STORMWATER MANAGEMENT PLAN

REPTILE AND AMPHIBIAN CONSERVATION CENTRE

PREPARED FOR:
TARONGA ZOO
Bradleys Head Road
Mosman NSW 2088

Document Status Note:

Meinhardt-Bonacci
Level 11, 501 Swanston Street, Melbourne VIC 3000
Australia

Revision	Date Issued	Prepared by	Approved by	Title
A	04/06/2021	PO	GK	Stormwater Management Plan
B	25/06/2021	PO	GK	Stormwater Management Plan
C	05/07/2021	PO	GK	Stormwater Management Plan

Prepared by: Parampreet Osahan

Date: 05/07/2021

Project Name: Taronga Zoo – Reptile and Amphibian Conservation Centre (RACC)

MIE BG Project No: 13087 01

Discipline: Civil

Contents

1.0 Introduction

The purpose of this report is to detail the proposed stormwater drainage management plan and WSUD strategy for the proposed Reptile and Amphibian Conservation Centre (RACC) development at Bradleys Head Road, Mosman NSW, on behalf of Taronga Zoo as required by the SEARs for the State Significant Development Application (SSDS) submission associated with the proposed development.

This report addresses the following items/condition of SEAR:

Condition 9. *Flooding* – Section 6 of this report identifies any on-site flood impacts associated with the proposed development and provides detailed study of the flood impact assessment as per SEAR.

Condition 10. *Stormwater drainage and water quality* – Section 3 and 4 of the report provides details on the following as required by SEAR:

- Proposed stormwater drainage design
- On-site detention facilities
- Water quality measures
- Nominated stormwater discharge point

Condition 21*. Construction impacts* - Section 5 of the report provides details on the assessment of potential impacts of proposed civil works on the amenity of the surrounding area. Details on site protection measures, such as site access, sediment control measures, temporary stormwater drainage, dust control and maintenance have been provided.

Consultation – As required by SEAR, the proposed stormwater drainage and water treatment scheme has been discussed with Mosman Council. All details of the consultation have been provided in Section 3 of the report.

This stage of the Taronga Zoo project involves redeveloping the existing Meerkat exhibit to a multi-level Reptile and Amphibian Conservation Centre (RACC). Post-development, the site will be completely built up with footpaths and structures, therefore the impervious coefficient (C) will be 0.9 to 1.00. The proposed stormwater drainage will connect to existing inground stormwater drainage discharging to existing end-of-line rainwater harvesting tanks and treatment units to attenuate flows to pre-development levels in accordance with Mosman Council – Policy for Stormwater Management in Mosman, dated October 2006.

The following design features are detailed in this report:

- Stormwater Management System Design
- Stormwater Treatment System
- Soil and Erosion Management

2.0 Site Location

The proposed site is located towards the south section of the Taronga Zoo precinct and is bound by Bradley Heads Road to the east and Athol Wharf Road to the south (Please see below Figure 2.0)

Figure 2.0 Proposed Site Location

3.0 Stormwater Drainage Design

3.1 Existing Stormwater Drainage Infrastructure

A desktop review and site inspection were carried out by Meinhardt Bonacci to determine the existing drainage infrastructure and overland flow paths within the development site. The inspection and desktop review revealed the following:

- The existing site slopes diagonally from northeast to southwest at an average fall of approximately 8%.
- There is a network of existing inground stormwater pits and pipes primarily around the perimeter of the proposed site area to facilitate draining.
- The existing stormwater drainage connects into the existing grated pit located to the southwest corner of the site located on the adjacent road running along the southern title boundary.
- These existing stormwater networks within the development area reticulate the captured stormwater to the existing stormwater treatment plant, which is located to the southwest of Taronga Zoo near Sydney Harbour, through the Zoo's internal private stormwater drainage system.
- All stormwater drainage is treated in above mentioned treatment plant before being discharged into Sydney Harbour. There are no stormwater connections into Mosman Council drainage assets.
- The details of existing stormwater drainage (location, size, and depth) have been provided in Service proving investigation report no.75166, prepared by SureSearch, dated 11.02.2021

Please refer to Figure 3.1 for an illustration of the existing stormwater drainage infrastructure.

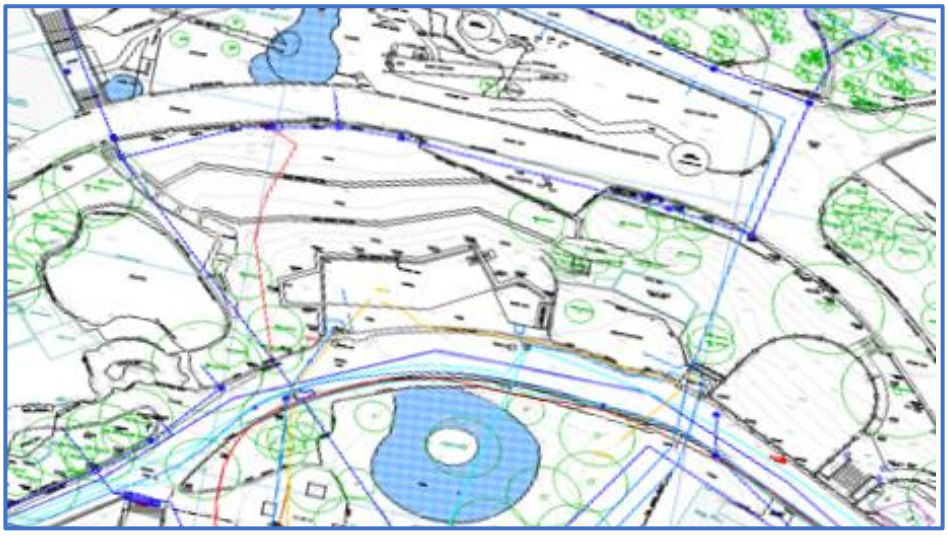


Figure 3.1 Existing Stormwater Drainage

3.2 Council Requirements

As per Mosman Council's general design parameters, the following design criteria will be adopted:

For gravity flow pipe systems:
Recurrence interval: 20 years
Time of concentration: 5 minutes
Rainfall intensity: 206 mm/hr
Runoff coefficient: Pervious: 0.75
Impervious: 1.0

For overland flowpath:
Recurrence interval: 100 years
Time of concentration: 5 minutes
Rainfall intensity: 267 mm/hr
Runoff coefficient: Pervious: 0.75
Impervious: 1.0
Minimum 1% fall from boundary to kerb.

Minimum freeboard of 300 mm to adjacent habitable floor levels of the development site and adjoining properties for overland flows.

Please refer to Table 3.2, for Pre-development and post-development catchments.

Catchment		Area [m²] (Total Area 2260m²)	Impervious Fractions (f)
Pre-development	Pervious	Landscape = 1980	0.75
	Impervious	Hardstand = 260	0.90
		Roof = 20	1.00

Post-development	Pervious	Landscape = 962	0.75
	Impervious	Hardstand = 947	0.90
		Roof = 351	1.00

Table 3.2 Pre-development and post-development catchments

3.3 Proposed Stormwater Drainage Scheme

The proposed roof catchment will be captured by downpipes that will transition through the building to the proposed inground stormwater drainage on ground floor. Level 1 and Level 2 catchments will be captured through downpipes and rainwater outlets and connect to the proposed inground stormwater drainage on ground floor as well.

The ground floor will be retained along the northern perimeter of the proposed building. Waterproofing of this retention wall to prevent seepage flows will require further coordination with the Architect and Structural Engineer.

Thus, all proposed stormwater drainage for the proposed development site will be captured by a network of inground pits and pipes connecting to existing downstream internal stormwater drainage of Taronga Zoo to discharge via gravity.

There are existing stormwater pits along the northern title boundary that will be relocated as they are within the proposed building layout. The existing drainage to be relocated will be shifted to the abutting bitumen road to the north of the proposed title boundary.

Please refer to Appendix A for proposed stormwater drainage scheme.

3.4 Rainfall Data

The Rainfall intensity for proposed site has been derived from Rainfall intensity data provided by Bureau of Meteorology on http://www.bom.gov.au. These rainfall intensities are in line with the design parameters provided by Mosman Council.

Please refer to Table 3.4 below for Rainfall data and Appendix B for IFD chart (Intensity and Frequency Data)

RAINFALL INTENSITY IN mm/h FOR VARIOUS DURATIONS AND RETURN PERIODS

DURATION	RETURN PERIOD (YEARS) 1	2	5	10	20	50	100
5 mins	100.	129.	163.	183.	209.	243.	269.
6 mins	93.9	120.	153.	171.	196.	228.	253.
10 mins	76.9	98.8	126.	142.	163.	191.	212.
20 mins	56.4	72.8	94.6	107.	124.	146.	163.
30 mins	45.9	59.5	77.9	88.8	103.	122.	136.
1 hour	31.1	40.4	53.4	61.2	71.2	84.5	94.7
2 hours	20.3	26.5	35.0	40.1	46.7	55.4	62.1
3 hours	15.7	20.4	27.0	30.8	35.8	42.5	47.6
6 hours	10.1	13.1	17.1	19.5	22.6	26.7	29.9
12 hours	6.49	8.40	11.0	12.5	14.4	17.0	19.0
24 hours	4.19	5.42	7.08	8.06	9.33	11.0	12.3
48 hours	2.64	3.43	4.49	5.13	5.95	7.03	7.86
72 hours	1.96	2.54	3.33	3.80	4.41	5.20	5.82

Table 3.4 Rainfall Data

3.5 Post-Development Site Discharge Rates

The site discharge rates have been calculated using rational method, based on Council parameters discussed above in section 3.2.

Rational method:

Discharge '$Q_{(20 \text{ or } 100 \text{ yrs})}$ = (C*I*A)/360,

where C = runoff co-efficient, I = Rainfall intensity, A = Catchment area

Storm Event (ARI)	1 in 20 years	1 in 100 years
Pre-development (L/s)	100L/s	129.8L/s
Post-development (L/s)	113L/s	148L/s

Table 3.5 Site Discharge Rates

We note the increase in post development discharge is approximately 30%, however upon initial consultation with Council drainage engineer Matthew Poon at Mosmon Council on 1st June 2021, it has been confirmed in principle that Council will not object to our drainage strategy since the proposed drainage connection is to private internal drainage, with no impact on Council assets. A follow up email was sent to Mosman Council to confirm the initial consultation. (Please refer to Appendix E). However, formal Council approval is pending for stormwater drainage plans.

4.0 Water Sensitive Urban Design (WSUD)

The aim of WSUD is to remove pollutants from stormwater before discharging it into existing drainage system/downstream catchment. Best Practice Environmental Management Guidelines (BPMEG) require the following pollution reduction targets:

- Total Suspended Solids 80%
- Total Phosphorous 45%
- Total Nitrogen 45%
- Litter 70%

Taronga Zoo has an existing Waste Water Treatment Plant (WWTP) located to the south west corner of the zoo, adjacent to Sydney Harbour that meets the WSUD requirements.

4.1 Existing Stormwater Treatment System

The WWTP captures the first-flush component from the overland stormwater flow from various animal enclosures and open areas within and surrounding the zoo – reclaiming approximately 100 ML annually. Excess stormwater during large storm events is redirected to an ocean outfall. The treated water from the plant is reused on site for irrigation, filling the moats, cleaning/hose down and toilet flushing purposes. Any excess treated water, such as during storm events, is also channeled to the ocean outfall following UV disinfection. The first flush diversion point and the effluent discharge are monitored by the NSW EPA.

This information has been extracted from *Taronga Zoo Wastewater Treatment Plant - Capacity and Condition Review*, prepared by KMH Environmental, dated March 2017.

Please refer to below Figure 4.1 for WWTP layout and Appendix C for treatment flowchart.

Figure 4.1 Waste Water Treatment Plant at Taronga Zoo

4.2 Proposed Stormwater Treatment

The proposed stormwater drainage will be treated in the existing WWTP before being discharged into Sydney Harbour. The treatment process will be same as noted in Section 4.1 above.

5.0 Sediment and Erosion Control Measures

Civil drawings or Sediment and Erosion control plans and details will be provided outlining the control measure. All sediment control measures to be installed in accordance with Landcom Managing Urban Stormwater ‘’Blue Book’’.

Please refer to Appendix D for proposed sediment and erosion control plan.

5.1 Site protection Measures

It is proposed to provide the following measures discussed below, to inhibit the movement of sediment off the site during the demolition and construction phases.

5.1.1 Site Access

The site access for construction vehicles will be provided from the roads adjacent to the site area, from north and south through Temporary Construction vehicle shaker ramps with a cattle grid. Please refer to Figure 5.2 below.

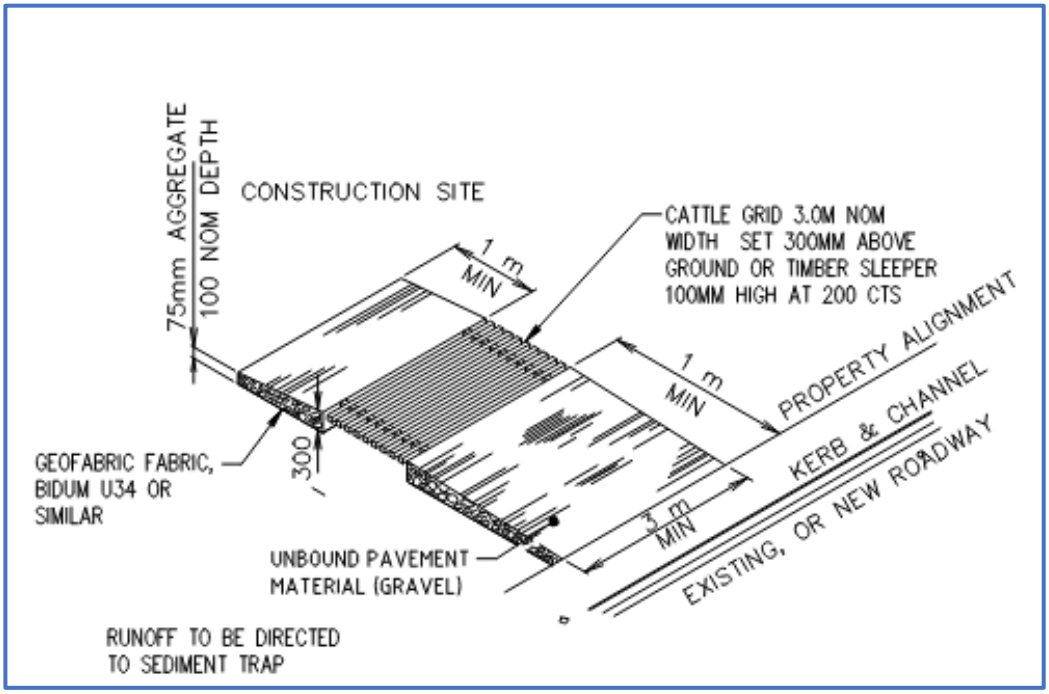


Figure 5.1.1 Temporary Construction Vehicle Entry/Exit Sediment Trap

5.1.2 Sediment Control

All exposed earth areas where it may be possible for runoff to transport silt down slope shall be protected with a sediment and erosion control silt fence generally installed along the boundaries of the site.

The fence will be constructed in accordance with details provided by the Department of Conservation and Land Management incorporating geotextile fabric which will not allow suspended particles greater than 50mg/L non-filterable solids to pass through, and as such comply with the appropriate provisions of the Clean Waters Act 1970.

The construction of the silt fence will include the following:

- Geotextile fabric buried to a maximum of 100mm below the surface
- Overlapping any joins in the fabric
- Turning up on the ends for a length of 1 meter to prevent volumes of suspended solids escaping in a storm event

Please refer to Figure 5.1.2(a) below.

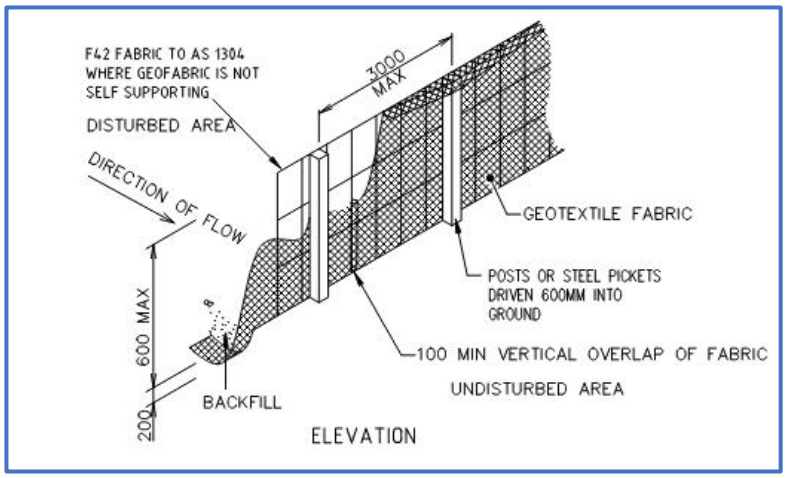


Figure 5.1.2 (a) Sediment Fence

Existing stormwater infrastructure is also to be protected from incoming sediment with the incorporation of geotextile pit filters to the existing downstream stormwater pits in proximity of the proposed site area.

Please refer to Figure 5.1.2(b) and Figure 5.1.2(c) below:

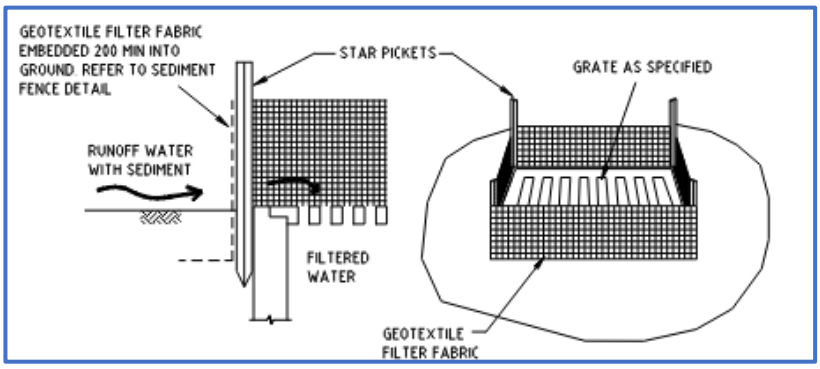


Figure 5.1.2(b) Geotextile Pit Filter 1

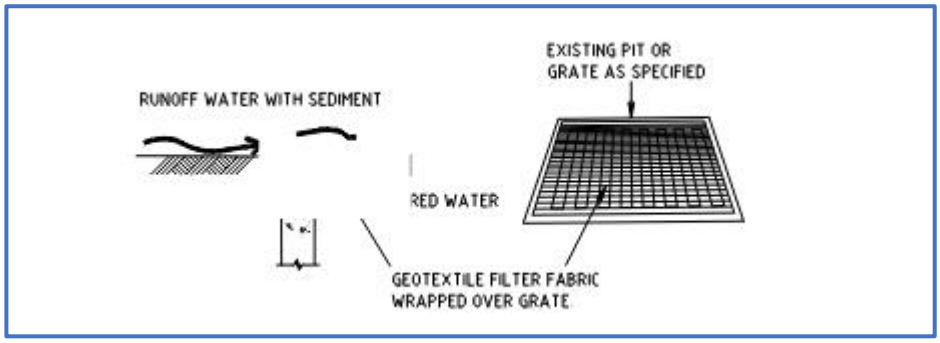


Figure 5.1.2(c) Geotextile Pit Filter 2

5.1.3 Temporary Stormwater Drainage (Where required)

Site runoff within the zones of the excavation will be drained into a central holding well within the excavation. Runoff will be allowed to settle out suspended particles and debris, and an acceptable water of 50mg per liter of Non-Filterable Residues (NFR) is required to be achieved prior to discharge.

5.1.4 Dust Control

The proposed dust control measures are as follows:

- Loose loads entering or leaving the site will be securely covered by a tarpaulin or like material in accordance with RMS and local Council Guideline
- Soil transport vehicles will use the single main access to the site
- There will be no burning of any materials on site
- Water sprays will be used across the site to suppress dust. The water will be applied either by water sprinklers or water carts across ground surfaces whenever the surface has dried out and has the potential to generate visible levels of dust either by the operation of equipment over the surface or by wind. The watercraft will be equipped with a pump and sprays
- Spraying water at the rate of not less than three (3) L/s and not less than 700kPa pressure. The area covered will be small enough that surfaces are maintained in a damp condition and large enough that runoff is not generated. The water spray equipment will be kept on site during the construction of the works
- During excavation, all trucks/machinery leaving the site will have their wheels washed and/or agitated prior to travelling on Council Roads

- Fences will have shade cloth or similar fabric fixed to the inside of the fence

5.1.5 Maintenance

- It will be the responsibility of the contractor to ensure sediment and erosion control devices on site are maintained. The devices shall be checked daily, and the appropriate maintenance undertaken as necessary
- Prior to the closing of the site each day, the road shall be swept, and materials deposited back onto the site
- Gutters and roadways will be kept clean regularly to maintain them free of sediment
- Appropriate covering techniques, such as the use of plastic sheeting will be used to cover excavation faces, stockpiles, and any unsealed surfaces
- If dust is being generated from a given surface, and water sprays fail
- If fugitive emissions have the potential to cause the ambient as quality to foul the ambient air quality
- The area of soils exposed at any one time will be minimized wherever possible by excavating in a localized progressive manner over the site
- Materials processing equipment suitably comply with regulatory requirements. The protection will include the covering of feed openings with rubber curtains or socks.

It is considered that by complying with the above, appropriate levels of protection are afforded to the site, the adjacent public roads, footpaths, and environment.

6.0 Flood Impact Assessment

The site under assessment was found to have little to no flood affection. Figure 6.1 below shows the topography and general layout of the upper catchments relevant to the proposed RACC building and the approximate location of the proposed RACC marked in grey. Under the staggered and sloped general terrain, the upper catchments one to seven highlighted in the below Figure 6.1 were found contributing overland flows to the downstream in an associated manner. However, little to no direct overland flow was found to encroach the proposed RACC site.

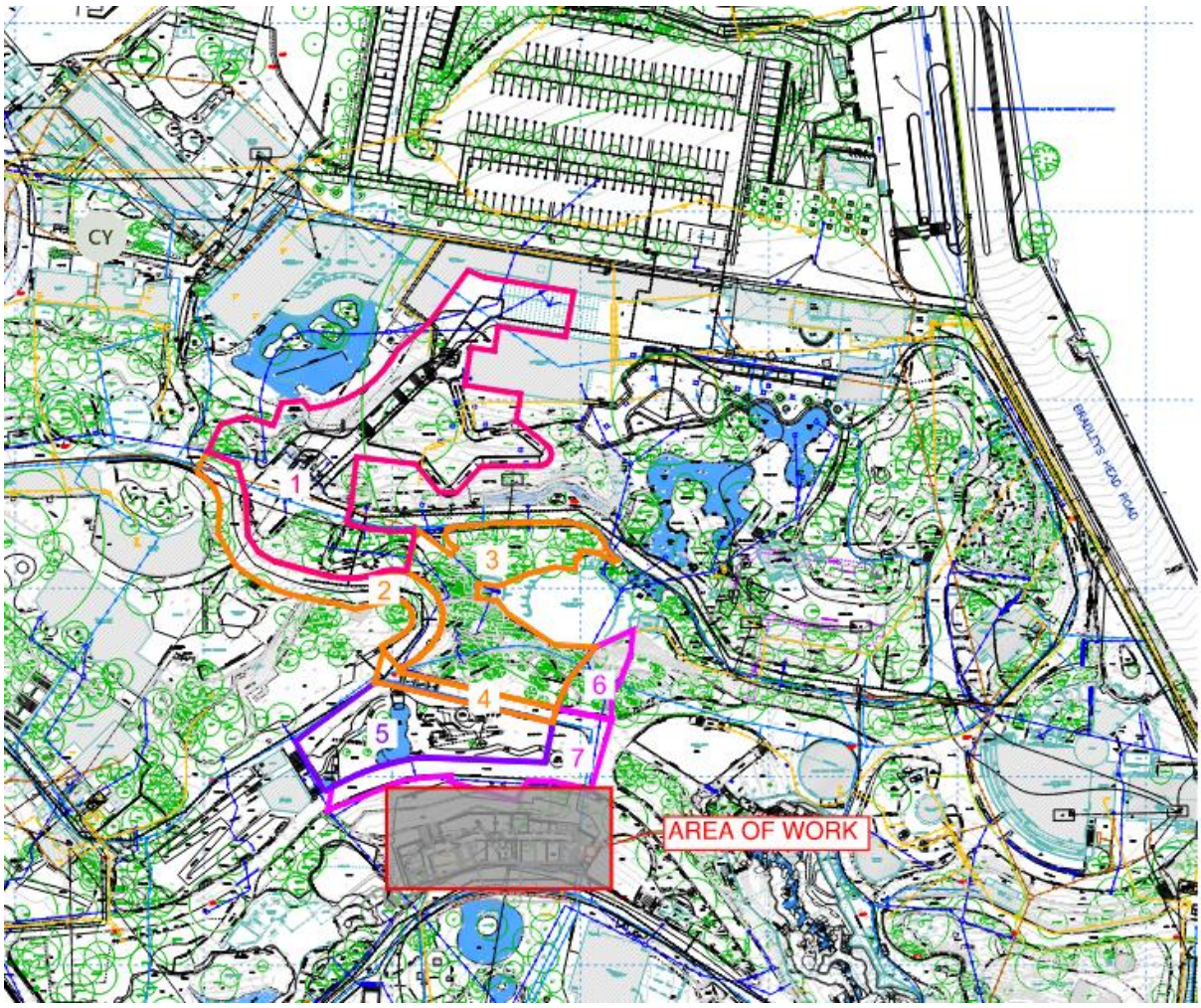


Figure 6.1 Upper Catchments to Proposed RACC Building

The upper catchments were determined based on a high level analysis of existing topographical contours and levels provided by surveyor Hammond Smeallie & Co Pty Ltd dated 20/03/2019. A detailed flood modelling had not been conducted for the site.

Further upstream to the highlighted catchments one was the main Zoo entrance and car park areas which were determined not impacting downstream with overland flow. This was outlined in the *Taronga Zoo Flood Impact Assessment* report by GRC Hydro dated 25th June 2020 provided to Warren Smith & Partners.

In understanding of these seven upper catchments, Table 6.1 below lists out the types and overflow scenarios pertaining to each of these seven catchments.

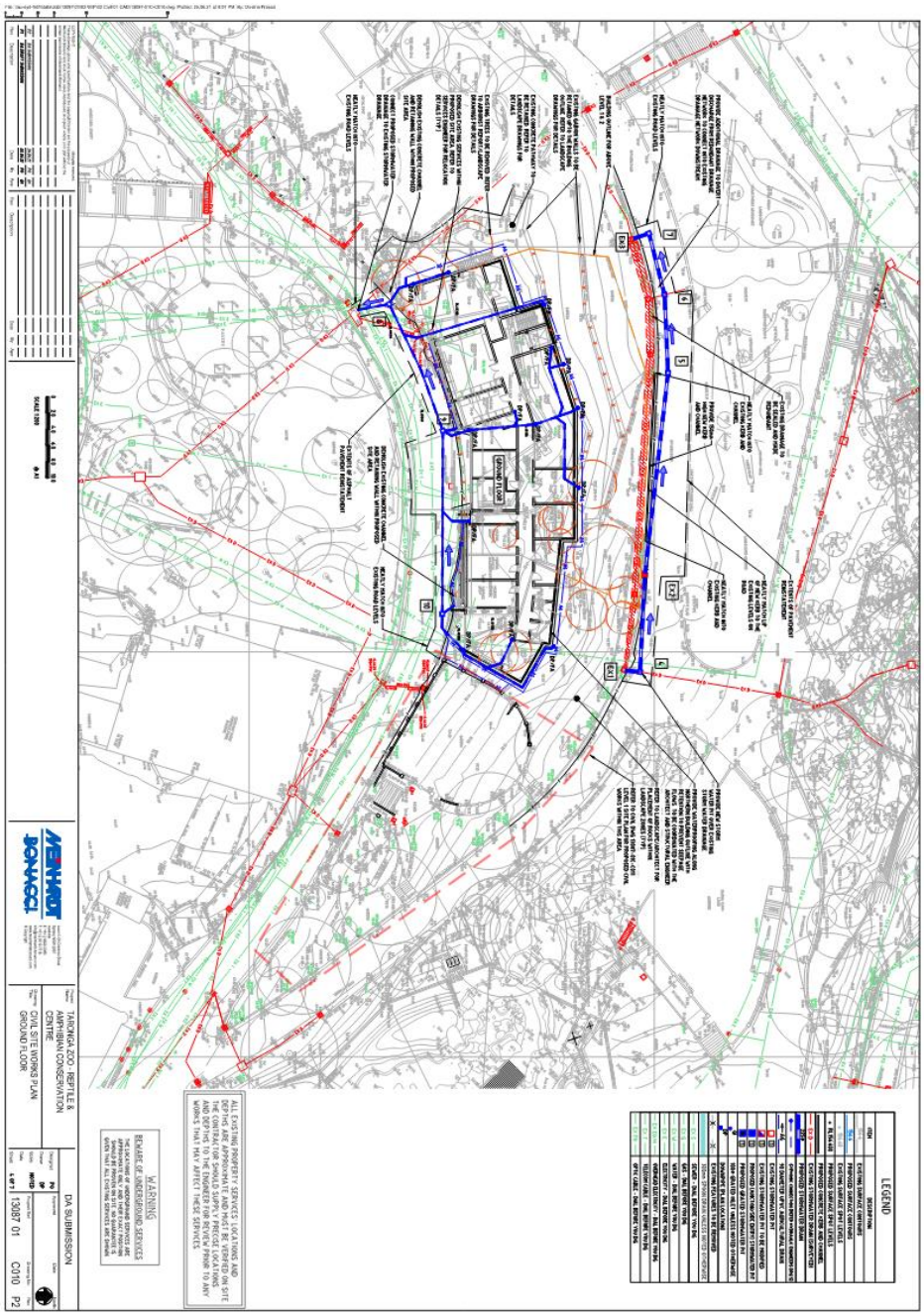
Overall, the only direct association to the downstream site should be the small landscape area in catchment no. 6 and internal roadway no. 7 as highlighted below. The site should be found free from flooding having had the internal roadway immediately above constructed with barrier kerb and channel which will convey runoff from a major storm event to further west of site.

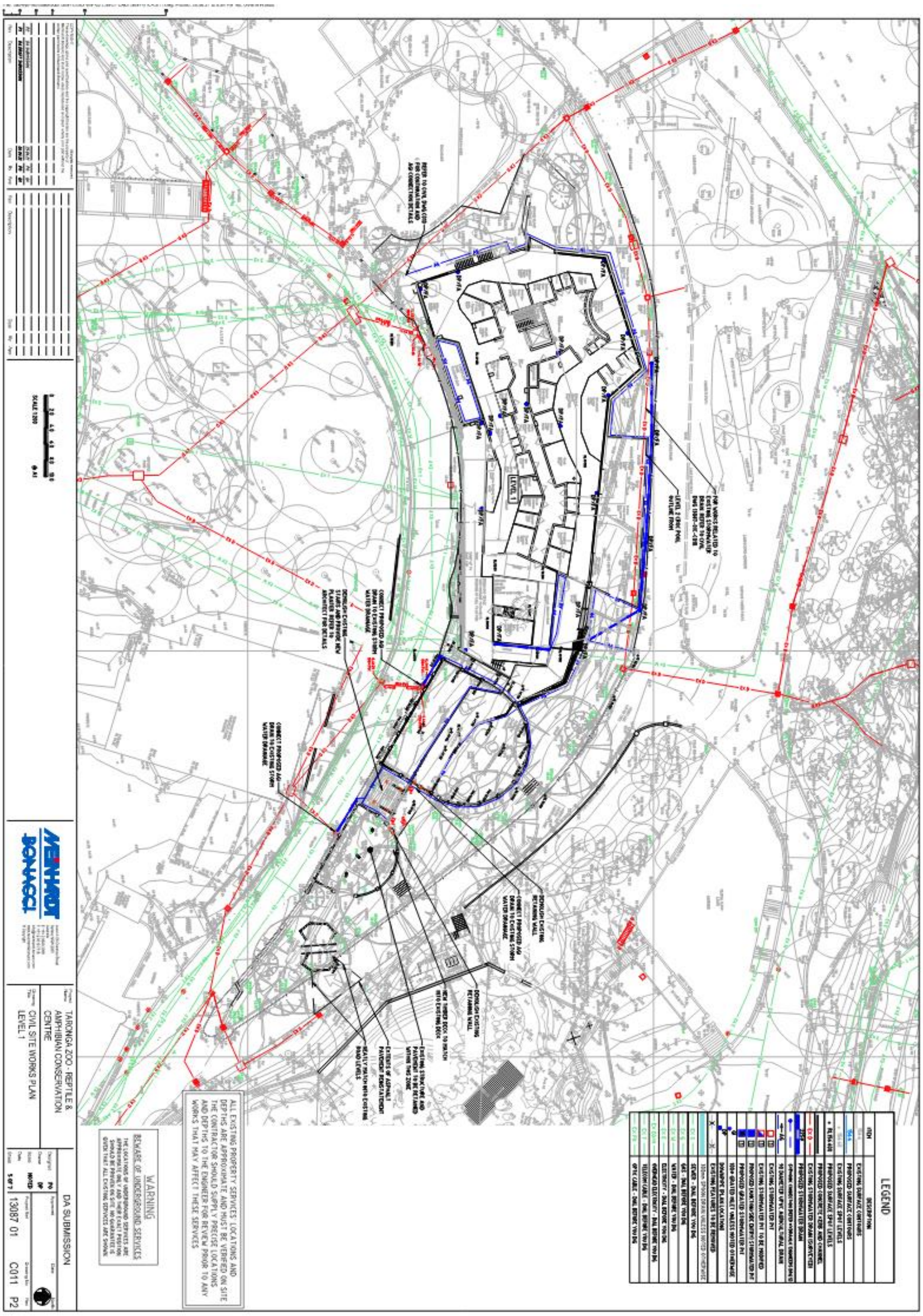
Catchment No.	Description	Overland Flow Effect on Proposed Site (Direct/ Indirect)
1	A mix of paved (car park and ramps) and unpaved landscape zones	Indirect/ No contribution. Overland flow can be contained/ conveyed by internal roadway of catchment 2
2	Internal roadway with bitumen surface	Indirect/ No contribution. Majority of overland flow from this catchment should continue southwest, only partial flow contributes to further downstream
3	Landscape area	Indirect/ No contribution. Being mainly a pervious zone the ground will need to be fully saturated first before overland flow starts to flow downstream
4	Internal access and ramp	Indirect/ No contribution. This area's overland flow contributes to the playground in catchment 5
5	Playground area that is sunken in comparison with terrains surround, which could act as a detention basin	Indirect/ No contribution. This catchment can be filled up as a detention basin. Under the current assessment it is taking overland flows contributed from all of above catchments
6	Landscape area	This small section of previous area may directly contribute to overland flow downstream
7	Internal roadway with bitumen surface and kerb and channel	This roadway has a barrier kerb and channel which helps to contain and convey the overland flow coming from 6 and 7 to further west

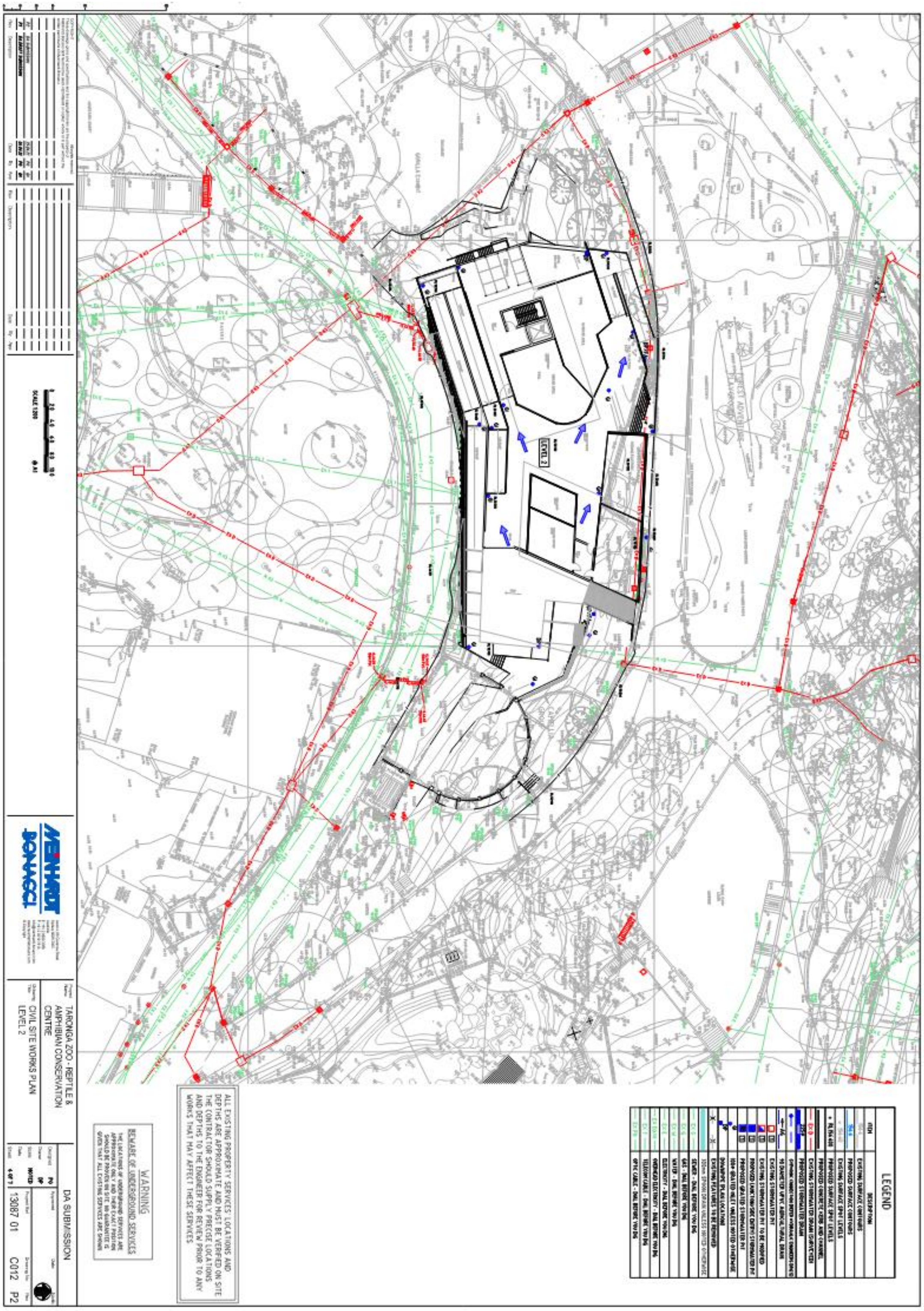
Table 6.1 Upper Catchment Types and Contribution Scenario

7.0 Appendices

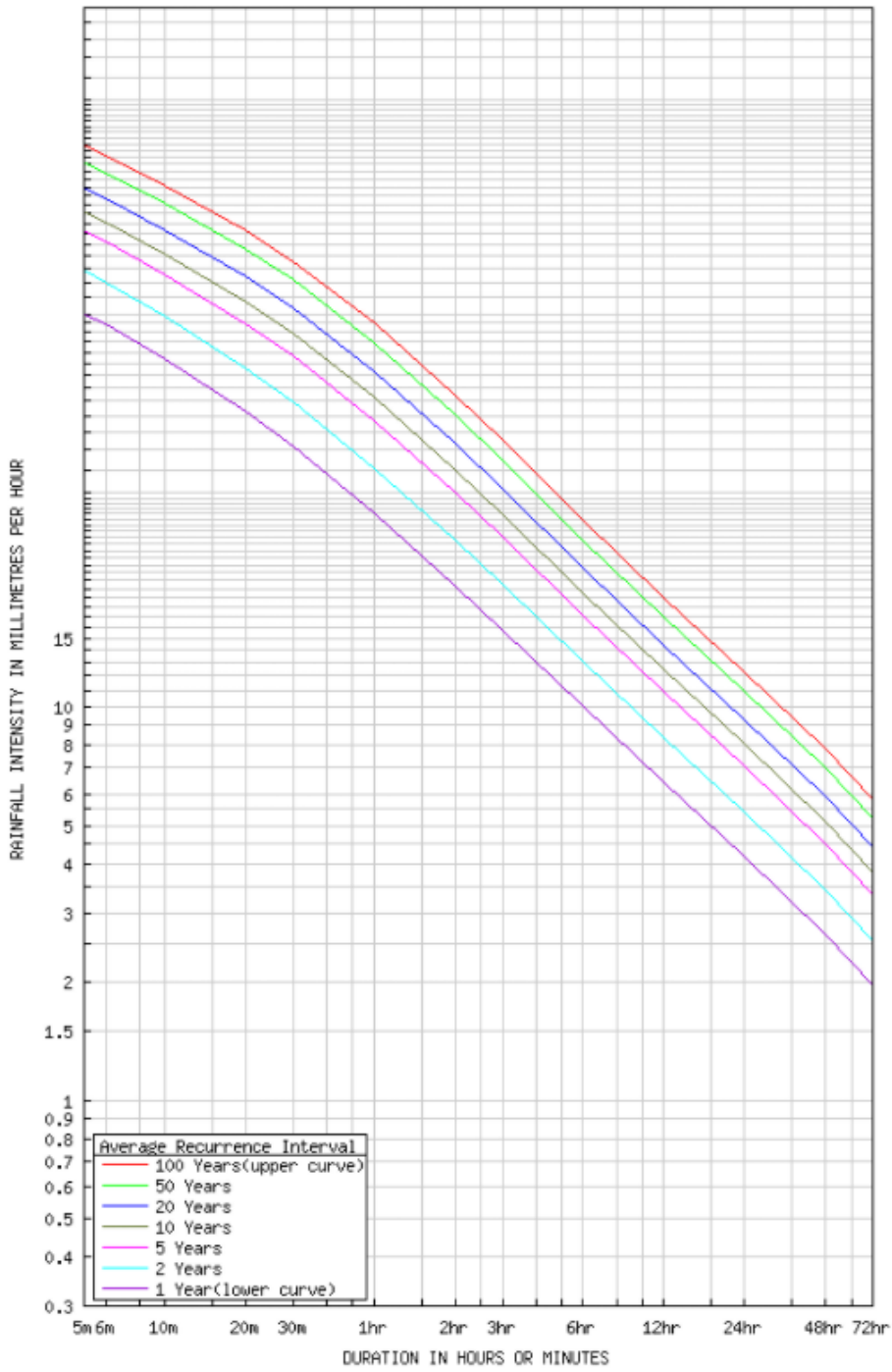
Appendix A – PROPOSED STORMWATER DRAINAGE SCHEME



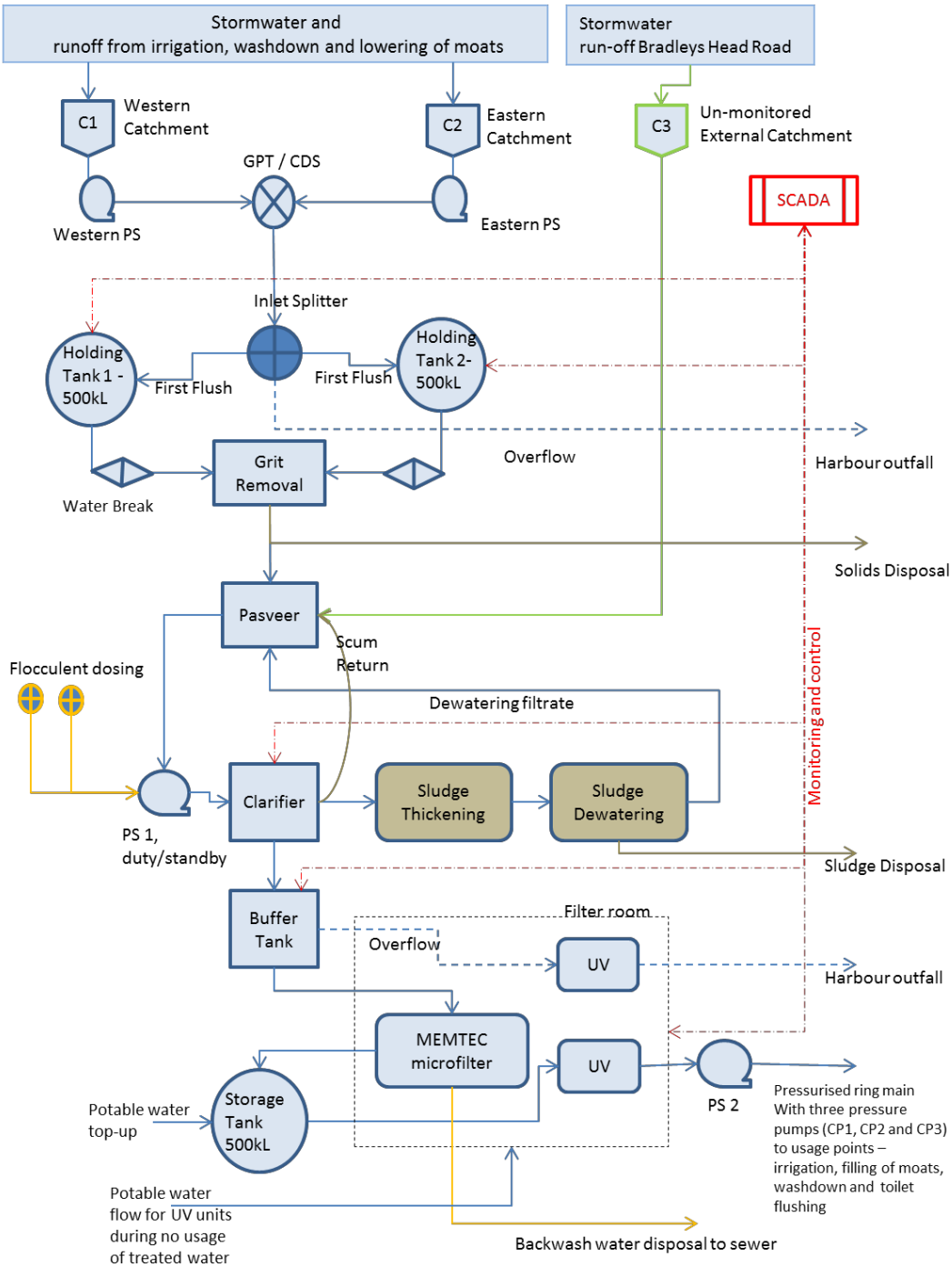

LEGEND
ALL EXISTING PROPERTY SERVICES LOCATIONS AND DEPTHS ARE APPROXIMATE AND MUST BE VERIFIED ON SITE. THE CONTRACTOR SHOULD SUPPLY PRECISE LOCATIONS AND DEPTHS TO THE ENGINEER FOR REVIEW PRIOR TO ANY WORKS THAT MAY AFFECT THESE SERVICES
WARNING
BEWARE OF UNDERGROUND SERVICES
TARONGA ZOO - REPTILE & AMPHIBIAN CONSERVATION CENTRE
CIVIL SITE WORKS PLAN
LEVEL 1
DA SUBMISSION
13087 01
C011
P2


LEVEL 2
LEGEND
ALL EXISTING PROPERTY SERVICES LOCATIONS AND DEPTHS ARE APPROXIMATE AND MUST BE VERIFIED ON SITE. THE CONTRACTOR SHOULD SUPPLY PRECISE LOCATIONS AND DEPTHS TO THE ENGINEER FOR REVIEW PRIOR TO ANY WORKS THAT MAY AFFECT THESE SERVICES
WARNING
BEWARE OF UNDERGROUND SERVICES
TARONGA ZOO - REPTILE & AMPHIBIAN CONSERVATION CENTRE
CIVIL SITE WORKS PLAN
LEVEL 2
DA SUBMISSION
13087 01
C012
P2

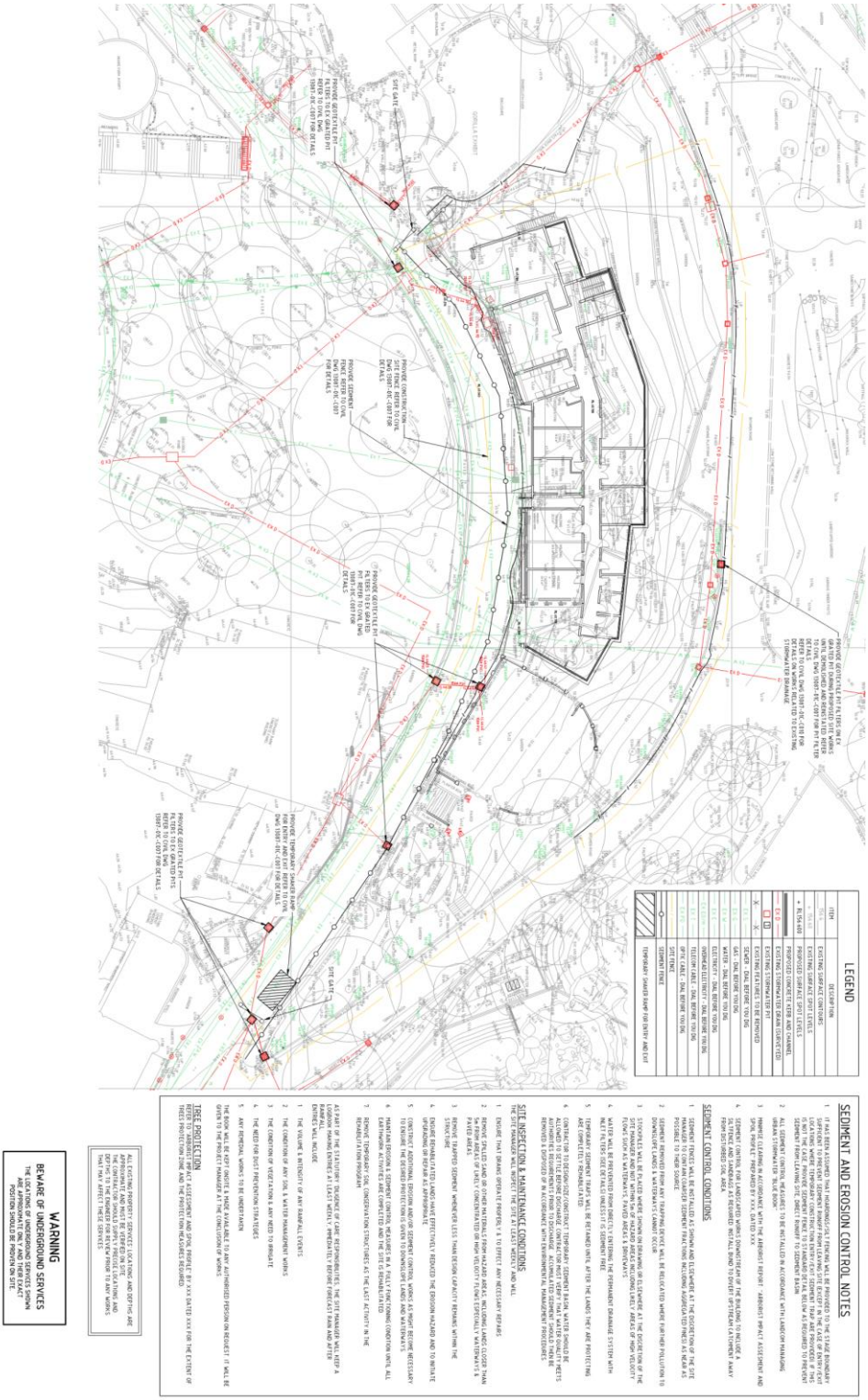
Appendix B – IFD CHART



Appendix C – WWTP TREATMENT FLOWCHART



Appendix D – PROPOSED SEDIMENT AND EROSION CONTROL PLAN



Appendix E – CONSULTATION

Parampreet Osahan

From: Parampreet Osahan
Sent: Tuesday, 15 June 2021 5:47 PM
To: council@mosman.nsw.gov.au
Subject: 13807 01_Taronga Zoo RACC_Stormwater drainage strategy

Attn: Matthew Poon

Hi Matthew,

Following our conversation earlier this month (1st June, 2021) in relation to proposed drainage design for Taronga zoo at Bradleys Head Road, Mosman NSW, I would like to confirm the following preliminary advice from council:

Council has no objections to our drainage strategy in principle (i.e. proposed drainage connection to existing drainage and existing storage and treatment tanks) since the proposed drainage connection is to private internal drainage (existing drainage at Taringa Zoo) which discharges into Sydney Harbour, with no impact on council assets. However, formal council approval is pending detailed review of stormwater drainage plans.

If you have any questions related to above, please feel free to contact me.

Regards,

Parampreet Osahan
Civil Project Engineer

www.meinhardtgroup.com
www.meinhardt-bonacci.com

Meinhardt-Bonacci
Level 11, 501 Swanston Street
Melbourne VIC 3000
Australia

P: +61 3 9418 4000
D: +61 3 9418 4038
E: Parampreet.Osahan@meinhardt-bonacci.com

Infrastructure & Environment | Structures | MEP | Project Management | Urban Development | Façade Engineering | Environmentally Sustainable Design | Fire Performance Engineering | Integrated Design Management | Mission Critical Facility Design