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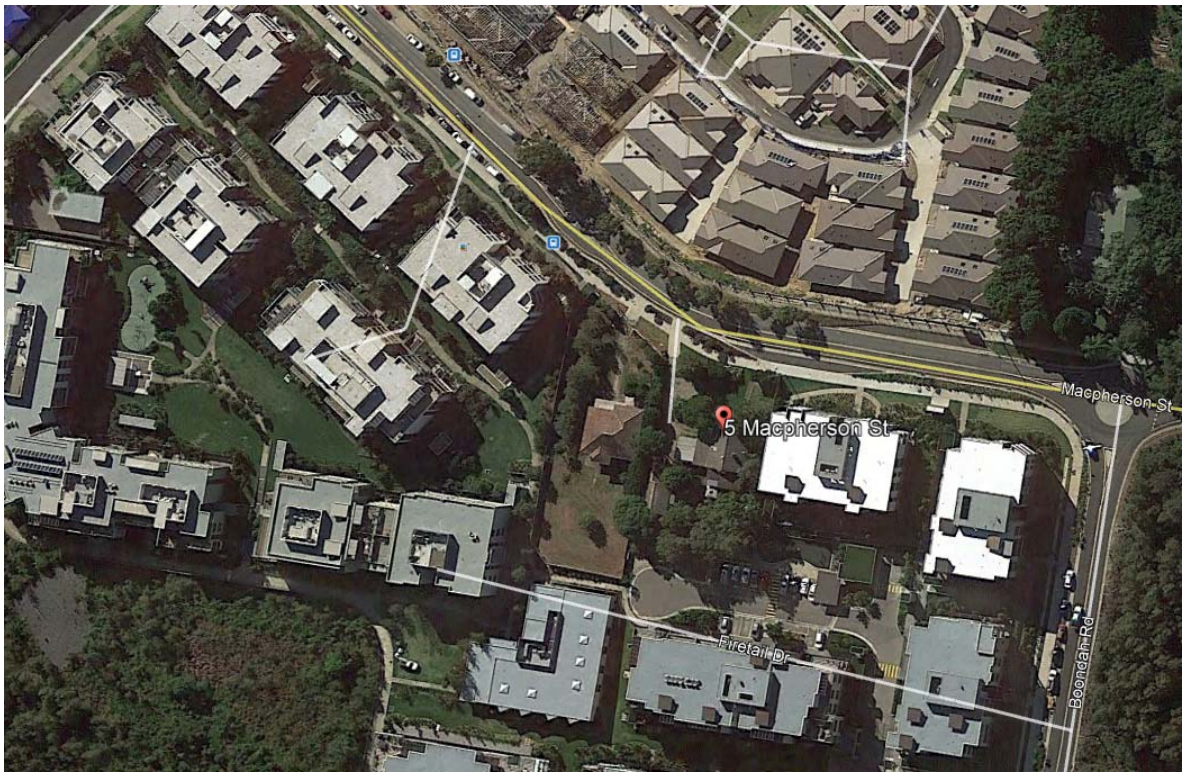

SITE WATER MANAGEMENT REPORT

Prepared for Level 88 Developments Pty Ltd

5 - 7 MacPherson Street Warriewood NSW 2102

Lot 1 DP314508 & Lot 21 DP1080979

March 2018

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Document Control

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1	Draft	02/03/2018	N Evans	Stephen Lynch	
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Contents

1 Background

1.1 Scope

This report is similar to the previous report approved at Development Application Stage (DA No. N0248/16) and makes reference to Martens Consulting Engineers' Site Water Cycle Management Report dated December 2016.

In this S96 application, the following modifications have been made :

Garage Level

1. The basement layout has been amended slightly to reduce the length of perimeter wall and improve buildability. The deep indentations between garages are proposed to be removed
2. Internal ramps removed to improve buildability.
3. The total number of residential parking spaces remains at 21.
4. The location of the visitors parking has been centralised near to the driveway for convenience.
5. Lifts are added
6. Fire stairs have been rearranged
7. Laundries have been added

Ground Floor

Northern Dwellings

1. Lifts added
2. Internal layout adjusted to co-locate living room and dining room for northern dwellings
3. Stairs consolidated
4. Letter boxes relocated to improve visibility

Southern Dwellings

1. Building entries redesigned to improve visibility
2. Lifts added
3. Stairs rearranged to allow lounge room to have greater depth increasing from 3.4 m to 4.2 m.
4. South facing Kitchen/Dining/Family rearranged to place kitchen in corner.
5. WC relocated
6. Laundries moved to garages
7. Terraces reconfigured
8. Introduction of accessible ramps in communal courtyard

First Floor

Northern Dwellings

1. Realignment of northern wall to align walls of north facing bedrooms
2. Lifts added
3. Reconfiguration of internal layouts
4. Indication of buildable external wall thicknesses

Southern Dwellings

1. Addition of lift
2. Reconfiguration of stairs

3. Minor reduction in area of sitting room to accommodate lift.
4. Rearrangement of stair to create sitting room that is not part of circulation space
5. Relocation of bathroom
6. Indication of buildable external wall thicknesses
7. Increase in southern wall articulation with a more regular pattern of stepping
8. Pushing out wall north of external void to align with built form of other levels.

Second Floor
Southern Dwellings
1. Addition of lift
2. Provision of blade walls to accommodate proposed façade frame at balcony
3. Reconfiguration of internal layouts to simplify construction
4. Pushing of stairs to edges of buildings to create centralised circulation zone and allow roof forms to be articulated
5. Indication of buildable external wall thicknesses
6. Reconfiguration of building footprint
7. Modification to side setbacks

1.2 Relevant Guidelines

As in the original accepted report, this modified report has been prepared in accordance with the following standards/guidelines:

- Northern Beaches Council – Warriewood Valley Urban Land Release: Water Management Specification (WMS) (February 2001).
- Pittwater 21 Development Control Plan (DCP) Part B: B5 Water Management and Part C: C6 Design Criteria for Warriewood Valley Release Area.
- NSW MUSIC Modelling Guidelines (August 2015).

2 Site Description

2.1 Site Description and Location

Site description is provided in Table 1.

Table 1: Site description summary.

Element	Site Details
Site Area	0.298 ha
Address	5-7 Macpherson Street, Warriewood, NSW 2102
Lot/DP	Lot 1 DP314508 & Lot 21 DP1080979
Existing site development	Two single story residential dwellings with associated carports and sheds.
Neighbouring environment	Site is bounded by medium density residential dwellings on the east, west and south sides. Macpherson Street runs along the north boundary. Narrabeen Creek is approximately 200 m NE of the site.
Site elevation	Site elevation is approx. 9.7 mAHD at the NE corner and approx. 6.2 mAHD at the rear SW boundary. Macpherson Street adjacent to site is at approx. 9.4 to 8.6 mAHD, grading down from east to west.
Site grading & Aspect	Site grading is approx. 4.5% towards the rear SW site boundary.
Local Government Area	Northern Beaches Council

The following details relevant to this study are noted in relation to the site:

- Site is located within Sector 14 of the Warriewood Valley Land Release area.

2.2 Proposed Development

The proposed development includes:

- Nine residential dwellings, constructed in two rows. The northern row consists of dwellings 1-4, dwellings 5-9 make up a row to the south.
- A covered basement garage is proposed between the two rows of dwellings and enclosed garages under each individual dwelling.
- Site regrading works.

2.3 Existing Drainage

Existing drainage infrastructure of the surrounding area includes:

- Council pit and pipe drainage network to the north of the site on Macpherson Street.
- Pit and pipe located south of the site in a cul-de-sac off Mallard Lane.
- Pit and 100 mm drainage pipe located on the western boundary approximately 15 m from the new south boundary. This pipe goes to the west connecting to the surrounding development's drainage network.
- Concrete dish drain, with stormwater pits, running down the southern and western boundaries of 7 Macpherson Street, collecting runoff and discharging it through the adjoining developments drainage network.
- Concrete dish drain running down the southern boundary of 5 Macpherson Street, pits collect water and discharge to the adjoining development's drainage network.

3 Stormwater Quality Assessment

3.1 Water Quality Objectives

Section 4.3.3. of Northern Beaches Council Warriewood Valley Urban Land Release Water Management Specification (2001) requires the following objectives be achieved:

- To ensure that the developed conditions do not worsen the existing conditions and that the opportunity is taken to improve/reduce constituent loads. This is equivalent to a net neutral or beneficial (NorBe) outcome.
- Consideration of a wet, average and dry year during the modelling process.

Additionally, the following methods have been used to comply with these objectives:

i. Modelling of pollutant loads for the existing and post development conditions. The use of 'MUSIC' modelling software is acceptable for this purpose.

ii. The implementation of specific stormwater quality improvement devices (SQIDs), which are specified in Section 4.3.2. of the Warriewood WMS (2001).

iii. Description of maintenance schedules for SQIDs, as well as sizing details, flow bypass locations and how the system is integrated with other infrastructure.

3.2 Modelling Methodology

3.2.1 Overview

As per the original report, the Model for Urban Stormwater Improvement Conceptualisation (*MUSIC*, Version 6.1) developed by the Cooperative Research Centre for Catchment Hydrology (CRCCH) was used to evaluate the following two scenarios for water quality improvements:

- *Scenario 1: Pre-development (modelled as existing insitu) VS post-development to achieve at least a zero net change.*

- *Scenario 2: Pre-development (modelled as forest with a 20% increase in pollutant load) VS post-development to achieve zero net change in pollutant loads*.

A MUSIC model was also used to provide an assessment of the water balance. For this an existing water balance was determined using locally sourced long-term data and compared with the modelled post- development conditions.

3.2.2 Approach

As per the original report, an iterative approach was used for post-development modelling to determine appropriate types and sizes of stormwater treatment devices and for modelling scenarios to achieve the stated objectives.

Both individual source treatment and end of line structures were assessed to determine the most effective treatment option.

3.2.3 Rainfall Data

It is understood that council requires long-term rainfall data acquired from a local source. Daily rainfall data was sourced from the gauge located at Mona Vale Golf Course, station number 066141 (1969 - 2016). This was determined to be the closest suitable station to obtain appropriate rainfall information. The data from three different years was modelled to consider:

- A wet year which occurred in 1989 with an annual rainfall of 1645.4 mm

- A dry year which occurred in 1994 with an annual rainfall of 760.7 mm

- A typical year which occurred in 1992 with an annual rainfall of 1081.4 mm

Daily rainfall data was extracted for each year and used in individual models to comply with council requirements, rainfall data is available in Attachment A.

3.2.4 Input Parameters

Input parameters for source and treatment nodes are consistent with BMT WBM (2015) guidelines.

3.2.5 Catchment Areas

Pre-development and post-development pervious and impervious areas were determined from survey plans and architectural drawings. Effective impervious area calculations were conducted in accordance with BMT WBM (2015) guidelines.

3.2.6 Model Parameters

Section 4.3.3. of the Warriewood WMS (2001) provides the suggested event mean concentrations to be used for modelling water quality management. Different pollutant parameters are allowable provided they are comparable or appropriate justifications are provided.

The MUSIC pollutant parameters that were input are consistent with BMT WBM (2015) values, these values were adopted over the event mean concentrations (EMC) provided in the Warriewood WMS (2001). Table 2 shows a comparison between the suggested and adopted EMC.

The BMT WBM (2015) values were adopted on the basis of the following information:

- Both guidelines produce comparable data, when isolated for a similar land use, such as the 'Urban' land use shown in Table 2.
- The Warriewood WMS (2001) does not provide any guidelines for base flow concentrations which are necessary for MUSIC modelling.
- BMT WBM (2015) values are able to provide concentrations for specific sub-catchments, such as driveways and roofs. This is thought to increase the veracity of the model.
- BMT WBM (2015) is a more recent guideline.

Table 2: Warriewood WMS (2001) and BMT WBM(2015) pollutant concentrations.

Land use	Event Mean Concentrations		
	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Suspended Solids (mg/L)
Warriewood WMS (Urban)	1.50	0.30	100
BMT WBM (Urban)	2.00	0.25	141.25
BMT WBM (Roofs)	2.00	0.13	19.95
BMT WBM (Pavement)	2.19	0.50	269.15
BMT WBM (Landscape)	2.00	0.25	141.25

3.3 Treatment Train Philosophy

The preferred stormwater treatment strategy for the site utilises roof water capture and reuse as well as end source controls to ensure treatment objectives are satisfied. A maintenance schedule for all WSUD assets has been provided in Attachment C. Individual stormwater quality improvement devices (SQIDs) are outlined in the following sections.

3.3.1 Rainwater Tank

Individual rainwater tanks for each dwelling are proposed with a capacity for 3kL and an average daily demand rate of 212 L/day (based on BMT WBM values for toilet and washing machine reuse, and general outdoor reuse) to assist in maintaining the current water balance and some pollutant removal.

It is recommended that the roof drainage system be fitted with first flush devices, gutter mesh and be connected directly to the rainwater tank. Further details of devices to be used can be provided at the design stage.

3.3.2 Pit Inserts

All areas shall be diverted through a Stormwater360 EnviroPod. This GPT device will be implemented to capture litter, debris and other pollutants. A high flow bypass parameter of 20 L/s has been applied as per manufacturer's specifications.

3.3.3 Infiltration/Detention Basin

The Warriewood WMS (2001) requires OSD be provided for the site to maintain the peak site runoff flow regime (Section 4.6). A 243 m^3 infiltration/detention basin has been proposed to act as on-site detention. Although it is likely to provide some additional treatment, as a dedicated water

quantity control, it has not been included in water quality modelling.

The proposed basin shall be fenced to prevent unauthorised access. As the area is inundated during storm events fencing compliance with applicable pool safety legislation is proposed. Access gates shall be provided with self-closing system to comply with pool fencing standards and legislation.

3.4 MUSIC Water Quality Results

3.4.1 Scenario 1: Pre-development (Existing) vs Post-development.

Modelling against the NorBE criteria for the site has been undertaken (Table 3).

Table 3: Scenario 1 - Pre-development VS Post-development (NorBE).

	Dry Year		Average Year		Wet Year	
Parameter	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
TSS (kg/year)	56.8	27.7	150.0	48.2	244	92.3
TP (kg/year)	0.146	0.097	0.550	0.175	0.720	0.479
TN (kg/year)	1.18	1.09	3.48	3.04	5.89	5.31
GP (kg/year)	15.2	0	19.3	0	26.5	0

These results demonstrate that the NorBE criteria are achieved for all climate scenarios considered. Water quality controls proposed reduce developed site pollutant loads below pre-development loads.

3.4.2 Scenario 2: Pre-development (Forest) vs Post-development

Assessment of the pre-development modelled as forest with a 20% increase in pollutant loads against post-development has been undertaken with results provided in Table 4.

Table 4: Scenario 2 - Pre-development (forest) VS Post-development.

	Dry Year		Average Year		Wet Year	
Parameter	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
TSS (kg/year)	1.23	27.7	13.8	48.2	39.0	92.3
TP (kg/year)	0.012	0.097	0.061	0.175	0.19	0.479
TN (kg/year)	0.073	1.09	0.50	3.04	1.26	5.31
GP (kg/year)	0	0	0	0	0	0

MUSIC results show that the criteria for pre-development loads equivalent to that of a forest node with 20% increase in pollutant load, is unachievable for the site.

3.5 MUSIC Water Balance Results

An assessment of the water balance of the existing site against the proposed developed site has been conducted and the results are provided in Table 5.

Table 5: Water balance – Pre-development VS Post-development.

	Dry Year		Average Year		Wet Year	
Parameter	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
Runoff (ML/yr)	0.60	0.63	1.22	1.28	2.86	2.91

The modelling results show that the proposed development will not adversely impact the site, with the modelled runoff found to be within ±10% of the current conditions.

The Warriewood WMS does not provide performance standards for changes between the pre- and post-development water balance. Section 4.6.3. states that a difference greater than 10% is not allowable for storm flows, this percentage was applied to the overall water balance to confirm compliance.

3.6 Discussion and Conclusions

Results from the MUSIC model demonstrated that no increase compared to existing sediment, nitrogen and phosphorus loads (NorBe) is achieved with proposed water sensitive urban design devices. This outcome was achieved for all three rainfall conditions (wet, dry and average year) as outlined by Council.

If the site is modelled as though it were a forest with 20% pollutant increase, the proposed development was found to increase sediment and nutrient loads. This is inconsistent with Warriewood WMS (2001) objectives, however, to not achieve this is consistent with local practice. Other developments that are subject to the Warriewood WMS (2001) regulation have been accepted by Council provided they achieve sediment and nutrient loads demonstrating compliance to NorBe. A previous report for a nearby property (DA: N0445/15), subject to the Warriewood WMS, indicates that Council suggested that achieving compliance with either NorBe or treatment train effectiveness (TTE) procedures would be sufficient. This is particularly the case for this site where site runoff passes through a downstream water quality management system prior to discharge to the receiving environment.

MUSIC modelling results demonstrate that the site water balance is adequately maintained after development. There was found to be no significant change in runoff, across all rainfall scenarios considered.

4 Stormwater Quantity Assessment

4.1 Overview

This original assessment was completed to determine onsite detention (OSD) requirements for the proposed development. DRAINS hydrological and hydraulic modelling package was used to perform hydraulic analysis.

A concept drainage plan has been provided in Attachment E. This plan is subject to further review.

4.2 Water Quantity Objectives

Stormwater quantity management is to comply with the objectives of Warriewood Valley WMS (2001). The site is located within Sector 14 and requires that the OSD satisfies the following criteria:

- Minimum site storage requirements (SSR) are achieved, from Table A.1.
- Permissible site discharges (PSD) not to be greater than those nominated in Table A.2.
- The post-development hydrograph is not more than 10% greater than the pre-development hydrograph.

4.3 Modelling Methodology and Approach

4.3.1 Approach

The Warriewood WMS (2001) provides a prescriptive OSD requirement of 519 kL/ha for sites in Sector 14. However, when a site is to have greater than 50% impervious area, as is proposed, site specific modelling is required to contain OSD volume and for the design to achieve prescriptive PSDs. For reference, the prescription OSD volume for 2980 m^2 site would be 155kL.

An iterative approach was used for post-development modelling to determine appropriate types, sizes and location for an on-site detention configuration.

4.3.2 Rainfall/IFD Data

IFD data that was used for the model was sourced from the Bureau of Meteorology (BOM), all storms up to the 1% AEP were examined.

4.3.3 Catchments

The site discharge to two different drainage networks, one for each of 5 and 7 Macpherson St. These systems are separate but similar being comprised of a concrete dish drain and pits. In the post-development scenario, discharge from the entire site will be directed through the pit in Mallard Lane which presently receives only 5 Macpherson Street runoff. For this reason, post-development discharge has been compared to the pre-development discharge of the entire site and to 5 Macpherson Street to allow assessment of potential local effects.

4.4 Results

Based on the storage requirements specified in the Warriewood Valley WMS (2001) permissible site discharge requirements and results have been provided in Table 6.

Table 6: Peak 1% AEP event site discharge values

Storm Duration (hr)	Council PSD requirement[1] (l/s/ha)	Site PSD (l/s)[2]	5 & 7 Macpherson pre-dev (l/s)	5 Macpherson pre-dev discharge[3] (l/s)	Post-dev site discharge with OSD[4] (l/s)
0.5	33	10	129	70	10
1	79	24	133	63	10
2	109	32	131	71	11
3	113	34	97	46	11
6	118	35	64	30	12

Notes:

1. Values obtained from Warriewood Valley WMS (2001) Table A.2.
2. Based on site area of 2980 m^2.
3. Pre-development site discharge for 5 Macpherson Street only.
4. Values obtained from DRAINS modelling.

The results in Table 6 demonstrate that the PSD requirement for all storm durations was achievable and that post-development flow rates were less than pre-development flow rates. Discharge to the Mallard Lane drainage system was also considerable reduced (i.e. comparison of post development discharge to 5 Macpherson St discharge).

It was observed that the site PSD prescribed in the Warriewood WMS (10 L/s for 30 minute storm) is not within the range of ±10% in the rising or falling limb of the pre-development hydrograph (peak of 70 L/s for 30 minute storm), thus the post-development hydrograph is not able to be within the 10% range either, if Council's prescribed PSD is to be maintained.

4.5 Conclusion

The original hydraulic modelling shows that the proposed OSD system complies with the SSR and PSD objectives outlined by the Warriewood Valley WMS (2001).

The OSD design criteria were based on limiting peak post-development flows discharges for the storm durations from 30 minutes to 6 hours. This assessment found a detention basin with a volume of 243 m^3 is required to contain peak flows. This is considerably larger than the PSD calculated using the prescriptive OSD requirements (155 m^3) of the Warriewood WMS (2001). This significant increase is a result of Council's requirement that design account for the maximum (+30%) potential climate change induced rainfall intensity increase as discussed in other Council reports. A significantly smaller OSD is required to comply with only the Warriewood WMS.

Review of modelling results indicate that the discharge from the site OSD to the Mallard Lane drainage system shall be less than the current 5 Macpherson St discharge to this same point. Therefore, the proposed development shall not have an unacceptable impact on the downstream drainage system to which it is proposed to be connected.

Similarly, overland flow from the proposed OSD (which shall only occur in events in excess of the 100-yr ARI storm or in future conditions should 30% rainfall intensity increases occur as a result of climate change). shall be by way of a broad spillway spilling onto the existing site driveway to Mallard Lane. This overflow shall pass to Mallard Lane in a manner similar to the present 5 Macpherson St flows. As discussed above flow as a result of the combined development shall be less than the present 5 Macpherson St flows and therefore no adverse impact due to overland flows shall result.

Assessment was undertaken to identify the rising and falling limb of the pre-development and post-development hydrograph. Compliance with Council's prescribed PSD was achieved however this means that the pre-development hydrograph is unable to be maintained.

5 Climate Change

5.1 Overview

This assessment has been completed as per the original report to consider the possible impacts of climate change, an increase in sea level and/or higher rainfall intensities.

The site is not likely to be impacted by climate change induced sea level rise impacts due to its location.

The potential impact of climate change induced rainfall intensity increase has been modelled using DRAINS hydrological and hydraulic modelling package.

5.2 Water Quantity Objectives

In response to the specific Council requirement, as stated at the S34 conference, climate change related increase in rainfall intensity of 30% is used for an assessment of system performance against the objectives of Section 4.2. This increase is noted by Council reports elsewhere as the upper limit of potential climate change induced rainfall intensity increases. Use of this figure for stormwater system design assessment purposes is considered highly conservative and is undertaken only at the specific request of Council.

5.3 Modelling Methodology and Approach

5.3.1 Approach

The approach undertaken in Section 4.3.1 has been replicated to model the effects of climate change.

5.3.2 Rainfall/IFD Data

The same IFD data adopted in the stormwater quantity assessment was used as the base case (no increase in rainfall intensity). The increase in rainfall intensity was modelled by manually increasing the rainfall intensities for each base case storm by factors of; 1.1, 1.2 and 1.3. This represents increased rainfall intensities of 10%, 20% and 30% - being the range (10 – 30%) of potential future climate change related rainfall intensity increases as noted by Council reports elsewhere.

5.3.3 Catchments

The same catchments and justifications found in Section 4.3.3. were adopted to model climate change.

5.4 Results

The results of the DRAINS modelling, for the impact of increased rainfall intensity due to climate change, have been presented in the Tables 7 - 9.

Table 7: Peak 1% AEP +10% rainfall intensity event site discharge values

Storm Duration (hr)	Council PSD requirement (l/s/ha)	Site PSD (l/s)	Pre-dev site discharge (l/s)	Post-dev site discharge with OSD (l/s)
0.5	33	10	70	10
1	79	24	63	11
2	109	32	71	12
3	113	34	46	13
6	118	35	30	13

Table 8: Peak 1% AEP + 20% rainfall intensity event site discharge values

Storm Duration (hr)	Council PSD requirement (l/s/ha)	Site PSD (l/s)	Pre-dev site discharge (l/s)	Post-dev site discharge with OSD (l/s)
0.5	33	10	70	10
1	79	24	63	12
2	109	32	71	13
3	113	34	46	26
6	118	35	30	22

Table 9: Peak 1% AEP + 30% rainfall intensity event site discharge values

Storm Duration (hr)	Council PSD requirement (l/s/ha)	Site PSD (l/s)	Pre-dev site discharge (l/s)	Post-dev site discharge with OSD (l/s)
0.5	33	10	70	11
1	79	24	63	12
2	109	32	71	13
3	113	34	46	32
6	118	35	30	24

When considering the impacts of climate change, the DRAINS modelling shows that the OSD is adequately sized to account for increases in rainfall intensity. The proposed 243 kL basin is able to limit discharge below Council's prescribed PSD and the pre-development discharge for all climate change scenario for all durations apart from the 30 minute event with 30% intensity increase. In this case the site discharge exceeds PSD by 1 L/s a result which is considered acceptable.

5.5 Conclusion

The potential impacts of climate change have been considered and the system design for the proposed development has been amplified to allow the system to accommodate increased rainfall intensity.

Hydraulic modelling shows that the proposed OSD has been designed with sufficient capacity to achieve an acceptable stormwater solution in the event that the maximum anticipated future climate change induced rainfall intensity increase (+30%) occurs.

The location of the site means that it is not likely to be impacted by any sea level increases.

Sizing of pits and pipes at the project detailed design stage shall address anticipated climate change induced rainfall intensity increases.

6 Compliance with Development Controls

6.1 Table of Compliance

As per the original report, compliance of the proposed stormwater solution to applicable Council controls is highlighted and summarised in Table 10 as follows.

Table 10: Issues raised from Statement of Facts and Contentions and actions to address

Issue	Action and Outcome	Section Covered
Pre & post development water balance modelling excluded from report. o 7.10 of PLEP 2014 o C6.1 Pittwater 21 DCP o Warriewood WMS	Assess pre & post model water balance with MUSIC determined compliant outcome.	MUSIC results in Section 3.5.
OSD design does not incorporate adhere to Warriewood WMS. o Appendix A, Warriewood WMS	DRAINS modelling assessed OSD performance and confirmed performance in accordance with targets in Table A.1 & A.2 to redesign OSD.	DRAINS results in 4.4.
Climate change impacts not considered. o C6.1 & B3.23 Pittwater P21 DCP	DRAINS modelling assessed OSD performance in accordance with targets in Table A.1 & A.2 to consider the effects of climate change.	DRAINS results in 5.4.
Pre & post development modelling not conducted. o C6.1 Pittwater 21 DCP o Section 4.3 Warriewood WMS	MUSIC model assessment of pre development as existing condition and as a forest, modelled proposed development.	Water quality modelled in Section 3.
No specific water quality treatment devices utilised. o 4.3.2. Warriewood WMS	Assess water quality outcomes and implement SQIDs as required to achieve performance standards.	Devices listed and described in Section 3.3.
Zero net increase on existing load or 20% increase if catchment were forested not achieved o 4.3.3. Warriewood WMS	MUSIC model assessment of proposed treatment devices confirm no increase from existing condition. Unable to meet reductions for a forested catchment, importantly, compliance with this objective has not been local practise.	MUSIC results in section 3.4 & 3.6.
No details of size, flow bypass, system integration and maintenance provided. o 4.3.2. Warriewood WMS	Details sourced from manufactures about recommended protocols	Details provide in Attachment C.
Documentation Checklist – Development Application has been omitted o Warriewood WMS pg 84	The relevant checklist has been completed and attached.	Checklist comprises Attachment D.

We therefore conclude based on the above that the stormwater management scheme as detailed in this report complies with relevant controls.

7 References

BMT WBM 2015, NSW MUSIC Modelling Guidelines, August 2015. EPA

(1997) Managing Urban Stormwater: Treatment Techniques

Pittwater Council 2001, *Warriewood Valley Urban Land Release: Water Management Specification.*

Pittwater Council 2015a, *Pittwater 21 DCP Part B – General Controls*.

8 Attachment A – Rainfall, MUSIC Input Parameters and Results.

Monthly Rainfall (millimetres)

MONA VALE GOLF CLUB

Station Number: 066141 · State: NSW · Opened: 1969 · Status: Open · Latitude: 33.68°S · Longitude: 151.31°E · Elevation: 10 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	112.3	128.8	110.7	118.4	101.7	121.0	66.5	75.5	61.0	68.3	91.4	69.4	1151.2
Lowest	5.2	0.0	7.2	9.6	3.6	0.4	1.5	0.0	0.0	0.0	0.0	7.6	613.9
5th percentile	15.4	13.1	16.3	14.6	9.0	12.1	4.7	1.7	2.5	9.2	19.0	14.2	680.9
10th percentile	27.5	23.7	25.4	24.5	17.1	20.1	6.1	5.8	9.1	14.4	27.4	18.4	760.7
Median	88.2	106.4	88.4	91.7	81.7	98.5	50.8	52.0	50.0	54.0	67.0	58.0	1081.4
90th percentile	251.7	239.1	249.2	242.9	200.0	253.6	135.9	145.9	135.2	160.7	183.4	127.4	1645.4
95th percentile	275.0	323.4	262.8	322.1	260.6	305.9	160.9	239.6	144.6	166.5	205.6	138.3	1681.2
Highest	348.6	593.8	290.2	496.8	329.4	325.7	287.6	535.6	264.2	270.5	266.7	251.7	1820.5

DATA: ALL YEARS

Daily Rainfall (millimetres)

MONA VALE GOLF CLUB

Station Number: 066141 · State: NSW · Opened: 1969 · Status: Open · Latitude: 33.68°S · Longitude: 151.31°E · Elevation: 10 m

1994	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	0	0	3.0	0	0	2.2	37.0	0	0	0	0	0
2nd	0	0.7	0	3.0	0	0	6.2	0	0	0	6.6	0
3rd	0	0	0	6.2	8.4	0	3.0	0	0	0	5.0	0
4th	0	0	0	0	7.2	0	0	0	0	0	0	0
5th	0	0	0	0	1.8	0	0	0	0	0	5.6	0
6th	0	0	0	0	5.0	0	0	0	1.0	0	0	0
7th	0	0	25.0	0	0	0	0	0	0	0	0	0
8th	0	0	0	0	1.0	31.0	0	0	0	0	0	0
9th	0	0	8.2	0	3.4	2.4	1.0	0	3.8	0	0	24.2
10th	2.1	0	13.4	0	3.0	0	0	0	8.0	0	0	5.0
11th	0	0	0	0	0	0	4.4	0	0	0	0	0
12th	0	3.5	14.0	0	0	0	0	0	0	0	0	0
13th	0	43.8	0	1.8	0	0	1.5	0	0	0	0	0
14th	1.0	0	0	24.6	0	0	0	0	0	0	1.0	0
15th	4.6	0	0	34.4	0	0	0	0	0	0	0	0
16th	5.2	17.4	3.0	0	0	0	0	0	0	0	0	0
17th	0	0	0	1.8	0	0	0	0	0	0	0	0
18th	8.0	0	0	0	0	0	0	4.8	0	0	20.0	0
19th	0	41.2	2.2	0	0	0	0	2.0	0	0	0	0
20th	0.8	4.8	0	0	0	0	0	0	0	26.0	0	0
21st	0	1.4	0	0	0	0	0	5.6	0	25.0	0	0
22nd	8.8	0	0	0	0	0	0	0	0	0	0	0
23rd	0	0	0	0	0	0	0	0	0	2.0	0	0
24th	0	0	0	0	0	0	13.4	0	0	0	0	10.0
25th	0	0	0	0	0	0	0	0	0	0	7.5	15.0
26th	0	0	0	0	0	0	0	0	0	0	0	0
27th	0	0	3.0	0	0	0	0	0	0	0	0	0
28th	0	35.4	39.0	0	0	16.3	0	0	0	0	0	0
29th	0		8.0	0	0	18.0	0	0	0	0	7.5	0
30th	1.0		10.0	0	0	18.0	0	1.0	0	0	7.4	0
31st	0		0		0		0	2.2		0		0
Highest daily	8.8	43.8	39.0	34.4	8.4	31.0	37.0	5.6	8.0	26.0	20.0	24.2
Monthly Total	31.5	148.2	128.8	71.8	29.8	87.9	66.5	15.6	12.8	53.0	60.6	54.2

Annual total for 1994 = 760.7mm

DATA: DRY YEAR (1994)

FIGURE 1 – RAINFALL

Daily Rainfall (millimetres)

MONA VALE GOLF CLUB

Station Number: 066141 · State: NSW · Opened: 1969 · Status: Open · Latitude: 33.68°S · Longitude: 151.31°E · Elevation: 10 m

1992	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	3.6	0	0	0	0	0	0	0	0	0	10.0	15.8
2nd	0	0	0	0	0	0	0	0	0	0	5.0	1.0
3rd	0	0	0	63.0	0.6	1.8	0	0	0	0	5.2	0
4th	1.8	1.8	0	20.0	0	0	0	10.0	0	0	1.6	4.0
5th	6.6	11.2	0	0	0	0	0	2.6	0	8.6	7.4	57.8
6th	0	7.2	0	0	0	0	0	0	0	0	4.6	2.6
7th	0	4.2	0	0	0	0	3.2	2.0	0	0	4.8	34.4
8th	11.2	0	0.8	6.4	5.0	0	0	5.6	0	0	0	0
9th	20.4	123.0	0	4.0	0	0	0	4.0	1.0	0	0	0
10th	2.4	118.6	0	0	0	0	0	0	0	0	1.0	0
11th	0	2.8	0	0	0	0	0	0	0	0	0.8	0
12th	0	5.0	0	0	0	0	0	0	2.0	1.4	20.6	0
13th	0	0	0	0	0	0	0	0	0	0	13.2	0
14th	0	1.2	0	0	0	0	0	0	0	0	0	2.2
15th	0	6.0	0	0	0	0	0	0	0	0	0	2.2
16th	0	1.0	0	0	0	0	0	0	0	2.0	0	0
17th	0	0	0	2.0	0	0	0.6	0	0	18.8	1.0	5.2
18th	0	0	0	5.0	0	0	1.2	0	0	1.5	11.4	0
19th	0	0	0	0	0	0.4	0	0	2.4	4.2	7.0	4.2
20th	0	0	0	0	0	0	0	0	0	0	0	0
21st	0	8.6	0	0	38.0	6.6	0	0	0	0	0	0
22nd	0	10.0	0	0	1.0	6.6	0	0	0	6.0	7.6	18.2
23rd	0	0	0	0	4.4	0	0	0	0	0	0	0
24th	2.8	17.0	0	0	0	0	0	0	0	0	0	0
25th	6.0	31.2	0	13.2	0	0	0	17.6	6.2	0	0	4.0
26th	0	0	18.0	0	0	10.4	0	0	0	0	0	3.4
27th	0	0	4.0	0	0	13.2	0	0	0	9.0	0	0
28th	0	0	0	6.4	0	21.6	0	0	0	0	0	0
29th	0	0	0	0	4.2	14.6	0	0	0	13.4	0	0
30th	0		0	0	4.0	19.8	0	2.3	0	0	0	0
31st	0		0		1.0		0	0		0		0
Highest daily	20.4	123.0	18.0	63.0	38.0	21.6	3.2	17.6	6.2	18.8	20.6	57.8
Monthly Total	54.8	348.8	22.8	120.0	58.2	95.0	5.0	44.1	11.6	64.9	101.2	155.0

Annual total for 1992 = 1081.4mm

DATA: AVERAGE YEAR (1992)

FIGURE 2 – RAINFALL

Daily Rainfall (millimetres)

MONA VALE GOLF CLUB

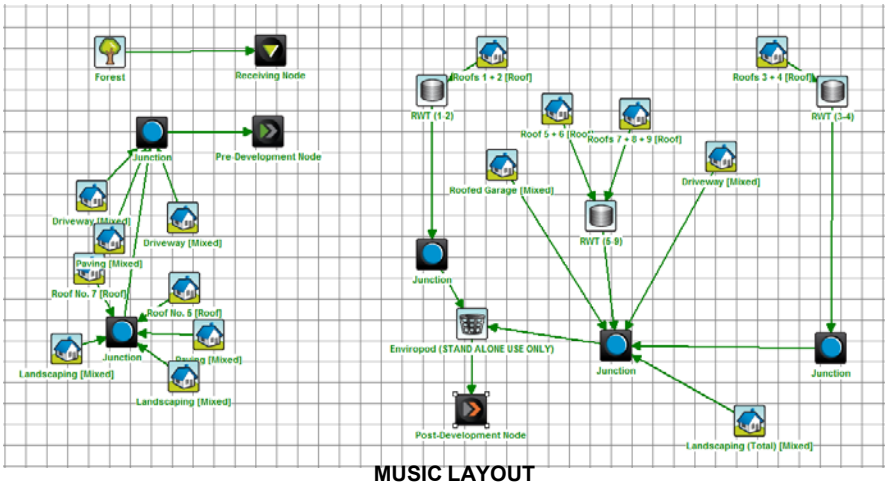
Station Number: 066141 · State: NSW · Opened: 1969 · Status: Open · Latitude: 33.68°S · Longitude: 151.31°E · Elevation: 10 m

1989	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	4.6	0	0	61.0	3.4	0.6	0	0	0	0	0	0
2nd	21.6	0	0	60.0	4.0	0	0	0	0	0	0	0
3rd	27.6	0	0	48.6	8.0	22.0	0	0	0	0	0	0
4th	4.0	3.0	14.2	2.6	0	50.2	0	0	0	0	0	28.4
5th	0	7.0	7.0	0	5.6	31.4	0	0	0	0	0	44.6
6th	15.8	0	0	0	0	14.2	0	0	0	0	0	24.0
7th	81.8	0	0	0	0	0.4	0	0	0	0	0.8	4.6
8th	0	0	0	10.2	0	0	0	0	0	0	1.8	6.2
9th	0	0	0	25.4	3.6	0	0.2	0	0	0	0	0
10th	9.2	0	17.8	1.0	3.0	0	0	0	0	0	3.4	0
11th	0	0	0	0	1.6	0	0	0	0	0	4.0	5.2
12th	0	0	4.4	0	0	22.0	0	0	0	0	12.0	2.0
13th	2.4	0	0	28.0	15.6	10.0	0	1.2	0	0	2.4	0
14th	1.6	0	10.4	2.2	13.2	0	0	0	0	0	0	6.4
15th	0	0	17.4	0	0	0	0	0	0	0	0	2.8
16th	0	0	22.4	0	7.2	0	0	0	0	0	0	0
17th	0	0	1.0	0	36.4	0	0	9.0	0	0	0	0
18th	1.4	0	2.4	0	0.6	0	0	33.6	0	0	0	0
19th	10.2	0	0	0	0	0	0	4.6	0	0	4.4	0
20th	0	27.4	0	25.6	6.2	28.5	0	1.2	0	0	4.0	0
21st	0	38.0	0	0	3.0	32.4	0	0	0	0	0	0
22nd	8.0	0	1.0	38.0	0	8.2	0	0	0	0	0	0
23rd	64.2	0	0	6.6	4.2	43.0	0	0	0	9.2	0	0
24th	0	0	0	24.0	0	0	1.4	0.3	0	0	0	0
25th	0	0	9.2	3.0	0	1.0	3.0	0	0	22.2	0	0
26th	4.6	6.0	21.0	23.0	0	0	3.0	0	0	0	0	0
27th	0	2.2	30.2	9.2	22.6	0	1.8	0	0	0	0	0
28th	2.0	0	4.2	16.4	20.0	33.0	0.2	0	0	0	0	0
29th	0		0.2	0	0	21.8	0	0	0	0	0	0
30th	0		0.4	13.0	0	7.0	0	0	0	0	0	0
31st	0		8.0		0		2.0	0		0		0
Highest daily	81.8	38.0	30.2	61.0	36.4	50.2	3.0	33.6	0	22.2	12.0	44.6
Monthly Total	259.0	83.6	171.2	397.8	158.2	325.7	11.6	49.9	0	31.4	32.8	124.2

Annual total for 1989 = 1645.4mm

DATA: WET YEAR - 1989

FIGURE 3 – RAINFALL DATA



MUSIC LAYOUT

Mean Annual Loads - Post-Development Node

	Inflow	
	Pre	Post
Flow (ML/yr)	0.598	0.629
Total Suspended Solids (kg/yr)	56.8	27.7
Total Phosphorus (kg/yr)	0.146	97.1E-3
Total Nitrogen (kg/yr)	1.18	1.09
Gross Pollutants (kg/yr)	15.2	0.00

Include Pre-Development

RESULTS: DRY YEAR

Mean Annual Loads - Post-Development Node

	Inflow	
	Pre	Post
Flow (ML/yr)	1.22	1.28
Total Suspended Solids (kg/yr)	150	48.2
Total Phosphorus (kg/yr)	0.550	0.175
Total Nitrogen (kg/yr)	3.48	3.04
Gross Pollutants (kg/yr)	19.3	0.00

Include Pre-Development

RESULTS: AVERAGE YEAR

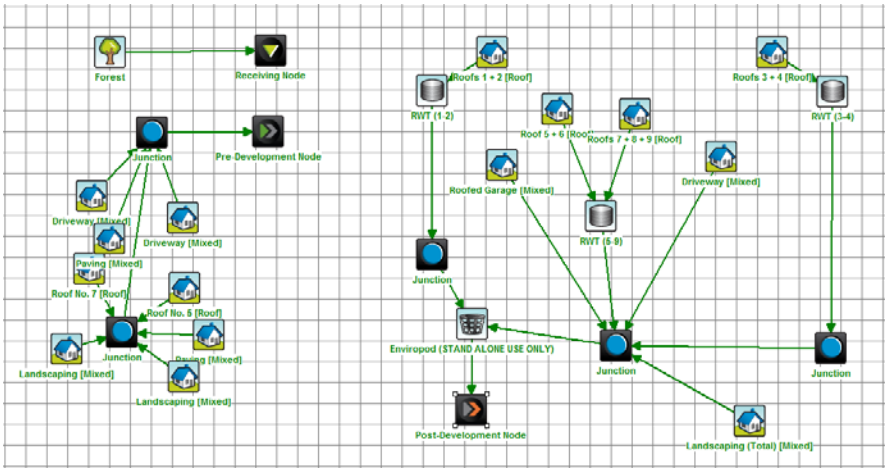
Mean Annual Loads - Post-Development Node

	Inflow	
	Pre	Post
Flow (ML/yr)	2.86	2.91
Total Suspended Solids (kg/yr)	244	92.3
Total Phosphorus (kg/yr)	0.720	0.479
Total Nitrogen (kg/yr)	5.89	5.31
Gross Pollutants (kg/yr)	26.5	0.00

Include Pre-Development

RESULTS: WET YEAR

FIGURE 4 – MUSIC LAYOUT



MUSIC LAYOUT

Treatment Train Effectiveness - Post-Development Node

	Sources		Residual Load		% Reduction	
	Pre	Post	Pre	Post	Pre	Post
Flow (ML/yr)	0.598	1.07	0.598	0.629	0	41.2
Total Suspended Solids (kg/yr)	56.8	56.5	56.8	27.7	0	51
Total Phosphorus (kg/yr)	0.146	0.184	0.146	0.0971	0	47.2
Total Nitrogen (kg/yr)	1.18	2.28	1.18	1.09	0	52.2
Gross Pollutants (kg/yr)	15.2	30.5	15.2	0	0	100

Include Pre-Development

RESULTS: DRY YEAR

Treatment Train Effectiveness - Post-Development Node

	Sources		Residual Load		% Reduction	
	Pre	Post	Pre	Post	Pre	Post
Flow (ML/yr)	1.22	1.78	1.22	1.28	0	28.1
Total Suspended Solids (kg/yr)	150	85.4	150	48.2	0	43.6
Total Phosphorus (kg/yr)	0.55	0.283	0.55	0.175	0	38.2
Total Nitrogen (kg/yr)	3.48	4.39	3.48	3.04	0	30.8
Gross Pollutants (kg/yr)	19.3	38.7	19.3	0	0	100

Include Pre-Development

RESULTS: AVERAGE YEAR

Treatment Train Effectiveness - Post-Development Node

	Sources		Residual Load		% Reduction	
	Pre	Post	Pre	Post	Pre	Post
Flow (ML/yr)	2.86	3.41	2.86	2.91	0	14.7
Total Suspended Solids (kg/yr)	244	155	244	92.3	0	40.5
Total Phosphorus (kg/yr)	0.72	0.659	0.72	0.479	0	27.3
Total Nitrogen (kg/yr)	5.89	7.05	5.89	5.31	0	24.7
Gross Pollutants (kg/yr)	26.5	54.7	26.5	0	0	100

Include Pre-Development

RESULTS: WET YEAR

FIGURE 5 – MUSIC LAYOUT

9 Attachment B – DRAINS layout and 1% AEP Event Pre and Post-Development Hydrographs

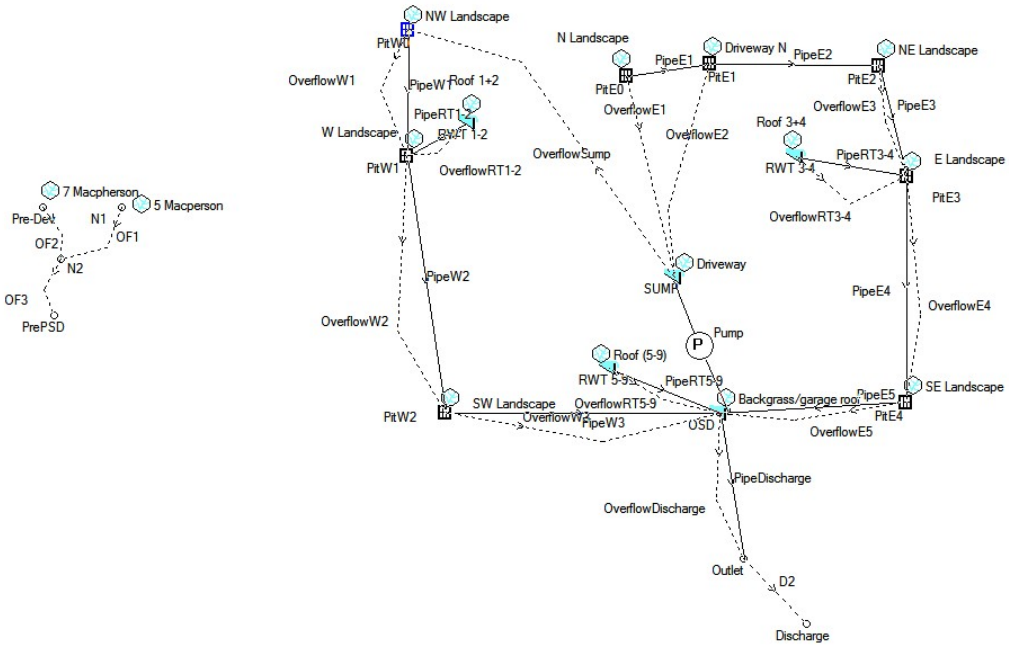
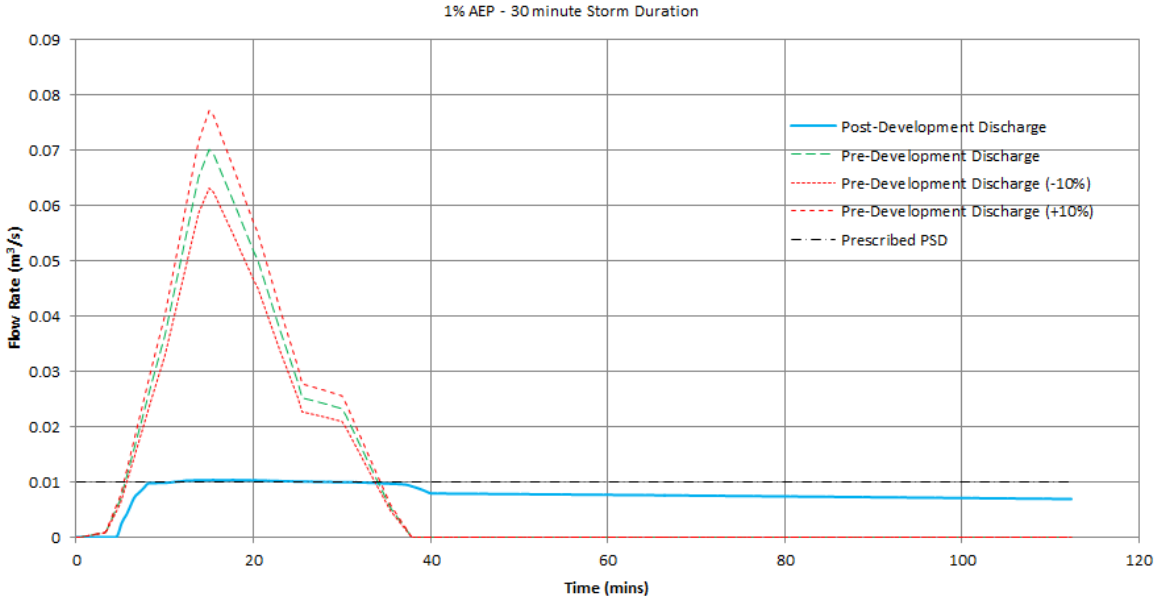


FIGURE 6 - DRAINS: PRE & POST DEVELOPMENT LAYOUT



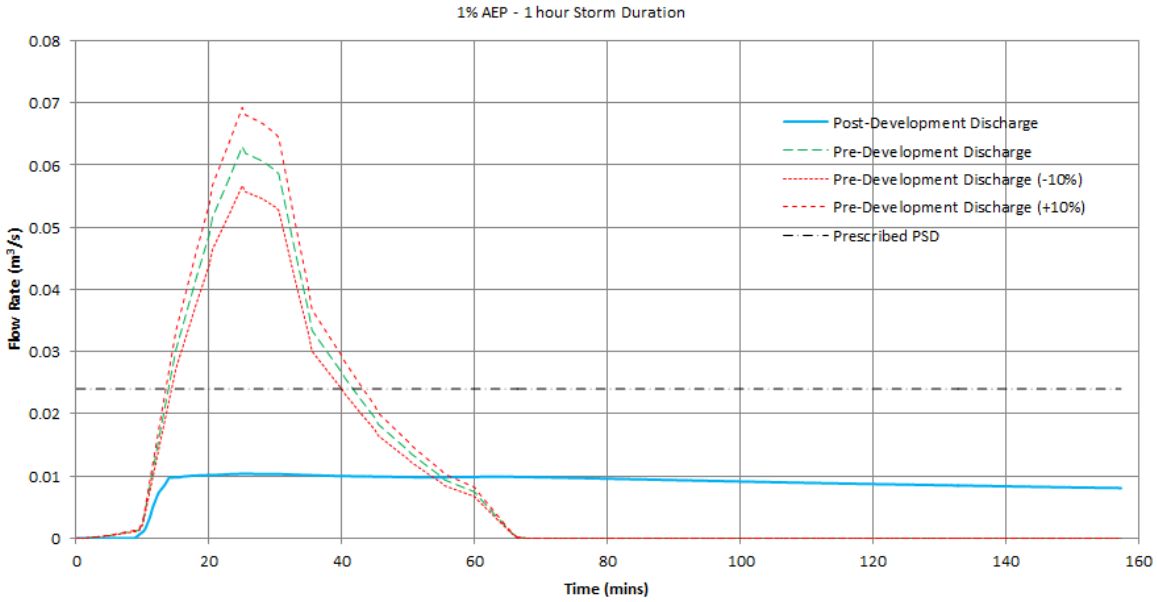
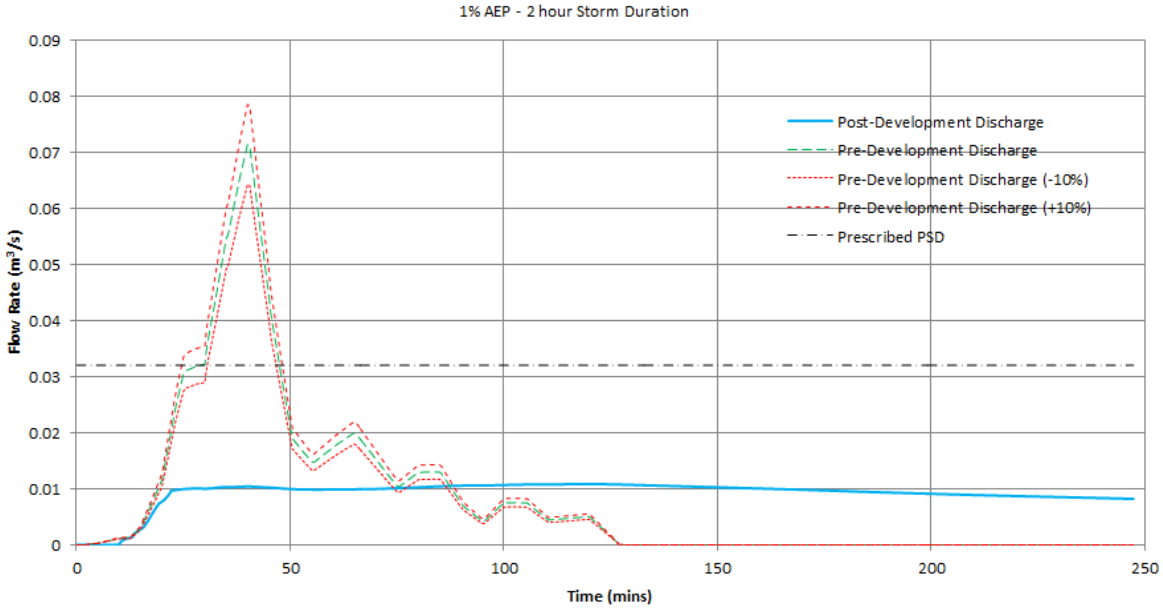


FIGURE 7 – DRAINS HYDROGRAPHS



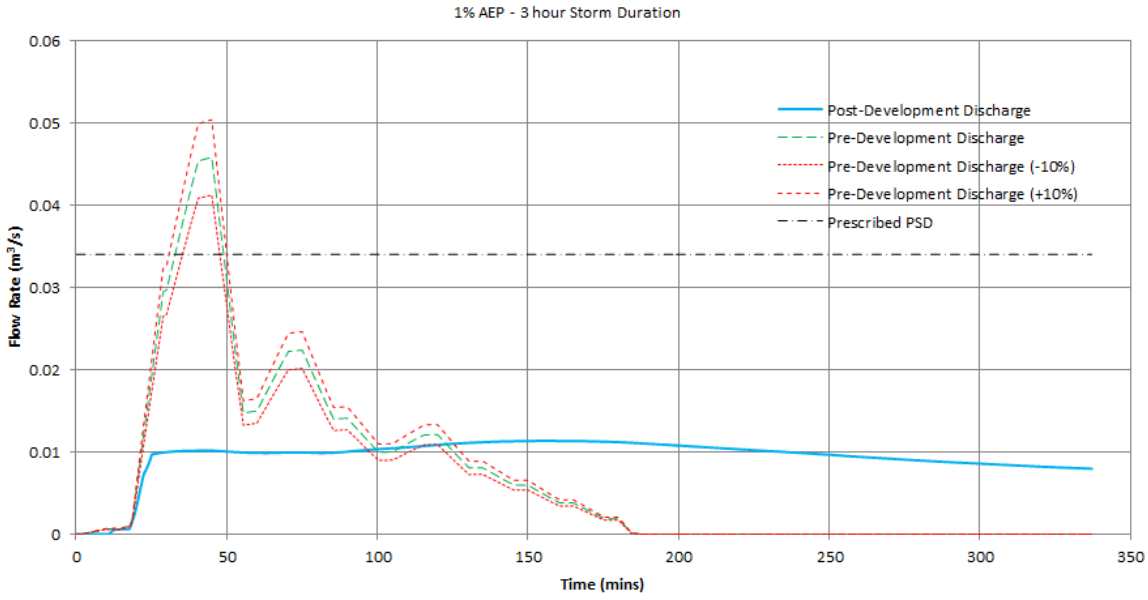


FIGURE 8 – DRAINS HYDROGRAPHS

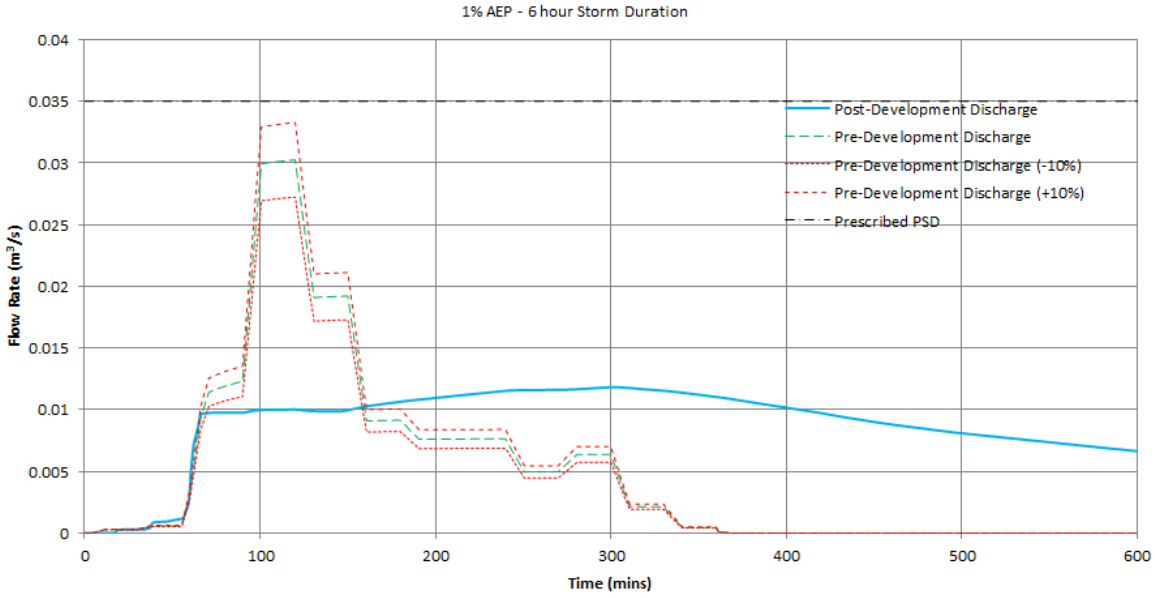


FIGURE 9 – DRAINS HYDROGRAPHS

10 Attachment C – Maintenance Schedule for WSUD Assets and On-Site Detention System

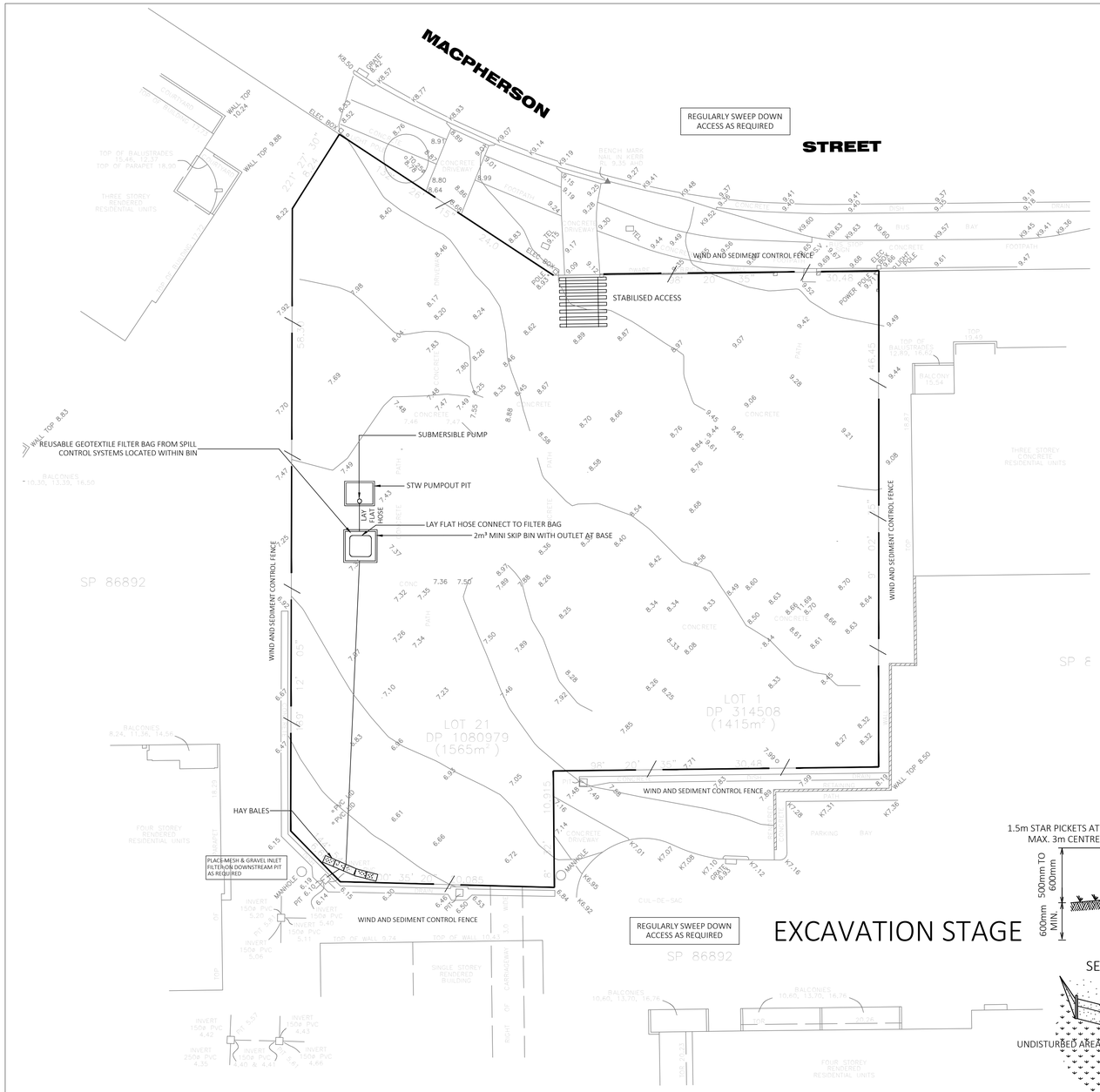
Detailed below is the Maintenance Schedule for Water Sensitive Urban Design Assets issued in respect to 5-7 Macpherson Street, Warriewood, NSW 2102.

Action	Frequency	Procedure
General:		
Participation	Monthly and after all rain events	Residents (or an engaged contractor) to inspect the pits in back yards, and clean or advise responsible maintenance contractors to clean EnviroPod pit inserts by removing any debris and disposing in garbage bins as necessary.
Awareness	Daily	Residents should remove and dispose in rubbish bins any debris or litter from the courtyard(s) or other spaces where they have the potential to enter stormwater pits.
Repair:		
EnviroPod	As reported	Any reported damage must be repaired as soon as possible by the maintenance contractor.
Pit	As reported	Repairs must be arranged immediately for any damages found in the pits during maintenance inspection or otherwise.
Tank	As reported	Repairs must be arranged immediately for any damages found in the rainwater storage tank during maintenance inspection or otherwise.
Outlet pipes from pits	As reported	Repairs must be arranged immediately for any blockage or damage discovered during maintenance inspection or otherwise.
Testing:		
Rain Water Tanks	Annually	Inspect for any damages to the leaf guard on gutters, first flush device, sump, pumps and other parts and replace immediately as required.
Water Quality	Annually	Water quality assessment shall be conducted from at least two samples from two different rain events. Any significant variation from design of water quality treatment effectiveness shall be investigated.

Detailed below is the Maintenance Schedule for OSD basin issued in respect to 5-7 Macpherson Street, Warriewood NSW 2102.

Action	Frequency	Responsibility	Procedure
Inspect outlet structure and remove any blockage	Six monthly	Maintenance Contractor	Remove screen. Check orifice and remove any blockages in outlet pipe. Flush outlet pipe to confirm it drains freely. Check for sludge and debris on upstream side of return line.
Check step irons for corrosion	Annually	Maintenance Contractor	Examine step irons and repair any corrosion or damage.
Check fixing of step irons is secure	Six monthly	Maintenance Contractor	Ensure fixings secure prior to placing weight on step iron.
Inspect pit and remove any sediment or sludge	Six monthly	Owner	Remove sediment and sludge build up.
Inspect for cracks or spalling	Annually	Maintenance Contractor	Inspect walls and repair as required. Clear vegetation from external walls if necessary and repair as required.
Inspect and remove any debris or litter from blocking the outlets	Six monthly	Owner	Remove blockages from the basin.
Vegetation management	As required	Maintenance Contractor	

11 Attachment E – Detailed Stormwater Drawings



EXCAVATION STAGE

EROSION AND SEDIMENT CONTROL PLAN

SCALE 1 : 250

LEGEND

PIPEWORK:

- SUB-SOIL
- 100 DIA uPVC STORMWATER PIPE U.N.O. WITH 1% GRADE (MIN.)
- TRUNK MAIN
- SILT AND DUST FENCE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER TO BE REMOVED
- RISE IN SERVICE
- DROP IN SERVICE

SERVICE ACCESSORIES:

- DOWNPIPE 100 DIA. U.N.O
- DOWNPIPE AND SPREADER
- PLANTER BOX DRAINAGE OUTLET 100 DIA. U.N.O.
- RAINWATER OUTLET (150 GRATE U.N.O.)
- BALCONY RAINWATER OUTLET (100 GRATE U.N.O.)
- OVERFLOW SPITTER (50 DIA. U.N.O.)
- GRATED INLET PIT (450SQ.MIN. U.N.O.)
- CONCRETE COVERED JUNCTION PIT
- GRATED TRENCH DRAIN (150 WIDE U.N.O.)
- KERB INLET PIT
- STORMWATER PUMPWELL
- VEHICULAR CROSSING
- REVISION
- OVERLAND FLOW PATH
- CLEANING EYE

ABBREVIATIONS :

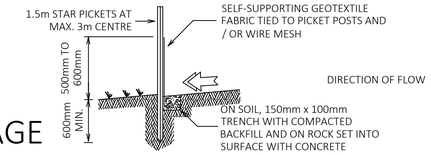
uPVC	UNPLASTICIZED POLYVINYL CHLORIDE
PVC	POLYVINYL CHLORIDE
HDPE	HIGH DENSITY POLYETHYLENE
FRC	FIBRE REINFORCED CONCRETE
CI	CAST IRON
CU	COPPER
GI	GALVANISE
RM	RISING MAIN
SYDP	SYPHONIC DOWNPIPE
RWT	RAINWATER TANK
TD	TUNDISH
TTD	TRAPPED TUNDISH
D.T.U.A.A.	DRAINAGE TURN-UP POINT
RWG	RAINWATER GUTTER
RWO	RAINWATER OUTLET
BRWO	BALCONY RAINWATER OUTLET
PBO	PLANTER BOX OUTLET
SPO	SPOON DRAIN OUTLET
RL	REDUCED LEVEL
IL	INVERT LEVEL
SL	SURFACE LEVEL
FFL	FINISHED FLOOR LEVEL
HL	HIGH LEVEL
LL	LOW LEVEL
TOW	TOP OF WALL
US	UNDERSIDE
M/H	PRESSURE IN METRES/HEAD
CIS	CAST IN SUB
CIC	CAST IN COLUMN
DIA.	DIAMETER
DIA.	DIAMETER
m	METRE
SQ.	SQUARE
U.N.O.	UNLESS NOTED OTHERWISE
PSD	PERMISSIBLE SITE DISCHARGE
SSR	SITE STORAGE REQUIREMENTS

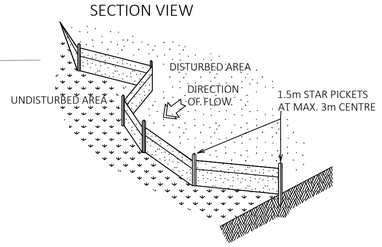
EROSION AND SEDIMENT CONTROL

1. THE NOTES AND MEASURES STATED HEREAFTER SHALL BE READ IN CONJUNCTION WITH THE NSW PUBLICATION "MANAGING URBAN STORMWATER, SOILS & CONSTRUCTION, FOURTH EDITION 2004 VOLUME 1" PREPARED BY LANDCOM. PARTICULAR ATTENTION SHALL BE PAID TO CHAPTERS 6 & 8.
2. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE PRIOR AND DURING THE CONSTRUCTION PERIOD. THESE CONTROL MEASURES SHALL BE INSPECTED AND MAINTAINED REGULARLY BY THE CONTRACTOR TO ENSURE THE EFFECTIVES OF THE SYSTEM, ESPECIALLY AFTER STORM EVENTS.
3. ALL NECESSARY WORKS SHALL BE CARRIED OUT TO PREVENT EROSION, CONTAMINATION AND SEDIMENTATION OF THE PROJECT SITE AND ADJACENT PROPERTIES AND DRAINAGE SYSTEMS.
4. MINIMISE DISTURBED AREAS COVERED WITH NATURAL VEGETATION, ONLY THOSE AREAS DIRECTLY REQUIRED FOR CONSTRUCTION ARE TO BE DISTURBED.
5. DIVERT CLEAN WATER FROM UNDISTURBED AREAS AROUND THE WORKING AREAS.
6. ADOPT TEMPORARY MEASURES AS MAY BE NECESSARY FOR EROSION AND SEDIMENT CONTROL, INCLUDING BUT NOT LIMTED TO THE FOLLOWING :
   - DRAINS - CONSTRUCT TEMPORARY DRAINS AND CATCH DRAINS
   - CONSTRUCT SPREADER BANKS OR OTHER STRUCTURES - DISPERSE CONCENTRATED RUN-OFF
   - SILT TRAPS - CONSTRUCT AND MAINTAIN SILT TRAPS TO PREVENT DISCHARGE OF SCOURED MATERIAL TO DOWNSTREAM AREAS
   - TEMPORARY FENCING - CONSTRUCT, MAINTAIN AND KEEP IN GOOD REPAIR ALL SILT AND WIND FENCES. CHECK AND CLAEN FENCES FOLLOWING RIN AND STORM EVENTS
   - REMOVE TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES WHEN THEY ARE NO LONGER REQUIRED
   - ALL DISCOLOURED WATER SHALL BE TREATED TO EPA TANDARDS PRIOR TO DICHARGE OFF SITE, OR ALTERNATIVELY REMOVED BY TANKER WITH A LICENSED TRADE WASTE COLLECTOR
7. ALL STORMWATER INLET PITS ARE TO BE PROTECTED FILTER FABRIC DROP INLET SEDIMENT TRAPS OR GRAVEL SAUSAGE, WHICH IS BLUE METAL WRAPPED IN GEOTEXTILE FABRIC.
8. STOCKPILED MATERIALS SHALL BE KEPT WITHIN THE SITE BOUNDARIES IN A POSITION NOT VULNERABLE TO CONCENTRATED SURFACE RUNOFF.

DUST CONTROL:

1. DUST IS TO BE WELL CONTROLLED ON THE CONSTRUCTION SITE AT ALL TIMES, ESPECIALLY AT EXCAVATIONS, DEMOLITION ETC.
2. WATER SPRAY TO BE USED TO CONTROL DUST ON DIRT/GRADED AREAS ONLY.
3. CARE TO BE EXERCISED TO ENSURE WATER SPRAY DISPENSE ONLY SUFFICENT WATER FOR DUST CONTROL PURPOSES.
4. CARE TO BE EXERCISED TO ENSURE ONLY OPTIMIUM MOISTURE CONTENT OF THE SOIL IS REACHED FOR COMPACTION.
5. FOR CONTROLLING DUST ON PAVED FOOTPATHS, A SWEEPER IS TO BE USED WITH WATER-JET SPRAYERS.
6. NO SURFACE WATER RUN-OFF IS TO BE GENERATED.
7. CARE IS TO BE EXERCISED TO ENSURE ONLY SUITABLE AMOUNTS OF WATER IS USED DURING SWEEPING.
8. NO RUN-OFF FROM SPRAYERS TO FLOW INTO CATCH BASINS.
9. MIMINISE THE AREAS OF EXISTING VEGETATED AREA THAT ARE DISTURBED DURING CONSTRUCTION.
10. AREAS NOT BEING WORKED ON FOR 30 DAYS OR MORE ARE TO BE VEGETATED OR COVERED TO AVOID DUST GENERATION.
11. SAND & SOIL STOCKPILE ARE TO BE SUFFICIENTLY COVERED DURING WEEKENDS AND AT TIMES WHEN WINDY CONDITIONS PREVAIL.

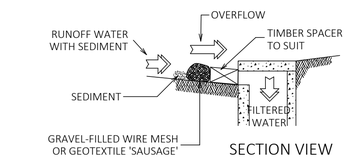




SEDIMENT CONTROL FENCE
NOT TO SCALE

CONSTRUCTION NOTES :

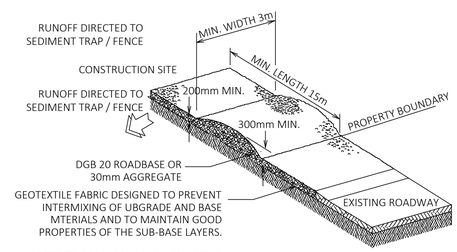
1. FABRICATE A SLEEVE MADE FROM GEOTEXTILE OR WIRE MESH LONGER THAN THE LENGTH OF THE INLET PIT
2. FILL THE SLEEVE WITH 25mm TO 50mm GRAVEL.
3. FORM AN ELLIPTICAL CROSS-SECTION ABOUT 150mm HIGH x 400mm WIDE.
4. PLACE THE FILTER AT THE BEGINNING OF THE KERB INLET LEAVING A 100mm GAP AT THE TOP TO ACT AS AN EMERGENCY SPILLWAY.
5. MAINTAIN THE OPENING WITH SPACER BLOCKS.
6. FORM A SEAL WITH THE KERBING AND PREVENT SEDIMENT BYPASSING THE FILTER.
7. FIT TO ALL KERB INLETS AT SAG POINTS.



MESH AND GRAVEL INLET FILTER
NOT TO SCALE

CONSTRUCTION NOTES :

1. STRIP TOPSOIL AND LEVEL SITE.
2. COMPACT SUBGRADE.
3. COVER AREA WITH NEEDLE PUNCHED GEOTEXTILE.
4. CONSTRUCT 200mm THICK PAD OVER GEOTEXTILE USING ROADBASE OR 30mm AGGREGATE MINIMUM LENGTH 15m OR TO BUILDING ALIGNMENT. MINIMUM WITH 3m.
5. CONSTRUCT HUMP IMMEDIATELY WITHIN BOUNDARY TO DIVERT WATER TO A SEDIMENT FENCE OR SEDIMENT TRAP.



STABILISED SITE ACCESS
NOT TO SCALE

VERIFY ALL DISCREPANCIES WITH PROJECT ARCHITECT/ MANAGER PRIOR TO PROCEEDING WITH ANY WORKS. **Do not scale off drawings.**

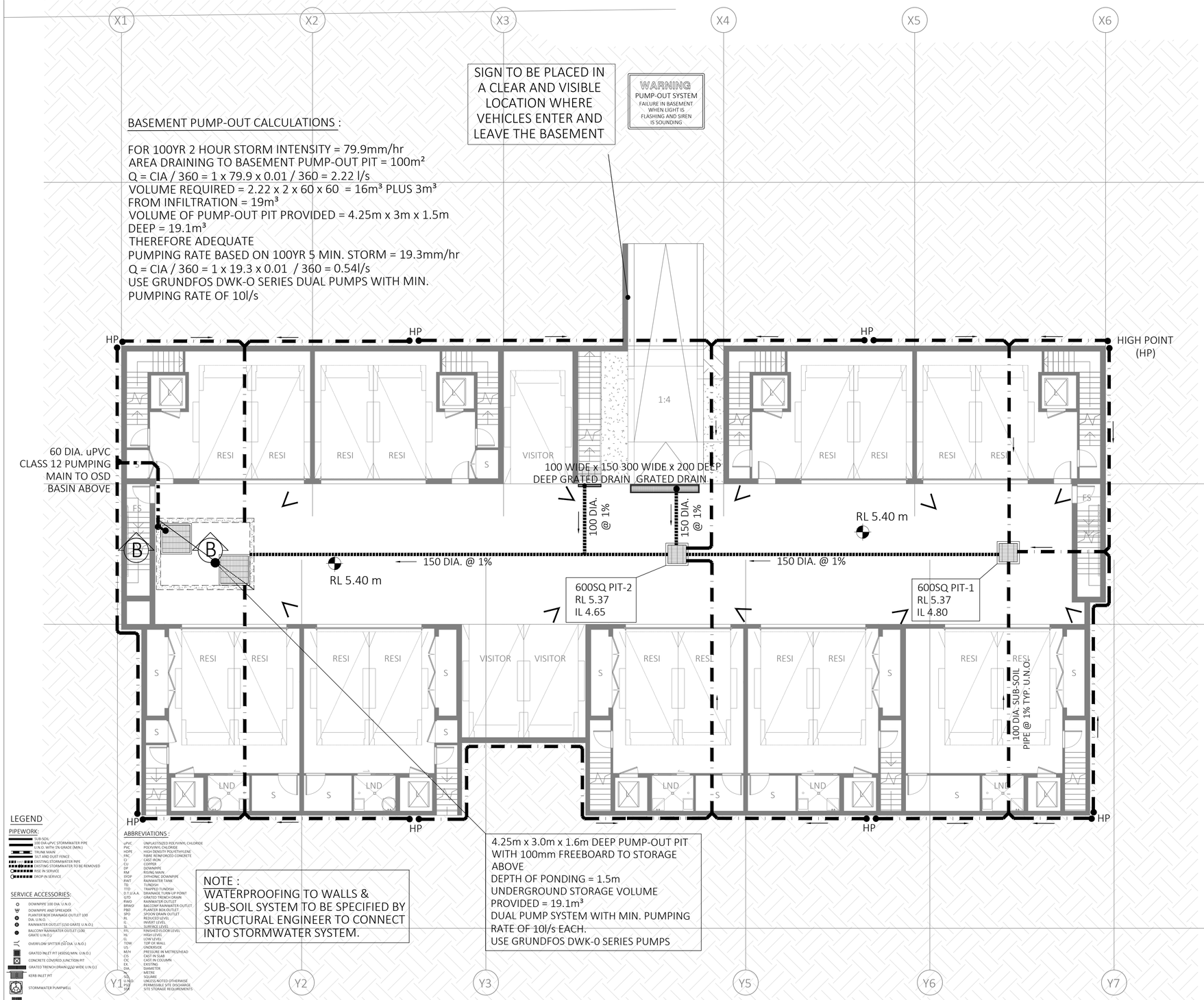
Issue	Description	Date of Drawing
A	Section 96 Application / Issued for Construction	28 Feb. 2018

Drawn & Designed By : K. Koh
Checked By : N. Evans
Approved By : Kenneth T. NG, MIEAust CPEng NER RPEQ (Reg. No. 2206352) Accredited Certifier (Cat. C1-C4, C6 & C15)(BPB No. 0827)

Designed By
ING CONSULTING ENGINEERS PTY LTD
P. O BOX 1543
BAULKHAM HILLS NSW 1755
F : (02) 8807 5656
M: 0433 778 109
E : ken@ingengineers.com.au

Project: Proposed Multi-Unit Development
At: 5 - 7 MacPherson Street Warriewood NSW 2102
Client: Level 88 Developments Pty Ltd

Drawing Title: Erosion & Sediment Control Plan
Date: February 2018
Scale: As Shown @ A1
Project No.: 076102017S96
Drawing & Sheet No./Issue: 07610-01/6 / A



LEGEND

PIPEWORK:
- TS-SOIL
- 100 DIA uPVC STORMWATER PIPE
- ST.N.O. WITH TS GRADE (MIN.)
- TRUNK MAIN
- VENT AND DUST FENCE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER TO BE REMOVED
- RISE IN SERVICE
- DROP IN SERVICE

SERVICE ACCESSORIES:
- DOWNPIPE 100 DIA. U.N.O.
- DOWNPIPE AND SPREADER
- PLANTER BOX DRAINAGE OUTLET 100 DIA. U.N.O.
- RAINWATER OUTLET (150 GRATE U.N.O.)
- BALCONY RAINWATER OUTLET (100 GRATE U.N.O.)
- OVERFLOW SPITTER (100 DIA. U.N.O.)
- GRATED INLET PIT (450SQ MIN. U.N.O.)
- CONCRETE COVERED JUNCTION PIT
- GRATED TRENCH DRAIN (150 WIDE U.N.O.)
- KERB INLET PIT
- STORMWATER PUMPWELL
- VEHICULAR CROSSING
- REVISION
- OVERLAND FLOW PATH
- CLEANING EYE

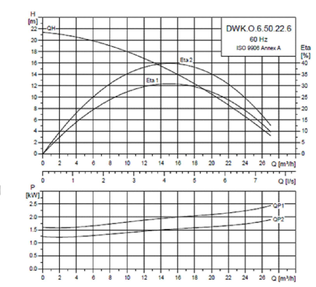
ABBREVIATIONS :

uPVC	UNPLASTICIZED POLYVINYL CHLORIDE
PVC	POLYVINYL CHLORIDE
HDPE	HIGH DENSITY POLYETHYLENE
FRC	FIBRE REINFORCED CONCRETE
CI	CAST IRON
GI	GALVANISED
DP	DOWNPIPE
RM	RISING MAIN
SYDP	SYPHONIC DOWNPIPE
RWT	RAINWATER TANK
TD	TUNDISH
TTD	TRAPPED TUNDISH
GTD / A.A.	GRAVITY DISCHARGE TURN-UP POINT
GD	GRATED TRENCH DRAIN
RWO	RAINWATER OUTLET
BRWO	BALCONY RAINWATER OUTLET
PBO	PLANTER BOX OUTLET
SPO	SPOON DRAIN OUTLET
RL	REDUCED LEVEL
IL	INVERT LEVEL
SL	SURFACE LEVEL
FFL	FINISHED FLOOR LEVEL
HL	HIGH LEVEL
LL	LOW LEVEL
TOW	TOP OF WALL
US	UNDERSIDE
M/H	PRESSURE IN METRES/HEAD
CIS	CAST IN SLAB
CIC	CAST IN COLUMN
EX.	EXISTING
DIA.	DIAMETER
%	METRE
SQ.	SQUARE
U.N.O.	UNLESS NOTED OTHERWISE
PSD	PERMISSIBLE SITE DISCHARGE
SSR	SITE STORAGE REQUIREMENTS

Performance curves/ Technical data

DWK and DPK pumps

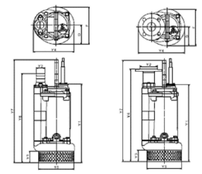
Performance curves DWK.O.6.50.22.6



Performance curves/ Technical data

DWK and DPK pumps

Dimensional sketches



Dimensions

Pump type	Connection type	Y1	Y2	Y3	Y4	Y5	Y6	Y7	D	F	Weight [kg]
DWK.O.6.50.22	Hose	448	50	65	231	202	437	496	110	213	40
	Flange	448	100	65	192	202	437	496	110	213	40

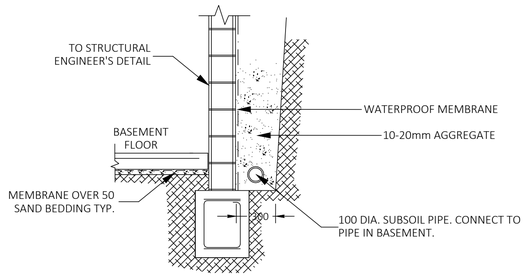
With 10 m cable

Electrical data

Pump type	Voltage [V]	P2 [kW]	RPM	Starting method	I_n [A]	Tmotor [°C]			Cos φ			Cable
						1/2	3/4	1/1	1/2	3/4	1/1	
DWK.O.6.50.22.6.GD	3 x 380-415V Y	2.2	3450	DOL	5.3	75.3	76.9	77.5	0.715	0.799	0.919	4 x 1.5 mm² + 4 x 1 mm²
DWK.O.6.50.22.6.GE	3 x 220-240V D	2.2	3450	DOL	9.1	75.3	76.9	77.5	0.715	0.799	0.919	4 x 1.5 mm² + 4 x 1 mm²
DWK.O.6.50.22.6.GE.R	3 x 380-415V Y	2.2	3450	DOL	5.3	75.3	76.9	77.5	0.715	0.799	0.919	4 x 1.5 mm²
DWK.O.6.50.22.6.GE.R	3 x 220-240V D	2.2	3450	DOL	9.1	75.3	76.9	77.5	0.715	0.799	0.919	4 x 1.5 mm²

Pump data

Pump type	Impeller type	Max. solids size [mm]	Max. number of starts per hour	Max. installation depth [m]	Enclosure class	Insulation class	Max. liquid temperature [°C]	pH
DWK.O.6.50.22.6	Semi-open	6	30	20	68	F	40	4-10



TYPICAL SUBSOIL DRAIN

NOT TO SCALE

SECTION A-A 19.1m³ BASEMENT PUMP-OUT PIT DETAIL

NOT TO SCALE

BASEMENT PUMP-OUT SYSTEM NOTES

THE PUMP-OUT SYSTEM SHALL BE DESIGNED TO BE OPERATED AS FOLLOWS :

1. A MINIMUM OF TWO PUMPS ARE TO BE PROVIDED - ONE DUTY PUMP AND ONE STAND-BY PUMP.
2. THE PUMPS SHALL BE PROGRAMMED TO OPERATE ALTERNATIVELY SO AS TO ALLOW BOTH PUMPS TO HAVE AN EQUAL OPERATIONAL LOAD AND PUMP LIFE.
3. A LOW-LEVEL FLOAT SHALL BE PROVIDED TO ENSURE THAT THE MINIMUM REQUIRED WATER LEVEL IS MAINTAINED WITHIN THE SUMP AREA OF THE UNDERGROUND TANK. THE FLOAT SHALL FUNCTION AS AN "OFF" SWITCH FOR THE PUMP.
4. A SECOND FLOAT SHALL BE PROVIDED AT A HIGHER LEVEL, WHICH IS APPROXIMATELY 200mm ABOVE THE MINIMUM WATER LEVEL, IN WHICH ONE OF THE PUMPS WILL OPERATE AND DRAIN THE UNDERGROUND TANK TO THE LEVEL OF THE LOW-LEVEL FLOAT.
5. A THIRD FLOAT SHALL BE PROVIDED AT A HIGH LEVEL, WHICH IS APPROXIMATELY 200mm ABOVE THE SECOND FLOAT. THIS FLOAT SHALL BE DESIGNED TO START THE STAND-BY PUMP THAT IS NOT OPERATING AND ACTIVATE THE ALARM.
6. AN ALARM WARNING SYSTEM SHALL BE PROVIDED WITH A FLASHING STROBE LIGHT, SIREN AND A PUMP FAILURE WARNING SIGN WHICH ARE TO BE LOCATED AT THE DRIVEWAY ENTRANCE TO TH BASEMENT. THE ALARM WARNING SYSTEM SHALL BE PROVIDED WITH A BATTERY BACK-UP IN CASE OF POWER FAILURES.

VERIFY ALL DISCREPANCIES WITH PROJECT ARCHITECT/ MANAGER PRIOR TO PROCEEDING WITH ANY WORKS. **Do not scale off drawings.**

Issue	Description	Date of Drawing
A	Section 96 Application / Issued for Construction	28 Feb. 2018

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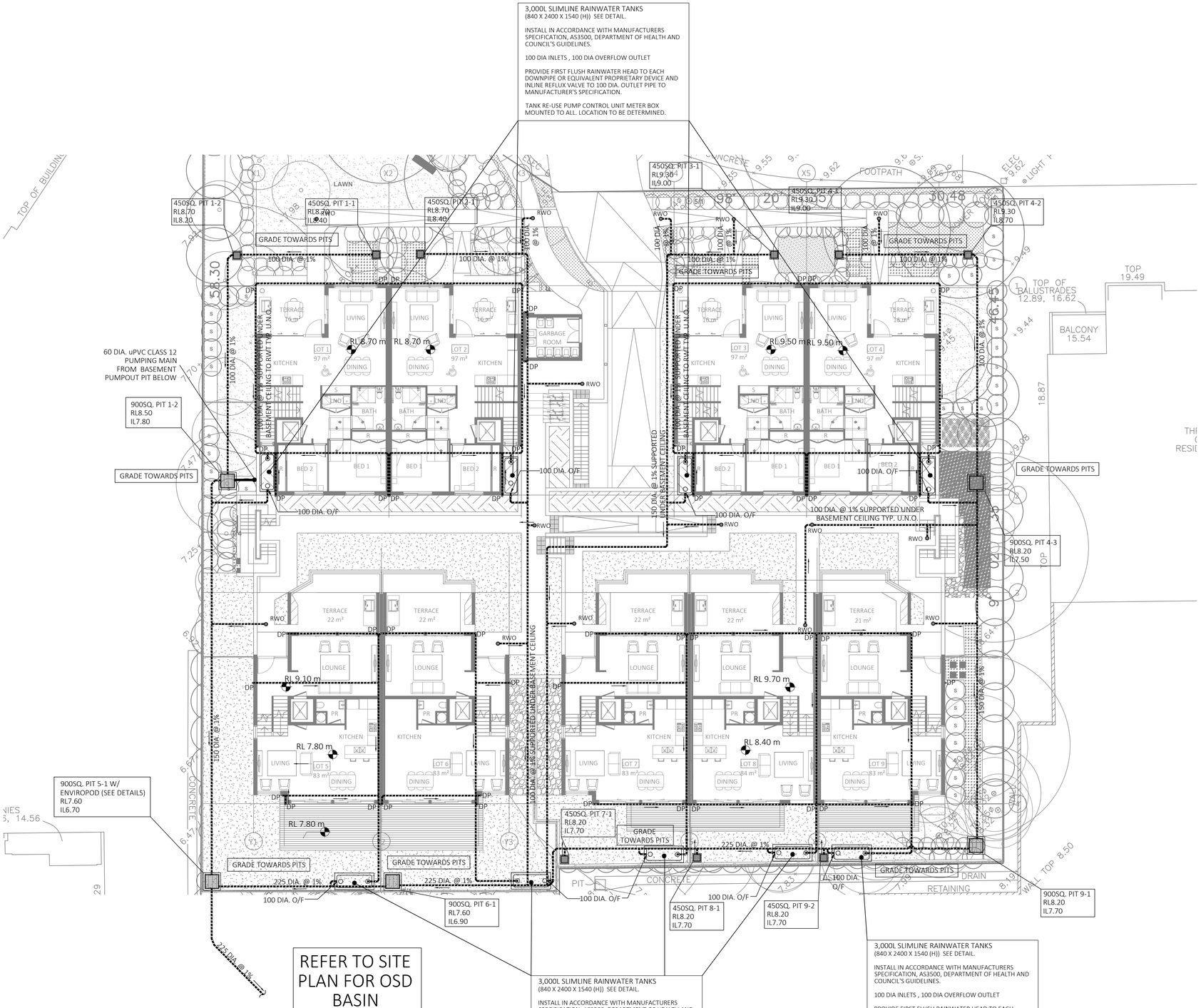
(Reg. No. 2206352)
Accredited Certifier
(Cat. C1-C4, C6 & C15)(BPB No. 0827)

Designed By
ING CONSULTING ENGINEERS PTY LTD
P. O BOX 1543
BAULKHAM HILLS NSW 1755
F : (02) 8807 5656
M: 0433 778 109
E : ken@ingengineers.com.au

Project: Proposed Multi-Unit Development
At: 5 - 7 MacPherson Street Warriewood NSW 2102
Client: Level 88 Developments Pty Ltd

Drawing Title: Basement Plan, Notes & Details
Date: February 2018
Scale: 1 : 100 @ A1
Project No.: 076102017S96
Drawing & Sheet No./Issue: 07610-02/6 / A



LEGEND

PIPEWORK:

- TOB-SOIL
- 100 DIA uPVC STORMWATER PIPE U.N.O. WITH 1% GRADE (MIN.)
- TRUNK MAIN
- SKIT AND DUST FENCE
- EXISTING STORMWATER PIPE
- EXISTING STORMWATER TO BE REMOVED
- RISE IN SERVICE
- DROP IN SERVICE

SERVICE ACCESSORIES:

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D.T.U.A.A.	DRAINAGE TURN-UP POINT
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RL	REDUCED LEVEL
SL	SURFACE LEVEL
TSL	TOPSOILE LEVEL
FFL	FINISHED FLOOR LEVEL
HL	HIGH LEVEL
LL	LOW LEVEL
TOW	TOP OF WALL
US	UNDERSIDE
M/H	PRESSURE IN METRES/HEAD
CJP	CONCRETE JUNCTION PIT
CIC	CAST IN COLUMN
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SQL	SQUARE
U.N.O.	UNLESS NOTED OTHERWISE
PSD	PERMISSIBLE SITE DISCHARGE
SSR	SITE STORAGE REQUIREMENTS

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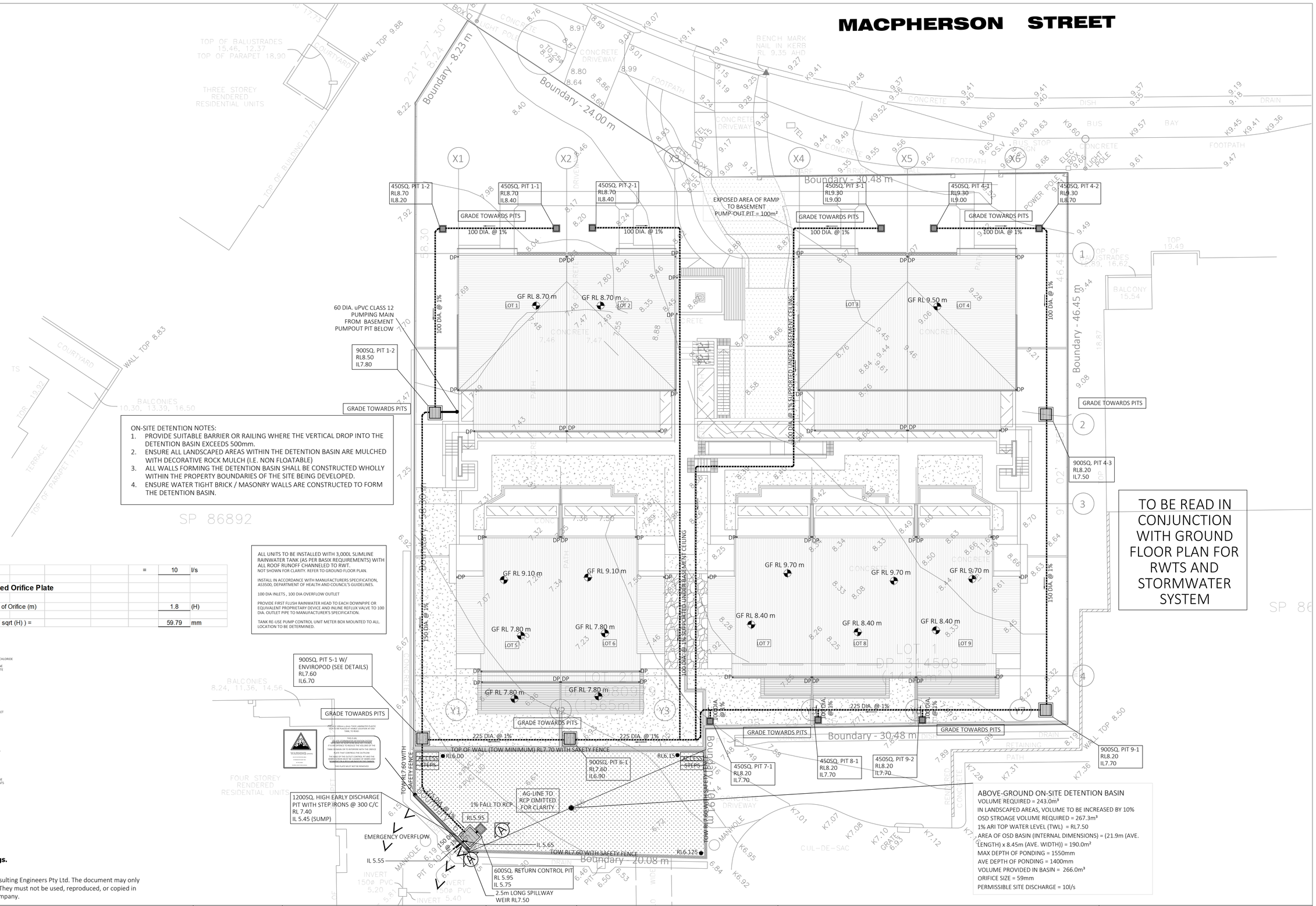
Designed By
ING CONSULTING ENGINEERS PTY LTD
P. O BOX 1543
BAULKHAM HILLS NSW 1755
F : (02) 8807 5656
M: 0433 778 109
E : ken@ingengineers.com.au

Project: Proposed Multi-Unit Development
At: 5 - 7 MacPherson Street Warriewood NSW 2102
Client: Level 88 Developments Pty Ltd

Drawing Title: Ground Floor Plan
Date: February 2018
Scale: 1 : 150 @ A1
Project No.: 076102017S96
Drawing & Sheet No./Issue: 07610-03/6 / A

MACPHERSON STREET



ON-SITE DETENTION NOTES:

1. PROVIDE SUITABLE BARRIER OR RAILING WHERE THE VERTICAL DROP INTO THE DETENTION BASIN EXCEEDS 500mm.
2. ENSURE ALL LANDSCAPED AREAS WITHIN THE DETENTION BASIN ARE MULCHED WITH DECORATIVE ROCK MULCH (I.E. NON FLOATABLE)
3. ALL WALLS FORMING THE DETENTION BASIN SHALL BE CONSTRUCTED WHOLLY WITHIN THE PROPERTY BOUNDARIES OF THE SITE BEING DEVELOPED.
4. ENSURE WATER TIGHT BRICK / MASONRY WALLS ARE CONSTRUCTED TO FORM THE DETENTION BASIN.

PERMITTED SITE DISCHARGE	=	10	l/s
OUTLET CONTROL - using a Sharp Edged Orifice Plate			
Height Difference between top water level and Centre of Orifice (m)		1.8	(H)
ORIFICE DIAMETER (mm) 21.9 x sqrt (PSD / sqrt (H)) =		59.79	mm

ALL UNITS TO BE INSTALLED WITH 3,000L SLIMLINE RAINWATER TANK (AS PER BASIX REQUIREMENTS) WITH ALL ROOF RUNOFF CHANNELED TO RWT.
NOT SHOWN FOR CLARITY. REFER TO GROUND FLOOR PLAN.

INSTALL IN ACCORDANCE WITH MANUFACTURERS SPECIFICATION, AS3500, DEPARTMENT OF HEALTH AND COUNCIL'S GUIDELINES.

100 DIA INLETS , 100 DIA OVERFLOW OUTLET

PROVIDE FIRST FLUSH RAINWATER HEAD TO EACH DOWNPIPE OR EQUIVALENT PROPRIETARY DEVICE AND INLINE REFLUX VALVE TO 100 DIA. OUTLET PIPE TO MANUFACTURER'S SPECIFICATION.

TANK RE-USE PUMP CONTROL UNIT METER BOX MOUNTED TO ALL LOCATION TO BE DETERMINED.

TO BE READ IN CONJUNCTION WITH GROUND FLOOR PLAN FOR RWTS AND STORMWATER SYSTEM

ABOVE-GROUND ON-SITE DETENTION BASIN
VOLUME REQUIRED = 243.0m³
IN LANDSCAPED AREAS, VOLUME TO BE INCREASED BY 10%
OSD STROAGE VOLUME REQUIRED = 267.3m³
1% ARI TOP WATER LEVEL (TWL) = RL7.50
AREA OF OSD BASIN (INTERNAL DIMENSIONS) = (21.9m (AVE. LENGTH) x 8.45m (AVE. WIDTH)) = 190.0m²
MAX DEPTH OF PONDING = 1550mm
AVE DEPTH OF PONDING = 1400mm
VOLUME PROVIDED IN BASIN = 266.0m³
ORIFICE SIZE = 59mm
PERMISSIBLE SITE DISCHARGE = 10l/s

LEGEND

PIPEWORK:

- TOB-SOIL
- 100 DIA uPVC STORMWATER PIPE U.N.O. WITH 1% GRADE (MIN.)
- TRUNK MAIN
- SILT AND DUST FENCE
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- EXISTING STORMWATER TO BE REMOVED
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SERVICE ACCESSORIES:

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- DOWNPIPE AND SPREADER
- PLANTER BOX DRAINAGE OUTLET 100 DIA. U.N.O.
- RAINWATER OUTLET (150 GRATE U.N.O.)
- BALCONY RAINWATER OUTLET (100 GRATE U.N.O.)
- OVERFLOW SPITTER (90° DIA. U.N.O.)
- GRATED INLET PIT (450SQ MIN. U.N.O.)
- CONCRETE COVERED JUNCTION PIT
- GRATED TRENCH DRAIN (150 WIDE U.N.O.)
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EL	ELEVATION
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FFL	FINISHED FLOOR LEVEL
HL	HIGH LEVEL
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US	UNDERSIDE
MH	MANHOLE
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C/C	CAST IN COLUMN
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m	METRE
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PSD	PERMISSIBLE SITE DISCHARGE
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BAULKHAM HILLS NSW 1755
F : (02) 8807 5656
M: 0433 778 109
E : ken@ingengineers.com.au

Project	Proposed Multi-Unit Development
At	5 - 7 MacPherson Street Warriewood NSW 2102
Client	Level 88 Developments Pty Ltd
Drawing Title	Site Plan
Date	February 2018
Scale	1 : 150 @ A1
Project No.	076102017S96
Drawing & Sheet No./Issue	07610-04/6 / A

GENERAL NOTES

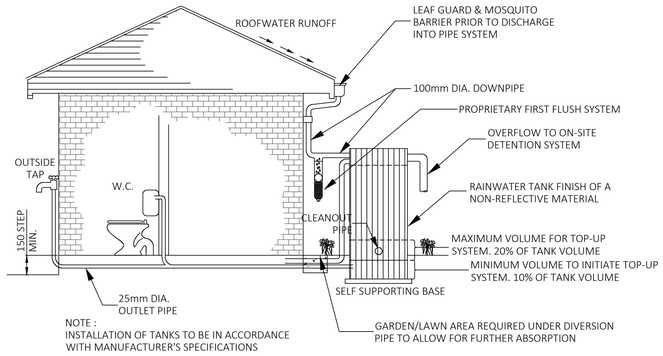
1. THE CONTRACTOR MUST VERIFY ALL DIMENSIONS AND EXISTING LEVELS ON SITE PRIOR TO COMMENCEMENT OF WORKS.
2. ALL WORKS ARE TO BE CARRIED OUT TO THE DETAILS SHOWN ON THE DRAWINGS.
3. THESE PLANS ARE READ IN CONJUNCTION WITH APPROVED ARCHITECTURAL, STRUCTURAL, HYDRAULIC AND MECHANICAL DRAWINGS AND SPECIFICATIONS.
4. CARE IS TO BE TAKEN WHEN EXCAVATING NEAR SERVICES. NO MECHANICAL EXCAVATION ARE TO BE UNDERTAKEN OVER TELECOMMUNICATION OR ELECTRICAL SERVICES. HAND EXCAVATE IN THESE AREAS ONLY.
5. DIAL 1100 BEFORE YOU DIG FOR LOCATION OF UNDERGROUND SERVICES PRIOR TO ANY CONSTRUCTION WORKS.
6. SERVICES HAVE NOT BEEN SHOWN ON THIS PLAN. FIELD INVESTIGATIONS ARE TO BE CARRIED OUT SEPARATELY TO DETERMINE EXACT POSITIONS OF SERVICES OR INFORMATION IS TO BE PROVIDED BY THE PROPERTY PROPRIETOR. NOT WITSTANDING THIS, ALL INFORMATION PROVIDED SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
7. THESE DRAWINGS ARE ONLY APPROVED WHEN THEY ARE SIGNED WITH AN ORIGINAL SIGNATURE BY THE ENGINEER.

STORMWATER DRAINAGE

8. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH AS 3500 AND THE REQUIREMENTS OF THE LOCAL COUNCIL'S POLICIES AND CODES.
9. ALL GUTTERS TO BE 100 x 75 MIN. AND DOWNPIPES TO BE 100 x 75 (76 DIA.) UNLESS OTHERWISE NOTED.
10. ALL PIPES TO BE 100mm uPVC SEWER GRADE UNLESS NOTED OTHERWISE.
11. ALL GRADIENTS FOR STORMWATER PIPES TO BE NOT LESS THAN 1.0% UNLESS NOTED OTHERWISE.
12. THE INVERTS OF ALL OUTLET PIPES ARE TO BE INSTALLED FLUSHED WITH THE BASE OF ALL STORMWATER/RAINWATER PIT.
13. ALL FENCES SHALL BE KEPT AT LEAST 100mm ABOVE THE GROUND LEVEL TO FACILITATE THE FREE PASSAGE FOR STORMWATER OVERLAND FLOW.
14. MANUFACTURER'S CERTIFICATE SHALL BE OBTAINED BY THE BUILDER FOR PIPES, PRE-CAST PITS AND GRATES FOR THE STRUCTURAL ADEQUACY RELATING TO ITS LOCATION.
15. AREAS SPREAD WITH BARK SHALL BE BARRICADED TO PREVENT BARK GETTING INTO THE PITS AND STORMWATER SYSTEMS.
16. MINIMUM SLOPE FOR PAVED AREAS SHALL BE 0.5%, FOR LANDSCAPED AREAS MINIMUM SLOPE SHALL BE 1% AND GRADED TOWARDS THE GRATED PITS.
17. ALL EXCAVATIONS WITHIN THE INFLUENCE OF BUILDINGS AND SERVICES SHALL BE UNDERTAKEN WITH THE KNOWLEDGE OF THE HYDRAULIC AND STRUCTURAL ENGINEER.
18. THE DETENTION AND DRAINAGE SYSTEM SHALL BE MAINTAINED AT REGULAR INTERVALS AND THE CONTRACTOR SHALL MAKE NECESSARY ARRANGEMENTS.
19. CONNECTION OF DISCHARGE PIPE TO EXISTING COUNCIL KERB AND GUTTER, PIPE OR KERB INLET PIT SHALL BE CARRIED OUT IN ACCORDANCE WITH COUNCIL'S REQUIREMENTS.
20. PROVIDE STEP-IRONS 'MASCOT S1:104' OR SIMILAR STAGGERED TO GIVE SPACING 300 VERTICAL AND 220 HORIZONTAL TO ALL PIT DEEPER THAN 1m .
21. SUITABLE AG-LINES SHALL BE PROVIDED AND CONNECTED TO STORMWATER SYSTEM OR AS INSTRUCTED BY THE ENGINEER ON SITE PRIOR TO BACKFILLING.

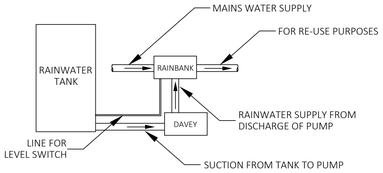
RAINWATER TANK

22. DRAWING IS TO BE READ IN CONJUNCTION WITH SYDNEY WATER'S "PLUMBING REQUIREMENTS - GUIDELINES FOR RAINWATER TANKS ON RESIDENTIAL PROPERTIES".
23. ALL PLUMBING WORK UNDERTAKEN ON OR FOR THE TANK THAT AFFECTS THE WATER SERVICE PIPE OR WATER MAIN MUST BE UNDERTAKEN WITH THE CONSENT OF SYDNEY WATER IN ACCORDANCE WITH THE REQUIREMENTS OF SYDNEY WATER, AND THE MANUFACTURER'S SPECIFICATIONS.
24. ALL PLUMBING WORKS UNDERTAKEN SHALL BE UNDERTAKEN BY A LICENSED PLUMBER IN ACCORDNACE WITH THE NEW SOUTH WALES CODE OF PRACTICE - PLUMBING AND DRAINAGE PRODUCED BY THE COMMITTEE ON UNIFORMITY OF PLUMBING AND DRAINAGE REGULATIONS IN NEW SOUTH WALES.
25. ALL PLUMBING MUST BE COMPLETED BY A LICENSED PLUMBER IN COMPLIANCE WITH AS/NZS3500.5, AND ANY OTHER RELEVANT NATIONAL STANDARDS.
26. INLET TO THE RAINWATER TANKS MUST BE SCREENED OR FILTERED TO PREVENT ENTRY OF FOREIGN MATTER AND CREATURES.
27. THE RAINWATER TANKS MUST BE MAINTAINED AT ALL TIMES SO AS NOT TO CAUSE A NUISANCE WITH RESPECT TO MOSQUITO BREEDING OR OVERLAND FLOW OF WATER.
28. A SIGN MUST BE AFFIXED TO THE RAINWATER TANKS CLEARLY STATING THAT THE WATER IN THE TANKS IS RAINWATER.
29. BOTH THE RE-USE AND ANY FITTINGS CONNECTED TO THE RAINWATER TANKS MUST BE LABELED "RAINWATER , NOT SUITABLE FOR DRINKING".
30. ALL ROOF GUTTERS ARE TO BE FITTED WITH LEAF GUARDS AND INSPECTED REGULARLY AND CLEANED TO ENSURE LEAF LITTER CANNOT ENTER THE DOWNPIPES.
31. PRESSURE PUMP ELECTRICAL CONNECTION TO BE CARRIED OUT BY A LICENSED ELECTRICIAN.



RAINWATER TANK (3000L AS PER BASIX) DETAILS

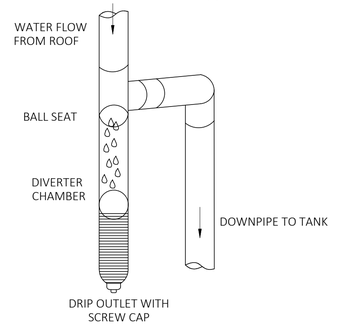
NOT TO SCALE



PLAN

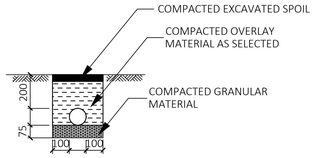
NOT TO SCALE

FIRST FLUSH OF CONTAMINATED WATER IS DIVERTED INTO CHAMBER. DIVERTER DESIGNED TO CAUSE MINIMUM OF 1mm OF INITIAL RUNOFF FROM ROOF AREA TO BYPASS RAINWATER TANK(S)



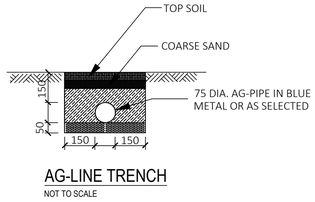
PROPRIETARY FIRST FLUSH DIVERTER

NOT TO SCALE



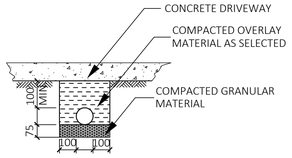
PIPE TRENCH

NOT TO SCALE



AG-LINE TRENCH

NOT TO SCALE

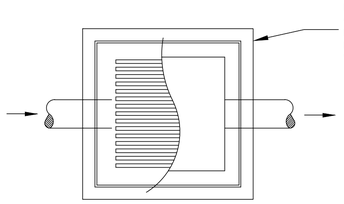


PIPE TRENCH

NOT TO SCALE

PIT SCHEDULE

1. PROVIDE LIGHT DUTY GRATES FOR NON VEHICULAR TRAFFICKED AREAS.
2. PROVIDE HEAVY DUTY GRATES FOR VEHICULAR TRAFFICKED AREAS.
3. PROVIDE 450 x 450 CLEAR OPENING FOR PIT DEPTHS UP TO 600mm U.N.O.
4. PROVIDE 600 x 600 CLEAR OPENING FOR PIT DEPTHS UP TO 900mm U.N.O.
5. PROVIDE 900 x 900 CLEAR OPENING FOR PIT DEPTHS GREATER THAN 900mm U.N.O.
6. ALL REINFORCED CONCRETE PIPES SHALL BE OF RUBBER RING JOINTS
7. ALL DISCHARGE CONTROL PITS SHALL HAVE A MINIMUM OF 900 x 900 CLEAR OPENING U.N.O.
8. ALL GRATED TRENCH SHALL BE A MINIMUM OF 150(W) x 200(H) U.NO.

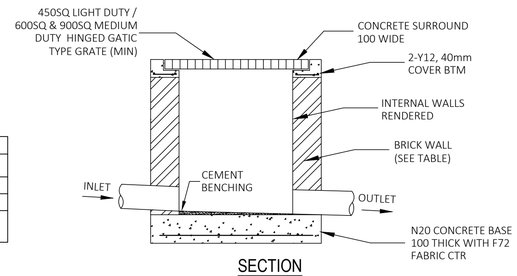


PLAN

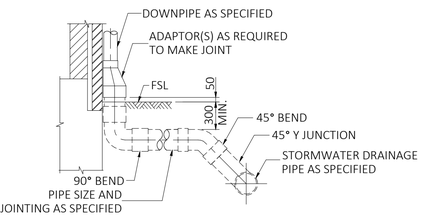
PIT WALL DETAILS	
DEPTH	WALL THICKNESS
0 m - 0.5m	SINGLE SKIN BRICK
0.5m-1.5m	DOUBLE SKIN BRICK
> 1.5m	TO STRUCTURAL DETAILS

TYPICAL INLET PIT DETAIL

NOT TO SCALE

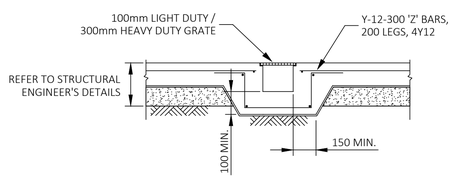


SECTION



TYPICAL DETAIL - DOWNPIPE CONNECTION TO STORMWATER DRAINAGE PIPE

NOT TO SCALE



GRATED DRAIN DETAIL

NOT TO SCALE

VERIFY ALL DISCREPANCIES WITH PROJECT ARCHITECT/ MANAGER PRIOR TO PROCEEDING WITH ANY WORKS. **Do not scale off drawings.**

Issue	Description	Date of Drawing
A	Section 96 Application / Issued for Construction	28 Feb. 2018

Drawn & Designed By : K. Koh

Checked By : N. Evans

Approved By : Kenneth T. NG
MIEAust CPEng NER RPEQ
(Reg. No. 2206352)
Accredited Certifier
(Cat. C1-C4, C6 & C15)(BPB No. 0827)

Designed By
ING CONSULTING ENGINEERS PTY LTD
P. O BOX 1543
BAULKHAM HILLS NSW 1755
F : (02) 8807 5656
M: 0433 778 109
E : ken@ingengineers.com.au

Project: Proposed Multi-Unit Development

At: 5 - 7 MacPherson Street Warriewood NSW 2102

Client: Level 88 Developments Pty Ltd

Drawing Title: Notes & Details

Date: February 2018

Scale: As Shown @ A1

Project No.: 07610201 7S96

Drawing & Sheet No./Issue: 07610-05/6 / A

110mm X 80mm SIGN TO BE PLACED AT VISIBLE LOCATION AT OSD TANK, TO READ:

THIS IS AN
ON-SITE STORMWATER
DETENTION SYSTEM

REQUIRED BY CUMBERLAND COUNCIL

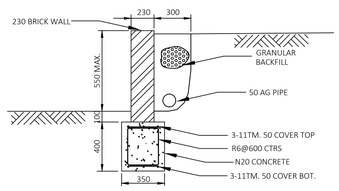
IT IS AN OFFENCE TO REDUCE THE VOLUME OF THE TANK OR BASIN OR TO INTERFERE WITH THE ORIFICE PLATE THAT CONTROLS THE OUTFLOW

THE BASE OF THE OUTLET CONTROL PIT AND THE DEBRIS SCREEN MUST BE CLEANED OF DEBRIS AND SEDIMENT ON A REGULAR BASIS BY THE OWNER

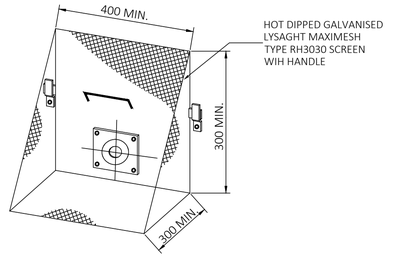
THIS PLATE MUST NOT BE REMOVED

OSD SIGNAGE
NOT TO SCALE

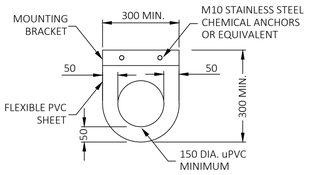
OSD WARNING SIGN (SIZE 300(L) x 225(W))
NOT TO SCALE



OSD WALL DETAIL
NOT TO SCALE

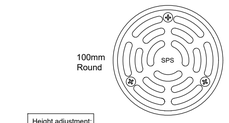


TRASH SCREEN DETAIL
NOT TO SCALE

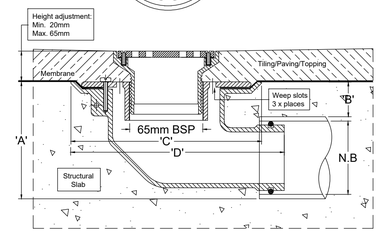


NICOLAS FLEXI FLAP VALVE DETAIL
NOT TO SCALE

Specification code:
R100B/C90 (brass grate, ABS lower body)
R100N/C90 (nickel bronze grate, ABS lower body)
R100S4/C90 (polished 304 stainless steel, ABS lower body)
R100S/C90 (satin 316 stainless steel grate, ABS lower body)



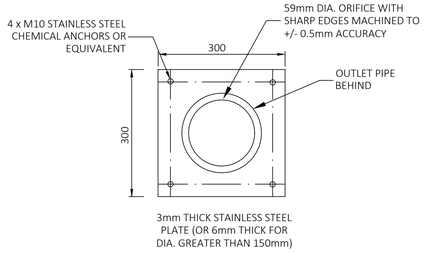
- Round grate available in nickel bronze, 304 & 316 stainless Steel. Bronze non-stock option.
- ABS 90° Body and Reversible Membrane Clamp Collar with female 65mm BSP thread.



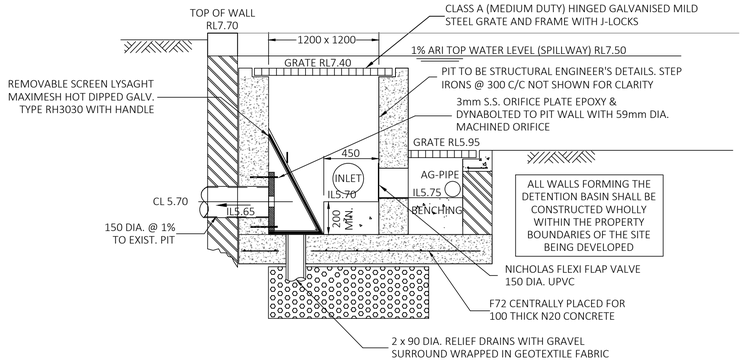
Spigot pushes into 65mm PVC or copper with o-ring connection, or connects to 50mm PVC/HDPE with no-hub coupling.

N.B.	A	B	C	D
50	100	40	180	200
65	105	37	180	200

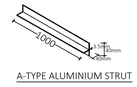
RAINWATER OUTLET (RWO) (TERRACE AND COURTYARDS) AND BRWO(BALCONIES)
NOT TO SCALE



ORIFICE PLATE DETAIL
NOT TO SCALE



SECTION A-A HIGH EARLY DISCHARGE PIT (HED) DETAIL
NOT TO SCALE

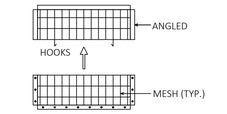


A-TYPE ALUMINIUM STRUT

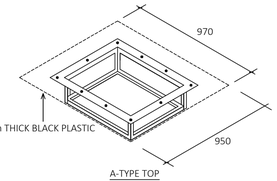
A-TYPE UNIT CONFIGURATIONS

UNIT TYPE	STRUT TYPE	TOP TYPE	CAGE TYPE 2 PART (HEIGHT mm)	RING TYPE	BAG TYPE (HEIGHT mm)
A1	A	A	A1(600)	A	A1(600)
A3	A	A	A3(350)	A	A3(300)
A5	A	A	N/A	A	A5(170)

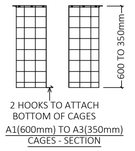
NOTE : UNIT TYPES A5 ARE INSTALLED WITHOUT ANY CAGES. USE ONLY STRUT, TOP, BAG & RING



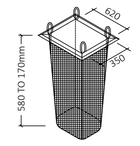
A1(600mm) TO A3(300mm) CAGES - PLAN



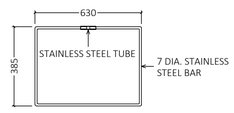
A-TYPE TOP



A1(600mm) TO A3(350mm) CAGES - SECTION



A1(600mm) TO A5(100mm NOM.) BAGS



A-TYPE RING

STANDARD ENVIROPOD FILTER A-TYPE CONFIGURATION & COMPONENTS GENERAL ARRANGEMENT
NOT TO SCALE

VERIFY ALL DISCREPANCIES WITH PROJECT ARCHITECT/ MANAGER PRIOR TO PROCEEDING WITH ANY WORKS. **Do not scale off drawings.**

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A	Section 96 Application / Issued for Construction	28 Feb. 2018

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MIEAust CPEng NER RPEQ
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Designed By
ING CONSULTING ENGINEERS PTY LTD
P. O BOX 1543
BAULKHAM HILLS NSW 1755
F : (02) 8807 5656
M: 0433 778 109
E : ken@ingengineers.com.au

Project: Proposed Multi-Unit Development
At: 5 - 7 MacPherson Street Warriewood NSW 2102
Client: Level 88 Developments Pty Ltd

Drawing Title: Notes & Details 2
Date: February 2018
Scale: As Shown @ A1
Project No.: 076102017S96
Drawing & Sheet No./Issue: 07610-06/6 / A