorded

C En = Critically Endangered, En = Listed as Endangered under the EBPC Act, Vu = Listed as Vulnerable under the EBPC Act, Mi = Listed as Migratory under the EBPC Act, Ma = Listed as Marine under the EBPC Act, P = Listed as Priority by the DBCA

4.1.5 Field survey results

During the field assessment 48 species from 17 families were recorded. This consisted of two amphibians from two families, one reptile species from one family, 25 bird species from 12 families and two mammal species from two families.

4.1.5.1 Amphibians

From the database searches, seven amphibian species have been previously recorded from the following three families in the surrounding area: *Limnodynastidae*, *Myobatrachidae* and *Hylidae*. During the survey, two amphibian species were recorded from the *Myobatrachidae* and *Hylidae* families (Appendix C).

4.1.5.2 Reptiles

From the database searches, a total of 28 reptile species have been previously recorded from the following six families in the surrounding area; Gekkonidae, Pygopodidae, Scincidae, Agamidae, Varanidae and Elapidae. During the field assessment, one reptile species was recorded. The South-western long-necked Turtle (*Chelodina colliei*) was recorded through observation of an old shell (Appendix C).

4.1.5.3 Birds

From the database searches, a total of 206 bird species from 51 families have been previously recorded in the surrounding area. During the field assessment 25 bird species were recorded from the following 12 families: *Anatidae, Pelecanidae, Ardeidae, Columbidae, Threskiornithidae, Psittacidae, Meliphagidae, Campephagidae, Dicruridae, Cracticidae, Corvidae* (Appendix C).

4.1.5.4 Mammals

From the database searches, a total of 18 mammal species from 12 families have been previously recorded in the surrounding area. During the field assessment two mammal species were recorded; the priority 4 Southern Brown Bandicoot (*Isoodon fusciventer*), was recorded indirectly through diggings and the domestic sheep (*Ovis aries*) (Appendix C).

4.1.6 Fauna habitat

As part of the fauna survey, five broad fauna habitat types were identified and mapped coarsely across the survey area. These habitat types and their respective extents are listed below in Table 4.2 and displayed in Figure 4.1. Cleared areas and those areas unable to be accessed have been provided in Table 4.2 for area calculation purposes.

Table 4.2: Fauna habitat types and extent within the survey area.

Fauna Habitat	Area (HA)	Area (%)
Eucalyptus/Melaleuca open woodland	43.61	5.57
Melaleuca shrubland	1.57	0.20
Melaleuca Woodland	23.18	2.96
Non-endemic	31.51	4.03
Sheoak trees	1.82	0.23
Artificial wetland	8.13	1.04
Degraded / Cleared Areas	487.81	62.35
Unable to access	184.77	23.62
Total	**782.4**	**100**

Of the fauna habitat types listed above, three were considered to be in at least Degraded to Good condition. These are:

- *Eucalyptus /Melaleuca open woodland Melaleuca* Woodland.
- Artificial wetland.

The remaining areas were all considered to consist of non-endemic eucalypts, cleared and degraded areas.

These habitats differed primarily in landform, geology and vegetation structure of the upper stratum. No tree hollows suitable for vertebrate fauna were recorded in any of the habitat types. Burrowing stability was moderate in most areas.

The habitat types in the Study Area were assessed on their extents and levels of significance according to the following criteria:

- Distribution: those habitats widespread and common within the surrounding regions were categorised as “Widespread”; otherwise

4.1.7 Black Cockatoo habitat assessment

The EPBC PMST and NatureMap searches identified all three Black Cockatoo species as occurring in the surrounding area; Carnaby’s Black Cockatoo, Baudin’s Black Cockatoo and FRTBC (Appendix B).

During the survey, four FRTBC were observed feeding on Marri nuts, in the survey area.

4.1.7.1 Foraging habitat

There is a total of 32.63 ha (5.5%) of Black Cockatoo foraging habitat in the survey area. The majority of this is considered to be representative of Poor quality, with some areas identified as being of Poor – Moderate quality. The low overall density of foraging species across this area reflects the poor quality of the habitat. Smaller, isolated areas have denser cover; however, these are limited, and separated by large areas with little or no foraging habitat value.

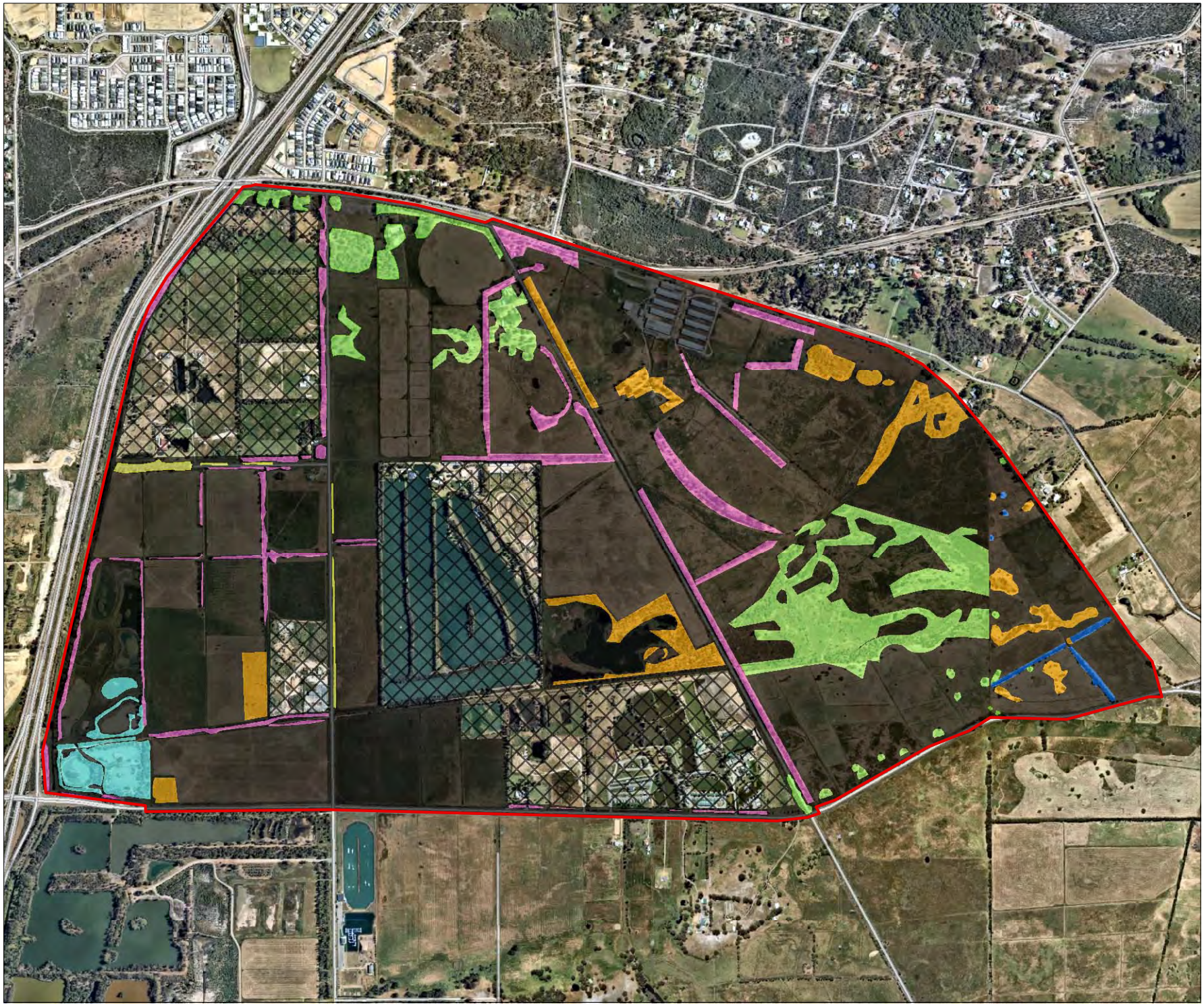
Two species of Eucalypt (*Corymbia calophylla* [Marri] and *Eucalyptus rudis*) recorded in the survey area are considered Black Cockatoo foraging habitat. One other foraging species was recorded; *Allocasuarina* sp., a known Black Cockatoo dietary item.

4.1.7.2 Potential breeding trees

Large Marri trees recorded in the survey area are also considered Black Cockatoo potential breeding habitat. The survey area contains 13 potential breeding trees with a DBH of more than 500 mm. The locations of these potential breeding trees area displayed in Figure 4.2.

No hollows considered to be large enough at their entrances (>120 mm) to be considered as potential breeding hollows in the future were observed in the survey area.

A number of Flooded Gum trees were also recorded in the survey area, some of which had a DBH of more than 500 mm. However, although their DBH is technically large enough for them to be considered potential breeding habitat, due to their low branching form, they are not considered suitable for Black Cockatoos to breed in.



Legend:

- Site boundary

Fauna habitat

- Artificial wetland (8.13 ha)
- Cleared (487.81 ha)
- *Eucalyptus* remnant (43.61 ha)
- *Melaleuca* shrubland (1.57 ha)
- *Melaleuca* woodland (23.18 ha)
- Non-endemic (31.51 ha)
- Sheoak trees (1.82 ha)
- Unable to access (184.77 ha)
- Roads (MRWA)

strategen JBS&G

Job No: 572265

Client: Stockland

Version: A	Date 18/12/2019
Drawn By: cthatcher	Checked By: WO

Scale 1:20,000

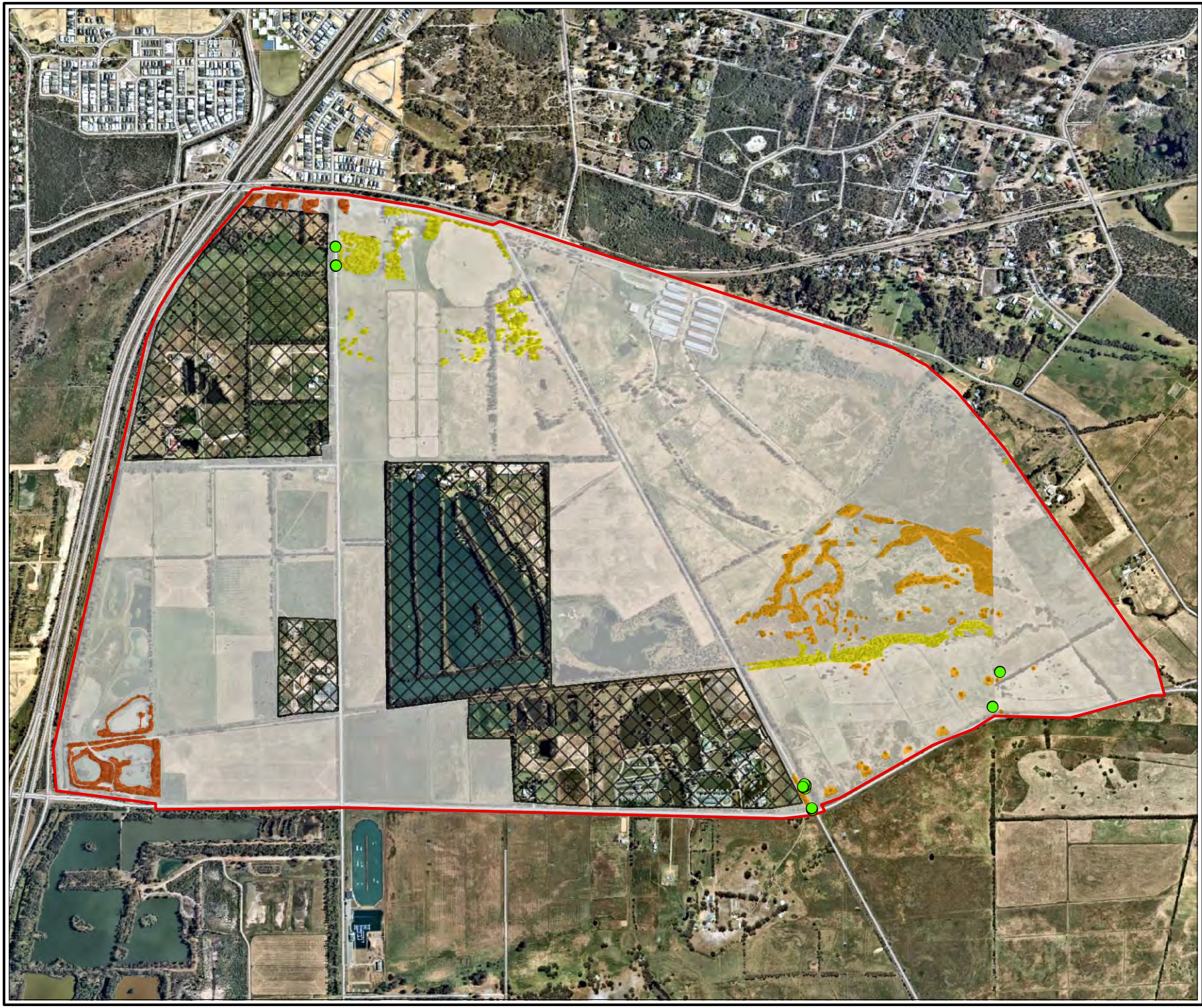
0 250 500
Metres

Wellard Farms
Perth, WA

FAUNA HABITAT

FIGURE 4.1

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Stockland\57226 Stockland Wellard Farms EPBC\GIS\Maps\R001_RevA\57226_04_1_FaunaHabitats.mxd
Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019



Legend:

- Site boundary

Black Cockatoo foraging habitat

- Poor - moderate (12.83 ha)
- Poor (14.20 ha)
- Very poor (5.60 ha)
- Nil (565.0 ha)
- Unable to access (184.77 ha)
- Black cockatoo potential breeding trees (13)
- Roads (MRWA)

strategen JBS&G

Job No: 572265

Client: Stockland

Version: A	Date 19/02/2020
Drawn By: hsullivan	Checked By: WO

Scale 1:20,000

0 250 500
Metres

Wellard Farms
Perth, WA

BLACK COCKATOO FORAGING HABITAT

FIGURE 4.2

File Name: W:\Projects\1)Open\Stockland\57226 Stockland Wellard Farms EPBC\GIS\Maps\R001_RevA\57226_03_7_BCHabitat.mxd
Image Reference: www.nearmap.com© - Imagery Date: 19 October 2019

5. Discussion

5.1 Fauna of conservation significance

A total of eight conservation significant species retrieved from the database searches are considered as either Likely, Possibly or Unlikely to occur in the survey area. Of these, four conservation significant species were recorded during the survey. Two species are considered Likely to occur and two species are considered as Unlikely to occur in the survey area. All eight conservation significant species will be discussed further below. As a Black Cockatoo habitat assessment forms part of this report, all three Black Cockatoo species will be discussed in detail in 5.3.

5.1.1 Species recorded

During the field survey, four conservation significant species were recorded; the Glossy Ibis, White-bellied Sea-eagle, Forest Red-tailed Black Cockatoo and the Southern Brown Bandicoot.

5.1.1.1 Glossy Ibis (*Plegadis falcinellus*)

The Glossy Ibis is listed as Migratory under the EPBC Act. It is a small all-dark ibis with reddish-brown neck and dark iridescent body. Usually seen in small flocks, often flying in a V-formation, it inhabits mainly shallow water and mudflats, where it thrusts its bill into semi-submerged clumps of grass for frogs and tadpoles (Slater et al. 2009).

The DBCA Threatened Fauna Databased returned just three records of the Glossy Ibis, however during the field survey it was recorded foraging in the Artificial Wetland habitat.

5.1.1.2 White-bellied Sea-eagle (*Haliaeetus leucogaster*)

The White-bellied Sea-eagle is listed as Migratory Marine under the EPBC Act. White-bellied Sea-eagles are a common resident or nomad along the coast of Australia, and on rivers, lakes and dams, feeding on fish. The species is a large sea- eagle which soars with wings upswept. Males are usually much smaller than females and have spectacular diving displays. Nests are large stick structures in trees or on ground (Slater *et al.* 2009).

The DBCA Threatened Fauna Databased returned no records of the White-bellied Sea-eagle, however during the field survey it was recorded on the wing near the Artificial Wetland habitat.

5.1.1.3 Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

A Black Cockatoo habitat assessment forms part of this report, so the FRTBC will be discussed in section 5.3.

5.1.1.4 Southern Brown Bandicoot (*Isoodon fusciventer*)

The Southern Brown Bandicoot is listed as Priority 4 under the DBCA Priority List. It once occurred throughout south-west WA; it now occurs from Guilderton southwards on the SCP, including the Perth Metropolitan area, in Jarrah and Karri (Eucalyptus diversicolor) forests and adjacent coastal vegetation complexes. The species inhabits scrubby, often swampy, vegetation with dense cover up to about 1m high. It feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. The Southern Brown Bandicoot is patchily distributed in suitable habitat, with populations inhabiting Jarrah and Wandoo forests usually associated with watercourses. On the Swan Coastal Plain it is often associated with wetlands with dense vegetation where they feed on fruit, seeds, insects and fungi (Woinarski *et al*. 2012).

The DBCA threatened fauna database returned 130 records from a 5 km radial search of the Southern Brown Bandicoot. The survey area contains soft sands and vegetation cover providing

habitat for the species and Southern Brown Bandicoot diggings were recorded within the survey area.

5.1.2 Species considered likely to occur

A total of two species are considered Likely to occur in the survey area; Baudin's Black Cockatoo, and Carnaby's Black Cockatoo. Both species will be discussed in section 5.3.

5.1.3 Species considered as possibly occurring

No species of conservation significance are considered as Possibly occurring in the survey area.

5.1.4 Species considered Unlikely to occur

A total of two conservation significance species are considered as unlikely to occur in the survey area; the Blue-billed Duck and the Common Greenshank.

5.1.4.1 Blue-billed Duck (*Oxyura australis*)

The Blue-billed Duck is listed as Priority 4 under the DBCA Priority List. The species is uncommon on deep vegetated swamps in south-west WA, where it nests in a cup of reeds, often domed on a trampled reed platform. The Blue-billed Duck is a dark, stiff-tailed diving duck with a broad blue or blue-grey bill. It is a bulky diving duck with a stiff pointed tail, often raised in display. Usually seen well out into large stretches of water.

The DBCA Threatened Fauna Database returned 44 records from a 5 km radial search of the Blue-billed Duck. The survey area contains an area of artificial wetland; however, all the records are from Alcoa / Wellard Wetland which is located approximately 2.5 km south-west of the survey area. As such the Blue-billed Duck is considered Unlikely to occur in the survey area.

5.1.4.2 Common Greenshank (*Tringa nebularis*)

The Common Greenshank is listed as Migratory Marine under the EPBC Act. The Common Greenshank has long greenish legs and extensive white on tail, rump and lower back. It is a noisy, large heavy wading bird that is a common to uncommon migrant from Asia to coastal mudflats, estuaries, salt marshes, mangroves, lakes and swamps throughout Australia.

The DBCA Threatened Fauna Database returned 21 records from a 5 km radial search of the Common Greenshank. The survey area contains an area of artificial wetland; however, all the records are from Alcoa / Wellard Wetland which is located approximately 2.5 km south-west of the survey area, or Baldivis Ski park which adjacent to the survey area. As such the Common Greenshank is considered Unlikely to occur in the survey area.

5.2 Fauna habitat

Three broad fauna habitats were identified and delineated from fauna habitat assessments and were considered to be in Degraded condition. The three habitats comprised:

- Eucalyptus /Melaleuca open woodland Melaleuca Woodland
- Artificial Wetland.

The remaining areas were all considered to consist of non-endemic eucalypts, cleared and degraded areas, which provide little to no habitat for native fauna species.

5.2.1 Eucalyptus /Melaleuca open woodland

This habitat comprises mainly of a single strata that variably comprises an open overstorey of Marri and Flooded Gum trees with intermittent Melaleuca. Marri occur in fewer numbers than the flooded gum and Melaleuca reflecting the proximity of groundwater to the surface. In the area associated with the drainage line/waterway, this habitat occurs over a midstorey that comprises species including Peppermint (*Agonis flexuosa)* over an understorey of mixed weedy grassland.

The large Marri trees provide potential breeding and foraging habitat for Black Cockatoos. In small areas this habitat has vegetation in multiple strata (canopy and mid-storey), a small amount of woody debris and leaf litter provides habitat for small reptile, bird and mammal species. However, as this patch is for the most part fragmented and isolated, fauna movement is therefore limited, particularly for the less mobile groups such as small reptiles and mammals.

5.2.2 Melaleuca woodland

This habitat typically consisted of *Melaleuca rhaphiophylla* isolated trees over a groundstorey of weedy grass species. There is generally a low diversity of microhabitats with few logs, debris, and hollows provided by the vegetation, making it unsuitable for many fauna, particularly hollow using fauna.

5.2.3 Artificial wetlands

The artificial wetlands are small areas of water that are likely to have formed from local construction in the past. These are now inundated and provide habitat to wetland fauna including amphibian species such as the Clicking Frog (*Crinia glauerti*) and Motorbike Frog (*Litoria moorei*), both of which were recorded during the field survey. As well as waterbirds including the Pacific Black Duck (*Anas superciliosa*), Australian Wood Duck (*Chenonetta jubata*) and Australian Shelduck (*Tadorna tadornoides*). The artificial wetlands also provide habitat for conservation significant species including the Glossy Ibis which was recorded in this habitat.

It is important to note however, that these wetland areas are artificial and there are a number of natural wetland areas within the vicinity, including the Wellard Wetlands which is 2.5 km from the survey area. This wetland provides more suitable habitat for wetland fauna, particularly avifauna, as shown by many of the DBCA records being from Wellard.

5.3 Black Cockatoo habitat assessment

5.3.1 Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

The FRTBC is listed as Vulnerable under the EPBC Act and BC Act. The FRTBC was returned from the EPBC PMST, NatureMap and DBCA searches and was observed during the field assessment.

The FRTBC is distributed through the humid and subhumid south-west of WA from Gingin through the Darling Ranges to the south-west from Bunbury to Albany. It occasionally occurs in the southern Swan Coastal Plain, and rarely in the Perth metropolitan area. The FRTBC occurs in pairs or small flocks, or occasionally large flocks of up to 200 birds (Johnstone & Storr 1998). The FRBC inhabits dense Jarrah, Karri and Marri forests that receive more than 600 mm average annual rainfall.

The FRTBC feeds primarily on Marri and Jarrah fruit (Johnstone & Kirkby 1999) and to a lesser extent on Blackbutt (*Eucalyptus patens*), Albany Blackbutt (*Eucalyptus staeri*), Karri, Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*). FRTBC can obtain energy faster when feeding on Marri and Jarrah than other food sources (Cooper *et al.* 2002) and these two plant species make up 90% of the diet of the FRTBC.

The DBCA threatened fauna database returned seven records of FRTBC and six individuals were observed during the assessment feeding on Marri nuts in the south-east corner of the survey area.

5.3.2 Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)

Baudin's Black Cockatoo is listed as Endangered under the EPBC Act and BC Act. Baudin's Black Cockatoo was returned from the EPBC PMST, however it was not recorded during the field assessment.

Baudin's Black Cockatoo is distributed through the south-western humid and subhumid zones, from the northern Darling Range and adjacent far east of the SCP (south of the Swan River), south to Bunbury and across to Albany (Johnstone & Kirkby 2011). Baudin's Black Cockatoo rarely occurs near the coast north of Mandurah, and rarely occurs north of the Swan River (Johnstone & Kirkby 2008, Johnstone & Storr 1998). Baudin's Black Cockatoo usually occur in small flocks of up to 30, or occasionally up to 50 and rarely in aggregations of up to 1200 (Johnstone & Kirkby 2008). Baudin's Black Cockatoo is distinguished from Carnaby's Black Cockatoo by its longer bill and slightly different call.

This species forages primarily in Eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds of Eucalypt, Banksia, Hakea and Pines (*Pinus* sp.) as well as fruiting apples and pears and beetle larvae from under the bark of trees (Johnstone & Kirkby 2008, Johnstone & Storr 1998). Baudin's Black Cockatoo forages at all levels of the forest from the canopy to the ground, often feeding in the understorey on proteaceous trees and shrubs, especially Banksia, and in orchards both in trees and on dropped or fallen fruit on the ground.

The breeding biology of this species is poorly known. It has been recorded breeding in deep south-west, north to the Whicher Range and Lowden and also isolated records at Wungong Catchment, Serpentine (hills area) and east to Kojonup and near Albany (Johnstone & Kirkby 2008). They nest in large, mostly vertical, hollows of Karri (*E. diversicolor*), Marri, Wandoo, and Bullich (*E. megacarpa*). Baudin's Black Cockatoos display strong pair bonds are monogamous and most likely mate for life (Johnstone & Kirkby 2008). The pair remain together all year round except when the female is incubating and brooding. Both adults play a part in selecting the nest hollow, but only the female is responsible for renovation and preparing the hollow for breeding. Preparation of the hollow consists of chewing around the entrance of the hollow and down one part of the interior wall. Pairs have also been recorded prospecting for hollows in most months and also outside the breeding range (Johnstone & Kirkby 2008).

The DBCA threatened fauna database returned no records of Baudin's Black Cockatoo from within 5 km of the survey area. however, the survey area does contain species including Marri which provide suitable foraging and breeding habitat. Given that these species are all highly mobile, Baudin's Black Cockatoo is considered as Likely to occur in the survey area.

5.3.3 Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black Cockatoo is listed as Endangered under both the EPBC Act and the BC Act. Carnaby's Black Cockatoo was returned from the EPBC PMST, NatureMap and DBCA searches, however it was not observed during the field assessment.

Carnaby's Cockatoo is endemic to south-west WA, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale 2003). The species was once common, but the population has declined significantly in the last half century, and is now locally extinct in some areas (Johnstone & Storr 1998; Shah 2006). In the last 45 years (prior to Cale 2003) the species has suffered a 50% reduction in its abundance (Cale 2003). More recent information

suggests this decline has continued. This reduction is due to the clearing of core breeding habitat in the wheatbelt, the deterioration of nesting hollows, and clearing of food resources on the Swan Coastal Plain (SCP) (Cale 2003). The total population of Carnaby's Cockatoo was estimated to be 40,000 (Johnstone & Kirkby 2008) in 2008. Since then, trend analyses of the seven Great Cocky Counts 2010 – 2016 identified strong indications that the population of Carnaby's Black-Cockatoo inhabiting the Perth-Peel Coastal Plain continues to decline.

Carnaby's Black Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants. Food plants include Banksia (including those previously included in the genus Dryandra), Pine trees (*Pinus* sp.), Marri, Jarrah, Grevillea, Allocasuarina, and Hakea species (Shah 2006). Marri nuts that are damaged extensively, especially on the main body of the nut, are likely to have been chewed by Carnaby's Black Cockatoo or Forest Red-tailed Black Cockatoos. The severed new growth, developing flower heads and chewed seed pods of Banksia species are also a good indicator of Black Cockatoo feeding. Recent damage to bark is regarded as Black Cockatoo feeding activity along with the stripping of pine needles and cones (Cale 2003).

The seeds from seed pods of Banksia and the cones of Pine trees provide the highest energetic yield (Cooper *et al.* 2002). Carnaby's Black Cockatoo are less efficient at extracting Marri seeds than (the long-billed) Baudin's Black Cockatoo (Cooper *et al.* 2002).

Breeding has been recorded from early July to mid-December, and primarily occurs in the wheatbelt in the semi-arid and subhumid interior (Johnstone & Storr 1998). Carnaby's Black Cockatoo was not observed during the assessment, however the survey area is located within the known distribution of this species and the vegetation contains species such as Marri which provide suitable foraging and breeding habitat. The DBCA threatened fauna database returned 167 records of the Carnaby's Black Cockatoo and as such the species is considered Likely to occur in the survey area.

5.3.4 Foraging habitat

The total area of foraging habitat present in the survey area is 32.63 ha (5.5%). The majority of this is considered to be representative of Poor quality, with some areas identified as being of Poor – Moderate quality. The low overall density of foraging species across this area reflects the poor quality of the habitat. Smaller, isolated areas have denser cover; however, these are limited, and separated by large areas with little or no foraging habitat value.

The foraging habitat present consisted primarily of flooded gum and Marri trees. Foraging habitat also consisted of species including *Allocasuarina* sp. a known dietary item of all three Black Cockatoo species (Johnstone & Kirkby 2011).

The FRTBC was observed feeding on Marri fruit in the survey area and evidence in the way of chewed marri fruit was recorded.

5.3.5 Breeding habitat

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone *et al.* 2013). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support Black Cockatoo breeding (SEWPaC 2012).

The Black Cockatoo habitat assessment revealed that the survey area contains Marri and Flooded Gum trees which have reached a size that are considered to be potential future hollow bearing

trees, therefore potential breeding trees (>500 mm DBH) according to the EPBC Act Black Cockatoo referral guidelines.

In total, 13 trees were recorded which met the criteria to be classed as a potential breeding trees. The potential breeding habitat consisted of Marri trees. Although a number of Flooded Gum trees were recorded with a DBH of greater than 500 mm, their low branching form made them unsuitable to be considered as suitable Black Cockatoo breeding habitat.

This can be highlighted by a paper by Johnstone & Kirkby (2013) which looked at FRTBC breeding hollow dimensions. They found that most nests are in very large and very old, mature Marri throughout the FRTBC range. Nest trees of all species had a mean circumference at breast height of 2.79 m, a mean estimated age of 222 years and a mean overall height of 20.24 m. Marri nest trees had a mean circumference at breast height of 2.76 m, a mean estimated age of 220 years (95% confidence limit 209–231 years) and an average overall height of 20.04 m. A wide range of hollow types, defined by position of the hollow in the tree, were found. Hollow aspects were also diverse. The mean height to a hollow was 14.49 m. Mean hollow depth was 1.44 m, mean floor space (the longest linear distance across the bottom of the hollow) was 33.2 cm and the mean hollow entrance area was 30 x 34 cm (Johnstone & Kirkby 2013).

Trees with a DBH of >500 mm suggests that these trees may develop hollows and have the potential to be use for breeding in the future. In order to be suitable for Black Cockatoos, the hollow entrances need to be greater than 120 mm diameter. No observable hollows large enough at their entrances to be considered as potential breeding hollows in the future, were recorded in the survey area.

6. Conclusion

A total of three broad fauna habitats were recorded in the survey area; Eucalypt Remnants, Melaleuca Woodland and Artificial Wetland. All habitats recorded within the survey area are considered to be in Degraded condition, widespread, common and of limited significance.

During the field survey, four conservation significant species were recorded; the Glossy Ibis, White-bellied Sea-eagle, Forest Red-tailed Black Cockatoo and the Southern Brown Bandicoot.

The survey identified 13 potential Black Cockatoo breeding trees, consisting of isolated Marri trees. None of these trees contained suitable hollows for breeding.

The FRTBC was observed feeding on Marri fruits in the survey area and evidence in the way of chewed Marri fruits was recorded. The total area of foraging habitat for Black Cockatoo species in the survey area is 32.63 ha. The majority of this is considered to be representative of Poor quality, with some areas identified as being of Poor – Moderate quality. The low overall density of foraging species across this area reflects the poor quality of the habitat. Smaller, isolated areas have denser cover; however, these are limited, and separated by large areas with little or no foraging habitat value.

The foraging habitat present consisted primarily of flooded gum and Marri trees. Due to the degraded and isolated extent of foraging habitat in the survey area, it is considered to be of limited value for Black Cockatoos.

The loss of Black Cockatoo habitat in the survey area is expected to be minor at a local and regional scale. These species are nomadic and are not wholly dependent on the habitats existing in the survey area for foraging or breeding. The potential impacts are not considered to be significant given the relatively small area of clearing involved and the degraded state of suitable foraging habitat types, along with the large expanses of better quality habitat in nearby state forest and reserve areas (including and not limited to Bush Forever sites; BF: 70, BF: 349 and BF: 368).

7. Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen-JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen-JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen-JBS&G has also not attempted to determine whether any material matter has been omitted from the data. Strategen-JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen-JBS&G. The making of any assumption does not imply that Strategen-JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen-JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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Appendix A Codes and terms used to describe species of conservation significance

Conservation Codes for Flora and Fauna of Conservation Significance

Flora and fauna may be protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Additionally, under the *Biodiversity Conservation Act* (2016) the Minister for the Environment may declare species of flora and fauna to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection. The following presents the different rankings and listings used to describe conservation status:

CR Critically Endangered

Taxa that is considered to be facing an extremely high risk of extinction in the wild in the immediate future.

En Endangered

Taxa that is considered to be facing a very high risk of extinction in the wild in the near future.

Vu Vulnerable

Taxa that is considered to be facing a high risk of extinction in the wild in the medium-term future.

Mi Migratory

Species that migrate to, over and within Australia and its external territories.

Appendix B Fauna database searches

NAME_SCI	FAMILY	GENUS	SPECIES	SUB SPECIES	NAME_COM	CONS CODE	CERTAINTY	METHOD	TYPE	COUNT	LOCALITY	SITE	GDA_LONG	GDA_LAT	YEAR
Calyptorhynchus sp. 'wh	Cacatuidae	Calyptorhynchus	sp. 'white-tailed black cockatoo'		white-tailed black cockatoo	EN	Moderately Certain	Observational	Sighting	1	OLDBURY	OLDBURY	115.91810000000	-32.24880000000	1978
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	OLDBURY	OLDBURY	115.91810000000	-32.24880000000	1977
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	OLDBURY	OLDBURY	115.91810000000	-32.24880000000	1978
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	OLDBURY	OLDBURY	115.91810000000	-32.24880000000	1979
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	OLDBURY	OLDBURY	115.91810000000	-32.24880000000	1980
Plegadis falcinellus	Threskiornithidae	Plegadis	falcinellus		glossy ibis	IA	Moderately Certain	Observational	Sighting	1	OLDBURY	OLDBURY	115.91810000000	-32.24880000000	1978
Plegadis falcinellus	Threskiornithidae	Plegadis	falcinellus		glossy ibis	IA	Moderately Certain	Observational	Sighting	1	OLDBURY	OLDBURY	115.91810000000	-32.24880000000	1978
Plegadis falcinellus	Threskiornithidae	Plegadis	falcinellus		glossy ibis	IA	Moderately Certain	Observational	Sighting	1	OLDBURY	OLDBURY	115.91810000000	-32.24880000000	1979
Apus pacificus	Apodidae	Apus	pacificus		fork-tailed swift	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83840000000	-32.30410000000	2000
Calidris acuminata	Scolopacidae	Calidris	acuminata		sharp-tailed sandpiper	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30490000000	2005
Calidris acuminata	Scolopacidae	Calidris	acuminata		sharp-tailed sandpiper	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83480000000	-32.30430000000	2010
Calidris ferruginea	Scolopacidae	Calidris	ferruginea		curlew sandpiper	VU & IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85670000000	-32.29000000000	2001
Calidris ruficollis	Scolopacidae	Calidris	ruficollis		red-necked stint	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85760000000	-32.28990000000	2000
Calidris ruficollis	Scolopacidae	Calidris	ruficollis		red-necked stint	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85790000000	-32.28880000000	2000
Calidris ruficollis	Scolopacidae	Calidris	ruficollis		red-necked stint	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85670000000	-32.29000000000	2001
Calidris ruficollis	Scolopacidae	Calidris	ruficollis		red-necked stint	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands, Baldivis	115.85760000000	-32.28990000000	2000
Calidris ruficollis	Scolopacidae	Calidris	ruficollis		red-necked stint	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30490000000	2005
Calidris ruficollis	Scolopacidae	Calidris	ruficollis		red-necked stint	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Lake Wellard	115.83830000000	-32.30440000000	2007
Calidris ruficollis	Scolopacidae	Calidris	ruficollis		red-necked stint	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83480000000	-32.30430000000	2010
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands	115.83670000000	-32.29940000000	2011
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83480000000	-32.30430000000	2012
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83480000000	-32.30430000000	2010
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands	115.83670000000	-32.29940000000	2013
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Observational	Sighting	1	MARDELLA	Lowlands	115.90150000000	-32.33380000000	1999
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Observational	Sighting	1	BALDIVIS	Lake Wellard	115.83830000000	-32.30440000000	2009
Falco peregrinus	Falconidae	Falco	peregrinus		peregrine falcon	OS	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83840000000	-32.30410000000	2000
Falco peregrinus	Falconidae	Falco	peregrinus		peregrine falcon	OS	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83840000000	-32.30410000000	1999
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83790000000	-32.30520000000	1999
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30410000000	2001
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands, Baldivis	115.83920000000	-32.30070000000	2001
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands, Baldivis	115.83900000000	-32.29880000000	2001
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83840000000	-32.30410000000	1998
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30410000000	2002
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83840000000	-32.30410000000	1999
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30410000000	2003
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Westlands Baldavis	115.83730000000	-32.30160000000	2005
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard	115.83840000000	-32.30490000000	2004
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30490000000	2005
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Lake Wellard	115.84060000000	-32.29930000000	2005
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Lake Wellard	115.83690000000	-32.30560000000	2006
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Lake Wellard	115.83830000000	-32.30440000000	2007
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83610000000	-32.30280000000	2006
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	WELLARD	Wellard Wetlands Baldivis	115.85150000000	-32.26550000000	2007
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	WELLARD	Wellard Wetlands Baldivis	115.85000000000	-32.26670000000	2007
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	WELLARD	Wellard Wetlands Baldi Vis	115.85000000000	-32.26670000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	WELLARD	Wellard Wetlands Baldnis	115.85000000000	-32.26670000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	WELLARD	Wellard Wetlands	115.85000000000	-32.26670000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	WELLARD	Wellard Wetlands	115.85000000000	-32.26670000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BERTRAM	Wellard Wetlands	115.85000000000	-32.25000000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	WELLARD	Wellard Wetlands Baldivis	115.85000000000	-32.26670000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	WELLARD	Wellard Wetlands Baldivis	115.85000000000	-32.26670000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellards Lagoon	115.83810000000	-32.30670000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetland	115.83930000000	-32.30490000000	2006
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetland	115.83930000000	-32.30490000000	2006
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.85000000000	-32.30000000000	2006
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa Wellard Wetlands	115.83810000000	-32.29970000000	2007
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands	115.83670000000	-32.29940000000	2010
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands east side	115.84250000000	-32.30110000000	2010
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands	115.83670000000	-32.29940000000	2011
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83480000000	-32.30430000000	2012
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands	115.83670000000	-32.29940000000	2013
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83950000000	-32.29960000000	2000
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Lake Wellard	115.83830000000	-32.30440000000	2008
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83330000000	-32.30560000000	2010

Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83840000000	-32.30410000000	1999
Thalasseus bergii	Laridae	Thalasseus	bergii		crested tern	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83480000000	-32.30430000000	2012
Tringa glareola	Scolopacidae	Tringa	glareola		wood sandpiper	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85670000000	-32.29170000000	2001
Tringa glareola	Scolopacidae	Tringa	glareola		wood sandpiper	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands east side	115.84250000000	-32.30110000000	2010
Tringa glareola	Scolopacidae	Tringa	glareola		wood sandpiper	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands	115.83670000000	-32.29940000000	2011
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83790000000	-32.30520000000	1999
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85760000000	-32.28990000000	2000
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30410000000	2001
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85670000000	-32.29000000000	2001
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands, Baldivis	115.85760000000	-32.28990000000	2000
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85760000000	-32.28990000000	2000
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30410000000	2002
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Water Ski Park, Baldivis	115.85670000000	-32.29170000000	2001
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Welland Wetlands	115.83840000000	-32.30490000000	2002
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetland	115.83840000000	-32.30490000000	2002
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Westlands Baldavis	115.83730000000	-32.30160000000	2005
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Baldavid Ski Park	115.85930000000	-32.28850000000	2005
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83840000000	-32.30490000000	2005
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Baldins water ski	115.85760000000	-32.28990000000	2005
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.85000000000	-32.30000000000	2006
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands	115.83670000000	-32.29940000000	2008
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands	115.83670000000	-32.29940000000	2010
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands east side	115.84250000000	-32.30110000000	2010
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	wellard wetlands east side	115.84250000000	-32.30110000000	2010
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Wellard Wetlands	115.83480000000	-32.30430000000	2010
Tringa nebularia	Scolopacidae	Tringa	nebularia		common greenshank, greenshank	IA	Moderately Certain	Observational	Sighting	1	BALDIVIS	Alcoa wetlands, Baldivis	115.83840000000	-32.30410000000	1999
Calyptorhynchus banksii	Cacatuidae	Calyptorhynchus	banksii	naso	forest red-tailed black cockatoo	VU	Certain	Survey	Unknown	10	BALDIVIS	Baldivis, Tamworth Reservoir	115.82110000000	-32.30770000000	2012
Calyptorhynchus banksii	Cacatuidae	Calyptorhynchus	banksii	naso	forest red-tailed black cockatoo	VU	Certain	Survey	Unknown	2	WELLARD	Casuarina, Banksia Road	115.88070000000	-32.26530000000	2015
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	6	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	32	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	12	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	13	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	6	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	4	BALDIVIS	Perth, Wellard	115.83930000000	-32.30450000000	2014
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	8	WELLARD	Casuarina, Banksia Road	115.88460000000	-32.26570000000	2015
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	3	WELLARD	Casuarina, Banksia Road	115.88280000000	-32.26580000000	2015
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	3	WELLARD	Casuarina, Banksia Road	115.88240000000	-32.26430000000	2015
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Survey	Unknown	1	WELLARD	Casuarina, Banksia Road	115.88220000000	-32.26490000000	2015
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	6	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	9	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	5	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	3	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	4	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	5	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	5	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	2	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	2	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	2	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	3	WELLARD	Wellard, Peter Carnley Angilcan (	115.81520000000	-32.25700000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	50	LEDA	Wellard, Leda Wetlands	115.81000000000	-32.26000000000	2010
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	12	WELLARD	Leda Wetland, Wellard,	115.81190000000	-32.25890000000	2011
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Bertram, Lot 4 and 67 Johnson Rc	115.84940000000	-32.23390000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84910000000	-32.23480000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84880000000	-32.23470000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84890000000	-32.23320000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84860000000	-32.23320000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84850000000	-32.23470000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	WAM Vouchered	Survey	Specimen	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84830000000	-32.23490000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84830000000	-32.23320000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84830000000	-32.23290000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84860000000	-32.23350000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84830000000	-32.23480000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84900000000	-32.23350000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	BERTRAM	Mandurah , Lot 4 and 67 Johnson	115.84840000000	-32.23450000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	3	WELLARD	Perth, Wellard	115.81190000000	-32.25900000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	7	WELLARD	Perth, Wellard	115.81190000000	-32.25900000000	2013

Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	LEDA	Perth, Wellard	115.81070000000	-32.26650000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	3	WELLARD	Perth, Wellard	115.81190000000	-32.25900000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	12	WELLARD	Perth, Wellard	115.81190000000	-32.25900000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	LEDA	Perth, Wellard	115.81070000000	-32.26650000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Wellard,	115.82900000000	-32.27110000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	4	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	25	WELLARD	Wellard, South of Wellard Train S	115.82010000000	-32.26550000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	LEDA	Kwinana, Perth, Durrant Ave	115.80520000000	-32.27350000000	2015
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	25	WELLARD	Wellard, Wellard	115.81820000000	-32.26690000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	1	WELLARD	Casuarina, Banksia Road	115.88240000000	-32.26430000000	2015
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	6	WELLARD	Casuarina, Banksia Road	115.88340000000	-32.26440000000	2015
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	3	WELLARD	Wellard, Wellard	115.81490000000	-32.26970000000	2015
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Unknown	5	WELLARD	Wellard, Wellard	115.81460000000	-32.26780000000	2016
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Caught or trapp(	5	WELLARD	Wellard	115.81460000000	-32.26780000000	2016
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Caught or trapp(	5	PARMELIA	Kwinana, Parmelia	115.82970000000	-32.25200000000	2016
Isoodon fusciventer	Peramelidae	Isoodon	obesulus	fusciventer	quenda, southern brown bandicoot	P4	Certain	Survey	Caught or trapp(	6	PARMELIA	Kwinana, Parmelia	115.82970000000	-32.25200000000	2016
Lerista lineata	Scincidae	Lerista	lineata		Perth slider, lined skink	P3	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Neelaps calonotos	Elapidae	Neelaps	calonotos		black-striped snake, black-striped bu	P3	Certain	Survey	Unknown	1	WELLARD	Casuarina, LOT 1320 LOT 53	115.88310000000	-32.26570000000	2013
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Certain	Survey	Unknown	14	BALDIVIS	Perth, Wellard	115.83890000000	-32.30150000000	2014
Oxyura australis	Anatidae	Oxyura	australis		blue-billed duck	P4	Certain	Survey	Unknown	6	BALDIVIS	Perth, Wellard	115.84300000000	-32.29910000000	2014
Westralunio carteri	Hyriidae	Westralunio	carteri		Carter's freshwater mussel	VU	Certain	Survey	Unknown	30	BALDIVIS	Peel Drain, Peel Drain	115.83700000000	-32.34000000000	2011
Calyptorhynchus banksii	Cacatuidae	Calyptorhynchus	banksii	naso	forest red-tailed black cockatoo	VU	Certain	Targeted survey	Day sighting	6	THE SPECTACLES	Thomas Road, Kwinana	115.84070000000	-32.23250000000	2000
Calyptorhynchus banksii	Cacatuidae	Calyptorhynchus	banksii	naso	forest red-tailed black cockatoo	VU	Certain	Targeted survey	Day sighting	4	WELLARD	Arundei Road, Wellard	115.86970000000	-32.26830000000	2003
Calyptorhynchus banksii	Cacatuidae	Calyptorhynchus	banksii	naso	forest red-tailed black cockatoo	VU	Moderately Certain	Opportunistic sighting	Day sighting	150	MARDELLA	In Tasmanian Blue gums next to h	115.90050000000	-32.31210000000	2015
Calyptorhynchus banksii	Cacatuidae	Calyptorhynchus	banksii	naso	forest red-tailed black cockatoo	VU	Moderately Certain	Opportunistic sighting	Day sighting	30	MARDELLA	in lemon-scented gums near hou	115.90190000000	-32.33510000000	2015
Calyptorhynchus banksii	Cacatuidae	Calyptorhynchus	banksii	naso	forest red-tailed black cockatoo	VU	Moderately Certain	Community survey	Dusk sighting	9	WELLARD	KWIWELR001	115.81190000000	-32.25930000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Community survey	Day sighting	167	OAKFORD	142 Cumming rd,	115.88580000000	-32.23390000000	2010
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Community survey	Day sighting	2	CASUARINA	Marri Park Golf Club 29 Surflin Ct	115.86720000000	-32.23360000000	2010
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Moderately Certain	Community survey	Day sighting	167	OAKFORD	Orton Rd and Cumming Rd, Oakf(	115.88530000000	-32.22920000000	2010
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Targeted survey	Day sighting	1200	WELLARD	Near Wellard	115.83890000000	-32.27140000000	2010
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Targeted survey	Day sighting	1	CASUARINA	Lavery Drive, Casuarina	115.88190000000	-32.24890000000	2006
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Targeted survey	Day sighting	1520	BALDIVIS	Karnup PP, corner of 68 and 80 rc	115.85140000000	-32.30830000000	2006
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Community survey	Day sighting	15	WELLARD	2013 Site code is KWIWELR001	115.81190000000	-32.25930000000	2012
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Community survey	Day sighting	16	WELLARD	2013 Site code is KWIWELR001	115.81190000000	-32.25930000000	2012
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Community survey	Day sighting	50	WELLARD	2013 Site code is KWIWELR001	115.81190000000	-32.25930000000	2013
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Community survey	Day sighting	40	BALDIVIS	2013 Site code is ROCBALR004	115.80560000000	-32.29690000000	2011
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Community survey	Day sighting	110	OAKFORD	2013 Site code is SEROAKR001	115.88580000000	-32.23390000000	2011
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	WELLARD	Wellard Road, Kwinana	115.81250000000	-32.25560000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Historical (written)	Day sighting	12	WELLARD	Wellard	115.85000000000	-32.26660000000	1941
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Historical (written)	Day sighting	12	WELLARD	Wellard	115.83330000000	-32.26660000000	1941
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Historical (written)	Day sighting	12	WELLARD	Wellard	115.85000000000	-32.26660000000	1941
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Historical (written)	Day sighting	12	WELLARD	Wellard	115.83330000000	-32.26660000000	1941
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.82660000000	-32.25800000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.82670000000	-32.25830000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.82700000000	-32.25790000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.82720000000	-32.25030000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.82730000000	-32.25760000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris		Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.82780000000	-32.24860000000	2009

Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.82850000000	-32.25300000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.82990000000	-32.25290000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.83020000000	-32.25280000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.83020000000	-32.25280000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	PARMELIA	Parmelia Drive, Parmelia	115.83140000000	-32.25130000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	12	PARMELIA	Parmelia Drive, Parmelia	115.83140000000	-32.25130000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	12	WELLARD	Miller & Woolcoot Rds area	115.86080000000	-32.27320000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	12	WELLARD	Miller & Woolcoot Rds area	115.86080000000	-32.27320000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	LEDA	Leda Nature Reserve, Leda	115.80810000000	-32.27660000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Monitoring	Secondary sign	1	BALDIVIS	Fifty Road, Baldivis	115.80900000000	-32.30850000000	2009
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	10	CASUARINA	Casuarina	115.86970000000	-32.23990000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	1	OAKFORD	Casuarina	115.88580000000	-32.23380000000	2010
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	6	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	6	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	10	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	10	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	10	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	50	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	50	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	150	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	150	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	63	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	63	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	72	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	72	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	20	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	20	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2005
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	23	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	23	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	20	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	20	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	34	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	34	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	40	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	40	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	47	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	47	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	63	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	63	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	47	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	47	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	50	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	50	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	44	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	44	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	120	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	120	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	77	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	77	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	150	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	150	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	2220	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	220	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	20	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004

Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	20	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	60	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	60	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	80	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	80	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	100	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	100	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	20	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	20	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	270	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	270	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	270	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	270	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	2	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	2	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	170	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	12	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	12	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	9	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	9	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	34	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	34	CASUARINA	Casuarina	115.87860000000	-32.22520000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	30	WELLARD	Braddock Road, Wellard	115.86310000000	-32.26910000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Survey	Day sighting	30	WELLARD	Braddock Road, Wellard	115.86310000000	-32.26910000000	2004
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Moderately Certain	Community survey	Day sighting	19	CASUARINA	Marri Park Golf Club 29 Surflin Ct	115.86720000000	-32.23350000000	2014
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Certain	Community survey	Day sighting	125	WELLARD	Henley Bushland between Henle	115.81190000000	-32.25930000000	2015
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	BALDIVIS	50 Powell Rd, Baldivis	115.85070000000	-32.34300000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	BALDIVIS	Bush blocks south west of MacNu	115.85050000000	-32.32380000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	BALDIVIS	MacNuts WA, 213 Doghill Rd Balc	115.85570000000	-32.31930000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	BALDIVIS	MacNuts WA, Macadamia orchar	115.85440000000	-32.31890000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	BALDIVIS	PP E end of Makin Rd, Baldivis	115.85320000000	-32.31330000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	BALDIVIS	PP between Doghill Rd and Horsf	115.85160000000	-32.31110000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	BALDIVIS	Baldivis Reserve, Baldivis	115.81970000000	-32.30700000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	LEDA	Leda Nature Reserve.	115.80870000000	-32.27650000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	WELLARD	41 Nella Pl, Wellard	115.86370000000	-32.26810000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	WELLARD	Remant bush on PP to W of Wella	115.83200000000	-32.26690000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	LEDA	Runnymead Bushland	115.81070000000	-32.26560000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	WELLARD	Bushland to W of intersection b/\	115.88300000000	-32.26480000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	WELLARD	Henley Bushland	115.81180000000	-32.25860000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	WELLARD	Remnant bush on PP b/w Casuari	115.87230000000	-32.25800000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	WELLARD	Remnant Bush, Bertram Rd, Well	115.83660000000	-32.25640000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	CASUARINA	319 - 343 Mortimer Rd, Wellard.	115.88000000000	-32.25530000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	WELLARD	King's College school, 170 Bertrar	115.83990000000	-32.25320000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	CASUARINA	Bushland to north of Mortimer R	115.86220000000	-32.25300000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	OLDBURY	Banksia Nature Reserve, Oldbury	115.88920000000	-32.25240000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	CASUARINA	105 Lavery Dr, Oakford	115.88370000000	-32.24620000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	CASUARINA	Bushland surrounding Casuarina	115.87050000000	-32.24160000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	OLDBURY	12 Tunney Rd, Oldbury	115.89460000000	-32.23790000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	CASUARINA	158 Orton Rd, Casuarina. Incl SE c	115.86530000000	-32.23690000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	OAKFORD	105-142 Cumming Rd, Oakford. P	115.88920000000	-32.23170000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	CASUARINA	N end pf Marri Park Golf Course i	115.86850000000	-32.23090000000	2016
Calyptorhynchus latirost	Cacatuidae	Calyptorhynchus	latirostris	Carnaby's cockatoo	EN	Very Certain	Regular monitoring	Remote sensing	1	CASUARINA	87 Newbold Rd, Casuarina	115.88100000000	-32.23050000000	2016
Calyptorhynchus sp. 'wh	Cacatuidae	Calyptorhynchus	sp. 'white-tailed black cockatoo'	white-tailed black cockatoo	EN	Certain	Opportunistic sighting	Day sighting	16	WELLARD	125 Braddock Rd, Wellard, east si	115.87110000000	-32.27170000000	2015
Dasyurus geoffroii	Dasyuridae	Dasyurus	geoffroii	chuditch, western quoll	VU	Certain	Survey	Caught or trapp(	1	MARDELLA	Lowlands property near Serpenti	115.91270000000	-32.31670000000	2000
Dasyurus geoffroii	Dasyuridae	Dasyurus	geoffroii	chuditch, western quoll	VU	Certain	Survey	Caught or trapp(	1	MARDELLA	Lowlands property (LL2)	115.90610000000	-32.31620000000	2000
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Opportunistic sighting	Sighting	0	CASUARINA	Lot 59 Mortimer Rd, Wellard.	115.86020000000	-32.25570000000	1974
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Survey	Caught or trapp(	6	PARMELIA	Bushland opposite Sicklemore Rd	115.83800000000	-32.24130000000	2001

Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Survey	Caught or trappe	1	CASUARINA	Casuarina reserve 31874	115.87370000000	-32.24160000000	1990
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Survey	Caught or trappe	2	CASUARINA	Casuarina reserve 31874	115.87370000000	-32.24160000000	1990
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Survey	Caught or trappe	3	CASUARINA	Casuarina reserve 31874	115.87370000000	-32.24160000000	1990
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Survey	Caught or trappe	3	CASUARINA	Casuarina reserve 31874	115.87370000000	-32.24160000000	1990
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Survey	Caught or trappe	1	OLDBURY	Duckpond Bushland, cnr Mundijo	115.88600000000	-32.29020000000	2010
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Opportunistic sighting	Night sighting	1	BALDIVIS	18 Herbert Meander, Baldivis	115.82240000000	-32.30320000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	23	WELLARD	Near Peter Carnley Anglican Com	115.81220000000	-32.25690000000	2009
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	3	PARMELIA	14 Tuart Ridge	115.82520000000	-32.25590000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Dead	3	WELLARD	30 Shoulder Close	115.87820000000	-32.27420000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	5	CASUARINA	15 Surflin Court	115.86980000000	-32.23030000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	2	WELLARD	4 Spinner Lane	115.82610000000	-32.26860000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	3	CASUARINA	60 Lavery Drive	115.88030000000	-32.25030000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	1	BERTRAM	Kwinana Train Station	115.84250000000	-32.23510000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	3	WELLARD	27 Goldsmith Dive, Wellard	115.83220000000	-32.26690000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Night sighting	1	WELLARD	Near Barker Road & Balka Court,	115.87590000000	-32.26370000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	30	OLDBURY	391 Boomerang Rd, Oldbury	115.88880000000	-32.26870000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	1	WELLARD	1 Homestead Drive, Wellard	115.82700000000	-32.26000000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	8	CASUARINA	320 Marri Park Drive, Casuarina	115.87170000000	-32.22770000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Dead	1	WELLARD	284 Mortimer Rd, Wellard	115.87510000000	-32.25570000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	3	CASUARINA	26 Born Rd, Casuarina	115.87300000000	-32.25300000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Night sighting	1	OLDBURY	251 Boomerang Rd, Oldbury	115.90230000000	-32.26710000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	5	WELLARD	25 Homestead Drive, Wellard	115.82590000000	-32.26350000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	3	CASUARINA	Casuarina Prison officers carpark,	115.87820000000	-32.23840000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	3	CASUARINA	252 Marri Park Drive, Casuarina	115.87770000000	-32.23030000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	2	WELLARD	23 Goldsmith Drive, Wellard	115.83260000000	-32.26640000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Dead	1	BERTRAM	34 Cheltenham Loop, Bertram	115.84060000000	-32.24210000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Dead	12	WELLARD	44 Alexander Parkway, Wellard	115.87290000000	-32.26230000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	1	CASUARINA	Marri Park Golf Course, Casuarina	115.86620000000	-32.23380000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Night sighting	1	PARMELIA	25 Sicklemore Ave, Parmelia	115.83580000000	-32.24360000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Night sighting	2	BALDIVIS	40 Bearfoot Rd, Baldivis	115.85220000000	-32.31050000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	10	CASUARINA	8 Newbold Rd, Casuarina	115.87780000000	-32.22440000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	1	WELLARD	20 Blacksmith Drive, Wellard	115.83130000000	-32.27140000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	10	WELLARD	43 Barker Rd, Wellard	115.87540000000	-32.25790000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Dead	10	WELLARD	7 Wheelwright Gardens, Wellard	115.83020000000	-32.27080000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	4	WELLARD	5 Groom Mews, Wellard	115.83070000000	-32.26600000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Night sighting	1	BALDIVIS	18 Makin Rd, Baldivis	115.85260000000	-32.31300000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Dead	6	BERTRAM	22 Sanctuary Drive, Bertram	115.85060000000	-32.24440000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	12	WELLARD	178 Braddock Rd, Wellard	115.86220000000	-32.27110000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Dead	1	BERTRAM	Price Parkway, Bertram	115.84340000000	-32.24070000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	1	BALDIVIS	Lot 447 Telephone Lane, Baldivis	115.83710000000	-32.27690000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	1	WELLARD	25 Westcliff St, Wellard	115.82390000000	-32.26150000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	1	WELLARD	Wellard Train Station Carpark, W	115.81770000000	-32.26390000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Dead	4	CASUARINA	13 Woodland Place, Casuarina	115.87360000000	-32.22630000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	2	BERTRAM	40 Waterfields Drive, Bertram ne	115.84890000000	-32.23890000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	10	CASUARINA	54 Marri Park, Casuarina	115.87060000000	-32.23220000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Community survey	Day sighting	1	OLDBURY	313 King Road, Oldbury	115.90640000000	-32.24610000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	2	WELLARD	Blacksmith Drive, Wellard	115.83110000000	-32.27020000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	1	PARMELIA	Park near the intersections of We	115.82910000000	-32.25930000000	2012
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Dead	1	MARDELLA	Lightbody Rd Mardella near the ju	115.92550000000	-32.29450000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Dead	1	OLDBURY	Mundijong Rd Mardella; near the	115.92710000000	-32.29390000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Opportunistic sighting	Day sighting	1	CASUARINA	203 Marri Park Drive, Casuarina	115.87950000000	-32.23490000000	2015
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	1	WELLARD	3 Balka Court	115.87640000000	-32.26270000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	2	CASUARINA	15 Surflin Court	115.86990000000	-32.23050000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	3	WELLARD	28 Goldsmith Drive	115.83260000000	-32.26640000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	4	WELLARD	240 Mortimer Road	115.87100000000	-32.25570000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	4	CASUARINA	26 Born Road	115.87330000000	-32.25300000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	5	WELLARD	Lot 904 Balka Court	115.87760000000	-32.26390000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Opportunistic sighting	Day sighting	2	WELLARD	125 Braddock Rd, Wellard. On ea	115.87110000000	-32.27170000000	2015
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	1	MARDELLA	cnr. Lightbody & Mundijong Roac	115.92590000000	-32.29400000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	4	CASUARINA	15 Surflin Court	115.86990000000	-32.23060000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	3	WELLARD	240 Mortimer Road	115.87100000000	-32.25580000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	10	CASUARINA	13 Woodland Place	115.87360000000	-32.22650000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	6	CASUARINA	26 Born Road	115.87330000000	-32.25320000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Community survey	Day sighting	3	WELLARD	178 Braddock Road	115.86220000000	-32.27130000000	2014
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Moderately Certain	Opportunistic sighting	Dead	2	WELLARD	Lyndhurst Crescent, Wellard	115.81280000000	-32.26070000000	2013
Isoodon fusciventer	Peramelidae	Isoodon	fusciventer	quenda, southwestern brown bandic	P4	Certain	Survey	Caught or trappe	28	MARDELLA	Modong Nature Reserve	115.89800000000	-32.33530000000	2015

Lerista lineata	Scincidae	Lerista	lineata		Perth slider, lined skink	P3	Certain	Survey	Caught or trappe	3	OAKFORD	Modong Nature Reserve, SW cor	115.89400000000	-32.23580000000	1997
Notamacropus eugenii d	Macropodidae	Notamacropus	eugenii	derbianus	tammar wallaby	P4	Not Sure	Opportunistic sighting	Dead	1	OLDBURY	Corner of Munjigong Rd & Lite Bo	115.92530000000	-32.29370000000	2015
Notamacropus irma	Macropodidae	Notamacropus	irma		western brush wallaby	P4	Certain	Survey	Day sighting	3	WELLARD	Leda Nature Reserve, Town of Kw	115.81320000000	-32.27710000000	1989
Notamacropus irma	Macropodidae	Notamacropus	irma		western brush wallaby	P4	Certain	Community survey	Night sighting	1	CASUARINA	Eastern boundary of Casuarina R	115.87230000000	-32.23630000000	1999
Notamacropus irma	Macropodidae	Notamacropus	irma		western brush wallaby	P4	Certain	Survey	Day sighting	1	OLDBURY	Banksia Road Nature Reserve	115.88900000000	-32.25340000000	1974
Notamacropus irma	Macropodidae	Notamacropus	irma		western brush wallaby	P4	Certain	Historical (written)	Day sighting	2	OLDBURY	Flora and Fauan Reserve, Lot 442	115.88900000000	-32.25340000000	1967
Notamacropus irma	Macropodidae	Notamacropus	irma		western brush wallaby	P4	Certain	Opportunistic sighting	Day sighting	1	CASUARINA	Lot 20, Mortimer Rd, Casuarina. /	115.88400000000	-32.25270000000	2005
Phascogale tapoatafa wa	Dasyuridae	Phascogale	tapoatafa	wambenger	south-western brush-tailed phascoga	CD	Moderately Certain	Opportunistic sighting	Night sighting	2	OLDBURY	360 Bommerang road, Oldbury	115.89280000000	-32.26720000000	2013
Westralunio carteri	Hyriidae	Westralunio	carteri		Carter's freshwater mussel	VU	Very Certain	Survey	Caught or trappe	1	BALDIVIS	Peel Drain, Peel Estate; Baldivis;	115.83330000000	-32.30000000000	1905
Westralunio carteri	Hyriidae	Westralunio	carteri		Carter's freshwater mussel	VU	Very Certain	Survey	Caught or trappe	1	BALDIVIS	Birrega Drain, near confluence wi	115.87370000000	-32.33320000000	2010
Westralunio carteri	Hyriidae	Westralunio	carteri		Carter's freshwater mussel	VU	Very Certain	Survey	Caught or trappe	1	BALDIVIS	Collie River, 100 m downstream f	115.81750000000	-32.30220000000	2010
Westralunio carteri	Hyriidae	Westralunio	carteri		Carter's freshwater mussel	VU	Very Certain	Survey	Caught or trappe	1	BALDIVIS	Collie River, 100 m downstream f	115.81750000000	-32.30220000000	2010
Westralunio carteri	Hyriidae	Westralunio	carteri		Carter's freshwater mussel	VU	Very Certain	Survey	Caught or trappe	1	BALDIVIS	Collie River, 100 m downstream f	115.81750000000	-32.30220000000	2010

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 25/06/2018

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 52' 01" E,32° 17' 06" S
Buffer 5km
Group By Family

Family	Species	Records
Acanthizidae	6	252
Accipitridae	12	142
Agamidae	3	9
Anatidae	11	687
Anhingidae	1	62
Apodidae	1	1
Ardeidae	8	145
Artamidae	2	22
Burhinidae	1	1
Cacatuidae	1	40
Campephagidae	1	58
Canidae	1	1
Charadriidae	3	57
Columbidae	6	100
Corvidae	1	109
Cracticidae	4	175
Cuculidae	3	16
Dasyuridae	1	1
Dicaeidae	1	1
Dicruridae	3	280
Elapidae	7	20
Falconidae	4	51
Gekkonidae	1	1
Halcyonidae	2	78
Hirundinidae	4	101
Hylidae	2	4
Hyriidae	1	1
Laridae	4	13
Limnodynastidae	2	48
Lycosidae	1	1
Macropodidae	2	5
Maluridae	1	83
Meliphagidae	8	311
Meropidae	1	14
Muridae	2	13
Myobatrachidae	4	14
Nemesiidae	2	6
Neosittidae	1	3
Pachycephalidae	2	99
Pardalotidae	2	52
Pelecanidae	1	76
Peramelidae	1	41
Petroicidae	3	13
Phalacrocoracidae	5	213
Phalangeridae	1	2
Phasianidae	1	2
Podargidae	1	2
Podicipedidae	4	188
Procellariidae	1	2
Psittacidae	15	393
Pygopodidae	4	35
Rallidae	10	185
Recurvirostridae	3	53
Salticidae	1	1
Scincidae	14	244
Scolopacidae	7	48
Sparassidae	2	2
Sulidae	1	1
Sylviidae	2	52
Threskiornithidae	4	141
Turnicidae	1	2
Tytonidae	1	1
Varanidae	1	2
Vespertilionidae	1	2
Zosteropidae	1	77
TOTAL	**209**	**4855**

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Acanthizidae					
1.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
2.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
3.	24262	*Acanthiza inornata (Western Thornbill)*			
4.	25530	*Gerygone fusca (Western Gerygone)*			
5.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
6.	30948	*Smicrornis brevirostris (Weebill)*			
Accipitridae					
7.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
8.	24281	*Accipiter cirrocephalus subsp. cirrocephalus (Collared Sparrowhawk)*			
9.	25536	*Accipiter fasciatus (Brown Goshawk)*			
10.	24282	*Accipiter fasciatus subsp. fasciatus (Brown Goshawk)*			
11.	24285	*Aquila audax (Wedge-tailed Eagle)*			
12.	24288	*Circus approximans (Swamp Harrier)*			
13.		*Elanus axillaris*			
14.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
15.	25541	*Haliastur indus (Brahminy Kite)*			
16.	24295	*Haliastur sphenurus (Whistling Kite)*			
17.	24296	*Hamirostra isura (Square-tailed Kite)*			
18.	47965	*Hieraaetus morphnoides (Little Eagle)*			
Agamidae					
19.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
20.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
21.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
Anatidae					
22.	24312	*Anas gracilis (Grey Teal)*			
23.	24315	*Anas rhynchotis (Australasian Shoveler)*			
24.	24316	*Anas superciliosa (Pacific Black Duck)*			
25.		*Anser anser*			
26.	24318	*Aythya australis (Hardhead)*			
27.	24319	*Biziura lobata (Musk Duck)*			
28.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
29.	24322	*Cygnus atratus (Black Swan)*			
30.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
31.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
32.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
Anhingidae					
33.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
Apodidae					
34.	25554	*Apus pacificus (Fork-tailed Swift, Pacific Swift)*		IA	
Ardeidae					
35.	24337	*Ardea garzetta subsp. nigripes (Little Egret)*			
36.	25558	*Ardea ibis (Cattle Egret)*			
37.	41324	*Ardea modesta (great egret, white egret)*			
38.	24340	*Ardea novaehollandiae (White-faced Heron)*			
39.	24341	*Ardea pacifica (White-necked Heron)*			
40.		*Egretta garzetta*			
41.		*Egretta novaehollandiae*			
42.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
Artamidae					
43.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
44.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
Burhinidae					
45.	24359	*Burhinus grallarius (Bush Stone-curlew)*			
Cacatuidae					
46.		*Eolophus roseicapillus*			
Campephagidae					
47.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
Canidae					
48.	24040	*Vulpes vulpes (Red Fox)*	Y		
Charadriidae					
49.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
50.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
51.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Columbidae					
52.	24399	*Columba livia (Domestic Pigeon)*	Y		
53.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
54.	24409	*Phaps chalcoptera (Common Bronzewing)*			
55.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
56.	30951	*Streptopelia chinensis subsp. tigrina (Spotted Turtle-Dove)*	Y		
57.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
Corvidae					
58.	25592	*Corvus coronoides (Australian Raven)*			
Cracticidae					
59.	25595	*Cracticus tibicen (Australian Magpie)*			
60.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
61.	25596	*Cracticus torquatus (Grey Butcherbird)*			
62.	25597	*Strepera versicolor (Grey Currawong)*			
Cuculidae					
63.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
64.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
65.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
Dasyuridae					
66.	48070	*Phascogale tapoatafa subsp. wambenger (South-western Brush-tailed Phascogale, Wambenger)*		S	
Dicaeidae					
67.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
Dicruridae					
68.	24443	*Grallina cyanoleuca (Magpie-lark)*			
69.	48096	*Rhipidura albiscapa (Grey Fantail)*			
70.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
Elapidae					
71.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	
72.	25252	*Notechis scutatus (Tiger Snake)*			
73.	25253	*Parasuta gouldii*			
74.	25511	*Pseudonaja affinis (Dugite)*			
75.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
76.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
77.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
Falconidae					
78.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
79.	24472	*Falco cenchroides subsp. cenchroides (Australian Kestrel, Nankeen Kestrel)*			
80.	25623	*Falco longipennis (Australian Hobby)*			
81.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
Gekkonidae					
82.	24980	*Christinus marmoratus (Marbled Gecko)*			
Halcyonidae					
83.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
84.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
Hirundinidae					
85.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
86.	24491	*Hirundo neoxena (Welcome Swallow)*			
87.	48060	*Petrochelidon ariel (Fairy Martin)*			
88.	48061	*Petrochelidon nigricans (Tree Martin)*			
Hylidae					
89.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
90.	25388	*Litoria moorei (Motorbike Frog)*			
Hyriidae					
91.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
Laridae					
92.		*Chroicocephalus novaehollandiae*			
93.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
94.	25643	*Sterna hybrida (Whiskered Tern)*			
95.	48597	*Thalasseus bergii (Crested Tern)*		IA	
Limnodynastidae					
96.	25410	*Heleioporus eyrei (Moaning Frog)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
97.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
Lycosidae					
98.		*Dingosa serrata*			
Macropodidae					
99.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
100.	48022	*Notamacropus irma (Western Brush Wallaby)*		P4	
Maluridae					
101.	25654	*Malurus splendens (Splendid Fairy-wren)*			
Meliphagidae					
102.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
103.	24561	*Anthochaera carunculata (Red Wattlebird)*			
104.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
105.	24567	*Epthianura albifrons (White-fronted Chat)*			
106.	25661	*Lichmera indistincta (Brown Honeyeater)*			
107.	24583	*Manorina flavigula (Yellow-throated Miner)*			
108.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
109.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
Meropidae					
110.	24598	*Merops ornatus (Rainbow Bee-eater)*			
Muridae					
111.	24223	*Mus musculus (House Mouse)*	Y		
112.	24245	*Rattus rattus (Black Rat)*	Y		
Myobatrachidae					
113.	25399	*Crinia glauerti (Clicking Frog)*			
114.	25400	*Crinia insignifera (Squelching Froglet)*			
115.	25420	*Myobatrachus gouldii (Turtle Frog)*			
116.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
Nemesiidae					
117.		*Aname mainae*			
118.		*Aname tepperi*			
Neosittidae					
119.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
Pachycephalidae					
120.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
121.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
Pardalotidae					
122.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
123.	25682	*Pardalotus striatus (Striated Pardalote)*			
Pelecanidae					
124.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
Peramelidae					
125.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
Petroicidae					
126.	25693	*Microeca fascinans (Jacky Winter)*			
127.	48066	*Petroica boodang (Scarlet Robin)*			
128.	24659	*Petroica goodenovii (Red-capped Robin)*			
Phalacrocoracidae					
129.		*Microcarbo melanoleucos*			
130.	25697	*Phalacrocorax carbo (Great Cormorant)*			
131.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
132.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
133.	25699	*Phalacrocorax varius (Pied Cormorant)*			
Phalangeridae					
134.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
Phasianidae					
135.	24671	*Coturnix pectoralis (Stubble Quail)*			
Podargidae					
136.	25703	*Podargus strigoides (Tawny Frogmouth)*			
Podicipedidae					
137.	25704	*Podiceps cristatus (Great Crested Grebe)*			
138.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
139.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
140.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
Procellariidae					
141.	24693	*Pachyptila desolata (Antarctic Prion)*			
Psittacidae					
142.		*Barnardius zonarius*			
143.	25715	*Cacatua roseicapilla (Galah)*			
144.	25716	*Cacatua sanguinea (Little Corella)*			
145.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
146.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
147.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
148.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
149.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
150.	24738	*Neophema elegans (Elegant Parrot)*			
151.	25720	*Platycercus icterotis (Western Rosella)*			
152.	24747	*Platycercus spurius (Red-capped Parrot)*			
153.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
154.	25722	*Polytelis anthopeplus (Regent Parrot)*			
155.		*Purpureicephalus spurius*			
156.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
Pygopodidae					
157.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
158.	24999	*Delma grayii*			
159.	25005	*Lialis burtonis*			
160.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
Rallidae					
161.	25727	*Fulica atra (Eurasian Coot)*			
162.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
163.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
164.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
165.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
166.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
167.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
168.	25732	*Porzana pusilla (Baillon's Crake)*			
169.	24771	*Porzana tabuensis (Spotless Crake)*			
170.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
Recurvirostridae					
171.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
172.	25734	*Himantopus himantopus (Black-winged Stilt)*			
173.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
Salticidae					
174.		*Zebraplatys fractivittata*			
Scincidae					
175.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
176.	30893	*Cryptoblepharus buchananii*			
177.	25027	*Ctenotus australis*			
178.	25039	*Ctenotus fallens*			
179.	25100	*Egernia napoleonis*			
180.	25119	*Hemiergis quadrilineata*			
181.	25131	*Lerista distinguenda*			
182.	25133	*Lerista elegans*			
183.	25147	*Lerista lineata (Perth Slider, Lined Skink)*		P3	
184.	25184	*Menetia greyii*			
185.	25192	*Morethia obscura*			
186.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
187.	25519	*Tiliqua rugosa*			
188.	25207	*Tiliqua rugosa subsp. rugosa*			
Scolopacidae					
189.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
190.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
191.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
192.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
193.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
194.	24806	*Tringa glareola (Wood Sandpiper)*		IA	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
195.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	

Sparassidae

196.		*Holconia westralia*			
197.		*Isopeda leishmanni*			

Sulidae

198.	48008	*Morus serrator (Australasian Gannet)*			

Sylviidae

199.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
200.	25758	*Megalurus gramineus (Little Grassbird)*			

Threskiornithidae

201.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
202.	24842	*Platalea regia (Royal Spoonbill)*			
203.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
204.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			

Turnicidae

205.	48147	*Turnix varius (Painted Button-quail)*			

Tytonidae

206.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			

Varanidae

207.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			

Vespertilionidae

208.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			

Zosteropidae

209.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

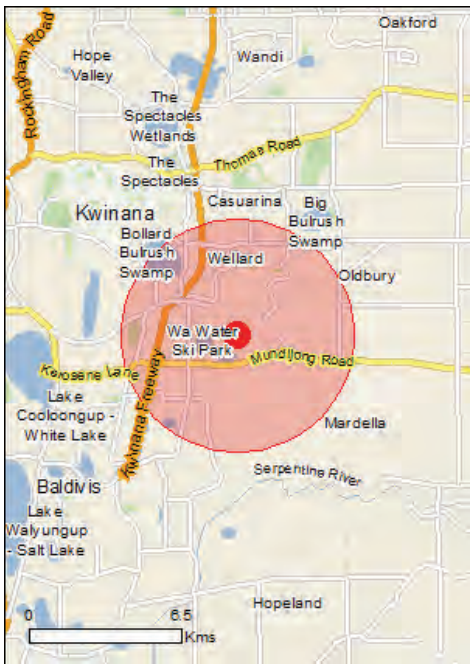
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 29/05/18 16:29:10



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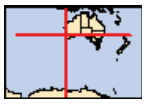
Coordinates
Buffer: 5.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	25
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Becher point wetlands	Within 10km of Ramsar
Forrestdale and thomsons lakes	Within 10km of Ramsar
Peel-yalgorup system	20 - 30km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat may occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat known to occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Banksia	WA
Leda	WA
Unnamed WA51784	WA

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.285 115.86694

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix C Fauna species list

AMPHIBIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DBCA = Department of Biodiversity, Conservation Attractions Priority Code, A = Listed in Naturemap, B= DBCA Threatened and Priority fauna search, C = EPBC Protected Matters search, D= Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

		Conservation Codes						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DBCA**	**A**	**B**	**C**	**D**
LIMNODYNASTIDAE								
Limnodynastes dorsalis	Western Banjo Frog				X			
MYOBATRACHIDAE								
Crinia glauerti	Clicking Frog				X			X
Crinia insignifera	Squelching Froglet				X			
Myobatrachus gouldii	Turtle Frog				X			
Pseudophyrne guentheri	Crawling Toadlet				X			
HYLIDAE								
Litoria adelaidensis	Slender Tree Frog				X			
Litoria moorei	Motorbike Frog				X			X

REPTILIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DBCA = Department of Biodiversity, Conservation Attractions Priority Code, A = Listed in Naturemap, B= DBCA Threatened and Priority fauna search, C = EPBC Protected Matters search, D= Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

		Conservation Codes						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DBCA**	**A**	**B**	**C**	**D**
CHELIDAE								
Chelodina colliei	South Western long-necked Turtle							X
GEKKONIDAE								
Christinus marmoratus	Marbled Gecko				X			
Hemidactylus frenatus	Asian house Gecko						X	
PYGOPODIDAE								
Delma fraseri	Fraser's Legless Lizard				X			
Delma grayii	Side-barred Delma				X			
Lialis burtonis	Burtons Snake Lizard				X			
Pletholax gracilis edelensis	Keeled Legless Lizard			P3	X			
SCINCIDAE								
Acritoscincus trilineatus	Western Three-lined Skink				X			
Cryptoblepharus buchanani	Buchanans snake-eyed skink				X			
Ctenotus australis	Western Limestone Ctenotus				X			
Ctenotus fallens	west Coast Ctenotus				X			
Ctenotus gemmula	Jewelled South-west Ctenotus (SCP popn)			P3	X			
Egernia napoleonis	South-western Crevice-Skink				X			
Hemiergis quadrilineata	Two-toed Earless Skink				X			
Lerista elegans	Elegant Slider				X			
Lerista lineata	Perth Slider			P3	X	X		
Menetia greyii	Common Dwarf Skink				X			
Morethia obscura	Shrubland Pale-flecked Morethia				X			
Tiliqua occipitalis	Western Bluetongue				X			
Tiliqua rugosa	Shingleback				X			
AGAMIDAE								
Ctenophorus adelaidensis	Western Heath Dragon				X			

		Conservation Codes						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DBCA**	**A**	**B**	**C**	**D**
Pogona minor minor	Dwarf Bearded Dragon				X			
VARANIDAE								
Varanus gouldii	sand Monitor				X			
ELAPIDAE								
Neelaps calonotos	Black-striped Snake			P3	X	X		
Notechis scutatus	Tiger Snake				X			
Parasuta gouldii	Goulds Snake				X			
Pseudonaja affinis	Dugite				X			
Pseudonaja mengdeni	Western Brown Snake				X			
Simoselaps bertholdi	Jan's Banded Snake				X			

AVIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DBCA = Department of Biodiversity, Conservation Attractions Priority Code, A = Listed in Naturemap, B= DBCA Threatened and Priority fauna search, C = EPBC Protected Matters search, D= Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

		Conservation Codes						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DBCA**	**A**	**B**	**C**	**D**
MEGAPODIIDAE								
Leipoa ocellata	Malleefowl	Vu					X	
PHASIANIDAE								
Coturnix pectoralis	Stubble Quail				X			
ANATIDAE								
Anas gracilis	Grey Teal				X			
Anas platyrhynchos	Mallard						X	
Anas rhynchotis	Australasian Shoveler				X			
Anas superciliosa	Pacific Black Duck				X			X
Anser anser	Greylag Goose				X			
Aythya australis	Hardhead				X			
Biziura lobata	Musk Duck				X			
Chenonetta jubata	Australian Wood Duck				X			X
Cygnus atratus	Black Swan				X			X
Malacorhynchus membranaceus	Pink-eared Duck				X			
Oxyura australia	Blue-billed Duck			P4	X	X		
Tadorna tadornoides	Australian Shelduck				X			X
PODICIPEDIDAE								
Podiceps cristatus	Great Crested Grebe				X			
Tachybaptus novaehollandiae	Australasian Grebe				X			
PHALACROCORACIDAE								
Phalacrocorax carbo	Great Cormorant				X			
Phalacrocorax melanoleucos	Little Pied Cormorant				X			
Phalacrocorax sulcirostris	Little Black Cormorant				X			
Phalacrocorax varius	Pied Cormorant				X			
BURHINIDAE								
Burhinus grallarius	Bush Stone-curlew				X			
SULIDAE								
Morus serrator	Australia Gannet				X			

Scientific Name	Common Name	EPBC	WC	DBCA	A	B	C	D
ANHINGIDAE								
Anhinga novaehollandiae	Australasian Darter				X			
PELECANIDAE								
Pelecanus conspicillatus	Australian Pelican				X			X
ARDEIDAE								
Ardea ibis	Cattle Egret	MiMa			X		X	
Ardea garzetta	Little Egret				X			
Ardea modesta	Eastern Great Egret	MiMa			X		X	
Egretta novaehollandiae	White-faced Heron				X			X
Ardea pacicia	White-necked Heron				X			
Botaurus poiciloptilus	Australasian Bittern	En	S1				X	
Nycticorax caledonicus	Rufous Night Heron				X			
RECURVIROSTRIDAE								
Cladorhynchus leucocephalus	Banded Stilt				X			
Himantopus himantopus	Black-winged Stilt				X			
Recurvirostra novaehollandiae	Red-necked Avocet	Ma			X			
CHARADRIIDAE								
Charadrius melanops	Black-fronted Dotterel				X			
Charadrius rubricollis	Hooded Plover			P4			X	
Charadrius ruficapillus	Red-capped Plover	Ma			X			
ROSTRATULIDAE								
Rostratula australis	Australian Painted Snipe	En					X	
SCOLOPACIDAE								
Limosa lapponica	Bar-tailed Godwit	CR	S3				X	
Actitis hypoleucos	Common Sandpiper	MiMa	S5		X		X	
Calidris acuminata	Sharp-tailed Sandpiper	MiMa	S5		X	X	X	
Calidris ferruginea	Curlew Sandpiper	CR, MiMa	S3		X	X	X	
Calidris melanotos	Pectoral Sandpiper	Ma	S5				X	
Tringa glareola	Wood Sandpiper	MiMa	S5			X		
Tringa nebularia	Common Greenshank	MiMa	S5		X	X	X	
Calidris canutus	Red Knot	MiMa	S5				X	
Calidris ruficollis	Red-necked Stint	MiMa	S5		X	X		
Calidris subminuta	Long-toed Stint	Ma	S5		X			
TURNICIDAE								
Turnix velox	Little Button-quail				X			
COLUMBIDAE								
Columba livia	Domestic Pigeon				X		X	
Ocyphaps lophotes	Crested Pigeon				X			X
Phaps chalcoptera	Common Bronzewing				X			
Streptopelia chinensis	Spotted Turtle-Dove				X		X	

Scientific Name	Common Name	EPBC	WC	DBCA	A	B	C	D
Streptopelia senegalensis	Laughing Dove				X		X	
PODARGIDAE								
Podargus strigoides	Tawny Frogmouth				X			
APODIDAE								
Apus pacificus	Fork-tailed Swift	MiMa			X	X	X	
PROCELLARIIDAE								
Pachyptila desolata	Antarctic Prion				X			
THRESKIORNITHIDAE								
Platalea flavipes	Yellow-billed Spoonbill				X			
Platalea regia	Royal Ibis				X			
Plegadis falcinellus	Glossy Ibis	Mi			X	X		X
Threskiornis moluccus	White Ibis							X
Threskiornis spinicollis	Straw-necked Ibis				X			X
ACCIPITRIDAE								
Accipiter cirrocephalus	Collared Sparrowhawk				X			
Accipiter fasciatus	Brown Goshawk				X			
Aquila audax	Wedge-tailed Eagle				X			
Circus approximans	Swamp Harrier				X			
Elanus axillaris	Black-shouldered Kite				X			
Haliaeetus leucogaster	White-bellied Sea Eagle	MiMa	S3		X		X	X
Haliastur indus	Brahminy Kite				X			
Lophoictinia isura	Square-tailed Kite				X			
Haliastur sphenurus	Whistling Kite				X			X
Pandion haliaetus	Osprey	Ma					X	
Hieraaetus morphnoides	Little Eagle				X			
FALCONIDAE								
Falco cenchroides	Australian Kestrel				X			
Falco longipennis	Australian Hobby				X			
Falco peregrinus	Peregrine Falcon		S7		X	X		
RALLIDAE								
Fulica atra	Eurasian Coot				X			
Gallinula tenebrosa	Dusky Moorhen				X			
Gallinula philippensis	Buff-banded Rail				X			
Porphyrio porphyrio bellus	Purple Swamphen				X			
Porzana pusilla	Ballions Crake				X			
Porzana tabuensis	Spotless Crake				X			
Tribonyx ventralis	Black-tailed Native-hen				X			
LARIDAE								
Chroicocephalus novaehollandiae	Silver Gull				X			
Sterna hybrida	Whiskered Tern				X			

Scientific Name	Common Name	EPBC	WC	DBCA	A	B	C	D
Chlidonias leucopterus	White-winged Black Tern	Mi			X			
Thalasseus bergii	Crested Tern				X	X		
PSITTACIDAE								
Cacatua roseicapilla assimilis	Galah				X			X
Cacatua sanguinea	Little Corella				X			
Cacatua tenuirostris	Eastern Long-billed Corella				X			
Calyptorhynchus banksii subsp. naso	Forest Red-tailed Black-Cockatoo	Vu			X	X	X	X
Calyptorhynchus baudinii	Baudin's Cockatoo	Vu					X	
Calyptorhynchus latirostris	Carnaby's Cockatoo	En			X	X	X	
Neophema elegans	Elegant Parrot				X			
Platycercus icterotis	Western Rosella				X			
Platycercus spurius	Red-capped Parrot				X			X
Platycercus zonarius	Australian Ringneck				X			X
Trichoglossus haematodus	Rainbow lorikeet				X			
CUCULIDAE								
Cacomantis flabelliformis	Fan-tailed Cuckoo				X			
Cacomantis pallidus	Pallid Cuckoo				X			
Chrysococcyx basalis	Horsefields Bronze Cuckoo				X			
TYTONIDAE								
Tyto alba subsp. Delicatula	Barn Owl				X			
HALCYONIDAE								
Dacelo novaeguineae	Laughing Kookaburra				X			
Todiramphus sanctus	Sacred Kingfisher				X			
MEROPIDAE								
Merops ornatus	Rainbow Bee-eater	Ma			X		X	
MALURIDAE								
Malurus splendens	Splendid Fairy-wren				X			
ACANTHIZIDAE								
Acanthiza apicalis	Inland Thornbill				X			
Acanthiza chrysorrhoa	Yellow-rumped Thornbill				X			
Acanthiza inornata	Western Thornbill				X			
Gerygone fusca	Western Gerygone				X			
Sericrornis brevirostris	Weebill				X			
Sericornis frontalis	White-browed Scrubwren				X			
PARDALOTIDAE								
Pardalotus punctatus	Spotted Pardalote				X			
Pardalotus striatus westraliensis	Striated Pardalote				X			
MELIPHAGIDAE								
Anthochaera carunculata	Red Wattlebird				X			X
Anthochaera lunulata	Western Little Wattlebird				X			

Scientific Name	Common Name	EPBC	WC	DBCA	A	B	C	D
Acanthorhynchus superciliosus	Western Spinebill				X			
Epthianura albifrons	White-fronted Chat				X			
Lichmera indistincta	Brown Honeyeater				X			X
Lichenostomus virescens	Singing Honeyeater							X
Manorina flavigula	Yellow-throated Miner				X			
Phylidonyris nigra	White-cheeked Honeyeater				X			
Phylidonyris novaehollandiae	New Holland Honeyeater				X			
PETROICIDAE								
Microeca fascinans	Jacky Winter				X			
Petroica boodang	Scarlet Robin				X			
Petroica goodenovii	Red-capped Robin				X			
NEOSITTIDAE								
Daphoenositta chrysoptera	Varied Sittella				X			
CAMPEPHAGIDAE								
Coracina novaehollandiae	Black-faced Cuckoo-shrike				X			X
PACHYCEPHALIDAE								
Colluricincla harmonica	Grey Shrike Thrush				X			
Pachycephala rufiventris	Rufous Whistler				X			
ARTAMIDAE								
Artamus cinereus	Black-faced Woodswallow				X			
Artamus cyanopterus	Dusky Woodswallow				X			
DICRURIDAE								
Grallina cyanoleuca	Magpie-lark				X			X
Rhipidura albiscapa	Grey Fantail				X			
Rhipidura leucophrys	Willie Wagtail				X			X
CRACTICIDAE								
Cracticus tibicen	Australian Magpie				X			X
Cracticus tibicen dorsalis	White-backed Magpie				X			
Cracticus torquatus	Grey Butcherbird				X			X
Strepera versicolor	Grey Currawong				X			
CORVIDAE								
Corvus coronoides	Australian Raven				X			X
ACROCEPHALIDAE								
Acrocephalus australis	Australian Reed-Warbler				X			
MEGALURIDAE								
Megalurus gramineus	Little Grassbird				X			
TIMALIIDAE								
Zosterops lateralis	Silvereye				X			
HIRUNDINIDAE								
Cheramoeca leucosterna	White-backed Swallow				X			

Scientific Name	Common Name	EPBC	WC	DBCA	A	B	C	D
Hirundo neoxena	Welcome Swallow				X			
Petrochelidon ariel	Fairy Martin				X			
Petrochelidon nigricans	Tree Martin				X			
TURDIDAE								
Turdus merula	Common Blackbird						X	
STURNIDAE								
Sturnus vulgaris	Common Starling						X	
Sturnus tristis	Common Myna						X	
NECTARINIIDAE								
Dicaeum hirundinaceam	Mistletoebird				X			
PASSERIDAE								
Passer domesticus	House Sparrow						X	
Passer montanus	Eurasian Tree Sparrow						X	

MAMMALIAN SPECIES RECORDED IN THE REGION

Key: EPBC = Environmental Protection and Biodiversity Conservation Act 1999, WC = Wildlife Conservation Act 1950, DBCA = Department of Biodiversity, Conservation Attractions Priority Code, A = Listed in Naturemap, B= DBCA Threatened and Priority fauna search, C = EPBC Protected Matters search, D= Current Survey

Note: For Definitions of Conservation Codes see Appendix A.

		Conservation Codes						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DBCA**	**A**	**B**	**C**	**D**
DASYURIDAE								
Dasyurus geoffroii	Western Quoll	Vu	S1			X	X	
phascogale tapoatafa wambenger	South-western Bush-tailed Phascogale	CD	S6		X	X		
PERAMELIDAE								
Isoodon obesulus	Southern Brown Bandicoot			P4	X	X		X
PSEUDOCHEIRIDAE								
Pseudocheirus occidentalis	Western Ringtail Possum	En	S1				X	
PHALANGERIDAE								
Trichosurus vulpecula	Common Brushtail Possum				X			
MACROPODIDAE								
Macropus fuliginosus	Western Grey Kangaroo				X			
Macropus eugenii derbanius	Tammar Wallaby (WA)			P5		X		
Macropus irma	Western Brush Wallaby			P4	X	X		
Setonix brachyurus	Quokka	Vu	S1				X	
VESPERTILIONIDAE								
Chalinolobus gouldii	Gould's Wattled Bat				X			
MURIDAE								
Mus musculus	House Mouse				X		X	
Rattus novegicus	Brown Rat						X	
Rattus rattus	Black Rat				X		X	
SCIURIDAE								
Funambulus pennantii	Northern Palm Squirrel						X	
CANIDAE								
Canis lupus	Domestic Dog						X	
Vulpes vulpes	Red Fox				X		X	
FELIDAE								
Felis catus	Cat						X	
LEPORIDAE								
Oryctolagus cuniculus	Rabbit						X	

		Conservation Codes						
Scientific Name	**Common Name**	**EPBC**	**WC**	**DBCA**	**A**	**B**	**C**	**D**
BOVIDAE								
Bos taurus	Cattle						X	

Appendix D Fauna Habitat Assessments

FAUNA HABITAT ASSESSMENT SHEET - STRATEGEN ENVIRONMENTAL

(South West)

Location: Wellard Farms	**Site Number: HA1**
Project Number: STO18278.01	

Date: 22/05/18	**Easting: 392578**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50	**Northing:6428077**		E	SE	W	**N/A**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description									
	Hummock Grassland	Other: Marri woodland		**Average Height in m**	**Cover**				
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Melaleuca rhaphiophylla*	**10**	0 <5%	**1 <20%**	2 20-60%	**3** 60-100%	
	Other Grassland	**Midstorey**			**0** <5%	1 <20%	2 20-60%	**3** 60-100%	
	Euc Woodland	**Ground Cover**	Introduced grasses	**<0.2**	**0** <5%	1 <20%	**2 20-60%**	3 60-100%	

	CONDITION						**LAST FIRE**			
Scale:	**5** Pristine	**4** Excellent	3 Very Good	2 Good	**1 Degraded**	**0** Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(sheep and cattle)**			
	0 heavy	1 medium	**2 mild**	3 none		**0 heavy**	1 medium	2 mild	3 none	

GROUND COVER

Bare Ground	**0** <5%	1 <20%	**2 20-60%**	**3** 60-100%	**Hummock Grass**	0 <5%	**1** <20%	**2** 20-60%	**3** 60-100%	
Rock	**0 <5%**	**1** <20%	**2** 20-60%	**3** 60-100%	**Other Grass**	0 <5%	**1** <20%	**2 20-60%**	3 60-100% *	
Leaf Litter	**0 <5%**	**1** <20%	2 20-60%	3 60-100%	**Herbs**	0 <5%	**1** <20%	**2** 20-60%	**3** 60-100%	
Logs >10cm	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%						

MICROHABITATS									
Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	**0 none**	1 rare	2 moderate	3 common
Pebbles Stones	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	0 >5km	1 2 5km	2 500m - 2km	**3 <500m**
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	0 none	**1 rare**	2 moderate	3 common

SPECIES			
Black Cockatoo Foraging Habitat			
Species:	**% cover**	**Hollows:**	
		Small (<120mm)	**0**
		Large (>120mm)	**0**

Birds	**Mammals**	**Reptiles**
Chewed Marri nuts (FRTBC)		

FAUNA HABITAT ASSESSMENT SHEET - STRATEGEN ENVIRONMENTAL

(South West)

Location: Wellard Farms	**Site Number: HA2**
Project Number: STO18278.01	
Date: 22/05/18	**Easting: 392863**
Quadrat Size: 50 x 50	**Northing: 6427575**

Aspect				
N	NE	SW	NW	
E	SE	W	**N/A**	

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description									
Hummock Grassland	Other: Marri woodland		**Average Height in m**	**Cover**				
Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
Riverine Woodland	**Overstorey**	*Eucalypt (non endemic)* *Casuarina obesa*	8	0 <5%	**1 <20%**	2 20-60%	**3** 60-100%	
Other Grassland	**Midstorey**			0 <5%	1 <20%	2 20-60%	**3** 60-100%	
Euc Woodland	**Ground Cover**	*Introduced grasses*	<0.3	0 <5%	1 <20%	**2 20-60%**	3 60-100%	

	CONDITION						**LAST FIRE**			
Scale:	**5** Pristine	**4** Excellent	3 Very Good	2 Good	**1 Degraded**	**0** Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**		(shep and cattle)		
0 heavy	**1 medium**	2 mild	3 none		**0 heavy**	1 medium	2 mild	3 none

GROUND COVER

Bare Ground	**0** <5%	1 <20%	**2 20-60%**	**3** 60-100%	**Hummock Grass**	**0 <5%**	**1** <20%	**2** 20-60%	**3** 60-100%	
Rock	**0 <5%**	**1** <20%	**2** 20-60%	**3** 60-100%	**Other Grass**	0 <5%	**1** <20%	**2 20-60%**	3 60-100% *	
Leaf Litter	**0** <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	**1** <20%	**2** 20-60%	**3** 60-100%	

Logs >10cm	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%						

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	0 none	**1 rare**	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	0 >5km	1 2 5km	2 500m - 2km	**3 <500m**
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	**0 none**	1 rare	2 moderate	3 common

SPECIES

Black Cockatoo Foraging Habitat

Species:	**% cover**	**Hollows:**	
		Small (<120mm)	**0**
		Large (>120mm)	**0**

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET - STRATEGEN ENVIRONMENTAL

(South West)

Location: Wellard Farms	**Site Number: HA3**
Project Number: STO18278.01	

Date: 22/05/18	**Easting: 393011**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50	**Northing: 6427284**		E	SE	W	**N/A**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in m**	**Cover**				
	Hummock Grassland	Other: Marri woodland							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Eucalypt (non endemic) Casuarina obesa*	10	0 <5%	**1 <20%**	2 20-60%	**3** 60-100%	
	Other Grassland	**Midstorey**			**0** <5%	1 <20%	2 20-60%	**3** 60-100%	
	Euc Woodland	**Ground Cover**	*Introduced grasses*	1 m	**0** <5%	1 <20%	**2 20-60%**	3 60-100%	

	CONDITION						**LAST FIRE**			
Scale:	**5** Pristine	**4** Excellent	3 Very Good	2 Good	**1 Degraded**	**0** Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**			**(shep and cattle)**			
	0 heavy	1 medium	**2 mild**	3 none		**0 heavy**	1 medium	2 mild	3 none	

GROUND COVER

Bare Ground	**0** <5%	1 <20%	**2 20-60%**	3 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	0 <5%	1 <20%	**2 20-60%**	3 60-100% *	
Leaf Litter	**0** <5%	1 <20%	**2 20-60%**	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

Logs >10cm	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%						

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	0 none	**1 rare**	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	0 >5km	1 2 5km	2 500m - 2km	**3 <500m**
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	**0 none**	1 rare	2 moderate	3 common

SPECIES

Black Cockatoo Foraging Habitat

Species:	**% cover**	**Hollows:**	
		Small (<120mm)	**0**
		Large (>120mm)	**0**

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET - STRATEGEN ENVIRONMENTAL

(South West)

Location: Wellard Farms	**Site Number: HA4**
Project Number: STO18278.01	

Date: 22/05/18	**Easting: 393587**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50	**Northing: 6426475**		E	SE	W	**N/A**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description				**Average Height in m**	**Cover**				
	Hummock Grassland	Other: Marri woodland							
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Corymbia calophylla*	12	0 <5%	**1 <20%**	2 20-60%	**3** 60-100%	
	Other Grassland	**Midstorey**		3	**0** <5%	1 <20%	2 20-60%	**3** 60-100%	
	Euc Woodland	**Ground Cover**	*Introduced grasses*	1.5	0 <5%	1 <20%	2 20-60%	**3 60-100%**	

	CONDITION						**LAST FIRE**			
Scale:	**5** Pristine	**4** Excellent	3 Very Good	2 Good	**1 Degraded**	**0** Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**		**(sheep and cattle)**			
	0 heavy	1 medium	**2 mild**	3 none	**0 heavy**	1 medium	2 mild	3 none	

GROUND COVER

Bare Ground	**0** <5%	**1 <20%**	2 20-60%	**3** 60-100%	**Hummock Grass**	**0 <5%**	**1** <20%	**2** 20-60%	**3** 60-100%
Rock	**0 <5%**	**1** <20%	**2** 20-60%	**3** 60-100%	**Other Grass**	0 <5%	**1** <20%	**2** 20-60%	**3 60-100%**
Leaf Litter	**0** <5%	**1** <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	**1** <20%	**2** 20-60%	**3** 60-100%

Logs >10cm	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%						

MICROHABITATS									
Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	0 >5km	1 2 5km	2 500m - 2km	**3 <500m**
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	**0 none**	1 rare	2 moderate	3 common

SPECIES			
Black Cockatoo Foraging Habitat			
Species:	**% cover**	**Hollows:**	
1 x Marri >500 mm		Small (<120mm)	**0**
		Large (>120mm)	**0**

Birds	**Mammals**	**Reptiles**
Chewed Marri nuts (FRTBC) and FRTBC		
seen foraging underneath the Mari above		

FAUNA HABITAT ASSESSMENT SHEET - STRATEGEN ENVIRONMENTAL

(South West)

Location: Wellard Farms	**Site Number: HA5**
Project Number: STO18278.01	

Date: 22/05/18	**Easting: 393712**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50	**Northing: 6428151**		E	SE	W	**N/A**

Soil Texture	sand	sandy-loam	loam	cracking clay	**clay**

VEGETATION

Vegetation Description									
	Hummock Grassland	Other: Marri woodland		**Average Height in m**	**Cover**				
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Melaleuca rhaphiophylla*	**8**	0 <5%	**1 <20%**	2 20-60%	**3** 60-100%	
	Other Grassland	**Midstorey**			0 <5%	1 <20%	2 20-60%	3 60-100%	
	Euc Woodland	**Ground Cover**	*Inroduced grasses*	**<0.10**	0 <5%	1 <20%	2 20-60%	**3 60-100%**	

	CONDITION						**LAST FIRE**			
Scale:	**5** Pristine	**4** Excellent	3 Very Good	2 Good	**1 Degraded**	**0** Completely Degraded	0 <1 year	**1 1 -3 Yr**	2 4-5 Yr	3 >5 Yr

	(general)				**DISTURBANCE**		**(cattle)**			
	0 heavy	1 medium	**2 mild**	3 none		**0 heavy**	1 medium	2 mild	3 none	

GROUND COVER

Bare Ground	**0** <5%	**1 <20%**	2 20-60%	**3** 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%	
Rock	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%	**Other Grass**	0 <5%	1 <20%	**2** 20-60%	**3 60-100%**	
Leaf Litter	**0** <5%	1 <20%	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%	

Logs >10cm	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%						

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	0 >5km	1 2 5km	2 500m - 2km	**3 <500m**
Suitability for Bats	YES		**NO**		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	**0 none**	1 rare	2 moderate	3 common

SPECIES

Black Cockatoo Foraging Habitat

Species:	**% cover**	**Hollows:**	
		Small (<120mm)	**0**
		Large (>120mm)	**0**

Birds	**Mammals**	**Reptiles**

FAUNA HABITAT ASSESSMENT SHEET - STRATEGEN ENVIRONMENTAL

(South West)

Location: Wellard Farms	**Site Number: HA6**
Project Number: STO18278.01	

Date: 22/05/18	**Easting: 392789**	**Aspect**	N	NE	SW	NW
Quadrat Size: 50 x 50	**Northing: 6427102**		E	SE	W	**N/A**

Soil Texture	sand	**sandy-loam**	loam	cracking clay	clay

VEGETATION

Vegetation Description									
	Hummock Grassland	Other: Marri woodland		**Average Height in m**	**Cover**				
	Acacia Shrubland	**Stratum**			**Scattered Plants**	**Sparse**	**Moderate**	**Thick**	
	Riverine Woodland	**Overstorey**	*Eucalyptus rudis, Casuarina obesa and Melaleuca sp.*	10	0 <5%	**1 <20%**	**2** 20-60%	**3** 60-100%	
	Other Grassland	**Midstorey**			**0** <5%	1 <20%	2 20-60%	**3** 60-100%	
	Euc Woodland	**Ground Cover**	*Introduced grasses*	1.5	0 <5%	**1** <20%	**2 20-60%**	3 60-100%	

	CONDITION						**LAST FIRE**			
Scale:	**5** Pristine	**4** Excellent	3 Very Good	**2 Good**	**1** Degraded	**0** Completely Degraded	0 <1 year	1 1 -3 Yr	2 4-5 Yr	**3 >5 Yr**

	(general)			**DISTURBANCE**		**(cattle)**			
	0 heavy	**1 medium**	2 mild	3 none	0 heavy	1 medium	2 mild	**3 none**	

GROUND COVER

Bare Ground	**0** <5%	**1 <20%**	2 20-60%	3 60-100%	**Hummock Grass**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	
Rock	**0 <5%**	1 <20%	2 20-60%	3 60-100%	**Other Grass**	0 <5%	1 <20%	**2 20-60%**	3 60-100% *	
Leaf Litter	0 <5%	**1 <20%**	2 20-60%	3 60-100%	**Herbs**	**0 <5%**	1 <20%	2 20-60%	3 60-100%	

Logs >10cm	**0 <5%**	1 <20%	**2** 20-60%	**3** 60-100%						

MICROHABITATS

Burrowing Suitability	0 Rock	1 Stony	**2 Sandy Loam**	3 Sand	**Peeling Bark**	0 none	**1 rare**	2 moderate	3 common
Pebbles Stones	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Large Hollows**	**0 none**	1 rare	2 moderate	3 common
Exfoliating Slabs	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Small Hollows**	**0 none**	1 rare	2 moderate	3 common
Rock Crevices	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Water Prescence**	**0 none**	1 rare	2 moderate	3 common
Boulders	**0 none**	1 0-30%	2 30-70%	3 70-100%	**Distance to Water**	0 >5km	1 2 5km	2 500m - 2km	**3 <500m**
Suitability for Bats	YES		NO		**Termite Mounds**	**0 none**	1 rare	2 moderate	3 common
Caves	**Absent**	Present			**Woody Debris**	**0 none**	1 rare	2 moderate	3 common

SPECIES

Black Cockatoo Foraging Habitat

Species:	**% cover**	**Hollows:**	
		Small (<120mm)	**0**
		Large (>120mm)	**0**

Birds	**Mammals**	**Reptiles**

Document Distribution

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Document Status

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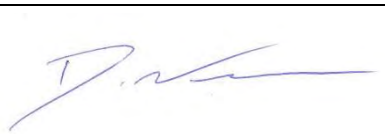
A	L Stevens	D Newsome	D Newsome		05/07/2018
B	L Stevens	D Newsome	D Newsome		31/07/2018
C	D Newsome	D Newsome	D Newsome		12/04/2019
D	W Oversby	D Newsome	D Newsome		20/02/2020

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Appendix F Wellard Farms: Nutrient Load Modelling (Strategen 2019b)

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To: Andrew Wallis

Date: 27 August 2019

Company: Stockland

Project No: STO18278.01

Fax/email: andrew.wallis@stockland.com.au

Inquiries: Dale Newsome

Wellard Farms
Nutrient load modelling

Strategen was engaged by Stockland to estimation of nutrient loading from current and proposed land uses within the proposed DSP area, to support Agency engagement on the change in land use at the Wellard Farms development (the Site, Figure 1).

The primary objectives of this letter report are to:

- undertake modelling to estimate current and future nutrient loads from the site
- describe the assumptions and methodology behind the nutrient model
- outline the findings of the work to demonstrate that the development will reduce nutrient loadings on the site.

Background

The project proposes development of a 756.9 ha rural site in the Peel-Harvey Catchment. The Peel-Harvey Catchment drains into the Peel Estuary portion of the Peel-Yalgorup Ramsar Wetland System, which has long term problems with algal blooms because of elevated loads of nutrients, particularly phosphorus, from the catchment. Ramsar Wetlands are protected under the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999.

Residential development typically results in increased nutrient loads where this replaces extensive rural activities such as grazing which it replaces (Department of Water [DoW] 2011). As a consequence, recent State Government planning such as *Perth and Peel @3.5 Million* (DoP 2015), have taken a more cautious approach to urbanisation in the Peel-Harvey Catchment compared to previous planning documents because of nutrient concerns.

The difference in nutrient load between urban development and pre-development depends on a number of factors including:

- the pre-development land use
- residential density (higher densities have less landscaping and consequently less fertiliser application)
- structure plan details such as public open space areas and management.

Approach

The site has been modelled as a spreadsheet model investigating nutrient loads (i.e. inputs) to the site from the current and proposed land use. Where information is available, pre- and post-development land use nutrient load assumptions have been based on DoW (2016) assumptions relating to nutrient loadings for rural and urban land uses. The DoW (2016) information covers a wide variety of land uses but does not address the full range of land uses on the site, particularly the large feedlot which covers approximately one third of the site. In these cases, additional data has been sought from DWER and other sources to accurately estimate nutrient loads on the site.

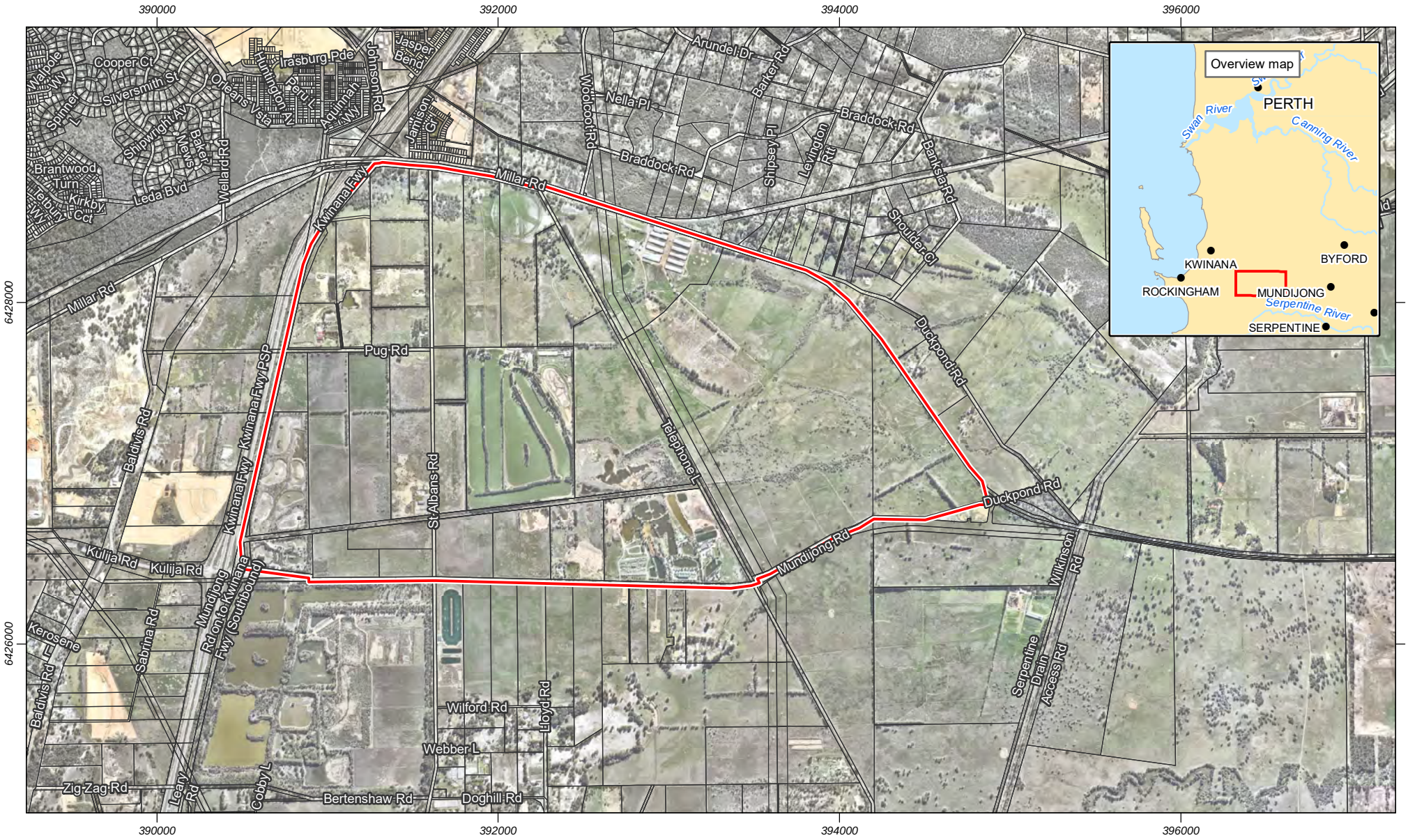

Figure 1: Site Locality

Scale 1:30,930 at A4

0 200 400 600 Metres

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 17/07/2018
Author: JCrute
Source:

Legend

- Site boundary
- Cadastre

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

Path: Q:\Consult\2018\STO\STO18278\01_GIS_documents\ArcMap_documents\STO18278_G003_RevA.mxd

Created by ENVIRONMAPS | e. simoncrofts@environmaps.com.au | p: 0406 590 006

IRONMONGER CT
WELLARD RD
LEDA BVD
BALDWIS RD
JOHNSON RD
KWINANA FWY
Kwinana Fwy FSP
MILLAR RD
WOOLCOOT RD
NELLA PL
BRADDOCK RD
BARKER RD
SHIPSEY PL
LEMINGTON RTT
DUCKPOND RD
PUG RD
KWINANA FWY
ST ALBANS RD
TELEPHONE 1
MUNDIJONG RD

0.291979 ha
0.393087 ha
0.566159 ha
0.381952 ha
20.068319 ha
8.837691 ha
17.626045 ha
4.681183 ha
2.620137 ha
8.542227 ha
14.28174 ha
6.998189 ha

Legend

Site Boundary (756.9 ha)

Cadastre

Land Use

Road (11.114203 ha)

Feedlot (5.870663 ha)

Water ski park (58.573875 ha)

Golden Ponds fish farm (37.321647 ha)

Native vegetation (8.730633 ha)

Non agricultural uses (80.614299 ha)

Agricultural uses (300.336206 ha)

Agricultural uses - feedlot (254.339682 ha)

Scale: 1:12,500 @ A3

0 50 100 200 300 400 500 Meters

N

Coordinate System: GDA 1994 MGA Zone 50
Note: Position errors may occur in some areas
Date: 14/06/2018
Author: ENVIRONMAPS
Source: Cadastre - Landgate, 2018
Orthophoto - Nearmaps, 25.08.17

strategen ENVIRONMENTAL

Pre-development Land Use

Figure 2

C:\GIS\Jobs\Strategen\STO18278.01\Figures\STO18278_Land Use_180614.mxd

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Strategen understands that DWER is currently working on guidance and criteria for nutrient modelling and exports in the Peel-Harvey Catchment but this has not yet been released. The modelling of nutrient exports from a development requires a more detailed structure plan and conceptual drainage design than is not available at this stage of development. As a consequence, modelling has been limited to the modelling of inputs. Modelling of nutrient exports may be undertaken at a later stage when the development plan and conceptual drainage design has been further developed and DWER guidance on the matter has been released.

Model outputs and nutrient loading rates are presented in Appendix 1. The model is based on the assumptions presented in this report and Appendix 1, including information from current landowners, agencies and the project team. The model relies on the accuracy of this data and should be considered in this context.

Current land use and nutrient loads

The site is currently predominantly used for agricultural purposes including extensive agriculture in the form of unirrigated grazing and cropping (approximately 300 ha), and the Wellard Rural Exports (WRE) feedlot, which include sheep housed in feedlot buildings and approximately 250 ha of open paddocks with supplemented feeding (Table 1, Figure 2). Approximately 81 ha has been identified as 'non-agricultural land' which is predominantly former claypits which are partially inundated and are unsuitable for agricultural use (Table 1, Figure 2). This category also includes small areas of miscellaneous uses such as storage yards. Assumptions of nutrient loads for these land uses are presented in DoW (2016).

Table 1: Land use areas

Type	Area (ha)
Agricultural uses - grazing and cropping (hay/wheat)	300.3
Feedlot (building)	5.9
Agricultural uses - feedlot	254.3
Golden ponds fish farm	37.3
Native vegetation	8.7
Non-agricultural uses	80.6
Road	11.1
Water ski park	58.6
Total	**756.9**

Two of the land uses within the site are licenced or registered by Department of Water and Environmental Regulation (DWER) under Part V of the Environmental Protection Act (1986) due to their potential nutrient outputs. These land uses are considered point sources and are not specifically covered by DoW (2016) and include:

- Golden Ponds Fish Farm
- WRE Feedlot.

Golden Ponds Fish Farm

The Golden Ponds Fish Farm includes a caravan park and function centre. The premises are licenced because wastewater from the caravan park and function centre is treated and disposed of on site. The DWER works approval for the construction of the wastewater treatment plant allows for disposal of up to 100 kg/yr total nitrogen (TN) and 41 kg/yr total phosphorus (TP) from effluent disposal on the site (Works Approval W5811/2015/1). For the purposes of the model, a conservative input rate of half the DWER licenced loading has been used in the model.

Wellard Rural Exports Feedlot

The WRE Feedlot is an intensive sheep holding facility which has been operating at its present location for over 25 years. The feedlot provides a location for sheep from rural areas to be collected and their condition improved prior to export. The facility was constructed before the Environmental Protection Act 1986 came into force. The premises has a licenced capacity of 800,000 sheep per year and approximately 90,000 sheep at any one time (Licence L8338/2009/2). Given the number of sheep, the feedlot is potentially a large source of nutrients. Nutrient loads for the feedlot were based on:

- Information from WRE regarding:
  - the management of sheep waste and runoff of the site
  - the number of sheep staying on the site
  - average duration of sheep stay
- existing WRE licence conditions
- Meat and Livestock Australia (2003) guidance on sheep nutrient excretion.

WRE advises that their current practices include keeping sheep both inside their eight buildings and outdoors. During summer, 50% of sheep are kept outdoors. In winter, 10% of sheep are kept outdoors. On average, a sheep will stay between 30 and 60 days at the feedlot.

Within the buildings, manure falls through the floor onto the ground where it is kept dry before collection and sale. The licence for the site does not specify allowable nutrient loads (Licence L8338/2009/2).

The licence requires that manure from the buildings is collected and removed from the premises The buildings are located on hardstand. Runoff and effluent from the buildings is discharged to a containment basin on the site as require by the licence. While the basin has the potential for liquid from the basin to be irrigated onto pasture, in practice this does not occur as the basin is large enough that volumes can be managed by evaporation (Bioscience 2017). Any nutrients from the feedlot buildings are consequently either removed through manure or contained in the containment basin and do not enter the broader groundwater or surface water from the site. As a consequence, these have not been considered in the nutrient loading for the site.

For sheep retained outside, the manure and effluent is not collected as in the buildings. Average sheep nutrient loads were estimated based on Meat and Livestock Australia (2003) data for sheep during export.

On the basis of this information, the maximum loading rate for sheep nutrients based on a maximum sheep population and average nutrient loads from MLA was estimated at:

- 105,120 kg/yr TN
- 42,705 kg/yr TP.

On the basis of a more conservative approach using a minimum 30 day sheep stay and the minimum MLA nutrient loads, the total feedlot nutrient load was estimated at:

- 62,400 kg/yr TN
- 24,960 kg/yr TP (Appendix 1).

Proposed land use

The proposed land use assumptions have been based on discussions with CLE to match landuses to DoW (2016) categories for nutrient loading. As nutrient loads vary based on lot size and the average lot size is not yet resolved, two post-development scenarios were run, being:

- Scenario 1 – average lot size of 350 m^2
- Scenario 2 – average lot size of 395 m^2.

Land use breakdowns for each scenario are presented in Table 2.

Table 2: Post-development land use breakdown

Land use	Scenario 1 – average lot area 350 m^2	Scenario 2 – average lot area 395 m^2
Lots less than 400 m^2	326.9	201.6
Lots 401 - 600 m^2	0.0	125.3
Total lots	***326.9***	***326.9***
School	38.2	38.2
Commercial/Offices	23.5	23.5
Water	14.3	14.3
Road - paving	115.3	115.3
Road - verge turf	38.4	38.4
Road - verge native planting	38.4	38.4
Total road	***192.2***	***192.2***
POS- nature	25.0	25.0
POS - sport	40.8	40.8
POS -recreation	11.6	11.6
POS - not fertilised (includes drainage structures)	63.9	63.9
POS - native garden	20.4	20.4
Total POS	***161.8***	***161.8***
Total area	**756.9**	**756.9**

The breakdown of the POS is based on a 'typical' development and does not include measures such as extensive revegetation that could further reduce nutrient loading.

Results

Pre-development nutrient load

The total pre-development nutrient load for the site excluding WRE and Golden Ponds is estimated at:

- 33,123 kg/yr TN
- 3621 kg/yr TP.

Including WRE and Golden Ponds this increases to an estimated:

- 95,579 kg/yr TN
- 28,601 kg/yr TP.

This is equivalent to:

- 126 kg/ha/yr TN
- 39 kg/ha/yr TP.

Pre-development nutrient load

The total post-development nutrient load for the site under Scenario 1 (average lot area 350 m^2) is estimated at:

- 22,102 kg/yr TN
- 4072 kg/yr TP.

This is equivalent to:

- 29 kg/ha/yr TN
- 5.4 kg/ha/yr TP.

The total post-development nutrient load for the site under Scenario 2 (average lot area 395 m^2) is estimated at:

- 30,505 kg/yr TN
- 6064 kg/yr TP.

This is equivalent to:

- 40 kg/ha/yr TN
- 8.0 kg/ha/yr TP.

Table 3: Total nutrient load

Scenario	TN (kg/yr)	TP (kg/yr)
Pre-development	95,579	28,601
Scenario 1 – average lot area 350 m^2	22,102	4072
Scenario 2 – average lot area 395 m^2	30,505	6064

In summary:

1. The majority of pre-development TN and TP is sourced from outdoor feedlot sheep.
2. The post-development TN load is approximately 23 to 31% of the pre-development load (reduction of at least 69%).
3. The post development TP load is approximately 14 to 21% of the pre-development load (reduction of at least 79%).

The proposed development is anticipated to result in a significant reduction in TN and TP loads from the site, compared to the pre-development scenario.

References

Bioscience 2017, *Annual Environmental Report Annual Environmental Report (AER) L8338/2009/2, 1 April 2016 / 31 March 2017, unpublished report to WRE, May 2017.*

Department of Water (DoW) 2011, *Hydrological and Nutrient Modelling of the Peel-Harvey Catchment,* Department of Water, Perth.

Department of Water (DoW) 2016, *UNDO Model Factsheets,* Department of Water, Perth.

Meat and Livestock Australia 2003, *Characteristics and Volume of Effluent Produced by Livestock Vessels,* unpublished report, December 2003.

Appendix 1
Model summary

Pre-development model, Proposed Stockland Wellard Development, based on Wellard Farms and DPIRD advice on sheep

Diffuse sources

Land use	Area (ha)	N application rate (kg/ha/yr)	P application rate (kg/ha/yr)	Total N (kg/yr)	Total P (kg/yr)	Reference
Roads	11.1	0.0	0.0	0.0	0.0	DoW (2016) for road paving and unfertilised verge
Cleared, non-agricultural uses	80.6	0.0	0.0	0.0	0.0	DoW (2016) for unfertilised land
Native vegetation	8.7	4.0	0.0	34.9	0.0	DoW (2016) for POS 'nature'
Agricultural (assumed mixing grazing)	300.3	79.5	9.9	23876.7	2973.3	DoW (2016) for mixed grazing
Feedlot buidlings	5.9	0.0	0.0	0.0	0.0	DoW (2016) for road paving and unfertilised verge.
Feedlot (balance of lot)	254.3	34.7	2.5	8825.6	635.8	DoW (2016) for sheep grazing
Water ski park - water area	52.7	0.0	0.0	0.0	0.0	DoW (2016) for areas of water
Water ski park - land area	5.9	66.0	2.0	386.6	11.7	DoW (2016) for recreation
Golden Ponds	37.3	0.0	0.0	0.0	0.0	DoW (2016) for areas of water, unfertilised land
Total area	**756.9**			**33123.8**	**3620.9**	

Allowance has not been made for atmospheric deposition, as this will be the same regardless of land use.

Point sources 300.336206

Land use	Total N (kg/yr)	Total P (kg/yr)	Reference
Golden Ponds	55.0	20.2	Half of allowable amound under DWER licence
Wellard Rural Exports	62400.0	24960.0	Based on sheep assumptions
Total Point Sources	**62455.0**	**24980.2**	

Golden Ponds licenced amount (current DWER licence W5811/2015/1, issued 2015)

Max TN conc	10	mg/L
Max TP conc	4	mg/L
Licenced volume	27.7	kL/day
	10110.5	kL/yr
TN load	**101.11**	**kg/yr**
TP load	**40.44**	**kg/yr**

Total

	Total N	Total P
kg/yr	**95578.8**	**28601.1**
kg/ha/yr	**126.28**	**37.79**

Sheep assumptions

Sheep advice (P. Page, DPIRD 20/08/17)

Values per sheep per day, based on sheep on livestock vessels (MLA 2003, quoted by DPIRD)

	Min	Max	Average	
N	6.5	9.5	8	g/sheep/day
P	2.6	3.9	3.25	g/sheep/day
N	2.37	3.47	2.92	kg/sheep/yr
P	0.95	1.42	1.19	kg/sheep/yr

Advice from Wellard Exports, email dated 14 August 2018

Licence allows for 90,000 sheep at a time to a maximum of 800,000 sheep year year

Percentage of sheep kept outside

Winter	10%
Rest of year	50%

Sheep stay 30-60 days

Maximum' nutrient loading estimate - based on maximum sheep population and average nutrient loads

Allow 90,000 sheep at any given time

90,000	sheep	62400
821,250	sheep days outside, winter	
12,318,750	sheep days outside, rest of year	
13,140,000	Sheep days outside per year	
105120	kg/yr N	Based on average load (MLA 2003 quoted by DPIRD)
42705	kg/yr P	Based on average load (MLA 2003 quoted by DPIRD)

Minimum' nutrient loading estimate - based on lower sheep population and minimum nutrient loads

Allow 800,000 sheep staying for 30 days each (conservative assumption)

24,000,000	sheep days per year	
600,000	sheep days outside during winter	
9,000,000	sheep days outside during rest of year	
9,600,000	Sheep days outside per year	
62400	kg/yr N	Based on minimu load (MLA 2003 quoted by DPIRD)
24960	kg/yr P	Based on average load (MLA 2003 quoted by DPIRD)

Adopt these rates as a conservative estimate of pre-development (i.e. low nutrient loading) to compare post-development against

Excerpt of Licence:

Premises description and Licence summary .

La Bergerie is an intensive sheep holding facility which has been operating at its present location for over 25 years. The facility was constructed before the *Environmental Protection Act 1986* came into force. The premises has the capacity to hold 800,000 sheep per year and approximately 90,000 sheep at any one time. The majority of the sheep are held under cover in eight sheds, with manure falling through the floor onto the ground where it is kept dry before collection and sale.

Scenario 1: Post-development model, Proposed Stockland Wellard Development, 350 m2 lot average, all lots below 400 m2

Diffuse sources

Land use	Area (ha)	N application rate (k	P application rate (kg/ha/yr)	Total N (kg/yr)	Total P (kg/yr)	Reference
Water	14.3	0.0	0.0	0.0	0.0	DoW (2016) for water
Lots less than 400 m2	326.9	23.4	6.9	7649.4	2255.6	DoW (2016) for lots less than 400 m2
Lots 401 - 600 m2	0.0	91.2	22.8	0.0	0.0	Kelsey et al 2010, quoted in DoW (2016) for lots 400 - 600 m2
School	38.2	101.0	20.1	3862.2	768.6	DoW (2016) for school
Commerical/Offices	23.5	26.4	6.4	620.5	150.4	DoW (2016) for commercial/office
Road - paving	115.3	0.0	0.0	0.0	0.0	DoW (2016) for road paving
Road - verge turf	38.4	112.0	15.0	4306.3	576.7	DoW (2016) for verge turf
Road - verge native planting	38.4	28.0	0.9	1076.6	34.6	DoW (2016) for verge native garden
POS- Nature	25.0	4.0	0.0	100.0	0.0	DoW (2016) for POS - nature
POS - sport	40.8	75.0	6.0	3057.7	244.6	DoW (2016) for POS sport
POS -recreation	11.6	66.0	2.0	768.6	23.3	DoW (2016) for POS recreation
POS - not fertilised	63.9	0.0	0.0	0.0	0.0	DoW (2016) for POS not fertilised
POS - native garden	20.4	28.0	0.9	570.7	18.3	DoW (2016) for POS native garden
Total Diffuse Sources	**756.9**			**22012.2**	**4072.2**	

Allowance has not been made for atmospheric deposition, as this will be the same regardless of land use.

Point sources

Land use	Total N (kg/yr)	Total P (kg/yr)
N/A	0.0	0.0
Total Point Sources	**0.0**	**0.0**

Total

	Total N	Total P
kg/yr	**22012.2**	**4072.2**
kg/ha/yr	**29.08**	**5.38**

Scenario 2: Post-development model, Proposed Stockland Wellard Development, 395 m2 lot average, 60% of lots below 400 m2

Diffuse sources

Land use	Area (ha)	N application rate (kg/ha/yr)	P application rate (kg/ha/yr)	Total N (kg/yr)	Total P (kg/yr)	Reference
Water	14.3	0.0	0.0	0.0	0.0	DoW (2016) for water
Lots less than 400 m2	201.6	23.4	6.9	4718.2	1391.3	UNDO model factsheets, DoW (2016) for lots less than 400 m2
Lots 400 - 500 m2	125.3	91.2	22.8	11424.1	2856.0	Kelsey et al 2010, quoted in DoW (2016) for lots 400 - 600 m2
School	38.2	101.0	20.1	3862.2	768.6	DoW (2016) for school
Commerical/Offices	23.5	26.4	6.4	620.5	150.4	DoW (2016) for commercial/office
Road - paving	115.3	0.0	0.0	0.0	0.0	DoW (2016) for road paving
Road - verge turf	38.4	112.0	15.0	4306.3	576.7	DoW (2016) for verge turf
Road - verge native planting	38.4	28.0	0.9	1076.6	34.6	DoW (2016) for verge native garden
POS- Nature	25.0	4.0	0.0	100.0	0.0	DoW (2016) for POS - nature
POS - sport	40.8	75.0	6.0	3057.7	244.6	DoW (2016) for POS sport
POS -recreation	11.6	66.0	2.0	768.6	23.3	DoW (2016) for POS recreation
POS - not fertilised	63.9	0.0	0.0	0.0	0.0	DoW (2016) for POS not fertilised
POS - native garden	20.4	28.0	0.9	570.7	18.3	DoW (2016) for POS native garden
Total Diffuse Sources	**756.9**			**30505.1**	**6064.0**	

Allowance has not been made for atmospheric deposition, as this will be the same regardless of land use.

Point sources

Land use	Total N (kg/yr)	Total P (kg/yr)
N/A	0.0	0.0
Total Point Sources	**0.0**	**0.0**

Total

	Total N	Total P
kg/yr	**30505.1**	**6064.0**
kg/ha/yr	**40.30**	**8.01**

Appendix G EPBC Act Referral Decision (Department of Agriculture, Water and the Environment 2020)

Australian Government
Department of Agriculture, Water and the Environment

Notification of

REFERRAL DECISION – not controlled action

Wellard Farms Urban Development, Baldivis, Western Australia (EPBC 2020/8634)

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

Person proposing to take the action	Stockland Development Pty Limited ABN: 71 000 064 835
proposed action	Clearing of vegetation for the construction of residential lots, commercial and educational facilities, public open space and associated roads and accessways, between Mundijong and Millar Roads in Baldivis, approximately 40 km south of Perth, Western Australia; as described in the referral received by the department on 15 May 2020 [See EPBC Act referral 2020/8634].

Referral decision: Not a controlled action

status of proposed action	The proposed action is not a controlled action.

Person authorised to make decision

Name and position	Declan O'Connor-Cox Acting Assistant Secretary Environment Approvals Division
signature	
date of decision	7 June 2020

Appendix H Mosquito Risk Assessment (JBS&G 2023)

64832 / 151,618

7 June 2023

Jacob Abbott

Stockland

Via email: jacob.abbott@stockland.com.au

Proposed Northeast Baldivis DSP – Mosquito Risk Assessment

Dear Jacob

Background

Stockland Development Pty Ltd (the Proponent) is proposing to lodge a District Structure Plan (DSP) (Attachment A), to be followed by a subsequent amendment process to the Metropolitan Region Scheme (MRS), across multiple lots on Mundijong Road, Baldivis to enable urban development. The proposal area (Attachment B) is located approximately 45 km south of the Perth CBD within the City of Rockingham (CoR) and is approximately 757 ha in area. The proposal area is currently zoned "Rural" under the MRS and a combination of "Rural", "Public Use" and "Special Rural" under the CoR Town Planning Scheme (TPS) No. 2. The area currently has multiple landowners and consists of various land uses, including rural living, stock grazing and stock holding, a water ski facility and caravan park, and aquaculture (JBS&G 2022).

An Environmental Assessment Report (EAR) prepared by JBS&G (2022) identified mosquitoes as a potential public health risk that may affect future residents of the DSP. Mosquito risk is one of many factors that are considered when determining the suitability of land for urban development, and so this Mosquito Risk Assessment (MRA) is to be considered in conjunction with the EAR (JBS&G 2022) as part of the DSP assessment process. As part of previous assessments that have occurred for other DSPs surrounding the proposal area, concerns have been raised by stakeholders about the risk of mosquitoes, due the proximity of DSPs to known mosquito breeding habitat. Therefore, it is anticipated that mosquito risk will be raised as a concern during assessment of Attachment A.

The CoR undertakes mosquito control activities as part of its program and membership of the Peel Mosquito Management Group (the Group). Mosquito control activities that are undertaken include chemical treatments and field surveillance of known breeding areas which include saltmarsh tidal wetlands that are connected to the Serpentine River (CoR n.d.). While the mosquito control activities of the Group are effective, they are not relevant to privately owned land, and it is not possible or environmentally feasible to completely eradicate mosquitoes (CoR n.d.). Therefore, the public health risk of mosquitoes for future residents of the proposal area is to be managed by several measures and by several stakeholders.

Scope

Mosquitoes have been identified as a public health risk that is likely to impact future residents of several Local Structure Plans (LSP) surrounding the proposal area. Assessment of several surrounding LSPs has included recommendations to the Western Australia Planning Commission (WAPC) about the types of conditions that are placed on subdivision approvals to manage mosquito risk, including the preparation of a Mosquito Management Plan (MMP) and notifications on certificates of title for lots that are affected by an MMP. Local Structure Plans for which mosquitoes have been identified as a potential public health risk and surround the proposal area include the following: Baldivis Parks (Lots 104, 105, 541, 543, 544 and 1000 Baldivis Road, Baldivis), The Edge (Lots 921 and 922 Baldivis Road and Lot 3 Key Close, Baldivis), One71 Baldivis (Lots 746-750 and Lot 545 Baldivis Road, Baldivis) and Greenlea Baldivis (Lots 129 and 306 Zig Zag Road, Baldivis) (CLE

Town Planning and Design [CLE] 2023; CLE 2015a; CLE 2015b; Taylor Burrell Barnett [TBB] Town Planning and Design 2016). Due to the proximity of these LSPs to the proposal area, it is anticipated that the potential public health risk of mosquitoes is likely to be raised by stakeholders during the assessment of Attachment A.

To understand the perceived public health risk of mosquito borne diseases to future residents of the proposal area, JBS&G has undertaken an assessment of potential mosquito breeding habitat within and surrounding the proposal area, including mosquito management strategies that are recommended. Mosquito management strategies are recommended to be undertaken by the Proponent and other stakeholders, including government agencies and future residents. Implementation of a combination of physical, chemical, and cultural strategies is recommended, and the mosquito management strategies should be carried out by various stakeholders across various times to ensure effective and sustainable management.

Mosquito Risk Assessment

Mosquitoes lay eggs and breed in water sources that are fresh or saline, and that are natural or man-made (DoH 2020). According to the EAR for the proposal area (JBS&G 2022), there are several wetland areas within and surrounding the proposal area that have been identified as potential mosquito breeding habitat.

Mosquito management

The following sites have been identified as potential mosquito breeding habitat within the proposal area (JBS&G 2022):

- Bonney's Water Ski Park and West Coast Jet Sprint
- Golden Pond Fish and Marron Farm
- Rural Export Holding Yard
- Multiple geomorphic wetlands
- Nine artificial lakes/ clay extraction pits in the southwest of the proposal area
- Multiple small dams in the northwest of the proposal area
- Minor drainage channels that transverse the proposal area.

Additional mosquito breeding habitat may be created within the proposal area due to construction associated with future land development.

The following sites have been identified as potential mosquito breeding habitat surrounding the proposal area (JBS&G 2022):

- Rosguy holding yard 1 km to the southeast of the proposal area
- Peel Main Drain along the western border of the proposal area
- Geomorphic wetland to the southeast of the proposal area.

Several of the sites that have been identified as potential mosquito breeding habitats within the proposal area, are intended to be modified by the development and therefore removed as potential mosquito breeding habitat that may affect future residents (Attachment A). The only sites identified as potential breeding habitats within the proposal area that are anticipated to remain after construction, include drainage channels and wetland areas (Attachment A). Strategies to manage mosquito breeding habitats that surround the proposal area, and those that are created within the area by future construction, may be implemented by various stakeholders including the Proponent, government agencies and future residents to protect public health. The District Water Management Plan (DWMP) will also ensure that the creation of mosquito breeding habitat is minimised by appropriate stormwater management.

While the proposal area is within the CoR, potential mosquito breeding habitats that surround the proposal area, such as wetland areas, are within the City of Kwinana (CoK) to the north, and the City of Serpentine-Jarrahdale (CoSJ) to the east. While some mosquito breeding habitats outside of the proposal area may be privately-owned land and not applicable to local government MMPs, the CoK works in conjunction with the City of Cockburn and the Department of Health as part of the South Metropolitan Contiguous Local Authority Group (CLAG) to undertake mosquito control activities during peak mosquito season (Department of Health 2021; City of Kwinana n.d.). The CoR works in conjunction with the City of Mandurah, the Shire of Murray, the Shire of Waroona, and the Department of Health to carry out mosquito control activities, including aerial application of mosquito-specific chemicals, field surveys to monitor mosquito breeding and mosquito trapping to determine the types and numbers of adult mosquitoes (CoR n.d.).

Table 1 summarises the possible mosquito management strategies and stakeholders that are relevant to mosquito breeding habitat within and surrounding the proposal area as it is known at this part of the approval process. The strategies can further be embellished as the certainty of development is known through the approval process. Existing and recommended strategies are categorised as physical, chemical, and cultural, as follows (DoH 2020):

Physical – modifications to remove mosquito breeding habitat, or distancing of future residents from mosquito breeding habitat (e.g., removing stagnant water bodies, designing buffers between future residential lots and mosquito breeding habitat, designing stormwater management systems that minimise durations of stagnant water, to be detailed in the DWMP).

Chemical – application of insecticide to kill mosquito larvae (larvicide) or mosquito adults (adulticide) (e.g., application of larvicide to kill mosquito larvae in mosquito breeding habitat, application of adulticide to kill flying adult mosquitoes in the air).

Cultural – human education about the public health risk of mosquitoes and protection measures that may be implemented to humans and buildings (e.g., signage and advice to future residents about the risk of mosquitoes, encouraging personal protection measures such as loosely-fitted clothing, mosquito repellent, and encouraging design of homes and outdoor living spaces to provide mosquito protection).

Table 1. Recommended mosquito management strategies and responsible stakeholders for mosquito breeding habitats.

Potential Mosquito Breeding Habitat (name and location)	Mosquito Management Strategy	Responsible Stakeholder	Time and/or duration of Management Action
Bonney's Water Ski Park and West Coast Jet Sprint	Physical – Modification for development to remove potential mosquito breeding habitat, where approved. Chemical – Not applicable. Cultural – Not applicable.	Proponent	Subdivision approval process
Golden Pond Fish and Marron Farm	Physical – Modification for development to remove potential mosquito breeding habitat, where approved. Chemical – Not applicable. Cultural – Not applicable.	Proponent	Subdivision approval process
Rural Export Holding Yard	Physical – Modification for development to remove potential mosquito breeding habitat, where approved. Chemical – Not applicable. Cultural – Not applicable.	Proponent	Subdivision approval process
Multiple geomorphic wetlands within the proposal area	Physical – Modification of the site for development to remove mosquito breeding habitat, where approved.	Proponent	Subdivision approval process

	Chemical – Application of insecticide, as approved. Cultural – Educate future residents and landowners by advising mosquito risk, encourage personal protection and design of outdoor living spaces.	Proponent Local government	In accordance with MMP to be prepared at subdivision approval stage.
Nine artificial lakes/ clay extraction pits in the southwest of the proposal area	Physical – Modification for development to remove potential mosquito breeding habitat. Chemical – Not applicable. Cultural – Not applicable.	Proponent	Subdivision approval process
Multiple small dams in the northwest of the proposal area	Physical – Modification for development to remove potential mosquito breeding habitat. Chemical – Not applicable. Cultural – Not applicable.	Proponent	Subdivision approval process
Minor drainage channels that transverse the proposal area	Physical – Modification for development to remove mosquito breeding habitat, where approved. Chemical – Application of insecticide to wetland area, as approved. Cultural – Educate future residents and landowners by advising mosquito risk, encourage personal protection and design of outdoor living spaces.	Proponent Proponent Local government	Subdivision approval process In accordance with MMP to be prepared at subdivision approval stage.

Rosguy holding yard 1 km to the southeast of the proposal area	Physical – Distance between residential lots and potential breeding habitat (e.g., via public open space). Chemical – Not applicable. Cultural – Educate future residents and landowners by advising mosquito risk, encourage personal protection and design of outdoor living spaces.	Proponent . Proponent Local government	Lodgement of DSP Ongoing by the Proponent until handover to local government.
Peel Main Drain along the western border of the proposal area	Physical – Maintenance to remove vegetation and prevent water stagnation. Chemical – Application of insecticide as approved. Cultural – Educate future residents and landowners by advising mosquito risk, encourage personal protection and design of outdoor living spaces.	Water Corporation and/or local government Local government Proponent Local government	In accordance with MMP. In accordance with MMP. Ongoing by the Proponent until handover to local government.
Geomorphic wetland to the southeast of the proposal area	Physical – Distance between residential lots and wetland areas (e.g., via public open space). Chemical – Application of insecticide as approved.	Proponent Local government	Lodgement of DSP In accordance with MMP.

	Cultural – Educate future residents and landowners by advising mosquito risk, encourage personal protection and design of outdoor living spaces.	Proponent Local government	Ongoing by the Proponent until handover to local government.
Water bodies created during construction of development	Physical – Remove water bodies created during construction within the proposal area. Chemical – Application of insecticide to water bodies not able to be removed, as approved. Cultural – Educate residents by advising of the mosquito risk, encouraging personal protection measures and design of outdoor living spaces.	Proponent Proponent Proponent	Ongoing by the Proponent during construction. Ongoing by the Proponent during construction. Ongoing by the Proponent during construction.
Water bodies created after completion of construction	Physical - Remove any water bodies created during construction and prevent future stagnation of water. Design stormwater system to prevent creation of mosquito breeding habitat (to be in DWMP). Chemical – Application of insecticide to water bodies not able to be removed, as approved. Cultural - Educate residents by advising of the mosquito risk, encouraging personal protection and design of outdoor living spaces.	Proponent Local government Proponent Proponent Local government	Proponent until handover to local government. Lodgement of DSP Proponent until handover to local government.

Conclusions and recommendations

The key outcomes of this mosquito risk assessment are as follows:

- The proposal area currently has multiple landowners and consists of various land uses, including rural living, stock grazing and stock holding, a water ski facility and caravan park, and aquaculture.
- Due to mosquito risk being raised as a concern for other DSPs surrounding the proposal area, and the presence of mosquito breeding habitat within and surrounding the area, it is expected that mosquito risk may be raised as a concern by government authorities during the assessment process of Attachment A.
- Several potential mosquito breeding habitats within the proposal area are to be removed via land modification as a result of future development, and therefore reduce the mosquito risk to future residents (Attachment A).
- Mosquito breeding habitats that remain within and surrounding the proposal area after construction are to be managed by various stakeholders using physical, chemical, and cultural strategies.
- The DWMP shall be used to manage risk of creating mosquito breeding habitat within the proposal area.
- As part of the Peel Mosquito Management Group and the Southern Metropolitan CLAG, the CoR and the CoK currently undertake mosquito control activities that target mosquito breeding within their respective boundaries, including breeding habitat likely to impact future residents of the proposal area.
- Mosquito risk management strategies can be implemented and enforced through the approval process, including via conditions that require an MMP to be prepared, approved, and implemented by the Proponent before handover of responsibilities to the local government, where appropriate.
- Effective mosquito management within the proposal area shall ensure that the public health risk of mosquitoes is not worsened by development.

As the proposed DSP for the proposal area requires removal of several mosquito breeding habitats to enable construction, and local governments of the area undertake mosquito control activities, the public health risk of mosquito borne disease is not expected to be worsened by the proposed DSP. Mosquito risk is one factor that should be considered in conjunction with all other factors that determine the suitability of land for urban development. Therefore, it is not practical to eliminate the possibility of development due to future residents living in proximity to mosquito breeding habitat where appropriate risk management measures can be undertaken. This risk assessment identifies a reasonable approach to mosquito management that may be implemented for the proposal area which will be in line with the approach undertaken for DSPs in the surrounding area. It may be used as a guide to ensure that the public health risk of mosquito borne disease is appropriately managed for future residents.

Should you require clarification, please contact the undersigned via email: jblitz@jbsg.com.au.

Yours sincerely:

Olivia Johnston

Consultant

JBS&G Australia Pty Ltd

Reviewed/Approved by:

James Blitz

Principal

JBS&G Australia Pty Ltd

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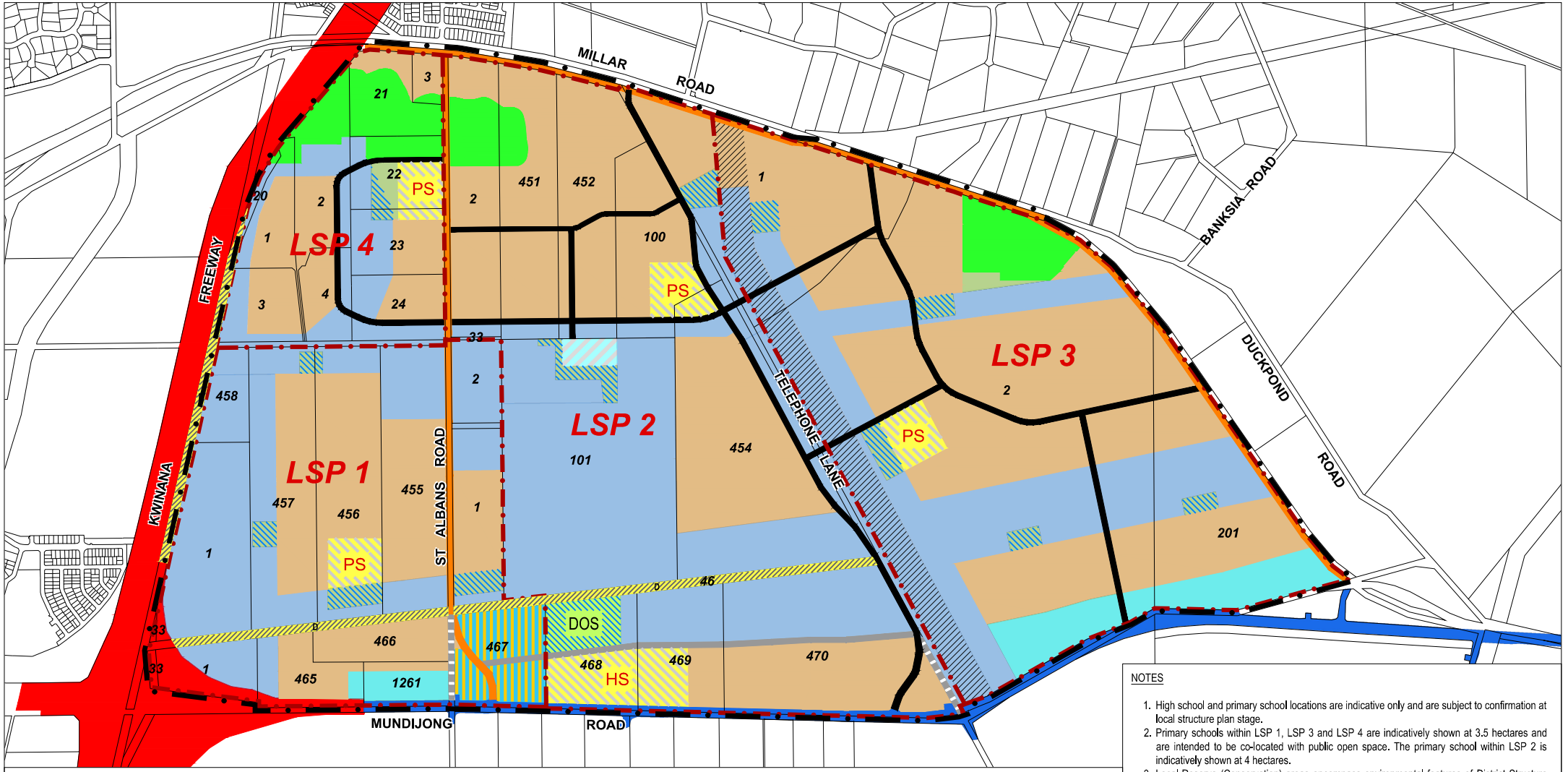
Attachment A Proposed District Structure Plan - North East Baldivis (CLE Planning & Design 2022)



LEGEND

- District Structure Plan Boundary
- Indicative Local Structure Plan Boundary
- Residential
- Employment
- Neighbourhood Centre
- Local Centre
- Multiple Use (Flood Storage)
- PS — Indicative Primary School
- HS — Indicative High School
- DOS — District Open Space (within Multiple Use)
- Local Reserve (Conservation)
- Local Reserve (Public Open Space)
- Local Reserve (Public Open Space - within Multiple Use)
- D — Public Purpose : Drain
- Powerline Easement
- Primary Regional Road Reserve
- Other Regional Road Reserve
- Integrator Arterial B Road
- Neighbourhood Connector Road
- Local Road
- Interim Road

NOTES

1. High school and primary school locations are indicative only and are subject to confirmation at local structure plan stage.
2. Primary schools within LSP 1, LSP 3 and LSP 4 are indicatively shown at 3.5 hectares and are intended to be co-located with public open space. The primary school within LSP 2 is indicatively shown at 4 hectares.
3. Local Reserve (Conservation) areas encompass environmental features of District Structure Plan-level significance. The refinement and reservation of these areas, as well as other localised areas of open space, as restricted open space, unrestricted open space or other will be determined following environmental reporting at the local structure plan stage.
4. An area of District Open Space (DOS) is identified and will accommodate future active district recreation needs of the community. Opportunities to co-locate the DOS with the High School may be considered at the local structure plan stage. The acquisition and development of the DOS is to be provided for within the relevant Development Contribution Plan for the DSP area to ensure the equitable provision of open space.
5. Road hierarchies are subject to review and refinement at local structure plan stage based on the outcomes of subsequent traffic modelling incorporated into revisions to the DSP Traffic Impact Statement or subsequent Traffic Impact Assessments prepared in support of local structure plans.
6. Primary Regional Road and Other Regional Road reserves are shown as per the Metropolitan Region Scheme.

0 200 400 600 800 1km

CLE Town Planning + Design

DISTRICT STRUCTURE PLAN MAP

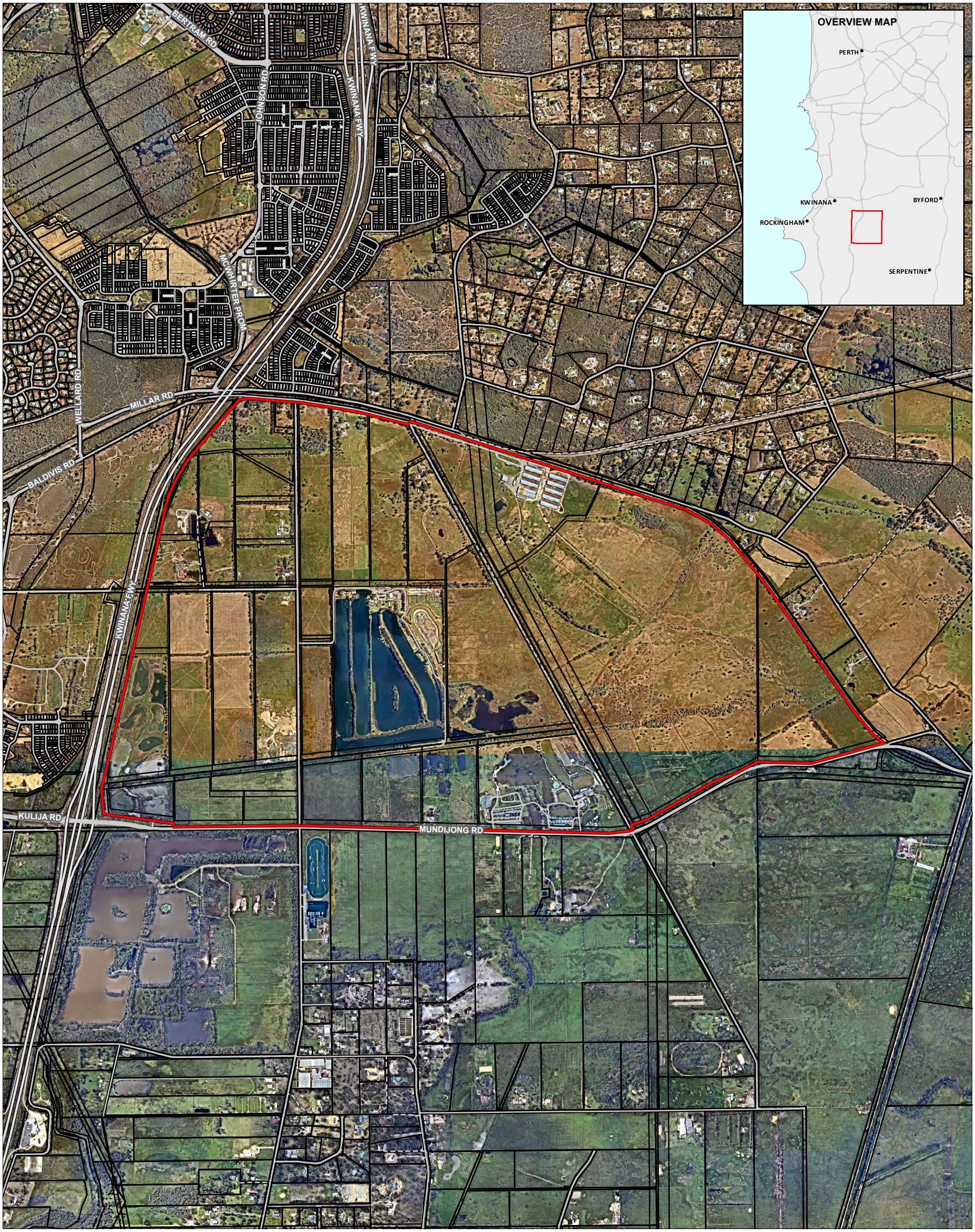
Mundijong Road, Baldivis

DRAFT

plan no: **3097-142-01**
date: 14 December 2022
scale: 1:20,000 @ A4

N

Attachment B The Proposal Area (JBS&G 2022)



Legend

- Site boundary
- Cadastral boundary
- Highways
- Main road
- Minor road
- Pedestrian way
- Track

JBS&G

0 580 metres

North East Baldivis, Mundijong Road Baldivis, WA

SITE LOCATION

Job No: 64058		Scale 1:20,000 at A3		
Client: Stockland Development Pty Ltd		Coord. Sys. GDA 1994 MGA Zone 50		
Drawn By: jcrute	Checked By:	Version: A	Date: 16-Nov-2022	**FIGURE: 1.1**

Document Path: W:\Projects\1)Open\Stockland\64058 EAR Review Wellard\GIS\Maps\R01_Rev_A\64058_01_1_A3P_SiteLocn.mxd

Image Reference: www.nearmap.com© - Imagery Date: 30 September 2022.

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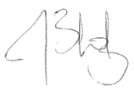
B	O Johnston	J Blitz	J Blitz		24/11/2022
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