ANSTEY PARK STRUCTURE PLAN

AMENDMENT No.1

SPN/0876M-1

PTS

TOWN
PLANNING

ENDORSEMENT PAGE

This structure plan is prepared under the provisions of the City of Rockingham Local Planning Scheme No. 2 and the *Planning and Development (Local Planning Schemes) Regulations 2015 (as amended).*

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

22 April 2002

In accordance with Schedule 2, Part 4, Clause 28 (2) and refer to Part 1, 2. (b) of the *Planning and Development (Local Planning Schemes) Regulations 2015.*

Date of Expiry: **19 October 2035**

Table of Amendments

Amendment No.	Summary	Date approved by the WAPC
1	• Relocate the northern public open space (POS) area on Lots 35 and 36 Surf Drive, Secret Harbour to the southwest corner (near the intersection of Surf Drive and Warnbro Sound Avenue); • Modify the density code from R20 to R30 for lots adjacent to the repositioned POS area; and • Modify the density code from R30 to R20 for all other lots.	**03 September 2024**

Executive Summary

The Structure Plan guides the subdivision and development of the land generally bounded by Warnbro Sound Avenue, Anstey Road, Mandurah Road and Kimberly Drive, Secret Harbour (referred to as the Anstey Park Structure Plan). The Structure Plan is approximately 130 hectares is area and located within the City of Rockingham.

The Anstrey Park Structure Plan was originally approved by the Western Australian Planning Commission (WAPC) on 22 April 2002.

Amendment No. 1 to the Structure Plan relates to Lots 35 and 36 being the land bound by Warnbro Sound Avenue to the west, Surf Drive to the south, Kimberly Drive (extension) to the north and established residential dwellings to the east. The area of Lots 35 and 36 is 8.0659 hectares.

The purpose of the amendment is to relocate the northern public open space (POS) area on Lots 35 and 36 to the southwest corner (near the intersection of Surf Drive and Warnbro Sound Avenue). As a result of the relocation of the POS, the lots adjacent to the new POS location has an increased density code from R20 to R30 with the lots adjacent to and comprising the old POS location having a density code of R20.

The relocation is required as the current location of the POS is on the highest point of the site which will require significant earthworks. The current location is not practical due to the required earthworks and a drainage network discharging into the stormwater basin contained within the POS. Amending the location will greatly reduce the volume of earthworks and tie-into the area with the surrounding road network.

The resultant estimated development on Lots 35 and 36 is:

- 99 - R20 lots.
- 14 - R30 lots.
- 6265m^2 of local open space.

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Part 1 Implementation

1. Structure Plan Area and Operation

The structure plan applies to land generally bounded by Warnbro Sound Avenue, Anstey Road, Mandurah Road and Kimberly Drive, Secret Harbour being the area outlined on the Structure Plan Map (**Plan1**).

The structure plan is identified as the Anstey Park Structure Plan.

The Anstrey Park Structure Plan was originally approved by the Western Australian Planning Commission (WAPC) on 22 April 2002.

Pursuant to *Planning and Development (Local Planning Schemes) Regulations 2015*, Schedule 2, Part 4, clause 28(4) the Structure Plan is taken to have been approved on 19 October 2015 by the Western Australian Planning Commission for a period of 10 years.

2. Purpose

The Structure Plan has been prepared to guide the future subdivision and development of the area.

2.1. Amendment No.1

The purpose of Amendment No.1 to the Structure Plan is to:

- Relocate the northern public open space (POS) area on Lots 35 and 36 Surf Drive, Secret Harbour to the southwest corner (near the intersection of Surf Drive and Warnbro Sound Avenue);
- Modify the density code from R20 to R30 for lots adjacent to the repositioned POS area; and
- Modify the density code to from R30 to R20 for all other lots.

3. Staging

The Structure Plan is substantially completed, except for Lots 35, 36, 9613 and 9614 Surf Drive, and Lot 431 Warnbro Sound Avenue, Secret Harbour.

4. Subdivision and development requirements

4.1. Land use zones and reserves

Plan 1 designates proposed zones and reserves in the Structure Plan area.

4.2. Public Open Space

Public open space is to be provided in accordance with Plan 1 and Table 1.

Table 1: Public Open Space Schedule

Site Area			124.727 ha
Deductions			
Wetland (non creditable POS area)		0.0616 ha	
Commercial		0.5 ha	
Community Purpose		0.3 ha	
Total deductions		0.8616 ha	
Gross Subdivisible area			123.865 ha
Public open space @ 10 per cent			12.386 ha
May Comprise			
- minimum 80% unrestricted POS		9.9088 ha	
- maximum 20% restricted use POS		2.4772 ha	
Public Open Space Provided			
POS Area #	**Open Space Area (Net)**	**50% Credit Drainage ***	**Net POS + 50% drainage**
1	0.6265 ha	0.0784 ha	0.5482 ha
2	1.2111 ha	0.0000 ha	0.7392 ha
3	0.4516 ha	0.0553 ha	0.3963 ha
4	2.7333 ha	0.1742 ha	2.5592 ha
5	0.5113 ha	0.0113 ha	0.5001 ha
6	0.7226 ha	0.0192 ha	0.7034 ha
7	0.2938 ha	0.0000 ha	0.2938 ha
8	3.0590 ha	0.0250 ha	3.0340 ha
9	0.8127 ha	0.0416 ha	0.7711 ha
10	0.9000 ha	0.0935 ha	0.8066 ha
11	1.4475 ha	0.0000 ha	1.4475 ha
12	0.6557 ha	0.0682 ha	0.5876 ha
Sub-Total	13.4251 ha	0.5665 ha	12.3868 ha
Total Public Open Space Provision			**12.3868 ha (10%)**
Note: * A 50 per cent POS credit for 'dry' drainage basins and a 25 per cent credit for drainage lakes variation was accepted by the City/WAPC in the assessment of the approved Structure Plan.			

4.3. Density and Development

Plan 1 designates the R-Codes applicable to subdivision and development in the Structure Plan area.

Residential densities vary from R5 to R40. Higher density areas (R30 and R40) are generally located close to POS areas and the commercial sites, whilst R5 density areas are proposed along the Mandurah Road interface.

4.4. Other Requirements

4.4.1. Notifications on Title

In respect of an application(s) for subdivision approval, the WAPC may, as a condition of subdivision approval require a notification, pursuant to Section 165 of the Planning and Development Act 2005, be placed on the Certificate(s) of Title:

- For all lots with a Bushfire Attack Level (BAL) rating of 12.5 or above advising the existence of a hazard or other factor: "This land is within a bushfire prone area as designated by an Order made by the Fire and Emergency Services Commissioner and is/ may be subject to a Bushfire Management Plan. Additional planning and building requirements may apply to development on this land."

4.4.2. ATCO Trigger Distance

The Structure Plan area falls within the ATCO trigger distance under WAPC's draft Development Control Policy 4.3 – Planning for High-Pressure Gas Pipelines (DC 4.3).

Pursuant to draft DC 4.3 consultation with the pipeline owner/operator to define setbacks and/or identify risk mitigation measures (if any) may be required at later stages of the planning process.

4.4.3. Developer Contributions

The Structure Plan area falls within City of Rockingham Local Planning Scheme No. 2 Development Contribution Area No. 1. Developer contributions are applicable at the subdivision and/or development approval stage.

The structure plan applies to land generally bounded by Warnbro Sound Avenue, Anstey Road, Mandurah Road and Kimberly Drive, Secret harbour being the area outlined in the Structure Plan Map (**Plan1**).

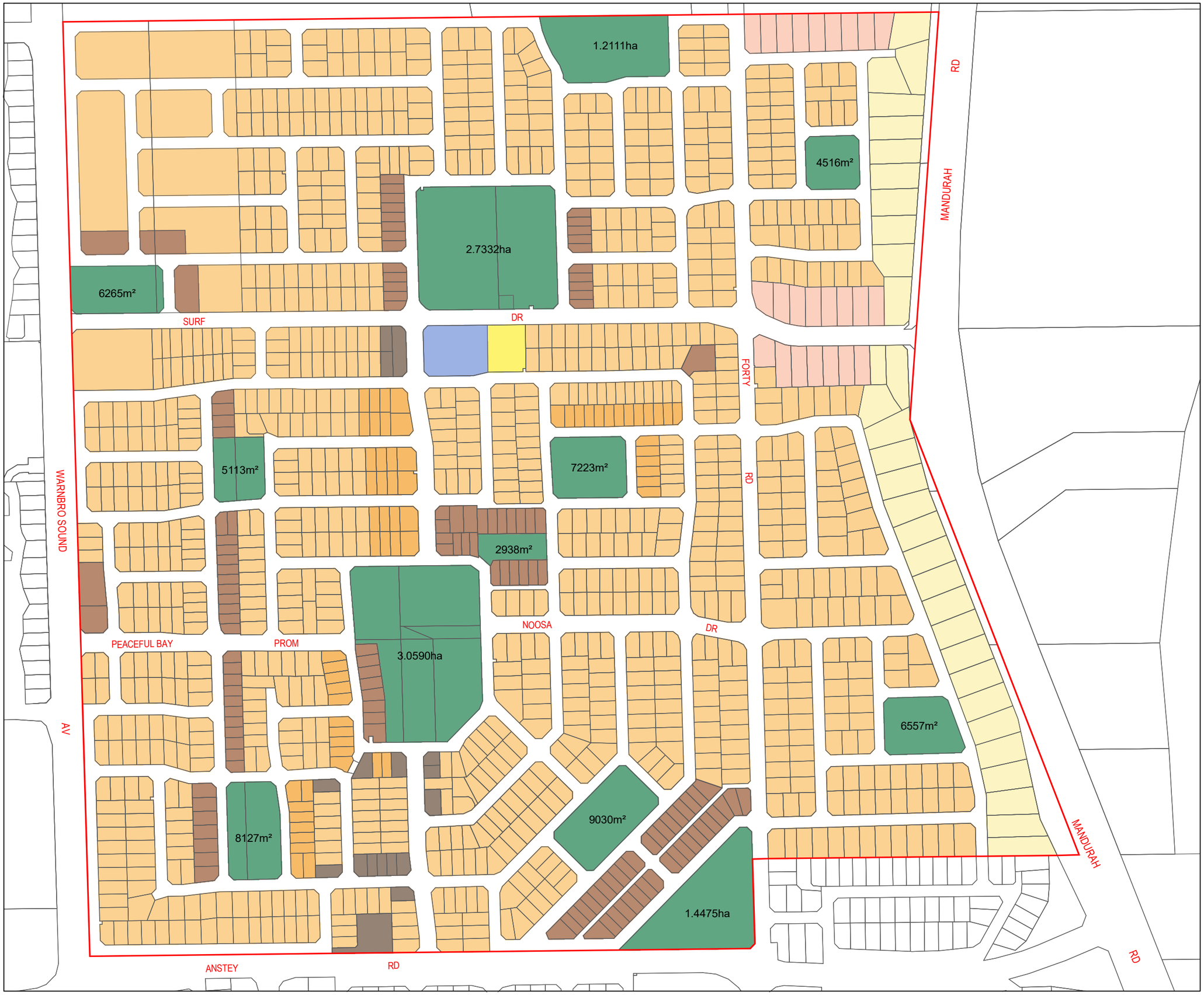
5. Additional Details

5.1. Information to be submitted with an application:

Additional Information / purpose	**Approval stage**	**Responsible agency (consultation required)**
Bushfire Management Plan	Subdivision	City of Rockingham Department of Fire and Emergency Services
Evidence of consultation with relevant pipeline owner/operator (if required)	Subdivision	ATCO Gas

5.2. Studies to be required under condition of subdivision/development approval.

Conditions of subdivision approval	**Responsible agency**
Urban Water Management Plan	City of Rockingham Department of Water and Environmental Regulation
Landscape Plan	City of Rockingham
Unexploded Ordnance (UXO) assessment survey (if required)	Department of Fire and Emergency Services



Anstey Park

- Commercial
- Community
- Public Open Space
- R10
- R20
- R25
- R30
- R40
- R5

Existing Cadastre

Anstey Park Boundary

NOT TO SCALE

city of Rockingham

Part 2 - Explanatory Report

1. Introduction

Anstey Park is located within the suburb of Secret Harbour. The structure plan is the overarching framework guiding the development of the residential estate known as Anstey Park.

The LSP supports residential development which is now substantially completed with the exception of the lots the subject of this amendment (Lots 35 and 36 indicated in blue in Figure 1 below) and some smaller lots along Surf Drive (refer to Figure 1 below). The LSP provides for a range of densities from R5 to R40, an established local centre and established and planned areas of open space.

Figure 1 - Anstey Park LSP Aerial Photograph

The primary purpose of this amendment is to relocate the proposed public open space (POS) to be located in the northern Figure 1 - Anstey Park LSP Aerial Photograph portion of Lots 35 and 36 to the southern portion of Lot 35 and Lot 36 along Surf Drive. As a result of the relocation of POS, the R30 lots are also to be relocated to around the new location of the POS.

The relocation is required as the current location of the POS is on the highest point of the site which will require significant earthworks. The current location is not practical due to the required earthworks and a drainage network discharging into the stormwater basin contained within the POS. Amending the location will greatly reduce the volume of earthworks and tie-into the area with the surrounding road network.

The area of the POS between the current and proposed locations is generally the same with similar dimensions. Both locations have roads on all sides of the POS and the structure plan roads are not required to substantially change. The location change is approximately 225 metres from the original location to the proposed location. The LSP Map has been amended to reflect the POS relocation and density code changes associated with the amendment.

This Amendment Report explains and justifies the amendments to the LSP Map. It does not replace the previous Explanatory Report, rather it forms an addendum and is supplementary to the previous Explanatory Report.

The following technical appendices have been prepared in support of this LSP amendment and are appended in full:

- Appendix A: Local Water Management Strategy; and
- Appendix B: POS Concept Plan.
- Appendix C: POS Areas Map

1.1 Ownership

The land the subject of the amendment is owned by A&R investments Pty Ltd, Kingalup Pty Ltd and A Nominees Pty Ltd. The amendment does not affect any lot currently held in third party ownership other than Lots 35 and 36.

2. Planning Framework

The LSP area is zoned 'Urban' under the Metropolitan Region Scheme.

The LSP area is zoned 'Development' under the City of Rockingham Local Planning Scheme No.2. The purpose of the 'Development' zone is:

1. *To identify areas requiring comprehensive planning prior to subdivision and development.*
2. *To coordinate subdivision, land use and development in areas requiring comprehensive planning.*

'The Anstey Park Structure Plan, formally known as the Anstey Park Comprehensive Development Plan, was originally approved by the Western Australian Planning Commission (WAPC) on 22 April 2002.The LSP is substantially completed with the exception of the lots the subject of this amendment and some smaller lots along Surf Drive.

The LSP provides for a range of densities from R5 to R40, an established local centre and established and planned areas of public open space.

3. Amendment Proposal

The primary purpose of this amendment is to relocate the public open space (POS) located in the northern portion of Lots 35 and 36 to the southern portion of Lot 35 along Surf Drive. As a result of the relocation of POS the R30 lots are also to be relocated to around the new location of the POS.

The Figure 2 provides the approved LSP as it relates to the site (extract).

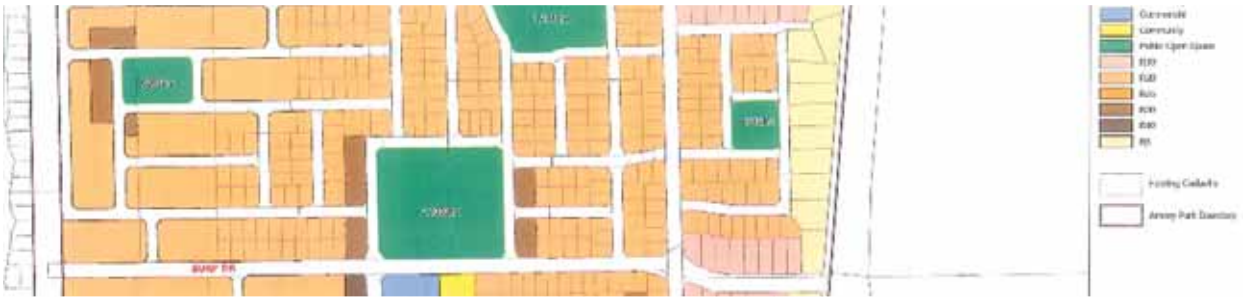


Figure 2 - Anstey Park Approved LSP Extract

The following Subdivision Concept Plan has been prepared in support of the amendment, showing the proposed changes.

Figure 3 - Subdivision Concept Plan

The relocation is required as the current location of the POS is on the highest point of the site which will require significant earthworks. The current location is not practical due to the required earthworks and a drainage network discharging into the stormwater basin contained within the POS. Amending the location will greatly reduce the volume of earthworks and tie-into the area with the surrounding road network.

4. Planning Considerations

4.1 Residential Density and Dwelling Yield

The amendment retains the existing residential density of R20 and R30 and generally the same dwelling yield noting that the R30 lots are to be relocated around the new location of the POS. This is consistent with the existing LSP.

4.2 Public Open Space

The amendment relocates the POS proposed to be located in the northern portion of Lots 35 and 36 to the southern portion of Lot 35 and Lot 36 along Surf Drive.

The proposed POS:

- Has the same size.

- Has similar length and depth dimensions.
- Is surrounded on all 4 sides by roads.
- Enables the R30 to more appropriately front the POS.
- Is within 225 metres of the approved POS, which provides that the majority of residents are within 300-400 metres of POS.

The proposed relocation of the POS has no impact on the provision of POS or the ability to access the POS.

4.3 Movement Network

There is generally no change to the movement network as the POS relocation is within the existing road network.

4.4 Bushfire Considerations

The subject site is identified as being in a bushfire prone location which triggers the bushfire planning requirements under State Planning Policy 3.7 Planning in Bushfire Prone Areas.

'The proposed amendment does not intensify the proposed land use and/or impact the bushfire considerations of the approved Structure Plan and will be addressed at subdivision stage.'

4.5 Unexploded Ordinance (UXO)

The lots may be impacted by unexploded ordinance which will be addressed at subdivision stage as the considerations of UXOs does not impact the structure plan design amendment.

4.6 Stormwater

The amendments are proposed to specifically address the drainage network. The approved location of the POS is on the highest point of the site and is not practical due to the required earthworks and a drainage network discharging into the stormwater basin contained within the POS. Amending the location will greatly reduce the volume of earthworks and tie-into the area with the surrounding road network.

4.7 Conditions of Subdivision

The following technical reports/ strategies are to be prepared and submitted as a condition of subdivision approval (where applicable):

- Urban Water Management Plan
- Bushfire Management Plan
- Landscaping Plan

5. Conclusion

The proposed amendments to the Anstey Park Local Structure Plan are proposed to address the drainage network by relocating the public open space (POS) located in the northern portion of Lots 35 and 36 to the southern portion of Lot 35 along Surf Drive.

The amendment has no impact on the size or dimensions of the POS, the residential density and dwelling yield or movement network as these matters are maintained as per the approved LSP.

The proposed dwellings on the subject site will still be within 400 metres of the POS.

The relocation of the POS has been proposed following further assessment and design of the drainage infrastructure required for the proposed subdivision of Amendment Area.

Amending the location of the POS to the corner of Surf Drive and Warnbro Sound Avenue reduces the volume of earthworks and allows the proposed development to tie into the levels of the surrounding road network to the east.

The relocation also decreases the future management and maintenance costs needed to meet the stormwater drainage requirements of discharging into the raised POS. Ensuring suitable development practices for the amendment area'.

Appendix A

Local Water Management Strategy

David Wills and Associates
Consulting Engineers

LOTS 35 AND 36 SURF DRIVE, ANSTEY PARK SECRET HARBOUR

Local Water Management Strategy

Prepared for Marchese Investments Pty Ltd

14163.04
REVISION C
JULY 2024

DOCUMENT CONTROL DATA

DWA David Wills and Associates Consulting Engineers	David Wills and Associates Unit 1/9 Shields Crescent Booragoon WA 6158 PO BOX 3084 Myaree WA 6158 Tel: (08) 9424 0900 www.dwaconsulting.com.au	**Title**	Local Water Management Strategy for Anstey Park, Secret Harbour
		Author	BC
		Checked	AR
		Approved	DW
		Synopsis	LWMS Amendment for Anstey Park, Secret Harbour

Reference: 14163.04
Client:

Revision Table

Ver	Description	Date	Authorised
A	Original	15/08/23	AR
B	Revision to Local Authority Comments	09/01/24	AR
C	Revision to WAPC Comments	11/07/24	BD
D			

Distribution Table

Date	Version	Distribution
15/08/23	A	City of Rockingham
09/01/24	B	City of Rockingham
11/07/24	C	City of Rockingham, Western Australian Planning Commission
	D	

EXECUTIVE SUMMARY

Lots 35 and 36 Surf Drive, Secret Harbour are undeveloped and are part of an existing Anstey Park Structure Plan which indicates the location of the Public Open Space (POS) at one of the highest locations of the land holding of Lots 35 and 36 Surf Drive.

To reduce the overall earthworks, it is proposed to adjust the location of the proposed POS to a lower area of the catchment. This relocated POS will be in the same area as the originally proposed POS.

This Local Water Management Strategy (LWMS) has been prepared to address the requirements of amending the location of the POS. This report has been developed in accordance with:

- *Western Australian Planning Commissions (WAPC) Better Urban Water Management Framework (WAPC 2008);*
- *The associated Planning Bulletin 92 – Urban Water Management;*
- *The Department of Water Interim: Developing a Local Water Management Strategy (2008);*
- *City of Rockingham Planning Policy 1-8;*
- *City of Rockingham Planning Policy 3-4-1,*
- *City of Rockingham Planning Policy 3-4-3;*
- *Address all requirements of Appendix 1 of the Better Urban Water Management (WAPC, 2008); and*
- *Decision Process for Stormwater Management in WA (DWER, 2017).*

The area has been assessed as an integrated water management approach with a specific focus on the effects of lowering the proposed stormwater basin bed.

- The existing ground level of the site varies between 4.50 mAHD and 10.9 mAHD;
- The soils expected are Tamala formation sands, these sands are medium-grained and have good drainage characteristics;
- Acid Sulphate Soil (ASS) risk maps classify the entire site as having no known risk;
- Groundwater underlying the site flows towards the Indian Ocean; and
- The site has historically been used as a naval artillery range.

Holistic water conservation measures are proposed, targeting specific water usage goals for irrigation (6,750 kL/ha/yr) and residential areas (100 kL/person/year, with a scheme water limit of 40-60 kL/person/year).

The development area will be fully serviced, with potable water and wastewater connections provided by the Water Corporation.

Stormwater management emphasizes quantity and quality control, maintaining existing hydrology by retaining surface flows and infiltrating runoff as close to the source as possible.

Specifics for Lots 35 and 36 Surf Drive include:

- Total area of approximately 80,700m^2;
- Retention of minor storm events within proposed residential lots;
- Treatment of road reserve and Public Open Space rainfall in a gross pollutant trap and bio-filtration area;
- Installation of a basin surrounding the bio-filtration area to contain major storm events (1 in 100 year) for the entire development area.

The proposed stormwater basin, with a base area of 637m^2, is designed to pool to a maximum depth of 0.7m during the 1% Annual Exceedance Probability storm event.

Groundwater monitoring indicates a generous separation of groundwater levels from the proposed base of the stormwater basin. The modelled 1% Annual Exceedance Probability storm event is at 5.4m AHD, ensuring a safe freeboard to the Final Floor Level (FFL) of all residential buildings.

The table below summarises the required and provided stormwater volumes for the critical 1% AEP (1in 100 years) storm event

Stormwater Summary Table: 1% AEP Stormwater Requirement

Location	Weighted Runoff Coefficient (C)	Catchment Area (m^2)	Required Storage for a 1% AEP event (m^3)	Storage Provided (m^3)
Total Site Catchment Area	0.47	80,700	1,380.8	1,513.9

This LWMS outlines a detailed plan for water management, addressing the relocation of the POS and ensuring sustainable development practices for Lots 35 and 36 Surf Drive in Secret Harbour.

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1 INTRODUCTION

Lots 35 and 36 Surf Drive, Secret Harbour are undeveloped and are part of an existing Structure Plan which indicates the location of the Public Open Space (POS) at one of the highest locations of the land holding.

Marchese Investments, the owners of Lots 35 and 36 Surf Drive, however they wish to confirm and set aside the location of the POS. After discussions with the City of Rockingham, it is now proposed to relocate this POS to a low-lying area of the site.

1.1 Background

Anstey Park is located in the City of Rockingham in the suburb of Secret Harbour. The area is bounded by Anstey Road, Mandurah Road, Warnbro Sound Avenue and Kimberley Drive. The original Anstey Park Structure Plan was completed in December 2009 with a minor amendment occurring in June 2011. Anstey Park is approximately 130 hectares and contains Lots 35 and 36 Surf Drive which have an area of approximately 8 hectares.

These lots are proposed to be subdivided into R20 lots and R30 lots. As defined in the Western Australian State Planning Policy 7.3, R20 lots are required to have an average size of 450m^2, with a minimum single lot size of 350m^2 whilst R30 lots are required to have an average size of 300m^2, and a minimum single lot size of 260m^2.

A development plan titled “Anstey Park Comprehensive Development Plan Cost Contributions Report” was previously undertaken by Worley Parsons in 2006. The stormwater drainage information of that report is attached in Appendix C of this report. There is no previous Local Water Management Strategy for the Structure Plan area.

Construction of Anstey Park is mostly complete, with only a few areas of subdivisions remaining to be developed. The final major subdivision is Lots 35 and 36 Surf Drive, located in the northwest corner of the area. An aerial image of the overall Anstey Park is shown below.

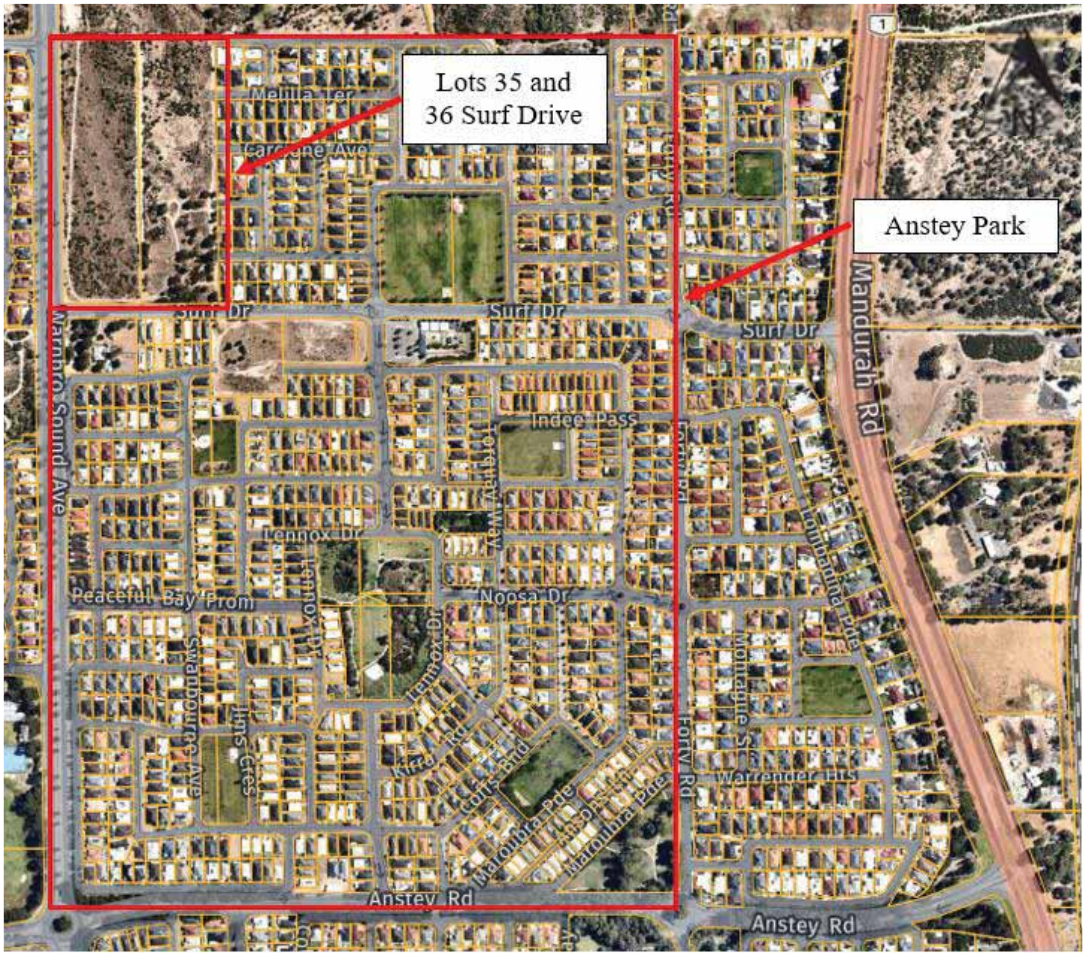

Figure 1: Anstey Park Aerial Overview (Courtesy of Nearmaps, April 2023)

Revised planning for the subdivision of Lots 35 and 36 Surf Drive has commenced, with a review of the proposed location of the POS. It is proposed to move the location of the Public Open Space from the original location shown in Figure 2 to the proposed location shown in Figure 3.

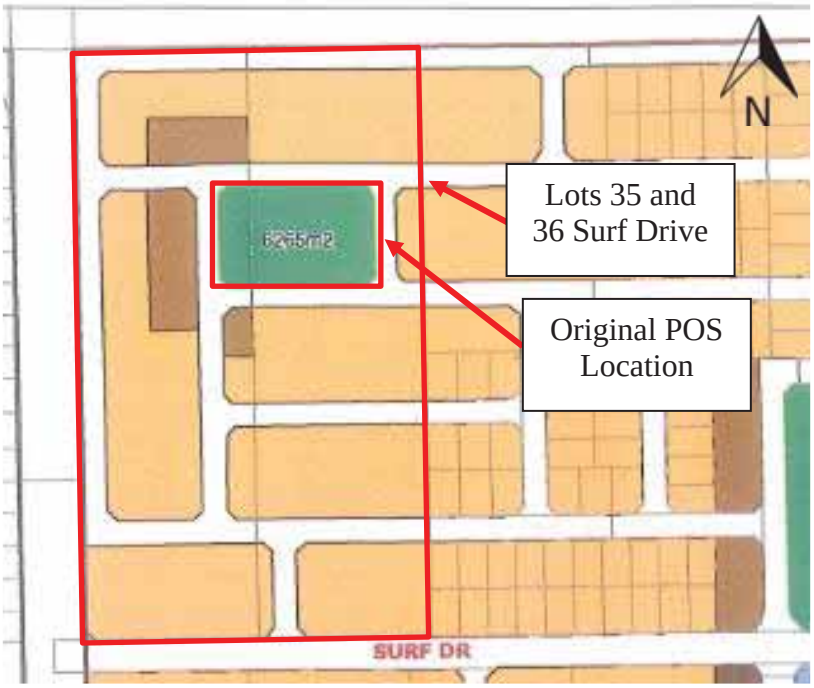

Figure 2: Existing Plan for Lots 35 and 36 Surf Drive

Figure 3: Proposed Amended Plan for Lots 35 and 36 Surf Drive

The proposed POS dimensions are similar to the original POS dimensions. with relocation proposed to reduce the total volume of earthworks required, to minimise the need for large retaining walls and to allow smooth transition into the already established road reserves.

The original location of the POS was proposed at the highest point of the site which is highly impractical due to the need of the required drainage network to discharge flows downhill via gravity into the stormwater basin contained within the POS.

Changing the location of the POS will lower the ground level of the proposed POS location from approximately 7m AHD to 5m AHD. This shall greatly reduce the volume of earthworks required to tie in the area with the surrounding road network.

1.2 Purpose

This Local Water Management Strategy (LWMS) focuses on Lots 35 and 36 Surf Drive, Secret Harbour only and address the requirements of and shall be in accordance with:

- *Western Australian Planning Commissions (WAPC) Better Urban Water Management Framework (WAPC 2008);*
- *The associated Planning Bulletin 92 – Urban Water Management;*
- *The Department of Water Interim: Developing a Local Water Management Strategy (2008);*
- *City of Rockingham Planning Policy 1-8;*

- *City of Rockingham Planning Policy 3-4-1,*
- *City of Rockingham Planning Policy 3-4-3;*
- *Adress all requirements of Appendix 1 of the Better Urban Water Management (WAPC, 2008); and*
- *Decision Process for Stormwater Management in WA (DWER, 2017).*

Other documents that are relevant to the LWMS are:

- *Australian Runoff Quality (Engineers Australia, 2006,)*
- *Australian Rainfall and Runoff (Engineers Australia, 2019); and*
- *Adoption Guidelines for Stormwater Biofiltration Systems (CRCWSC, 2015).*

1.3 LWMS Objectives

This LWMS is to address the requirements of an LWMS as defined by the Department of Water and Environmental Regulation (DWER).

The key points addressed are listed below.

- Provide integration with the planning processes,
- Minimise public risk; and
- Protect infrastructure and assets from flooding and inundation.

The following storm events will be modelled and assessed in order to achieve the above requirements.

- Small Storm Event – the first 15mm of rainfall inside the catchment;
- Minor Storm Event – the 20% AEP (1 in 5 year) storm event of critical duration; and
- Major Storm Event – the 1% AEP (1 in 100 year) storm event of critical duration.

2 PRE-DEVELOPED CONDITIONS

2.1 Site Conditions

The site currently consists of remnant shrubland and appears to have been cleared many years ago. A detailed feature and contour survey on Lots 35 and 36 Surf Drive was undertaken in 2015 by Guidice Surveys – a high-resolution copy is attached in Appendix A. The natural surface of the site falls to the south-west, by approximately 4.5m.

At the boundary between Lot 36 and the existing developed area immediately to the east, there is existing natural ridge line. This results in Lots 35 and 36 becoming a trapped low point as stormwater cannot flow overland outside of the catchment. Because of this, it is imperative that the proposed stormwater system can contain a 1 in 100 year storm event and provide adequate storage to protect infrastructure.

2.2 Geotechnical

A detailed geotechnical report was completed by Brown Geotechnical for the nearby Dolly Link subdivision area in March 2023. This location is immediately southeast of the site and there is less than 300m from the centre of Dolly Link to the centre of Lots 35 and 36 Surf Drive.

At Dolly Link, medium-grained sand was encountered in all test holes to at least 2m depth. The sand is medium dense to dense, becoming very dense below about 1m. The sands have been identified as Tamala Formation and have good drainage characteristics. A full copy of the geotechnical report is attached in Appendix B.

The previous geotechnical report has been compared against soil mapping data. From mapping provided by the Western Australian Department of Mines, Industry Regulations and Safety, the site soils are classed as Warnbro Group Sands. These sands consist of Interbedded sandstone, siltstone, and shale, with minor conglomerate. This classified the site as a Class A site as defined by AS 2870 – Residential Slabs and Footings. An extract of the soil mapping is attached below in Figure 4 with the Site and location of the previous geotechnical report annotated.

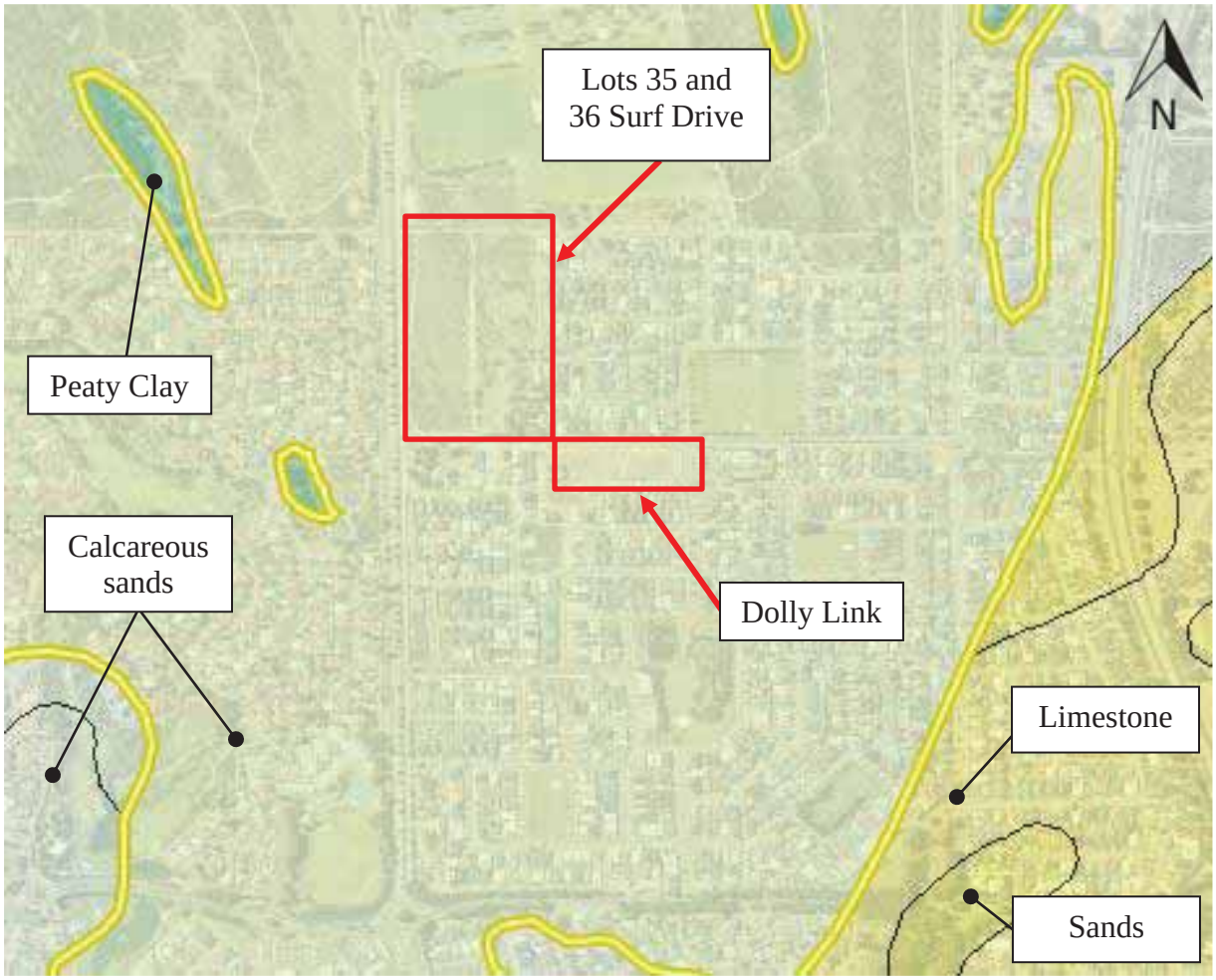

Figure 4: Soil Mapping (Courtesy of the Department of Mines, Industry Regulations and Safety)

Legend:

Pale Blue -	Calcareous Sands - white medium-grained
Green -	Peaty Clay
Yellow -	Sand - pale and olive-yellow medium to coarse-grained
Pale Yellow -	Limestone- pale yellow-brown fine-grained angular and medium-grained rounded

A site-specific geotechnical investigation will be undertaken at the subdivision design stage but due to the previous designs carried out in the surrounding area, it is not anticipated that there will be a requirement to modify this Local Water Management Strategy.

Mapping of the relevant area and surrounds has been undertaken from Acid Sulphate Soils data provided by Geoscience Australia. Lots 35 and 36 Surf Drive are in an area with “an extremely low probability of occurrence”. There are a few small pockets beyond the site to the North and the West with a “high probability of occurrence”. This is shown in Figure 5 below.

There is no significant risk of Acid Sulphate Soils.

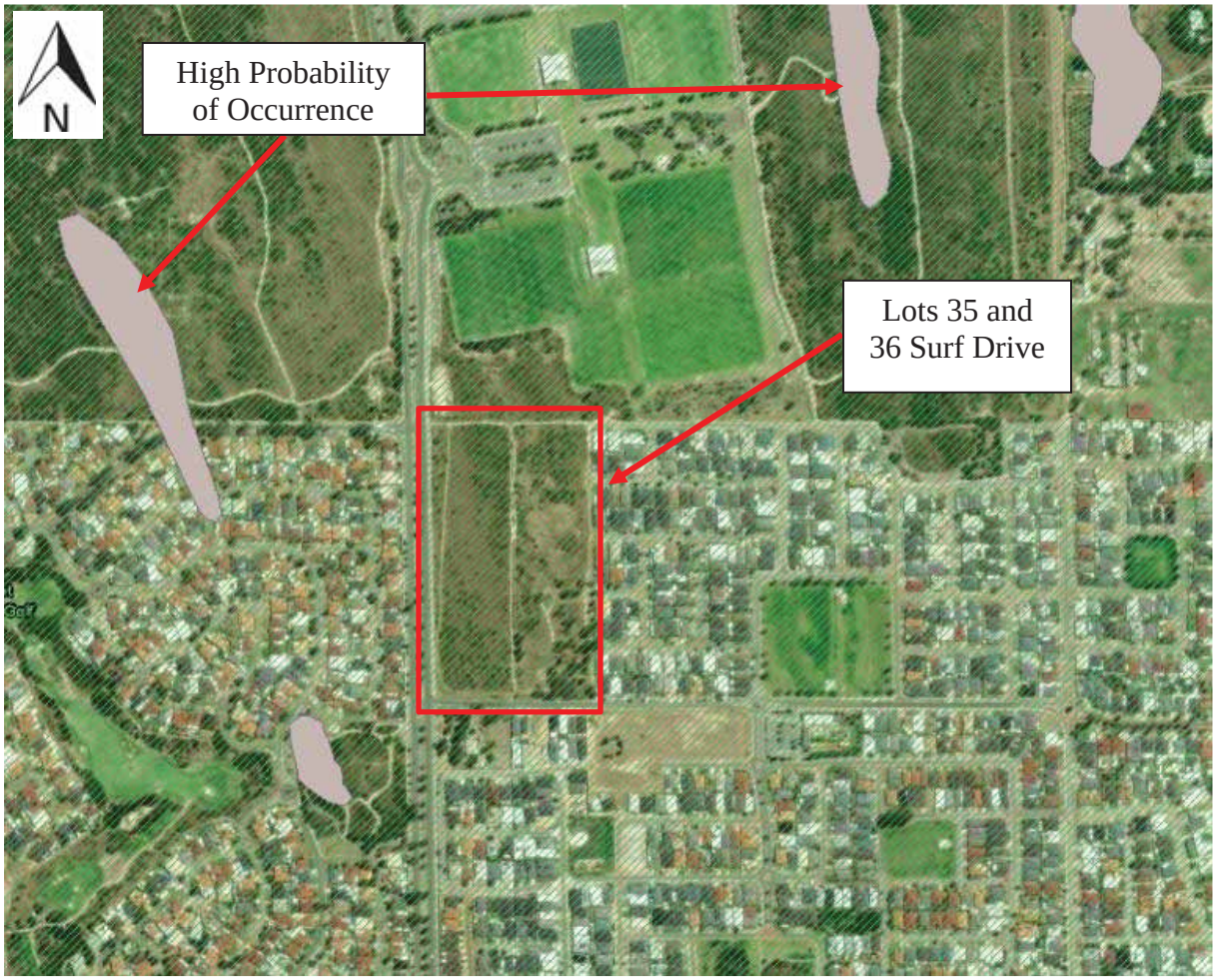

Figure 5: Acid Sulphate Soils Mapping, (Courtesy of Geoscience Australia, 2023)

2.3 Environmental

Flora in the area is low shrub. No waterways or wetlands have been identified within the area of the future subdivision.

In the 1940's, the area was used regularly as a naval artillery range, resulting in severe unexploded ordnance (UXO) contamination. Neighbouring lots that were recently subdivided encountered UXO's.

The area is classified as a "Substantial Potential" Risk by the Australian Government Department of Defence, which is the most extreme classification. To allow for development, 100% of the site is required to have a UXO search after completely devegetating or mulching the site. The search is to be performed in 3m layers, and the extent will depend upon the ultimate earthworks and services design.

An overview of the UXO risk mapping from the Department of Defence is attached below in Figure 6.

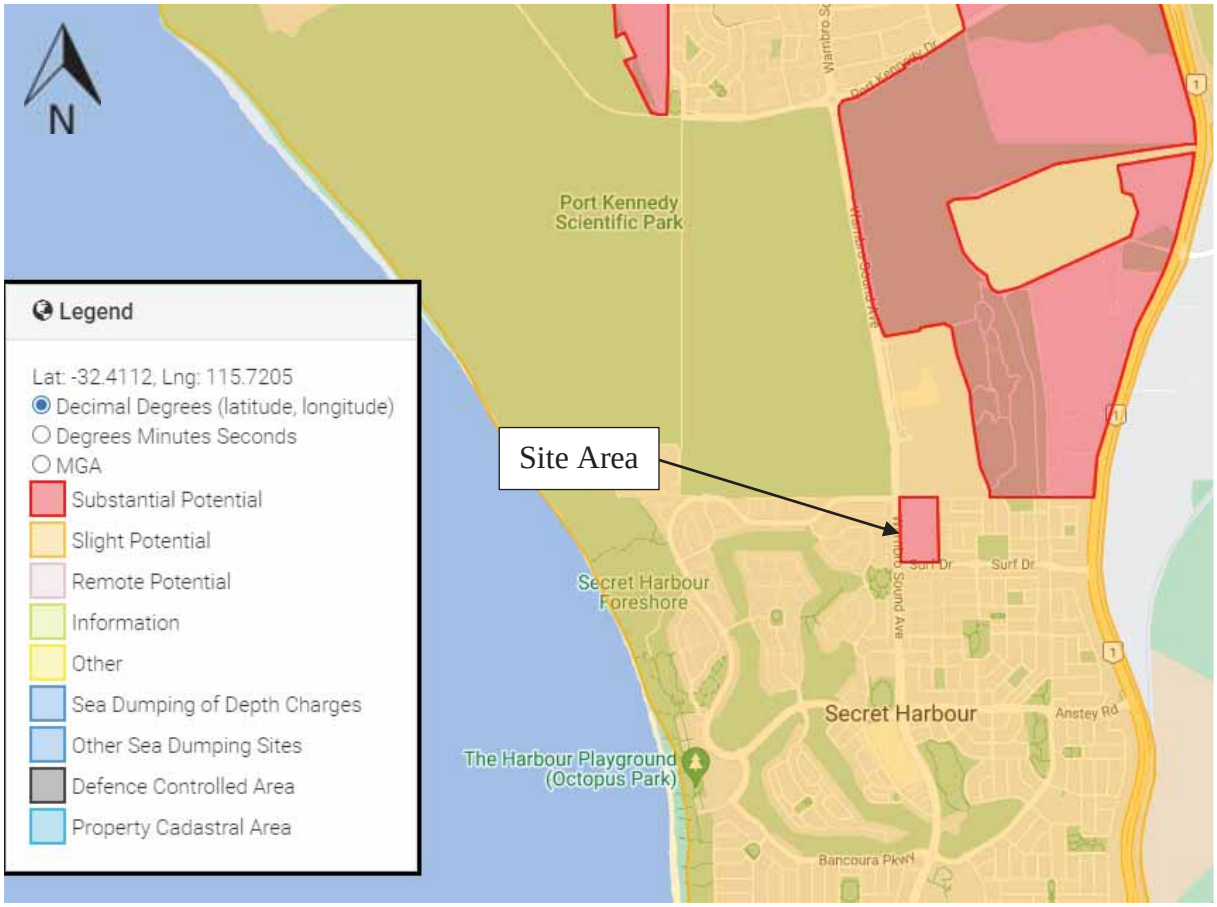

Figure 6: Unexploded Ordnance Risk Mapping, (Courtesy of the Australian Government of Defence, 2023)

2.4 Groundwater

The existing ground level of the site varies between 4.50 mAHD and 10.9 mAHD.

An estimate of the groundwater levels has been obtained from nearby, groundwater monitoring bores and data available from the Department of Water and Environmental Regulations (DWER) groundwater mapping.

The groundwater table recorded at nearby groundwater monitoring bores, based on the Department of Water and Environmental Regulations groundwater mapping, has been summarised in Table 1 below.

Table 1: Nearby Groundwater Monitoring Bores (Data provided by DWER, 2023)

Bore Name	Maximum Groundwater level (mAHD)	Year of Maximum Groundwater	Direction and Distance to Proposed Development (km)
61407115	2.8	2023	Southeast - 1.5
61410030	2.9	1981	South - 1.0
61410050	2.7	2004	Northeast - 3.0
61410280	3.4	1986	North - 2.3

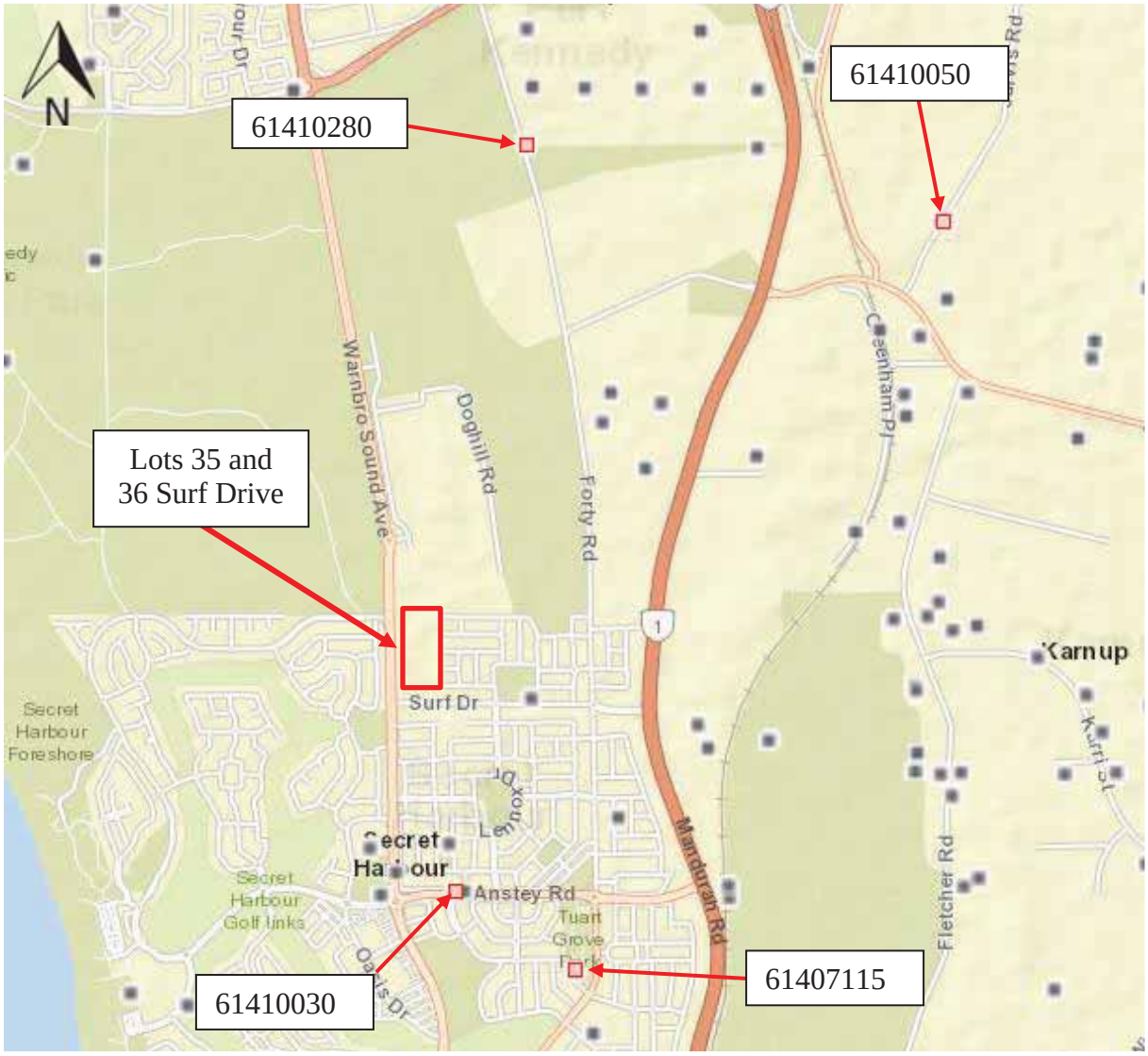

Figure 7: Groundwater Monitoring Bores, (Courtesy of the Western Australian Department of Water, 2023)

The majority of sites with groundwater monitoring data are to the north of the site. The average groundwater level of the nearby bores is approximately 2.95m AHD. A conservative value of 3.2m AHD will be used for the initial design. As the development area is between areas of existing development where groundwater issues have not been reported, groundwater is not expected to be a concern.

The proposed finished lot level of the development is anticipated to range from 6.1m AHD to approximately 9.0m AHD.

The lowest Finished Floor Level of a residential dwelling is expected to be at approximately 6.2m AHD. This is to be confirmed at the detailed design stage but provides a generous separation from all dwellings to the maximum historical groundwater level.

The proposed base of the stormwater basin inside the POS is 4.7 mAHD. This level allows for the basin to effectively collect stormwater runoff from the development and infiltrate into the sandy soils.

The design ensures that the minimum separation between the groundwater and the finished lot level is greater than 3.0m. Because of the expected groundwater separation, there is no requirement for the importation of fill as specified by the City of Rockingham in their Urban

Water Management Planning Policy. This is a generous separation to the groundwater level and hydraulically adequate.

Further increasing the separation between the groundwater level and the finished surface level of the POS will require lifting a large percentage of the site, resulting in a significant increase of the earthworks cost with no practical benefit due to the current generous separation to the groundwater.

Site specific groundwater levels should be measured and included in the future Urban Water Management Plan (UWMP) during the detailed design phase.

2.5 Earthworks

Projected earthworks for the site are expected to be minor. The new location of the proposed Public Open Space (POS) allows for the proposed lots to integrate with the existing contours of the site allowing the development to effectively tie in with the already developed areas surrounding the site.

Due to the minor scale of the development, the small amount of earthworks expected to be required and the proximity of the site to the coast, it is expected that groundwater levels will not be impacted by the development.

A comprehensive assessment of earthworks, including detailed site grading and level specifications, will be conducted during the detailed design stage of the project to ensure precise planning and execution.

3 WATER SUSTAINABILITY

3.1 Service Connections

At the time of subdivision, the requirements of the relevant Statutory Authorities will be met, encompassing elements such as water supply and wastewater disposal.

The development area shall be a fully serviced subdivision and potable water connections and waste water connections shall be supplied by the Water Corporation.

In collaboration with the Water Corporation, arrangements will be made to secure and guarantee the presence of a suitable water supply, and sewerage services for the proposed lots.

3.2 Stormwater Approach

Stormwater generated within the proposed residential lots will be retained and infiltrated at the source. Residential lots less than 350m^2, are required to manage the first 15mm of rainfall on site. Residential lots greater than 350m^2 are required to manage the 20% AEP storm event of critical duration on site. All residential lots are proposed to use soakwells installed inside the property to manage the required stormwater disposal.

For storms beyond the specified above, excess stormwater will overland flow from the residential lots into the road reserves and ultimately flow towards the infiltration basin inside the Public Open Space.

Minor rainfall that lands within the road reserves and Public Open Space will flow into the proposed basin inside the Public Open Space. This basin is sized to allow for the surcharge flow up to the critical duration of 1% AEP storm event over the entire development area.

A landscaping plan for the POS has been produced by Tim Davies Landscaping. It is attached in Appendix F.

4 STORMWATER MANAGEMENT STRATEGY

4.1 Design Criteria

The stormwater management strategy for the proposed developed area is to:

- Provide a high degree of water quality treatment for the initial 15mm of rainfall;
- Manage the storage and retention of the 1 in 5 year AEP storm event;
- Provide peak flow rates, detention areas and expected Top Water Levels for the 1 in 100 year storm event;
- Ensure 80% of the POS is reserved for active and passive recreation purposes as defined in the Liveable Neighbourhoods (2007) for the 1 in 100 year storm event; and
- Provide a minimum of 500mm freeboard from the 1 in 100 year flood level to the minimum Finished Floor Level (FFL).
- Amended soils with a PRI of at least 15, will be installed to a minimum depth of 300mm inside the bioretention area.

4.2 Design Approach

Storm events landing in the catchment will be infiltrated at source, or directed towards the proposed stormwater system in the POS. As specified by the City of Rockingham, all residential lots >350m^2 must support the 20% AEP storm event and lots <350m^2 must support the first 15mm of rainfall. These residential lots account for approximately 52,635m^2 of the total subdivision area of 80,700m^2.

Rainfall from the road reserve area will be directed to the compensating basin via the proposed pit and pipe stormwater system. Well liners are proposed to be installed inside the road reserve and will accommodate the 1 in 5 year storm event of critical duration. The pit and pipe system in the road reserve will be sized to accommodate the peak flow generated by the 1 in 5 year storm event. Stormwater volumes beyond this will flow through the underground stormwater network installed within road reserves towards the proposed compensating basin inside the POS.

The stormwater from the pit and pipe system inside the road reserves will be designed to discharge at a 1800mm diameter bubble-up pit with a silt trap located in a bioretention basin at the base of the proposed compensating basin in the POS.

The bio-retention basin has been sized to contain the 20% AEP storm event of critical duration rather than the initial 15mm of rainfall. This is a conservative approach compared to the initial 15mm of rainfall and is a rule of thumb to easily approximate the 1 in 1 year, 1 hour long storm event. Assessing the critical duration 20% AEP storm event will provide significantly greater storage requirements when compared to the 1 in 1 year, 1 hour long storm event.

For storm events beyond the 20% AEP and up to the 1% AEP storm event of critical duration, the bio-retention area will fill and the stormwater will pool inside the proposed stormwater basin.
The biofiltration basin is required to be designed and constructed in accordance with the Adoption Guidelines for Stormwater Biofiltration Systems (CRCWSC, 2015). To meet these requirements, it is recommended that robust sedges and rushes are planted inside the bioretention area. These plant species are to be planted at a density of approximately 6-10 plant/m^2 to provide adequate filtration.

Soils in the biofiltration area shall consist of amended soils with a Phosphorus Retention Index (PRI) of 15 or greater. These amended soils shall be a minimum of 300mm thick and cover the entire bioretention area.

The total stormwater basin inside the POS is to be sized for the 1% AEP storm event. This includes the surcharge flow generated by the 1% AEP storm event inside the road reserve areas and all lots inside the subdivision.

The POS will make up 10% of the total development area, with 80% of the POS (or 8% of the total development area) reserved for active and passive recreational purposes. To achieve the necessary stormwater storage volume within the available area, a concept detail of the stormwater system is attached in the drawing set provided in Appendix E. Calculations of the required basin size to contain the critical duration 1% AEP storm event are attached in Appendix D.

Due to the location of the basin, it is proposed that the banks be graded at 1 in 6 or flatter to ensure that public safety is not compromised. The area is to be grassed, reducing the risk of long-term erosion of the basin side slopes.

4.3 Preliminary Grading Design

A concept grading of the proposed POS has been undertaken by David Wills and Associates, including grading of the proposed stormwater compensating basin area. Based on the calculations undertaken, a Top Water Level of 5.7m AHD inside the basin is expected for the 1% AEP storm event.

Assuming a 3% crossfall and a 1% longitudinal fall for the road network, the maximum 1% AEP depth of flow is approximately 0.1m. This is required to be confirmed during the detailed design and will change with the final location of the stormwater pits inside the road network.

This design provides a minimum 0.5m separation between the 1 in 100 year maximum water level inside the stormwater basin and all existing and proposed dwellings as well as protection of all houses from stormwater flowing through the road network. The top water level is required to be confirmed during the detailed design stage.

4.4 Stormwater Storage Volumes

Stormwater storage requirements for Lots 35 and 36 Surf Drive have been assessed by the modified COPAS method for various catchments. These include the road reserve area, the area of the Public Open Space, and all residential lots.

When sizing the POS, a conservative approach has been used to not include storage or infiltration that will be provided by the pit and pipe system that is proposed to be installed inside the road reserve.

A weighted runoff value was calculated by comparing runoff from the POS, road reserve, R20, and R30 lots. For the road reserve, the ratio of the impervious road (C=0.95) and the previous verge (C=0.3) provided a weighted C value of 0.58 for the entire road reserve. A runoff value of C=0.1 has been used for the Public Open Space. A conservative weighted runoff value of C=0.60 has been used for the combined Road Reserve and Public Open Space during the design of the stormwater system.

Storage volumes required have been calculated by comparing inflow into the site against the outflow provided by the infiltration through the floor of the proposed basin. The infiltration rate for the soils has been previously assessed at 10 m/day.

David Wills and Associates has completed infiltration testing in the nearby area and encountered values between 25 to 30 m/day. Using a design value of 10m/day allows for clogging of the soil and some variance over the site and is still very conservative.

With these values, the local catchment of Lots 35 and 36 Surf Drive has been assessed for the 20% AEP (1 in 5 year) storm event and for the 1% AEP (1 in 100 year) storm event. The following Tables are a summary of the system under different design storm events. Further details of the stormwater calculations are attached in Appendix D. This includes the critical storm durations as well as storm hydrographs.

Table 2: Small Storm Summary (Initial 15mm)

Location	Weighted Runoff Coefficient (C)	Catchment Area (m^2)	Required Storage for a small storm event (m^3)	Storage Provided (m^3)	Notes
A Single R30 Lot	0.6	375	3.6	3.8	**Storage achieved by 1x 1.8m diameter x 1.5m deep soakwell installed within the lot.*

Table 3: Minor Storm Summary (20% AEP)

Location	Weighted Runoff Coefficient (C)	Catchment Area (m^2)	Required Storage for a minor storm event (m^3)	Storage Provided (m^3)	Notes
A Single R20 Lot	0.4	500	3.0	3.8	**Achieved by 1x 1.8m diameter x 1.5m deep soakwell **500m^2 is the maximum size of the proposed lots.*
Total Lot Area	0.4	52,635	304.8	431.2	**This reflects the actual total area of the lots rather than 350m^2 and 500m^2 lot sizes only*
Road Reserve and POS	0.6	28,065	196.6	213.4	*Storage provided by the Bioretention Area*

Table 4: Major Storm Summary (1% AEP)

Location	Weighted Runoff Coefficient (C)	Catchment Area (m^2)	Required Storage for a 1% AEP event (m^3)	Storage Provided (m^3)	Notes
Total Lot Area	0.4	52,635	1,008.5	431.2	**Excess stormwater is to be stored inside the basin inside the POS*
Road Reserve and POS	0.6	28,065	508.8	1,082.7	
Total	**0.47**	**80,700**	**1,380.8**	**1,513.9**	***(Refer *Note 1)***

**Note 1: The total storage required to contain stormwater generated within the total catchment area is less than the sum of the storages needed for individual areas when considered separately. This discrepancy arises from the variability of critical storm durations within the catchment, which is influenced by factors such as catchment area, outflow rate, and total storage. As a result, the stormwater is distributed more consistently over the storm event, reducing the peak storage requirements. Refer to the Storm Hydrographs in Appendix D for full calculations.*

The stormwater generated during the 1 in 100 year storm event is to be contained inside the proposed stormwater infiltration basin area. The 1% AEP storm event will result in a water depth of 0.7m inside the basin. Modelling of the system estimates that the stormwater basin will empty in approximately 2.0 hours after the end of the storm event.

The basin will be required to be confirmed during the detailed design phase with computer modelling. It is expected that the final basin will be smaller than the current basin size due to the conservative values used in the stormwater calculations.

The area of development is surrounded by previously developed areas on three sides. There is an existing high point on all sides of the proposed developed area. This high point is sufficiently higher than the modelling 1% AEP flood level inside the site catchment. This will ensure no stormwater from the catchment overtops into the surrounding area and will provide a minimum of 500mm vertical separation to the finished floor levels of the existing dwellings.

5 CONCEPT LANDSCAPING

A preliminary landscaping plan has been detailed by Tim Davies Landscaping and is attached in Appendix F. Due to the unknown timeframe of the development of the site, it is recommended that the landscaping plans be re-assessed during the detailed design phase.

This reassessment will confirm the internal layout of the POS and the plans species to be used.

5.1 Irrigation Requirements

The area of the Public Open Space is approximately 6,265m^2 and is proposed to be largely grassed, with some larger trees installed around the perimeter.

Irrigation for the POS is required to be limited to a rate of 6,750 kL/ha/yr to meet the criteria set by the City of Rockingham in Planning Policy 1.8. This value is approximately 90% of the

standard allowance of 7,500kL/ha/yr specified by the Department of Water and Environment Regulations. This results in approximately 4,230 kL/year required to be used for irrigating the POS.

There is currently no groundwater bore licence in place for the irrigation requirements. Bore licence approval is required to be gained at the commencement of the design phase of the subdivision.

6 WATER CONSERVATION MEASURES

The development will utilise water-wise garden (Water Corporation, 2003) principles for lot gardens and within estate landscaping and water efficient fixtures and appliances (WEFA) to ensure that the development minimises the use of water. These measures are further discussed in the following Sections.

6.1 Water-Efficient Fixtures and Appliances

Significant reductions in in-house water use can be achieved with the adoption of WEFA (water-efficient fixtures and appliances). Implementation of WEFA can result in between a 30% and 50% reduction in water use in residential dwellings as listed by Melbourne Water in a 2003 study.

The water conservation strategy proposes that all dwellings use WEFA. Water-efficient fittings will be implemented by the lot owner during building construction, while uptake of water-efficient appliances can be encouraged by state and local government rebates, as well as education from the proponent at the point of sale.

6.2 Water Wise Gardens

Reductions in water use for irrigation by employing water efficiency measures can significantly reduce the total water usage. The development will undertake a variety of measures to limit water use in the future within the POS and within private residential landscape works under the control of the developer.

A variety of methods and approaches will be considered including any or all of the following:

- The adoption of water-wise species, with a focus on using local native water-wise species;
- Where required, existing site soil may 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 is proposed to be designed and installed according to best water efficient practices including consideration of hydro zone design solutions;
- The amount of turfed areas will be controlled while also being designed to meet community needs;
- Garden beds will be mulched to 75 mm with a product certified to Australian Standard AS 4454;
- The landscape design will cater for efficient water requirements during POS maintenance. Implementation of an appropriate management and maintenance program for POS areas will be further detailed at the UWMP stage;
- Community awareness of water conservation will be promoted at the point of sale and during the project's lifespan. This will reference the project as a whole and focus on

private gardens by providing educational literature to lot owners. Waterwise gardens will not be mandated inside the lot 35 and 36 Surf Drive development, however, they will be promoted by the proponent at the point of sale by providing educational literature regarding the benefits of waterwise gardening practices;
- It is assumed that 50% of future residents will utilise WWG, based on typical uptake rates provided by the Australian Bureau of Statistics.

6.3 Non-Structural Stormwater Management Measures

Several non-structural measures will also be implemented across the site to help reduce nutrient loads within stormwater runoff. These measures include:

- Street sweeping;
- Minimising fertiliser use to establish and maintain vegetation within POS areas and road verges;
- Use of drought-tolerant turf species that require minimal water and nutrients; and
- Education of residents regarding fertiliser use and nutrient-absorbing vegetation species within lots through the provision of educational material at the point of sale.

These measures will assist in achieving the required stormwater objectives.

7 FUTURE MONITORING AND IMPLEMENTATION

7.1 Funding

The site is owned by a single landowner and all funding will be provided by the landowner.

7.2 Construction Period

It is anticipated that the construction stage will require management of various aspects required for the construction of the subdivision. These aspects include but are not limited to:

- Dust Management;
- Surface Runoff,
- Noise Management; and
- Traffic Management.

The management measures undertaken for construction management will be specifically addressed in a future Construction Management Plan (CMP).

7.3 Condition Monitoring

It is proposed that the overall condition of the development 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 development, with the aim of ascertaining that the maintenance activities are achieving the overall management objectives for the development. The parameters that will be monitored include:

- Gross pollutants levels;
- Terrestrial weeds;

- Irrigation;
- Vegetation density;
- Vegetation is disease free of not infected by pests; and
- The condition of paths, benches, walkways and other infrastructure.

Further details of the monitoring and inspection of the POS shall be further detailed in the UWMP.

8 IMPLEMENTATION

The development of the LWMS has been undertaken to provide a clear structure within which future development that is consistent with the specified integrated water cycle management approach can occur.

It is also intended to provide overall guidance to the general stormwater management principles for the area and to guide the development of future UWMPs.

8.1 Roles and Responsibility

This 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 the City of Rockingham.

The responsibility for working within the framework established within the LWMS rests with the subdivider, although it is anticipated that future Urban Water Management Plans (UWMP) will be developed in consultation with the City of Rockingham and DWER and in consideration of other relevant policies and documents.

Due to the size of the proposed developed area, it is possible for the development to be developed in a staged manner. It will be the responsibility of the proponent to prepare detailed subdivision designs and a supportive UWMP at the appropriate time (i.e. at the subdivision stage).

It is also the responsibility of the proponent to demonstrate that the proposed subdivision designs and the supportive UWMP not only complies with the objectives and management approaches provided in this LWMS, but that they can also achieve the water quantity and quality criteria proposed by this LWMS.

8.2 Review

The surface runoff calculators detailed in this report will not need to be revised unless areas of the subdivision are replaced with large-scale commercial development.

The Basin sizing will be confirmed during the detailed design phase (UWMP) with computer modelling.

A detailed geotechnical report is required to be undertaken at the subdivision stage and the stormwater calculations detailed in this report do not need to be revised if an effective infiltration rate of 10m/day can be achieved.

9 CONCLUSIONS

The proposed change to the layout of the subdivision of Lots 35 and 36 Surf Drive is minor in nature. The size of the proposed Public Open Space is to be maintained to provide the previously agreed in the approved Anstey Park Structure Plan.

The required grading is feasible and will provide adequate cover for the stormwater pipes that are proposed to be installed on the verge of the proposed road reserves.

A stormwater storage basin is proposed to be installed inside the POS. Inside this basin will be a bio-filtration area that is sized to treat the first 15mm of stormwater generated inside the road reserves and Public Open Space. For storm events larger than this, the stormwater basin will pool and support the 1% AEP storm event for the entire development area (1% AEP storm event inside the road reserves and the overflow from all residential lots to the 1% AEP storm).

The slopes of the proposed basin are to be gentle (1 in 6 or shallower) providing public safety, and limiting erosion and soil runoff.

The Public Open Space area is to be vegetated as per the approved detailed Landscape Design.

All requirements of the relevant guidelines are satisfied.

Prepared by:

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Authorised by:

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AIT(Civil) GradDipB FIEAust CPEng EngExec NER APEC RPEQ RBP IntPE (Aus)
Director

Appendices:

Appendix A: Feature and Contour Survey of Lots 35 and 36 Surf Drive
Appendix B: Geotechnical Report
Appendix C: Worley Parsons, Anstey Park Comprehensive Development Plan Appendix 2 – Stormwater Drainage
Appendix D: Stormwater Calculations
Appendix E: DWA Drawings Set
Appendix F: TDL Landscaping Plans
Appendix G: Completed Checklist from Appendix 1 of Better Urban Water Management (WAPC, 2008)

APPENDIX A: FEATURE AND CONTOUR SURVEY OF LOTS 35 AND 36 SURF DRIVE

SERVICE LEGEND

PLEASE NOTE:
Point Symbol is Indicative
Only and Does Not Depict
The Size or Shape of Object.

WATER
- STOP VALVE
- HYDRANT
- FLUSH POINT — fp
- WATER TAP
- WATER MARKER — wm
- WATER METER

DRAINAGE
- SW MANHOLE
- GRATE
- SIDE ENTRY PIT
- UNDEFINED MANHOLE

SEWERAGE
- SEWER MANHOLE
- INSPECT. OPENING

POWER
- CONSUMER POLE
- POWER POLE
- LIGHT POLE
- STAY POLE
- S.WIRE ANCHOR
- U.G CABLE BOX
- CABLE DOME

TELECOMMUNICATION
- TELECOMMUNICATION MARKER — tmk
- TELECOMMUNICATION PIT
- TELECOMMUNICATION M/H — tmh

GAS
- GAS MARKER
- GAS METER
- GAS VALVE

LINE STYLES
- BASE OF BRICKWALL
- SEWER LINE
- TOP OF BANK
- BASE OF BANK
- POWER LINE
- FENCE
- BOUNDARY
- WINDOW
- ROAD CENTRELINE
- TOP OF L/STONE WALL
- BASE OF L/STONE WALL
- BUILDING LINE
- TOP OF KERB
- BASE OF KERB

FEATURES
- STREET SIGN
- CLOTHES HOIST
- BORE COVER
- GATE

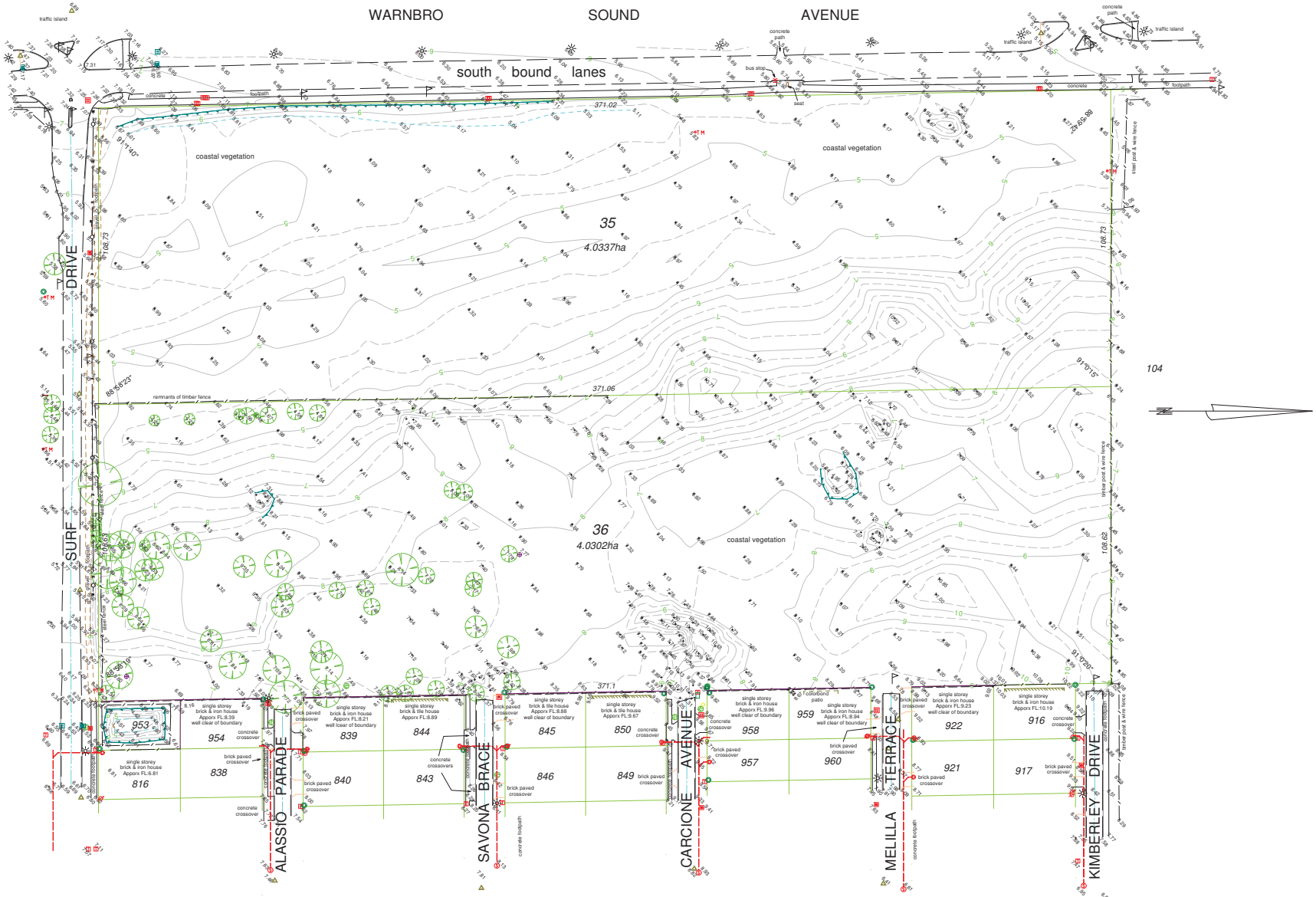
SURVEY
- CONTROL POINT
- DATUM
- 0.5m CONTOUR INTERVAL

TREE SPECIES
- BANKSIA
- DEAD TREE
- GRASS TREE
- PALM TREE
- PAPER BARK
- PEPPERMINT
- PINE TREE
- SHE OAK
- TREE UNNAMED

SERVICE RECORD

SERVICE \ STATUS	LOCATED	AVAILABLE	NO SERVICE	CONFIRM
WATER	✓			
SEWER	✓			
GAS				✓
TELSTRA	✓			
POWER U/G	✓			
O/H	✓			

NOTE: Services marked 'CONFIRM' require builder/client to confirm position on site.



TITLE:

FEATURE & CONTOUR SURVEY
LOTS 35 & 36 SURF DRIVE
SECRET HARBOUR

CLIENT: MARCHESE INVESTMENTS

GIUDICE SURVEYS
ESTABLISHED 1972

LICENSED LAND SURVEYORS
Land Subdivisions, Strata Consultants,
Engineering Surveys, Project Management
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LOT:	PLAN/DIAG:	C/T: VOL / FOL
35	P8071	1298-313
36	P8071	1747-669

REVISION:

SCALE: @ A1 — 1:750 (0, 20, 40, 60)

DATE: 29/06/2015
SURV'YD 25/06/2015

REF: 87/04-DET

WAPC REF:

DATUM: AHD FROM SSM PEELHURST 27 RL:5.944m

SURVEYED: D.R.D.

DRAWN: D.R.D.

CHECKED:

PLEASE NOTE:
This drawing has been prepared for the purpose of designing new constructions on the land and should not be used for any other purpose.
* The title boundaries shown hereon have been plotted from FB 104852 and Landgate plans only.
* Boundary redefinition recommended before design and/or construction.
* Certificate of Title should be referred to re encumbrances prior to design
* Only visible services have been located. Prior to any demolition, construction, or excavation the relevant authorities should be contacted for detailed location of all services.
* The position of sewer line shown is indicative only and Water Authority as-constructed plans should be referred to prior to design.
* Approx FL taken at Threshold of Door
* This note forms an integral part of this plan.

LOT 35-36DET - A1 detail

APPENDIX B: GEOTECHNICAL REPORT

Brown Geotechnical

Consulting Engineers – Land Development
Geotechnical/Acid Sulphate Soil/Groundwater Monitoring

Our reference: 23008 10 March 2023
Your reference:

Marchese Investments
C/- David Wills and Associates
Unit 1/9 Shields Crescent
Booragoon

Attention: Paul Ivkovic

Geotechnical Investigation Report – Lot 9613, 9614 Surf Drive, Secret Harbour

Introduction

Brown Geotechnical was commissioned by Marchese Investments to undertake a geotechnical investigation for a residential subdivision. This report presents the results of the investigation conducted at the site. Fieldwork commenced on 24 March 2023.

Brief

The brief discussed with the engineer required the report to address:

- Subsurface conditions.
- The existing soil classification.
- Any earthworks required to obtain a classification suitable for development.
- Suitability of existing soils for use in the development.
- Bearing capacity and settlement.
- CBR for road pavement design.
- Retaining wall parameters.
- Site permeability and drainage issues.

Scope of Work

The following scope of work was undertaken:

- An auger was used to excavate test holes for soil descriptions and sampling.
- Groundwater levels were recorded in each test hole.
- Penetrometer tests were carried out adjacent to test holes to determine soil density.
- Samples were taken for geotechnical laboratory testing for soil classification.
- Permeability tests were undertaken to determine soil drainage characteristics.

Test Results

Table 1 – Geotechnical Test Results

Test Hole No.	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	MMDD (%)	OMC (%)
TH1	1.0 – 1.5	2	98	0	NP	NP	-	-
TH3	1.0 – 1.5	1	99	0	NP	NP	-	-
TH6	0.2 – 0.8	-	-	-	NP	NP	1.65	16.5
TH16	1.0 – 1.5	1	99	0	NP	NP	-	-

*NP: Non-plastic

Table 2 – Permeability Test Results

Test Location	Testing Material	Permeability Test Result (m/s)	Drainage Characteristics
(P1) 0.5-1.5m	Dense sand	$2.5x10^{-4}$ m/s	Good
(P2) 0.5–1.5m	Dense sand	$5.5x10^{-4}$ m/s	Good

Subsurface Conditions

A thin layer of grass and silty sand topsoil was encountered to approximately 0.1m.

Medium grained, sand was encountered in all test holes to at least 2m depth. The sand is medium dense to dense, becoming very dense below about 1m. The sands have been identified as the Tamala Formation.

Groundwater Levels

No groundwater was encountered in the test holes. The Department of Water - Perth Groundwater Map indicates the groundwater level to be approx. 1m AHD (approx. 7m bgl).

Existing Site Classification

The site is underlain by granular soils with no plasticity. It has been determined that the appropriate site classification for footing design is Class 'A' in accordance with AS2870-2011 (refer Table 3). The land is therefore suitable for development.

Table 3. Definition of Site Classifications (Australian Standard AS2870-2011)

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement for moisture changes (y_s<20mm).
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes (y_s 20-40mm).
H1	Highly reactive clay site, which can experience moderate to high ground movement from moisture changes (y_s 40-60mm)
H2	Highly reactive clay site, which can experience high ground movement from moisture changes (y_s 60-75mm)
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes (y_s>75mm)

y_s: Characteristic Surface Movement

Suitability of Existing Soils for use in the Development

The sands on site have low fines, are medium grained, cohesionless and free draining. They will be suitable for use as engineering fill in the development.

Earthworks

All earthworks should be undertaken in accordance with AS3798-1996 “Guidelines on earthworks for commercial and residential developments”.

Topsoil / Fill

Topsoil is not suitable for foundation support and should be removed. There are some trees adjacent to the proposed building envelopes. Unless they are to be retained, they should be removed with the entire root bulb material. The excavations should then be backfilled and compacted with material exhibiting the same geotechnical properties as the surrounding soils, then compacted as stated below. No uncontrolled fill materials were identified in the test holes.

Proof Rolling and Site Compaction

The site is underlain by sand to at least 2m. Prior to footing placement or placing any additional fill on site, the surface should be proof rolled to achieve at least 95% SMDD. This approximates to at least 8 blows per 300mm using a Perth Sand Penetrometer to a depth of 750mm.

Imported Fill Material

Cut to fill material, and any additional sand fill imported to obtain site formation levels should be compacted in layers not more than 300mm thick to at least 95% SMDD. In-situ density tests should be carried out to calibrate the PSP to specific densities of the compacted material. Moisture conditioning (wetting) of the sand may to be required to optimise compaction. Imported sand should ideally contain less than 5% non-plastic fines to retain good drainage characteristics and should be compacted at optimum moisture content.

Following excavation for foundations, the bases of pad and strip footings should also be compacted to achieve at least 95% SMDD.

Earthwork Inspections

A geotechnical consultant should inspect the site following the removal of topsoil, trees, other unsuitable materials, and to confirm the compaction of the subsurface following proof rolling. Inspections and auditing of the earthworks should be carried out by the geotechnical consultant to enable confirmation of the final site classification.

Californian Bearing Ratio

Laboratory testing indicates a CBR of 25 may be used for road pavement design within the in-situ sand.

For imported Perth sand fill, typical CBR values can vary from 12 to 20. Testing of additional imported fill should be carried out to determine exact values.

Bearing Capacity

The following allowable bearing pressures have been based on a dense sand from 0m to 2m and a Young's modulus, E = 35 MPa. Potential settlements should be taken into account for design bearing pressures.

Table 4 - Strip Footing Allowable Bearing Pressure and Estimated Settlement

Footing Depth (m)	Footing Width (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.3	0.3	125	1-5
	0.5	150	5-15
	1.0	175	15-20
0.5	0.5	115	1-5
	1.0	130	10-15
	1.5	150	15-20

Table 5 - Pad Footing Allowable Bearing Pressure and Estimated Settlement

Footing Depth (m)	Footing Dimension (m)	Allowable Bearing Pressure (kPa)	Estimated Settlement (mm)
0.5	0.5 x 0.5	145	1-5
	1.0 x 1.0	150	5-10
	1.5 x 1.5	160	10-15

The bearing pressures presented in Table 4 and 5 are also based on the following:

- Loading is isolated, vertical, non-eccentric, on level ground, and not influenced by any nearby cuttings or embankments;
- Factor of Safety of 3;
- It is recommended to limit the total settlement to 25mm,
- Differential Settlement to be no greater than nominally half the total.

Retaining Wall Parameters

Assuming compaction / proof rolling of the soils has been carried out as stated above, the following retaining wall parameters have been based on a dense sand soil with $\phi=40^{o}$.

$\gamma=19$ kN/m^3

Ko=0.36

Ka=0.22

Kp=4.

The parameters detailed above assume design of the retaining structure and compaction of the foundations are in accordance with AS 4678-2002, and that backfill material is composed of clean cohesionless sand.

Drainage Conditions

Permeability results indicates good drainage conditions. Soakwells will be suitable for stormwater runoff. The slightly lower permeability is a result of the dense sand on site.

Note: Permeability and drainage conditions may be reduced during earthworks due to compaction of in-situ and imported sands. Over compaction during earthworks can seriously reduce soil permeability. Additional permeability tests are recommended following the completion of the earthworks.

Regards

Benjamin Boers
Graduate Geotechnical Engineer
BROWN GEOTECHNICAL

Reviewed By
Ken Brown
Senior Geotechnical Engineer
BROWN GEOTECHNICAL

Attachments: Site and Test Location Plans
Test Hole Logs & Photos
PSP Plots
Laboratory Test Certificates

Brown Geotechnical
Suite 9, 47 Monash Avenue
Como WA6152
Email: admin@browngeotechnical.com.au

Date	Description	Drawn	Checked	Approved
20.03.23	Test Location Plan	BB	KB	

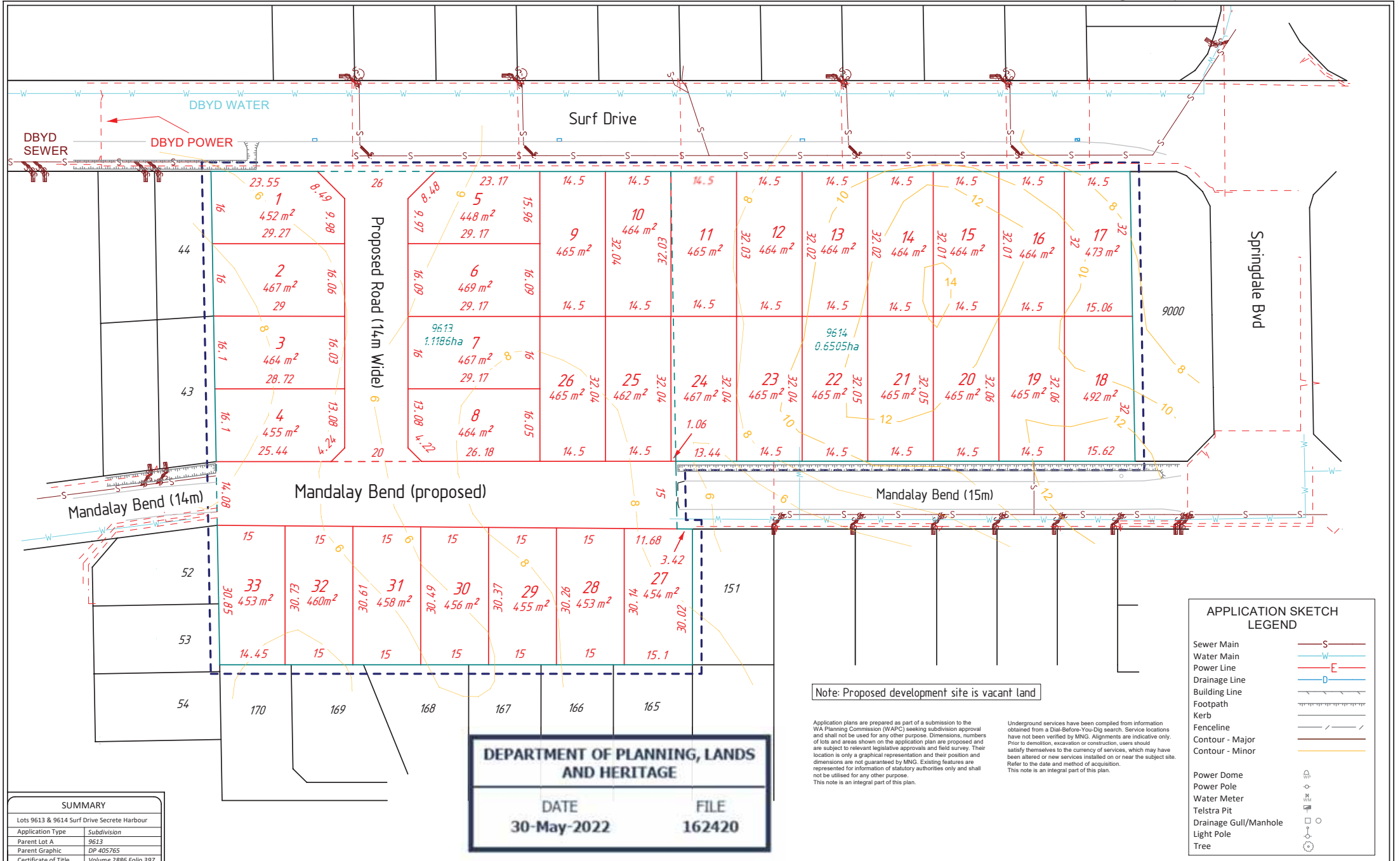
TEST LOCATION PLAN

Lot 9613, 9614
Surf Drive, Secret Harbour

CLIENT

Marchese Investments

Drawing No.23008 Fig 1
Scale: NTS
Sheet Size: A4
Job No: 23008.01
FIGURE 1



Note: Proposed development site is vacant land

Application plans are prepared as part of a submission to the WA Planning Commission (WAPC) seeking subdivision approval and shall not be used for any other purpose. Dimensions, numbers of lots and areas shown on the application plan are proposed and are subject to relevant legislative approvals and field survey. Their location is only a graphical representation and their position and dimensions are not guaranteed by MNG. Existing features are represented for information of statutory authorities only and shall not be utilised for any other purpose.
This note is an integral part of this plan.

Underground services have been compiled from information obtained from a Dial-Before-You-Dig search. Service locations have not been verified by MNG. Alignments are indicative only. Prior to demolition, excavation or construction, users should satisfy themselves to the currency of services, which may have been altered or new services installed on or near the subject site. Refer to the date and method of acquisition.
This note is an integral part of this plan.

APPLICATION SKETCH LEGEND

- Sewer Main
- Water Main
- Power Line
- Drainage Line
- Building Line
- Footpath
- Kerb
- Fenceline
- Contour - Major
- Contour - Minor
- Power Dome
- Power Pole
- Water Meter
- Telstra Pit
- Drainage Gull/Manhole
- Light Pole
- Tree

DEPARTMENT OF PLANNING, LANDS AND HERITAGE

DATE 30-May-2022

FILE 162420

SUMMARY

Lots 9613 & 9614 Surf Drive Secrete Harbour

Application Type	*Subdivision*
Parent Lot A	*9613*
Parent Graphic	*DP 405765*
Certificate of Title	*Volume 2886 Folio 397*
Total Area	*1.1186ha*
Parent Lot B	*9614*
Parent Graphic	*DP 405765*
Certificate of Title	*Volume 2886 Folio 398*
Total Area	*0.6505ha*
Local Authority	*City of Rockingham*
TPS	*2*
Zoning	*Urban*
Original No. of Lots	*2*
Proposed No. of Lots	*33*

This plan, which was prepared by MNG for Marchese Group, shows the proposed subdivision of Lots 9613 & 9614 Surf Drive and is intended to accompany an application to the Western Australian Planning Commision (WAPC) for approval to subdivide. All information relating to the subdivision, including lot dimensions and areas are subject to approval by the WAPC, the Local Authority and other servicing authorities having an interest in the land.
Existing boundaries shown heron are a graphical representation only, they have been extracted from Landgate's Spatial Cadastral Database, which is only a model of the cadastre, and has not been re-established by survey. MNG does not guarantee position unless stated otherwise.
Existing easements, encumberances and interests are not necessarily depicted on the planand a current title search is recommended to check this information prior to sale and development of proposed lot(s).
The use of this plan for other than the purpose for which it is commissioned is strictly prohibited. In particular, the information shown on the plan in not relied upon for financial dealings involving the land either in the whole or in the part.
The contents of this plan are current and correct as of the date stated within the revision panel. All consultants and persons wishing to utilise this data should satisfy themselves of this plans currency by contacting the McMullen Nolan Group.
Contours are compiled from Landgate SUP Data and are subject to change without notice.
This plan is not to be distributed without this note, which is an integral part of the plan.

N

Boundary of Subject Land
Existing Boundaries
Proposed Boundaries

Surveyor:- Not Surveyed
SCDB Date:- SCDB
Precal Date:- SCDB

ALL DISTANCES ARE IN METRES
For a true to scale reproduction of this plan, plot it to A3 with the Paging Scaling set to None.

CLIENT:
Marchese Group

PROPOSED SUBDIVISION
Lots 9613 & 9614 Surf Drive
Secret Harbour

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Project Mngr.	Matt Jilley	Datum	PCG94

104644 - AP - 002 - A
Job Number | Type | Plan Number | Revision

BOREHOLE NUMBER TH01

BG Brown Geotechnical

CLIENT Marchese Investments **PROJECT NAME** Lot 9613, 9614 Surf Drive

PROJECT NUMBER 23008 **PROJECT LOCATION** Secret Harbour

DATE STARTED 24/3/23 **COMPLETED** 24/3/23 **R.L. SURFACE** 8.3 **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

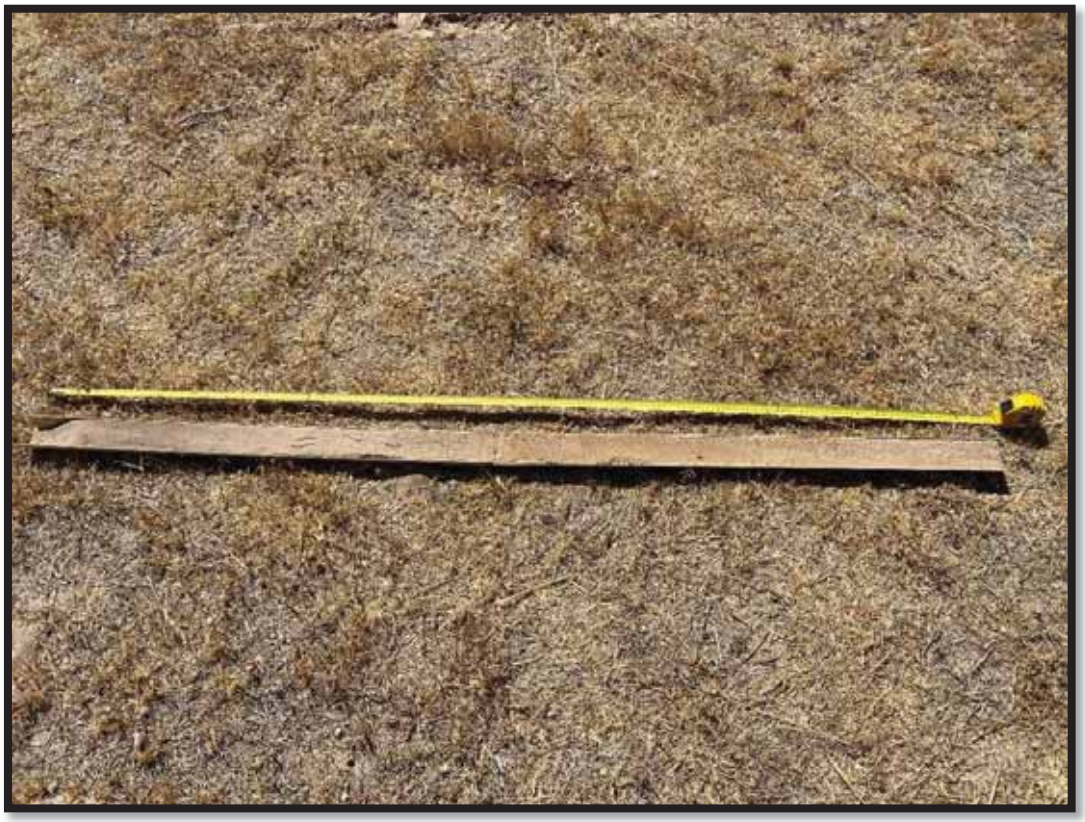
EQUIPMENT Auger **HOLE LOCATION** 32.39983 S, 115.76298 E

HOLE SIZE 820mm **LOGGED BY** BB **CHECKED BY** KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
		8.0	0.5		SP	SAND: Medium dense to dense, medium grained, light brown, dry, trace silt		
	Not Encountered	7.5	1.0			Very dense below 0.9m		
		7.0	1.5			Yellow below 1.2m	Fines=2% Sand=98% Gravel=0% (Medium=74%)	
		6.5	2.0					
						Borehole TH01 terminated at 2m		
		6.0	2.5					
		5.5	3.0					

TH1



BOREHOLE NUMBER TH02

BG Brown Geotechnical

CLIENT Marchese Investments **PROJECT NAME** Lot 9613, 9614 Surf Drive

PROJECT NUMBER 23008 **PROJECT LOCATION** Secret Harbour

DATE STARTED 24/3/23 **COMPLETED** 24/3/23 **R.L. SURFACE** 7.0 **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT Auger **HOLE LOCATION** 32.39990 S, 115.76224 E

HOLE SIZE 820mm **LOGGED BY** BB **CHECKED BY** KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
					SP	SAND: Medium dense to dense, medium grained, light brown, dry, trace silt		
		6.5	0.5					
	Not Encountered					Very dense below 0.9m		
		6.0	1.0					
		5.5	1.5					
		5.0	2.0					
						Borehole TH02 terminated at 2m		
		4.5	2.5					
		4.0	3.0					

TH2

BOREHOLE NUMBER TH03

BG Brown Geotechnical

CLIENT Marchese Investments **PROJECT NAME** Lot 9613, 9614 Surf Drive

PROJECT NUMBER 23008 **PROJECT LOCATION** Secret Harbour

DATE STARTED 24/3/23 **COMPLETED** 24/3/23 **R.L. SURFACE** 8.2 **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

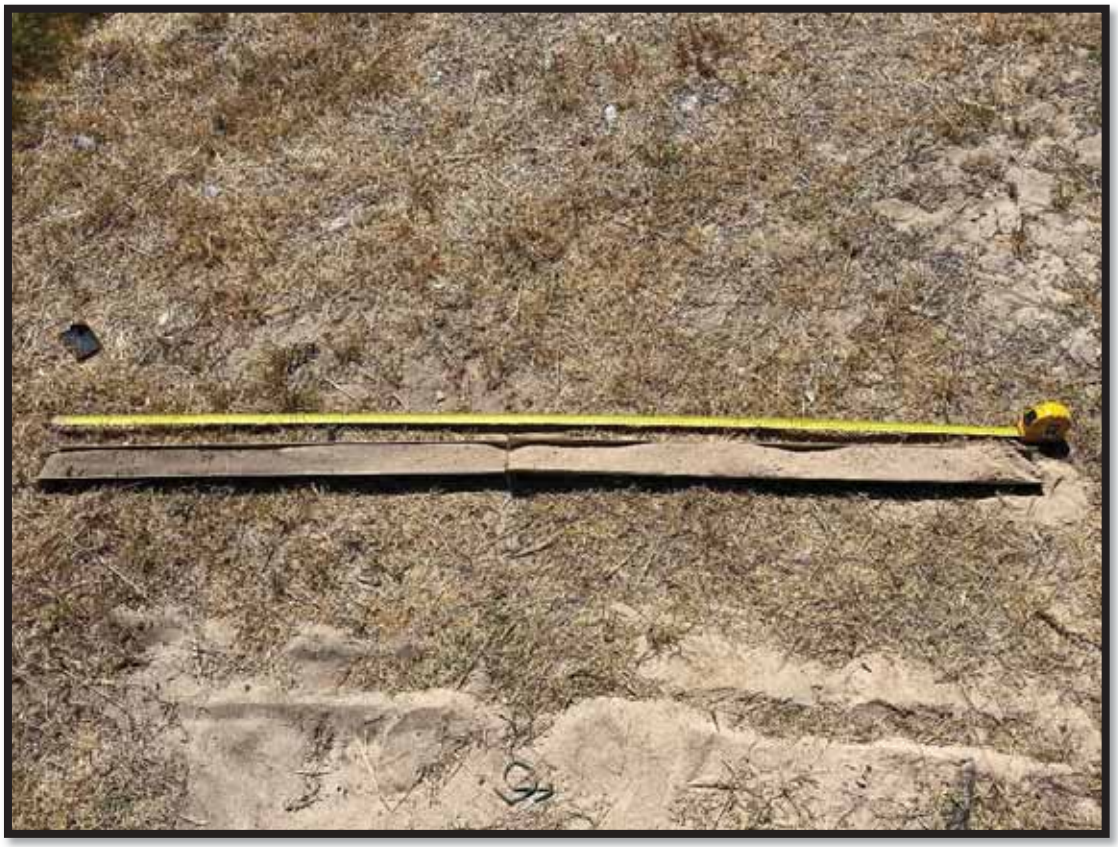
EQUIPMENT Auger **HOLE LOCATION** 32.39966 S, 115.76295 E

HOLE SIZE 820mm **LOGGED BY** BB **CHECKED BY** KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
		8.0	0.0			TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
	Not Encountered				SP	SAND: Medium dense to dense, medium grained, light brown, dry, trace silt		
		7.5	0.5					
			1.0			Very dense below 0.9m		
		7.0					Fines=1% Sand=99% Gravel=0% (Medium=72%)	
		6.5	1.5					
			2.0			Borehole TH03 terminated at 2m		
		6.0	2.5					
		5.5						
			3.0					

TH3



BOREHOLE NUMBER TH04

PA1 E F O4 F

BG Brown 1 eotechnical

CLIENT Marchese InGestments **PROJECT NAME** Lot 96F3, 96F2 Surf DriGe

PROJECT NUMBER W3008 **PROJECT LOCATION** Secret Harbour

DATE STARTED W2/3/W3 **COMPLETED** W2/3/W3 **R.L. SURFACE** 6.5 **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT Auger **HOLE LOCATION** 3W39959 S, FF5.76WW5 E

HOLE SIZE 8W0mm **LOGGED BY** BB **CHECKED BY** KB

NOTES

Method	p ater	k L (m)	DeRth (m)	1 raRhic Log	Classification Symbol	Material DescriRtion	SamRles Tests k emarvs	Additional ObserGations
						TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
					SP	SAND: Medium dense to dense, medium grained, light brown, dry, trace silt		
		6.0	0.5					
	Not Encountered					Very dense below 0.9m		
		5.5	F.0					
		5.0	F.5					
		2.5	W0					
						Borehole TH02 terminated at Wm		
		2.0	W5					
		3.5	3.0					

BOk EHOLE / TEST PIT SUk 4 DkIVE LO1 S.1 PJ 1 INT STD AUSTk ALIA.1 DT F3/3/W8

TH4

BOREHOLE NUMBER TH05

BG Brown Geotechnical

CLIENT Marchese Investments **PROJECT NAME** Lot 9613, 9614 Surf Drive

PROJECT NUMBER 23008 **PROJECT LOCATION** Secret Harbour

DATE STARTED 24/3/23 **COMPLETED** 24/3/23 **R.L. SURFACE** 6.0 **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT Auger **HOLE LOCATION** 32.39926 S, 115.76266 E

HOLE SIZE 820mm **LOGGED BY** BB **CHECKED BY** KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
					SP	SAND: Medium dense to dense, medium grained, light brown, dry, trace silt		
		5.5	0.5					
	Not Encountered					Very dense below 0.9m		
		5.0	1.0					
						Yellow below 1.2m		
		4.5	1.5					
		4.0	2.0					
						Borehole TH05 terminated at 2m		
		3.5	2.5					
		3.0	3.0					

TH5

BOREHOLE NUMBER TH06

2Dk E = P4 =

BG (roh n k eotecAnfcgy

CLIENT F grcAeLe TnReLtl entL

PROJECT NAME Oot B1=0: B1=/ 7ur, SrfRe

PROJECT NUMBER m0. . 5

PROJECT LOCATION 7ecret Hgrbour

DATE STARTED m/ v0vm0 **COMPLETED** m/ v0vm0

R.L. SURFACE 1a **DATUM** I DHS

DRILLING CONTRACTOR

SLOPE B. 8 **BEARING** °°°

EQUIPMENT DuGer

HOLE LOCATION 0ma0BB. = 7: ==9a61mmmE

HOLE SIZE 5m I I

LOGGED BY ((**CHECKED BY** K(

NOTES

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	Not Encountered					) P27PTOI OooLe: ,fne Grgfned: LfytwLgnd: hftA orGgnfcL: drw		
					72	7DNSI F edful denLe to denLe: I edful Grgfned: yfGAt broh n: drw trgce Lfyt		
		9a9	. a9				Fi s=1% SSs=a19F GJ ° i (Msm9%	
						VerwdenLe beyoh . aBI		
		9a	=a					
		/ a9	=a9			Grewbroh n beyoh =a9I		
		/ a	ma					
						(oreAoye) H. 1 terl fngted gt mI		
		0a9	ma9					
		0a	0a					

(PMEHPOE v) E7) 2T) 7- M4 SMTVE OPk 7ak 2U k TN) 7) S D- 7) MDOTDak S) =0v0vm0

TH6

BOREHOLE NUMBER TH06

BG Brown Geotechnical

CLIENT Marchese Investments **PROJECT NAME** Lot 9613, 9614 Surf Drive

PROJECT NUMBER 23008 **PROJECT LOCATION** Secret Harbour

DATE STARTED 24/3/23 **COMPLETED** 24/3/23 **R.L. SURFACE** 7.8 **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT Auger **HOLE LOCATION** 32.39945 S, 115.76332 E

HOLE SIZE 820mm **LOGGED BY** BB **CHECKED BY** KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
					SP	SAND: Medium dense to dense, medium grained, light brown & brown, dry, trace silt		
		7.5	0.5					
	Not Encountered	7.0	1.0			Very dense below 0.9m		
		6.5	1.5					
		6.0	2.0					
						Borehole TH07 terminated at 2m		
		5.5	2.5					
		5.0	3.0					

TH7

BOREHOLE NUMBER TH08

BG Brown Geotechnical

CLIENT Marchese Investments **PROJECT NAME** Lot 9812, 981/ Surf Drive

PROJECT NUMBER W2003 **PROJECT LOCATION** Secret Harbour

DATE STARTED W/k2/KW2 **COMPLETED** W/k2/KW2 **R.L. SURFACE** 11.5 **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT Auger **HOLE LOCATION** 2W299/ 2 S, 115.78/ 03 E

HOLE SIZE 3W0mm **LOGGED BY** BB **CHECKED BY** 6B

NOTES

Method	Water	Depth (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
					SP	SAND: Medium dense to dense, medium grained, light brown, dry, trace silt		
	Not Encountered	11.0	0.5					
						Very dense below 0.9m		
		10.5	1.0				Fines=1% Sand=99% Gravel=0% (Medium=72%)	
		10.0	1.5					
		9.5	W0					
						Borehole TH03 terminated at Wm		
		9.0	W5					
		3.5	2.0					

TH8

BOREHOLE NUMBER TH09

BG Brown Geotechnical

CLIENT Marchese Investments **PROJECT NAME** Lot 9613, 9614 Surf Drive

PROJECT NUMBER 23008 **PROJECT LOCATION** Secret Harbour

DATE STARTED 24/3/23 **COMPLETED** 24/3/23 **R.L. SURFACE** 9.0 **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT Auger **HOLE LOCATION** 32.39905 S, 115.76404 E

HOLE SIZE 820mm **LOGGED BY** BB **CHECKED BY** KB

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
						TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
					SP	SAND: Medium dense to dense, medium grained, light brown, dry, trace silt		
		8.5	0.5					
	Not Encountered					Very dense below 0.9m		
		8.0	1.0					
		7.5	1.5					
		7.0	2.0					
						Borehole TH09 terminated at 2m		
		6.5	2.5					
		6.0	3.0					

TH9

BOREHOLE NUMBER TH01

BG Brown 1 eotechnical

CLIENT Marchese InGestments **PROJECT NAME** Lot 9623, 9624 Surf DriGe

PROJECT NUMBER W3008 **PROJECT LOCATION** Secret Harbour

DATE STARTED W4/3/W3 **COMPLETED** W4/3/W3 **R.L. SURFACE** 7.W **DATUM** m AHD

DRILLING CONTRACTOR **SLOPE** 90° **BEARING** ---

EQUIPMENT Auger **HOLE LOCATION** 3W39909 S, 225.76W9WE

HOLE SIZE 8W0mm **LOGGED BY** BB **CHECKED BY** KB

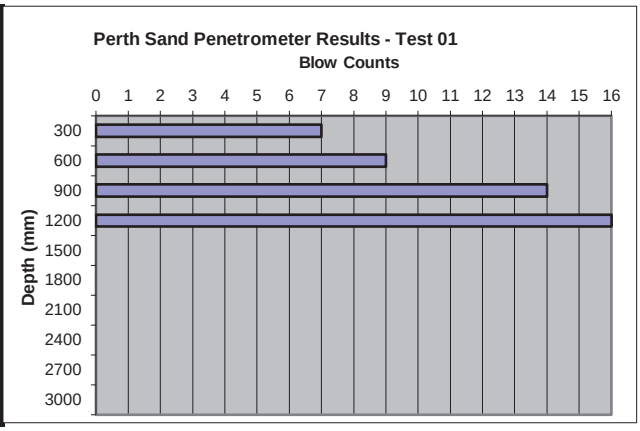
NOTES

Method	p ater	k L (m)	DeRth (m)	1 raRhic Log	Classification Symbol	Material DescriRtion	SamRles Tests k emarvs	Additional ObserGations
						TOPSOIL: Loose, fine grained, silty sand, with organics, dry		
		7.0			SP	SAND: Medium dense to dense, medium grained, light brown, dry, trace silt		
			0.5					
		6.5						
	Not Encountered					Very dense below 0.9m		
			2.0					
		6.0						
			2.5					
		5.5						
			W0					
						Borehole TH20 terminated at Wm		
		5.0						
			W5					
		4.5						
			3.0					

TH10

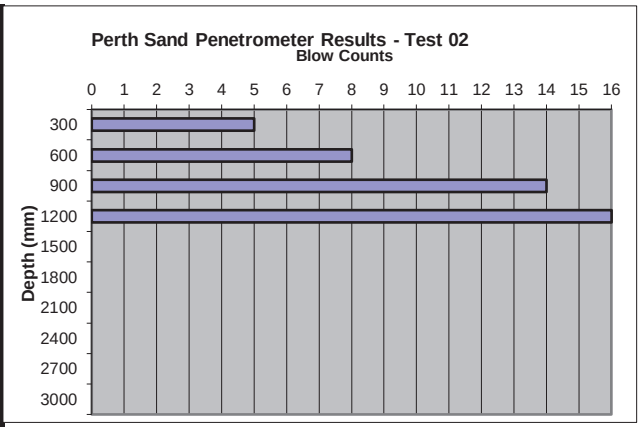
Perth Sand Penetrometer Test Plots

Depth (mm)	Blow Counts
300	7
600	9
900	14
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



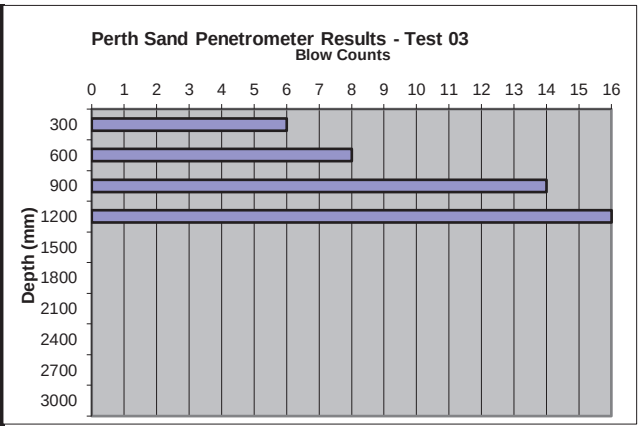
Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH01

Depth (mm)	Blow Counts
300	5
600	8
900	14
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



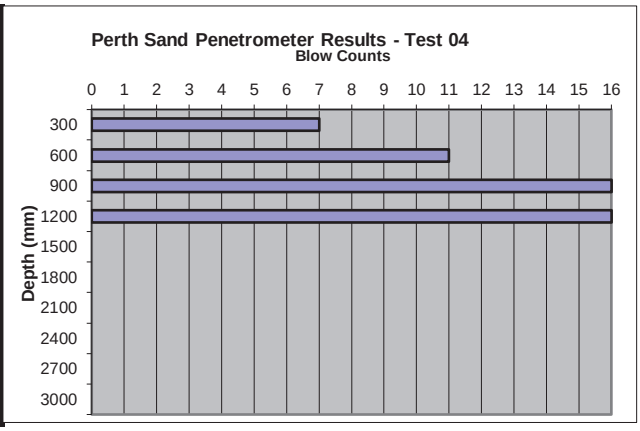
Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH02

Depth (mm)	Blow Counts
300	6
600	8
900	14
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



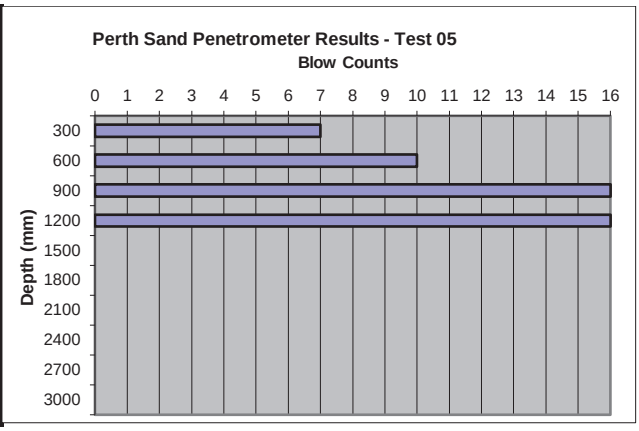
Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH03

Depth (mm)	Blow Counts
300	7
600	11
900	16
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH04

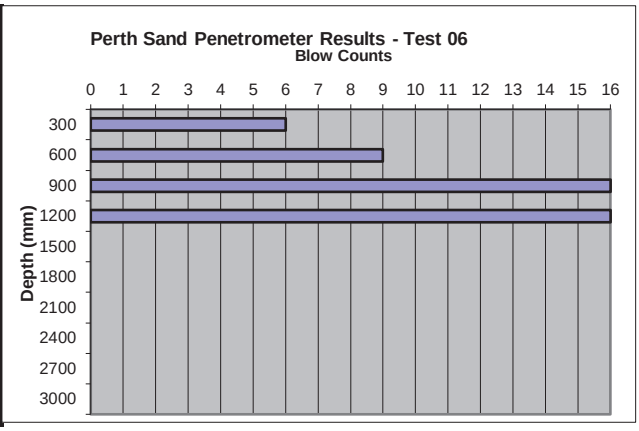
Depth (mm)	Blow Counts
300	7
600	10
900	16
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH05

Lot 9613, 9614

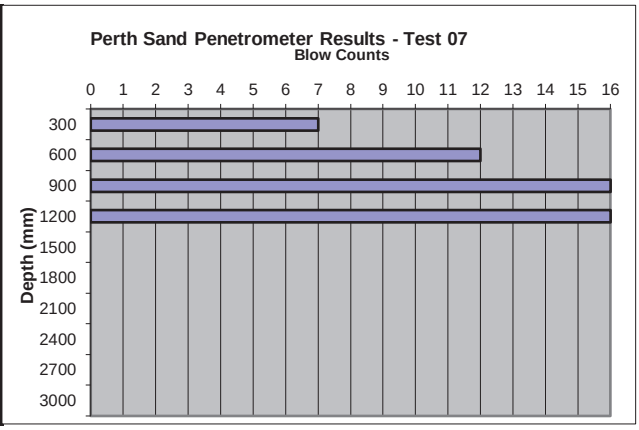
Depth (mm)	Blow Counts
300	6
600	9
900	16
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH06

Lot 9613, 9614

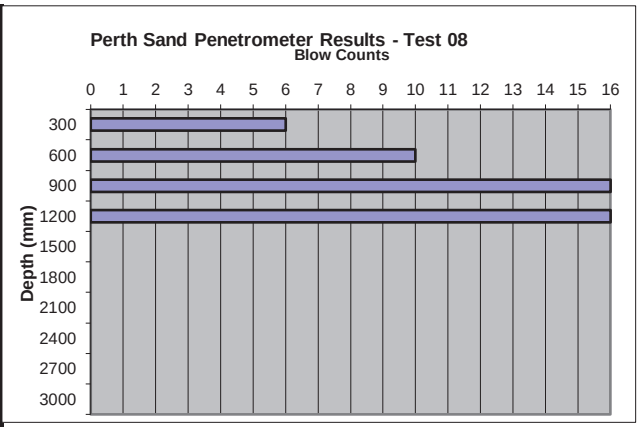
Depth (mm)	Blow Counts
300	7
600	12
900	16
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH07

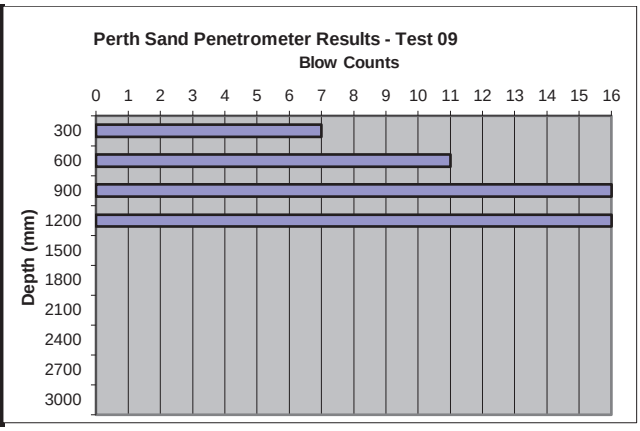
Lot 9613, 9614

Depth (mm)	Blow Counts
300	6
600	10
900	16
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH08

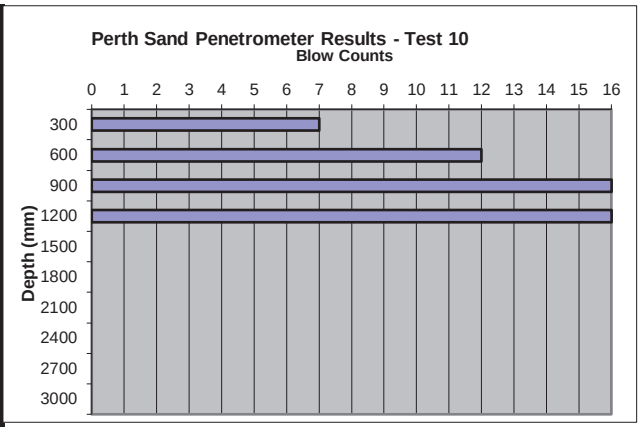
Depth (mm)	Blow Counts
300	7
600	11
900	16
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH09

Lot 9613, 9614

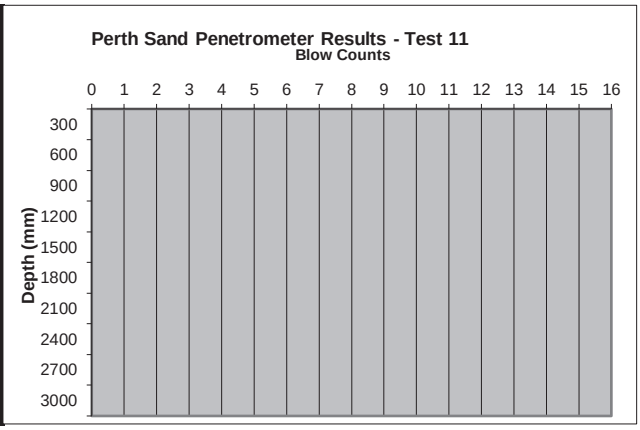
Depth (mm)	Blow Counts
300	7
600	12
900	16
1200	16
1500	
1800	
2100	
2400	
2700	
3000	



Job Name: Lot 9613, 9614 Surf Drive Secret Harbour
Job No: 23008
Date: 24/02/2023
Location: TH10

Lot 9613, 9614

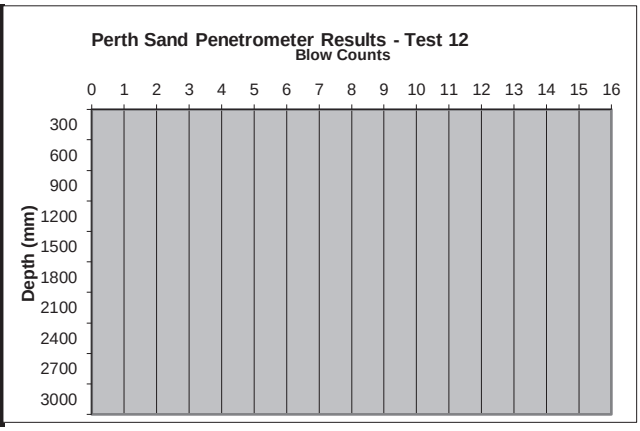
Depth (mm)	Blow Counts
300	
600	
900	
1200	
1500	
1800	
2100	
2400	
2700	
3000	



Job Name:
Job No:
Date:
Location:

Lot 9613, 9614

Depth (mm)	Blow Counts
300	
600	
900	
1200	
1500	
1800	
2100	
2400	
2700	
3000	



Job Name:
Job No:
Date:
Location:

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

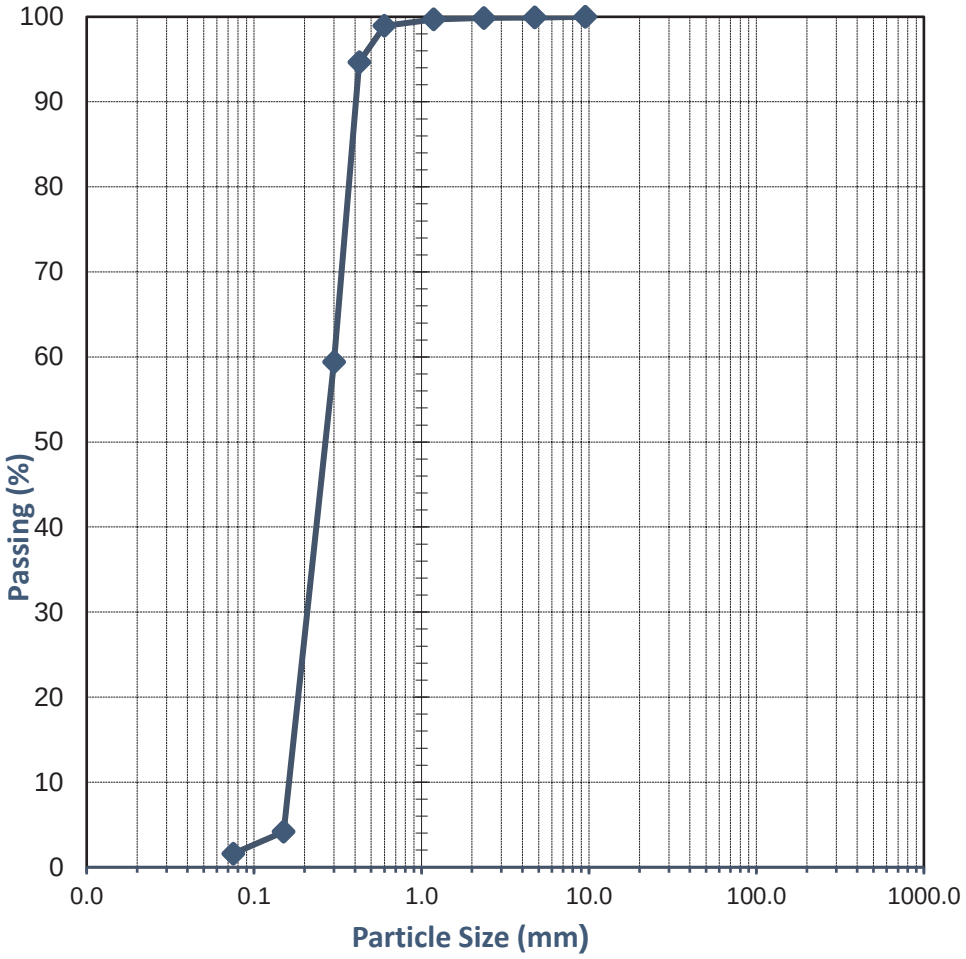
TEST REPORT - AS 1289.3.6.1

Client:	Brown Geotechnical	*Ticket No.*	S8959
Client Address:	PO Box 278, Como WA 6952	*Report No.*	WG23.4260_1_PSD
Project:	Lot 9613, 9614 Surf Drive	*Sample No.*	WG23.4260
Location:	Secret Harbour	*Date Sampled:*	13/02/2023
Sample Identification:	TH1	*Date Tested:*	7/03/2023

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	100
1.18	100
0.600	99
0.425	95
0.300	59
0.150	4
0.075	2



Comments:

Approved Signatory: JL

Name: Jack Leonard

Date: 07/March/2023

NATA

Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

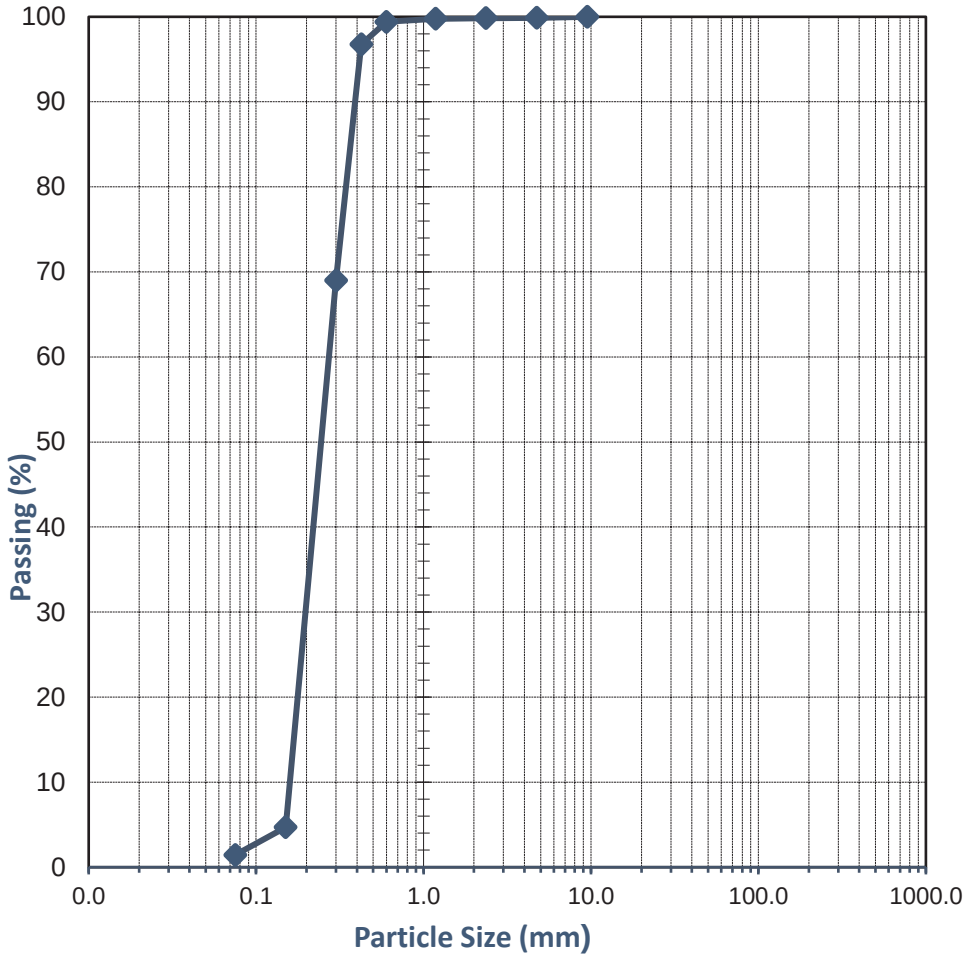
TEST REPORT - AS 1289.3.6.1

Client:	Brown Geotechnical	*Ticket No.*	S8959
Client Address:	PO Box 278, Como WA 6952	*Report No.*	WG23.4261_1_PSD
Project:	Lot 9613, 9614	*Sample No.*	WG23.4261
Location:	Secret Harbour	*Date Sampled:*	13/02/2023
Sample Identification:	TH3	*Date Tested:*	7/03/2023

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	100
1.18	100
0.600	99
0.425	97
0.300	69
0.150	5
0.075	1



Comments:

Approved Signatory: JL

Name: Jack Leonard

Date: 07/March/2023

NATA Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Brown Geotechnical	*Ticket No.*	S8959
Client Address:	PO Box 278, Como WA 6952	*Report No.*	WG23.4262_1_MMDD
Project:	Lot 9613, 9614 Surf Drive	*Sample No.*	WG23.4262
Location:	Secret Harbour	*Date Sampled:*	13-02-2023
Sample Identification:	TH6	*Date Tested:*	3-03-2023

TEST RESULTS - Modified Maximum Dry Density

Sampling Method: Sampled by Client, Tested as Received

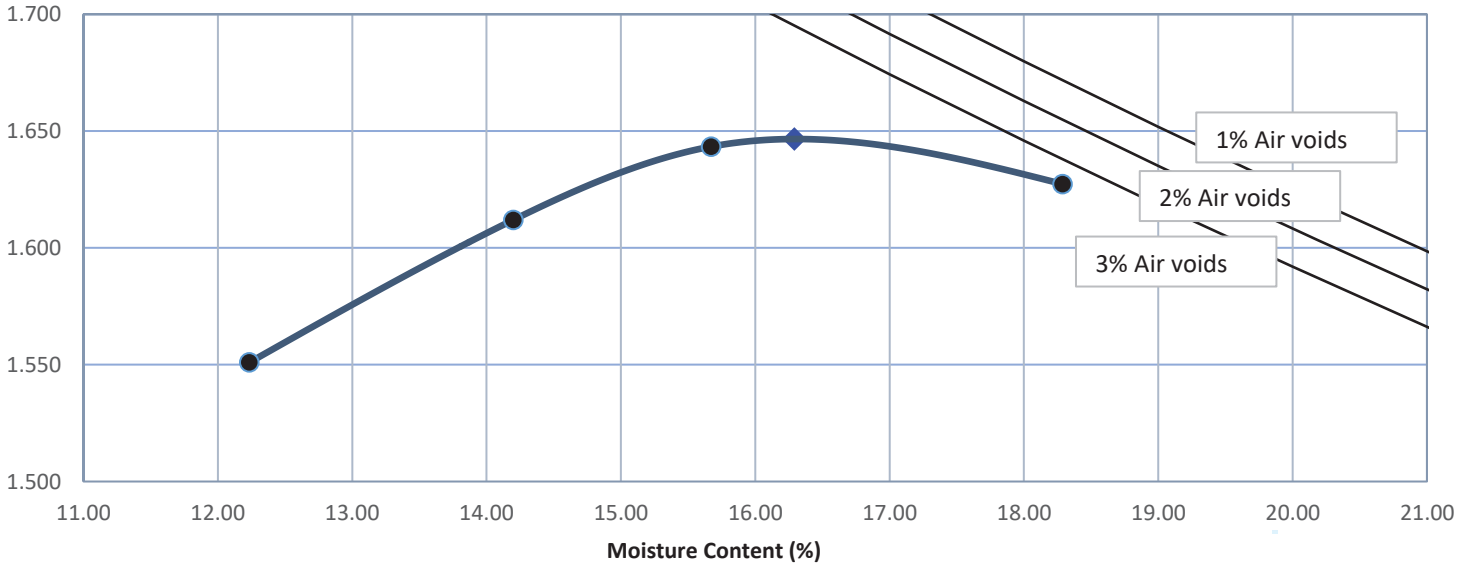
Sample Curing Time (Hours): 2

Method used to Determine Liquid Limit: Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%): 0 **Material + 37.5mm (%)** -

Moisture Content (%)	**12.2**	**14.2**	**15.7**	**18.3**	
Dry Density (t/m³)	**1.551**	**1.612**	**1.643**	**1.627**	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³) **1.65**

Optimum Moisture Content (%) **16.5**

Comments: *The above air void lines are derived from a calculated apparent particle density of 2.443 t/m³*

Approved Signatory:

Name: Brooke Elliott

Date: 07-March-2023

NATA Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

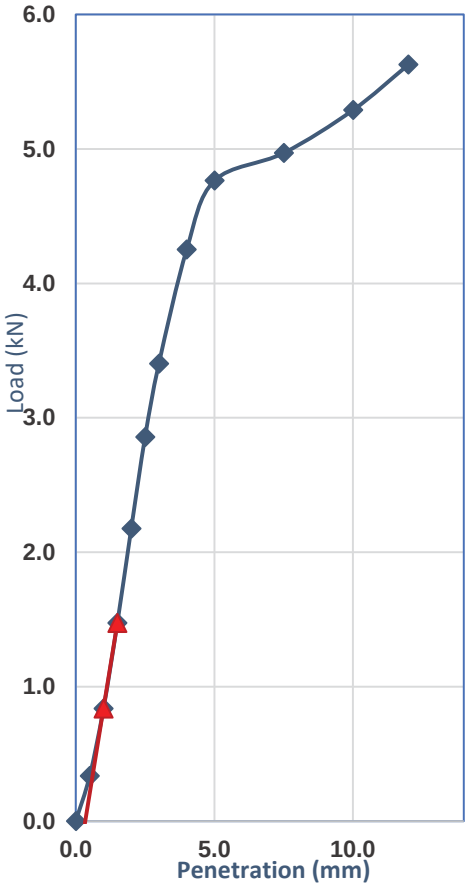
Client:	Brown Geotechnical	*Ticket No.*	S8959
Client Address:	PO Box 278, Como WA 6952	*Report No.*	WG23.4262_1_SCBR
Project:	2 Cabarita Road	*Sample No.*	WG23.4262
Location:	Kalamunda	*Date Sampled:*	13/02/2023
Sample Identification:	TH6	*Date Tested:*	3/3 - 11/3/23

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand

Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m^3)	1.65	Optimum Moisture (%)	16.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m3)	1.56	Moisture Content (%)	16.5
Density Ratio (%)	95.0	Moisture Ratio (%)	101.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m³)	1.56	Dry Density Ratio (%)	95.0
Moisture Content (%)	21.3	Moisture Ratio (%)	130.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	20.4	Remaining Depth (%)	21.4

Correction applied to Penetration: 0.3mm

Determined at a Penetration of: 2.5mm

California Bearing Ratio (CBR): 25%

Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 13/March/2023

NATA

Accreditation No. 20599

Accredited for compliance with ISO/IEC 17025 - Testing

WESTERN GEOTECHNICAL & Laboratory Services

SOIL | AGGREGATE | CONCRETE | CRUSHING

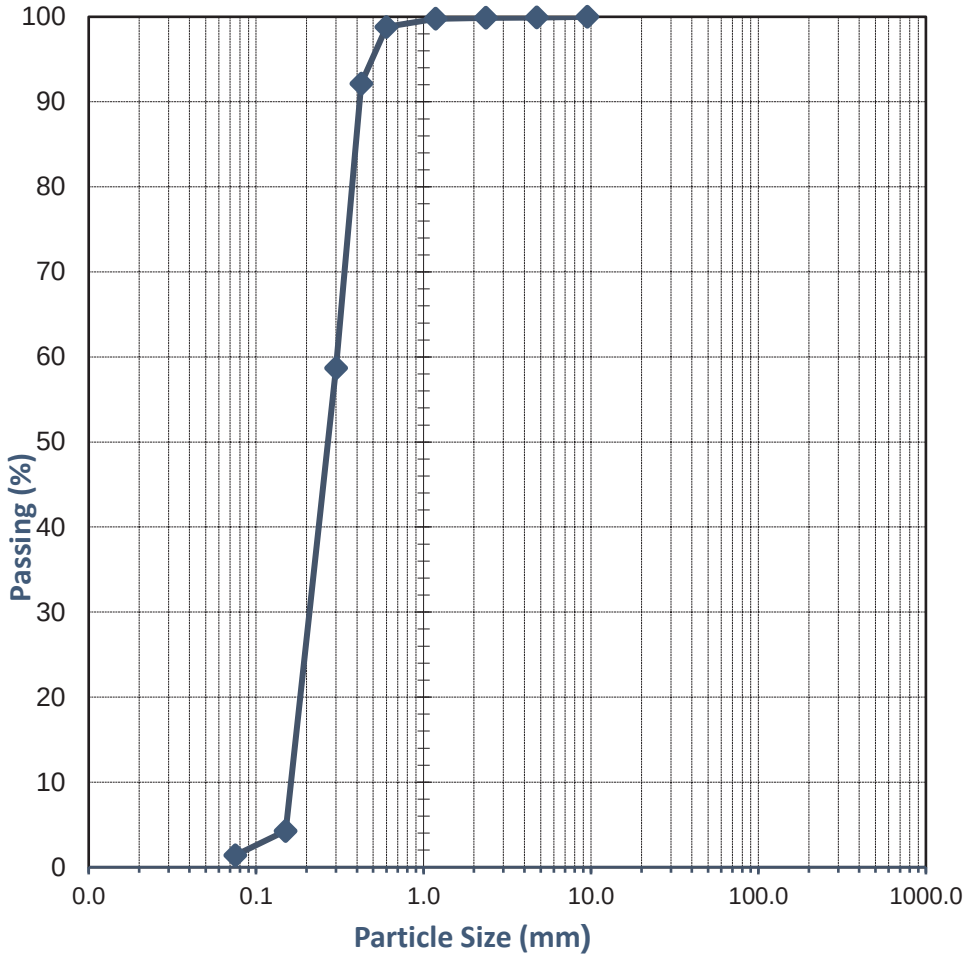
TEST REPORT - AS 1289.3.6.1

Client:	Brown Geotechnical	*Ticket No.*	S8959
Client Address:	PO Box 278, Como WA 6952	*Report No.*	WG23.4263_1_PSD
Project:	Lot 9613, 9614 Surf Drive	*Sample No.*	WG23.4263
Location:	Secret Harbour	*Date Sampled:*	13/02/2023
Sample Identification:	TH8	*Date Tested:*	7/03/2023

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	100
1.18	100
0.600	99
0.425	92
0.300	59
0.150	4
0.075	1



Comments:

Approved Signatory: JL

Name: Jack Leonard

Date: 07/March/2023

NATA

Accreditation No. 20599
Accredited for compliance with ISO/IEC 17025 - Testing

CONDITIONS RELATING TO THIS REPORT

1. This report has been prepared for the sole use of the client. It has been issued in accordance with the agreed terms and scope detailed in the proposal for the investigation. No responsibility or liability to any third party is accepted for any damages arising out of the use of this report.

2. This report has been prepared by suitably qualified and experienced personnel for the purposes stated herein. Every care is taken with the report as it relates to interpretation of sub-surface conditions, discussion of findings and recommendations given. No responsibility for the consequences of extrapolation by others is accepted by the company.

3. Findings and conclusions produced in the report are based on the investigation of the sub-surface through isolated locations. Conditions between investigated sites are based on extrapolation, interpretation and professional estimates. Unexpected variations in ground conditions often occur which cannot always be anticipated. The conclusions and recommendations in the report were considered accurate at the time of issue and based on certain assumptions at the time. Conditions and assumptions change with time and may affect the accuracy of the report.

4. Certain content within this report is based on information provided by the client and/or other parties and the accuracy of this information cannot be guaranteed.

5. These conditions must be read as part of the report and must be reproduced with all future copies.

6. The recommendations of this report should be considered a starting point. Recommendations should be continuously reviewed during the earthworks stage as sub-surface information and results from monitoring become available. It is strongly recommended that the Brown Geotechnical be retained to provide consultancy and/or inspections during the earthwork stages.

APPENDIX C: WORLEY PARSONS, ANSTEY PARK COMPREHENSIVE DEVELOPMENT PLAN APPENDIX 2 – STORMWATER DRAINAGE

Appendix 2 – Stormwater Drainage

The stormwater drainage system is based on a series of piped networks leading to several compensating basins located throughout the proposed comprehensive development plan. A central lake is located in a recreation reserve straddling Lots 46, 47, 56 & 57. The original intention in the Comprehensive Development Plan for this lake was to provide a central area for the accumulation of a large percentage of the Anstey Park stormwater drainage flow, however the topography, (particularly on the eastern side of the proposed lake with a line of trees to be retained) minimises the volume of stormwater drainage that could be economically piped to this location. As such, a number of sub-catchments are required throughout the Anstey Park area. Finalised Comprehensive Development Plan drainage designs show that all recreation reserves (except for the triangular shaped reserve at the intersection of Forty and Anstey Roads and the proposed wetland buffer reserve in Lot 40 at the northern boundary of the release area) are required to detain water during a 1 in 10 year storm event.

The City of Rockingham will allow a maximum of 25% of the recreation reserve to be inundated with water for a maximum period of 7 days. An infiltration rate of 1×10^{-5} m/sec (equating to 864mm/day) for water through fine to sandy soils was allowed. Whilst this number is seen as conservative for sandy soils, it is important to note that stormwater drainage flows can contain fines which will over time decrease the voids ratio of the soil. In addition, sand which is inundated with water will convey water at a slower rate due once again to the lack of voids in the soil structure. The rate of evaporation used is 3.7mm/day which is the average evaporation for Perth in June. This is the lowest rate of evaporation and whilst this delivers a conservative estimate for the purposes of this design, is considered reasonable due to the increased potential for significant rain events in Perth in winter months than in warmer months where evaporation levels may be higher.

The stormwater drainage pipe system is designed to cater for a 6 minute 1 in 5 year Average Return Interval storm event with larger rainfall events (up to 1 in 100 years) to be catered for by overland flow paths to the various compensating and infiltration basins. Rainfall data for Perth Airport has been used in the analysis of probable flows which is considered conservative, as the data for Perth Airport is slightly higher than local IFD data for Rockingham. A runoff coefficient of 0.78 has been adopted for road reserves with a zero bypass coefficient. A zero runoff coefficient has been adopted for areas within lot boundaries and Public Open Space areas.

Stormwater drainage cost contributions were calculated on the basis of contribution by all landowners to drainage infrastructure across the Anstey Park release area for pipe sizes greater than 450 mm diameter. This infrastructure is deemed to include all stormwater pit and pipe configurations, excavation, dewatering and backfilling requirements associated with the construction of stormwater drainage infrastructure.

APPENDIX D: STORMWATER CALCULATIONS

		ARI event						
Duration (hrs)	Duration (min)	1	2	5	10	20	50	100
0.02	1	114	126	162	188	213	247	274
0.03	2	101	109	137	156	175	200	218
0.05	3	89.6	97.7	123	141	159	182	200
0.07	4	81	88.6	113	130	146	168	186
0.08	5	74.2	81.3	104	120	136	157	174
0.10	6	68.6	75.3	97	112	127	147	163
0.17	10	53.6	59	76.6	88.8	101	117	130
0.25	15	43	47.5	61.6	71.4	81.2	94.4	105
0.33	20	36.5	40.2	52.1	60.3	68.5	79.6	88.3
0.42	25	32	35.2	45.5	52.6	59.7	69.2	76.7
0.50	30	28.7	31.5	40.6	46.9	53.1	61.6	68.2
0.58	35	26.1	28.6	36.8	42.4	48.1	55.7	61.6
0.67	40	24	26.3	33.8	38.9	44.1	51	56.5
0.75	45	22.3	24.5	31.3	36.1	40.8	47.2	52.2
0.83	50	20.9	22.9	29.2	33.7	38.1	44.1	48.7
0.92	55	19.7	21.5	27.5	31.6	35.8	41.4	45.8
1.00	60	18.6	20.4	26	29.9	33.8	39.1	43.3
1.50	90	14.4	15.7	20	22.9	26	30.1	33.4
2	120	12	13.1	16.6	19.1	21.6	25.1	27.9
3	180	9.23	10.1	12.8	14.7	16.8	19.6	22
4.5	270	7.07	7.71	9.85	11.4	13.1	15.4	17.4
6	360	5.84	6.38	8.19	9.54	11	13	14.7
9	540	4.43	4.85	6.28	7.36	8.51	10.2	11.6
12	720	3.63	3.98	5.18	6.09	7.07	8.49	9.69
18	1080	2.71	2.98	3.91	4.62	5.37	6.46	7.38
24	1440	2.2	2.42	3.18	3.75	4.37	5.24	5.98
30	1800	1.87	2.05	2.69	3.18	3.69	4.42	5.02
36	2160	1.63	1.79	2.35	2.77	3.21	3.82	4.32
48	2880	1.32	1.45	1.89	2.21	2.55	3.01	3.38
72	4320	0.985	1.08	1.39	1.61	1.84	2.13	2.37
96	5760	0.812	0.887	1.13	1.3	1.47	1.68	1.85
120	7200	0.708	0.772	0.973	1.11	1.25	1.42	1.55
144	8640	0.641	0.697	0.873	0.991	1.1	1.26	1.37
168	10080	0.595	0.647	0.807	0.912	1.01	1.15	1.26

Summary of all drainage Infrastructure

k= 10.0 m/day

No*	Catchment	Name	Basin/Soakwell/Cell	no*	Basin=Plan area / Soakwell=Dia (m), Cell Number	Ave depth (m) / Depth of Cell	Volume (m^3)	Outflow (L/s)	Note
1	1	Lot Soakwell	Soakwell	1	1.8	1.5	3.8	0.54	Single R30 lot
2	2	Lot Soakwell	Soakwell	1	1.8	1.5	3.8	0.54	Single R20 Lot
3	3	Lot Soakwell	Soakwell	14	1.8	1.5	53.4	7.56	Total R30 lots
4	3	Lot Soakwell	Soakwell	99	1.8	1.5	377.8	53.5	Total R20 lots
5	4	Lot Soakwell	Soakwell	1	1.8	1.5	3.8	0.54	Single 350m2 lot
6	5	Road Reserve							
7	6	Bio-retention	Basin	-	637.2	0.275	175.2	73.8	Bioretention area in basin
8	6	PRI soils storage	Basin	-	637.2	0.3	38.2	0.0	Storage inside the PRI soils. 20% Void Ratio assumed
9	8	Total Basin	Basin		-	-	1,044.5	105.2	Above ground storage (refer to Basin Design Table)
10									
11									
12									
13									
14									
15									
						sum	1,513.9	166.2	

Design Summary - Lookup to use in Catchment Detention Tab

Catchment	Area (m2)	outflow (l/s)	Storage Volume (m3)	C	Note
Manual Overwrite					
1	375	0.5	3.8	0.60	*Single R30 lot*
2	500	0.5	3.8	0.40	*Single R20 Lot*
3	52,635	61.0	431.2	0.40	*All Residential Lots*
4	350	0.5	3.8	0.60	*350mm lot for the first 15mm*
5	21,800	0.5	3.8	0.60	*Road Reserve to Size Bio-Retention Area*
6	28,065	73.8	213.4	0.60	*Road Reserve and POS - minor storm outflow*
7	28,065	105.2	1,082.7	0.60	*Road Reserve and POS - max outflow*
8	80,700	166.2	1,513.9	0.47	*Total Area exc. storage and outflow in RR*

key

calc cell
input cell

Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Single R30 lot

Inputs		
Project Location	Surf Drive, Secret harbour	
Sub-Catchment Selectin or Manual Input	Sub-Catchment	
Sub-Catchment	1	*Single R30 lot*
Referenced Area from Subcatchment (sq.m)	375.0	
Site Area Manual Overwrite (sq.m)		
Pre-development flow ARI (1 in ...)	5	
Post-development flow ARI (1 in ...) minor storm	5	
Post-development flow ARI (1 in ...) major storm	100	
Area for consideration (sq.m)	375.0	
Pre-developed flow		
Infiltration Rate (m/day)	10	
Total Time of Concentration (min)	10	
Manual Outflow (L/s)		
5 year ARI intensity for 10 minute time of concentration	76.6	
Calculated outflow from subcatchment (L/sec)	0.5	
Site Outflow Rate (L/sec)	0.5	

	1 in 5 year storm	*1 in 100 year storm*	*storage provided*
Post developed coefficient of runoff 'C_{10}'	0.60	0.60	
Frequency Factor (F_f)	0.95	1.2	
Apopted C Value (C_{10}*F_f)	0.6	0.7	
Area for consideration (sq.m)	375	375	
Time of concentration (min)	10.0	10.0	
Storage required (m^3)	**3.6**	**12.2**	**3.8**
Critical Storm (min)	60.0	360.0	

Sub-Catchment Reference Cells
Input cell
Calculation cell
Formula cell

Frequency Factor	
ARI	Fy
1.0	0.80
2.0	0.85
5.0	0.95
10.0	1.00
20.0	1.05
50.0	1.15
100.0	1.20

Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Minor ON SITE DETENTION CALCULATION - Single R30 lot

		E	*F*	*PSD*	*G*	*H*
D	*I*	*F_y = CIA /3600*	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 5 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	104	3.09	926	0.13	40	886
6	97	3.46	1244	0.16	58	1186
10	76.6	4.55	2729	0.27	162	2567
15	61.6	3.66	3292	0.40	364	2927
20	52.1	3.09	3712	0.54	648	3064
25	45.5	2.70	4052	0.54	810	3242
30	40.6	2.41	4339	0.54	972	3367
35	36.8	2.19	4589	0.54	1134	3455
40	33.8	2.01	4817	0.54	1296	3521
45	31.3	1.86	5018	0.54	1458	3560
50	29.2	1.73	5201	0.54	1620	3581
55	27.5	1.63	5388	0.54	1782	3606
60	26	1.54	5558	0.54	1944	3614
90	20	1.19	6413	0.54	2916	3497
120	16.6	0.99	7097	0.54	3888	3209
180	12.8	0.76	8208	0.54	5832	2376
360	8.19	0.49	10504	0.54	11663	
720	5.18	0.31	13287	0.54	23326	
1440	3.18	0.19	16313	0.54	46653	
2880	1.89	0.11	19391	0.54	93305	
					Max Storage (L)	3614
					Design Storage	**3620**
					Critical duration (min)	60

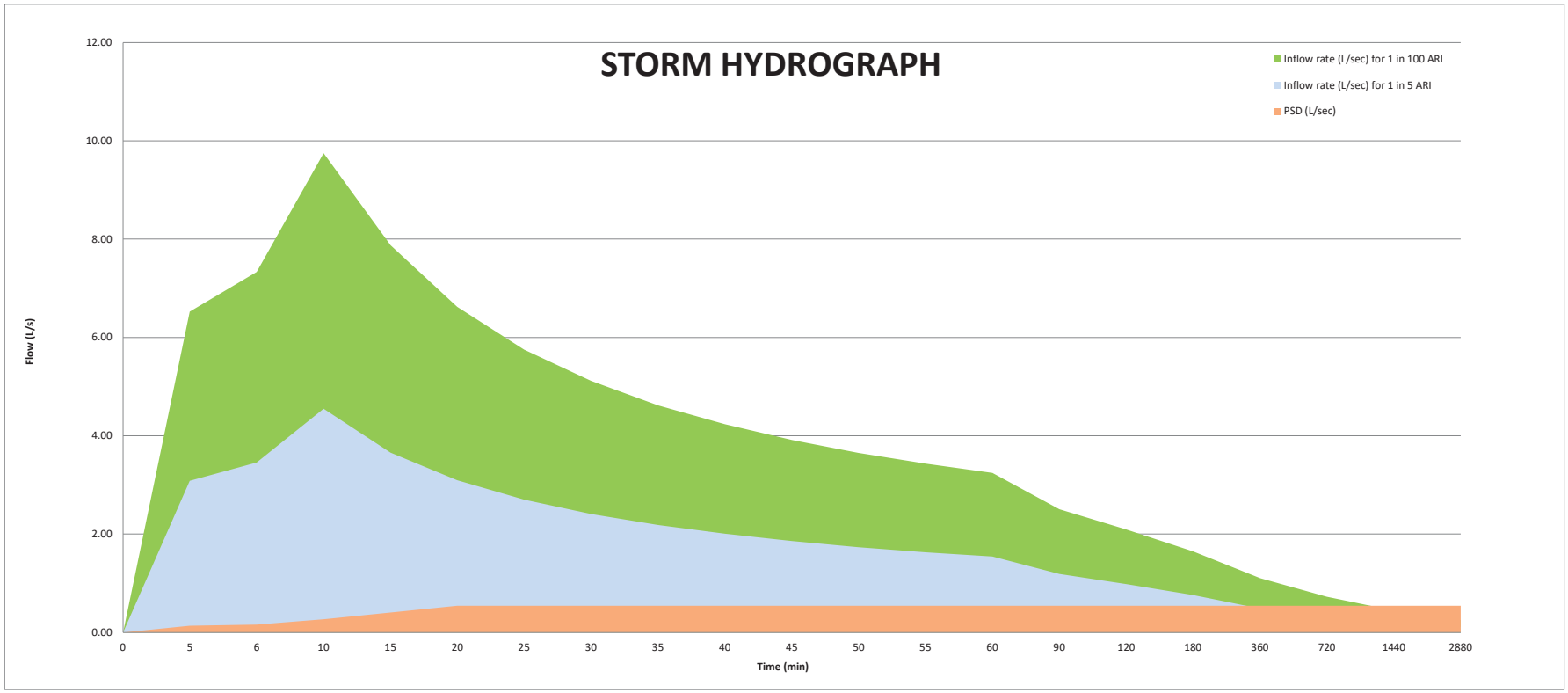
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Major ON SITE DETENTION CALCULATION - Single R30 lot

		E	*F*	*PSD*	*G*	*H*
D	*I*	F_y *CIA2/3600*	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 100 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	174	6.53	1958	0.13	40	1917
6	163	7.34	2641	0.16	58	2582
10	130	9.75	5850	0.27	162	5688
15	105	7.88	7088	0.40	364	6723
20	88.3	6.62	7947	0.54	648	7299
25	76.7	5.75	8629	0.54	810	7819
30	68.2	5.12	9207	0.54	972	8235
35	61.6	4.62	9702	0.54	1134	8568
40	56.5	4.24	10170	0.54	1296	8874
45	52.2	3.92	10571	0.54	1458	9113
50	48.7	3.65	10958	0.54	1620	9338
55	45.8	3.44	11336	0.54	1782	9554
60	43.3	3.25	11691	0.54	1944	9747
90	33.4	2.51	13527	0.54	2916	10611
120	27.9	2.09	15066	0.54	3888	11178
180	22	1.65	17820	0.54	5832	11988
360	14.7	1.10	23814	0.54	11663	12151
720	9.69	0.73	31396	0.54	23326	8069
1440	5.98	0.45	38750	0.54	46653	
2880	3.38	0.25	43805	0.54	93305	
					Max Storage (L)	12151
					Design Storage	**12160**
					Critical duration (m	360

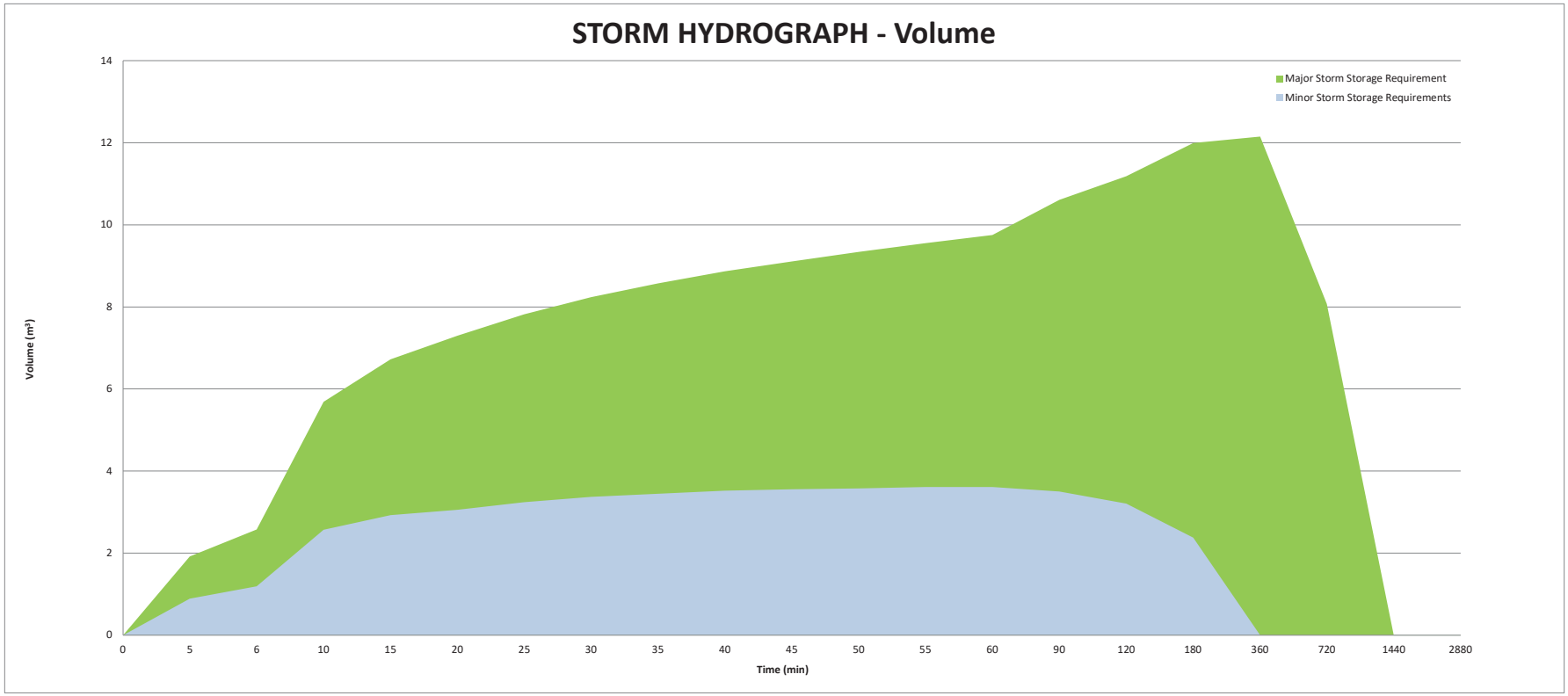
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Single R30 lot



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Single R30 lot



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Single R20 Lot

Sub-Catchment Reference Cells		
Input cell		
Calculation cell		
Formula cell		

Inputs

Project Location	Surf Drive, Secret harbour	
Sub-Catchment Selectin or Manual Input	Sub-Catchment	
Sub-Catchment	2	*Single R20 Lot*
Referenced Area from Subcatchment (sq.m)	500.0	
Site Area Manual Overwrite (sq.m)		
Pre-development flow ARI (1 in ...)	5	
Post-development flow ARI (1 in ...) minor storm	5	
Post-development flow ARI (1 in ...) major storm	100	
Area for consideration (sq.m)	500.0	

Frequency Factor	
ARI	Fy
1.0	0.80
2.0	0.85
5.0	0.95
10.0	1.00
20.0	1.05
50.0	1.15
100.0	1.20

Pre-developed flow

Infiltration Rate (m/day)	10
Total Time of Concentration (min)	10
Manual Outflow (L/s)	
5 year ARI intensity for 10 minute time of concentration	76.6
Calculated outflow from subcatchment (L/sec)	0.5
Site Outflow Rate (L/sec)	0.5

	1 in 5 year storm	*1 in 100 year storm*	*storage provided*
Post developed coefficient of runoff 'C_{10}'	0.40	0.40	
Frequency Factor (F_f)	0.95	1.2	
Apopted C Value (C_{10}*F_f)	0.4	0.5	
Area for consideration (sq.m)	500	500	
Time of concentration (min)	10.0	10.0	
Storage required (m^3)	**3.0**	**10.0**	**3.8**
Critical Storm (min)	55.0	180.0	

Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Minor ON SITE DETENTION CALCULATION - Single R20 Lot

		E	*F*	*PSD*	*G*	*H*
D	*I*	*F_y = CIA /3600*	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 5 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	104	2.74	823	0.13	40	783
6	97	3.07	1106	0.16	58	1047
10	76.6	4.04	2426	0.27	162	2264
15	61.6	3.25	2926	0.40	364	2562
20	52.1	2.75	3300	0.54	648	2652
25	45.5	2.40	3602	0.54	810	2792
30	40.6	2.14	3857	0.54	972	2885
35	36.8	1.94	4079	0.54	1134	2945
40	33.8	1.78	4281	0.54	1296	2985
45	31.3	1.65	4460	0.54	1458	3002
50	29.2	1.54	4623	0.54	1620	3003
55	27.5	1.45	4790	0.54	1782	3008
60	26	1.37	4940	0.54	1944	2996
90	20	1.06	5700	0.54	2916	2784
120	16.6	0.88	6308	0.54	3888	2420
180	12.8	0.68	7296	0.54	5832	1464
360	8.19	0.43	9337	0.54	11663	
720	5.18	0.27	11810	0.54	23326	
1440	3.18	0.17	14501	0.54	46653	
2880	1.89	0.10	17237	0.54	93305	
					Max Storage (L)	3008
					Design Storage	**3010**
					Critical duration (min)	55

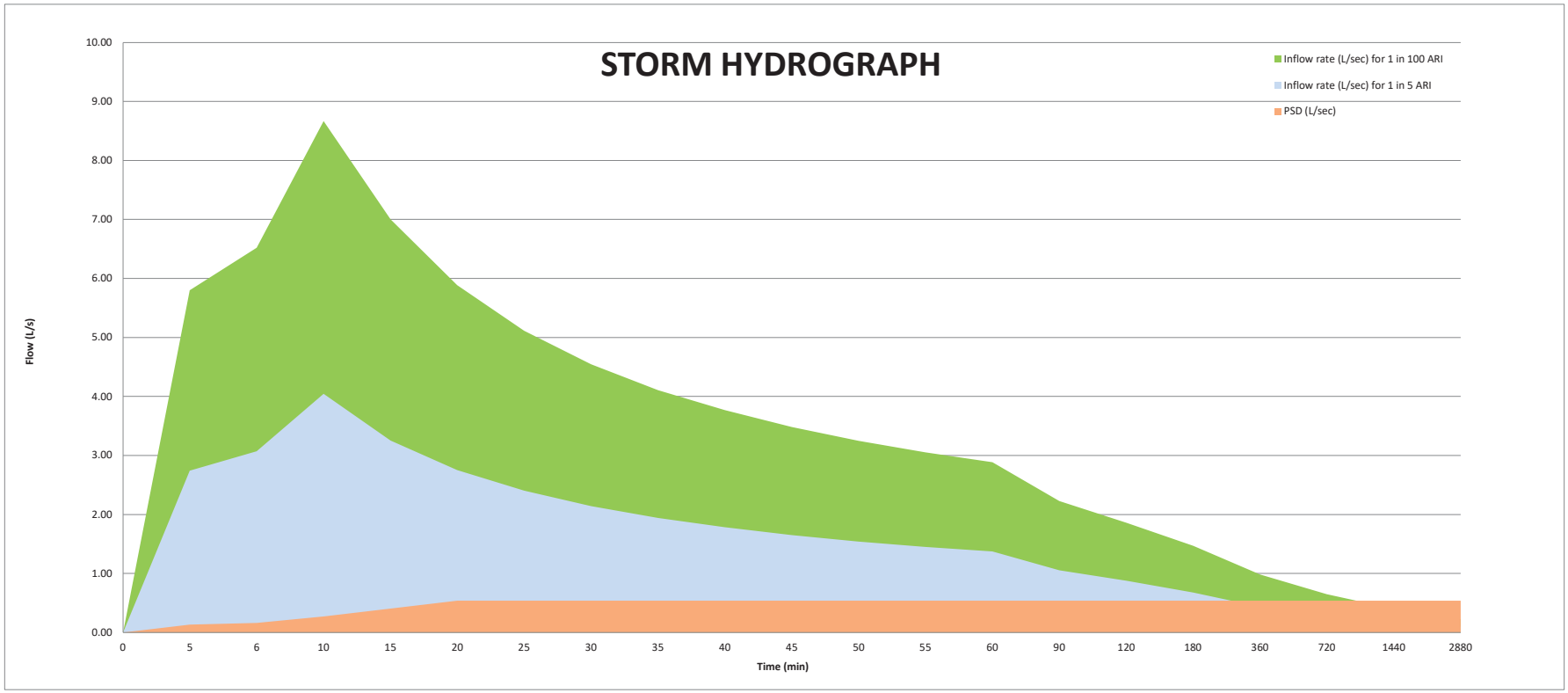
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Major ON SITE DETENTION CALCULATION - Single R20 Lot

D	*I*	*E*	*F*	*PSD*	*G*	*H*
		F_y CIA2/3600	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 100 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	174	5.80	1740	0.13	40	1700
6	163	6.52	2347	0.16	58	2289
10	130	8.67	5200	0.27	162	5038
15	105	7.00	6300	0.40	364	5936
20	88.3	5.89	7064	0.54	648	6416
25	76.7	5.11	7670	0.54	810	6860
30	68.2	4.55	8184	0.54	972	7212
35	61.6	4.11	8624	0.54	1134	7490
40	56.5	3.77	9040	0.54	1296	7744
45	52.2	3.48	9396	0.54	1458	7938
50	48.7	3.25	9740	0.54	1620	8120
55	45.8	3.05	10076	0.54	1782	8294
60	43.3	2.89	10392	0.54	1944	8448
90	33.4	2.23	12024	0.54	2916	9108
120	27.9	1.86	13392	0.54	3888	9504
180	22	1.47	15840	0.54	5832	10008
360	14.7	0.98	21168	0.54	11663	9505
720	9.69	0.65	27907	0.54	23326	4581
1440	5.98	0.40	34445	0.54	46653	
2880	3.38	0.23	38938	0.54	93305	
					Max Storage (L)	10008
					Design Storage	**10010**
					Critical duration (m	180

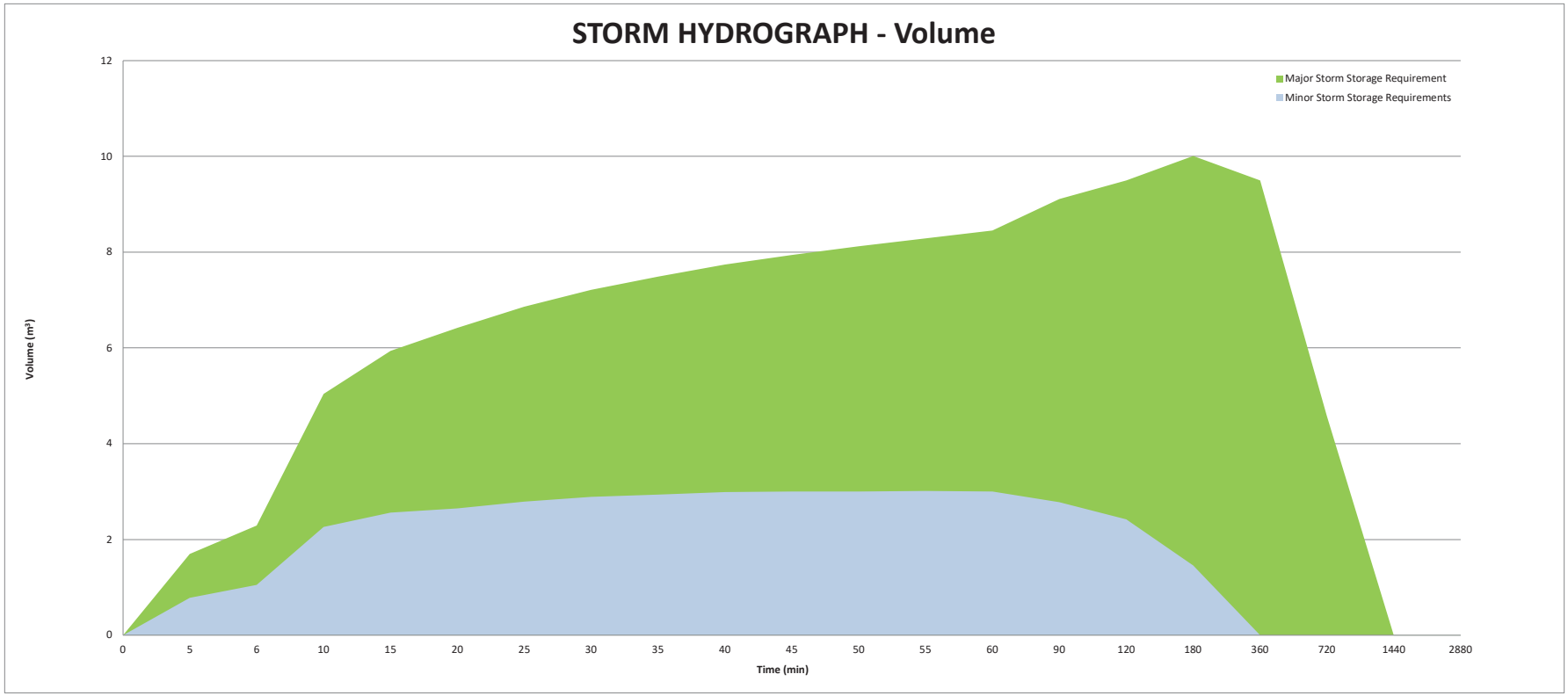
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Single R20 Lot



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Single R20 Lot



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - 350mm lot for the first 15mm

No Lots currently fit the requirements, to prove feasability only

Sub-Catchment Reference Cells
Input cell
Calculation cell
Formula cell

Inputs		
Project Location	Surf Drive, Secret harbour	
Sub-Catchment Selectin or Manual Input	Sub-Catchment	
Sub-Catchment	4	*350mm lot for the first 15mm*
Referenced Area from Subcatchment (sq.m)	350.0	
Site Area Manual Overwrite (sq.m)		
Pre-development flow ARI (1 in ...)	5	
Post-development flow ARI (1 in ...) minor storm	5	
Post-development flow ARI (1 in ...) major storm	100	
Area for consideration (sq.m)	350.0	
Pre-developed flow		
Infiltration Rate (m/day)	10	
Total Time of Concentration (min)	10	
Manual Outflow (L/s)		
5 year ARI intensity for 10 minute time of concentration	76.6	
Calculated outflow from subcatchment (L/sec)	0.5	
Site Outflow Rate (L/sec)	0.5	

Frequency Factor	
ARI	Fy
1.0	0.80
2.0	0.85
5.0	0.95
10.0	1.00
20.0	1.05
50.0	1.15
100.0	1.20

	Initial 15mm of rainfall	*storage provided*	
Post developed coefficient of runoff 'C_{10}'	0.60		
Frequency Factor (F_f)	1.0		
Apopted C Value (C_{10}*F_f)			
Area for consideration (sq.m)	350		
Time of concentration (min)	-		
Storage required (m^3)	**3.2**		**3.8**
Critical Storm (min)	-		

Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Minor ON SITE DETENTION CALCULATION - 350mm lot for the first 15mm

		E	*F*	*PSD*	*G*	*H*
D	*I*	*F_y CIA /3600*	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 5 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	104	2.88	865	0.13	40	824
6	97	3.23	1161	0.16	58	1103
10	76.6	4.24	2547	0.27	162	2385
15	61.6	3.41	3072	0.40	364	2708
20	52.1	2.89	3465	0.54	648	2817
25	45.5	2.52	3782	0.54	810	2972
30	40.6	2.25	4050	0.54	972	3078
35	36.8	2.04	4283	0.54	1134	3149
40	33.8	1.87	4495	0.54	1296	3199
45	31.3	1.73	4683	0.54	1458	3225
50	29.2	1.62	4855	0.54	1620	3235
55	27.5	1.52	5029	0.54	1782	3247
60	26	1.44	5187	0.54	1944	3243
90	20	1.11	5985	0.54	2916	3069
120	16.6	0.92	6623	0.54	3888	2736
180	12.8	0.71	7661	0.54	5832	1829
360	8.19	0.45	9803	0.54	11663	
720	5.18	0.29	12401	0.54	23326	
1440	3.18	0.18	15226	0.54	46653	
2880	1.89	0.10	18099	0.54	93305	
					Max Storage (L)	3247
					Design Storage	**3250**
					Critical duration (min)	55

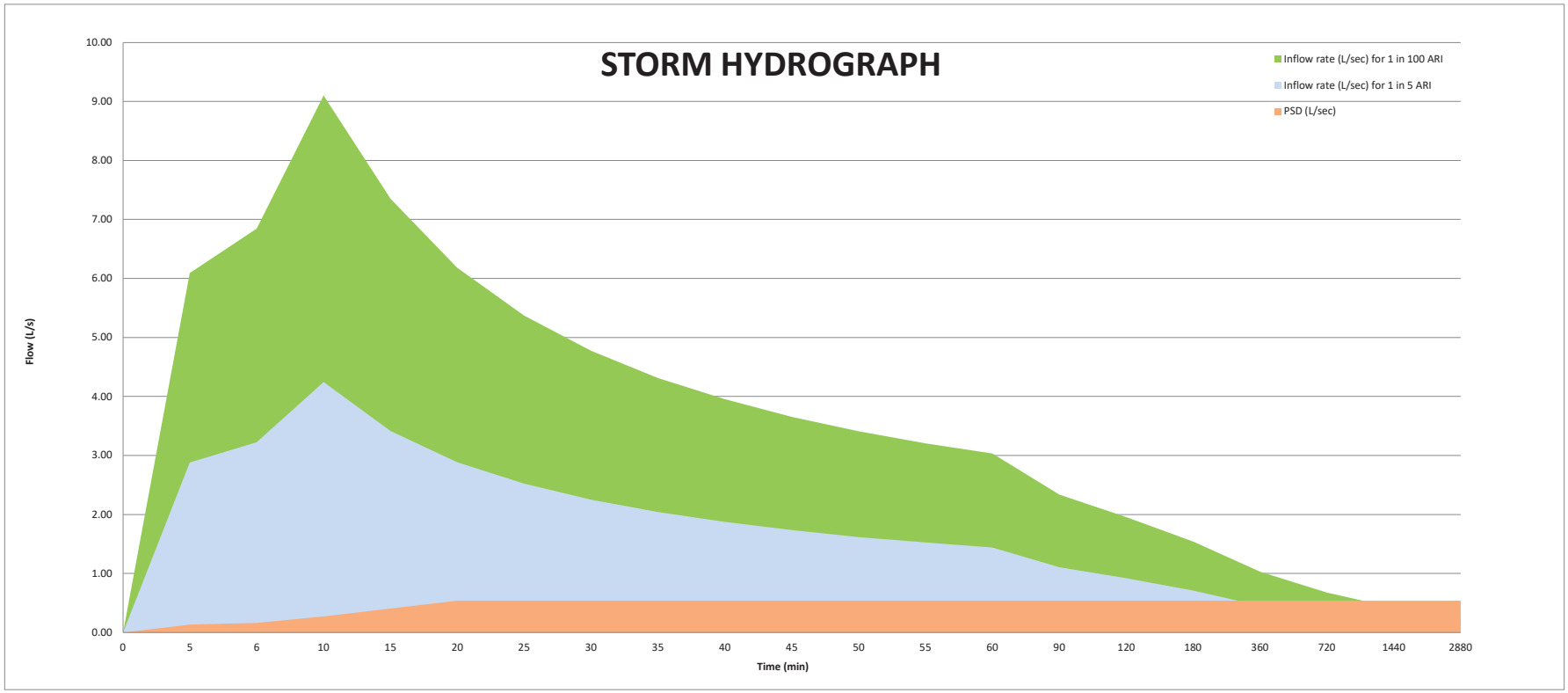
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Major ON SITE DETENTION CALCULATION - 350mm lot for the first 15mm

		E	*F*	*PSD*	*G*	*H*
D	*I*	F_y *CIA2/3600*	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 100 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	174	6.09	1827	0.13	40	1787
6	163	6.85	2465	0.16	58	2406
10	130	9.10	5460	0.27	162	5298
15	105	7.35	6615	0.40	364	6251
20	88.3	6.18	7417	0.54	648	6769
25	76.7	5.37	8054	0.54	810	7244
30	68.2	4.77	8593	0.54	972	7621
35	61.6	4.31	9055	0.54	1134	7921
40	56.5	3.96	9492	0.54	1296	8196
45	52.2	3.65	9866	0.54	1458	8408
50	48.7	3.41	10227	0.54	1620	8607
55	45.8	3.21	10580	0.54	1782	8798
60	43.3	3.03	10912	0.54	1944	8968
90	33.4	2.34	12625	0.54	2916	9709
120	27.9	1.95	14062	0.54	3888	10174
180	22	1.54	16632	0.54	5832	10800
360	14.7	1.03	22226	0.54	11663	10563
720	9.69	0.68	29303	0.54	23326	5976
1440	5.98	0.42	36167	0.54	46653	
2880	3.38	0.24	40884	0.54	93305	
					Max Storage (L)	10800
					Design Storage	**10810**
					Critical duration (m	180

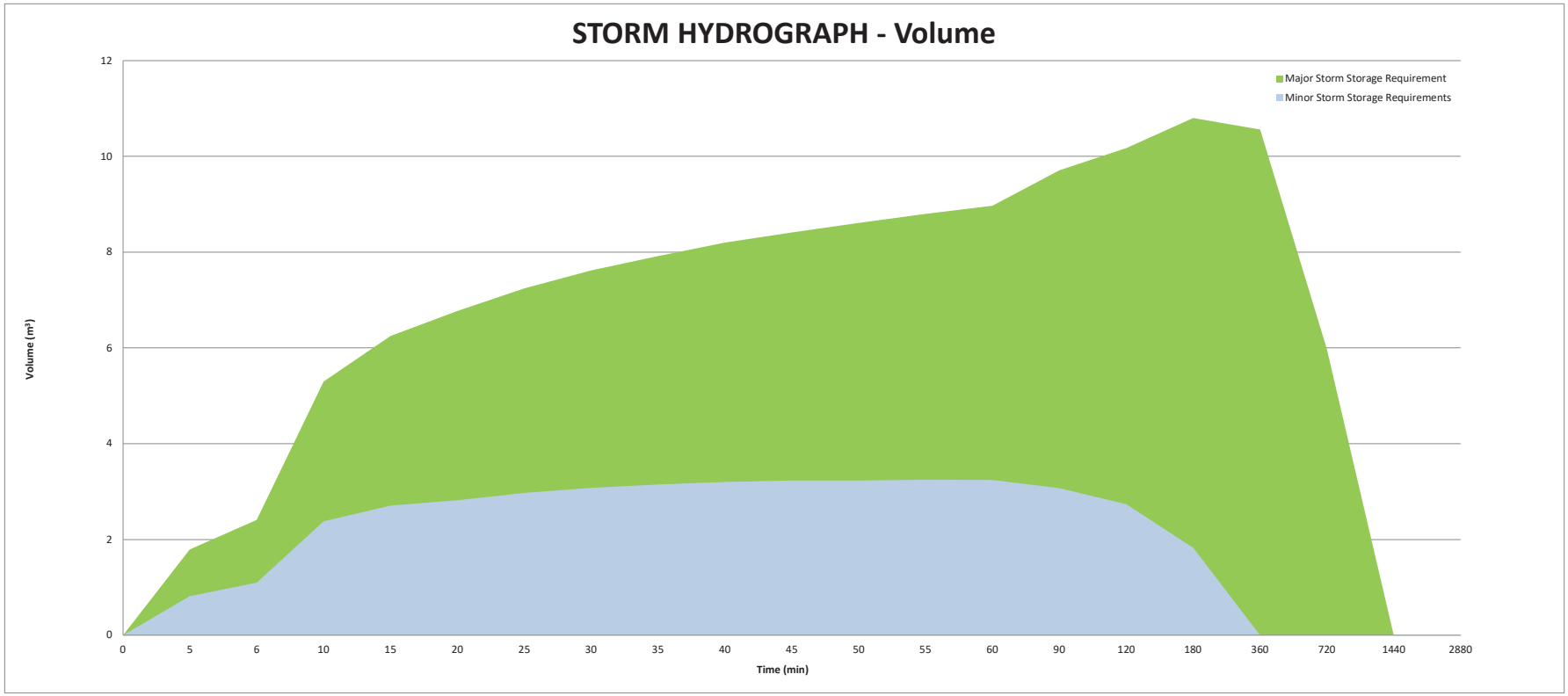
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - 350mm lot for the first 15mm



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - 350mm lot for the first 15mm



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - All Residential Lots

Sub-Catchment Reference Cells
Input cell
Calculation cell
Formula cell

Inputs

Project Location	Surf Drive, Secret harbour	
Sub-Catchment Selectin or Manual Input	Sub-Catchment	
Sub-Catchment	3	*All Residential Lots*
Referenced Area from Subcatchment (sq.m)	52,635.0	
Site Area Manual Overwrite (sq.m)		
Pre-development flow ARI (1 in ...)	5	
Post-development flow ARI (1 in ...) minor storm	5	
Post-development flow ARI (1 in ...) major storm	100	
Area for consideration (sq.m)	52,635.0	

Frequency Factor	
ARI	Fy
1.0	0.8
2.0	0.9
5.0	1.0
10.0	1.0
20.0	1.1
50.0	1.2
100.0	1.2

Pre-developed flow

Infiltration Rate (m/day)	10
Total Time of Concentration (min)	10
Manual Outflow (L/s)	
5 year ARI intensity for 10 minute time of concentration	76.6
Calculated outflow from subcatchment (L/sec)	61.0
Site Outflow Rate (L/sec)	61.0

	1 in 5 year storm	*1 in 100 year storm*	*storage provided*
Post developed coefficient of runoff 'C_{10}'	0.40	0.40	
Frequency Factor (F_f)	1.0	1.2	
Apopted C Value (C_{10}*F_f)	0.4	0.5	
Area for consideration (sq.m)	52,635	52,635	
Time of concentration (min)	10.0	10.0	
Storage required (m^3)	**304.8**	**1,008.5**	**431.2**
Critical Storm (min)	45.0	180.0	

Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Minor ON SITE DETENTION CALCULATION - All Residential Lots

		E	*F*	*PSD*	*G*	*H*
D	*I*	*F_y = CIA /3600*	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 5 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	104	288.91	86672	15.25	4576	82096
6	97	323.35	116408	18.30	6590	109818
10	76.6	425.58	255350	30.51	18305	237045
15	61.6	342.24	308020	45.76	41186	266834
20	52.1	289.46	347356	61.02	73219	274137
25	45.5	252.79	379191	61.02	91523	287668
30	40.6	225.57	406026	61.02	109828	296198
35	36.8	204.46	429361	61.02	128133	301228
40	33.8	187.79	450696	61.02	146437	304258
45	31.3	173.90	469531	61.02	164742	304788
50	29.2	162.23	486698	61.02	183047	303651
55	27.5	152.79	504199	61.02	201352	302848
60	26	144.45	520034	61.02	219656	300378
90	20	111.12	600039	61.02	329484	270555
120	16.6	92.23	664043	61.02	439312	224731
180	12.8	71.12	768050	61.02	658969	109081
360	8.19	45.50	982864	61.02	1317937	
720	5.18	28.78	1243281	61.02	2635875	
1440	3.18	17.67	1526499	61.02	5271750	
2880	1.89	10.50	1814518	61.02	10543499	
					Max Storage (L)	304788
					Design Storage	**304790**
					Critical duration (min)	45

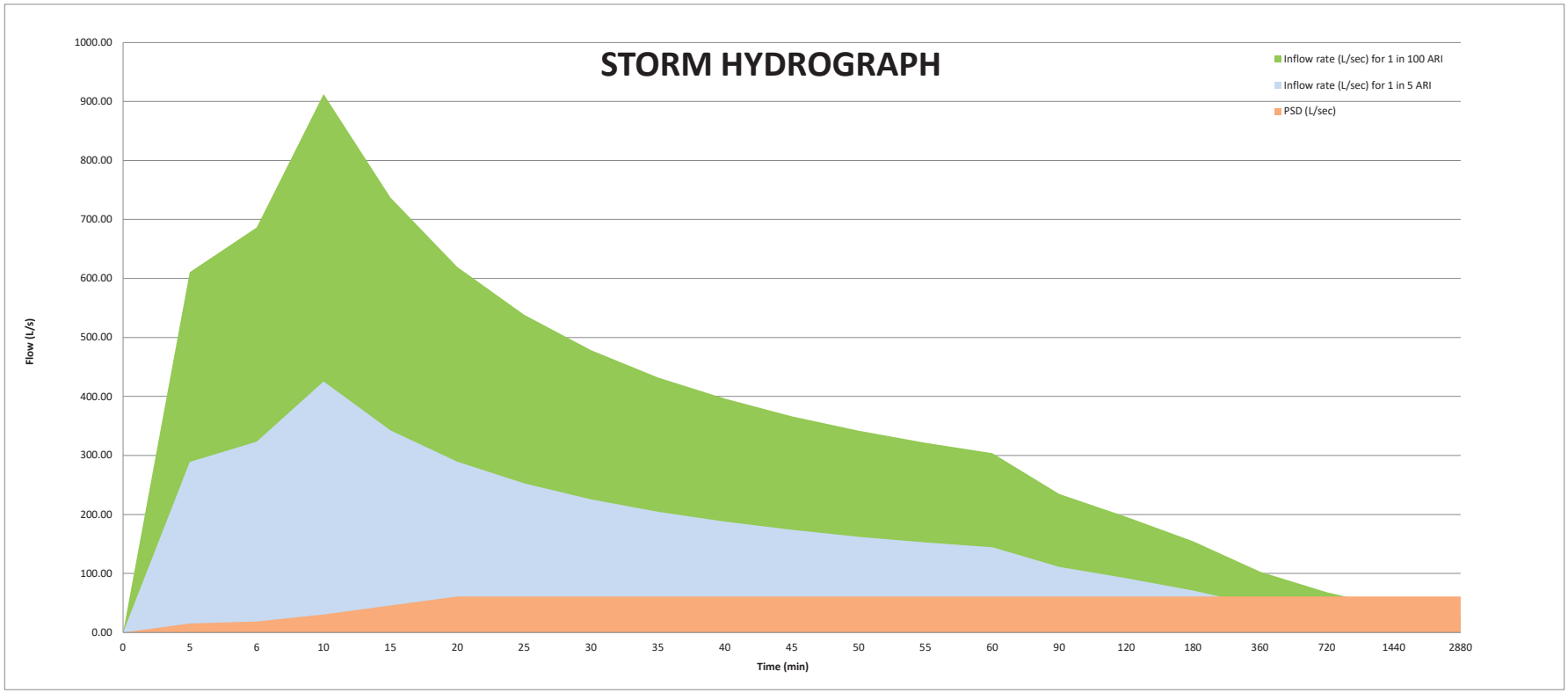
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Major ON SITE DETENTION CALCULATION - All Residential Lots

D	*I*	*E*	*F*	*PSD*	*G*	*H*
		F_y CIA2/3600	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 100 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	174	610.57	183170	15.25	4576	178594
6	163	686.36	247090	18.30	6590	240500
10	130	912.34	547404	30.51	18305	529099
15	105	736.89	663201	45.76	41186	622015
20	88.3	619.69	743627	61.02	73219	670409
25	76.7	538.28	807421	61.02	91523	715897
30	68.2	478.63	861530	61.02	109828	751702
35	61.6	432.31	907848	61.02	128133	779716
40	56.5	396.52	951641	61.02	146437	805203
45	52.2	366.34	989117	61.02	164742	824375
50	48.7	341.78	1025330	61.02	183047	842283
55	45.8	321.42	1060701	61.02	201352	859349
60	43.3	303.88	1093966	61.02	219656	874310
90	33.4	234.40	1265766	61.02	329484	936282
120	27.9	195.80	1409776	61.02	439312	970463
180	22	154.40	1667477	61.02	658969	1008508
360	14.7	103.16	2228355	61.02	1317937	910418
720	9.69	68.00	2937791	61.02	2635875	301916
1440	5.98	41.97	3626004	61.02	5271750	
2880	3.38	23.72	4098961	61.02	10543499	
					Max Storage (L)	1008508
					Design Storage	**1008510**
					Critical duration (m	180

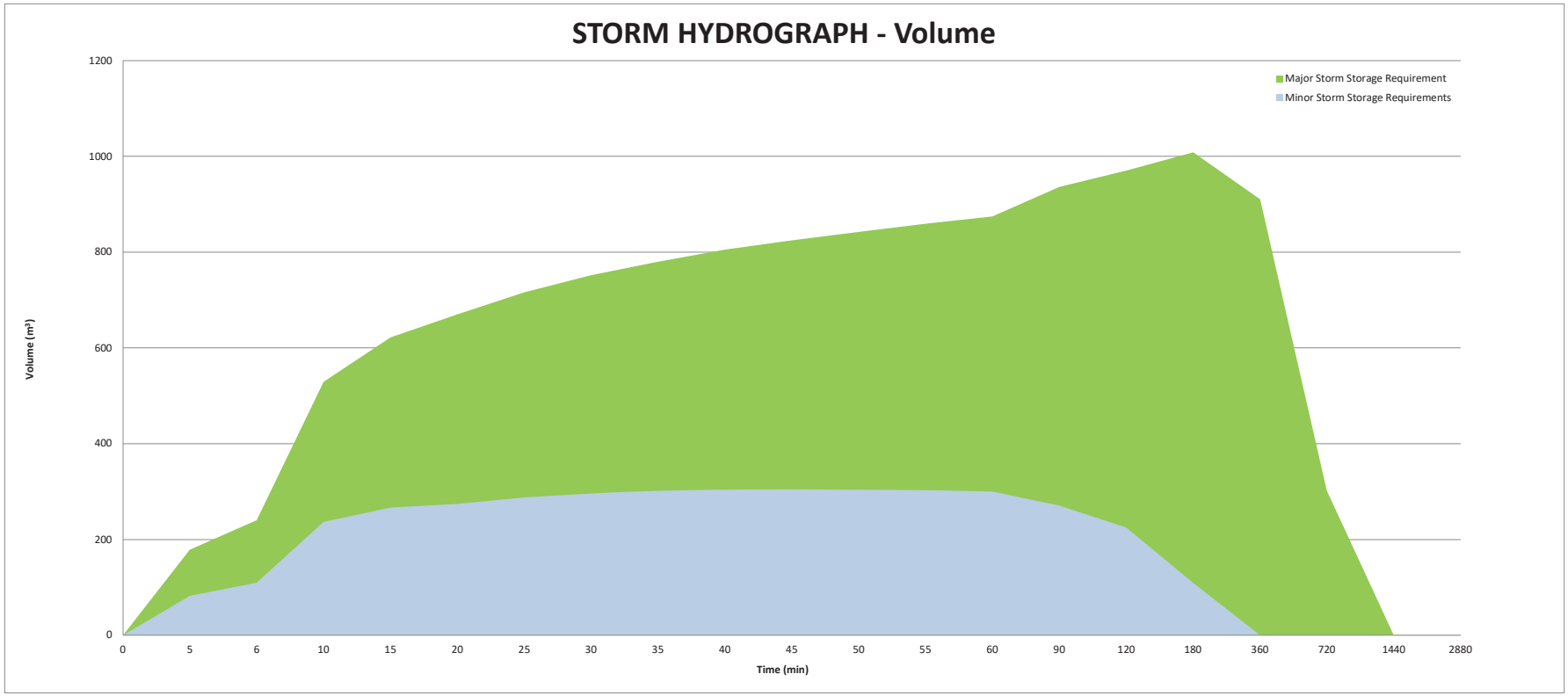
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - All Residential Lots



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - All Residential Lots



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Road Reserve and POS - minor storm outflow

Sub-Catchment Reference Cells
Input cell
Calculation cell
Formula cell

Inputs

Project Location	Surf Drive, Secret harbour	
Sub-Catchment Selectin or Manual Input	Sub-Catchment	
Sub-Catchment	6	*Road Reserve and POS - minor storm outflow*
Referenced Area from Subcatchment (sq.m)	28,065.0	
Site Area Manual Overwrite (sq.m)		
Pre-development flow ARI (1 in ...)	5	
Post-development flow ARI (1 in ...) minor storm	5	
Post-development flow ARI (1 in ...) major storm	100	
Area for consideration (sq.m)	28,065.0	

Frequency Factor	
ARI	Fy
1.0	0.8
2.0	0.9
5.0	1.0
10.0	1.0
20.0	1.1
50.0	1.2
100.0	1.2

Pre-developed flow

Infiltration Rate (m/day)	10
Total Time of Concentration (min)	10
Manual Outflow (L/s)	
5 year ARI intensity for 10 minute time of concentration	76.6
Calculated outflow from subcatchment (L/sec)	73.8
Site Outflow Rate (L/sec)	73.8

	1 in 5 year storm	*1 in 100 year storm*	*storage provided*
Post developed coefficient of runoff 'C_{10}'	0.60	0.60	
Frequency Factor (F_f)	0.95	1.2	
Apopted C Value (C_{10}*F_f)	0.6	0.7	
Area for consideration (sq.m)	28,065	28,065	
Time of concentration (min)	10.0	10.0	
Storage required (m^3)	**196.6**	**614.1**	**213.4**
Critical Storm (min)	15.0	90.0	

Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Minor ON SITE DETENTION CALCULATION - Road Reserve and POS - minor storm outflow

D	*I*	*E*	*F*	*PSD*	*G*	*H*
		F_{y*} CIA /3600	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 5 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	104	231.07	69321	18.44	5531	63789
6	97	258.62	93103	22.13	7965	85138
10	76.6	340.38	204229	36.88	22125	182104
15	61.6	273.73	246355	55.31	49781	196573
20	52.1	231.51	277815	73.75	88500	189315
25	45.5	202.18	303277	73.75	110625	192652
30	40.6	180.41	324740	73.75	132750	191990
35	36.8	163.53	343403	73.75	154875	188528
40	33.8	150.19	360467	73.75	177000	183467
45	31.3	139.09	375531	73.75	199125	176406
50	29.2	129.75	389262	73.75	221250	168012
55	27.5	122.20	403259	73.75	243375	159884
60	26	115.53	415923	73.75	265500	150423
90	20	88.87	479912	73.75	398250	81662
120	16.6	73.76	531102	73.75	531000	102
180	12.8	56.88	614287	73.75	796500	
360	8.19	36.39	786095	73.75	1593000	
720	5.18	23.02	994377	73.75	3186000	
1440	3.18	14.13	1220895	73.75	6372000	
2880	1.89	8.40	1451252	73.75	12744000	
					Max Storage (L)	196573
					Design Storage	**196580**
					Critical duration (min)	15

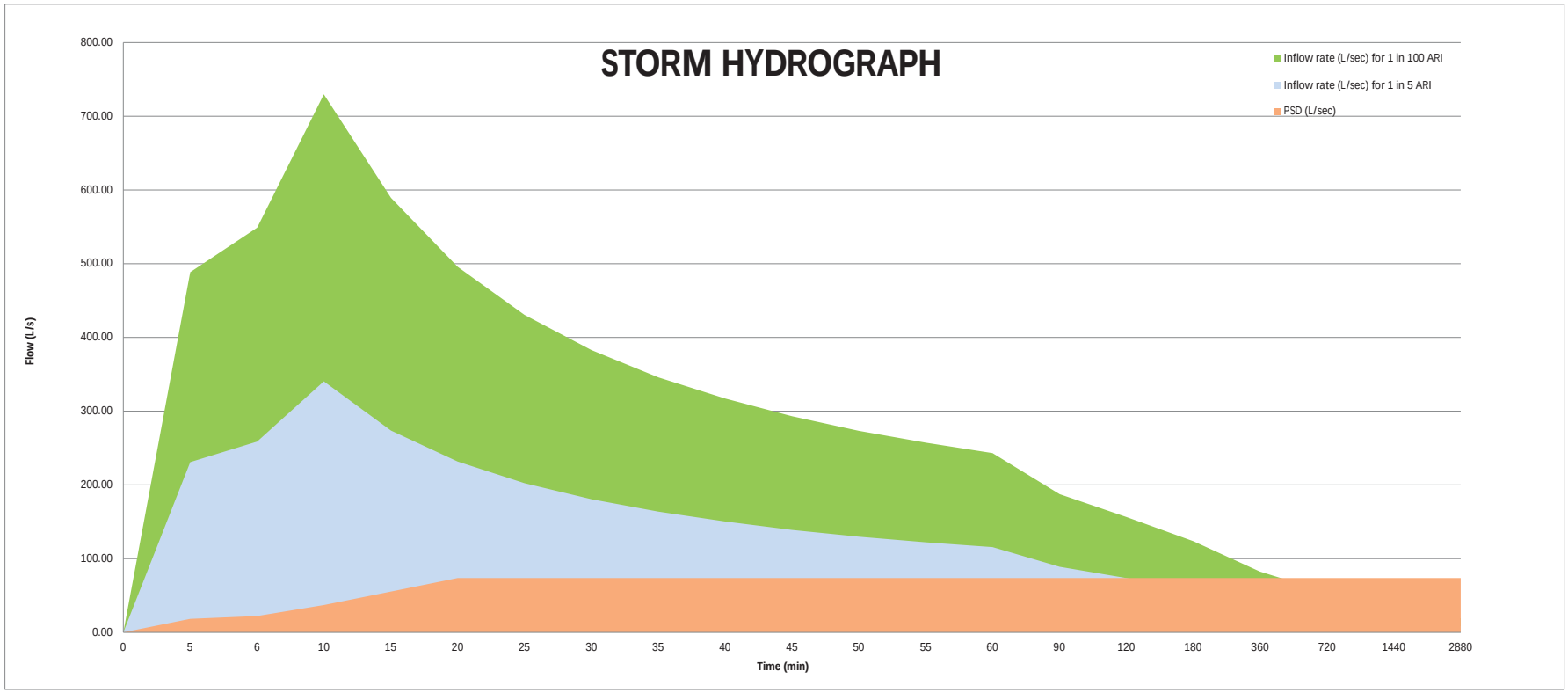
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Major ON SITE DETENTION CALCULATION - Road Reserve and POS - minor storm outflow

D	*I*	*E*	*F*	*PSD*	*G*	*H*
		$F_y CIA2/3600$	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 100 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	174	488.33	146499	18.44	5531	140968
6	163	548.95	197623	22.13	7965	189658
10	130	729.69	437814	36.88	22125	415689
15	105	589.37	530429	55.31	49781	480647
20	88.3	495.63	594753	73.75	88500	506253
25	76.7	430.52	645776	73.75	110625	535151
30	68.2	382.81	689052	73.75	132750	556302
35	61.6	345.76	726098	73.75	154875	571223
40	56.5	317.13	761123	73.75	177000	584123
45	52.2	293.00	791096	73.75	199125	591971
50	48.7	273.35	820059	73.75	221250	598809
55	45.8	257.08	848349	73.75	243375	604974
60	43.3	243.04	874954	73.75	265500	609454
90	33.4	187.47	1012361	73.75	398250	614111
120	27.9	156.60	1127539	73.75	531000	596539
180	22	123.49	1333649	73.75	796500	537149
360	14.7	82.51	1782240	73.75	1593000	189240
720	9.69	54.39	2349647	73.75	3186000	
1440	5.98	33.57	2900080	73.75	6372000	
2880	3.38	18.97	3278351	73.75	12744000	
					Max Storage (L)	614111
					Design Storage	**614120**
					Critical duration (m	90

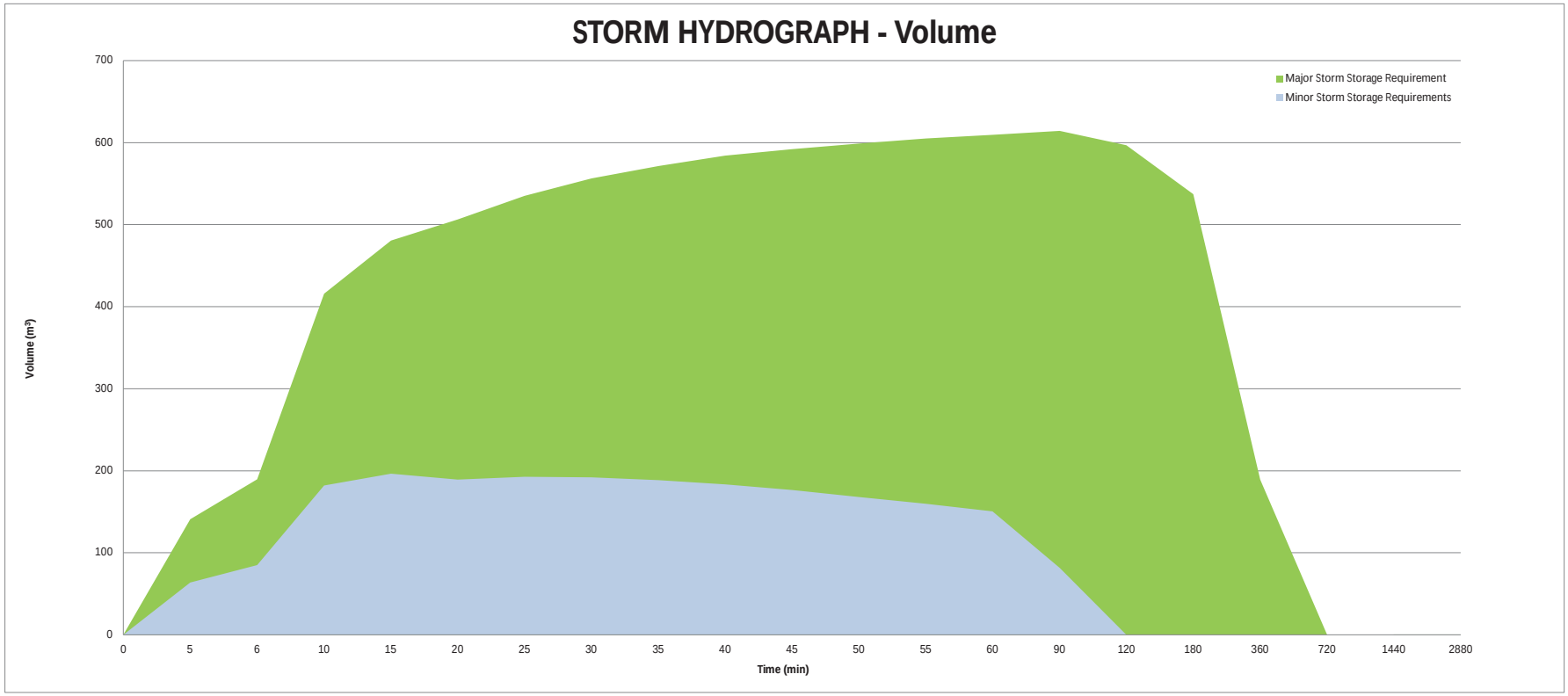
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Road Reserve and POS - minor storm outflow



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Road Reserve and POS - minor storm outflow



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Road Reserve and POS - max outflow

Sub-Catchment Reference Cells
Input cell
Calculation cell
Formula cell

Inputs

Project Location	Surf Drive, Secret harbour	
Sub-Catchment Selectin or Manual Input	Sub-Catchment	
Sub-Catchment	7	*Road Reserve and POS - max outflow*
Referenced Area from Subcatchment (sq.m)	28,065.0	
Site Area Manual Overwrite (sq.m)		
Pre-development flow ARI (1 in ...)	5	
Post-development flow ARI (1 in ...) minor storm	5	
Post-development flow ARI (1 in ...) major storm	100	
Area for consideration (sq.m)	28,065.0	

Frequency Factor	
ARI	Fy
1.0	0.8
2.0	0.9
5.0	1.0
10.0	1.0
20.0	1.1
50.0	1.2
100.0	1.2

Pre-developed flow

Infiltration Rate (m/day)	10
Total Time of Concentration (min)	10
Manual Outflow (L/s)	
5 year ARI intensity for 10 minute time of concentration	76.6
Calculated outflow from subcatchment (L/sec)	105.2
Site Outflow Rate (L/sec)	105.2

	1 in 5 year storm	*1 in 100 year storm*	*storage provided*
Post developed coefficient of runoff 'C_{10}'	0.60	0.60	
Frequency Factor (F_f)	0.95	1.2	
Apopted C Value (C_{10}*F_f)	0.6	0.7	
Area for consideration (sq.m)	28,065	28,065	
Time of concentration (min)	10.0	10.0	
Storage required (m^3)	**175.4**	**508.8**	**1082.7**
Critical Storm (min)	15.0	40.0	

Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Minor ON SITE DETENTION CALCULATION - Road Reserve and POS - max outflow

D	*I*	*E*	*F*	*PSD*	*G*	*H*
		F_{y*} CIA /3600	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 5 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	104	231.07	69321	26.29	7886	61434
6	97	258.62	93103	31.55	11357	81746
10	76.6	340.38	204229	52.58	31546	172683
15	61.6	273.73	246355	78.86	70978	175376
20	52.1	231.51	277815	105.15	126183	151632
25	45.5	202.18	303277	105.15	157729	145548
30	40.6	180.41	324740	105.15	189275	135465
35	36.8	163.53	343403	105.15	220821	122583
40	33.8	150.19	360467	105.15	252367	108100
45	31.3	139.09	375531	105.15	283913	91618
50	29.2	129.75	389262	105.15	315458	73803
55	27.5	122.20	403259	105.15	347004	56255
60	26	115.53	415923	105.15	378550	37373
90	20	88.87	479912	105.15	567825	
120	16.6	73.76	531102	105.15	757100	
180	12.8	56.88	614287	105.15	1135650	
360	8.19	36.39	786095	105.15	2271300	
720	5.18	23.02	994377	105.15	4542600	
1440	3.18	14.13	1220895	105.15	9085200	
2880	1.89	8.40	1451252	105.15	18170400	
					Max Storage (L)	175376
					Design Storage	**175380**
					Critical duration (min)	15

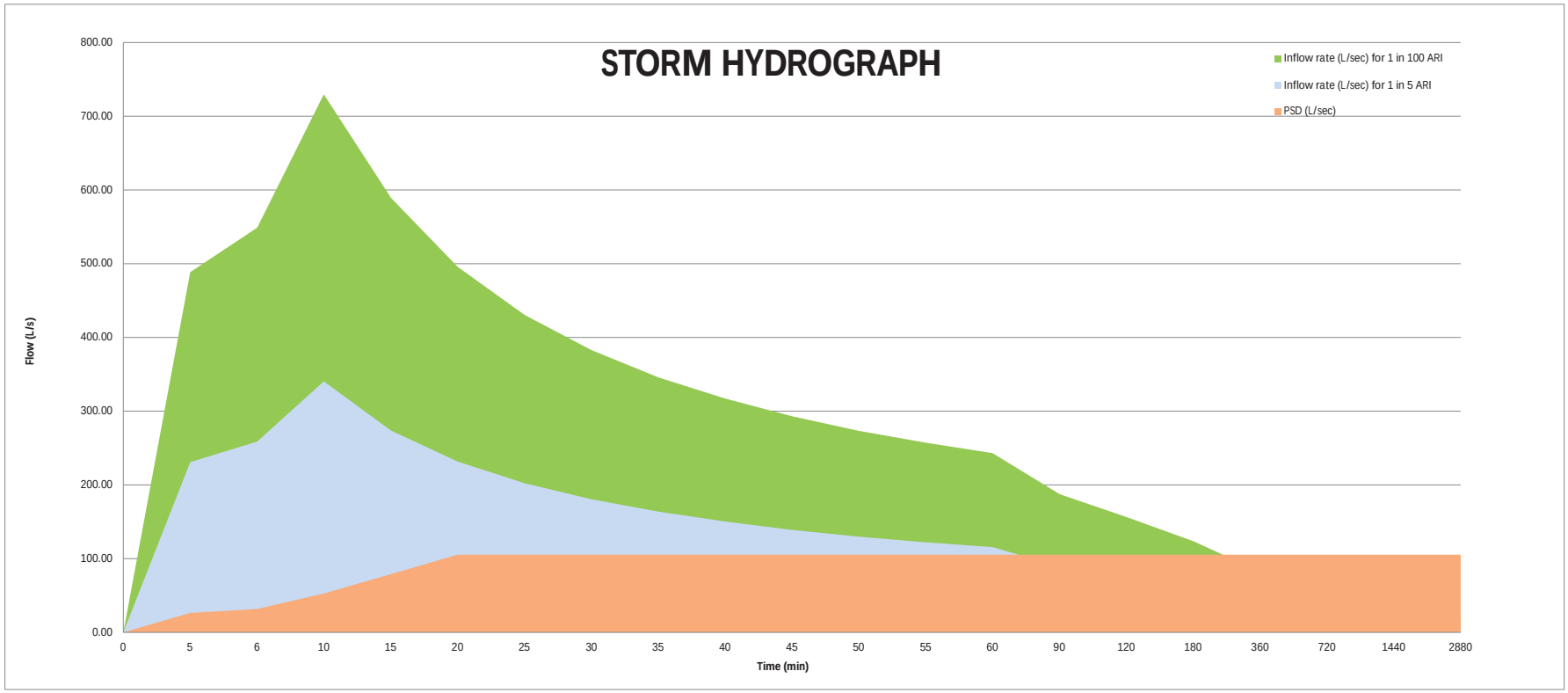
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Major ON SITE DETENTION CALCULATION - Road Reserve and POS - max outflow

D	*I*	*E*	*F*	*PSD*	*G*	*H*
		$F_y CIA2/3600$	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 100 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	174	488.33	146499	26.29	7886	138613
6	163	548.95	197623	31.55	11357	186266
10	130	729.69	437814	52.58	31546	406268
15	105	589.37	530429	78.86	70978	459450
20	88.3	495.63	594753	105.15	126183	468570
25	76.7	430.52	645776	105.15	157729	488046
30	68.2	382.81	689052	105.15	189275	499777
35	61.6	345.76	726098	105.15	220821	505277
40	56.5	317.13	761123	105.15	252367	508756
45	52.2	293.00	791096	105.15	283913	507184
50	48.7	273.35	820059	105.15	315458	504601
55	45.8	257.08	848349	105.15	347004	501345
60	43.3	243.04	874954	105.15	378550	496404
90	33.4	187.47	1012361	105.15	567825	444536
120	27.9	156.60	1127539	105.15	757100	370439
180	22	123.49	1333649	105.15	1135650	197999
360	14.7	82.51	1782240	105.15	2271300	
720	9.69	54.39	2349647	105.15	4542600	
1440	5.98	33.57	2900080	105.15	9085200	
2880	3.38	18.97	3278351	105.15	18170400	
					Max Storage (L)	508756
					Design Storage	**508760**
					Critical duration (m	40

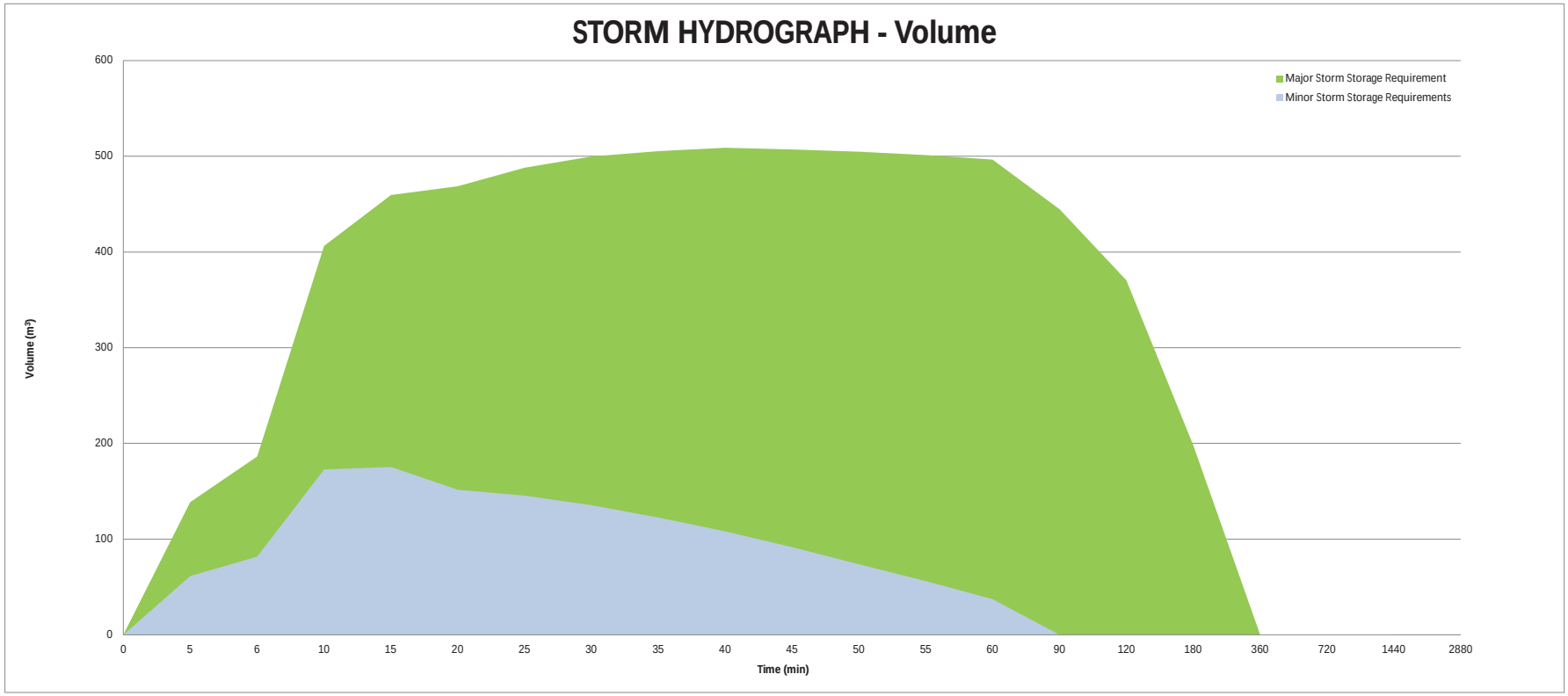
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Road Reserve and POS - max outflow



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Road Reserve and POS - max outflow



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Total Area exc. storage and outflow in RR

Sub-Catchment Reference Cells
Input cell
Calculation cell
Formula cell

Inputs

Project Location	Surf Drive, Secret harbour	
Sub-Catchment Selectin or Manual Input	Sub-Catchment	
Sub-Catchment	8	*Total Area exc. storage and outflow in RR*
Referenced Area from Subcatchment (sq.m)	80,700.0	
Site Area Manual Overwrite (sq.m)		
Pre-development flow ARI (1 in ...)	5	
Post-development flow ARI (1 in ...) minor storm	5	
Post-development flow ARI (1 in ...) major storm	100	
Area for consideration (sq.m)	80,700.0	

Frequency Factor	
ARI	Fy
1.0	0.8
2.0	0.9
5.0	1.0
10.0	1.0
20.0	1.1
50.0	1.2
100.0	1.2

Pre-developed flow

Infiltration Rate (m/day)	10
Total Time of Concentration (min)	10
Manual Outflow (L/s)	
5 year ARI intensity for 10 minute time of concentration	76.6
Calculated outflow from subcatchment (L/sec)	166.2
Site Outflow Rate (L/sec)	166.2

	1 in 5 year storm	*1 in 100 year storm*	*storage provided*
Post developed coefficient of runoff 'C_{10}'	0.47	0.47	
Frequency Factor (F_f)	0.95	1.2	
Apopted C Value (C_{10}*F_f)	0.4	0.6	
Area for consideration (sq.m)	80,700	80,700	
Time of concentration (min)	10.0	10.0	
Storage required (m^3)	**442.2**	**1,380.8**	**1513.9**
Critical Storm (min)	15.0	90.0	

Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Minor ON SITE DETENTION CALCULATION - Total Area exc. storage and outflow in RR

		E	F	PSD	G	H
D	I	F_{y^*} CIA /3600	60 x D x E		60D x PSD	F - G
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 5 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	104	519.98	155993	41.54	12463	143530
6	97	581.97	209510	49.85	17946	191564
10	76.6	765.96	459579	83.08	49851	409728
15	61.6	615.97	554375	124.63	112164	442211
20	52.1	520.98	625171	166.17	199402	425769
25	45.5	454.98	682469	166.17	249253	433216
30	40.6	405.98	730767	166.17	299103	431663
35	36.8	367.98	772765	166.17	348954	423811
40	33.8	337.98	811163	166.17	398804	412359
45	31.3	312.99	845061	166.17	448655	396407
50	29.2	291.99	875960	166.17	498505	377455
55	27.5	274.99	907458	166.17	548356	359103
60	26	259.99	935957	166.17	598206	337751
90	20	199.99	1079951	166.17	897309	182641
120	16.6	165.99	1195145	166.17	1196412	
180	12.8	127.99	1382337	166.17	1794619	
360	8.19	81.90	1768959	166.17	3589237	
720	5.18	51.80	2237657	166.17	7178475	
1440	3.18	31.80	2747394	166.17	14356950	
2880	1.89	18.90	3265770	166.17	28713899	
					Max Storage (L)	442211
					Design Storage	**442220**
					Critical duration (min)	15

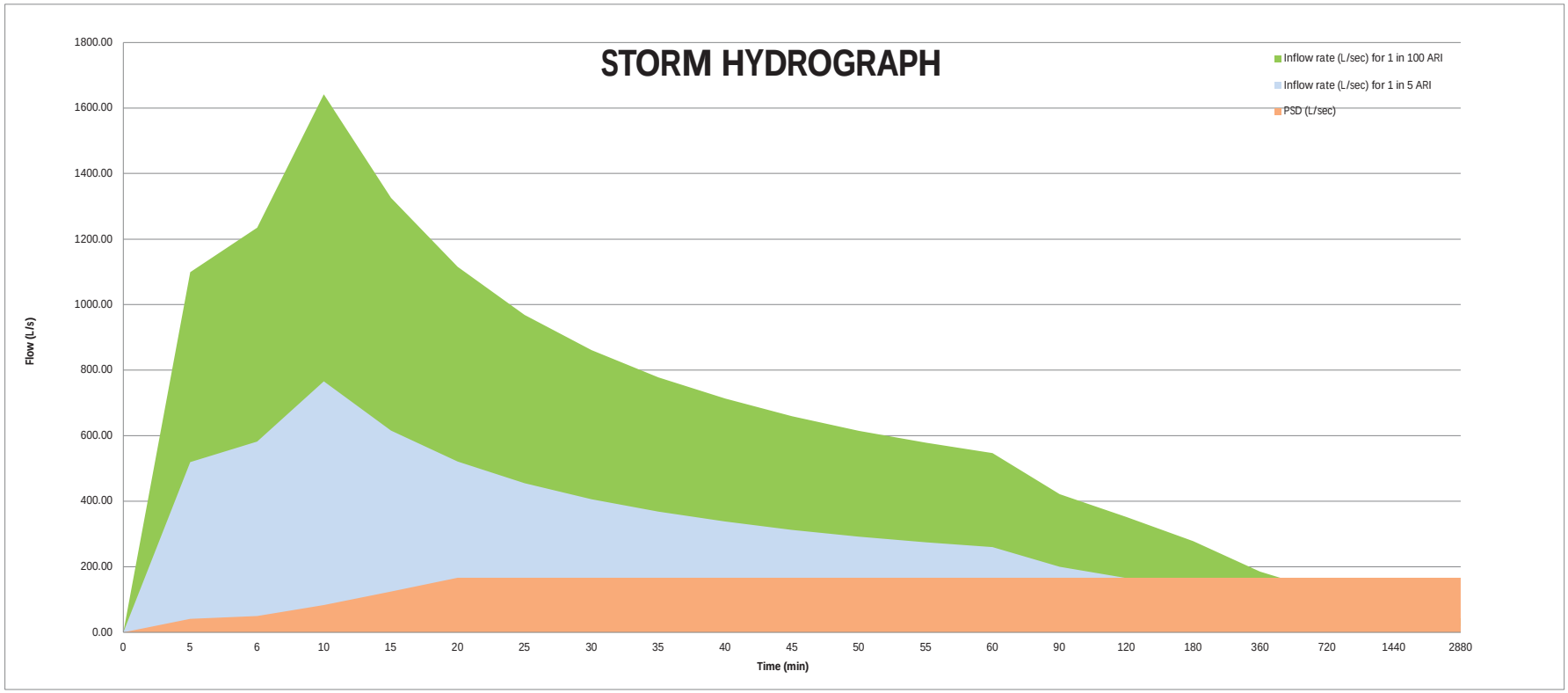
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

Storm Routing - Major ON SITE DETENTION CALCULATION - Total Area exc. storage and outflow in RR

D	*I*	*E*	*F*	*PSD*	*G*	*H*
		$F_y CIA2/3600$	*60 x D x E*		*60D x PSD*	*F - G*
Storm duration (min)	Intensity (mm/h)	Inflow rate (L/sec) for 1 in 100 ARI	Total Inflow (L)	PSD (L/sec)	Outflow (L)	Storage required (L)
0	0	0.00	0	0.00	0	0
5	174	1098.90	329669	41.54	12463	317206
6	163	1235.31	444712	49.85	17946	426766
10	130	1642.03	985218	83.08	49851	935367
15	105	1326.26	1193630	124.63	112164	1081466
20	88.3	1115.32	1338381	166.17	199402	1138979
25	76.7	968.80	1453197	166.17	249253	1203944
30	68.2	861.43	1550582	166.17	299103	1251478
35	61.6	778.07	1633946	166.17	348954	1284993
40	56.5	713.65	1712764	166.17	398804	1313959
45	52.2	659.34	1780213	166.17	448655	1331558
50	48.7	615.13	1845389	166.17	498505	1346884
55	45.8	578.50	1909049	166.17	548356	1360694
60	43.3	546.92	1968920	166.17	598206	1370714
90	33.4	421.88	2278127	166.17	897309	1380818
120	27.9	352.40	2537315	166.17	1196412	1340903
180	22	277.88	3001126	166.17	1794619	1206507
360	14.7	185.68	4010595	166.17	3589237	421358
720	9.69	122.39	5287438	166.17	7178475	
1440	5.98	75.53	6526084	166.17	14356950	
2880	3.38	42.69	7377312	166.17	28713899	
					Max Storage (L)	1380818
					Design Storage	**1380820**
					Critical duration (m	90

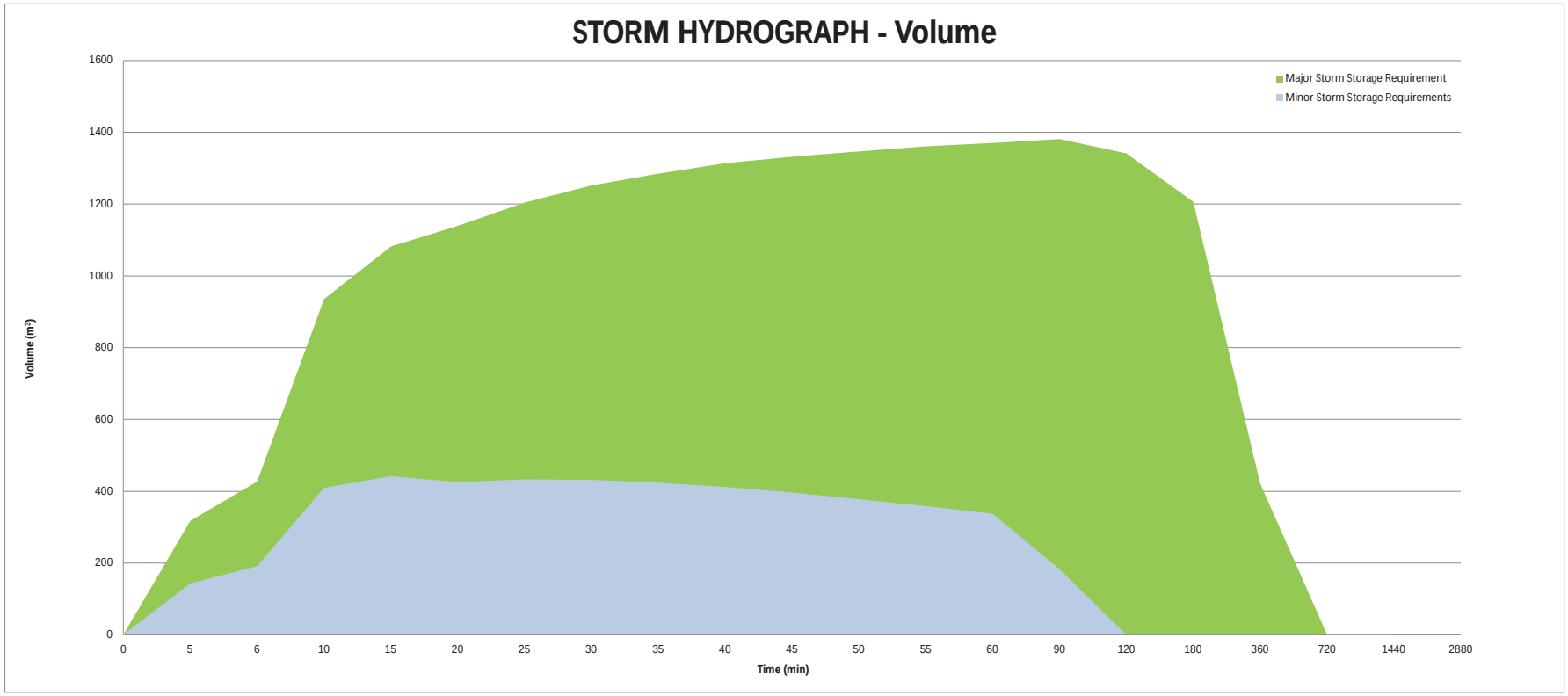
Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Total Area exc. storage and outflow in RR



Anstey Park, Secret harbour
2016 IFD, Storm Hydrograph

ON SITE DETENTION CALCULATION - Total Area exc. storage and outflow in RR



Anstey Park, Secret harbour

Inputs

Overall width (m)	W =	37.5
Overall length (m)	L =	48
Overall depth (m)	D =	1
Base RL (m)	H =	4.7
Input batter slopes 1	S_1 =	6
Input batter slopes 2	S_2 =	6
Input batter slopes 3	S_3 =	6
Input batter slopes 4	S_4 =	10

Calculation Cells
Input Cell

Area analysis

At TWL (sq.m)	A_{top} =	1800.0	m^2
At base (sq.m)	A_{bot} =	637.2	m^2

Outflows

Infiltration rate (m/day)	k =	10.0	m/day
Outflow Area	A_Q =	908.5	m^2
Outflow of Basin (L/s)	Q=	105.2	L/s
1% AEP Emptying time (hr)	t=	2.1	hr

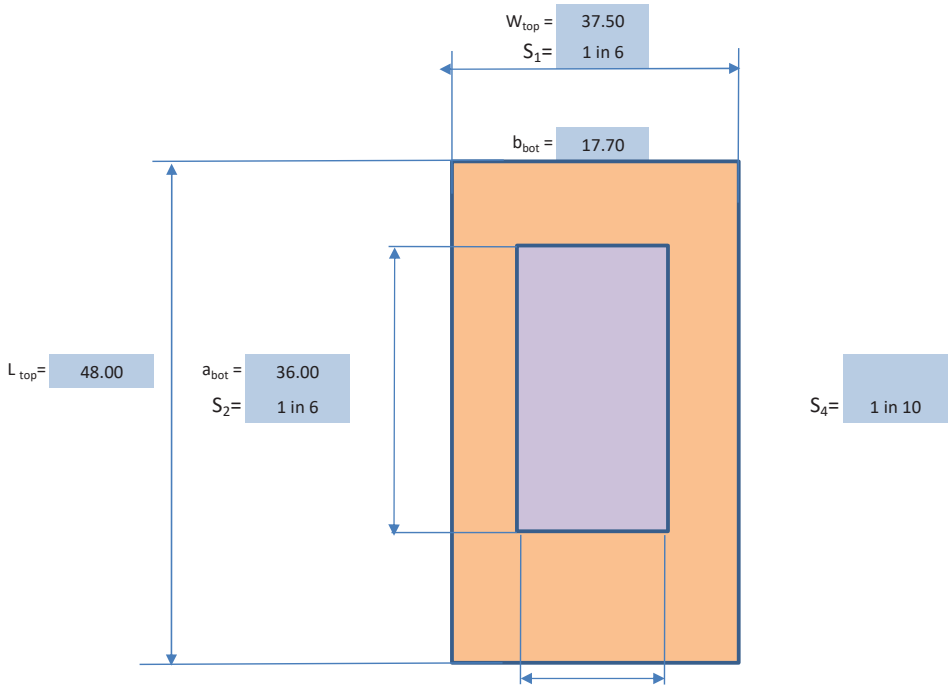
Total development area	'=	80,735	m^2

10% AEP basin % of total area		0.37	%
1% AEP basin % of total area		0.99	%

<2% .: ok

Volumes

Total depth (%)	Depth (m)	RL (m)	Plan area (m^2)	Volume to TWL (m^3)	
0.00	0.00	4.7	637.2	0.0	
0.05	0.05	4.8	695.3	34.8	
0.10	0.10	4.8	753.5	75.3	
0.15	0.15	4.9	811.6	121.7	
0.20	0.20	4.9	869.8	174.0	
0.25	0.25	5.0	927.9	232.0	
0.30	0.30	5.0	986.0	295.8	
0.35	0.35	5.1	1044.2	365.5	
0.40	0.40	5.1	1102.3	440.9	
0.45	0.45	5.2	1160.5	522.2	
0.50	0.50	5.2	1218.6	609.3	
0.53	0.53	5.2	1253.5	664.3	
0.60	0.60	5.3	1334.9	800.9	
0.65	0.65	5.4	1393.0	905.5	
0.70	0.70	5.4	1451.2	1044.5	Q_{100} TWL



$$Volume = \frac{d}{3} \times [(Top\ Area + Base\ Area) + (Top\ Area \times Base\ Area)^{0.5}]$$

APPENDIX E: DWA DRAWINGS SET

LEGEND:

- PUBLIC OPEN SPACE = 0.63ha
- R20 = 4.73 ha
- R30 = 0.52 ha
- SUBDIVISION BOUNDARY
- ROAD RESERVES = 2.18 ha

PROPOSED SUBDIVISION LAYOUT PLAN

SCALE 1:1000

metres 0 20 40 60 80 m

1:1000

scales quoted apply to original drawing scale

A1

FOR APPROVAL ONLY

REV	DATE	ISSUE / REVISION DESCRIPTION	DRN	CHK	APP
A	08/06/2023	ISSUED FOR INFORMATION	DA	BC	AR
B	26/07/2023	ISSUED FOR APPROVAL	DA	BC	AR

ISSUE/REVISIONS

DRAWING REFERENCES

DRAWING NUMBER	DRAWING TITLE / DESCRIPTION

DRAWING INFORMATION

TITLE	NAME	DATE
DRAFTER	DA	01/06/2023
DESIGNER	BC	01/06/2023
ENG. CHECK	AR	07/06/2023

DISCLAIMER:

NORTH

CLIENT INFORMATION

MARCHESE INVESTMENTS PTY LTD

DWA
David Wills and Associates
Consulting Engineers

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Phone (08) 9424 0900
Fax (08) 9330 3133
E-mail dwa@dwaconsulting.com.au
ABN 93 622 377 011

PROJECT INFORMATION

PROPOSED SUBDIVISION
LOTS 35 & 36 ALASSIO PARADE
SECRET HARBOUR

SUBDIVISION LAYOUT PLAN

AUTHORISED BY: A.Rowcliffe 26/07/2023
Athena Rowcliffe BE MIEAust CPEng NER

CLIENT REF | SCALE 1:1000 @A1

DRAWING No. 14163.07-C-01 | REV B

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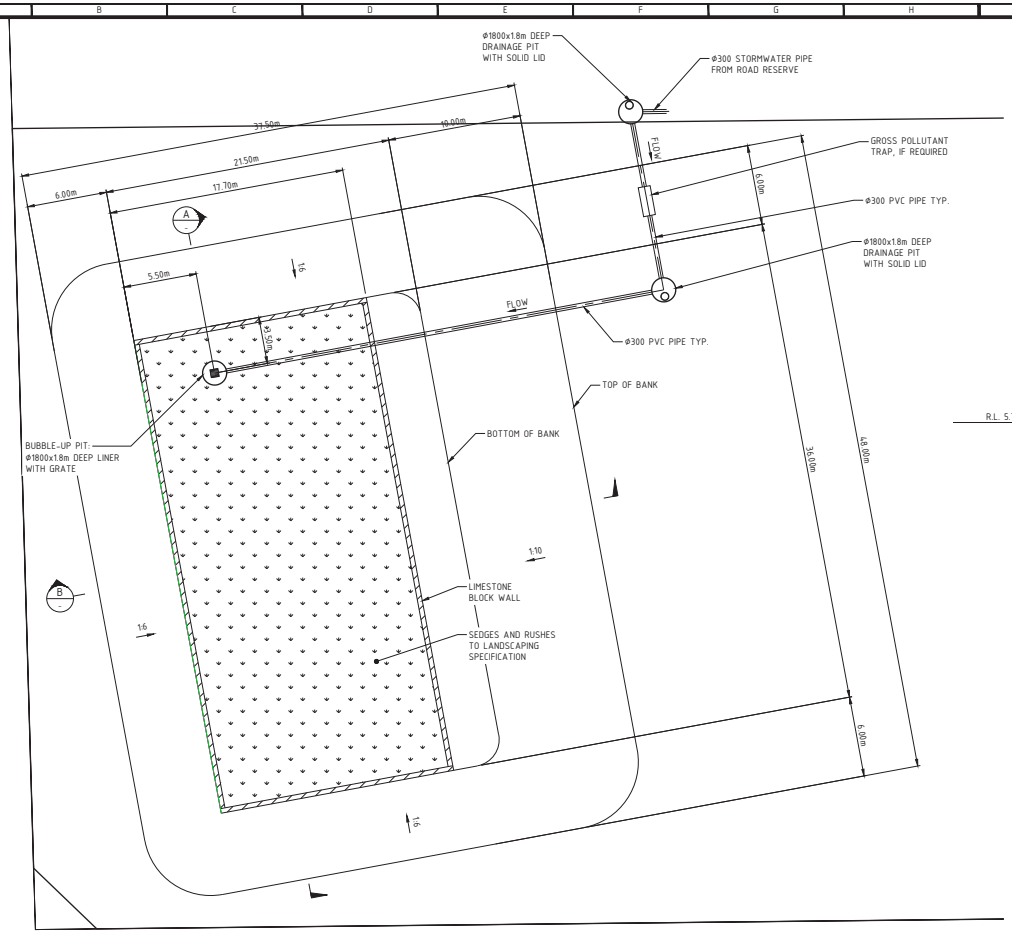


COMPENSATING BASIN PLAN
SCALE 1:200

STORMWATER CONCEPT DESIGN NOTES:

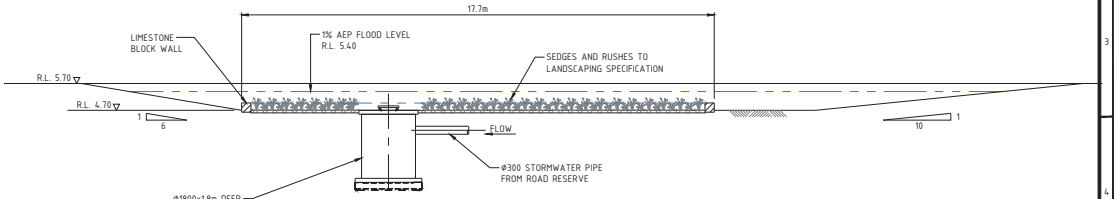
1. STORMWATER SYSTEM HAS BEEN DESIGNED TO CONTAIN THE 1 IN 100 YEAR STORM EVENT.
2. ASSUMED PERMEABILITY OF 10m/ DAY.
3. NO STORMWATER STORAGE INSIDE THE ROAD RESERVE IS INCLUDED.

STORAGE REQUIRED FOR A 1 IN 100 YEAR STORM FOR THE ENTIRE CATCHMENT = 1341.30m³

STORAGE PROVIDED IN RESIDENTIAL LOTS = 431.20m³

STORAGE PROVIDED IN THE BASIN = 1082.70m³

TOTAL STORAGE PROVIDED = 1513.90m³



SECTION B
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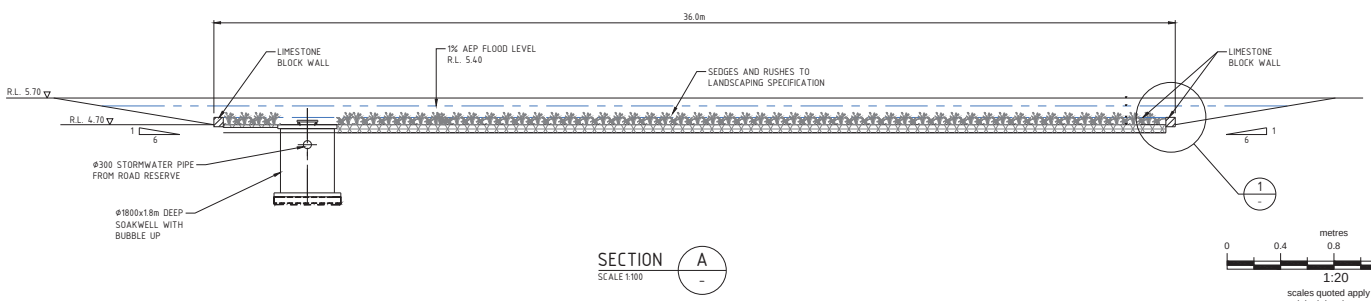
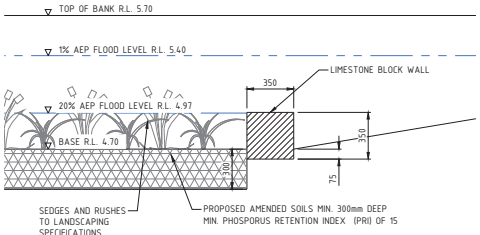


SECTION A
SCALE 1:100



DETAIL 1
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1:20
scales quoted apply to original drawing scale
A1

metres 0 2 4 6 8 m
1:100
scales quoted apply to original drawing scale
A1

metres 0 4 8 12 16 m
1:200
scales quoted apply to original drawing scale
A1

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B	26/07/2023	ISSUED FOR APPROVAL	DA	BC	AR
C	20/12/2023	ISSUED FOR APPROVAL	JS	BC	AR
D	10/07/2024	ISSUED FOR APPROVAL	DA	BC	BD

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DRAWING NUMBER	DRAWING TITLE / DESCRIPTION

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TITLE	NAME	DATE
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ENG. CHECK	AR	07/08/2023

NORTH

CLIENT INFORMATION

MARCHESE INVESTMENTS PTY LTD

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Consulting Engineers
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ABN 93 622 377 011

PROJECT INFORMATION

PROPOSED SUBDIVISION
LOTS 35 & 36 ALASSIO PARADE
SECRET HARBOUR

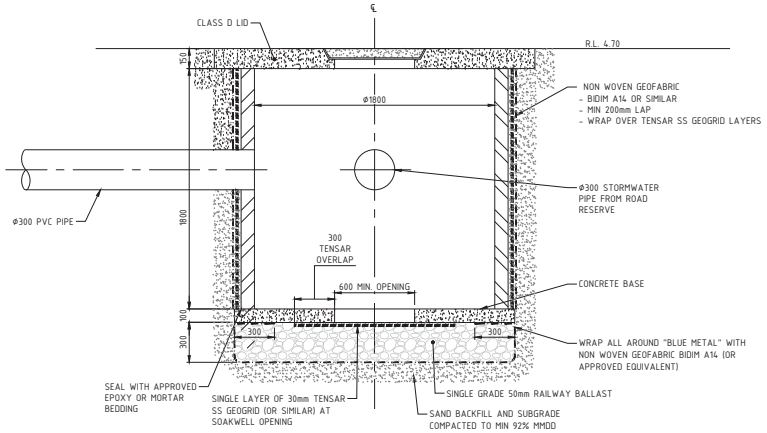
COMPENSATING BASIN PLAN AND SECTIONS

AUTHORISED BY: 10/07/2024
B.Dryhinicz
Barbara Dryhinicz MScEng MIEAust CPEng NER

CLIENT REF | SCALE AS SHOWN @A1

DRAWING No. 14163.07-C-02 | REV D

SHEET SIZE: A1



TYPICAL SINGLE SOAKWELL DETAIL
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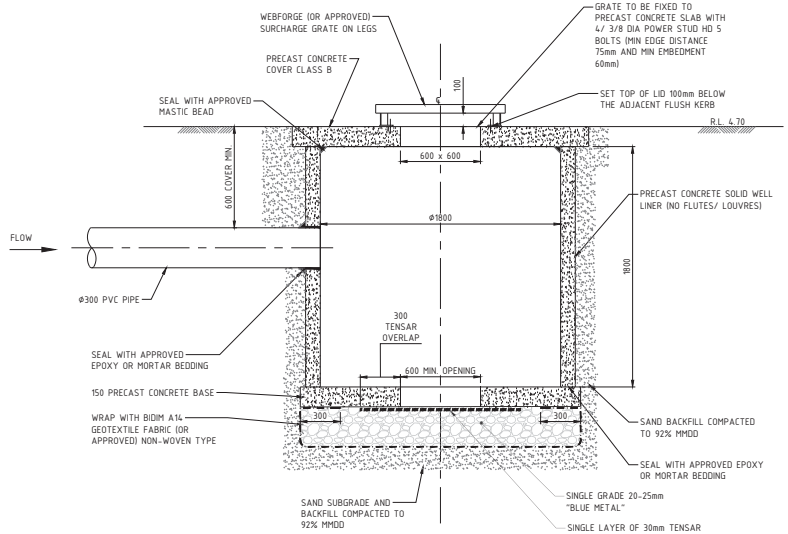

TYPICAL BUBBLE-UP PIT
SCALE 1:20

metres
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1:20
scales quoted apply to original drawing scale
A1

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PROJECT INFORMATION

PROPOSED SUBDIVISION
LOTS 35 & 36 ALASSIO PARADE
SECRET HARBOUR

DETAILS

AUTHORISED BY: A. Rowcliffe 26/07/2023
Athena Rowcliffe BE MIEAust CPEng NER

CLIENT REF | SCALE 1:20 @A1

DRAWING No. 14163.07-C-03 | REV B

SHEET SIZE: A1

APPENDIX F: TDL LANDSCAPING PLANS

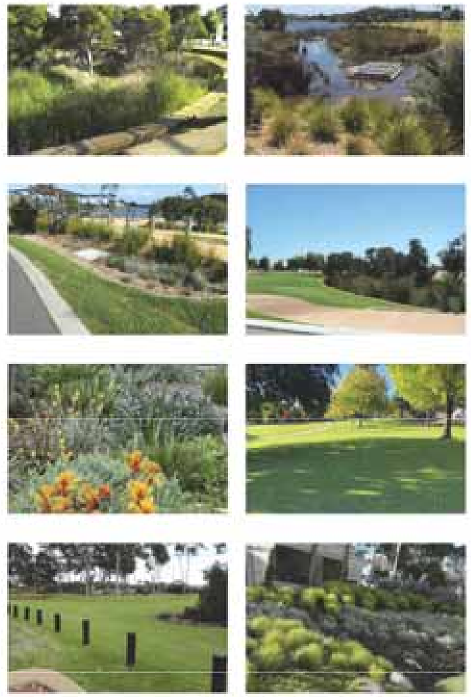
01 / 200 CONCEPT PLAN - PLAN 1:250 @ A1

LEGEND

- EXTENT OF LANDSCAPE WORKS
- PROPOSED TREES
- ROLL ON TURF
- PLANTING MIX 1
- PLANTING MIX 2
- PLANTING MIX 3
- SWALE PLANTING 1
- SWALE PLANTING 2

HARDSCAPE LEGEND

INSPIRATIONAL IMAGES



PUBLIC OPEN SPACE
35/36 SURF DRIVE, SECRET HARBOUR

DRAFT

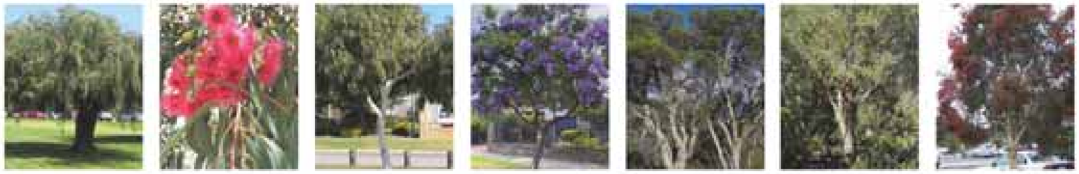
Revision	Description	By	Date
B	SKETCH DESIGN LANDSCAPE - ISSUE FOR REVIEW		14.08.23
C	PLANTING DENSITY REVISED	DWA	10.07.24

TDL

LANDSCAPE PLAN
15734-ANS-LS-200 C

PLANTS IMAGES

TREES



Agonis flexuosa | Eucalyptus leucoxylon rosea | Eucalyptus victrix | Jacaranda mimosifolia | Melaleuca preissiana | Melaleuca rhaphiophylla | Melaleuca viridiflora

PLANT MIX 01

Acacia lasiocarpa | Dampiera linearis | Eremophila Kalbarri Carpet | Grevillea lavandulacea | Grevillea seaspray | Grevillea obtusifolia | Myoporum parvifolium

PLANT MIX 02

Dianella revoluta | Lepidosperma calcicola | Melaleuca nesophila | Olearia axillaris min | Scaevola crassifolia | Westringia grey box | Westringia mundi

PLANT MIX 03

Atriplex cinerea | Banksia carnarvon candles | Banksia menziesii | Boronia crenulata | Chamelaucium purple pride | Chamelaucium uncinatum alba | Leucophyta brownii

BASIN PLANT MIX 01

Baumea juncea | Carex appressa | Cyperus gymnocaulos | Ficinia nodosa | Isolepis nodosa | Juncus pallidus | Juncus usitatus

BASIN PLAN MIX 02

Baumea articulata | Baumea rubiginosa | Carpobrotus virescens | Calothamnus quadrifidus | Gaura belleza | Lomandra longifolia | Melaleuca huegelii pencil

PLANTING SCHEDULE

Trees

Key	Species	Common Name	Planting Centres	Pot Size	Mature size
AF	Agonis flexuosa	Peppermint	As shown	100lt	3-6m
EL	Eucalyptus leucoxylon	Rosea	As shown	100lt	5-8m
EV	Eucalyptus victrix	Little Ghost Gum	As shown	100lt	5-8m
JM	Jacaranda mimosifolia	Jacaranda	As shown	100lt	5-8m
MP	Melaleuca preissiana	Stout Paperbark	As shown	100lt	3-5m
MR	Melaleuca rhaphiophylla	Swamp paperbark	As shown	100lt	3-5m
MV	Melaleuca viridiflora	Broad-leaved Paperbark	As shown	100lt	3-5m

PLANT MIX 01

Shrubs/Ground Covers

Key	Species	Common Name	Planting Density	Pot Size	Mature size
Al	Acacia lasiocarpa prostrate	Wattle	3m/2	140mm	300-500mm
Dl	Dampiera linearis	Cobalt Blue	3m/2	140mm	150-300mm
Eg	Eremophila glabra	Kalbarri Carpet	3m/2	140mm	100-300mm
Gl	Grevillea lavandulacea	Lavender grevillea	3m/2	140mm	300-500mm
Gs	Grevillea seaspray	Seaspray	3m/2	140mm	300-500mm
Go	Grevillea obtusifolia	Gin Gin Gem	3m/2	140mm	100-300mm
My	Myoporum parvifolium	Yareena	3m/2	140mm	50-300mm

PLANT MIX 02

Shrubs/Ground Covers

Key	Species	Common Name	Planting Density	Pot Size	Mature size
Dr	Dianella revoluta	Dianella	3m/2	140mm	200-400mm
Lc	Lomandra longifolia	Cassica	3m/2	140mm	200-400mm
Mn	Melaleuca nesophila	Little Nessy	3m/2	140mm	200-400mm
Oa	Olearia axillaris min	Coastal Daisy Bush Min	3m/2	140mm	300-500mm
Sc	Scaevola crassifolia	Prostrate	3m/2	140mm	300-500mm
Wgb	Westringia fruticosa	Grey Box	3m/2	140mm	300-1000mm
Wm	Westringia fruticosa	Mundi	3m/2	140mm	300-500mm

PLANT MIX 03

Shrubs/Ground Covers

Key	Species	Common Name	Planting Density	Pot Size	Mature size
Ac	Atriplex cinerea	Saltbush	2m/2	140mm	300-900mm
Bc	Banksia carnarvon candles	Carnarvon candles	2m/2	140mm	300-1200mm
Bm	Banksia menziesii	Firewood Banksia	2m/2	140mm	300-1200mm
Bo	Boronia crenulata	Pink Boronia	2m/2	140mm	300-900mm
Cu	Chamelaucium purple pride	Purple Pride	2m/2	140mm	300-1200mm
Cu	Chamelaucium uncinatum alba	Geraldton Wax White	2m/2	140mm	300-1200mm
Lb	Leucophyta brownii	Cushion Bush	2m/2	140mm	300-1000mm

BASIN PLANT MIX 01

Shrubs/Ground Covers

Key	Species	Common Name	Planting Density	Pot Size	Mature size
Bj	Baumea juncea	Bare twig rush	6m/2	140mm	300-600mm
Ca	Carex appressa	Tall Sedge	6m/2	140mm	300-600mm
Cg	Cyperus gymnocaulos	Spiny Sedge	6m/2	140mm	300-600mm
Fn	Ficinia nodosa	Knobby club-rush	6m/2	140mm	300-900mm
In	Isolepis nodosa	Club Rush	6m/2	140mm	300-900mm
Jp	Juncus pallidus	Pale Rush	6m/2	140mm	300-900mm
Ju	Juncus usitatus	Common Rush	6m/2	140mm	300-900mm

BASIN PLANT MIX 02

Shrubs/Ground Covers

Key	Species	Common Name	Planting Density	Pot Size	Mature size
Ba	Baumea articulata	Jointed rush	6m/2	140mm	300-900mm
Br	Baumea rubiginosa	Twig Rush	6m/2	140mm	300-900mm
Cv	Carpobrotus virescens	Pig face	6m/2	140mm	100-300mm
Cq	Calothamnus quadrifidus	One Sided Bottlebrush	6m/2	140mm	300-900mm
Gb	Gaura belleza	Pink Gaura	6m/2	140mm	300-600mm
Ll	Lomandra longifolia	Mat Rush	6m/2	140mm	300-900mm
Mh	Melaleuca huegelii	Pencil Melaleuca	6m/2	140mm	300-1000mm

PUBLIC OPEN SPACE
35/36 SURF DRIVE, SECRET HARBOUR

DRAFT

Rev	Description	By	Date
B	SKETCH DESIGN LANDSCAPE - ISSUE FOR REVIEW		14.08.23
C	PLANTING DENSITY REVISED	DWA	10.07.24

TDL

DWA CONSULTING

IMAGES AND PLANT SCHEDULE

15734-ANS-LS-400 C

APPENDIX G: COMPLETED CHECKLIST FROM APPENDIX 1 OF BETTER URBAN WATER MANAGEMENT (WAPC, 2008)

Checklist for integrated water cycle management assessment of local structure plan or local planning scheme amendment

1. Tick the status column for items for which information is provided.
2. Enter N/A in the status column if the item is not appropriate and enter the reason in the comments column.
3. Provide brief comments on any relevant issues.
4. Provide brief description of any proposed best management practices, eg. multi-use corridors, community based-social marketing, water re-use proposals.

Local water management strategy item	Deliverable	☑	Comments
Executive summary			
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Table 1: Design elements and requirements for BMPs and critical control points	☑	Executive Summary Provided
Introduction			
Total water cycle management – principles & objectives Planning background Previous studies		☑	Section 1.2 Section 1.1 Section 1.3
Proposed development			
Structure plan, zoning and land use. Key landscape features Previous land use	Site context plan Structure plan	☑ ☐	Appendix D
Landscape - proposed POS areas, POS credits, water source, bore(s), lake details (if applicable), irrigation areas	Landscape Plan	☑	Appendix E
Design criteria			
Agreed design objectives and source of objective		☑	Section 1.2
Pre-development environment			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		☑	
Site Conditions - existing topography/ contours, aerial photo underlay, major physical features	Site condition plan	☑	Section 2.1
Geotechnical - topography, soils including acid sulfate soils and infiltration capacity, test pit locations	Geotechnical plan	☑	Section 2.2
Environmental - areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental Plan plus supporting data where appropriate	☑	Section 2.3
Surface Water – topography, 100 year floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface Water Plan	☐	N/A
Groundwater – topography, pre development groundwater levels and water quality, test bore locations	Groundwater Plan plus details of groundwater monitoring and testing	☑	Section 2.4
Water use sustainability initiatives			
Water efficiency measures – private and public open spaces including method of enforcement		☑	Section 6.1, 6.2
Water supply (fit-for-purpose strategy), agreed actions and implementation. If non-potable supply, support with water balance		☑	Section 3.1
Wastewater management		☑	Section 3.1
Stormwater management strategy			
Flood protection - peak flow rates, volumes and top water levels at control points,100 year flow paths and 100 year detentions storage areas	100yr event Plan Long section of critical points	☑ ☑	Section 4.4, T3 Appendix D
Manage serviceability - storage and retention required for the critical 5 year ARI storm events Minor roads should be passable in the 5 year ARI event	5yr event Plan	☑	Section 4.4, T2 Appendix D

Local water management strategy item	Deliverable	☑	Comments
Protect ecology – detention areas for the 1 yr 1 hr ARI event, areas for water quality treatment and types of (including indicative locations for) agreed structural and non-structural best management practices and treatment trains. Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages	1yr event plan Typical cross sections	☑ ☑	Section 4.4, T1 Appendix D
Groundwater management strategy			
Post development groundwater levels, fill requirements (including existing and likely final surface levels), outlet controls, and subsoils areas/exclusion zones	Groundwater/subsoil Plan	☑	Section 2.4
Actions to address acid sulfate soils or contamination		☐	N/A
The next stage – subdivision and urban water management plans			
Content and coverage of future urban water management plans to be completed at subdivision. Include areas where further investigations are required prior to detailed design.		☑	Sections 8.1, 8.2
Monitoring			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		☑	Section 7.3
Implementation			
Developer commitments		☑	Section 7
Roles, responsibilities, funding for implementation		☑	Sections 7.1, 8.1
Review		☑	Section 8.2

Appendix B

POS Concept Plan

LEGEND

EXTENT OF LANDSCAPE WORKS

PROPOSED TREES

ROLL ON TURF

PLANTING MIX 1

PLANTING MIX 2

PLANTING MIX 3

SWALE PLANTING 1

SWALE PLANTING 2

HARDSCAPE LEGEND

CONCRETE FOOT PATH

INSPIRATIONAL IMAGES








PUBLIC OPEN SPACE
35/36 SURF DRIVE, SECRET HARBOUR

DRAFT

REVISION	DESCRIPTION	BY	DATE
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C	PLANTING DENSITY REVISED	DWA	10.07.24

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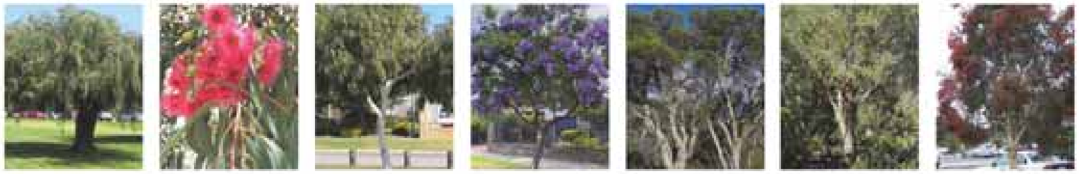
LANDSCAPE PLAN

15734-ANS-LS-200 C

PLANTS IMAGES

TREES



Agonis flexuosa | Eucalyptus leucoxylon rosea | Eucalyptus victrix | Jacaranda mimosifolia | Melaleuca preissiana | Melaleuca rhaphiophylla | Melaleuca viridiflora

PLANT MIX 01

Acacia lasiocarpa | Dampiera linearis | Eremophila Kalbarri Carpet | Grevillea lavandulacea | Grevillea seaspray | Grevillea obtusifolia | Myoporum parvifolium

PLANT MIX 02

Dianella revoluta | Lepidosperma calcicola | Melaleuca nesophila | Olearia axillaris mini | Scaevola crassifolia | Westringia grey box | Westringia mundi

PLANT MIX 03

Atriplex cinerea | Banksia carnarvon candles | Banksia menziesii | Boronia crenulata | Chamelaucium purple pride | Chamelaucium uncinatum alba | Leucophyta brownii

BASIN PLANT MIX 01

Baumea juncea | Carex appressa | Cyperus gymnocaulos | Ficinia nodosa | Isolepis nodosa | Juncus pallidus | Juncus usitatus

BASIN PLAN MIX 02

Baumea articulata | Baumea rubiginosa | Carpobrotus virescens | Calothamnus quadrifidus | Gaura belleza | Lomandra longifolia | Melaleuca huegelii pencil

PLANTING SCHEDULE

Trees

Key	Species	Common Name	Planting Centres	Pot Size	Mature size
AF	Agonis flexuosa	Peppermint	As shown	100L	3-6m
EL	Eucalyptus leucoxylon	Rosea	As shown	100L	5-8m
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JM	Jacaranda mimosifolia	Jacaranda	As shown	100L	5-8m
MP	Melaleuca preissiana	Ghost Paperbark	As shown	100L	3-5m
MR	Melaleuca rhaphiophylla	Swamp paperbark	As shown	100L	3-5m
MV	Melaleuca viridiflora	Broad-leaved Paperbark	As shown	100L	3-5m

PLANT MIX 01

Shrubs/Ground Covers

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Dl	Dampiera linearis	Cobalt Blue	3m/2	140mm	150-300mm
Eg	Eremophila glabra	Kalbarri Carpet	3m/2	140mm	100-200mm
Gl	Grevillea lavandulacea	Lavender grevillea	3m/2	140mm	300-600mm
Gs	Grevillea seaspray	Seaspray	3m/2	140mm	300-600mm
Go	Grevillea obtusifolia	Gin Gin Gem	3m/2	140mm	100-300mm
Mp	Myoporum parvifolium	Yareena	3m/2	140mm	50-300mm

PLANT MIX 02

Shrubs/Ground Covers

Key	Species	Common Name	Planting Density	Pot Size	Mature size
Dr	Dianella revoluta	Dianella	3m/2	140mm	200-400mm
Ll	Lomandra longifolia	Catalina	3m/2	140mm	200-400mm
Mn	Melaleuca nesophila	Little Nessy	3m/2	140mm	200-400mm
Oa	Olearia axillaris mini	Coastal Daisy Bush Mini	3m/2	140mm	300-600mm
Sc	Scaevola crassifolia	Prostrate	3m/2	140mm	300-600mm
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PLANT MIX 03

Shrubs/Ground Covers

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Bm	Banksia menziesii	Firewood Banksia	3m/2	140mm	300-1200mm
Bc	Boronia crenulata	Pink Boronia	3m/2	140mm	300-900mm
Cp	Chamelaucium purple pride	Purple Pride	3m/2	140mm	300-1200mm
Cu	Chamelaucium uncinatum alba	Geraldton Wax White	3m/2	140mm	300-1200mm
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BASIN PLANT MIX 01

Shrubs/Ground Covers

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Ca	Carex appressa	Tall Sedge	6m/2	140mm	300-900mm
Cg	Cyperus gymnocaulos	Spiny Sedge	6m/2	140mm	300-900mm
Fn	Ficinia nodosa	Knobby club-rush	6m/2	140mm	300-900mm
In	Isolepis nodosa	Club Rush	6m/2	140mm	300-900mm
Jp	Juncus pallidus	Pale Rush	6m/2	140mm	300-900mm
Ju	Juncus usitatus	Common Rush	6m/2	140mm	300-900mm

BASIN PLANT MIX 02

Shrubs/Ground Covers

Key	Species	Common Name	Planting Density	Pot Size	Mature size
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Cq	Calothamnus quadrifidus	One Sided Bottlebrush	6m/2	140mm	300-900mm
Gb	Gaura belleza	Pink Gaura	6m/2	140mm	300-900mm
Ll	Lomandra longifolia	Mat Rush	6m/2	140mm	300-900mm
Mh	Melaleuca huegelii	Pencil Melaleuca	6m/2	140mm	300-1000mm

PUBLIC OPEN SPACE
35/36 SURF DRIVE, SECRET HARBOUR

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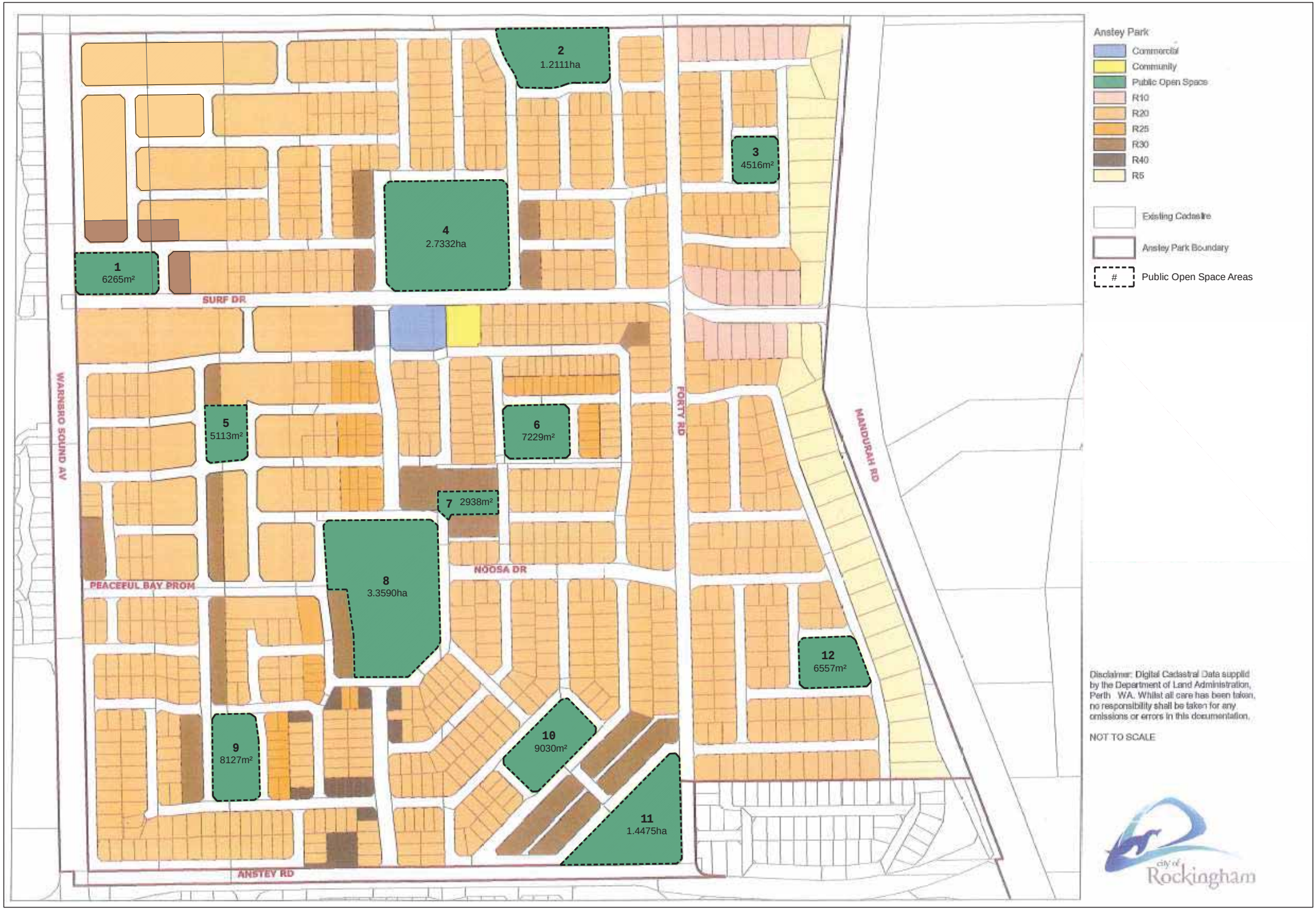
TDL

IMAGES AND PLANT SCHEDULE

15734-ANS-LS-400 C

Appendix C

POS Areas Map


Anstey Park
Commercial
Community
Public Open Space
R10
R20
R25
R30
R40
R5
Existing Cadastre
Anstey Park Boundary
Public Open Space Areas
1
6265m²
2
1.2111ha
3
4516m²
4
2.7332ha
5
5113m²
6
7229m²
7
2938m²
8
3.3590ha
9
8127m²
10
9030m²
11
1.4475ha
12
6557m²
SURF DR
WARNBRO SOUND AV
FORTY RD
MANDURAH RD
NOOSA DR
PEACEFUL BAY PROM
ANSTEY RD
Disclaimer: Digital Cadastral Data supplid by the Department of Land Administration, Perth WA. Whilst all care has been taken, no responsibility shall be taken for any omissions or errors in this documentation.
NOT TO SCALE
city of Rockingham