



Sunshine Coast City Hall

Lot 6 Maroochydore City Centre, Maroochydore

Stormwater Management Plan

Sunshine Coast Regional Council

9th August 2019

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

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EXECUTIVE SUMMARY

ADG Engineers (Aust.) Pty Ltd has been engaged by Sunshine Coast Regional Council to prepare a Stormwater Management Plan (SMP) for submission to Economic Development Queensland in support of a Development Application for a proposed commercial building development, henceforth referred to as *the site*. The site is located at Lot 6, Maroochydore City Centre, Maroochydore, which is within the Maroochydore Priority Development Area.

The proposed development described by Cottee Parker Architects architectural drawings is for the proposed new Sunshine Coast City Hall. The development comprises of nine (9) level structure with three (3) levels of above ground carparking, five (5) levels of dedicated commercial space and a rooftop café/restaurant.

This report has been updated to harmonise with the Maroochydore City Centre Stage 1 Local Flooding Technical Memorandum in regards to the minimum floor level to achieve flooding immunity. For more information refer to **Appendix D**.

The report comprises of stormwater quality and quantity assessments for the proposed development. No onsite stormwater detention is required, and the development shall have a minimum floor level of 3.72m AHD for flood immunity. The quality assessment was undertaken to determine the required stormwater treatment measures to meet the State Planning Policy 2017. In order to comply with the relevant standards, the following Stormwater Quality Improvement Devices are proposed:

Alternative 1

- Three (3) OceanGaurd filter baskets to be placed within pits on the ground / podium levels; and
- 5 x 690mm Ocean Protect StormFilters (or approved equivalent); and
- A 100kL rain water tank to collect and retain roof water flows for reuse within the building and landscaped areas.

Alternative 2

- A 20m² Bioretention basin; and
- A 100kL rain water tank to collect and retain roof water flows for reuse within the building and landscaped areas.

1 INTRODUCTION

1.1 General

The purpose of this SMP is to provide advice as to the development proposal as detailed in the architectural drawings in **Appendix A**. The works described herein are subject to further approvals and cover works required to service the proposed development with regard to stormwater treatment.

1.2 Background Information

This report was compiled using information from the following sources:

- ▶ Architectural plans supplied by Cottee Parker Architects (**Appendix A**);
- ▶ Detailed survey plan prepared by Project Urban (**Appendix B**)
- ▶ Technical Memorandum: Maroochydore City Centre Flooding and Stormwater Management Consideration for Stage 1 prepared by Cardno (**Appendix D**)
- ▶ Maroochydore City Centre Stage 1 Construction Plans (not provided as part of this report)

1.3 Property Details

Lot 6 of Maroochydore City Centre is part of the master planned Maroochydore City Centre development area. The site currently comprises of a vacant land with no dwellings or structures. The site is covered with poor to medium grass coverage. The site is bounded by South Sea Islander Way to the north-east, First Avenue to the south-east, Future Way to the south-west and Lightning Lane to the north-west. The site has a boundary level generally between 3.4mAHD and 3.5mAHD and falls towards the centre of the site's Future Way frontage to a minimum level of 2.95mAHD.

The existing land titles that make up the site are given in **Table 1**. The current condition of the site is shown in **Figure 1**.

Table 1 - Property Details

Property	Site Details
Title	Lot 80 on SP305312
Street Address	Lot 6 Maroochydore City Centre, Maroochydore QLD 4558
Total Site Area	2,942m ²



Figure 1 - Site Locality Plan (Nearmap 30.05.2019)

2 PROPOSED DEVELOPMENT

The proposed development described by Cottee Parker Architects architectural drawings is for the proposed new Sunshine Coast City Hall. The development comprises of nine (9) level structure with three (3) levels of above ground carparking, five (5) levels of dedicated commercial space and a rooftop café/restaurant.

Table 2 - Proposed Development Area Fraction Impervious

Description	Area (m ²)	Percentage Impervious (%)
Roof Area	1,146	100%
Podium Area	1,264	85%
Ground Floor Area	532	85%
Total Development	2,942	90.8%

Refer to the architectural drawings in **Appendix A** for further information regarding the proposed development.

2.1 Existing Stormwater Infrastructure

Stormwater Connection has been provided to the site as part of the subdivision process. The discharge arrangement consists of the following:

- ▶ A 600x900mm field inlet pit located on the site's Lightning Lane frontage 22.5m south of the site's northern corner with a DN375 stormwater connection to the stormwater reticulation network within Lightning Lane. The invert level of the pit is 1.87mAHD.
- ▶ A 600x900mm field inlet pit located on the site's Lightning Lane frontage in the western corner of the site with a DN375 stormwater connection to the stormwater reticulation network within Lightning Lane. The invert level of the pit is 1.57mAHD.
- ▶ A 600x900mm field inlet pit approximately centrally located on the site's Future Way frontage with a DN375 stormwater connection to the stormwater reticulation network within Future Way. The invert level of the pit is 1.52mAHD.
- ▶ A 900x900mm field inlet pit located on the site's First Avenue frontage 10m south of the site's eastern corner with a DN450 stormwater connection to the stormwater reticulation network within First Avenue. The invert level of the pit is 1.60mAHD.

Refer to the detailed survey prepared by Project Urban in **Appendix B** for further details regarding the existing stormwater infrastructure surrounding the subject site.

2.2 Existing Services

The contour and detail survey for the site has identified the following infrastructure directly available to the site in confirmation to the Maroochydore City Centre subdivision operational works drawings by Cardno. The operational works design for the site included a multitude of services allowing for the accommodation of the proposed building development outlined in this report. The following services have been specifically identified:

- ▶ Four (4) optional drainage discharge points as listed above.
- ▶ Two (2) water supply points inside the boundary.
- ▶ Two (2) sewerage reticulation discharge points.

- › Pneumatic waste
- › Electrical and Telecommunication
- › Refer to the detailed survey prepared by Project Urban in **Appendix B** for further details regarding the existing services for the subject site.

2.3 External Catchments

Upon review of the detailed survey and grading plan for the Maroochydore City Centre Stage 1 works, it has been confirmed there are no external catchments which discharge flows into the proposed development site.

3 STORMWATER QUANTITY ASSESSMENT

3.1 Stormwater Detention

As the subject site forms part of the Maroochydore City Centre development masterplan, no on-site stormwater detention is required. As the site is located within close proximity to a downstream waterway and mouth of the Maroochydore River, it is beneficial to release site stormwater without detention to allow site flows to be discharged prior to the larger upstream catchment flows being conveyed through the system. The design of the Maroochydore City Centre stage 1 works stormwater has allowed for a fully developed site (95% fraction impervious) which further supports the requirement for no detention as the downstream infrastructure has capacity to cater for a fully developed site.

3.2 Flooding Considerations

As part of the masterplan subdivision to create that Maroochydore City Centre, significant upgrades were made to the drainage within the area to reduce the flooding impacts on the area. The Technical Memorandum: Maroochydore City Centre Flooding and Stormwater Considerations for Stage 1 prepared by Cardno, summarises the flooding and stormwater management strategies for the Maroochydore City Centre. As part of the stage 1 works upgrades to the Maud Canal have been completed to increase the flood conveyance capacity. These works have ensured the proposed development site is not subject to flood inundation. The Technical Memorandum advises that the minimum floor level for developments within the Maroochydore City Centre shall be 3.32mAHD to provide immunity to the 1% AEP climate change flood level in Maud Canal. However, to be consistent with future stages of the Maroochydore City Centre development, a minimum floor level of 3.72mAHD be adopted.

For further information regarding flooding considerations refer to the Technical Memorandum: Maroochydore City Centre Flooding and Stormwater Considerations for Stage 1 prepared by Cardno **Appendix D**.

4 STORMWATER QUALITY ASSESSMENT

4.1 Stormwater Quality Objectives

This assessment identifies issues relating to stormwater quality runoff and assesses possible methods of treatment if required. The aim of this section is to determine practical approaches to achieving improvements in the quality of the stormwater run-off from the site that can be readily implemented.

The proposal includes a development works for urban purposes that involve disturbing more than 2,500m² of land. Hence, the development is classed as 'high risk' for water quality and State Planning Policy (SPP) July 2017 applies. The SPP July 2017 suggests the development aims to:

- Avoid or otherwise minimises adverse impacts on the environmental values of receiving waters, arising from:
 - altered stormwater quality or flows, and
 - wastewater (other than contaminated stormwater and sewage), and
 - the creation or expansion of non-tidal artificial waterways, and
- Demonstrate compliance with the SPP code - Water quality (Part 3).

Part 3 Table B of SPP July 2017 suggests 'Post Construction Phase – Stormwater Management Design Objectives' as:

Table 3 - South East Queensland (SEQ) Targets

Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)	Gross Pollutants >5mm
80% Removal	60% Removal	45% Removal	90% Removal

The objective is to provide the following:

- Nitrogen and Phosphorous removal
- Gross Pollutant and Suspended Solids Removal
- All of the site's impervious areas discharge to suitable treatment device/s
- Treatment device selection criteria are to be in accordance with Industry Best Practice and, WSUD Engineering Guidelines
- Provide engineering diagrams of the stormwater quality treatment of the proposed development

4.2 Stormwater Quality Improvement Devices (SQID's)

The proposed stormwater quality treatment measures for the development will consist of:

- **Alternative 1**
 - Three (3) OceanGaurd filter baskets to be placed within pits on the ground / podium levels; and
 - 5 x 690mm Ocean Protect StormFilters (or approved equivalent); and
 - A 100kL rain water tank to collect and retain roof water flows for reuse within the building.

Alternative 2

- A 20m² Bioretention basin; and
- A 100kL rain water tank to collect and retain roof water flows for reuse within the building.

4.3 Rainwater Harvesting

The building is to be fitted with rainwater harvesting and reuse capability that will accommodate for the collection of rainwater roof and hardstand areas. The demand for reuse is proposed to be Irrigation of landscaped areas throughout the development along with pedestal flushing. Measures should be implemented during the detailed construction design process to ensure no contaminated flows enter the system. The total harvesting storage tank capacity shall be 100kL.

4.4 MUSIC Model

The sites stormwater run-off was modelled using MUSIC (version 6.2.1) and the water quality objectives for South East Queensland specified in the SPP 2017 of 80% TSS reduction, 60% TP reduction, 45% TN reduction, and 90% Gross Pollutants reduction. The modelled treatment trains for Alternative 1 and Alternative 2 are show in **Figure 2** and **Figure 3** respectively.

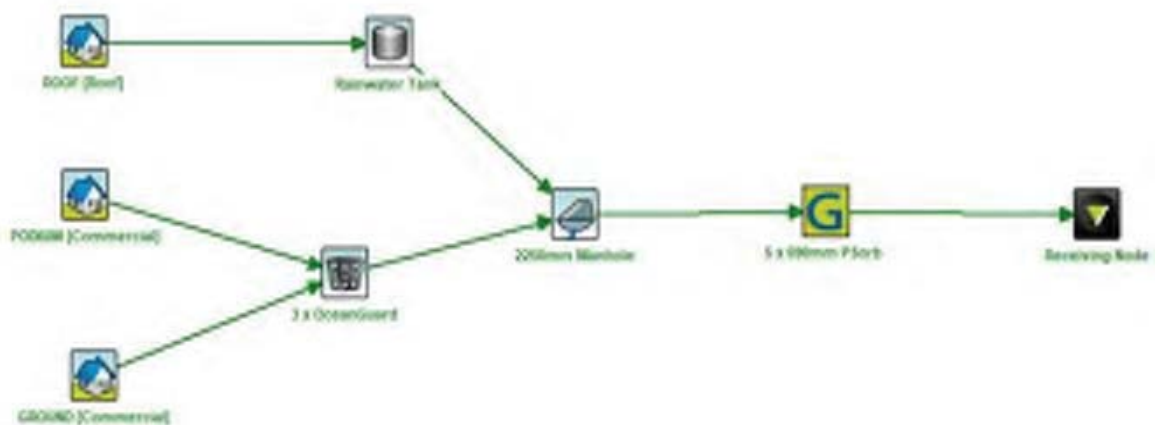


Figure 2 - Alternative 1 MUSIC Model Treatment Train

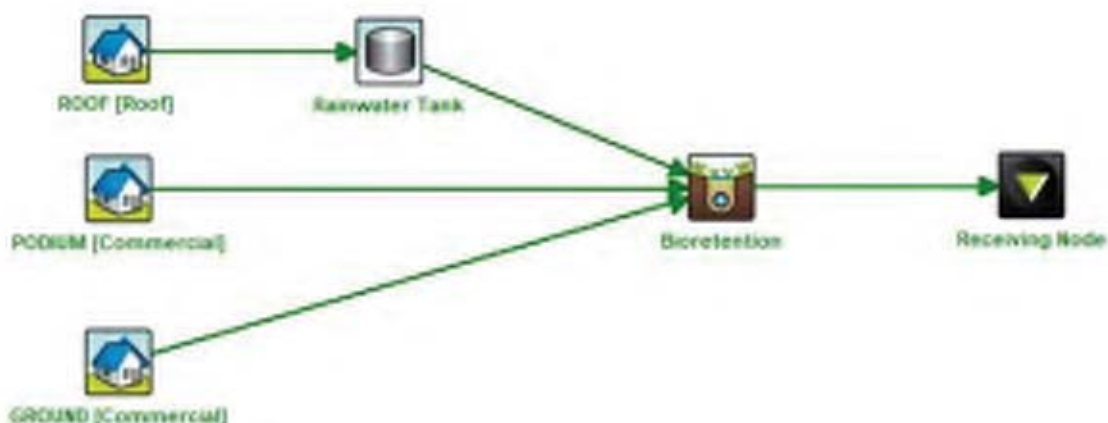


Figure 3 - Alternative 2 MUSIC Model Treatment Train

The results of the above MUSIC models are presented in **Figure 4** and **Figure 5** for Alternative 1 and Alternative 2 respectively.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	3.5	3.3	5.8
Total Suspended Solids (kg/yr)	448	45.5	89.8
Total Phosphorus (kg/yr)	2.56	0.677	73.6
Total Nitrogen (kg/yr)	8.05	4.35	46
Gross Pollutants (kg/yr)	81.8	0	100

Figure 4 - Alternative 1 MUSIC Model Results

	Sources	Residual Load	% Reduction
Flow (ML/yr)	3.5	3.26	7
Total Suspended Solids (kg/yr)	448	87.4	80.5
Total Phosphorus (kg/yr)	2.57	0.452	82.4
Total Nitrogen (kg/yr)	8.12	4.13	49.2
Gross Pollutants (kg/yr)	81.8	0	100

Figure 5 - Alternative 2 MUSIC Model Results

The above results meet the percent reduction water quality objectives identified by Sunshine Coast Council standards and the SPP 2017.

4.5 Water Quality Monitoring

No water quality monitoring is proposed for this development at this stage due to the nature of the development and the fact that no monitoring currently takes place.

4.6 Lifecycle Costs

A lifecycle cost analysis is not a part of the scope of this report. All the recommended water quality treatment infrastructure lies within the development site and it shall be maintained and serviced by the owners of the development at **no cost to Council**.

4.7 Construction phase

During the construction phase of this development, there is a higher risk of sedimentation transport during construction due to the large areas of disturbed land. A sediment and erosion control plan is required for the lodgement of operational works and the following construction phase of the development.

A sediment and erosion control plan is required for the lodgement of operational works and shall be implemented during the construction phase of the development as follows:

Stage 1: Pre construction

- ▶ All erosion and sediment control (ESC) devices are to be installed prior to any earth disturbing activities

Stage 2: Construction

- ▶ All ESC devices are to be maintained to operational levels, as specified in the management plans and drawings.
- ▶ The maintenance plan needs to be in accordance with the Water by Design Construction and Establishment Guidelines.
- ▶ The filter media installed is to be in accordance with the FAWB 2008 specifications and certified by the contractor prior to installation.
- ▶ During any excavations, the contractor shall provide a temporary sediment basin (sump pit) and pump out stormwater only once the water has settled and has achieved an acceptable quality to the satisfaction of Council (i.e. no turbidity and acceptable pH levels).

Stage 3: Pre-Operational Stage (all disturbed areas stabilized, 90% of all structures completed)

- ▶ Impervious layer removed and the nutrient removing plants, as specified in the landscaping plan, are installed.
- ▶ Property owner to implement a maintenance plan to ensure correct establishment of plants.
- ▶ All ESC devices can be removed only if approved by the superintendent and engineers.

4.8 Operational phase

Once directed to be commissioned by the Superintendent and engineers, the Stormwater Quality Improvement Devices (SQIDs) will provide the required level of stormwater quality treatment to runoff from the site prior to discharging into Council's stormwater drainage infrastructure. It is expected that sediment laden runoff and the erosion potential at the subject site during the operational phase will be minimal. This is due to the high amount of permanent impervious area in the form of roofs, paths, courtyards, driveways and other impervious structures. The proposed landscaped areas will be maintained in a manner that will minimise erosion.

4.9 Maintenance

4.9.1 Alternative 1

The maintenance regime for the proposed litter baskets and filter cartridges shall be as per the Ocean Protect maintenance specification attached within **Appendix E**.

4.9.2 Alternative 2

Table 4 provides a monitoring and maintenance program to be completed upon the implementation of the bioretention system. The site operator will be responsible for organising all monitoring and maintenance activities associated with the operation of the proposed bio-retention systems.

Table 4 - Bioretention Monitoring and Maintenance Program

Time Frame (After Construction)	Monitoring Activity	Frequency
0-6 months	Discharge water quality	After major storm event

	Structural integrity of Bio-Retention	Every 3 months
	Gross Pollutant/course sediment accumulation within the bio retention	Every 3 months
	Debris/litter in trash blockages	After major storm events and/or every 3 months
> 6 months	Structural integrity of Bio-Retention	Every 3 months
	Course sediment accumulation within the Bio-Retention	Every 3 months
	Odour within Bio-retention	Every 3 months
	Discharge water quality	Bi-annually
	Debris/litter in trash blockages	After major storm events and/or every 3 months

The site operator will be responsible for organising all monitoring and maintenance activities associated with the operation of the proposed bio-retention systems.

5 CONCLUSIONS

In preparing this stormwater overview, we have achieved all requirements for Stormwater Management Plans as described in QUDM 2013 standards, as well as a pollutant load reduction as required by the SPP 2017 and Sunshine Coast Regional Council standards. No onsite stormwater detention is required and the development shall have a minimum floor level of 3.72mAHD for flood immunity.

To achieve stormwater quality best management guidelines for this development, ADG recommends the use of the following treatment devices:

Alternative 1

- Three (3) OceanGaurd filter baskets to be placed within pits on the ground / podium levels; and
- 5 x 690mm Ocean Protect StormFilters (or approved equivalent); and
- A 100kL rain water tank to collect and retain roof water flows for reuse within the building.

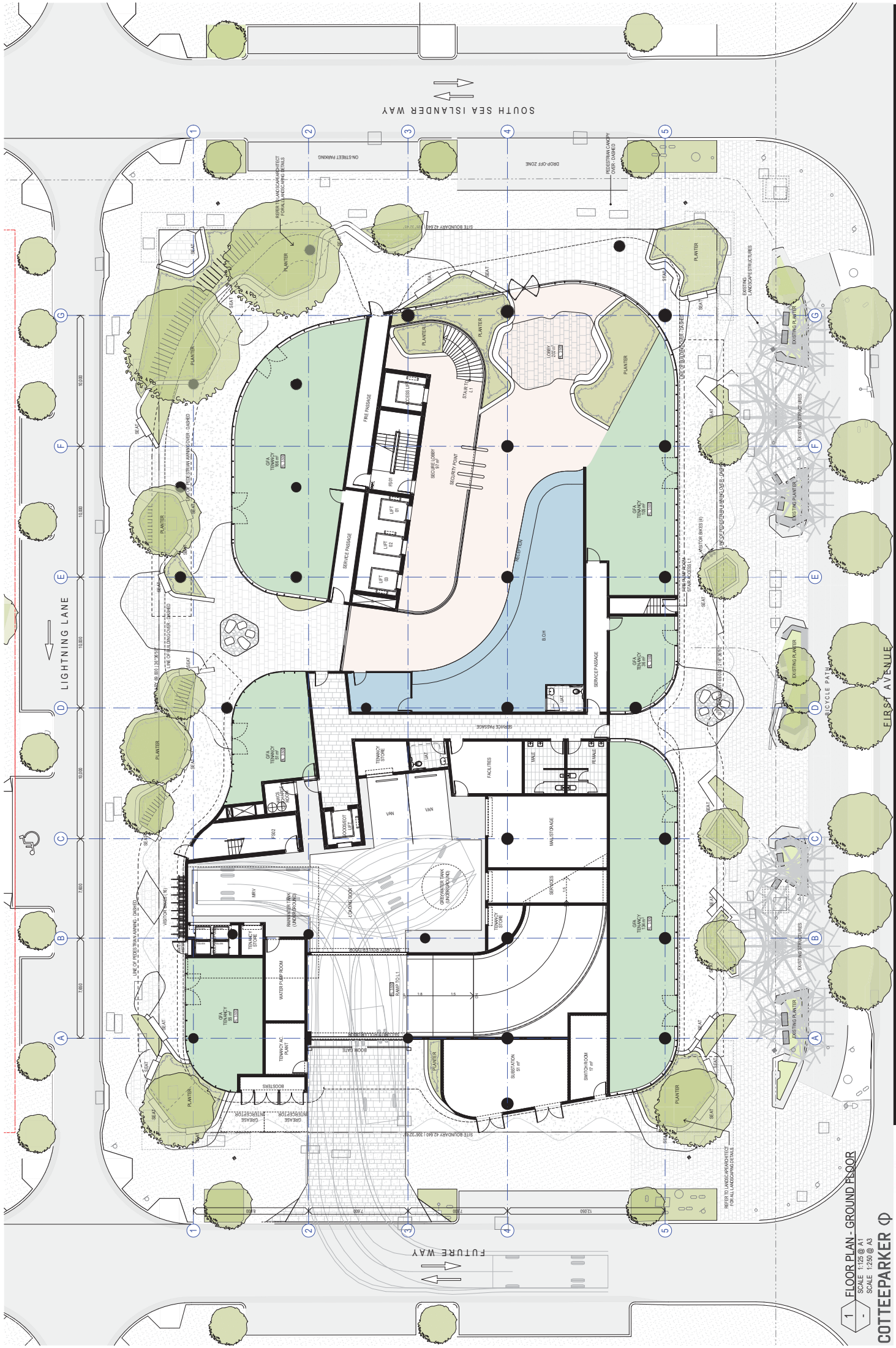
Alternative 2

- A 20m² Bioretention basin; and
- A 100kL rain water tank to collect and retain roof water flows for reuse within the building.

Detailed engineering diagrams and management requirements for the proposed development are to be submitted to Council for approval prior to any works commencing on site with design certification prepared by a qualified stormwater engineer or scientist. Two (2) options have been provided for the treatment of stormwater runoff from the development. During detailed design, additional options may be explored, however any changes will be subject to further approvals and must adhere to the State Planning Policy stormwater quality requirements.



Appendix A Architectural Drawings



1 FLOOR PLAN - GROUND FLOOR
SCALE 1:125 @ A1
SCALE 1:250 @ A3

COTTEPARKER

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RPM 171100
COTTEPARKER.COM.AU



0 2.5 5 7.5 10 12.5
SCALE 1:125 @ A1
SCALE 1:250 @ A3

DATE 12/03/2019
DRAWN BY D. C. A.
CHECKED BY A. L.
STATUS: ISSUE FOR PERMIT

SUNSHINE COAST CITY HALL
ONE FIRST AVENUE & SOUTH SEA ISLANDER WAY, ANSON COOK
CLIENT: SUNSHINE COAST COUNCIL
PROJECT NO: 171100
DATE: 30/01/2019
DRAWN BY: 5807
CHECKED BY: A. L.
STATUS: ISSUE FOR PERMIT



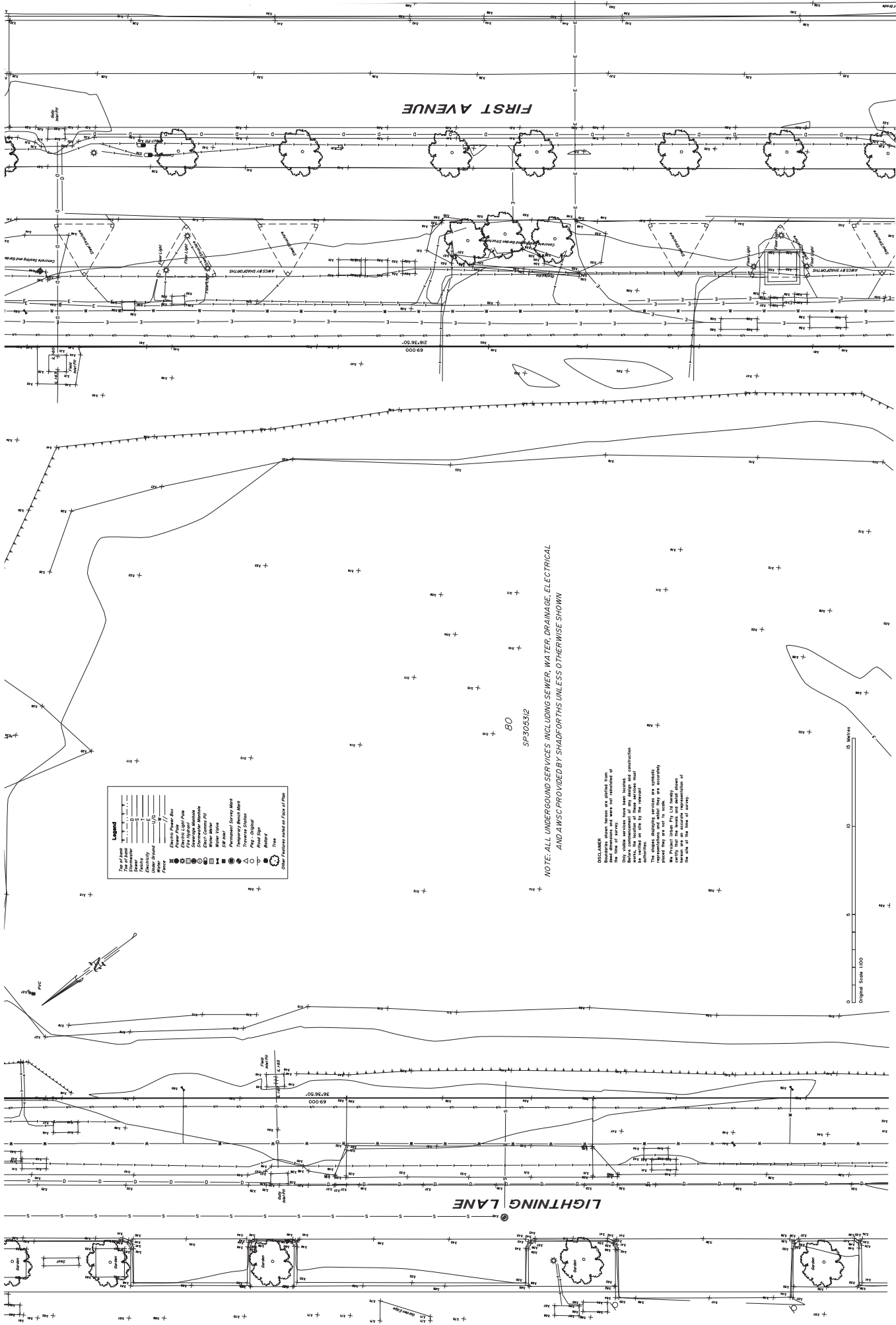
Appendix B

Detailed Survey Plan



Appendix B

Detailed Survey Plan



NOTE: ALL UNDERGROUND SERVICES INCLUDING SEWER, WATER, DRAINAGE, ELECTRICAL
AND A WSC PROVIDED BY SHADFOR THIS UNLESS OTHERWISE SHOWN

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LOT 80 ON SP305312
COMPLETED ON THE 15/03/2019

NOTES
DATUM: AND
LEVEL ORIGIN: PSM9897 RL:4.008
Hor. DATUM: Plane MAG (ISB)
ORIGIN POINT: PSM9872
E509627.741 N7050789.482

AMENDMENTS		DATE	DESIGNED	SURVEYED	DRAWN	DATE
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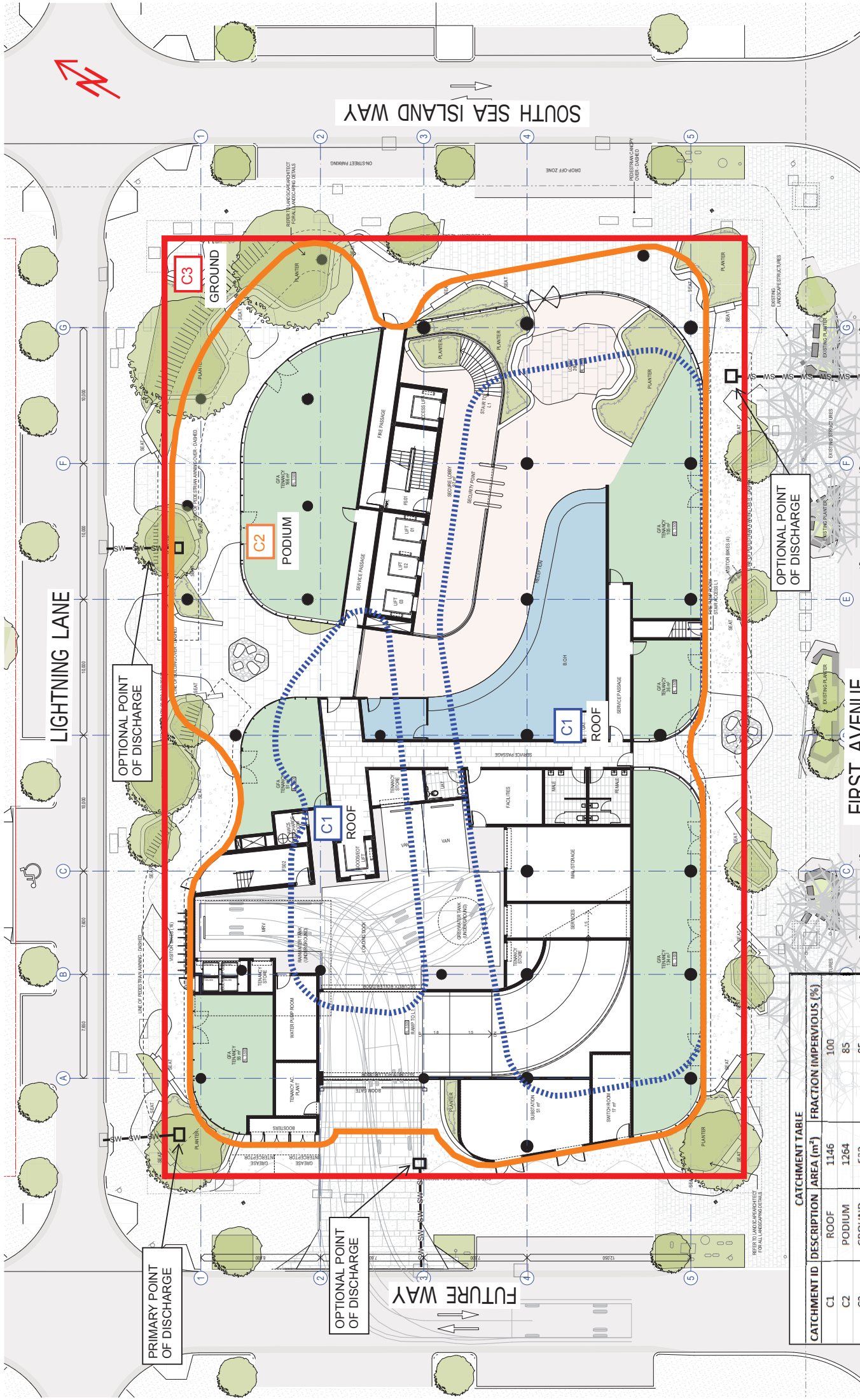
Appendix C

ADG Catchment Plans



CATCHMENT TABLE			
CATCHMENT ID	DESCRIPTION	AREA (m ²)	FRACTION IMPERVIOUS (%)
EX1	EXISTING SITE	2,942	0

[illegible]



CATCHMENT TABLE			
CATCHMENT ID	DESCRIPTION	AREA (m ²)	FRACTION IMPERVIOUS (%)
C1	ROOF	1146	100
C2	PODIUM	1264	85
C3	GROUND	532	85

Rev	Date	Description
B	27.06.2019	UPDATED ARCHITECTURAL PLAN
A	31.02.2019	ISSUED FOR INFORMATION



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NTS
NTS
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POST DEVELOPMENT CATCHMENT PLAN

Drawing No. SK02
Revision B



PLACED AS TO THE FRONT OF 3 FILTER OF BASKETS

Appendix D

Technical Memorandum: Maroochydore City Centre Flooding and Stormwater Considerations for Stage 1

Technical Memorandum

Title	Maroochydore City Centre Flooding and Stormwater Management Considerations for Stage 1		
Client	Suncentral Maroochydore	Project No	249402
Date	26 August 2015	Status	Preliminary
Author	Nadia Guterres	Discipline	Civil Engineering
Reviewer	Darryl Hone	Office	Sunshine Coast

FLOODING AND STORMWATER MANAGEMENT

1. Summary

Stage 1 of the Maroochydore City Centre (MCC) development is PDA Precinct 3, which is the Core Business District area located to the north of Maud Canal. As part of Stage 1 works Maud Drain will be realigned and constructed as a canal with increased flood conveyance capacity. The channel will be relocated further north at the eastern end of the site and further south at the western end of the site, so that the canal has a straighter configuration. The canal will be deepened to RL -2.0m AHD and will have a minimum width of 20 metres. From RL -2.0 to -0.5m AHD, 1 in 3 side slopes will be adopted. Above this level the canal will have vertical walls, and/or terraced walls, dependent on the landscape design and access. The typical surface levels adjacent to the canal will be around RL 3.3m AHD. The normal water surface level in the canal will typically vary between RL -0.33m AHD (MLWS) and RL 0.47m AHD (MHWS). A typical cross-section of the proposed canal is attached.

The current drain has a minimum level of RL -0.5m AHD at the eastern end of the site to around RL -1.2m AHD at the western end. It has a bed width of around 10 metres and side slopes ranging from 1 in 3 to 1 in 5.

The current site where Stage 1 works are to take place consists of former golf course, club house and associated car parking. The majority of the existing Stage 1 area currently drains towards the north, where a stormwater inlet in the car park drains to an 825mm RCP. This connects northward to the underground stormwater drainage, which discharges to Cornmeal Creek at the end of Cornmeal Parade. The limited capacity of this stormwater drainage network has created urban flooding issues in the past. The MCC design will reduce the area that drains towards the north so that there is no increase in flows as a result of development. The current area of the site that drains towards the north is around 7.9 hectares, of which about 1.1 hectares is impervious. The ultimate design of Stage 1 will have around 0.55 hectares continuing to drain towards the north. This decrease in flows directed towards the north will result in a reduction of local flooding to the north of the site.

The *Cornmeal Creek Flood Study* (Cardno, 2013) was undertaken for Sunshine Coast Regional Council (SCRC) to inform the master planning for the site. In this study it was assumed that the majority of the Stage 1 area drainage would be re-directed towards Maud Canal. The increased capacity of the canal proposed as part of the MCC development ensured that there were no adverse flood impacts on adjacent properties. The results of the flood study showed that the MCC development resulted in reduction in peak water levels at Maud Street by up to 169mm.

Additional flood modelling has been conducted for the Stage 1 earthworks, to ensure that temporary diversion works and redirection of flows do not have an unacceptable impact on adjacent properties. The results of this analysis are provided in this Technical Note.

2. Flood Behaviour of Existing Site

In the existing case, flows from the urban catchment to the east of the site are conveyed west through Maud Drain and discharge into Cornmeal Creek downstream of Plaza Parade. Flood flows from south of Dalton Drive are conveyed in two directions: north into the golf course lake, and west beneath Maroochy Boulevard into Sunshine Cove Lake. Flood flows that enter the golf course eventually discharge via a swale along the north western boundary of the golf course, into Maud Drain near Plaza Parade, or they flow south-west to go back under Dalton Drive (near the intersection with Maroochy Boulevard), which then flows to the Sunshine Cove Lake. The majority of flood flows from the south do not overtop into Maud Drain, except for a small section at the eastern end of the site. This is due to the high southern bank, which is at levels of around RL 2.3 to 3.0m AHD, which is shown in Image 1 below. Flood flows in Maud Drain do not overtop the northern bank and therefore do not flow into the area that will be developed as part of Stage 1 works.



Image 1 **Location of Existing Southern Bank**

3. Flood Impacts during Stage 1 Works

The construction of Maud Canal during Stage 1 works will be conducted in a way that will ensure that flows from the east and south are not obstructed during construction. The existing channel will be retained while a temporary diversion channel is excavated and stabilised. A 15 metre wide overland flow path at RL 1.60m AHD will also be provided on the southern side of the temporary diversion drain, to direct flows from the south to existing low points in the north-west. A plan showing the proposed temporary diversion channel is attached. Once the temporary diversion drain is stabilised, works within the existing Maud Drain will be able to proceed. Stockpiling of excavation material will occur in existing flood free areas identified on the site.

The existing case TUFLOW flood model of the site set up for the *Cornmeal Creek Flood Study* (Cardno, 2013) was modified to take into account the temporary works required for Stage 1. For the flood

modelling it has been assumed that the section of Maud Drain undergoing excavation would not contribute to flood storage. The results of the analysis are attached. The TUFLOW analysis was able to demonstrate that Stage 1 temporary works can proceed with minimal flood impacts. There is a minor increase of around 30mm in the 1% and 39% Annual Exceedance Probability (AEP) peak water levels within the creek through Sunshine Plaza. No residential areas are affected. Given the temporary nature of these works, these impacts are considered acceptable. As shown in Figures 1 to 6, the residential area upstream of Maud Street will experience a reduction in peak flood levels for all AEP events.

The 1% AEP flood impact plot is also shown in Image 2. This image highlights areas that were dry and now are wet, or vice versa, in the 1% AEP event, with the temporary Stage 1 works in place. As shown by this image, the temporary works improve flooding for properties to the west and also for properties around Maud Street. The increase in inundation area around Sunshine Plaza is minimal. The difference in peak water levels in the 1% AEP event are shown in Figure 6.

In the 39% AEP event the flood extent around Sunshine Plaza is contained within the channels, so a minor increase in peak water level does not increase the area being inundated.

In the 1% AEP flood event none of the surrounding road crossings are overtopped, therefore the flood immunity of the roads is not reduced as part of Stage 1 works.



Image 2 1% AEP Stage 1 Temporary Works Flood Impact

4. Local Stormwater Drainage

A 675mm RCP runs along the eastern boundary of the site and drains into Maud Canal. The stormwater line drains local stormwater from Maud Street. This drainage line will be retained and a swale will be

constructed to convey any overland flow from this area, around Stage 1 works and towards Maud Canal. Similarly the existing stormwater drainage lines along the northern boundary of the site, that connect stormwater flows from Golf Street and Maud Street to the Cornmeal Parade drainage line will be retained.

For Stage 1, the internal stormwater network has been designed to have 5% AEP capacity. This is greater than the capacity required by the *Queensland Urban Drainage Manual* (QUDM), which specifies 10% AEP for commercial areas. Allowance for climate change has been made in the internal drainage design. The assumed tailwater level is the 5% AEP climate change storm tide level of RL 2.2m AHD. A 20 percent increase in rainfall intensity has also been allowed for in the design. In localised areas where overland flow paths are not able to be provided, the underground drainage network will be designed to have 1% AEP capacity. A duplicate 1% AEP capacity network will also be provided in these localised areas to account for the potential impact of blockage. This satisfies the requirements of QUDM, which stipulates that 100 percent blockage should be considered in severe events.

5. Flood Levels

The flood levels that have been used to define the minimum floor levels for the Stage 1 area are taken from the *Cornmeal Creek Flood Study* (Cardno, 2013), and are summarised below. They are based on *Planning Scheme Policy No.15: Maroochydore Principal Activity Centre Structure Plan*:

- 1% AEP Storm Surge level of RL 2.5m AHD + 819mm allowance for Mean Sea Level rise, i.e. RL 3.32m AHD. This is inclusive of 400mm of freeboard.
- 1% AEP Flood Level, including allowances for Climate Change (in 2100) + 400mm freeboard for residential, commercial and industrial buildings = RL 3.07m AHD. This is based on the 1% AEP climate change flood level in Maud Canal of RL 2.67m AHD.

The minimum floor level for the development within Stage 1 is therefore RL 3.32m AHD. However, to be consistent with future stages of the MCC development, **a minimum floor level of RL 3.5m AHD has been adopted.**

STORMWATER QUALITY

1. Summary

As part of Stage 1 works it is necessary to demonstrate that the stormwater quality objectives for the site, for this stage of works, can be achieved.

The overall stormwater quality strategy for the site is to use a combination of stormwater harvesting for irrigation, centralised treatment of upstream catchments entering the site and localised treatment of internal catchments. At Dalton Drive, approximately 291 hectares of urbanised area drains to the existing waterbody on the southern side of Dalton Drive and into Dalton Lake located within the site. By treating and reusing this water, significant reductions in pollutant loads can be achieved. As a weir at RL 1.4m AHD will ultimately be installed downstream of Dalton Drive this section of the lake will always contain freshwater. It is therefore suitable for use as irrigation water. The benefits of treating this external inflow and using it for stormwater harvesting include:

- Pollutant loads entering the Dalton Lake will be reduced, which will decrease the risk of algal blooms within the lake.
- Stormwater will be reused for irrigation, reducing the potable water demand of the site. It is proposed to use stormwater to irrigate open space areas proposed within Stage 3 works. The estimated irrigation demand for this area is 23 ML/year.
- By targeting external stormwater pollutant loads, less reduction of internal pollutant loads is required in order to meet the stormwater pollutant load reduction targets. This will allow for more flexibility within the urban design.

The stormwater treatment measures being considered within the public realm areas of the site include:

- Litter baskets in stormwater field inlets.

- End of line gross pollutant traps (GPTs) for areas where the installation of litter baskets is problematic.
- Porous pavement where suitable.
- Bio-retention street trees.
- Passively irrigated landscape areas.
- Bio-retention gardens or swales where suitable, such as in the median strip.
- Floating wetlands within the lake.

Litter baskets target the removal of gross pollutants, sediment, oil and grease. They also remove the nutrient load that is associated with these pollutants. Litter baskets are considered to be the most suitable method of removing gross pollutants within Stage 1. As the internal stormwater drainage network will be permanently backwatered from tidal inflows from Maud Canal, the design of an in-ground GPT would need to take these conditions into consideration for operation and maintenance. Due to the future infrastructure requirements for light rail, the area that is available for the installation of an in-ground GPT is limited at the downstream end of some of the stormwater drainage lines.

Litter baskets are able to be cleaned in-situ by vacuum hose attached to vacuum street sweeper trucks. They do not require confined space entry. As the litter baskets store the captured pollutants above standing water level, they reduce the potential breakdown of captured organic material. This reduces the potential for odour issues and the leaching of pollutants.

The design of the internal stormwater drainage will ensure that sufficient overflow capacity is provided if the litter basket is full.

2. Stage 1 Works

Stormwater harvesting is not proposed to commence during Stage 1 works. In order to meet the stormwater pollutant removal targets for this stage it is proposed to:

- Improve the treatment provided by the existing waterbody around Dalton Drive by installing floating wetlands. Installation of floating wetlands in this area would not require any modification during future stages. As a weir at RL 1.4m AHD will ultimately be installed downstream of Dalton Drive, this waterbody will always contain freshwater. Floating wetlands are currently being tested on local urban developments by the University of the Sunshine Coast.
- Provide litter baskets on all field inlets within the public realm.

Although not included in the MUSIC modelling (so as to allow flexibility within the landscape design), the following stormwater treatment measures will also be considered within Stage 1:

- Porous pavement where suitable.
- Passively irrigated trees and landscape areas.

Internal lots within Stage 1 will be responsible for providing their own stormwater treatment. It is expected that this will be provided via a combination of rainwater or stormwater harvesting (for example passive irrigation of vertical gardens) and proprietary treatment devices.

3. Stage 1 MUSIC Modelling

The Stage 1 works were modelled using MUSIC Version 6.10. The Stage 1 MUSIC source nodes included:

- Stage 1 Roads – 6.8 hectares, 80% impervious Commercial Road
- Stage 1 Open Space - 1.75 hectares, 60% impervious Commercial Road
- External Urban Catchment - 291 hectares, 50% impervious Urban

No stormwater harvesting was assumed for this stage of the works. The internal lots within Stage 1 were also not included in the modelling.

Typical stormwater treatment MUSIC nodes were used for the analysis. The treatment assumed for the litter baskets was 40 percent removal of Total Suspended Solids (TSS), 20 percent removal of Total Nitrogen (TN) and Total Phosphorus (TP) and 100 percent removal of Gross Pollutants (GP). Based on reported removal efficiencies from manufacturers, these removal rates are considered conservative. A high flow bypass of 11L/s for each litter basket was assumed, with one litter basket provided for every 0.25 hectares of catchment area. This was a conservative assumption as the preliminary number of litter baskets required is around 120.

As the existing waterbody provides treatment similar to a pond, this treatment node was included in the base case. The pond was modelled as having a 2.5ha surface area, storage volume of 50ML and extended detention depth of 0.3 metres. Only treatment in addition to that already provided by the pond would therefore be included in the developed case. The floating wetland was modelled as a wetland with a 50ML inlet pond. The storage surface area was conservatively modelled as the actual proposed area of floating macrophytes. The treatment efficiency of floating wetlands should be significantly greater due to the increased biological surface area in contact with water.

The treatment efficiency of floating wetlands is currently being tested. Once this testing is completed, specific MUSIC nodes will be made available from which the required treatment area can be verified. Using standard wetland treatment nodes it was found that floating wetland of 100m², coupled with the litter baskets could provide enough treatment to meet all of the stormwater quality pollutant reduction targets. However, preliminary site investigations have determined that a wetland area of around 300m² would be required to target all inflow points in the waterbody. It is therefore recommended that this larger area be installed during Stage 1 works. The installation of a solar powered recirculation pump is also recommended for the downstream section of the waterbody. The establishment time for floating wetlands is 6 to 12 months. The preliminary locations for the floating wetlands are attached.

If the litter baskets are not installed, then sufficient treatment is provided by the floating wetland for all pollutants with the exception of gross pollutants. Therefore the assumed treatment efficiency of litter baskets for the removal of TSS, TP and TN does not need to be relied upon in order to meet the pollutant reduction targets for Stage 1.

The MUSIC results are summarised in Table 1 below. The third column shows the pollutant loads relating to Stage 1 public realm areas. The fifth column shows the pollutant load removal targets for Stage 1 public realm areas. As shown by the last columns, as external loads are also being treated, more than 100 percent of Stage 1 pollutant loads are being removed for TSS and TP.

Table 1 Stage 1 MUSIC Model Results

Pollutant	Pollutant Load (kg/yr)		Total Pollutant Load After Treatment (kg/yr)	Pollutant Removal Required for Stage 1 (kg/yr)	Total Pollutant Removal Achieved Without Litter Baskets (kg/yr)	Total Pollutant Removal Achieved With Litter Baskets (kg/yr)
	External Catchment (After Pond Treatment)	Stage 1 Public Realm Areas (No Treatment)				
Total Suspended Solids	328000	42300	222500	33840 (80%)	133000 (>100%)	147800 (>100%)
Total Phosphorous	774	72.3	655	43 (60%)	179 (>100%)	191 (>100%)
Total Nitrogen	5130	338	5188	152 (45%)	220 (65%)	280 (83%)
Gross Pollutants	23.8	2410	114	2169 (90%)	0 (0%)	2319 (96%)

4. Future Stages

The treatment efficiency of the floating wetlands is currently being tested by the University of the Sunshine Coast. Preliminary results show that observed removal rates are significantly higher than those provided by standard wetland MUSIC nodes, which were adopted for this analysis. Using the specific MUSIC nodes that will be created as part of this work, the treatment provided for Stage 1 will be able to be verified.

If floating wetlands are found to be efficient, then they should be adopted for future stages. Additional floating wetlands could be installed in the existing waterbody as well as within areas of the proposed Dalton Lake. These floating wetlands would need to be planted with different vegetation that was able to tolerate brackish conditions. They would be positioned near stormwater culvert inlets into the lake. The depths of the lake in these areas would be limited to 1.6 metres, so that the treatment provided by the floating wetlands was maximised. An added benefit of having floating wetlands installed on the culvert inlets is that some treatment will also be provided for the lake re-circulation water that will be pumped into the lake. The floating wetlands will also provide for some fish habitat areas.

The expanded use of floating wetlands would remove the requirement to construct a wetland and bio-retention treatment system in the parkland area within Stage 3 works. If the floating wetlands are found not to be sufficiently effective, then a wetland and bio-retention treatment system within the Stage 3 parkland area will be required. This will need to be sized to also compensate for Stage 1 works.

The waterbody will also be used for stormwater harvesting, with the intake located upstream of the weir proposed to the north of Dalton Drive. The water used for irrigation will therefore be freshwater.

The waterbody has an area of 2.5 hectares, and a minimum level of RL -10m AHD. Preliminary water balance modelling in MUSIC was conducted using 50 years of daily rainfall data. This demonstrated that if a maximum drawdown of 300mm was allowed, then the waterbody could provide around 98 percent of the irrigation demand of 23 ML/year, which is the approximate irrigation demand for Stage 3. Therefore there is potential to use this waterbody to provide for additional non-potable demands. A reliability of around 87 percent can be achieved for a demand of 100 ML/year.

Additional preliminary MUSIC modelling has been conducted to take into account all future development of public realm areas, including Stage 1 works. The additional MUSIC nodes included:

- Stage 2 Entertainment Facility – 3.4 hectares, 100% impervious Commercial Roof
- Stage 3 Open Space – 5.3 hectares, 20% impervious, Commercial Ground
- Stage 3 Roads – 1.8 hectares, 80% impervious, Commercial Road
- Future Open Space – 1.3 hectares, 20% impervious Urban Ground
- Future Roads – 7.5 hectares, 80% impervious, Urban Road

Runoff from all areas, with the exception of open space, was assumed to be treated via litter baskets on all field inlets. For the purposes of MUSIC modelling, each litter basket was assumed to treat 0.25 hectares. The open space areas were assumed to be treated by grassed swales. The storage surface area of the wetland was increased and a re-use of 23ML/year was assumed.

The results of MUSIC modelling found that pollutant removal targets could be achieved if:

- The floating wetland area for external catchment treatment is maintained as per Stage 1 requirements.
- Floating wetland area of at least 200m² is provided within Dalton Lake near culvert inlets into the lake.
- Stormwater harvesting is used to irrigate Stage 3 open space, i.e. 23 ML/year.
- Litter baskets are installed on all field inlets.

It should be noted that although not included in the MUSIC modelling, additional stormwater treatment will be provided within public realm areas, as outlined in Section 1.

The results of the MUSIC modelling are summarised in Table 2. The removal targets are achieved for all pollutants with the proposed stormwater treatment strategy in place.

Table 2 Future Stages Preliminary MUSIC Model Results

Pollutant	Pollutant Load IN (kg/yr)		Total Pollutant Load After Treatment (kg/yr)	Pollutant Removal Required for All Public Realm Areas (kg/yr)	Pollutant Removal Achieved (kg/yr)
	External Catchment (After Pond Treatment)	All Public Realm Areas (No Treatment)			
Total Suspended Solids	326000	100000	255500	80000 (80%)	170500 (>100%)
Total Phosphorous	777	184	738	110 (60%)	228 (>100%)
Total Nitrogen	5130	933	5595	420 (45%)	468 (50%)
Gross Pollutants	23.8	6960	113.8	6264 (90%)	6870 (99%)

It should be noted that additional MUSIC modelling will be completed for future stages to verify the required floating wetland areas, once a specific MUSIC node becomes available.

There is potential to further increase the removal of stormwater pollutants from the public realm. This could be achieved through:

- Increased stormwater harvesting for non-potable uses throughout the site.
- Increased floating wetlands installed in the upstream waterbody.
- Rainwater harvesting for toilet flushing for the Entertainment and Convention Centre.
- Inclusion in MUSIC of the treatment that will be provided by landscape stormwater treatment measures.

5. Treatment of Internal Lots

It has been assumed that internal lots for Stage 1 and all future stages will be responsible for providing their own stormwater treatment. It is expected that this will be provided via a combination of rainwater or stormwater harvesting and proprietary treatment devices.

Technical Memorandum

Title	Maroochydore City Centre Stage 1 Local Flooding		
Client	Suncentral Maroochydore	Project No	249402
Date	29 October 2015	Status	Preliminary
Author	Nadia Guterres	Discipline	Civil Engineering
Reviewer	Darryl Hone	Office	Sunshine Coast

1. Summary

Given the flat nature of the Stage 1 works and the locations of raised intersections which would block overland flow paths, detailed two-dimensional flood analysis was conducted to ensure that the proposed road and internal drainage design would be sufficient to convey stormwater flows during major flood events. The purpose of this analysis was to:

- > Determine the 100 year ARI local flood levels throughout Stage 1 and the corresponding floor levels for each lot.
- > Determine the impact of complete blockage of stormwater gully and field inlets to ensure that the freeboard provided to minimum floor levels was sufficient.
- > Determine whether the peak depths within the road reserve during major flood events complied with the requirements of QUDM.
- > Determine if any areas required additional drainage infrastructure.

The proposed stormwater drainage has been designed to have 5% Annual Exceedance Probability (AEP) capacity using 12d. This drainage design was then transferred into TUFLOW for analysis of the major 1% AEP storm event.

2. Methodology

The TUFLOW model was set up using the following methodology:

- > The 1% AEP rainfall was increased by 20% to account for the potential impact of climate change.
- > The Duration Independent Storm (DIS) was used, with a time step of 5 minutes. The DIS method converts peak rainfall intensities from various storm duration into the one temporal pattern.
- > A 0.5m grid size was adopted so that the road reserve was captured in sufficient detail.
- > The road reserve areas were modelled using rainfall on grid. No rainfall losses were assumed.
- > The runoff from the surrounding lots was directed towards the underground drainage network. As the roof drainage is likely to have 5% AEP capacity, flows in excess of this capacity were directed as inflows onto the road surface. No rainfall losses were assumed.
- > The tailwater level in the canal was assumed to be 2.35m AHD. This is the 1% AEP storm tide level with potential climate change included. Storm tide levels are to be used in preference to

storm surge levels as wave runup is not included as it is not a factor in protected waterways such as Maud Canal.

- > The tailwater level for the existing northern drainage system was assumed to be equal to the obvert of the existing pipe.
- > The road reserve was modelled with a Manning's roughness of 0.02.
- > For the design scenario the blockage factors for field and gully inlets as specified by QUDM were assumed.
- > For the blockage scenario all inlets were blocked by 100%. Roof water drainage (to 5% AEP capacity) was still assumed to be able to enter the drainage network.
- > The manhole losses were automatically calculated by TUFLOW using the Engelund Method.

3. **Results**

The preliminary results of the analysis identified areas where additional inlets would be required. Once these modifications were made to the design the results showed that:

- > The depth of flooding in the 1% AEP climate change design event was less than 250mm in all areas of the proposed development.
- > Once complete blockage of inlets was included the increase in peak water levels was less than 300mm in all areas of the site. As freeboard of 300mm above the 1% AEP local flood level is required for minimum floor levels based on the requirements of QUDM, this confirmed that all lots would have sufficient flood immunity for the major local flood event. For the majority of the site the increase was less than 100mm, with 95% of impacts being less than 200mm.
- > The peak depth-velocity (dV) product for the 1% AEP design flood event was extremely low in all areas, with a maximum of around $0.05\text{m}^2/\text{s}$. This indicates that flood hazards to motorists and pedestrians will be minimal.

The preliminary proposal for drainage design within Stage 1 nominated that areas where overland flow paths were blocked would have a duplicate drainage network with 1% AEP capacity. The results of this analysis have shown that even if all inlets are completely blocked that the peak water levels will not be increased by more than the specified minimum freeboard of 300mm. This is because there are some alternate flow paths available for areas around the raised intersections. It has therefore been deemed not necessary to provide a dual drainage network for these areas.

The results of the TUFLOW modelling are shown in the attached figures.

The minimum floor level for each lot, as specified by the manhole number relating to the roof drainage inlet point, is summarised in Table 1. A freeboard of 300mm above the 1% AEP flood level with climate change has been specified to comply with QUDM. The minimum floor levels required are all higher than those obtained using the 1% AEP climate change storm surge level, i.e. 3.32m AHD. The minimum floor levels in Table 1 were obtained by adding 300mm to the maximum design flood level along the street frontage of each lot.

Table 1 Minimum Floor Levels for each Lot

Lot Identifier	Minimum Floor Level (mAHD)	Freeboard with Complete Blockage (mm)	Lot Identifier	Minimum Floor Level (mAHD)	Freeboard with Complete Blockage (mm)
1-11	3.60	187	1-51	3.97	300
1-12	3.56	159	1-52	3.74	300
1-15	3.60	179	1-53	3.90	300
1-16	3.59	175	1-54	3.74	245
1-17	3.66	238	1-55	3.86	292
1-18	3.68	213	1-56	3.82	297
1-20	3.66	248	1-57	3.87	300
1-21	3.67	258	1-58	3.87	300
1-23	3.69	206	1-59	3.92	300
1-24	3.70	244	1-6	3.58	237
1-25	3.70	222	1-60	3.89	299
1-26	3.74	248	1-61	3.87	284
1-27	3.69	203	1-64	3.89	299
1-3	3.71	300	1-65	3.32*	590
1-30	3.85	297	1-66	3.79	294
1-31	3.66	215	1-7	3.52	263
1-32	3.60	182	1-75	3.80	215
1-33	3.60	184	1-78	3.77	247
1-34	3.74	254	1-79	3.67	147
1-35	3.63	162	1-8	3.67	257
1-37	3.70	199	1-80	3.70	175
1-38	3.69	210	1-81	3.77	245
1-39	3.70	227	1-83	3.63	180
1-41	3.70	226	1-84	3.63	180
1-42	3.72	217	1-85	3.63	118
1-45	3.86	290	1-86	3.72	209
1-48	3.89	285	1-90	3.78	267
1-49	3.88	296	1-91	3.97	300
1-50	3.88	294	1-92	3.70	186

* Based on 1% AEP storm surge level



Appendix E

SQID Maintenance Requirements



OceanGuard™

Operations & Maintenance Manual

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Introduction

The primary purpose of stormwater treatment devices is to capture and prevent pollutants from entering waterways, maintenance is a critical component of ensuring the ongoing effectiveness of this process. The specific requirements and frequency for maintenance depends on the treatment device and pollutant load characteristics of each site. This manual has been designed to provide details on the cleaning and maintenance processes as recommended by the manufacturer.

The OceanGuard technology is a gully pit basket designed to fit within new and existing gully pits to remove pollution from stormwater runoff. The system has a choice of Filtration liners, designed to remove gross pollutants, total suspended solids and attached pollutants as either a standalone technology or as part of a treatment train with our StormFilter or Jellyfish Filtration products. OceanGuard pit baskets are highly effective, easy to install and simple to maintain.

Why do I need to perform maintenance?

Adhering to the maintenance schedule of each stormwater treatment device is essential to ensuring that it functions properly throughout its design life.

During each inspection and clean, details of the mass, volume and type of material that has been collected by the device should be recorded. This data will assist with the revision of future management plans and help determine maintenance interval frequency. It is also essential that qualified and experienced personnel carry out all maintenance (including inspections, recording and reporting) in a systematic manner.

Maintenance of your stormwater management system is essential to ensuring ongoing at-source control of stormwater pollution. Maintenance also helps prevent structural failures (e.g. prevents blocked outlets) and aesthetic failures (e.g. debris build up), but most of all ensures the long term effective operation of the OceanGuard.

Health and Safety

Access to pits containing an OceanGuard typically requires removing (heavy) access covers/grates, but typically it is not necessary to enter into a confined space. Pollutants collected by the OceanGuard will vary depending on the nature of your site. There is potential for these materials to be harmful. For example, sediments may contain heavy metals, carcinogenic substances or sharp objects such as broken glass and syringes. For these reasons, there should be no primary contact with the waste collect and all aspects of maintaining and cleaning your OceanGuard require careful adherence to Occupational Health and Safety (OH&S) guidelines.

It is important to note that the same level of care needs to be taken to ensure the safety of non-work personnel, as a result it may be necessary to employ traffic/pedestrian control measures when the device is situated in, or near areas with high vehicular/pedestrian activity.

Personnel health and safety

Whilst performing maintenance on the OceanGuard pit insert, precautions should be taken in order to minimise (or when possible prevent) contact with sediment and other captured pollutants by maintenance personnel. In order to achieve this the following personal protective equipment (PPE) is recommended:

- Puncture resistant gloves
- Steel capped safety boots,
- Long sleeve clothing, overalls or similar skin protection
- Eye protection
- High visibility clothing or vest

During maintenance activities it may be necessary to implement traffic control measures. Ocean Protect recommend that a separate site specific traffic control plan is implemented as required to meet the relevant governing authority guidelines.

The OceanGuard pit insert is designed to be maintained from surface level, without the need to enter the pit. However depending on the installation configuration, location and site specific maintenance requirements it may be necessary to enter a confined space occasionally. It is recommended that all maintenance personnel evaluate their own needs for confined space entry and compliance with relevant industry regulations and guidelines. Ocean Protect maintenance personnel are fully trained and carry certification for confined space entry.

How does it Work?

OceanGuard is designed to intercept stormwater as it enters the stormwater pits throughout a site. The OceanGuard has diversion panels that sit flush with the pit walls, this ensures that as stormwater enters at the top of the pit it is directed to the middle of the insert where the Filtration bag is situated. The filtration bag allows for screening to occur removing 100% of pollutants greater than the opening of the filtration material (200micron, 1600micron bags available).



During larger rain events the large flows overflow slots in the flow diverter of the OceanGuard ensure that the conveyance of stormwater is not impeded thus eliminating the potential for surface flooding. As the flow subsides, the captured pollutants are held in the OceanGuard Filtration bag dry. The waste then starts to dry which reduces the magnitude of organic material decomposition transitioning between maintenance intervals.

Maintenance Procedures

To ensure that each OceanGuard pit insert achieves optimal performance, it is advisable that regular maintenance is performed. Typically the OceanGuard requires 2-4 minor services annually, pending the outcome of these inspections additional maintenance servicing may be required.

Primary Types of Maintenance

The table below outlines the primary types of maintenance activities that typically take place as part of an ongoing maintenance schedule for the OceanGuard.

	Description of Typical Activities	Frequency
Minor Service	Filter bag inspection and evaluation Removal of capture pollutants Disposal of material	2-4 Times Annually
Major Service	Filter Bag Replacement Support frame rectification	As required

Maintenance requirements and frequencies are dependent on the pollutant load characteristics of each site. The frequencies provided in this document represent what the manufacturer considers to be best practice to ensure the continuing operation of the device is in line with the original design specification.

Minor Service

This service is designed to return the OceanGuard device back to optimal operating performance. This type of service can be undertaken either by hand or with the assistance of a Vacuum unit.

Hand Maintenance

1. Establish a safe working area around the pit insert
2. Remove access cover/grate
3. Use two lifting hooks to remove the filtration bag
4. Empty the contents of the filtration bag into a disposal container
5. Inspect and evaluate the filtration bag
6. Inspect and evaluate remaining OceanGuard components (i.e. flow diverter, filtration cage and supporting frame)
7. Rejuvenate filtration bag by removing pollutant build up with a stiff brush, additionally the filtration bag can be washed using high pressure water
8. Re-install filtration bag and replace access cover/grate

Vacuum Maintenance

1. Establish a safe working area around the pit insert
2. Remove access cover/grate
3. Vacuum captured pollutants from the filtration bag
4. Remove filtration bag
5. Inspect and evaluate the filtration bag
6. Inspect and evaluate remaining OceanGuard components (i.e. flow diverter, filtration cage and supporting frame)
7. Rejuvenate filtration bag by removing pollutant build up with a stiff brush, additionally the filtration bag can be washed using high pressure water
8. Re-install filtration bag and replace access cover/grate

Major Service (Filter Bag Replacement)

For the OceanGuard system, a major service is a reactionary process based on the outcomes from the minor service.

Trigger Event from Minor Service	Maintenance Action
Filtration bag inspection reveals damage	Replace the filtration bag ^[1]
Component inspection reveals damage	Perform rectification works and if necessary replace components ^[1]

[1] Replacement filtration bags and components are available for purchase from Ocean Protect.

Additional Reasons of Maintenance

Occasionally, events on site can make it necessary to perform additional maintenance to ensure the continuing performance of the device.

Hazardous Material Spill

If there is a spill event on site, all OceanGuard pits that potentially received flow should be inspected and cleaned. Specifically all captured pollutants from within the filtration bag should be removed and disposed in accordance with any additional requirements that may relate to the type of spill event. All filtration bags should be rejuvenated (replaced if required) and re-installed.

Blockages

The OceanGuards internal high flow bypass functionality is designed to minimise the potential of blockages/flooding. In the unlikely event that flooding occurs around the stormwater pit the following steps should be undertaken to assist in diagnosing the issue and implementing the appropriate response.

1. Inspect the OceanGuard flow diverter, ensuring that they are free of debris and pollutants
2. Perform a minor service on the OceanGuard
3. Remove the OceanGuard insert to access the pit and inspect both the inlet and outlet pipes, ensuring they are free of debris and pollutants

Major Storms and Flooding

In addition to the scheduled activities, it is important to inspect the condition of the OceanGuard pit insert after a major storm event. The inspection should focus on checking for damage and higher than normal sediment accumulation that may result from localised erosion. Where necessary damaged components should be replaced and accumulated pollutants disposed.

Disposal of Waste Materials

The accumulated pollutants found in the OceanGuard must be handled and disposed of in a manner that is in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. If the filtration bag has been contaminated with any unusual substance, there may be additional special handling and disposal methods required to comply with relevant government/authority/industry regulations.

Maintenance Services

With over a decade and a half of maintenance experience Ocean Protect has developed a systematic approach to inspecting, cleaning and maintaining a wide variety of stormwater treatment devices. Our fully trained and professional staff are familiar with the characteristics of each type of system, and the processes required to ensure its optimal performance.

Ocean Protect has several stormwater maintenance service options available to help ensure that your stormwater device functions properly throughout its design life. In the case of our OceanGuard system we offer long term pay-as-you-go contracts, pre-paid once off servicing and replacement filter bags.

For more information please visit www.OceanProtect.com.au



StormFilter

Operations & Maintenance Manual

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Introduction

The primary purpose of stormwater treatment devices is to capture and prevent pollutants from entering waterways, maintenance is a critical component of ensuring the ongoing effectiveness of this process. The specific requirements and frequency for maintenance depends on the treatment device and pollutant load characteristics of each site. This manual has been designed to provide details on the cleaning and maintenance processes for the StormFilter as recommended by the manufacturer.

The StormFilter is designed and sized to meet stringent regulatory requirements. It removes the most challenging target pollutants (including fine solids, soluble heavy metals, oil, and soluble nutrients) using a variety of media. For more than two decades, StormFilter has helped clients meet their regulatory needs and, through ongoing product enhancements, the design continues to be refined for ease of use and improved performance.

Why do I need to perform maintenance?

Adhering to the inspection and maintenance schedule of each stormwater treatment device is essential to ensuring that it functions properly throughout its design life.

During each inspection and clean, details of the mass, volume and type of material that has been collected by the device should be recorded. This data will assist with the revision of future management plans and help determine maintenance interval frequency. It is also essential that qualified and experienced personnel carry out all maintenance (including inspections, recording and reporting) in a systematic manner.

Maintenance of your stormwater management system is essential to ensuring ongoing at-source control of stormwater pollution. Maintenance also helps prevent structural failures (e.g. prevents blocked outlets) and aesthetic failures (e.g. debris build up), but most of all ensures the long term effective operation of the StormFilter.

Health and Safety

Access to a StormFilter unit requires removing heavy access covers/grates, and it is necessary to enter into a confined space. Pollutants collected by the StormFilter will vary depending on the nature of your site. There is potential for these materials to be harmful. For example, sediments may contain heavy metals, carcinogenic substances or objects such as broken glass and syringes. For these reasons, all aspects of maintaining and cleaning your StormFilter require careful adherence to Occupational Health and Safety (OH&S) guidelines.

It is important to note that the same level of care needs to be taken to ensure the safety of non-work personnel. As a result, it may be necessary to employ traffic/pedestrian control measures when the device is situated in, or near areas with high vehicular/pedestrian activity.

Personnel health and safety

Whilst performing maintenance on the StormFilter, precautions should be taken in order to minimise (or, if possible, prevent) contact with sediment and other captured pollutants by maintenance personnel. The following personal protective equipment (PPE) is subsequently recommended:

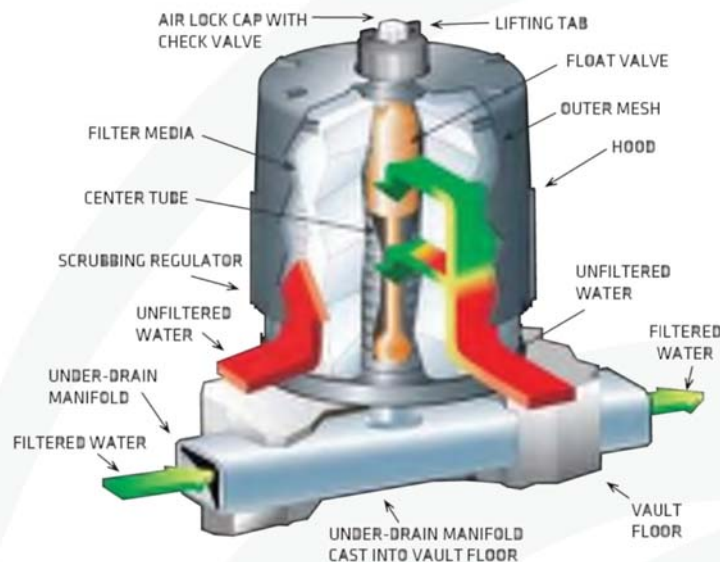
- Puncture resistant gloves
- Steel capped safety boots
- Long sleeve clothing, overalls or similar skin protection
- Eye protection
- High visibility clothing or vest

During maintenance activities, it may be necessary to implement traffic control measures. Ocean Protect recommend that a separate site-specific traffic control plan is implemented as required to meet the relevant governing authority guidelines.

Whilst some aspects of StormFilter maintenance can be performed from surface level, there will be a need to enter the StormFilter system (confined space) during a major service. It is recommended that all maintenance personnel evaluate their own needs for confined space entry and compliance with relevant industry regulations and guidelines. Ocean Protect maintenance personnel are fully trained and carry certification for confined space entry applications.

How does it Work?

Stormwater enters the cartridge chamber, passes through the filtration media and begins filling the cartridge center tube. When water reaches the top of the cartridge the float valve opens and filtered water is allowed to drain at the designed flow rate. Simultaneously, a one-way check valve closes activating a siphon that draws stormwater evenly throughout the filter media and into the center tube. Treated stormwater is then able to discharge out of the system through the underdrain manifold pipework.



As the rain event subsides, the water level outside the cartridge drops and approaches the bottom of the hood, air rushes through the scrubbing regulators releasing the water column and breaking the siphon. The turbulent bubbling action agitates the surface of the cartridge promoting trapped sediment to drop to the chamber floor. After a rain event, the chamber is able to drain dry by way of an imperfect seal at the base of the float valve.

Maintenance Procedures

To ensure optimal performance, it is advisable that regular maintenance is performed. Typically, the StormFilter requires an inspection every 6 months with a minor service at 12 months. Additionally, as the StormFilter cartridges capture pollutants the media will eventually become occluded and require replacement (expected media life is 1-3 years).

Primary Types of Maintenance

The table below outlines the primary types of maintenance activities that typically take place as part of an ongoing maintenance schedule for the StormFilter.

	Description of Typical Activities	Frequency
Inspection	Visual Inspection of cartridges & chamber Remove larger gross pollutants Perform minimal rectification works (if required)	Every 6 Months
Minor Service	Evaluation of cartridges and media Removal of accumulated sediment (if required) Wash-down of StormFilter chamber (if required)	Every 12 Months
Major Service	Replacement of StormFilter cartridge media	As required

Maintenance requirements and frequencies are dependent on the pollutant load characteristics of each site. The frequencies provided in this document represent what the manufacturer considers to be best practice to ensure the continuing operation of the device is in line with the original design specification.

Inspection

The purpose of the inspecting the StormFilter system is to assess the condition of the StormFilter chamber and cartridges. When inspecting the chamber, particular attention should be taken to ensure all cartridges are firmly connected to the connectors. It is also an optimal opportunity to remove larger gross pollutants and inspect the outlet side of the StormFilter weir.

Minor Service

This service is designed to ensure the ongoing operational effectiveness of the StormFilter system, whilst assessing the condition of the cartridge media.

1. Establish a safe working area around the access point(s)
2. Remove access cover(s)
3. Evaluate StormFilter cartridge media (if exhausted schedule major service within 6 months)
4. Measure and record the level of accumulated sediment in the chamber
(if sediment depth is less than 100 mm skip to step 9)
5. Remove StormFilter cartridges from the chamber
6. Use vacuum unit to removed accumulated sediment and pollutants in the chamber
7. Use high pressure water to clean StormFilter chamber
8. Re-install StormFilter cartridges
9. Replace access cover(s)

Major Service (Filter Cartridge Replacement)

For the StormFilter system a major service is reactionary process based on the outcomes from the minor service, specifically the evaluation of the cartridge media.

Trigger Event	Maintenance Action
Cartridge media is exhausted ^[1]	Replace StormFilter cartridge media ^[2]

[1] Multiple assessment methods are available, contact Ocean Protect for assistance

[2] Replacement filter media and components are available for purchase from Ocean Protect.

This service is designed to return the StormFilter device back to optimal operating performance

1. Establish a safe working area around the access point(s)
2. Remove access cover(s)
3. By first removing the head cap, remove each individual cartridge hood to allow access to the exhausted media.
4. Utilise a vacuum unit to remove exhausted media from each cartridge
5. Use vacuum unit to remove accumulated sediment and pollutants in the chamber
6. Use high pressure water to clean StormFilter chamber
7. Inspect each empty StormFilter cartridges for any damage, rectify damage as required
8. Re-fill each cartridge with media in line with project specifications
9. Re-install replenished StormFilter cartridges
10. Replace access cover(s)

Additional Types of Maintenance

Occasionally, events on site can make it necessary to perform additional maintenance to ensure the continuing performance of the device.

Hazardous Material Spill

If there is a spill event on site, the StormFilter unit should be inspected and cleaned. Specifically, all captured pollutants and liquids from within the unit should be removed and disposed in accordance with any additional requirements that may relate to the type of spill event. Additionally, it will be necessary to inspect the filter cartridges and assess them for contamination, depending on the type of spill event it may be necessary to replace the filtration media.

Blockages

In the unlikely event that flooding occurs upstream of the StormFilter system the following steps should be undertaken to assist in diagnosing the issue and determining the appropriate response.

1. Inspect the upstream diversion structure (if applicable) ensuring that it is free of debris and pollutants
2. Inspect the StormFilter unit checking the underdrain manifold as well as both the inlet and outlet pipes for obstructions (e.g. pollutant build-up, blockage), which if present, should be removed.

Major Storms and Flooding

In addition to the scheduled activities, it is important to inspect the condition of the StormFilter after a major storm event. The focus is to inspect for damage and higher than normal sediment accumulation that may result from localised erosion. Where necessary damaged components should be replaced and accumulated pollutants should be removed and disposed.

Disposal of Waste Materials

The accumulated pollutants found in the StormFilter must be handled and disposed of in a manner that is in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. If the filter media has been contaminated with any unusual substance, there may be additional special handling and disposal methods required to comply with relevant government/authority/industry regulations.

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