Appendix 16

Stormwater Report

Robert Birds

Robert Bird Group

Stormwater Management Report

East Quarter St Leonards

Issue: P01

11 April 2022

Prepared For: GREATON DEVELOPMENT PTY LTD

Project No.: 20535

Document No.: 20535-RBG-ZZ-XX-RP-CV-87001-P01

Report Amendment Register

Issue Ref	Amended Section(s)	Issue / Amendment Details	Author(s)	Reviewer	Date
P01	All	First Issue	Saeika Saiara	Colin Rope	11/04/22

REVISION/ISSUE AUTHOR:

.. ..
Saeika Saiara
Signing for and on behalf of
Robert Bird Group Pty Ltd
Date: 11 April 2022

REVIEWER:

.....
Colin Rope
Signing for and on behalf of
Robert Bird Group Pty Ltd
Date: 11 April 2022

Table of Contents

APPENDICES

1 INTRODUCTION

1.1 Scope

This document forms the basis for the stormwater management design and documentation for the project.

This report provides reference information, standards and inputs, a description of the existing site and the proposed works, discussion on the hydrological and hydraulic analysis of the proposed stormwater design. This report also addresses the proposed stormwater quality treatment proposed for the development.

1.2 Project Overview

The Project site is located in St Leonards, a suburb in Sydney approximately 5km north-west of the Sydney central business district. The project site is within the Lane Cove Council Local Government Area. The project consists of proposed residential development at 22-34 Berry Road, 21-31 Holdsworth Avenue and 42-46 River Road. The proposed development consists of basement car parking and residential apartment blocks (10 storeys to the north, down to 4 storeys to the south fronting River Road).

Figure 1 – Site Location and Extents

1.3 Existing Site Description and Conditions

The site is approximately 131m long and 73m wide consisting of 16 no. existing residential properties and sloping towards the south onto River Road. The site is bound by Berry Road on the east and Holdsworth Avenue on the west. The total site area is 8758m^2.

2 DESIGN INPUTS AND GUIDELINES

2.1 Consultation

Robert Bird Group has consulted with the project team during the concept design stages. The proposed stormwater drainage design will be carried out in accordance with the Lane Cove Council's Development Control Plan (DCP).

2.2 Codes and Guidelines

The initial stormwater drainage design of the project has been carried out in accordance with the relevant local, state and national design guidelines and Australian Standard Codes of Practices including the following:

- Australian Rainfall and Runoff 2019 (AR&R).
- AS3500 National Plumbing and Drainage Codes.
- Managing Urban Stormwater: Soils and Construction, 4th Edition, Landcom.
- Lane Cove Council Development Control Plan, Stormwater Management Part O

2.3 Other Consultants Inputs

The concept stormwater design is based on:

- Architectural design information provided by Koichi Takada Architects,
- Landscape concept provided by ASPECT STUDIO

3 STORMWATER MANAGEMENT DESIGN

3.1 Design Storm Events

Proposed stormwater drainage systems are designed for the peak flow of 50-year Average Recurrence Interval (ARI) storm events, and for overland flow / flooding for major storms up to 100-year ARI.

3.2 Design Requirements

3.2.1 Design Criteria

Table 3-1 below have summarised the design criteria for hydrology and hydraulic analysis.

Table 3-1 Hydrology & Hydraulic Design Criteria

<table>
<tr><th colspan="3">Pit and Pipe Design Parameters</th></tr>
<tr><th>Parameter</th><th>Criteria Adopted</th><th>Reference</th></tr>
<tr><td>Design Average Recurrence Intervals</td><td>Drainage systems shall be designed to provide both minor and major flow conveyance systems as detailed in Australian Rainfall and Runoff (AR&R).
<table>
<tr><th>Element of Stormwater System</th><th>Design ARI</th></tr>
<tr><td>All pipes and associated components for:</td><td></td></tr>
<tr><td>single occupancy developments</td><td>20 Year</td></tr>
<tr><td>Residential flat buildings, commercial and industrial developments</td><td>50 Year</td></tr>
<tr><td>Overland flowpaths</td><td>100 Year</td></tr>
</table></td><td>PART 0- Stormwater Management – Section 3.1</td></tr>
<tr><td>Design pipe flow velocities</td><td>Min. velocity: 0.5m/s.

Max. velocity: 6m/s to prevent any pipe scouring.</td><td>PART 0- Stormwater Management – Section 9.2.1

AS3500.3: Plumbing and drainage Part 3 - Stormwater drainage</td></tr>
<tr><td>Minimum Pipe Sizes</td><td>In ground and within the building development - 225mm dia.

Within the road reserve - 375mm dia.

Connection to existing council stormwater infrastructure - 375mm dia.</td><td>AS3500.3: Plumbing and drainage Part 3 - Stormwater drainage

PART 0- Stormwater Management – Section 9.2.1</td></tr>
<tr><td>Pipe Gradients</td><td>Minimum pipe gradient shall be 1.0%.

Thrust blocks required for all grades in excess of 15%.

A maximum pipe grade of 20% is not to be exceeded.</td><td>PART 0- Stormwater Management – Section 9.2.3

AS3500.3: Plumbing and drainage Part 3 - Stormwater drainage</td></tr>
<tr><td>Pipe Cover</td><td>
<table>
<tr><th>Location</th><th>Minimum Cover</th></tr>
<tr><td>Not Subject to vehicle loading</td><td>100mm single residential
300mm all other developments</td></tr>
<tr><td>Subject to Vehicle Loading</td><td>450mm where not in a road</td></tr>
<tr><td>Under a sealed road</td><td>600mm</td></tr>
<tr><td>Unsealed road</td><td>750mm</td></tr>
<tr><td>Paved Driveway</td><td>250mm</td></tr>
</table></td><td>PART 0- Stormwater Management – Section 3.3.3</td></tr>
<tr><td>Sub-soil Drainage System</td><td>Sub-soil drainage systems are to be discharged to a council pit and not directly into the kerb and gutter. Sub-soil drainage systems are to be designed and constructed in accordance with Section 6 of AS 3500.3-1990.</td><td>PART 0- Stormwater Management – Section 3.2</td></tr>
<tr><td>Pit Freeboard</td><td>The water surface level for inlet pits shall be 0.15m below the invert of the gutter or 0.15m below the underside of the lid for junction pits.</td><td>Not mentioned in the Council Stormwater management, however based on previous experiences and hydraulic analysis in Drains.</td></tr>
<tr><td>Pit Blockages</td><td>Side Entry - 10% Blocked

Grated + 30% Blocked

Combination – 100% side inlet capacity only

Letterbox – 50%

All other on grade pits - 20% blocked

All other sag pits - 50% blocked</td><td>PART 0- Stormwater Management – Section 9.1.3

AS3500.3: Plumbing and drainage Part 3 - Stormwater drainage</td></tr>
</table>

<table>
<tr><td>Step Irons</td><td>Step irons are required for all pits deeper then 1200mm in accordance with AS1657.

Pits greater than 6.0m requires other means of access.</td><td>PART 0- Stormwater Management – Section 3.4.3</td></tr>
<tr><td>Minimum internal pit dimensions</td><td>The following table indicates the minimum pits sizes required for various pipe diameters.
<table><tr><th>Depth to invert (mm)</th><th>Minimum Pit Size (mm)</th></tr><tr><td>300 ≥ D</td><td>300x300</td></tr><tr><td>600 ≥ D > 300</td><td>450x450</td></tr><tr><td>900 ≥ D > 600</td><td>600x600</td></tr><tr><td>1200 > D > 900</td><td>900x900</td></tr><tr><td>D > 1200</td><td>900x900</td></tr></table></td><td>PART 0- Stormwater Management – Section 3.4.3</td></tr>
<tr><th colspan="3">Overland Flow Design</th></tr>
<tr><th>Parameter</th><th>Criteria Adopted</th><th>Reference</th></tr>
<tr><td>Overland Flow Design</td><td>Maximum DxV = 0.4m2/s

Maximum DxV = 0.6m2/s (Kerb and Gutter)</td><td>PART 0- Stormwater Management – Section 9.2.2</td></tr>
<tr><td>Swale Freeboard</td><td>Major: All swales shall be designed to have a minimum freeboard of;
- 150mm (No flood risk to adjacent property)
- 20% of the flow depth
- Velocity head of the flow</td><td>Austroads Part 5B: Drainage – open channels, Culverts and Floodway's</td></tr>
<tr><td rowspan="2">Swale Design</td><td rowspan="2">Grass lined channels; adopt Manning's formula for unpressurised flow with a Manning (n) = 0.03 – (Grass lined channels TYP)</td><td>Austroads Part 5B: Drainage – open channels, Culverts and Floodway's</td></tr>
<tr><td>AS3500.3: Plumbing and drainage Part 3 - Stormwater drainage</td></tr>
<tr><td rowspan="3">Design Swale Velocities</td><td>Min. velocity: 0.5m/s (Grass Lined)</td><td rowspan="3">Austroads Part 5B: Drainage – open channels, Culverts and Floodway's</td></tr>
<tr><td>Max Velocity: 1.7m/s (Grass Lined – allows for minimum 70% coverage)</td></tr>
<tr><td>Maximum DxV = 0.4m^2/s</td></tr>
<tr><td>Minimum Grade</td><td>All Swales are to be designed to a minimum of 1.0% grade, however Austroads allows the designer to reduce the grade to 0.2% if the minimum velocity is achieved.</td><td>Austroads Part 5B: Drainage – open channels, Culverts and Floodway's</td></tr>
</table>

<table>
<tr><th colspan="3">Sediment Erosion control</th></tr>
<tr><th>Parameter</th><th>Criteria Adopted</th><th>Reference</th></tr>
<tr><td>Design Approach</td><td>Industry Standards in accordance with Council guidelines and Managing Urban Stormwater, Soils and Construction prepared by Landcome ‘Fourth Edition 2004, Volume 1’</td><td>PART 0- Stormwater Management- Section 0.11

Managing Urban Stormwater: Soils and Construction Volume 1 (Blue Book)</td></tr>
<tr><td>Silt and Sediment Control</td><td><table><tr><th>Area of disturbance (m2)</th><th>Nominal type of activity</th><th>Suggested type of plan</th></tr><tr><td>< 2,500</td><td>Any construction works where disturbance of ground will occur</td><td>ESCP addressing soil and erosion and sediment pollution</td></tr><tr><td>> 2,500</td><td>Large subdivisions, large medium/high density housing, large civil works</td><td>SWMP addressing soil erosion and sediment pollution, including a calculation as to the need for a sediment basin</td></tr></table></td><td>PART 0-Stormwater Management – Section 0.11</td></tr>
</table>

3.3 Proposed Stormwater Management Design

3.3.1 Catchment Analysis

Stormwater Catchment Plan in Appendix A has shown the post-development catchment breakdown. As shown in the catchment plan, Catchment A will be treated by an OSD tank within the building basement whilst Catchment B will be bypassing the OSD.

3.3.2 On-Site Detention Tank

The proposed OSD tank has been calculated using the Lane Cove Council's OSD calculation sheet (included in Appendix B). The OSD tank has a capacity of 185m3 and the maximum discharging rate from the OSD will be limited to 84l/s by an orifice plate. A portion of the development site will bypass detention as discussed in section 3.3.1 above.

A weir wall will be provided inside the OSD tank with the orifice plate, in case of any blockage to the orifice plate the weir wall will allow the water level to build up within the tank and spill over the weir and free flow into the proposed stormwater system. Access hatches will be placed above the inlet and outlet for maintenance purposes. The outlet from the OSD will discharge into a proposed stormwater pit which will discharge to the existing pit in River Road.

The proposed OSD tank location is shown in the Stormwater Management Plan in Appendix A.

4 STORMWATER QUALITY IMPROVEMENTS

To ensure that the development improves the quality of stormwater leaving the development site, Robert Bird Group have reviewed the site, formulated a Water Sensitive Urban Design Concept, modelled the treatment train performance and have summarised the results in the following sections.

4.1 Design Objective

The Land Cove Council DCP does not stipulate specific stormwater quality objectives for development. As such, the design has adopted the Landcom WSUD Guideline for NSW as a best practice design approach. The average annual pollutant load reduction targets from the Landcom guide have therefore been adopted and are as shown in the

Table 4-1 Stormwater Quality Design Criteria

Stormwater Quality Design Criteria	
Pollutant	**Average Annual Pollutant Load Reduction Objective (%)**
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	65%
Total Nitrogen (TN)	45%

Gross Pollutants (GP)	90%

(Source: Landcom Water Sensitive Urban Design Guideline)

A concept stormwater quality assessment has been undertaken for the development using MUSIC software. The assessment has determined the quality of stormwater discharging from the site in the post-development scenario to comply with the adopted targets.

Achieved Pollutant Reduction Targets	
Pollutant	**Average Annual Pollutant Load Reduction Achieved (%)**
Total Suspended Solids (TSS)	89.7%
Total Phosphorus (TP)	65.3%
Total Nitrogen (TN)	53.7%
Gross Pollutants (GP)	100%

4.2 Treatment Train

Devices that have been used in the model are listed below, other equivalent proprietary devices may be substituted in detail design provided they meet the above requirements.

- Proprietary filtration device
  A proprietary water quality treatment device is proposed to be utilised to treat all roof catchments. A system such as the Ocean Protect storm filter cartridges system to be installed in the OSD tank, which is effective at removing TSS, TP, and TN to reach the reduction targets.
- Enviropods/Pit baskets
  These use a fine mesh to separate debris from stormwater as it enters the pit grate. They are easy to install, maintain, repair and replace as required.

4.3 Water Quality Treatment Train Performance

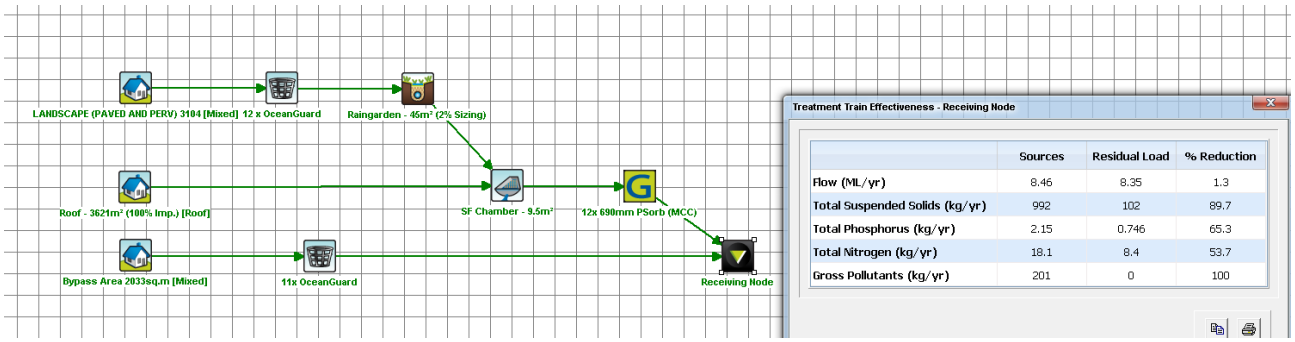
An initial stormwater quality assessment was undertaken using MUSIC software. The assessment has determined the quality of the water discharging from the site in the post-development scenario. This analysis confirms that the treatments can be achieved using the proposed approach.

A design has been completed for the current project characteristic and arrangement and this has resulted in the proposal for the following treatment systems:

- 12NO. of 690mm StormFilter Cartridges installed in a chamber within the OSD tank.

- 23NO. of OceanGuard Enviropods to be installed in all the stormwater pits.

The treatment train with reduction is illustrated in Table 4-2



	Sources	Residual Load	% Reduction
Flow (ML/yr)	8.46	8.35	1.3
Total Suspended Solids (kg/yr)	992	102	89.7
Total Phosphorus (kg/yr)	2.15	0.746	65.3
Total Nitrogen (kg/yr)	18.1	8.4	53.7
Gross Pollutants (kg/yr)	201	0	100

Table 4-2 MUSIC Treatment Train Screenshot, including Percentage of Reduction Results

5 EROSION AND SEDIMENT CONTROL

To maintain the water quality during the construction stage, erosion and sediment control measures will be installed. Soil management measures shall follow the Landcom guidelines – Managing Urban Stormwater Runoff: Soils and Construction (“Blue Book”).

Potential erosion and sediment control measures for the development may include, but not limited to, the following:

- Sediment fences around stockpiles and construction zones where soils are exposed.
- Settlement tanks/basins
- Catch drains/bunds to collect construction site runoff and convey flows to the settlement basin.
- Sediment protection devices on existing and proposed inlet pits i.e., filter socks; and
- Truck Wash/Shaker Grid at all site access/egress points.

6 CONCLUSION

This Report outlines the concept design principles that are intended for the management of stormwater runoff quality and quantity associated with the proposed development.

APPENDICES

Appendix A **Civil Drawings**

Appendix B **OSD Calculation Sheet**

APPENDIX A Civil Drawings

APPENDIX B OSD Calculation Sheet

Appendix 13 – OSD Checklist for DA Submission

ON-SITE STORMWATER DETENTION CHECKLIST

This form is to be used to determine if OSD will be required for residential developments and must be completed before the submission of any application.

PART A. Address and type of proposed development

Street No……..Street Name……
Lot No…….. DP No…… Suburb……

Type of development (tick relevant box).

- ☐ Duplex Residential Building
- ☐ Extensions
- ☐ Commercial
- ☐ Other……
- ☐ Multiple Occupancy Residential (villa, flats etc)
- ☐ Single Residential
- ☐ Garages

PART B. Exemption for discharge directly to Lane Cove River

Is the site within the designated exclusion zone along the foreshore of the Lane Cove River. (tick one only). (Confirm with Council's Urban Services Division).

- ☐ No
- ☐ Yes

If yes, OSD is not required, If no go to part C

PART C. Exemption for minimum allowable size of site impervious area

(a) Site Area …… m^2
(b) Existing impervious area to be removed …… m^2
(c) Existing impervious to be retained …… m^2
(d) Proposed new impervious area:
  (d1) Roof area …… m^2
  (d2) Driveways …… m^2
  (d3) Other paved area …… m^2
  (d4) Supplementary areas (i.e Pervious paving area x 25%) …… m^2
(e) Total proposed NEW impervious area (d1) + (d2) + (d3) + (d4) – (b) = …… m^2
(f) Total post development impervious area (c) + (d1) + (d2) +(d3) + (d4) =…… m^2
(g) Post development impervious area (f) x 100 / (a) = …… %

OSD will not be required if one or more of the following are satisfied

- ☐ (e) is less than $50m^2$ increase in site cover and (f) is less than 65% of the total site area. (only applicable for alterations and additions)
- ☐ (g) is less than 35% of site area

Note: If OSD is not required, then the collected stormwater runoff is to be directed to a 600x600mm environmental pollution control pit with sediment collection sump and drainage filter, prior to discharging to an approved outlet. The control pit is to be designed as a gross pollutant trap to remove pollutants from the stormwater flow.

PART D. Special Consideration

Where the applicant believes that special consideration should be given for exemption from OSD, even though Parts A, B, C, or D are not satisfied, they may request exemption from OSD. Consideration may only be given on reasonable grounds and should be discussed with Council's Development Engineer.

Appendix 14 – OSD Calculation Sheet

ON-SITE DETENTION CALCULATION SHEET

DEVELOPMENT TYPE: Eastern Quarter

ADDRESS: _____

Site Area (m²)	8758	(A)
Total Impervious Area (roofs, driveways, hardstand etc) (m²)	6303.7	(B)
Total Area draining to the Storage Facility (m²) (impervious and pervious areas)	6725	(C)
New Impervious Area bypassing the Storage Facility	500	(D)
$\frac{(B)+(D)}{(B)} =$	1.0793	(E)

cannot be greater than 1.25.

Permitted Site Discharge (PSD) rate per m²

If (D) = 0 then PSD = 0.014 l/sec/m²

If (D) ≠ 0 then PSD = $0.014x(E)^{-1.37}$ l/sec/m² — 00126 (F)

PERMITTED SITE DISCHARGE (l/s) (C) x (F) — 84.802 l/s

Storage Volume per m²
(G) = 0.0255 m³/m² for all Catchments — *0.0255* (G)

SITE STORAGE REQUIREMENT (m³) ((C) + (D)) x (G) — 184.24 m³

OUTLET CONTROL - using a Sharp Edged Orifice Plate

Height Difference between top water level and Centre of Orifice (m) 2.7 (H)

ORIFICE DIAMETER (mm)

159 mm $= 21.9\sqrt{\frac{PSD}{\sqrt{(H)}}}$

Should pipe and pit losses be used to control outflow, the calculations are to be attached.

Appendix 15 – OSD Certification Form

LANE COVE COUNCIL

ON-SITE STORMWATER DETENTION CERTIFICATION SHEET

Address ..... DA Number .....

Required Volume .....m^3 Permissible Site Discharge .....l/sec

Type of Detention System

Tank

Description Buffa tank, circular concrete
Precast concrete, Brick or block wall
Other .....

Surface Basin

Description, Grassed, Landscaped, Paved,
Retaining walls:- sleeper, brick, pine log, fill
Other .....

Dimensions Length .....m Width ..... m Average length .....m Av Width .....m
Depth .....m Average Depth .....m Max Depth .....m

If over 1.2 m deep are step irons provided yes/no Has adequate fencing been provided yes/no
Access to tank grate lid other .....
(can it be easily lifted) . . . . . yes/no

Actual Volume Attained .....m^3

Overflow type: Pipe Weir Surface grate
Where is it directed .....

Outlet Control Stainless Steel orifice .....mm dia
Galvanised plate orifice.....mm dia
Other .....mm dia

Depth from centre of orifice to overflow.....mm

Outflow Attained .....l/sec

Outlet Pipe: Where is it directed, kerb, pipe
Other.....
Is connection in accordance with Council
Requirements . . . . . yes/no

Debris Screen Maximesh Is a handle provided yes/no
Other..... Is it readily removable without tools yes/no
Is screen fitted exclusively over outlet yes/no

Silt Trap Dimensions Wide .....mm; Long .....mm Deep .....mm Weepholes yes/no
Has subsoil drainage been provided to outlet line . . . . . yes/no

Is there any uncontrolled flow from the impervious areas on the site . yes/no if yes .....m^2
Can access be easily gained to the system for inspection purposes yes/no

COMMENTS

.....

I HEREBY CERTIFY THE ABOVE ON-SITE DETENTION STORAGE FACILITY HAS BEEN CONSTRUCTED IN ACCORDANCE WITH THE APPROVED PLANS

NAME: .....SIGNATURE.: .....DATE .....

QUALIFICATIONS: .....

Sydney Office

Robert Bird Group Pty Ltd
ABN 67 010 580 248 ACN 010 580 248

Level 6, 100 Pacific Highway
North Sydney NSW 2060
PO Box 6461
North Sydney NSW 2059
Australia

P: +61 (0) 2 8246 3200
F: +61 (0) 2 8246 3201