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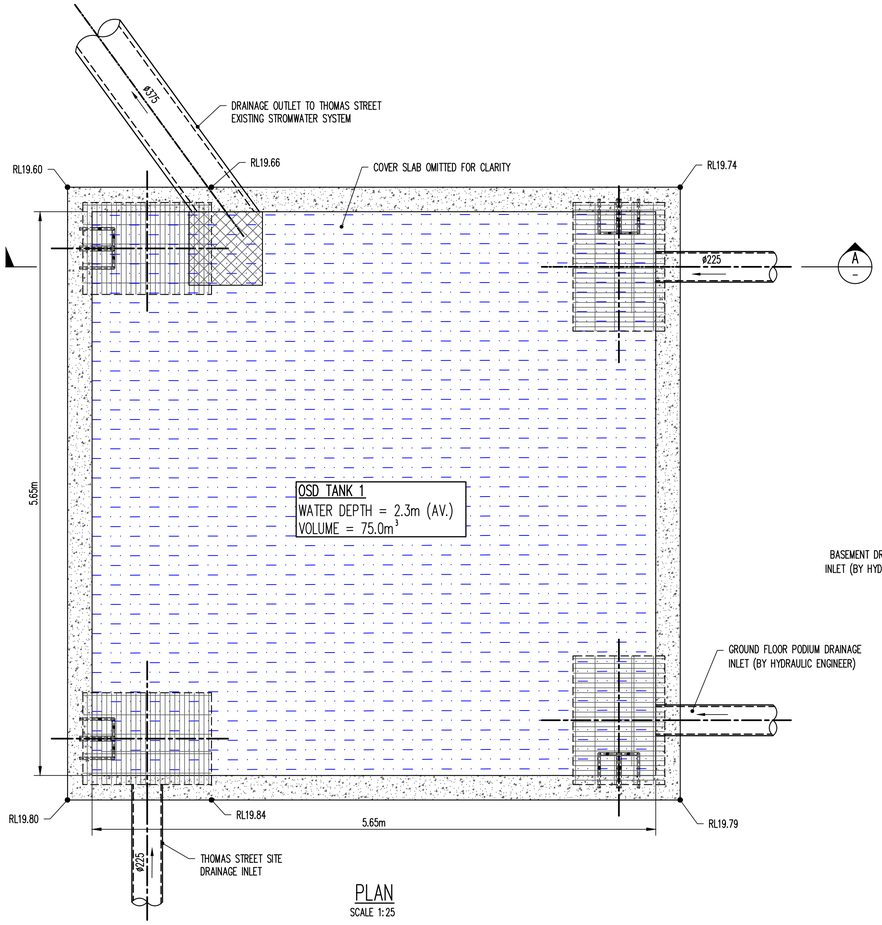

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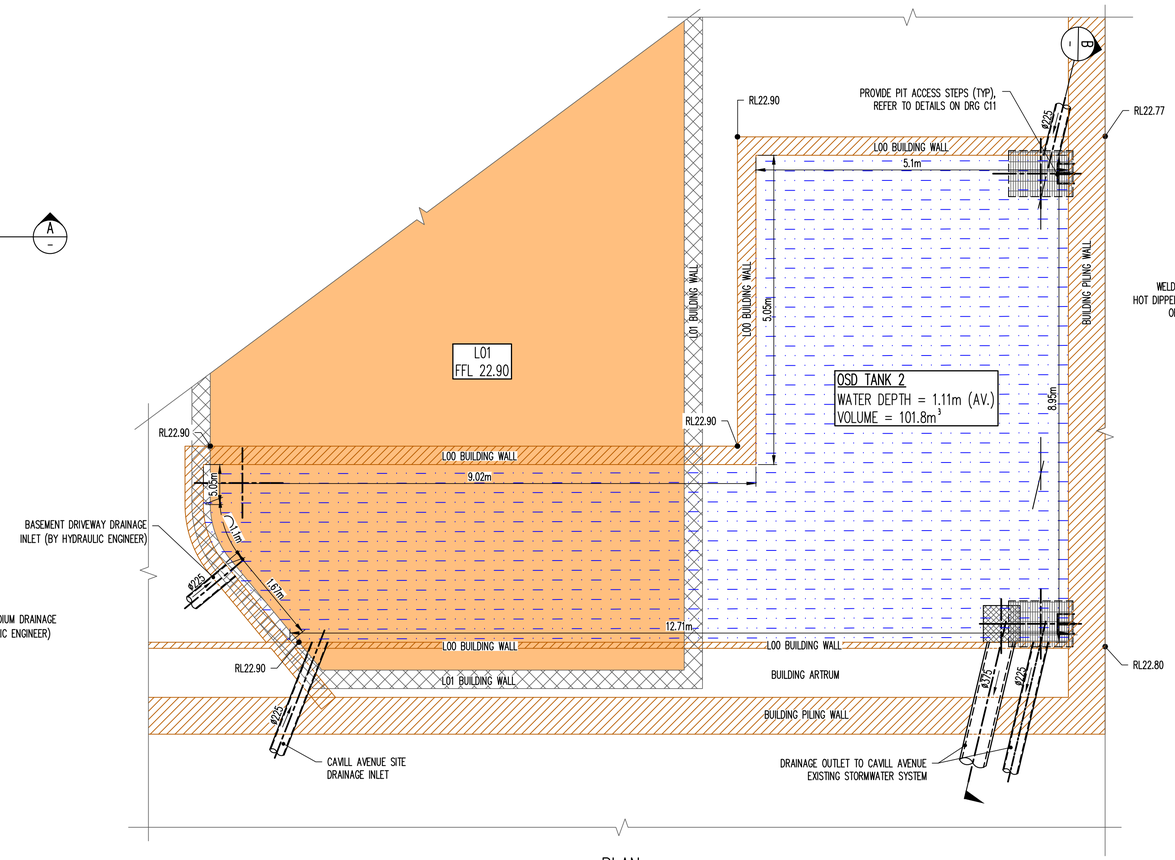

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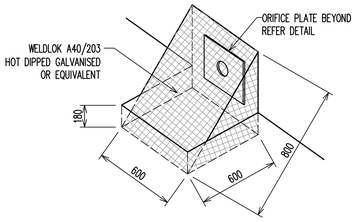

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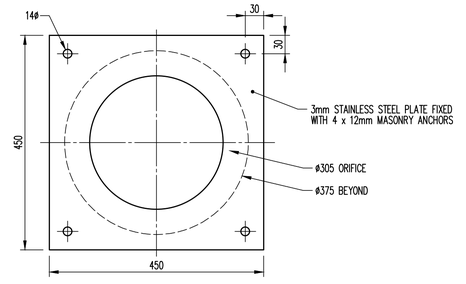

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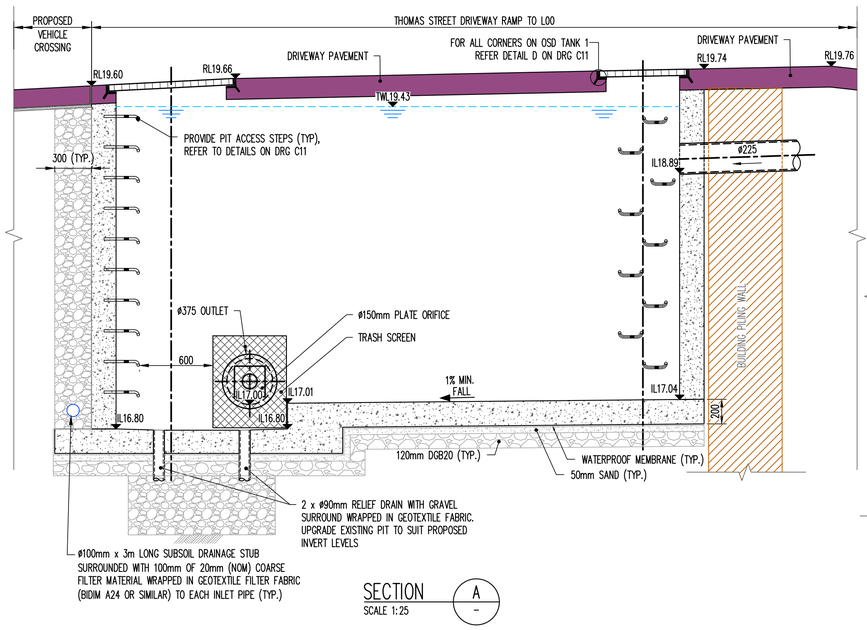

SECTION A
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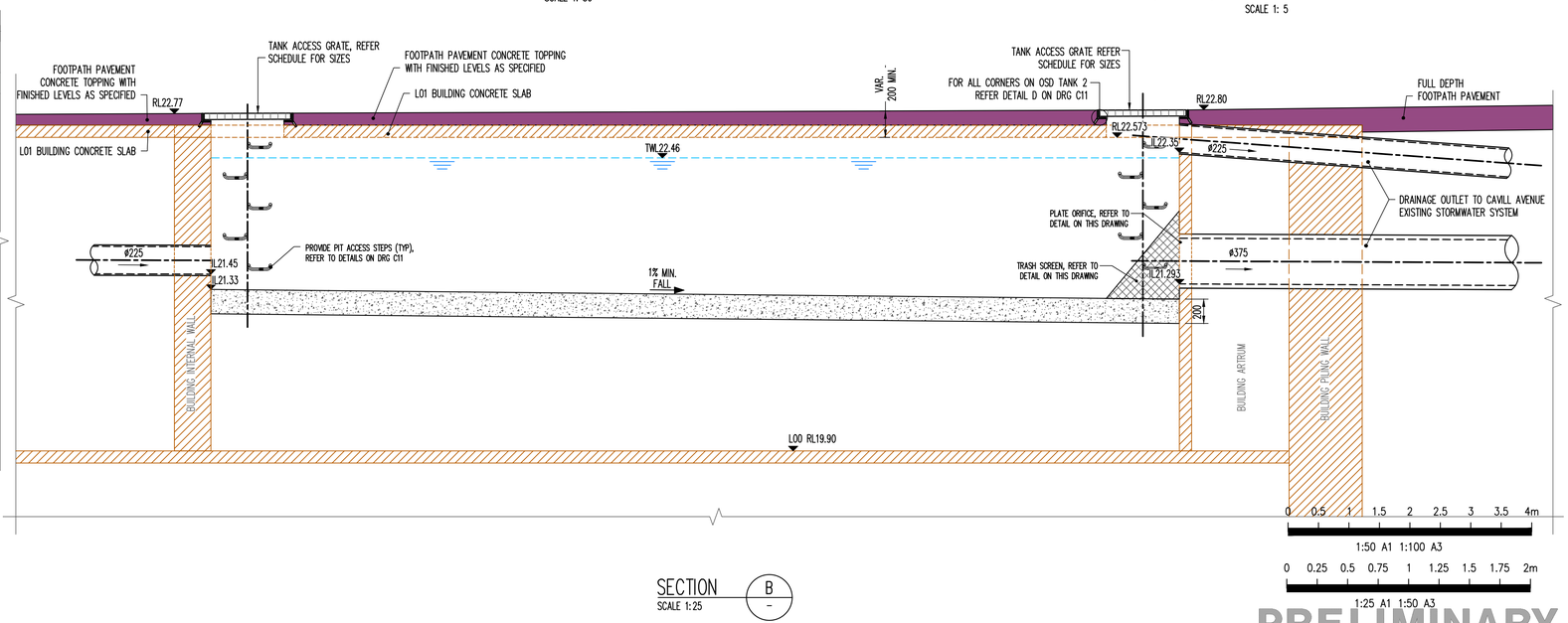

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P2	ISSUED FOR REVISED SETBACKS	AL	LS	07.05.21
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Revision
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Stormwater Report

2-6 Cavill Avenue, Ashfield

Shayher Group / 14 May 2021 – Rev 3

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Contents

Revision Control

Revision	Date	Description		Prepared by	Approved by
3	14/05/21	DA ISSUE	**Name**	A.Lahoud	N.Biason Jr
			Signature		

1.0 Introduction

This stormwater report has been prepared in accordance with Best Practices and in accordance with relevant authorities' objectives and performance targets to support the proposed development of 2-6 Cavill Avenue, Ashfield. The proposed work will include the construction of multi-storey residential development from an existing commercial facility. The purpose of this report is for the Development Application and the proposed stormwater strategy to comply with the Inner West Council - Marrickville Council Stormwater and On-Site Detention Code.

The following information and documents were utilised in this investigation:

- Marrickville Council Stormwater and On-Site Detention Code
- "Managing Urban Stormwater – Soils and Construction, 4th Edition (2004)" by Landcom;
- Architectural Plans by PTW;
- EPA – Pollution control manual for urban stormwater.
- "Australian Rainfall and Runoff (2016);

1.1 Existing Pre-DA Application Advice

This report addresses the relevant pre DA advice Inner West Council conditions as follows:

13. Stormwater

- The site drainage shall be connected to the Council's drainage pipe system at the corner of Thomas Street and The Avenue in accordance with Council's DCP.

- A local catchment investigation report (Local Flood Study) to determine the capacity of the downstream Council's drainage system shall be carried out. Considering the downstream trunk drainage system is subject to high risk flooding, the site drainage discharge shall be restricted to the ARI (Average Recurrence Interval) event flow rate that is equivalent to the downstream Council's pipe capacity. Council's drainage may require amplification works.

- All stormwater drainage shall be designed in accordance with Australian Rainfall and Runoff (A.R.R.), Australian Standard AS3500.3 'Stormwater Drainage' and Marrickville Council Stormwater and On-Site Detention Code. Pipe drainage systems shall be designed to cater for the fifty (50) year Average Recurrence Interval (A.R.I.) storm. Major event surface flow paths shall be designed to cater for the one hundred (100) year A.R.I. Storm. If the surface flow path is not possible, the pipe drainage system will have to cater for the one hundred (100) year Average Recurrence Interval (A.R.I).

- A concept Stormwater Drainage Plan shall be submitted with the Development Application. No pumps or charged pipes must be included in the design. All pipes must have a minimum of 1% slope.

- Basements must be fully tanked construction unless demonstrated that groundwater flows are minimal or intermittent as demonstrated by geotechnical investigation and not subject to the ingress of surface waters. Minor areas of vehicular ramp that drain to the basement may be permitted to drain via basement pump-out system. Where pump out system is proposed, the site must connect to Council's piped drainage system.

- Modelling for the determination of the pollution load reductions must be undertaken in MUSIC (the Model for Urban Stormwater Improvement Conceptualisation) and in accordance with Marrickville Council's WSUD Reference Guideline.

- Stormwater quality load reduction controls are:
    - 90% reduction in the post development mean annual load of Gross Pollutants (greater than 5mm).
    - 85% reduction in the post development mean annual load of Total Suspended Solids (TSS).
    - 60% reduction in the post development mean annual load of Total Phosphorus (TP).
    - 45% reduction in the post development mean annual load of Total Nitrogen (TN).

- A WSUD Strategy Report must be provided to ensure the treatment measures proposed to meet Council's water quality targets. MUSIC model file (* .sqz file) must be included with the report.

- A detailed WSUD maintenance plan outlining how all elements of the water quality treatment facility will be maintained and to record annual inspections/maintenance works to be undertaken.

2.0 Site Background

The subject site is located within a residential/commercial area located to the north of Hume Highway on Cavill Avenue as shown in Figure 1. The subject site area is 8,422m^2.

Figure 1 – Existing Site

2.1 Key Issues

The key issues to be addressed in this report include:

- Sedimentation and erosion control
- External Stormwater Drainage Capacity
- Stormwater Quantity Control
- Stormwater Quality Control

3.0 Sedimentation and Erosion Control

3.1 Strategies

The proposed sedimentation and erosion control measures to manage runoff and ensure no detriment to the receiving environments have been divided into temporary and permanent strategies as summarised below.

STRATEGY	DESCRIPTION
Temporary	Temporary strategies generally refer to the control of sediment erosion and water pollution during the construction phase. The primary risks occur when soil is excavated and exposed to the elements during construction works. It is at this stage that suspended solids and other construction activity associated pollutants can be washed into the receiving stormwater network and subsequently the downstream waterways. The strategies that are implemented to prevent potential soil degradation and pollution of waterways include the adequate provision of sedimentation and erosion control measures. Generally, the measures outlined in this report form a minimum basis that should be considered and further documented by the contractor prior to commencement of the works through a Sediment & Erosion Control Plan (ESCP). The temporary controls that are proposed in the concept plans by TTW will limit the displacement of sediment caused by runoff from disturbed areas and are designed to remove sediment prior to discharging from site.
Permanent	Permanent strategies generally refer to the installation of a number of permanent treatment measures to remove gross pollutants, total suspended solids, and phosphorus/nitrogen nutrients effectively in order to maintain stormwater quality discharged from the site. For the permanent water quantity and quality measures refer to Section 4 of the report.

Table 2 - Temporary & Permanent Strategies

3.2 Proposed Measures

An Erosion & Sediment Control Plan is attached to this report in **Appendix A-Drawing C03-P1.**

3.3 Installation of Measures

The measures are to be installed as per the requirements outlined below:

- Clearly visible barrier, site fencing and hoarding shall be installed at the discretion of the Superintendent to ensure site security, safety of the public, manage traffic control and prohibit any unnecessary site disturbance. Vehicular access to the site shall be limited to only what is essential for the construction activities and shall enter the site only through the stabilised access points.
- All disturbed areas are to be stabilised within 14 working days of the completion of earthworks. All disturbed areas are to be protected so that the land is permanently stabilised within six months.
- Proprietary silt fencing shall be installed by the Contractor in accordance with the final approved Sedimentation and Erosion Control Plan and elsewhere at the discretion of the site superintendent to contain sedimentation to as near as possible to the original source.
- Sediment removed from any sediment trapping device shall be relocated where further pollution to downslope lands and waterways cannot occur.
- Stockpiles shall be located by the Contractor in accordance with the final approved Sedimentation and Erosion Control Plan and elsewhere at the discretion of the Project Manager and/or Superintendent. Where stockpiles are to be in place longer than 30 days they shall be stabilised.
- Water shall be prevented from entering the permanent drainage system unless it is sediment free. Drainage pits are to be protected in accordance with the final approved Sedimentation and Erosion Control Plan.
- Temporary sediment traps located at pits shall be retained throughout the early works stage and until the appropriate replacement measures for the subsequent stages are installed.

3.4 Land Disturbance

Where practicable, the soil erosion hazard shall be kept as low as possible. Limitations to access are to be in accordance with the following table:

Land Use	**Limitation**
Access areas	Access is to be limited to the designated work zones via the stabilised site access.
Truck cleaning areas	Any truck exiting out of the site shall be thoroughly cleaned and limit the exportation of soil and sediment on public roads.
Remaining undisturbed areas.	Access to any undisturbed areas and remaining lands is only permitted with permission from the Project Manager and/or Superintendent.

Table 3 - Limitations to Access

- Any spilled material shall be immediately removed from areas subject to runoff or concentrated flow;

- Trapped sediment shall be removed where the capacity of the sedimentation trapping device falls below 60%;

- Sedimentation traps are to be inspected after each rainfall event and/or weekly to;
    - Ensure that all sediment is removed once the sediment storage zone is full;
    - Ensure that outlet and emergency spillway works are maintained in a fully operational condition at all times;
    - Ensure rehabilitated lands have effectively reduced the erosion hazard and initiate upgrading or repair as appropriate;

- Additional erosion or sediment control works may be required to be constructed as appropriate to ensure the protection of downslope lands and waterways;

- Erosion and sediment control measures are to be maintained in a fully functioning condition at all times until the site is rehabilitated or secondary stage measures are installed;

- Revegetation schemes are to be adhered to and that any grass coverings are kept healthy, including watering and mowing;

- The removal of the temporary soil conservation and sedimentation control structures is to be the last activity in the rehabilitation program.

4.0 Stormwater Design

The objective is to provide stormwater controls that ensure that the proposed development does not adversely impact on the quantity or quality of stormwater flows within, adjacent and downstream of the site.

4.1 Existing Stormwater System

The existing site, with an area of 8,422m^2, sits on the top crest of three medium sized catchments. Portions of the site fall into and split into four nominated catchments namely Thomas Street to the south-west (Area = 1857m^2), Bypass(The Avenue) Catchment to the west (Area = 1110m^2), Cavill Av to the north (Area = 4224m^2) and Hume Highway to the south (Area = 1231m^2).

Figure 1 – Existing Catchments

The existing Inner West Council/Sydney Water trunk drainage system is shown below in Figure 2 & 3.

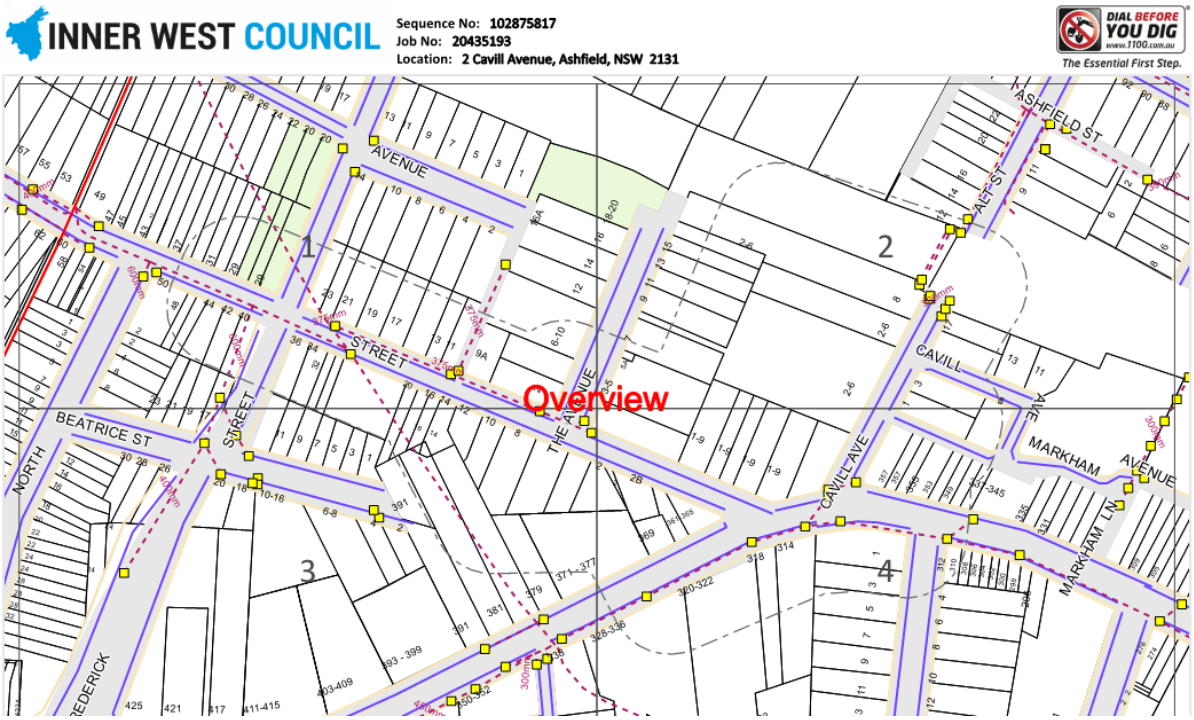


Figure 2 – Existing Inner West Trunk Drainage System

Figure 3 – Existing Sydney Water Trunk Drainage System

The Thomas St and Hume Hwy catchments traverse through council 375 dia pipe drainage systems until connect to the Sydney Water 2300x1500 stormwater culvert trunk main running in the north-west direction across Fredrick St joining Iron Cove Creek in the northerly direction until it arrives into the Parramatta River catchment at Dobroyd Point.

The Cavill Street catchment drains north under the railway until it meets Iron Cove Creek downstream near Elizabeth Street.

The recent development of No. 2-6 Thomas Street Ashfield on the south side of Thomas St. in April 2018 included the stormwater line construction from a new kerb inlet pit adjacent to the development to the existing stormwater line to the west adjacent to Heighway Avenue laneway on Thomas Street. Refer to Figure 4 for a depiction.

Figure 4 – Existing/Proposed Stormwater System

Taylor Thomson Whitting (NSW) has set up a DRAINS model to simulate the drainage capacity of the existing stormwater drainage line and proposed connection points to the Thomas St and Cavill Avenue lines.

The existing DRAINS layout plan is shown in Figure 5a and 5b below.

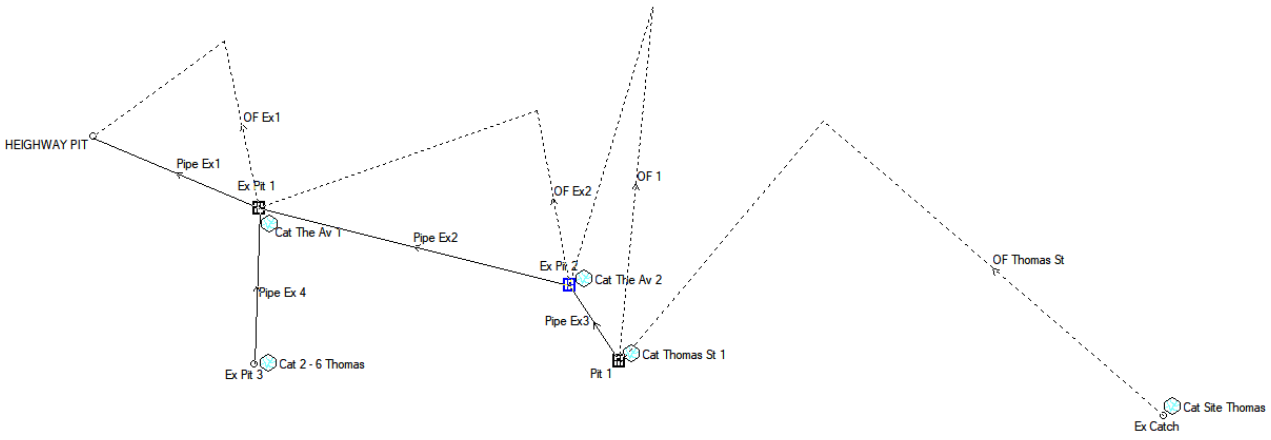


Figure 5a – Existing Drainage Layout Thomas St in DRAINS

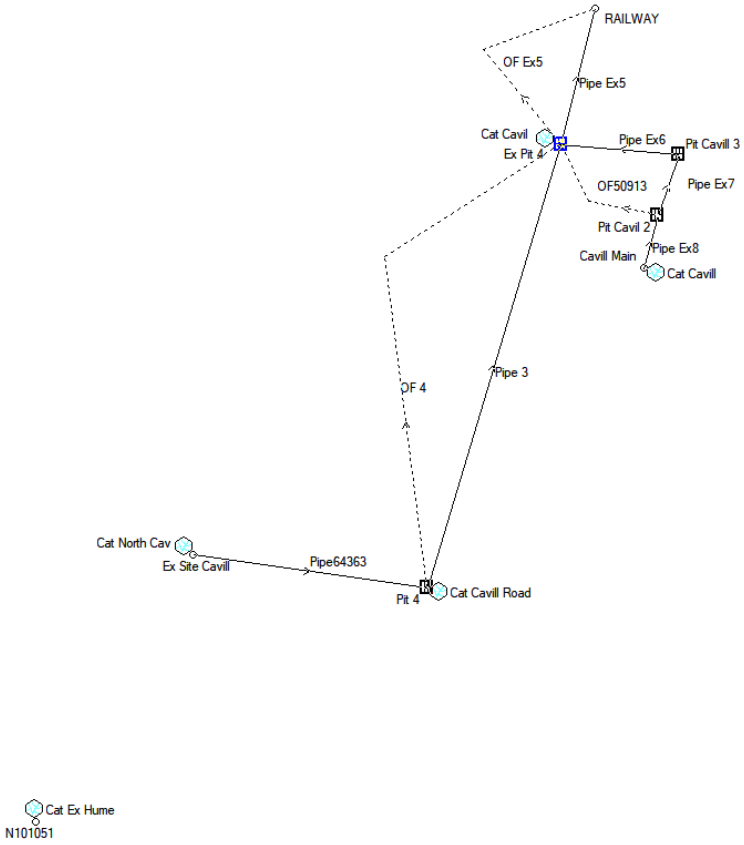


Figure 5b – Existing Drainage Layout Cavill Av & Hume Hwy in DRAINS

The existing 10-year model run in DRAINS is shown in Figure 5c and 5d below.

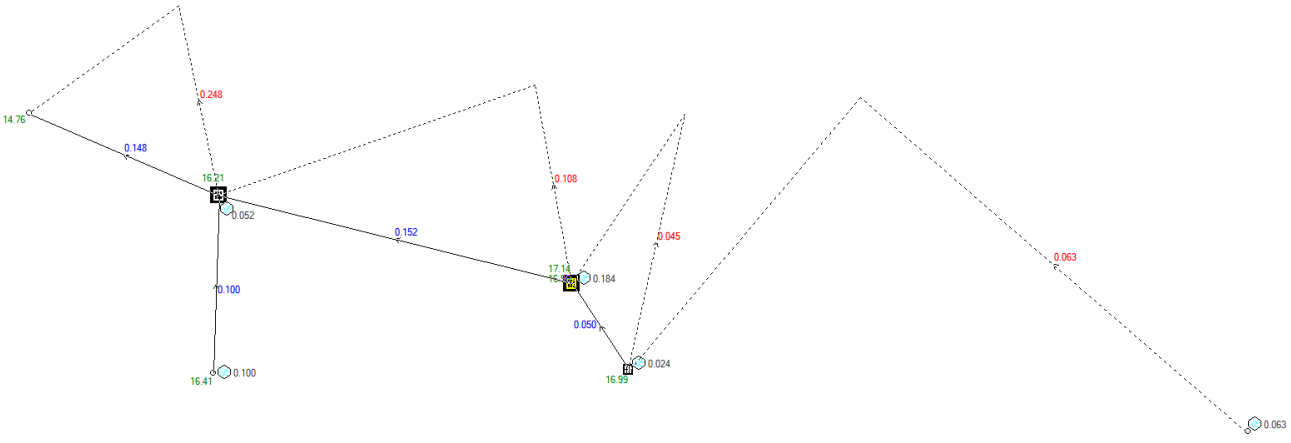


Figure 5c – Existing 10 year Drainage Layout Thomas St in DRAINS

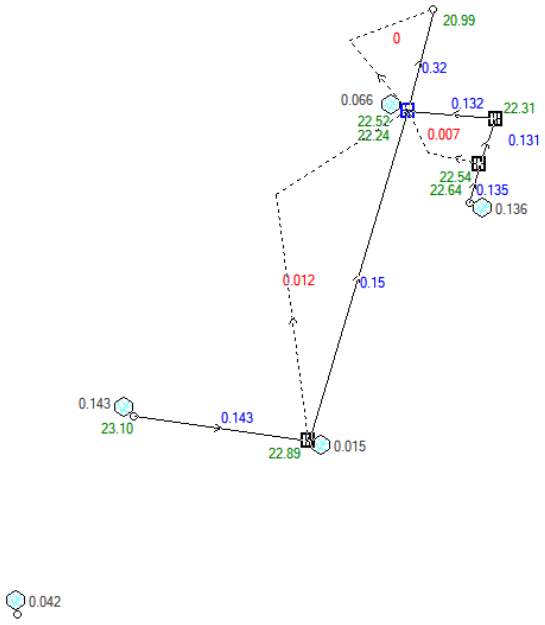


Figure 5d – Existing 10 year Drainage Layout Cavill Av & Hume Hwy in DRAINS

The existing drainage network on Thomas Street has been analysed as over capacitated at Pit 1 and Ex Pit 2 as shown below in Figure 6 in the 1 in 10 year storm.

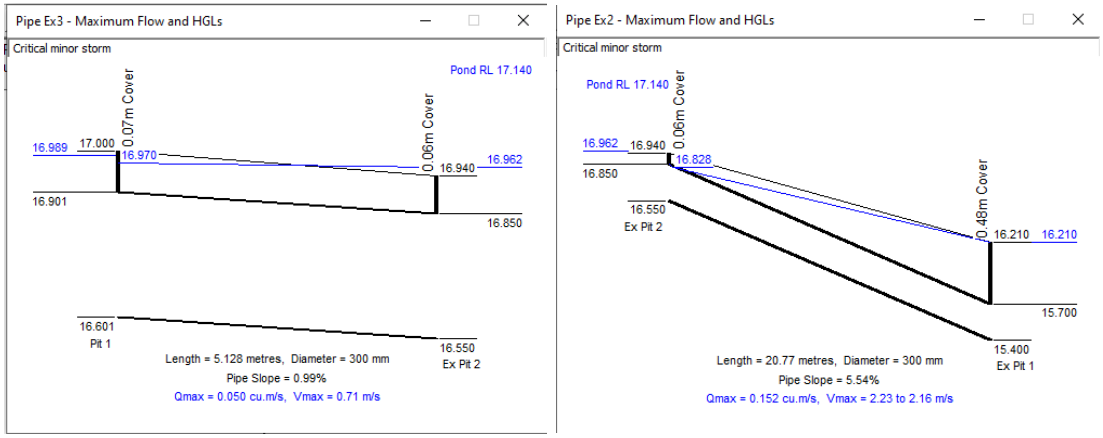


Figure 6 Thomas St Pipes over cacitiised in the existing 1 in 10 year scenario in DRAINS

The existing drainage network on Cavill Avenue has also been analysed as over capacitated at Pit 4 and Ex Pit 4 as shown below in Figure 7 in the 1 in 10 year storm.

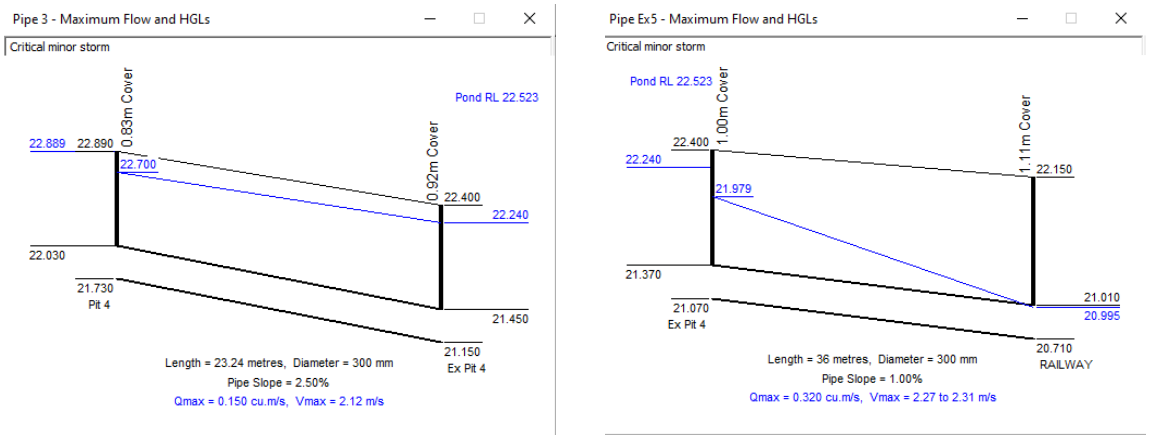


Figure 7 Cavill Av Pipes over cacitiised in the existing 1 in 10 year scenario in DRAINS

4.2 Proposed Drainage System

The site stormwater system for the development has been designed to capture concentrated flows from impermeable surfaces including on-grade pavements, landscape areas, building roofs, footpaths and courtyards open to the sky. The proposed stormwater management system for the roads includes:

- Pit and pipe drainage network to collect runoff from roadway public domain areas;
- Stormwater flows up to the 5% annual exceedance probability (AEP) event are conveyed by a minor drainage system; and
- Stormwater flows up to the 1% annual exceedance probability event are conveyed by a major drainage system;

It is to be noted that the flowrates generated to size the internal pit and pipe network are based off Australian Rainfall and Runoff – A Guide to Flood Estimation 2016.

The internal drainage design including On-Site Detention is to be in accordance with section 2.25 of Marrickville Development Control Plan 2011.

A reduced set of the stormwater management plans, catchment plans, DRAINS long sections are included in **Appendix B.**

The internal catchments for the proposed development have been analysed using the two main trunk drainage routes to coincide with two on-site detention (OSD) tank outlets: -

- Thomas St with a total catchment of 3548m^2
- Cavill Av with a total catchment of 4359m^2
- Bypass with a total catchment of 515m^2

We have excluded Hume Hwy from the proposed catchment flow and analysis and only provided two outlets.

The catchments are represented in Figure 8 below on the catchment plan C202 and site stormwater plan C210 and C211 in Appendix B.

Figure 8 – Proposed Catchment Plan for Downstream Connecting System Thomas St and Cavill Av

4.3 Proposed On-Site Detention

In order to comply with Section 2.25 of the Marrickville DCP 2011, two OSD tanks are proposed to capture the Thomas St and Cavill Avenue outlets with subsequent catchments areas 3548m2 and 4359m^2 respectively as shown on our drawing C06 and detail sheet C12.

Calculations for the OSD tank sizes were based on 2.25.3.3 of the DCP requirements which can be summarised as follows:

(i) For developments greater than 1000m 2 in site area, allowable discharges will be limited to the equivalent fully pervious discharges for the site area

(ii) OSD tanks were sized to store from the 2 year to the 1 in 100 year ARI storm event.

DRAINS modelling software was used to model the OSD tanks volume requirement to comply with the site's PSD requirements.

Table 1 & 2 results show that the proposed subdivided area site does not have any adverse impact on the downstream (northern) properties and receiving stormwater system.

THOMAS STREET CATCHMENT

ARI	Pre-Development (perv.) incl bypass(l/s)	Developed Bypass (l/s)	Developed with OSD (l/s)	Total Developed Flow (l/s)
2-year	58	10	37	47
5-year	80	13	47	60
10-year	105	15	53	68
20-year	136	17	57	74
100-year	164	23	70	93

Table 1: Site's Thomas St Discharge Pre vs Post Development scenario

The modelling indicates the OSD tank 1 with outlet to Thomas Street requires a total OSD storage volume of 75m^3 as summarised in **Table 2** below.

OSD Tank 1	Storage Volume Requirement (cu.m)	PSD Flow Rate minus bypass	OSD Flow Rate	Base Level Tank (RL m)	Top Water Level Tank 1% AEP (RL m)
TOTAL	**75.00**	**141 l/s**	**70 l/s**	**RL 17.15m**	**RL 19.43m**

Table 2 OSD Storage Volume

CAVILL STREET CATCHMENT

ARI	Pre-Development (perv.) (l/s)	Total Developed Flow (l/s)
2-year	63	61
5-year	87	77
10-year	113	98
20-year	146	113
100-year	176	173

Table 3: Site's Discharge Pre vs Post Development scenario

The modelling indicates the tank requires a total s OSD storage volume of 80m^3 and 60 m^3 as summarised in **Table 4** below.

OSD Tank 2	Storage Volume Requirement (cu.m)	PSD Flow Rate minus bypass	OSD Flow Rate	Base Level Tank (RL m)	Top Water Level Tank 1% AEP (RL m)
TOTAL	**102**	**176 l/s**	**173 l/s**	**RL 21.295m**	**RL 22.46m**

Table 4 OSD Storage Volume

Refer to **Appendix B & C** for Catchment plan, DRAINS modelling layout, schematic and detailed results.

4.4 Proposed Drainage System Post OSD

The proposed council drainage systems with the installation of OSD have been analysed in DRAINS.

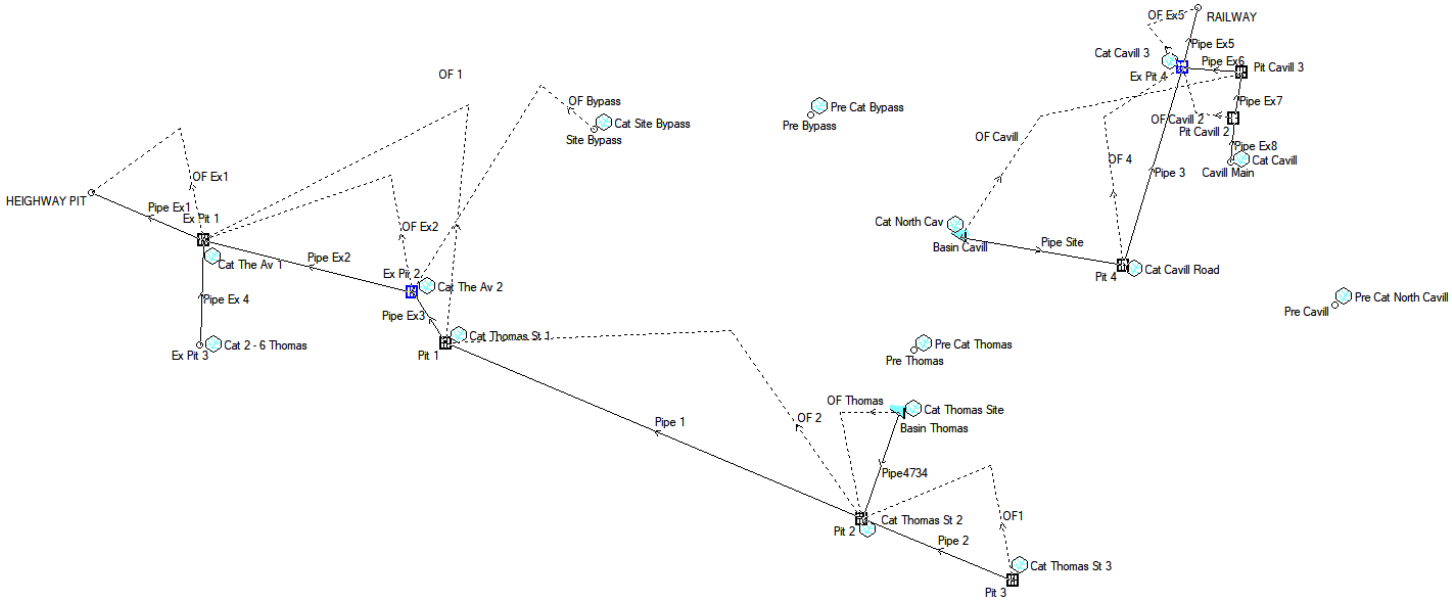


Figure 9 – Proposed Drainage Layout Cavill Av & Hume Hwy in DRAINS

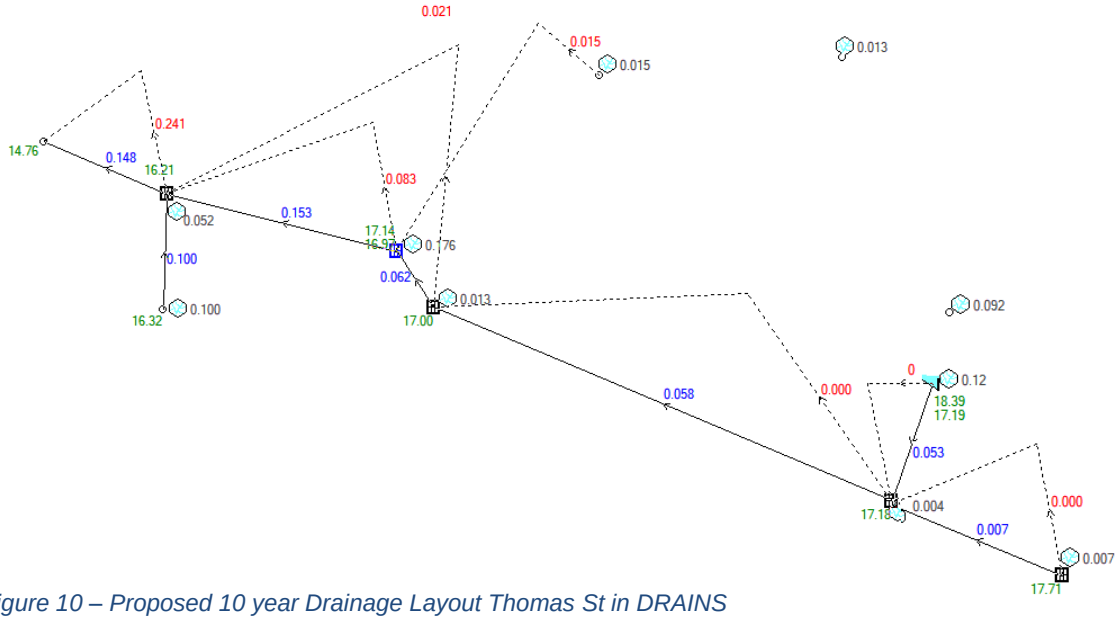


Figure 10 – Proposed 10 year Drainage Layout Thomas St in DRAINS

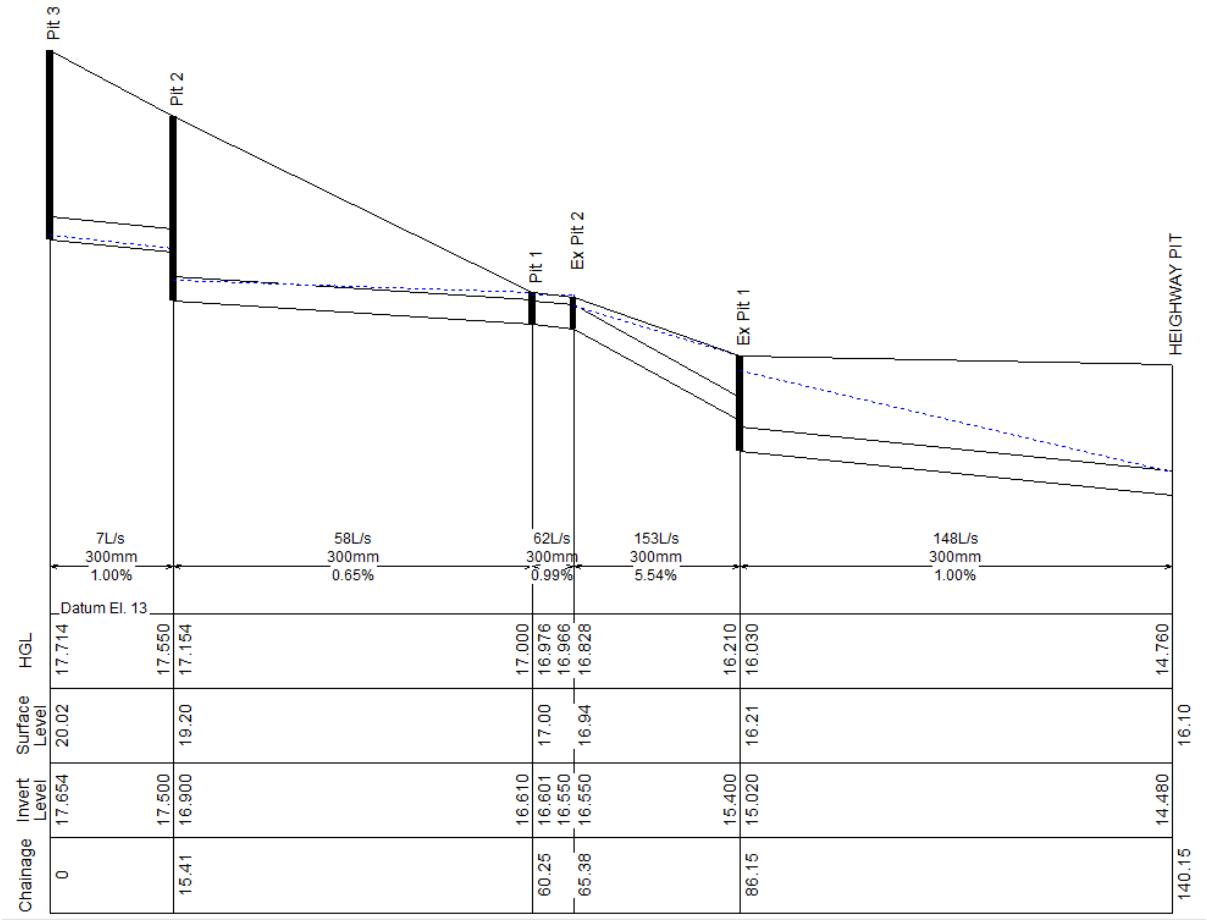


Figure 11 – Proposed 10 year Drainage LongsectionThomas St in DRAINS

Using the results above in the 10 year storm, the installation of OSD 1 and the re-direction of the Hume Highway catchment to the Thomas St catchment has reduced the overall flow by 7L/s plus the Hume Hwy flow of 42L/s. The new 300 dia pipe stormwater line from Pit 3 to connection at Pit 1 provides sufficient hydraulic grade line below the proposed pits in the 10 year storm and is within the drainage capacity.

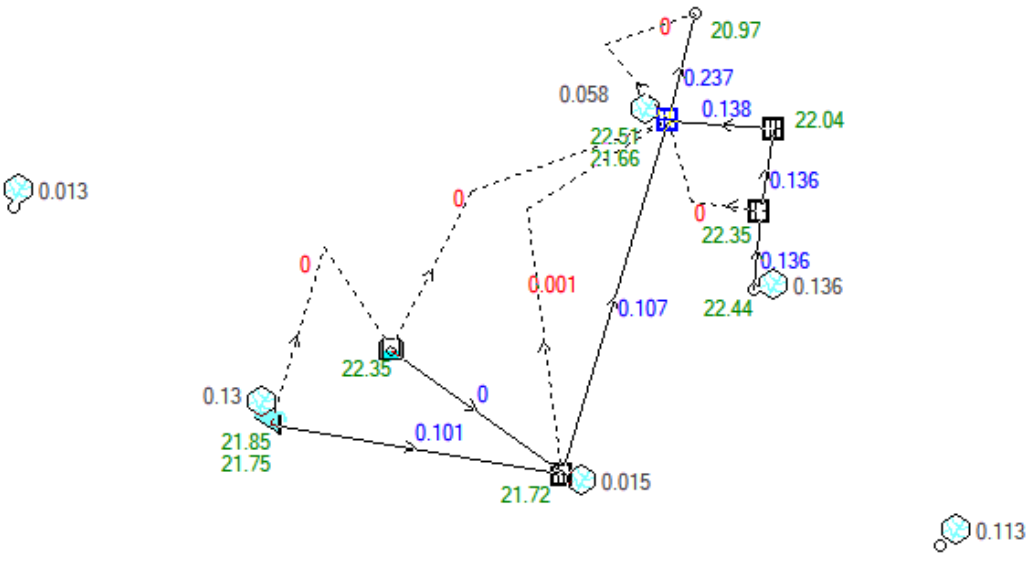


Figure 12 – Proposed 10 year Drainage Layout Cavill Av in DRAINS

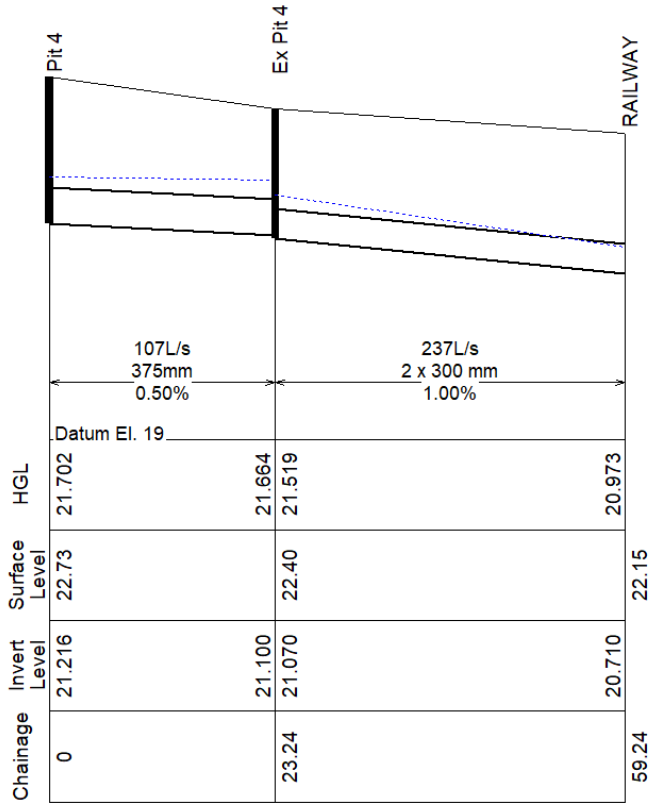


Figure 13 – Proposed 10 year Drainage LongsectionThomas St in DRAINS

Using the Cavill Av results above in the 10 year storm, the installation of OSD 2 has reduced the overall flow by 81L/s. The new 375 dia pipe stormwater line from Pit 4 to connection at Ex Pit 4 provides sufficient hydraulic grade line below the proposed pits in the 10 year storm and is within the drainage capacity.

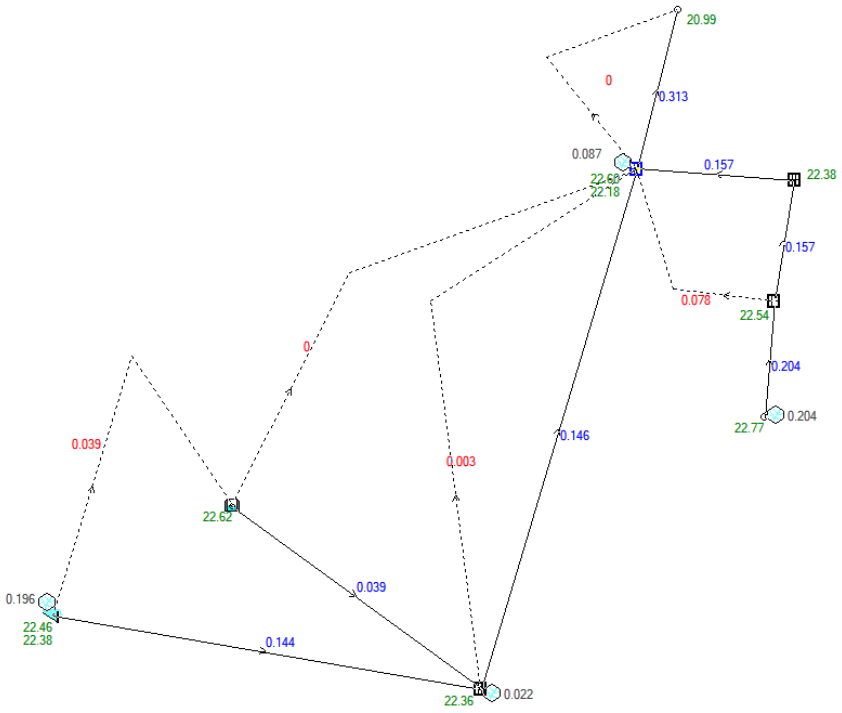


Figure 14 – Proposed 100 year Drainage Layout Cavill Av Railway Crossing in DRAINS

4.5 Stormwater Water Quality Control

Increases to impervious areas often results in the increase of gross pollutants, total suspended solids, and phosphorus and nitrogen nutrients. These pollutants are washed away into the stormwater network during rainfall events, transported from their site of origin into downstream waterways. To limit the impact of on the receiving water body, quality control measures need to be designed in the form of a treatment train that reduces pollutant loads prior to discharging into the drainage network.

The quality of site stormwater runoff depends upon a number of factors including land use, degree of imperviousness, population size, sanitation and waste collection methods, topography, geotechnical characteristics of the soil and the amount of rainfall based on climate. Litter, garbage, sediment, soils, nutrients, oils, hydrocarbons, grease, and heavy metals are all examples of pollutants that are typically transported off site by runoff. Whilst these pollutants have an adverse impact on the overall quality of the receiving water body it is gross pollutants, suspended solids and the nutrients phosphorus/nitrogen which are the most detrimental to the environment. Litter, garbage, oils, hydrocarbons and other pollutants that typically float on the surface generally have a bigger aesthetic impact to water quality.

The proposed buildings are part of the Ashfield catchment which includes provision for water sensitive urban design (WSUD) treatment train for all upstream developed catchments including the proposed buildings. The WSUD treatment terrain includes the following measures; 2 x OceanGuards, and 16 storm filters. According to the MUSIC modelling results, the proposed strategy achieves the reduction targets specified by Council listed below in Table 3. As such, **no further permanent water quality management system is required for the site**.

Pollutant Type	Pollutant Reduction Target by BCC (Average Annual Load)
Gross Pollutants (GP)	90%
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	65%
Total Nitrogen (TN)	45%

Table 5: Water Quality Targets (Source: NSW Office of Environment and Heritage)

4.3.1 Stormwater Quality Control Measures

There are a number of measures that can reduce pollutant loadings with their effectiveness varying depending on the targetted pollutant, land use type, maintenance access or requirements and site topography. The proposed combination of measures aims to provide the most efficient and manageable measures suited to the site.

The individual elements of the proposed treatment train for the site are summarised in the table below:

Element	Description
OceanGuard	• 2 x OceanGuard are proposed to treat impervious/pervious areas in catchment
690 Psorb Stormfilters	• 16 storm filters are proposed to treat all areas in separate catchments.

Table 4 - Proposed Water Quality Measures

4.3.2 MUSIC Modelling

The effectiveness of the combination of treatment train measures has been assessed using numerical modelling within MUSIC (Model for Urban Stormwater Improvement Conceptualisation version 6). The results of the modelling were compared against the Council's pollutant reduction targets to determine the effectiveness of the proposed measures.

MUSIC simulates the performance of a group of stormwater management measures, configured in series or in parallel to form a "treatment train" against historic rainfall event data sets. It is the industry standard water quality modelling software developed by the MUSIC Development Team of the Cooperative Research Centre for Catchment Hydrology (CRCCH).

The MUSIC User Manual suggests that the time-step should not exceed the time of concentration of the smallest sub-catchment however due consideration must also be made regarding the shortest detention time of nodes within the treatment train.

4.3.3 Event Mean Concentration

MUSIC uses different event mean concentrations (EMC) to determine the pollutant loads generated by different land uses. The standard EMCs adopted within MUSIC were based on research undertaken by Duncan (1999) through the CRCCH and the results are reproduced in Australian Runoff Quality – A Guide to Water Sensitive Urban Design (ARQ). The EMC values used in the MUSIC models for this project were based on the Sydney Catchment Management Authority (CMA) Source Node(s) utilising modified % impervious area, rainfall threshold, soil properties & pollutant concentrations. The table below summarises the parameters used for the development site;

NODE TYPE	MEAN BASE FLOW CONCENTRATIONS Log_{10} (mg/L)			MEAN STORM FLOW CONCENTRATIONS Log_{10} (mg/L)		
	TSS	TP	TN	TSS	TP	TN
Impervious	Not Applicable*Note			2.150	-0.600	0.300
Pervious	1.200	-0.850	0.110	2.150	-0.600	0.300

Table 5 - EMC Inputs for MUSIC
**Note – Impervious areas do not have base flows.*

4.3.4 Catchment Breakdown

The two main catchments were split into the following: roof, pervious, impervious, and driveway with varying imperviousness ratios.

Table 6 provides a breakdown of the catchment areas and the respective impervious percentages used in the MUSIC model:

CATCHMENT	AREA (m^2)	IMPERVIOUSNESS RATIO (%)
Thomas St Catchment	3548	80%
Cavill St Catchment	4359	79%
Bypass Catchment	515	70%

Table 6 - Catchment Breakdown

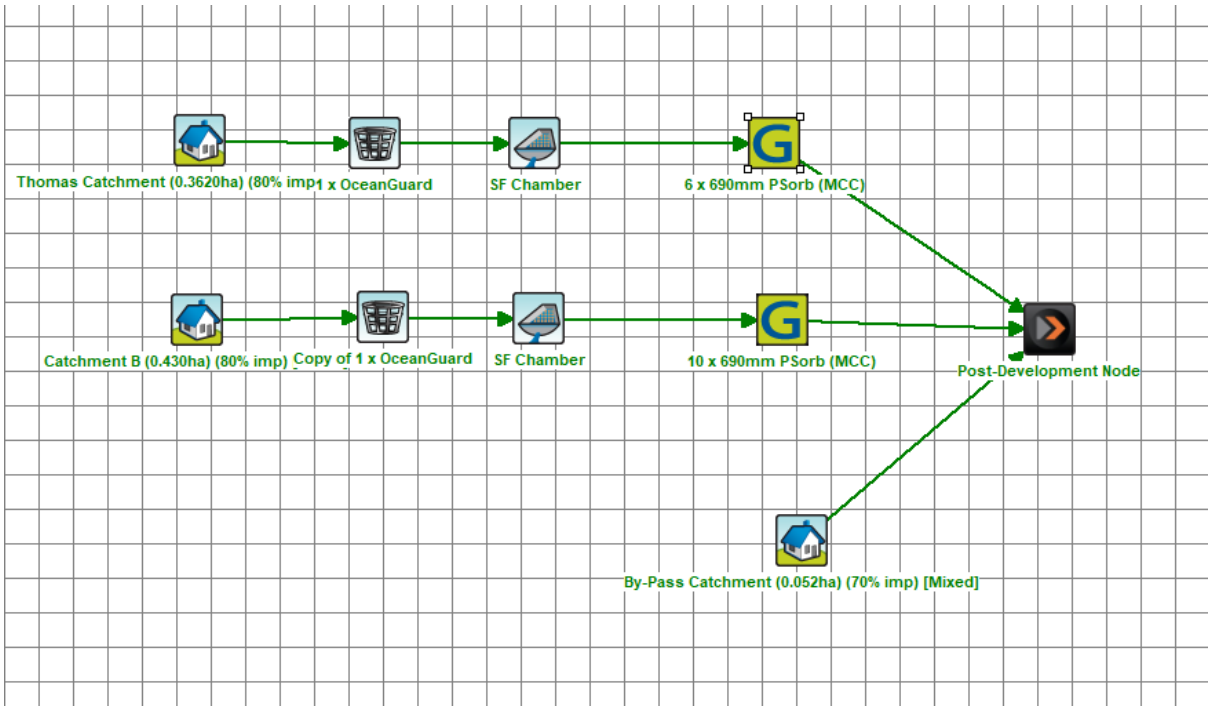
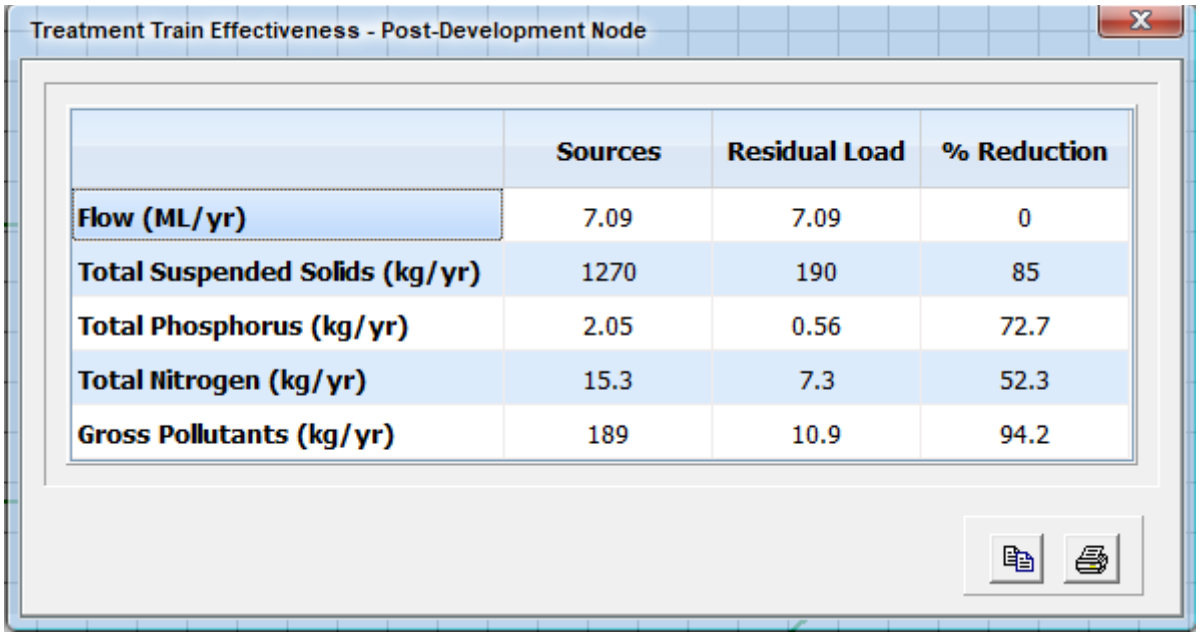


Figure 14– Treatment Train

4.3.6 Results

The results of the modelling are summarised below with the pollutant loads expressed in kilograms per year. The reduction rate is expressed as a percentage and compares the pollution from the post developed site to that of the existing developed state of the site to determine whether the reduction targets have been achieved.



	Sources	Residual Load	% Reduction
Flow (ML/yr)	7.09	7.09	0
Total Suspended Solids (kg/yr)	1270	190	85
Total Phosphorus (kg/yr)	2.05	0.56	72.7
Total Nitrogen (kg/yr)	15.3	7.3	52.3
Gross Pollutants (kg/yr)	189	10.9	94.2

Table 7 - MUSIC Results

GP	=	Gross Pollutants	TSS	=	Total Suspended Solids
TP	=	Total Phosphorus	TN	=	Total Nitrogen

The final MUSIC model layout is attached in Figure 14 and **Appendix C**.

The results table shows that the proposed treatment train will achieve the reduction targets for full range of pollutants. Through the implementation of the proposed water quality measures stormwater discharge from the site can be effectively managed to ensure that there is no detrimental effect to the water quality downstream of the subject site.

4.6 Stormwater Quality During Construction

During the construction stage of the project, an erosion and sediment control plan is to be implemented to prevent sediment laden stormwater from flowing into adjoining properties, bushland, roadways or receiving water bodies. Stormwater controls onsite are detailed in an erosion and sediment control plan which is in accordance with relevant authority guidelines including Inner West Council's Development Control Plan and Infrastructure Design Standards, and Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book"). Refer to Civil Engineering drawing reference number C02 for the proposed concept erosion and sediment control plan.

4.7 Lifecycle Costs & Maintenance

The manufacturer of the Storm-Filter, Ocean Protect, has analysed the worst-case mass loads to determine the expected life cycle replacement interval for the media that is within the filters.

They have stated that the physical Storm Filter cartridges they will last for a few decades.

However the media inside the filters, will require period replacement as the media becomes occluded (blocked) or the media is exhausted. They facilitate this media replacement as a swap and go system – similar to gas bottle system for consumers.

The two branches of the site stormwater system have different expected loads, hence the media replacement will be slightly out of balance. This is overcome by rotating the filters at each annual clean of the manhole tanks.

The upper branch north western has an expected media replacement period of 3 to 6 years. The lower south eastern branch has an expected media replacement of 1 to 3 years.

A typical clean out of the tank and inspection of the system and the media would be circa $2.5k (exc GST) per tank.

The replacement of media would be circa $2k (exc GST) as a swap and go per tank – ex Sydney

A one off cleanout and replacement of the media by our Sydney based truck would be circa $6k (exc GST) per tank

This includes the disposal of waste and all the labour and associated transport and so forth required to completely rejuvenate a system back to pristine condition.

Ocean Protect offer a 10 year contract the annual rate would likely drop to circa $4.6k per tank and would include a 6 monthly check.

The OceanGuards are typically inspected and maintained on a 3 to 4 times per year basis – subject to mass load considerations this would normally be conducted by Council's maintenance team.

4.8 Stormwater Maintenance Schedules and Procedures

In order to comply with the Inner West Council Pre Development Application request we have detailed a maintenance program below of the proposed stormwater pipes, pits and water quality device in Figure 8.

4. A detailed maintenance plan shall be submitted outlining how all elements of the stormwater system including the backflow prevention devices and water quality treatment facility will be maintained and inspections recorded annually.

Maintenance Action	Frequency	Procedure	Performance Target
Inspect pits, OSD, Ocean Guard & Stormfilter for blockages and sediment build up.	3 Monthly/After a major storm event	Remove grate/cover and inspect pit for debris. Remove any collected sediment, debris, litter and vegetation to pit and grate. Ensure flush placement of grate/cover on replacement.	Clear of debris.
Dilapidation Inspection	6 Monthly	Inspect visible drainage structures noting damage. Carry out all necessary repair work as required.	Good structural integrity.
Check for faulty pipe joints or separated joins and reseal or repair the joints.	A year after construction and then CCTV every 5 years.	Remove soil around the pipes for in ground pipes. Ensure faulty or separated joints are securely sealed where required. Seal gaps as required.	Pipe joints securely sealed and no gaps remain.
Inspect for internal scouring, and sediment build up in pipes and pits.	A year after construction and then CCTV every 5 years.	Perform maintenance after rain, but when external pavements have dried. Remove grate and screen. Use a battery torch to shine through pit's access hole for inspection. Do not enter pipes.	Pipes and pits are clear of debris and undamaged.
Inspect for performance of backflow prevention device	Every 6 months	Access backflow prevention device or valve. Test functionality or water retention.	Good Structural Integrity and Water tightness

5.0 Recommendations

The key strategies to be adopted for this development include the following:

1. An internal pit and pipe network to collect all stormwater runoff up to the 20% AEP event with overflows up to the 1% AEP to be directed to the roads as shown in the Site and Stormwater Plan Drawings C05 & C06 in **Appendix B**.

2. External Construction of 300 diameter Stormwater line on Thomas St to the connection point near The Avenue. Reconstruction of 375 diameter pipe on Cavill Avenue to lower the existing stormwater pit.

3. For the temporary measures and short term effects (i.e. during the early works phase) water quality is managed by implementing the measures covered in the Sediment & Erosion Control Plan as documented on our drawing C02 in **Appendix A.**

4. Water Quality Measures:

    - Sixteen (16) x Ocean Protect 690 Psorb Storm Filters;
    - Six (6) OceanGuards to treat all pervious and driveway areas by the removal of litter.

    Implementation of all water quality measures mentioned above will achieve the water quality reduction targets set by Council.

The results from the investigations and modelling summarised in this report indicate that the development can provide a safe and ecologically sustainable environment with the proposed stormwater network, water sensitive urban design management strategy.

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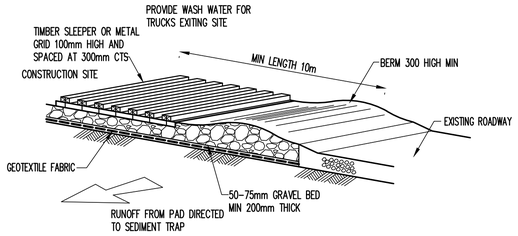
Appendix A

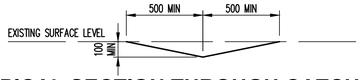
- Sedimentation and Erosion Control Plan

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C02



TEMPORARY CONSTRUCTION VEHICLE EXIT

NTS



TYPICAL SECTION THROUGH CATCH DRAIN

SCALE 1: 20

EROSION AND SEDIMENT CONTROL LEGEND

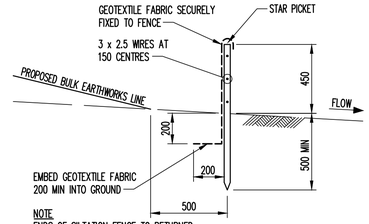
- Siltation fence
- Hay bale barriers
- Sandbag sediment trap
- Catch drain

EROSION AND SEDIMENT CONTROL NOTES

1. All work shall be generally carried out in accordance with
   (A) Local authority requirements,
   (B) EPA – Pollution control manual for urban stormwater,
   (C) LANDCOM NSW – Managing Urban Stormwater: Soils and Construction ("Blue Book").
2. Erosion and sediment control **drawings and notes are** provided for the whole of the works. Should the Contractor stage these works then the design may be required to be modified. Variation to these details may require approval by the relevant authorities.
   The erosion and sediment control **plan** shall be implemented and adapted to meet the varying situations as work on site progresses.
3. Maintain all erosion and sediment control devices to the satisfaction of the superintendent and the local authority.
4. When stormwater pits are constructed prevent site runoff entering the pits unless silt fences are erected around pits.
5. Minimise the area of site being disturbed at any one time.
6. Protect all stockpiles of materials from scour and erosion. Do not stockpile loose material in roadways, near drainage pits or in watercourses.
7. All soil and water control measures are to be put back in place at the end of each working day, and modified to best suit site conditions.
8. Control water from upstream of the site such that it does not enter the disturbed site.
9. All construction vehicles shall enter and exit the site via the temporary construction entry/exit.
10. All vehicles leaving the site shall be cleaned and inspected before leaving.
11. Maintain all stormwater pipes and pits clear of debris and sediment. Inspect stormwater system and clean out after each storm event.
12. Clean out all erosion and sediment control devices after each storm event.

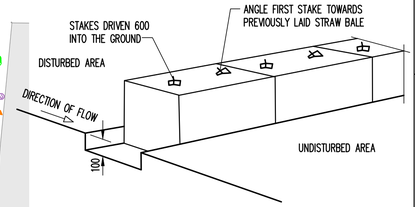
Sequence Of Works

1. Prior to commencement of excavation the following soil management devices must be installed.
1.1. Construct silt fences below the site and across all potential runoff sites.
1.2. Construct temporary construction entry/exit and divert runoff to suitable control systems.
1.3. Construct measures to divert upstream flows into existing stormwater system.
1.4. Construct sedimentation traps/basin including outlet control and overflow.
1.5. Construct turf lined swales.
1.6. Provide sandbag sediment traps upstream of existing pits.
2. Construct geotextile filter pit surround around all proposed pits as they are constructed.
3. On completion of pavement provide sand bag kerb inlet sediment traps around pits.
4. Provide and maintain a strip of turf on both sides of all roads after the construction of kerbs.



SILTATION FENCE DETAIL

SCALE 1: 20



HAY BALE SEDIMENT FILTER

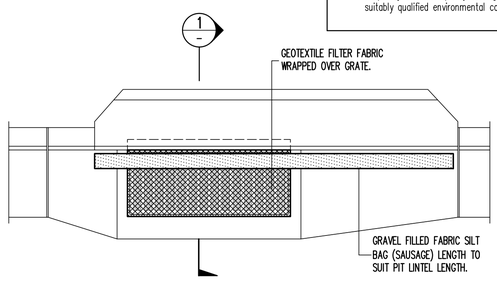
NTS

NOTE: STAKE TO BE EITHER TAR COATED STAR OR 50 x 50 HARDWOOD

WATER QUALITY TESTING REQUIREMENTS

Prior to discharge of site stormwater, groundwater and seepage water into council's stormwater system, contractors must undertake water quality tests in conjunction with a suitably qualified environment consultant outlining the following:

- Compliance with the criteria of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)
- If required subject to the environmental consultants advice, provide remedial measures to improve the quality of water that is to be discharged into Councils storm water drainage system.This should include comments from a suitably qualified environmental consultant confirming the suitability of these remedial measures to manage the water discharged from the site into Councils storm water drainage system. Outlining the proposed, ongoing monitoring, contingency plans and validation program that will be in place to continually monitor the quality of water discharged from this site. This should outline the frequency of water quality testing that will be undertaken by a suitably qualified environmental consultant.



SECTION 1

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A1

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P3	ISSUED FOR REVISED SETBACKS	AL	LS	07.05.21
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2-6 CAVILL AVENUE, ASHFIELD

Sheet Subject
SEDIMENT AND EROSION CONTROL PLAN & DETAILS

Scale : A1	Drawn	Authorised
1:250	LS	NB

Job No	Drawing No	Revision
192006	C03	P3

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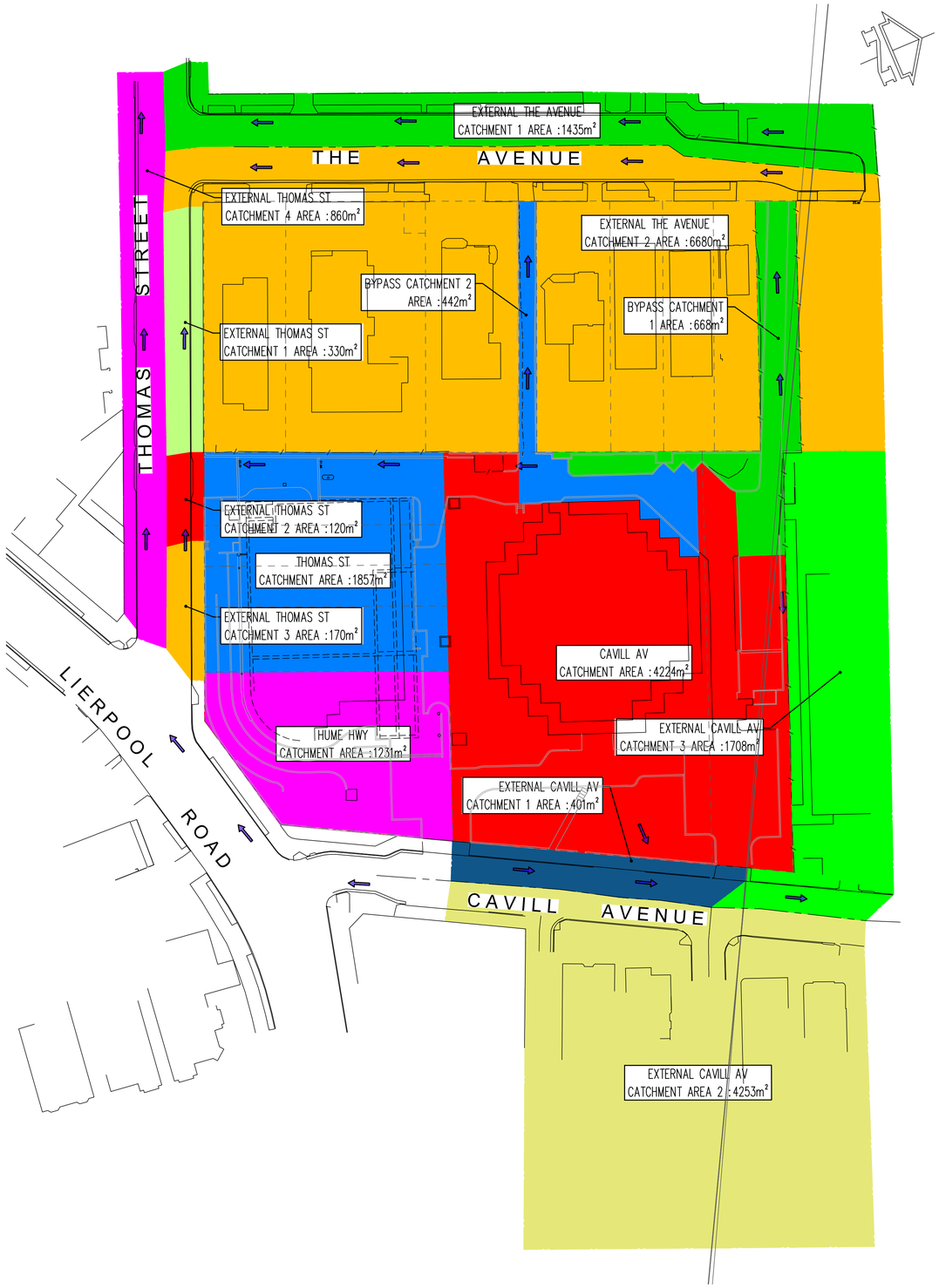
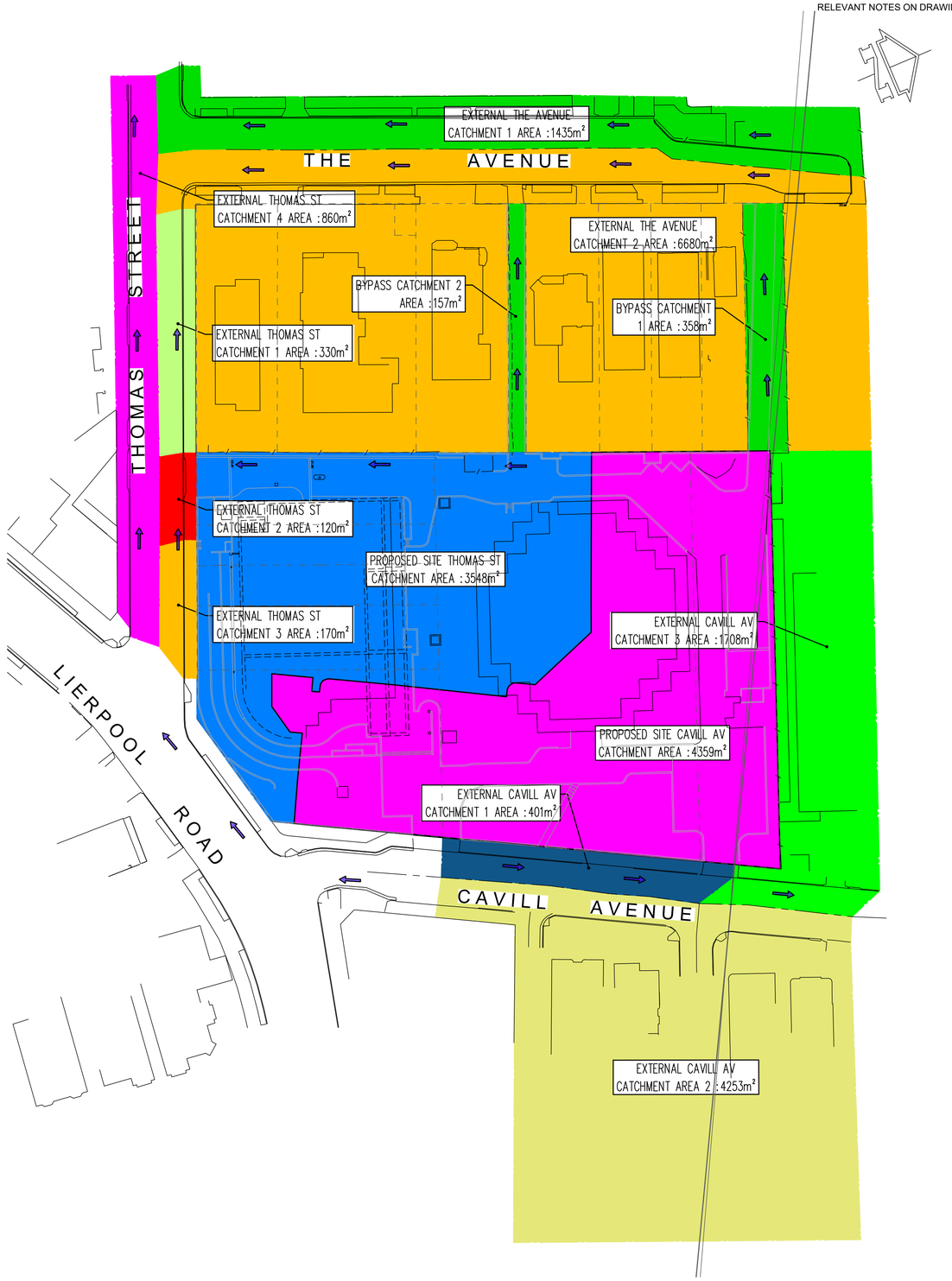
Appendix B

- Stormwater Management Plans

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C02



EXISTING CATCHMENT PLAN
SCALE 1:500



PROPOSED CATCHMENT PLAN
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Sheet Subject
STORMWATER CATCHMENT PLAN

Scale : A1 1:500
Drawn LS
Authorised NB
Job No 192006
Drawing No C04
Revision P4
Plot File Created: May 14, 2021 - 11:02am

FOR CONTINUATION REFER TO DRAWING NoC06

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C02

LEGEND:

- STORMWATER PIT, FLOW DIRECTION AND LINE
- CLASS B–C GRATED DRAIN (GDA)
- CLASS D GRATED DRAIN (GDB)
- RAINWATER OUTLET (RO)
- BUILDING FOOTPRINT
- BUILDING PILING WALL
- LANDSCAPED AREAS
- PAVED AREAS
- RETAINING WALL TYPE A (RWA)
- RETAINING WALL TYPE B (RWB)
- FINISHED SURFACE LEVEL (F22.20)
- SITE BOUNDARY

IL17.00 ø375 'Z' 1.0% Q10=54L/s IL16.90

OSD TANK 1 BASE IL17.10 OBVERT RL19.51 AVER. DEPTH 2.3m AREA 32m² VOLUME 75.0m³

CONSTRUCT VEHICULAR CROSSING (VC) TO COUNCIL SPECIFICATION. REFER TO DRG C10 FOR DETAILS

PROVIDE 6 X 690 PSORB STORMFILTERS BY OCEANPROTECT WITHIN OSD CHAMBER

IL19.65 ø225 uPVC 3.0% IL18.89

IL19.75 ø150 uPVC 1.0% IL19.67

IL19.93 ø150 uPVC 1.0% IL19.77

IL19.99 ø150 uPVC 1.0% IL19.93

IL20.07 ø150 uPVC 1.0% IL20.01

IL20.16 ø150 uPVC 1.0% IL20.09

IL21.98 ø150 uPVC 0.7% IL21.89

IL21.88 ø150 uPVC 0.7% IL21.81

IL21.80 ø150 uPVC 0.7% IL21.76

IL17.65 ø300 'Z' 1.0% Q10=?L/s IL17.50

IL19.50 ø225 uPVC 2.0% IL19.00

IL19.80 ø225uPVC 2.0% IL19.50

IL22.00 ø150uPVC 5% IL20.50

IL23.10 ø150uPVC 1.0% IL22.95

IL22.92 ø225uPVC 1.0% IL22.70

IL22.70 ø225uPVC 1.0% IL22.50

IL22.25 ø225uPVC 1.0% IL22.10

IL21.293 ø375 'Z' 0.5% Q10=98L/s IL21.22

IL22.35 ø225 'uPVC' 6.9% Q100=39L/s IL21.31

IL21.216 ø375 'Z' 0.5% Q10=105L/s IL21.10

GF LEVEL FFL 20.50

GF LEVEL FFL 21.00

GF LEVEL FFL 21.10

LEVEL 1 FFL 22.90

LEVEL 01 FFL 24.10

FFL 24.10

FFL 21.00

GROUND FLOOR PODIUM AB=ND ROOF DRAINAGE TO BE DIRECTED TO OSD TANK 1, REFER TO HYDRAULIC ENGINEER FOR DESIGN AND OSD TANK INLET CONNECTION DETAILS

PROVIDE OCEANPROTECT OCEAN GUARD FILTER BASKET

PROVIDE OCEANPROTECT OCEAN GUARD FILTER BASKET

CONSTRUCT VEHICULAR CROSSING (VC) TO COUNCIL SPECIFICATION. REFER TO DRG C10 FOR DETAILS

REMOVE OLD PIT AND CONSTRUCT NEW 1.8m KERB INLET PIT

EXISTING ø300 DRAINAGE LINE TO BE RE-LAID AT LOWER LEVEL SO THIS PIT HAS IL21.216

CONSTRUCT NEW KERB AND GUTTER (K&G) TO ALLOW FOR STORMWATER LINE CONSTRUCTION

CONNECT 375ø PIPE INTO EXISTING COUNCIL PIT AND MAKE GOOD

BENCH MARK SSM167639 RL 23.34m

STREET THOMAS

LIERPOOL ROAD

CAVILL AVENUE

0 2 4 6 8 10 12 14 16m

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P3	ISSUED FOR REVISED SETBACKS	AL	LS	07.05.21
P2	ISSUED FOR DA	AL	LS	03.12.20
P1	DA REVEIW	AL	LS	23.11.20

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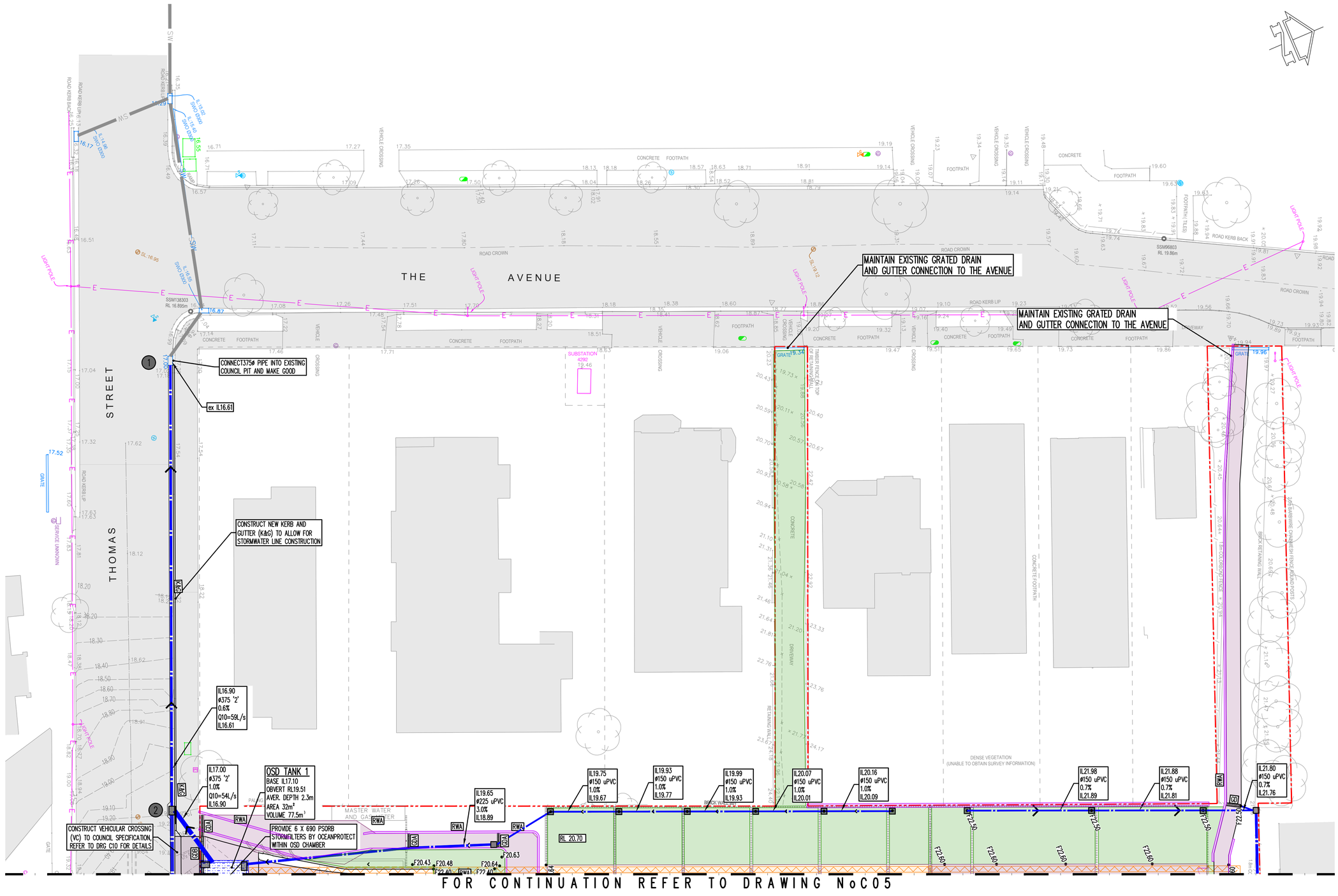
Sheet Subject
SITEWORKS PLAN, SHEET 1

Scale : A1 1:200
Drawn LS
Authorised AL
Job No 192006
Drawing No C05
Revision P4
Plot File Created: May 14, 2021 - 10:58am

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C02

LEGEND:

- STORMWATER PIT, FLOW DIRECTION AND LINE
- CDA — CLASS B–C GRATED DRAIN
- CDB — CLASS D GRATED DRAIN
- RO — RAINWATER OUTLET
- BUILDING FOOTPRINT
- BUILDING PILING WALL
- LANDSCAPED AREAS
- PAVED AREAS
- RWA — RETAINING WALL TYPE A
- RWB — RETAINING WALL TYPE B
- F22.20 — FINISHED SURFACE LEVEL
- SITE BOUNDARY



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A1

Rev	Description	Eng	Draft	Date
P3	ISSUED FOR REVISED SETBACKS	AL	LS	07.05.21
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Project: 2-6 CAVILL AVENUE, ASHFIELD

Sheet Subject: SITEWORKS PLAN, SHEET 2

Scale : A1	Drawn	Authorised
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Job No	Drawing No	Revision
192006	C06	P3

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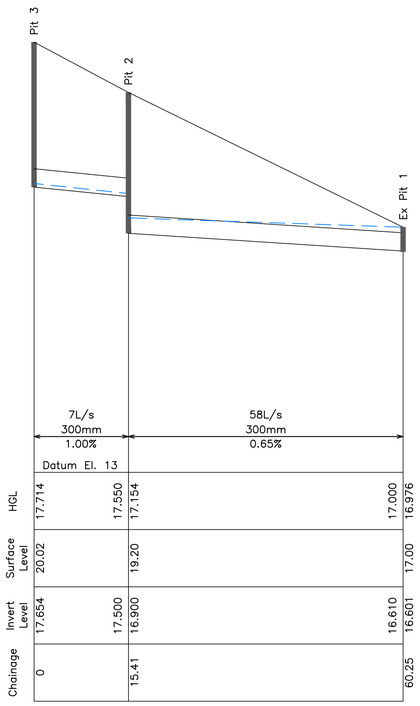
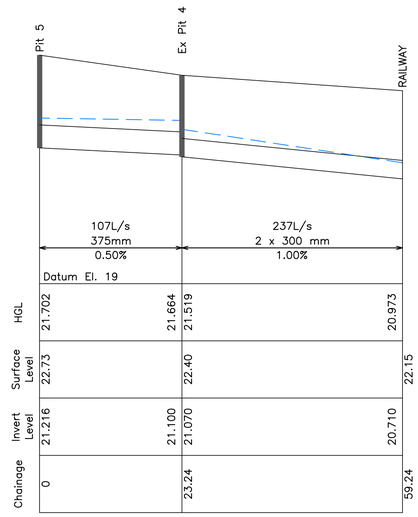


THOMAS STREET LONGSECTION 10ARI



CAVILL AV LONGSECTION 10ARI

A1

0 2 4 6 8 10 12 14 16m

1:200 A1 1:400 A3

Rev	Description	Eng	Draft	Date
P2	ISSUED FOR REVISED SETBACKS	AL	LS	07.05.21
P1	ISSUED FOR DA	AL	LS	03.12.20

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Project
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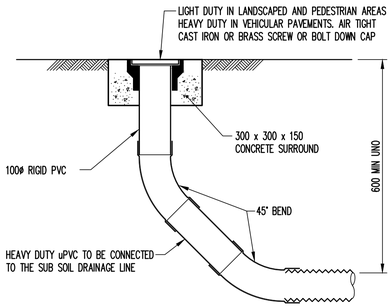
Sheet Subject
STORMWATER LONGSECTIONS

Scale : A1 1:200
Drawn LS
Authorised NB
Job No 192006
Drawing No C07
Revision P2
Plot File Created: May 07, 2021 - 10:46pm

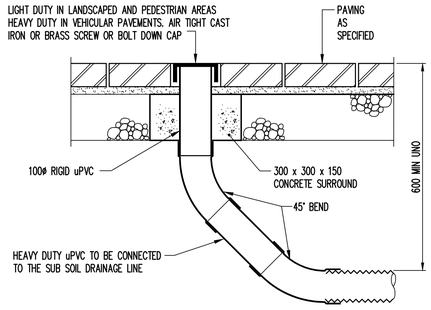
THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C02



FLUSHING POINT (FP)

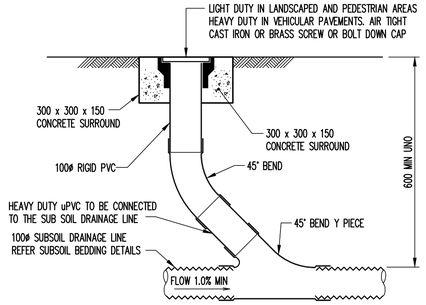
SCALE 1: 10

NOTE: SLOTTED RIGID PVC PIPE AND FITTINGS MAY BE USED



FLUSHING POINT (FP) IN PAVING BRICKS

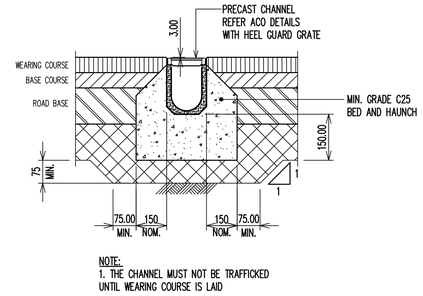
SCALE 1: 10



INTERMEDIATE RISER (IR)

SCALE 1: 10

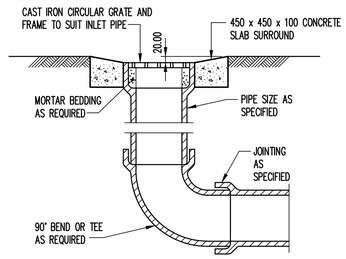
NOTE: SLOTTED RIGID PVC PIPE AND FITTINGS MAY BE USED



NOTE:
1. THE CHANNEL MUST NOT BE TRAFFICKED UNTIL WEARING COURSE IS LAID

GRATED DRAIN (GD)

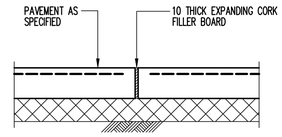
SCALE 1:10



GRATED INLET DETAIL (GI)

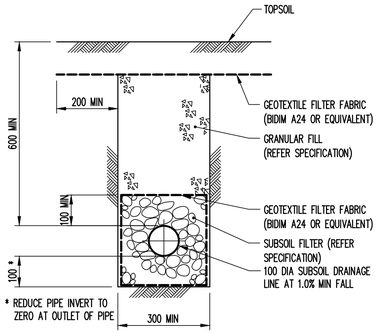
SCALE 1: 10

PIT TYPE D



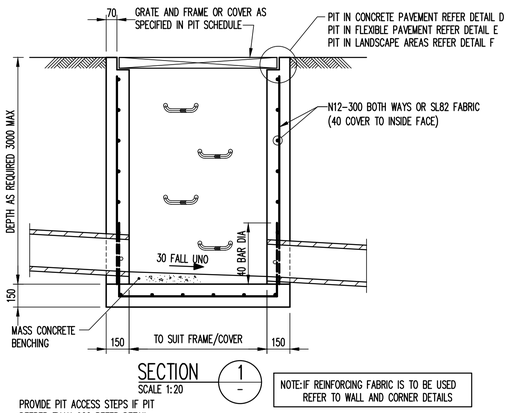
EXPANSION JOINT (EJ)

SCALE 1: 20



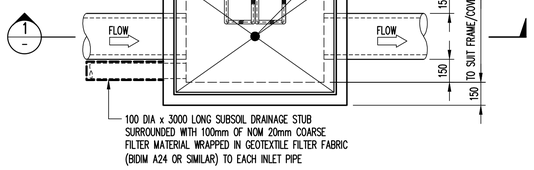
SUBSOIL IN LANDSCAPED AREAS

SCALE 1: 10



SECTION 1 / - SCALE 1:20

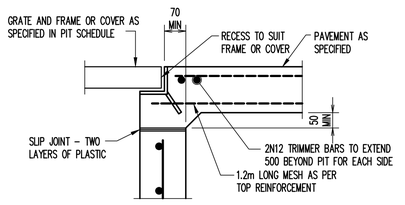
NOTE:IF REINFORCING FABRIC IS TO BE USED REFER TO WALL AND CORNER DETAILS



PLAN

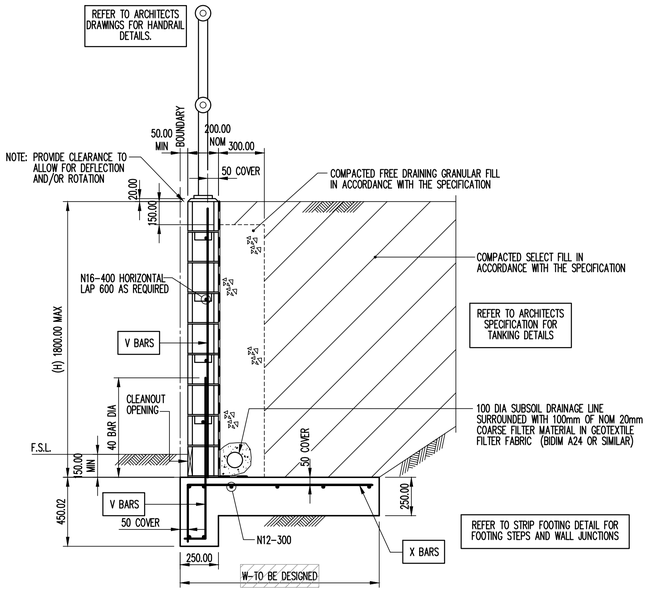
SCALE 1: 20

PIT TYPE A



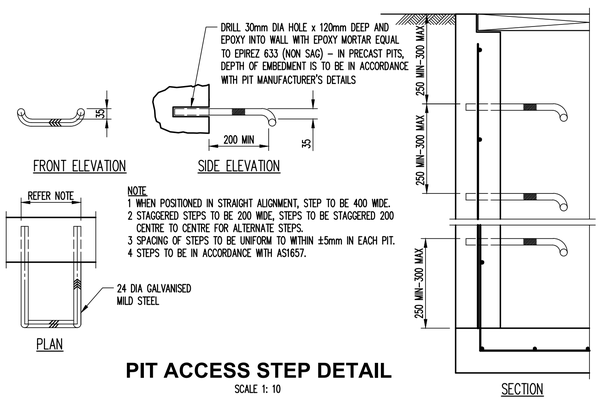
DETAIL D

SCALE 1: 10



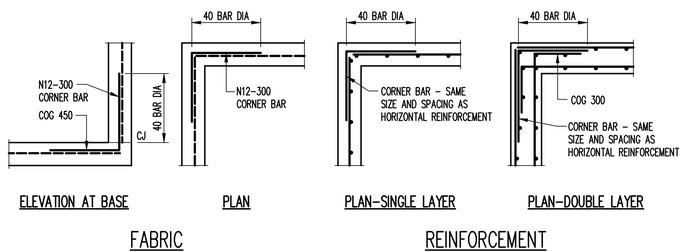
200 WALL(RW#)

SCALE 1: 20



PIT ACCESS STEP DETAIL

SCALE 1: 10



FABRIC REINFORCEMENT

PIT CORNER DETAILS

SCALE 1: 20

DESIGNER TO VERIFY EXTENT OF DETAILING

PRELIMINARY

FILENAME: Z:\Jobs\19\192006\cad\ C11.dwg - USER: lanso - Plot File Created: May 07, 2021 - 2:38pm

A1

Rev	Description	Eng	Draft	Date
P3	ISSUED FOR REVISED SETBACKS	AL	LS	07.05.21
P2	ISSUED FOR DA	AL	LS	03.12.20
P1	DA REVIEW	AL	LS	23.11.20

Rev Description Eng Draft Date

Rev Description Eng Draft Date

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Project
2-6 CAVILL AVENUE, ASHFIELD

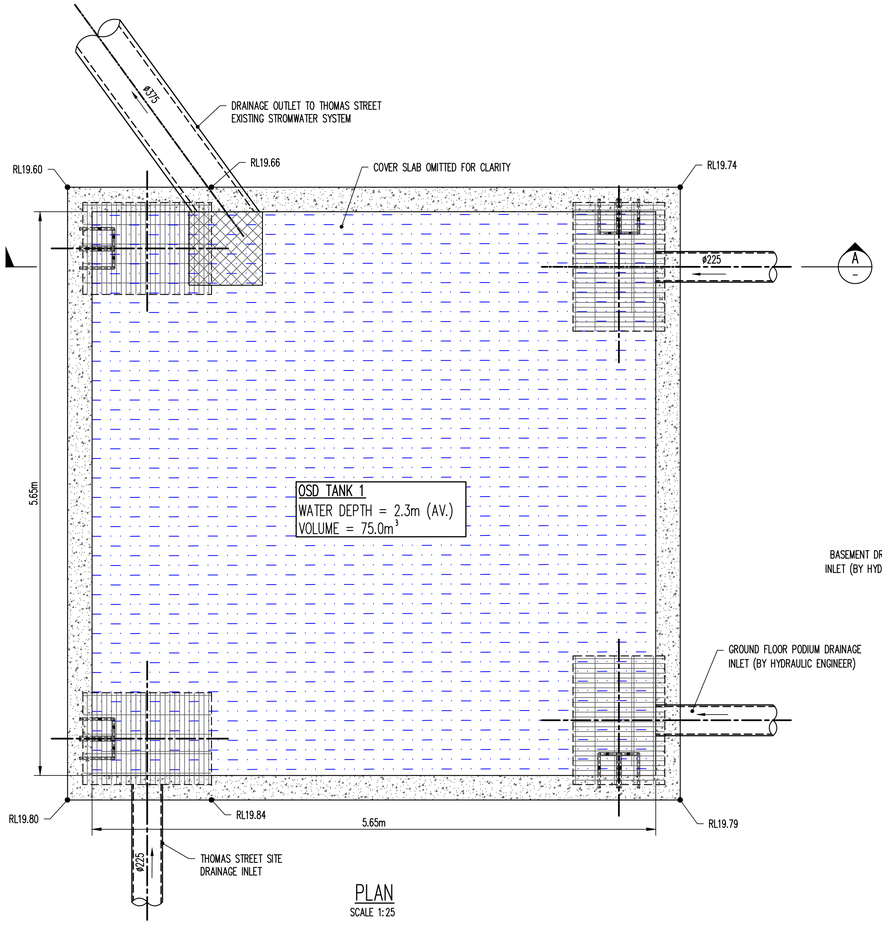
Sheet Subject
DETAILS, SHEET 2

Scale : A1	Drawn	Authorised
AS SHOWN	LS	NB

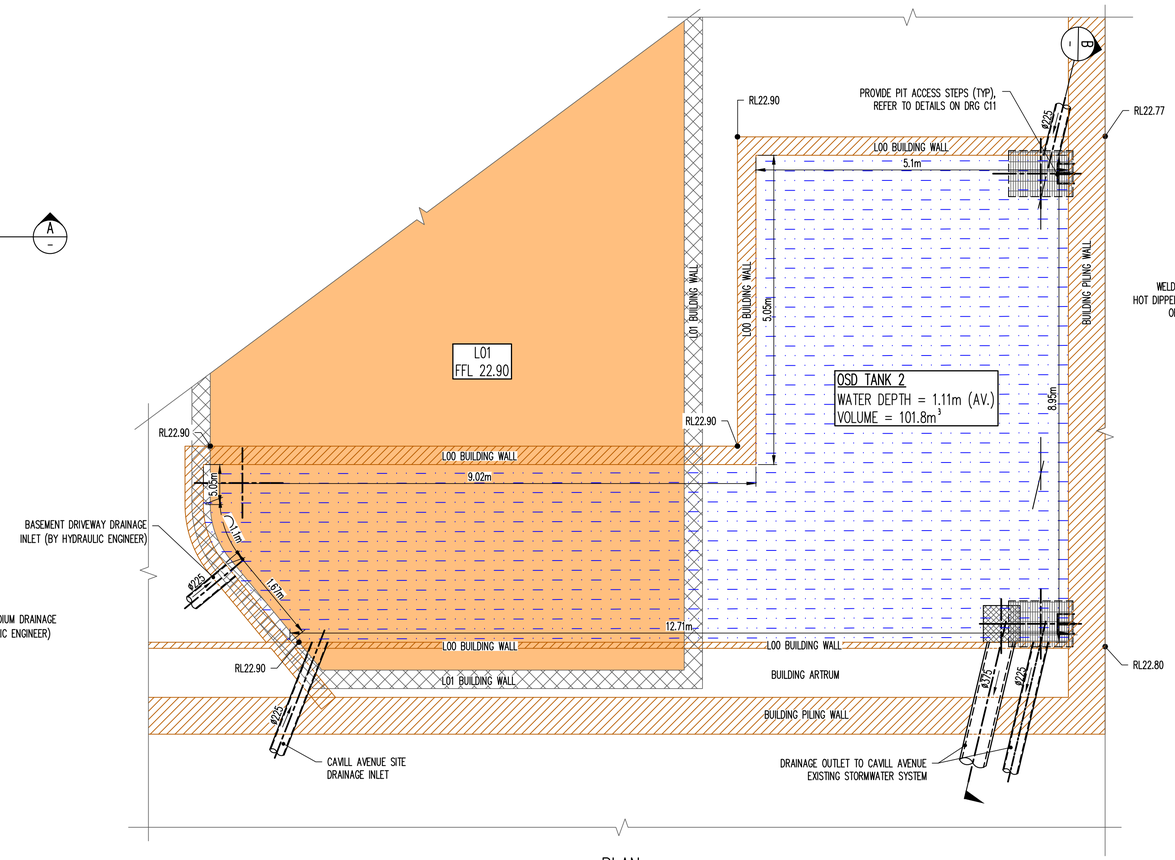
Job No	Drawing No	Revision
192006	C11	P3

Plot File Created: May 07, 2021 - 2:38pm

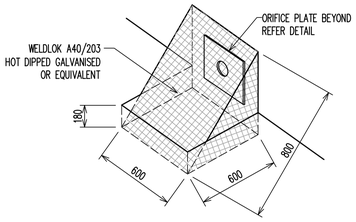
THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT NOTES ON DRAWING C02



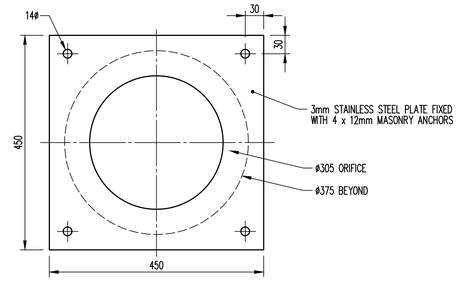
PLAN
SCALE 1:25



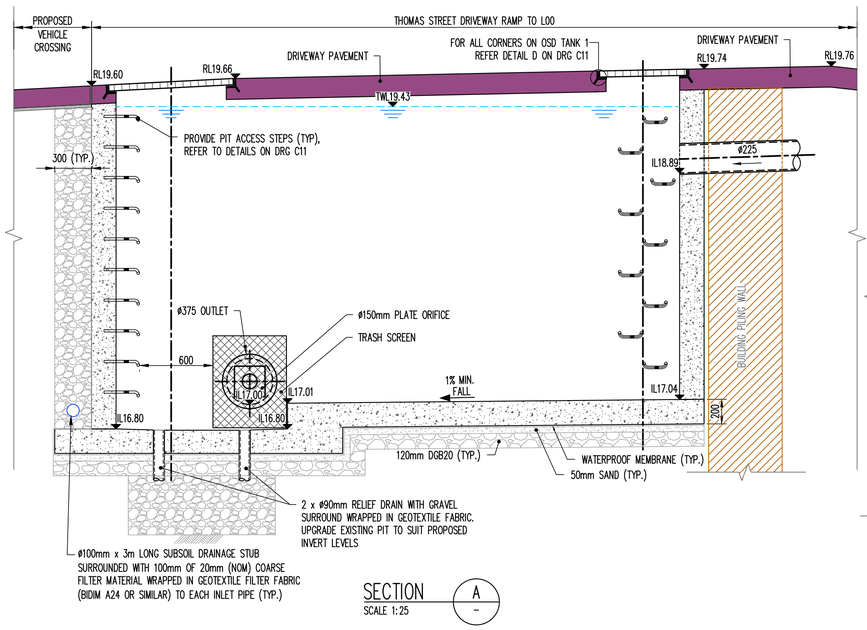
PLAN
SCALE 1: 50



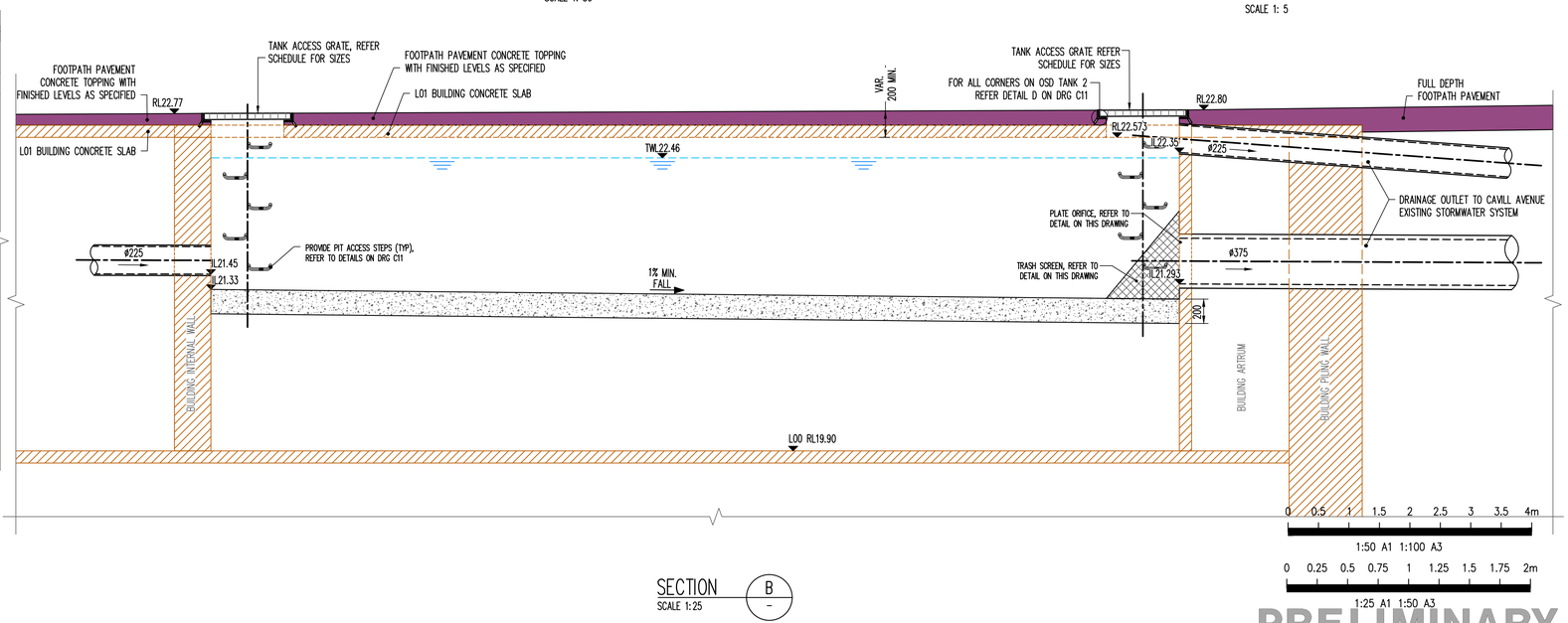
TRASH SCREEN DETAIL
NTS



ORIFICE PLATE DETAIL
SCALE 1: 5



SECTION A
SCALE 1:25



SECTION B
SCALE 1:25

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A1

Rev	Description	Eng	Draft	Date
P3	REVISED FOR REVISED SETBACKS	AL	LS	14.05.21
P2	ISSUED FOR REVISED SETBACKS	AL	LS	07.05.21
P1	ISSUED FOR DA	AL	LS	03.12.20

Rev Description Eng Draft Date

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Project
2-6 CAVILL AVENUE, ASHFIELD

Sheet Subject
OSD TANK DETAILS,

Scale : A1
AS SHOWN

Drawn
LS

Authorised
NB

Job No
192006

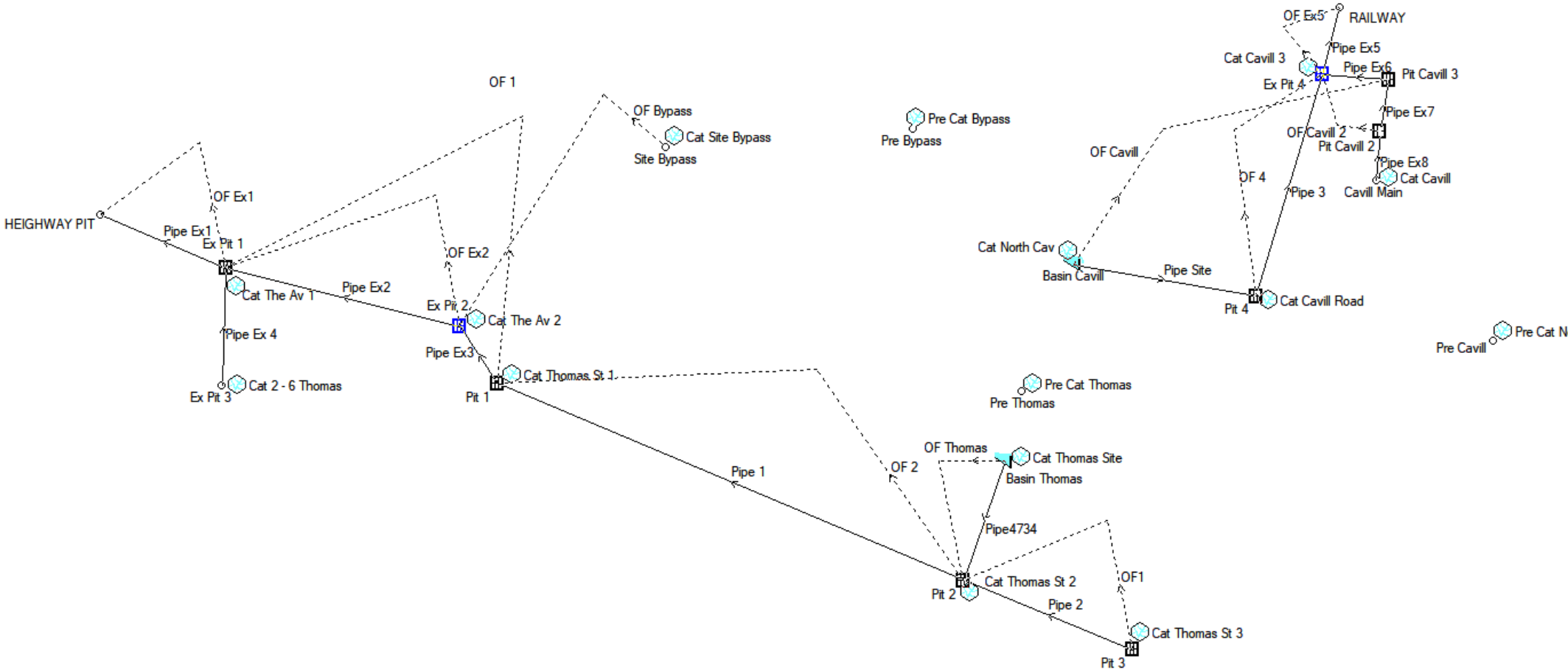
Drawing No
C11

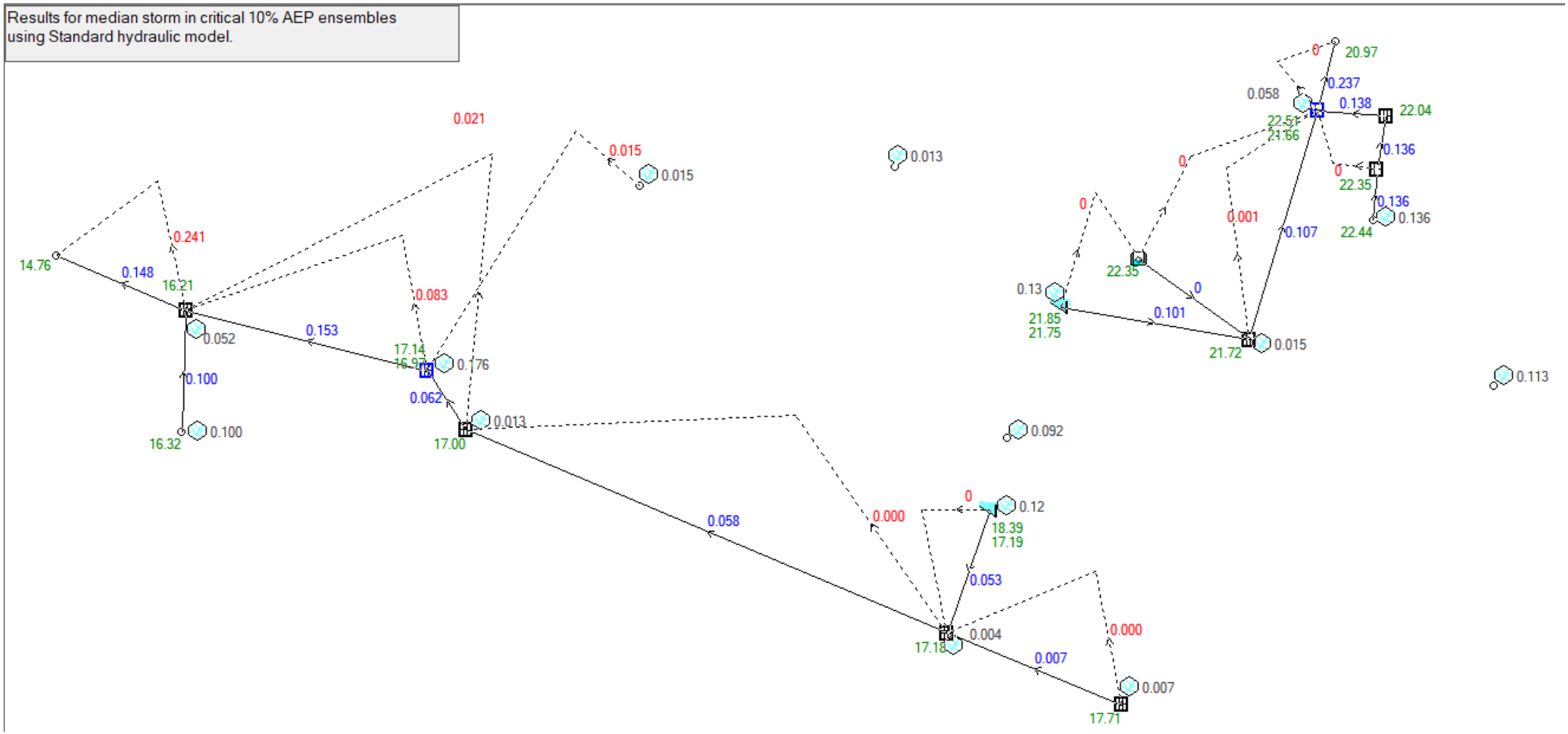
Revision
P3

Plot File Created: May 14, 2021 - 11:05am

Appendix C

- DRAINS & MUSIC Model Information


OF 1
OF Bypass
Cat Site Bypass
Site Bypass
Pre Cat Bypass
Pre Bypass
OF Ex5
RAILWAY
Pipe Ex5
Cat Cavill 3
Pipe Ex6
Pit Cavill 3
Ex Pit 4
Pipe Ex7
OF Cavill 2
Pit Cavill 2
Pipe Ex8
Cat Cavill
Cavill Main
OF Cavill
OF 4
Pipe 3
HEIGHWAY PIT
OF Ex1
Pipe Ex1
Ex Pit 1
OF Ex2
Cat North Cav
Basin Cavill
Pipe Site
Cat Cavill Road
Pit 4
Cat The Av 1
Pipe Ex2
Ex Pit 2
Cat The Av 2
Pre Cat N
Pre Cavill
Pipe Ex 4
Pipe Ex3
Cat Thomas St 1
Ex Pit 3
Cat 2 - 6 Thomas
Pit 1
Pre Cat Thomas
Pre Thomas
OF Thomas
Cat Thomas Site
Basin Thomas
OF 2
Pipe 1
Pipe4734
OF1
Cat Thomas St 2
Pit 2
Pipe 2
Cat Thomas St 3
Pit 3


Results for median storm in critical 10% AEP ensembles using Standard hydraulic model.
14.76
0.148
16.21
0.241
0.021
0.015
0.015
0.013
0.083
0.153
0.052
17.14
16.97
0.176
0.062
0.100
16.32
0.100
17.00
0.013
0.092
0.058
0.000
0
0.12
18.39
17.19
0.053
17.18
0.004
0.000
0.007
0.007
17.71
0.113
20.97
0
0.237
0.058
0.138
22.04
22.51
21.66
0.136
0
22.35
0.136
0.136
22.44
0.001
0.107
0
0
22.35
0.13
0
0.101
21.85
21.75
21.72
0.015

Drains Data

PIT / NODE DETAILS Version 15

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	Internal Width (mm)	Inflow is Misaligned	Minor Safe Pond Depth (m)	Major Safe Pond Depth (m)
Pit 3	OnGrade	Hornsby Cc	Hornsby 1.8 m lintel		1.5	20.02		0	0.2	326239.2	6248740	No	5	1 x Ku	No	New				
Pit 2	OnGrade	Hornsby Cc	Hornsby 1.8 m lintel		1	19.2		0	0.2	326223.9	6248746	No	4	1 x Ku	No	New				
Pit 1	OnGrade	Hornsby Cc	Hornsby 1.8 m lintel		1.2	17		0	0.2	326181.4	6248764	No	3	1 x Ku	No	New				
Ex Pit 2	Sag	Hornsby Cc	Hornsby 1.	15	1	16.94	0.2	0	0.5	326178	6248769	No	2	1 x Ku	No	New			0.2	0.25
Ex Pit 1	OnGrade	Hornsby Cc	Hornsby 1.8 m lintel		0.8	16.21		0	0.2	326156.7	6248774	No	1	1 x Ku	No	New				
HEIGHWAY	Node					16.1		0		326145.3	6248779		26		No					
Ex Pit 3	Node					16.17		0		326156.4	6248764		27		No					
Pre Thoma	Node							0		326229.1	6248763		551081		No					
Pre Cavill	Node							0		326272.1	6248768		5097591		No					
Pre Bypass	Node							0		326219.2	6248787		5097606		No					
Pit 4	OnGrade	NSW Dept.	RM7		0.8	22.73		0	0.2	326250.4	6248772	No	5364400	1 x Ku	No	New				
Ex Pit 4	Sag	Hornsby Cc	Hornsby 1.	20	1	22.4	0.3	0	0.5	326256.5	6248792	No	5364404	1 x Ku	No	New			0.3	0.35
RAILWAY	Node					22.15		0		326258.1	6248798		5364425		No					
Cavill Main	Node					23		0		326261.4	6248782		25813836		No					
Pit Cavill 2	OnGrade	Hornsby Cc	Hornsby 1.8 m lintel		1	22.54		0	0.2	326261.8	6248787	No	25813834	1 x Ku	No	New				
Pit Cavill 3	OnGrade	NSW Dept.	RM7		1	22.4		0	0.2	326262.6	6248792	No	25813832	1 x Ku	No	New				
Site Bypass	Node					19.73		0		326196.7	6248785		37407355		No					
HW1	Headwall				0.5	22.65		0		326240.8	6248779		1.35E+08							

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Lengt	id
Basin Thon	17	1		Orifice		150	17.1			326227.7	6248757	No			1892293
	17.15	32													
	19.9	32													
Basin Cavill	21.29	87		Orifice		320	21.45			326233.9	6248775	No			5364551
	22.5	87													
	22.51	2													
	22.8	2													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	EIA %	Perv Area %	RIA %	EIA Time (min)	Perv Time (min)	RIA Time (min)	EIA Length (m)	Perv Length (m)	RIA Length (m)	EIA Slope(%)	Perv Slope %	RIA Slope %	EIA Rough	Perv Rough	RIA Rough	Rainfall Multiplier
Cat Thoma	Pit 3	0.0168	100	0	0	5	0	0										1
Cat Thoma	Pit 2	0.0116	90	10	0	5	5	0										1
Cat Thoma	Pit 1	0.0336	90	10	0	5	5	0										1
Cat The Av	Ex Pit 2	0.688	70	30	0	7	7	0										1
Cat The Av	Ex Pit 1	0.1435	85	15	0	5	5	0										1
Cat 2 - 6 Th	Ex Pit 3	0.26	90	10	0	5	5	0										1
Pre Cat Thc	Pre Thoma	0.3553	0	100	0	0	5	0										1
Cat Thoma	Basin Thon	0.3553	79	21	0	5	5	0										1
Pre Cat No	Pre Cavill	0.4365	0	100	0	0	5	0										1
Pre Cat Byp	Pre Bypass	0.0515	0	100	0	0	5	0										1
Cat North (	Basin Cavill	0.4365	79	21	0	6	6	0										1
Cat Cavill R	Pit 4	0.0401	90	10	0	5	5	0										1
Cat Cavill 3	Ex Pit 4	0.1708	90	10	0	6	6	0										1
Cat Cavill	Cavill Main	0.425	90	10	0	8	8	0										1
Cat Site By	Site Bypass	0.0515	70	30	0	5	5	0										1

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
Pipe 2	Pit 3	Pit 2	15.41	17.654	17.5	1	Concrete, u	300	300	0.013	New	1	Pit 3	0					
Pipe 1	Pit 2	Pit 1	44.842	16.9	16.61	0.65	Concrete, u	300	300	0.013	New	1	Pit 2	0					
Pipe Ex3	Pit 1	Ex Pit 2	5.128	16.601	16.55	0.99	Concrete, u	300	300	0.013	New	1	Pit 1	0					
Pipe Ex2	Ex Pit 2	Ex Pit 1	20.77	16.55	15.4	5.54	Concrete, u	300	300	0.013	New	1	Ex Pit 2	0					
Pipe Ex1	Ex Pit 1	HEIGHWAY	54	15.02	14.48	1	Concrete, u	300	300	0.013	New	1	Ex Pit 1	0					
Pipe Ex 4	Ex Pit 3	Ex Pit 1	9.258	15.113	15.02	1	Concrete, u	300	300	0.013	New	1	Ex Pit 3	0					
Pipe4734	Basin Thon	Pit 2	10	17	16.9	1	uPVC, unde	375	386	0.01	NewFixed	1	Basin Thon	0					
Pipe Site	Basin Cavill	Pit 4	14.6	21.293	21.22	0.5	Concrete, u	375	375	0.013	NewFixed	1	Basin Cavill	0					
Pipe 3	Pit 4	Ex Pit 4	23.24	21.216	21.1	0.5	Concrete, u	375	375	0.013	New	1	Pit 4	0					
Pipe Ex5	Ex Pit 4	RAILWAY	36	21.07	20.71	1	Concrete, u	300	300	0.013	New	2	Ex Pit 4	0					
Pipe Ex8	Cavill Main	Pit Cavill 2	5	22.09	22.04	1	Concrete, u	300	300	0.013	New	1	Cavill Main	0					
Pipe Ex7	Pit Cavill 2	Pit Cavill 3	5	22.04	21.72	6.4	Concrete, u	300	300	0.013	New	1	Pit Cavill 2	0					
Pipe Ex6	Pit Cavill 3	Ex Pit 4	9.2	21.72	21.07	7.07	Concrete, u	300	300	0.013	New	1	Pit Cavill 3	0					
Pipe32855(	HW1	Pit 4	14	22.35	21.3	7.5	uPVC, not u	225	242	0.01	NewFixed	1	HW1	0					

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	etc	etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	Safe Depth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id	
OF1	Pit 3	Pit 2		0.1			8 m wide r	0.3	0.15	0.4	2	0	126	10
OF 2	Pit 2	Pit 1		0.3			8 m wide r	0.3	0.15	0.4	2	0	129	40
OF 1	Pit 1	Ex Pit 1		0.1			8 m wide r	0.3	0.15	0.4	2	0	133	5
OF Ex2	Ex Pit 2	Ex Pit 1		0.1			8 m wide r	0.3	0.15	0.4	2	0	138	10
OF Ex1	Ex Pit 1	HEIGHWAY		0.1			8 m wide r	0.3	0.15	0.4	2	0	141	10
OF Thomas	Basin Thon	Pit 2		0.1	19.9	1.2	1.74	Dummy us	0.2	0.05	0.6	1	0	2206666	10
OF Cavill	Basin Cavill	HW1		0.1	22.39	1.2	1.74	Dummy us	0.2	0.05	0.6	1	0	12881119	10
OF 4	Pit 4	Ex Pit 4		0.1				8 m wide r	0.3	0.15	0.4	1	0	13393521	10
OF Ex5	Ex Pit 4	RAILWAY		0.1				8 m wide r	0.3	0.15	0.4	1	0	24850164	10
OF Cavill 2	Pit Cavill 2	Ex Pit 4		0.1				Dummy us	0.2	0.05	0.6	1	0	25813846	10
OF Bypass	Site Bypass	Ex Pit 2		0.1				8 m wide r	0.3	0.15	0.4	2	0	37407471	5
OF272147	HW1	Ex Pit 4		0.1	22.65	1.2	1.74	Dummy us	0.2	0.05	0.6	1	0	1.35E+08	10

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover	Cover (m)	
Pipe 2	Concrete, u	300	0.6	1.37	
Pipe 1	Concrete, u	300	0.6	0.06	Unsafe
Pipe Ex3	Concrete, u	300	0.6	0.06	Unsafe
Pipe Ex2	Concrete, u	300	0.6	0.06	Unsafe
Pipe Ex1	Concrete, u	300	0.6	0.86	
Pipe Ex 4	Concrete, u	300	0.6	0.73	
Pipe4734	uPVC, unde	386	0.6	-0.39	Unsafe
Pipe Site	Concrete, u	375	0.6	0.7	
Pipe 3	Concrete, u	375	0.6	0.89	
Pipe Ex5	Concrete, u	300	0.6	1	
Pipe Ex8	Concrete, u	300	0.6	0.17	Unsafe
Pipe Ex7	Concrete, u	300	0.6	0.17	Unsafe
Pipe Ex6	Concrete, u	300	0.6	0.35	Unsafe
Pipe32855(	uPVC, not u	242	0.6	0.05	Unsafe

This model has no pipes with non-return valves

DRAINS Results

DRAINS results prepared from Version 2020.034

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surfac Flow Arrivi (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Pit 3	17.71		0.008		2.31	0	None
Pit 2	17.18		0.005		2.02	0	None
Pit 1	17		0.016		0	0.021	Outlet System
Ex Pit 2	16.97	17.14	0.25	12.9	0	0.083	Outlet System
Ex Pit 1	16.21		0.236		0	0.241	Outlet System
HEIGHWAY	14.76		0.357				
Ex Pit 3	16.32		0.123				
Pit 4	21.72		0.019		1.01	0.001	Inlet Capacity
Ex Pit 4	21.66	22.51	0.072	4.2	0.74	0	Inlet Capacity
RAILWAY	20.97		0				
Cavill Main	22.44		0.144				
Pit Cavill 2	22.35		0		0.19	0	None
Pit Cavill 3	22.04		0		0.36		None
HW1	22.35		0		0.3	0	None

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	EIA Max Q (cu.m/s)	Remaining Max Q (cu.m/s)	EIA Tc (cu.m/s)	RIA Tc (min)	PA Tc (min)	Due to Storm (min)
Cat Thomas	0.007	0.007	0	5	0	0	10% AEP, 5 min burst, Storm 1
Cat Thomas	0.004	0.004	0	5	0	5	10% AEP, 5 min burst, Storm 1
Cat Thomas	0.013	0.013	0	5	0	5	10% AEP, 5 min burst, Storm 1
Cat The Av	0.176	0.155	0.022	7	0	7	10% AEP, 15 min burst, Storm 5
Cat The Av	0.052	0.052	0	5	0	5	10% AEP, 5 min burst, Storm 1
Cat 2 - 6 Th	0.1	0.1	0	5	0	5	10% AEP, 5 min burst, Storm 1
Pre Cat Thc	0.092	0	0.092	0	0	5	10% AEP, 1 hour burst, Storm 6
Cat Thomas	0.12	0.12	0	5	0	5	10% AEP, 5 min burst, Storm 1
Pre Cat Nor	0.113	0	0.113	0	0	5	10% AEP, 1 hour burst, Storm 6
Pre Cat Byp	0.013	0	0.013	0	0	5	10% AEP, 1 hour burst, Storm 6
Cat North C	0.13	0.119	0.011	6	0	6	10% AEP, 15 min burst, Storm 5
Cat Cavill R	0.015	0.015	0	5	0	5	10% AEP, 5 min burst, Storm 1
Cat Cavill 3	0.058	0.058	0.002	6	0	6	10% AEP, 15 min burst, Storm 2
Cat Cavill	0.136	0.136	0	8	0	8	10% AEP, 10 min burst, Storm 8
Cat Site Byp	0.015	0.015	0	5	0	5	10% AEP, 5 min burst, Storm 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe 2	0.007	0.9	17.714	17.55	10% AEP, 5 min burst, Storm 1
Pipe 1	0.058	0.92	17.154	17	10% AEP, 20 min burst, Storm 4
Pipe Ex3	0.062	0.87	16.976	16.966	10% AEP, 30 min burst, Storm 4
Pipe Ex2	0.153	2.24	16.828	16.21	10% AEP, 45 min burst, Storm 4
Pipe Ex1	0.148	2.16	16.03	14.76	10% AEP, 5 min burst, Storm 1
Pipe Ex 4	0.1	1.41	16.321	16.21	10% AEP, 5 min burst, Storm 1
Pipe4734	0.053	0.57	17.748	17.182	10% AEP, 30 min burst, Storm 8
Pipe Site	0.101	0.91	21.812	21.719	10% AEP, 15 min burst, Storm 9
Pipe 3	0.107	0.97	21.702	21.664	10% AEP, 15 min burst, Storm 9
Pipe Ex5	0.237	1.81	21.519	20.973	10% AEP, 15 min burst, Storm 6
Pipe Ex8	0.136	1.92	22.444	22.347	10% AEP, 10 min burst, Storm 8
Pipe Ex7	0.136	2.04	22.309	22.043	10% AEP, 10 min burst, Storm 8
Pipe Ex6	0.138	2.05	21.99	21.664	10% AEP, 10 min burst, Storm 6
Pipe32855(	0	0	22.35	21.719	10% AEP, 5 min burst, Storm 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

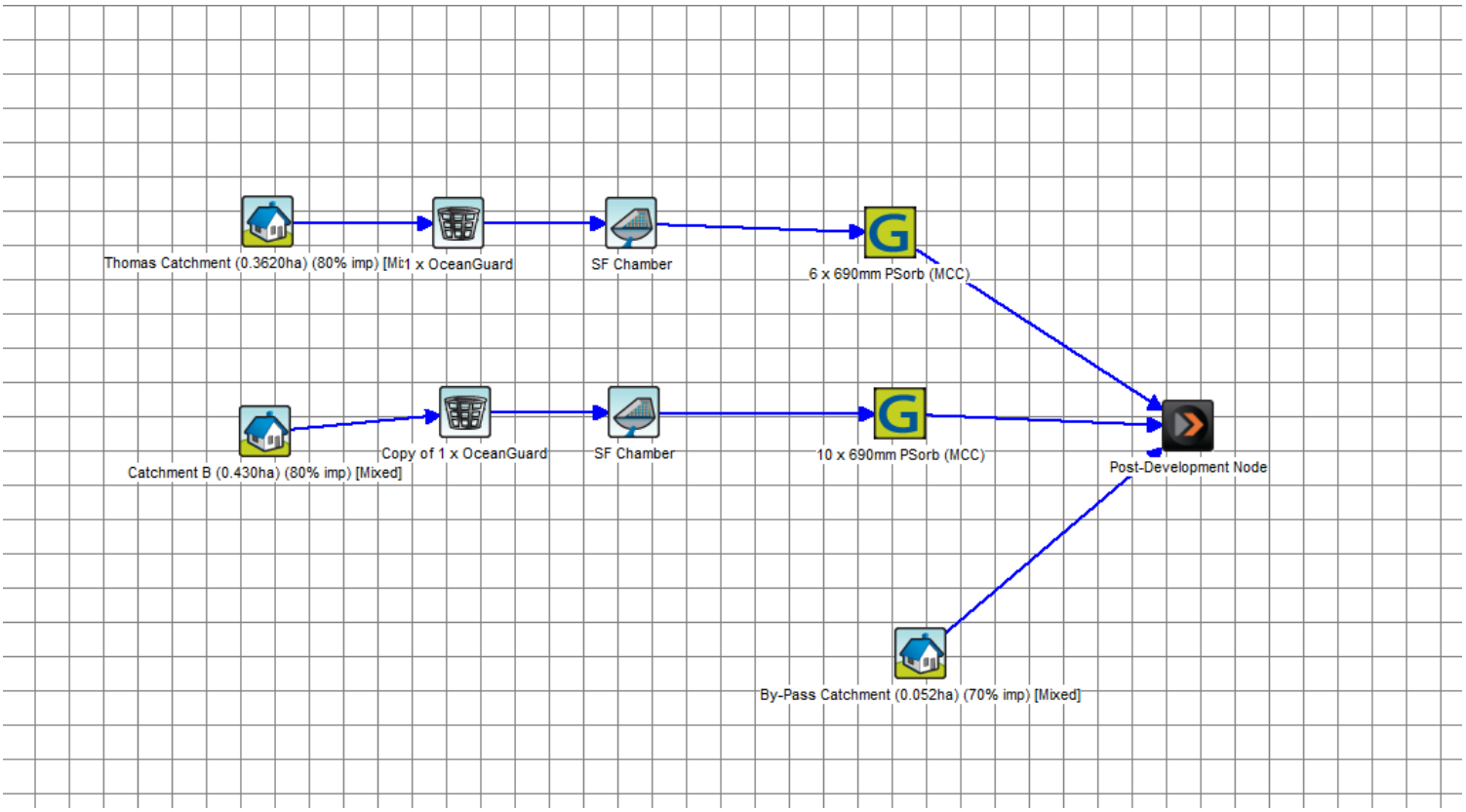
OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1	0	0	0.336	0	0	0	0	
OF 2	0	0	0.336	0	0	0	0	
OF 1	0.021	0.021	0.336	0.065	0.07	0.82	1.11	10% AEP, 20 min burst, Storm 4
OF Ex2	0.083	0.083	0.336	0.098	0.13	1.92	1.28	10% AEP, 15 min burst, Storm 5
OF Ex1	0.241	0.241	0.336	0.135	0.21	3.15	1.52	10% AEP, 15 min burst, Storm 3
OF Thomas	0	0	0.256	0	0	0	0	
OF Cavill	0	0	0.256	0	0	0	0	
OF 4	0.001	0.001	0.238	0.021	0.01	0.17	0.37	10% AEP, 5 min burst, Storm 1
OF Ex5	0	0	0.238	0	0	0	0	
OF Cavill 2	0	0	0.256	0	0	0	0	
OF Bypass	0.015	0.015	0.336	0.059	0.06	0.61	1.05	10% AEP, 5 min burst, Storm 1
OF272147	0	0	0.256	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin Thor	18.39	41.5	0.053	0.053	0
Basin Cavill	21.85	49	0.101	0.101	0

Run Log for 210507 OSD sizing + STREET.drn run at 22:38:09 on 7/5/2021 using version 2020.034
Upwelling occurred at: Ex Pit 1
Freeboard was less than 0.15m at Pit 1, Ex Pit 2
Flows were safe in all overflow routes.



Treatment Train Effectiveness - Post-Development Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	7.09	7.09	0
Total Suspended Solids (kg/yr)	1260	187	85.1
Total Phosphorus (kg/yr)	2.05	0.559	72.8
Total Nitrogen (kg/yr)	15.3	7.27	52.4
Gross Pollutants (kg/yr)	189	10.9	94.2

MUSIC MODEL LOCATION
https://ttwau-my.sharepoint.com/:f:/g/personal/anthonyl_ttw_net_au/Euskphah1w9EvsC26zfSABwBBdi2ZNCOyFjqOEsC0HBtFg?e=Vyag4q