16 July 2026

Department of Biodiversity, Conservation and Attractions ('DBCA')
Locked Bag 104, Bentley Delivery Centre
BENTLEY WA 6983

Attention: Josie Watson – Senior Environmental Officer & Mitch Jones – Environmental Officer

Dear Josie and Mitch

Retrospective Approval - Part 5 Application under the Swan and Canning Rivers Management Act 2006
Lot 831 (No. 201) Southern River Road, Gosnells

Proven Project Management acts on behalf of the landowner of Lot 830 (No. 179) Southern River Road, Gosnells ('Lot 830'). We have been instructed to prepare and lodge a retrospective approval application under Part 5 of the *Swan and Canning Rivers Management Act 2006* ('SCRM Act') for the construction of a rockpitched stormwater drainage swale within Lot 831 (No. 201) Southern River Road, Gosnells (the 'subject land').

Further background information in support of this Application is provided below.

Site Details and Development Context

The subject land is located on the northwestern side of Southern River Road in Gosnells and is owned by the Western Australian Planning Commission ('WAPC'). The subject land directly abuts Lot 830 on the west and southwestern boundaries.

The subject land is identified within the Swan and Canning River Development Control Area ('DCA') with a portion of the Wungong Brook traversing the southern corner of the lot.

<u>Lot 830 Subdivision Approval and Implementation</u>

On 28 August 2024, a subdivision application was approved over Lot 830 (WAPC ref: 200145). The subdivision approval included 22 lots and public open space ('POS'). The POS area included a drainage basin in the southern corner, which was proposed in accordance with the approved Local Water Management Strategy (prepared by JDA in 2017).

In accordance with the condition of subdivision approval, a subsequent Urban Water Management Plan ('UWMP') was prepared by Hyd2O to support the proposed engineering design for drainage. The UWMP included the provision for "outflow from the POS basin for events in excess of the 15mm event as managed conveyance, with erosion control for up to the 1% AEP event" and to the satisfaction of the City of Gosnells.

This stormwater discharge strategy also aligned with the requirements of the overarching LWMS in maintaining pre-development discharge, noting an informal swale already existed in the subject location prior to subdivisional development.

Description of Development

Current Development

This Application seeks retrospective approval for the construction of the unmortared rockpitched swale from the lot boundary of Lot 830 through Lot 831 to the Wungong Brook. The swale has been constructed at a width of 3m and a length of 25m.

The rockpitched swale was constructed in accordance with the approved UWMP and engineering drawings. Provision of the rockpitching within the discharge swale produces longterm stabilisation, to the satisfaction of City of Gosnells, mitigating future erosion impacts and maintenance costs.

Proposed Modifications

Following discussions onsite with the relevant stakeholders (including the City of Gosnells, DBCA and DPLH), it is understood that the full removal of the rock pitching is not considered to be the most appropriate solution, noting that the proposed solutions must still address future erosion mitigation of the basin outflow path.

In this regard, in consultation with the project landscape architect (Emerge Associates), we propose the following modifications to the current unmortared rock pitching:

- Planting of reed species within the swale, including Juncus pallidus (Pale Rush) and Ficinia nodosa (Knotted Club Rush).
- Addition of native groundcovers in a 1m strip each side of rockpitching to support the existing grassy banks. Species include Hemiandra pungens (snakebush), Grevillea crithmifolia prostrate (Prostrate Grevillea) and Eremophila glabra prostrata (Prostrate Emu Bush).

The proposed modifications are considered to deliver an appropriate outcome that provides for a softer landscape interface whilst still providing for an appropriate level of erosion control along the outflow path.

Conclusion

Having regard to the above, the current rockpitching and proposed planting modification are considered an acceptable form of development on the subject land.

On this basis, it is requested that this application for retrospective approval be supported by the Department of Biodiversity and Environmental Conservation.

Yours faithfully,

[redacted]

Jaida Adams
Proven Project Management

Attachments are listed on the following page.

Attachment 1 – DBCA Form 1

Attachment 2 – Proposed Modifications (Emerge EMG91-401)

Attachment 3 – Extracted Engineering Drawings (as approved)

Attachment 4 – Extracted Figures LWMS (JDA, 2017)

Attachment 5 – Full LWMS (JDA, 2017)

Attachment 6 – Full UWMP (Hyd2O, 2025)

Department of Biodiversity, Conservation and Attractions

SWAN CANNING RIVERPARK

Form 1 – Application for Approval of Development

Swan and Canning Rivers Management Act 2006 – Part 5 – section 72(1)

1. Applicant details

The applicant is the person with whom the department, on behalf of the Chief Executive Officer, will correspond, unless an authorised agent has been appointed to act on behalf of the applicant, in which case correspondence will be sent direct to the agent.

Name	Silversky Investments Pty Ltd				
Position (if applicable)					
Organisation (if applicable)					
Contact person	Refer authorised agent details.				
Postal address					
Town/Suburb		State		Postcode	
Telephone	Work		Mobile		
Email					

I give authority for an agent (as identified at item No. 3) to act on my behalf during the assessment of the application ☑ YES ☐ NO

If 'YES', please provide Agent's details at item No. 3

Applicant signature	[redacted]	Date	

2. Landowner details

All owner(s) of the land **must sign this application**. Where land is owned by the Crown or has a management order granted to a local government or other agency, this application must be signed by the relevant landowner or management body as required under section 72(5)(a) of the Act. If there are more than two landowners, please provide the additional information and signature(s) on a separate page.

Details of first landowner

Name	Western Australian Planning Commission				
Position (if applicable)	[redacted]				
Organisation (if applicable)	Department of Planning Lands and Heritage				
Contact person	[redacted]				
Postal address	140 William Street				
Town/Suburb	Perth	State	WA	Postcode	6000

I consent to this application being made.

First landowner signature	[redacted]	Date	30/7/2026

Details of second landowner (if applicable)

Name					
Position (if applicable)					
Organisation (if applicable)					
Contact person					
Postal address					
Town/Suburb		State		Postcode	

I consent to this application being made.

Second landowner signature		Date	

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

SWAN CANNING RIVERPARK

3. Authorised agent details (if applicable)

The applicant must sign the form and tick the authorisation under item No. 1 to provide authority for an appointed authorised agent to act on their behalf.

Details of authorised agent

Name	[redacted]				
Position (if applicable)	Project Manager				
Company/agency (if applicable)	Proven Project Management				
ACN/ABN (if applicable)	093 308 715				
Postal address	Level 3, 369 Newcastle Street				
Town/Suburb	Northbridge	State	WA	Postcode	6003
Telephone	Work		Mobile	[redacted]	
Email	Jaida.Adams@provenpm.com.au				
Authorised Agent signature	[redacted]	Date	10/07/2026		

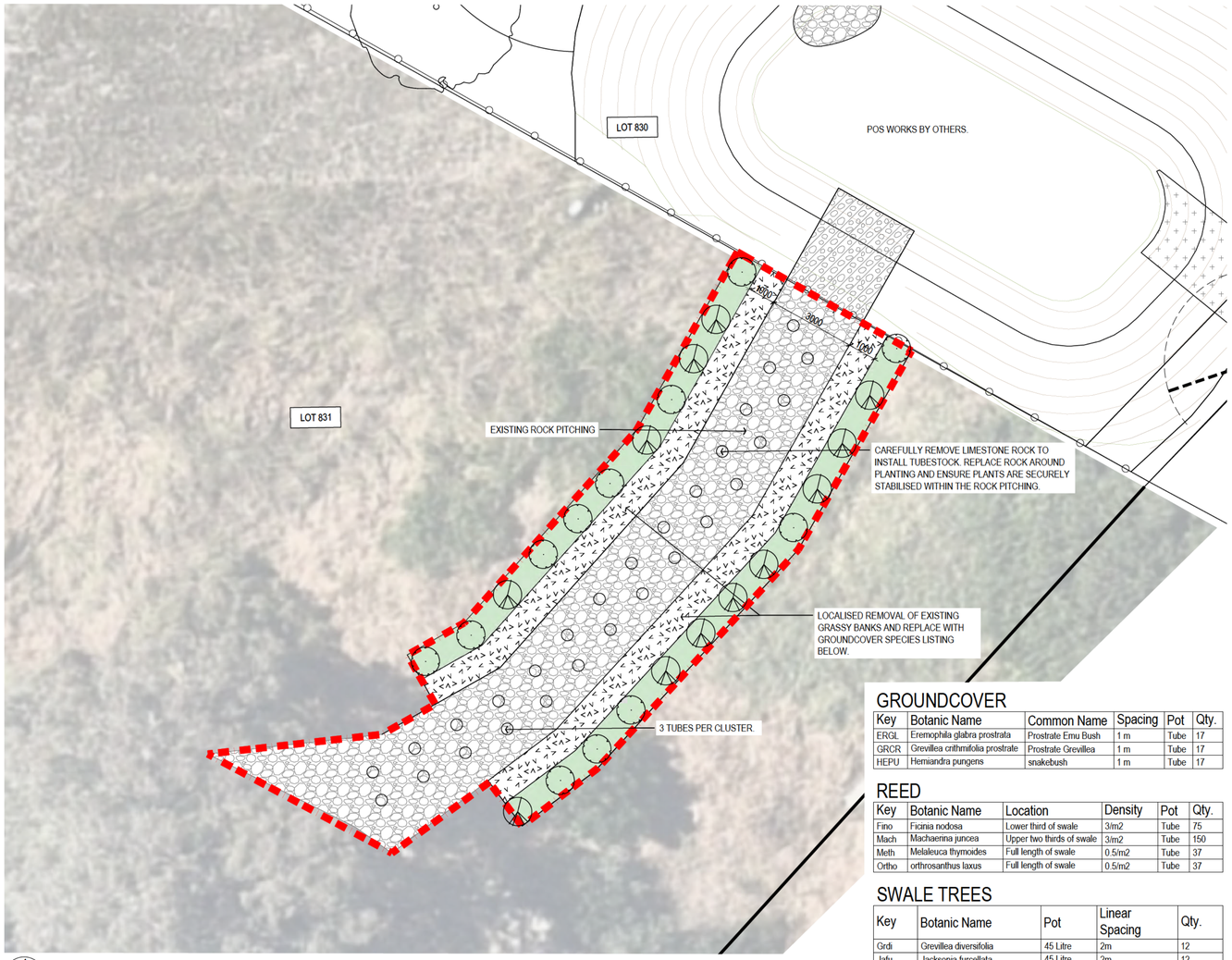
4. Location of proposed development

Certificate of title information	Volume	2991	Folio	317
	Diagram/plan/deposit plan no.	408215		
Lot No.(s)	831			
Location				
Reserve No.(s) (if applicable)				
Street No.(s) and name	201 Southern River Road			
Town/Suburb	Gosnells			
Nearest road intersection	Bullfinch Street			

5. Details of proposed development

Please provide a written description of the proposed development (refer to the Development Application Guidelines for further details on what information to include in this section).

Estimated cost of development	$16,000
Current use of land	Regional reserve
Proposed development	Refer cover letter - Unmortared rock pitching from basin outflow to minimise future erosion. Proposed modifications include informal planting of suitable reed and groundcover species to to soften landscape outcome.



1 401 ROCK PITCHED SWALE PLANTING
PLAN

PLAN 1:100

GROUNDCOVER

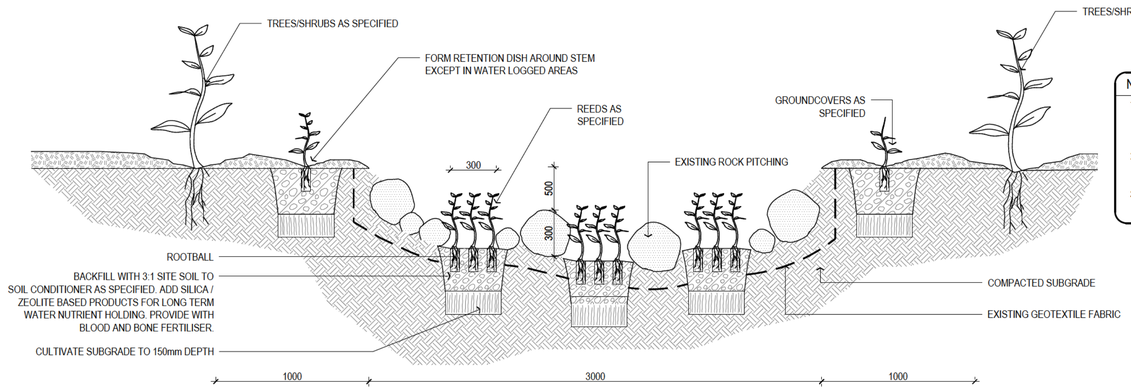
Key	Botanic Name	Common Name	Spacing	Pot	Qty.
ERGL	Eremophila glabra prostrata	Prostrate Emu Bush	1 m	Tube	17
GRCR	Grevillea crithmifolia prostrate	Prostrate Grevillea	1 m	Tube	17
HEPU	Hemiandra pungens	snakebush	1 m	Tube	17

REED

Key	Botanic Name	Location	Density	Pot	Qty.
Fino	Ficinia nodosa	Lower third of swale	3/m2	Tube	75
Mach	Machaerina juncea	Upper two thirds of swale	3/m2	Tube	150
Meth	Melaleuca thymoides	Full length of swale	0.5/m2	Tube	37
Ortho	orthrosanthus laxus	Full length of swale	0.5/m2	Tube	37

SWALE TREES

Key	Botanic Name	Pot	Linear Spacing	Qty.
Grdi	Grevillea diversifolia	45 Litre	2m	12
Jafu	Jacksonia furcellata	45 Litre	2m	12

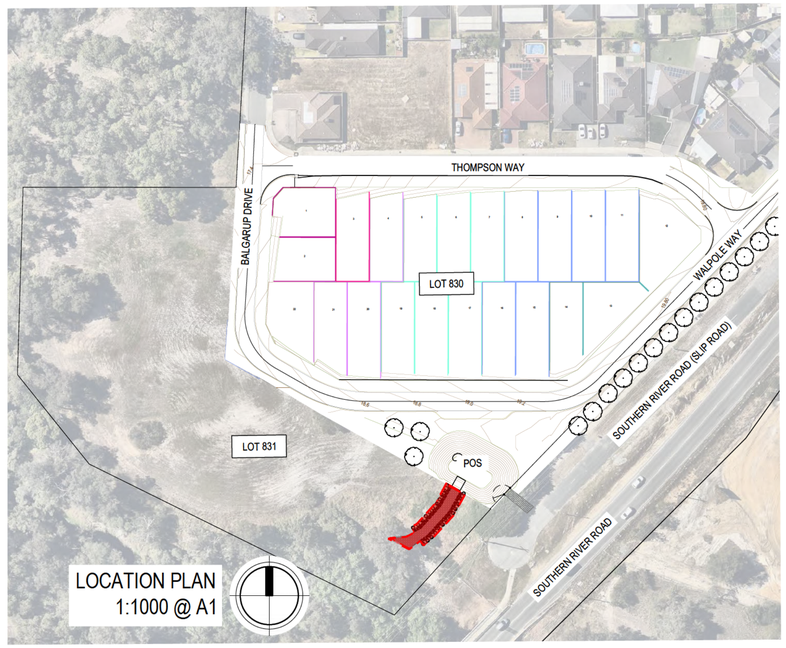


NOTES

1. APPLY GROSAFE GRANULAR SPREADABLE MICROBES AT PLANTING, AT ONE YEAR AND AT TWO YEARS.
2. HYDROFISH AND KELP EMULSION OR EQUIVALENT APPLIED AT SPRING AND AUTUMN.
3. ALL PLANT LABELS ARE TO BE REMOVED AT PLANTING

2 401 ROCK PITCHED SWALE PLANTING
SECTION

SCALE 1:20



LOCATION PLAN
1:1000 @ A1



LEGEND

- EXTENT OF WORKS
- EXISTING ROCKPITCHED SWALE (UNMORTARED)
- EXISTING ROCKPITCHED WEIR (MORTARED)
- PROPOSED GROUNDCOVER
- PROPOSED TREES/SHRUBS

STANDARD NOTES

1. **SET OUT & DIMENSIONS.** THE CONTRACTOR SHALL SET OUT ALL PATHS, WALLS, HARD SURFACES AND ELEMENTS EITHER ON OR OFF SITE PRIOR TO CONSTRUCTION AND SHALL OBTAIN THE SUPERINTENDENTS SET OUT APPROVAL PRIOR TO WORKS COMMENCING. WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALE. CHECK ALL DRAWING SCALES IN CONJUNCTION WITH DRAWING SIZE.
2. **SERVICES & SITE ASSETS.** THE CONTRACTOR SHALL INVESTIGATE THE NATURE AND LOCATION OF ALL EXIST NG SERVICES AND RETAINED SITE ASSETS AFFECTED BY THE R WORKS. FAILURE TO TAKE DUE CARE SHALL NOT L MIT THE CONTRACTORS LIAB LITIES.
3. **REFERENCE.** THE CONTRACTOR SHALL REFER TO ALL CONTRACT DOCUMENTS, THE SPECIFICATION AND DRAWINGS PRIOR TO AND DURING THE WORKS.
4. **DISCREPANCIES.** NOT FY SUPERINTENDENT OF ANY SUSPECTED OR KNOWN DISCREPANCIES OR ERRORS PRIOR TO THE ORDERING OF AFFECTED MATERIALS AND OR CONSTRUCTION OF AFFECTED WORKS.
5. **RELEVANT STANDARDS.** THE CONTRACTOR SHALL UNDERTAKE ALL PROC NG AND WORKS IN ACCORDANCE WITH CURRENT INDUSTRY BEST PRACTICE AND ALL RELEVANT AUSTRALIAN STANDARDS.
6. **SERVICE LOCATOR.** THE CONTRACTOR SHALL UNDERTAKE A DIAL BEFORE YOU DIG PROCESS PRIOR TO COMMENCING WORKS ON SITE. THE CONTRACTOR SHALL ENGAGE A SERVICE LOCATOR TO MAP THE SPECIFIED LOCATIONS AND DEPTH OF ALL SERVICES AND ADVISE ALL RELEVANT STAFF AND SUBCONTRACTORS IN WRITING PRIOR TO COMMENC NG WORKS ON SITE.

REV	DATE	BY	ISSUE OR AMENDMENT
D	21.08.2026	YTL	ISSUE FOR COMMENT
C	09.07.2026	JB	ISSUE FOR COMMENT
B	30.06.2026	JB	ISSUE FOR COMMENT
A	19.06.2026	YTL	ISSUE FOR COMMENT

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emerge ASSOCIATES
Integrated Science & Design

PROJECT
LOT 830 SOUTHERN RIVER ROAD
GOSNELLS
STAGE OR PHASE

DRAWING TITLE
ROCKPITCHED SWALE PLANTING

CL ENT
SILVERSKY INVESTMENTS

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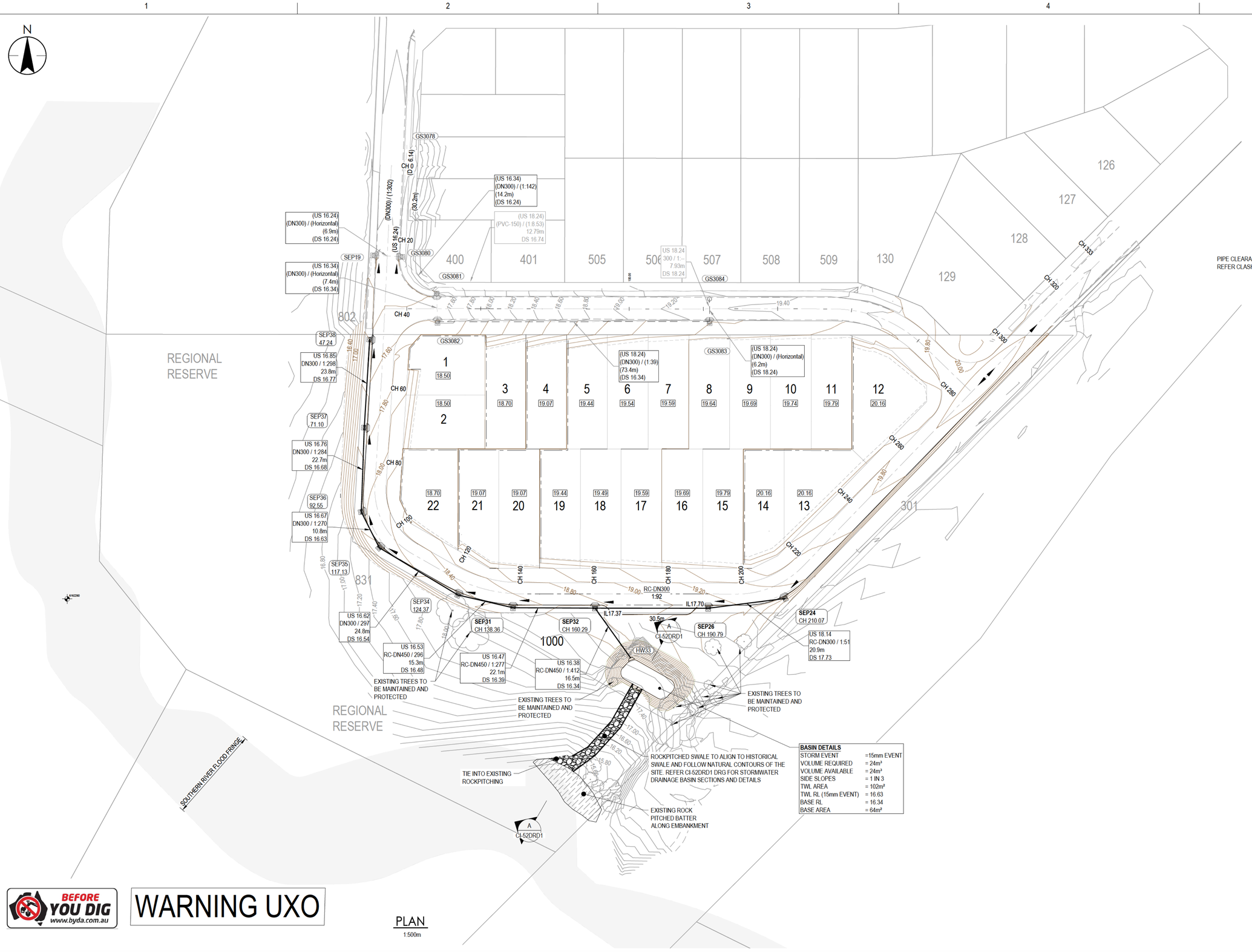
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DRAWN BY	YTL	PRELIM DWG REVIEWED BY	PMA
DATE INITIALLY DRAWN	19.06.26		

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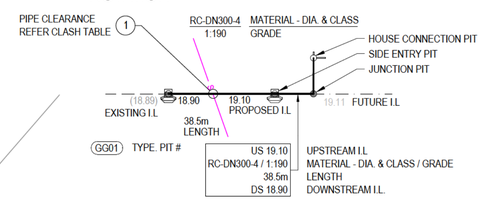
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LEGEND

- SITE BOUNDARY
- PROPOSED STORMWATER DRAINAGE
- PROPOSED SUBSOIL DRAINAGE (MEGAFLOW 170)
- END CAP
- EXISTING STORMWATER DRAINAGE
- OVERLAND FLOW DIRECTION
- PROPOSED SEWER
- EXISTING SEWER
- EXISTING SURFACE CONTOURS
- PROPOSED FINISHED SURFACE CONTOURS
- PROPOSED FINISHED PAD LEVEL
- EXISTING PAD LEVEL
- PROPOSED ROAD
- EXISTING KERB
- PROPOSED RETAINING WALL
- EXISTING TREE (TO BE PROTECTED)
- PROPOSED ROCKPITCHING (REFER DRG CI-52DRD1)

NOTATION



PIPE TYPE PREFIX:
PVC = UNPLASTICIZED POLYVINYL CHLORIDE
RC = REINFORCED CONCRETE

PIT TYPE PREFIX:

GG = GRATED GULLY	SW = SOAKWELL WITH SEP LID
SEP = SIDE ENTRY PIT	HC = HOUSE CONNECTION PIT REFER DETAIL
JP = JUNCTION PIT	HW = HEADWALL

NOTES

1. GENERAL
1.1. LEVELS ARE REDUCED FROM A.H.D.
1.2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL DRAWINGS IN THIS SET AND THE SPECIFICATION.
1.3. THE CONTRACTOR SHALL LIMIT THE MOVEMENT OF EQUIPMENT AND MANPOWER TO THE MINIMUM AREA NECESSARY AND PROTECT ALL VEGETATION ON SITE.

2. STORMWATER DRAINAGE
2.1. DRAINAGE PIPES SHALL BE CLASS 2 UNLESS NOTED OTHERWISE.
2.2. PIPE ALIGNMENT SHALL BE 3.0m FROM THE ROAD RESERVE BOUNDARY UNLESS OTHERWISE AS SHOWN.
2.3. MANHOLE, SEP'S AND GULLY PITS SHALL BE LOCATED AT THE POSITIONS SHOWN IRRESPECTIVE OF THE PIPE LENGTHS SHOWN.
2.4. FOR CONSTRUCTION PURPOSES THE TENDERER SHALL MAKE HIS OWN ASSESSMENT OF GROUND WATER AND ITS LIKELY AFFECT ON THE WORKS AND MAKE ALL DUE ALLOWANCE IN THE LUMP SUM TENDER.

3. UNEXPLODED ORDNANCE (UXO)
3.1. THE SITE MAY CONTAIN UNEXPLODED ORDNANCE. REFER RELEVANT CLAUSE IN SECTION 8 OF THE CONTRACT SPECIFICATION FOR MORE INFORMATION.

BEFORE YOU DIG www.byda.com.au

WARNING UXO

PLAN
1:500m

1:500 10 5 0 10 20 A1
1:1000 A3

D	LOT CONNS DELETED, PIPE NETWORK REDESIGN	DG	MDB	26.06.2025
C	DRAINAGE DESIGN AMENDED	DG	MDB	12.06.2025
B	SOAKWELL, PIPE NETWORK & BASIN AMENDED	DG	MDB	13.05.2025
A	ORIGINAL ISSUE	DG	TS	01.05.2025
Issued/Revision		By	Appd	YYYY.MM.DD

Issue Status
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SOUTHERN RIVER ROAD, GOSNELLS

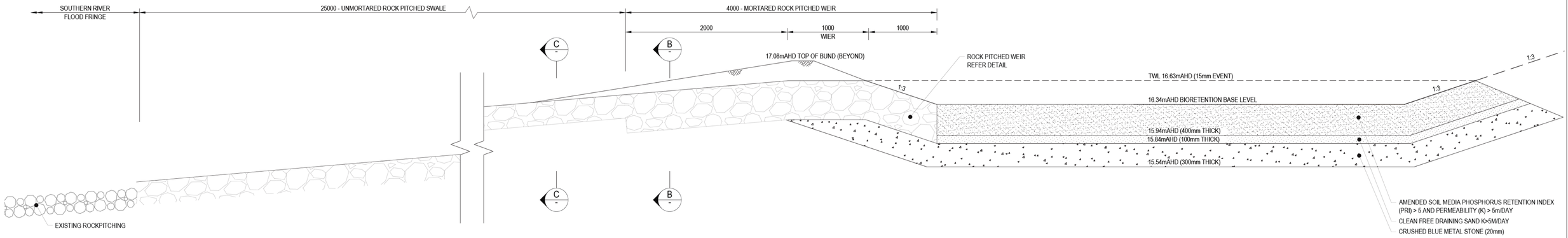
DG	DG	TS	MDB	28.04.2025
Drawn	Designed	Reviewed	Approved	YYYY.MM.DD

Title DRAINAGE PLAN

Project No.	WAPC No.	Scale at A1
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Revision D
Drawing No. CI-50DRP1

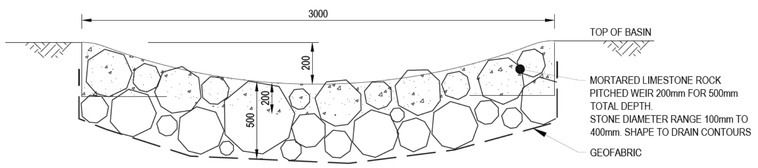
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ORIGINAL SHEET - ISO A1



BIORETENTION BASIN SECTION A-A

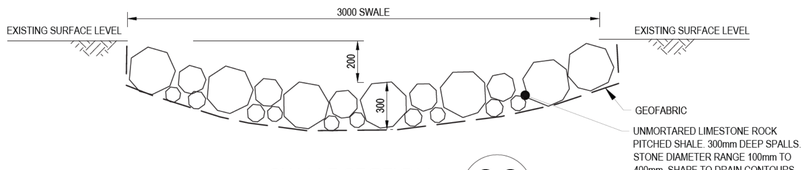
SCALE 1:25 (A1)
1:50 (A3)

50DRP1



WEIR SECTION B-B

SCALE 1:50 (A1)
1:100 (A3)



SWALE SECTION C-C

SCALE 1:50 (A1)
1:100 (A3)

1:25 0.25 0 0.25 0.5 0.75 1.0 1.25 A1
1:50 A3
1:50 1 0.5 0 1 2 A1
1:100 A3

D	BASIN DETAILS AMENDED	DG	MDB	26.06.2025
C	DRAINAGE DESIGN AMENDED	DG	MDB	12.06.2025
B	BASIN DETAIL AMENDED	DG	MDB	13.05.2025
A	ORIGINAL ISSUE	DG	TS	01.05.2025
Issued/Revision		By	Appd	YYYY.MM.DD

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DG	DG	TS	MDB	28.04.2025
Drawn	Designed	Reviewed	Approved	YYYY.MM.DD

Title DRAINAGE DETAILS
SHEET 1

Project No. 304770573
WAPC No. 200145
Scale at A1 AS SHOWN
Revision D
Drawing No. CI-55DRD1

\\AU201-1vfs01_p\50\shared_projects\304770573\Community Development\10_cad\drawings\shared_dgn\304770573-SHV01-00XX-CI-55DRD1.dwg
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ORIGINAL SHEET - ISO A1



Data Source: Nearmap (2017), Rowe Group (2017), DoW (2009)

Coordinate System: GDA 94, Zone 50

JDA

Job No. J6442
Scale: 1:1,500 @A4
0 20 40 60 80 Meters

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Sabrechief Pty Ltd
Lot 1297 (No. 295) Southern River Road, Gosnells - LWMS
Figure 5: Proposed Local Structure Plan



Flow is contained within lots and road pipe system and infiltrated in soakwells and in bioretention area.



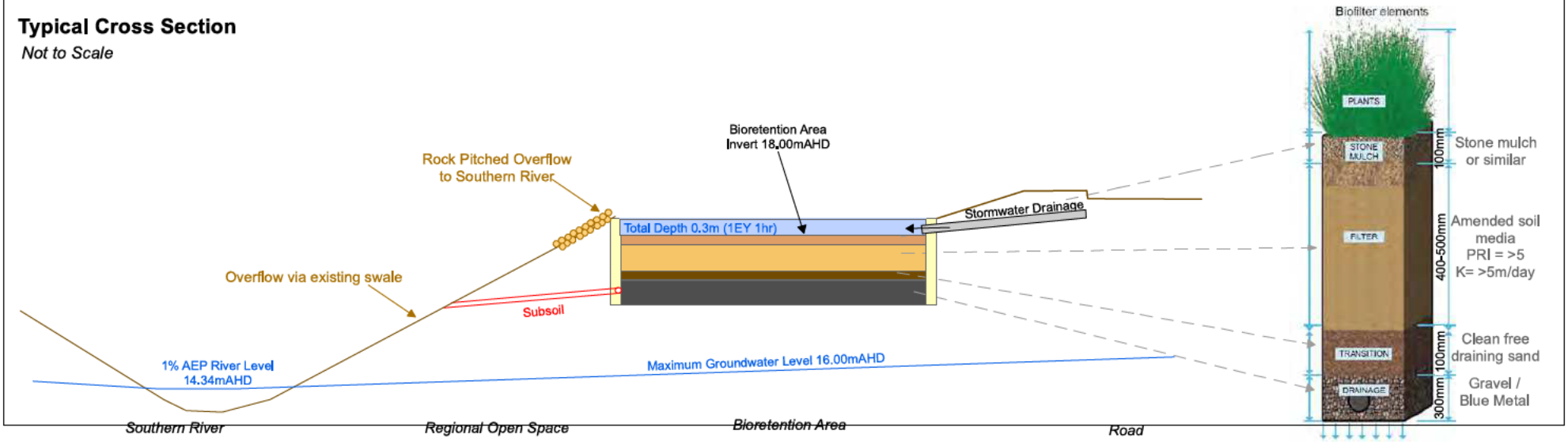
Flow is conveyed within road gutter and pipe system. Attenuation of flow is within bioretention area. Bioretention area will overtop via an overflow spillway into an existing swale towards the Southern River.



Flow is conveyed both overland and within pipe system. Attenuation of flow in bioretention area. Bioretention area will overtop via an overflow spillway into an existing swale towards the Southern River.

Typical Cross Section

Not to Scale



Note: Indicative bioretention area design only. Detailed design to be presented in UWMP.

Job No. J6442

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Sabrechief Pty Ltd

Lot 1297 (No. 295) Southern River Road, Gosnells - LWMS

Figure 6: Conceptual Stormwater Management & Event Plans

Sabrechief Pty Ltd

Lot 1297 (No. 295) Southern River Road, Gosnells

Local Water Management Strategy



July 2017

DISCLAIMER

This document is published in accordance with and subject to an agreement between JDA Consultant Hydrologists ("JDA") and the client for whom it has been prepared ("Client"), and is restricted to those issues that have been raised by the Client in its engagement of JDA. It has been prepared using the skill and care ordinarily exercised by Consultant Hydrologists in the preparation of such documents.

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JDA does not take responsibility for checking any landscape and engineering plans attached to this report for accuracy or consistency with this report.

QUALITY ASSURANCE

The JDA quality control system has been in place since 1997 and meets the requirements of AS/NZS ISO 9001:2008. JDA is committed to maintaining and improving the quality management system.

Document Version No.	Issue Date
J6442a	24 July 2017

	Name	Signature	Date
Author	[redacted]		24 July 2017
Checked by			24 July 2017
Approved by			24 July 2017

EXECUTIVE SUMMARY

JDA has been engaged by Sabrechief Pty Ltd to complete a Local Water Management Strategy (LWMS) for Lot 1297 (No. 295) Southern River Road, Gosnells. This LWMS has been prepared to guide water management for proposed residential development of approximately 2.33 ha, and to support the Local Structure Plan (LSP) amendment for the Study Area. This document provides conceptual level drainage planning to assist in providing a coordinated approach to future subdivision.

Table 1 below provides a summary of the key elements of the LWMS in addressing principles and objectives.

TABLE 1: SUMMARY OF PROPOSED LOCAL WATER MANAGEMENT STRATEGY

Principle	Key LWMS Elements
Water Quantity To maintain the total water cycle balance within development areas relative to the pre-development conditions.	• Maintain flow paths for existing catchments; • Retain and treat runoff from the 1 Exceedances Per Year (EY) 1 hour event. • Post development discharge to be no more than pre-development discharge rates for events greater than the 1 EY.
Water Quality To maintain or improve the surface and groundwater quality within development areas relative to pre-development conditions.	• Change in land use and WSUD to reduce nutrient input in the site; • Application of source controls – including street sweeping, education to reduce nutrient application, native plantings, and lot soakwells; and • Application of structural controls – bioretention area
Water Conservation To maximise the reuse of stormwater	• Encourage implementation of water efficiency and demand management measures both internal and external of buildings; • Maximise stormwater infiltration opportunities where possible; and • Use of native plantings in drainage areas to minimise irrigation.
Ecosystem Health To retain natural drainage systems and protect ecosystem health	• Retain and treat 1 EY 1hour post development discharge relative to pre-development conditions; and • Manage major event flows from the site.
Public Health To minimise the public risk, including risk of injury or loss of life to the community	• Design in accordance with relevant design standards, best management practices, council regulations and government agency requirements.
Protection of Property To protect the built environment from flooding and waterlogging	• Identification of 1% Annual Exceedance Probability (AEP) flood levels for the Southern River; • Protection of downstream areas by managing stormwater discharge; and • Sub-soil drainage to be implemented to control seasonal groundwater rise to a controlled watertable level.
Development To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability & precautionary principles.	• Urban water management in accordance with Better Urban Water Management (WAPC, 2008); and • Development of the LWMS in accordance with government agency guidelines and best management practice recommendations. • Post-development monitoring for a period 2 years

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1. INTRODUCTION

1.1 Background and Statutory Framework

This LWMS has been prepared by JDA Consultant Hydrologists on behalf of the Sabrechief Pty Ltd for the development of Lot 1297 (No. 295) Southern River Road, Gosnells (herein referred to as the Study Area). The Study Area falls within the southern portion of the Chamberlain Street Outline Development Plan (ODP) (CoG, 2003) and is currently zoned Residential R20. The location of the Study Area is shown in Figure 1.

This LWMS document has been prepared to support the Local Structure Plan (LSP) amendment to increase the density code of the Residential lots from R20 to R30 for the Study Area and to provide conceptual level drainage planning to assist in providing a coordinated approach to future subdivision.

This document presents a recommended approach for total water cycle management within the Study Area consistent with sustainability principles. The document is consistent with State Planning Policy 2.9 Water Resources (WAPC, 2006) and guidelines presented in Better Urban Water Management (WAPC, 2008). The preparation of this document in relation to the requirements of Better Urban Water Management (BUWM) (WAPC, 2008) is shown in Table 2.

This document includes a range of expertise and guidelines from leading government authorities including the Department of Water and Environment Regulation (DWER) and City of Gosnells (CoG), to assist in achieving the implementation of best practices in sustainable urban development and urban water management.

A copy of a completed LWMS Checklist for Developers (WAPC, 2008) and DWER LWMS Checklist have been included as Appendix A to assist the CoG and DWER in review of this document.

TABLE 2: INTEGRATED PLANNING AND URBAN WATER MANAGEMENT PROCESS

Planning Phase	Planning Document	Urban Water Management Document and Status
District	NA	NA
Local	Lot 1297 (No. 295) Southern River Road Local Structure Plan	Lot 1297 (No. 295) Southern River Road, Gosnells Local Water Management Strategy (LWMS) **THIS DOCUMENT**
Subdivision	Subdivision Application	Urban Water Management Plan (UWMP) (required for individual stages of development) **FUTURE PREPARATION**

This LWMS uses the following key documents to define its principles, criteria, and objectives:

- Statement of Planning Policy 2.9: Water Resources (WAPC, 2006)
- Stormwater Management Manual for WA (Department of Water, 2007)
- Decision Process for Stormwater Management in WA (Department of Water, 2009a)
- Better Urban Water Management (WAPC, 2008)
- Southern River Integrated Land and Water Management Plan (Department of Water, 2009b)
- Swan-Canning Water Quality Improvement Plan (SRT, 2009a)

- Southern River Catchment Local Water Quality Improvement Plan (SRT, 2009b)

1.2 Key Principles and Objectives

Summaries of key principles and objectives applicable to the LWMS for the Study Area based on these documents and advice from DWER and CoG are provided in Table 3.

TABLE 3: SUMMARY OF LWMS PRINCIPLES AND OBJECTIVES

Key Guiding Principles		
• Facilitate implementation of sustainable best practice in urban water management • Encourage environmentally responsible development • Provide integration with planning processes and clarity for agencies involved with implementation • Facilitate adaptive management responses to the monitored outcomes of development • To minimise public risk • To maintain the total water cycle		
Category	**Principles**	**Objectives**
Water Use	• Consider all potential water sources in water supply planning • Integration of water and land use planning • Sustainable and equitable use of all water sources having consideration of the needs of all users, including community, industry and environment • No potable water should be used outside of homes and buildings	• Minimise the use of potable water where drinking water quality is not essential, particularly ex-house uses • Consumption target for potable water of 40 – 60 kL/ person/ year
Groundwater Levels and Surface Water Flows	• To retain natural drainage systems and protect ecosystem health • To protect from flooding and waterlogging • To implement economically viable stormwater systems • Post development annual discharge volume and peak flow rates to remain at predevelopment levels or defined environmental water requirements • Ensure no increase in outflow from the Study Area during the Southern River's 1% AEP 48 hour critical storm	• The minimum habitable floor level will be 14.84 mAHD in order to provide a minimum 0.5 m clearance to the 1% AEP flood level in the Southern River. • Maintain 1.5m clearance between habi floor level and MGL • 1 EY 1hr (first 15mm runoff) event from lots will be infiltrated on lot via soakwells • 1 EY 1 hour event from the road network will be retained in bioretention area • Retain and restore existing elements of the natural drainage system.
Groundwater and Surface Water Quality	• To maintain or improve groundwater and surface water quality • Where waterways/open drains intersect the water table, minimise the discharge of pollutants from groundwater • Where development is associated with an ecosystem dependent upon a particular hydrologic regime, minimise discharge or pollutants to receiving waterways and maintain water quality in specified environment. • As compared to a development that does not actively manage stormwater quality: • At least 80% reduction of TSS • At least 60% reduction of TP • At least 45% reduction of TN • At least 70% reduction of gross pollutants	• Implement current known best management practice as detailed in the DWER's Stormwater Management Manual for Western Australia (2007) and the Decision Process for Stormwater Management in Western Australia. (DoW 2009), with an emphasis on a treatment train approach including nutrient input source control, use of bioretention systems, and maintaining 1EY post development discharge volumes and peak flow rates at pre development levels.
Disease and Nuisance Insect Management	• To reduce health risks from mosquitoes, retention and detention treatments should be designed so that between November and May, detained immobile stormwater is fully infiltrated in a time period not exceeding 96 hours	• Permanent water bodies not proposed for the Study Area.

2. PRE-DEVELOPMENT ENVIRONMENT

2.1 Location and Topography

The Study Area is approximately 2.33ha and located 18km south east of the Perth CBD and 6km north west of Armadale, within the City of Gosnells, see Figure 1.

The topography is generally flat with a gentle grade north east to south west towards the Southern River. Elevations range between approximately 20 mAHD and 12 mAHD as shown by 1m LiDAR contours on Figure 1. A detailed feature survey of the Study Area has not been undertaken.

2.2 Climate

The Study Area has a Mediterranean climate with warm dry summers and cool wet winters. The mean summer maximum temperature is 32.2 °C and the mean winter minimum temperature of 19.3 °C (BoM, 2017).

Annual rainfall recorded at the Bureau of Meteorology's (BoM) Gosnells City station (009106) is shown in Figure 2. The 1975 – 2016 average annual rainfall for this site is 765 mm. The 2000 – 2016 average annual rainfall has declined to 718 mm, a 6% reduction.

2.3 Existing Land Use

An aerial photograph (Nearmap, 2017) showing existing land use within the Study Area is shown in Figure 1. The Study Area is predominately cleared with a house present on the eastern boundary of the lot.

A search by JDA of the Aboriginal Heritage Inquiry System database indicates the Study Area is within Registered Aboriginal Site 3511 – Southern River (Figure 3).

A search of the DWER Contaminated Sites database indicates no known contaminated sites within the Study Area.

2.4 Environmental Geology

Surface geology mapping is shown in Figure 3. The 1:50,000 Armadale Environmental Geology Map (GSWA, 1989) indicates the geology of the Study Area is typically as follows:

- S8 SAND - pale yellowish brown, medium to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.
- Ms4 SANDY SILT - cream to pale brown, angular to rounded sand, low cohesion, of alluvial origin.

The majority of the Study Area lies over sand (S8), which allows for infiltration of stormwater.

A geotechnical investigation has not been undertaken for the Study Area. A geotechnical investigation will be required prior to subdivision to aid detailed engineering design including opportunities for infiltration of stormwater.

Based on JDA's experience on the Swan Coastal Plain, sands within post-development Study Area (S8) have a low Phosphorus Retention Index (PRI), typically less than 10.

2.5 Acid Sulfate Soils

Acid Sulfate Soil mapping is shown in Figure 3. Regional ASS mapping indicates majority of the Study Area is classified Moderate to Low Risk of ASS within 3m of the natural surface. The western portion of the Study Area, closest to the Southern River is classified as High to Moderate Risk of ASS greater than 3m below natural surface (DER, 2014).

A preliminary site ASS investigation has not been performed as the majority of the site is classified at the Moderate to Low Risk. A detailed ASS Investigation should be undertaken prior to subdivision and relevant management, presented in an ASS Management Plan.

2.6 Wetlands

The Southern River abuts the Study Area to the west and is classified as both Multiple Use Palusplain and Resource Enhancement Dampland (DPAW, 2016) as shown on Figure 3.

- **Multiple Use**: Wetlands with few attributes which still provide important wetland functions
- **Resource Enhancement**: Wetlands which have been partly modified but still support substantial functions and attributes.

There are no Environmental Protection Policy (EPP) wetlands in the Study Area.

To guide development, a foreshore reserve within land to be acquired by WAPC for Regional Open Space is to be allocated outside of the development area as outlined on the approved Chamberlain Street ODP (CoG, 2003).

2.7 Surface Runoff

The majority of rainfall infiltrates within the sandy areas of the Study Area, with any runoff that does occur traveling by shallow sheet flow to the Southern River located along the western and southern boundary of the Study Area.

The following loss model (adopted from Cardno, 2011) was used to determine pre-development runoff for the Study Area as described further in Section 5.1.2.

- Initial Loss: 17.5mm
- Continuing Loss: 2.5mm/hr

2.8 Southern River

The Southern River is a major waterway that starts at the confluence of the Neerigen and Wungong Brooks and discharges into the Canning River (DoW, 2009b). The river flows year round and only dries after a series of low rainfall years. The Southern River catchment contributes more water than any other catchment to the Canning River and has been identified as a priority catchment as it contributes some of the greatest amounts of nutrients and other contaminants to the Swan Canning river system. Due to this, a Southern River Catchment Local Water Quality Improvement Plan (SRT, 2009b) was been implemented to guide management measures to achieve water quality targets.

2.8.1 Floodplain Mapping

DWER 1% Annual Exceedance Probability (AEP) floodplain mapping shows that the Southern River floodway encroaches only into the most southern portion and western boundary of Lot 1297 (Figure 4).

A floodplain is described by Water and Rivers Commission (2000) as the portion of a river valley next to the river channel that becomes covered with water during major river flows. The 1% AEP floodplain can be divided into two portions, the Floodway and the Flood Fringe.

A Floodway consists of the river channel and a portion of the floodplain which becomes part of the main flow path once the capacity of the main channel has been exceeded. Development (i.e. filling or building) within this area is considered obstructive to major flows and is not acceptable.

The Flood Fringe is the area outside of the Floodway that becomes inundated with still or slow moving water. Development (i.e. filling or building) can be undertaken within this area with appropriate measures. Minimum floor level of habitable buildings is 0.5m above the adjacent 1% AEP flood level.

DWER (pers comm. Carlie Slodecki, DWER, 10 July 2017) has indicated the 1% AEP critical storm duration for Southern River is 48 hour (Appendix B). Flood level immediately downstream of Southern River Road that is applicable to the Study Area is shown in Figure 4 and provided in Table 4 below.

TABLE 4: DWER SOUTHERN RIVER FLOOD LEVEL

	1% AEP Critical Duration (hrs)	1% AEP Flood Level (mAHD)	Minimum Habitable Floor Level (mAHD)
Southern River (downstream of Southern River Road Bridge)	48	14.34	14.84

2.8.2 Water Quality

Sampling of the Southern River has been conducted by DWER from October 2006 to November 2012 at DWER Site 6162260 located on the western boundary of the Study Area (see Figure 4). These results will be used to provide baseline water quality information for future development of the Study Area.

The long term targets for Total Phosphorous and Total Nitrogen for the Southern River as identified in the Swan-Canning WQIP (2009a) and Southern River Catchment LWQIP (2009b) are 0.075mg/L and 0.75mg/L respectively.

2.9 Groundwater Hydrology

There are three distinct aquifers underlying the Study Area, each being assigned the name of a major geological unit contributing to it.

From natural surface level in descending order, they are:

- Superficial aquifer (unconfined)
- Leederville aquifer (confined)
- Yarragadee aquifer (confined)

The superficial aquifer is unconfined and directly recharged from direct rainfall percolation.

2.9.1 Groundwater Levels

Groundwater levels taken from the Perth Groundwater Atlas (DoW, 1997) indicate that maximum groundwater levels for the Study Area range from 18mAHD in the north east to 14mAHD nearer to the Southern River (Figure 4). Minimum separation from natural surface contours to maximum groundwater levels is 2m.

Regional groundwater level seasonal variation on the Swan Coastal Plain is in the order of 1.5m, however due to the close proximity of Southern River, the groundwater level seasonal variation has been calculated by JDA to be 0.8m from nearby DWER Bore T75 (WIN Site ID: 4880), see Appendix C.

2.9.2 Groundwater Quality

Groundwater quality monitoring has been conducted extensively within the Southern River Catchment. Results from these studies indicate that nutrient concentrations are elevated most likely due to historical land uses and associated application of nutrients (DoW, 2009b).

Whilst groundwater quality samples have not been taken from the Study Area, sampling that has occurred within the Southern River Catchment should be used as indicator levels for groundwater quality. Swan-Canning Cleanup Program Targets (SRT, 2009a) should be used in the interim due to the close proximity of the Southern River. These long term targets are 0.075mg/L for Total Phosphorous and 0.75mg/L for Total Nitrogen.

2.10 Water Resources

The Study Area is located within the City of Gosnells Sub-Area of the Perth Groundwater Management Area. The Superficial aquifer in this location is currently 60.5% allocated of a total estimated groundwater resource of 5,484,500kL available for allocation (Appendix D). A Licence to Take Water should be applied for during detailed design.

Potable water supply to homes surrounding the Study Area is via the Water Corporation. Connection to the existing supply scheme will require the extension of existing infrastructure. Confirmation and details of Water Corporation supply will be provided during detailed design. There are no existing DWER groundwater licences within the Study Area.

2.11 Hydrological Opportunities and Constraints

The above described characteristics of the pre-development environment in the Study Area provide a number of key constraints and opportunities for the application of water sensitive urban design with land use change:

- Sandy soils will aid the infiltration of frequently occurring storm events (ie. 1 Exceedances Per Year (EY) 1hr = 15 mm) at source where possible via soakwells in imported fill.
- WAPC's Bulletin 64 (WAPC, 2003) ASS risk mapping for the Study Area indicates moderate risk of Actual ASS or Potential ASS within 3 m of the existing surface for the vast majority of the Study Area. An ASS Investigation and Management Plan will be required prior to development.
- The Southern River is located to the west and south of the Study Area and encroaches along these boundaries, therefore consideration in regard to drainage and water quality is required. Drainage infrastructure is to be placed within the development's POS and appropriate erosion control is to be installed where the bioretention area overflows to the Southern River.
- Groundwater mapping has been obtained from the Perth Groundwater Atlas and has allowed for a high level assessment of groundwater levels in relation to existing natural surface level. Subsoil drainage will be required for management and control in the post-development environment to prevent a rising groundwater table.
- Habitable floor levels are to be minimum 14.84 mAHD, that is 0.5m above the adjacent Southern River 1% AEP flood level of 14.34 mAHD.
- Historical rural land use within the Study Area has to varying degrees affected groundwater quality and there are currently no water quality controls. Change in land use provides an opportunity to improve groundwater quality through application of sustainability principles, water sensitive urban design, and establishment of water quality targets, monitoring and compliance reporting.

These constraints and opportunities are used in to assist development of a suitable Local Water Management Strategy (LWMS) for the Study Area.

3. PROPOSED DEVELOPMENT

The proposed Local Structure Plan for the Study Area is shown in Figure 5. The land use is predominately residential lots (R30) with an allocated area for Regional Open Space located along the western and southern boundary of the development area (Appendix E).

Key elements of the LSP related to urban water management include:

- At-source infiltration of frequently occurring storm events, up to 1EY 1hr duration, at lot level and in POS where practical;
- Use of an ephemeral bioretention area for management of local stormwater in POS;
- Maintenance of drainage/stormwater discharge point from the Study Area to the receiving environment;
- Use of existing swale for discharge of stormwater from development site to Southern River;
- Control of post-development groundwater rise within imported fill via subsoil drainage;
- Minimisation of fill consistent with sustainability principles;
- Use of native plants within POS;
- Use of non-potable groundwater for irrigation of POS (if required).

4. WATER USE SUSTAINABILITY INITIATIVES

4.1 Water Conservation

Development of the Study Area will lead to an increased demand for water for new residents as well as irrigation of public open space areas.

Water conservation measures will be implemented to reduce scheme water consumption within the development and will be consistent with Water Corporation's "Waterwise" land development criteria, and include:

- Use of high density residential zoning and smaller lots to reduce garden (ex-house) use of water.
- Promotion of use of waterwise practices including water efficient fixtures and fitting (taps, showerheads, toilets and appliances, rainwater tanks, waterwise landscaping).
- Consumption target for water of 100 kL/person/year, including not more than 40-60 kL/person/year scheme water.
- All houses to be built to 5 star building standards.
- Utilise fit for purpose water sources throughout the development.
- Use of native plants in POS area.
- Maximising on site retention of stormwater (where practicable).

Specific agreed measures and locations to achieve water conservation will be detailed during detailed design.

4.2 Potable & Non-Potable Water Supplies

4.2.1 Household Scale

The water source planning strategy for the Study Area is for use of scheme water for domestic household use (both in and ex-house). The development will be connected to Water Corporation's Integrated Water Supply Scheme (IWSS). More detailed information and Water Corporation confirmation of supply will be provided during detailed design.

The use of rainwater tanks to supplement potable water use ex-house and in-house will be encouraged by the developer. The use of rainwater tanks will be assessed as part of the subdivision stage when more detailed planning is commenced. The integration of rainwater tanks for non-potable water with the domestic water supply scheme would assist in reducing excess stormwater generation and minimise scheme water importation.

4.2.2 Public Open Space Areas

POS maintenance and irrigation supply requirements will be managed by the developer for a period of two years before hand-over to the City of Gosnells. Detail landscaping design and planting will be presented during detailed design.

Sources of non-potable water supply for short-term and long-term irrigation of POS areas (should it be required) have been investigated. The DWER Water Register in June 2017 indicated that water allocations for the superficial groundwater aquifer in this area are currently available (Appendix D). Based on DWER's standard irrigation application rate of 7,500kL/ha/year, the development will require an allocation of 1,200kL/yr which is well within the allocation available of 2,165,429kL. A licence for this allocation amount can be applied for if required.

Based on the household and POS water strategies, a water balance for the site has not been provided in the LWMS, as it is typically required to support the identification of excess water generated by the development where use of this excess water as a non-potable water supply scheme is proposed. A water balance would not provide any further information on water use and potable/non-potable supply options. Furthermore, design and building of the proposed development to current industry standard should ensure water use is within current Water Corporation and DWER consumption targets.

4.3 Wastewater

Wastewater disposal from the development is proposed to be serviced via an extension of the Water Corporation's existing infrastructure. Further advice from Water Corporation on the completion of wastewater infrastructure planning for the Study Area will be provided during detailed design.

5. MANAGEMENT STRATEGIES

5.1 Stormwater Management Strategy

The stormwater management strategy has been prepared to meet the objectives and principles of urban water management outlined in Table 3. In addition, the proposed strategy is consistent with advice provided by DWER and CoG (Appendix B).

The key elements of the stormwater management strategy are:

- To retain, treat and infiltrate the first 15 mm of the rainfall (1 EY 1hr) across the development area.
    - Lots: Retention of the first 15mm of rainfall within soakwells or other infiltration structures.
    - Roads: To treat the first 15 mm rainfall event through a bioretention area/swale within the allocated POS.
    - POS: Retention and infiltration of the first 15mm of rainfall onsite.
- All lots are required to have an overflow drainage connection to the City's drainage system (pers. comm. Dumal Kannangara, CoG, 6 July 2017).
- Stormwater run-off from lots and roads for rainfall events greater than 15 mm will be directed and detained within the bioretention area within the POS.
- Overflow from the bioretention area to the Southern River will be via a weir with appropriate erosion control.
- Post development flows will not exceed pre-development flows. This includes the 48hr critical duration for the Southern River 1% AEP flood event.
- No stormwater infrastructure will be constructed within the foreshore area.
- The bioretention area will be located above the Southern River 1% AEP Flood Level.
- Habitable floor levels are to be minimum 0.5m above the Southern River 1% AEP Flood Level.
- There is to be a minimum of 500 mm clearance from the base of the bioretention area to the Maximum Groundwater Level (MGL) at that specific location.
- Use of subsoil drains to mitigate the rise of groundwater within fill and maintain a minimum separation of 1.5m between MGL and finished lot level.

5.1.1 Conceptual Stormwater System Design

A major and minor approach to the design of the stormwater management system has been adopted for the Study Area. The minor system consists of pipes, kerbs and gutters designed to convey the stormwater to the bioretention area designed to infiltrate stormwater as close to source as possible. The major system consists of the road, bioretention area and POS to provide protection of the community from extreme flooding events (up to the 1% AEP rainfall event) that exceed the capacity of the minor system.

Runoff coefficients for events greater than the 1 EY are displayed in Table 5 alongside land use areas and their calculated impervious areas. Figure 5 displays the structure plan.

CoG have advised that the Study Area does not receive any drainage contribution from surrounding development, and it is to have a self-contained stormwater system (pers comm. Dumal Kannangara, CoG, 6 July 2017).

TABLE 5: LAND USE BREAKDOWN

Land Use	Total Area (ha)	Runoff Coefficient	Impervious Area (ha)
Lots	0.71	0.70	0.50
Road Reserves	0.38	1.00	0.38
POS	0.13	0.30	0.04
Total	**1.22**	**-**	**0.92**

Drainage practices and concepts intended for stormwater management are described below and they will be subject to further design and engineering specifications during detailed design.

Minor System (15 mm Rainfall Event)

Management of the frequent 1 EY 1hr event (15 mm rainfall event) is related to water quality protection of the receiving environments. Run-off from this event is most likely to contain pollutants originating within the catchment, therefore measures are required to retain and treat this storm event on site.

Lots

15 mm rainfall event will be retained and infiltrated within the lot boundary. Impervious areas, such as driveways and roof will be connected directly to soakwells (or similar) which have sufficient storage capacity for 15 mm of rainfall. Soakwells will have an overflow connection to street drainage for events greater, with a 0.70 runoff coefficient assumed for these events. The system is achievable based on the adequate clearance to the groundwater level across the site (generally calculated to be approximately 2 metres) and favourable fill material suitable for sufficient infiltration rates. The following assumptions were modelled for lots:

- Initial Loss: 15mm
- Runoff Coefficient: 0.70

Road Reserves

The road network will generate and convey stormwater runoff during the 1 EY 1hr rainfall event. Runoff coefficient adopted for the Road Reserve is 1.0 assuming footpaths on both sides, as per the adjacent development as seen on aerial imagery (Figure 5). The following assumptions were modelled:

- Initial Loss: 1.5mm
- Runoff Coefficient: 1.00

Runoff from the road reserve is to be conveyed via a piped street drainage system to the bioretention area for treatment and infiltration to help to reduce the export of nutrients or pollutants in stormwater run-off from the site during the more frequent, minor storm events (see Section 5.3.2 for bioretention design).

The total impervious road reserve area in the development is 0.39 ha. Assuming a bioretention storage depth of 0.3m, and a hydraulic conductivity rate of 5m/day, INFIL (the JDA in-house infiltration model) indicates that the bioretention will be required to have an area of 130m^2 and a maximum volume of 36m^3 (see Appendix F).

The indicative location of the bioretention area within the POS is provided in Figure 5.

Major System (Rainfall Events Greater than 15 mm)

Stormwater runoff from the development will be directed along the roads as overland flow towards the bioretention area. When the capacity of the bioretention area is reached (i.e. after the first 15 mm of rainfall or 0.3m depth), the basin will overtop via a spillway into an existing swale that drains to the Southern River (Figure 5). The existing swale will be rehabilitated and designed to minimise erosion and scouring during

discharge events. The spillway will be set above the 1EY 1hr top water level with discharge not exceeding the estimated pre-development rate.

5.1.2 Stormwater Modelling Results

To determine the flood storage requirements for the Study Area, provided by the bioretention area and POS around it, flood modelling was performed with the hydraulic model XP-STORM based on the current local structure plan (Figure 5), neglecting infiltration into the bioretention area.

The design storms modelled by XP-STORM were calculated internally by the model with reference to the methodology in Australian Rainfall & Runoff (AR&R) (Institution of Engineers, Australia 2000). The rainfall temporal pattern was assumed to be spatially uniform across the Study Area. Storm durations modelled ranged from 10 minutes to 72 hours with critical durations for the bioretention ranging from 1 to 6 hours.

Flood modelling for the Study Area detailing indicative area required in the POS for flood management purposes with storage volumes, areas, flood rise and inverts are presented in Table 6 and Figure 6.

Note that the flood modelling results presented are a guide for the determination of drainage area requirements as minor changes may occur and the drainage design being dependent upon the final structure plan, earthworks and road design levels for the development.

TABLE 6: XP-STORM STORMWATER MODELLING RESULTS

	Bioretention Area
Flood Storage Data	
Invert (mAHD)	18.00
Base Area (m^2)	130
Side Slopes (v:h)	1 in 0
Spillway Invert (mAHD)	18.30
Spillway Width (m)	3.00
1 EY 1hr *(15mm Rainfall)*	
Flood Storage Volume (m^3)	36 *
Flood Depth (m)	0.28 *
Flood Top Water Level (mAHD)	18.28 *
Post-Development Peak Outflow (m^3/s)	0.00 *
0.2 EY *(5 Yr ARI)*	
Critical Storm Duration (hrs)	6
Flood Storage Volume (m^3)	45
Flood Depth (m)	0.35
Flood Top Water Level (mAHD)	18.35
Pre-Development Peak Outflow (m^3/s)	0.09
Post-Development Peak Outflow (m^3/s)	0.06
1% AEP *(100 Yr ARI)*	
Critical Storm Duration (hrs)	1
Flood Storage Volume (m^3)	50
Flood Depth (m)	0.38
Flood Top Water Level (mAHD)	18.38
Pre-Development Peak Outflow (m^3/s)	0.21
Post-Development Peak Outflow (m^3/s)	0.12

*Results from INFIL model, see Section 5.1.1

To satisfy DWER criteria, the critical 1% AEP 48hr storm for Southern River floodplain mapping was also modelled for the development area. Result presented in Table 7 below indicates a lower post development outflow of 0.05m^3/s compared to the pre-development rate of 0.06m^3/s during the time when the Southern River flood level peaks.

TABLE 7: SOUTHERN RIVER 1% AEP STORMWATER MODELLING RESULTS

	1% AEP Southern River Critical Duration (hrs)	Pre-Development Flow Rate (m^3/s)	Post-Development Flow Rate (m^3/s)
Development Area	48	0.06	0.05

5.2 Groundwater Management

Minimum separation between building floor levels for development and the Maximum Groundwater Level (MGL) will be achieved by combination of subsoil drainage and the importation of clean sand fill. The design of the proposed development should incorporate a minimum habitable floor level 1.5m above the MGL to meet the recommended clearance, unless otherwise indicated in future geotechnical reports completed as part of the UWMP.

Use of subsoil drains is recommended by JDA to mitigate any rise of groundwater post development. It will not be used to lower groundwater levels, but will be installed as a backup to ensure post development groundwater levels are maintained and minimum separation 1.5m is achieved. A design groundwater level (DGL) will be implemented by setting subsoil drainage inverts, in road reserves, at a minimum of MGL. Subsoil is to discharge into the bioretention area and be free draining.

Detailed cross section including stormwater pits and pipes and detailed design of subsoil drainage including spacing to achieve the DGL is to be undertaken at detailed design.

Finished lot levels and fill requirements will be addressed during detailed design and submitted for council approval at that stage. Note that other factors such as the neighbouring development and constructed road levels may be the determining factor for fill level, rather than groundwater clearance.

Groundwater mapping presented in Figure 4 should be considered indicative only for assisting in LWMS strategy development purposes and subject to further investigation/refinement during detailed design.

5.3 Water Quality Management

With respect to water quality management the LWMS proposes the use of a treatment train approach including source control techniques. The proposed water quality management approach for the Study Area will include:

- **Non Structural Controls**
  Planning practices (POS locations and configuration, watercourse buffers)
  Construction practices (construction management)
  Maintenance practices (street sweeping, stormwater system, POS area)
  Educational and participatory practices (community education)
- **Structural Controls**
  - Infiltration of lot runoff at source via soakwells and gardens
  - Infiltration of road runoff via bioretention swale or basin (designed with soils with a PRI >5)

- **Monitoring**
  Establishment of post development monitoring network
  Annual reporting, including assessment of BMP's performance

With respect to criteria for water quality, the principle of improving water quality in comparison to existing water quality will be adopted via Water Sensitive Urban Design, and water quality targets developed on this basis as percentage reductions as per Best Management Practise water quality targets (see Section 5.4.1). Assessment of compliance with targets will be through post-development monitoring (refer Section 6.4).

To achieve its water quality objectives, the LWMS focuses on implementing current known best management practice as detailed in the DoW's Stormwater Management Manual for Western Australia (2007) and the Decision Process for Stormwater Management in Western Australia (DoE & SRT, 2005), with an emphasis on nutrient input source control and establishing bioretention systems for treatment of frequently occurring storm events and subsoil drainage. Detailed design of these management items will be presented in the UWMP.

Ideally, WSUD structures would be sized for the 4EY event (equivalent to the 3 month ARI) which would provide >95% treatment efficiency (Wong, 2006). The rainfall depth for the 4EY 1hr event in Gosnells is 11.1mm. The stormwater strategy proposed for lots and roads within the Study Area is to retain and treat the first 15mm, which exceeds the 4EY event.

5.3.1 Assessment of Proposed Structural BMP's to Design Criteria

Table 8 details a summary from DoW's Stormwater Management Manual for Western Australia (2007) of expected pollutant removal efficiencies for vegetated swales and detention/retention systems in relation to the water quality design criteria specified in Table 1.

TABLE 8: BMP WATER QUALITY PERFORMANCE IN RELATION TO DESIGN CRITERIA

Parameter	Structural Controls Nutrient Output Reduction [1]	
	Vegetated Swales/ Bioretention Systems	Detention/ Retention Storages
Total Suspended Solids	60-80%	65-99%
Total Phosphorus	30-50%	40-80%
Total Nitrogen	25-40%	50-70%
Gross Pollutants	-	>90%

1. Typical Performance Efficiencies via DoW (2007)

While DoW (2007) does not provide expected pollutant removal efficiencies for all BMP's, the development will include infiltration at source at lot level and a bioretention area with amended soils. Specific details on the location, scale of application, and management responsibilities for individual BMP's are to be assessed during detailed design.

The Study Area will meet design criteria specified in Table 1 as a bioretention/detention area will be implemented.

5.3.2 Bioretention Area

Final design of the bioretention area including amended soil medium will be determined during detailed design commensurate with:

- *DWER criteria to capture and threat the 1EY 1hr rainfall event.*
- *FAWB (2009) "Stormwater Biofiltration Sustems – Adoption Guidelines".*
- *DoW (2011) "Water Sensitive Urban Design – Biofilters".*
- *Monash University (2014) "Vegetation Guidelines for Stormwater Biofilters in the South-West of Western Australia" for Plant Selection, Density and Distribution as appropriate.*

As a guide, the specifications listed in Table 9 should be adopted for the design of the bioretention area. A cross section is presented in Figure 6.

TABLE 9: BIORETENTION DESIGN SPECIFICATIONS

Item	Specification
Amended soil media	• 400-500mm thick • PRI >5 • Hydraulic Conductivity (sat) > 5m/day
Plant selection	• Tolerant of periodic inundation and extended dry periods • Spreading root system • Preferential selection of endemic and local native species • Planting to provide 80% coverage at plant maturity
Planting density and distribution	• Planting density appropriate for species selection • Even spatial distribution of plant species
Maintenance	• 12 months following initial planting

5.4 Construction Management

5.4.1 Dewatering

Dewatering of the superficial aquifer may be required for some elements of development construction. As the volume of dewatering will be small compared to aquifer storage and this is to be infiltrated back into the superficial aquifer, the impact upon the aquifer will be minimal.

Drawdown will occur at the dewatering site, and mounding where the water is infiltrated. It should be noted that there will be zero net loss of groundwater, as all water abstracted will be infiltrated (except for minor losses to evaporation).

Prior to the commencement of any dewatering, construction contractors will be required to apply for and obtain from DWER a 'Licence to Take Water'. All dewatering will be carried out in accordance with the conditions of this licence.

Where possible, construction will be timed to minimise impact on groundwater and dewatering requirement.

5.4.2 Acid Sulphate Soils

All assessment and management of ASS will be conducted in accordance with the Acid Sulfate Soil Guideline Series Identification and Investigation of Acid Sulfate Soils (DoE, 2004), including the Preliminary

Site Assessment (PSA) involving a targeted soil and groundwater sampling and analysis program, detailed site assessment (if required), and ultimately and an ASS Management Plan if ASS is to be impacted.

During construction, appropriate handling methods will need to be employed by the construction contractor to manage any potential acid sulphate soils. Handling should be in accordance with the Acid Sulfate Soils Guidelines Series Treatment and Management of Disturbed Acid Sulphate Soils (DoE, 2003). These guidelines specify holding times and specific methods for treatment of such soils. To confirm the status of soils, the site engineer or scientist will regularly inspect the excavations and spoil, and ensure such soils are appropriately tested and managed before reuse or disposal off-site.

6. IMPLEMENTATION

6.1 Roles and Responsibilities

Table 10 details the roles and responsibilities to undertake the implementation plan.

TABLE 10: IMPLEMENTATION RESPONSIBILITIES

IMPLEMENTATION	RESPONSIBILITY	
Action	**The Developer**	**City of Gosnells**
Preparation of an Urban Water Management Plan (if required by CoG)	✓	
Construction of stormwater system and 12 months maintenance post construction (defects period)	✓	
Long term stormwater system operation and maintenance		✓
Monitoring program – 2 years post development	✓	

6.2 Subdivision Application Process

Should CoG request an Urban Water Management Plan (UWMP) be prepared for this development, it will be consistent with processes defined in WAPC (2008) and submitted to support subdivision application.The UWMP will address:

- Demonstrated compliance with LWMS criteria and objectives to the satisfaction of CoG and DWER.
- Agreed/approved measures to achieve water conservation and efficiencies of water use.
- Refine stormwater management design presented in the LWMS including the size, location and design of public open space areas, integrating major and minor flood management capability.
- Refine the management of groundwater levels (including proposed fill levels (if any) and subsoil drainage inverts) as presented in the LWMS.
- Specific structural and non-structural BMPs and treatment trains to be implemented including their function, location, maintenance requirements, expected performance and agreed ongoing management arrangements.
- Management of subdivisional works (including development of a strategy for sediment control during construction).
- Implementation plan including roles, responsibilities, funding and maintenance arrangements.
- Specific monitoring and reporting to be undertaken for each UWMP area consistent with the monitoring program defined in the LWMS (Section 6.4).
- Contingency plans (where necessary).
- A geotechnical investigation and Acid Sulfate Soil Investigation to be carried out for Lot 1297.

6.3 Stormwater System Operation & Maintenance

Operation and maintenance of the drainage system will initially be the responsibility of the developer, ultimately reverting to the local authority, excluding proposed strata development areas. The surface drainage system will require regular maintenance to ensure its efficient operation. It is considered the following operating and maintenance practices will be implemented periodically:

- removal of debris to prevent blockages;
- street sweeping to reduce particulate build up on road surfaces and gutters;
- cleaning of sediment build up and litter layer on the bottom of the bioretention area;
- application of slow release/zero phosphorus fertilisers for maintenance of POS and bioretention area;
- undertake education campaigns regarding source control practices to minimise pollutant runoff into stormwater drainage system; and
- checks on any subsoil drainage function.

6.4 Monitoring Program

The monitoring program has been designed consistent with Joint Australian/ New Zealand Standards (2000) to allow quantitative assessment of hydrological impacts of proposed development within the Study Area.

In particular the program addresses the monitoring of groundwater quality from the development area. The program may need to be modified as data are collected to increase or decrease the monitoring effort in a particular area or to alter the scope of the program itself. Any modification to the program would require the agreement of all parties (DWER, CoG, and developer). The program is designed to operate over a two year post development period including construction to allow for time lag for full impacts of development on the receiving environment to occur.

All water quality testing will be conducted by a NATA approved laboratory. Laboratory analysis results will be typically obtained within 1 month of sample submission.

The timing of commencement of the monitoring program should be negotiated at detailed design with DWER and the CoG. Typically the monitoring program is commenced at practical completion of the subdivision.

Surface and groundwater monitoring are described below and summarised in Table 11.

6.4.1 Groundwater Monitoring

Monthly monitoring of groundwater levels in ~2 locations is proposed, with quarterly monitoring of groundwater quality for the following parameters:

- In situ - pH, EC and Temperature
- Nitrogen & Phosphorus (full suite)

The depth to water table will be measured by electrical depth probe or an alternative suitable device. Water samples are to be taken after purging the bores to ensure a fresh sample is obtained.

Assessment of performance compliance against water quality criteria will require careful consideration to account for inter seasonal and inter annual variability, as groundwater quality will be a function of historical land use practices not only within the development area, but over the entire upstream catchment.

The following criteria, taken from the Southern River Swan Canning Catchment Nutrient Report Update (DoW, 2014) and the Swan Canning Water Quality Improvement Plan (SRT, 2009a) should be used for post-development water quality targets (Table 11).

TABLE 11: POST DEVELOPMENT WATER QUALITY CRITERIA

Monitoring Parameter	Swan Canning Nutrient Report (DoW, 2014)	Swan-Canning WQIP (SRT, 2009a)
Total P (mg/L)	0.1	0.075
Total N (mg/L)	1.0	0.75

For all non-nutrient contaminants, ANZECC & ARMCANZ 2000 guidelines are to be used as targets (SRT, 2009b).

6.4.2 Annual Reporting

Reporting is proposed to be annually, co-ordinated by the developer and submitted to CoG and DWER for review. The report will compare the monitoring results with target design criteria and performance objectives and determine what, if any, further actions may be necessary, and provide ongoing assessment of the suitability of existing monitoring and reporting frequencies.

Assessment of performance compliance against water quality criteria will require careful consideration to account for inter seasonal and inter annual variability, and as both surface and groundwater quality will be a function of historical land use practices not only within the development area, but over the entire upstream catchment.

The proposed process for contingency action in the assessment of performance non-compliance is

- Assess if an isolated, development area or regional occurrence.
- Determine if due to the development or other external factors.
- Perform appropriate contingency action as required, which may include:
  a) Identify and remove any point sources.
  b) Reinforce Community Education/Awareness program.
  c) Review constructional, operational and maintenance (e.g. fertilising) practices.
  d) Consider alterations to POS areas including landscape regimes and soil amendment.
  e) Consider modifications to the stormwater system.
  f) Consider initiation of community based projects.
- Record in the annual report any action taken, and communicate findings with DWER and CoG.
- If necessary, inform residents of any required works and their purpose.

Monitoring and reporting outcomes will be used in a continual improvement capacity to review proposed WSUD, and inform the planning and design approaches for subsequent stages of development.

Suggested monitoring and reporting schedules are presented in Table 12.

TABLE 12: MONITORING SCHEDULE AND REPORTING

Monitoring Type	Parameter	Location	Method	Frequency and Timing	Reporting
Groundwater Level	Water Level (m AHD)	~2 locations	Electrical depth probe or similar	Monthly for 2 years	Annual assessment reports to be submitted to DWER & CoG for a 2 year period. Suitability of existing monitoring and reporting frequencies to be assessed annually with any modifications requiring agreement by all parties (DWER, CoG, & Developer)
Groundwater Quality	pH, EC Nitrogen Phosphorus	~2 locations	Pumped bore samples	Quarterly for 2 years (typically Jan, Apr, Jul & Oct)	

7. REFERENCES

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Geological Survey of Western Australia (1989) 1:50 000 Armadale Environmental Geology Mapping

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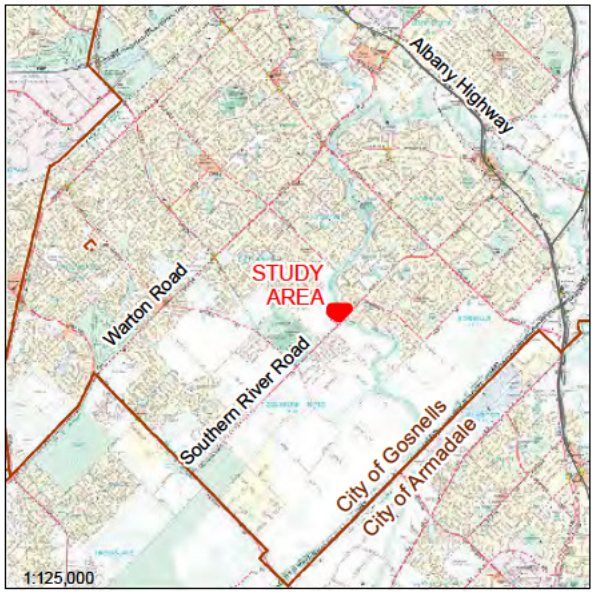
Western Australian Planning Commission (2003) Planning Bulleting No. 64: Acid Sulfate Soils. Western Australian Planning Commission, November 2003

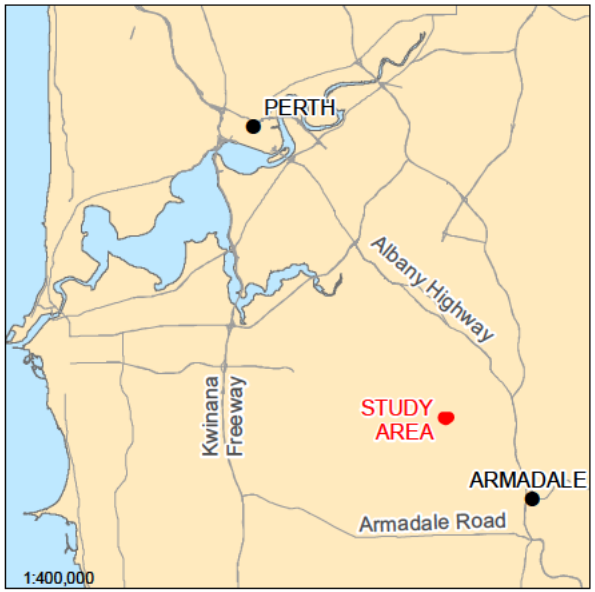
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Wong T.H.F. (2006) Australian Runoff Quality: A guide to Water Sensitive Urban Design. Engineers Australia.

FIGURES







Data Source: Nearmap (2017), Rowe Group (2017), Street Express (2012), DoP (2008)

Coordinate System: GDA 94, Zone 50

JDA

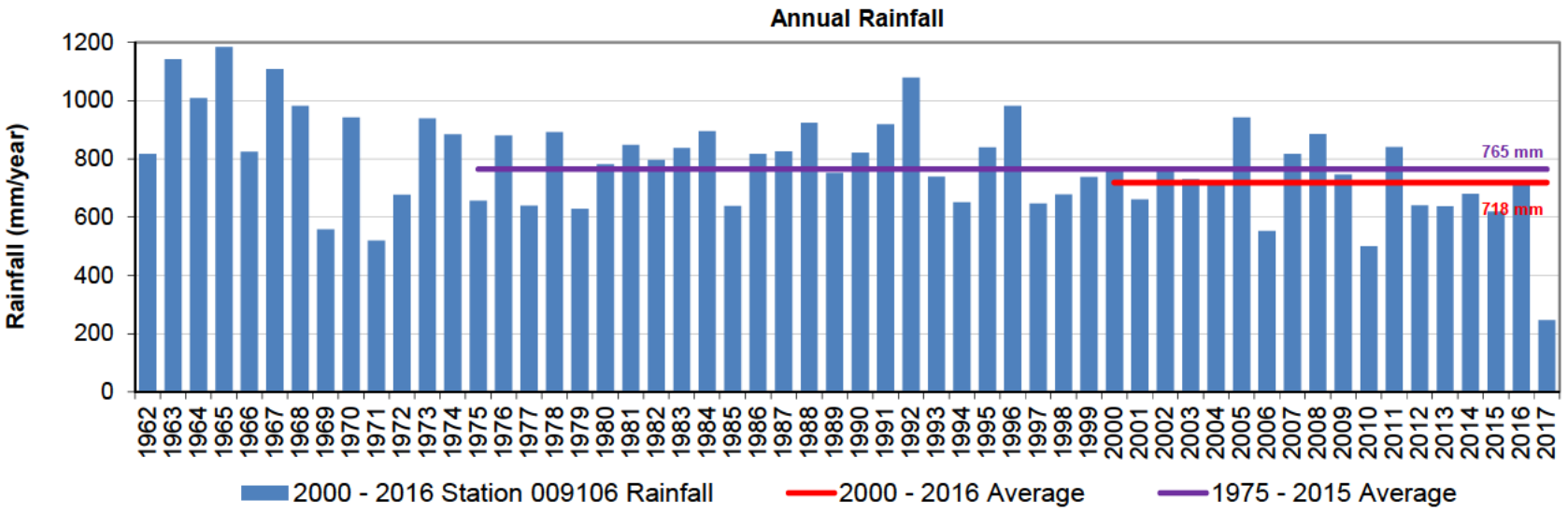
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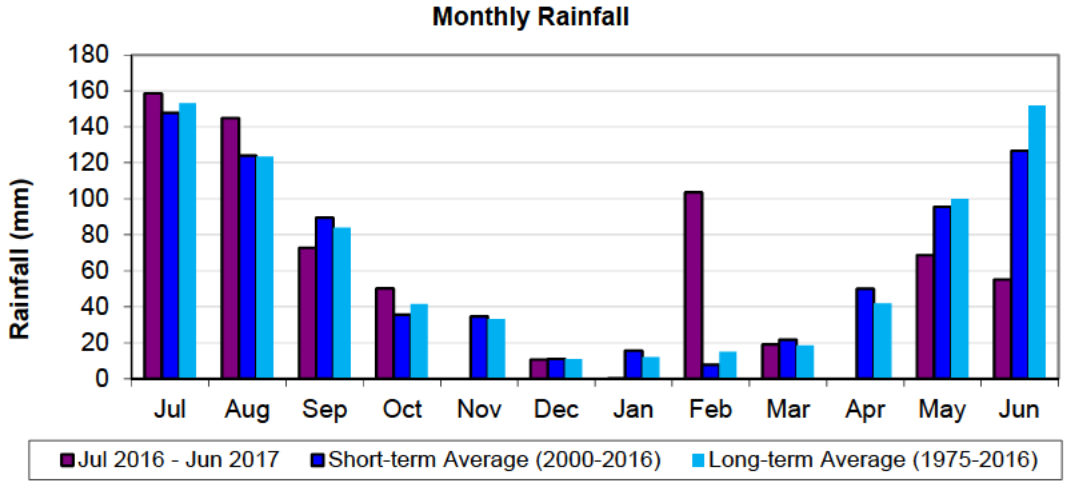
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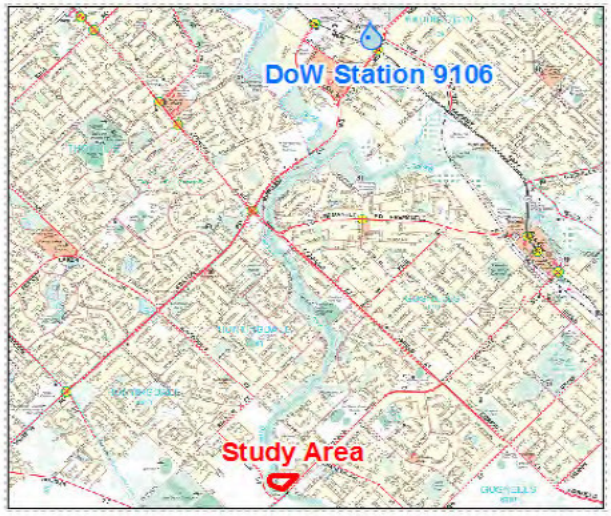
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Sabrechief Pty Ltd
Lot 1297 (No. 295) Southern River Road, Gosnells - LWMS
Figure 1: Location Plan







Data Source: http://www.bom.gov.au (accessed July 2017)

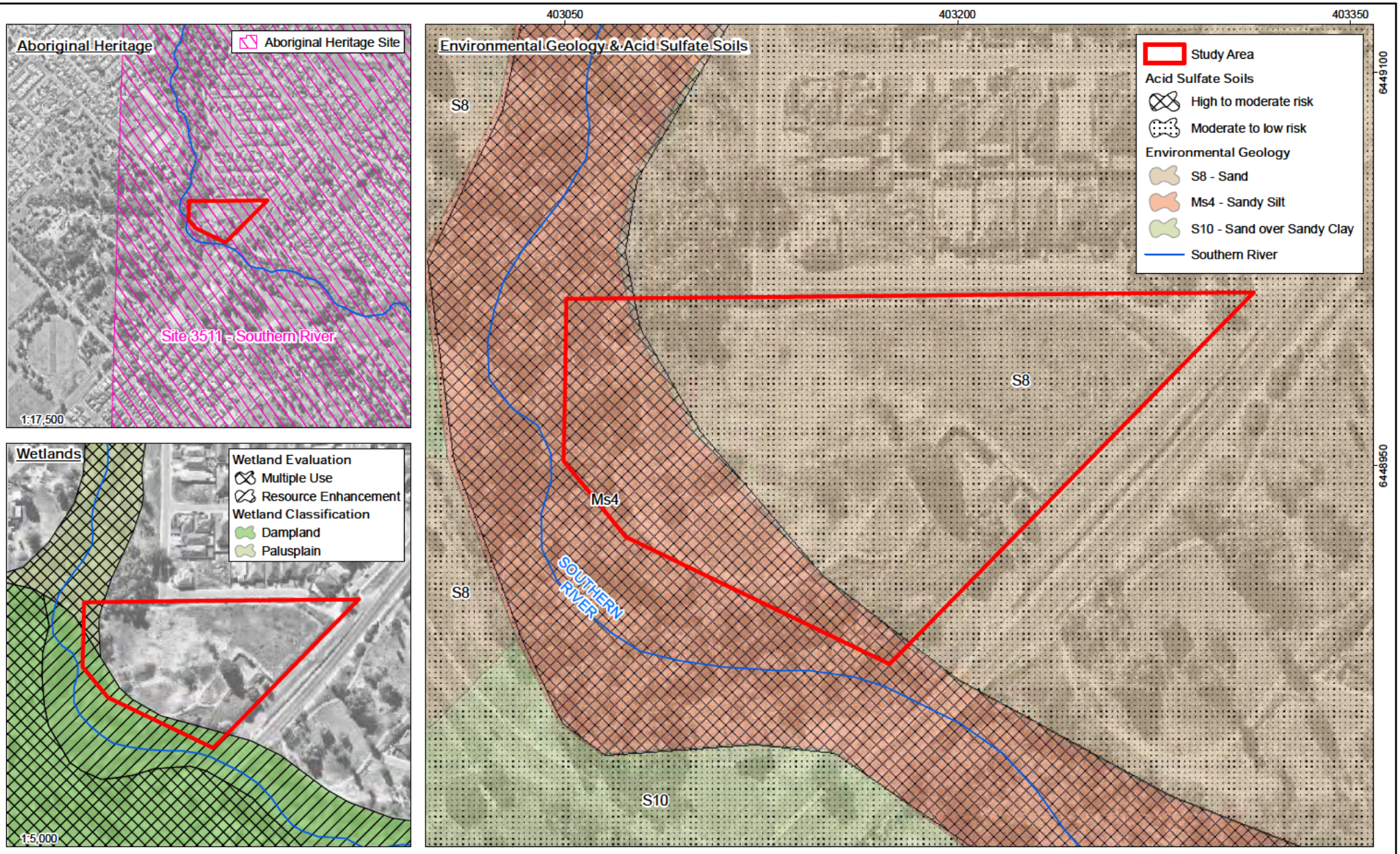
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Lot 1297 (No. 295) Southern River Road, Gosnells - LWMS

Figure 2: Annual and Monthly Rainfall



Data Source: Nearmap (2017), Rowe Group (2017), DER (2014), GSWA (1989), DAA (2015), DPAW (2016)

Coordinate System: GDA 94, Zone 50

JDA

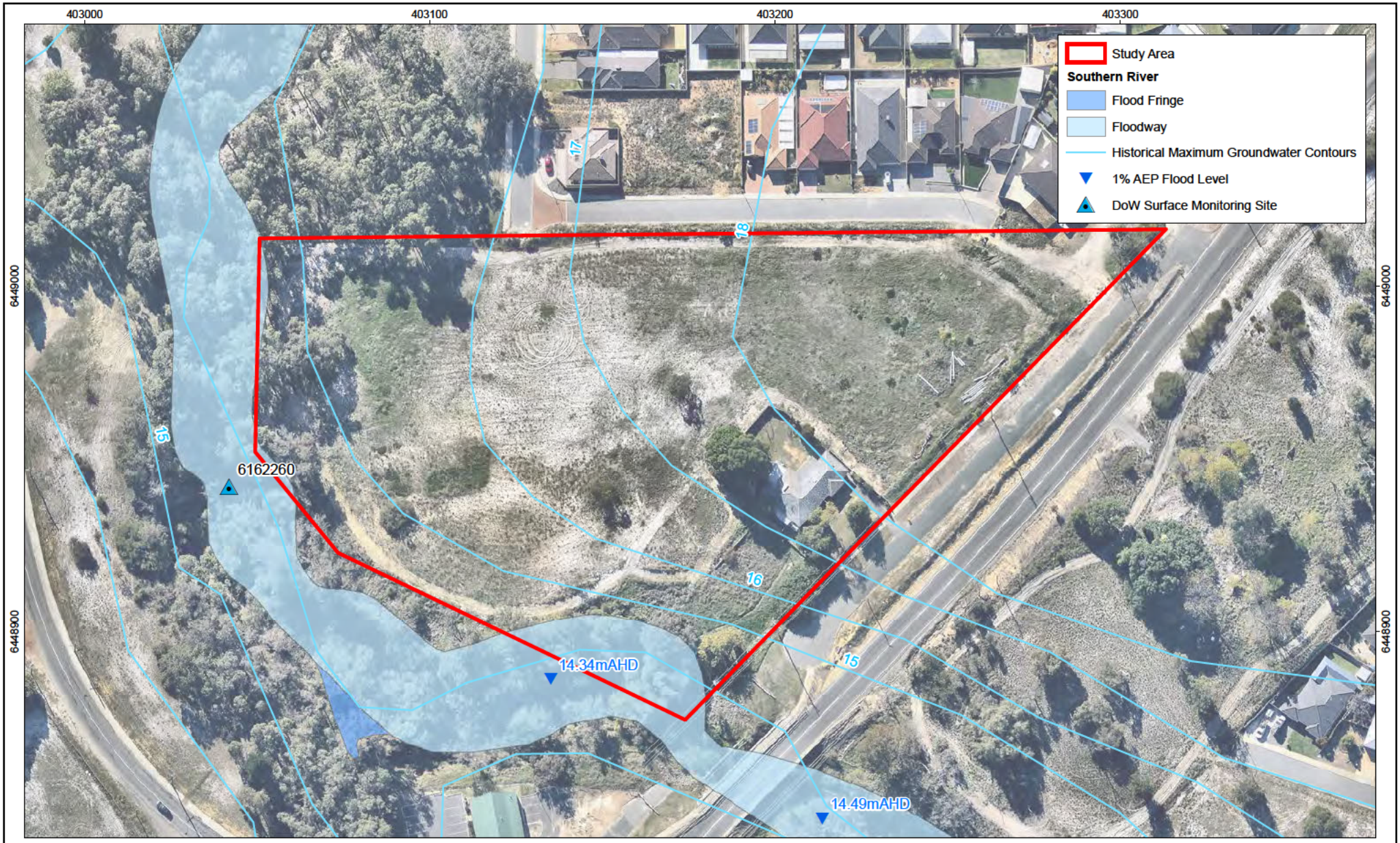
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0 40 80 120 160 Meters

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Lot 1297 (No. 295) Southern River Road, Gosnells - LWMS
Figure 3: Environmental Factors



Data Source: Nearmap (2017), Rowe Group (2017), DoW (1997 & 2009)

Coordinate System: GDA 94, Zone 50

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Scale: 1:1,500 @A4

0 20 40 60 80 Meters

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Lot 1297 (No. 295) Southern River Road, Gosnells - LWMS

Figure 4: Southern River Floodplain Mapping & Maximum Groundwater Contours



Data Source: Nearmap (2017), Rowe Group (2017), DoW (2009)

Coordinate System: GDA 94, Zone 50

JDA

Job No. J6442
Scale:1:1,500 @A4
0 20 40 60 80
Meters

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Sabrechief Pty Ltd
Lot 1297 (No. 295) Southern River Road, Gosnells - LWMS
Figure 5: Proposed Local Structure Plan



Flow is contained within lots and road pipe system and infiltrated in soakwells and in bioretention area.



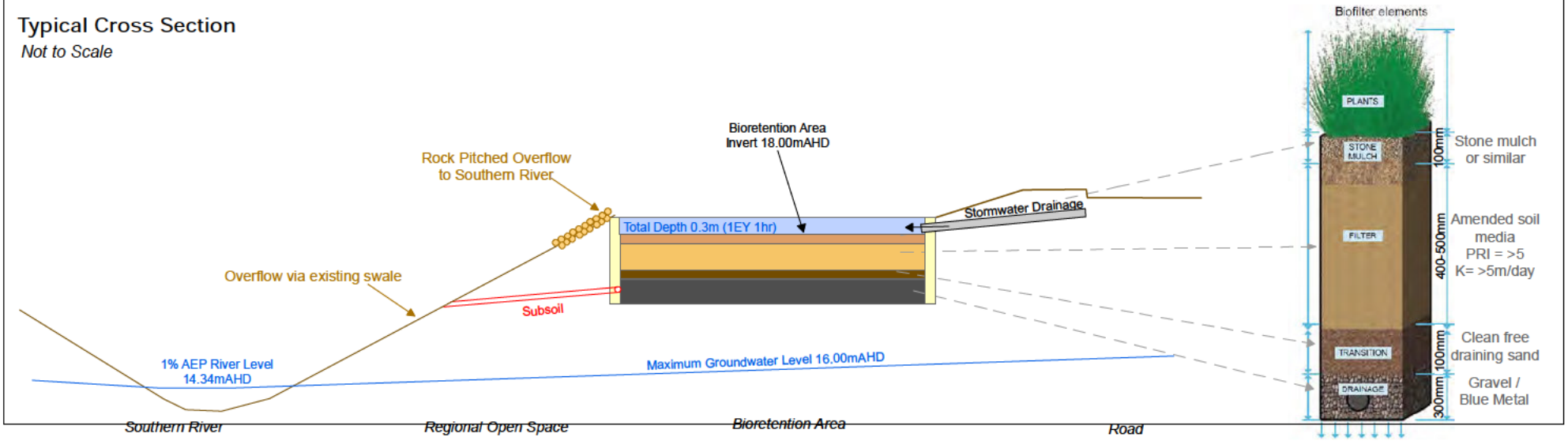
Flow is conveyed within road gutter and pipe system. Attenuation of flow is within bioretention area. Bioretention area will overtop via an overflow spillway into an existing swale towards the Southern River.



Flow is conveyed both overland and within pipe system. Attenuation of flow in bioretention area. Bioretention area will overtop via an overflow spillway into an existing swale towards the Southern River.

Typical Cross Section

Not to Scale



Note: Indicative bioretention area design only. Detailed design to be presented in UWMP.

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Lot 1297 (No. 295) Southern River Road, Gosnells - LWMS
Figure 6: Conceptual Stormwater Management & Event Plans

APPENDIX A

LWMS Checklist

LOCAL WATER MANAGEMENT STRATEGY: CHECKLIST (WAPC, 2008)

The following checklist provides a guide to items which should be addressed by developers in the preparation of Local Water Management Strategies for assessment by the local authority when an application for a structure plan is lodged.

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 descriptions of any proposed best management practices, e.g. multi-use corridors, community based-social marketing, water re-use proposals

Client: Sabrechief Pty Ltd **Date:** August 2017
Name of Plan: Lot 1297 (No. 295) Southern River Rd, Gosnells
Document No: J6442a
Contact: Matthew Yan, JDA Consultant Hydrologists
Address: Suite 1, 27 York St Subiaco WA 6008
Telephone: 9388 2436
Email: matt@jdahydro.com.au

Local Water Management Strategy Item	Required Deliverable	Deliverable LWMS Reference	☐	Comment
Executive Summary				
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Design elements and requirements for BMPs and critical control points	Executive Summary	✓	
Introduction				
Total water cycle management – principles & objectives Planning background Previous studies		Section 1.2 Section 1.1 n/a	✓	
Proposed Development				
Structure plan, zoning and land use. Key landscape features Previous land use	Site context plan Structure plan	Sections 2 & 3, Figs 1, 3 & 5	✓	
Landscape - proposed POS areas, POS credits, water source, bore(s), lake details (if applicable), irrigation areas	Landscape Plan	Sections 3 & 4, Fig 6	✓	

Local Water Management Strategy Item	Required Deliverable	Deliverable LWMS Reference	☐	Comment
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?	Existing Site Characteristics	Section 2, Figs 1 – 4	✓	
Site Conditions - existing topography / contours, aerial photo underlay, major physical features	Site Condition Plan	Section 2.1, Fig 1	✓	
Geotechnical - topography, soils including acid sulfate soils and infiltration capacity, test pit locations	Geology Description	Sections 2.4 & 2.5, Fig 3	✓	
Environmental - areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental Plan plus supporting datasets where appropriate	Sections 2.6, Fig 3	✓	
Surface Water – topography, 100 year floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface Water Plan	Sections 2.7 & 2.8, Fig 4	✓	
Groundwater – topography, pre development groundwater levels and water quality, test bore locations	Groundwater Plan	Section 2.9, Fig 4	✓	
Water Use Sustainability Initiatives				
Water efficiency measures – private and public open spaces including method of enforcement		Section 4	✓	
Water supply (fit-for-purpose strategy), agreed actions and implementation. If non-potable supply, support with water balance		Section 4.2	✓	
Wastewater management		Section 4.3	✓	
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		Section 5.1, Fig 6	✓	
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		Section 5.1, Fig 6	✓	

Local Water Management Strategy Item	Required Deliverable	Deliverable LWMS Reference	☐	Comment
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		Sections 5.1 to 5.3, Fig 6	✓	
Groundwater Management Strategy				
Post development groundwater levels, fill requirements (including existing and likely final surface levels), outlet controls, and subsoils areas/exclusion zones	Groundwater Plan	Section 5.2	✓	
Actions to address acid sulfate soils or contamination		Section 5.4.2	✓	
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.		Section 6.2	✓	
Monitoring				
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		Section 6.4	✓	
Implementation				
Developer commitments		Section 6.1	✓	
Roles, responsibilities, funding for implementation		Section 6.1	✓	
Review		Section 6.1	✓	

Western Australian Planning Commission (2008), *Better Urban Water Management*, Perth.

APPENDIX B

DWER and CoG Personal Communication

Angela Shirazee

From: [redacted]

Hi Dumal,

Thank you for your comments.

To satisfy both CoG and DoW criteria, the following will be adopted:

- JDA will calculate the critical storm duration and size the detention basin and outflow based on post-development not exceeding pre-development;
- JDA will also ensure that pre-development flow for the 48hr duration for Southern River is not exceeded.

Should you have any queries or wish to discuss this further, please don't hesitate to contact me, thanks.

Regards,

[redacted]

JDA CONSULTANT HYDROLOGISTS
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[redacted]

Hi Angela,

My comments are given below in RED.

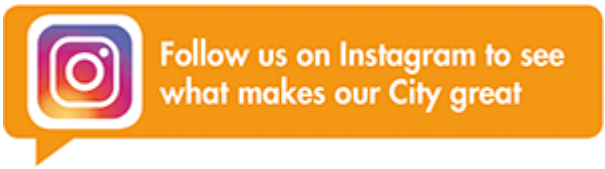
Thank you,

[redacted]

CITY OF GOSNELLS

2120 Albany Highway Gosnells WA 6110
PO Box 662 Gosnells WA 6990

T 08 9397 3264 | **F** 08 9397 3333 | **M** 0407 987 450
www.gosnells.wa.gov.au



[redacted]

Hi All,

Thank you for your comments in regards to the Lot 1297 Southern River Road, Gosnells.

We confirm preparation of a LWMS for this site.

Proposed approach for water management strategy is as follows:

- Lot Drainage
  - All lots will retain and infiltrate the 1EY 1hr rainfall event (first 15mm) on lots within soakwells.
  - All lots will have an overflow drainage connection to the street drainage for events that exceed the 1EY up to the 1% AEP.
- Street Drainage
  - 1EY 1hr (first 15mm) from roads to be retained and treated on site within a bio-retention area or swale (designed in accordance to FAWB & DoW biofilter guidelines).
  - Events greater than the 1EY up to the 1% AEP will be managed within a bio-retention/detention basin within the POS. Overflow will be via a weir into a swale with appropriate erosion control to Southern River.
- Stormwater Detention/Discharge
  - 1% AEP critical storm duration of the Southern River is 48hr. (Provide the reference?)Development is to show no increase in the 1% AEP 48hr stormwater discharge from the developed site compared to pre-development conditions. If you follow the above dot points then I cannot see a point of doing this. Calculate the critical storm duration, peak flow rates for the development site and maintain the same flow rates at the post development stage to calculate the storage requirement. This is all we need to do.
  - Stormwater for events >1EY is to be detained on site within the bioretention/detention basin and be discharged into the Southern River at the pre-development rate.

Can you please confirm the approach summarised above is acceptable for this LWMS? Yes. Follow the BUWM check list and provide all the details as per the checklist.

Should you have any queries or wish to discuss this further, please don't hesitate to contact me, thanks.

Regards,

[redacted]

JDA CONSULTANT HYDROLOGISTS
Suite 1/27 York St, Subiaco WA 6008 | PO Box 117, Subiaco WA 6904 |
Direct: (08) 6380 3412 | Reception: (08) 9388 2436 | Fax: (08) 9381 9279 | www.jdahydro.com.au

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[redacted]

Dear all,

I agree with your comments [redacted] and I will see if I can get some references for these criteria from our Floodplain Management Branch. I would just add that if the proponent does not want to undertake this level of investigation then the default positon would be for pre-development flows to be maintained. This, however, may result is the take of a large parcel of land for detention of the 1% AEP.

[redacted]

[redacted]

Thank you.

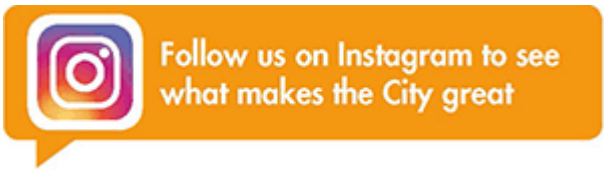
I have gone through this document few times and provided comments on it. It is not implemented yet and it is still in draft format. It doesn't talk anything about discharges without compensating including the first 15mm up to 1% EAP flood event. I agree with you this new draft criteria has given more flexibility to think bit widely than earlier. But it is less practical. Where did you get that 48 hours critical duration time. Can you please forward me that reference link for my future assessments? Do we have the published catchment plan for this area ? It has been clearly mentioned that "alteration to the pre-development flood regime is dependent on the constraints of the catchment receiving environments and requires assessment of the capacity of the entire system and impacts from the change in flood regime to the satisfaction of the DoW and other relevant agencies". This task is not easy to do by one small developer and it would be very expensive unless the flood level data is readily available with DoW after doing a complete modelling to cover the entire system under the criteria has been discussed as per the new draft decision process.

Any way I hope, the City of Gosnells has now provided enough advices to JDA to move forward with the LWMS as per the DWER below request. Further comments can be provided after completing the assessment under first submission of the LWMS.

Thank you,

[redacted]

2120 Albany Highway Gosnells WA 6110
PO Box 662 Gosnells WA 6990
[redacted]
www.gosnells.wa.gov.au



[redacted]

[redacted]

Thank you for your emails regarding Lot 1297 Southern River Road Gosnells.

Further to [redacted] response below, the recommended LWMS (which can be a very concise document that only addresses issues relevant to the site) should also address the following advice that was received from the Department of Water and Environmental Regulation's (DWER) floodplain management section;

- Demonstration that the proposed development will not result in increased stormwater discharge for the critical duration of the receiving waterway 1% AEP flood. Case-by-case adjustments of this requirement may be considered based on:
  - Size of the site;
  - Level of existing flood risk downstream of the site;
  - Location relative to the downstream end of the receiving waterway.

  For this development, Southern River is the receiving waterway and it has an approximate critical duration of 48 hours for the 1% AEP flood. The Proponent will need to show no increase in the 1% AEP stormwater discharge from the developed site compared to the undeveloped site for a 48 hour duration storm.

In regards to the most current DoW recommended stormwater management criteria please refer to the *Decision Process for stormwater management in WA: Draft for consultation* (DWER, 2016).

Water Resource Advice Only
The Department of Water has recently merged with the Department of Environment Regulation and Office of the Environmental Protection Authority to create the new agency Department of Water and Environmental Regulation. The former agencies are in the process of amalgamating their functions. Until this fully occurs, please note that the advice in this correspondence pertains only to water resource matters previously dealt with by the Department of Water.

Kind regards,
Carlie

[redacted]

Department of Water and Environmental Regulation

[redacted] www.dwer.wa.gov.au

Twitter: @DWER_WA



[redacted]

[redacted]

Thank you for your reply.

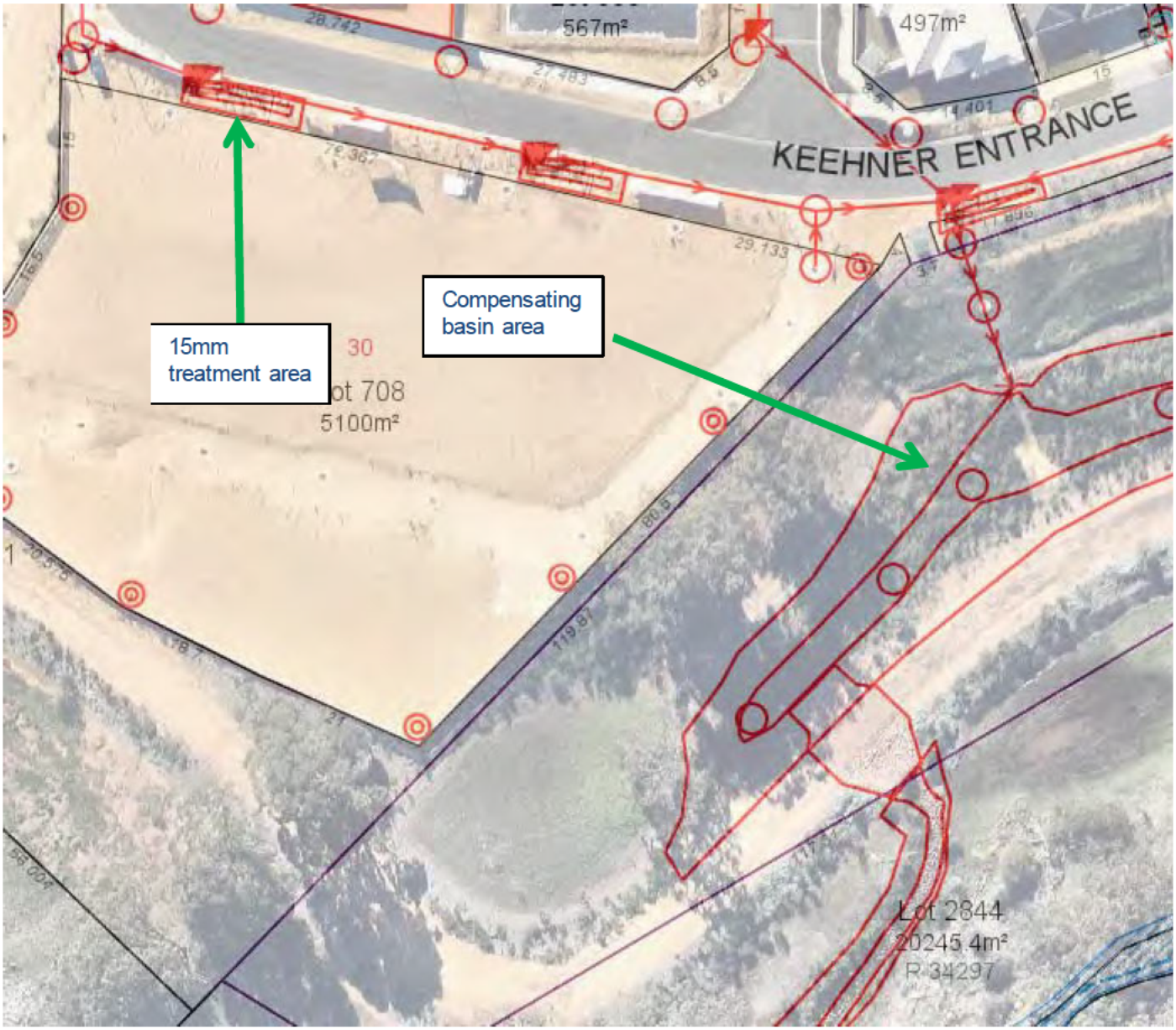
Let's go with the LWMS. When it comes to subdivision stage, the City can decide whether the UWMP is required or not.

I understand the 15mm treatment criteria. Even, the City of Gosnells does not allow to discharge any flows greater than 15mm directly without compensating the additional runoff as we need to meet "Pre is equal Post" criteria too. If any development does not follow the Pre is equal Post criteria, then it is a kind of direct discharge. If I am not correct, can you please send me any approved references that you follow, so that I can update the City of Gosnells drainage assessment criteria accordingly. Currently, the City of Gosnells follows BUWM and all the other common references.

I have copied a one screen shot from one of our recent development which shows how the City of Gosnells met the both first 15mm treatment criteria and the Pre is equal Post criteria onsite. This development is very similar to the one in Lot 1297 which interface with foreshore and finally discharge in to the river.

[redacted]

Lot 1297 can follow a very similar approach. However by considering the size of development, we can combine the both storage and treatment areas together in to one place in this development. Happy to discuss further in detail.



Thank you,

[redacted]

CITY OF GOSNELLS

2120 Albany Highway Gosnells WA 6110

[redacted]

www.gosnells.wa.gov.au

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[redacted]

[redacted]

We should stick by requirements for a LWMS. Needs to address:

- Interface with foreshore;
- Treatment of first 15mm;
- Transport of overflow to river and how erosion is managed.

We could leave out the foreshore assessment stuff as there is an existing foreshore reserve and it's unlikely we would get more reserve.

Explain to Dumal that we cannot support direct discharge as first 15mm needs treatment and erosion needs to be controlled for overland flows to river. Also explain that we would not request UWMP as we are not involved in UWMP stage.

Cheers

[redacted]

Department of Water

[redacted]

[redacted]

Hi Carlie,

I had a chat with Angela from JDA consultant regarding the above mentioned development. This development is going to create only 21 lots under one owner ship. As per the guidelines available, this development may not require even a UWMP. We normally request an UWMP if it generates more than 25 lots. If the development is under few different ownerships then it is worth to go for an LWMS in order to resolve some of the practical difficulties between ownerships. But we don't have any of those issues with this development. This development is straight forward only 12500 m2 of developable area under one ownership. If we consult the DPaW from now, I have a confidant that the drainage of this small site can be easily address through UWMP without spending too much money unnecessarily.

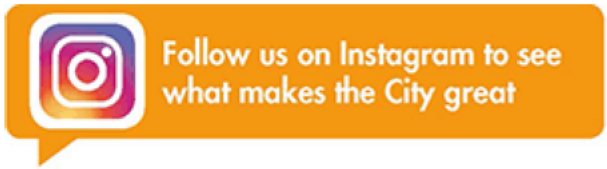
The most critical element in the LWMS is likely finished surface levels. But for this site, the finished floor levels are already locked by the existing road levels (Thomson Way). Then, If DoW give us written approval for direct discharges from the site, what else JDA needs to address under drainage by providing LWMS and after UWMP ?

Thank you,

[redacted]

CITY OF GOSNELLS

2120 Albany Highway Gosnells WA 6110
PO Box 662 Gosnells WA 6990
[redacted]
www.gosnells.wa.gov.au



[redacted]

[redacted],

Please find the advice for an LWMS from DoW below.

Regards,

[redacted]

JDA CONSULTANT HYDROLOGISTS
Suite 1/27 York St, Subiaco WA 6008 | PO Box 117, Subiaco WA 6904 |
[redacted]

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[redacted]

Subject: RE: Lot 1297 Southern River Rd, Gosnells - Stormwater Management

[redacted]

As stated in my response below, the DoW would recommend that a LWMS is prepared for the site.

Regards,
[redacted]

[redacted]

[redacted]
Subject: RE: Lot 1297 Southern River Rd, Gosnells - Stormwater Management

Hi Carlie,

Thank you for your email, we note that you are still awaiting advice from Floodplain Planning Section.

Could you please advise whether an LWMS will be required over this lot? City of Gosnells have advised that a UWMP may be required in future, but have stated that a Stormwater Management Plan should suffice at this level dependent on advice from DoW.

Should you have any queries or wish to discuss this further, please don't hesitate to contact me, thanks.

Regards,

[redacted]

JDA CONSULTANT HYDROLOGISTS
Suite 1/27 York St, Subiaco WA 6008 | PO Box 117, Subiaco WA 6904 |
[redacted]

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[redacted]

[redacted]

Thank you for your email below.

The Department of Water (DoW) has reviewed the limited information provided and advises the following;

- The DoW considers that the proposed Structure Plan Amendment could be supported by a Local Water Management Strategy for the subject site only since the site will have no stormwater interactions with the adjacent existing development. However, the City of Gosnells should also be consulted as to their requirements.

- The LWMS will need to include a biophysical assessment/foreshore area report, in accordance with the DoW's Operational Policy 4.3, in order to determine an appropriate foreshore reserve area.

- The DoW is currently awaiting internal advice from our Floodplain Management Section on whether post-development flows to Southern River can be increased from pre-development flows.

Please note that the DoW had not yet responded to your request as we are awaiting Flood advice as to whether the River at this location has the capacity to receive increased flows. The DoW will therefore update its advice once this information has been received.

Sincere regards,

Carlie

[redacted]

Department of Water

[redacted]

Note: Office hours are 8:30 am to 4 pm Monday - Friday

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Government of Western Australia
Department of Water

[redacted]

Subject: Lot 1297 Southern River Rd, Gosnells - Stormwater Management

Hi Carlie,

I am currently seeking some advice in regards to stormwater management of Lot 1297 Southern River Rd in Gosnells, which is covered by the Chamberlain ODP (Lot 1297 is located along the southern boundary- see attached). This ODP was accompanied by a Drainage and Nutrient Management Plan, but did not encompass Lot 1297. A Structure Plan Amendment is to be submitted for this lot to increase the residential density from R20 to R30. Could you please confirm whether an LWMS will be required for this Lot to accompany the structure plan amendment or if a letter addressing a Stormwater Management Strategy suffice (detail design to be provided in a UWMP at subdivision stage)?

We have also been advised by City of Gosnells that existing drainage systems along Thompson Way and Southern River Road are at capacity and have been recommended to allow stormwater runoff events greater than the 1yr ARI to overflow into the Southern River. Could you please advise if this stormwater strategy is acceptable by DoW?

Please don't hesitate to contact me should you have any queries or wish to discuss this further, thanks.

Regards,

[redacted]

JDA

JDA CONSULTANT HYDROLOGISTS

Suite 1/27 York St, Subiaco WA 6008 | PO Box 117, Subiaco WA 6904 |

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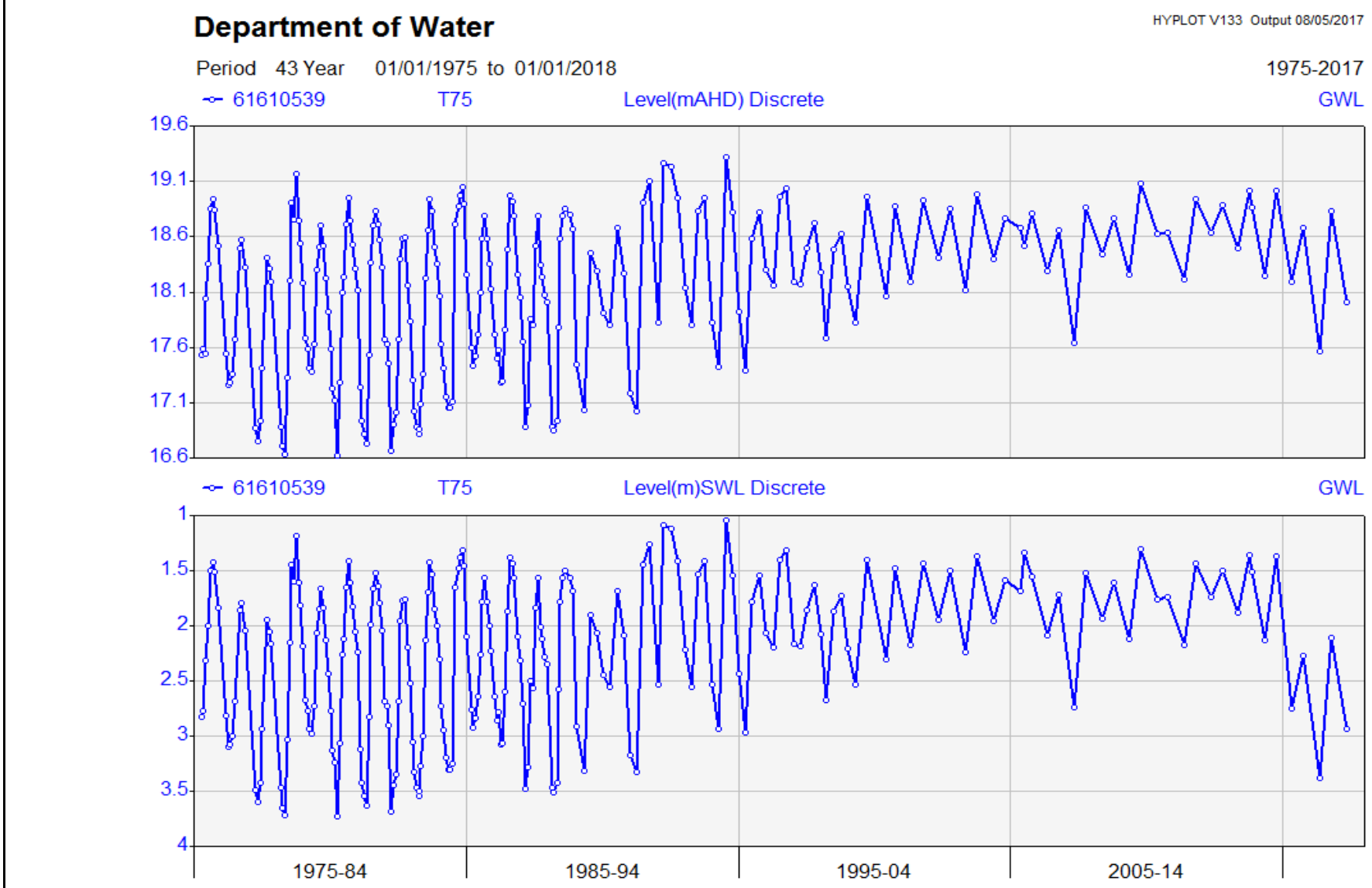
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APPENDIX C

DWER Bore T75 (WIN Site ID: 4880) Hydrograph



Data Source: DWER Water Information Reporting Portal (June, 2017)

Job No. J6442

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Rowe Group

Lot 1297 (No. 295) Souhern River Road, Gosnells - LWMS

Appendix C: DWER Bore T75 (WIN Site ID: 4880) Hydrograph

APPENDIX D

Aquifer Allocation Report (27 June 2017)

Government of Western Australia
Department of Water

Resource Allocation Report

(All Volumes in kL)

Water Online

Data Last Refreshed : **27 Jun 2017**
Rows Returned :**1**

As Of Date : 27 Jun 2017
Resource Type : All
Allocation Planning Area : All
Management Area : Perth
Management Sub Area : City of Gosnells
Allocation Category : Total Licensable
Component : General

Management Area	Management Sub Area	Resource	Component	Component Status	Allocation Limit	Allocated Volume	Committed Volume	Remaining Volume	% Allocated and Committed	Additional Requested
Perth	City of Gosnells	Perth, City of Gosnells, Perth - Superficial Swan	General	G2	5,484,500	3,319,071	0	**2,165,429**	**60.52%**	209,059
					5,484,500	**3,319,071**	**0**	**2,165,429**	**60.52%**	**209,059**

REGISTER EXTRACT INFORMATION

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APPENDIX E

Structure Plan Amendment Concept (Rowe Group, 2017)

Planning Design Delivery



LEGEND

- Subject Site
- 7 Existing Lot Numbers
- 7 Proposed Lot Numbers
- Existing Boundaries
- Road Widening
- Land Reserved for Parks and Recreation
- Residential R30
- Public Open Space

0 25 50 Metres

REVISIONS

Rev	Date	Drawn
A	2016.09.19	M. Sullivan
B	2017.08.03	F.Chesterman

ROWEGROUP
PLANNING DESIGN DELIVERY

w: www.rowegroup.com.au
e: info@rowegroup.com.au
p: 08 9221 1991

Date Drawn:	2017-08-03
Job Ref:	8619
Scale:	1:1,000 @ A3
Client:	Sabrechief Pty Ltd the Canci Investment Trust
Designer:	F. Chesterman
Drawn:	M. Sullivan
Projection:	MGA50 GDA94
Plan ID:	8619-CON-01-B

Cadastre supplied by Water Corporation of WA

Structure Plan Amendment Concept

Lot 1297 Southern River Road Gosnells

N:\TOWN PLANNING\8000-8999\8619\DRAFTING\A-CAD\8619_CON01B_20170803 GOSNELLS (SUBDIVISION CONCEPT).DWG
Forbes Chesterman 4 August 2017

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All areas and dimensions are subject to survey.

APPENDIX F

INFIL Modelling Results

INFIL v3.1 - INF 2.02

JDA March 2007

Input Parameters

Catchment

Catchment area	0.39	[ha]
Runoff coefficient	1	

Soil

Hydraulic conductivity	5	[m/d]
Soil suction	-5	[cm]
Effective porosity	0.2	

Basin

Base length	See Basin Data entry on the right	
Base width		
Average side slope		
Total depth		
Infiltration area	0.01	[ha]

Initial Conditions

Water depth in basin	0	[m]
Wetting front depth	0	[m]
Soil saturation	0.2	

Project Name

J6442 - Lot 1297 Southern River, Gosnells

Project Description

Disposal of stormwater runoff into a swale for the 1EY 1hr storm event.

Function Keys

Auto Calc On:	Ctrl+o
Auto Calc Off:	Ctrl+f
Calc Now:	F9
Help On:	Ctrl+h
Help Off:	Ctrl+j

Design Storms / Maximum Levels

	Storm	Duration [hrs]	Intensity [mm/hr]	ARI [yrs]	Level [m]	Volume [m^3]	Area [m^2]	Wetting Front [m]
	1	0.5			0.00	0	0	0.0
	2	1	17.4	1	0.28	36	130	1.7
	3	3			0.00	0	0	0.0
	4	6			0.00	0	0	0.0
	5	12			0.00	0	0	0.0
	6	24			0.00	0	0	0.0
	7	48			0.00	0	0	0.0
	8	72			0.00	0	0	0.0
Critical	**2**	**1**	**17.4**	**1**	**0.28**	**36**	**130**	
Plot	5	12	0	0	0.00	0	0	

Basin Stage Volume Area Data

Depth [m]	Volume [m^3]	Area [m^2]
0.00	0	130
0.02	2	130
0.04	5	130
0.05	7	130
0.07	9	130
0.09	11	130
0.11	14	130
0.12	16	130
0.14	18	130
0.16	21	130
0.18	23	130
0.19	25	130
0.21	28	130
0.23	30	130
0.25	32	130
0.26	34	130
0.28	37	130
0.30	39	130

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