Environmental Assessment Report

Ascot Racecourse Structure Plan

Project No: EP23-109(05)

Prepared for Perth Racing
July 2024



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		Emma Bentley	EKB		
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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Executive Summary

Perth Racing (the 'proponent') propose to progress a structure plan (SP) over an area of land in Ascot. The area is bounded by the Swan River to the north, Grandstand Road to the west and south, Matherson Road to the south and existing residential areas to the east, and is referred to herein as 'the site'. The site includes the Ascot Racecourse area. The site is located approximately 8.5km east of Perth central business district (CBD) and is approximately 62 ha in size, within the City of Belmont (CoB). The SP consists of six precincts: Precinct A, Precinct B, Precinct C, Precinct D, Precinct E, and the racecourse. The proponent additionally intends to progress a local planning scheme amendment for the site in parallel with the structure plan process.

The site is currently zoned 'Urban', 'Parks and Recreational', and 'Private Recreation' under the Metropolitan Regional Scheme (MRS). Under the Local Planning Scheme No. 15 (LPS 15), the site is currently zoned as 'Place of Public Assembly' and 'Mixed Use'. A small portion of the site is 'Parks and Recreation: water supply sewerage and drainage'.

This Environmental Assessment Report (EAR) supports the SP and is the principal supporting environmental document for the scheme amendment and SP process for the site. It includes a preliminary assessment of the proposed SP land uses, future management considerations and associated predicted environmental outcomes, against the applicable environmental factors as defined by the Environmental Protection Authority (EPA) policy framework.

The proponent has taken a range of measures to provide for the accommodation of environmental values within the Ascot SP. This is primarily achieved through the strategic location of public open space (POS) in the northern area of the site to retain intact native vegetation, as well as retention of existing wetland features located centrally within the site.

In this context, the SP has considered the identified environmental values within the site, including the proposed future retention of:

- Subtropical and temperate coastal saltmarsh TEC/PEC
- Native vegetation
- Fauna habitat.

As part of the future development process, considerations, approvals and management plans are likely to be necessary for individual proponents of development proposals within the Ascott SP, which would further minimise environmental impacts that have the potential to arise through development in accordance with the SP. The management framework and relevant considerations are summarised in **Table 1**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 1: Summary of environmental management framework and relevant considerations

Environmental Factor	Management Framework and considerations		
	Local Structure Plan	Subdivision and/or Development	Construction
Flora and Vegetation	Environmental Assessment Report including preliminary investigations (Emerge Associates 2024a) (**Appendix D**).	• Native Vegetation Clearing permit pursuant to Part V of the EP Act if clearing is required within the SP area and clearing is not exempt. • Preparation of a Conservation and Environment Management Plan (CEMP), where required.	Clearing Permit and compliance with approval conditions and management plans, in accordance with the EP Act.
Terrestrial Fauna	Environmental Assessment Report including preliminary investigations (Emerge Associates 2024a) (**Appendix D**).	• Potential impacts to MNES (listed black cockatoo species) in relation to the EPBC Act and the need to consider referral in accordance with the *Matters of National Environmental Significance Significant Impact Guidelines* (DotE 2013). • Preparation of a fauna management plan, where required, to minimise impacts to fauna through the clearing and construction works.	Compliance with approval conditions and management plans, in accordance with the EP Act and EPBC Act, where required.
Acid Sulfate Soils	Environmental Assessment Report including preliminary investigations.	• Detailed ASS Investigation and Management Plan for intrusive works in areas mapped as 'Class 1: High to moderate risk' will likely be required in accordance with the WAPC's *Acid Sulfate Soils Planning Guidelines* (2008).	Implementation of ASS Management Plan.
Inland Waters	The LWMS prepared for the SP by Emerge Associates (2024b) (**Appendix E**).	• Detailed UWMPs will be required (most relevant to Precinct D) to support individual subdivision applications. Other precincts may be developed under Development Approval and therefore water management will likely be documented through Stormwater Management Plans (SMs). Both UWMPs and SMPs will be prepared in accordance with the *Better Urban Water Management* Framework. • Protection of the Swan River and associated Conservation Category Wetland (CCW) through consideration of hydrological processes and water quality management into design of future development areas to protect the adjacent Swan River and associated values. • Development Control Area (DCA) permit application for works within or affecting the DCA to the DBCA in accordance with the *Swan and Canning Rivers Management Act 2006* and the *Swan and Canning River Management Regulations 2007*.	Compliance with UWMP/SMP and DCA permit if necessary.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 1: Summary of environmental management framework and relevant considerations (continued)

Environmental Factor	Management Framework and considerations		
	Local Structure Plan	Subdivision	Construction
Social Surroundings	Preliminary investigations for Aboriginal Cultural Heritage. Transport Noise Assessment for the proposed SP (Lloyd George Acoustics 2023) in accordance with SPP 5.4.	• Detailed Acoustic Assessment and Management Plan (where required) or 'Quiet House Package A' implemented to upper floors of noise sensitive dwellings within Precinct E.	Section 18 approval may be required pursuant to the *Aboriginal Heritage Act 1972* prior to ground disturbing works. Compliance with noise management plan and appropriate house packages applied where appropriate.

Overall, a range of environmental impact mitigation measures (primarily impact avoidance and minimisation) are proposed within the SP layout and through the future environmental management framework. In this context, it is anticipated that implementation of the proposed SP can be suitably managed through future stages of the land use planning processes (including development) such that the EPA objectives for the relevant environmental factors can be achieved.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table of Contents

1 Introduction 1

1.1 Background 1
1.2 Purpose of this report 2
1.3 Previous surveys and assessments 2

2 Existing Environment 3

2.1 Landforms 3
2.1.1 Landform, soils and geology 3
2.1.2 Topography 3
2.2 Terrestrial Environmental Quality 4
2.2.1 Acid sulfate soils 4
2.2.2 Potential site contamination 4
2.2.3 Historical context 4
2.3 Flora and Vegetation 6
2.3.1 Regional Context 6
2.3.2 Site-specific investigations 7
2.3.3 Vegetation units 7
2.3.4 Vegetation condition 7
2.3.5 Threatened and Priority Ecological Communities 8
2.3.6 Conservation significant flora 8
2.3.7 Weeds 9
2.3.8 Environmentally Sensitive Areas 9
2.3.9 Bush Forever 10
2.3.10 Ecological linkages 10
2.3.11 City of Belmont Collective Local Biodiversity Strategy 10
2.4 Terrestrial Fauna 11
2.4.1 Site-specific surveys and investigations 11
2.4.2 Fauna habitat 11
2.4.3 Conservation significant fauna 12
2.4.3.1 Black Cockatoos 13
2.5 Inland Waters 14
2.5.1 Surface water 14
2.5.2 Groundwater 15
2.5.2.1 Regional groundwater 15
2.5.2.2 Site-specific groundwater monitoring 15
2.5.3 Wetlands 16
2.5.4 Public drinking water source areas 17
2.6 Social Surroundings 17
2.6.1 Aboriginal cultural heritage 17
2.6.2 Non-Indigenous heritage 17
2.6.3 Surrounding land uses 18
2.7 Other Considerations 18
2.7.1 Bushfire hazards 18
2.8 Summary of Existing Environmental Values 18

3 Proposed Land Use and the Planning and Approval Framework 20

3.1 Ascot Racecourse Proposed Development 20
3.1.1 Environmental considerations of the structure plan 20
3.1.1.1 Public Open Space 21
3.1.1.2 Hydrology 21
3.1.1.3 Wetlands 21

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3.1.1.4 Conservation significant fauna 22
3.1.1.5 Aboriginal cultural heritage 22
3.1.1.6 Non-Indigenous heritage 22
3.2 Future planning and environmental approvals process 22
3.2.1 Metropolitan Region Scheme 23
3.2.2 Local Planning Scheme No. 15 23
3.2.3 *Environmental Protection Act* 1986 - Section 38 proposals 23
3.2.4 *Environmental Protection Act 1986* - Section 48 scheme amendment referral 24
3.2.5 Environmental Protection Act 1986 – Part V Clearing Permits 25
3.2.6 Environment Protection and Biodiversity Conservation Act 1999 25
3.2.7 Swan and Canning River Development Control Area 25

4 Assessment of Predicted Environmental Outcomes 26

5 Conclusions 33

6 References 36

6.1 General references 36

List of Tables

Table 1: Summary of environmental management framework and relevant considerations iii
Table 2: Description and extent of vegetation type identified within the site 7
Table 3: Vegetation condition categories within the site 8
Table 4: Fauna habitats identified within the site 11
Table 5: Conservation significant fauna species with potential to occur within the site 12
Table 6: Foraging habitat recorded within the site 14
Table 7: Geomorphic wetland management categories 16
Table 8: Summary of existing environmental values within the site relevant to EPA factors 18
Table 9: Summary of EPA environmental factors and objectives relevant to the proposed future land use 27
Table 10: Summary of Environmental Management Framework Considerations 34

List of Plates

Plate 1: Ascot Racecourse Precinct Plan with proposed uses (draft) 1
Plate 2: 1953 aerial (Landgate 2023) 5
Plate 3: 2005 aerial (Landgate 2023) 5
Plate 4: 2024 aerial (Landgate 2023) 6

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Figures

Figure 1: Site Location
Figure 2: Site Geology
Figure 3: Topographic Contours
Figure 4: Acid Sulfate Soils
Figure 5: Vegetation Types
Figure 6: Vegetation Condition
Figure 7: Threatened Ecological Community and Native Vegetation under the EP Act
Figure 8: Bush Forever, Ecological Linkages and Environmental Sensitive Areas
Figure 9: Carnaby's Black Cockatoo Foraging Habitat
Figure 10: Forest Red-tailed Black Cockatoo Foraging Habitat
Figure 11: Black Cockcatoo Habitat Trees
Figure 12: Hydrological Features
Figure 13: Social Surroundings

Appendices

Appendix A

Ascot Racecourse Structure Plan (ROWE Group Design, 2024)

Appendix B

Ascot Racecourse Precinct Plan (ROWE Group Design, 2024)

Appendix C

Draft Master Plan Concept (ROWE Group Design, 2024)

Appendix D

Flora, Vegetation and Fauna Assessment (Emerge Associates 2024a)

Appendix E

Local Water Management Strategy (Emerge Associates 2024b)

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
CoB	City of Belmont
DEC	Department of Environment and Conservation (now DER)
DEP	Department of Environmental Protection (now DER)
DER	Department of Environment Regulation
DFES	Department of Fire and Emergency Services
DoE	Department of Environment (now DER)
DoW	Department of Water
DPLH	Department of Planning, Lands and Heritage
EPA	Environmental Protection Authority
WAPC	Western Australia Planning Commission

Table A2: Abbreviations – General terms

General terms	
AHEF	Aboriginal Heritage Enquiry Form
BPA	Bushfire prone area
CBD	Central Business District
CCW	Conservation category wetland
EAR	Environmental Assessment Report
ESA	Environmentally sensitive area
MUW	Multiple use wetland
PEC	Priority ecological community
P3	Priority 3
REW	Resource enhancement wetland
SP	Structure Plan
SPP	State Planning Policy
T	Threatened
TEC	Threatened ecological community
UFI	Unique feature identifier

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table A3: Abbreviations –Legislation

Legislation	
AH Act	*Aboriginal Heritage Act 1972*
BAM Act	*Biosecurity and Agriculture Management Act 2007*
CS Act	*Contaminated Sites Act 2003*
EP Act	*Environmental Protection Act 1986*
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*

Table A4: Abbreviations – units of measurement

Units of measurement	
ha	Hectare
m	Metre
m AHD	m in relation to the Australian height datum
mBNS	m below natural surface

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

1 Introduction

1.1 Background

Perth Racing (the proponent) proposes to progress a structure plan (SP) over an area of land in Ascot to support and guide future development (the Ascot SP; referred to herein as 'the SP'). The SP area includes the existing Ascot Racecourse and is bounded by the Swan River to the north, Grandstand Road to the west and south, Matherson Road to the south and existing residential areas to the east (referred to herein as 'the site'; see **Figure 1**). The site is located approximately 8.5 km east of Perth central business district (CBD) and is approximately 62 ha in size, within the City of Belmont (CoB). The SP layout is shown in **Appendix A** and consists of six precincts: Precinct A, Precinct B, Precinct C, Precinct D, Precinct E, and the racecourse, as demonstrated below on **Plate 1**, **Figure 1**, and provided in **Appendix B**.

The proponent additionally intends to progress a local planning scheme amendment as well as the structure planning process in parallel for the site. The site is currently zoned 'Urban', 'Parks and Recreation', and 'Private recreation' under the Metropolitan Regional Scheme (MRS). Under the Local Planning Scheme No. 15 (LPS 15), the site is currently zoned as 'Place of Public Assembly' and 'Mixed Use'.

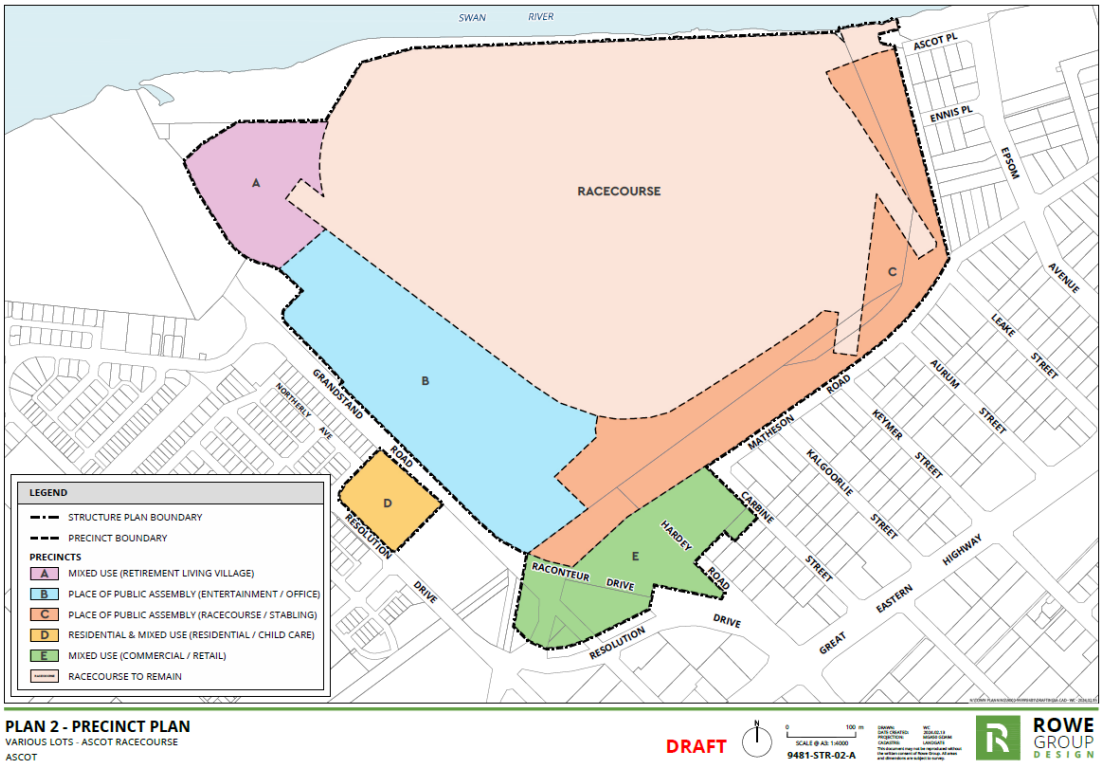


Plate 1: Ascot Racecourse Precinct Plan with proposed uses (draft)

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

1.2 Purpose of this report

The proponent engaged Emerge Associates (Emerge) to prepare an Environmental Assessment Report (EAR), with the intent to be the principal supporting environmental document for the local scheme amendment and SP process for the site. The EAR supports the structure planning process and provides a synthesis of information regarding the environmental values and attributes of the site. The EAR is consistent with the Western Australia Planning Commission's (WAPC) *Structure Plan Framework* (WAPC 2015) and:

- Identifies and assesses the existing environmental values and attributes of the site (**Section 2**).
- Discusses the land use planning context and the proposed SP, in the context of applicable statutory requirements under applicable legislation (**Section 3**).
- Provides an assessment of the proposed SP layout and land uses and predicted environmental outcomes against the applicable Environmental Protection Authority (EPA) environmental factors and objectives (**Section 4**).

1.3 Previous surveys and assessments

The following surveys, investigations and assessment reports were prepared to support preparation of the SP and are relevant to this EAR:

- Reconnaissance Flora, Vegetation, Fauna and Targeted Black Cockatoo Habitat Assessment (Emerge 2024a) (Appendix D)
- Ascot Racecourse Local Water Management Strategy (Emerge 2024b) (Appendix E)
- Transport Noise Assessment (Lloyd George Acoustics 2023).

An Environmental Report was prepared for the Draft Golden Gateway Local Structure Plan (LSP) in 2018 by Essential Environmental for the CoB (Essential Environmental 2018). The Draft Golden Gateway LSP is located immediately south of the site and is being progressed but has not been finalised. The Golden Gateway LSP no longer includes the site, and this SP is proposed to progress on Perth Racings landholdings exclusively. A review of the Golden Gateway LSP was undertaken as part of the preparation of this report to understand background information and context for the proposed SP.

The Draft Golden Gateway LSP provides contextual information for the proposed SP due to the proximity, and specifically through the following documents:

- Golden Gateway Bushfire Management Plan (Urbaqua 2018)
- Golden Gateway Local Structure Plan Environmental Report (Essential Environmental 2018)
- Golden Gateway Local Water Management Strategy (Essential Environmental 2018).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2 Existing Environment

The outcomes of desktop and site-specific investigations undertaken by Emerge and others have informed the identification and assessment of the existing environmental attributes and values within the site and are discussed in the below **Section 2.1** to **Section 2.8**.

The Environmental Protection Authority (EPA) identifies a number of environmental principles, factors and objectives within the *Statement of Environmental Principles, Factors and Objectives* (EPA 2018), which are used to guide the determination of significant environmental impacts and whether impacts can be appropriately mitigated or managed. Existing environmental values have been described according to the applicable EPA environmental factor (where applicable to the site), which include:

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

2.1 Landforms

2.1.1 Landform, soils and geology

The site occurs on the Swan Coastal Plain, the geomorphic unit that characterises much of the Perth metropolitan area. The site is within the Pinjarra System with a portion of the site within the Bassendean System. The Pinjarra System is described as *poorly drained coastal plain with variable alluvial and aeolian soils*, whilst the older Bassendean Dune system is characterised by lower relief, with variable depth to groundwater, consisting of lower sandy hills interspersed with permanent and seasonal wetlands (Churchward and McArthur 1980; Gozzard 2011).

Geological Survey of Western Australia (Gozzard 2007) indicates that the site lies within the Swan River Terraces system having Guildford formation of Alluvial and leached yellow sand. As shown on **Figure 2**, the site soil types include:

- **Ms2 –** Sandy Silt: Strong brown to mid grey, mottled, blocky, disseminated fine sand, hard when dry, variable clay content of alluvial origin.
- **Ms4 –** Sandy Silt: light yellow brown, blocky, mottled some some fine to medium sand, soft when moist, variable clay content.
- **S8 –** Sand: very light grey at surface, yellow at depth, fine to medium-grained, sub rounded quartz, moderately well sorted of eolian origin.

2.1.2 Topography

The site is generally flat with a slightly higher elevation in its eastern extent. The northern portion of the site, adjacent to the Swan River, lies at 0 m Australian Height Datum (mAHD). The remainder of the site is slightly elevated, ranging from 1 mAHD to the northwest to 7 mAHD to the east.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

The topographic contours of the site are shown on **Figure 3**.

2.2 Terrestrial Environmental Quality

2.2.1 Acid sulfate soils

Acid sulfate soils (ASS) refers to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state, present in waterlogged and/or anoxic conditions, ASS generally do not present any risk to the environment. However, when oxidised, ASS can pose issues through sulphuric acid production, which can present a range of risks for the surrounding environment, infrastructure, and human health.

The Department of Water and Environmental Regulation (DWER) provides broad-scale mapping indicating areas of potential ASS risk (DWER 2023). A review of the DWER mapping indicates that the majority of the site is considered to have 'high to moderate' risk of ASS occurrence and a small portion in the south is considered to have 'moderate to low' risk of ASS occurring within the 3 m of the natural surface.

The DWER ASS risk mapping is shown on **Figure 4**.

2.2.2 Potential site contamination

A review of the publicly available DWER Contaminated Sites Database indicates that no areas within the site are registered as a 'contaminated site' pursuant to the *Contaminated Sites Act 2003*. A basic summary of records (BSR) of Lot 9002 on DP60342 was requested from DWER which shows that Lot 9002 (including the racecourse, Precinct A and Precinct B) is classified as "possibly contaminated – investigation required" and the extent of which is shown on **Figure 4**Figure 4. The contamination is associated with the sites historical land use for horse racing and runoff from animal storage on the site and agistment in the surrounding areas causing the potential for contamination, including nutrient runoff. Monitoring and investigation is required to be reviewed by DWER and potentially re-classified and the proponent has commenced investigations to address this. The BSR notes that if groundwater is to be abstracted, analytical testing should be undertaken to determine if groundwater is suitable for its intended use.

2.2.3 Historical context

Historical aerial images available from 1953 and onwards (Landgate 2023) were reviewed and show that Ascot Racecourse has existed since prior to 1953 (**Plate 2**) and the associated racecourse infrastructure, including grandstands and stables were established between 1953 and 1977. Residential development to the south east of the site steadily increased between 1953 to 1995 and majority of residential development to the south west occurred between 1995 and 2005 (see **Plate 2** to **Plate 4**).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

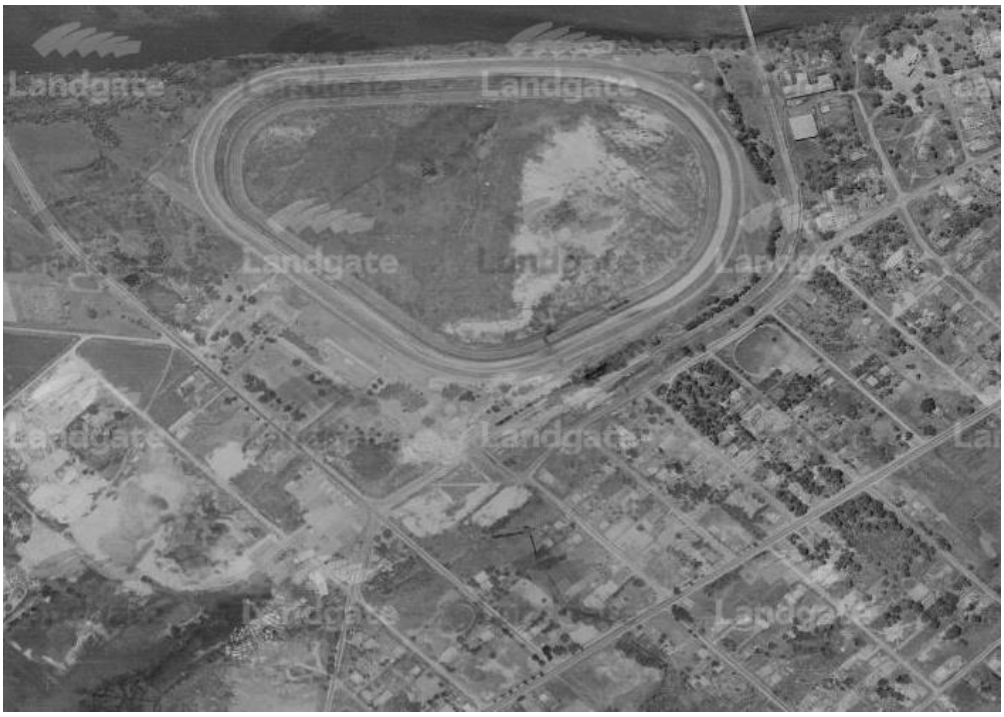


Plate 2: 1953 aerial (Landgate 2023)



Plate 3: 2005 aerial (Landgate 2023)

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024



Plate 4: 2024 aerial (Landgate 2023)

2.3 Flora and Vegetation

2.3.1 Regional Context

Native vegetation within the site can be classified based on regional vegetation mapping. Heddle *et al.* (1980) mapping shows the site as comprising the 'Guildford' complex , which is described as 'open forest to tall open forest and woodland'. The site is within 'Bassendean association 1009',typically comprising a combination of *Corymbia calophylla*, *Eucalyptus wandoo* and *Eucalyptus marginata (DPIRD 2021).* This association was determined to have 16.4% remaining of its original pre-European extent within the Swan Coastal Plain, of which 0.02% is protected for conservation purposes (Government of Western Australia 2019).

The EPA's *Environmental Guidance for Planning and Development Studies* (EPA 2008) states that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent. The Guidance also references the biodiversity conservation national objective and target of retaining 30% of the original extent of each vegetation association, and the states' minimum target of 10% for constrained urban areas such as the Swan Coastal Plain. The percentage remaining of the Bassendean vegetation association (16.4%) is below the 30% retention objective but above the 10% minimum retention target for the Swan Coastal Plain.

Vegetation is typically considered to represent an intact occurrence of its overarching vegetation complex when it is in 'good' or better condition. As outlined in **Section 2.3.4**, vegetation in some portions of the site has been assessed to be in 'good' or 'very good' condition; therefore, this indicates that these areas of remnant native vegetation within the site, is consistent with vegetation associations of the 'Guildford' formation.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2.3.2 Site-specific investigations

Emerge completed a reconnaissance flora and vegetation survey for the site on 27 March 2023 in accordance with EPA's *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016; Emerge Associates 2024a). The survey boundary incorporated the entire site.

The survey included traversing the site on foot and recording composition and condition of vegetation. Photographs were taken during the survey to show particular site conditions. Prior to the field survey, information on the habitat preferences of threatened and priority flora species and communities were reviewed. Areas of potentially suitable habitat for threatened and priority flora species were opportunistically traversed along transects and searched for conservation significant species, as required.

The findings of the survey and the associated assessment report (Emerge Associates 2024a) is summarized below and is contained within **Appendix D.**

2.3.3 Vegetation units

Four vegetation units were identified within the site during the field survey and descriptions of each is provided below in **Table 2**. The associated vegetation mapping is shown in **Figure 5.**

Table 2: Description and extent of vegetation type identified within the site

Vegetation Community	Description	Area (ha)
Er	Woodland *Corymbia calophylla* over closed grass/forbland of pasture weeds and scattered native species (or absent).	1.12
Cc	Woodland *Eucalyptus rudis* over closed grass/forbland of pasture weeds and scattered native species (or absent)..	0.28
ErJkSt	Open woodland Eucalyptus rudis and occasional Melaleuca raphiophylla over sedgeland Juncus kraussii and Schoenoplectus tabernaemontani over low shrubland Suaeda australis over forbland Apium prostratum subsp. prostratum var. prostratum and Heliotropium curassavicum over grassland *Avena sp., Cynodon dactylon and * Paspalum vaginatum (or absent).	0.17
To	Fringing rushland of *Typha orientalis*, with occasional planted native and non-native trees, shrubs and/or non-woody vegetation, over closed grass/forbland of pasture weeds.	0.46
Non-native	Heavily disturbed areas comprising bare ground and weeds with occasional native trees and forbs and/or sealed ground and buildings.	56.62

2.3.4 Vegetation condition

The majority of the site was heavily disturbed with limited intact native vegetation present. The vegetation was therefore mostly determined to be in 'degraded – completely degraded' and 'completely degraded' condition with a small portion determined to be 'very good – good'. Vegetation condition is shown in **Figure 6** and detailed below in **Table 3**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 3: Vegetation condition categories within the site

Condition category (Keighery (1994))	Size (ha)
Pristine	0
Excellent	0
Very good	0
Good – very good	0.07
Good	0
Degraded	1.04
Degraded – completely degraded	0.98
Completely degraded	56.57

2.3.5 Threatened and Priority Ecological Communities

Threatened Ecological Communities (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection.

At a Commonwealth level, TECs are afforded statutory protection under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and at a State level, TECs are afforded statutory protection under the *Biodiversity Conservation Act 2016* (BC Act). Under both Acts, TECs are listed as either 'critically endangered', 'endangered' or 'vulnerable', noting listing status may be different between Commonwealth and State frameworks.

Ecological communities that are not listed as threatened, but are otherwise considered rare or under threat, may be added to the Department of Biodiversity, Conservation and Attractions (DBCA) priority list (DBCA 2022, 2023). PECs are classified as either 'priority 1' (P1), 'priority 2' (P2), 'priority 3' (P3) or 'priority 4' (P4). Whilst PECs are not afforded statutory protection under the BC Act, they are recognised and categorised by the DBCA and are considered through State environmental approval processes.

The 'subtropical and temperate coastal saltmarsh' ecological community is listed as a TEC ('vulnerable') under the EPBC Act and as a PEC (P3) under the BC Act. The TEC/PEC was identified within a portion of the ErJkSt vegetation unit, located in a small part of the site to the north (**Figure 7**). A total of 0.07 ha of this TEC/PEC was mapped within the site. Only part of the ErJkSt vegetation unit represents the TEC/PEC with the remaining ErJkSt vegetation unit representing canopy overhang into the site with limited to no understory vegetation, which is not characteristic of the TEC/PEC.

2.3.6 Conservation significant flora

Flora species that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth and State level, flora species may be listed as 'threatened' pursuant to the EPBC Act and BC Act. However, listing status may be different between Commonwealth and State levels. Flora species that are not listed as threatened, but are otherwise considered rare or under threat, may be added to the DBCA priority list (DBCA 2022, 2023). Priority flora are classified as either 'priority 1' (P1), 'priority 2' (P2), 'priority 3' (P3) or 'priority

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

4' (P4). Whilst priority flora are not afforded statutory protection under the BC Act, they are recognised and categorised by the DBCA and are considered through approval processes.

The desktop search results identified a total of 100 flora species including 25 threatened and 75 priority flora species as occurring or potentially occurring within a 9 km radius of the site. Of these, two priority flora species (*Angianthus micropodioides* (P3) and *Aponogeton hexatepalus* (P4)) were considered to have 'high' or 'moderate' likelihood of occurrence within the site (Emerge Associates 2024a).

No threatened or priority flora species were recorded during the survey and suitable habitat for threatened or priority species was not considered to be present (Emerge Associates 2024a). The two threatened and priority flora species identified in the desktop assessment were not considered likely to occur due to lack of suitable habitat.

2.3.7 Weeds

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. At a State level, a particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to the *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. At a Commonwealth level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2019c).

A total of 58 weed species were recorded during the field survey. One weed species recorded, (**Tamarix aphylla* (athel pine)), is listed as a declared pest. Athel pine is listed in the exempt keeping category, meaning management is not obliged.

2.3.8 Environmentally Sensitive Areas

Environmentally sensitive areas (ESAs) are prescribed protection under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding significant, threatened or scheduled flora, vegetation communities or ecosystems.

Within an ESA, no exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply and would indicate that the site is likely to support significant environmental values. However, exemptions under Schedule 6 of the *Environmental Protection Act 1986* (EP Act) apply, including any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the *Environmental Protection Act 1986*).

The Swan River, located adjacent to the site, is also considered a "Conservation Category Wetland" and as such, a portion of the site (3.4 ha) is listed as an ESA (**Figure 8**).

A total of 1.10 ha of vegetation meeting the definition of 'native vegetation' pursuant to the EP Act occurs within the site, as shown in **Figure 7**. This is comprised of scattered flooded gum (*Eucalyptus rudis*) and marri (*Corymbia calophylla*) trees, and fringing vegetation (vegetation type ErJkSt).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2.3.9 Bush Forever

The Government of Western Australia's *Bush Forever Policy* (Government of WA 2000) is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of Bush Forever is to protect comprehensive representations of all original vegetation complexes by targeting a minimum of 10% of each for protection. Bush Forever areas represent regional ecosystems and habitat and have a vital role in conserving Perth's biodiversity.

No Bush Forever Sites occur within the site. The closest Bush Forever Site is Bush Forever Site 313 – Swan River Saltmarshes, Bayswater/Maylands, located approximately 100 m to the northwest of the site, separated by Grandstand and Garrett Road (see **Figure 8**).

2.3.10 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. The Perth Biodiversity Project, supported by the Western Australian Local Government Association have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). While the linkages generally align with areas of vegetation and Bush Forever areas, in many locations these linkages are not contiguous with vegetation coverage.

Ecological linkage ID 35 (Swan River) partially overlaps the northern portion of the site. However, most of the northern portion of the site does not support native vegetation due to historical clearing, and only a small portion remains within the northeast of the site.

Broadscale identified ecological linkages are shown in **Figure 8**.

2.3.11 City of Belmont Collective Local Biodiversity Strategy

In partnership with Town of Bassendean and City of Bayswater, the CoB developed a collective Local Biodiversity Strategy (LBS) as a commitment to the protection and enhancement of a network of local natural areas (LNAs).

LNAs across the three councils were ranked by viability using the Natural Area Initial Assessment templates detailed in the Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region (WALGA, 2004). The viability assessment was used to determine the reserves of high biodiversity value that would benefit from increased protection status. The highest viability areas within the CoB were as follows:

- Goodwood Parade Estuarine Dampland
- Signall Hill
- Tomato Lakes Bushland.

No reserves deemed to have high biodiversity value, as outlined in the LBS, were identified as occurring within the site. As such, no LNAs need to be considered as part of future development within the site.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2.4 Terrestrial Fauna

2.4.1 Site-specific surveys and investigations

In conjunction with the flora and vegetation assessment, Emerge Associates undertook a basic fauna and targeted black cockatoo survey, and the assessment boundary encompassed the entire site. The targeted black cockatoo survey extended beyond the SP area, and three potential habitat trees located adjacent to the site were identified outside the SP area. These trees are located beyond the SP area however the location of the trees are shown in Figure 7 of **Appendix D**.

Transects were traversed across the site, during the day, and the characteristics of fauna habitat and presence of fauna species was recorded. Microhabitats such as logs, rocks and leaf litter were investigated and evidence of species presence such as tracks, scats, skeletal remains, foraging evidence or calls was also noted. An opportunistic fauna species list was compiled and fauna habitat values were described, with particular reference to conservation significant fauna species that have the potential to occur within the site.

The findings of the survey and the associated assessment report (Emerge Associates 2024a) is summarised below and contained within **Appendix D.**

2.4.2 Fauna habitat

Emerge (2024) identified four habitat types within the site with most of the site (52.64 ha) described as 'cleared' (see **Table 4**). Habitat values in the site are limited by historical disturbance and are primarily suited to widespread fauna species with non-specific habitat requirements.

The fringing woodland fauna habitat, associated with the **ErJkSt** vegetation unit, was noted to provide a cover of native trees and understory cover of riparian vegetation that offers habitat for ground dwelling fauna. The fringing woodland is associated with the Swan River and extends into the northeast of the site. The scattered trees and shrubs habitat type comprised of large native trees was associated with vegetation units **Cc** and **Er** would provide value to native birds and other arboreal fauna (see **Figure 5**).

Table 4: Fauna habitats identified within the site

Fauna habitat	Description	Area (ha)
Fringing woodland	Native fringing vegetation consisting of a native tree overstorey and an understorey of sedges/rushes.	0.07
Wetland	Wetland waterbodies and associated riparian sedgeland/rushland.	3.72
Scattered trees and shrubs	Scattered native and non-native trees and shrubs, providing habitat mainly for avifauna.	5.45
Cleared	Predominantly grassy weeds, bare ground and built form.	52.64

Twenty-four fauna species were recorded within the site including two conservation significant fauna species.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2.4.3 Conservation significant fauna

Fauna species that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth and State level, fauna species may be listed as 'threatened' pursuant to the EPBC Act and BC Act, respectively. However, listing status may be different between Commonwealth and State levels. Fauna species that are not listed as threatened, but are otherwise considered rare or under threat, may be added to the DBCA priority list (DBCA 2022, 2023). Priority fauna are classified as either 'priority 1' (P1), 'priority 2' (P2), 'priority 3' (P3) or 'priority 4' (P4). Whilst priority fauna are not afforded statutory protection under the BC Act, they are recognised and categorised by the DBCA and are considered through environmental approval processes.

A total of 77 conservation significant fauna species were identified as occurring or potentially occurring within a 10 km radius of the site (Emerge Associates 2024a). Of these, 11 species were considered to have a 'moderate' or 'high' likelihood of occurrence within the site, including six migratory and/or specifically protected bird species, two threatened bird species, one priority bird species and two priority mammal species **Table 5**.

The field survey confirmed the 11 species identified from the desktop assessment have the potential to occur within the site. Based on observations of fauna habitat for migratory species, it was noted that occurrences of migratory species within the site are likely to be a flyover or for marginal foraging habitat due to the site and surrounding area lacking suitable habitat.

Rakali may utilise the Swan River and are likely to occasionally occur in the northern most portion of the site associated with the fringing woodland habitat type. Quenda may occur in understorey vegetation or where grasses provide dense cover.

One threatened species, *Zanda banksii naso* (forest red-tailed black cockatoo (FRTBC)) and one P4 species (*Oxyura australis* (blue-billed duck)) were recorded at the time of survey (Emerge Associates 2024a). FRTBC were observed foraging in the southern portion of the site in cape lilac (*Melia azedarach*), which were overhanging from adjacent private properties.

Table 5: Conservation significant fauna species with potential to occur within the site

Taxa	Common name	Conservation Status	
		EP Act	EPBC Act
Birds			
Zanda banksii naso[1]	Forest red-tailed black cockatoo	VU	VU
Zanda latirostris[2]	Carnaby's black cockatoo	EN	EN
Oxyura australis	Blue-billed duck	P4	-
Pandion haliaetus	Osprey	MI	MI
Apus pacificus	Pacific swift	MI	MI

[1] Previously *Calyptorhynchus*
[2] Previously *Calyptorhynchus*

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 5: Conservation significant fauna species with potential to occur within the site (continued)

Taxa	Common name	Conservation Status	
		EP Act	EPBC Act
Calidris ruficollis	Red-necked stint	MI	MI
Plegadis falcinellus	Glossy Ibis	MI	MI
Thalasseus bergii	Crested tern	MI	MI
Falco peregrinus	Peregrine falcon	OS	-
Mammals			
Hydromys chrysogaster	Rakali	P4	-
Isoodon fusciventer	Quenda	P4	-

2.4.3.1 Black Cockatoos

Three threatened species of black cockatoo occur in the south-west of WA:

- *Zanda*[3] *latirostris* (Carnaby's black cockatoo) (CBC) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Zanda*[4] *baudinii* (Baudin's black cockatoo) (BBC) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) (FRTBC) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

The site is within the modelled distribution of CBC and FRTBC (DAWE 2022) and are therefore these species have been considered further in this section. Additionally, FRTBC were observed during the survey, in cape lilac (*Melia azedarach*) overhanging the site boundary (Emerge Associates 2024a). The site does not lie within the modelled distribution of BBC and therefore, the species is not likely to occur and have not been considered further.

Black cockatoo habitat consists of breeding, roosting and foraging categories. Foraging and breeding habitat for CBC and FRTBC was identified. No roosts or evidence of roosts were observed. However, tall trees within the site have the potential to be roosting trees. Foraging and breeding habitat for CBC and FRTBC was identified.

Foraging habitat was identified and classified as either 'primary' or 'secondary' based on black cockatoo foraging preferences. Primary food plants were defined as those with historical and contemporary records of regular consumption by a black cockatoo species. Secondary food plants were defined as plant species that black cockatoo species have been recorded consuming occasionally or that, based on their limited extent or agricultural origin, should not be considered a sustaining resource.

A total of 1.27 ha of foraging habitat for CBC was recorded, of which 0.35 ha comprised primary foraging habitat. Primary foraging habitat included 0.28 ha of primary native foraging habitat

[3] Previously *Calyptorhynchus*
[4] Previously *Calyptorhynchus*

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

associated with *Corymbia calophylla,* 0.07 ha of primary non-native foraging habitat associated with *Pinus pinaster*. A total of 0.92 ha of secondary foraging habitat was recorded, including 0.41 ha of secondary native foraging habitat associated with *Acacia saligna*, *Jacksonia furcellata* and X*anthorrhoea* spp. and 0.51 ha of secondary non-native habitat associated with *Eucalyptus gomphocephala* (**Figure 9**).

A total of 0.84 ha of foraging habitat for FRTBC was recorded in the site, which comprises 0.28 ha of primary native habitat associated with *Corymbia calophylla,* 0.07 ha of secondary native foraging habitat associated with *Jacksonia furcellata* and 0.49 ha of non-native secondary habitat associated with *Eucalyptus gomphocephala* and *Eucalyptus camaldulensis* (see **Figure 10**).

The extent of foraging habitat by value category is detailed in **Table 6**.

Table 6: Foraging habitat recorded within the site

Foraging habitat	Black cockatoo species and area of foraging habitat (ha)	
	Carnaby's	Forest red-tailed
Primary native	0.28	0.28
Primary non-native	0.07	0
Secondary native	0.41	0.07
Secondary non-native	0.51	0.49
Total	**1.27**	**0.84**

Breeding habitat was identified through 'habitat trees' which are typically defined as a native eucalypt that is known to support (or with the potential to support) black cockatoo breeding. Habitat trees include species such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum, with a diameter at breast height (DBH) of greater than 50 cm (or DBH greater than 30 cm for wandoo or salmon gum). A total of 66 habitat trees were recorded during the fauna survey. Of these, 5 trees contained hollows potentially suitable for black cockatoo breeding and the remaining 61 habitat trees did not contain hollows potentially suitable for black cockatoo breeding. Hollow potential for breeding habitat was based on inspection from ground level, which could be further verified through more detailed hollow inspections (Emerge Associates 2024a). The location of the habitat trees within the site are shown on **Figure 11**.

2.5 Inland Waters

2.5.1 Surface water

The surface hydrology within the site is dominated by the Swan River, which is located adjacent to the site. During summer, the influence of the river is limited to the riverine fringe, while in winter levels rise and can extend inland. The 1 in 100-year flood and fringe level area (see **Figure 12**) shows that the north east corner and the north west corner of the site is within the floodway and the flood fringe area extends into the site.

Within the centre of the racecourse there are three lakes including an irrigation lake, a lined lake for overflow from the irrigation lake and a wetland lake, which is the largest lake and allows excess

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

water to flow under the grass track to the Swan River (Emerge Associates 2024b). The irrigation lake is filled from an adjacent production bore and provides irrigation for the racetrack and surrounding landscaped areas. The lined lake is sealed with a natural clay liner and is used to provide irrigation for landscaped areas and water features.

2.5.2 Groundwater

2.5.2.1 Regional groundwater

The *Water Register* (DWER 2023) indicates that groundwater beneath the site is a multi-layered system comprised of the following:

- City of Bayswater – Perth Superficial Swan unconfined aquifer
- Perth South – Perth Leederville confined aquifer
- Perth South – Perth Yarragadee confined aquifer.

The Perth Groundwater Map indicates (DWER 2023) that the groundwater level sits at 0.5 mAHD across the site. The groundwater clearance from southeast to northwest of the site ranges from 6.5 m to 0.5 m (**Figure 12**).

2.5.2.2 Site-specific groundwater monitoring

Groundwater monitoring has been undertaken within the SP area. There are two groundwater level and quality monitoring bores and one production bore within the Racecourse, which are monitored by Perth Racing.

Groundwater depth monitoring undertaken by D.C. Blandford & Associates Pty Ltd in 2001 (D.C Blandford & Associates 2001) indicated groundwater depths ranging between 2.03 mAHD to 0.16 mAHD at the site. Additional results from bore monitoring of the Ascot Racecourse undertaken by JDA in 2022 indicated that groundwater levels ranged from 2.06 m below natural surface (mBNS) to 0.34 mBNS.

Groundwater depth monitoring was undertaken within Precinct A where six monitoring wells were installed for the geotechnical investigation by Douglas Partners (2024). The groundwater depth varied from 1.09 m below ground level (mBGL) to 2.37 mBGL during January 2024 (Douglas Partners 2024). Groundwater depth monitoring was undertaken within Precinct D by Galt Geotechnics during the geotechnical investigation. The highest groundwater level was reported as 3.03 mBGL during February 2024 (Galt 2024).

Groundwater quality monitoring was also undertaken by D.C. Blandford & Associates Pty Ltd in 2001. Concentrations of total nitrogen, nitrate, total phosphorus, as well as pH indicated minor fluctuations throughout the year, but trends were generally consistent with previous results. Results indicated metals concentrations below laboratory detection limits, with the exception of one elevated nickel concentration detected.

Groundwater quality monitoring undertaken by JDA Consulting Hydrologists in 2022 (JDA 2022) indicated similar conditions to the 2001 results. Groundwater salinity and pH levels were below the trigger value and within the guideline limits. Concentrations of total nitrogen and total phosphorous were in exceedance but were generally consistent with historical trends at the site.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2.5.3 Wetlands

Wetlands include "*areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries*" (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of international significance (such as Ramsar wetlands) are afforded protection under the EPBC Act. No such wetlands occur within or in close proximity to the site.

At a regional level, DBCA maintains the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA 2023), which categorises wetland features into management categories to guide land use and conservation, as outlined in **Table 7**. Wetland types are based on landform shape and water permanence, whilst management categories of wetlands are determined based on hydrological, biological and human use features.

Table 7: Geomorphic wetland management categories

Management Category	Description of wetland	Management objectives
Conservation Category Wetland (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource Enhancement Wetland (REW)	Modified or degraded but still supporting substantial attributes and functions	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple Use Wetland (MUW)	Few remaining important wetland attributes and functions but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The Geomorphic Wetlands of the Swan Coastal Plain dataset indicates three Multiple Use Category Wetland (MUW) areas (UFI 8424, UFI 8425 and UFI 8426) and one Resource Enhancement Wetland (REW) area (UFI 8423 are present within the site. After review of local surface water hydrology, the Geomorphic Wetlands of the Swan Coastal Plain dataset mapping and field observations (refer to **Figure 5** and **Figure 6** of Emerge Associates 2024b), it was determined that the area designated as an REW in the Geomorphic Wetlands of the Swan Coastal Plain dataset does not accurately reflect the conditions observed on ground.

The Swan River Estuary, situated outside the northern boundary of the site, is recognised as a "Conservation Category Wetland" (CCW) (UFI 1316 - Estuary waterbody) within the Geomorphic Wetlands of the Swan Coastal Plain dataset and has additional significant ecological, cultural and heritage values (DEC 2011). The riparian vegetation identified in Emerge Associates (2024a) is associated with the Swan River and extends into the northeast of the site. Riparian vegetation would provide habitat for waterbirds, including birds which nest in dense stands of sedges and rushes and those waterbirds which forage in mud flats along the river. In addition, the fringing vegetation would

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

provide habitat for both terrestrial and aquatic fauna species, including reptiles, small mammals, fish and invertebrates.

The location of the geomorphic wetlands is shown on **Figure 12.**

2.5.4 Public drinking water source areas

DWER proclaims Public Drinking Water Source Areas (PDWSAs) to protect identified drinking water sources, including surface water and groundwater sources (DoW 2009). They are proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947* as Water Reserves, Catchment Areas or Underground Water Pollution Control Areas.

No PDWSAs exist within or surrounding the site.

2.6 Social Surroundings

2.6.1 Aboriginal cultural heritage

An enquiry was submitted to the Department of Planning, Lands and Heritage (DPLH) through the Aboriginal Heritage Enquiry Form (AHEF), which identified Site 3753 partially intersects with the western edge of the site and Site 3756 is located immediately adjacent to the site (**Figure 13**). Details on these sites are shown below:

- Site ID 3753 – Registered site, Name: Perth, Type: Historical, mythological, hunting place, named place, natural feature.
- Site ID 3536 – Registered site, Name: Swan River, Type: Creation / Dreaming Narrative.

It should be noted that the Site 3753 boundary is a broader area and the exact area is not defined (**Figure 13**). Therefore, it is possible that the exact location of Site 3753 is outside the site boundary.

2.6.2 Non-Indigenous heritage

A review of the State Heritage Office database (Heritage Council WA 2022) was undertaken to determine presence of sites or features of non-indigenous heritage significance within the site at a federal, state and local government level.

The Ascot Racecourse Complex (place number 06123) is listed at a local level with the CoB and occurs across the racecourse itself, which is excluded from any development areas within the SP. A portion of the Ascot Racecourse Complex is also mapped across the site (Precinct A, B and C) and comprises original buildings and newly established buildings.

The following places occur in the surrounding area and are state or local listed places:

- Bristile Kilns (fmr), Belmont (place number 00868) (state)
- Garratt Road Bridge (place number 11342) (state)
- Ascot Residential & Stables Precinct (place number 16779) (local).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2.6.3 Surrounding land uses

The surrounding area is mostly residential, with the exception of commercial land and some public open space to the south and the Swan River and public open space to the north (**Figure 13**). A Parks and Recreation Reserve (reserved under the MRS), associated with the Swan River foreshore, extends along the northern boundary of the site and intersects with a portion of the site. This area includes part of the racecourse itself and vegetation within the northeast of the site. Both of these areas are planned to be retained as part of the SP.

No surrounding land uses are likely to cause amenity impacts associated with dust, gaseous or odour emissions.

Great Eastern Highway is less than 300 m south of the southern boundary of the SP which will require consideration of transport noise and management/mitigation in line with the State Planning Policy (SPP) 5.4 *Road and Rail Noise*. Precinct E falls within the SPP 5.4 area and requires further consideration regarding potential noise impacts.

2.7 Other Considerations

2.7.1 Bushfire hazards

Review of the Department of Fire and Emergency Services (DFES) Bushfire Prone Area (BPA) mapping (DFES 2021) indicated no Bushfire Prone Areas (BPA) within the site. The nearest BPA is greater than 500 m to the west of the site and therefore no further consideration to bushfire hazards is required.

2.8 Summary of Existing Environmental Values

Table 8 below summarises the existing environmental values occurring within the site, as identified and discussed previously in **Sections 2.1** to **2.7**.

Table 8: Summary of existing environmental values within the site relevant to EPA factors

EPA factor	Summary of existing environmental values within the site
Landforms	• No restricted landforms or unique geological features have been identified within the site. • The Swan River is located adjacent to the site.
Terrestrial environmental quality	• The majority of the site is considered to have high to moderate risk of ASS occurrence and a small portion in the south is considered to have moderate to low risk of ASS occurring within the 3 m of the natural surface. • Lot 9002 (including Precinct A and Precinct B) is classified as "possibly contaminated – investigation required" pursuant to the *Contaminated Sites Act 2003.*

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 8: Summary of existing environmental values within the site relevant to EPA factors (continued)

EPA factor	Summary of existing environmental values within the site
Flora and vegetation	• No threatened or priority flora species were recorded in the site. The threatened and priority flora species identified in the desktop assessment are not considered to occur in the site due to lack of suitable habitat. • The majority of the site is heavily disturbed (degraded to completely degraded) and limited native intact native vegetation is present. • One small patch of vegetation (vegetation community type ErJkSt) was identified in 'good – very good' condition. • A total of 0.07 ha of the 'subtropical and temperate coastal saltmarsh' TEC/PEC (listed as Vu under the EPBC Act and listed as P3 under the EP Act) occurs within the northern portion of the site adjacent to the Swan River. • A total of 1.1 ha of native vegetation as classified under the EP Act was mapped within the site.
Terrestrial fauna	• Eleven conservation significant fauna species were considered to have a 'moderate' or 'high' likelihood of occurrence within the site including six migratory and/or specifically protected bird species, two threatened bird species, one priority bird species and two priority mammal species. • One priority listed species, blue-billed duck (P4) was recorded during the survey (Emerge Associates 2024a). • As a result of historical disturbance, the site contains limited fauna habitat and is likely only utilised by fauna traversing through the wider area, especially birds. However, the small patch of 'Fringing Woodland' in the site's northeast may provide habitat value for smaller ground-dwelling fauna. **Black cockatoos** • CBC (EN) and FRTBC (VU) have the potential to occur within the site based on the desktop assessment undertaken. • FRTBC was observed foraging in the southern portion of the site in cape lilac (*Melia azedarach*), which were overhanging from adjacent private properties (Emerge Associates 2024a). • 66 potential black cockatoo habitat trees were recorded within the site. • A total of 1.27 ha of foraging habitat for CBC was recorded, of which 0.35 ha comprised primary foraging habitat. • A total of 0.84 ha of foraging habitat for FRTBC was recorded, of which 0.28 ha comprised primary foraging habitat.
Inland waters	• No CCWs have been identified within the site; however, the Swan River is a CCW and occurs immediately north of the site. • Three MUWs (UFI 8424, UFI 8425, UFI 8426) are mapped across the site. • One REW (UFI 8423) is mapped across the site, however, after review of local surface water hydrology, the Geomorphic Wetlands of the Swan Coastal Plain dataset mapping and field observations (refer to **Figure 5** and Figure 6 of Emerge Associates 2024b), it was determined that the area designated as an REW in the Geomorphic Wetlands of the Swan Coastal Plain dataset does not accurately reflect the conditions observed on ground.
Social surroundings	• Aboriginal Cultural Heritage Site 3753 partially overlaps with a portion of the west of the site and Site ID 3536 (Swan River) is located immediately north of the site. These places are associated with creation/dreaming narrative and is also associated with a mythological value. • The Ascot Racecourse Complex, place number 06123, occurs across the racecourse itself and Precinct A, B and C. • Noise and acoustic impact from Great Eastern Highway must be considered for Precinct E residential development.
Other considerations	• No Bushfire Prone Areas exist within the site.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3 Proposed Land Use and the Planning and Approval Framework

3.1 Ascot Racecourse Proposed Development

The proposed zoning for the SP is in line with existing zoning in adjacent areas and aims to provide a framework of what might be considered appropriate from a land use planning perspective, and provides a framework for the future land use, subdivision and development within the site. Additionally, a master plan has been prepared which provides a detailed conceptual layout for proposed residential and commercial areas, the road network, public open spaces and other facilities (**Appendix C**). The master plan (**Appendix C**) indicates the following future land use per precinct as:

- The racecourse is proposed to remain, within which there is expected to be minimal future additional development.
- Precinct A is proposed to include a retirement living village.
- Precinct B includes the existing car parking and racecourse grandstand and is proposed to include additional car parking spaces and provide new buildings for offices/hospitality.
- Precinct C includes proposed stables, horse float parking and car parking.
- Precinct D includes a proposed residential area and childcare centre.
- Precinct E includes proposed equine and jockey services, car parking and pad site and potential retail and bulky goods.

The SP has been developed through an iterative and collaborative design process involving a variety of stakeholders, including a multi-disciplinary design team providing expertise in the following fields:

- Town planning and urban design
- Environmental planning
- Aboriginal heritage
- Hydrology
- Civil and geotechnical engineering
- Traffic engineering
- Economic analysis.

3.1.1 Environmental considerations of the structure plan

Environmental values and considerations have been addressed as part of the SP design process, which has culminated in the proposed SP and master plan layout provided in **Appendix A** and **Appendix C**.

As outlined above, the primary structural basis of the SP layout has generally been informed by the location and extent of the various existing district-scale land uses. This has provided a level of restriction to the ability for the SP layout to strategically respond to environmental values within the site. Notwithstanding, the proponent has taken a range of measures to provide for the future retention of significant environmental values where possible (i.e. where there remains flexibility in the layout design process).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3.1.1.1 Public Open Space

The area reserved for Parks and Recreation in the northern extent of the SP, along the foreshore of the Swan River, has been retained as Parks and Recreation as part of the proposed land uses within the SP. Retention of this vegetation avoids direct impacts to the 0.07 ha of subtropical and temperate coastal saltmarsh TEC/PEC. In addition, this vegetation was identified as being in good to very good condition with potential to provide canopy cover and habitat for avian species as well as riparian vegetation for ground dwelling fauna.

3.1.1.2 Hydrology

To address the proximity of the Swan River and support the SP design and process, a Local Water Management Strategy (LWMS) has been prepared by Emerge Associates (2024b) to consider water sensitive urban design principles, flood storage requirements and a water conservation strategy. The principal management objective for hydrology within the site is to ensure that post-development environmental flows and/or hydrological cycles are maintained or improved upon pre-development conditions, especially regarding the Swan River located adjacent to the site and lake features within the site. Specifically, the LWMS has aimed to:

- Protect water quality in the Swan River by providing appropriate water quality treatment at source.
- Mitigate potential flooding within the SP area and immediate surrounds.
- Take account of existing drainage infrastructure capacity and ensure that sufficient land is set aside to manage stormwater.
- Provide a broad level stormwater management framework to support future urban development.
- Incorporate appropriate best management practices into the drainage systems that address the environmental and stormwater management issues identified.
- Minimise transport of nutrients/pollutants to groundwater.
- Develop a non-potable water conservation strategy that will accommodate existing groundwater allocation constraints for the area.
- Gain support from DWER, DBCA, CoB and Water Corporation for the proposed method to manage stormwater within the site.

3.1.1.3 Wetlands

A total of three MUW as per the Geomorphic Wetlands of the Swan Coastal Plain dataset exist within the site, specifically within the boundary of the Ascot Racecourse track. No considerations are required for MUWs however the planning and design of the SP does not intend to disturb the MUW.

One REW (UFI 8423) is mapped across the site, however, after review of local surface water hydrology, the Geomorphic Wetlands of the Swan Coastal Plain dataset mapping and field observations (refer to **Figure 5** and Figure 6 of Emerge Associates 2024b), it was determined that the area designated as a REW is unlikely represent a REW. Regardless, the planning and design of the SP has avoided the REW and no disturbance to the REW is anticipated.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3.1.1.4 Conservation significant fauna

The SP design retains the most suitable fauna habitat, the fringing woodland habitat type which is associated with the remnant vegetation along the foreshore reserve. This vegetation was noted to provide habitat for conservation significant fauna species, including rakali and will be retained in the current SP design.

The black cockatoo foraging habitat identified by the field survey is patchily distributed across the site and interspersed with plant species not used by CBC or FRTBC. No signs of use were identified during the targeted black cockatoo survey, such as chew marks, droppings or moulted feathers within any of the habitat trees with hollow(s) in the site.

The potential foraging habitat and habitat trees for CBC and FRTBC within the site is unlikely to represent critical foraging or breeding habitat, given its small extent within an urban setting with minimal potentially suitable hollows and no evidence of use by CBC or FRTBC. Potential black cockatoo habitat trees identified will be opportunistically retained. The potential foraging and breeding habitat in the SP occurs within the 'Place of public assembly,' where future development is permitted to occur. Black cockatoo habitat will need to be considered as part of future subdivision and development approvals.

3.1.1.5 Aboriginal cultural heritage

Whilst not identified as occurring within the precinct areas, the Swan River (Site ID 3536) is a key Aboriginal cultural heritage site for consideration. The SP design retains the Parks and Recreation Reserve which excludes future development adjacent to the Swan River and protects this place of cultural heritage significance from potential development impacts.

No works associated with SP development are currently proposed to directly impact the Swan River, however, should any future proposed works impact the riverbank, foreshore or any other Aboriginal cultural heritage site, approval for the proposed works under Section 18 of the *Aboriginal Heritage Act 1972* would be required.

3.1.1.6 Non-Indigenous heritage

The Ascot Racecourse Complex (place 06123) includes the racecourse itself and the surrounding proposed precincts, excluding Precinct D, as outlined in the SP. The SP design proposes to retain the racecourse itself and does not propose development within the racecourse. The remaining part of the Ascot Racecourse Complex (place 06123) is within Precinct A, B, C and E. The SP design for these precincts allows for the development of additional facilities and renovation of current facilities.

3.2 Future planning and environmental approvals process

A key component of implementing the future development of any area is the relevant environmental management framework. Subject to approval and endorsement of the structure plan by the WAPC, development of the site will be progressed through subdivision and/or development approval/s. Where required, the environmental management requirements can be implemented through

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

applicable subdivision and/or development approval conditions. The future planning and environmental approvals process is discussed in this section.

3.2.1 Metropolitan Region Scheme

The site is currently zoned a combination of 'Urban,' 'Private Recreation' and 'Parks and Recreation' under the Metropolitan Region Scheme (MRS). The majority of surrounding land is zoned as 'Urban,' and land abutting the Swan River reserved for 'Parks and Recreation'. The MRS zoning of Precinct A area is currently 'Private Recreation' and lodgment of an MRS amendment may be required with the Western Australian Planning Commission (WAPC) to rezone the Precinct A area from 'Private Recreation' to be consistent with finalised land uses.Correspondingly, LPS 15 could be amended either through a concurrent or subsequent local scheme amendment (see further details regarding LPS 15 in **Section 3.2.2**).

Any scheme amendment request received and initiated by the responsible authority (WAPC), would be formerly referred to the EPA under Section 48A of the EP Act (unless exempt under Section 48AAA of the EP Act). This is discussed further in **Section 3.2.4**.

3.2.2 Local Planning Scheme No. 15

The site is currently zoned 'Public place of assembly' and 'Mixed Use' under the CoB LPS 15. The existing Ascot Racecourse covers the majority of the site, which attributes the 'Place of public assembly' zoning and the south of the site within part of Precinct E is zoned 'Mixed Use'.

The current LPS 15 zonings are inconsistent with the proposed land uses within Precinct A and Precinct D. As such, a local scheme amendment will be required to rezone Precinct A from 'place of public assembly' to 'retirement living/mixed use' and to rezone Precinct D from 'Place of Public Assembly' to 'Mixed Use'.

The Swan River foreshore is also subject to the *City of Belmont Foreshore Precinct Plan* (CoB 2018) which guides the future use and management of the Belmont foreshore and the development interface with the Parks and Recreation reserve.

3.2.3 *Environmental Protection Act* 1986 - Section 38 proposals

Section 38 of the EP Act enables any person to refer a 'proposal' (as opposed to a planning scheme, as per Section 48) likely to have a significant impact on the environment to the EPA, who then decide whether or not to assess the proposal. The SP area, or part thereof, will need to be considered in relation to Section 38 of the EP Act.

A preliminary assessment of the anticipated environmental outcomes as a result of the anticipated future urban development (based on the SP layout) has been undertaken against relevant EPA factors and objectives, which is outlined in **Section 4**. Based on this assessment, it is not considered likely that any future development within the SP would require referral to the EPA pursuant to Section 38 of the EP Act.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3.2.4 *Environmental Protection Act 1986* - Section 48 scheme amendment referral

An amendment to a planning scheme (regional or local) is required to be referred to the EPA (unless exempt under Section 48AAA of the EP Act) to determine whether environmental assessment is required, pursuant to Section 48 of the EP Act. All amendments to a planning scheme are required to be referred to the EPA by the responsible authority (in this case, the WAPC) unless the amendment is exempt under Section 48AAA of the EP Act. Exemptions under Section 48AAA relate to amendments that seek changes to the planning scheme that do not relate to the environment and will not impact the environment and therefore do not require EPA consideration. Exemptions include:

- Amendments seeking to correct an administrative or minor error, amend a definition or correct a title in the planning scheme if it will not impact the operation of the scheme.
- Amendments seeking to classify an area of land as a reserve for Parks and Recreation or Regional Open Space.
- Amendments seeking to zone an area of land as a reserve if the land has been subdivided and developed by an approved redevelopment scheme and the redevelopment scheme no longer applies and the amendment is required to reflect a zone or reserve created in accordance with the approved redevelopment scheme.
- Amendments seeking to create, alter or remove a road reserve of a regional road if a clearing permit under Part V of the EP Act has been granted or if the impacts associated with construction of the road has been assessed under Part IV of the EP Act and a decision has been made that the proposal can be implemented.

The required scheme amendment for the SP will not be exempt under Section 48AAA of the EP Act. Upon referral on an amendment to a planning scheme, the EPA will make a decision on whether the proposed scheme amendment requires formal assessment and often consider significance in their assessment. The EPA may also provide informal advice on the proposed scheme amendment without formally assessing the scheme or determine that the proposed amendment is not capable of being environmentally acceptable. Areas of the SP area not assessed under Section 48A will need to be considered and referred under Section 38 of the EP Act if impacts to the environment are considered significant. As stated above, a preliminary assessment of the anticipated environmental outcomes as a result of the anticipated future urban development (based on the SP layout) has been undertaken against relevant EPA factors and objectives and is outlined in **Section 4**.

Section 48A outlines that any proposal likely to have a significant impact on the environment, but which is within an area and for a land use that is subject to an assessed scheme (i.e. a scheme for which a determination has been made by the EPA under Section 48A), is not required to be referred to the EPA under Section 38 of the EP Act.

Section 48A will only apply to the SP area which has undergone a scheme amendment (regional or local) through the Section 48A process and where the potential environmental impacts were considered by the EPA. The EPA may choose to provide advice at this time and defer assessment of environmental factors to subsequent stages of the planning process, which would mean Section 48A would not apply and referral under Section 38 would be required. Based on the assessment undertaken and the nature/layout of the SP it is unlikely that any future development within the SP extent would quire referral to the EPA pursuant to Section 38 of the EP Act.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3.2.5 Environmental Protection Act 1986 – Part V Clearing Permits

Where native vegetation is required to be cleared within the site, this will likely be undertaken in accordance with a subdivision approval and associated authorised subdivision works, which will provide an exemption from the requirements for a native vegetation clearing permit. Should bulk earthworks or any other works be commenced within the site that requires clearing of native vegetation before subdivision approvals are gained, a clearing permit pursuant to Part V of the EP Act will be required.

In addition, and as part of subdivision, the WAPC may include a standard condition (model subdivision condition EN2) which requires:

Prior to the commencement of subdivisional works, measures being undertaken to identify any vegetation on the site worthy of retention, including any potential habitat or foraging trees for threatened fauna species, and protection measures implemented to ensure such vegetation is not impacted by subdivisional works (Local Government).

This can be used to ensure that vegetation retention opportunities (likely to be limited to mature trees) are considered through the subdivisional works process.

3.2.6 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides statutory protection for listed Matters of National Environmental Significance (MNES). The CBC is listed as endangered and FRTBC is listed as vulnerable under the EPBC Act. Any future development proposals within the SP should consider the requirements of the EPBC Act in relation to CBC and FRTBC and their habitat, which will primarily be in relation to the potential breeding habitat.

The subtropical and temperate coastal saltmarsh TEC is listed as vulnerable under the EPBC Act. TEC's listed in the vulnerable category are not considered matters of national environmental significance (MNES) for the purposes of Part 3 of the EPBC Act and therefore no further considerations to the TEC/PEC are required in relation to the EPBC Act.

Individual proponents of future development within the site will need to consider their obligations under the EPBC Act and the potential need to refer any proposed action that may have a significant impact on MNES. This would largely be limited to the consideration of potential impacts on listed black cockatoo species. While this would be considered on a proposal-by-proposal basis (and potentially progressed by different proponents), it is unlikely that the potential impacts on black cockatoo would be considered significant.

3.2.7 Swan and Canning River Development Control Area

The northern boundary of the site falls within the Swan Canning Development Control Area (DCA) (CoB 2018) and the Swan Canning River Park. Any proposed development on land adjacent to the river within the DCA and/or partly within DCA would be subject to assessment and approval by the DBCA through a permit application, under Part 5 of the *Swan and Canning Rivers Management Act 2006* and the *Swan and Canning River Management Regulations 2007*.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

4 Assessment of Predicted Environmental Outcomes

The predicted environmental outcomes that will need to be accommodated in the implementation of the proposed SP, through future development, have been assessed against the EPA objectives for each environmental factor relevant to the site (as listed in **Section 2**).

This is provided in **Table 9**, which considers the spatial layout responses of the SP and provision of POS intended to provide for the protection and conservation of existing environmental assets within the site. In addition, **Table 9** also outlines the future management of environmental values or considerations that will require further specific attention as part of the future development of the site.

A range of environmental impact mitigation measures (primarily impact avoidance and minimisation) are proposed within the SP layout and through the future environmental management framework. In this context, it is anticipated that implementation of any future development within the proposed SP can be suitably managed through future stages of the land use planning processes (including subdivision and development) such that the EPA objectives for the relevant environmental factors can be achieved.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 9: Summary of EPA environmental factors and objectives relevant to the proposed future land use

Environmental factor	EPA objective	Ascot Local Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	The Swan River is located immediately adjacent to the north of the site. No development is proposed within the Swan River foreshore Reserve. Additionally, retention of the riparian vegetation associated with the Swan River in the northern portion of the site allows for protection of biological diversity and ecological integrity along the Swan River foreshore. Further responses associated with the Swan River in regard to hydrology are discussed below.	Future management considerations for the Swan River in regard to inland waters are discussed below.	No significant impacts likely
Terrestrial environmental quality	To maintain the quality of land and soils so that environmental values are protected.	There are no SP spatial responses to terrestrial environmental quality considerations, which primarily relate to ASS risk. To address Lot 9002 which is classified as "potentially contaminated – investigation required", investigations have been commenced by the proponent in preparation of anticipated subdivision or development approval conditions.	To facilitate development within the site, ASS investigations and management considerations for the site will likely be required (as a portion of the site is mapped as Class 1 'high to moderate' risk of ASS occurring within 3 m of the natural soil surface). Given the relatively shallow depths to groundwater within portions of the site, any dewatering that may be required for development works would likely trigger the need for a dewatering and ASS management plan. If required, any future ASS considerations will be identified and suitably managed by each proponent as part of the future development process in accordance with the WAPC's *Acid Sulfate Soils Planning Guidelines* (2008). Any future development within Lot 9002 will need to resolve the current CS Act classification, and this would involve the completion of investigations and any remediation that is identified as being required.	Any potential impacts associated with ASS can be suitably minimised at future development stages within the site. If determined to be required, an ASS management plan and dewatering management plans would be prepared and implemented as part of any works associated with subdivision or development works. Site contamination will be adequately investigated and remediation completed (if required) to resolve any site contamination risk.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 9: Summary of EPA environmental factors and objectives relevant to the proposed future land use (continued)

Environmental factor	EPA objective	Ascot Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Flora and vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	The SP layout has been designed to maintain the northern vegetated area within Parks and Recreation Reserve. This includes 0.07 ha of the subtropical and temperate coastal saltmarsh TEC/PEC. Retention of this vegetation in the northern portion of the site allows for protection of flora, vegetation, biological diversity and ecological integrity along the Swan River foreshore. Remaining vegetation within the site was recorded in 'degraded' to 'completely degraded' condition with minimal environmental value. As such, no additional SP vegetation retention provisions are considered necessary.	Should any works within the site that require clearing of native vegetation prior to subdivision approvals, a clearing permit pursuant to Part V of the EP Act will be required, unless otherwise exempt from a clearing permit. Subdivision approval and associated authorised subdivision works will provide an exemption from the requirements for a clearing permit. Future subdivision and/or development applications and approval conditions would consider vegetation retention where possible. Conditions associated with subdivision and/or development approvals often require the preparation of a Conservation and Environment Management Plan, which would further minimise potential impacts to retained flora and vegetation values during proposed construction in development stages.	Overall, the SP layout responds to flora and vegetation values where possible, primarily associated with retention of established vegetation along the Swan River foreshore. Protection of an area of subtropical and temperate coastal saltmarsh TEC/PEC is also a key outcome of this response.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 9: Summary of EPA environmental factors and objectives relevant to the proposed future land use (continued)

Environmental factor	EPA objective	Ascot Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Terrestrial fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	The SP layout has been designed to maintain the northern vegetated area within POS. Retention of this vegetation in the northern portion of the site allows for protection of biological diversity and ecological integrity along the Swan River foreshore. A total of 66 habitat trees potentially suitable for black cockatoo breeding were identified within the site, of which five contain potentially suitable hollows for black cockatoo breeding habitat. A total of 1.27 ha and 0.84 ha of foraging habitat (primary and secondary) for CBC and FRTBC, respectively, was recorded within the site. Of this, primary foraging habitat (native and non-native) comprised a total of 0.35 ha and 0.27 ha for CBC and FRTBC, respectively. The remaining area consisted of secondary foraging habitat. The foraging habitat is patchily distributed and is interspersed with plant species not used for CBC or FRTBC for foraging. No signs of use were identified during the targeted black cockatoo survey, such as chew marks, droppings or moulted feathers within any of the habitat trees with potential hollow(s). The potential foraging habitat and habitat trees for threatened black cockatoo species mapped within the site are unlikely to represent critical foraging or breeding habitat, given its small extent within an urban setting with minimal potentially suitable hollows and no evidence of use by CBC or FRTBC.	Where future development works within the site will result in potential impacts to MNES (including CBC and FRTBC), proponents will need to consider their EPBC Act obligations and need for referral, based on the specific impacts of their proposed action. Individual proposed actions can be addressed through preliminary self-assessment against the *Matters of National Environmental Significance Significant Impact Guidelines* (DotE 2013) in relation to any potential impacts on MNES. As part of future subdivision, there may be requirements to prepare a fauna management plan prior to works commencing for development involving clearing of native vegetation or any fauna habitat in order to minimise impacts to fauna during clearing and construction works. Fauna management plans can be prepared as required as part of future subdivision works and are often associated with conditions of subdivision and/or development approval. Conditions associated with subdivision and/or development approvals often require the preparation of a Conservation and Environment Management Plan, which would further minimise potential impacts to fauna during proposed construction in development stages.	Overall, the SP layout responds to terrestrial fauna values, primarily associated with retention of intact native vegetation along the northern border of the site, providing potential habitat for terrestrial fauna. Notwithstanding, impacts to MNES such as CBC and FRTBC are possible and EPBC Act obligations will need to be considered by proponents before development, depending on the nature and extent of the development and magnitude of likely impacts. In general, the extent of impact on black cockatoo is not likely to be considered significant.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 9: Summary of EPA environmental factors and objectives relevant to the proposed future land use (continued)

Environmental factor	EPA objective	Ascot Local Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Inland waters	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.	The *State Water Strategy for Western Australia* (Government of WA 2003) and *Better Urban Water Management* (WAPC 2008) endorses the promotion of integrated water cycle management and application of water sensitive urban design (WSUD) principles to provide improvements in the management of stormwater, and to increase the efficient use of other existing water supplies. Whilst not a spatial response, a Local Water Management Strategy (LWMS) has been prepared by Emerge Associates for the site in line with water sensitive urban design principles, flood storage requirements and a water conservation strategy. The principal management objective for hydrology within the site is to ensure that post-development environmental flows and/or hydrological cycles are maintained or improved upon pre-development conditions, especially regarding the Swan River adjacent to the site and lake features retained within the site. Specifically, the LWMS has aimed to: • Protect water quality in the Swan River by providing appropriate water quality treatment at source. • Mitigate potential flooding within the SP area and immediate surrounds. • Take account of existing drainage infrastructure capacity and ensure that sufficient land is set aside to manage stormwater. • Provide a broad level stormwater management framework to support future urban development. • Incorporate appropriate best management practices (BMPs) into the drainage systems that address the environmental and stormwater management issues identified.	A LWMS has been prepared to support the SP process. Detailed Urban Water Management Plans (UWMP) will be required in support of individual subdivision applications in accordance with the *State Water Strategy for Western Australia* (Government of WA 2003) and *Better Urban Water Management* (WAPC 2008). UWMPs will be most relevant most relevant to Precinct D. Other precincts may be developed under a Development Approval and therefore water management will likely be documented within a Stormwater Management Plan (SMP) also in accordance with *Better Urban Water Management* (WAPC 2008). Should any future developments propose to impact the Swan River CCW and as such impact the mapped ESA associated with the Swan River, wetland buffers and separation distances should be implemented in accordance with the draft *Guideline for the Determination of Wetland Buffer Requirements* (WAPC 2005) for protection of wetland values, habitat protection, edge effects and water quality management with relevant guidelines to protect wetland values, habitat and water quality. Where proposed development is within or adjacent to the Swan and Canning River Development Control Area (DCA), proponents will be required to submit a DCA permit application to the DBCA in accordance with the *Swan and Canning Rivers Management Act 2006* and the *Swan and Canning River Management Regulations 2007.*	The SP does not specifically respond to the inland waters environmental factor. However, the LWMS defines the intended hydrological management approach, which will be implemented during future development.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 9: Summary of EPA environmental factors and objectives relevant to the proposed future land use (continued)

Environmental factor	EPA objective	Ascot Local Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Inland waters (continued)	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected (continued).	• Minimise transport of nutrients/pollutants to groundwater. • Develop a non-potable water conservation strategy that will accommodate existing groundwater allocation constraints for the area. Three MUWs and one REW will be retained in the current SP design. Although an REW is mapped within the site, after review of local surface water hydrology, aerial imagery and field observations (refer to Figure 5 and Figure 6 of Emerge Associates 2024b), it was determined that the area designated as an REW in the Geomorphic Wetlands of the Swan Coastal Plain dataset does not accurately reflect the conditions observed on ground. However, the REW will be retained in the current SP design. The Swan River is a CCW and is located immediately adjacent to the site. The SP design avoids the CCW and associated ESA by retaining the Parks and Recreation Reserve which encompasses the CCW buffer area and values associated with the Swan River.		

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 9: Summary of EPA environmental factors and objectives relevant to the proposed future land use (continued)

Environmental factor	EPA objective	Ascot Local Structure Plan spatial response	Future management considerations	Predicted environmental outcome
Social Surroundings	To protect social surroundings from significant harm.	Aboriginal Cultural Heritage (ACH) site 3536 (Swan River) is located immediately north of the site and ACH Site3753 has a minor overlap with the western boundary of the site. These sites are not considered to be potentially impacted by the proposed SP layout. However, should any future development propose to impact these sites, further consultation and AH Act requirements would be required. The Ascot Racecourse Complex (place 06123) is a non-indigenous heritage place, located within the site. The SP design proposes to retain the racecourse itself and excludes the racecourse from proposed development. The remaining part of the Ascot Racecourse Complex (place 06123) is within Precinct A, B and C. The SP design of these precincts allows for the development of additional facilities and renovation of current facilities. No responses are required in regard to noise and acoustics.	The Swan River is associated with Site 3536 and as such any future proposed works that may impact the riverbank and/or the foreshore will require approval under Section 18 of the *Aboriginal Heritage Act 1972*. Further requirements and consultation would be required to identify the extent of Site 3753 within the SP area and if future consideration is required in accordance with the *Aboriginal Heritage Act 1972*. Future development would need to consider the Ascot Racecourse Complex heritage site and can be addressed as part of any Development Approval process. A Transport Noise Assessment for the proposed SP was undertaken by Lloyd George Acoustics in November 2023 (Lloyd George Acoustics 2023) to understand the spatial responses that might be required to address potential noise and acoustic impacts in the SP from the adjacent Great Eastern Hwy. Based on the results, future proponents undertaking noise sensitive development in Precinct E could undertake further noise assessments to quantify actual noise levels from Great Eastern Highway, rather than using the screening assessment criteria. Alternatively, the screening assessment procedure could be adopted, resulting in requirements for a 'Quiet House Package A' to upper floors of noise sensitive dwellings within Precinct E. Future development would need to consider noise impacts from the racecourse and can be addressed as part of any Development Approval process.	Any potential impacts to social surroundings can be suitably mitigated through a range of impact avoidance and minimisation measures such that it is unlikely any significant residual impacts will occur.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

5 Conclusions

The proponent has taken a range of measures to provide for the future retention of relevant environmental values within the Ascot SP. This is primarily achieved through the strategic location of the Parks and Recreation Reserve in the northern area of the site to preserve intact native vegetation.

In this context, the SP has been designed to respond to the identified environmental values within the site where possible, including the proposed retention of:

- Subtropical and temperate coastal saltmarsh TEC/PEC
- Fauna habitat
- Native vegetation.

A local scheme amendment will be required to rezone Precinct A from 'place of public assembly' to 'retirement living/mixed use' and to rezone Precinct D from 'Place of Public Assembly' to 'Mixed Use'.

Considerations, approvals and management plans may be necessary for each individual proponent for future development works, which would further minimise environmental impacts through development within the SP area. Environmental factors and the management framework considerations are summarised in **Table 10.**

Overall, a range of environmental impact mitigation measures (primarily impact avoidance and minimisation) are proposed within the SP layout and through the future environmental management framework. In this context, it is anticipated that implementation of the proposed SP can be suitably managed through future stages of the land use planning processes (including development) such that the EPA objectives for the relevant environmental factors can be achieved.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 10: Summary of Environmental Management Framework Considerations

Environmental Factor	Management Framework and considerations		
	Local Structure Plan	Subdivision and/or Development Approval	Construction
Flora and Vegetation	Environmental Assessment Report including preliminary investigations (Emerge Associates 2024a) (**Appendix D**).	• Native Vegetation Clearing permit pursuant to Part V of the EP Act if clearing is required within the SP area and clearing is not exempt. • Preparation of a Conservation and Environment Management Plan (CEMP), where required.	Clearing Permit and compliance with approval conditions and management plans.
Terrestrial Fauna	Environmental Assessment Report including preliminary investigations (Emerge Associates 2024a) (**Appendix D**).	• Potential impacts to MNES in relation to the EPBC Act and need to consider the need for referral in accordance with the *Matters of National Environmental Significance Significant Impact Guidelines* (DotE 2013). • Preparation of a fauna management plan for any development within the SP area prior to works commencing for development involving clearing of native vegetation or any fauna habitat.	Compliance with approval conditions and management plans, in accordance with EPBC Act, where required.
Acid Sulfate Soils	Environmental Assessment Report including preliminary investigations.	• Detailed ASS Investigation and Management Plan for areas mapped as 'Class 1: High to moderate risk' will likely be required in accordance with the WAPC's *Acid Sulfate Soils Planning Guidelines* (2008).	Implementation of ASS Management Plan.
Inland Waters	The LWMS prepared for the SP by Emerge Associates (2024b) (**Appendix E**).	• Detailed UWMPs will be required (mostly relevant to Precinct D) to support individual subdivision applications. Other precincts may be developed under Development Approval and therefore water management will likely be documented through SMPs. Both UWMPs and SMPs will be prepared in accordance with the *Better Urban Water Management* Framework. • Protection of the Swan River CCW and ESA through consideration of hydrological processed and water quality management into design of future development areas to protect the adjacent Swan River and associated values. • DCA permit application for works within or affecting the DCA to the DBCA in accordance with the Swan and Canning Rivers Management Act 2006 and the Swan and Canning River Management Regulations 2007.	Compliance with UWMP/SMP and approved DCA permit.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 10: Summary of Environmental Management Framework Considerations (continued)

Environmental Factor	Management Framework and considerations		
	Local Structure Plan	Subdivision and/or Development Approval	Construction
Social Surroundings	Preliminary investigations for Aboriginal Cultural Heritage. Transport Noise Assessment for the proposed SP (Lloyd George Acoustics 2023) in accordance with SPP 5.4.	• Detailed Acoustic Assessment and Management Plan (where required) or 'Quiet House Package A' implemented to upper floors of noise sensitive dwellings within Precinct E. • Completion of any contamination investigations and identification of any remediation requirements within Lot 9002.	Approval pursuant to Section 18 of the *Aboriginal Heritage Act 1972* will be required prior to ground disturbing works if impacts to known sites are likely. Compliance with noise management plan and appropriate house packages applied where appropriate. Completion of remediation works (if required) for Lot 9002.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

6 References

6.1 General references

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Document Set ID: 5885126
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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Figures

Figure 1: Site Location

Figure 2: Site Geology

Figure 3: Topographic Contours

Figure 4: Acid Sulfate Soils

Figure 5: Vegetation Types

Figure 6: Vegetation Condition

Figure 7: Threatened Ecological Community and Native Vegetation under the EP Act

Figure 8: Bush Forever, Ecological Linkages and Environmental Sensitive Areas

Figure 9: Carnaby's Black Cockatoo Foraging Habitat

Figure 10: Forest Red-tailed Black Cockatoo Foraging Habitat

Figure 11: Black Cockcatoo Habitat Trees

Figure 12: Hydrological Features

Figure 13: Social Surroundings

Document Set ID: 5885126
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Figure 1: Site Location

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F06

Drawn:	WJC
Date:	03/04/2024
Checked:	EKB
Approved:	JDH
Date:	29/04/2024

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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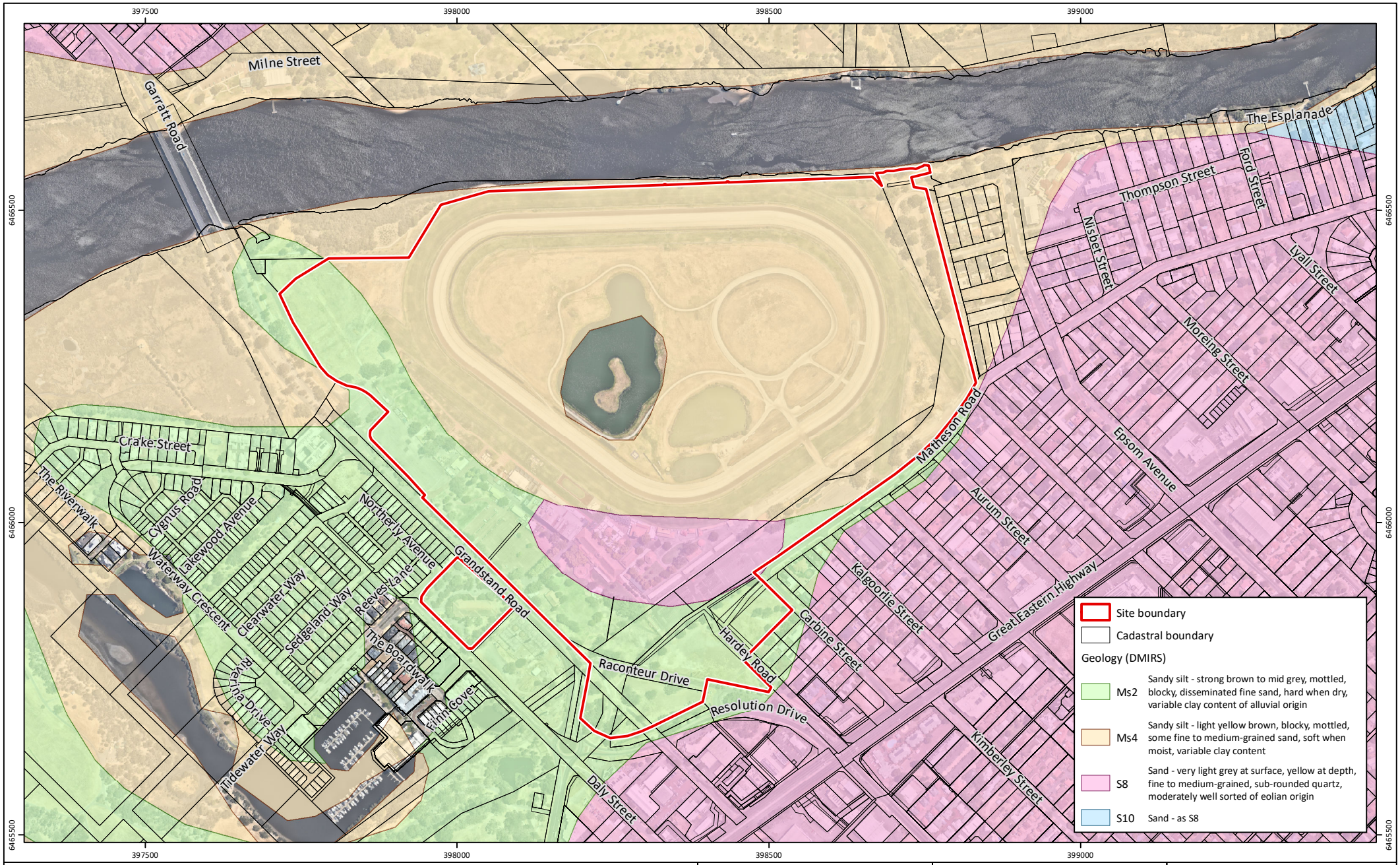


Figure 2: Site Geology

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F07

Drawn:	WJC
Date:	03/04/2024
Checked:	EKB
Approved:	JDH
Date:	29/04/2024

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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Figure 3: Topographic Contours

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Client:	Perth Racing

Plan Number:
EP23-109(05)--F08

Drawn:	WJC
Date:	03/04/2024
Checked:	EKB
Approved:	JDH
Date:	29/04/2024

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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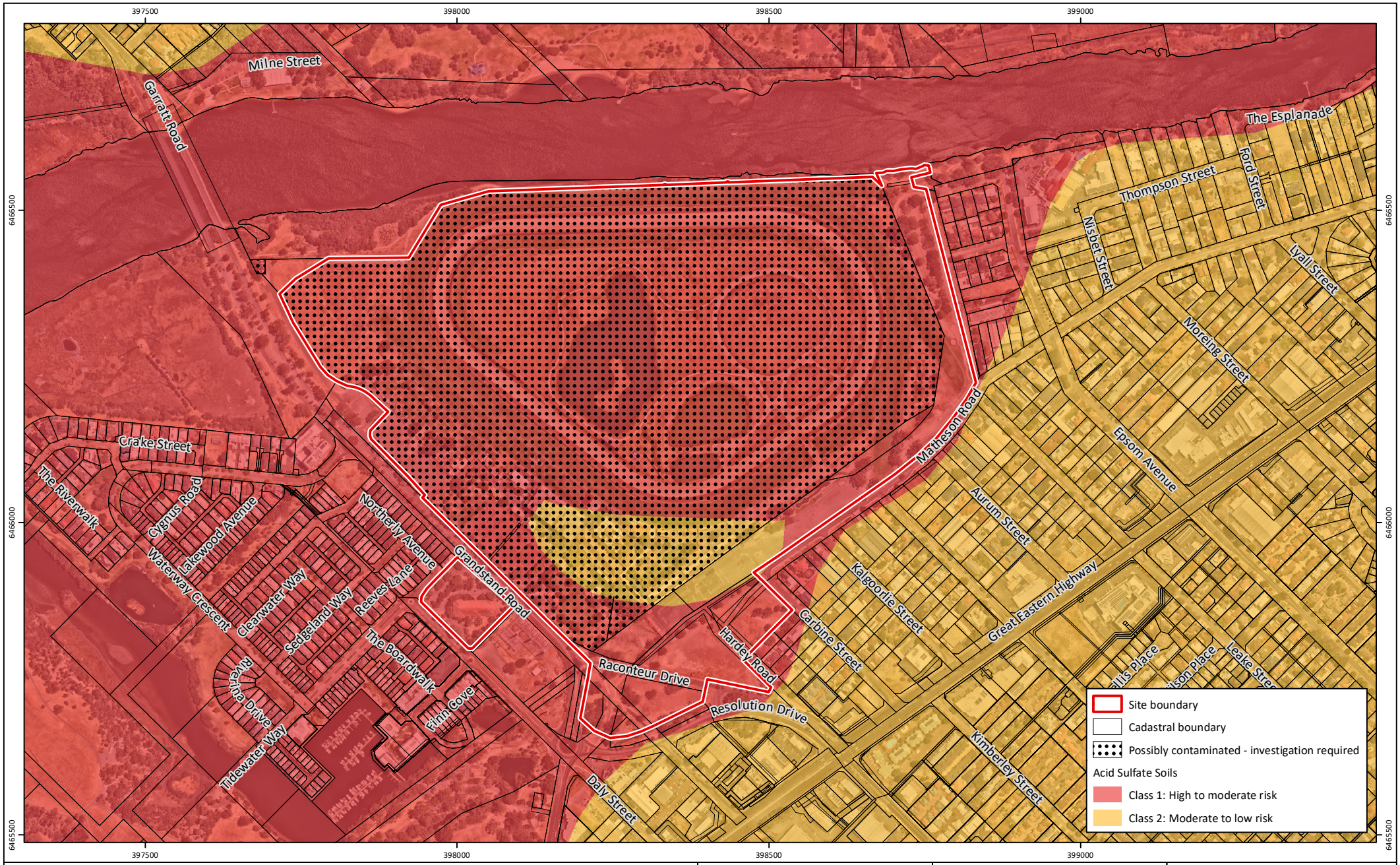


Figure 4: Acid Sulfate Soils

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F09a

Drawn:	WJC
Date:	22/07/2024
Checked:	EKB
Approved:	JDH
Date:	23/07/2024

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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Figure 5: Vegetation Types

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F10

Drawn:	WJC
Date:	03/04/2024
Checked:	EKB
Approved:	JDH
Date:	29/04/2024

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Metres

Scale: 1:6,500@A4

GDA2020 MGA Zone 50

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Figure 6: Vegetation Condition

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F11

Drawn:	WJC
Date:	03/04/2024
Checked:	EKB
Approved:	JDH
Date:	29/04/2024

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Metres

Scale: 1:6,500@A4

GDA2020 MGA Zone 50

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Figure 7: Threatened and Priority Ecological Community and Native Vegetation under the EP Act

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F12

Drawn:	WJC
Date:	03/04/2024
Checked:	EKB
Approved:	JDH
Date:	01/05/2024

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Metres

Scale: 1:6,500@A4

GDA2020 MGA Zone 50

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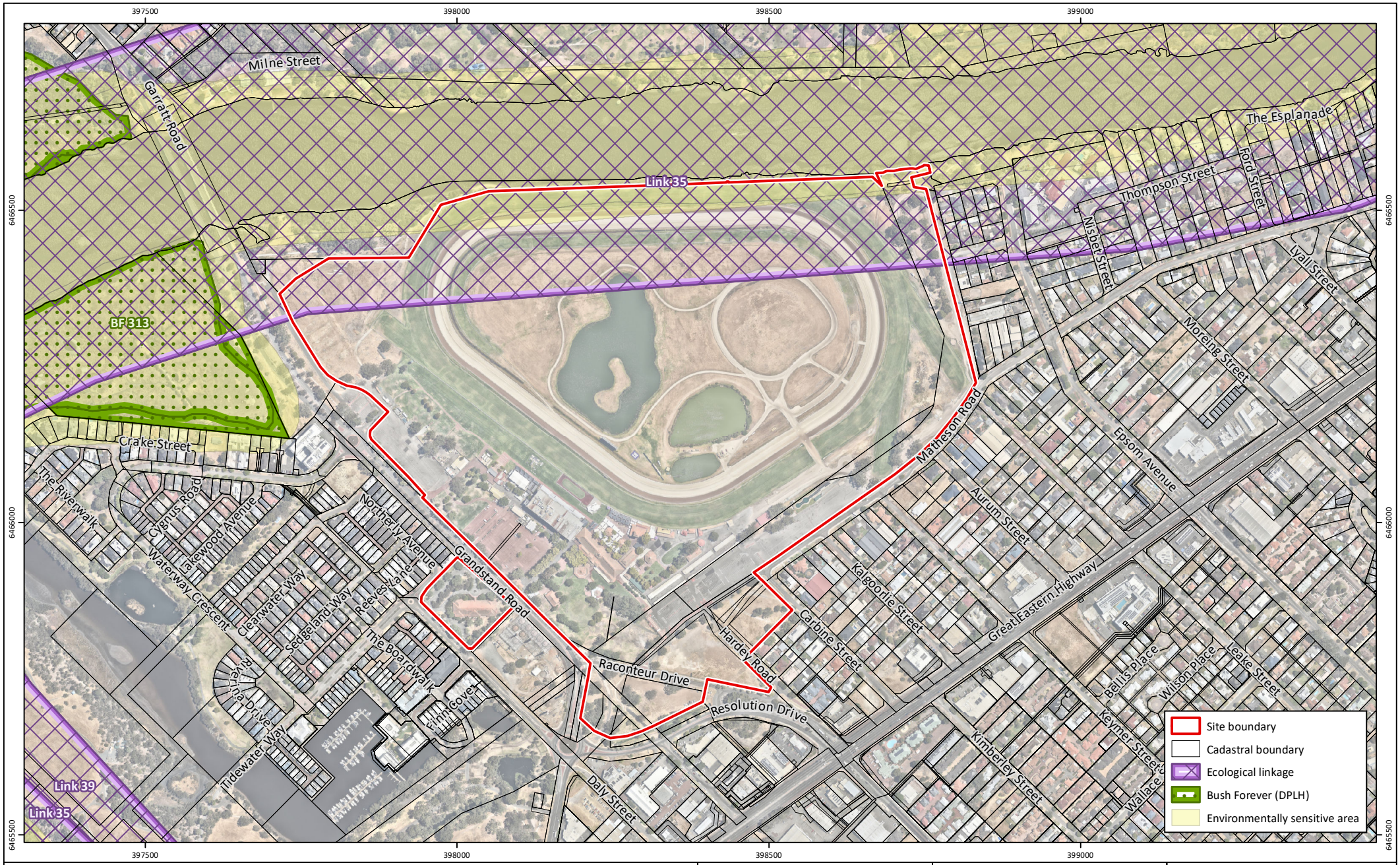


Figure 8: Bush Forever, Ecological Linkages and Environmentally Sensitive Areas

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F13

Drawn:	WJC
Date:	03/04/2024
Checked:	EKB
Approved:	JDH
Date:	29/04/2024

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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Figure 9: Carnaby's Black Cockatoo Foraging Habitat

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F20

Drawn:	WJC
Date:	08/04/2024
Checked:	EKB
Approved:	JDH
Date:	29/04/2024

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Metres

Scale: 1:6,500@A4

GDA2020 MGA Zone 50

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Figure 10: Forest Red-tailed Black Cockatoo Foraging Habitat

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F21

Drawn:	WJC
Date:	08/04/2024
Checked:	EKB
Approved:	JDH
Date:	29/04/2024

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Metres

Scale: 1:6,500@A4

GDA2020 MGA Zone 50

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Figure 11: Black Cockatoo Habitat Trees

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F22a

Drawn:	GAR
Date:	28/06/2024
Checked:	TDP
Approved:	RAW
Date:	01/07/2024

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Metres

Scale: 1:6,500@A4

GDA2020 MGA Zone 50

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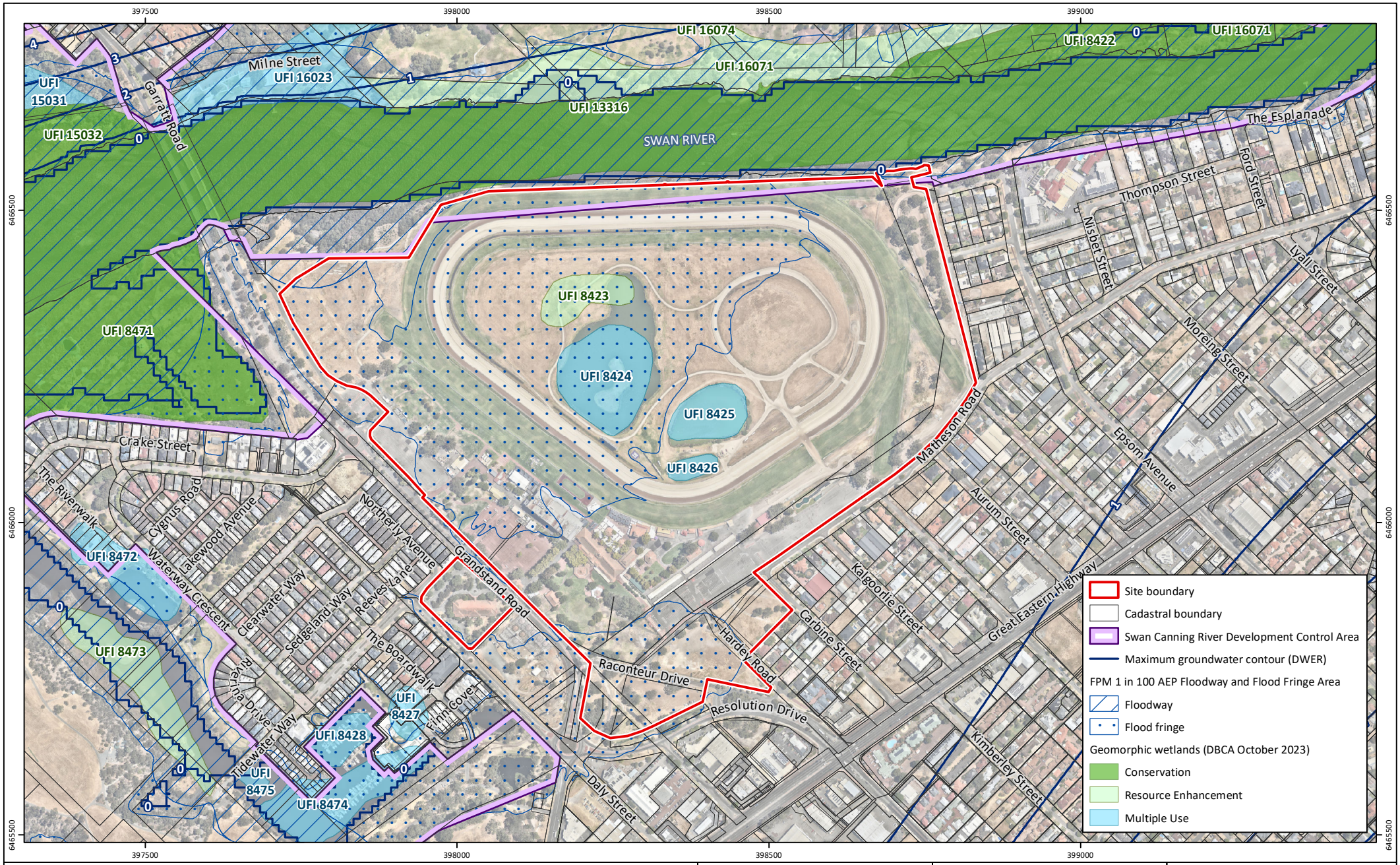


Figure 12: Hydrological Features

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F14

Drawn:	WJC
Date:	03/04/2024
Checked:	EKB
Approved:	JDH
Date:	01/05/2024

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Metres

Scale: 1:8,000@A4

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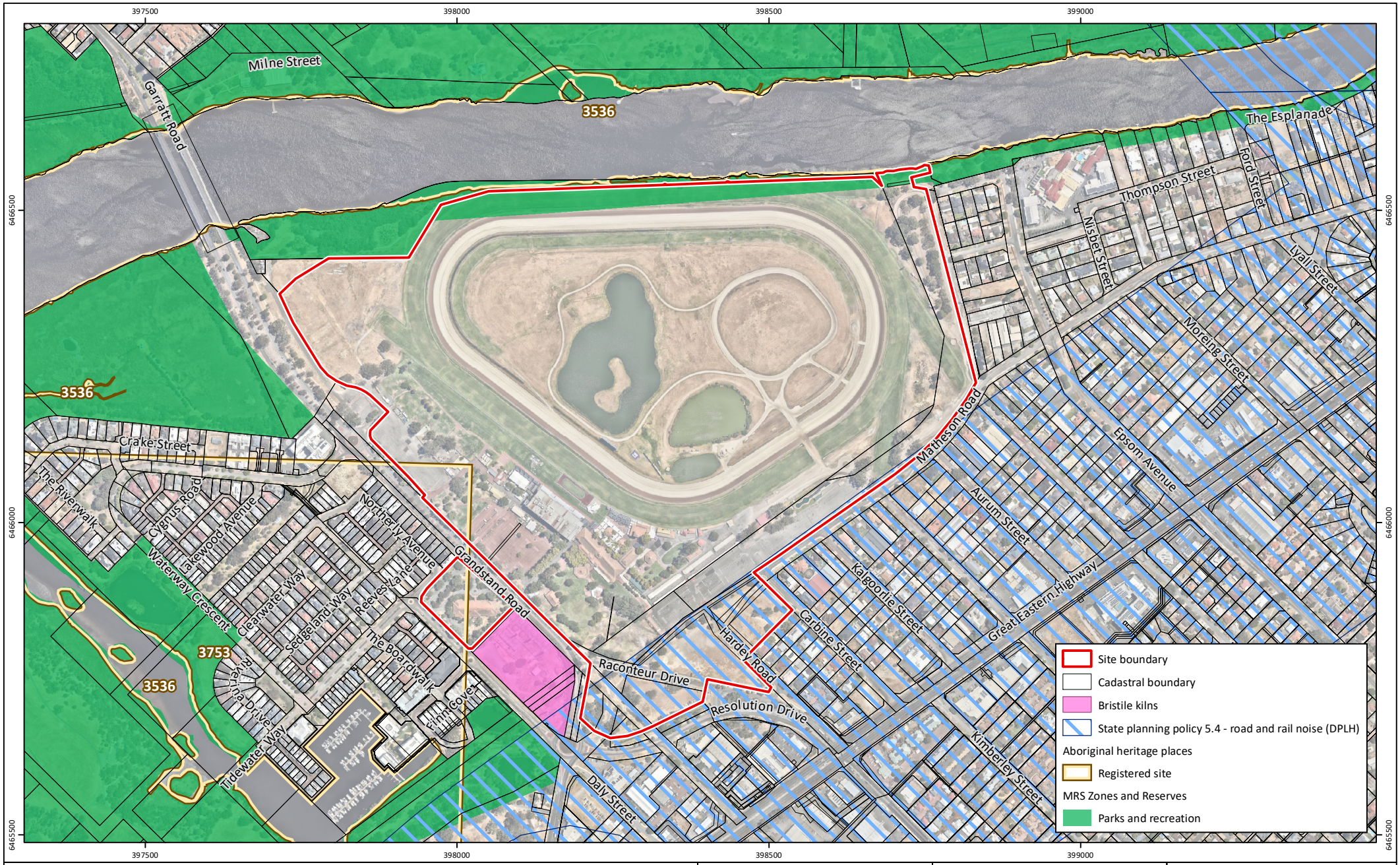


Figure 13: Social Surroundings

Project:	Environmental Assessment Report Ascot Racecourse Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(05)--F15a

Drawn:	WJC
Date:	08/05/2024
Checked:	EKB
Approved:	JDH
Date:	09/05/2024

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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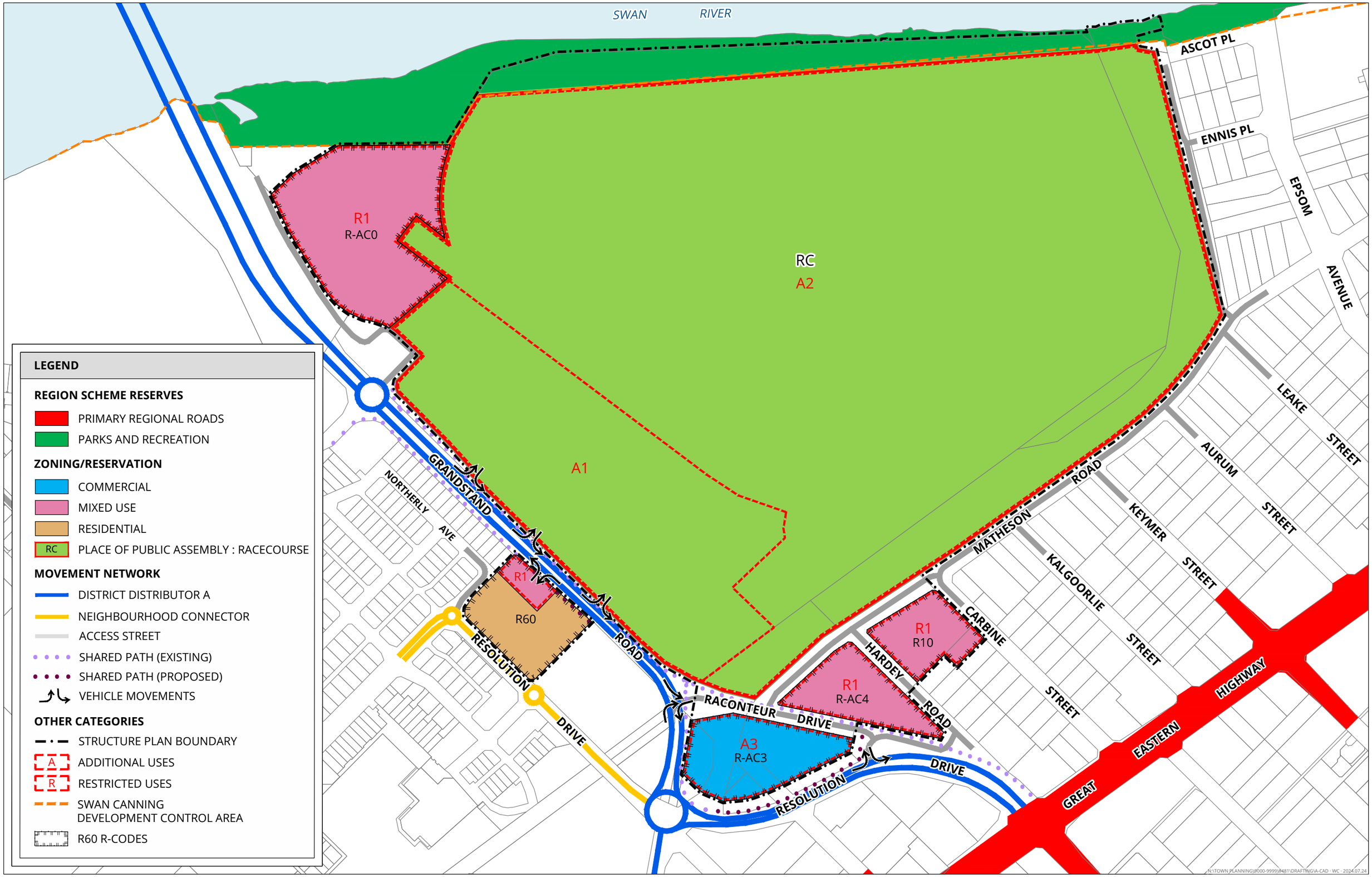
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Appendix A

Ascot Racecourse Structure Plan (ROWE Group Design, 2024)

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Version: 1, Version Date: 18/09/2024



PLAN 1 - STRUCTURE PLAN

VARIOUS LOTS - ASCOT RACECOURSE

ASCOT

N

0 100 m

SCALE @ A3: 1:4000

9481-STR-01-G

DRAWN: WC
DATE CREATED: 2024.07.24
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE

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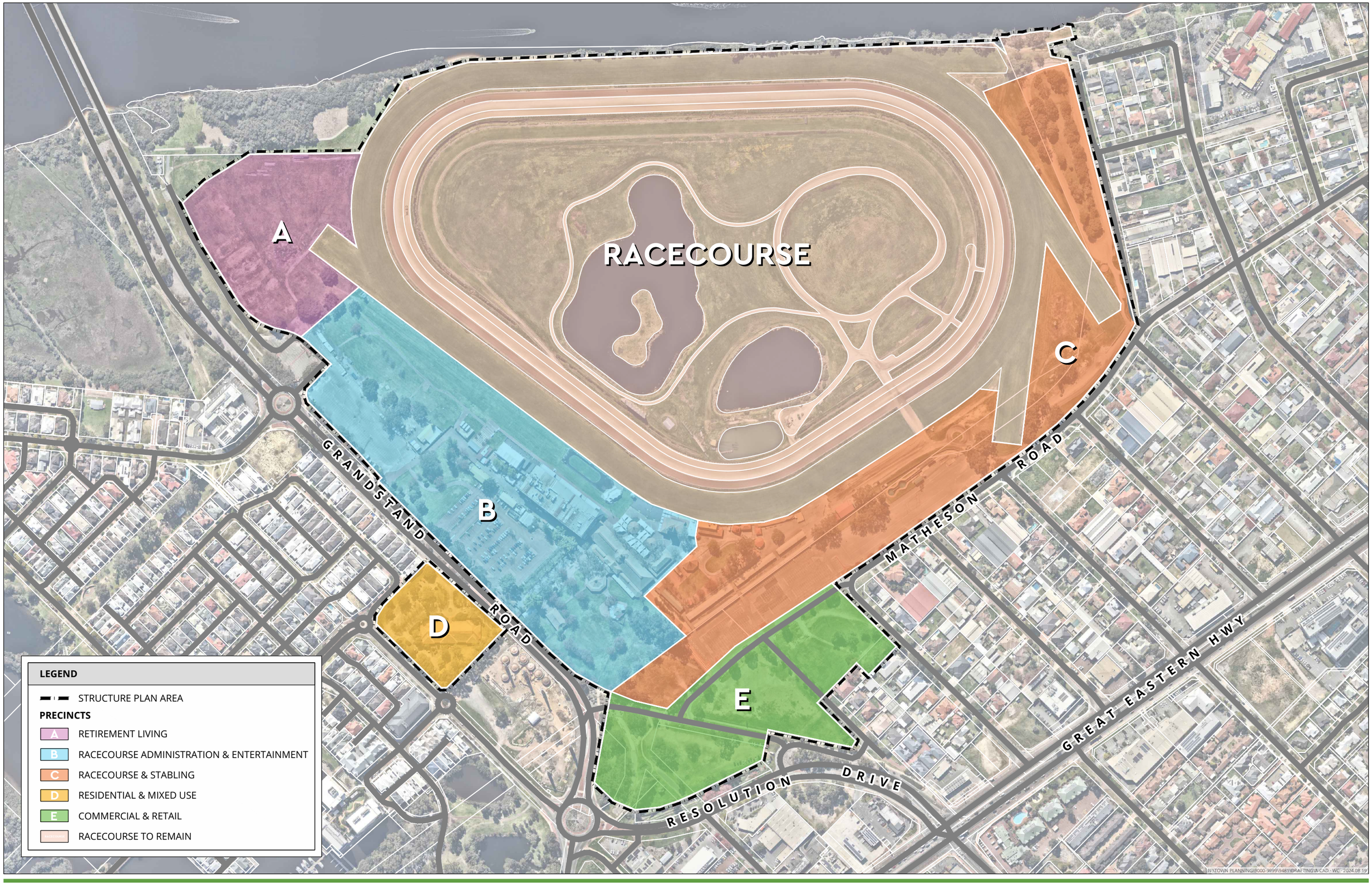
ROWE GROUP DESIGN

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Appendix B

Ascot Racecourse Precinct Plan (ROWE Group Design, 2024)

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Version: 1, Version Date: 18/09/2024



STRUCTURE PLAN PRECINCTS

VARIOUS LOTS - ASCOT RACECOURSE

ASCOT

N

0 100 m

SCALE @ A3: 1:4000

9481-FIG-02-C

DRAWN: WC
DATE CREATED: 2024.08.19
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
AERIAL: NEARMAP 20230831

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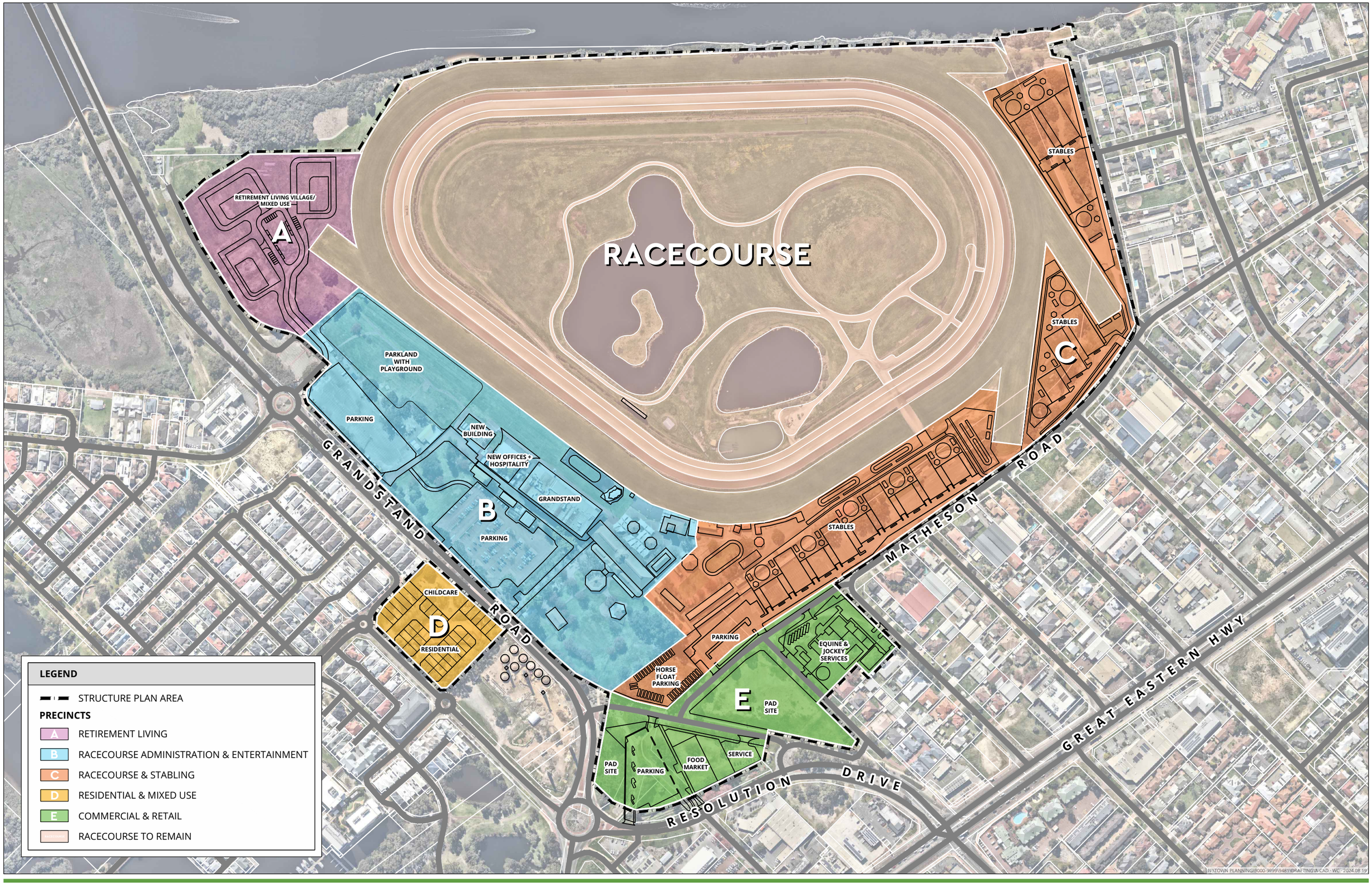
ROWE GROUP DESIGN

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Appendix C

Draft Master Plan Concept (ROWE Group Design, 2024)

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Version: 1, Version Date: 18/09/2024



DRAFT MASTER PLAN CONCEPT

VARIOUS LOTS - ASCOT RACECOURSE

ASCOT

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SCALE @ A3: 1:4000

9481-CON-01-D

DRAWN:	WC
DATE CREATED:	2024.08.19
PROJECTION:	MGA50 GDA94
CADASTRE:	LANDGATE
AERIAL:	NEARMAP 20230831

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Appendix D

Flora, Vegetation and Fauna Assessment (Emerge Associates 2024a)

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TECHNICAL MEMORANDUM

Flora, Vegetation and Fauna Assessment
Various lots, Grandstand Rd and Raconteur Dr, Ascot

PROJECT NUMBER	EP23-109(06)	**DOC. NUMBER**	EP23-109(06)—003A TDP
PROJECT NAME	Ascot Local Structure Plan	**CLIENT**	Perth Racing
AUTHOR	TDP/AJU	**REVIEWER**	RAW
VERSION	A	**DATE**	11/07/2024

1. INTRODUCTION

1.1. Project background

Emerge Associates (Emerge) were engaged by Perth Racing to undertake a flora, vegetation and fauna assessment at Lots 1, 3, 13, 50, 452, 7705 and 9002 Grandstand Rd and Lots 51 and 100 Raconteur Dr, Ascot, in the City of Belmont (herein referred to as the 'site').

The site is located approximately 5.5 kilometres (km) east of the Perth Central Business District within the City of Belmont. The site extends over approximately 61.8 hectares (ha) and is bounded by Matheson Rd to the east, Grandstand Rd to the west, Resolution Dr to the south, and the Swan River to the north. The location of the site is shown in **Figure 1**.

1.2. Purpose and scope of work

The flora, vegetation and fauna assessment was required to support the development of a Local Structure Plan (LSP) within the site. Specifically, the scope of work was to provide sufficient detail on the flora, vegetation and fauna values within the site to inform this process.

As part of the scope of work the following tasks were completed:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for conservation significant flora, fauna and communities.
- A field survey to record flora, vegetation and fauna values.
- Identification of potential habitat for conservation significant flora and vegetation.
- Documentation of the desktop assessment, methodology, field surveys and results into a report.

2. Desktop assessment

A search was conducted for threatened, specially protected and priority flora and fauna that may occur or have been recorded within a 10 km radius of the site using NatureMap (DBCA 2023), *Protected Matters Search Tool* (DCCEEW 2023), *Atlas of Living Australia* (ALA 2023) and the Department of Biodiversity, Conservation and Attraction's (DBCA) conservation significant fauna and flora databases (reference no. FAUNA#8125/53-0323FL).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2.1. Likelihood of occurrence method

2.1.1. Flora and vegetation

The distribution and habitat preferences of threatened flora species and ecological communities listed in **Section 2** were reviewed against site context information[1] and preliminary survey results. Likelihood of occurrence of threatened flora species and ecological communities within the site was classified as 'high', 'moderate', 'low' or 'negligible' as outlined below in **Table 1**.

Table 1: Decision matrix for likelihood of occurrence of threatened and priority flora and ecological communities

		Distribution[1]	
		Reliable record within search area	No reliable record within search area (20 km)
Habitat	Suitable	High	Negligible
	Potentially suitable	Moderate	
	Unsuitable	Low	

[1]Reliable record defined as validated, recent (within the last ~40 years) and spatially accurate (refer DBCA search meta data) in order to exclude unverified range or habitat projections.

2.1.2. Fauna

The distribution and habitat preferences of the threatened and specially protected fauna species identified from **Section 2** was reviewed against site context[1] information and preliminary survey results. Likelihood of occurrence of threatened and specially protected fauna species within the site was classified as 'high', 'moderate', 'low', 'negligible' or 'nil' as outlined in **Table 2**. Noting some marine species were excluded due to lack of suitable habitat.

Table 2: Decision matrix for likelihood of occurrence of threatened, specially protected and priority fauna

		Reliable record[1]		Unreliable record[2]
		Access to site not impeded	Access to site impeded	
Habitat	Suitable	High	Low	Nil
	Potentially suitable	Moderate		
	Unsuitable	Negligible		

[1]Reliable record defined as DBCA or validated ALA record from the last ~20 years, [2]Unreliable record defined as record >20 years old or PMST prediction.

2.2. Likelihood of occurrence results

2.2.1. Threatened and priority flora

A total of 100 conservation significant flora species were identified from database searches as occurring or potentially occurring within 9km of the site. Based on background information available for the site and habitat preferences of the species, two priority flora species were considered to have a high or moderate likelihood of occurring within the site, as outlined in

[1] Including relevant Commonwealth documentation such as approved conservation advice, listing advice and other relevant literature.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 3. The complete likelihood of occurrence assessment is provided as **Appendix A**.

Table 3: Threatened or priority flora species with a high or moderate likelihood occurrence in the site

Species	Status		Life strategy	Flowering period
	WA	EPBC Act		
Angianthus micropodioides	P	P3	-	Nov-Dec or Jan-Feb
Aponogeton hexatepalus	P	P4	-	Jul-Oct

2.2.2. Vegetation

The database search results identified 13 TECs and 6 PECs as occurring or potentially occurring within a 10 km radius of the site. Information on these communities is provided in **Appendix C**.

Due to historical disturbance the likelihood of occurrence of any TEC or PEC was considered negligible.

2.2.3. Threatened, specially protected and priority fauna

A total of 77 conservation significant fauna species were identified from database searches as occurring or potentially occurring within 10 km of the site.

Two threatened, six specially protected and three priority species were classified as having a 'high' or 'moderate' likelihood of occurrence. The legislative or policy status and habitat preferences of these species are shown in **Table 4**.

The remainder of the conservation significant fauna species identified in the desktop assessment (66 species) were considered as having a 'low', 'negligible' or 'nil' likelihood of occurrence. Refer to **Table 4** and **Appendix D** for detail on individual species likelihood of occurrence.

Table 4: Summary of conservation significant fauna species with potential to occur in the site

Species name	Common name	Status		Habitat description
		WA	EPBC Act	
Birds				
Apus pacificus	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities.
Calidris ruficollis	Red-necked stint	MI	MI	Tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands (coastal and inland), saltfields, sewage ponds.
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding *Corymbia calophylla*, *Eucalyptus marginata*, introduced *Melia azedarach* and *Eucalyptus* spp. trees.
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes.
Oxyura australis	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters.

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Version: 1, Version Date: 18/09/2024

Species name	Common name	Status		Habitat description
		WA	EPBC Act	
Pandion haliaetus	Osprey	MI	MI	Coasts, estuaries, bays, inlets, islands, and surrounding waters; coral atolls, reefs, lagoons, rock cliffs, stacks.
Plegadis falcinellus	Glossy Ibis	MI	MI	Well-vegetated wetlands, wet pasture, ricefields, floodwaters, floodplains, brackish or occasionally saline wetlands, mangroves, mudflats and occasionally dry grassland.
Thalasseus bergii	Crested tern	MI	MI	Mainly blue-water seas (especially within 3 km of land), including southern estuaries in summer and autumn (when free of silt); also tidal creeks in north, but not penetrating far into larger estuaries.
Zanda latirostris	Carnaby's black cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of *Pinus* spp. Attracted to seeding *Banksia* spp., *Hakea* spp., *Eucalyptus* spp., *Corymbia calophylla*, *Grevillea* spp., and *Allocasuarina* spp.
Mammals				
Hydromys chrysogaster	Rakali	P4	-	Areas with permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south-west. Intact riparian vegetation and associated bank stability is critical to their survival.
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high.

3. Methods

3.1.1. Vegetation

Vegetation units were identified from information collected during the field survey in January 2024. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (NVIS Technical Working Group 2017). The identified vegetation units were mapped on aerial photography during the field survey and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography based on notes recorded during the field survey to define areas with differing condition and using the Keighery (1994) scale **Table 5**.

Table 5: Vegetation condition scale applied during the field assessment

Condition	Definition (Keighery 1994)
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation

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Condition	Definition (Keighery 1994)
	structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

3.1.2. Threatened and priority ecological community

Areas of native vegetation potentially representing a TEC were assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds.

3.1.3. Native vegetation under the EP Act

Vegetation within the site that meets the definition of 'native vegetation' under the *Environmental Protection Act 1986* (EP Act) was mapped on aerial imagery.

3.1.4. Fauna habitat

Transects were traversed across the site, during the day, and the characteristics of fauna habitat and presence of fauna species was recorded. Microhabitats such as logs, rocks and leaf litter were investigated and secondary evidence of species presence such as tracks, scats, skeletal remains, foraging evidence or calls was also noted.

3.1.5. Black cockatoo habitat

Black cockatoo foraging, breeding and roosting habitat was assessed and mapped within the site.

Foraging habitat

Foraging habitat was identified by assessing vegetation in the site for plant species known to provide food for black cockatoos (Davies 1966; Saunders 1980; Johnstone and Storr 1998; Johnstone and Kirkby 1999; Groom 2011; Johnstone *et al.* 2011; DAWE 2022). Foraging habitat was classified as either 'native' or 'non-native' based on the predominant vegetation's naturalised status and in accordance with DAWE (2022).

It was also classified as either 'primary' or 'secondary' based on black cockatoo foraging preferences. Primary food plants were defined as those with historical and contemporary records of regular consumption by a black cockatoo species. Secondary food plants were defined as plants that black cockatoo species have been recorded consuming occasionally or that, based on their limited extent or agricultural origin, should not be considered a sustaining resource. A list of plant species classified as primary or secondary food plants is provided as **Appendix E**.

Each patch of foraging habitat was assigned a foraging value for each species of black cockatoo likely to occur within the site. As it is not always possible to separate out food plants from non-food plants,

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Version: 1, Version Date: 18/09/2024

mapped foraging habitat may also include vegetation comprising non-food plants. The proportion of non-food plants in mapped foraging habitat was minimised as far as practicable.

Evidence of black cockatoo foraging, such as chewed fruits, was searched for within the site and allocated to a black cockatoo species where possible.

Breeding habitat

Breeding habitat comprises 'habitat trees' which was defined as a native eucalypt that is typically known to support black cockatoo breeding such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum, with a DBH ≥50 cm or DBH ≥30 cm for wandoo or salmon gum.

All native eucalypts within the site that met the required DBH were recorded. Occasionally, native eucalypts were encountered that met DBH requirements but did not contain a trunk/branch of a sufficient size to support a hollow suitable for use by black cockatoos. For example, the tree may have been less than 3 m tall or had a trunk that forked between 1.3 m and 3 m in height and after the fork no limbs had a diameter of ≥50 cm or ≥30 cm for wandoo or salmon gum. These trees were not recorded as habitat trees as the likelihood they would form a suitable hollow was low.

Habitat trees were individually identified and the attributes outlined in **Table 6** were recorded for each tree.

Table 6: Attributes recorded for each habitat tree in the site

Attribute	Description
GPS location	The location was recorded using a handheld GPS unit
Tree species	Species and common name were identified
Diameter at breast height (DBH) (cm)	DBH was measured at breast height (1.3 m) using a diameter tape
Hollows potentially suitable for breeding by a black cockatoo	Number of hollows potentially suitable for breeding by a black cockatoo recorded (assessed from ground level only)

Each habitat tree was assigned to a category listed in **Table 7** based on current black cockatoo guidelines (DAWE 2022).

Table 7: Habitat tree categories (DAWE 2022)

Category	Specifications
Known nesting tree	Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers).
Suitable nesting tree	Trees with suitable nesting hollows present^, although no evidence of use. Note that any species of tree may develop suitable hollows for breeding.
Potential nesting tree	Trees that have a suitable DBH to develop a nest hollow, but do not currently have suitable nesting hollows. Trees suitable to develop a nest hollow in the future are 300-500 mm DBH. Note that many species of eucalypt may develop suitable hollows for breeding.

^Hollow determined to be suitable for use as breeding habitat by black cockatoos.

Roosting habitat

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

If present, groups of tall native and non-native trees were assumed to provide roosting habitat. The presence of active or historical roosts in these trees was determined through evidence of roosting activity, such as branch clippings, droppings or moulted feathers.

4. Results

4.1. Flora

4.1.1. Flora species inventory

A total of 58 weed species and 21 native species were recorded in the site during the field surveys. This comprises a total of 29 families and 60 genera. The dominant families containing native taxa were Myrtaceae (three native taxa) and Fabaceae (three native taxa). The family containing the most non-native taxa was Poaceae (thirteen non-native species).

A complete species list is provided in **Appendix B**.

4.1.2. Threatened and priority flora

No threatened or priority flora were recorded and none are considered likely to occur in the site due to the lack of suitable habitat.

4.1.3. Declared pests

One species listed as a declared pest (pursuant to s22(2) of the *Biosecurity and Agriculture Management Act 2007*), **Tamarix aphylla* (athel pine), was recorded within the site. Athel pine is listed in exempt keeping category meaning management is not obliged.

4.2. Vegetation

4.2.1. Vegetation units

Four vegetation units were identified within the site: Cc, Er, ErJkSt, and non-native.

A description and the area of each vegetation unit is provided in **Table 8** and representative photographs of each are provided in **Plate 1** to **Plate 4**. The location of each vegetation unit is shown in **Figure 2**.

Table 8: Vegetation unit present within the site

Vegetation Unit	Description	Area (ha)
Er	Woodland *Corymbia calophylla* over closed grass/forbland of pasture weeds and scattered native species (or absent) (**Plate 1**).	1.12
Cc	Woodland *Eucalyptus rudis* over closed grass/forbland of pasture weeds and scattered native species (or absent) (**Plate 2**).	0.28
ErJkSt	Open woodland *Eucalyptus rudis* and occasional *Melaleuca raphiophylla* over sedgeland *Juncus kraussii* and *Schoenoplectus tabernaemontani* over low shrubland *Suaeda australis* over forbland *Apium prostratum* subsp. *prostratum* var. *prostratum* and *Heliotropium curassavicum* over grassland **Avena* sp., *Cynodon dactylon* and **Paspalum vaginatum* (or absent) (**Plate 3**).	0.17

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Vegetation Unit	Description	Area (ha)
To	Fringing rushland of *Typha orientalis*, with occasional planted native and non-native trees, shrubs and/or non-woody vegetation, over closed grass/forbland of pasture weeds.	0.46
Non-native	Heavily disturbed areas comprising bare ground and weeds with occasional native trees and forbs and/or sealed ground and buildings (**Plate 4**).	56.62



*Plate 1: Vegetation unit **Er** in 'degraded' condition*



*Plate 2: Vegetation unit **Cc** in 'degraded' condition*

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024



*Plate 3: Vegetation unit **ErJkSt** in 'good – very good' condition*



*Plate 4: Vegetation unit **Non-native** in 'completely degraded' condition*

4.2.2. Vegetation condition

The vegetation in the site occurred in 'good – very good', 'degraded', 'degraded - completely degraded' and 'completely degraded condition. The extent of vegetation by condition category is detailed in **Table 9** and shown in **Figure 3**.

Table 9: Vegetation condition categories within the site

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Condition category (Keighery (1994))	Size (ha)
Pristine	0
Excellent	0
Very good	0
Good – very good	0.07
Good	0
Degraded	1.04
Degraded – completely degraded	0.98
Completely degraded	56.57

4.2.3. Threatened and priority ecological communities

The 'subtropical and temperate coastal saltmarsh' TEC which is listed as vulnerable under the EPBC Act was identified within a patch of ErJkSt the northern portion of the site as shown in **Figure 5**. A total of 0.07 ha of this TEC/PEC was mapped. Not all of the ErJkSt represents the TEC as some patches represent canopy overhang into the site with limited to no understory vegetation.

The 0.07 ha of coastal saltmarsh TEC vegetation mapped in the site also represents the State listed Priority 3 (P3) PEC of the same name.

4.2.4. Native vegetation under the EP Act

A total of 1.10 ha of vegetation meeting the definition of 'native vegetation' pursuant to the EP Act occurs within the site, as shown in **Figure 4**. This comprises of scattered flooded gum (*Eucalyptus rudis*) and marri (*Corymbia calophylla*) trees, and fringing vegetation **ErJkSt** (**Table 8**).

4.3. Fauna

4.3.1. Fauna habitat

Habitat values in the site are limited by historical disturbance and are primarily suited to widespread fauna species with non-specific habitat requirements.

The ErJkSt vegetation provides a cover of native trees and understory cover of riparian vegetation that would offer cover for ground dwelling fauna.

Large native trees associated with plant communities Cc and Er would also provide value to native birds and other arboreal fauna. The extent of fauna habitat is detailed in **Table 10** and shown in **Figure 5.**

Table 10: Fauna habitats identified within the site

Fauna habitat	Description	Area (ha)
Fringing woodland	Native fringing vegetation consisting of a native tree overstorey and an understorey of sedges/rushes.	0.07
Wetland	Wetland waterbodies and associated riparian sedgeland/rushland.	3.72

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Scattered trees and shrubs	Scattered native and non-native trees and shrubs, providing habitat mainly for avifauna.	5.45
Cleared	Predominantly grassy weeds, bare ground and built form.	52.64

4.3.2. Fauna species inventory

Twenty-four fauna species were recorded within the site:

- *Aix sponsa* (wood duck)
- *Anas gracilis* (grey teal)
- *Anas superciliosa* (Pacific black duck)
- *Anhinga novaehollandiae* (Australasian darter)
- *Cacatua sanguinea* (little corella)
- *Calyptorhynchus banksii* (forest red-tailed black cockatoo)
- *Columba livia* (feral pigeon)
- *Corvus coronoides* (Australian raven)
- *Cygnus atratus* (black swan)
- *Eolophus roseicapilla* (galah)
- *Equus ferus* (horse)
- *Fulica atra* (Eurasian coot)
- *Grallina cyanoleuca* (magpie-lark)
- *Gymnorhina tibicen* (Australian magpie)
- *Malacorhynchus membranaceus* (pink-eared duck)
- *Microcarbo melanoleucos* (little pied cormorant)
- *Oxyura australis* (blue-billed duck)
- *Pelecanus conspicillatus* (Australian pelican)
- *Phalacrocorax sulcirostris* (little black cormorant)
- *Porphyrio porphyria* (purple swamphen)
- *Rhipidura leucophrys* (willie wagtail)
- *Spilopelia chinensis* (spotted dove)
- *Tadorna tadornoides* (Australian shelduck)
- *Threskiornis moluccus* (Australian white ibis)
- *Trichoglossus moluccanus* (rainbow lorikeet)

4.3.3. Conservation significant fauna

One threatened (forest red-tailed black cockatoo, (VU)) and one priority (blue-billed duck, (P4)) fauna species were recorded at the time of survey.

Zanda latirostris (Carnaby's black cockatoo (EN)) is considered to have a high likelihood of occurring in this site and is discussed further below in **Section 4.3.4**. Six additional conservation significant bird species not recorded during the survey have potential to occur within the site:

Apus pacificus (Pacific swift (MI)), and *Falco peregrinus* (peregrine falcon (OS)) are both highly mobile species that are sometimes recorded over urbanised areas. Any occurrence of these species is likely

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

to be a flyover or brief forage as the site and surrounding area lacks suitable habitat for breeding or persistence of any other kind. *Calidris ruficollis* (red-necked stint (MI)), and *Thalasseus bergii* (crested tern (MI)) are both shorebirds which may briefly utilise the site as marginal foraging habitat. *Plegadis falcinellus* (glossy ibis (MI)) are known to forage in wet grassland areas when nearby to water sources but this type of habitat is likely to provide a marginal foraging resource. *Pandion haliaetus* (osprey (MI)), have been recorded nesting nearby and are therefore likely to forage near or within the site.

Two priority 4 mammal species not recorded during the survey, *Hydromys chrysogaster* (rakali) and *Isoodon fusciventer* (quenda), could also occur in the site. Rakali may utilise the Swan River and so could occasionally occur in the northern most portion of the site associated with the ErJkSt vegetation. Quenda commonly occur in urban areas, particularly where understorey vegetation or grasses provide dense cover.

4.3.4. Black cockatoos

Forest red-tailed black cockatoo was observed foraging in the site in cape lilac (*Melia azedarach*) overhanging the site. The site lies within the modelled distribution of Carnaby's black cockatoo and therefore they may also occur. The site does not lie within the modelled distribution of Baudin's black cockatoo and therefore they are not likely to occur and have not been considered further.

4.3.4.1. Breeding habitat

A total of 66 black cockatoo habitat trees were recorded, of which five contained hollows potentially suitable for black cockatoo breeding based on inspection from ground level. Internal hollow inspection using a camera pole or drone would be required to confirm if hollows are suitable for breeding by black cockatoos. The remaining 61 habitat trees did not contain hollows suitable for black cockatoo breeding.

The habitat trees comprised four tuarts, eight marris and 54 *Eucalyptus rudis* (flooded gum) trees.

A summary of the habitat trees recorded within the site is provided in **Table 11** and the locations of habitat trees are shown in **Figure 7**.

Table 11: Habitat trees

Category	No. trees
Known nesting trees	0
Suitable nesting trees	5
Potential nesting trees	61
Total nesting trees	66

4.3.4.2. Roosting habitat

No roosts or evidence of roosting was observed in the site. Tall trees within the site represent potential roosting trees.

4.3.4.3. Foraging habitat

A total of 1.27 ha of foraging habitat for Carnaby's black cockatoo was recorded in the site, which comprised 0.28 ha of primary native foraging habitat associated with *Corymbia calophylla,* 0.07 ha of

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

primary non-native foraging habitat associated with *Pinus pinaster*, 0.41 ha of secondary native foraging habitat associated with *Acacia saligna*, *Jacksonia furcellata* and *Xanthorrhoea* spp. and 0.51 ha of secondary non-native habitat associated with *Eucalyptus gomphocephala*.

A total of 0.84 ha of foraging habitat for forest red-tailed black cockatoo was recorded in the site, which comprises 0.28 ha of primary native habitat associated with *Corymbia calophylla,* 0.07 ha of secondary native foraging habitat associated with *Jacksonia furcellata* and 0.49 ha of non-native secondary habitat associated with *Eucalyptus gomphocephala* and **Eucalyptus camaldulensis.*

The extent of foraging habitat by value category is detailed in **Table 12** and shown in **Figure 8** and **Figure 9**.

Table 12: Foraging habitat recorded within the site

Foraging habitat	Black cockatoo species and area of foraging habitat (ha)	
	Carnaby's	Forest red-tailed
Primary native	0.28	0.28
Primary non-native	0.07	0
Secondary native	0.41	0.07
Secondary non-native	0.51	0.49
Total	1.27	0.84

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

5. CONCLUSIONS

Outcomes of the assessment include the following:

- No threatened or priority flora species were recorded in the site. None of the threatened and priority flora species identified in the desktop assessment are considered to occur in the site due to lack of suitable habitat and/or because they were not recorded during the field survey.
- The majority of the site is heavily disturbed (degraded to completely degraded) and limited native intact native vegetation is present. One small patch of vegetation (ErJkSt) is identified in 'good – very good' condition.
- A total of 0.07 ha of the 'subtropical and temperate coastal saltmarsh' TEC/PEC occurs within the northern portion of the site adjacent to the Swan River.
- One threatened, forest red-tailed black cockatoo (EN), and one priority, blue-billed duck (P4), species were recorded in the site. A further nine conservation significant fauna species also have potential to occur in the site.
- As a result of historical disturbance, the site contains limited high-quality fauna habitat and is likely only utilised by fauna traversing through the wider area, especially birds. However, the small patch of 'fringing woodland' fauna habitat in the site's northeast (associated with vegetation type ErJkSt) may provide value for smaller ground-dwelling fauna.
- A total of 66 black cockatoo habitat trees were recorded of which five contained hollows potentially suitable for breeding. Internal hollow inspection would be required to confirm if these hollows are suitable for black cockatoo breeding.
- No evidence of roosting was recorded in the site. Tall trees in the site may represent potential roosting trees.
- A total of 1.27 ha of foraging habitat for Carnaby's black cockatoo and 0.84 ha of foraging habitat for forest red-tailed black cockatoo exists in the site.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

6. REFERENCES

6.1. General references

Atlas of Living Australia (ALA) 2023, *Atlas of Living Australia - Spatial Portal*, <http://www.ala.org.au/>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023, *NatureMap*, <https://static.dbca.wa.gov.au/pages/naturemap.html>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022, *Referral guideline for 3 WA threatened black cockatoo species*.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2023, *Protected Matters Search Tool*, <https://pmst.awe.gov.au/#/map>.

Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

NVIS Technical Working Group 2017, *Australian Vegetation Attribute Manual: National Vegetation Information System*, Department of the Environment and Energy, Canberra.

6.2. Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 6.1**, with access date information provided in **Table R 1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
DCCEEW (2023)	24 January 2024	Protected Matters Search Tool
DBCA (2023)	28 March 2023	NatureMap
ALA(2023)	24 January 2024	Spatial Portal - Atlas of Living Australia

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Figures

Figure 1: Site Location

Figure 2: Vegetation Units

Figure 3: Vegetation Condition

Figure 4: Threatened Ecological Community

Figure 5: Native Vegetation Under the EP Act

Figure 6: Fauna Habitat

Figure 7: Black Cockatoo Habitat Trees

Figure 8: Carnaby's Black Cockatoo Foraging Habitat

Figure 9: Forest Red-tailed Black Cockatoo Foraging Habitat

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024



Figure 1: Site Location

Project:	Flora, Vegetation and Fauna Assessment Golden Gateway Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(06)--F01

Drawn:	AS
Date:	13/02/2024
Checked:	AJU
Approved:	RAW
Date:	08/04/2024

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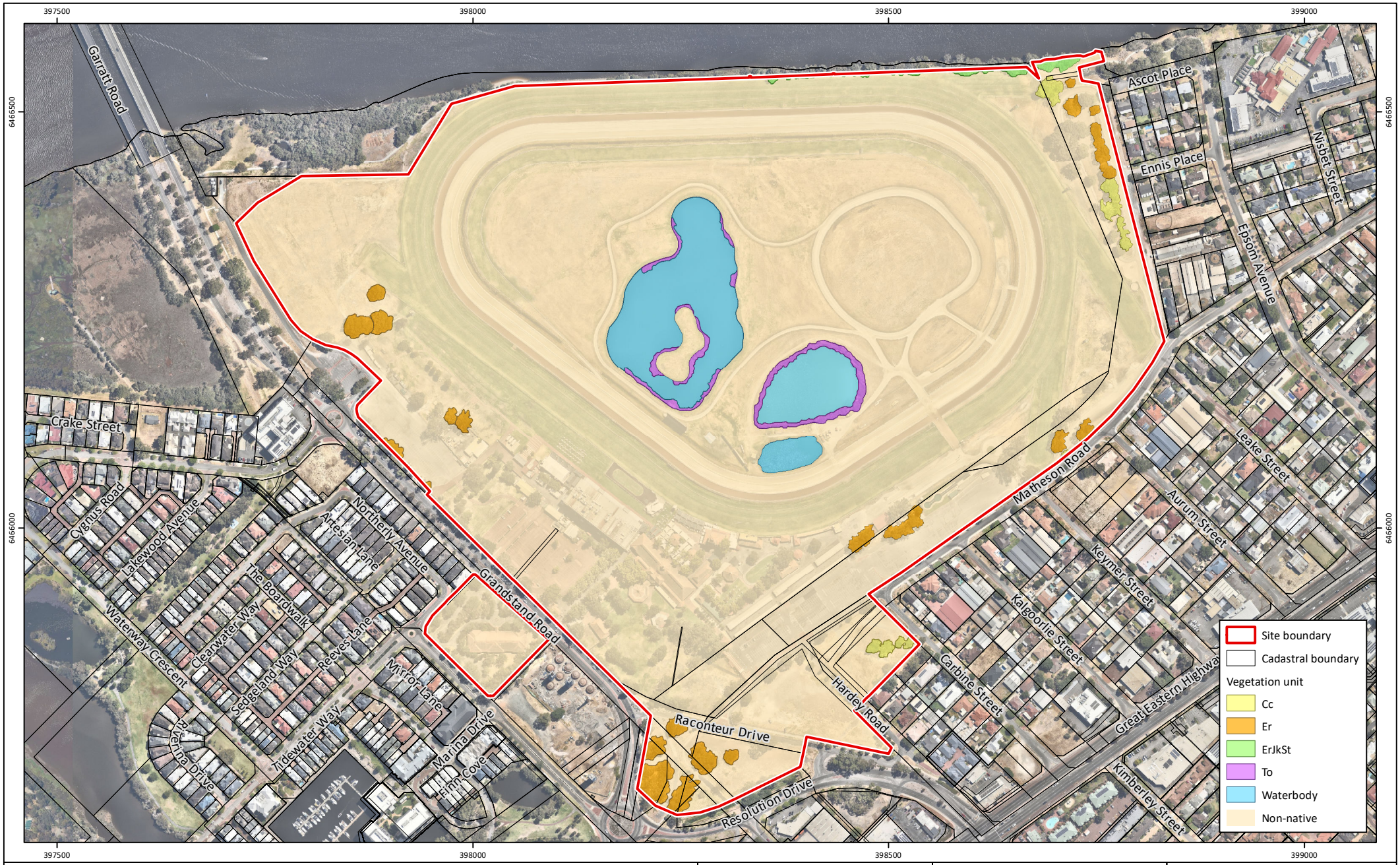


Figure 2: Vegetation Units

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Client:	Perth Racing

Plan Number:
EP23-109(06)--F02

Drawn:	AS
Date:	13/02/2024
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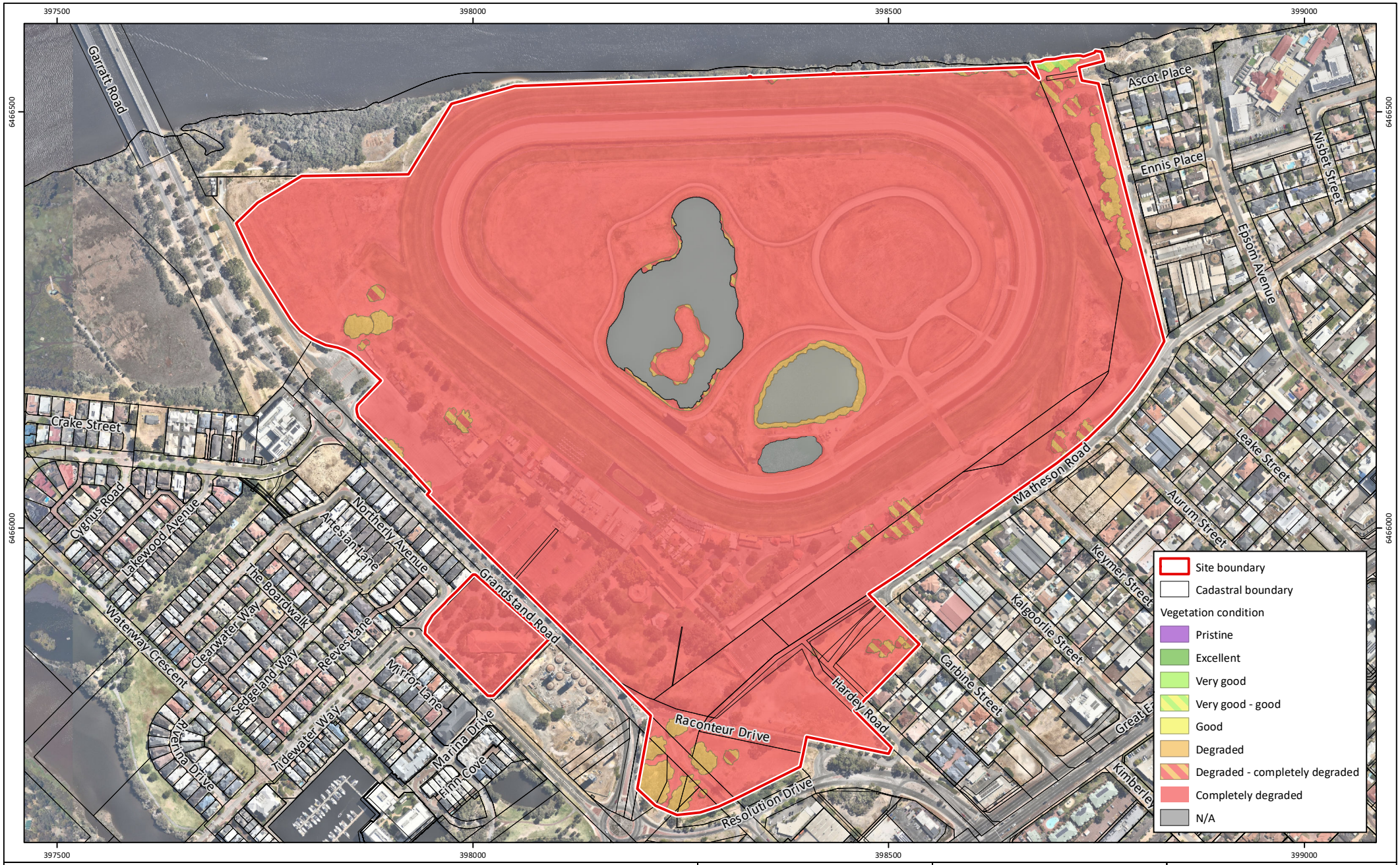


Figure 3: Vegetation Condition

Project:	Flora, Vegetation and Fauna Assessment Golden Gateway Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(06)--F03

Drawn:	AS
Date:	13/02/2024
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Figure 4: Threatened and Priority Ecological Community

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Client:	Perth Racing

Plan Number:
EP23-109(06)--F04

Drawn:	AS
Date:	13/02/2024
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Date:	08/04/2024

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Figure 5: Native Vegetation Under the EP Act

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Client:	Perth Racing

Plan Number:
EP23-109(06)--F16

Drawn:	WJC
Date:	04/04/2024
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Date:	08/04/2024

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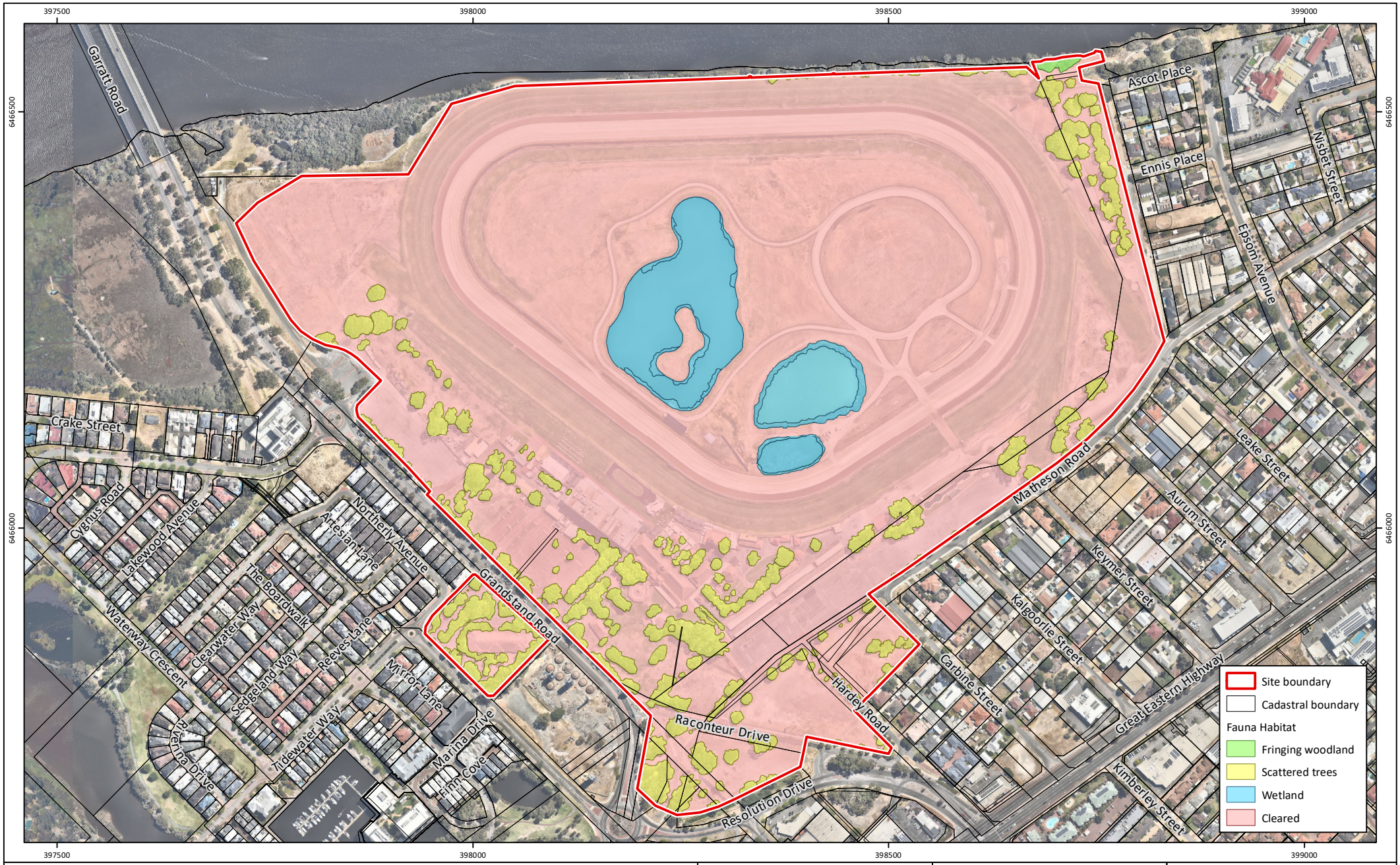


Figure 6: Fauna Habitat

Project:	Flora, Vegetation and Fauna Assessment Golden Gateway Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(06)--F05

Drawn:	AS
Date:	13/02/2024
Checked:	AJU
Approved:	RAW
Date:	08/04/2024

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Figure 7: Black Cockatoo Habitat Trees

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Client:	Perth Racing

Plan Number:
EP23-109(06)--F19a

Drawn:	GAR
Date:	28/06/2024
Checked:	TDP
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Figure 8: Carnaby's Black Cockatoo Foraging Habitat

Project: Flora, Vegetation and Fauna Assessment
Golden Gateway Structure Plan

Client: Perth Racing

Plan Number:
EP23-109(06)--F17

Drawn:	WJC
Date:	04/04/2024
Checked:	AJU
Approved:	RAW
Date:	08/04/2024

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Version: 1, Version Date: 18/09/2024



Figure 9: Forest Red-tailed Black Cockatoo Foraging Habitat

Project:	Flora, Vegetation and Fauna Assessment Golden Gateway Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(06)--F18

Drawn:	WJC
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Checked:	AJU
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Version: 1, Version Date: 18/09/2024

Appendix A

Conservation Significant Flora Likelihood of Occurrence

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Species name	Level of		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Calectasia cyanea	CR	CR	P	Heathland on white sand or laterite gravel over laterite. Known only from one population near Albany.	Jun-Oct	Low
Grevillea thelemanniana	CR	CR	P	Sand, sandy clay. Winter-wet low-lying flats.	May-Nov	Low
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Low
Caladenia huegelii	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Low
Calytrix breviseta subsp. breviseta	CR	EN	P	Seasonally wet sandy-clay soil on swampy flats	Oct-Nov	Low
Drakaea elastica	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of Kunzea glabrescens.	late Sep-Oct/Nov, survey Jul-Aug	Low
Eucalyptus x balanites	CR	EN	P	Light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland (Population 2) or heathland with emergent mallees (population 1)	Oct - Feb	Low
Trithuria occidentalis	CR	EN	A	Partly submerged on the edge of shallow winter-wet clay pans in very open shrubland.	Oct-Nov	Low
Diuris purdiei	EN	EN	PG	Sand to sandy clay soils in areas subject to winter inundation.	late September to mid-October, but only after a summer or early autumn fire (Brown et al., 1998)	Low
Grevillea curviloba subsp. incurva	EN	EN	P	Sand, sandy loam. Winter-wet heath.	Aug-Sep	Low
Macarthuria keigheryi	EN	EN	P	Low-lying winter-wet damp grey/white sands in open patches.	Sep-Dec or Feb-Mar	Low

	WA	EPBC Act	strategy		period	occurrence
Thelymitra stellata	EN	EN	PG	Sandy loam, clay or gravel over laterite or gravel.	Sep-Nov	Low
Andersonia gracilis	VU	EN	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Low
Banksia mimica	VU	EN	P	Flat to gentle slopes in grey and white sand in open woodlands.	Dec-Jan	Low
Drakaea micrantha	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Low
Acacia denticulosa	VU	VU	P	Sand, loam, clay. Granite outcrops, rarely on sandplains.	Sep-Oct	Low
Anigozanthos viridis subsp. Terraspectans	VU	VU	P	Grey sand, clay loam. Winter-wet depressions.	Aug-Sep	Low
Conospermum undulatum	VU	VU	P	Sand and sandy clay soils, on flat or gently sloping sites between the Swan and Canning Rivers	May-Oct	Low
Diuris drummondii	VU	VU	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Low
Diuris micrantha	VU	VU	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep- early Oct	Low
Eleocharis keigheryi	VU	VU	P	Clay or sandy loam in freshwater creeks and transient waterbodies such as seasonally wet clay pans.	Aug-Dec	Low
Eucalyptus rhodantha var. rhodantha	VU	VU	P	Grey/yellow/red sand over laterite. Undulating country, hillslopes.	Jul-Sep or Dec-Jan	Low
Morelotia australiensis	VU	VU	P	Sand over clay, winter wet depressions and drainage lines.	Nov-Dec	Low
Eremophila glabra subsp. chlorella	EN	-	P	Sandy clay. Winter-wet depressions.	Jul-Nov	Low
Hypocalymma magnificum	EN	-	P	Sandy loam, granite.	Aug-Nov (limited information)	Low
Bolboschoenus fluviatilis	P1	-	P	Floodplain with grey/brown wet sand.	Nov	Moderate
Calandrinia sp. Bayswater (C. Andrews s.n. 11/1902)	P1	-	Unknown	Unknown	Unknown	Low

	WA	EPBC Act	strategy		period	occurrence
Drosera patens	P1	-	P	Sandy soils on margins of winter-wet depressions, swamps and lakes.	Aug-Dec	Low
Drosera x sidjamesii	P1	-	P	Along lake margins, close to winter high-water line	Nov-Dec or Jan-Mar	Low
Haloragis scoparia	P1	-	P	Clay in winter-wet areas.	May	Low
Hydrocotyle striata	P1	-	A	Sand and clay in springs and creeklines.	Nov	Low
Levenhookia preissii	P1	-	A	Grey or black, peaty sand. Swamps	Sep-Dec/Jan	Low
Ptilotus sericostachyus subsp. roseus	P1	-	P	Unknown. Seem to be associated with wetlands/rivers.	Sep-Dec	Moderate
Senecio gilbertii	P1	-	P	Peaty sand in swamps and on slopes.	Sep-Nov	Low
Thelymitra magnifica	P1	-	PG	Gravelly soil on stony ridges.	Sep-Oct	Low
Typhonium peltandroides	P1	-	P	Shallow sand amongst rough sandstone, red clay. Sides of gorges, vine thickets, rocky sites or along watercourses.	Dec or Jan-Feb	Low
Acacia benthamii	P2	-	P	Sand, typically on limestone breakaways	Aug - Sept	Low
Calothamnus macrocarpus	P2	-	P	Rocky quartzite soils, sand. Slopes.	Feb or Aug-Dec	Low
Chamelaucium floriferum subsp. diffusum	P2	-	P	Sand, clay. Frequently with outcropping granite.	Jan-Dec	Low
Eucalyptus educta	P2	-	P	Shallow soils. Granite rocks.	Apr	Low
Grevillea manglesii subsp. ornithopoda	P2	-	P	Red-brown loam over clay	Sep-Nov	Low
Hypocalymma inopinatum	P2	-	P	White sand on laterite. Shallow sandy loam Slopes and rises (limited information).	Nov? (limited information	Low
Johnsonia pubescens subsp. cygnorum	P2	-	P	Grey white yellow sands on flats and seasonally wet areas.	Sep	Low
Lepyrodia curvescens	P2	-	P	Sand, laterite. Seasonally inundated swampland.	Sep-Nov	Low
Melaleuca viminalis	P2	-	P	Sand, clay in creeklines and wetlands.	Oct-Dec	Moderate
Phyllangium palustre	P2	-	A	Winter-wet claypans, low-lying seasonal wetlands on clay	Oct-Nov	Low
Poranthera moorokatta	P2	-	A	Sandy or clay soils. Dampland or low sandy dunes.	Oct or Feb	Low
Thelymitra variegata	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep	Low

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

	WA	EPBC Act	strategy		period	occurrence
Thysanotus brachiatus	P2	-	P	Grey sand	Nov-Dec	Low
Adenanthos cygnorum subsp. chamaephyton	P3	-	P	Grey sand, lateritic gravel.	Jul or Sep to Dec or Jan	Low
Alyogyne sp. Great Victoria Desert (D.J. Edinger 6212)	P3	-	P	Unknown	Unknown	Low
Angianthus micropodioides	P3	-	A	Saline sandy soils on edge of rivers, depressions and clay pans.	Nov-Dec or Jan-Feb	Moderate
Babingtonia urbana	P3	-	P	Grey sand, lateritic gravel.	Jan-Mar	Low
Banksia pteridifolia subsp. vernalis	P3	-	P	White/grey sand over laterite.	Sep-Oct	Low
Beaufortia purpurea	P3	-	P	Lateritic or granitic soils on rocky slopes.	Oct-Feb	Low
Byblis gigantea	P3	-	P	Sandy-peat swamps. Seasonally wet areas.	Sep-Jan	Low
Carex tereticaulis	P3	-	P	Black peaty sand.	Sep-Oct	Low
Conostylis bracteata	P3	-	P	Sand, limestone. Consolidated sand dunes	Aug-Sep	Low
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Low
Dampiera triloba	P3	-	P	Damp peat/loam soil.	Aug-Dec	Low
Dicrastylis micrantha	P3	-	P	Red sand. Sandplains.	Sep-Dec	Low
Eryngium sp. Subdecumbens (G.J. Keighery 5390)	P3	-	A	Clay in seasonal wetlands.	Sep-Nov	Low
Haemodorum loratum	P3	-	P	Grey or yellow sand, gravel.	Nov	Low
Halgania corymbosa	P3	-	P	Gravelly soils, soils over granite.	Aug-Nov	Low
Hibbertia leptotheca	P3	-	P	Brown to white sand with limestone.	Aug-Sep	Low
Hypocalymma quadrangulare	P3	-	P	Sandy loam in depressions (limited infroamtion)	Jul-Sep (limited information)	Low
Isopogon autumnalis	P3	-	P	Yellow-grey sand.	Feb,Mar,Apr, May or June	Low
Jacksonia gracillima	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Low
Lasiopetalum glutinosum subsp. glutinosum	P3	-	P	Brown clay loam on slopes	Sep-Dec	Low
Lasiopetalum membranaceum	P3	-	P	Sand over limestone	Sep-Dec	Low

	WA	EPBC Act	strategy		period	occurrence
Meionectes tenuifolia	P3	-	P	Clay loam in seasonally wet areas.	Oct-Dec	Low
Myriophyllum echinatum	P3	-	A	Clay in winter-wet flats.	Nov	Low
Platysace ramosissima	P3	-	P	Sandy soils.	Oct-Nov	Low
Schoenus benthamii	P3	-	P	White, grey ands, sandy clay in winter wet flats and swamps	Oct-Nov	Low
Schoenus pennisetis	P3	-	A	Grey or peaty sand in swamps and winter-wet depressions.	Aug-Sep	Low
Stylidium aceratum	P3	-	A	Sandy soils in swamp heathland.	Oct-Nov	Low
Stylidium asteroideum	P3	-	P	Sand, clay, loam in winter wet areas.	Sep-Nov	Low
Stylidium paludicola	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Low
Styphelia filifolia	P3	-	P	Brown over pale yellow sand.	Feb-Apr	Low
Thysanotus anceps	P3	-	P	White or grey sand, lateritic gravel, laterite.	Oct-Dec	Low
Verticordia venusta	P3	-	P	Yellow sand, sandy gravel. Sandplains.	Sep-Dec or Jan	Low
Aponogeton hexatepalus	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Moderate
Calothamnus accedens	P4	-	P	Sandy soils over laterite.	Sep-Jan	Low
Calothamnus graniticus subsp. leptophyllus	P4	-	P	Clay over granite, lateritic soils. Hillsides.	Jun-Aug	Low
Cyanothamnus tenuis	P4	-	P	Laterite, stony soils, granite.	Aug-Nov	Low
Dodonaea hackettiana	P4	-	P	Sand, outcropping limestone.	Jul-Oct	Low
Drosera occidentalis	P4	-	P	Flat, brown/white/yellow moist sand/clay/peat, often near swamps.	Oct-Dec/Jan	Low
Eucalyptus caesia subsp. caesia	P4	-	P	Loam. Granite outcrops.	May-Sep	Low
Eucalyptus caesia subsp. magna	P4	-	P	Loam. Granite outcrops.	May-Sep	Low
Eucalyptus kruseana	P4	-	P	Sandy loam. Granite outcrops & hills.	Jun-Sep	Low
Grevillea pimeleoides	P4	-	P	Gravelly soils over granite. Rocky hillsides.	May-Nov	Low
Hydrocotyle lemnoides	P4	-	A	Floating in swamps.	Aug-Oct	Low

	WA	EPBC Act	strategy		period	occurrence
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Low
Lasiopetalum bracteatum	P4	-	P	Sandy clay, clay, lateritic gravel along drainage lines, creeks, gullies, granite outcrops.	Aug-Nov	Low
Ornduffia submersa	P4	-	A	Sandy clay in inundated wetland/creek.	Aug-Nov	Low
Schoenus griffinianus	P4	-	P	White sand	Sep-Oct	Low
Schoenus natans	P4	-	A	Aquatic, in winter-wet depressions.	Oct	Low
Stylidium longitubum	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Low
Stylidium striatum	P4	-	P	Brown clay over laterite on hill slopes.	Oct-Nov	Low
Verticordia lindleyi subsp. Lindleyi	P4	-	P	Sand and sandy clay in winter wet areas.	May or Nov-Jan	Low

Note: CR=critically endangered, EN=endangered, VU=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual.

Appendix B

Flora Species Inventory

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Family	Status	Species
Amaranthaceae		
	*	*Amaranthus viridis*
	*	*Atriplex prostrata*
		Suaeda australis
Anacardiaceae		
	*	*Schinus terebinthifolia*
Apiaceae		
		Apium prostratum subsp. prostratum var. prostratum
Araliaceae		
	*	*Schefflera arboricola*
Araucariaceae		
	*	*Araucaria heterophylla*
Arecaceae		
	*	*Arecaceae sp.*
	*	*Phoenix canariensis*
	*	*Syagrus romanzoffiana*
	*	*Washingtonia filifera*
Asphodelaceae		
	Pl	*Xanthhorrea sp.*
Asteraceae		
	*	*Erigeron sp.*
	*	*Hypochaeris glabra*
	*	*Lactuca serriola*
	*	*Ursinia anthemoides*
Bignoniaceae		
	*	*Jacaranda mimosifolia*
Boraginaceae		
		Heliotropium curassavicum
Casuarinaceae		
		Casuarina ?cunninghamiana
		Casuarina obesa
	Pl	*Casuarina sp.*
Cyperaceae		
		Bolboschoenus caldwellii
	*	*Cyperus ?tenuiflorus*
	*	*Cyperus congestus*
	*	*Cyperus polystachyos*
		Lepidosperma longitudinale
		Schoenoplectus tabernaemontani
Fabaceae		
		Acacia saligna
	*	*Acacia iteaphylla*
		Kennendia prostrata
	*	*Tipuana tipu*
	*	*Trifolium michelianum*
		Viminaria juncea
Fabaeae		
	*	*Erythrina indica*

Juncaceae		
		Juncus kraussii
Malvaceae		
	*	*Brachychiton populneus*
	*	*Malva sp.*
Moraceae		
	*	*Ficus macrophylla*
Myrtaceae		
	Pl	*Agonis flexuosa*
	Pl	*Callistemon sp.*
		Corymbia calophylla
	*	*Corymbia citriodora*
	*	*Corymbia cladocalyx*
	*	*Eucalyptus ?leptopoda*
	*	*Eucalyptus botryoides*
	*	*Eucalyptus camaldulensis*
	*	*Eucalyptus cladocalyx*
	Pl	*Eucalyptus gomphocephala*
	*	*Eucalyptus grandis*
	*	*Eucalyptus leucoxylon*
	*	*Eucalyptus maculata*
		Eucalyptus rudis
	*	*Eucalyptus sideroxylon*
	*	*Eucalyptus sp.*
		Melaleuca rhaphiophylla
	*	Myrtaceae sp.
Onagraceae		
	*	*Oenothera drummondii*
Pinaceae		
	*	*Pinus sp.*
Plantaginaceae		
	*	*Plantago lanceolata*
Plantanaceae		
	*	*Platanus ×hispanica*
Poaceae		
	*	*Avena barbata*
	*	*Bambusa sp.*
	*	*Briza maxima*
	*	*Cenchrus ciliaris*
	*	*Cortaderia selloana*
	*	*Cynodon dactylon*
	*	*Ehrharta calycina*
	*	*Ehrharta longiflora*
	*	*Ergagrostis curvula*
	*	*Melinis repens*
	*	*Paspalum dilatatum*
	*	*Paspalum vaginatum*
	*	*Setaria verticillata*
Polygonaceae		

	*	*Persicaria ?decipiens*
	*	*Polygonum aviculare*
Rosaceae		
	*	*Rosa sp.*
Solanaceae		
	*	*Solanum nigrum*
Tamaricaceae		
	*	*Tamarix aphylla*
Typhaceae		
		Typha sp.

*=non-native, Pl=planted

Appendix C

Conservation Significant Communities Likelihood of Occurrence

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
SCP10a	Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson et al. (1994))	TEC	EN	CR	Low
SCP07	Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson et al. (1994))	TEC	VU	CR	Low
Tuart woodlands	Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain	TEC/ PEC	P3	CR	Low
SCP3a	Corymbia calophylla - Kingia australis woodlands on heavy soils, Swan Coastal Plain (floristic community type 3a as originally described in	TEC	CR	EN	Moderate
SCP3c	Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in in Gibson et al. (1994))	TEC	CR	EN	Moderate
SCP20c	Shrublands and woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20c as originally described in in Gibson et al. (1994))	TEC	CR	EN	Low
SCP20b	Banksia attenuata and/or Eucalyptus marginata woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20b as originally described in Gibson et al. (1994))	TEC	EN	EN	Low
SCP20a	Banksia attenuata woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson et al. (1994))	TEC	EN	EN	Low
Muchea Limestone	Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain	TEC	EN	EN	Low
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain ecological community	TEC/ PEC	P3	EN	Low
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	TEC/ PEC	P3	VU	High
SCP02	Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson et al. (1994)	TEC	EN	-	Low
SCP3b	Corymbia calophylla - Eucalyptus marginata woodlands on sandy clay soils of the southern Swan Coastal Plain (floristic community type 3b as originally described in Gibson et al. (1994))	TEC	VU	-	Moderate
SCP22	Banksia ilicifolia woodlands	PEC	P3	-	Low
SCP21c	Low lying Banksia attenuata woodlands or shrublands	PEC	P3	-	Low
SCP23b	Swan Coastal Plain Banksia attenuata - Banksia menziesii woodlands	PEC	P3	-	Low

Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3

Appendix D

Conservation Significant Fauna

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Birds					
Actitis hypoleucos	Common sandpiper	MI	MI	Edge of sheltered waters salt or fresh, e.g. estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations where low perches are available (Johnstone & Storr 1998).	Nil
Anous tenuirostris melanops	Australian lesser noddy	EN	VU	Very common in blue-water seas around the Abrolhos (endemic to this area, accidental occurrences on lower west coast of Australia) (Johnstone and Storr 1998).	Nil
Apus pacificus	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Pizzey & Knight 2012).	Moderate
Botaurus poiciloptilus	Australasian bittern	EN	EN	In or over water, in tall reedbeds, sedges, rushes, cumbungi, lignum. Also occurs in ricefields, drains in tussocky paddocks and occasionally in saltmarshes and brackish wetlands (TSSC 2019).	Negligible
Cacatua pastinator pastinator	Muir's corella	CD	-	Wheat and sheep farming country with remnant native forest. Species is restricted to the south-west corner of WA, near Lake Muir (DPaW 2015).	Nil

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Calidris acuminata	Sharp-tailed sandpiper	VU (MI)	VU (MI)	Occurs in tidal mudflats, saltmarshes and mangroves, as well as, shallow fresh, brackish or saline inland wetlands. It is also known from floodwaters, irrigated pastures and crops, sewage ponds, saltfields (Pizzey & Knight 2012).	Nil
Calidris alba	Sanderling	MI	MI	Mainly steeply shelving sandy beaches exposed to ocean swell. Also sandy inlets, estuarine sandbanks and near-coastal saltlakes (including saltwork ponds) (Johnstone & Storr 1998).	Nil
Calidris canutus	Red knot	EN	EN (MI)	Mud and sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds (Pizzey & Knight 2012).	Nil
Calidris ferruginea	Curlew sandpiper	CR	CR (MI)	Mainly shallows of estuaries and near-coastal saltlakes (including saltwork ponds) and drying near-coastal freshwater lakes and swamps. Also beaches and near-coastal sewage ponds (Johnstone & Storr 1988).	Negligible
Calidris melanotos	Pectoral sandpiper	MI	MI	Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also samphire flats around estuaries and saltlakes (Johnstone & Storr 1998).	Nil
Calidris ruficollis	Red-necked stint	MI	MI	Tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands (coastal and inland), saltfields, sewage ponds (Pizzey and Knight 2012).	Moderate

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Calidris subminuta	Long-toed stint	MI	MI	Mainly freshwater swamps (especially when drying and where vegetation is short), river pools, lagoons and claypans; also brackish pools, sewage ponds and samphire flats around estuaries and saltlakes (Johnstone & Storr 1988).	Nil
Calidris tenuirostris	Great knot	CR	CR (MI)	Mud or sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds (Johnstone & Storr 1988).	Negligible
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding Corymbia calophylla, Eucalyptus marginata, introduced Melia azedarach and Eucalyptus spp. trees (Johnstone et al. 2013).	High
Charadrius leschenaultii	Great sand plover	VU	VU (MI)	Wide sandy or shelly beaches, sandpits, tidal mudflats, reefs, sand cays, mangroves, saltmarsh, dune wilderness, bare paddocks, seldom far inland (Pizzey & Knight 2012).	Negligible
Dasyornis longirostris	Western bristlebird	EN	EN	Dense, low, closed coastal heaths. Open heaths with dense clumps of shrubs, eucalypt thickets and tall swampy heaths. Much reduced by fire, draining for agriculture, but may need fire for optimal status over 50-10+ years. Current range in WA confined to south coast from Albany to Hopetoun (Pizzey and Knight 2012).	Nil

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Diomedea amsterdamensis	Amsterdam Island albatross	CR	EN (MI)	The Amsterdam albatross is a marine, pelagic seabird. It nests in open patchy vegetation (among tussocks, ferns or shrubs) near exposed ridges or hillocks (Weimerskirch et al. 1985). It sleeps and rests on ocean waters when not breeding (Marchant and Higgins 1990)	Nil
Diomedea epomophora	Southern royal albatross	VU	VU (MI)	Rare visitor to Western Australian seas; it breeds on subantarctic islands south of New Zealand (Johnstone and Storr 1998).	Nil
Diomedea exulans	Wandering albatross	VU	VU (MI)	Marine, pelagic and aerial species. It breeds on Macquarie Island and feeds in Australian portions of the Southern Ocean (DoE 2018).	Nil
Elanus scriptus	Letter-winged kite	P4	-	Open to sparsely wooded country and grassland near tree-lined streams or watercourses (Johnstone and Storr 1998).	Nil
Falco hypoleucos	Grey falcon	VU	-	Species occurs in arid and semi-arid Australia, where it inhabits timbered lowland plains. In particular Acacia shrublands and that are crossed by tree-lined water courses. Species has also been observed hunting in treeless areas and frequenting tussock grassland and open woodlands (TSSC 2020).	Nil
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	Moderate

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Hydroprogne caspia	Caspian tern	MI	MI	Mainly sheltered areas, estuaries (when not laden with silt) and tidal creeks; occasionally near-coastal saltlakes (including saltwork ponds) and brackish pools in lower courses of rivers; rarely fresh waters (DCCEEW 2023).	Negligible
Ixobrychus dubius	Australian little bittern	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of Typha spp., Baumea spp. and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).	Negligible
Ixobrychus flavicollis australis	Black bittern	P2	-	Freshwater pools, swamps and lagoons, well-screened with trees. Occasionally feeding by day but mainly sheltering in dense waterside vegetation (Melaleuca spp., Eucalyptus camaldulensis, Pandanus spp. and long grass) (Johnstone and Storr 1998).	Nil
Leipoa ocellata	Malleefowl	VU	VU	Scrubs and thickets of Eucalyptus spp., Melaleuca lanceolata and Acacia linophylla; also other dense litter-forming shrublands. Attracted to fallen wheat in stubbles and along roads (Johnstone and Storr 1998).	Nil
Limosa lapponica	Bar-tailed godwit	MI	MI	Estuarine sand and mudflats and sandy beaches with loads of seaweed; also reef flats and near-coastal saltlakes (including saltwork and sewage ponds) (Johnstone and Storr 1998).	Nil

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Limosa limosa	Black-tailed godwit	EN MI	EN (MI)	Tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures, airfields (Pizzey & Knight 2012).	Nil
Macronectes giganteus	Southern giant-petrel	MI	EN (MI)	Breeds on southern subantarctic and antarctic islands. May visit Western Australian waters from February to December (mostly June to September) (Johnstone and Storr 1998).	Nil
Macronectes halli	Northern giant petrel	MI	VU (MI)	Breeds on subantarctic islands. May visit Western Australian water from February to September (Johnstone and Storr 1998).	Nil
Numenius madagascariensis	Eastern curlew	CR	CR (MI)	Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds) (Johnstone and Storr 1998).	Nil
Oxyura australis	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters (Johnstone and Storr 1998).	High
Pachyptila turtur subantarctica	Fairy prion	-	VU	Breeds on subantarctic islands and is presumed to frequent subtropical waters during non-breeding period (TSSC 2015).	Nil
Pandion haliaetus	Osprey	MI	MI	Coasts, estuaries, bays, inlets, islands, and surrounding waters; coral atolls, reefs, lagoons, rock cliffs, stacks (Pizzey & Knight 2012).	High

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Phoebetria fusca	Sooty albatross	EN	VU (MI)	Marine, pelagic species that tolerates a wide range of sea surface temperatures and salinities. breeds on subtropical and subantarctic islands in the Indian and Atlantic Oceans, on vegetated cliffs and steep slopes that are sheltered from prevailing winds, often amongst tussock grass (Pizzey & Knight 2012).	Nil
Platycercus icterotis xanthogenys	Western rosella (inland)	P4	-	Open eucalypt woodlands with heath understorey (Pizzey & Knight 2012).	Negligible
Plegadis falcinellus	Glossy Ibis	MI	MI	Well-vegetated wetlands, wet pasture, ricefields, floodwaters, floodplains, brackish or occasionally saline wetlands, mangroves, mudflats and occasionally dry grassland (Pizzey & Knight 2012).	Moderate
Pluvialis fulva	Pacific golden plover	MI	MI	Estuaries, mudflats, saltmarshes, mangroves; rocky reefs and stranded seaweed on ocean shores; margins of shallow open inland swamps; sewage ponds, short-grass paddocks, sportsgrounds, airfields, ploughed land (Pizzey & Knight 2012).	Nil
Pluvialis squatarola	Grey Plover	VU (MI)	VU (MI)	Mudflats, saltmarsh, tidal reefs and estuaries, rarely inland (Pizzey and Knight 2012).	Negligible
Rostratula australis	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	Negligible
Sternula nereis nereis	Australian fairy tern	VU	VU	Sheltered blue-water seas close to land, estuaries (when free of silt) and near-coastal lakes (Johnstone and Storr 1998).	Negligible

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Thalassarche cauta	Shy albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Nil
Thalassarche impavida	Campbell albatross	VU	VU (MI)	Scarce visitor to south-western and western Australian seas. Breeds on Campbell Island (Pizzey & Knight 2012).	Nil
Thalassarche melanophris	Black-browed albatross	EN	VU (MI)	Seas of south and west coasts. Visitor to Western Australian mainland from January to early November (mostly May to September). Breeds on southern subantarctic and Antarctic islands (Johnstone and Storr 1998).	Nil
Thalassarche steadi	White-capped albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Nil
Thalasseus bergii	Crested tern	MI	MI	Mainly blue-water seas (especially within 3 km of land), including southern estuaries in summer and autumn (when free of silt); also tidal creeks in north, but not penetrating far into larger estuaries (DCCEEW 2023).	Moderate
Tringa glareola	Wood sandpiper	MI	MI	Mainly shallow fresh waters (lagoons, swamps, claypans, river pools, dams, bore overflows and sewage ponds); occasionally brackish swamps, rarely saltlakes and estuaries (Pizzey & Knight 2012).	Nil

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Tringa nebularia	Common greenshank	EN (MI)	EN (MI)	Mudflats, estuaries, saltmarshes, margins of lakes, wetlands, claypans (fresh and saline), commercial saltfields, sewage ponds (Pizzey & Knight 2012).	Nil
Tyto novaehollandiae novaehollandiae	Australian masked owl	P3	-	Forests, open woodlands, farmlands with large trees. E.g. river red gums, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight 2012).	Nil
Zanda baudinii	Baudin's black cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding Corymbia calophylla, Banksia spp., Hakea spp., and to fruiting apples and pears (Johnstone and Storr 1998).	Negligible
Zanda latirostris	Carnaby's black cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	High
Invertebrates					
Euoplos inornatus	Inornate trapdoor spider	P3	-	Has previously been recorded in jarrah forest, including near clay banks and granite outcrop. Most records are from the Darling scarp/Jarrah Forest Region, with limited records from the Swan Coastal Plain (DBCA 2020).	Nil
Hylaeus globuliferus	Woollybush bee	P3	-	Males are territorial and may be found perched on the growing tips of Adenanthos sp., Banksia sp. or Jacksonia sp. Has also been recorded visiting the flowers of Grevillea sp. (PaDIL 2022).	Nil

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003). Species predominantly recorded from remnant banksia woodland vegetation and heath on sandy soils (Rix et. al 2018).	Negligible
Leioproctus contrarius	a short-tongued bee	P3	-	Life history and habits are poorly documented/ unknown. It has been recorded only on flowers of Goodeniaceae and possibly Lechenaultia stenosepala (Bamford 2003).	Nil
Leioproctus douglasiellus	a short-tongued bee	EN	CR	Life history and habits are poorly documented/ unknown. It has been recorded only on the flowers of Goodenia filiformis and Anthotium junciforme (Houston 2000).	Negligible
Neopasiphae simplicior	a short-tongued bee	EN	CR	This species of native bee has been collected on flowers of Goodenia filiformis, Lobelia tenuior, Angianthus preissianus and Velleia sp. (Houston 2000).	Nil
Synemon gratiosa	Graceful sun-moth	P4	-	Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant Lomandra maritima. Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant L. hermaphrodita is widespread (DEC 2011).	Negligible

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Westralunio carteri	Carter's freshwater mussel	VU	VU	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots. Also occupies lentic systems including large water supply dams and even on-stream farm dams. Salinity tolerance quite low (Morgan et al. 2011).	Nil
Mammals					
Bettongia penicillata ogilbyi	Woylie	CR	EN	Woodlands and adjacent heaths with a dense understorey of shrubs, particularly Gastrolobium spp. (TSSC 2018).	Nil
Dasyurus geoffroii	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along roadsides in the wheatbelt (DEC 2012).	Low
Dasyurus hallucatus	Northern quoll	EN	EN	Most abundant in rocky eucalypt woodland but occurs in range of vegetation types, mostly within 200 km of the coast (Menkhorst & Knight 2011).	Nil
Falsistrellus mackenziei	Western false pipistrelle	P4	-	High rainfall forests dominated by jarrah, karri, marri, and tuart. Occupies hollow logs for breeding and resting (Van Dyck and Strahan 2008). Also known to utilise Banksia woodland on the Swan Coastal Plain (Hosken and O'Shea 1995).	Nil

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Hydromys chrysogaster	Rakali	P4	-	Areas with permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south-west (Christensen et al. 1984). Intact riparian vegetation and associated bank stability is critical to their survival (DWER 2023).	Moderate
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012)	Moderate
Macrotis lagotis	Bilby	VU	VU	Open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises and hummock grassland (spinifex) growing on sandplains and dunes, drainage systems, salt lake systems and other alluvial areas (DBCA 2017).	Nil
Myrmecobius fasciatus	Numbat	EN	EN	Generally dominated by Eucalyptus spp. that provide hollow logs and branches for shelter and termites for food (van Dyck & Strahan 2008).	Nil
Notamacropus irma	Western brush wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	Negligible
Phascogale tapoatafa wambenger	South-western brush-tailed phascogale	CD	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Triggs 2003).	Negligible

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Pseudocheirus occidentalis	Western ringtail possum	CR	CR	On the Swan Coastal Plain in Agonis flexuosa woodlands and Agonis flexuosa/ Eucalyptus gomphocephala forests. Also Eucalyptus marginata forests (DBCA 2017).	Nil
Reptiles					
Ctenotus delli	Dell's skink	P4	-	Jarrah and marri woodland with a shrub dominated understorey, sheltering in dense vegetation, inside grass trees and beneath rocks, sometimes in burrows (Nevill 2005).	Nil
Ctenotus gemmula	-	P3	-	Pale soils supporting heathlands and usually in association with Banksia spp. (Bush et al. 2010)	Nil
Ctenotus ora	Coastal plains skink	P3	-	Sandy substrates with low vegetation (including heath) in open Eucalyptus spp. and Corymbia calophylla woodland over Banksia spp. (Kay and Keogh 2012).	Nil
Lerista lineata	Perth slider	P3	-	Sandy coastal heath and low scrubland. Banksia spp. woodland, Eucalyptus gomphocephala open woodland over deep sands, and coastal dunes immediately adjacent to the beach (Wilson and Swan 2021).	Nil
Neelaps calonotos	Black-striped snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2010).	Negligible
Pseudemydura umbrina	Western swamp tortoise	CR	CR	Clay based ephemeral swamps (Bush et al. 2010).	Negligible

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Pseudonaja affinis exilis	Rottnest Island dugite	P4	-	Subspecies found on Rottnest Island. Found in a wide range of habitats including coastal dunes, heathlands, scrublands, and woodlands, but tend to prefer sandy areas. More urban spaces that have been degraded also make an attractive habitat for these shy reptiles, with golf courses, industrial parks and agricultural country among areas listed as potential home environments (Wilson and Swan 2021).	Nil
Note: CR=critically endangered, EN=endangered, VU=vulnerable, CD=conservation dependent, MI=migratory, OS=other specially protected, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4. Species with a high or moderate likelihood to occur within the site are shaded green.					

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Appendix E

Black Cockatoo Foraging Plant Species List

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Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Acacia baileyana	Cootamundra wattle	Secondary	-	-	Groom 2011
Acacia pentadenia	Karri wattle	Secondary	-	-	Groom 2011
Acacia saligna	Orange wattle	Secondary	-	-	Groom 2011
Agonis flexuosa	Peppermint tree	Secondary	-	-	Groom 2011
Allocasuarina fraseriana	Sheoak	Secondary	Secondary	Secondary	Johnstone & Storr 1998; Johnstone *et al.* 2010; Johnstone 2017; DoEE 2017
Allocasuarina spp.		Secondary	-	Secondary	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Anigozanthos flavidus	Tall kangaroo paw	-	Secondary	-	Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Araucaria heterophylla	Norfolk island pine	Secondary	-	-	Groom 2011; DoEE 2017
Banksia ashbyi	Ashby's banksia	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
Banksia attenuata	Slender banksia	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia baxteri	Baxter's banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia carlinoides	Pink dryandra	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia coccinea	Scarlet banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia dallanneyi	Couch honeypot dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia ericifolia	Heath-leaved banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia fraseri		Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia gardneri	Prostrate banksia	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia grandis	Bull banksia	Primary	Secondary	-	Saunders 1980; Johnstone & Storr 1998; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia hookeriana	Hooker's banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia ilicifolia	Holly banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; Johnstone & Storr 1998; DoEE 2017
Banksia kippistiana		Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia leptophylla		Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia lindleyana	Porcupine banksia	Primary	Secondary	-	Johnstone *et al.* 2010; DoEE 2017

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Banksia littoralis	Swamp banksia	Primary	Secondary	-	Saunders 1980; Groom 2011Johnstone & Storr 1998; Johnstone *et al.* 2010; DoEE 2017
Banksia menziesii	Firewood banksia	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia mucronulata	Swordfish dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia nivea	Honeypot dryandra	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
Banksia nobilis	Golden dryandra	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
Banksia praemorsa	Cut-leaf banksia	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia prionotes	Acorn banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia prolata		Primary	Secondary	-	Johnstone *et al.* 2010; DoEE 2017
Banksia quercifolia	Oak-leaved banksia	Primary	Secondary	-	Johnstone & Storr 1998; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia sessilis	Parrot bush	Primary	Secondary	-	Saunders 1980; Johnstone & Storr 1998; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia speciosa	Showy banksia	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia spp.		Primary	Secondary	-	Saunders 1979; DSEWPaC 2012; DoEE 2017
Banksia squarrosa	Pingle	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Banksia tricuspis	Pine banksia	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia undata	Urchin dryandra	Primary	Secondary	-	Groom 2011; DoEE 2017
Banksia verticillata	Granite banksia	Primary	Secondary	-	Saunders 1980; Groom 2011; DoEE 2017
Brassica campestris	Canola	Secondary	-	-	Groom 2011; DoEE 2017
Callistemon spp.		Secondary	Secondary	-	Johnstone *et al.* 2010; DoEE 2017
Callistemon viminalis	Captain cook bottlebrush	Secondary	-	-	Groom 2011
Callitris sp.		Secondary	-	-	Johnstone *et al.* 2010; Groom 2011
Carya illnoinensis	Pecan	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; Groom 2014; DoEE 2017
Casuarina cunninghamiana	River sheoak	Secondary	-	-	Groom 2011
Citrullus lanatus	Pie or afghan melon	Secondary	-	-	Johnstone *et al.* 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Corymbia calophylla	Marri	Primary	Primary	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Saunders 1979; Johnstone & Kirkby 2008
Corymbia citriodora	Lemon scented gum	Secondary	Secondary	Secondary	Johnstone *et al.* 2010; DSEWPaC 2012; Groom 2011; Johnstone 2017
Corymbia ficifolia	Red flowering gum	Secondary	-	-	Groom 2011
Corymbia haematoxylon	Mountain marri	Secondary	-	Secondary	Groom 2011; DoEE 2012; DoEE 2017
Corymbia maculata	Spotted gum	-	-	-	-
Darwinia citriodora	Lemon-scented darwinia	Secondary	Secondary	-	Groom 2011; Johnstone *et al.* 2010
Diospryros sp.	Sweet persimmon	Secondary	Secondary	-	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eremophila glabra	Tarbush	Secondary	-	-	Groom 2011
Erodium aureum		Secondary	-	-	Groom 2011
Erodium botrys	Long storksbill	Secondary	Secondary	-	Groom 2011; Johnstone & Storr 1998; Johnstone *et al.* 2010
Erodium spp.		Secondary	Secondary	-	Johnstone *et al.* 2010; DoEE 2017
Eucalyptus caesia	Silver princess	Secondary	-	Secondary	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone 2017
Eucalyptus camaldulensis	River red gum	-	-	Secondary	DoEE 2012; DoEE 2017
Eucalyptus decipiens	Red heart/moit	-	-	Secondary	Johnstone 2017
Eucalyptus diversicolor	Karri	-	-	Primary	Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998
Eucalyptus erythrocorys	Illyarrie	Secondary	-	Secondary	DSEWPaC 2012; DoEE 2017; Johnstone 2017, Johnstone *et al.* 2010
Eucalyptus gomphocephala	Tuart	Secondary	-	Secondary	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eucalyptus grandis	Flooded gum, rose gum	-	-	Secondary	DoEE 2012; DoEE 2017
Eucalyptus lehmannii	Bushy yate	-	-	Secondary	Johnstone 2017
Eucalyptus leucoxylon	Yellow gum	Secondary	-	-	Groom 2014

		Foraging category as assigned by Emerge			
Species name	**Common name**	**CBC**	**BBC**	**FRTBC**	**Literature references**
Eucalyptus loxophleba	York gum	Secondary	-	-	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Eucalyptus marginata	Jarrah	Primary	Secondary	Primary	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone 2017
Eucalyptus patens	Blackbutt	Primary	-	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Groom 2011
Eucalyptus pleurocarpa	Tallerack	Secondary	-	-	Groom 2011
Eucalyptus preissiana	Bell-fruited mallee	Secondary	-	-	Groom 2011
Eucalyptus robusta	Swamp mahogany	Secondary	-	-	Johnstone *et al.* 2010; Groom 2011
Eucalyptus salmonophloia	Salmon gum	Primary	-	-	Johnstone *et al.* 2010; Groom 2011; DSEWPaC 2012; DSEWPaC 2012; DoEE 2017
Eucalyptus staeri	Albany blackbutt	-	-	Secondary	Johnstone & Storr 1998
Eucalyptus todtiana	Coastal blackbutt	Secondary	-	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011; Johnstone & Kirkby 2008
Eucalyptus wandoo	Wandoo	Primary	Secondary	Primary	Saunders 1980; Johnstone *et al* . 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
Ficus sp.	Fig	Secondary	-	-	Groom 2011
Grevillea armigera	Prickly toothbrushes	Primary	-	-	Groom 2011
Grevillea bipinnatifida	Fuschia grevillea	Primary	-	-	Groom 2011
Grevillea hookeriana	Red toothbrushes	Primary	-	-	Groom 2011
Grevillea hookeriana subsp. api	Black toothbrushes	Primary	-	-	Groom 2011
Grevillea paniculata	Kerosene bush	Primary	-	-	Groom 2011
Grevillea paradoxa	Bottlebrush grevillea	Primary	-	-	Groom 2011
Grevillea petrophiloides	Pink poker	Primary	-	-	Groom 2011
Grevillea robusta	Silky oak	Primary	-	-	Johnstone *et al.* 2010; Groom 2011

		Foraging category as assigned by Emerge			
Species name	**Common name**	**CBC**	**BBC**	**FRTBC**	**Literature references**
Grevillea spp.		Primary	-	-	Saunders 1979; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Grevillea wilsonii	Native fuchsia	-	Secondary	-	Johnstone *et al.* 2010
Hakea auriculata		Primary	-	-	Saunders 1980; Groom 2011
Hakea candolleana		Primary	-	-	Groom 2011
Hakea circumalata	Coastal hakea	Primary	-	-	Groom 2011
Hakea commutata		Primary	-	-	Groom 2011
Hakea conchifolia	Shell-leaved hakea	Primary	-	-	Groom 2011
Hakea costata	Ribbed hakea	Primary	-	-	Groom 2011
Hakea cristata	Snail hakea	Primary	Secondary	-	Groom 2011; Johnstone *et al.* 2010
Hakea cucullata	Snail hakea	Primary	-	-	Groom 2011
Hakea cyclocarpa	Ramshorn	Primary	-	-	Saunders 1980; Groom 2011
Hakea eneabba		Primary	-	-	Groom 2011
Hakea erinacea	Hedgehog hakea	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011
Hakea falcata	Sickle hakea	Primary	-	-	Groom 2011
Hakea flabellifolia	Fan-leaved hakea	Primary	-	-	Groom 2011
Hakea gilbertii		Primary	-	-	Saunders 1980; Groom 2011
Hakea incrassata	Golfball or marble hakea	Primary	-	-	Johnstone *et al.* 2010; Groom 2011
Hakea lasiantha	Woolly flowered hakea	Primary	-	-	Johnstone *et al* . 2010; Groom 2011
Hakea lasianthoides		Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011
Hakea laurina	Pin-cushion hakea	Primary	-	-	Johnstone *et al.* 2010; Groom 2011
Hakea lissocarpha	Honeybush	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011
Hakea marginata		-	Secondary	-	Johnstone *et al.* 2010
Hakea megalosperma	Lesueur hakea	Primary	-	-	Groom 2011
Hakea multilineata	Grass leaf hakea	Primary	-	-	Groom 2011
Hakea neospathulata		Primary	-	-	Groom 2011
Hakea obliqua	Needles and corks	Primary	-	-	Saunders 1980; Groom 2011
Hakea oleifolia	Dungyn	Primary	-	-	Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Hakea pandanicarpa subsp. crassifolia	Thick-leaved hakea	Primary	-	-	Groom 2011
Hakea petiolaris	Sea urchin hakea	Primary	-	-	Groom 2011
Hakea polyanthema		Primary	-	-	Groom 2011
Hakea preissii	Needle tree	Primary	-	-	Groom 2011
Hakea prostrata	Harsh hakea	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011
Hakea psilorrhyncha		Primary	-	-	Groom 2011
Hakea ruscifolia	Candle hakea	Primary	Secondary	-	Saunders 1980; Groom 2011; Johnstone *et al.* 2010
Hakea scoparia	Kangaroo bush	Primary	-	-	Groom 2011
Hakea smilacifolia		Primary	-	-	Groom 2011
Hakea spp.		Primary	Secondary	-	Saunders 1979; DSEWPaC 2012; DoEE 2017
Hakea stenocarpa	Narrow-fruited hakea	Primary	Secondary	-	Johnstone et al. 2010; Groom 2011
Hakea sulcata	Furrowed hakea	Primary	-	-	Groom 2011
Hakea trifurcata	Two-leaved hakea	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011
Hakea undulata	Wavy-leaved hakea	Primary	Secondary	-	Saunders 1980; Johnstone *et al.* 2010; Groom 2011
Hakea varia	Variable-leaved hakea	Primary	Secondary	-	Saunders 1980; Groom 2011
Harpephyllum caffrum	Kaffir plum	-	-	Secondary	Johnstone 2017
Helianthus annuus	Sunflower	Secondary	-	-	Johnstone *et al.* 2010; Groom 2011
Hibiscus sp.	Hibiscus	Secondary	-	-	Groom 2011
Isopogon scabriusculus		Secondary	-	-	Groom 2011
Jacaranda mimosifolia	Jacaranda	Secondary	Secondary	-	Johnstone *et al.* 2010; Groom 2011
Jacksonia furcellata	Grey stinkwood	Secondary	-	-	Groom 2011
Kingia australis	Kingia	-	Secondary	-	Johnstone *et al.* 2010
Lambertia inermis	Chittick	Secondary	-	-	Johnstone & Storr 1998; Groom 2011
Lambertia multiflora	Many-flowered honeysuckle	Secondary	-	-	Saunders 1980; Groom 2011

		Foraging category as assigned by Emerge			
Species name	**Common name**	**CBC**	**BBC**	**FRTBC**	**Literature references**
Liquidamber styraciflua	Liquid amber	Primary	-	Secondary	Johnstone *et al.* 2010; Groom 2011; Groom 2014; Personal observation
Lupinus sp.	Lupin	Secondary	-	-	Saunders 1980; Groom 2011
Macadamia integrifolia	Macadamia	Primary	Secondary	-	Johnstone *et al.* 2010; Grooms 2011; Groom 2014
Malus domestica	Apple	Secondary	Secondary	-	Johnstone *et al* . 2010; Johnstone & Storr 1998; DSEWPaC 2012; DoEE 2017; Groom 2011
Melaleuca leuropoma		Secondary	-	-	Saunders 1980; Groom 2011
Melia azedarach	Cape lilac or white cedar	Secondary	-	Primary	Johnstone *et al.* 2010; Groom 2011
Mesomeleana spp.		Secondary	-	-	Johnstone *et al.* 2010; Groom 2011
Olea europea	Olive	-	-	Secondary	Johnstone 2017
Persoonia longifolia	Snottygobble	-	-	Secondary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Pinus canariensis	Canary island pine	Primary	-	-	Johnstone *et al.* 2010; Groom 2011
Pinus caribea	Caribbean pine	Primary	-	-	Johnstone *et al.* 2010; Groom 2011
Pinus pinaster	Pinaster or maritime pine	Primary	-	-	Groom 2011
Pinus radiata	Radiata pine	Primary	Secondary	-	Johnstone *et al.* 2010; Groom 2011
Pinus spp.		Primary	Secondary	-	Johnstone & Storr 1998; Saunders 1979; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Protea 'Pink Ice'		Secondary	-	-	Groom 2011
Protea repens		Secondary	-	-	Groom 2011
Protea spp.		Secondary	-	-	Johnstone *et al.* 2010
Prunus amygdalus	Almond tree	Secondary	-	-	Johnstone & Storr 1998; Johnstone *et al.* 2010; Groom 2011; DoEE 2017
Pyrus communis	European pear	-	Secondary	-	Johnstone & Storr 1998; Johnstone *et al.* 2010; DSEWPaC 2012; DoEE 2017
Quercus spp.	Oak	-	Secondary	-	Johnstone *et al.* 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
Raphanus raphanistrum	Wild radish	Secondary	-	-	Groom 2011; DoEE 2017
Reedia spathacea		-	Secondary	-	Johnstone *et al.* 2010
Rumex hypogaeus	Doublegee	Secondary	-	-	Saunders 1980
Stenocarpus sinuatus		Secondary	-	-	Johnstone *et al.* 2010
Syzygium smithii	Lilly pilly	Secondary	-	-	Groom 2014
Tipuana tipu	Tipu or rosewood tree	Primary	-	-	Groom 2011, Groom 2014
Xanthorrhoea preissii	Grass tree	Secondary	Secondary	-	Groom 2011; Johnstone *et al.* 2010
Xylomelum occidentale	Woody pear	Secondary	-	-	Groom 2014

CBC=Carnaby's black cockatoo, BBC=Baudin's black cockatoo and FRTBC=Forest red-tailed black cockatoo

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Appendix E

Local Water Management Strategy (Emerge Associates 2024b)

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Local Water Management Strategy

Ascot Racecourse Local Structure Plan

Project No: EP23-109(03)

Prepared for Perth Racing
July 2024



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Version: 1, Version Date: 18/09/2024

Executive Summary

Perth Racing (the 'proponent') proposes to progress a local structure plan (LSP) over its landholdings in Ascot. The area is bounded by the Swan River to the North, Grandstand Road to the west and south, Matheson Road and Resolution Drive to the south and residential areas to the east, referred to herein as 'the site'. The structure plan area also includes the existing Ascot Racecourse. The site is located approximately 8.5 km east of Perth central business district (CBD) and is approximately 62 ha in size, within City of Belmont (CoB). The LSP consists of six precincts: Precinct A, Precinct B (largely unchanged form existing), Precinct C, Precinct D, Precinct E, and the racecourse. The layout of LSP and precinct plan is shown on **Figure 1** and provided in **Appendix A**. The site is currently zoned "Urban", "Parks and Recreation", and "Private Recreation" under the Metropolitan Regional Scheme (MRS) (WAPC 2023b). Under the Local Planning Scheme (LPS) No. 15 (WAPC 2023a), the site is zoned as "RC – Place of Public Assembly: Racecourse", Mixed Use", "Parks and Recreation" and "Parks and Recreation: Water Supply Sewerage and Drainage".

This Local Water Management Strategy (LWMS) outlines the water management approach as required for the site by *Better Urban Water Management* (WAPC 2008b) and supports the Ascot Racecourse Structure Plan. It is intended to satisfy the expectations of the Department of Water and Environmental Regulation (DWER) and City of Belmont (CoB). The LWMS also aids in achieving the goals and objectives outlined in the *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth Action Plan 2* (DWER 2023d).

The first step in applying integrated water cycle management in urban catchments is to establish agreed environmental values for receiving environments. In summary, the environmental investigations conducted to date indicate that:

- The site is being used for horse racing, mixed uses (i.e. car park, stables and entertainment/hospitality venues, and commercial). Some portions of the site are only used infrequently (e.g. for parking or events).
- The site is located in an area of moderate to high rainfall, receiving 756.3 mm on average annually with the majority of rainfall received between June and August.
- The majority of the site has a relatively flat topography of 1 mAHD at the northwest (along the Swan River) and 2 mAHD to the south and rising to 7 mAHD to the east of the site.
- The site is within the Swan River Terraces system and displays Guildford formation soils of alluvial and leached yellow sand described as:
    - **Ms2 –** Sandy Silt: Strong brown to mid grey, mottled, blocky, fine sand, hard when dry, variable clay content of alluvial origin
    - **Ms4 –** Sandy Silt: light yellow brown, blocky, mottled some fine to medium sand, soft when moist, variable clay content
    - **S8 –** Sand: very light grey at surface, yellow at depth, fine to medium-grained, sub rounded quartz, moderately well sorted of eolian origin
- The groundwater depth below the surface of Precinct A varies from 1.09 m mBGL to 2.37 mBGL (Douglas Partners 2024).
- The highest groundwater level beneath the site is reported 3.03 mBGL during February 2024 (Galt 2024), located beneath Precinct D.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

- Most of the site is considered to have a high to moderate risk of ASS occurring, however some portions of Precinct B, Precinct C and the Racecourse are considered to have a moderate to low risk of ASS occurring within the 3 m of the natural surface.
- The northern portion of the site along the Swan River is identified as an ESA.
- The entirety of the site is classified as a SSA and classified as:
  - a) Estuary catchments on the Swan and Scott Coastal Plains.
  - f) The area is <1 km up-groundwater-gradient and 250 m down-gradient of a significant wetland; or where the groundwater gradient is unknown within 1 km of the significant wetland.
- The following wetlands are located within the site and these are classified as:
  - Multiple Use category wetland (MUW) area (UFI 8424, UFI 8425, UFI 8426).
  - Resource Enhancement wetland (REW) area (UFI 8423).
- The dominant hydrological feature of the site is the Swan River estuary. The northern boundary of the site falls within the Swan Canning Development Control Area (DCA) (CoB 2018) and Swan Canning River Park.
- The floodway of the Swan River is immediately adjacent to but not within the site. The 1% AEP flood elevation of the Swan River adjacent to the site is 2.8 mAHD.
- There are two existing major drainage network systems within or adjacent to the site include:
  - The Central Belmont Main Drain (CBMD), managed by the Water Corporation. This currently receives runoff from Precinct C (via the CoB drainage network) and Precinct E.
  - The CoB local piped drainage network, which exists along Matheson Road, Grandstand Road and the northern portion of Resolution Drive.
- There are three lakes (Irrigation Lake, Lined Lake and Wetland Lake) located within the centre of the racecourse. These are understood to receive runoff from the Grandstand buildings in Precinct B and stables/buildings in Precinct C.
- The groundwater beneath the site is a multi-layered system consisting of the Superficial, Kings Park Formation, Leederville and Yarragadee aquifers.
- Regional groundwater mapping indicates that the groundwater levels across the site are at approximately 0.5 m AHD.
- Local groundwater level monitoring indicates that annual maximum groundwater levels (recorded in August 2022) were measured at 1.26 m AHD and 1.70 m AHD at Bore 1 and Bore 2 respectively. Groundwater levels in adjacent areas included Precinct A levels at 1.09 mBGL to 2.37 mBGL and Precinct D levels of approximately 3.03 mBGL.
- Water quality monitoring indicates that EC, TDS and pH values do not exceed guideline trigger values. However, TN and TP concentrations continually exceed the ANZECC guideline trigger value of 1.2 mg/L and 0.065 mg/L respectively.

The design criteria and the manner in which they are proposed to be achieved are presented in **Table E1**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table E1: Water management criteria and compliance summary

Management Aspect	Criteria Number	Criteria Description	Manner in which compliance will be achieved	Responsibility for implementation	Timing of implementation
Water Conservation	WC1	For residential dwellings consumption target of 60 kL/person/year scheme water.	Provide advice to Precinct A and Precinct D residents on water conservation measures	Proponent	Point of sale
			RWTs can be utilised for non-potable uses	Lot owner	Post-house construction
			Promotion and use of WWG in lots within Precinct D and other open spaces across all precincts	Proponent/Lot owner	Point of sale/Post-house construction
			Promotion and use of water efficient appliances within Precinct A and Precinct D	Proponent/Lot owner	Point of sale/Post-house construction
			Mandate water efficient fittings within Precinct A and Precinct D	CoB	Building approval
	WC2	Ensure the efficient use of all water resources.	Use of waterwise landscaping principles in all open spaces and verges	Proponent	Landscape design
			Open spaces designed to use no more than allocated groundwater		
			Minimise water requirements for open spaces and verge maintenance		
			Use of water efficient appliances within Precinct A and Precinct D	Lot owner	Post-house construction
			Use of WWG principles within Precinct A and Precinct D		
	WC3	Non-potable irrigation water to be sourced from existing groundwater licences held over the area.	The proponent holds a groundwater Licence with an allocation of 347,000 kL per annum which will meet the irrigation requirements of the racecourse.	Proponent	Landscape design

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table E1: Water management criteria and compliance summary (Continued)

Management Aspect	Criteria Number	Criteria Description	Manner in which compliance will be achieved	Responsibility for implementation	Timing of implementation
Stormwater Management	SW1	Retain and treat the first 15 mm of rainfall as close to source as possible	Lots within Precinct D and Precinct E to retain the first 15 mm of rainfall on lot in soakwells/soakage. Lot storage will be the responsibility of the lot owners.	Lot owner/developer	Construction
	SW2	Retain up to 1% AEP rainfall event on-site.	Runoff up to the 1% AEP to be detained within the FSA in Precinct A. Precinct A and a portion of Precinct C will ultimately discharge to the centre of the track.	Proponent	Construction
			Runoff up to 1% AEP to be managed with the sub-surface storage in Precinct D.	Proponent	Construction
	SW3	Post-development critical 1% AEP peak flows leaving the site to mimic pre-development peak flows.	Runoff up to 1% AEP event to be detained in the detention basin and subsurface storage which will maintain the pre-development peak flow of 0.95 m^3/s from Precinct E and 0.463 m^3/s from Precinct D respectively.	Proponent	Construction
	SW4	Finished floor levels must have a minimum of 300 mm clearance above the 1% AEP TWL in the FSA.	It is anticipated that the FSA and detention basin invert will be set so that the Finished floor levels must have a minimum of 300 mm clearance above the 1% AEP TWL in the basins.	Proponent	Detailed drainage design
	SW5	All lots must have a minimum of 500 mm clearance above the 1% AEP flood level in the Swan River.	The 1% AEP flood level in the Swan River is 2.8 mAHD. The preliminary bulk earthworks concept provided in shows that finished floor level will be at 4.0 mAHD.	Proponent	Detailed drainage design
	SW6	Nutrient concentrations within surface water discharging from the site to the Swan River are to meet regional water quality targets.	BRA will be designed so that after treatment the nutrient concentrations within surface water meet the regional water quality target.	Proponent	Detailed drainage design
	SW7	Reduce nutrient loads by applying appropriate non-structural measures	• Minimise use of fertilisers within POS and road verges. • Street sweeping at regular intervals. • Use of drought tolerant turf species. • Education of residents regarding fertiliser use	Landscape/Maintenance Contactor/Proponent	Landscape Implementation/ Point of Sale
	SW8	Design infiltration areas to avoid creating mosquito habitat	Stormwater infrastructure will be designed to ensure all runoff is infiltrated within 96 hours.	Proponent	Detailed drainage design

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table E1: Water management criteria and compliance summary (Continued)

Management Aspect	Criteria Number	Criteria Description	Manner in which compliance will be achieved	Responsibility for implementation	Timing of implementation
Groundwater Management	GW1	Surface based infiltration should have 300 mm clearance above MGL.	Basin inverts will be set at 300 mm above the MGL, and subsoil drainage will be provided in the POS.	Proponent	Detailed drainage design
	GW2	Finished floor levels should have a clearance to the MGL of at least 1.2 m.	Lots will be set at least 1.2 m above the MGL.	Proponent	Detailed drainage design

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table of Contents

1 Introduction 4

1.1 Background 4
1.2 Town planning context 4
1.3 Purpose of this report 4
1.4 Policy Framework 4
1.5 Previous Studies 5
1.5.1 Golden Gateway Local Water Management Strategy 5
1.6 LWMS objectives 6

2 Proposed Development 7

3 Pre-development Environment 8

3.1 Sources of information 8
3.2 Land use context 8
3.3 Climate 8
3.4 Topography 8
3.5 Geotechnical conditions 9
3.5.1 Geology and soils 9
3.5.2 Precinct A geotechnical investigation 9
3.5.3 Precinct D geotechnical investigation 10
3.5.4 Acid sulfate soils 10
3.6 Environmental assets 10
3.6.1 Environmentally sensitive area 10
3.6.2 Sewerage sensitive area 11
3.6.3 Geomorphic wetlands 11
3.7 Hydrology 11
3.7.1 Surface water 11
3.7.1.1 Water Resources 11
3.7.1.2 Lakes 12
3.7.1.3 Drainage network systems 12
3.7.2 Groundwater 13
3.7.2.1 Groundwater Resource 13
3.7.2.2 Groundwater levels 14
3.7.2.3 Groundwater quality 15
3.8 Summary of existing environment 16

4 Design Criteria and Objectives 18

4.1 Integrated water cycle management 18
4.2 Water conservation 18
4.3 Stormwater management 19
4.4 Groundwater management 19

5 Water Conservation Strategy 20

5.1 Fit for purpose water use 20
5.1.1 Scheme water supply 20
5.1.2 Groundwater 20
5.1.3 Rainwater tanks 20
5.2 Lot scale water conservation measures 20
5.2.1 Rainwater tanks 20
5.2.2 Water efficient fixtures and appliances 21
5.2.3 Waterwise gardens 21

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

5.3 Water use analysis 21
5.3.1 Lot scale water use analysis 21
5.4 Wastewater management 22
5.5 Water conservation management criteria compliance 22

6 Stormwater Management 24

6.1 Lot scale drainage measures 24
6.2 Development drainage measures 24
6.2.1 Bio-retention areas 24
6.2.2 Flood detention/storage 25
6.2.3 Subsurface storage 25
6.2.4 Lake storage 25
6.3 Precinct based drainage approach 26
6.3.1 Precinct A 26
6.3.2 Precinct B and Racecourse 26
6.3.3 Precinct C 26
6.3.4 Precinct D 27
6.3.5 Precinct E 27
6.3.6 Precinct drainage summary 28
6.3.7 Non-structural measures 28
6.3.8 Earthwork levels 29
6.4 Stormwater criteria compliance 29

7 Groundwater Management 31

7.1 Groundwater management approach 31
7.2 Groundwater level management 31
7.3 Groundwater quality management 32
7.4 Groundwater criteria compliance summary 32

8 Subdivision and Urban Water Management Plans 33

8.1 Extent of land uses within Precincts 33
8.2 Connection to local and Main Drainage networks 33
8.3 Surface runoff modelling 33
8.4 Implementation of water conservation strategies 34
8.5 Non-structural water quality improvement measures 34
8.6 Management and maintenance requirements 34
8.7 Construction period management strategy 35

9 Monitoring 36

9.1 Post-development monitoring 36
9.1.1 Trigger values 36
9.1.2 Condition monitoring 37
9.1.3 Contingency Action Plan 37
9.2 Reporting 38

10 Implementation 39

10.1 Roles and responsibility 39
10.2 Funding 39
10.3 Review 39

11 References 41

11.1 General references 41
11.2 Online references 44

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

List of Tables

Table 1: Water conservation management criteria compliance 22
Table 2: Precinct drainage summary 28
Table 3: Stormwater management criteria compliance 29
Table 4: Groundwater criteria compliance summary 32
Table 5: Post-development trigger values 36
Table 6: Roles and responsibilities for various planning stages 39

Figures

Figure 1: Site Location
Figure 2: Topographic and Groundwater Contours
Figure 3: Geological Mapping
Figure 4: Acid Sulfate Soil Mapping
Figure 5: Environmental Assets
Figure 6: Hydrological Features
Figure 7: Ascot LSP Precinct Plan surface water management
Figure 7A: Precinct A Stormwater Management Plan
Figure 7B: Precinct C Stormwater Management Plan
Figure 7C: Precinct D Stormwater Management Plan
Figure 7D: Precinct E Stormwater Management Plan

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Appendices

Appendix A

Concept plan

Appendix B

Geotechnical Reports

Appendix C

Preliminary Civil Drawing

Appendix D

Modelling Assumption Report

Appendix E

Central Belmont Main Drain Water Corporation

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
ANZECC	Australian and New Zealand Environment and Conservation Council
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
CoB	City of Belmont
WC	Water Corporation of Western Australia (Water Corp)

Table A2: Abbreviations – General terms

General terms	
AEP	Annual exceedance probability
ASS	Acid sulfate soils
CCW	Conservation category wetland
CEMP	Construction Environmental Management Plan
DCA	Development Control Area
DMP	Drainage management plan
EC	Electrical conductivity
FMP	Foreshore management plan
LWMS	Local Water Management Strategy
MGL	Maximum groundwater level
MRS	Metropolitan Region Scheme
NWQMS	National Water Quality Management Strategy
POS	Public open space
SCWQIP	Swan and Canning Water Quality Improvement Plan
SRA	Swan River Alluvium
TDS	Total dissolved solids
TEC	Threatened ecological community
TKN	Total Kjeldahl nitrogen
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

General terms	
TWL	Top water level
UFI	Unique feature identifier
UWMP	Urban Water Management Plan
WSUD	Water sensitive urban design
WWG	Water wise gardening

Table A3: Abbreviations – units of measurement

Units of measurement	
cm	centimetre
ha	hectare
m	metre
m^2	square metre
m^3	cubic metre
m^3 / s	cubic metres per second
mAHD	metres in relation to the Australian height datum
mBGL	metres below ground level
mm	millimetre
mS / cm	millisiemens per centimetre
µg/L	micrograms per litre
mg / L	milligrams per litre

Table A4: Terminology – design rainfall

Rainfall event	Annual exceedance probability (AEP)	Approximate equivalent average recurrence interval (ARI)
Small	1 exceedance year (EY) event (frequent)	1 in 1 year ARI event
Minor (residential purposes)	20% AEP event	1 in 5 year ARI event
Minor (commercial purposes)	10% AEP event	1 in 10 year ARI event
Major	1% AEP event	1 in 100 year ARI event

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

1 Introduction

1.1 Background

Perth Racing (the 'proponent') proposes to progress a local structure plan (LSP) over its landholdings in Ascot. The area is bounded by the Swan River to the North, Grandstand Road to the west and south, Matheson Road and Resolution Drive to the south and residential areas to the east, referred to herein as 'the site'. The structure plan area also includes the existing Ascot Racecourse and Perth Racing Administration lot/building on Grandstand Road. The site is located approximately 8.5 km east of Perth central business district (CBD) and is approximately 62 ha in size, within City of Belmont (CoB). The LSP consists of six precincts: Precinct A, Precinct B, Precinct C, Precinct D, Precinct E, and the racecourse. The layout of LSP and precinct plan is shown on **Figure 1** and provided in **Appendix A**.

1.2 Town planning context

The site is currently zoned "Urban", "Parks and Recreation", and "Private Recreation" under the Metropolitan Regional Scheme (MRS) (WAPC 2023b). Under the Local Planning Scheme (LPS) No. 15 (WAPC 2023a), the site is zoned as "RC – Place of Public Assembly: Racecourse", Mixed Use", "Parks and Recreation" and "Parks and Recreation: Water Supply Sewerage and Drainage".

1.3 Purpose of this report

This Local Water Management Strategy (LWMS) outlines the water management approach as required for the site by *Better Urban Water Management* (WAPC 2008b) and supports the Ascot Racecourse Structure Plan. It is intended to satisfy the expectations of the Department of Water and Environmental Regulation (DWER) and CoB. The LWMS also aids in achieving the goals and objectives outlined in the *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth Action Plan 2* (DWER 2023d).

1.4 Policy Framework

There are a number of State Government legislation and policies of relevance to the site. These policies include:

- *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth Action Plan 2* (DWER 2023d)
- *Swan and Canning Rivers Management Act 2006* (Government of WA 2006)
- *Policy 49 – Planning for stormwater management affecting the Swan Canning Development Control Area* (DPaW 2016)
- *Local Planning Scheme No. 15 (City of Belmont)* (WAPC 2023a)
- *State Water Plan* (Government of WA 2007)
- *Draft State Planning Policy 2.9: Planning for Water Guidelines* (DPLH 2021)
- *State Planning Policy 2.10 Swan Canning River System* (WAPC 2006b)
- *Guidance Statement No. 33: Environmental Guidance for Planning and Development* (EPA 2008)
- *Liveable Neighbourhoods* (WAPC 2009a)
- *Planning Bulletin No. 64: Acid Sulfate Soils* (WAPC 2009b)

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

In addition to the above policies, there are a number of published guidelines and standards available that provide direction regarding the water management characteristics that urban developments should aim to achieve. These are key inputs that relate either directly or indirectly to the site and include:

- *Better Urban Water Management* (WAPC 2008b)
- *Urban Water Management Plans: Guidelines for Preparing Plans and for Complying with Subdivision Conditions* (DoW 2008)
- *National Water Quality Management Strategy (NWQMS)* (ANZECC 2000)
- *Australian Runoff Quality* (Wong et al. 2006)
- *National Water Quality Management Strategy* (ANZECC 2000)
- *Stormwater Management Manual for Western Australia* (DoW 2007)
- *Decision Process for Stormwater Management in Western Australia* (DWER 2017)
- *Australian Rainfall and Runoff* (Ball J et al. 2019)
- *Swan and Canning Water Quality Improvement Plan* (SCWQIP) (SWT 2009)
- *Swan and Canning Rivers Foreshore Assessment and Management Strategy* (SRT 2008)
- *Golden Gateway Structure Plan* (CoB 2019).

1.5 Previous Studies

1.5.1 Golden Gateway Local Water Management Strategy

The draft Golden Gateway LWMS (Essential Environmental 2018b) was prepared to support the Golden Gateway Structure Plan (CoB 2019) by Essential Environmental. The LWMS was prepared in consideration of *Better Urban Water Management* (WAPC 2008b) and *State Planning Policy 2.9: Water Resources* (WAPC 2006a). The key objectives and design criteria of the draft LWMS (Essential Environmental 2018b) included:

Water Conservation:

- Ensure the efficient use of all water resources in the redeveloped urban form and aim to achieve highest value use of fit-for-purpose water.
- Maintain opportunities for future generations by using water more efficiently.

Stormwater management:

- The first 15 mm of rainfall is to be retained within all lots through a combination of raingardens, water tanks and soakwell systems.
- Raingardens and tree-pits are to be installed in all new or upgraded streets to provide infiltration of the first 15 mm of rainfall.
- Minor event runoff from events larger than 15mm total depth are to be managed in accordance with serviceability requirements of the City of Belmont.
- Roads and public open spaces are to be designed to cater for the surface overflow for more severe storm events with habitable floors at least 0.3 m above the 1% AEP flood or storage level at any location.
- Habitable floors are to be constructed at least 0.5m above the 1% AEP flood level in the Swan River adjacent to the development area.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

- Water quality treatment systems and stormwater management structures should be designed in accordance with the *Stormwater Management Manual for Western Australia* (DoW 2007) and *Australian Runoff Quality: A guide to water sensitive urban design* (Wong et al. 2006).

Groundwater management:

- Groundwater management systems are to be designed as free discharging under normal operating conditions.
- Flows from groundwater management systems are to be treated prior to discharge.

1.6 LWMS objectives

Whilst the criteria proposed in the Golden Gateway LWMS are relevant to some parts of the Ascot Racecourse structure plan area, it is not representative of all areas and site characteristics and therefore only partially applicable. This LWMS supports the Ascot Racecourse Structure Plan, which proposes an alternate layout (to the Golden Gateway Structure Plan) to some of the land uses surrounding the Ascot Racecourse. The design criteria and objectives proposed in this LWMS are generally based on those proposed in the Golden Gateway LWMS, though with additional consideration for site and Precinct- specific characteristics. This LWMS adopts the following major objectives:

- Protect water quality in the Swan River by providing appropriate water quality treatment at source.
- Mitigate potential flooding within the Structure Plan area and immediate surrounds.
- Take account of existing drainage infrastructure capacity and ensure that sufficient land is set aside to manage stormwater.
- Provide a broad level stormwater management framework to support future urban development.
- Incorporate appropriate best management practices (BMPs) into the drainage systems that address the environmental and stormwater management issues identified.
- Minimise development construction costs, which will result in reduced land costs for future home owners.
- Minimise transport of nutrients/pollutants to groundwater.
- Develop a non-potable water conservation strategy that will accommodate existing groundwater allocation constraints for the area.
- Gain support from DWER, DBCA, CoB and Water Corporation for the proposed method to manage stormwater within the site.

Detailed objectives for water management within the site are further discussed in **Section 4**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2 Proposed Development

A total of approximately 62.0 ha is proposed to be developed as shown on **Figure 1**. The Ascot Racecourse Structure Plan proposes six precincts with different objectives and character, and these include:

- **Precinct A –** Approximately 3.0 ha for retirement living/village and mixed use purposes
- **Precinct B –** Approximately 9.3 ha for the use of public assembly (i.e. entertainment/office purposes)
- **Precinct C –** Approximately 8.0 ha for the use of public assembly (i.e. racecourse/stabling purposes)
- **Precinct D –** Approximately 1.5 ha for residential/childcare purposes
- **Precinct E –** Approximately 4.2 ha for mixed use (i.e. commercial/retail purposes)
- **The Racecourse –** Approximately 36.0 ha of retained 'Place of Public Assembly: Racecourse' uses.

The proposed land uses surrounding Ascot Racecourse will be integrated into the Racecourse Precinct. Management of surface and groundwater will take a water sensitive urban design (WSUD) approach that will integrate the management of water within the Precincts with the Racecourse and immediately surrounding infrastructure.

The WSUD measures that will be adopted within the Structure Plan area will include:

- Bio-retention areas (BRAs) to meet water quality treatment requirements
- Subsurface infiltration cells that will facilitate at-source infiltration
- Flood storage integrated into existing surface water bodies located centrally within the Racecourse
- Flood storage areas (FSAs) to provide flood detention, retention and infiltration as close to source as possible.

The WSUD approaches are further discussed in **Section 6**.The detailed concept plan and preliminary civil drawings are provided in **Appendix A** and **Appendix C**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3 Pre-development Environment

3.1 Sources of information

The following sources of information were used to provide a broad regional environmental context for the site:

- *Geological Survey of Western Australia* (Gozzard 2007)
- *Map Viewer Plus* (Landgate 2023)
- *Water Register* (DWER 2024c)
- *Perth Groundwater Map* (DWER 2024a)
- *Weather and Climate Statistics Data* (BoM 2024)
- *Acid Sulfate Soil Mapping* (DWER 2023a)
- *Water Information Reporting* (DWER 2024b).

In addition to the above information, site-specific investigations have been conducted. These have aimed at providing more detail to the existing regional information. These site-specific investigations and information have been available from the following sources:

- *Draft Golden Gateway Structure Plan* (CoB 2019)
- *Draft Golden Gateway LWMS* (Essential Environmental 2018b)
- *Draft Golden Gateway Environmental Report* (Essential Environmental 2018a)
- *Draft Infrastructure Assessment Report : Golden Gateway Precinct* (Cardno 2017)
- *Swan and Canning Water Quality Improvement Plan* (SCWQIP) (SWT 2009)
- *Swan and Canning Rivers Foreshore Assessment and Management Strategy* (SRT 2008).

3.2 Land use context

The site has been used as the Ascot Racecourse since 1892 (Landgate 2023). The northeast portion of the site is being used for horse racing and training purposes and the surrounding area is being used for stabling, training and entertainment venues which support the above purposes. Some portions of the site are predominantly cleared (e.g. Precinct A, Precinct E) and are occasionally used for parking or other temporary uses. The Precinct D area is used for commercial purposes, being the current Perth Racing administration building.

3.3 Climate

The site experiences a dry Mediterranean climate of hot dry summers and cool wet winters and is located in an area of moderate to high rainfall, receiving 756.3 mm on average annually with the majority of rainfall received between June and August (BoM 2024). The region experiences rainfall for 84.8 days annually (on average).

3.4 Topography

The site is mostly flat with a slight downward slope from east to north and northwest, with a few low points. The variance in topography of the Precincts is described further as:

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

- The Racecourse slopes from Precinct C towards the Swan River with topography approximately 7 m Australian Height Datum (mAHD) to 1m AHD and from 7 mAHD (east) to 3 mAHD (west). There are a few local depressions (i.e., lakes and swale) observed within the centre of the racecourse.
- Precinct A has a generally flat topography of 2 mAHD with a high point of 3 mAHD to the west adjacent to Grandstand Road.
- Precinct B slopes from south to north (4 mAHD to 2 mAHD) and from west to east (3 mAHD to 2 mAHD). Precinct D and E are generally flat with a topography of 3 mAHD and 2 mAHD respectively.
- Parts of Precinct C (existing stables and buildings) drain towards the Racecourse, however most of Precinct C is currently carpark that drains towards Precinct E and the Southern Main Drain.
- Precinct D is generally flat with a topographic level 3 mAHD.
- Precinct E has a gentle slope from east to west. The topography of the precinct ranges from 4 mAHD to the east to 2 mAHD to the west.

The topographic contours of the site are shown on **Figure 2**.

3.5 Geotechnical conditions

3.5.1 Geology and soils

The Perth Metropolitan Region 1:50,000 Environmental Geology Series (Gozzard 1986) *and Sea to scarp - geology, landscape, and land use planning in the southern Swan Coastal Plain* (Gozzard 2011) describes that the site lies in the Swan River Terraces system, being underlain by the Guildford formation of alluvial and leached yellow sand. The regional geological mapping indicates that the site soils include:

- **Ms2 –** Sandy Silt: Strong brown to mid grey, mottled, blocky, fine sand, hard when dry, variable clay content of alluvial origin
- **Ms4 –** Sandy Silt: light yellow brown, blocky, mottled some fine to medium sand, soft when moist, variable clay content
- **S8 –** Sand: very light grey at surface, yellow at depth, fine to medium-grained, sub rounded quartz, moderately well sorted of eolian origin

The regional geological mapping is shown on **Figure 3**.

3.5.2 Precinct A geotechnical investigation

A detailed geological investigation has been carried out in January 2024 (Douglas Partners 2024) for Precinct A (see **Appendix B**). This investigation generally confirms the regional geological mapping, and the ground conditions of Precinct A are described as:

- Uncontrolled Fill
  - Granular FILL - SAND, Organic SAND, Gravelly SAND, Silty SAND and Sandy GRAVEL
  - Cohesive FILL - Clayey SAND, Sandy CLAY, CLAY
- Overlying natural soils includes
  - Clayey soils including Clayey SAND and CLAY
  - Sandy soils including SAND and Silty SAND

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Douglas Partners (2024) concluded that if unmodified, Precinct A is considered unsuitable for on-site stormwater disposal due to the low permeability soils and shallow groundwater depth. To meet geotechnical requirements, stormwater should be managed by connecting to a suitable outflow (Douglas Partners 2024).

3.5.3 Precinct D geotechnical investigation

Galt has undertaken a geotechnical study in March 2024 (Galt 2024) for Precinct D (provided in **Appendix B**) and has described the Precinct D ground conditions as:

- **Surficial Topsoil** (in landscaped areas) up to 0.3 m thick and **Hardstand Fill Layers** (in carparks and access ways); overlying
- **FILL: SAND / SAND (SP)**, fine to medium grained, sub-rounded to sub-angular, yellow / brown / grey layers, includes trace gravel / Sandy GRAVEL layers, trace / with fines, some typically medium dense to dense, extending to depths of about 0.4 m to 0.9 m; overlying
- **In BH03 and BH04 only: Silty SAND / Clayey SAND (SM/SC)** fine to medium grained, sub-rounded to sub-angular, brown / grey, low to medium plasticity fines, some typically medium dense to dense, extending to depths of about 0.7 m to 1.2 m; overlying
- **Sandy CLAY / CLAY (CI)**, medium plasticity, brown / orange / grey, trace sand to sandy, trace gravel in some zones, desiccated, CPT traces indicate presence of occasional sand layers, typically very stiff to hard, extending to the maximum depth investigated of 10 m.

Whilst detailed geotechnical investigations have not been undertaken in each Precinct, it is expected that the soils encountered will be generally consistent with regional geological mapping and the investigations undertaken for Precincts A and D and will consist of generally shallow layers of sand overlying sandy clay of the Guildford formation. Such soils are unlikely to be suitable for onsite infiltration of all stormwater and onsite detention unless modified and stormwater management will need to be supplied with an outlet so that flood storage areas have a way to drain between storm events.

3.5.4 Acid sulfate soils

The acid sulfate soil (ASS) risk mapping (DWER 2023b) indicates that most of the site is considered to have a high to moderate risk of ASS occurring within the 3 m of the natural surface. Some portions of Precinct B, Precinct C and the Racecourse are mapped to have a moderate to low risk of ASS occurring within the 3 m of the natural surface.

The ASS risk mapping is shown on **Figure 4**.

3.6 Environmental assets

3.6.1 Environmentally sensitive area

The northern portion of the site (along the Swan River) is identified as an environmentally sensitive area (ESA). ESAs are shown on **Figure 5**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3.6.2 Sewerage sensitive area

The entirety of the site is classified as a sewage sensitive area (SSA) by the *Government Sewerage Policy* (DPLH 2019). The two classifications of relevance to the site define a SSA as:

- a) Estuary catchments on the Swan and Scott Coastal Plains.
- f) The area is <1 km up-groundwater-gradient and 250 m down-gradient of a significant wetland; or where the groundwater gradient is unknown within 1 km of the significant wetland.

3.6.3 Geomorphic wetlands

The *Geomorphic Wetlands of the Swan Coastal Plain* dataset indicates the following wetlands within the site:

- Multiple Use Category Wetland (MUW) area (UFI 8424, UFI 8425, UFI 8426).
- Resource Enhancement Wetland (REW) area (UFI 8423)

The Swan River, situated immediately adjacent to the northern boundary of the site, is recognised as a "Conservation Category Wetland" (CCW) (UFI 1316 - Estuary waterbody) within the *Geomorphic Wetlands of the Swan Coastal Plain* dataset and has additional significant ecological, cultural and heritage values (DEC 2011).

The location of the geomorphic wetlands is shown on **Figure 5.**

3.7 Hydrology

3.7.1 Surface water

3.7.1.1 Water Resources

The dominant hydrological feature of the site is the Swan River estuary. The estuary is subject to marked seasonality, which controls the salinity of the site, and particularly the foreshore area. This seasonality is a result of the short winter rainfall patterns, a small tidal range and the landform of the estuary (Hodgkin and John 1986).

The northern boundary of the site falls within the Swan Canning Development Control Area (DCA) (CoB 2018) and Swan Canning River Park (shown on **Figure 6**). Any proposed development on land adjacent river within the DCA and/or partly within DCA are subject to assessed and approved by the Department of Biodiversity, Conservation and Attraction (DBCA) under Part 5 of the *Swan and Canning Rivers Management Act 2006* and the *Swan and Canning River Management Regulations 2007* (CoB 2018).

Water management strategies will be needed to ensure protection (i.e. water quality improvement) of the Swan River. The catchments of the Swan Canning River system are the subject of the Swan Canning Water Quality Improvement Plan (SRT 2009) which contains catchment management measures and control actions.

The major event flood levels in the Swan River have been documented in recent studies undertaken on behalf of DWER (DWER 2023c).These flood levels, along with the extent of floodway/floodplain

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

are shown in the DWER online floodplain mapping tool. This tool indicates that the anticipated 1% AEP flood level adjacent to the site is 2.8 mAHD – noting that this level includes consideration for future climate change. The extent of floodway/floodplain from the Swan River adjacent to the site is shown on **Figure 6**.

3.7.1.2 Lakes

There are three lakes within the racecourse including:

- **Irrigation lake** – located adjacent to the Production Bore 1 (PB01) and has a volume of 6,000 m^3 to 7,000 m^3. Water is pumped out from PB01 into the lake, and irrigation water is drawn from the Irrigation Lake. During winter the Irrigation Lake overflows into the adjacent Lined Lake. The current irrigation demand for the Racecourse is approximately 3,000 m^3/day, there is no shortage of irrigation water supply as the lake has sufficient storage capacity. The top water level (TWL) of the Irrigation Lake is approximately 3.1 mAHD.
- **Lined Lake** – this Lake is sealed with a natural clay liner and fed via a 225 mm overflow pipe from the Irrigation Lake. The Lined Lake overflows into the Wetland Lake. The elevation of the Lined Lake is approximately 2.1 mAHD.
- **Wetland lake** – is the largest of the three lakes and has approximately 2.6 ha of surface area. The Wetland Lake has a TWL of approximately 0.4 mAHD. Two overflow pipes at the northern end of the Wetland Lake allow excess water within the Lake to flow to the Swan River.

Peak water levels within the Lined Lake and Wetland Lake were predicted for a 10% AEP storm event (Evangelisti & Associates 1997). The peak water level for was 2.68 mAHD in the Lined Lake which then discharged to the Wetland Lake. The Wetland Lake discharged to the Swan River after reaching the peak water level of 0.53 mAHD. The lakes are connected by 450 mm RCP pipes. The outfall into the Swan River is directed via two pipes (450 mm RCP and 375 mm RCP). The pipes are fitted with headwall and tidal control gate to mitigate inundation from the Swan River (Evangelisti & Associates 1997).

The location of the lakes and overflow pipes are shown on **Figure 6**.

3.7.1.3 Drainage network systems

The Central Belmont Main Drain (CBMD) is managed by the Water Corporation and is the regional drainage system and has a catchment area of 189 ha and which discharges into the Swan River. Catchment plans for the CBMD indicate that inflow from the site occurs in the southwestern corner of Precinct E, where an open drain connects to the CBMD at node CAN008 as shown in **Appendix E** and **Figure 6**.

The CoB has a local drainage piped network located beneath Hardey Road adjacent to Precinct C and which discharges to the CBMD within Precinct E. A larger local CoB network extends along Matheson Road to the East. This is currently connected to the 900 mm pipe that discharges northwards to the lined lake within the centre of the racecourse.

CoB local drainage pipes also exist beneath Grandstand Road adjacent to Precinct A however there is no current connection between Precinct A and the local drainage network. The same network also extends past/adjacent to Precinct D along the northern end of Resolution Drive, however there is no

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

current connection from Precinct D to the local pipe network. The pipe network along Resolution Drive includes a 450 mm and 525 mm pipe which are understood to discharges into the CBMD. Whilst the CoB catchment has not been modelled to determine peak flows under differing storm durations, an estimate can be made based on the capacity of the pipes which discharge to the CBMD. The combined capacity of the two existing pipes is estimated to be 0.62 m^3/s, and therefore the allowable discharge from Precinct C and Precinct E is estimated to be 0.33 m^3/s.

Within the Racecourse an existing swale is being used around the racecourse to convey water from the track into the central Wetland Lake.

The location of the swales within the Racetrack Precinct and outlet to Swan River from the Wetland Lake is shown on **Figure 6**.

3.7.2 Groundwater

3.7.2.1 Groundwater Resource

The groundwater beneath the site is a multi-layered system comprised of the following:

City of Bayswater – Perth Superficial Swan unconfined aquifer. The Superficial Aquifer is approximately 20 m thick under the Ascot Racecourse, with the base of the aquifer under the racecourse at approximately - 20 mAHD (Davidson, 1995). The aquifer is recharged directly by rainfall and from the Swan River.

King Park Aquifer. The Kings Park Aquifer is 155 m thick starting from - 20 mAHD and is recharged laterally from the adjacent northern Mirrabooka Aquifer and Superficial Aquifer. The Kings Park Aquifer comprises 2 members: the Mullaloo Sandstone and Como Sandstone. Only the Mullaloo Sandstone member is present at the Ascot site (Davidson, 1995). The Mullaloo Sandstone member is underlain by the Kardinya Shale confining bed of the Osborne Formation.

The groundwater salinity in the aquifer in 1995 was mapped as 500 mg/L to 1,000 mg/L TDS (Davidson, 1995). However, data in recent years indicates the aquifer salinity levels are increasing due to saltwater intrusion.

Perth South – Perth Leederville confined aquifer is below -160 mAHD and is approximately 370 m thick. In the Ascot area the Leederville Aquifer is confined but further to the south and north of Perth it is hydraulically connected to the Superficial Aquifer. The Leederville Aquifer comprises of four formations under the Ascot Racecourse, namely Henley Sandstone, Pinjar Member, Wanneroo Member and the Mariginiup Member.

Groundwater flow is generally westwards through the Leederville Aquifer. Lateral discharge can occur to the Kings Park Aquifer but depends on levels of abstraction in the Leederville Aquifer adjacent to the discharge area.

Generally, groundwater salinity in the Leederville Aquifer can be divided into an upper and a lower zone. The upper zone is generally fresh with salinity ranging from 250 to 1,000 mg/L. Salinity in the lower zone (below -400 mAHD) ranges from 1,000 mg/L to greater than 3,000 mg/L.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Groundwater is abstracted from an artesian production bore (PB1) assigned to the Leederville Aquifer to meet the irrigation demand of the Racecourse and surrounds. The bore is located adjacent the Irrigation Lake at the south corner of the Ascot Racecourse track. The bore is screen in the upper Leederville Formation which extends between -160 mAHD and -400 mAHD.

The allocation status of aquifers is further discussed in **Section 5.1.2**.

3.7.2.2 Groundwater levels

Perth Groundwater Map indicates (DWER 2023e) that the regional groundwater level sits at 0.5 m AHD across the site. Therefore, the groundwater clearance from southeast to northwest of the site ranges from 6.5 m to 0.5 m.

There are two groundwater level and quality monitoring bores (Bore1 and Bore2) and one production bore (PB1) within the Racecourse (see **Figure 2**) which are monitored by Perth Racing. Groundwater levels in these are monitored monthly.

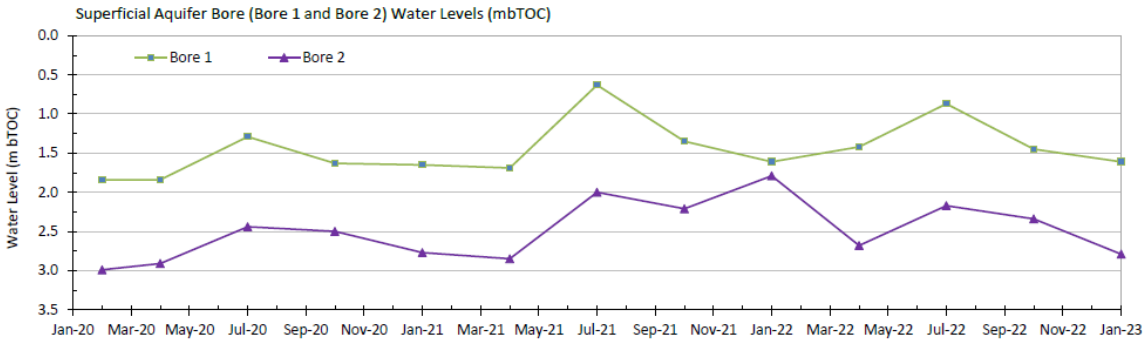


Plate 1: Groundwater levels within the Superficial Aquifer at Bore1 and Bore2 (JDA 2023)

Plate 1 depicts the groundwater levels observed within the Racecourse which clearly indicates the rise and fall of groundwater levels seasonally. The peak groundwater level at Bore 1 and Bore 2 were recorded 1.26 m AHD and 1.70 m AHD respectively, during August 2022.

Monitoring has recently been undertaken within Precinct A. Six monitoring wells were installed for the Precinct A geotechnical investigation. The groundwater depth below the surface of the Precinct A (during January 2024) varied from 1.09 m below ground level (mBGL) to 2.37 mBGL (Douglas Partners 2024).

Monitoring has also recently been undertaken within Precinct D by Galt Geotechnics during the geotechnical investigation. The highest groundwater level beneath Precinct D is reported as 3.03 mBGL during February 2024 (Galt 2024).The various monitoring data/sources have been collated to prepare estimated maximum groundwater contours beneath the site. These have also considered the surface elevation of swales adjacent to the racetrack and the reported TWL of the Wetland Lake. The regional groundwater levels are shown in **Figure 2,** with spot heights recorded at the various locations also provided. It is noted that these do not necessarily represent the annual maximum groundwater levels at all parts of the site given the various timing of measurement of groundwater. Notwithstanding the variability of timing, it is likely that the management of stormwater (and in

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

particular infiltration) will more likely be influenced by localised soil conditions than seasonal peak groundwater levels in the superficial aquifer.

3.7.2.3 Groundwater quality

Water quality monitoring was conducted monthly at PB1 and quarterly at Bore1 (JDA 2023). Water quality parameters those were analysed during the monitoring period include:

Monitoring Bore (Bore1)

- EC
- pH
- TDS
- Total phosphorus (TP)
- Filterable Reactive Phosphorus or Phosphorus in Orthophosphate (PO_4-P)
- Total Nitrogen (TN)
- Nitrogen in Total Oxidised Nitrogen (NO_x-N)
- Nitrogen in Ammonia (NH_3-N)
- Total Kjeldahl Nitrogen (TKN)

Production Bore (PB1)

- Electrical conductivity (EC)
- pH
- Total Dissolved Solids (TDS)

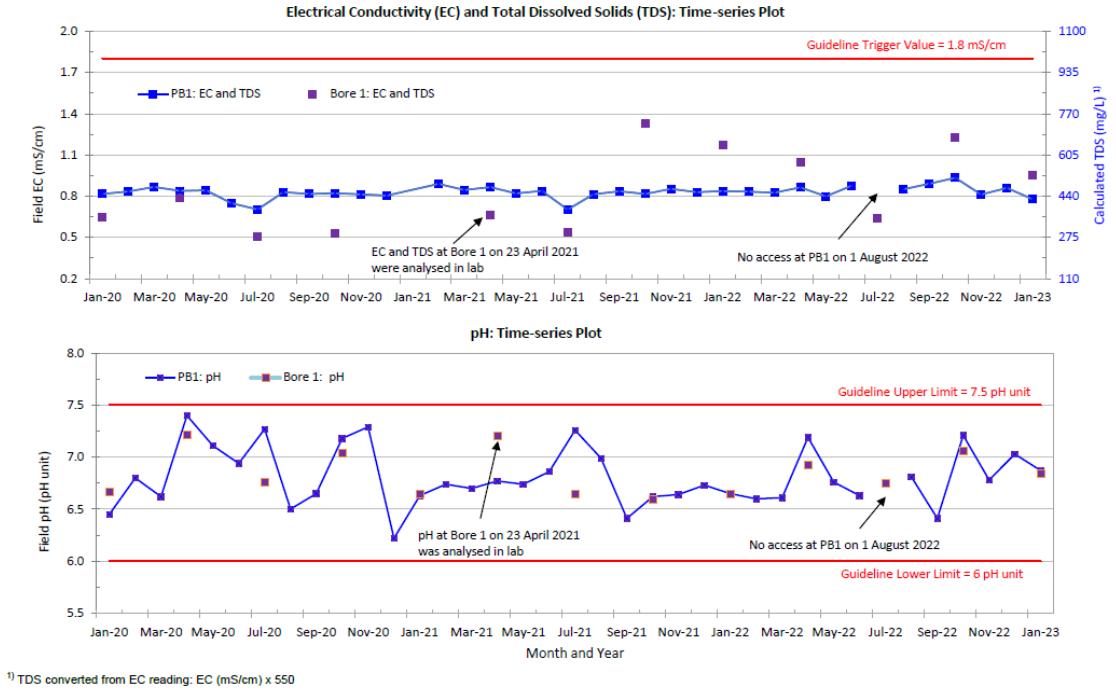


Plate 2: Water Quality (EC, TDS and pH) Monitoring results (JDA 2023)

Plate 2 and **Plate 3** illustrate the water quality of the groundwater within the site is generally consistent over the monitoring periods with typically low variance in parameters tested. EC, TDS and

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

pH values did not display any exceedances of the trigger values. However, TN and TP regularly exceeded the ANZECC guideline trigger value of 1.2 mg/L and 0.065 mg/L (respectively). It is also noted a large exceedance in TN occurred in August 2022 however this does not appear to be representative of long-term values.



Plate 3: Water Quality (TN and TP) Monitoring results (JDS 2023)

3.8 Summary of existing environment

In summary, the environmental investigations conducted to date indicate that:

- The site is being used for horse racing, mixed uses (i.e. car park, stables and entertainment/hospitality venues, and commercial). Some portions of the site are only used infrequently (e.g. for parking or events).
- The site is located in an area of moderate to high rainfall, receiving 756.3 mm on average annually with the majority of rainfall received between June and August.
- The majority of the site has a relatively flat topography of 1 mAHD at the northwest (along the Swan River) and 2 mAHD to the south and rising to 7 mAHD to the east of the site.
- The site is within the Swan River Terraces system and displays Guildford formation soils of alluvial and leached yellow sand described as:
    - **Ms2 –** Sandy Silt: Strong brown to mid grey, mottled, blocky, fine sand, hard when dry, variable clay content of alluvial origin
    - **Ms4 –** Sandy Silt: light yellow brown, blocky, mottled some fine to medium sand, soft when moist, variable clay content
    - **S8 –** Sand: very light grey at surface, yellow at depth, fine to medium-grained, sub rounded quartz, moderately well sorted of eolian origin
- The groundwater depth below the surface of Precinct A varies from 1.09 m mBGL to 2.37 mBGL (Douglas Partners 2024).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

- The highest groundwater level beneath Precinct D is reported 3.03 mBGL during February 2024 (Galt 2024).
- Most of the site is considered to have a high to moderate risk of ASS occurring, however some portions of Precinct B, Precinct C and the Racecourse are considered to have a moderate to low risk of ASS occurring within the 3 m of the natural surface.
- The northern portion of the site along the Swan River is identified as an ESA.
- The entirety of the site is classified as a SSA and classified as:
  - a) Estuary catchments on the Swan and Scott Coastal Plains.
  - f) The area is <1 km up-groundwater-gradient and 250 m down-gradient of a significant wetland; or where the groundwater gradient is unknown within 1 km of the significant wetland.
- The following wetlands are located within the site and these are classified as:
  - Multiple Use category wetland (MUW) area (UFI 8424, UFI 8425, UFI 8426).
  - Resource Enhancement wetland (REW) area (UFI 8423).
- The dominant hydrological feature of the site is the Swan River estuary. The northern boundary of the site falls within the Swan Canning Development Control Area (DCA) (CoB 2018) and Swan Canning River Park.
- The floodway of the Swan River is immediately adjacent to but not within the site. The 1% AEP flood elevation of the Swan River adjacent to the site is 2.8 mAHD.
- There are two existing major drainage network systems within or adjacent to the site include:
  - The CBMD, managed by the Water Corporation. This currently receives runoff from Precinct C (via the CoB drainage network) and Precinct E.
  - The CoB local piped drainage network, which exists along Mathieson Road, Grandstand Road and the northern portion of Resolution Drive.
- There are three lakes (Irrigation Lake, Lined Lake and Wetland Lake) located within the centre of the Racecourse. These are understood to receive runoff from the grandstand buildings in Precinct B and stables/buildings in Precinct C.
- Allowable discharge to the CBMD from the local drainage network is 0.95 m^3/s based on Water Corporation modelling.
- The groundwater beneath the site is a multi-layered system consisting of the Superficial, Kings Park Formation, Leederville and Yarragadee aquifers.
- Regional groundwater mapping indicates that the groundwater levels across the site are at approximately 0.5 m AHD.
- Local groundwater level monitoring indicates that annual maximum groundwater levels (recorded in August 2022) were measured at 1.26 m AHD and 1.70 m AHD at Bore 1 and Bore 2 respectively. Groundwater levels in adjacent areas included Precinct A levels at 1.09 mBGL to 2.37 mBGL and Precinct D levels of approximately 3.03 mBGL.
- Water quality monitoring indicates that EC, TDS and pH values do not exceed guideline trigger values. However, TN and TP concentrations continually exceed the ANZECC guideline trigger value of 1.2 mg/L and 0.065 mg/L respectively.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

4 Design Criteria and Objectives

This section outlines the objectives and design criteria that this LWMS and future management plans must achieve. The water management strategy includes water conservation, groundwater management and stormwater management.

4.1 Integrated water cycle management

Better Urban Water Management (WAPC 2008a) endorses the promotion of integrated water cycle management and application of WSUD principles to provide improvements in the management of stormwater, and to increase the efficient use of other existing water supplies.

The key principles of integrated water cycle management include:

- Considering all water sources, including wastewater, stormwater and groundwater
- Integrating water and land use planning
- Allocating and using water sustainably and equitably
- Integrating water use with natural water processes
- Adopting a whole catchment integration of natural resource use and management.

Integrated water cycle management addresses not only physical and environmental aspects of water resource use and planning, but also integrates other social and economic concerns. Water management design objectives should therefore seek to deliver better outcomes in terms of:

- Potable water consumption
- Stormwater quality management
- Groundwater management.

The first step in applying integrated water cycle management in urban catchments is to establish agreed environmental values for receiving environments. The existing environmental context of the site has been discussed in **Section 3** of this document. Guidance regarding environmental values and criteria is provided by a number of national and state policies/guidelines and site-specific studies undertaken in and around the site. These were detailed in **Section 1.4** and **Section 1.5** respectively.

4.2 Water conservation

This LWMS proposes the following water conservation criteria:

Criteria WC1 For residential dwellings, consumption target of 60 kL/person/year.

Criteria WC2 Ensure the efficient use of all water resources

Criteria WC3 Non-potable irrigation water to be sourced from existing groundwater licences held over the area.

The manner in which this objective will be achieved is further detailed in **Section 5**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

4.3 Stormwater management

The principle behind stormwater management at the site is to mimic the pre-development hydrological conditions and utilise existing infrastructure where sensible to do so, as described in **Section 3.7**. This principle and the guidance documents discussed in **Section 1.4** and **Section 1.5** and have guided the stormwater management criteria.

Criteria SW1 Retain and treat the first 15 mm of rainfall as close to source as possible and within site.

Criteria SW2 Detain up to 1% AEP rainfall event on-site.

Criteria SW3 Post-development critical 1% AEP peak flows leaving the site to mimic pre-development peak flows.

Criteria SW4 Finished floor levels must have a minimum of 300 mm clearance above the 1 % AEP TWL in the FSA.

Criteria SW5 All lots must have a minimum of 500 mm clearance above the 1 % AEP flood level in the Swan River.

Criteria SW6 Nutrient concentrations within surface water discharging from the site to the Swan River are to meet regional water quality targets.

Criteria SW7 Reduce nutrient loads by applying appropriate non-structural measures.

Criteria SW8 Design infiltration areas to avoid creating mosquito habitat.

The manner in which these objectives will be achieved is further detailed in **Section 6**.

4.4 Groundwater management

The principle behind the groundwater management strategy is to maintain the existing groundwater hydrology. The groundwater management criteria for the site include:

Criteria GW1 Surface based infiltration structures should have 300 mm clearance above the MGL.

Criteria GW2 Habitable floor levels should have a clearance to the MGL of at least 1.2 m.

The manner in which the groundwater management objectives will be achieved is further detailed in **Section 7**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

5 Water Conservation Strategy

5.1 Fit for purpose water use

Conservation of water through fit-for-purpose use and best management practices is encouraged so that scheme water is not wasted. Fit-for-purpose describes the use of water that is of a quality suitable for the required use of the water. Fit-for-purpose principles have been utilised in the water conservation strategy for the site and will achieve **Criteria WC1**.

5.1.1 Scheme water supply

Scheme water will be supplied by the Water Corporation Integrated Water Supply System. Scheme water is proposed to be used for all potable uses. Scheme water will also service some external uses, where fit-for-purpose alternatives are not available.

5.1.2 Groundwater

As discussed in **Section 3.7.2.1**, the site is located beneath a multi-layered system comprising of the Superficial Swan, Kings Park Formation, Leederville and Yarragadee aquifers.

The proponent holds a groundwater allocation from the Perth South Leederville confined aquifer for the following:

- GWL 178519 - 347,000 kL

This licence will be used to meet the irrigation requirements for the Racecourse Precinct, Precinct A, Precinct B and part of Precincts C and E.

The above-mentioned measure will achieve **Criteria WC3**.

5.1.3 Rainwater tanks

Rainwater tanks (RWTs) can be used within private lots to harvest roof runoff. This water is considered non-potable but can be used to supplement non-potable water uses.

5.2 Lot scale water conservation measures

This LWMS proposes that the water conservation measures to be adopted would include RWTs, waterwise principles for lot scale gardens and within estate landscaping (WWG) and water efficient fixtures and appliances (WEFA) to ensure that the residential portion of the development minimises the use of water. These are summarised in the following sections.

5.2.1 Rainwater tanks

The use of RWTs will not be mandated, and the stormwater quantity management strategy does not rely on their use. They are therefore only considered to be a water conservation measure. Given that rainwater tanks will not be mandated or supplied by the proponent, it has been assumed that these would be implemented by 7.5% of households within Precinct D. Whilst they may be considered for

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Precinct A they are not proposed to be taken up in other Precincts. The assumed uptake rate has been based on data obtained from the Australian Bureau of Statistics (ABS 2013). It is assumed (for the purposes of the water balance analysis) that all rainwater tanks have a capacity of 3 kL.

5.2.2 Water efficient fixtures and appliances

Water conservation strategy for the site proposes the use of WEFA. Water efficient fittings will be mandated through the building licence, while uptake of water efficient appliances can be encouraged by State and Local Government rebates in addition to education from the proponent at point of sale. WEFA are relevant to Precinct A and Precinct D. It is assumed that water efficient appliances will be implemented by 40% of households within Precinct A and Precinct D, which has been based on data obtained from the Australian Bureau of Statistics (ABS 2013, 2014).

5.2.3 Waterwise gardens

Landscape packages will not be provided as a part of the land sale contract. Lot scale waterwise gardening principles (WWG) are only relevant for Precinct D. These will be achieved by promoting Waterwise gardening principles (WWG) (WC 2003) at the time of sale of land within Precinct D. It is assumed that 75% of households in Precinct D will implement WWG principles within lot gardens (ABS 2013). WWG principles include:

- Soil to be improved with soil conditioner certified to Australian Standard (AS) 4454 to a minimum depth of 150 mm where turf is to be planted and a minimum depth of 300 mm for garden beds.
- The irrigation system shall be designed and installed according to best water efficient practices:
  - The controller must be ‘hydrozoned’.
  - Emitters must disperse coarse droplets or be subterranean.
- Garden beds to be mulched to 75mm with a product certified to AS4454.
- Increasing community awareness of water conservation by promoting Waterwise practices, fixtures and fittings at the point of sale.

WWG principles will also be considered for Precinct A and Precinct E, however it is anticipated that these areas will have minimal irrigated landscaping to which this would apply. The current approach to irrigation within the Racecourse Precinct, Precinct B and Precinct C adopts a range of water conservation measures (including non-irrigated area and retention of existing trees/vegetation) to ensure that Perth Racing operates within the available groundwater allocation. This approach is not proposed to be significantly modified.

The above measures will assist in achieving **Criteria WC1** and **WC2**.

5.3 Water use analysis

5.3.1 Lot scale water use analysis

A water use analysis has been undertaken for Precinct D to estimate the expected individual residential lot water use to demonstrate the effectiveness of the water conservation strategy. The water use analysis has been based on the rates and calculation methodology presented in the Water

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Corporation (2011) spreadsheet *AltWaterSupply_Water_Use_Model.xls*. This spreadsheet has been adapted to model the effects of using the water conservation measures proposed, and key assumptions include:

- Lot area has been based on a conceptual lot layout (see **Appendix A**).
- Average residency of 2.6 people per single lot dwelling. This value has been calculated from data provided by ABS for new housing developments in Perth (ABS 2022).
- Assumed up-take rates include:
  - 100% uptake of water efficient fittings
  - 40% uptake of water efficient appliances
  - 7.5% uptake of RWTs
  - 55% uptake of WWG principles.

The results of the water balance indicate that if households in Precinct A and Precinct D adopt the proposed water conservation measures (e.g. efficient fittings, RWT, WWG principals) at typical uptake rates they will use an average of 33.0 kL/year/person. This achieves the water target of no more than 60 kL/year/person of scheme water and satisfies **Criteria WC1**.

5.4 Wastewater management

The wastewater generated from the site will be managed by connecting the development to the Water Corporation deep sewer network.

5.5 Water conservation management criteria compliance

A summary of the proposed water conservation management criteria and how these are addressed is provided within **Table 1.**

Table 1: Water conservation management criteria compliance

Criteria number	Criteria description	Manner in which compliance will be achieved
WC1	Residential consumption target of 60 kL/person/year scheme water.	Provide advice to residents in Precinct A and Precinct D on water conservation measures
		RWTs can be utilised for non-potable uses within Precinct D
		Promotion and use of WWG in lots within Precinct D
		Promotion and use of water efficient appliances to Precinct A and Precinct D
		Mandate water efficient fittings within Precinct A and Precinct D
WC2	Ensure the efficient use of all water resources.	Use of waterwise landscaping principles in open spaces
		Open spaces designed to use no more than allocated groundwater
		Minimise water requirements for open space and verge maintenance
		Use of water efficient appliances within Precinct A and Precinct D
		Use of WWG principles in lots in Precinct D

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 2: Water conservation management criteria compliance (Continued)

Criteria number	Criteria description	Manner in which compliance will be achieved
WC3	Non-potable irrigation water to be sourced from existing groundwater licences held over the area.	The proponent holds a groundwater Licence with an allocation of 347,000 kL per annum which will meet the irrigation requirements of the Racecourse and surrounding Precincts.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

6 Stormwater Management

The principle behind the stormwater management strategy for the site is to maintain the existing hydrology by detaining, retaining and treating runoff from the small rainfall event (i.e. first 15 mm) as close to source as possible and detaining/retaining the major event (1% AEP) on site prior to discharge to either the centre of the Racecourse (i.e. self-retained) or to the CBMD the pre-development outflow rates. Due to the existing soil conditions (See **Section 3.5**), the site is not well suited for structural controls utilising infiltration of stormwater unless modified. However, given that fill will be utilised to ensure that habitable floor levels are above the 1% AEP flood elevation of the Swan River, final elevations will be approximately 4 mAHD. Where fill is used to achieve this there will be sufficient clearance to MGL and permeability of soils to adopt WSUD measures which utilise infiltration.

WSUD measures proposed will vary across the Precincts and will include:

- BRAs to achieve water quality treatment (Precincts A, C, D and E)
- FSAs to detain runoff prior to discharge to the adjacent road network system
- Subsurface infiltration cells that will facilitate at-source infiltration (Precinct D)
- Flood storage integrated into existing surface water bodies located centrally within the Racecourse (for Precinct A and C)
- FSAs to provide flood detention and infiltration as close to source as possible (Precinct E).

The overall approach to precinct drainage is shown on **Figure 7**.

The WSUD measures that will be implemented as a part of the development are described in the following sections. Precinct B has been assumed to be self-retained and a portion of Precinct C (already connected to the Lakes in the centre of the track) has been assumed to be the same as it is now. Surface runoff modelling undertaken using XPSWMM has been used to inform the design of stormwater infrastructure as detailed in the following sections. Assumptions used to represent the post-development environment are provided in the modelling assumptions report in **Appendix D**.

6.1 Lot scale drainage measures

Lots within Precinct D and Precinct E will retain the first 15 mm rainfall event runoff within soakwells/soakage which will need a capacity of 150 m^3/ha. Lot storage is the responsibility of the lot owner and will be assessed as part of the building approval process prior to construction.

The use of soakwells/soakage areas will assist in achieving **Criteria SW1**.

6.2 Development drainage measures

6.2.1 Bio-retention areas

Runoff from the first 15 mm of rainfall will be captured and retained within a vegetated BRA located in open spaces. The BRA is assumed to have a depth of 500 mm with 1:3 side slopes. Treatment of

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

runoff will be provided through interaction with vegetation and adsorption to sand particles through infiltration prior to reaching groundwater.

The BRA will be underlain by material with an appropriate PRI (nominally a PRI of 20 at 150 mm or equivalent). It is acceptable for this to be achieved with a thicker layer of lower PRI soil (e.g. 300 mm of PRI 10). This will be finalised prior to detailed design. The location of the BRA will either be in a drainage reserve, an open space or they may be within the centre of the Racecourse as a separate treatment area (separate from the existing Lakes). The sizing and spatial requirements of BRAs will be confirmed in the detailed designs.

The use of BRA will assist in achieving **Criteria SW1, SW6,** and **SW8**.

6.2.2 Flood detention/storage

An FSA will be utilised to detain runoff above the first 15 mm and up to the 1% AEP rainfall event. To achieve this, the invert of the FSA will have sufficient clearance above groundwater 300 mm. FSAs are assumed to be 1.2 m depth with 1:6 side slope and will be integrated into POS or drainage reserve, and will overflow to the Water Corporation drainage network. The sizes and spatial requirements for the FSA will be confirmed in the detailed designs and development stages.

The use of an FSA will assist in achieving **Criteria SW1, SW2, SW4,** and **SW6.**

6.2.3 Subsurface storage

Surface runoff generated by lots, stables and hardstand/carpark areas will be directed into sub-surface storage. Precinct D will have an independent drainage pipe network within individual precincts which convey flows to downstream sub-surface retention structures.

These structures have been sized to accommodate up to the 1% AEP rainfall event and have been designed as a 1 m deep structure. The detailed configurations could be modified to suit site constraints. These will either be location beneath road reserve/verge or beneath an open space and will require an overflow connection to the local (CoB) drainage network to ensure that they can dry out. The sizes and spatial requirements for the subsurface storages are provided in **Table 2** and illustrated in **Figure 7A**: Precinct A Stormwater Management Plan

Figure 7B: Precinct C Stormwater Management Plan

Figure .

The use of the sub-surface storage will assist in achieving **Criteria SW1, SW2,** and **SW6.**

6.2.4 Lake storage

Precinct A and Precinct C (stables) will first direct runoff to a bio-retention areas, however overflow from these will be catered for in the Wetland Lake. In a 1% AEP storm event an additional 78 mm of depth will occur within the Wetland Lake from both Precincts.

As indicated in **Section 3.7.1.2**, the Wetland Lake is connected/discharges to the Swan River via a 375 mm and 450 mm culvert. These are not proposed to be modified. The combined nominal flow capacity of the 375 mm and 450 mm pipes is approximately 0.4 m^3/s. The inlet, length, grade, etc of

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

these pipes is not proposed to be modified and therefore the current overflow regime from the site to the Swan River will remain unchanged.

The use of the Wetland Lake storage will assist in achieving **Criteria SW1, SW2, SW3,** and **SW6.**

6.3 Precinct based drainage approach

6.3.1 Precinct A

There is no current connection point for drainage to be exported from site to the local CoB network. Runoff will therefore need to be managed within Precinct A and the Racecourse. Precinct A will require a single BRA that will address treatment of water quality; this will be located within Precinct A as close to source as possible. The BRA should have the following characteristics:

- Base will be vegetated with reeds/rushes as per a biofilter
- 1:3 side slopes
- Depth of 300 – 500 mm pending final design
- Volume of the BRA will need to achieve 194 m^3
- Nominal surface area of 450 m^2.

In addition to the volume achieved by the BRA, in a major (1% AEP) storm event a further 1,345m^3 of flood retention storage will be required. The proposed earthwork level of Precinct A (4.0 mAHD) means that it is possible to direct runoff exceeding BRA capacity to the Wetland Lake in the centre of the Racecourse. This approach will add approximately 52 mm to the central 2.6 ha Wetland Lake.

The volumes of storage required and locations of storage across the Precincts is summarised in **Table 2**. The approach to water management in Precinct A is shown in **Figure 7A**.

6.3.2 Precinct B and Racecourse

As indicate previously, there are no substantial changes proposed to Precinct B. Precinct B currently manages surface runoff within the precinct and adjacent Racecourse, largely via at source infiltration, swales around the perimeter of the track surface and the existing lake system Precinct B and the Racecourse are proposed to be retained largely as is.

As indicated in **Section 3**, the Wetland Lake currently has a piped overflow connection to the Swan River. This overflow pipe(s) reportedly rarely overflow and can be controlled via a structure at the outlet (which also prevents tidal influence on the Wetland Lake). The Wetland Lake has a 2.6 ha surface area, and therefore can provide significant volume of stormwater retention in the event of a major storm event. There are no new connections proposed to the Swan River and there are no changes proposed to the management approach currently taken for the Wetland Lake and the current piped outlets.

6.3.3 Precinct C

Precinct C is the existing stables area, adjacent carparks and future stables areas along the south and east of the Structure Plan area. The existing buildings currently either infiltrate runoff at source or

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

discharge to the Lined Lake in the centre of the Racecourse. This approach is proposed to be retained.

Surface runoff generated by hardstand/carpark areas of Precinct C will be directed and discharged towards Precinct E via the existing connections to the CoB drainage network along Matheson Road or via the existing pipe connection in the southwest of the Structure Planning area to the existing connection to the CBMD (Water Corporation drainage system) within Precinct E.

The drainage requirements for the southern (carpark) portion of Precinct C are therefore detailed with those proposed for Precinct E.

For the two currently undeveloped portions of Precinct C (future stables along the south and east of the Structure Plan area), the post-development drainage system will collect the runoff from these areas and direct them to the centre of the Racecourse. Initial treatment will be provided by a BRA which accommodates 418 m^3, with a nominal surface area of 924 m^2.

Runoff exceeding the capacity of the BRA (which will be 684 m^3) will be directed to the Wetland Lake. The direction of major event stormwater runoff to the Wetland Lake will add 26 mm to the top water level of the Wetland Lake.

The volumes required to be treated and for flood mitigation for Precinct C are summarised in **Table 2**. The approach to water management in Precinct A is shown in **Figure 7B**.

6.3.4 Precinct D

As indicated in **Section 6.1**, private lots and the childcare building within Precinct D are assumed to retain the first 15 mm within the lot boundary, most likely within soakwells, which should be appropriate given that some measure of imported fill will be required to meet clearance above regional flood levels. Based on the density of lots proposed in Precinct and lack of open space, this precinct will need 42 m^3 of subsurface storage to accommodate and detain the 1% AEP storm event to ensure that the post development peak flow rates will mimic the pre -development conditions. This is assumed to be located adjacent to Resolution Drive as shown in **Figure 7C**. The outflow from this Precinct will likely be predominantly overland flow once the first 15 mm of storage has reached capacity, however a low flow to ensure that these can adequately drain between storm events is recommended.

The volumes required to be treated and for flood mitigation for Precinct D are summarised in **Table 2**.

6.3.5 Precinct E

Surface runoff from across Precinct E (inclusive of Precinct C hardstand/carpark) will be conveyed via the drainage network firstly to a BRA for water quality treatment and then this will overflow to an FSA (detention drainage structure) at the south western corner of Precinct E for detention of the 1% AEP storm event. Overflow from Precinct E basin will discharge into the CBMD (Water Corporation drainage system) at existing flow rates. The Water Corporation surface runoff modelling of the CBMD indicates that the local drainage network contributes 0.95 m^3/s at node CNA008. This is understood to be contributed to by existing 450 mm and 525 mm pipes beneath Resolution Drive and therefore it is assumed that 0.62 m^3/s is taken up by the existing pipe network, and approximately 0.33 m^3/s of

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

capacity is available to convey runoff from Precinct C, Precinct E and upstream contributing catchments.

The volumes required to be treated and for flood mitigation for Precinct E are summarised in **Table 2**. The approach to water management in Precinct E is shown in **Figure 7D**.

6.3.6 Precinct drainage summary

The requirements for water quality treatment within the Precincts is summarised in **Table 2**.

Table 2: Precinct drainage summary

Precinct	First 15 mm requirement (m^3)	Location of first 15 mm	1% AEP flood mitigation requirement (m^3)	Location of 1% AEP flood mitigation requirement	1% AEP outflow from site
Precinct A	194	BRA located within Precinct A	1,345	Wetland Lake, centre of Racecourse	0
Precinct B	No change to existing	Precinct B	No change to existing	Precinct B	Self-retained
Precinct C (Stables)	418	BRA located in the centre of the Racecourse	684	Wetland Lake in centre of Racecourse	0
Precinct C (carpark)	Combined with Precinct E volumes	BRA in Precinct E	Combined with Precinct E volumes	FSA in Precinct E	
Precinct D	28	Subsurface storage cells beneath road reserve/drainage reserve	42	Subsurface storage cells beneath road reserve/drainage reserve	0.402 m^3/s to local drainage network/road pavement
Precinct E	365	Southwest corner of Precinct E, adjacent to FSA	930	South west corner of Precinct E	0.32 m^3/s to CBMD

There will be no new connections to the Swan River or to the CBMD, and the existing flow regimes at these outlet points will be maintained. Specifically with regard to overflow from the Wetland Lake which occurs via gravity, the peak flow rates that the existing 375 mm and 450 mm pipes are capable of achieving (approximately 0.4 m^3/s) will not change given that the inlet, length, grade and outlet of these pipes is not proposed to be modified.

Precinct D will require a connection to the local drainage network, however the outflow rate will be nominal, and has not been accounted for when sizing the subsurface storage cells within Precinct D. The direction of runoff from Precinct A and a portion of Precinct C to the centre of the Racecourse will require a BRA with a surface area of 1,105 m^2 (for Precinct C) and will add a total of 78 mm depth to the top water levels within the Wetland Lake.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

The precinct areas and a summary of the approach to surface water management are shown on **Figure 7**.

6.3.7 Non-structural measures

A number of non-structural measures will be implemented to help reduce nutrient loads within stormwater runoff. These measures include:

- Minimising fertiliser use to establish and maintain vegetation within POS and road verges.
- Street sweeping at regular intervals.
- Ongoing management of nutrient application to Precinct B and the Racecourse.
- Precinct A to adopt a similar nutrient application management regime as that currently applied to Precinct B.
- Minimising the use of turf within open spaces.
- Active management of equine waste within Precinct C and the Racecourse. This includes manual collection and remove of manure from site.
- Education of residents regarding fertiliser use and nutrient absorbing vegetation species within lots.

The above measures will assist in achieving **Criteria SW7**.

6.3.8 Earthwork levels

Finished floor levels of the entire development will be set at minimum of 4.0 mAHD (See **Appendix C**) which will assist in achieving **Criteria SW5**.

6.4 Stormwater criteria compliance

A summary of the proposed stormwater design criteria and how these are addressed is provided in **Table 3**.

Table 3: Stormwater management criteria compliance

Criteria number	Criteria description	Manner in which compliance will be achieved
SW1	Retain and treat the first 15 mm of rainfall as close to source as possible	Lots within Precinct D and Precinct E to retain the first 15 mm of rainfall on lot in soakwells/soakage. Lot storage will be the responsibility of the lot owners.
SW2	Retain up to 1% AEP rainfall event on-site.	Runoff up to the 1% AEP to be detained within the FSA in Precinct A. Precinct A and a portion of Precinct C will ultimately discharge to the centre of the track.
		Runoff up to 1% AEP to be managed with the sub-surface storage in Precinct D.
SW3	Post-development critical 1% AEP peak flows leaving the site to mimic pre-development peak flows.	Runoff up to 1% AEP event to be detained in the detention basin and subsurface storage which will maintain the pre-development peak flow of 0.32 m^3/s from Precinct E and 0.463 m^3/s from Precinct D respectively.
SW4	Finished floor levels must have a minimum of 300 mm clearance above the 1% AEP TWL in the FSA.	It is anticipated that the FSA and detention basin invert will be set so that the habitable floor levels must have a

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

		minimum of 300 mm clearance above the 1% AEP TWL in the basins.
SW5	All lots must have a minimum of 500 mm clearance above the 1% AEP flood level in the Swan River.	The 1% AEP flood level in the Swan River is 2.8 mAHD. The preliminary bulk earthworks concept provided in shows that finished floor level will be at 4.0 mAHD.
SW6	Nutrient concentrations within surface water discharging from the site to the Swan River are to meet regional water quality targets.	BRA will be designed so that after treatment the long term nutrient concentrations within surface water meet the regional water quality targets.

Table 4: Stormwater management criteria compliance (Continued)

Criteria number	Criteria description	Manner in which compliance will be achieved
SW7	Reduce nutrient loads by applying appropriate non-structural measures	• Minimise use of fertilisers within open space and road verges. • Street sweeping at regular intervals. • Use of drought tolerant turf species. • Education of residents regarding fertiliser use
SW8	Design infiltration areas to avoid creating mosquito habitat	Stormwater infrastructure will be designed to ensure all runoff is infiltrated within 96 hours.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

7 Groundwater Management

7.1 Groundwater management approach

The principle behind groundwater management is to maintain the existing hydrology across the site, provide appropriate protection from groundwater inundation, and maintain or improve existing groundwater quality.

7.2 Groundwater level management

The regional groundwater map (DWER 2023e), localised measurement of groundwater and the surface contours of the site (see **Section 3.4** and **Figure 2**) indicate that there is sufficient clearance to groundwater beneath the site to facilitate infiltration of stormwater runoff, on the basis that fill is being imported to raise finished levels to 4.0 mAHD.

Whilst the underlying parent soils have demonstrated generally low permeability, the earthworks approach will require import of fill to 4.0 mAHD to achieve clearance above the 1% AEP flood level in the Swan River for Precinct A, Precinct D and Precinct E. Therefore, stormwater will be encouraged to infiltrate at source wherever possible to minimise stormwater runoff and to adopt an at-source approach to management of runoff where possible. This will occur within soakwells, permeable portions of lots and BRAs which will have at least 300 mm of clearance above the MGL. The above-mentioned measure will assist in achieving **Criteria GW1**.

For Precinct C (stables) runoff will be directed to the centre of the racetrack. The stables facilities do not require a specific separation from groundwater, and in order to accommodate equine uses the land between buildings/facilities should be as flat as possible. The most appropriate response is therefore to accommodate stormwater quality treatment and flood retention within the centre of the racetrack. Given the low permeability of soils in the centre of the racetrack, the BRA is unlikely to achieve separation from groundwater or the low permeability soil layer. This is however considered acceptable as it is consistent with the presence of the three Lakes currently within the centre of the racetrack.

The control of groundwater by subsoil drainage is not proposed due to requirements to provide adequate clearance above the 1% AEP flood levels and the proximity of the Swan River. Rather, groundwater separation requirements will be achieved by the use of imported fill as described above. The earthworks strategy provided in **Appendix C** shows that all habitable floor levels will be greater than 1.2 m above the MGL. The above-mentioned measure will assist in achieving **Criteria GW2**.

As previously discussed, there are no changes proposed to the form of development within Precinct B or to the Racecourse. These areas are currently managed by the swales aligned with the existing racetrack which control soil moisture conditions in these areas, and which discharge to the Wetland Lake. This approach will be retained in the post-development environment.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

7.3 Groundwater quality management

Whilst not specified in a design criterion, the main objective for groundwater quality management is to maintain or improve the existing groundwater quality. This can be achieved by reducing the total nutrient load into the groundwater that originates from the site. Groundwater that originates from the site is surface runoff that has infiltrated into the soil profile. Therefore, improving groundwater quality can be achieved by treatment of the surface runoff prior to infiltrating to groundwater.

The reduction of nutrient load to the groundwater will be achieved by:

- Retention of existing trees within open spaces wherever possible.
- Directing stormwater to a vegetated (with native wetland species) BRA.
- The BRA will be underlain by material with an appropriate PRI (nominally a PRI of 20 at 150 mm or equivalent). It is acceptable for this to be achieved with a thicker layer of lower PRI soil (e.g. 300 mm of PRI 10).
- Minimise fertiliser use to establish and maintain vegetation within open space areas and road verges.
- Ongoing management of nutrient application to Precinct B and the Racecourse.
- Precinct A to adopt a similar nutrient application management regime as that currently applied to Precinct B.
- The use of turf will be minimised, however where adopted a drought tolerant turf species that require minimal water, and nutrients will be used.
- Roll-on turf will be used within the open space areas and road verges, to prevent the high nutrient input requirement during establishment of the turf.
- Garden beds should not be immediately adjacent to BRAs to reduce nutrient transportation into these infiltration areas.
- Active management of equine waste within Precinct C and the Racecourse. This includes manual collection and remove of manure from site.

The above measures will improve the quality of water prior to it infiltrating into the underlying groundwater.

7.4 Groundwater criteria compliance summary

A summary of the proposed groundwater quantity design criteria and how these are addressed within the site is provided in **Table 4**.

Table 4: Groundwater criteria compliance summary

Criteria number	Criteria description	Manner in which compliances will be achieved
GW1	Surface based infiltration should have 300 mm clearance above MGL.	Basin inverts will be set at 300 mm above the MGL, the exception being the BRA in the centre of the racetrack.
GW2	Finished floor levels should have a clearance to the MGL of at least 1.2 m.	Lots will be set at least 1.2 m above the MGL.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

8 Subdivision and Urban Water Management Plans

The requirements to undertake preparation of more detailed water management plans to support subdivision is generally imposed as a condition of subdivision. This will be most relevant to Precinct D. Other precincts may be developed under a Development Approval and therefore water management will likely be documented within a Stormwater Management Plan (SMP). The development of future UWMP/SMPs should follow *Urban Water Management Plans: Guidelines for preparing plans and for Complying with Subdivision Conditions* (DoW 2008).

While strategies have been provided within this LWMS that address planning for water management within the site, it is a logical progression that future subdivision designs and the supportive UWMP/SMP will clarify details not provided within the LWMS. The main areas that will require further clarification within future UWMP/SMPs may include (pending which precinct is being addressed):

- Extent of land uses within Precincts
- Connection to local and Main Drainage networks
- Surface runoff modelling
- Implementation of water conservation strategies
- Non-structural water quality improvement measures
- Management and maintenance requirements
- Construction period management strategy.

These are further detailed in the following sections. As stated above, ongoing (post-development) monitoring of groundwater will be detailed in the UWMP/SPM, however in this LWMS is outlined broadly in **Section 9**.

8.1 Extent of land uses within Precincts

It is expected that the layout and extent of land uses within Precincts may evolve over time. Future water planning documents will need to be updated to align with the most up to date spatial plans for each Precinct. Changes to the spatial plans will likely have an implication on the size of stormwater infrastructure and possibly their location, and should be revised and clarified in future UWMP/SMPs.

8.2 Connection to local and Main Drainage networks

This LWMS has made assumptions regarding connectivity to the CoB local drainage network and to the Water Corporation's CBMD. These are assumptions are made based on the information available at the time of preparing this LWMS and may need to be revised pending feedback from these agencies. This could result in updates to surface runoff modelling (see **Section 8.3**).

8.3 Surface runoff modelling

It is acknowledged that the water management strategies documented in this LWMS are based upon broad-scale assumptions and to some extent regional data. These assumptions are considered

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

adequate for development of this LWMS and are of an appropriate level of detail. However, verification of proposed subdivision drainage designs will be undertaken once the specific basin designs and extent of inclusion of finer scale WSUD elements are confirmed.

It is expected that future UWMP/SMPs will update surface runoff modelling as appropriate, and this may result in evolution of the spatial layout of the structure plan/future subdivisions or detailed civil design approach.

8.4 Implementation of water conservation strategies

The non-potable water needs from the Precincts are to be accommodated from the existing groundwater allocation and therefore, track water usage is a significant consideration. Notwithstanding licensed volumes available, there is minimal new open space areas proposed within the Precincts that would demand significant additional groundwater allocation, and it is therefore anticipated that non-potable water needs can be met by the existing licence held by Perth Racing.

A number of potential measures to conserve water have been presented within this LWMS. These water conservation strategies will be incorporated into design and the on-going maintenance of the Precinct A, B and C open spaces and where relevant. Landscape concept design measures that will be incorporated into the water conservation strategy will be further detailed within the future UWMP/SMPs produced for the development.

The manner in which the developer intends to promote water conservation measures discussed in this LWMS to future lot owners will also be discussed within the future UWMP/SMPs.

8.5 Non-structural water quality improvement measures

Guidance for the development and implementation of non-structural water quality improvement measures is provided within the *Stormwater Management Manual for Western Australia* (DWER 2022). Some measures will be more appropriately implemented by CoB for local roads, such as street sweeping, however many can be implemented relatively easily within the design and maintenance of the subdivision and the open space areas. It is expected that any privately managed development areas (e.g. Precinct A, Precinct B and Precinct C) will be managed by Perth Racing or another appropriate management body, and that the management of areas exposed to equine uses (Precinct C and the Racecourse) will continue to adopt contemporary best practice nutrient management.

Future UWMP/SMPs will provide an implementation plan/timing/responsibility for measures such as street sweeping, public education (through measures such as signage that may be implemented to raise awareness), etc.

8.6 Management and maintenance requirements

The management measures to be implemented to address surface water quality (such as the use of vegetation within WSUD assets) will require ongoing maintenance. It is therefore expected that the future UWMP/SMPs will detail management and maintenance procedures that will set out required maintenance actions (e.g. gross pollutant removal), timing (e.g. how often it will occur), locations (e.g. exactly where it will occur) and responsibilities (e.g. who will be responsible for carrying out the

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

actions). Given that approval from the CoB will be sought for the proposed measures, it is anticipated that consultation will be undertaken and referral to guiding policies and documents will be made.

8.7 Construction period management strategy

It is anticipated that the construction stage will require some management of various aspects (e.g. soil erosion, sedimentation of downstream water bodies, dust, surface runoff, noise, traffic etc.). The management measures undertaken for construction management will be addressed either in the future UWMP/SMPs or a separate Construction Management Plan (CMP).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

9 Monitoring

9.1 Post-development monitoring

The post-development monitoring of water quality should be undertaken within groundwater immediately upstream and downstream of BRAs within Precinct A, Precinct C and Precinct E. It should also be undertaken at the outlet to or adjacent to the subsurface detention system in Precinct D. This should be undertaken via shallow groundwater bores installed immediately upstream and immediately downstream based on local groundwater flow direction, based on information available at the time (or in the case of Precinct D it could be at the outlet from the subsurface storage cells).

The monitoring should also consider and be generally consistent in the approach with the monitoring undertaken to comply with conditions of Groundwater Licence GWL 178519.

The WSUD measures (BRAs) should also be monitored to ensure their continued effectiveness. This should occur at the outlets from BRAs prior to their discharge to the Wetland Lake. It is noted that this may be difficult to achieve as it will require a rainfall event > 15 mm and to be timed to occur when overflow is occurring or alternatively auto samplers could be employed.

Monitoring of the outlet to the Swan River from the Wetland Lake is not proposed to be undertaken given the infrequent nature of overflow from the Lake to the River. Further, the Lake intersects shallow groundwater and any discharge from the pipes to the River is likely to be influenced by local groundwater quality.

9.1.1 Trigger values

The water quality targets from the *National Water Quality Management Strategy* (ANZECC and ARMCANZ 2000) and the trigger criteria are acknowledged as long term targets for the site, being 1.2 mg/L for TN and 0.065 mg/L for TP. However, it is also recognised that recent site monitoring undertaken (and reported in **Section 3**) shows repeated exceedances of the NWQMS default trigger criteria. Therefore, short term trigger values are proposed based on the approximate average nutrient concentrations measured in groundwater, and these are shown in **Table 5**.

Table 5: Post-development trigger values

Analyte	pH	EC (uS/cm)	TN (mg/L)	TP (mg/L)
Value	6-7.5	1800	3.0	0.15

Monitoring should be undertaken on a quarterly basis and should include:

- pH
- Conductivity
- Dissolved oxygen
- Temperature
- Nutrients (TN, TP)
- Nutrient Species (Ammonium, NH_4, Oxides of nitrogen, NO_x ortho-phosphorous (ORP))

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

9.1.2 Condition monitoring

It is proposed that the overall condition of the Precincts will be monitored on a bi-annual basis. This monitoring will be implemented after the completion of the civil and landscaping works and will continue for a period of two years.

A visual assessment will be undertaken to monitor the overall condition of the Precincts, with the aim to ascertain that the maintenance activities are achieving the overall management objectives for the development. The parameters that will be monitored include:

- Gross pollutants
- Terrestrial weeds
- Irrigation
- Vegetation density
- Paths, benches, walkways and other infrastructure.

The management and maintenance objectives will be detailed within future UWMPs along with details of the corresponding monitoring program.

9.1.3 Contingency Action Plan

If the results from the initial monitoring occasion indicate that nutrient concentrations exceed the nominated (short term) trigger values, a number of contingency measures may be employed.

The first action that should be undertaken if groundwater trigger criteria are exceeded is to repeat the monitoring to remove the potential for sampling error. If the repeat monitoring still shows results which breach the trigger value, the next action will be to compare the upstream (incoming) nutrient concentrations with the outgoing (downstream) nutrient concentrations. If the downstream nutrient concentrations are >50% higher than the upstream nutrient concentrations, the following actions should be undertaken:

- Review open space nutrient application practices to identify source if possible.
- Conduct surveillance of Precincts and drainage infrastructure to determine any other potential and obvious nutrient inputs.
- Remove source if possible (i.e. fertiliser input, etc.).
- Remove sediment–bound nutrients by removing basin sediments.
- Manual removal of plant material from BRAs to facilitate further nutrient uptake.

If the downstream nutrient concentrations are found to be generally consistent with the upstream concentrations the next action will be to conduct a site – specific comparison of long-term background data presented in this LWMS. There is some amount of variability (temporally) in nutrient concentrations experienced across the site, and this is the reason for the proposed short and long term trigger values. The comparison of measured values to trigger values and historical monitoring data should then be used as a management tool to determine if the trigger values should be revised.

Following the implementation of the above contingency measures the groundwater quality will be re – sampled. If the results of the analysis still show water quality characteristics which breach the trigger values an additional set of upstream/downstream monitoring bores may be installed. The

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

additional bores would be sampled as per the ongoing sampling regime already being undertaken for the first two bores. If the additional locations demonstrate results consistent with the initial monitoring, an assessment will be undertaken as to whether the results are representative of a broader site management concern, and whether any additional contingency actions need to be implemented onsite.

9.2 Reporting

A post-development monitoring report will be prepared on conclusion of the two-year monitoring period and will be provided to CoB on request. This will be undertaken per Precinct once development within the Precinct has occurred. Interim results (spreadsheet) can be provided to either CoB, DWER or DBCA on request during the monitoring program.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

10 Implementation

10.1 Roles and responsibility

The LWMS provides a framework that the proponent can utilise to assist in establishing stormwater management methods that have been based upon site-specific investigations, are consistent with relevant State and Local Government policies and have been endorsed by DWER, DBCA and CoB. The responsibility for working within the framework established within the LWMS rests initially with the proponent, although it is anticipated that a future UWMP/SMP will be developed in consideration of other relevant policies and documents. A summary of roles and responsibilities relevant to the current and future planning stages and ongoing management of the site is summarised in **Table 6**.

Table 6: Roles and responsibilities for various planning stages

Stakeholder	Perth Racing	City of Belmont	Water Corporation	DWER	DBCA	WAPC
LWMS preparation	√					
LWMS review and advice		√	√	√	√	
LWMS approval				√		√
UWMP/SMP & civil design preparation	√					
UWMP/SMP review and approval		√				
Precinct implementation	√					
Post development Precinct management	√					
Public roads/open space ongoing management	√	√				

10.2 Funding

The proponent will fund all subdivision, civil and landscape works within the public realm (roads and open spaces) and within Precincts that are being privately managed (Precinct A, Precinct B and Precinct C). Development of individual lots will be the responsibility of the lot owner at the lot-scale development application stage.

10.3 Review

It is not anticipated that this LWMS will be reviewed unless the Ascot Racecourse Structure plan undergoes significant change post-lodgement of the LWMS. If the proposed layout of the

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

development is substantially modified, the surface runoff modelling undertaken for this LWMS may need to be reviewed and the criteria revised to ensure that all are still appropriate.

The next stage of water management for most of the Precincts is UWMP preparation to support subdivision (relevant to Precinct D) or SMP preparation to support Development Approval (relevant to all other precincts). The UWMP/SMP is largely an extension of the LWMS, as it should provide detail to the designs proposed within this LWMS and will demonstrate compliance with the criteria proposed in **Section 4**. Regardless of whether a UWMP or SMP is prepared, these should be prepared as per *Better Urban Water Management*.

The next stage of development following the UWMP is single lot development. It is recognised that certain elements of the LWMS and the UWMP will not be implemented until this late stage, and that there is little or no statutory control that can be applied to ensure the implementation of any remaining measures. While the remaining measures are unlikely to be enforced at this stage their implementation could be encouraged by the CoB through policy (or modification of these where necessary), building licence or awareness programs (such as the Water Corporation Waterwise program).

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

11 References

11.1 General references

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

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11.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 11.1**, with access date information provided in **Table R1**.

Table R1 Access dates for online references

Reference	Date accessed	Website or dataset name
(ABS 2013)	19/4/2024	ABS: Water Use and Conservation Data
(ABS 2014)	19/4/2024	ABS: Energy Use and Conservation Data
(DWER 2023a)	12/04/2024	Acid Sulfate Soil Risk Map
(BoM 2024)	12/04/2024	Climate Data
(Landgate 2023)	31/01/2024	Landgate Map Viewer Plus
(WAPC 2023a)	11/12/2023	Local Planning Scheme No. 15 Map
(DWER 2024a)	12/04/2024	Perth Groundwater Map
(DWER 2024b)	12/04/2024	Water Information Reporting
(DWER 2024c)	12/04/2024	Water Register
(DWER 2023c)	26/04/2024	FPM Floodplain Area (DWER-020)

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Figures

Figure 1: Site Location

Figure 2: Topographic and Groundwater Contours

Figure 3: Geological Mapping

Figure 4: Acid Sulfate Soil Mapping

Figure 5: Environmental Assets

Figure 6: Hydrological Features

Figure 7: Ascot LSP Precinct Plan surface water management

Figure 7A: Precinct A Stormwater Management Plan

Figure 7B: Precinct C Stormwater Management Plan

Figure 7C: Precinct D Stormwater Management Plan

Figure 7D: Precinct E Stormwater Management Plan

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024



Figure 1: Site Location

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F23

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

0 100 200 300
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

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Version: 1, Version Date: 18/09/2024



Figure 2: Topographic and Groundwater Contours

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F24

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

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Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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Version: 1, Version Date: 18/09/2024

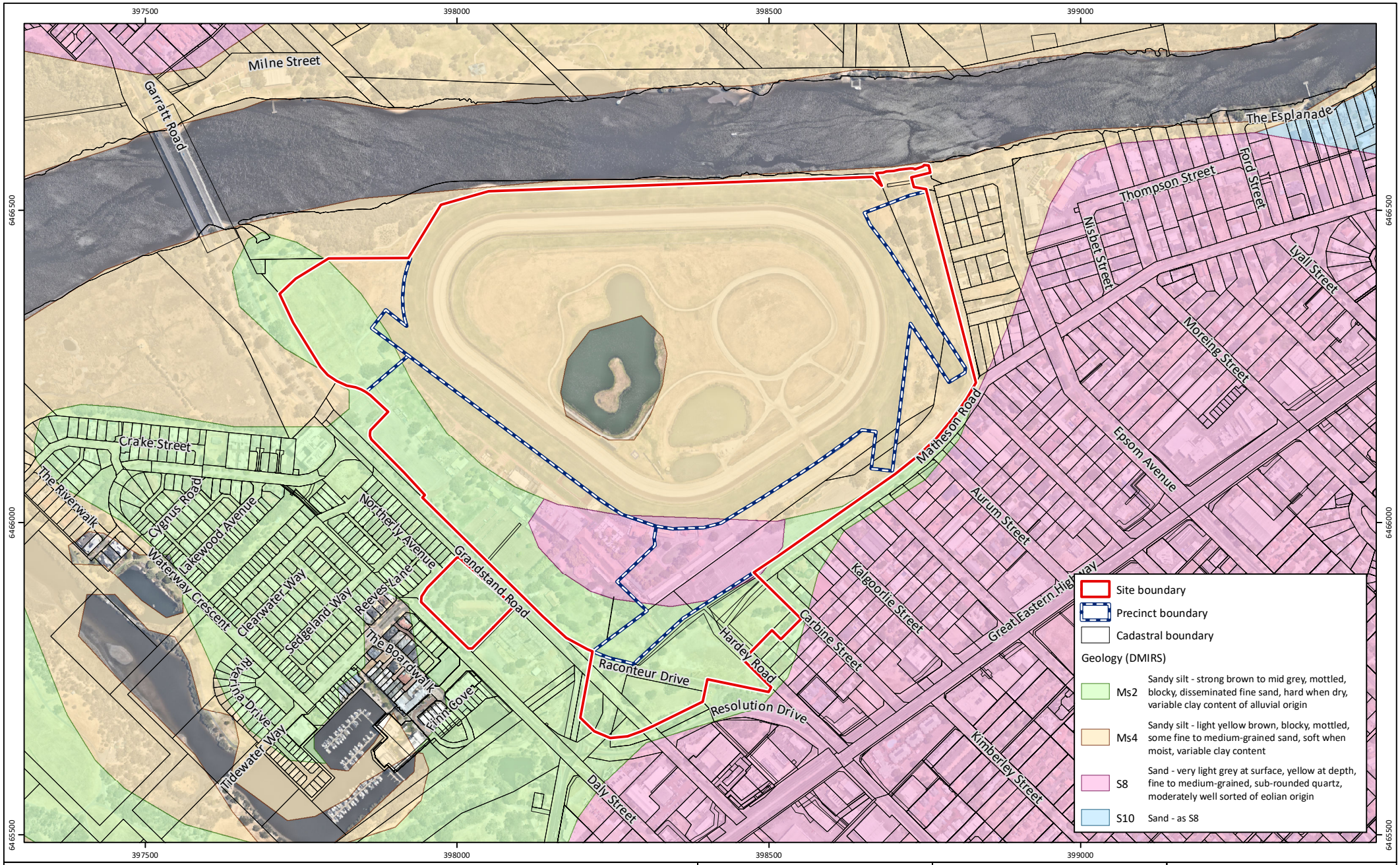


Figure 3: Geological Mapping

Project: Local Water Management Plan
Golden Gateway Local Structure Plan

Client: Perth Racing

Plan Number:
EP23-109(03)--F25

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

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Metres

Scale: 1:8,000@A4

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Version: 1, Version Date: 18/09/2024

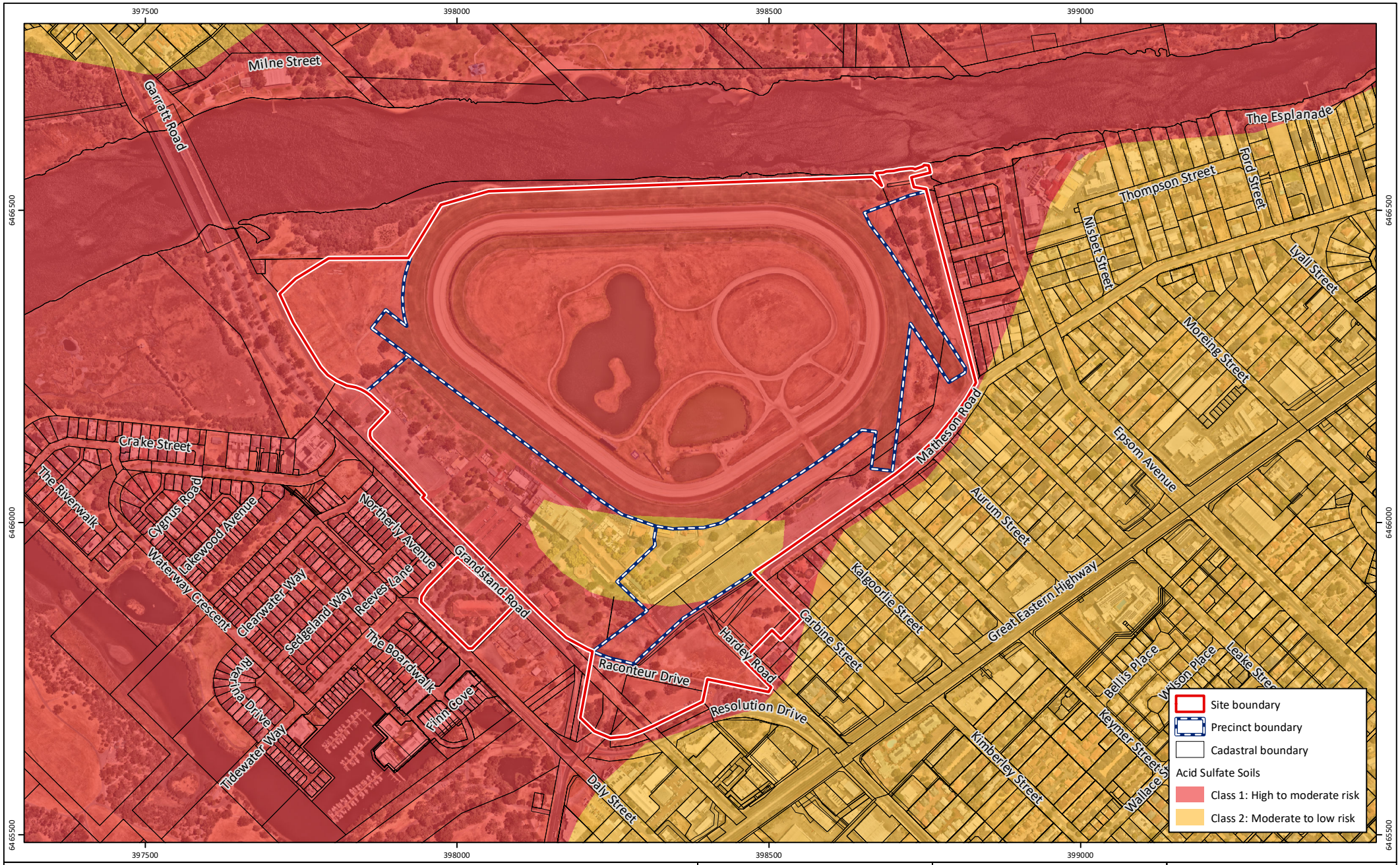


Figure 4: Acid Sulfate Soil Mapping

Project: Local Water Management Plan
Golden Gateway Local Structure Plan

Client: Perth Racing

Plan Number:
EP23-109(03)--F26

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

0 100 200 300
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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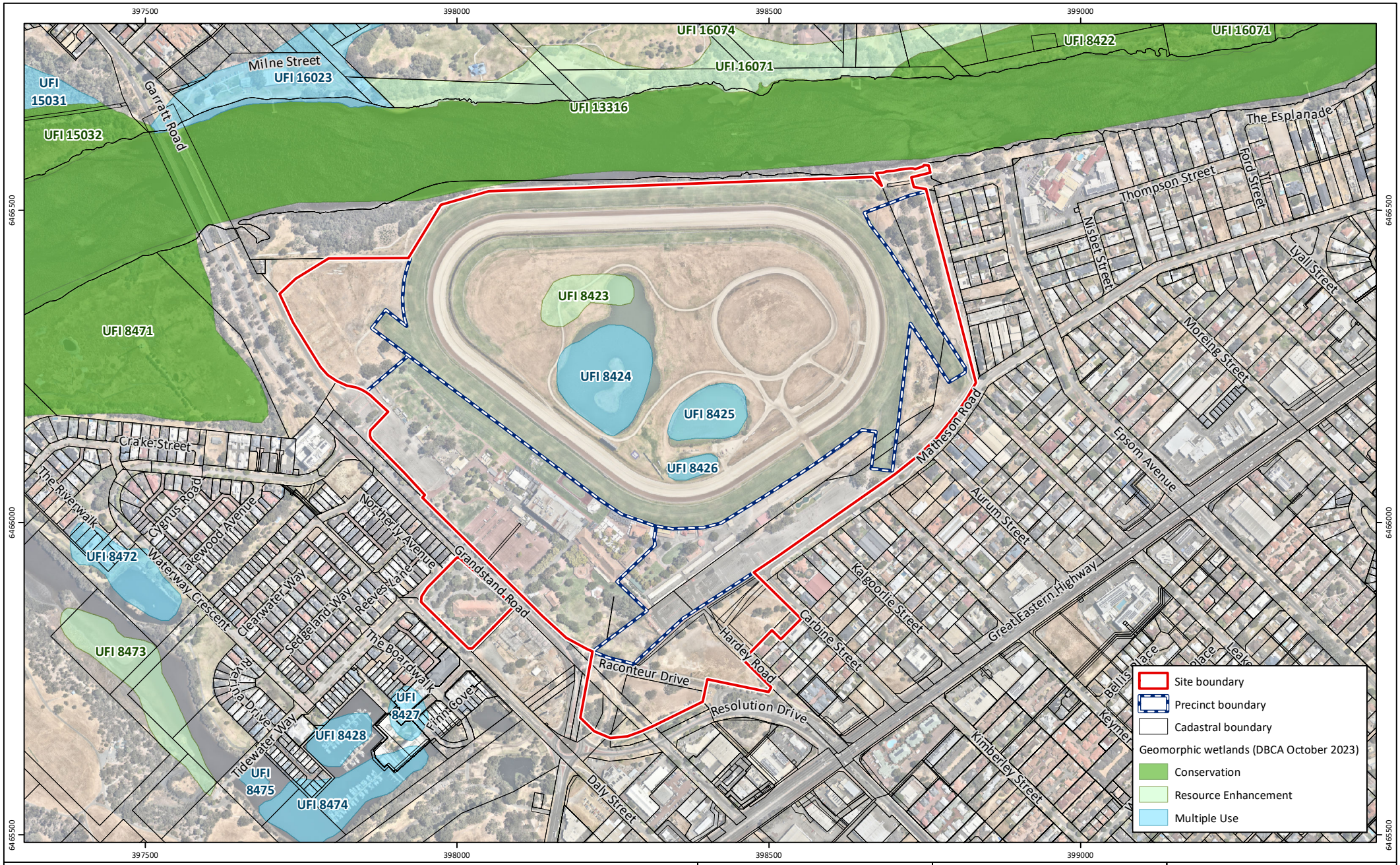


Figure 5: Environmental Assets

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F27

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

0 100 200 300
Metres
Scale: 1:8,000@A4
GDA2020 MGA Zone 50

emerge ASSOCIATES

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Version: 1, Version Date: 18/09/2024

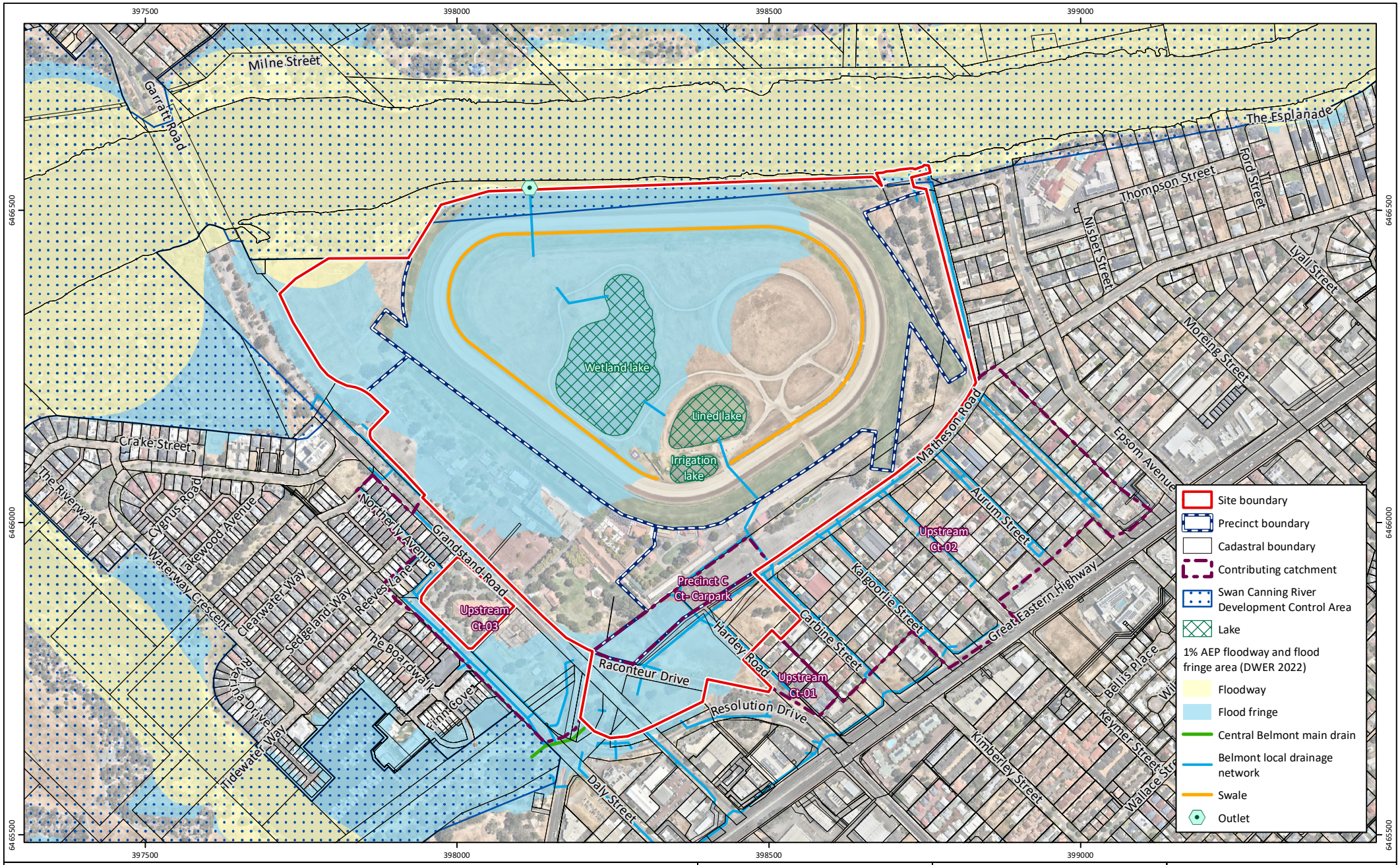


Figure 6: Hydrological Features

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F28

Drawn:	WJC
Date:	26/04/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

0 100 200 300
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

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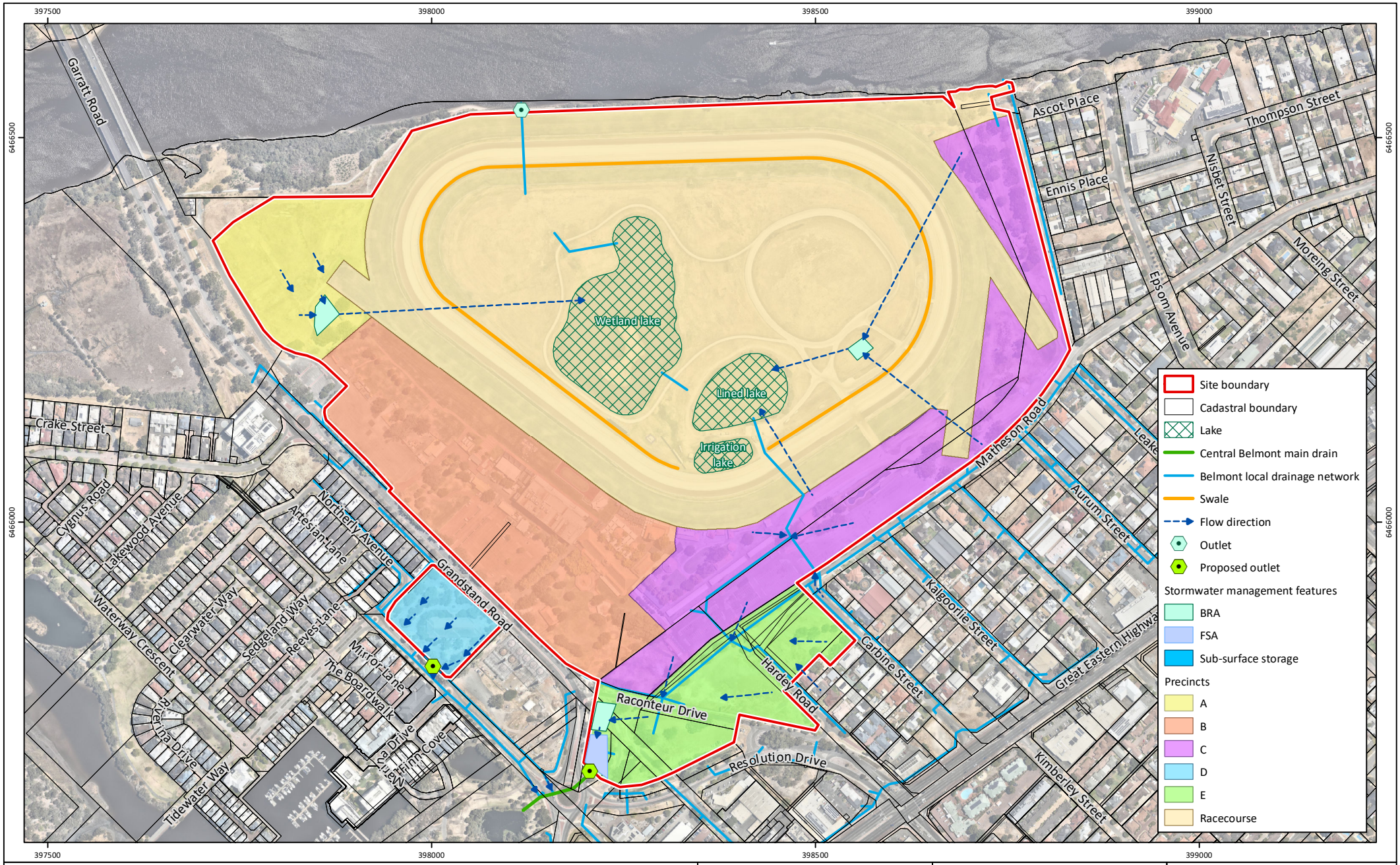


Figure 7: Ascot LSP Precinct Plan

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F29

Drawn:	WJC
Date:	01/05/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

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0 100 200
Metres
Scale: 1:6,500@A4
GDA2020 MGA Zone 50

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

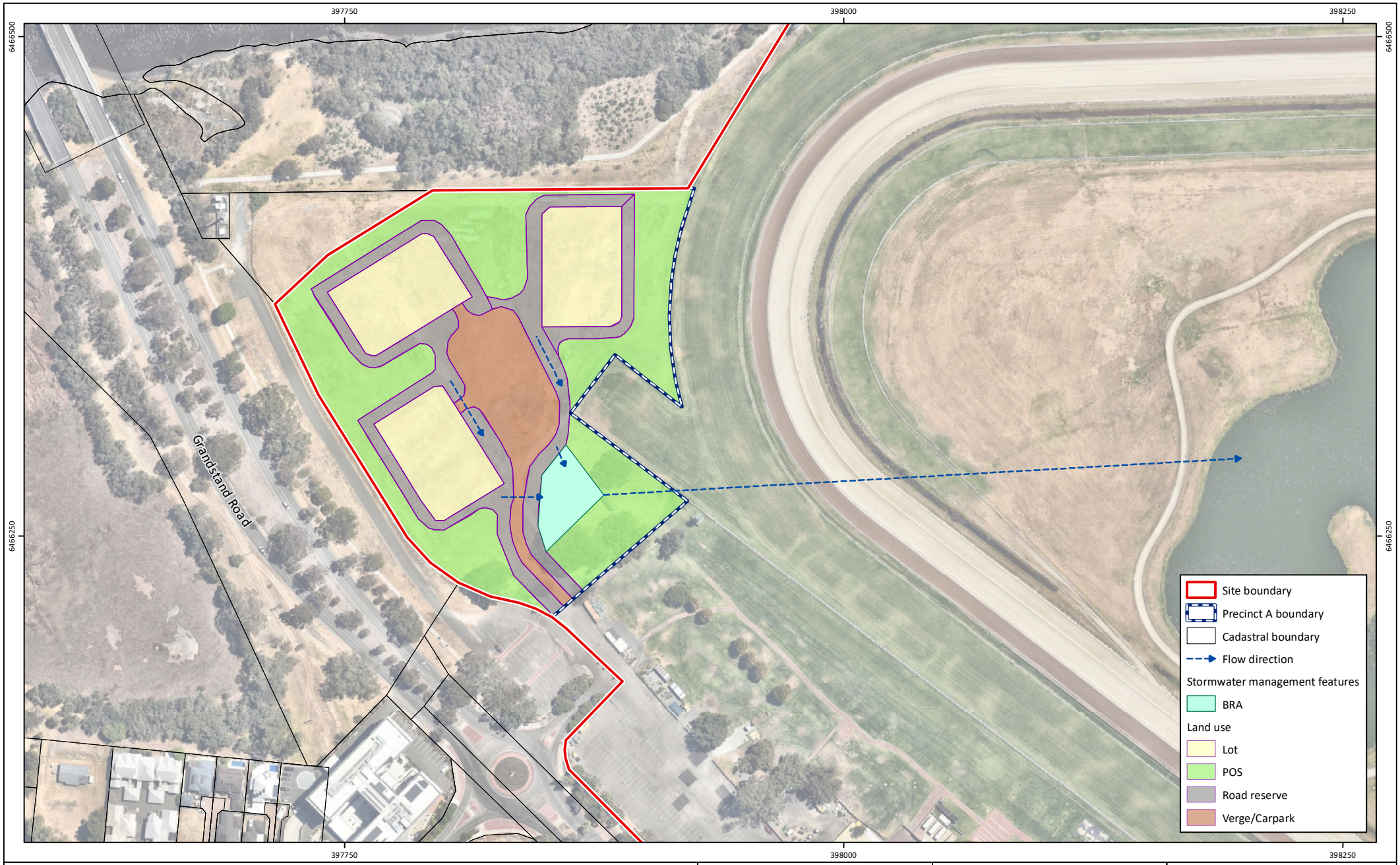


Figure 7A: Precinct A Stormwater Management Plan

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F32

Drawn:	WJC
Date:	01/05/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

0 40 80
Metres

Scale: 1:2,500@A4

GDA2020 MGA Zone 50

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

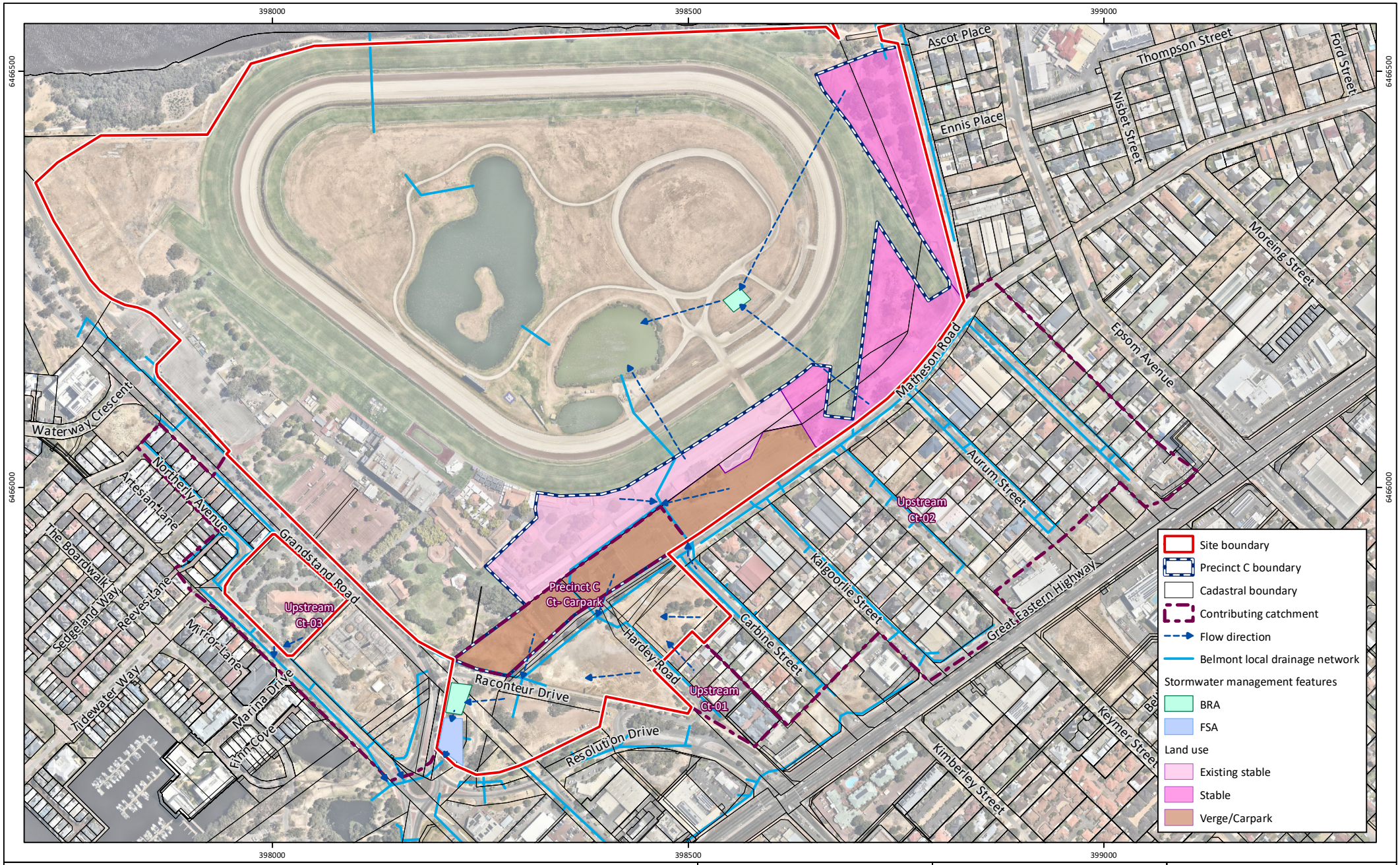


Figure 7B: Precinct C Stormwater Management Plan

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F33

Drawn:	WJC
Date:	01/05/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

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Version: 1, Version Date: 18/09/2024

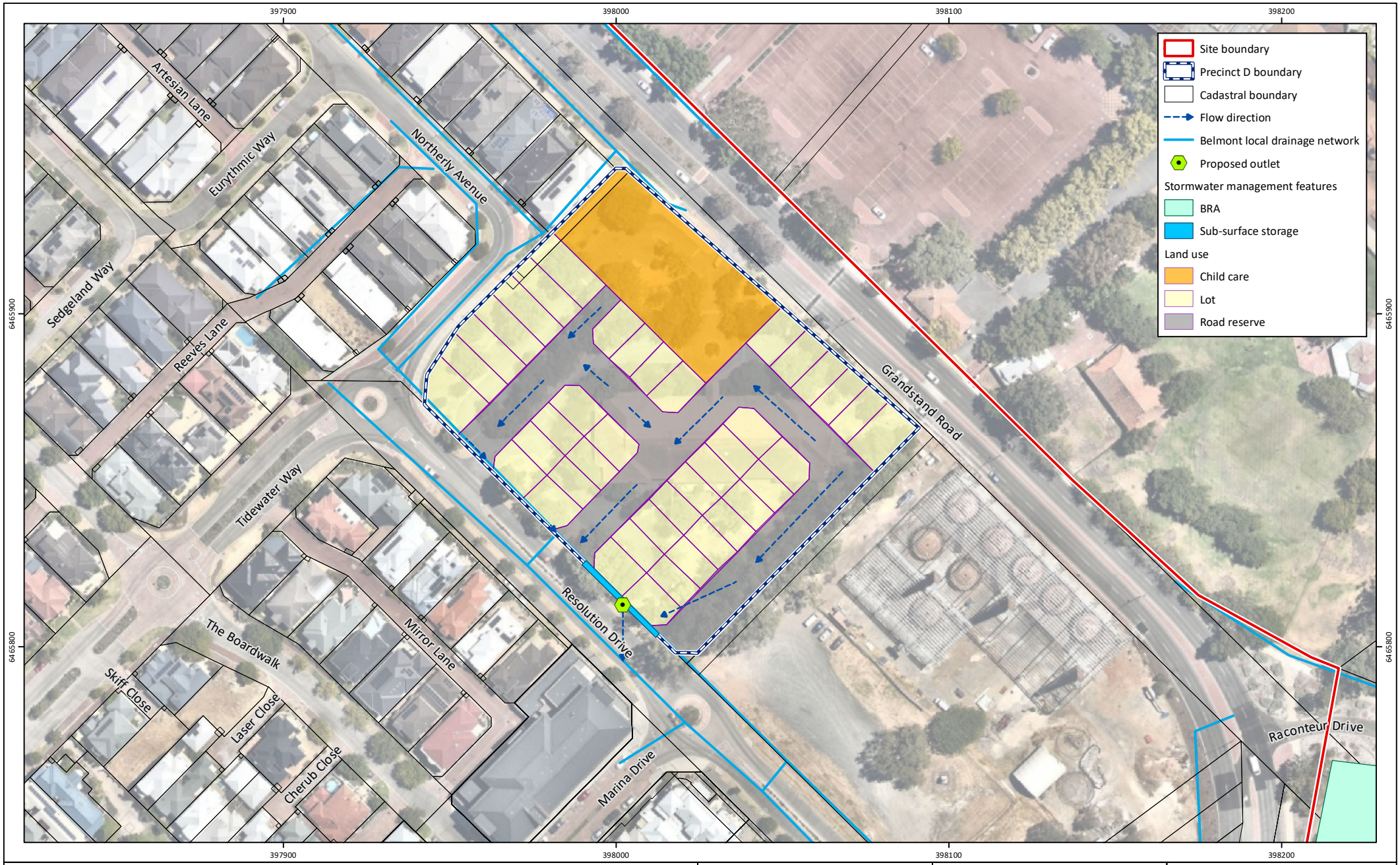


Figure 7C: Precinct D Stormwater Management Plan

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F34

Drawn:	WJC
Date:	01/05/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

0 25 50
Metres

Scale: 1:1,500@A4

GDA2020 MGA Zone 50

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

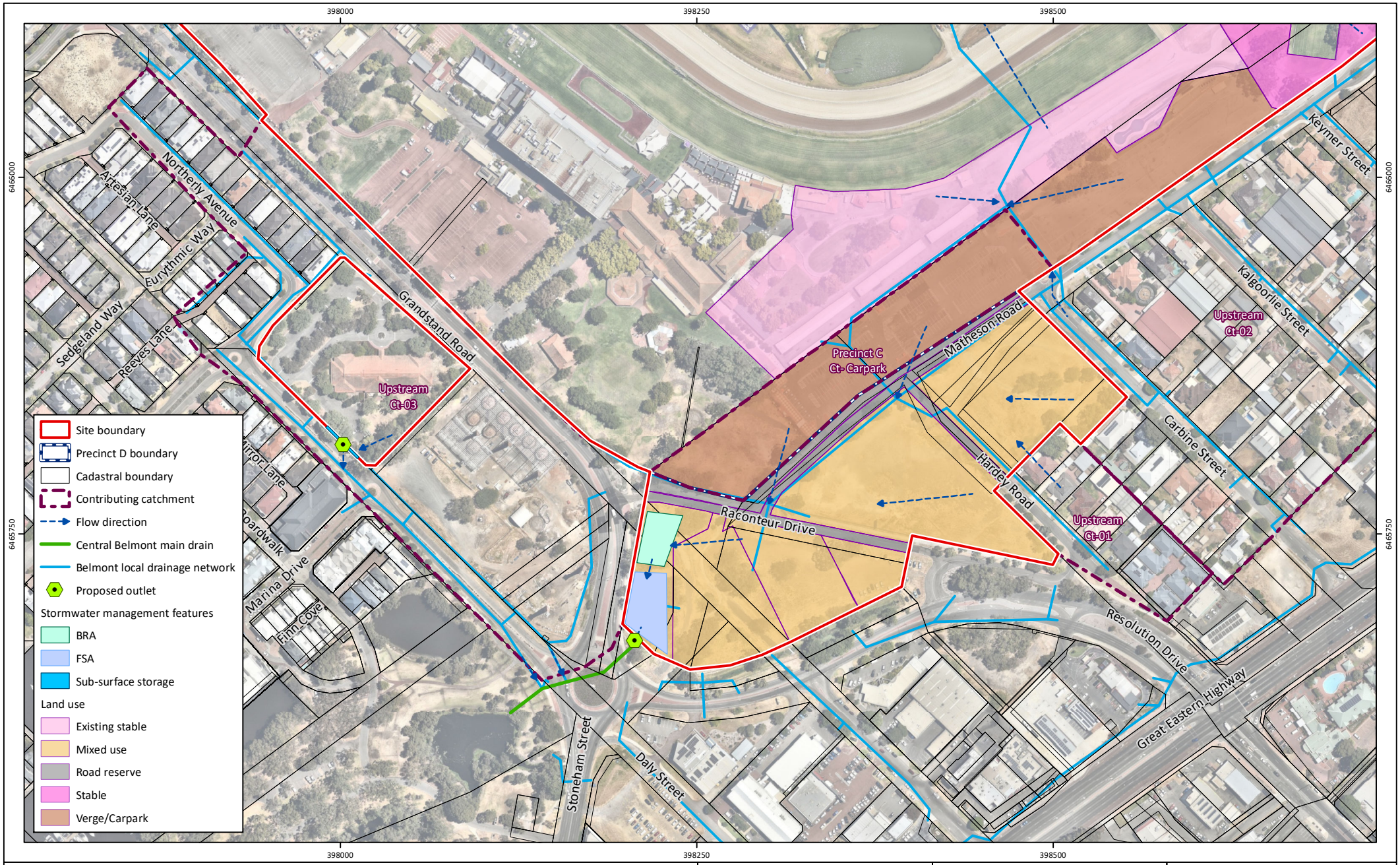


Figure 7D: Precinct E Stormwater Management Plan

Project:	Local Water Management Plan Golden Gateway Local Structure Plan
Client:	Perth Racing

Plan Number:
EP23-109(03)--F35

Drawn:	WJC
Date:	01/05/2024
Checked:	JM
Approved:	DPC
Date:	17/05/2024

N

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Metres
Scale: 1:3,500@A4
GDA2020 MGA Zone 50

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Version: 1, Version Date: 18/09/2024

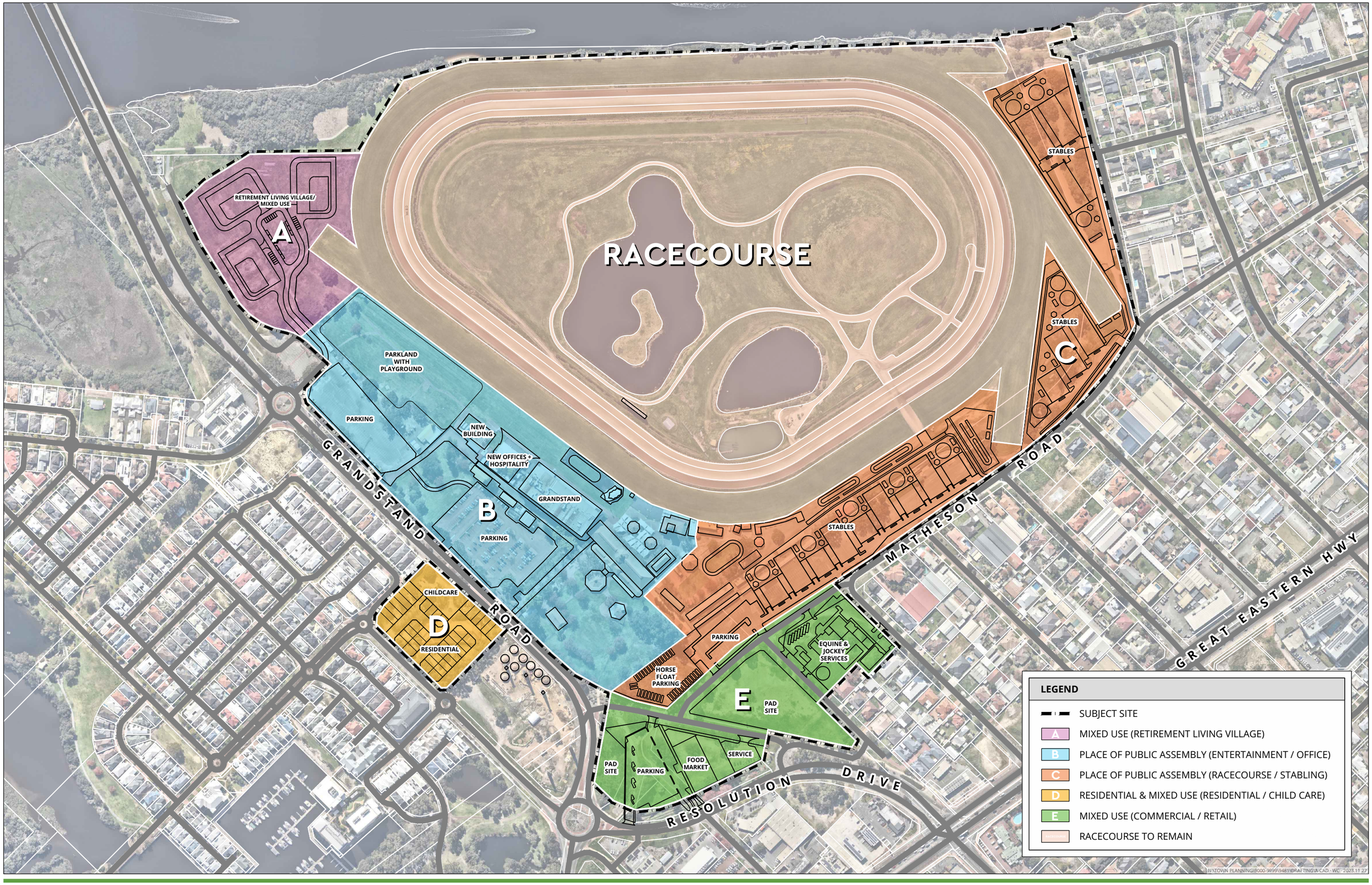
Appendix A

Concept plan

ROWE Group Design (2023)

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Version: 1, Version Date: 18/09/2024

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Version: 1, Version Date: 18/09/2024



DRAFT MASTER PLAN CONCEPT

VARIOUS LOTS - ASCOT RACECOURSE

ASCOT

DRAFT

N

0 100 m

SCALE @ A3: 1:4000

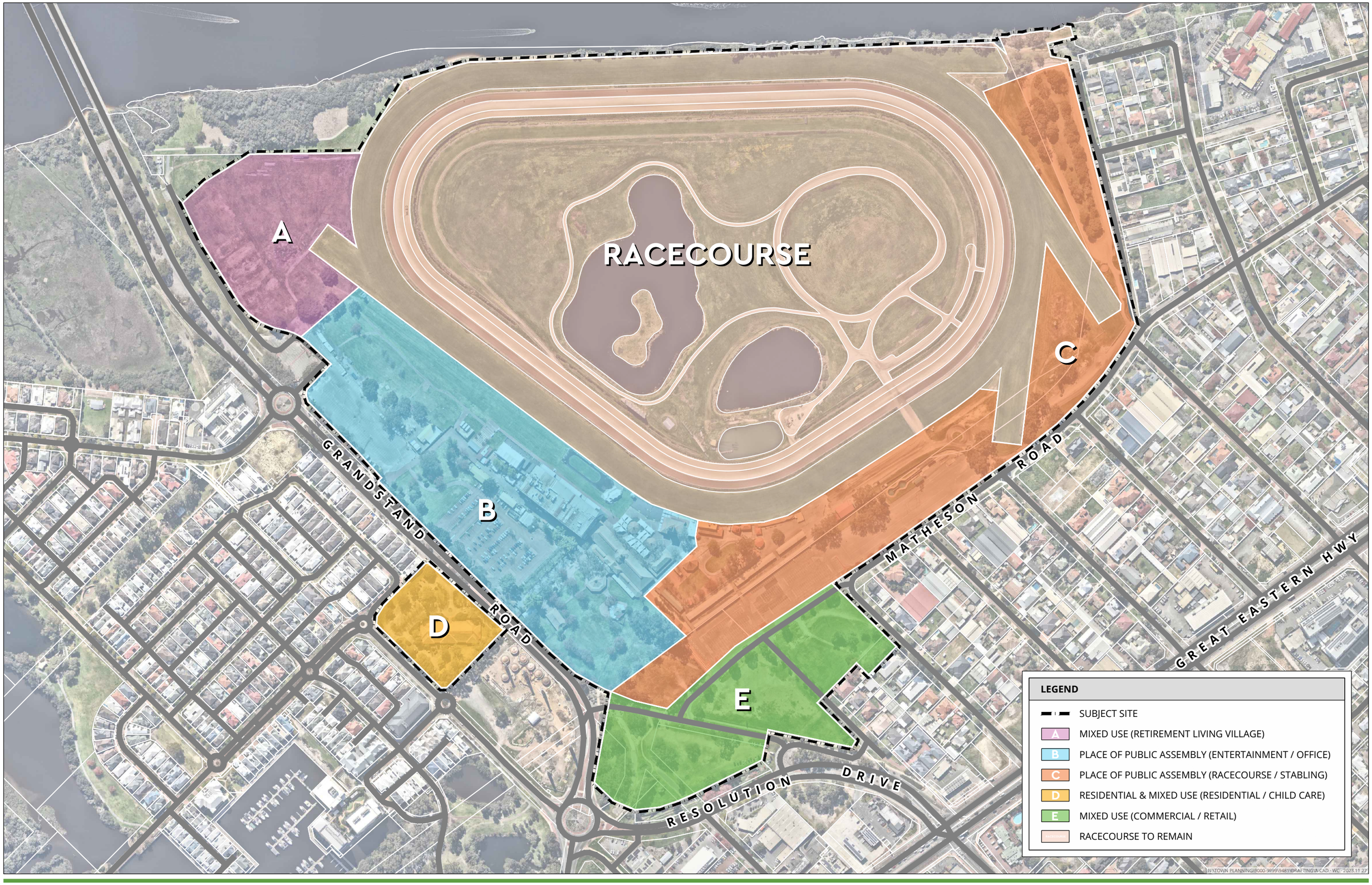
9481-CON-01-C

DRAWN: WC
DATE CREATED: 2023.11.27
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
AERIAL: NEARMAP 20230831

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STRUCTURE PLAN PRECINCTS

VARIOUS LOTS - ASCOT RACECOURSE

ASCOT

DRAFT

N

0 100 m

SCALE @ A3: 1:4000

9481-FIG-02-B

DRAWN:	WC
DATE CREATED:	2023.11.27
PROJECTION:	MGA50 GDA94
CADASTRE:	LANDGATE
AERIAL:	NEARMAP 20230831

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Appendix B

Geotechnical Reports

Precinct A – Douglas Partners 2024

Precinct D – Galt 2024

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Version: 1, Version Date: 18/09/2024

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Douglas PARTNERS

GROUNDED EXPERTISE

Report on Preliminary Geotechnical Investigation

Proposed Residential Development

Part of Lot 9002 Grandstand Road, Ascot WA

Prepared for Perth Racing

Project 219164.03

25 January 2024

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Douglas Partners Pty Ltd
ABN 75 053 980 117
douglaspartners.com.au
36 O'Malley Street, Osborne Park, WA 6017
(08) 9204 3511

Document History

Details

Project No.	219164.03
Document Title	Report on Preliminary Geotechnical Investigation
Site Address	Part of Lot 9002 Grandstand Road, Ascot WA
Report Prepared For	Perth Racing
Filename	219164.03.R.001.Rev0

Status and Review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Venkat Vallurapalli/Brendan Divilly	Frederic Verheyde	25 January 2024

Distribution of Copies

Status	Issued to
Revision 0	Perth Racing

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature	Date
Author	25 January 2024
Reviewer	25 January 2024

FS604853

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Version: 1, Version Date: 18/09/2024

Table of Contents

Page No

1. Introduction 1
2. Site Description 2
3. Field Work Methods 2
4. Field Work Results 3
   - 4.1 Ground Conditions 3
   - 4.2 Groundwater 4
5. Laboratory Testing 6
6. Proposed Development 6
7. Comments 7
   - 7.1 Site Suitability 7
   - 7.2 Site Classification 7
   - 7.3 Site Seismic Classification 7
   - 7.4 Excavation Conditions 8
   - 7.5 Slope Stability 8
   - 7.6 Foundation Options 9
   - 7.7 Pavement Construction 10
   - 7.8 Stormwater Drainage 10
   - 7.9 Additional Geotechnical Investigation 10
8. References 11
9. Limitations 11

Appendix A: About This Report

Appendix B: Test Location Plan

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Test Pit and Borehole Logs

CPT Results

Appendix C: Geotechnical Laboratory Test Certificates

ISO 9001 Quality Management Systems CERTIFIED
FS604853

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Report on Preliminary Geotechnical Investigation
Proposed Residential Development
Part of Lot 9002 Grandstand Road, Ascot WA

1. Introduction

This report presents the results of a preliminary geotechnical investigation undertaken for a proposed residential development across Part of Lot 9002 Grandstand Road, Ascot WA. The investigation was commissioned by Mr. James Oldring of Perth Racing in a signed order to proceed dated 8 August 2023 and was undertaken in accordance with Douglas' proposal dated 8 May 2023.

It is understood that Perth Racing is evaluating the feasibility of developing the northwest portion of Lot 9002 for possible residential use (the 'site').

The objective of the investigation is to assess the subsurface soil and groundwater conditions at across the site to provide preliminary comments on:

- The geotechnical suitability of the site for the proposed development.
- Geotechnical opportunities and constraints relevant to the proposed development.
- Areas of foundation risk including the presence of aggressive soils and strategies to address identified risks.
- Site preparation, including the possible reuse of existing soil as controlled fill.
- Excavation conditions.
- The likely site classification in accordance with the requirements of AS 2870-2011.
- Appropriate earthquake design factor for the site, in accordance with AS 1170.4-2007.
- Suitable foundation systems, including preliminary design parameters.
- Preliminary design parameters for the design of retaining structures and batter slopes.
- Depth to groundwater at the time of the investigation.
- Recommendations on additional geotechnical investigation at detailed design phase or to address specific ground conditions encountered.

The investigation included eight cone penetration tests, 16 test pits and one borehole excavated and drilled as a part of detailed site investigation (for contamination), and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

The investigation was conducted concurrently with a detailed site investigation (for contamination), which has been reported under separate cover (219164.01.R.001.Rev0). The detailed site investigation (for contamination) report should be read in conjunction with this report.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2. Site Description

The site comprises an irregular shaped area, approximately 36.2 ha in size, that covers a part of Lot 9002 Grandstand Road, within the Ascot Racecourse.

At the time of the field work, the majority of the site was vacant and vegetated with short grass. A few mature trees, about 5 m to 10 m in height, occupied the southern part of the site. A parking lot and small loading area were located at the south-western corner of the site. Some fly-tipped rubbish, including fences and posts, were observed at several locations across the site.

According to publicly available LiDAR data (DEM derived to 5 m), the topography across Lot 9002 is relatively flat with existing surface levels ranging from approximately RL 2 m relative to the Australian Height Datum (AHD) in the western part of the site to RL 3.5 in the north-eastern corner of the site.

The Perth 1: 50 000 Environmental Geology sheet indicates that shallow sub surface conditions beneath the western two thirds of the site comprise sandy silt of the Guildford Formation, and beneath the north-eastern corner and eastern corner of the site comprise alluvium.

The Perth Groundwater Atlas (2004) indicates that in May 2003, the groundwater level beneath the site was less than RL 1 m, or between approximately 1.0 m and 2.5 m below the existing surface level. The Atlas also indicates that the groundwater flow direction beneath the site in May 2003 was approximately northwest towards the Swan River.

The published acid sulfate soil risk mapping indicates that the site is located within an area which is mapped as "*high to moderate risk of acid sulfate soils occurring within 3 m of natural soil surface*".

3. Field Work Methods

Field work for the investigation was carried out between 11 October and 9 November 2023 and comprised:

- The excavation of 16 test pits.
- The drilling of one borehole.
- Perth sand penetrometer (PSP) or Dynamic cone penetrometer (DCP) testing adjacent to each test pit or borehole location.
- The performance of cone penetration tests at 8 locations (CPT24 to CPT31A). A total of 14 CPTs were undertaken after repeating CPTs at some locations in attempt to achieve greater testing depth following shallow refusal in uncontrolled fill.

The test pits (locations 7 to 22) were excavated using a 5-tonne excavator, equipped with 450 mm toothed bucket, and the borehole (location 23) was drilled using a 250 mm diameter power auger attached to the same excavator. The ground conditions at each test pit and borehole were logged in accordance with Australian Standard (AS 1726, 2017) by a geo-environmental engineer from Douglas. Soil samples were recovered from selected locations for subsequent laboratory testing.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Dynamic cone penetrometer (DCP) and Perth sand penetrometer (PSP) tests were undertaken adjacent to the test pit and borehole locations in accordance with Australian Standards (AS 1289.6.3.3, 1997; AS 1289.6.3.2, 1997) to assess the in-situ density of the shallow soils.

The CPTs use a 36 mm diameter instrumented cone with a following 130 mm long friction sleeve attached to rods of the same diameter, pushed continuously at a rate of 20 mm/sec into the soil by hydraulic thrust from a truck rig. Strain gauges in the cone and sleeve measure resistance to penetration and friction along the sleeve during penetration. This data is recorded on a computer and analysed to assess the type, properties and condition of the materials penetrated. The CPT's were pushed to termination depths of up to 20.2 m. Upon withdrawing the CPT probe, each test hole was dipped in an attempt to measure groundwater levels. CPTs were repeated at several test locations to attempt achieving greater testing depth following shallow CPT refusal on inferred hard foreign inclusions in the uncontrolled fill.

Test locations were determined using a handheld GPS and site features and are marked on Drawing 1, Appendix B. Surface elevations were recorded using a differential GPS with a reported accuracy of 0.1 m.

4. Field Work Results

4.1 Ground Conditions

The logs of the ground conditions and results of the field testing are presented in Appendix B, together with notes defining descriptive terms and classification methods, in Appendix A.

- **Uncontrolled FILL**
    - **Granular FILL - SAND, Organic SAND, Gravelly SAND, Silty SAND and Sandy GRAVEL (SP, SP-SM, SM and GP-GM)** – generally sandy fill (or gravelly material associated with pavement layers at location 23), uncontrolled (apart from the pavement layers), from surface to depths of between 0.6 m and 3.6 m depth, encountered at all locations. A layer of organic sandy fill layer was observed between 1.4 m and 1.8 m depth at location TP8. The sandy fill was generally loose to medium.
    - **Cohesive FILL - Clayey SAND, Sandy CLAY, CLAY (SM, SC, CI and CL-CI)** – generally stiff to very stiff, either underlying the aforementioned sandy fill material or interbedded within layers of sandy fill, encountered at test pit locations 9, 20, 21, 23, and CPT locations 24, 24A, 29 and 29A.

  A considerable amount of foreign inclusions such as fragments of brick, glass, timber, geo-fabric, concrete, plastic, rubber, scrap metal, terracotta pipes, redundant cables and PACMs were observed at all test pit locations, except location 22. A layer of asphalt was encountered at 0.95 m depth at TP9. The fill materials across the site are uncontrolled.

  It is noted that the fill extended below groundwater level at many locations.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Overlying natural soils including:

- **Clayey soils including Clayey SAND and CLAY** – ranging between very soft to soft and stiff to very stiff, encountered under the fill materials at CPTs 25, 30 and 31A to depths between 4.2 m and 14.9 m.
- **Sandy soils including SAND and Silty SAND** – underlying and interbedded within the above clayey soils at CPTs 25, 30 and 31A. The sand was generally very loose and loose to medium dense to depths between 10.5 m and 14.9 m, becoming medium dense and dense below.

4.2 Groundwater

Groundwater level observations between 18 September and 9 November 2023 are summarised in Table 1 and are shown on the logs in Appendix B.

The test holes were immediately backfilled following sampling, which precluded longer-term monitoring of groundwater levels. Six monitoring wells (MW01 to MW06) were installed as part of the preliminary environmental investigation (reported separately) and groundwater observations available from these wells at the time of report writing have been included in Table 1.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 1: Summary of Groundwater Levels

Location	Date of Measurement	Ground Surface Level [1] (m AHD)	Groundwater Depth (m)	Groundwater Level [2] (RL m AHD)
MW01	18 September 2023	1.9	1.30	0.6
MW02		2.0	1.46	0.5
MW03		3.2	2.37	0.8
MW04		2.4	1.59	0.8
MW05		2.5	1.21	1.3
MW06		2.2	1.09	1.1
TP7	9 November 2023	2.9	2.30	0.6
TP9		2.1	2.10	0.0
TP12		2.1	2.10	0.0
TP13		2.8	2.50	0.3
TP15		2.2	2.40	-0.2
TP16		2.6	2.50	-0.1
TP17		2.2	2.10	0.1
TP19		2.2	1.80	0..4
TP20		2.0	2.10	-0.1
TP21		2.1	1.80	0.3
TP22		2.3	1.80	0.5
BH23		2.4	1.70	0.7
CPT25	11 October 2023	3.4	3.00	0.4
CPT28		1.9	1.30	0.6
CPT29A		2.3	2.20	0.1
CPT30		3.2	2.80	0.4
CPT31A		2.1	2.00	0.1

Notes for Table 1: [1]: Surface level measured using a differential GPS.
[2]: Groundwater Level = Surface Level – Groundwater Depth.

It should be noted that groundwater levels are affected by climatic conditions and land usage and will therefore vary with time. In addition, owing to the proximity of the Swan River, the groundwater levels are expected to be impacted by the tidal river conditions and river flood levels.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

5. Laboratory Testing

A geotechnical laboratory testing programme was carried out by a NATA accredited laboratory and comprised:

- the particle size distributions on seven samples;
- the Atterberg Limits and linear shrinkage on three samples; and
- the organic content on four samples.

Results of the laboratory testing are summarised in Tables 2. The test certificates are presented in Appendix C.

Table 2: Results of Laboratory Testing for Soil Identification

Location	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	LS (%)	OC (%)	Material
TP8	1.5	9	61	30	-	-	-	-	6.8	FILL / Organic SAND SP-SM, with gravel and silt
TP13	1.5	4	95	1	-	-	-	-	1.6	FILL / SAND SP, trace gravel and silt
TP19	2.5	5	83	12	-	-	-	-	1.5	FILL / SAND SP, trace gravel and silt
TP21	2.0	40	51	9	37	24	13	8.5	-	Sandy CLAY CI, medium plasticity, trace gravel
TP22	2.0	7	93	0	NO	NP	NP	-	-	SAND SP-SM, with silt
TP23	2.0	45	48	7	44	22	22	9.5	-	FILL / Sandy CLAY CI, medium plasticity, trace gravel
TP23	2.5	12	87	1	-	-	-	-	1.2	FILL / SAND SP-SM, with silt, trace gravel

Notes: Fines = Finer than 75 µm.
Sand = Between 2.36 mm and 75 µm.
Gravel = Larger than 2.36 mm.
LL – liquid limit PL – plastic limit PI – plasticity index LS – linear shrinkage
OC – organic content NO – not obtainable NP – non plastic

6. Proposed Development

At the time of preparing this report, the details for the proposed development were not yet available. Notwithstanding, it is understood that the proposed development is likely to be residential and, given the location, is presumed would likely be multistorey and possibly include a basement level.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

7. Comments

7.1 Site Suitability

The investigation indicates that the site is generally underlain by uncontrolled fill overlying very soft to stiff clayey materials and very loose sandy soils becoming medium dense and dense with depth as described in Section 4.1 above.

From a geotechnical standpoint, there are several significant geotechnical constraints that will adversely impact on any development of the site including;

- Deep uncontrolled fill, unsuitable to support shallow foundations, and will impact on construction activities associated with deep piled foundations.
- Deep very soft and very loose natural soils under the uncontrolled fill, unsuitable to support shallow foundations.
- Shallow groundwater which will make earthworks across the site any possible remediation works of the above difficult. It should be noted that the abovementioned uncontrolled fill and soft soils both extend below groundwater.

Owing to the significant geotechnical constraints, any possible development will likely require a piled foundation solution into the medium dense and dense sandy soils, encountered below depths of approximately 10 m to 15 m. Additional geotechnical investigation will be required to confirm the foundation design and suitable pile design parameters. Also, noting that any proposed additional loading of the ground (for instance from the placement of fill to raise site levels, if proposed) would generate further consolidation of the soft soils underlying the site and cold result in some possible significant ground settlement. Therefore, surcharging areas (by placing temporary fill prior to construction of any structure) outside the proposed building envelopes might also be required during the site preparation to manage the risk of differential settlements between proposed buildings and adjacent ground, following their construction.

7.2 Site Classification

The shallow ground conditions beneath the site comprise uncontrolled fill materials and deep loose and soft soil deposits. Based on the results of the investigation and in accordance with Australian Standard (AS 2870, 2011), a site classification of 'Class P' applies to the site, owing to the presence of the uncontrolled fill and deep loose and soft soil.

7.3 Site Seismic Classification

Owing to the uncontrolled fill and deep very loose and very soft soil deposits across the site, an earthquake design soil sub-class of Ee is considered appropriate for this site in accordance with Australian Standard (AS 1170.4, 2007). The Hazard Factor (Z) for the site is 0.09, according to Australian Standard (AS 1170.4, 2007). Due to the deep loose soil below the water table, the site also has a significant potential for liquefaction. An assessment on the liquefaction potential of the site should be considered during any detailed investigation, when more details can be collected on the extent of deep loose soils.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

7.4 Excavation Conditions

The encountered ground conditions generally comprise uncontrolled fill, with some large foreign inclusions within the fill, extending below groundwater. Conventional earthmoving equipment (such as large excavators, say at least 20 t) should be generally suitable for shallow excavations in the surficial uncontrolled fill. Shallow groundwater is likely to impact excavations across the site.

The majority of the uncontrolled fill encountered during this preliminary investigation is considered to be geotechnically unsuitable for re-use as structural fill in its current condition. Any further consideration to reuse the uncontrolled fill would require some specific geotechnical provisions, such as screening and disposing its unsuitable components. Separating the re-useable granular components (e.g. the sandy fill) from its cohesive components (e.g. clayey fill) might also prove to be practically difficult. Owing to the significant variability of uncontrolled fill materials across the site, any re-use potential from a geotechnical standpoint should be confirmed on-site by a geotechnical engineer. Some environmental considerations (i.e. contamination) are also anticipated to be required. Overall, at this stage of the study, the reuse of the encountered uncontrolled fill should be considered to be associated with some significant constraints that might preclude such reuse.

7.5 Slope Stability

During construction, it is recommended that temporary batter slopes across the site are maintained flatter than 2:1 (H:V) if not retained. This batter angle is valid provided no surcharge loads (including live loads such as vehicles and machinery) apply at the top of the slope. In uncontrolled fill materials, a safe batter angler not steeper than 3:1 (H:V) is recommended for design for slopes not greater than 3 m in height, however, owing to variability of the uncontrolled fill materials, this value should be adjusted during construction based on the encountered conditions.

The design of unpropped flexible or rigid walls should be undertaken using a triangular pressure distribution and the earth pressure parameters given in Table 4. In addition to the soil pressure, wall design should also allow for external loads such as buildings, live loads and hydrostatic pressure. Owing to the likely significant settlements associated with the uncontrolled fill and deep soft soils, the requirement to adopt a piles foundation system to support proposed retaining walls is anticipated.

Table 4: Preliminary Soil Parameters for Earth Retaining Design

Soil Type and Density	Soil Unit Weight Above Water γ (kN/m^3)	Submerged Soil Unit Weight γ' (kN/m^3)	Drained Angle of Friction Φ' (°)	Undrained Shear Strength Cu (kPa)	Coefficient of Earth Pressure – Active K_a	Coefficient of Earth Pressure – Passive K_p	Coefficient of Earth Pressure – at Rest K_0
Uncontrolled Fill Materials	16	6	28	-	0.36	2.7	0.5

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

It should be noted that the passive earth pressure coefficient (second last column of Table 4) is an ultimate value and does not incorporate a factor of safety. Because the stress-strain relationship curve for lateral loading is not linear, relatively large strains are required to mobilise full passive pressure, but only relatively small strains are required to mobilise half the passive pressure, therefore it would be prudent to incorporate a factor of safety of at least 2 for uncontrolled fill materials, to derive design values from the ultimate values.

7.6 Foundation Options

Shallow footings are not considered suitable across this site, owing to the significant thickness of uncontrolled fill and deep loose and soft soils.

7.6.1 Piles

It is anticipated that a piled foundation system, with deep bored piles that penetrate the deep loose and soft soils into the medium dense and dense sandy soils at depth, would likely be required for any foundations on-site.

Bored piles will require temporary or permanent casing throughout the uncontrolled fill materials, noting that possible obstructions within the uncontrolled might cause some difficulties when driving the casing or drilling the pile hole. This pile type will involve soil excavation to target founding level and hence would produce spoil that needs to be handled and disposed of in a suitable manner, which will need to also be considered from an environmental standpoint.

Installation through the uncontrolled fill materials could be affected by the possible presence of large, hard inclusions and the design of the pile installation methodology should take this possibility into consideration.

The settlement of the uncontrolled fill will exert negative skin friction on the piles, which the piles will need to be designed to accommodate or be constructed in sleeves.

Additional deep geotechnical boreholes will be required across the site to inform on the pile design.

7.6.1 Controlled Modulus Columns

Controlled modulus columns could be installed as an alternative to conventional pile foundations, allowing shallow footings to be used whilst controlling settlements to acceptable limits.

Installation of controlled modulus columns involves displacing a column of material using a reverse flight auger, densifying the soil around the auger, and backfilling the resulting hole with cement ground under moderate pressure to create a 'hard' inclusion in the ground. The columns are typically 250 mm to 500 mm in diameter. Column spacings of columns typically 1.8 m to 2.5 m but would need input from a specialist ground improvement contractor. Columns can be installed to depths of up to 50 m, so could penetrate to the base of the uncontrolled fill and deep loose and soft soils. However, if large hard inclusions such as concrete slabs or beams, are encountered then the auger may experience refusal, as the CPTs did at several locations during the preliminary geotechnical investigation.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

A load transfer platform, such as a granular, well compacted fill layer, possibly reinforced with geogrid or geotextile, would be needed to transfer loads from shallow foundations to the columns.

One main benefit of this ground improvement option (compared to piling) would be to minimise differential settlement across the site and notably between buildings and surrounding grounds. However, it would likely be limited to low level development (say 2 to 3 level buildings), and this option is anticipated to likely be prohibitively expensive, with likely significant mobilisation and installation costs. The advice of a specialist ground improvement contractor, such as Menard Oceania, is suggested to be sought to further assess the suitability of this ground improvement to the proposed development.

7.7 Pavement Construction

The uncontrolled fill across the site does not form a suitable subgrade material for pavement in its current condition. Depending on the expected loading of proposed pavement, the requirement for some over-excavation of uncontrolled fill is likely. Construction should involve the use of a geo-composite layer (such as Global Synthetics' Combigrid) across the base of the over-excavation, overlain by a 500 mm thick layer of compacted crushed limestone, placement of a layer of geogrid (such as Global Synthetics' Secugrid), and a further 500 mm of compacted sand fill. The base of the constructed floating pavement footprint should be at least 2 m wider on each side than the total pavement width (4 m wider in total) to account for a suitable batter and transfer of load. Standard flexible pavements could then be constructed on the 1 m thick raft of stiffened subgrade. Placement of the initial base layer of composite geogrid may be difficult across areas of exposed uncontrolled fill. As such, depending on the site conditions, a 300 mm thick capping layer of clean fill may be required.

Regardless of the above site preparation, some settlement of the pavement should be expected over its service life and should be considered in the selection of the pavement surfacing. The use of pavers should be considered as such surfacing treatment would deform without cracking. Alternatively, a bituminous seal should be preferred over say an asphalt, owing to greater flexibility and to decrease maintenance and repair requirements, noting however that seals are less resistant than asphalt to shearing forces from tyres of turning heavy vehicles. The use a specialised asphalt, such as a stone mastic asphalt, could also be considered, noting it would be less resistant to the risk of cracking than a seal. Some allowance for regular maintenance and repairs should be allowed during the serviceability of the pavement.

7.8 Stormwater Drainage

Owing to the occurrence of low permeability soils and groundwater at shallow depth, the site is considered unsuitable for on-site stormwater disposal. It is suggested that stormwater is controlled using positive drainage or a subsoil drainage network, connected to a suitable outflow.

7.9 Additional Geotechnical Investigation

Additional geotechnical investigation across the site, by way of deep geotechnical boreholes (as a minimum), further CPT and additional laboratory testing, should be undertaken to help refine the ground model, provide pile design parameters, confirm suitable bearing strata for piles, and assess the soil aggressivity and exposure classification for piles. It is recommended that the detailed investigation programme be developed once some details of the proposed development

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

are known, if possible, in order to target specific geotechnical issues associated with the development.

The investigation covered in this report should be considered preliminary and as noted in selected sections of the report, additional detailed geotechnical testing at a greater testing frequency is anticipated once the project design has progressed.

8. References

AS 1170.4. (2007). *Structural Design Actions, Part 4: Earthquake Actions in Australia.* Reconfirmed 2018. Incorporating Amendments 1 & 2: Standards Australia.

AS 1289.6.3.2. (1997). *Methods for testing soils for engineering purposes - Soil strength and consolidation tests - Determination of the penetration resistance of a soil - 9kg dynamic cone penetrometer test.* Reconfirmed 2013: Standards Australia.

AS 1289.6.3.3. (1997). *Methods for testing soils for engineering purposes - Soil strength and consolidation tests - Determination of the penetration resistance of a soil - Perth sand penetrometer test.* Reconfimed 2013: Standards Australia.

AS 1726. (2017). *Geotechnical Site Investigations.* Standards Australia.

AS 2159. (2009). *Piling - Design and Installation.* Standards Australia.

AS 2870. (2011). *Residential Slabs and Footings.* Standards Australia.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at Part of Lot 9002 Grandstand Road, Ascot WA in accordance with DP's proposal dated 8 May 2023 and acceptance received from Mr James Oldring in a signed services order dated 8 August 2023. The work was carried out under DP's Engagement Terms. This report is provided for the exclusive use of Perth Racing for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope of work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

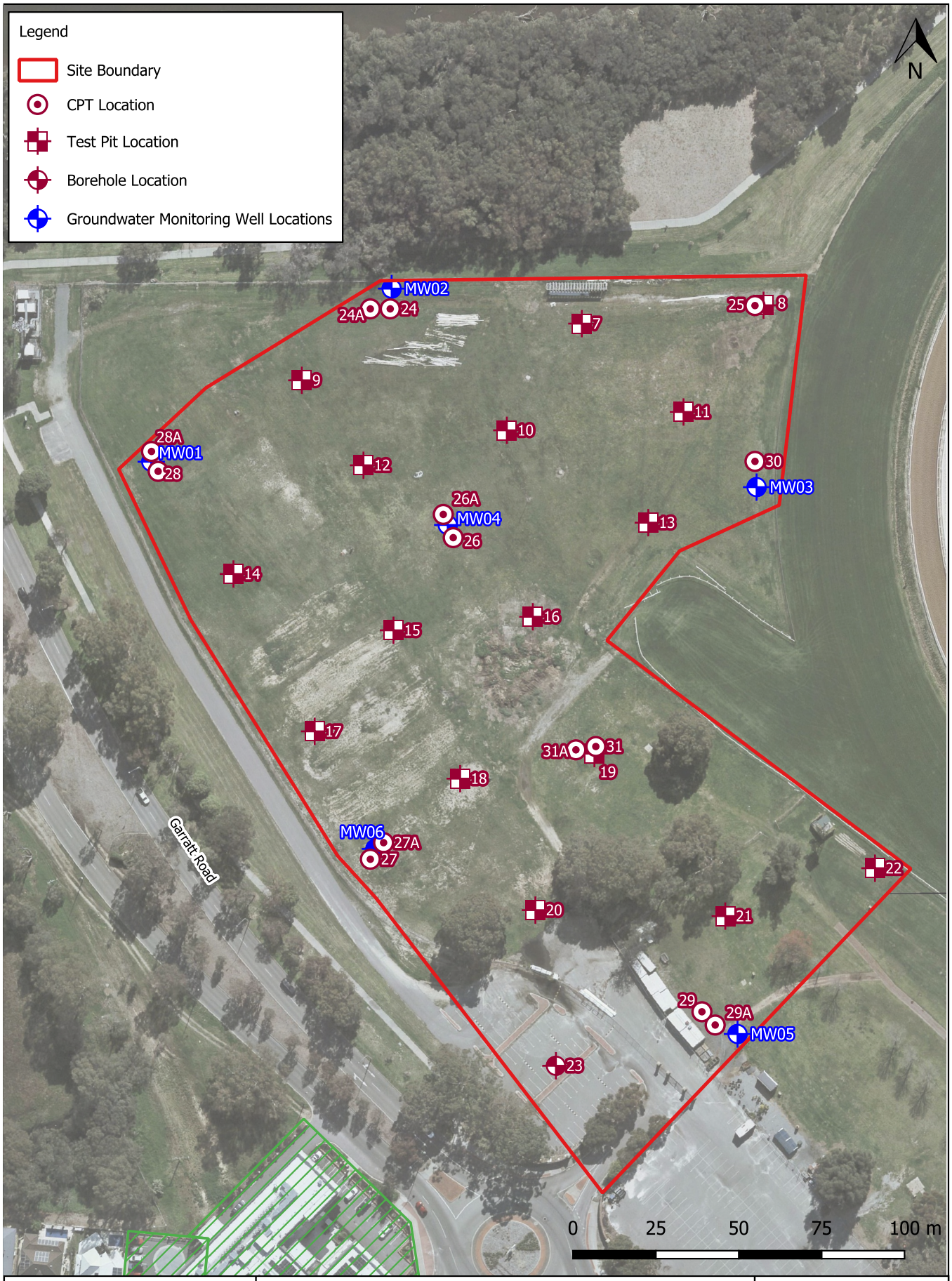
Appendix B

Test Location Plan

Test Pit and Borehole Logs

CPT Results

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024



Douglas PARTNERS	**Test Location Plan** **Proposed Residential Development** **Lot 9002 Grandstand Road, Ascot, WA**	PROJECT: 219164.03 Drawing No: 1 REV: 0
	CLIENT: Perth Racing	DATE: 24/1/2024

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 1.9 AHD
COORDINATE: E:397722.0, N:6466365.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 01
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
		0.00	FILL / SAND (SP-SM), with silt, trace rootlets: grey-brown; fine to medium; poorly graded.		FILL											
		0.40	FILL / SAND (SP-SM), with silt, trace rootlets: grey - brown; fine to medium.		FILL			M		ASS		0.50				
	1	1								ASS		1.00				
Ground Water Measured at 1.3 m 18/09/23										ASS		1.50				
	0	2								ASS		2.00				
		2.10	SAND (SP), trace silt: grey; fine to medium.		ALV			W		ASS		2.50				
	-1	3								ASS		3.00				
		3.60	Clayey SAND (CL-Cl): grey; fine to medium; low to medium plasticity clay.		ALV					ASS		3.50				
	-2	4	Borehole discontinued at 4.00m depth. Target Depth Reached.							ASS		4.00				
	-3	5										5				
	-4															

BACKFILL: 0.0 Bentonite Concrete; 0.5 Gravel backfill; 50mm Class 18
WELL PIPE: 50mm Class 18

NOTES (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.0 AHD
COORDINATE: E:397795.0, N:6466418.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 02
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
			FILL / SAND (SP-SM), with silt, trace gravel: grey; fine to medium.													
			From 0.40m: becoming orange-brown					M		ASS		0.50				
	1	1	From 1.10m: becoming grey-brown, trace limestone gravel		FILL					ASS		1.00				
▼										ASS		1.50				
Ground Water Measured at 1.46 m 18/09/23			1.60m: trace brick, limestone gravel, wet @ 1.6 m													
	0	2								ASS		2.00				
		2.20	Sandy CLAY (CL-CI): grey; low to medium plasticity; fine to medium sand.		ALV					ASS		2.50				
		2.70	SAND (SP), trace rootlets, trace silt: grey; fine to medium.					W								
	-1	3			ALV					ASS		3.00				
										ASS		3.50				
	-2	4	Borehole discontinued at 4.00m depth. Target Depth Reached.							ASS		4.00				
	-3	5										5				

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NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 3.2 AHD
COORDINATE: E:397905.0, N:6466358.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 03
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	3		FILL / SAND (SP), trace silt: orange; fine to medium.		FILL										Bentonite Concrete	
			From 0.30m: becoming grey, trace clay, limestone gravel													50mm Class 18
	2	1										1				
	1	1.60	FILL / Clayey SAND (SC), trace gravel: grey; fine to medium; low to medium plasticity clay.		FILL											
		2										2				
	1	2.20	FILL / SAND (SP), trace silt: orange - grey; fine to medium.		FILL										Gravel backfill	
▼ Ground Water Measured at 2.37 m 18/09/23			2.80m: trace brick													50mm Class 18
	0	3.00	FILL / Clayey SAND (SC): grey; fine to medium; low to medium plasticity clay.		FILL							3				
			3.30m-3.50m: with bitumen layer													
		3.60	FILL / CLAY (CL-CI), trace sand: grey - green; low to medium plasticity.		FILL											
	-1	4	Borehole discontinued at 4.00m depth. Target Depth Reached.									4				
	-2	5										5				

NOTES (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.4 AHD
COORDINATE: E:397812.0, N:6466346.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 04
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL / WELL PIPE
	2	0.00	FILL / SAND (SP-SM), with silt, trace rootlets: orange grey; fine to medium.		FILL				ASS		0.50			Bentonite Concrete; Gravel backfill; 50mm Class 18
		0.60	FILL / SAND (SP), with gravel, trace clay: grey; fine to medium; fine to medium gravel.						ASS		1.00			
	1								ASS		1.50			
▼			1.50m: trace brick, wet											
Ground Water Measured at 1.59 m 18/09/23	0		2.00m: trace brick		FILL				ASS		2.00			
									ASS		2.50			
	-1		3.00m: trace brick						ASS		3.00			
		3.20	SAND (SP), trace silt: grey-orange; fine to medium.		ALV									
		3.40	Clayey SAND (SC): orange-grey; fine to medium; low to medium plasticity clay.		ALV				ASS		3.50			
		3.60	Sandy CLAY (CL): grey; low to medium plasticity; fine to medium sand.		ALV									
	-2	4.00	Borehole discontinued at 4.00m depth. Target Depth Reached.						ASS		4.00			
	-3													

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

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Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.5 AHD
COORDINATE: E:397900.0, N:6466193.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 05
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL	WELL PIPE
Ground Water Measured at 1.21 m 18/09/23	2	0.60	FILL / SAND (SP-SC), with rootlets, with silt: orange-grey; fine to coarse. 0.30m: trace gravel		FILL					ASS		0.50			Bentonite Concrete	50mm Class 18
	1	1.40	FILL / Clayey SAND (SC): orange-grey; fine to medium; low to medium plasticity clay.		FILL					ASS		1.00			Gravel backfill	
	0	2.60	SAND (SP), trace silt: orange-grey; fine to medium.		ALV					ASS		1.50				
	-1	3.10	Sandy CLAY (CL): grey-black; low to medium plasticity; fine to medium sand.		ALV					ASS		2.00				50mm Class 18
		3.40	SAND (SP): grey; fine to medium.		ALV					ASS		2.50				
		4	Sandy CLAY (CL): grey-black; low to medium plasticity; fine to medium sand.		ALV					ASS		3.00				
			Borehole discontinued at 4.00m depth. Target Depth Reached.							ASS		3.50				
												4.00				
	-2	5										5				
	-3															

NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

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Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397790.0, N:6466249.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: MW 06
PROJECT No: 219164.01
DATE: 11/09/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	TESTING AND REMARKS: RESULTS AND REMARKS	BACKFILL	WELL PIPE
Ground Water Measured at 1.09 m 18/09/23	2	0.40	FILL / SAND (SP) : Sand, with rootlets, trace silt: orange-grey; fine to medium.		FILL										Bentonite Concrete	50mm Class 18
	1		FILL / SAND (SP), with gravel: grey-brown; fine to medium.							ASS		0.50				
			From 0.80m: becoming grey, no gravel													
			From 1.10m: becoming orange-grey		FILL											
	0	2	From 1.80m: becoming grey and trace brick									2				
		2.20	FILL / Clayey SAND (CL): grey; fine to medium; low to medium plasticity clay; may be natural.		FILL										Gravel backfill	50mm Class 18
		2.60	SAND (SP): grey; fine to medium.		ALV											
	-1	3										3				
		3.10	Sandy CLAY (CL): dark grey; low to medium plasticity; fine to medium sand.		ALV											
		4	Borehole discontinued at 4.00m depth. Target Depth Reached.									4				
	-2															
		5										5				
	-3															

NOTES (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Geoprobe 7822DT
METHOD: Direct Push Probing
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.

OPERATOR: DPP

LOGGED: VV
CASING: Nil

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

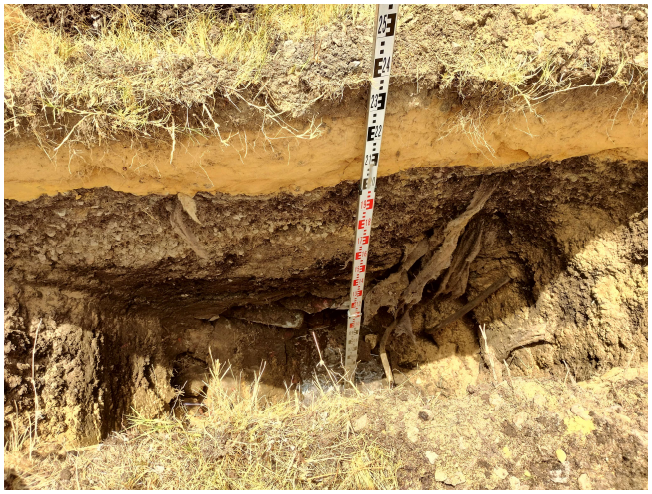
CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.9 AHD
COORDINATE: E:397852.9, N:6466410.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP07
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium. From 0.17m: becoming orange		FILL	MD to VD	D to M		ES		0.10	PID	<1ppm
			0.54m: trace geo-fabric						ES		0.40 / 0.50	PID	<1ppm
		0.60	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand. 0.84m: trace geo-fabric		FILL								
		0.90	FILL / GRAVEL (GP-GM) : Gravel, with mulch, with sand: dark brown and dark grey-brown; with silt.		FILL				ES		1.00 / 1.10	PID	<1ppm
		1.40	FILL / SAND (SP-SM), with silt: dark grey; fine to medium. 1.50m: trace PACM fragment. From 1.60m-2.60m: with fragments of bricks, concrete and metal roofing sheetings		FILL	ND	M	ASB9, ASB10 AF/FA	D / ES		1.50 / 1.60	PID	<1ppm
▼ 09/11/23									ES		2.00 / 2.10	PID	<1ppm
							W		ES		2.50 / 2.60	PID	<1ppm
			Test Pit discontinued at 2.60m depth. (Collapsing conditions).										

DCP9/150 — PID <1ppm — 5 — 10 — 15





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.3 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 3.6 AHD
COORDINATE: E:397905.7, N:6466414.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP08
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL	VD	M		ES		0.10	PID	<1 ppm
		From 0.43m: becoming pale grey, trace gravel									PSP/150	5 / 10 / 15 / Refusal 20
								ES		0.50 0.60	PID	<1 ppm
	1	From 1.20m: becoming grey						ES		1.00 1.10	PID	<1 ppm
	1.40	FILL / organic SAND (SP-SM), with silt, with gravel: dark grey-brown; fine to medium; trace fragments of brick and concrete.		FILL	ND		AF/FA ASB 8	D ES MAT		1.50 1.60	PID	<1 ppm
	2	1.55m-2.00m: with fragments of brick, concrete and PVC										
	1.80	FILL / SAND (SP), trace gravel, fragments of brick and concrete, trace silt: dark grey; fine to medium.		FILL				D ES		2.00 2.10	PID	<1 ppm
		2.20m: trace metal sheet, PVC										
		2.40m: trace rubber pipe, metal bar						ES		2.50 2.60	PID	<1 ppm
		Test Pit discontinued at 2.70m depth. (Test Pit terminated due to slow digging).										





NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.1 AHD
COORDINATE: E:397768.9, N:6466392.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP09
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.45	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL	D to VD	D to M		ES		0.10	PID	<1ppm
		FILL / Clayey SAND (SC): orange-brown; fine to medium; low to medium plasticity clay.		FILL				D ES		0.50 0.60	PID	<1ppm
	0.95 0.98	FILL / ASPHALTIC CONCRETE: black, 7 mm sized nominal aggregate.						ES		1.00 1.10	PID	<1ppm
		FILL / Silty SAND (SM): brown; fine to medium. From 1.15m: becoming grey-brown From 1.20m: with fragments of brick, concrete slab of 0.4 m in thickness, geo-fabric, metal bar and terracotta pipe 1.40m: trace metal sheet		FILL	ND	M		ES		1.50 1.60	PID	<1ppm
▼ 09/11/23	2	1.90m-2.10m: trace pockets of Clayey SAND SC				W		ES		2.00 2.10	PID	<1ppm
		Test Pit discontinued at 2.30m depth. (Collapsing conditions).										

PID (ppm): 5, 10, 15
PID/150: REFUSAL 25 25





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.1 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.4 AHD
COORDINATE: E:397829.1, N:6466375.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP10
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0	FILL / SAND (SP-SM), with silt, trace rootlets: bands of grey, orange-brown and pale grey; fine to medium.		FILL	MD to D		DUP 2	ES		0.10	PID	<1ppm
		0.70m: trace geo-fabric						ES		0.50	PID	<1ppm
	0.80	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL						0.60		
	1							ES		1.00	PID	<1ppm
	1.20	FILL / SAND (SP), trace rootlets, trace silt: grey -brown; fine to medium.		FILL	ND					1.10		
		From 1.40m-1.80m: with fragments of brick and concrete						ES		1.50	PID	<1ppm
		From 1.80m: becoming dark grey, trace fragments of brick and concrete								1.60		
	2							ES		2.00	PID	<1ppm
		Test Pit discontinued at 2.15m depth. (Test Pit terminated due to slow digging).								2.10		

PSP/TD





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NOTES: [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

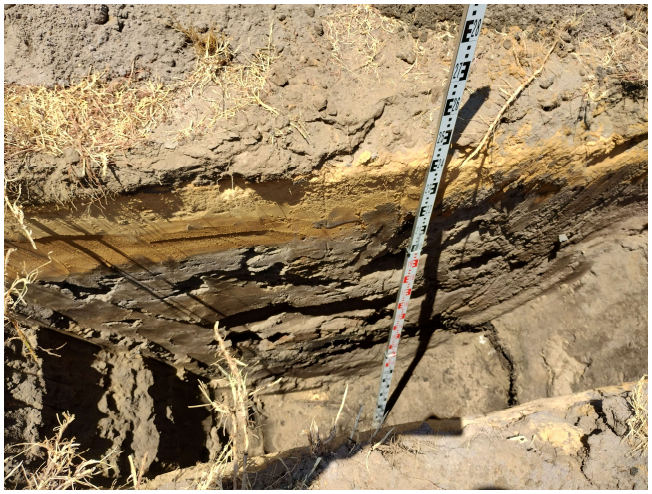
TEST PIT LOG

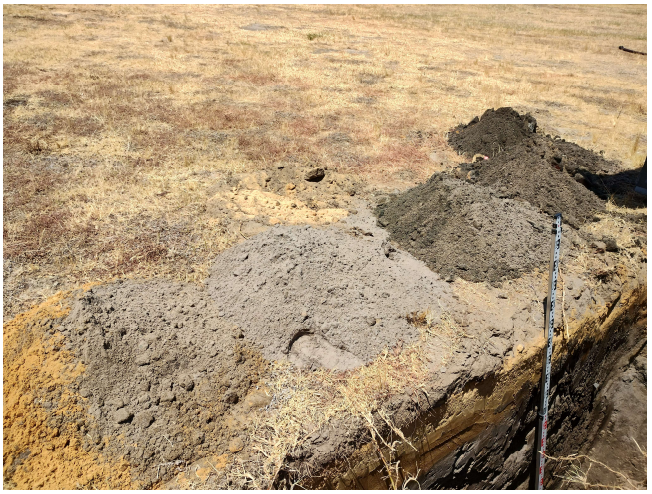
CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 3.1 AHD
COORDINATE: E:397881.2, N:6466387.1
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP11
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) / DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	3	FILL / SAND (SP-SM), with silt: grey and orange-brown; fine to medium.			VD	D to M		ES		0.10	PSP/150	5 10 15 REFUSAL 25 25
		From 0.35m: becoming grey						ES		0.50 0.60		
	1						DUP 3	D ES		1.00 1.10		
	2			FILL		M						
		From 1.60m: becoming dark grey, trace fragments of brick			ND			D ES		1.60 1.70		
		From 1.70m-2.40m: with fragments of brick and concrete										
	2	1.80m: piece of concrete boulder (1 m x 0.5 m) observed						ES		2.00 2.10		
	1	2.10m: trace plastic bottle, glass bottle, concrete rubble										
		2.30m: trace fragments of wooden plank and timer						D		2.30		
		Test Pit discontinued at 2.40m depth. (Test Pit terminated due to slow digging).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.1 AHD
COORDINATE: E:397785.4, N:6466366.6
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP12
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0	FILL / SAND (SP-SM), with silt, trace gravel and rootlets: grey; fine to medium.		FILL	D to VD	D to M		ES		0.10	PID	<1ppm
		From 0.20m: becoming yellow-brown						ES		0.50 0.60	PID	<1ppm
	0.85 0.90	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL				D ES		1.00 1.10	PID	<1ppm
	1	FILL / SAND (SP), trace fragments of brick, scrap metal, timber and rubber cable, trace silt: dark grey-brown; fine to medium.					AF/FA, ASB 6, ASB 7					
		1.30m-1.80m: with fragments of plastic waste, insulation material, terracotta pipes and concrete, trace PACM fragments		FILL	ND	M		ES		1.50 1.60	PID	<1ppm
	2	From 1.90m: becoming green-grey, trace pockets of CLAY CL-CI						B ES		2.00 2.10	PID	<1ppm
▼ 09/11/23	0					W						
		Test Pit discontinued at 2.30m depth. (Collapsing conditions).										

PSP/TD: 5 10 15 25





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.1 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.8 AHD
COORDINATE: E:397872.7, N:6466350.7
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP13
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) / DENSITY.(†)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium; 10% non-plastic fines. From 0.15m: becoming orange. 0.70m: trace geo-fabric		FILL	D to VD	D to M		ES		0.10	PID	<1ppm
		0.75	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand. 1.20m: trace geo-fabric		FILL				D		0.50	PSP/150	5 / 10 / 15 / 25
									ES		0.60	PID	<1ppm
		1.30	FILL / SAND (SP), trace gravel, fragments of brick and concrete, trace silt: dark grey; fine to medium. 1.50m-2.40m: with fragments of bricks and concrete slab		FILL	ND	M		ES		1.00	PID	<1ppm
											1.10		
									D		1.50	PID	<1ppm
									ES		1.60		
					FILL				ES		2.00	PID	<1ppm
											2.10		
▼ 09/11/23							W		ES		2.50	PID	<1ppm
											2.60		
			Test Pit discontinued at 2.70m depth. (Collapsing conditions).										





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NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.5 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397745.6, N:6466334.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP14
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	2 / 0.25	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL	D to VD	D to M		ES		0.10	PID	<1ppm
		FILL / Silty SAND (SM): brown and grey-brown; weakly to moderately cemented.									DCP9/150	29 / 30
		0.65m: trace fragments of brick and glass						D		0.50		
		0.72m-2.00m: with framgnes of brick, metal sheet and insulation material						ES		0.60	PID	<1ppm
	1	0.92m: trace fragments of plastic waste, glass and limestone boulders						ES		1.00	PID	<1ppm
	1			FILL	ND	M				1.10		
								ES		1.50	PID	<1ppm
										1.60		
	2	2.00m: becoming gren-grey, trace fragments of timber, brick and concrete blocks, with pockets of Clayey SAND SC						ES		2.00	PID	<1ppm
	0									2.10		
		From 2.20m: with fragments of brick and scrap metal						D		2.40		
		Test Pit discontinued at 2.50m depth. (Test Pit terminated due to slow digging).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397794.3, N:6466319.4
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP15
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace gravel and rootlets: orange-brown; fine to medium.						ES		0.10	PID	<1ppm
			From 0.24m: becoming grey		FILL	VD	D to M					DCP9/150	
			From 0.42m: becoming pale grey						D		0.50	PID	<1ppm
									ES		0.60		
		0.75	FILL / Sandy GRAVEL (GP-GM), with silt: dark brown and grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL	ND							22
		0.95	FILL / SAND (SP), with fragments of brick and concrete, trace silt: grey; fine to medium.						D		1.00	PID	<1ppm
									ES		1.10		
			1.20m: trace fragments of timber, terracotta pipe and scrap metal										
			1.50m: trace redundant cable				M		ES		1.50	PID	<1ppm
											1.60		
			From 1.80m: becoming orange-brown		FILL	ND							
			2.00m: trace PACM pipe					AF/FA, ASB 5	ES		2.00	PID	<1ppm
			2.10m: trace fragments of timer								2.10		
▼ 08/11/23			From 2.40m: becoming dark grey				W		ES		2.50		
											2.60		
			Test Pit discontinued at 2.70m depth. (Test Pit flodded with water seepage).										





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.4 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.4 AHD
COORDINATE: E:397837.5, N:6466321.2
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP16
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*)	DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace gravel and rootlets: grey; fine to medium.		FILL					ES		0.10	PID	<1ppm
		0.34	FILL / Sandy (GP-GM), with silt: grey; fine to medium sand.		FILL	ND		D to M		ES		0.50 0.60	PID	<1ppm
			0.80m: trace fragments of plastic waste											
		0.84	FILL / SAND (SP), with fragments of brick and concrete, trace silt: grey; fine to medium.		FILL	MD to D		M		ES		1.00 1.10	PID	<1ppm
			1.50m: trace fragments of plastic waste							D ES		1.50 1.60	PID	<1ppm
			2.00m: trace metal plate (0.5 m x 0.5 m) 2.10m: with limestone boulders			ND				ES		2.00 2.10	PID	<1ppm
▼ 08/11/23								W		D ES		2.50 2.60	PID	<1ppm
			Test Pit discontinued at 2.60m depth. (Collapsing conditions).											

DCP9/150: 5, 10, 15





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:

REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.5 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Generated with CORE:GS by Geroc - Soil Log with Photo

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

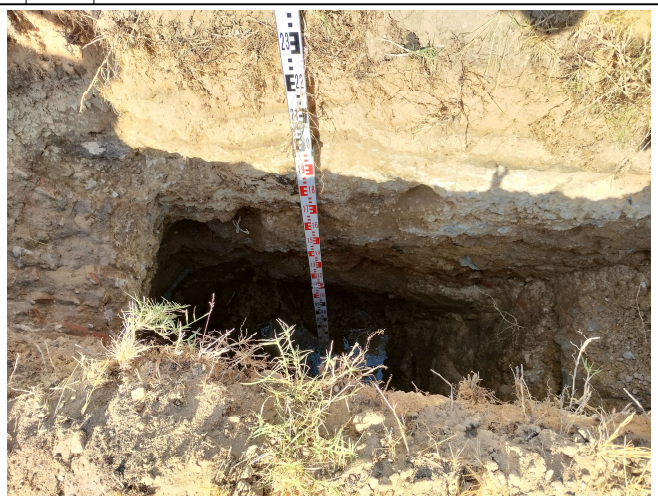
CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397775.7, N:6466289.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP17
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†) / DENSITY.(†)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	0.15	FILL / SAND (SP-SM), with silt, trace rootlets: orange - grey; fine to medium.		FILL	L to VD	D to M		ES		0.10	PID	<1ppm
		FILL / Sandy GRAVEL (GP-GM), with fragments of concrete, with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL				ES		0.50 0.60	PID	<1ppm
	0.90	FILL / SAND (SP), with fragments of brick and concrete, trace silt: grey; fine to medium.		FILL	ND	M		ES		1.00 1.10	PID	<1ppm
		1.10m: trace fragments of plastic waste										
		1.60m: trace metal sheets					ASB 3	ES		1.50 1.60	PID	<1ppm
		1.90m: piece of concrete block observed										
▼ 08/11/23						W	ASB 4	ES		2.00 2.10	PID	<1ppm
		Test Pit discontinued at 2.50m depth. (Collapsing conditions).										

DCP9/150: 5, 10, 15, 25





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:

REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.1 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397816.0, N:6466272.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP18
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	2 / 0.26	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium; weakly cemented.		FILL		D to M		ES		0.10	PID	<1ppm
	0.45	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand.		FILL	ND							
	1	FILL / SAND (SP), with fragments of brick and concrete, with clay: grey; fine to medium.		FILL	MD to VD	M	ASB 1	ES		0.50 0.60	PID	<1ppm
		0.50m-1.50m: with fragments of tile and brick, trace PACM fragments 0.75m: trace metal bar 1.00m: trace fragments of redundant cables, glass, geo-fabric and limestone blocks From 1.20m: with limestone boulders						D ES		1.00 1.10	PID DCP 9/150	<1ppm 5 10 15
					ND			ES		1.40 1.50	PID	<1ppm
	0 / 2	Test Pit discontinued at 1.50m depth. (Test Pit terminated due to slow digging).								2		





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NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
No free groundwater observed.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.2 AHD
COORDINATE: E:397856.8, N:6466280.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP19
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
			FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL			DUP 1	ES		0.10	PID	<1ppm
	2	0.20	FILL / Sandy GRAVEL (GP-GM), with silt: orange-brown; medium to coarse; fine to medium sand; Gravel is crushed limestone.		FILL	ND	D		D		0.50	PID	<1ppm
									ES		0.60		
		0.70	FILL / SAND (SP-SM), with silt, trace gravel: grey-brown; fine to medium.										
			0.75m: trace concrete slab, fragments of brick and terracotta pipes										
	1		From 0.90m: with fragments of brick			MD			ES		1.00	PID	<1ppm
			From 1.20m: becoming grey, trace fragments of timber		FILL		M				1.10	PSD 150	5 10 15
			From 1.60m: becoming grey-brown						ES		1.50	PID	<1ppm
▼ 09/11/23											1.60		
		1.90	FILL / SAND (SP), trace roots, trace silt: dark grey; fine to medium.						ES		2.00	PID	<1ppm
	2				FILL	ND	W				2.10		
			2.40m: trace fragments of sea shells						D		2.50	PID	<1ppm
									ES		2.60		
			Test Pit discontinued at 2.60m depth. (Collapsing conditions).										





NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:

REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 1.8 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.0 AHD
COORDINATE: E:397838.6, N:6466231.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP20
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED									SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) DENSITY.(*)	MOISTURE		REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.05	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL		D to M			ES		0.10	PID	<1ppm
		0.34	FILL / Sandy GRAVEL (GP-GM), with silt: yellow-brown; medium to coarse; fine to medium sand.		FILL									
			FILL / SAND (SP-SM), with silt, trace gravel: grey and orange-brown; fine to medium.			MD to VD				ES		0.50	PID	<1ppm
			0.50m: with fragments of brick and concrete									0.60		
			0.80m: trace fragments of rubber waste and scrap metal											
	1				FILL					D		1.00	PID	<1ppm
										ES		1.10		
			From 1.20m: becoming dark grey, with fragments of brick				M							
			1.30m-2.10m: with hydrocarbon odour											
			1.50m: with pockets of Clayey SAND SC							D		1.50	PID	9.4ppm
										ES		1.60		
		1.80	FILL / Clayey SAND (SC): dark grey; fine to medium; low to medium plasticity clay.			ND								
08/11/23	0	2								ES		2.00	PID	1.4ppm
			From 2.10m: becoming green-grey		FILL		W					2.10		
										ES		2.50	PID	1.1ppm
			Test Pit discontinued at 2.60m depth. (Collapsing conditions).									2.60		

PSP/10





NOTES [#] Soil origin is "probable" unless otherwise stated. [*] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 2.1 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.1 AHD
COORDINATE: E:397896.5, N:6466231.5
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP21
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[^] / DENSITY.[^]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
	2 / 0.17	FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL				ES		0.10	PID	<1ppm
		FILL / Sandy GRAVEL (GP-GM), with silt: grey; fine to coarse; fine to medium sand; Gravel is crushed limestone.		FILL	MD to D	D to M		ES		0.50 0.60	PID	<1ppm
	0.70 / 1	FILL / SAND (SP-SM), with fragments of brick and concrete, with silt: grey; fine to medium.		FILL		M		ES		1.00 1.10	PID	<1ppm
		1.20m: trace fragments of rubber waste and scrap metal		FILL	ND			D ES		1.50 1.60	PID	<1ppm
▼ 08/11/23		From 1.80m: trace pockets of CLAY CL-CI										
	1.90 / 2	FILL / Sandy CLAY (CI), trace fragments of brick and timber, trace gravel: dark grey; medium plasticity; fine to medium sand.		FILL		w>PL		B ES		2.00 2.10	PID	<1ppm
	0	Test Pit discontinued at 2.10m depth. (Collapsing conditions).										

DCP 9/150

NOTES [#] Soil origin is "probable" unless otherwise stated. [^] Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 1.8 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

TEST PIT LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.3 AHD
COORDINATE: E:397941.6, N:6466244.9
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP22
PROJECT No: 219164.01
DATE: 09/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
	2		FILL / SAND (SP-SM), with silt, trace rootlets: grey; fine to medium.		FILL	MD	D to M		ES		0.10	PID	<1ppm
			From 0.22m: becoming orange										
			From 0.40m: becoming brown						ES		0.50	PID	<1ppm
			From 0.70m: becoming dark grey-brown								0.60		
	1						M		ES		1.00	PID	<1ppm
											1.10		
	1	1.40	SAND (SP-SM), with silt: pale yellow-brown; fine to medium.		possibly ALV	ND			ES		1.50	PID	<1ppm
09/11/23			From 1.70m: becoming orange-grey								1.60		
	2						W		B		2.00	PID	<1ppm
									ES		2.10		
	0		Test Pit discontinued at 2.20m depth. (Collapsing conditions).										

PSP/1m: 5, 10, 15





NOTES: (#) Soil origin is "probable" unless otherwise stated. (*) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
OPERATOR: SLE Earthmoving
LOGGED: VV
METHOD:
REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 1.8 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

BOREHOLE LOG

CLIENT: Perth Racing
PROJECT: Proposed Residential Development
LOCATION: 71 Grandstand Road, Ascot, WA 6104

SURFACE LEVEL: 2.4 AHD
COORDINATE: E:397844.9, N:6466181.0
DATUM/GRID: MGA2020 Zone 50
DIP/AZIMUTH: 90°/---°

LOCATION ID: TP23
PROJECT No: 219164.01
DATE: 08/11/23
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS.(†)	DENSITY.(†)	MOISTURE	REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TESTING AND REMARKS: TEST TYPE	RESULTS AND REMARKS
		0.05	ASPHALT: black, 7 mm sized nominal aggregate.		FILL			D						
		0.15	FILL / Sandy GRAVEL (GP-GM), with silt: grey; medium to coarse, angular to sub-angular; fine to medium sand; BASECOURSE, gravel is crushed rock.		FILL	ND								
		0.30			FILL			M						
	2		FILL / Sandy GRAVEL (GP-GM), with silt: red-brown; medium to coarse, angular to sub-angular; fine to medium sand; SUB-BASE, gravel is granitic and lateritic.							ES		0.50	PID	<1ppm
		0.65	FILL / Silty SAND (SM), trace gravel: brown; fine to medium; with pockets of Clayey SAND SC. 0.90m: trace fragments of brick		FILL	MD to D		M				0.60		
										D		1.00	PID	<1ppm
	1		FILL / Clayey SAND (SC): orange-grey; fine to medium; low to medium plasticity clay.							ES		1.10		
		1.40	FILL / SAND (SP), trace silt: grey; fine to medium; trace pockets of Clayey SAND SC.		FILL					ES		1.50	PID	<1ppm
▼ 08/11/23			1.80m: trace fragments of brick									1.60		
		1.90	FILL / Sandy CLAY (CI), trace gravel: dark grey; medium plasticity; fine to medium sand.		FILL	ND		W		D		2.00	PID	<1ppm
	2									ES		2.10		
		2.20	FILL / SAND (SP-SM), with silt: dark grey; fine to medium.		FILL					D		2.50	PID	<1ppm
	0									ES		2.60		
			Borehole discontinued at 2.60m depth. (Collapsing conditions).											

DCP9/150





NOTES: (#) Soil origin is "probable" unless otherwise stated. (†) Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5T excavator with 450 mm toothed bucket
METHOD:
OPERATOR: SLE Earthmoving
LOGGED: VV
CASING: Nil

REMARKS: Surface lvel surveyed using a differential GPS with a reported accuracy of +/- 0.1 m.
Groundwater encountered at 1.7 m depth.

Refer to explanatory notes for symbol and abbreviation definitions

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Appendix C

Geotechnical Laboratory Test Certificates

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18256-18262_1_ORG
Project:	Proposed Residential Development	*Sample No.*	WG23.18256-18262
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	Various See Below	*Date Tested:*	15/11/2023

TEST RESULTS - Organic Content

Sampling Method: Sampled by Client, Tested as Received

Testing Completed By: WGLS-LC

Furnace Temperature (°C): 440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG23.18256	TP13/1.5	98.4	1.6
WG23.18257	TP8/1.5 m	93.2	6.8
WG23.18258	TP19/2.5	98.5	1.5
WG23.18262	BH23/2.5 m	98.8	1.2

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 16/November/2023

NATA WORLD RECOGNISED ACCREDITATION

Accreditation No. 20599

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

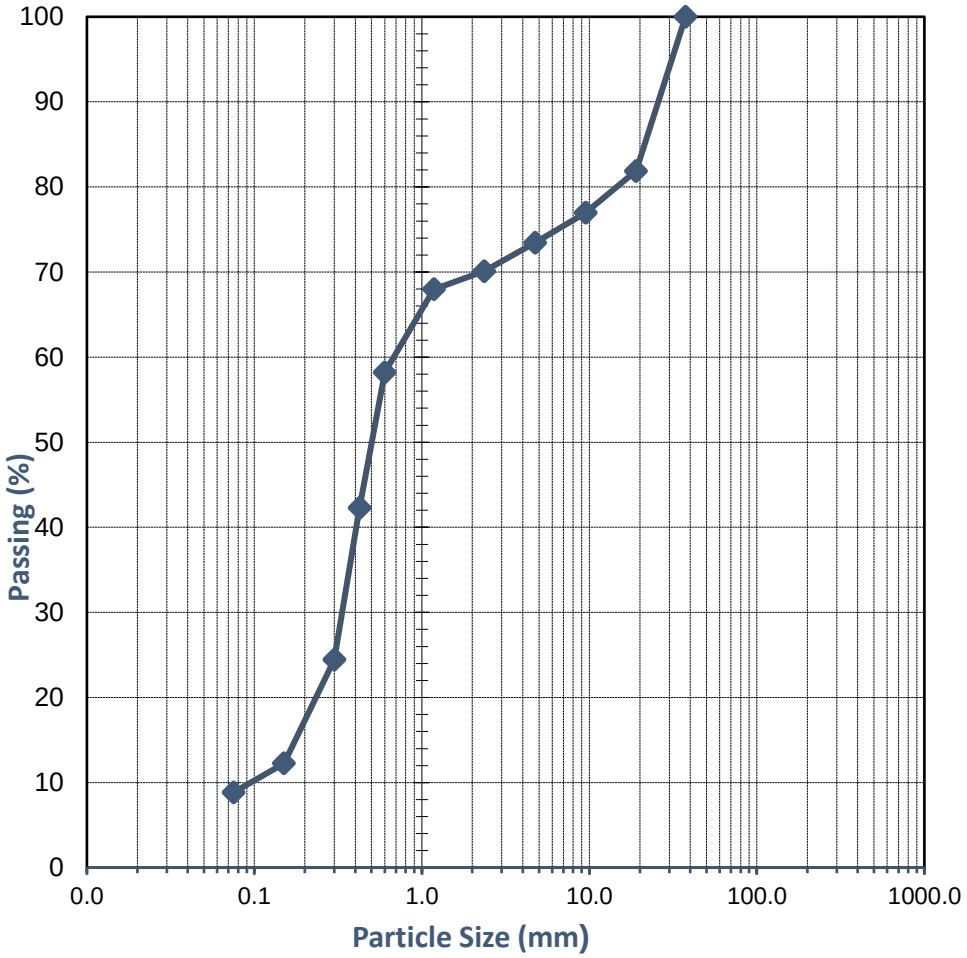
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18257_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18257
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP8/1.5 m	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	100
19.0	82
9.5	77
4.75	73
2.36	70
1.18	68
0.600	58
0.425	42
0.300	24
0.150	12
0.075	9



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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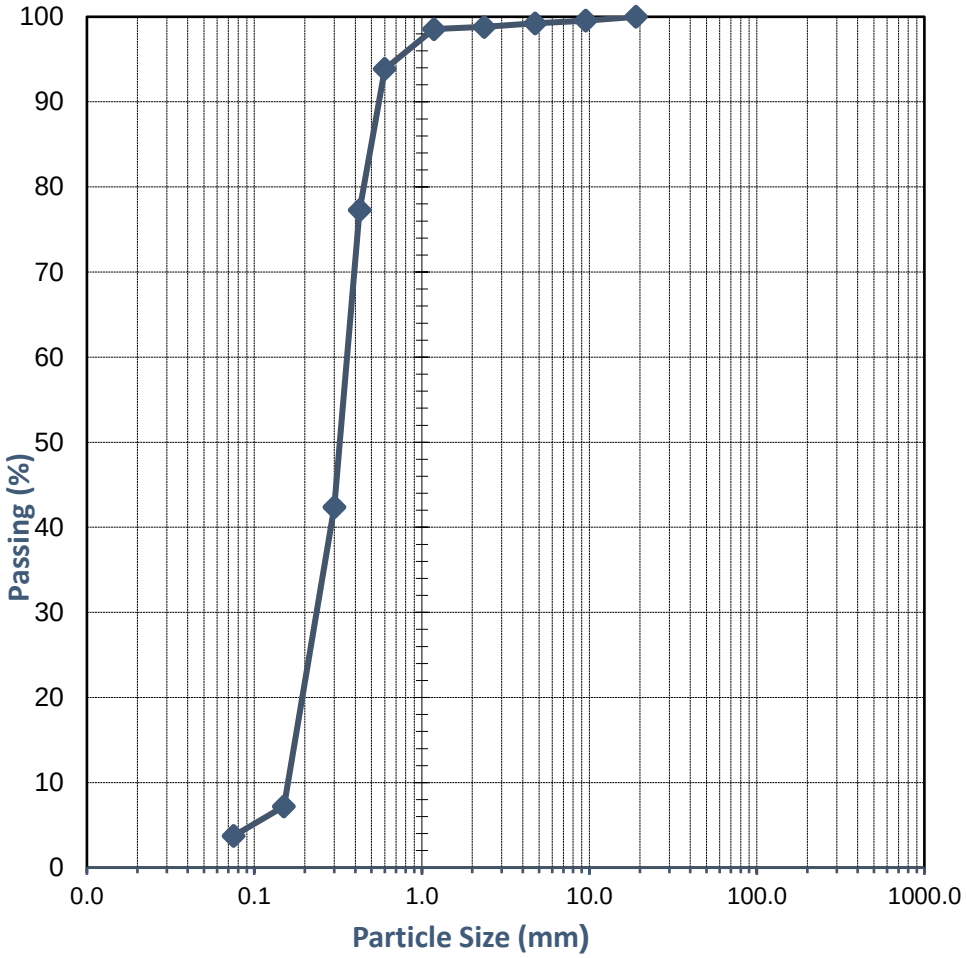
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18256_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18256
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP13/1.5	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	100
4.75	99
2.36	99
1.18	99
0.600	94
0.425	77
0.300	42
0.150	7
0.075	4



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

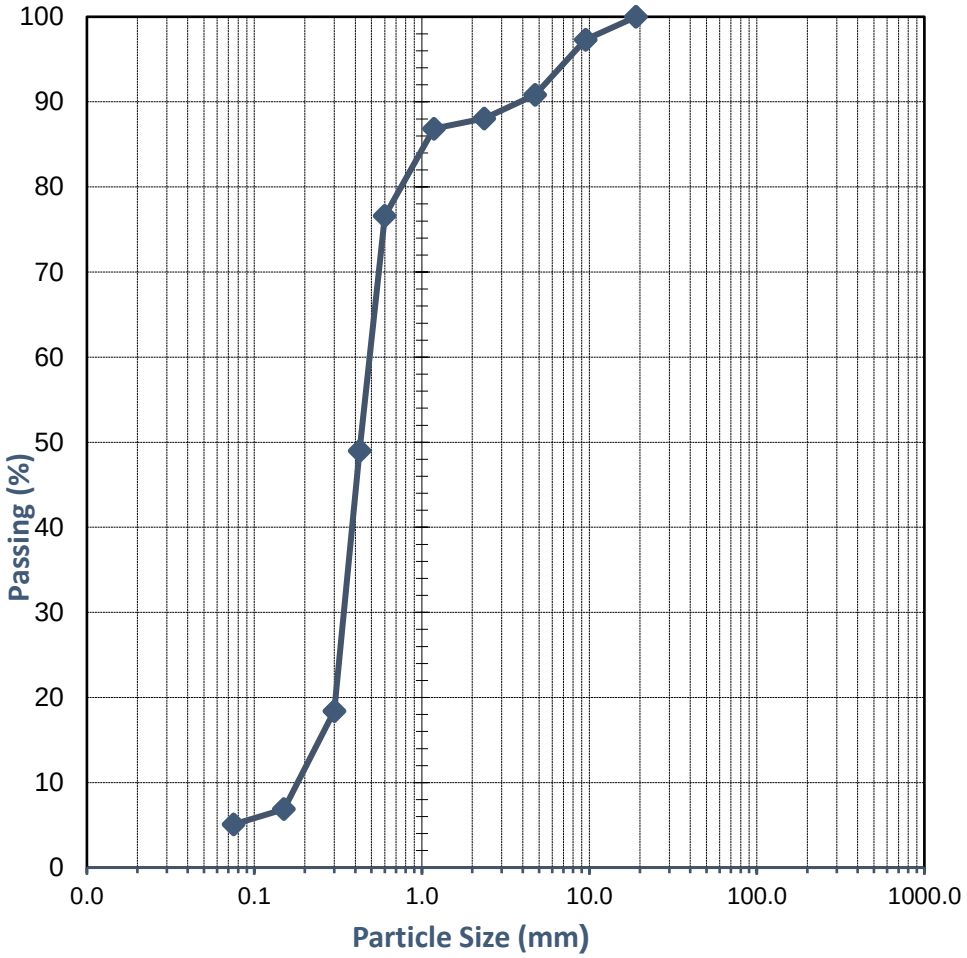
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18258_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18258
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP19/2.5	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	97
4.75	91
2.36	88
1.18	87
0.600	77
0.425	49
0.300	18
0.150	7
0.075	5



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

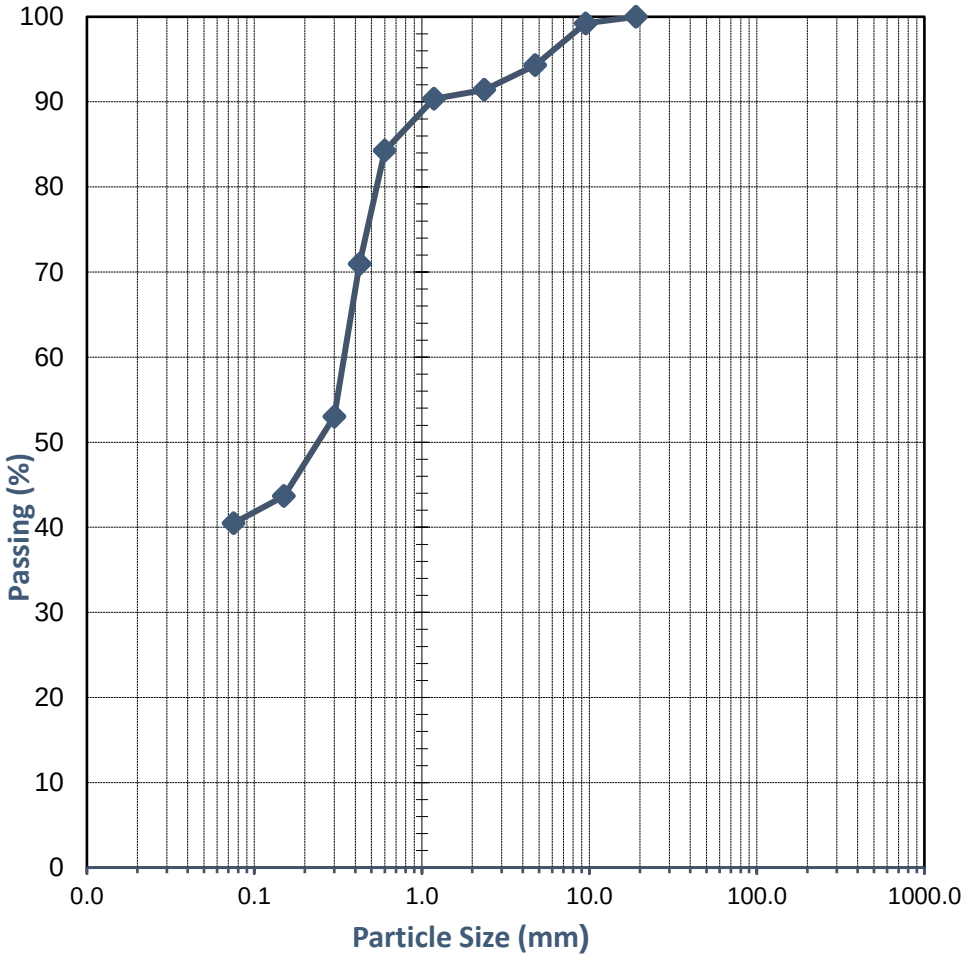
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18259_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18259
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP21/2.0 m	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	100
9.5	99
4.75	94
2.36	91
1.18	90
0.600	84
0.425	71
0.300	53
0.150	44
0.075	40



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18259_1_PI
Project:	Proposed Residential Development	*Sample No.*	WG23.18259
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP21/2.0 m	*Date Tested:*	17/11/2023

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**37**
AS 1289.3.2.1	**Plastic Limit (%)**	**24**
AS 1289.3.3.1	**Plasticity Index (%)**	**13**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**8.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Curled**

Comments:

Approved Signatory:

Name: Madhav Basnet

Date: 20/November/2023

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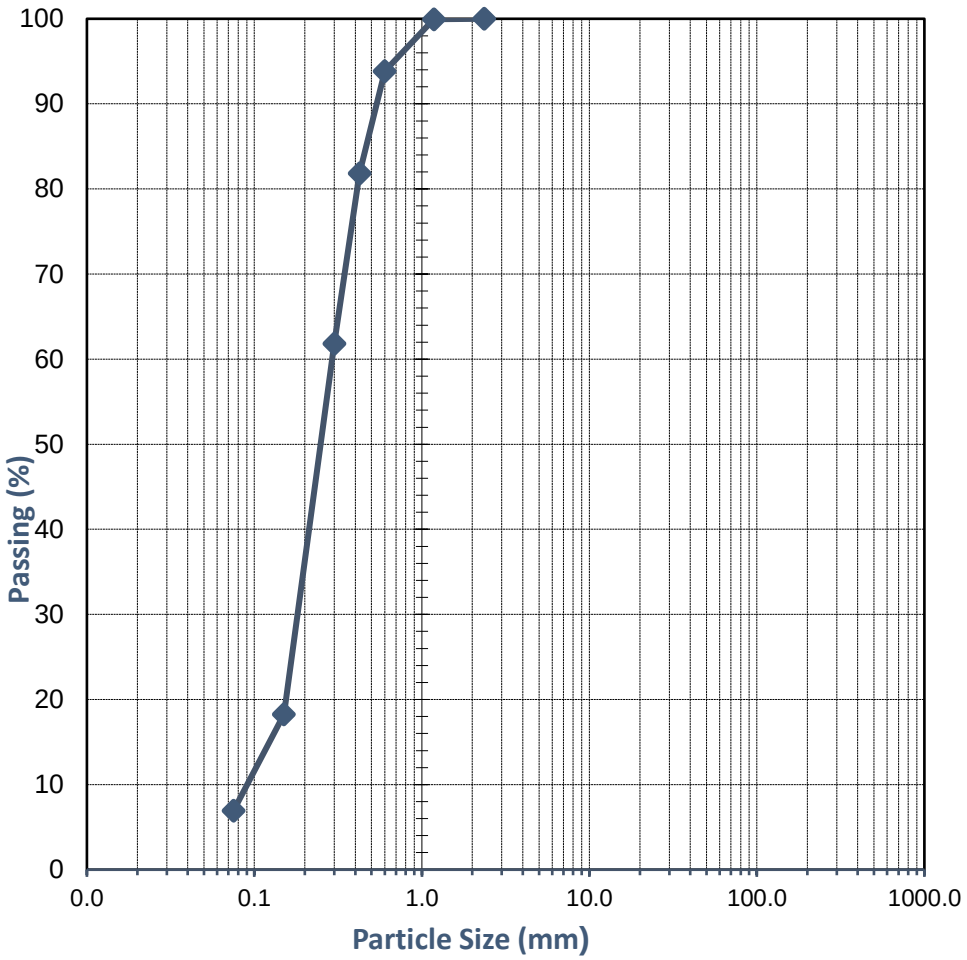
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18260_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18260
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/2023
Sample Identification:	TP22/2.0	*Date Tested:*	22/11 - 23/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	94
0.425	82
0.300	62
0.150	18
0.075	7



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 23/November/2023

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WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18260_1_PI
Project:	Proposed Residential Development	*Sample No.*	WG23.18260
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	TP22/2.0	*Date Tested:*	23/11/2023

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**Not Obtainable**
AS 1289.3.2.1	**Plastic Limit (%)**	**Non-Plastic**
AS 1289.3.3.1	**Plasticity Index (%)**	**Non-Plastic**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**0.0**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**-**

Comments:

Approved Signatory:

Name: Matthew Lichon

Date: 24/November/2023

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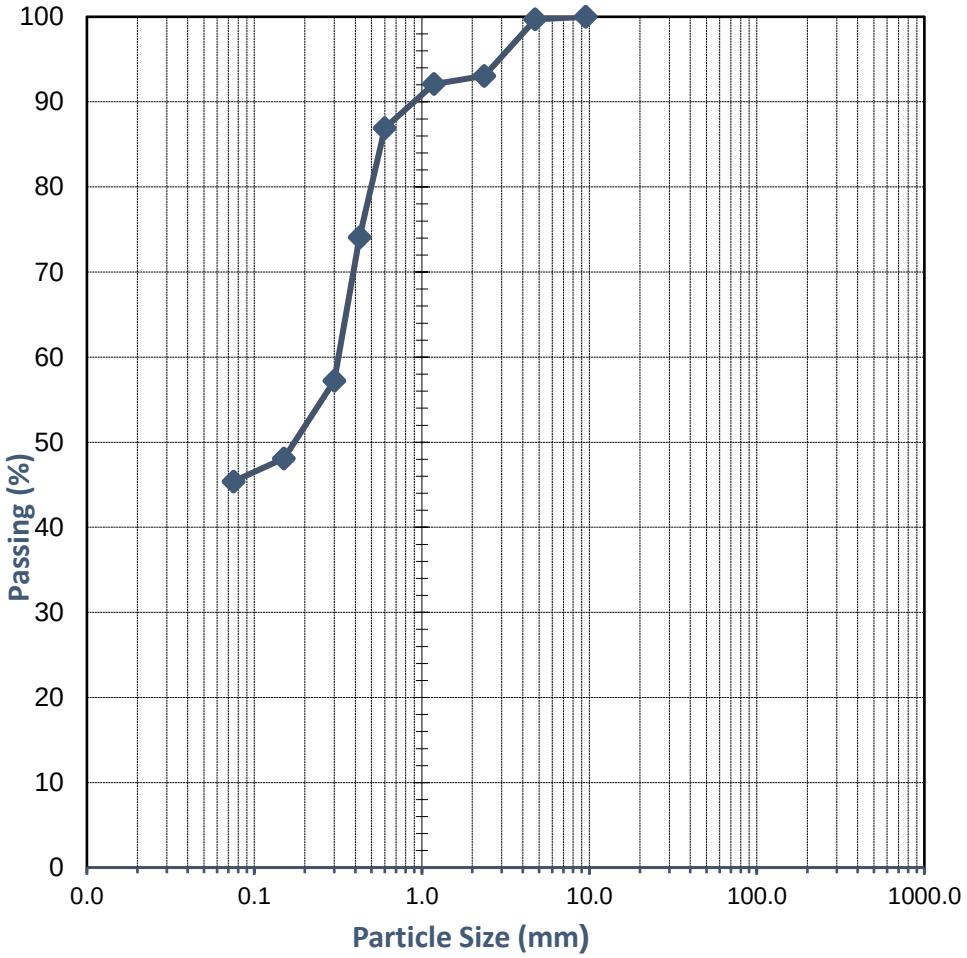
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18261_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18261
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	BH23/2.0 m	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	93
1.18	92
0.600	87
0.425	74
0.300	57
0.150	48
0.075	45



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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TEST REPORT - AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18261_1_PI
Project:	Proposed Residential Development	*Sample No.*	WG23.18261
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	BH23/2.0 m	*Date Tested:*	17/11/2023

TEST RESULTS - Consistency Limits (Casagrande)

Sampling Method:	**Sampled by Client, Tested as Received**
History of Sample:	**Oven Dried <50°C**
Method of Preparation:	**Dry Sieved**

AS 1289.3.1.1	**Liquid Limit (%)**	**44**
AS 1289.3.2.1	**Plastic Limit (%)**	**22**
AS 1289.3.3.1	**Plasticity Index (%)**	**22**
AS 1289.3.4.1	**Linear Shrinkage (%)**	**9.5**
AS 1289.3.4.1	**Length of Mould (mm)**	**250**
AS 1289.3.4.1	**Condition of Dry Specimen:**	**Curled**

Comments:

Approved Signatory:

Name: Madhav Basnet

Date: 20/November/2023

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SOIL | AGGREGATE | CONCRETE | CRUSHING

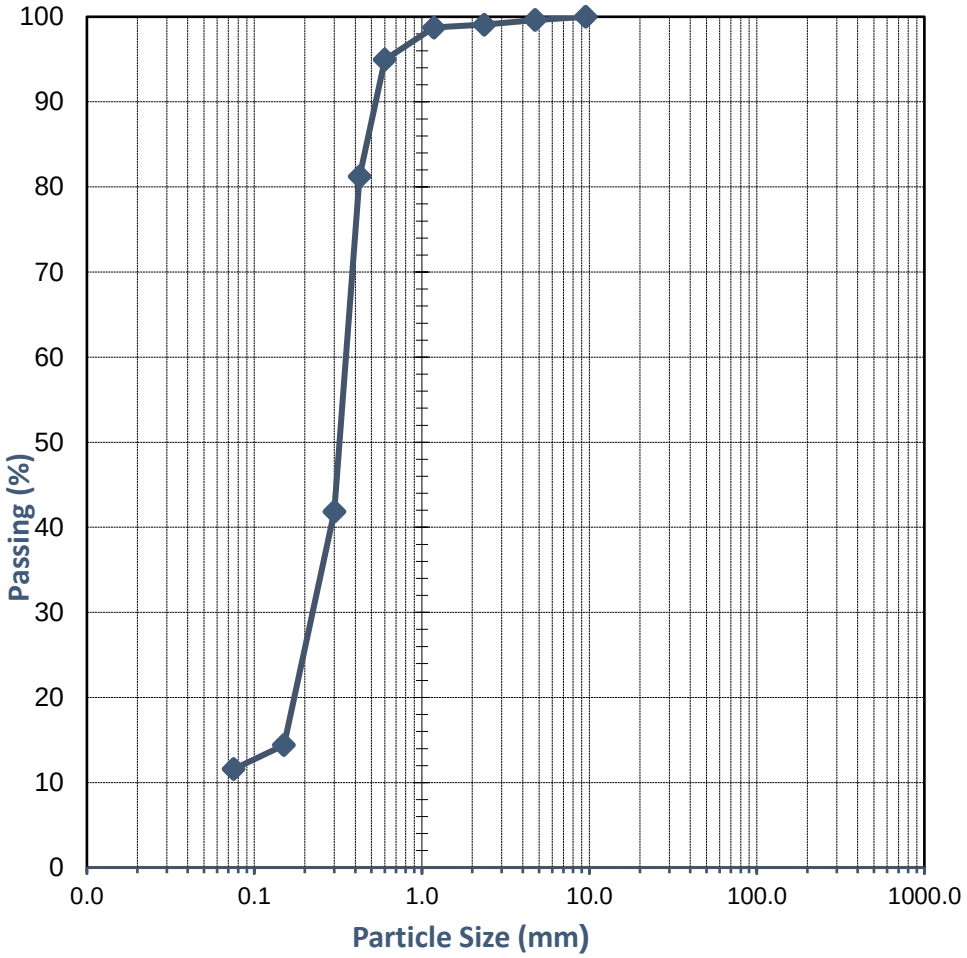
TEST REPORT - AS 1289.3.6.1

Client:	Perth Racing	*Ticket No.*	S11610
Client Address:	-	*Report No.*	WG23.18262_1_PSD
Project:	Proposed Residential Development	*Sample No.*	WG23.18262
Location:	Lot 9002 Grandstand Rd, Ascot	*Date Sampled:*	08/11 - 09/11/23
Sample Identification:	BH23/2.5 m	*Date Tested:*	16/11 - 17/11/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method: Sampled by Client, Tested as Received

Sieve Size (mm)	Percent Passing Sieve (%)
150.0	
100.0	
75.0	
37.5	
19.0	
9.5	100
4.75	100
2.36	99
1.18	99
0.600	95
0.425	81
0.300	42
0.150	14
0.075	12



Comments:

Approved Signatory: Cody O'Neill

Name: Cody O'Neill

Date: 17/November/2023

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Report on:

GEOTECHNICAL STUDY PROPOSED DEVELOPMENT LOT 452 RESOLUTION DRIVE ASCOT WA

WAG230750-01 002 R Rev0

Submitted to:

Tabec Pty Ltd

PO Box 409

West Perth WA 6872

12 March 2024

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

CONTENTS

1. INTRODUCTION 2
2. KEY FINDINGS 2
3. PROPOSED DEVELOPMENT 2
4. PROJECT OBJECTIVES 2
5. FIELDWORK 3
6. LABORATORY TESTING 3
7. SITE CONDITIONS 3
7.1. Geology 3
7.2. Groundwater 4
8. GROUND MODEL 5
9. GEOTECHNICAL ASSESSMENT 6
9.1. 6
9.1. Summary 6
9.2. Shallow Footings 7
9.3. Soil Aggressivity 7
10. CLOSURE 8

Table 1: Summary of Site 2
Table 2: Summary of Proposed Development 2
Table 3: Summary of Field Data 3
Table 4: Summary of Geology Mapping 3
Table 5: Summary of Groundwater Levels 4
Table 6: Geotechnical Model Units and Design Parameters 5
Table 7: Summary of Geotechnical Assessment 6
Table 8: Isolated Pad Footing Allowable Bearing Pressures and Estimated Settlements 7
Table 9: Isolated Strip Footing Allowable Bearing Pressures and Estimated Settlements 7

Attached Table 1: Summary of Geotechnical Index Test Results 9
Attached Table 2: Summary of Chemical Test Results and Exposure Classification 10

Figure 1: Site and Location Plan

Appendix A: Site Photographs
Appendix B: Cone Penetration Test Results
Appendix C: Machine Borehole and Monitoring Well Logs
Appendix D: Laboratory Test Results

Standard Geotechnical Definitions, Recommendations, Requirements and Limitations

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

1. INTRODUCTION

This report presents the outcomes of Galt Geotechnics' (Galt's) geotechnical study for the proposed development at Lot 452 Resolution Drive, Ascot ("the site").

This report is to be read in conjunction with the appended "Geotechnical Definitions, Recommendations, Requirements and Limitations". 'Clause GDR1', etc. refer to this Appendix, found at the back of this report.

2. KEY FINDINGS

Site Description

Table 1: Summary of Site

Item	Comment
Site Extent	Refer Figure 1.
Site Area	About 1.14 Ha.
Current Site Surface Levels[1]	About RL 3 m AHD.
Vegetation	Mature trees, shrubs and lawn in landscaped areas covering a large portion of the site.
Existing Infrastructure	Single Storey building (used by Perth Racing Security Services) with surrounding accessways, car parking and landscaped areas.
Site History[2]	**Prior to 1953**: two residences in northern portion of site. Remainder of site relatively clear. **1953 to 1985**: Relatively unchanged. Undeveloped portion of site used as laydown area, car park area, and to stockpile materials at different times. **1989**: Existing Perth Racing Security Services development (as described above) is present **1989 to Present**: Site relatively unchanged.

NOTES: ***1.*** *Site level based on correspondence with client.*

2. *Site history based on aerial imagery (Landgate).*

3. PROPOSED DEVELOPMENT

Table 2: Summary of Proposed Development

Item	Comment
Proposed Development	Unknown, assumed subdivision for commercial/residential purposes.
Proposed Finished Level	Assumed within about 1 m of current ground levels.
Cut/Fill	Assumed ± 1 m with up to 5 m excavation to connect development to existing sewer.
Assumed Foundation Type	Shallow Footings.
Assumed Retaining Walls	Gravity walls up to 1 m in height.
Assumed Stormwater Disposal	Off site into council network.
Assumed Sewage Disposal	Off site via reticulated sewer.

NOTES: ***1.*** *FFL – finished floor level*

2. *Proposed development details based on supplied information.*

4. PROJECT OBJECTIVES

The objectives of the study were to:

- Assess the geotechnical suitability of the site for the proposed development;

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

- Geotechnical opportunities and constraints relevant to the proposed development;
- Areas of foundation risk including the presence of aggressive soils and strategies to address identified risks;
- Site preparation including possible reuse of existing soil as controlled fill;
- Excavation conditions;
- The likely site classification;
- Suitable foundation systems including preliminary design parameters;
- Preliminary design parameters for the design of retaining structures and batter slopes;
- Depth to groundwater at time of investigation; and
- Recommendations on additional geotechnical investigation at detailed design phase or to address specific ground conditions encountered.

5. FIELDWORK

Fieldwork was carried out in the presence of a representative from Galt between the 8 and 14 February 2024 and comprised:

Table 3: Summary of Field Data

Type	Results Appendix	Summary	GDR Clause	Equipment Used	No. Tests	Depth Range (m)
Site Plan	Figure 1	-	-	Hand held GPS[1]	-	-
Photographs	A	-	-	-	-	-
Cone Penetration Tests (CPTs)	B	Section 8	GDR3.2	14-tonne truck	5	1.6 to 10.1
Machine Auger Boreholes (BH)	C	Section 8	GDR3.3	AMS Power Probe	4	0.7 to 6.5
Monitoring Well (MW)	C	Section 8	GDR3.3	AMS Power Probe	1	6.0

NOTES: ***1.*** *Hand held GPS is accurate to ±5 m.*

6. LABORATORY TESTING

Laboratory test certificates are presented in Appendix D, and summarised in Attached Tables 1 and 2.

7. SITE CONDITIONS

7.1. Geology

Table 4: Summary of Geology Mapping

Map Sheet	Map Scale	Mapped Soils	Typical Site Findings
Perth	50K	Guildford Formation, described as: "*SANDY SILT - strong brown to mid grey, mottled, blocky, disseminated fine sand, hard when dry, variable clay content of alluvial origin.*"	**Thin topsoil** (landscaped areas) **and pavement materials** (car parks / access ways) **over FILL: SAND / SAND** to about 0.4 m to 0.9 m depth, **over Sandy CLAY / CLAY**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

7.2. Groundwater

Table 5: Summary of Groundwater Levels

Item	Date	Depth Range (m)	Elevation Range (m AHD)	Comment
Perth Groundwater Atlas	1997	-	3.0	Historical maximum
Department of Water and Environmental Regulation (DWER) Flood Mapping	-	-	2.7 to 2.9 (DWER mapped 1% AEP flood event level)	Portion of site along southern and south western site boundaries, and the northern side of Grandstand road are mapped as being part of flood fringe by DWER. **Advice on development within the defined flood event (DFE) floodplain is provided by DWER on a case by case basis.** **DWER recommends a minimum building floor level of 0.50 metres above this level** (**RL 3.4 m AHD**).
Site observations in MW01	February 2024	3.03	-	Based on highest recorded water levels in monitoring well.
Site observations in CPT test probes	February 2024	1.90 to 2.80	-	CPT probes may not have had sufficient time to recharge to hydrostatic levels.
Recommended Design	-	-	2.7 to 2.9	Groundwater likely to perch on clay soils at site. Proposed development must be designed for DWER DFE flood event.

NOTES: ***1.*** *Depths for site observations based on the site surface level at the time of investigation.*

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

8. GROUND MODEL

The encountered subsurface conditions are summarised as comprising:

- **Surficial Topsoil (in landscaped areas)** up to 0.3 m thick **and Hardstand Fill Layers** (in carparks and access ways); **overlying**
- **FILL: SAND / SAND (SP)**, fine to medium grained, sub-rounded to sub-angular, yellow / brown / grey layers, includes trace gravel / Sandy GRAVEL layers, trace / with fines, some typically medium dense to dense, extending to depths of about 0.4 m to 0.9 m; overlying
- **In BH03 and BH04 only: Silty SAND / Clayey SAND (SM/SC)** fine to medium grained, sub-rounded to sub-angular, brown / grey, low to medium plasticity fines, some typically medium dense to dense, extending to depths of about 0.7 m to 1.2 m; overlying
- **Sandy CLAY / CLAY (CI)**, medium plasticity, brown / orange / grey, trace sand to sandy, trace gravel in some zones, desiccated, CPT traces indicate presence of occasional sand layers, typically very stiff to hard, extending to the maximum depth investigated of 10 m.

Geotechnical design parameters for the generalised subsurface units described above are presented in Table 6.

Table 6: Geotechnical Model Units and Design Parameters

Unit Name	γ_{bulk} (kN/m^3)	ϕ' (°)	c' (kPa)	S_u (kPa)	E_v (MPa)	ν	k_0	Wall Friction=0		Wall Friction=0.5ϕ	
								k_a	k_p	k_a	k_p
Compacted Approved FILL	18	36	-	-	50	0.25	0.41	0.26	3.85	0.22	6.54
SAND / Silty SAND / Clayey SAND	18	35	-	-	25	0.3	0.43	0.27	3.69	0.24	6.08
Sandy CLAY / CLAY	18	21	0 to 5	150	30	0.45	Earth pressure coefficients can be calculated for undrained or drained conditions as outlined in GDR11.2.2 using Firm parameters (undrained) or Fines Content >35% & PI 40% (drained).				

NOTES:

1. *These units are a generalization of results from individual tests, which should be referred to for more information.*
2. *Conditions at CPT locations below depth of soil sample recovery are inferred (refer to clause GDR3.2)*
3. *Surficial topsoil and hardstand layers are not included as discrete units.*
4. *Compacted approved fill is as described in Table 7.*
5. *For all earth pressure coefficients (retaining wall design) refer to clause GDR11.2 for more detail and interpretation. Unit weights for retaining structure design should be as per GDR11.2 or 1 kN/m^3 greater than the values in the table above.*

γ_{bulk} – bulk unit weight
ϕ' – effective friction angle
S_u – undrained shear strength
c'– effective cohesion
E_v – vertical elastic modulus
ν – Poisson's Ratio
k_a – coefficient of active earth pressure (Coulomb – AS4678-2002, Appendix E)
k_p – coefficient of passive earth pressure (Coulomb – AS4678-2002, Appendix E)
k_0 – coefficient of at-rest earth pressure (Jaky)

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

9. GEOTECHNICAL ASSESSMENT

9.1. Summary

Table 7: Summary of Geotechnical Assessment

Type	Clause	Parameter	Comment
Site Suitability	-	-	We consider the site to be geotechnically suitable for the proposed subdivision development. Standard site preparation measures will apply. However, groundwater could impact construction if it occurs during winter. Flood levels will impact site levels (refer Table 5).
Construction Methodology and Suitability	-	-	Shallow footings in accordance with AS2870-2011 will be suitable for this site. Mass retaining will be suitable for retaining however, must be designed for potential flooding of the site. Stormwater disposal via infiltration is **not** suitable.
Site Classification (AS2870)	GDR5	S	Where **no less than 0.7 m of sand** (including insitu silty sand and clayey sand layers encountered in BH03 and BH04) is present **over in situ CLAY / Sandy CLAY.**
Site Subsoil Class (AS1170.4)	-	Ce	Base of superficial formation mapped to be about 25 m below ground.
Site Preparation	GDR6	-	**GDR6.2.1 Common Measures** followed by **GDR6.2.4 Clayey Sites** followed by **GDR6.2.5 Sand Topping Layer.**
Approved Fill	GDR8	-	**Approved Fill** for this site is to comprise **Permeable Sand**. Only relatively thin surficial layers of sand at the site (excluding topsoil) are suitable as approved fill. If additional fill is required, imported **Permeable Sand** will be needed. Although not classed as 'approved fill', where clay is encountered in trench excavations, this material could possibly be reused to backfill the same portion of the trench (excluding any special fill materials required around buried elements). However, this material will be difficult to work and moisture condition to near optimum (particularly if removed from below the groundwater table).
Compaction Control	GDR7	-	A PSP may be used for compaction control on **Permeable Sand.** Deemed to comply values for 'Tamala' sand in GDR7.4 are applicable. Where filling with clay is done (in trenches, etc), compaction control must be done with the NDG as outlined in GDR7.3 Nuclear Density Gauge.
Shallow Footings	GDR9	q_{all} = 100 kPa to 250 kPa	Design tables for shallow footings are presented in Section 9.2. Estimated settlements are not considered excessive. 70% of the settlement is expected to occur during construction.
Earth Pressure Coefficients	GDR11	Table 6	Earth pressure coefficients are presented in Table 6.
Unsaturated Hydraulic Conductivity	GDR13	-	On site disposal of stormwater unlikely to be suitable due to shallow depth to clay and potential for flooding adjacent the site. Off site disposal of stormwater likely to be required.
Pavement Subgrade CBR	GDR16	CBR = 10%	Subgrade to comprise compacted **Approved Fill no less than 0.6 m thick.**
Soil Aggressivity	GDR17	-	Refer Section 9.3
Batters	GDR12	**Temporary:** Sand: 1V:2H Clay: 1V:1H **Permanent:** 1V:3H	Batter angles apply to soil units (refer Table 6) above the water table, as per GDR12.3. Dewatering and possibly retention (i.e. shoring) required below the groundwater table.
Excavations	GDR12.1	20 Ton Excavator	Potential for obstructions (buried concrete, Soakwells etc…), cemented soils and surficial pavement layers must be considered when selecting earthmoving plant.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

NOTES:
1. q_{all} – *allowable bearing pressure (maximum for all footings, refer to footing tables for further details)*

9.2. Shallow Footings

Table 8: Isolated Pad Footing Allowable Bearing Pressures and Estimated Settlements

d_e (m)	b (m)	q_{all} (kPa)	s (mm)
0.5	0.5	120	< 5
0.5	1.0	130	< 5
1.0	1.0	240	5 - 10
1.0	2.0	250	10 - 15
1.0	3.0	250	20 - 25

NOTES:
1. d_e – *minimum embedment depth (below finished ground level or floor slab)*
2. *b – Footing breadth (footings assumed approximately square)*
3. q_{all} – *allowable bearing pressure (peak). Limited to keep estimated settlements less than 25 mm. Higher q_{all} may be possible if higher settlements can be tolerated – refer queries to us.*
4. *s – estimated settlement (excludes shrink/swell from site class)*
5. *Refer to GDR9*
6. *Groundwater assumed to be at ground level.*

Table 9: Isolated Strip Footing Allowable Bearing Pressures and Estimated Settlements

d_e (m)	b (m)	q_{all} (kPa)	s (mm)
0.5	0.5	100	< 5
0.5	1.0	130	5 - 10
1.0	1.0	190	10 - 15
1.0	2.0	250	20 - 25

NOTES:
1. d_e – *minimum embedment depth (below finished ground level or floor slab)*
2. *b – Footing breadth (footings assumed long relative to breadth)*
3. q_{all} – *allowable bearing pressure (peak). Limited to keep estimated settlements less than 25 mm. Higher q_{all} may be possible if higher settlements can be tolerated – refer queries to us.*
4. *s – estimated settlement (excludes shrink/swell from site class)*
5. *Refer to GDR9*
6. *Groundwater assumed to be at ground level.*

9.3. Soil Aggressivity

Results of aggressivity testing on clay samples is summarised in Attached Table 2. The results indicate the clay is 'non aggressive' to concrete and steel (in accordance with AS2159-2009) with a AS3600-2009 classification of 'A1'.

Based on regional experience, we anticipate the sand will have the same aggressivity classifications as the underlying clay where above the groundwater. However, for concrete in sand below the water table, an AS2159-2009 'mild' classification, and AS3600-2009 'A2' classification is appropriate.

Groundwater was not tested.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

10. CLOSURE

GALT GEOTECHNICS PTY LTD





Owen Woodland CPEng
Geotechnical Engineer

Tyrone Mardesic CPEng
Geotechnical Engineer

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Attached Table 1: Summary of Geotechnical Index Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	Fines (%)	Sand (%)	Gravel (%)	LL (%)	PI (%)	LS (%)
BH03	1.5 - 2.2	CLAY (CI)	89	11	0	46	28	12.5
BH04	1.0 - 1.3	Sandy CLAY (CI)	54	43	3	34	20	8.5

Notes

1. *Particle size distribution (by mass)*
   Gravel: 2.36 mm – 63 mm *Sand: 0.075 mm – 2.36 mm* *Fines: <0.075 mm*
2. *Atterberg Limits*
   LL: Liquid limit *PI: Plasticity index* *LS: Linear shrinkage*
   NO: Not obtainable *NP: Non-plastic*

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Attached Table 2: Summary of Chemical Test Results and Exposure Classification

Location	Sample Depth (m)	Soil Description	Soil Condition	pH	SO_4 (ppm)	Cl (ppm)	AS2159 Steel EC	AS2159 Concrete EC	AS3600 Concrete EC
BH03	1.5 - 2.2	CLAY (CI)	B	8.8	100	210	Non-Aggressive	Non-Aggressive	A1
BH04	1.0 - 1.3	Sandy CLAY (CI)	B	7.5	170	94	Non-Aggressive	Non-Aggressive	A1

NOTES:

1. *Soil condition*
   A – high permeability soils (sands and gravels) which are below water table. *B – Low permeability soils (silts and clays) and all soils above water table*
2. *Sulfate expressed as SO_4*
3. *Cl – Chloride*
4. *ER – Electrical Resistivity*
5. *EC – Exposure Classification*
5. *Exposure Classification for AS2159-2009 (for steel and concrete piles)*
   [Exposure Classification for AS3600-2009 (for buried concrete structures)]

Non-aggressive [A1]	*Mild [A2]*	*Moderate [B1]*	*Severe [B2]*	*Very Severe [C2]*

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Figures

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024





Legend

- Site Boundary
- Borehole
- Cone Penetration Test

N

0 10 20 30 40 50
Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP



SCALE	1:750	(A3)
DRAWN	CED	
DATE DRAWN	13/2/2024	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

Galt Geotechnics Pty Ltd
ACN : 138 490 865
Tel : +61 (0)8 6272-0200
Address : 50 Edward Street
Osborne Park WA 6017

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CLIENT	**TABEC CIVIL ENGINEERING CONSULTANTS**
PROJECT	PROPOSED DEVELOPMENT
LOCATION	LOT 452 RESOLUTION DRIVE ASCOT
TITLE	SITE & LOCATION PLAN
Job No	WAG230750-01
Fig No	FIGURE 1
Rev	**A**

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Appendices

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Appendix A: Site Photographs

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Photograph 1: Near CPT02 facing south



Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Photograph 2: Near CPT02 facing south west



Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Photograph 3: Site photo from near northern portion of site



Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Appendix C: Machine Borehole and Monitoring Well Logs

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HE	Hand Excavation	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

►	Water Inflow	▼	Water Level
◄	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ROCK CORE RECOVERY

TCR = Total Core Recovery (%) $= \frac{CRL}{TCL} \times 100$

RQD = Rock Quality Designation (%) $= \frac{ALC>100}{TCL} \times 100$

TCL	Length of Core Run
CRL	Length of Core Recovered
ALC>100	Total Length of Axial Lengths of Core Greater than 100 mm Long

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

Graphic	USCS	Soil Name
		FILL (various types)
		COBBLES / BOULDERS
	GP	GRAVEL (poorly graded)
	GW	GRAVEL (well graded)
	GC	Clayey GRAVEL
	GM	Silty GRAVEL
	SP	SAND (poorly graded)
	SW	SAND (well graded)
	SC	Clayey SAND

Graphic	USCS	Soil Name
	SM	Silty SAND
	ML	SILT (low liquid limit)
	MH	SILT (high liquid limit)
	CL	CLAY (low plasticity)
	CI	CLAY (medium plasticity)
	CH	CLAY (high plasticity)
	OL	Organic SILT (low liquid limit)
	OH	Organic SILT (high liquid limit)
	Pt	PEAT

NOTE: Dual classification given for soils with a fines content between 5% and 12%.

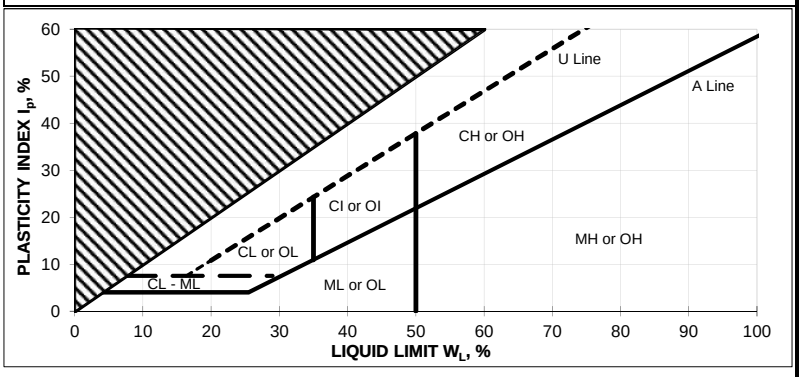
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil descriptions are based on AS1726-2017. Material properties are assessed in the field by visual/tactile methods in combination with field and laboratory testing techniques (where used).

NOTE: AS 1726-2017 defines a fine grained soil where the total dry mass of fine fractions (<0.075 mm particle size) exceeds 35%.

PARTICLE SIZE		
Soil Name		**Particle Size (mm)**
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	19 to 63
	Medium	6.7 to 19
	Fine	2.3 to 6.7
SAND	Coarse	0.6 to 2.36
	Medium	0.21 to 0.6
	Fine	0.075 to 0.21
FINES	SILT	0.002 to 0.075
	CLAY	<0.002

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



RESISTANCE TO EXCAVATION		
Symbol	**Term**	**Description**
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

MOISTURE CONDITION	
Symbol	**Term**
D	Dry
M	Moist
W	Wet

CEMENTATION	
Cementation	**Description**
Weakly cemented	Soil may be easily disaggregated by hand in air or water
Moderately cemented	Effort is required to disaggregate the soil by hand in air or water

CONSISTENCY		
Symbol	**Term**	**Undrained Shear Strength (kPa)**
VS	Very Soft	0 to 12
S	Soft	12 to 25
F	Firm	25 to 50
St	Stiff	50 to 100
VSt	Very Stiff	100 to 200
H	Hard	>200

ORGANIC SOILS	
Material	**Organic Content % of dry mass**
Inorganic soil	<2%
Organic soil	2% to 25%
Peat	>25%

DENSITY		
Symbol	**Term**	**Density Index (%)**
VL	Very Loose	<15
L	Loose	15 to 35
MD	Medium Dense	35 to 65
D	Dense	65 to 85
VD	Very Dense	>85

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

REPORT OF BOREHOLE: BH01/MW01

Job No	: WAG230750-01	Easting	: 0.00	Sheet	: 1 OF 1
Client	: Tabec	Northing	: 0.00	Logged	: MDS
Project	: Proposed Development	UTM	:	Logged Date	: 08/02/2024
Location	: Lot 452 Resolution Drive, Ascot	Drill Rig	: AMS Super Rig	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 25/02/2024

General comments: Monitoring Well Installed at this location

Drilling Method	Depth (m)	Water	Classification Code	Soil Origin	Graphic Log	Consistency/Density	Moisture	Material Description	Structural and Additional Observations	Well Diagram
90mm Solid Auger	0.3		SP	Natura			D	Natural SAND: dark brown and black, fine to coarse grained, with low plasticity clay, (trace organics present in upper 200mm).	(trace organics present in upper 200mm)	Backfill (Drill Spoil)
	0.45		SP	Natura		MD-D		Natural SAND: pale yellow, fine to coarse grained, trace low plasticity clay.		50mm PVC Solid
			SP	Natura				Natural SAND: dark brown and black, fine to coarse grained, trace low plasticity clay.		Bentonite (Sealed above Slotted PVC)
	0.9									
	1		CI	Natura		VSt-H		Natural Sandy CLAY: medium plasticity, brown and pale orange, fine grained sand, inorganic, clay is highly desiccated.	Clay is highly desiccated	
	2									
	2.3		SC	Natura				Natural Clayey SAND: low plasticity clay, brown and dark brown, fine to coarse grained, trace fine to medium sized gravel.		
	2.5		CI	Natura		VSt-H			Clay is desiccated at shallower depths	Filter Pack (Gravel Filter Medium Installed)
	3	▼						Natural CLAY: medium plasticity, brown and pale orange, trace fine to medium grained sand, inorganic, clay is desiccated at shallower depths.		
	4									50mm PVC Slotted
	5									
	6							**BH01/MW01 Terminated at 6m (Target Depth GW @3.03m)**		
	7									
	8									



Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

REPORT OF BOREHOLE: BH02

Job No	: WAG230750-01	Easting	: 0.00	Sheet	: 1 OF 1
Client	: Tabec	Northing	: 0.00	Logged	: MDS
Project	: Proposed Development	UTM	:	Logged Date	: 08/02/2024
Location	: Lot 452 Resolution Drive, Ascot	Drill Rig	: AMS Super Rig	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 25/02/2024

Drilling Method	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
90mm Solid Auger				Natural		SP	Natural SAND: dark grey and black, fine to coarse grained, trace low plasticity clay, (trace organics present in upper 200mm).	M-D	MD-D		
			1 2 3 4 5 6 7 8				**BH02 refusal at 0.7m (Refusal on Desiccated Clay Groundwater not encountered)**				

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

REPORT OF BOREHOLE: BH03

Job No	: WAG230750-01	Easting	: 0.00	Sheet	: 1 OF 1
Client	: Tabec	Northing	: 0.00	Logged	: PA
Project	: Proposed Development	UTM	:	Logged Date	: 14/02/2024
Location	: Lot 452 Resolution Drive, Ascot	Drill Rig	: AMS Super Rig	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 25/02/2024

Drilling Method	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
90mm Solid Auger			0.1	Topsoil		SP	Topsoil SAND: dark grey, fine to medium grained, trace medium plasticity clay, with roots / organics.	D	MD-D		
			0.25	Fill		SP	Fill SAND: brown, medium dense to dense, fine to medium grained, trace low plasticity clay.				
			0.4	Fill		GP	Fill Sandy GRAVEL: grey, medium dense to dense, fine to medium sized, fine to medium grained sand, trace low to medium plasticity clay.				
				Natural		SM	Natural Silty SAND: grey brown, fine to medium grained.				
			0.7	Natural		CI	Natural CLAY: medium plasticity, grey, with fine to medium grained sand, inorganic, trace organics, clay is desiccated at shallow depths.		VSt-H		
			1								
			1.5	Natural		CI	As above, brown, trace organics.				
			2								
			3								
			4	Natural		CI	As above.	M			
			5								
			6				**BH03 Terminated at 6m (Target depth. Groundwater not encountered)**				
			7								
			8								



Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

REPORT OF BOREHOLE: BH04

Job No	: WAG230750-01	Easting	: 0.00	Sheet	: 1 OF 1
Client	: Tabec	Northing	: 0.00	Logged	: PA
Project	: Proposed Development	UTM	:	Logged Date	: 14/02/2024
Location	: Lot 452 Resolution Drive, Ascot	Drill Rig	: AMS Super Rig	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 25/02/2024

Drilling Method	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
90mm Solid Auger			0.25	Topsoil		SP	Topsoil SAND: grey, fine to medium grained, trace medium plasticity clay, trace / with organics.	D			
			0.5	Fill		SP	Fill SAND: brown, fine to medium grained, trace low plasticity clay.				
			1	Natura		SC	Natural Clayey SAND: medium plasticity clay, brown, fine to medium grained.				
			1.2	Natura		Cl	Natural Sandy CLAY: medium plasticity, brown mottled red, fine to medium grained sand, trace fine to medium sized gravel, inorganic, clay is desiccated.		VSt-H		
			1.5	Natura		Cl	Natural CLAY: medium plasticity, brown, with fine to medium grained sand, inorganic, clay is desiccated at shallow depths.				
			2								
			3	Natura		Cl	As above.	M			
			4								
			4.5	Natura		Cl	As above.	W			
			5								
			6								
							BH04 Terminated at 6.5m (Target depth. Groundwater possibly at 4.5 m depth)				
			7								
			8								



Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Appendix C

Preliminary Civil Drawing

Tabec 2024

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

SWAN RIVER

NO EARTHWORKS OR REGRADING OF RACETRACK OR INTERNAL OPEN AREAS IS ENVISAGED .

RETIREMENT VILLAGE / MIXED USE SITE TO BE FILLED TO MINIMUM LEVEL OF 3.2m AHD TO SATISFY 500mm MIMIMUM CLEARANCE TO 100 YEAR SWAN RIVER FLOOD EXPECTATIONS.

A
FILL to 3.2m. min.

EXISTING PARKING AND OPEN SPACE TO ONLY REQUIRE FILL FOR APPEARANCE OR DRAINAGE PURPOSES. OTHERWISE MAY REMAIN AT EXISTING LEVELS.

PROPOSED STABLES TO BE FILLED TO RL 6.1m TO SUIT SURROUNDING LEVELS AND CLEARANCE TO GROUNDWATER.

C
FILL to 6.1m

PROPOSED STABLES TO BE FILLED TO RL 7.3m TO SUIT SURROUNDING LEVELS AND CLEARANCE TO GROUNDWATER.

C
FILL to 7.3m

PROPOSED STABLES TO BE FILLED FROM RL 4.2m - 6.1m TO SUIT SURROUNDING LEVELS AND CLEARANCE TO GROUNDWATER.

FILL to 3.2m min.
B

NEW OFFICES AND HOSPITALITY BUILDINGS MAY HAVE REQUIREMENT TO BE FILLED TO MINIMUM LEVEL OF 3.2m AHD TO SATISFY 500mm MIMIMUM CLEARANCE TO 100 YEAR SWAN RIVER FLOOD EXPECTATIONS.

C
FILL VARIES
4.2m to 6.1m

CHILDCARE AND RESIDENTIONAL SITE TO BE FILLED TO MIN. RL OF 3.2m AHD TO SATISFY MINIMUM CLEARANCE TO FLOOD EXPECTATIONS.

D
FILL to 3.2m

DEVELOPMENT SITE TO BE FILLED TO MIN. RL OF 4.5m AHD TO ACHIEVE LEVEL SURACE.

FILL to 4.5m

E
FILL to 3.2m

FILL to 3.2m

MINIMAL FILLING AND REGRADING OF EXISTING ROADS MAY BE REQUIRED.

EXISTING BUILDINGS AND GRASSED PARKLAND FUNCTION AREAS TO REMAIN AT EXISTING LEVELS WITH ONLY LANDSCAPE AMENDMENTS TO BE MADE.

FOODMARKETS AND DEVELOPMENT SITE TO BE FILLED TO MIN. RL OF 3.2m AHD TO SATISFY MINIMUM CLEARANCE TO FLOOD EXPECTATIONS.

MAXIMUM GROUNDWATER CONTOURS FROM GOLDEN GATEWAY - LWMS - 2018

ASCOT PL
ENNIS PL
MATHESON RD
AURUM ST
KALGOORLIE ST
KEYMER ST
CARBINE ST
GREAT EASTERN HWY
KIMBERLEY DRIVE
RACONTEUR DRIVE
RESOLUTION DRIVE
GRANDSTAND
THE BOARDWALK DR
TIDEWATER WAY
RIVERINA DR
CRCS
SEDGELAND WAY
GOLF STREET
CR

SCALE 1:2000 0 40 80 120

A1

WAPC No.

No.	DATE	DRAWN	APPROVED	AMENDMENT
C	21.06.24	PK	JZ	MINIMUM FILL LEVELS AMENDED IN LINE WITH THE LWMS
B	18.06.24	PK	JZ	PRELIMINARY ISSUE FOR INFORMATION ONLY
A	24.01.24	PK	JZ	PRELIMINARY ISSUE FOR REVIEW

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COLOUR
This drawing is required to be printed in full colour. Failure to do so may result in loss of information.

CLIENT: PERTH RACING

DESIGNED	CHECKED	APPROVED
PK	JZ	
DRAWN	CHECKED	DATE
PK	JZ	

TABEC
Civil Engineering Consultants
TABEC PTY LTD
ACN 090 796 204
Level 2, 54-58 Havelock Street, West Perth WA 6005
t 08 9425 5900 e info@tabec.com.au
www.tabec.com.au

PROJECT: ASCOT RACECOURSE - LOCAL STRUCTURE PLAN

TITLE: EARTHWORKS CONCEPT PLAN

DRAWING NUMBER: 2541-00-100

ISSUE: C

Plotted By: pkeenan Plot Date: 21/06/24 - 14:47 Cad File: C:\TABS\data\TB-100\2541 - Ascot Racecourse LSP_127\CAD\LCAD\2541-00\2541-00-100.dwg

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Appendix D

Modelling Assumption Report

Emerge Associates 2024

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Modelling Assumptions Report

Golden Gateway Local Structure Plan

Project No: EP23-109(03)

Prepared for Perth Racing
May 2024



Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Document Control

Doc name:	Modelling Assumptions Report Golden Gateway Local Structure Plan				
Doc no.:	EP23-109(03)--008 JM				
Version	Date	Author		Reviewer	
1	May 2024	Joyti Mabruk	JM	David Coremans	DPC
	Appendix to the LWMS				

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Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table of Contents

1 Background 1

2 Methodology 2

2.1 Rainfall 2

3 Post-development model 4

4 References 7

4.1 General references 7
4.2 Online references 7

List of Tables

Table 1: Post-development parameters 5
Table 2: Post-development catchment areas (ha) 5

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

1 Background

Perth Racing (the 'proponent') proposed to progress a local structure plan (LSP) over its landholdings in Ascot. The area is bounded by the Swan River to the North, Grandstand Road to the west and south, Matheson Road and Resolution Drive to the south and residential areas to the east, referred to herein as 'the site'. The structure plan area also includes the Ascot Racecourse area. The site is located approximately 8.5 km east of Perth central business district (CBD) and is approximately 62 ha in size, within City of Belmont (CoB). The LSP consists of six precincts: Precinct A, Precinct B, Precinct C, Precinct D, Precinct E, and the racecourse.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

2 Methodology

XPSWMM hydrologic and hydraulic modelling software (v21.3) was used to calculate the surface water runoff volumes within the road reserves and lots associated with the development of Ascot Racecourse.

The hydrologic component of the software uses the Laurenson non-linear runoff-routing method to simulate runoff from design storm events. Key assumptions regarding the hydrologic model include:

- Runoff is proportional to slope, area, infiltration and percentage of imperviousness of a catchment.
- Sub-catchment areas and slopes are determined from surveyed topographical data and earthworks plans.
- Infiltration rates and percentage imperviousness have been selected based on experience with model preparation for similar soil conditions.

Runoff from each sub-catchment is routed through the catchment using the hydraulic component of XPSWMM. Generally, assumptions associated with the hydraulic component of the model include:

- Virtual links (i.e. purely for model construction, not equivalent to flow path onsite) between nodes within a sub-catchment are given the length of 10 m and slope of 0.05 to minimise the lag time of conveying the water from a sub-catchment node to a 'storage' node, a 'dummy intermediate' node or a conduit/link.
- Links between sub-catchment storages act as conveyance channels (e.g. sheet flow within roads in a 1% annual exceedance probability (AEP)). These links are given lengths and slopes that are representative of the site conditions and actual pathway lengths between catchments.
- All channels are designed with a width of 5 m, roughness of 0.014 (Manning's n) and are trapezoidal in shape. This allows for easy conveyance and represents concrete pipes and road surfaces within the model.
- Where relevant median swales, bio-retention areas (BRAs), and flood storage areas (FSAs) are modelled as nodal-reservoirs with infiltration depth-rating curves to account for differential infiltration rates with changing depth.

2.1 Rainfall

The ensemble temporal patterns obtained from the Australian Rainfall and Runoff (AR&R) Data Hub (AR&R 2019) were used for the rainfall analysis.

Durations ranging between 15 min and 72 hours were tested, with the peak flood elevation being assessed as the determining result.

Following the process suggested by AR&R (Ball J et al. 2019), the highest mean duration was selected as the critical duration. AR&R also recommends that when it is not practical to run the entire ensemble array, the ensemble that produces the result closest to the mean (for the critical duration) should be adopted and provided in **Table 1**.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Table 1: Critical Duration Analysis

Catchment	Critical Duration (20% AEP)	Critical Duration (10% AEP)	Critical Duration (1% AEP)
Precinct A	3 hour duration ensemble 4	3 hour duration ensemble 1	3 hour duration ensemble 1
Precinct C	30 min duration ensemble 6	30 min duration ensemble 7	30 min duration ensemble 8
Precinct D	1 hour duration ensemble 1	30 min duration ensemble 5	30 min duration ensemble 1
Precinct E	45 min duration ensemble 6	30 min duration ensemble 5	30 min duration ensemble 8

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

3 Pre-development model

The catchment parameters determined for Precinct D within the LWMS for the initial loss – continuous loss model have been adopted to account for catchment losses. The pre-development loss parameters used are given in **Table 2**.

Table 2: Pre-development loss parameters

Land type	Initial loss (mm)	Continual loss (mm)	Roughness
Existing residential/Carpark	15	0.1	0.014

Catchment analysis for pre-development scenario was based on topographic contour data, site visit and aerial photography. Pre-development catchment area within Precinct D is 1.145 ha.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

4 Post-development model

An initial loss continuing loss model was adopted to account for post-development catchment losses. The post-development catchment area, land types and loss values were based on the structure plan design, typical infiltration rates for the soils which occur onsite and based on project team experience. Post-development catchment areas and land types within the site were informed by sub-division plan provided by LPD surveyors. **Table 3** summarises the loss parameters used within the post-development model.

Table 3: Post-development loss parameters

Land type	Initial loss (mm)	Continual loss (mm)	Roughness
Road Surface	1	0.1	0.02
Road Verge	9	1.5	0.05
Fully Impervious	1	0.1	0.02
Roof	1	0.1	0.02
Lot IMP	1	0.1	0.02
Gardens	25	2	0.05
POS	25	2	0.05
Precinct E Lots	15	0.1	0.014

A summary of post-development catchment information is provided in **Table 4** with the catchment plan and basin location shown in Figure 08 of the LWMS.

Table 4: Post-development catchment areas (ha)

Road reserve	Lots	Road Reserve	POS	Fully Impermeable	Child Care
Precinct A	0.714	0.606	1.360	0.330	-
Precinct C	-	5.903	-	-	-
Precinct D	0.526	0.421	-	-	0.199
Precinct E	3.622	0.365	0.219	-	-

The following assumptions were incorporated into the model:

- Precinct A
  - Lots will have 100% roof areas and road reserve contains 5% pervious verge and 95% impervious bitumen areas.
  - POS will be 100% pervious.
  - There is no current connection point for drainage to be exported from Precinct A.
  - 1 single basin/Flood storage area (FSA) for both treatment and flood mitigation.
  - Base of the FSA will need to be vegetated with reeds/rushes as per a biofilter.
  - FSA will have 1:6 side slopes and maximum depth 1.2m in a 1% AEP – to avoid the need for fencing or access control.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

- A hydraulic conductivity of 1m/day is assumed.

- Precinct C
  - The existing portion of Precinct C already connected to the centre of the track (existing buildings and stables) and no change has been assumed.
  - Rest of the Precinct C were modelled as two separate catchments i.e., carpark and stables which are 95% impervious and 5% pervious.
  - 1m deep sub-surface storage has been designed to accommodate 1% AEP event.
  - A hydraulic conductivity of 1m/day is assumed.
  - The storage configuration could be changed/modified to suit site layout/constraints.
  - The carpark in Precinct C that discharges to the southwest will discharge to Precinct E.

- Precinct D
  - Lots will have 50% roof areas, 45% paved areas and 5% pervious garden areas, the childcare has roof areas and Road reserve contains 20% pervious verge and 80% impervious bitumen areas.
  - 1m deep sub-surface storage has been designed to accommodate and detain upto 1% AEP events that will mimic pre-development flow of 0.4.
  - A hydraulic conductivity of 1m/day is assumed.
  - The storage configuration could be changed/modified to suit site layout/constraints.

- Precinct E
  - The carpark in Precinct C discharges to Precinct E.
  - Outflow of pre-development Water Corporation (WC) drain is 0.95 m^3/s as per WC modelling.
  - All lots of Precinct E retain 15mm of rainfall.
  - Runoff above 15 mm rainfall up to the 1% AEP will be managed by a detention basin which will mimic pre-development 1% AEP peak flow of 0.463 m^3/s.
  - The basin will have 1:6 side slopes and maximum depth 1.2m in a 1% AEP – to avoid the need for fencing or access control.
  - A hydraulic conductivity of 1m/day is assumed.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

5 References

5.1 General references

The references listed below have been considered as part of preparing this document.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M and Testoni I (Editors) 2019, *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia (Geoscience Australia).

5.2 Online references

Australian Rainfall and Runoff (AR&R) 2021, ARR Data Hub, viewed 1 December 2021, Available from: <https://data.arr-software.org/>.

Bureau of Meteorology (BoM) 2021a, Climate Data Online, viewed 1 December 2021, Available from, <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>.

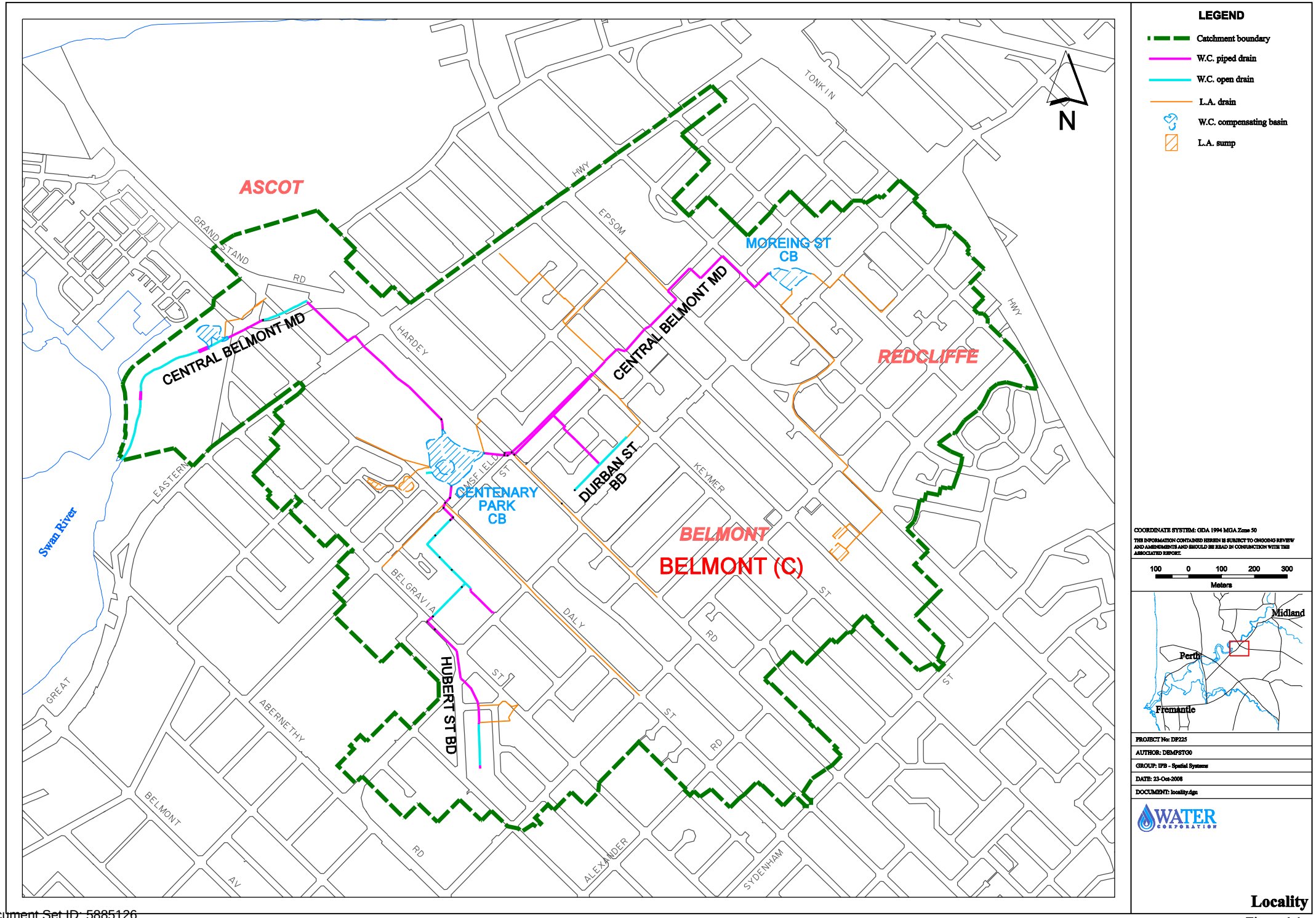
Bureau of Meteorology (BoM) 2021b, Design Rainfall Data System (2016), viewed 1 December 2021, Available from, <http://www.bom.gov.au/water/designRainfalls/revised-ifd/>.

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

Appendix E

Central Belmont Main Drain Water Corporation

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

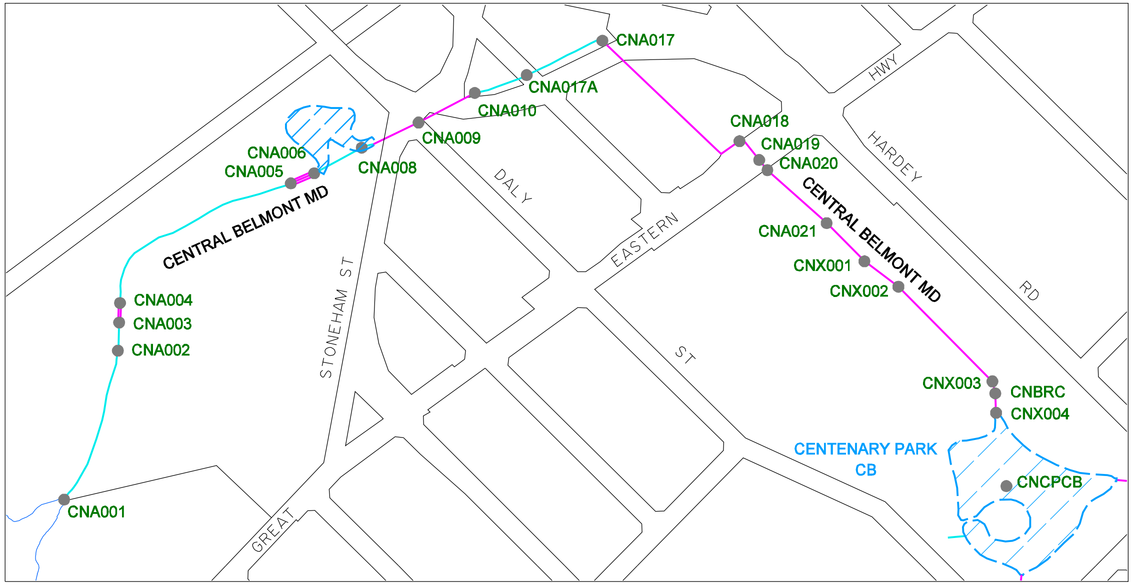


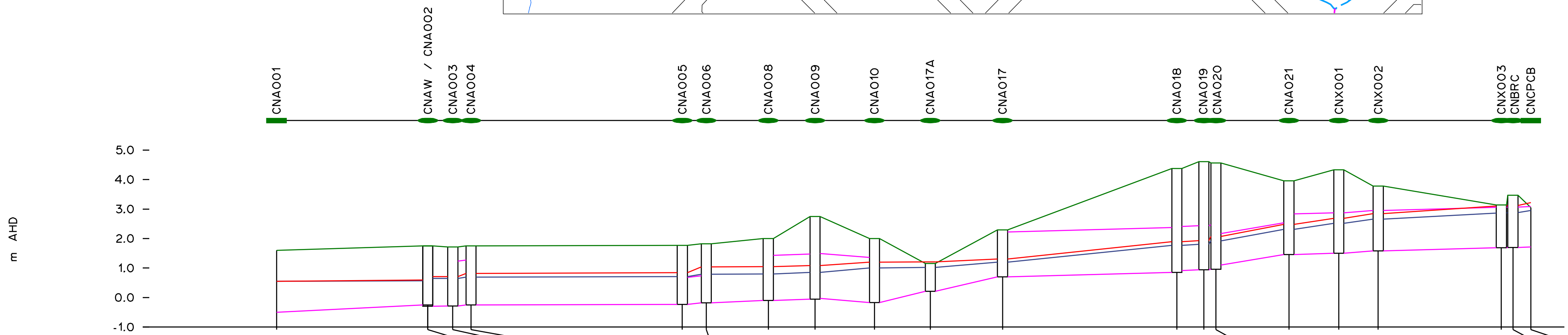
Locality

Figure 1.1

Document Set ID: 5885126
Version: 1, Version Date: 18/09/2024

THE INFORMATION CONTAINED HEREIN IS SUBJECT TO ONGOING REVIEW AND AMENDMENTS AND SHOULD BE READ IN CONJUNCTION WITH THE ASSOCIATED REPORT.





Chainage (m)	Ground level (m AHD)	10 year ARI HGL level (m AHD)	100 year ARI HGL level (m AHD)	Invert level (m AHD)	Invert level (m AHD)
0	1.60	0.55	0.55	.	-0.50
169	1.75	0.57	0.59	-0.25	.
169	1.75	0.65	0.71	.	-0.30
197	1.71	0.65	0.71	-0.29	-0.29
217	1.75	0.69	0.81	-0.25	-0.25
454	1.77	0.71	0.84	-0.23	-0.23
481	1.82	0.79	1.04	-0.18	-0.18
550	2.00	0.80	1.05	-0.10	-0.10
603	2.75	0.85	1.08	-0.05	-0.03
669	2.00	0.99	1.20	-0.17	-0.17
732	1.16	1.01	1.21	0.21	0.21
813	2.29	1.19	1.30	0.70	0.70
1008	4.37	1.75	1.88	0.85	0.91
1038	4.60	1.79	1.92	0.94	0.94
1052	4.56	1.90	2.06	0.96	1.10
1133	3.96	2.30	2.47	1.46	1.46
1189	4.33	2.50	2.67	1.50	1.50
1233	3.78	2.63	2.82	1.58	1.58
1371	3.14	2.83	3.07	1.69	1.69
1384	3.47	2.85	3.09	1.70	1.70
1404	3.05	2.92	3.18	1.71	.

Size (mm)	Max 10 year ARI flow (m3/s)	Max 100 year ARI flow (m3/s)
11000x2000	1.80	2.80
	.	.
11000 x2000	1.78	2.73
2/ 1524	1.78	2.72
11000x2000	1.78	2.72
3/ 910	1.80	2.78
11000 x2000	1.79	2.78
1524	1.43	1.83
1524	1.43	1.83
5600 x1200	1.43	1.83
5600x1200	1.44	1.83
1524	1.36	1.74
1500	1.27	1.62
1500	1.27	1.62
1070	1.27	1.62
1370	1.23	1.55
1370	1.23	1.55
1370	1.23	1.55
1370	1.23	1.55
1370	1.23	1.55

CENTRAL BELMONT MAIN DRAIN

LONGITUDINAL SECTION

Hgls and Flows Existing Scheme (1 of 2)

Figure C1.1

AUTHOR: DEMPSTER DESIGN FILE: Central Belmont MD.dgn

WATER CORPORATION

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