



STORMWATER AND WATER QUALITY MANAGEMENT REPORT

Prepared for Platino Properties Pty Ltd

at 5 Skyline Place, FRENCHS FOREST, NSW 2086

Lot 1, DP 1209504

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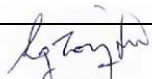
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1	Draft	2/05/2021	N Evans		K. Ng	
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1. Introduction

ING Consulting Engineers P/L have been engaged by Platino Properties P/L to prepare a report on Stormwater and Water Quality Management for the 5 Skyline Place, Frenchs Forest NSW 2086 (Lot 1, DP1209504). Incorporating a number of these objectives will enhance the living environment of the residents in the community and foster the development vision of an innovative, leading edge intergenerational precinct. This document should be read in conjunction with the Social Impact report, prepared by Chris Faulks, Deputy Chancellor of the University of Canberra, which outlines the social benefits of the proposal (seniors housing, affordable housing & disability housing) which enhance further the sustainability objectives of the application.

1.1 Site Description

The site is approximately 7,811m², and is located at Frenchs Forest, approximately 13km from Sydney's CBD, and along Frenchs Forest Road East.

The site is surrounded by industrial buildings and warehouse. Platino Properties intends to repurpose the land to facilitate three separate buildings, ranging in height from 3 to 12 floors, containing:

- A total of approximately 133 seniors living units including 12 affordable dwellings for seniors.
- A mix of 1, 2, 2 bed + study and 3 bedroom dwellings
- 10 units to be operated by Project Independence
- 941 m² commercial floor space
- Basement car parking for 232 spaces
- Common facilities including pool and central community gardens

1.2 Objectives

This report has been prepared in accordance with Northern Beaches Council's Water Management Policy (26 August 2020), in conjunction with the proposed development submitted under Development Application No. 2021/0212.

This report has been prepared in accordance with the following standards / guidelines:

- Northern Beaches Council – Water Management for Development Policy – August 2020.
- NSW MUSIC Modelling Guidelines (August 2015).

2. Stormwater Quality Assessment

2.1 Water Quality Objectives and Requirements

Based on Northern Beaches Council’s Water Management for Development Policy – August 2020, the water quality objectives and quality requirements are shown in the following tables:

Criteria	Objectives
Stormwater Quality	Stormwater quality (temperature, salinity, chemical makeup and sediment loads) discharging from the development shall not impact the receiving waters. Reference shall be made to local data if available, including the Warringah Creek Management Study and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC), or other widely accepted guidelines. Stormwater and other drainage shall not be discharged into saltmarsh.
Sediment	Disturbance to stream and wetland sediments is to be minimised by regulated discharge of stormwater and dissipation of flows at discharge locations. Runoff from the development must be retained at natural discharge rates and sediments controlled at the source.
Hydrology	Stormwater and groundwater flow is to mimic natural conditions and ensure a dispersed pattern of flow, avoiding centralised or concentrated discharge points into the wetland or waterway. Natural flow regimes must be retained. The reduction or increase in flows, alteration in seasonality of flows, changes to the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels must be avoided.

Table 1 – Stormwater Quality Objectives

Pollutant	Performance Requirements
Total Phosphorous	65% reduction in the post development mean annual load ¹
Total Nitrogen	45% reduction in the post development mean annual load ¹
Total Suspended Solids	85% reduction in the post development mean annual load ¹
Gross Pollutants	90% reduction in the post development mean annual load ¹ (for pollutants greater than 5mm in diameter)
pH	6.5 - 8.5
Hydrology	The post-development peak discharge must not exceed the pre-development peak discharge for flows up to the 50% AEP

¹The percentage reduction in the post development mean annual loads are relative to the loads from the proposed development without treatment applied.

Table 2 – General Stormwater Quality Requirements

2.2 Modelling Methodology

The Model for Urban Stormwater Improvement Conceptualisation (*MUSIC*, Version 6.3) developed by the Cooperative Research Centre for Catchment Hydrology (CRCCH) was used to evaluate the following two scenarios for water quality improvements:

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.

2.3 Input Parameters - Rainfall Data, Catchment Areas and Soil Properties

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

Rainfall Data

Council requires that the long-term rainfall data be acquired from a local source. Daily rainfall data was sourced from the gauge located at Rainfall Station 66062 Sydney Observatory Hill, 6 Minute Time Step 1981 To 1985.

Catchment Areas

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

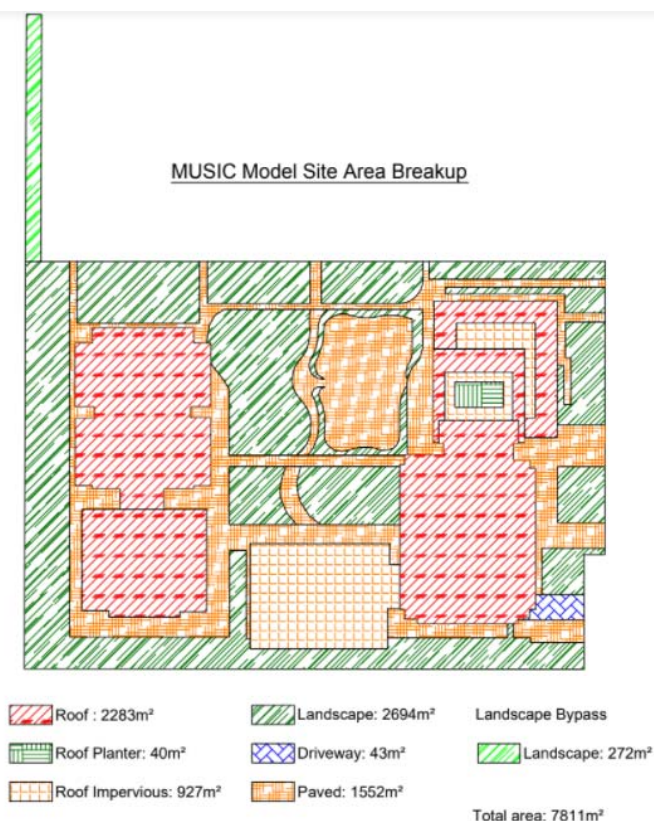


Figure 1 – Site Area Breakdown (Post Development)

Soil Parameters

The soil parameters based on eSPADE was used. The name of the soil for this site is **9130lh**. Based on council’s guidelines, the soil properties of Sandy Clay Loam soil was used in the modelling. Please see below for 5 Skyline Place, Frenchs Forest (Soil – LH) (based on Google map and eSPADE map).

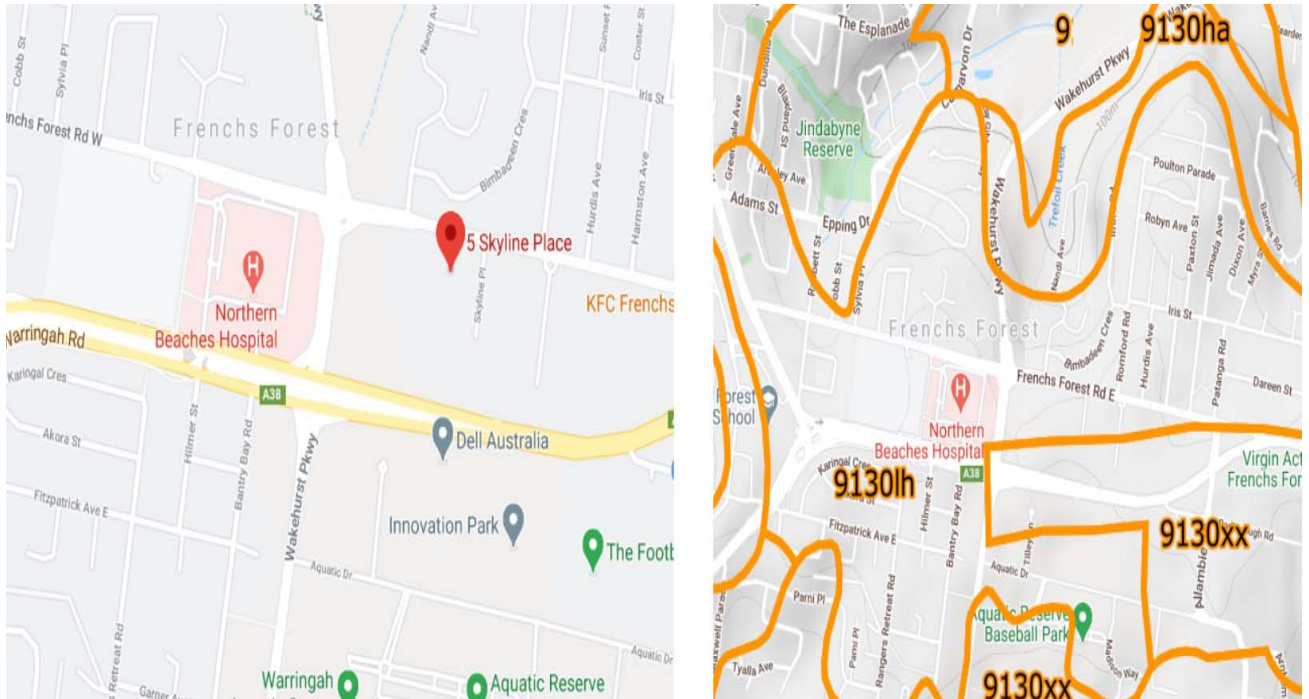


Figure 2 – Site and eSPADE Maps

2.4 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.

Rainwater Tank

A 65,000 L centrally located rainwater tank was included in the model to collect the non-trafficable roof areas. An annual irrigation reuse of 0.4kL/m² was applied and the irrigated areas would be the landscaped areas and the planters on site.

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.

Oceanguard Pit Inserts

All areas shall be diverted through a series of Ocean Protect Oceanguards. These Oceanguards (installed in selected pits) will be implemented to capture litter, debris and other pollutants. In total eight (8) OceanGuard with 200micron mesh bags (OG-200) are required – seven (7) are installed in the pits on the ground level, and one (1) in the basement for the driveway ramp. Please refer to stormwater drawings in Appendix B for locations.

On-site Detention (OSD) Tank

An OSD system will be provided for the site to maintain the peak site runoff flow regime (Section 3). A 83 m³ detention tank 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 tank is dedicated within the Basement Mechanical Room and is isolated to prevent unauthorised access as the area will be inundated during storm events.

9 numbers of (690) PSorb cartridge StormFilter system within a 20m² StormFilter chamber, inside the OSD tank has been used to achieve the water quality results.

2.5 MUSIC Water Quality Results and Conclusion

The MUSIC modelling for the site was carried out to meet the current Northern Beaches Council's targets of :

- 85% Total Suspended Solids Reduction
- 65% Total Phosphorus Reduction
- 45% Total Nitrogen Reduction
- 90% Gross Pollutant Reduction

Results from the MUSIC model demonstrated that the targets for sediment, nitrogen and phosphorus loads have been achieved, and exceeded with the proposed water sensitive urban design devices.

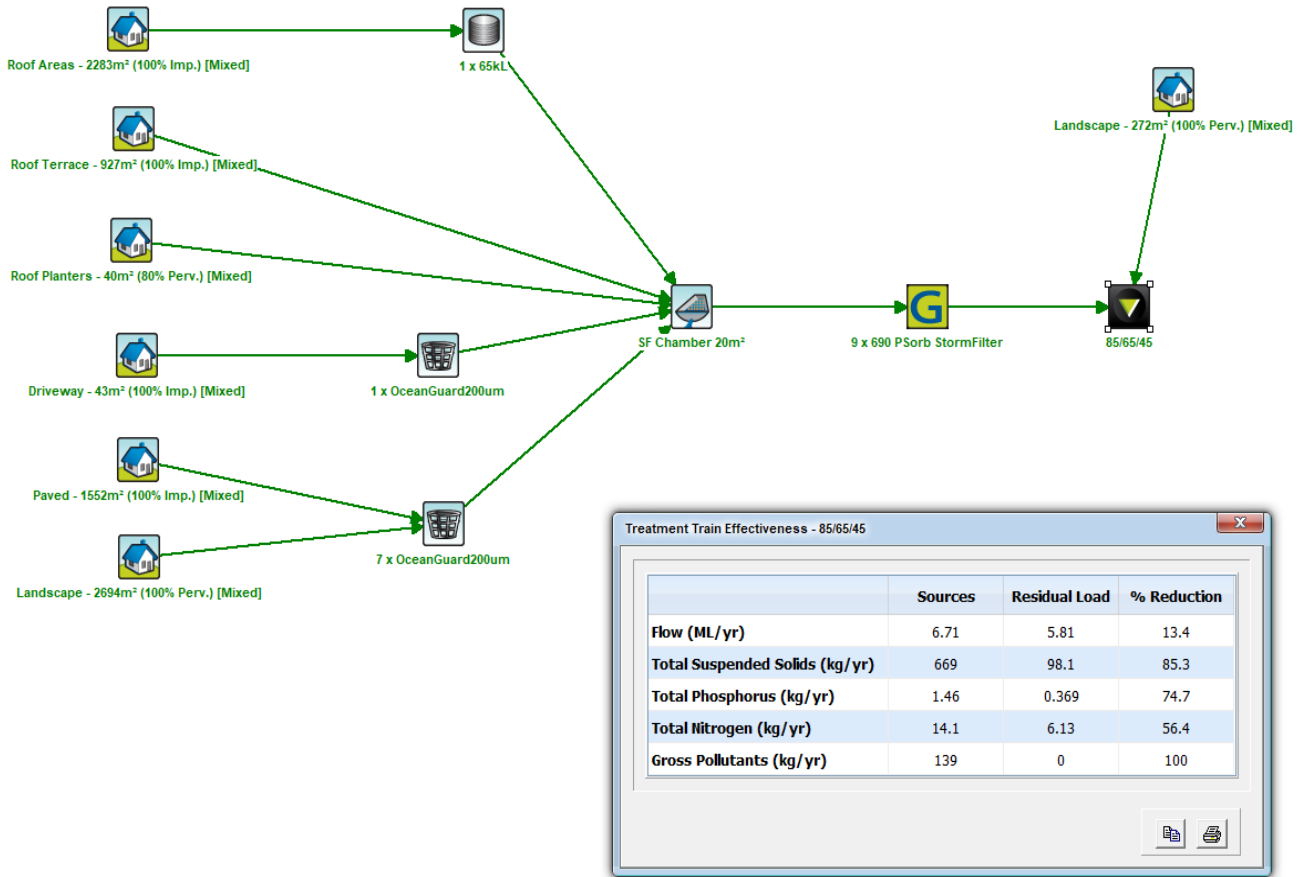


Figure 3 – Water Quality Treatment and Results

3. Stormwater Quantity Assessment

3.1 Overview

This assessment has been completed to determine the on-site 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 B. This plan is subject to further review.

3.2 Water Quantity Objectives

Stormwater quantity management is to comply with the objectives of Northern Beaches Council’s Water Management for Development Policy. The site will be designed to have post-development peak event stormwater discharge from the site to not exceed the pre-development peak event stormwater discharge, using the Average Exceedence Probability (AEP) of the 1-in-100 year storm event.

3.3 Modelling Methodology and Approach

Approach

Generally, OSD is required for all residential flat buildings, commercial and industrial developments and subdivisions resulting in the creation of three (3) lots or more. Where possible, the OSD system must be designed to capture stormwater runoff from the entire existing and proposed roof and paved areas of the site and any other areas that can be physically directed to the system. Where this is not possible, then the majority of hardstand surfaces of the site must be directed to the OSD system. In this regard, only 20% of the hardstand area will be allowed to bypass the OSD system, that is, a minimum of 80% of the total hardstand must be directed through the OSD system. Design of the OSD system has been undertaken in accordance with Full Computation Method.

The total site runoff for the 20% AEP and the 1% AEP storm event under existing site conditions (pre-development) must be determined, with a check of the 5% AEP storm event being made. The direction of runoff from the site, which has to fall in the same direction of the catchment, must be maintained.

For all developments, the runoff from the site after development is not to exceed the runoff from the total site prior to the development for all storm durations for the 20% AEP, 5% AEP and a 1% AEP storm event.

The overland flow from the site is not to be concentrated at any single point, where necessary, flows are to be spread evenly across the entire site as uniform overland flow.

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.

Catchment

The total site area, based on the survey plan is 7,811m². All impervious areas (roof, pathways etc) are to be collected and channeled to the on-site detention system, following the application of water sensitive urban design. Discharge is via the on-site detention system, via a drainage easement running along the north-western boundary for discharge to the existing drainage system along Frenchs Forest Road East.

3.4 Results

Based on the full computational method using DRAINS, the permissible site discharge requirements and results have been provided in Table 3.

Annual Exceedence Probability (years)	Storm Duration (min.)	Pre-dev site discharge (l/s)	Post-dev site discharge with OSD Discharge at KIP (l/s)
1 – in - 5	25	282	241
1 – in - 20	25	392	312
1 – in - 100	15	479	365

Table 3 – Summary of Peak 20%, 5% and 1% AEP Event Discharge Values

The results in Table 3 demonstrate that the PSD requirement for the 20%, 5% and 1% storm events for all storm duration up to 9 hours (with the critical duration of 25 and 15 minutes), was achievable and that the post-development flow rates were less than the pre-development flow rates. Discharge to the Frenchs Forest Road East drainage system was also considerable reduced.

3.5 Conclusion

Hydraulic modelling shows that the proposed OSD system complies with the SSR and PSD objectives outlined in Council's Stormwater Management Policy.

The OSD design criteria were based on limiting peak post-development flows discharges for the 20% and 1% storm event, with the 5% storm event used as a check. Critical duration is 15 and 25 minutes. This assessment found a detention tank with a volume of 83m³ is required to contain peak flow for the 1% AEP storm event.

Review of modelling results indicate that the discharge from the site OSD to Frenchs Forest Road East drainage system is equal or less than the pre development storm discharge to this same point. Therefore, the proposed development shall have a negligible 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 1% AEP storm event, and should the 375mm dia. emergency overflow pipe be blocked, shall be by way of an access grate spillway spilling onto the landscaped areas and via a drainage easement on the north-western section of the development site to Frenchs Forest Road East. No adverse impact due to overland flows shall result.

4. Climate Change

4.1 Overview

This assessment has been completed 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.

5. References

BMT WBM 2015, NSW MUSIC Modelling Guidelines, August 2015. EPA (1997) Managing Urban Stormwater: Treatment Techniques

Northern Beaches Council Water Management Policy – 26 August 2020.

Appendix 1

On-Site Detention Checklist

Appendix 16 – On-site Detention Checklist

This checklist is to be used to determine the on-site stormwater disposal requirement for developments and must be completed and included with the submission of any development application for these works. Please read this form carefully for its notes, guidelines, definition and relevant policies.

For assistance and support, please contact Council’s Development Engineering and Certification team on 1300 434 434.

Part 1 Location of the Property			
House Number	5	Legal Property Description	
Street	Skyline Place	Lot	1
Suburb	Frenchs Forest	Section	-
Postcode	2086	DP	1209504

Part 2 Site Details			
Northern Beaches Stormwater Regions (refer to Map 2 of Northern Beaches Council’s Water Management for Development policy)		Total Site Area	7,811m ²
Pre-Development Impervious Area	5,467m ²	Post-Development Impervious Area	4,845m ²
Is the site of the development located within an established Flood Prone Land as referred to Council’s Local Environmental Plans? If yes, On-site stormwater Detention system (OSD) is not required and please proceed to part 5 of this checklist If no, please proceed to part 3 of this checklist.			Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

Part 3: Northern Beaches Stormwater Regions (refer to Map 2 of Northern Beaches Council’s Water Management for Development policy)
If the site of the development located within Region 1, please proceed to the part 4.1 of this checklist
If the site of the development located within Region 2, please proceed to the part 4.2 of this checklist
If the site of the development located within Region 3, please proceed to the part 4.3 of this checklist
If the site of the development located within Region 4, please refer to Council’s Warriewood Valley Water Management Specification.

Part 4 Determination of OSD Requirements

Part 4.1 Northern Beaches Stormwater Region 1	
Is the additional impervious area of the development more than 50 m ² on a cumulative basis since February 1996?	Yes <input type="checkbox"/> No <input type="checkbox"/>
If yes, OSD is required and please refer to section 9.3.1 of Council's Water Management for Development Policy If no, OSD is not required and please proceed to the part 5 of this checklist	

Part 4.2 Northern Beaches Stormwater Region 2	
Part 4.2.1 Description of Work	
Residential flat building, commercial, industrial, multiple occupancy development and subdivisions resulting in the creation of three lots or more, will require OSD in all case. Please provide a design in accordance with the section 9.3.2 of Council's Water Management for Development Policy. Any single residential building development, please proceed to part 4.2.2 of this checklist.	
Part 4.2.2 Exemption	
Is the site area less than 450m ² ?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Does the site of the development drain directly to the ocean without the need to pass through a drainage control structure such as pipe, bridge, culvert, kerb and gutter or natural drainage system?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Is it an alternation and addition development to the existing dwellings?	Yes <input type="checkbox"/> No <input type="checkbox"/>
If yes to any of the above questions, OSD is not required. If no to all the above questions, proceed to part 4.2.3	
Part 4.2.3 Determination of OSD Requirements	
Calculation	a) Site area m ² x 0.40 (40%) = m ² b) Post- development impervious area = m ² OSD will not be required when (a) is greater than (b) Is OSD required for this development (tick one only) Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, provide a design in accordance with the section 9.3.2 of Council's Water Management for Development Policy. If no, OSD is not required and plea

Part 4.3 Northern Beaches Stormwater Region 3	
Part 4.3.1 Stormwater Zone	
In the region, the method of stormwater control to be applied shall depend on the location of the site. Please refer to Map 3 of Northern Beaches Council's Water Management for Development policy.	
If the site of the development located within stormwater zone 1, please proceed to the part 4.3.2 of this checklist	
If the site of the development located within stormwater zone 2, please provide a design in accordance with the section 9.3.3.3 of Council's Water Management for Development Policy.	
If the site of the development located within stormwater zone 3, please provide a design in accordance with the section 9.3.3.4 of Council's Water Management for Development Policy.	
If the site of the development located within stormwater zone 4, please provide a design in accordance with the section 9.3.3.5 of Council's Water Management for Development Policy.	
Part 4.3.2 Determination of OSD requirements in Stormwater Zone 1	
Part 4.3.2.1 For A New Building	
1) Exemption	<p>a) Is the site area less than 400? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>b) Is the post-development impervious area less than 190 m²? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>If yes to both questions, OSD is not required. If no to any of the above questions, please process to calculation</p>
2) Calculation	<p>a) Site area _____ m² x 0.35 = _____ m² + 50 = _____ m²</p> <p>b) Post- development impervious area _____ m²</p> <p>OSD will not be required when (b) is less than 250 m² and (a) is greater than (b) Is OSD required for this development? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>If yes, provide a design in accordance with the section 9.3.3.2 of Council's Water Management for Development Policy. If no, OSD is not required and please proceed to part 5.</p>
Part 4.3.2.2 For Alterations and Additions	
If the current impervious area of the site is more than 60% of the site area, OSD will be required. Alternatively, please proceed to the next calculation section.	
1) Calculation	<p>Is the post development impervious area increased by less than 50 m²? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>Is the post development impervious area less than 60% of the site area? Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p>If yes to both questions, OSD is not required. If no to any of the above questions, provide a design in accordance with section 9.3.3.2 of Council's Water Management for Development Policy</p>

Part 5 Disposal of Stormwater

Does the site fall naturally towards the street? Yes No

If yes, provide a design in accordance with section 5.1 of Council's Water Management for Development Policy.

If no, provide a design in accordance with section 5.5 of Council's Water Management for Development Policy.

Definitions

Designed to help you fill ou this application

Site area: This refers to the area of the land bounded by its existing or proposed boundaries.

Impervious area: This refers to driveways, parking spaces, pathways, paved areas, hardstand areas, roofed areas, garages and outbuildings.

Pre Development Impervious area: This refers all impervious areas of the site before the development.

Post Development Impervious areas: This refers all the impervious areas within the site after the development is completed.

Appendix 2

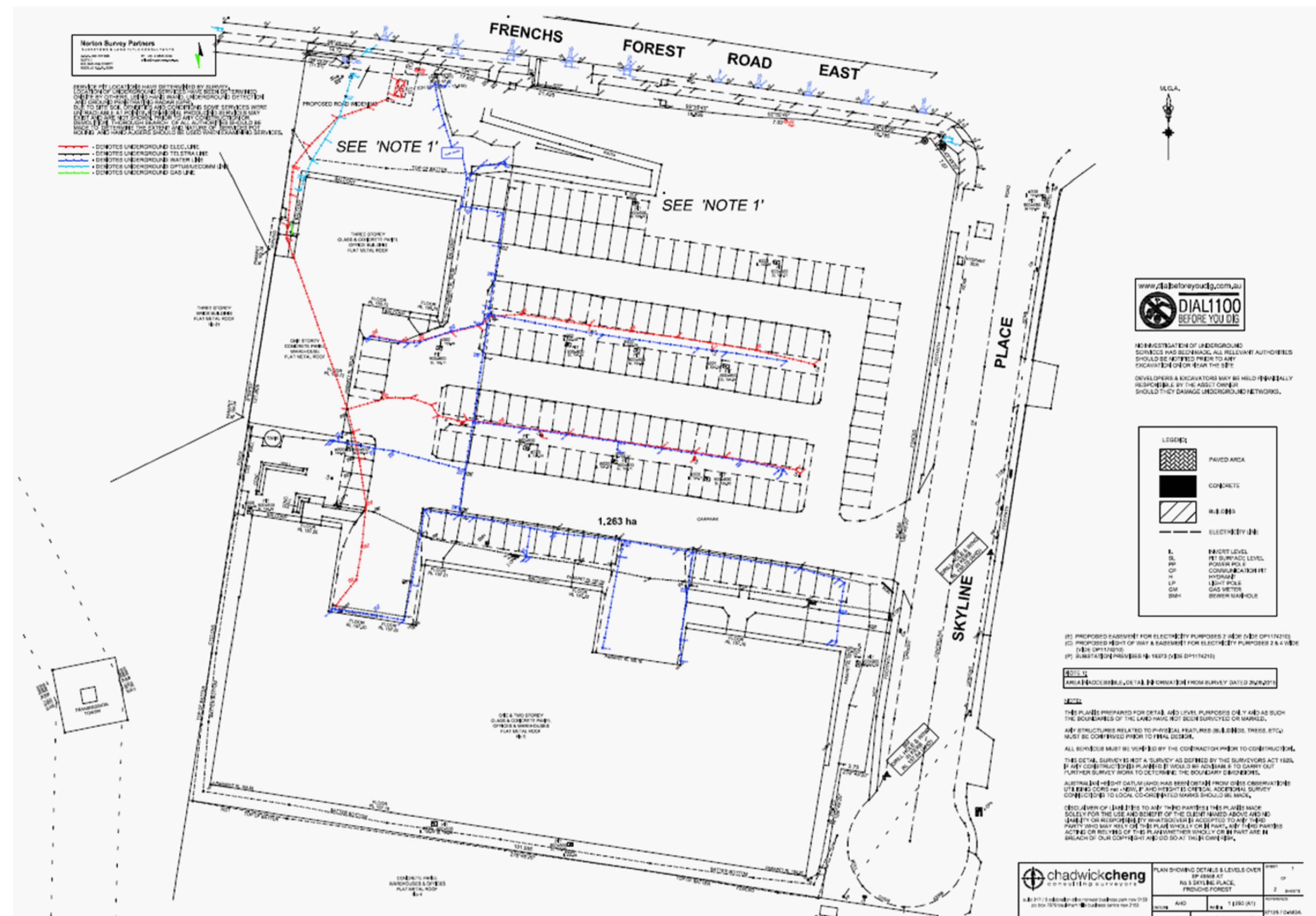
Existing Survey and Stormwater Drawings

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EXISTING COUNCIL'S STORMWATER ASSET

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SURVEY OF EXISTING SERVICES WITHIN DEVELOPMENT SITE

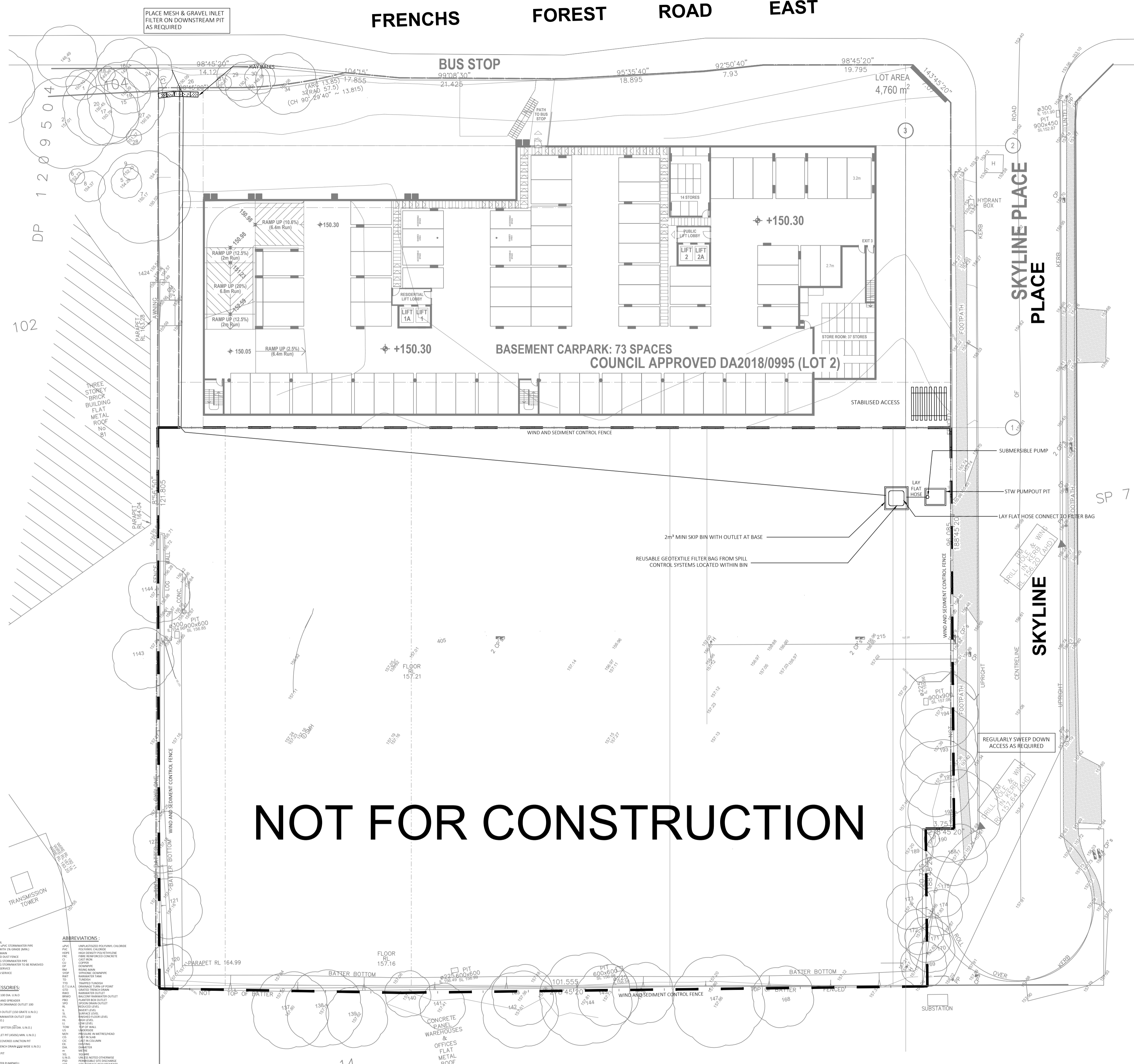
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VERIFY ALL DISCREPANCIES WITH PROJECT ARCHITECT/ MANAGER PRIOR TO PROCEEDING WITH ANY WORKS. **Do not scale off drawings.**

		Drawn & Designed By : R. Koh		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 Seniors Living (Stage 2)	Drawing Title Existing Services and Survey Plan	
		Checked By : N. Evans		At 5 Skyline Place Frenchs Forest NSW 2086	Date January 2021	Scale As Shown @ A1	
		Approved By : Kenneth T. NG MIEAust CPEng NER APEC Engineer IntPE(Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)		Client	Project No. 284012021DA	Drawing & Sheet No./Issue 28401-00/21 / A	
A	Development Application	28 Jan. 2021					
Issue	Description	Date of Drawing					

FRENCHS FOREST ROAD EAST

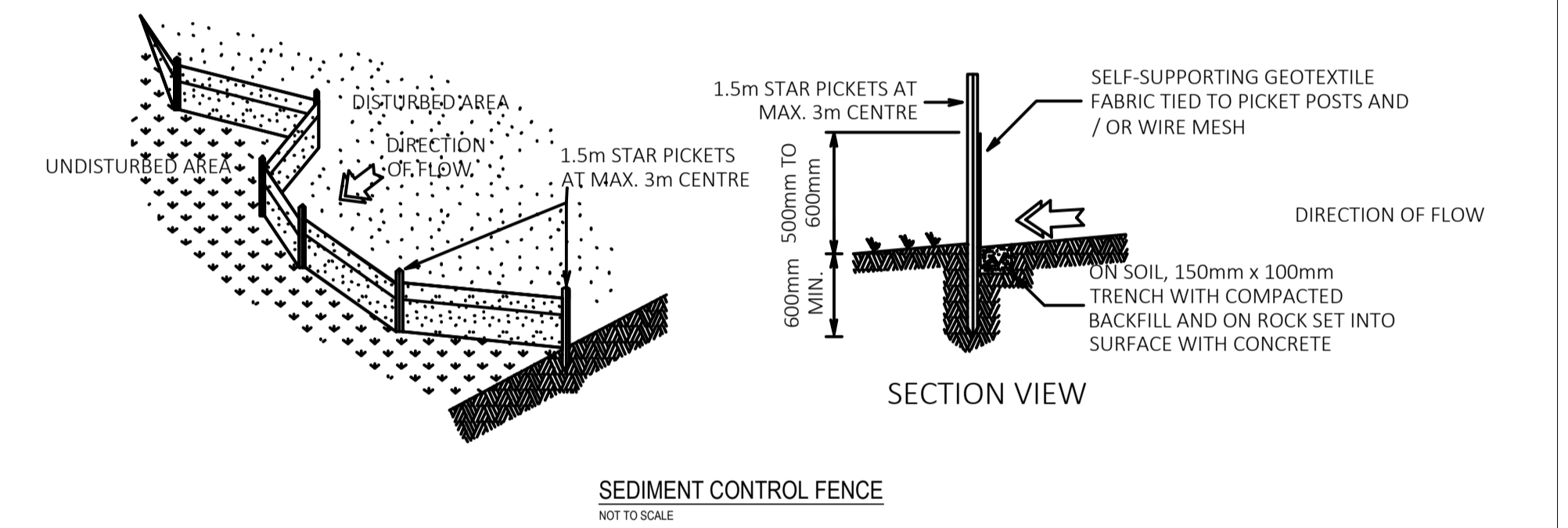


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EROSION AND SEDIMENT CONTROL PLAN

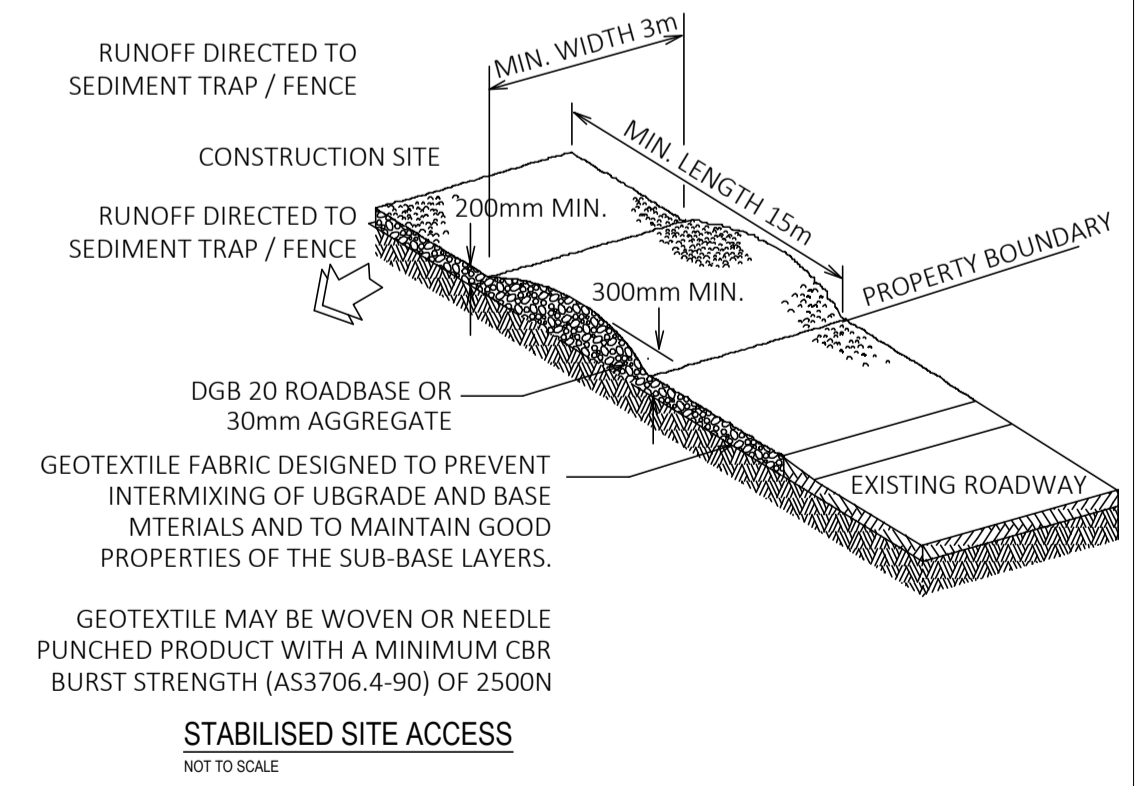
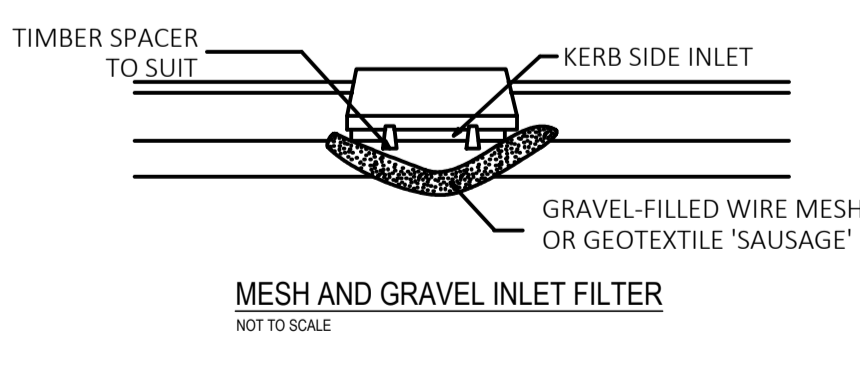
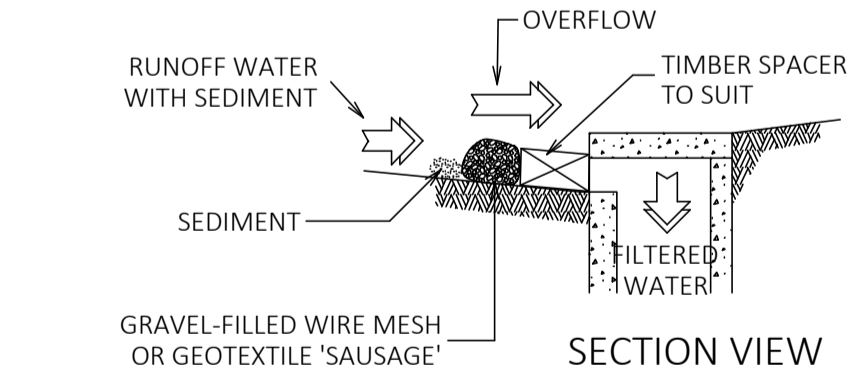
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- EROSION AND SEDIMENT CONTROL
- THE NOTES AND MEASURES STATED HEREAFTER SHALL BE READ IN CONJUNCTION WITH THE NSW PUBLICATION "MANAGING URBAN STORMWATER, SOILS & CONSTRUCTION, FOURTH EDITION 2004 VOLUME 1" PREPARED BY LANDCOM. PARTICULAR ATTENTION SHALL BE PAID TO CHAPTERS 6 & 8.
 - 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.
 - ALL NECESSARY WORKS SHALL BE CARRIED OUT TO PREVENT EROSION, CONTAMINATION AND SEDIMENTATION OF THE PROJECT SITE AND ADJACENT PROPERTIES AND DRAINAGE SYSTEMS.
 - MINIMISE DISTURBED AREAS COVERED WITH NATURAL VEGETATION, ONLY THOSE AREAS DIRECTLY REQUIRED FOR CONSTRUCTION ARE TO BE DISTURBED.
 - DIVERT CLEAN WATER FROM UNDISTURBED AREAS AROUND THE WORKING AREAS.
 - ADOPT TEMPORARY MEASURES AS MAY BE NECESSARY FOR EROSION AND SEDIMENT CONTROL, INCLUDING BUT NOT LIMITED 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 CLAEIN 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
 - 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.
 - STOCKPILED MATERIALS SHALL BE KEPT WITHIN THE SITE BOUNDARIES IN A POSITION NOT VULNERABLE TO CONCENTRATED SURFACE RUNOFF.
- DUST CONTROL:
- DUST IS TO BE WELL CONTROLLED ON THE CONSTRUCTION SITE AT ALL TIMES, ESPECIALLY AT EXCAVATIONS, DEMOLITION ETC.
 - WATER SPRAY TO BE USED TO CONTROL DUST ON DIRT/GRADED AREAS ONLY.
 - CARE TO BE EXERCISED TO ENSURE WATER SPRAY DISPENSE ONLY SUFFICIENT WATER FOR DUST CONTROL PURPOSES.
 - CARE TO BE EXERCISED TO ENSURE ONLY OPTIMUM MOISTURE CONTENT OF THE SOIL IS REACHED FOR COMPACTION.
 - FOR CONTROLLING DUST ON PAVED FOOTPATHS, A SWEEPER IS TO BE USED WITH WATER-JET SPRAYERS.
 - NO SURFACE WATER RUN-OFF IS TO BE GENERATED.
 - CARE IS TO BE EXERCISED TO ENSURE ONLY SUITABLE AMOUNTS OF WATER IS USED DURING SWEEPING.
 - NO RUN-OFF FROM SPRAYERS TO FLOW INTO CATCH BASINS.
 - MINIMISE THE AREAS OF EXISTING VEGETATED AREA THAT ARE DISTURBED DURING CONSTRUCTION.
 - AREAS NOT BEING WORKED ON FOR 30 DAYS OR MORE ARE TO BE VEGETATED OR COVERED TO AVOID DUST GENERATION.
 - SAND & SOIL STOCKPILE ARE TO BE SUFFICIENTLY COVERED DURING WEEKENDS AND AT TIMES WHEN WINDY CONDITIONS PREVAIL.



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

- CONSTRUCTION NOTES :
- STRIP TOPSOIL AND LEVEL SITE.
 - COMPACT SUBGRADE
 - COVER AREA WITH NEEDLE PUNCHED GEOTEXTILE.
 - CONSTRUCT 200mm THICK PAD OVER GEOTEXTILE USING ROADBASE OR 300mm AGGREGATE MINIMUM LENGTH 15m OR TO BUILDING ALIGNMENT. MINIMUM WITH 3m.
 - CONSTRUCT HUMP IMMEDIATELY WITHIN BOUNDARY TO DIVERT WATER TO A SEDIMENT FENCE OR SEDIMENT TRAP.



LEGEND

PIPEWORK

ABBREVIATIONS:

SERVICE ACCESSORIES:

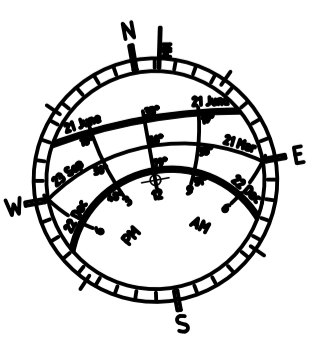
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A	Development Application	28 Jan. 2021
Issue	Description	Date of Drawing

Drawn & Designed By : R. Koh

Checked By : N. Evans

Approved By : Kenneth T. NG
MIEAust CPEng NER APEC Engineer IntPE(Aus)
(Reg. No. 2206352) RPEQ
Registered Certifier
(Hydraulic (stormwater), Road & Drainage and Stormwater)
NSW Fair Trading (Reg. No. BDC0827)



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

Project
Proposed Seniors Living (Stage 2)

At
5 Skyline Place
Frenchs Forest NSW 2086

Client

Drawing Title
Erosion & Sediment Control Plan

Date
January 2021

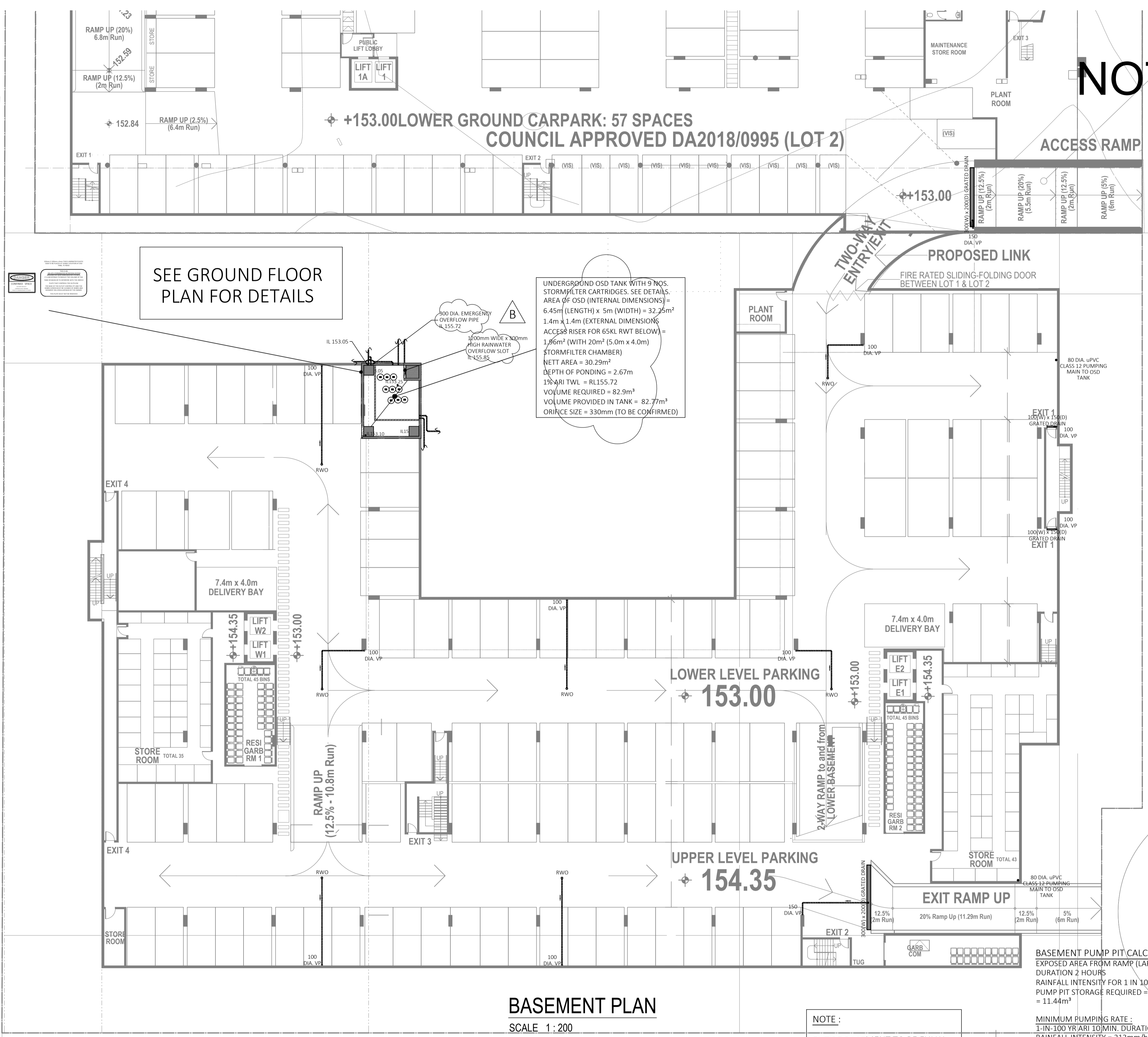
Scale
As Shown @ A1

Project No.
284012021DA

Drawing & Sheet No./Issue
28401-01/21 / A

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

NOT FOR CONSTRUCTION



SKYLINE PLACE

WARNING
PUMP-OUT SYSTEM
FAILURE IN BASEMENT
WHEN LIGHT IS
FLASHING AND SIREN
IS SOUNDING

COLOURS :
"WARNING" - RED
BORDER - BLACK
WORDING - BLACK

BASEMENT PUMP-OUT FAILURE WARNING SIGN
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 THE BASEMENT. THE ALARM WARNING SYSTEM SHALL BE PROVIDED WITH A BATTERY BACK-UP IN CASE OF POWER FAILURES.

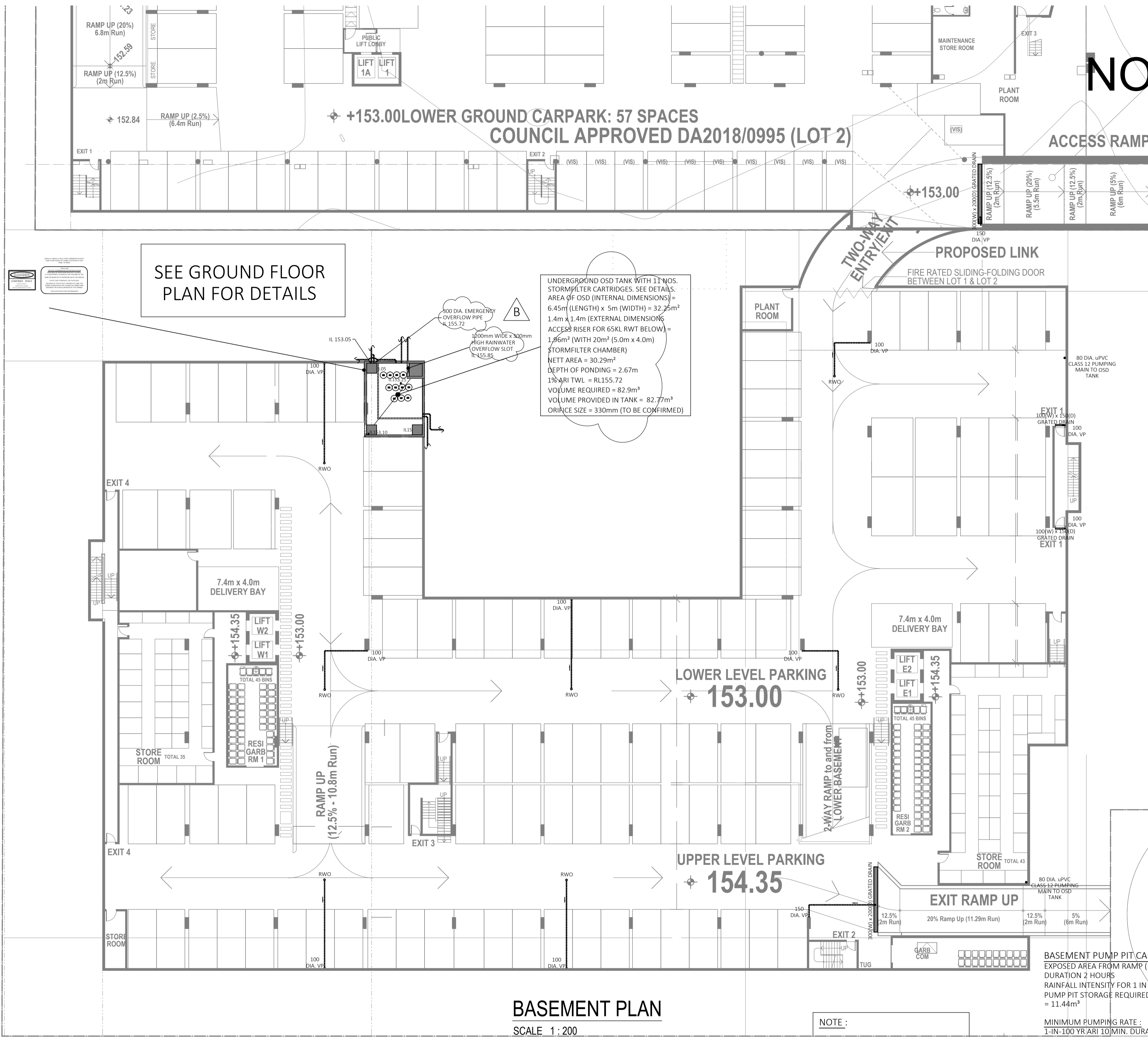
BASEMENT PUMP PIT CALCULATIONS:
EXPOSED AREA FROM RAMP (LARGER OF 2) = 88m²
DURATION 2 HOURS
RAINFALL INTENSITY FOR 1 IN 100-YR ARI = 62mm/hr
PUMP PIT STORAGE REQUIRED = 2 x 65 x 0.0088 x 60 x 360 / 360 = 11.44m³

MINIMUM PUMPING RATE :
1-IN-100 YR ARI 10MIN. DURATION
RAINFALL INTENSITY = 213mm/hr
Q = 1 x 213 x 0.0088 x 1000 / 360 = 5.2l/s
MIN. PUMPING RATE = 10 l/s
USE GRUNDFOS DWK-0 SERIES OR EQUIVALENT DUAL PUMP SYSTEM

NOTE :
ENTIRE BASEMENT TO BE FULLY TANKED, DETAILS TO BE PROVIDED BY STRUCTURAL ENGINEER.

LEGEND		ABBREVIATIONS:	
PIPEWORK:	PIPEWORK:	APPC	APPROVED PLANNING CONDITIONS
100 DIA. VP	100 DIA. VP	APC	APPROVED PLANNING CONDITIONS
150 DIA. VP	150 DIA. VP	APD	APPROVED PLANNING CONDITIONS
200 DIA. VP	200 DIA. VP	APF	APPROVED PLANNING CONDITIONS
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NOT FOR CONSTRUCTION



SKYLINE PLACE

WARNING
 PUMP-OUT SYSTEM
 FAILURE IN BASEMENT
 WHEN LIGHT IS
 FLASHING AND SIREN
 IS SOUNDING

BASEMENT PUMP-OUT FAILURE WARNING SIGN
 NOT TO SCALE

BASEMENT PUMP-OUT SYSTEM NOTES

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BASEMENT PUMP PIT CALCULATIONS:
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MIN. PUMPING RATE = 10 l/s
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LEGEND		ABBREVIATIONS	
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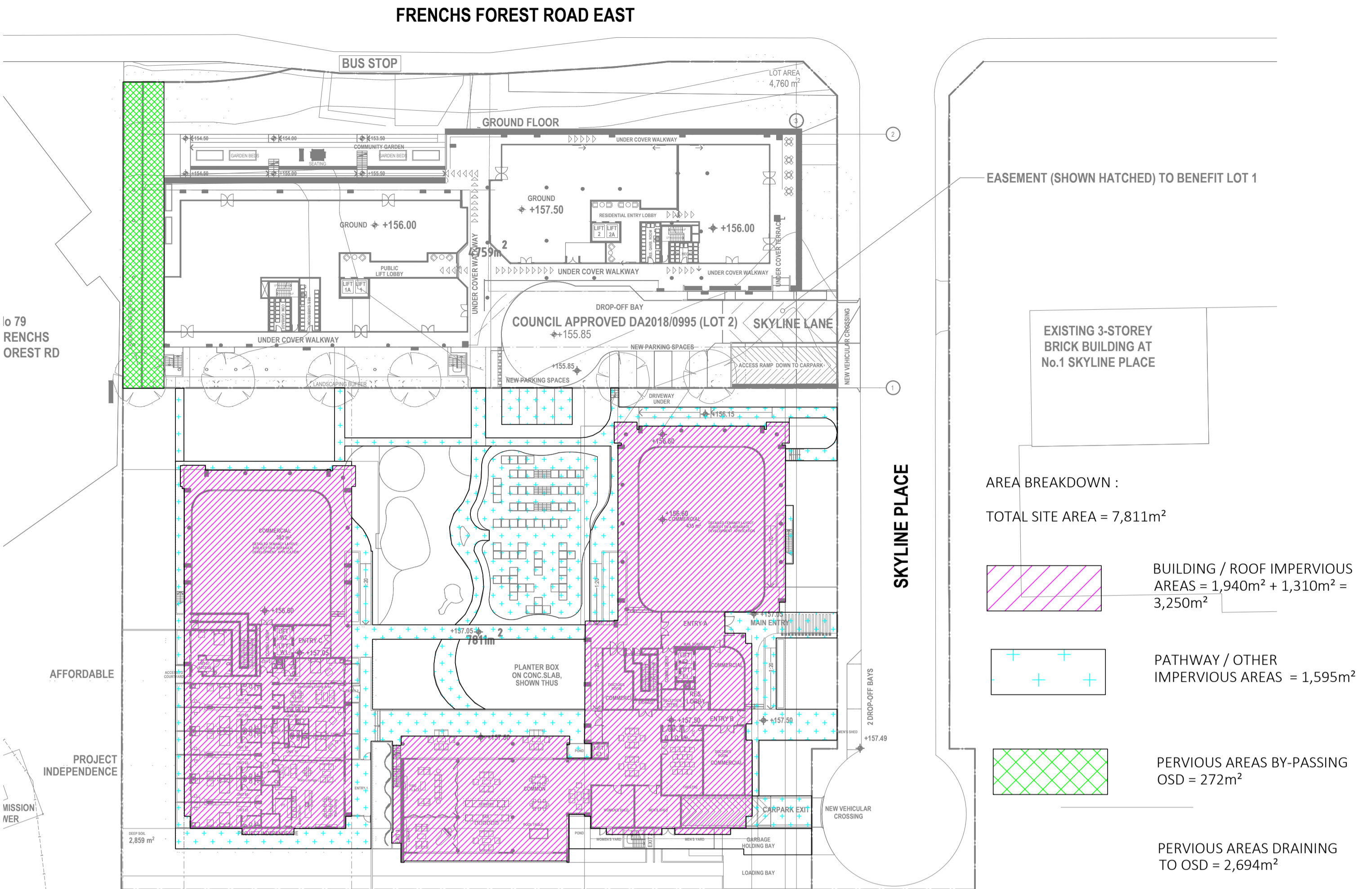
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Drawn & Designed By : R. Koh				Project Proposed Seniors Living (Stage 2)		Drawing Title Basement Plan	
Checked By : N. Evans				At 5 Skyline Place Frenchs Forest NSW 2086		Date January 2021	Scale As Shown @ A1
Approved By : Kenneth T. NG MIE Aust CP Eng NER APEC Engineer IntPE(Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)				Client		Project No. 284012021DA	Drawing & Sheet No./Issue 28401-03/21 / B
B	Incorporate Council's Comments re WSUD	20 Apr. 2021	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				
A	Development Application	28 Jan. 2021					
Issue	Description	Date of Drawing					

DRAINS results prepared from Version 2020.061

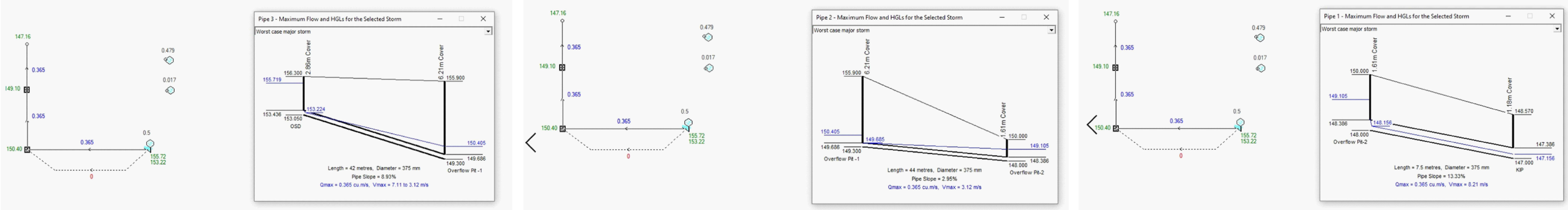
PIT / NODE DETAILS		Version 8						
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint	
Overflow Pit.1	150.4		0		5.5		None	
Overflow Pit.2	149.1		0		0.9		None	
KIP	147.16		0					
SUB-CATCHMENT DETAILS								
Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm	
Flow Q (cu.m/s)	Max Q (cu.m/s)	Max Q (cu.m/s)	Max Q (cu.m/s)	Tc (min)	Tc (min)	Tc (min)		
Lot1.Pre	0.479	0	0.479	5	5	0	AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1	
Lot1.Post (ex bypass)	0.5	0.335	0.165	5	5	0	AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1	
Bypass Area	0.017	0	0.017	5	5	0	AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1	
Outflow Volumes for Total Catchment (0.48 impervious + 1.08 pervious = 1.56 total ha)								
Storm		Pervious						
AR&R 100 year, 5 minutes storm, average 276.1 mm/h, Zone 1	Total Rainfall cu.m 359.54	Total Runoff cu.m (Runoff %) 261.08 (72.6%)	Impervious Runoff cu.m (Runoff %) 106.72 (95.7%)	Pervious Runoff cu.m (Runoff %) 154.36 (62.2%)				
AR&R 100 year, 10 minutes storm, average 211.2 mm/h, Zone 1	549.89	428.30 (77.9%)	165.79 (97.2%)	262.51 (69.2%)				
AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1	688.15	546.64 (79.4%)	208.69 (97.7%)	337.96 (71.2%)				
AR&R 100 year, 20 minutes storm, average 153.4 mm/h, Zone 1	798.8	639.86 (80.1%)	243.03 (98.0%)	396.83 (72.0%)				
AR&R 100 year, 25 minutes storm, average 136.9 mm/h, Zone 1	891.09	715.11 (80.3%)	271.66 (98.2%)	443.44 (72.2%)				
AR&R 100 year, 30 minutes storm, average 124.4 mm/h, Zone 1	971.69	780.99 (80.4%)	296.67 (98.4%)	484.32 (72.3%)				
AR&R 100 year, 45 minutes storm, average 99.58 mm/h, Zone 1	1166.72	939.91 (80.6%)	357.19 (98.7%)	582.72 (72.4%)				
AR&R 100 year, 1 hour storm, average 84.46 mm/h, Zone 1	1319.43	1064.34 (80.7%)	404.58 (98.8%)	659.76 (72.5%)				
AR&R 100 year, 2 hours storm, average 56.68 mm/h, Zone 1	1770.9	1434.30 (81.0%)	544.67 (99.1%)	889.63 (72.8%)				
AR&R 100 year, 4.5 hours storm, average 35 mm/h, Zone 1	2460.47	1971.32 (80.1%)	758.64 (99.4%)	1212.68 (71.5%)				
AR&R 100 year, 6 hours storm, average 29.63 mm/h, Zone 1	2777.28	2196.08 (79.1%)	856.95 (99.4%)	1339.12 (69.9%)				
AR&R 100 year, 9 hours storm, average 23 mm/h, Zone 1	3233.83	2471.68 (76.4%)	998.63 (99.5%)	1473.05 (66.0%)				
PIPE DETAILS		Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm		
Pipe 3	0.365	7.11	153.224	150.405	AR&R 100 year, 25 minutes storm, average 136.9 mm/h, Zone 1			
Pipe 2	0.365	3.12	149.685	149.105	AR&R 100 year, 25 minutes storm, average 136.9 mm/h, Zone 1			
Pipe 1	0.365	8.21	148.156	147.156	AR&R 100 year, 25 minutes storm, average 136.9 mm/h, Zone 1			
CHANNEL DETAILS		Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	Due to Storm		
OVERFLOW ROUTE DETAILS	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V Due to Storm	
OF	0	0	1.939	0	0	0	0	
DETENTION BASIN DETAILS		Max WL	Max Vol	Max Q	Max Q	Due to Storm		
OSD	155.72	82.9	Total 0.365	Low Level 0.365	High Level 0		0	
CONTINUITY CHECK FOR AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1		Node		Storage Change (cu.m)	Difference %			
KO	Inflow (cu.m) 245	Outflow (cu.m) 245	0	0				
OSD	293.11	293.06	0.05	0				
Overflow Pit.1	293.06	293.06	0	0				
Overflow Pit.2	293.06	293.05	0	0				
KIP	293.05	293.05	0	0				
K O	8.53	8.53	0	0				

DRAINS MODELLING RESULTS
NOT TO SCALE



CATCHMENT PLAN FOR OSD CALCULATIONS
SCALE 1:500

NOT FOR CONSTRUCTION

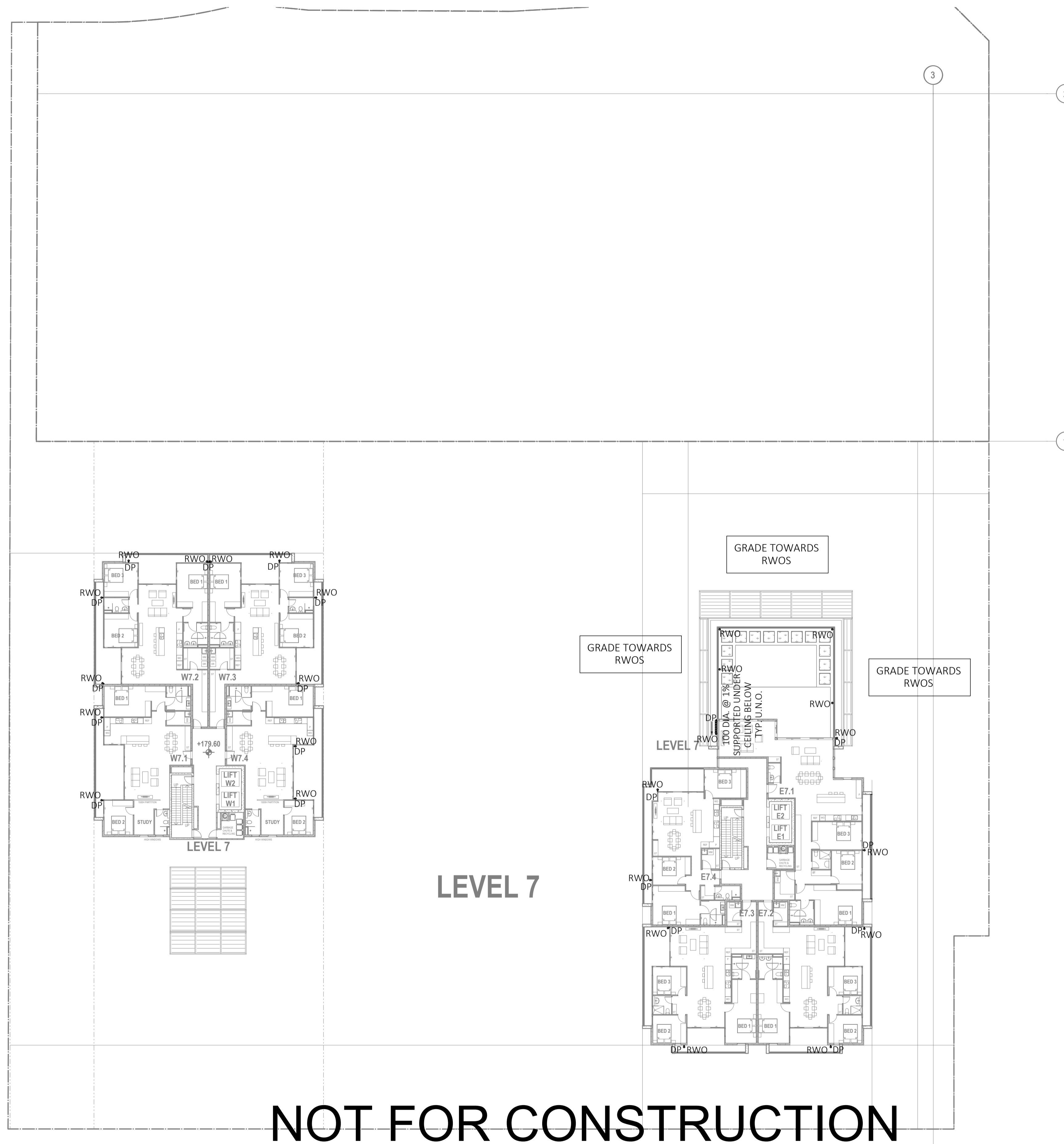


HYDRAULIC GRADE LINE (FROM OSD TO KIP)
NOT TO SCALE

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Checked By : N. Evans			At 5 Skyline Place Frenchs Forest NSW 2086		Date January 2021	Scale As Shown @ A1		
Approved By : Kenneth T. NG MIEAust CPEng NER APEC Engineer IntPE(Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)			Client		Project No. 284012021DA	Drawing & Sheet No./Issue 28401-04/21 / B		
B	Incorporate Council's Comments re WSUD	20 Apr. 2021						
A	Development Application	28 Jan. 2021						
Issue	Description	Date of Drawing						



LEGEND

PIPEWORK

- 100mm PVC DWV
- 150mm PVC DWV
- 200mm PVC DWV
- 100mm HDPE DWV
- 150mm HDPE DWV
- 200mm HDPE DWV
- 100mm RCP DWV
- 150mm RCP DWV
- 200mm RCP DWV
- 100mm PVC DWV
- 150mm PVC DWV
- 200mm PVC DWV
- 100mm HDPE DWV
- 150mm HDPE DWV
- 200mm HDPE DWV
- 100mm RCP DWV
- 150mm RCP DWV
- 200mm RCP DWV

SERVICE ACCESSORIES

- 100mm PVC DWV
- 150mm PVC DWV
- 200mm PVC DWV
- 100mm HDPE DWV
- 150mm HDPE DWV
- 200mm HDPE DWV
- 100mm RCP DWV
- 150mm RCP DWV
- 200mm RCP DWV
- 100mm PVC DWV
- 150mm PVC DWV
- 200mm PVC DWV
- 100mm HDPE DWV
- 150mm HDPE DWV
- 200mm HDPE DWV
- 100mm RCP DWV
- 150mm RCP DWV
- 200mm RCP DWV

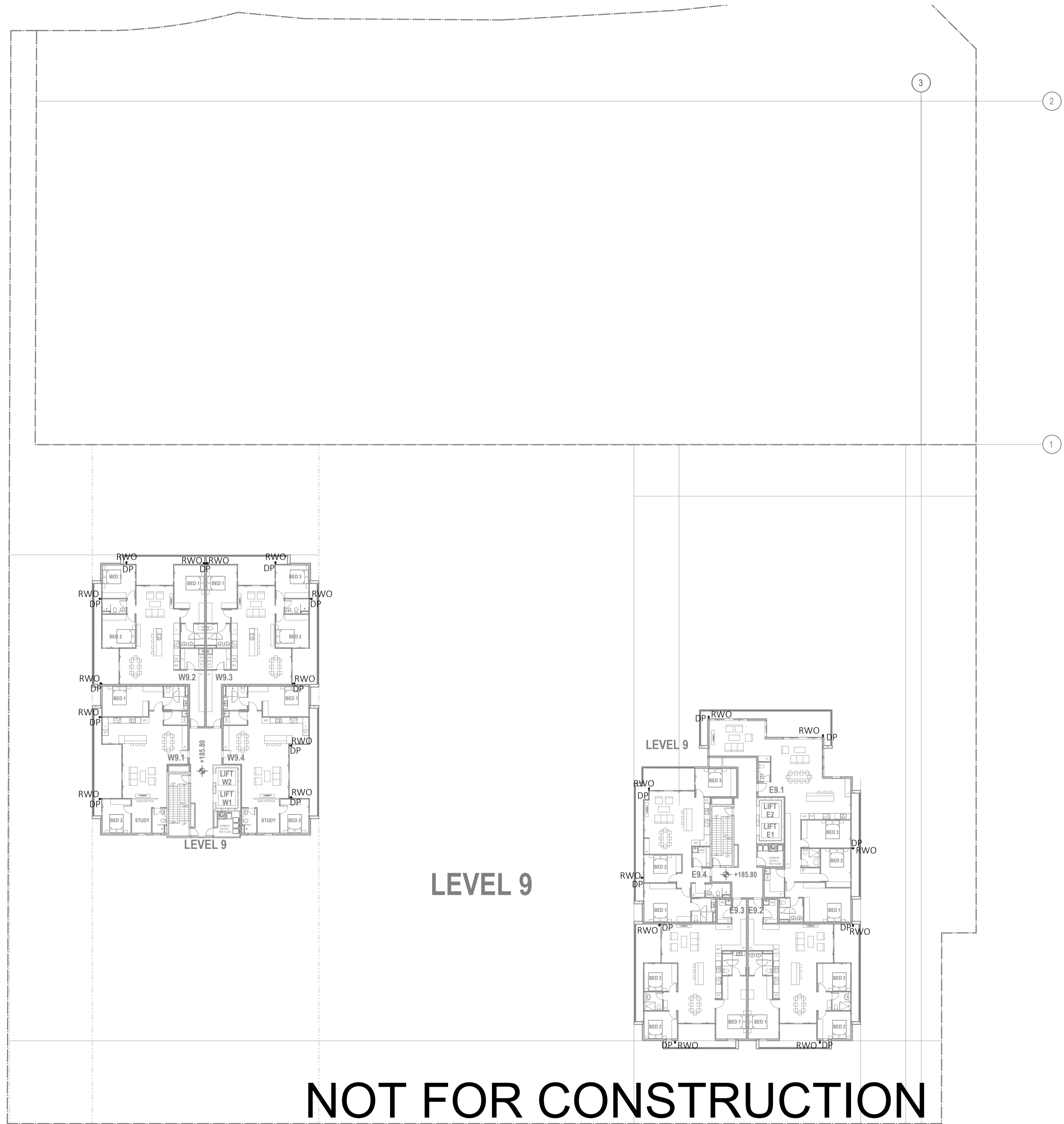
ABBREVIATIONS

- 100mm PVC DWV
- 150mm PVC DWV
- 200mm PVC DWV
- 100mm HDPE DWV
- 150mm HDPE DWV
- 200mm HDPE DWV
- 100mm RCP DWV
- 150mm RCP DWV
- 200mm RCP DWV
- 100mm PVC DWV
- 150mm PVC DWV
- 200mm PVC DWV
- 100mm HDPE DWV
- 150mm HDPE DWV
- 200mm HDPE DWV
- 100mm RCP DWV
- 150mm RCP DWV
- 200mm RCP DWV

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		Checked By : N. Evans		At 5 Skyline Place Frenchs Forest NSW 2086		Date January 2021	Scale 1 : 250 @ A1			
		Approved By : Kenneth T. NG MIEAust CPEng NER APEC Engineer IntPE(Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)		Client		Project No. 284012021DA	Drawing & Sheet No./Issue 28401-12/20 / A			
A	Development Application	28 Jan. 2021								
Issue	Description	Date of Drawing								



NOT FOR CONSTRUCTION

LEGEND

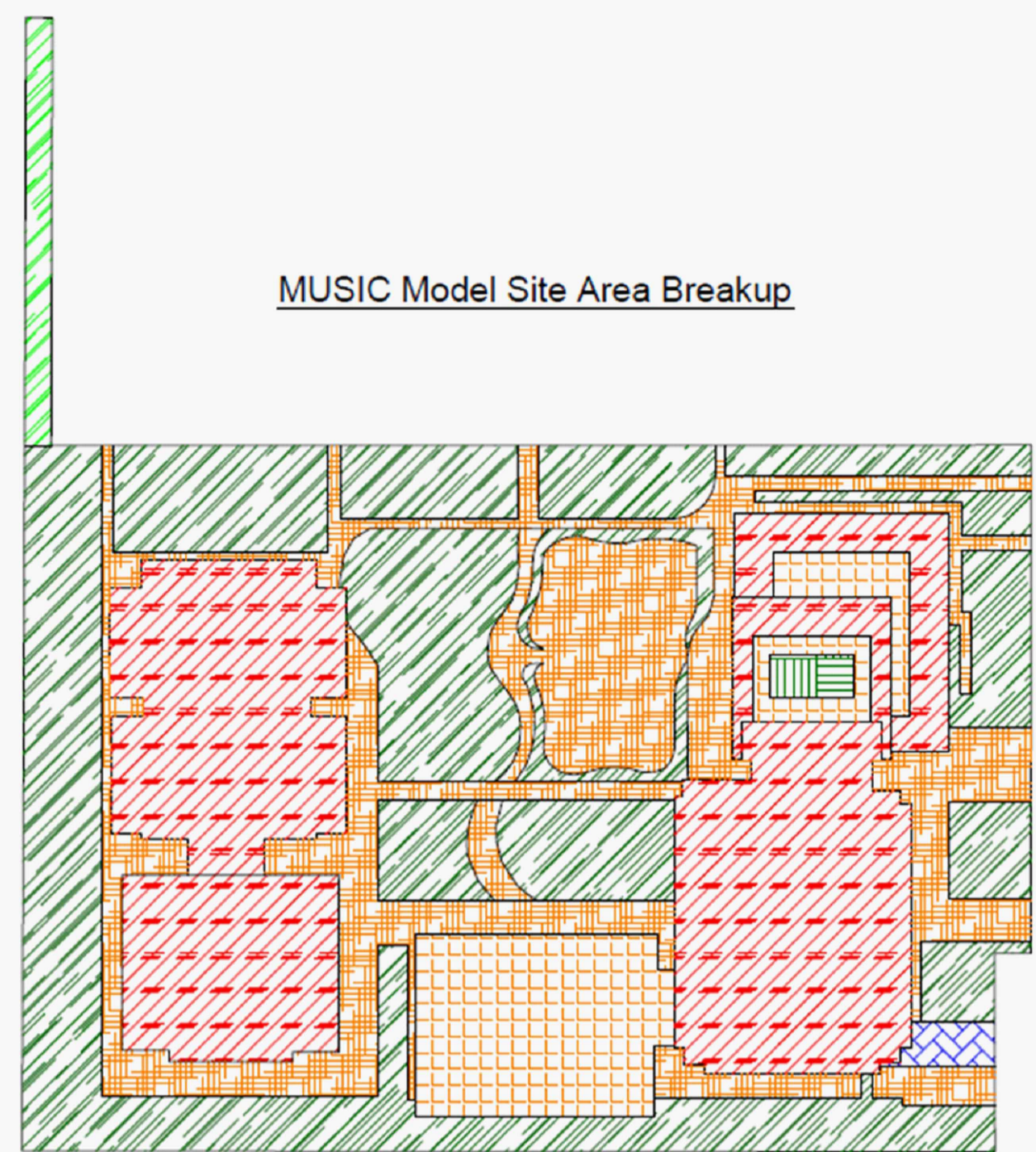
- PIPEWORK**
- 100mm PVC DWV
 - 150mm PVC DWV
 - 200mm PVC DWV
 - 250mm PVC DWV
 - 300mm PVC DWV
 - 350mm PVC DWV
 - 400mm PVC DWV
 - 450mm PVC DWV
 - 500mm PVC DWV
 - 600mm PVC DWV
 - 700mm PVC DWV
 - 800mm PVC DWV
 - 900mm PVC DWV
 - 1000mm PVC DWV
 - 1200mm PVC DWV
 - 1500mm PVC DWV
 - 2000mm PVC DWV
 - 2500mm PVC DWV
 - 3000mm PVC DWV
 - 3500mm PVC DWV
 - 4000mm PVC DWV
 - 4500mm PVC DWV
 - 5000mm PVC DWV
 - 6000mm PVC DWV
 - 7000mm PVC DWV
 - 8000mm PVC DWV
 - 9000mm PVC DWV
 - 10000mm PVC DWV
- SERVICE ACCESSORIES**
- DOWNPIPE (D.P.)
 - DOWNPIPE (D.P.) - 100mm
 - DOWNPIPE (D.P.) - 150mm
 - DOWNPIPE (D.P.) - 200mm
 - DOWNPIPE (D.P.) - 250mm
 - DOWNPIPE (D.P.) - 300mm
 - DOWNPIPE (D.P.) - 350mm
 - DOWNPIPE (D.P.) - 400mm
 - DOWNPIPE (D.P.) - 450mm
 - DOWNPIPE (D.P.) - 500mm
 - DOWNPIPE (D.P.) - 600mm
 - DOWNPIPE (D.P.) - 700mm
 - DOWNPIPE (D.P.) - 800mm
 - DOWNPIPE (D.P.) - 900mm
 - DOWNPIPE (D.P.) - 1000mm
 - DOWNPIPE (D.P.) - 1200mm
 - DOWNPIPE (D.P.) - 1500mm
 - DOWNPIPE (D.P.) - 2000mm
 - DOWNPIPE (D.P.) - 2500mm
 - DOWNPIPE (D.P.) - 3000mm
 - DOWNPIPE (D.P.) - 3500mm
 - DOWNPIPE (D.P.) - 4000mm
 - DOWNPIPE (D.P.) - 4500mm
 - DOWNPIPE (D.P.) - 5000mm
 - DOWNPIPE (D.P.) - 6000mm
 - DOWNPIPE (D.P.) - 7000mm
 - DOWNPIPE (D.P.) - 8000mm
 - DOWNPIPE (D.P.) - 9000mm
 - DOWNPIPE (D.P.) - 10000mm

- ABBREVIATIONS:**
- W.C. WATER CLOSET
 - B.E.D. BED
 - S.T.U.D.Y. STUDY
 - W. WASH BASIN
 - E. ENTRY
 - L.I.F.T. LIFT
 - R.W.O. RAINWATER OVERFLOW
 - D.P. DOWNPIPE
 - W.9.1 WASH BASIN 9.1
 - W.9.2 WASH BASIN 9.2
 - W.9.3 WASH BASIN 9.3
 - W.9.4 WASH BASIN 9.4
 - E.9.1 ENTRY 9.1
 - E.9.2 ENTRY 9.2
 - E.9.3 ENTRY 9.3
 - E.9.4 ENTRY 9.4

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		Drawn & Designed By : R. Koh		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 Seniors Living (Stage 2)		Drawing Title Level 9 Floor Plan		
		Checked By : N. Evans			At 5 Skyline Place Frenchs Forest NSW 2086		Date January 2021	Scale 1 : 250 @ A1	
		Approved By : Kenneth T. NG MIE Aust CP Eng NER APEC Engineer IntPE (Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)			Client		Project No. 284012021DA	Drawing & Sheet No./Issue 28401-14/20 / A	
A	Development Application	28 Jan. 2021							
Issue	Description	Date of Drawing							

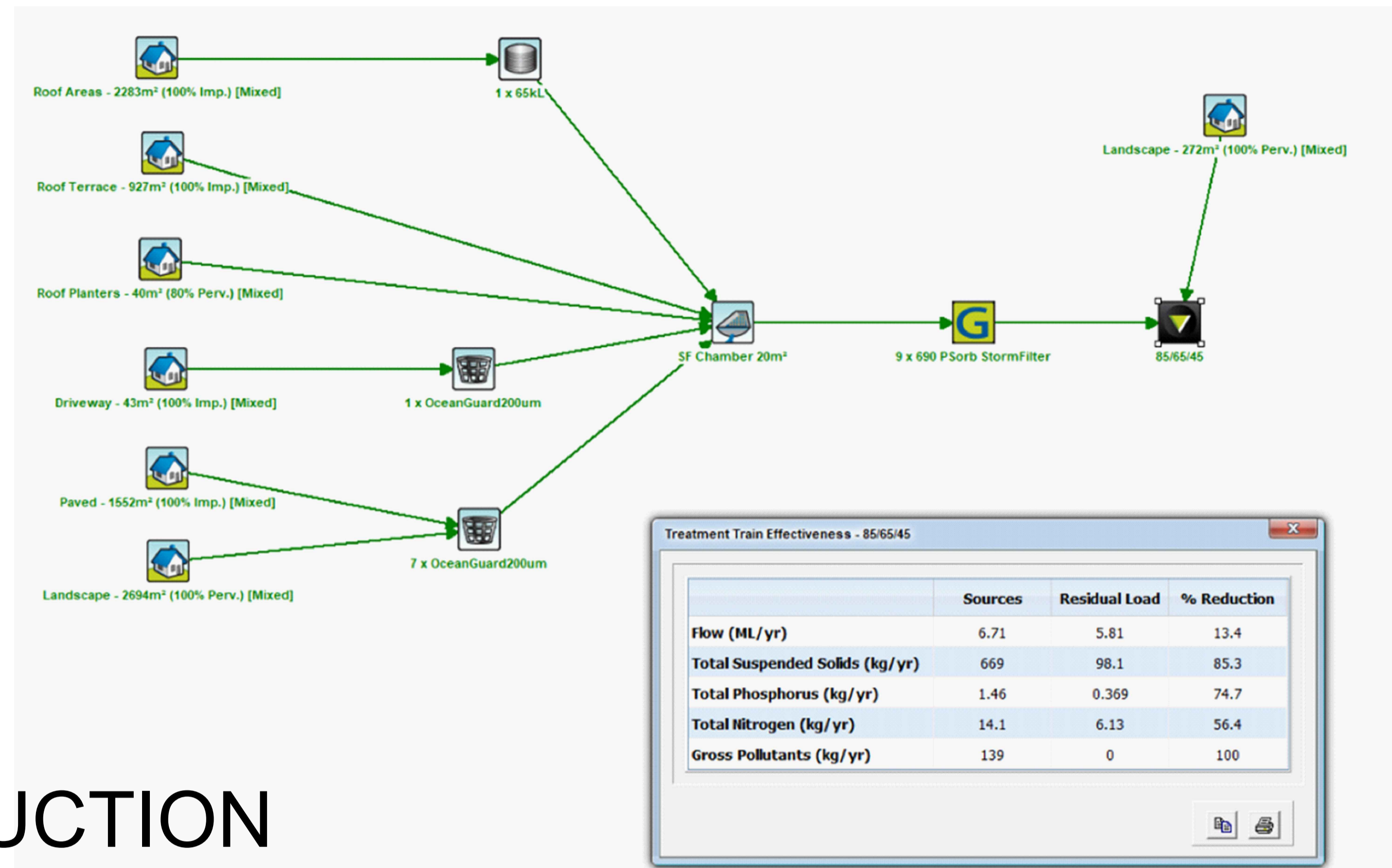


MUSIC Model Site Area Breakup

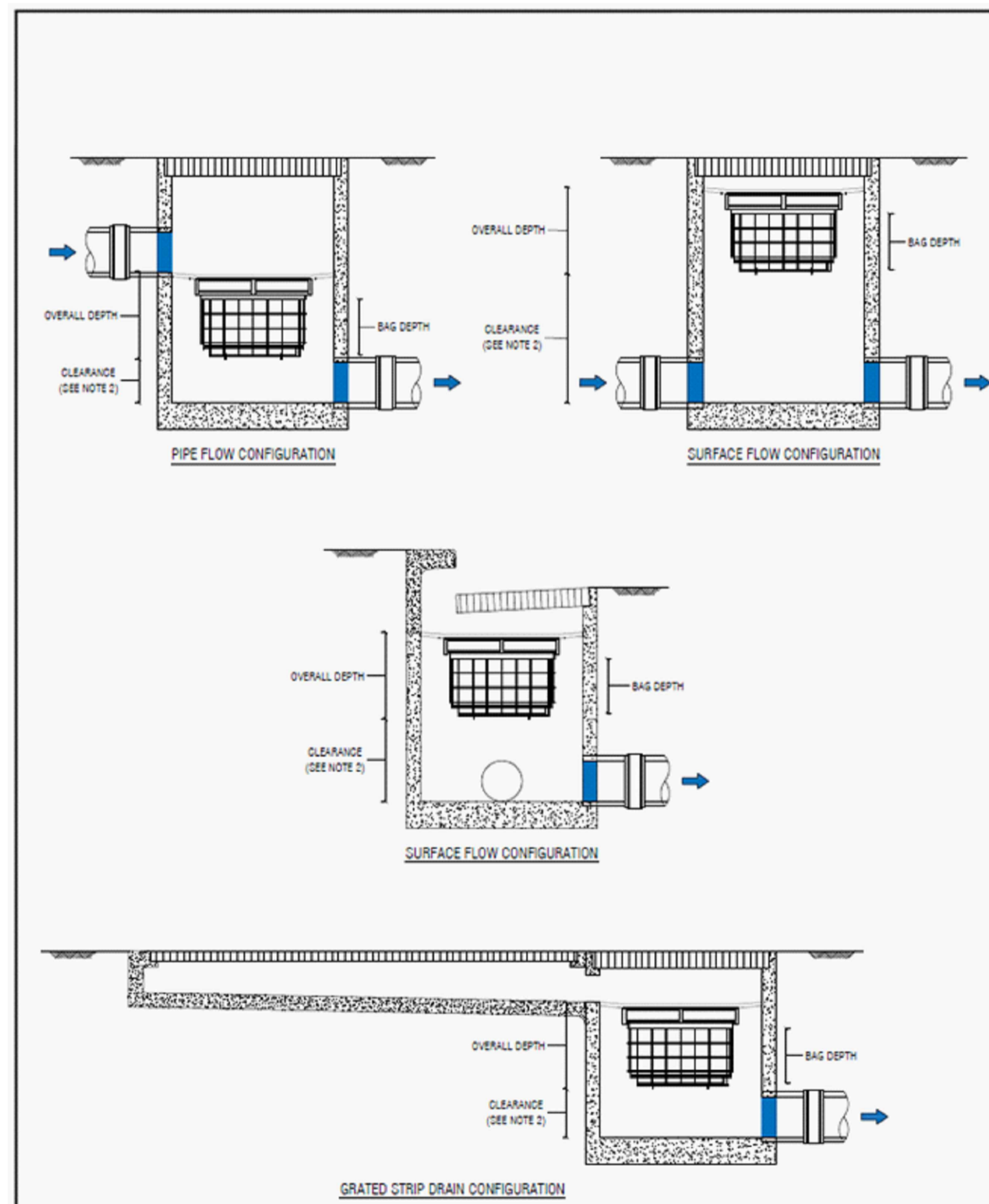
	Roof: 2283m ²		Landscape: 2694m ²	Landscape Bypass
	Roof Planter: 40m ²		Driveway: 43m ²	Landscape: 272m ²
	Roof Impervious: 927m ²		Paved: 1552m ²	
Total area: 7811m ²				

15789 - 5 Skyline Place, Frenchs Forest (Rev1 - Site Area Breakup)

NOT FOR CONSTRUCTION



	Sources	Residual Load	% Reduction
Flow (ML/yr)	6.71	5.81	13.4
Total Suspended Solids (kg/yr)	669	98.1	85.3
Total Phosphorus (kg/yr)	1.46	0.369	74.7
Total Nitrogen (kg/yr)	14.1	6.13	56.4
Gross Pollutants (kg/yr)	139	0	100



PLAN ID	MAXIMUM PIT PLAN DIMENSIONS		
S	450mm x 450mm		
M	600mm x 600mm		
L	900mm x 900mm		
XL	1200mm x 1200mm		

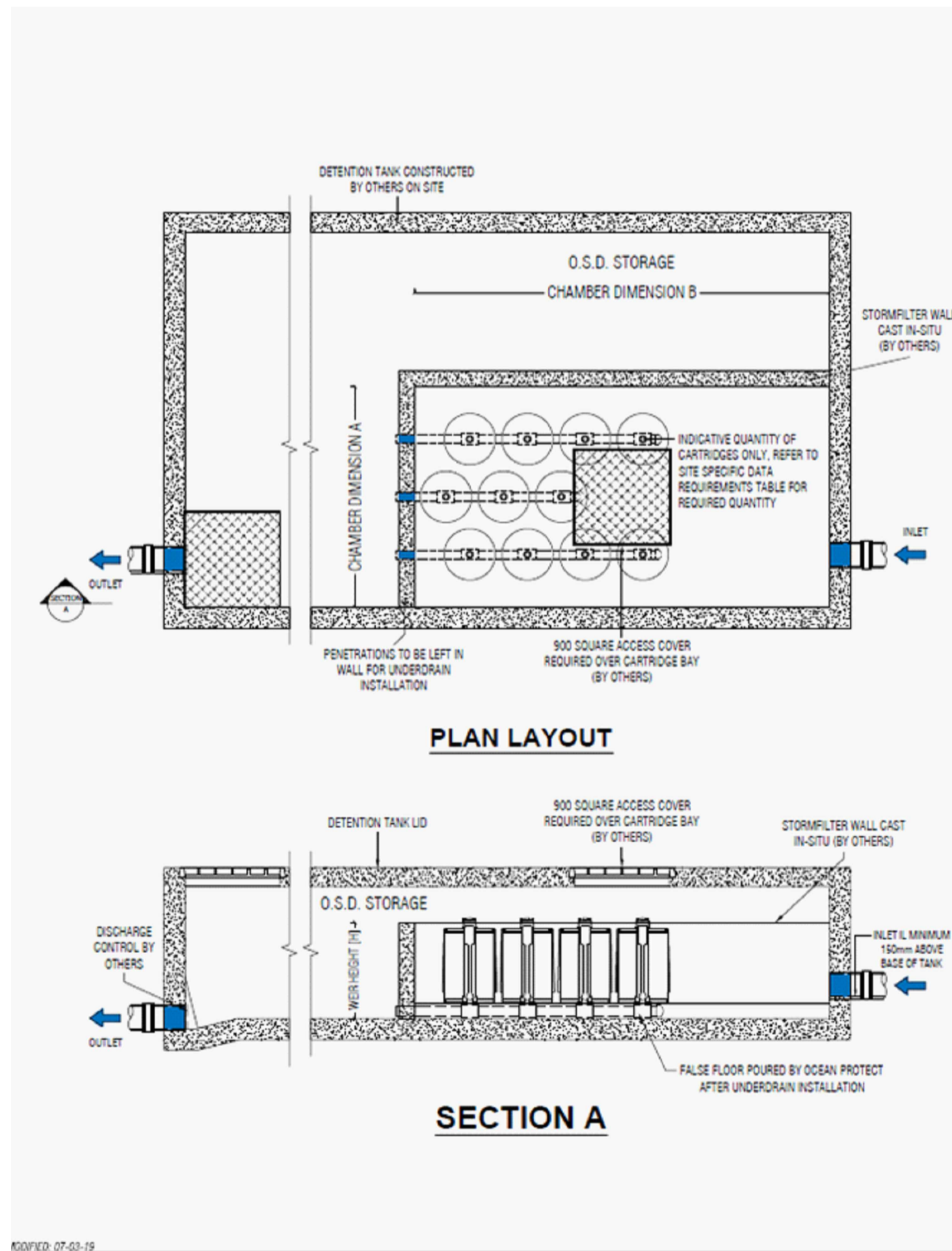
DEPTH ID	BAG DEPTH	OVERALL DEPTH
1	170	270
2	300	450
3	600	700

PLAN ID	DEPTH ID		
	1	2	3
S	•	•	•
M	•	•	•
L	•	•	•
XL	•	•	•

GENERAL NOTES

- THE MINIMUM CLEARANCE DEPENDS ON THE CONFIGURATION (SEE NOTE 2) AND THE LOCAL COUNCIL REQUIREMENTS.
- CLEARANCE FOR ANY PIT WITHOUT AN INLET PIPE (ONLY USED FOR SURFACE FLOW) CAN BE AS LOW AS 50mm. FOR OTHER PITS, THE RECOMMENDED CLEARANCE SHOULD BE GREATER OR EQUAL TO THE PIPE OBVERT SO AS NOT TO INHIBIT HYDRAULIC CAPACITY.
- OCEAN PROTECT PROVIDES TWO FILTRATION BAG TYPES - 200 MICRON BAGS FOR HIGHER WATER QUALITY FILTERING AND A COARSE BAG FOR TARGETING GROSS POLLUTANTS.
- DRAWINGS NOT TO SCALE.

OCEAN PROTECT
 OCEANGUARD
 TYPICAL ARRANGEMENTS
 SPECIFICATION DRAWING



CARTRIDGE NAME / SIPHON HEIGHT (mm)	690	460	310
CARTRIDGE PHYSICAL HEIGHT (mm)	840	600	600
TYPICAL WEIR HEIGHT [H] (mm)	920	690	540
CARTRIDGE FLOW RATE FOR ZPG MEDIA (L/s)	1.6	1.1	0.7
CARTRIDGE FLOW RATE FOR PSORB MEDIA (L/s)	0.9	0.46	0.39

STRUCTURE ID	
NUMBER OF CARTRIDGES REQ'D	
SIPHON HEIGHT (310 / 460 / 690)	
MEDIA TYPE (ZPG / PSORB)	
WATER QUALITY FLOW RATE (L/S)	
DIMENSION A	
DIMENSION B	

TOTAL CARTRIDGE BAY AREA (A x B) TO MATCH AREA REQUIRED BY MUSIC MODELLING OR COUNCIL SPECIFIC REQUIREMENTS

GENERAL NOTES

- INLET AND OUTLET PIPES TO BE IN ACCORDANCE WITH APPROVED PLANS.
- A HIGH FLOW BYPASS ARRANGEMENT OR DISSIPATION STRUCTURE MAY BE REQUIRED TO MINIMISE RE-SUSPENSION OF SOLIDS OR ANY SIGNIFICANT INERTIAL FORCES ON THE CARTRIDGES.
- ALL WATER QUALITY TREATMENT DEVICES REQUIRE PERIODIC MAINTENANCE. REFER TO OPERATION AND MAINTENANCE MANUAL FOR GUIDELINES AND ACCESS REQUIREMENTS.
- SITE SPECIFIC PRODUCTION DRAWING WILL BE PROVIDED ON PLACEMENT OF ORDER.
- THE INVERT LEVEL OF THE INLET PIPE MUST BE GREATER THAN THE RL OF THE FALSE FLOOR WITHIN THE CARTRIDGE CHAMBER.
- CONCRETE STRUCTURE AND ACCESS COVERS DESIGNED AND PROVIDED BY OTHERS. ACCESS COVERS TO BE A MINIMUM 900 X 900 ABOVE CARTRIDGES. OHS REGARDING ACCESS COVERS AND TANK ACCESS TO BE ASSESSED BY OTHERS ON SITE.
- THE STRUCTURE THICKNESSES SHOWN ARE FOR REPRESENTATIONAL PURPOSES.
- DRAWINGS NOT TO SCALE.

INSTALLATION NOTES

- UNDERDRAIN AND FALSE FLOOR INSTALLED BY OCEAN PROTECT.

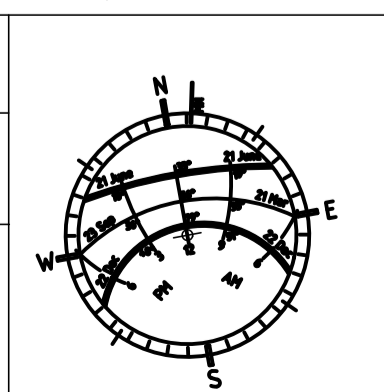
OCEAN PROTECT
 STORMFILTER SYSTEM
 DETENTION TANK ARRANGEMENT
 SPECIFICATION DRAWING

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Issue	Description	Date of Drawing
B	Incorporate Council's Comments re WSUD	20 Apr. 2021
A	Development Application	28 Jan. 2021

Drawn & Designed By :	R. Koh
Checked By :	N. Evans
Approved By :	Kenneth T. NG MIE Aust CP Eng NER APEC Engineer IntPE(Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)



Designed By
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 M: 0433 778 109
 E : ken@ingengineers.com.au

Project
 Proposed Seniors Living (Stage 2)
 At
 5 Skyline Place
 Frenchs Forest NSW 2086
 Client

Drawing Title	Water Sensitive Urban Design	
Date	January 2021	Scale
		As Shown @ A1
Project No.	284012021DA	Drawing & Sheet No./Issue
		28401-18/21 / B

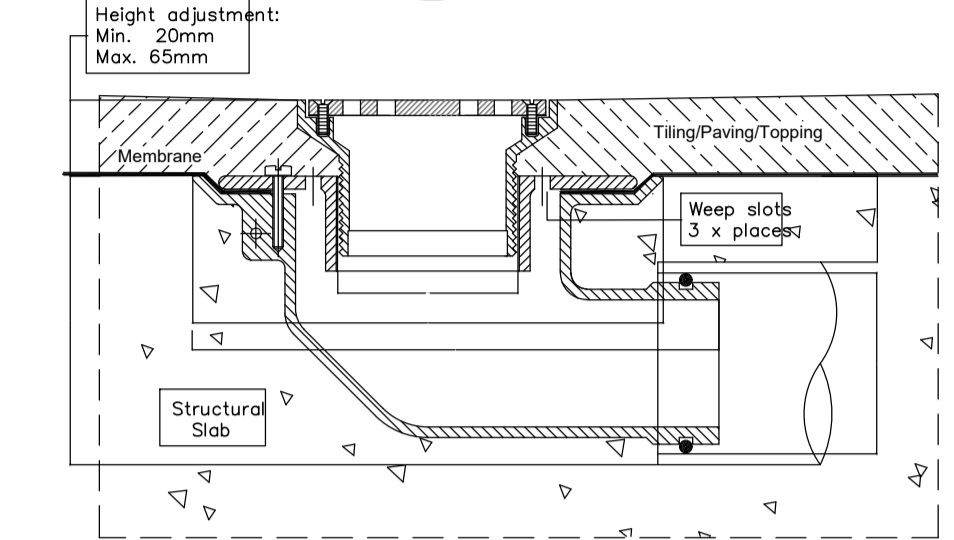
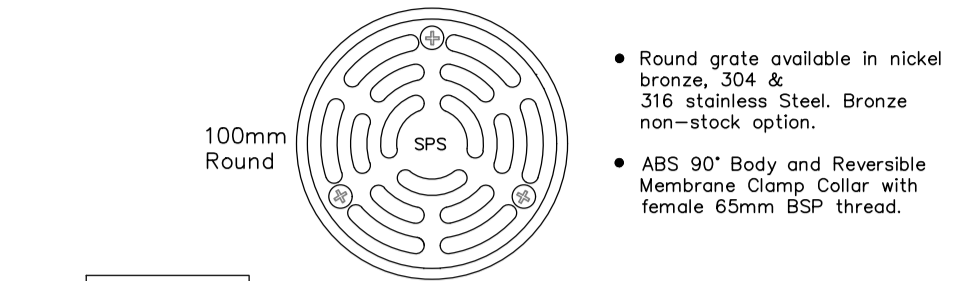
VERIFY ALL DISCREPANCIES WITH PROJECT ARCHITECT/ MANAGER PRIOR TO PROCEEDING WITH ANY WORKS. **Do not scale off drawings.**

- 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 WITHSTANDING 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 FLUSH 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 ACCORDANCE 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.

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)

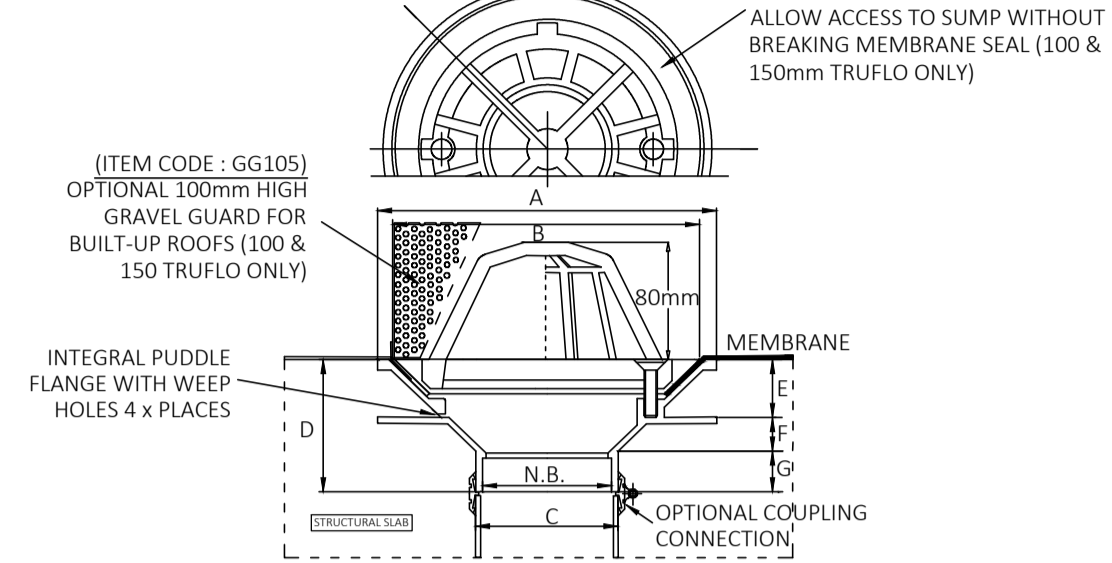


N.B.	A	B	C	D
50	100	40	180	200
65	105	37	180	200

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

SPS TRUFLO & SUPERFLO DOME GRATE RWO (2-PIECE DOME GRATE, MEMBRANE CLAMP)

SUGGESTED APPLICATIONS:
 MEMBRANED ROOFS, CONCRETE BOX GUTTERS, GRAVEL ROOFS



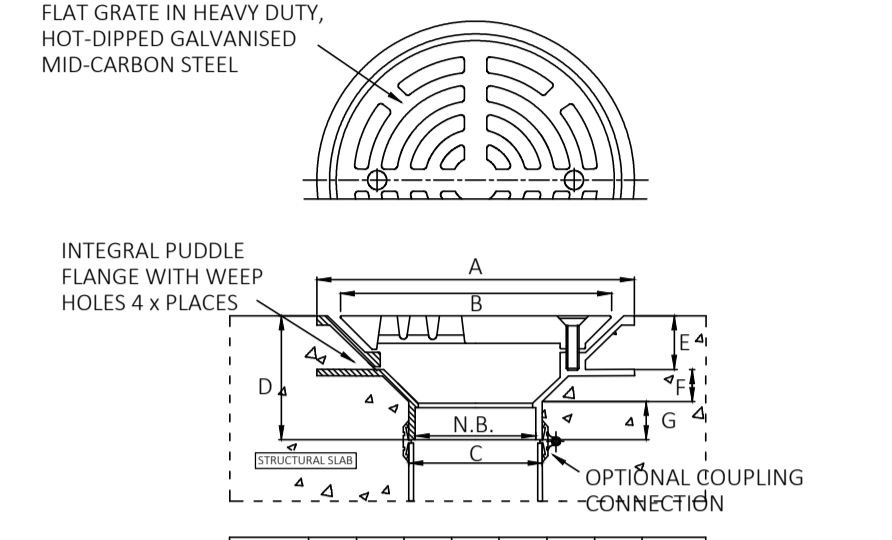
N.B.	A	B	C	D	E	F	G	H	I	J
100	200	180	250	80	33	22	25	25	25	25
150	260	240	300	80	48	4	28	22	25	25
200	300	280	340	80	66	49	38	22	25	25

SPECIALITY PLUMBING SUPPLIES PTY LTD
 TEL : (02) 9416 8031 FAX : (02) 9416 7614 E-MAIL : SP5@BIGPOND.NET.AU

ROOF RAINWATER WATER OUTLET (RWO) 100 TRUFLO
NOT TO SCALE

SPS TRUFLO & SUPERFLO FLAT GRATE RWO (1-PIECE GRATE, NO MEMBRANE CLAMP)

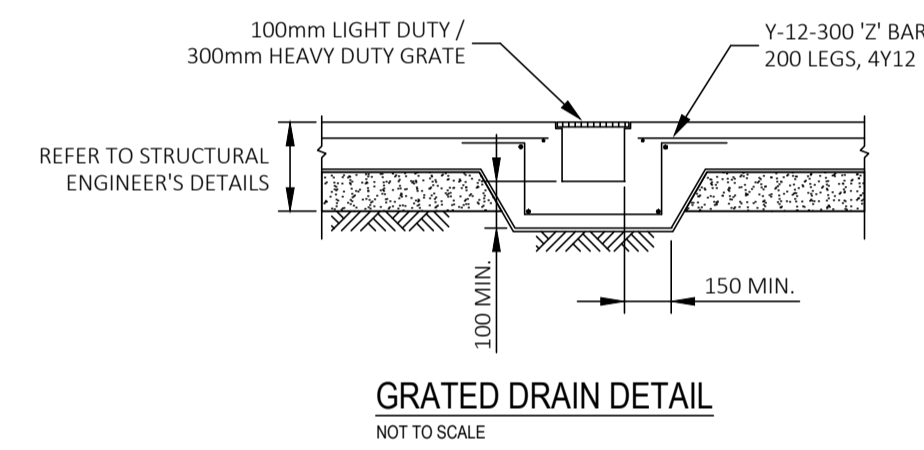
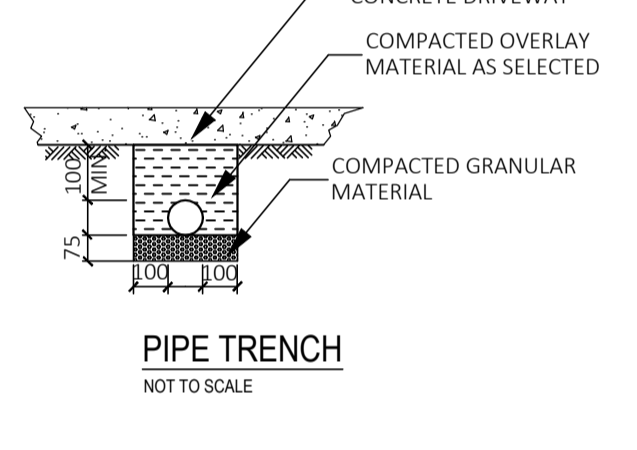
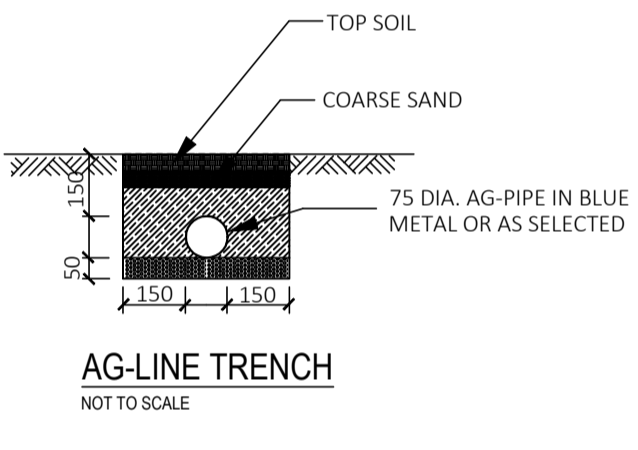
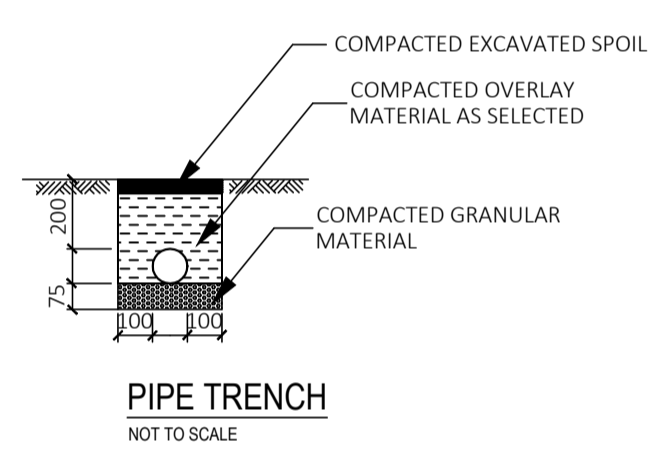
SUGGESTED APPLICATIONS:
 CAR PARK DECKS
 PLANT ROOMS
 PEDESTRIAN PRECINCTS



N.B.	A	B	C	D	E	F	G	H	I	J
100	200	180	250	80	33	22	25	25	25	25
150	260	240	300	80	48	4	28	22	25	25
200	300	280	340	80	66	49	38	22	25	25

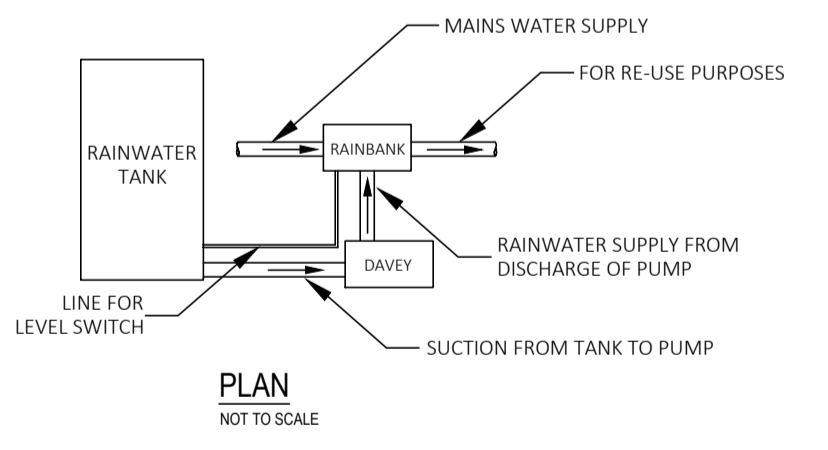
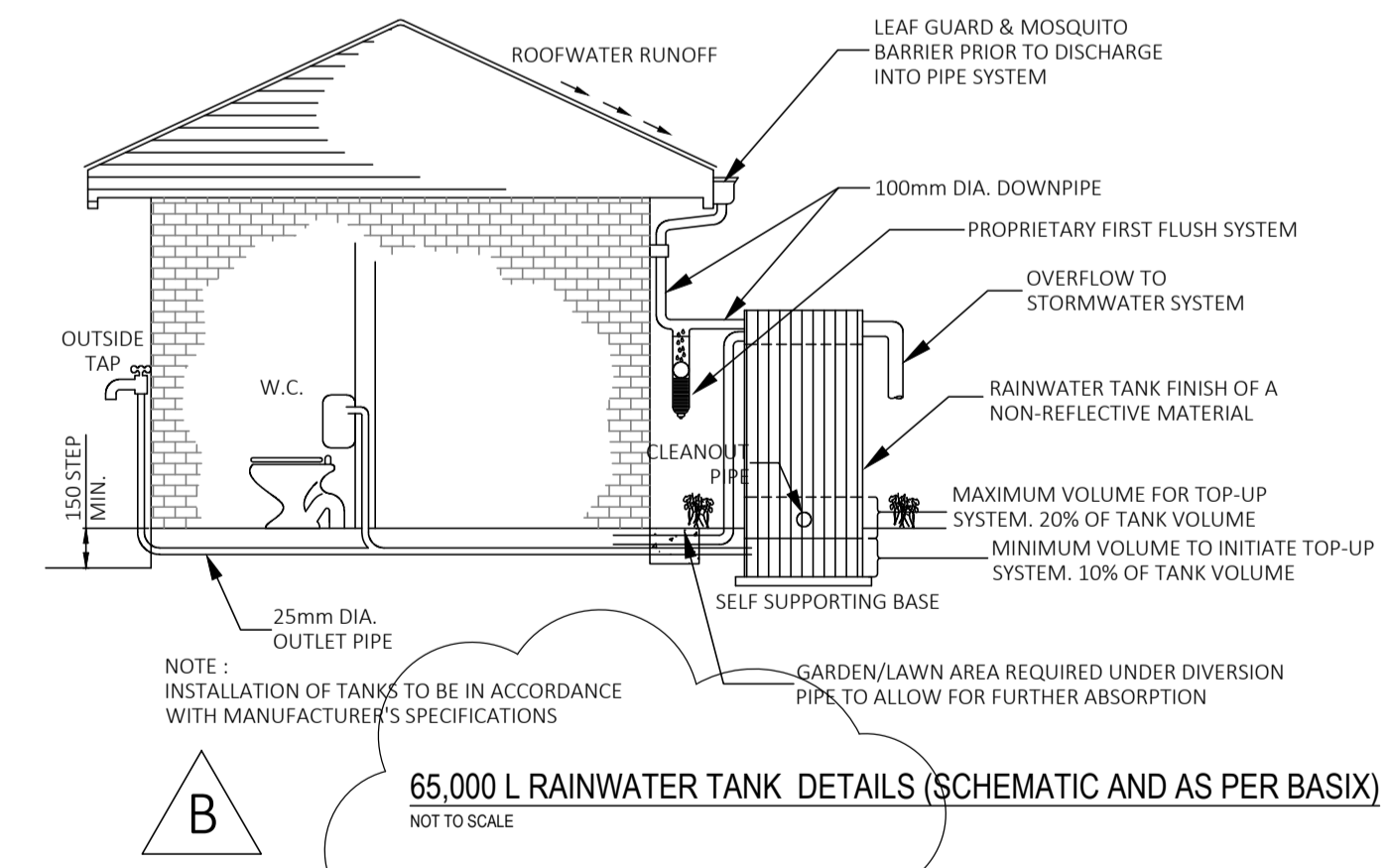
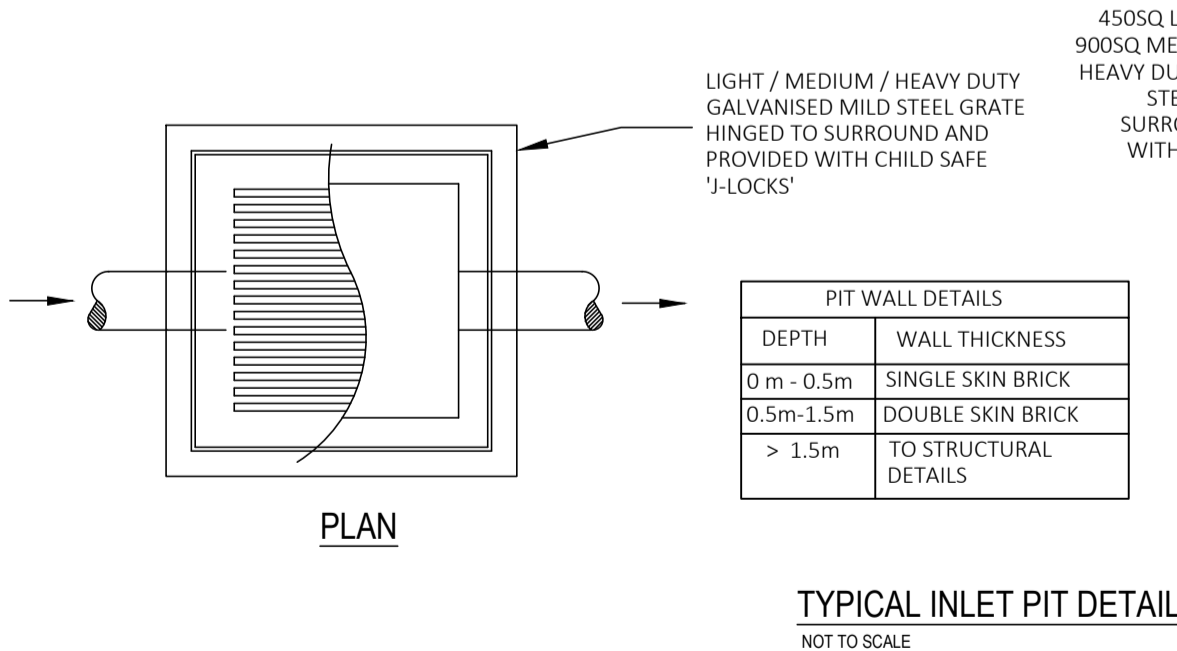
SPECIALITY PLUMBING SUPPLIES PTY LTD
 TEL : (02) 9416 8031 FAX : (02) 9416 7614 E-MAIL : SP5@BIGPOND.NET.AU

CARPARK TRUFLOW (RWO)
NOT TO SCALE



NOT FOR CONSTRUCTION

- 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.N.O.



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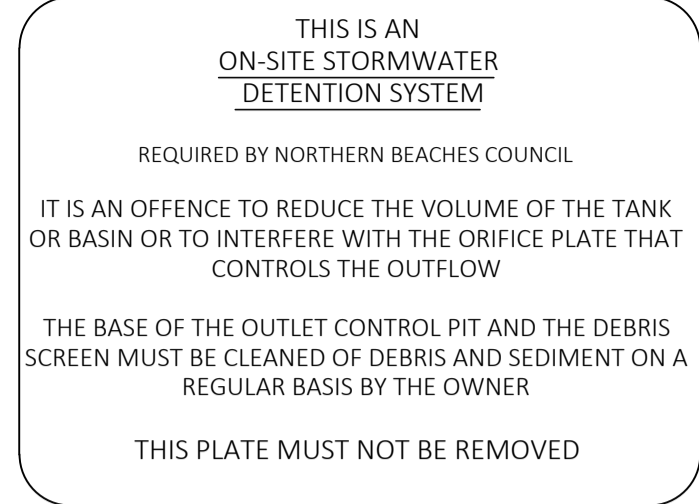
VERIFY ALL DISCREPANCIES WITH PROJECT ARCHITECT/ MANAGER PRIOR TO PROCEEDING WITH ANY WORKS. **Do not scale off drawings.**

			Drawn & Designed By : R. Koh		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 Seniors Living (Stage 2)	Drawing Title Notes & Details	
			Checked By : N. Evans			At 5 Skyline Place Frenchs Forest NSW 2086	Date January 2021	Scale As Shown @ A1
B	Incorporate Council's Comments re WSUD	20 Apr. 2021	Approved By : Kenneth T. NG MIEAust CPEng NER APEC Engineer IntPE(Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)			Client	Project No. 284012021DA	Drawing & Sheet No./Issue 28401-19/21 / B
A	Development Application	28 Jan. 2021						
Issue	Description	Date of Drawing						

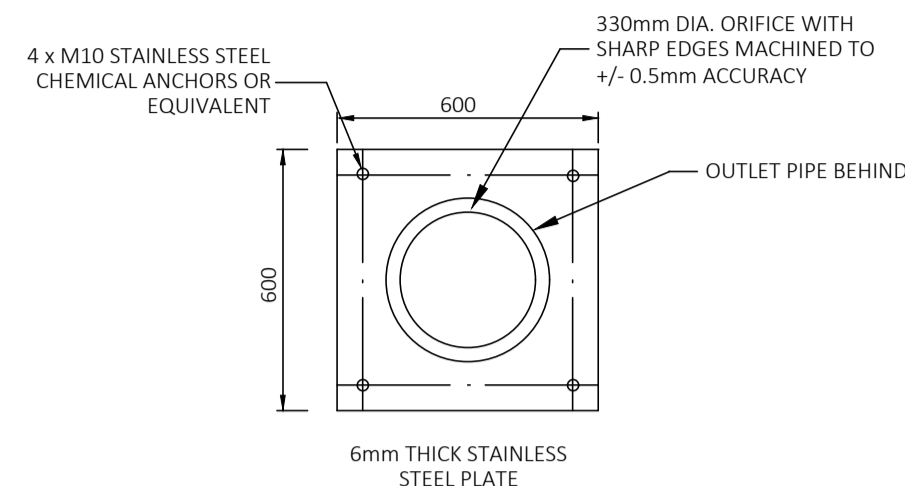


CONFINED SPACE SIGNAGE
NOT TO SCALE

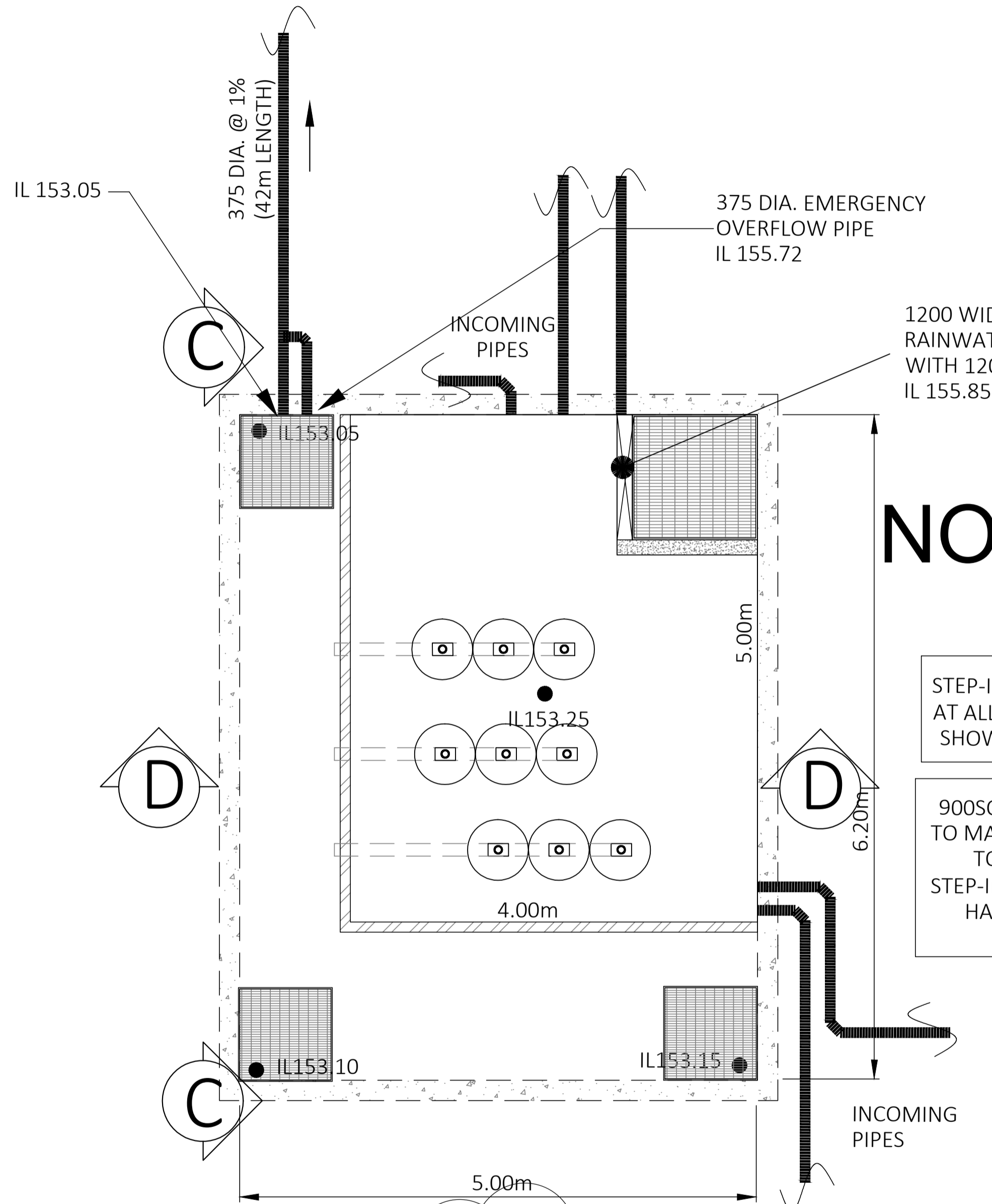
110mm X 80mm SIGN TO BE PLACED AT VISIBLE LOCATION AT OSD TANK, TO READ:



OSD SIGNAGE
NOT TO SCALE



ORIFICE PLATE DETAIL
NOT TO SCALE

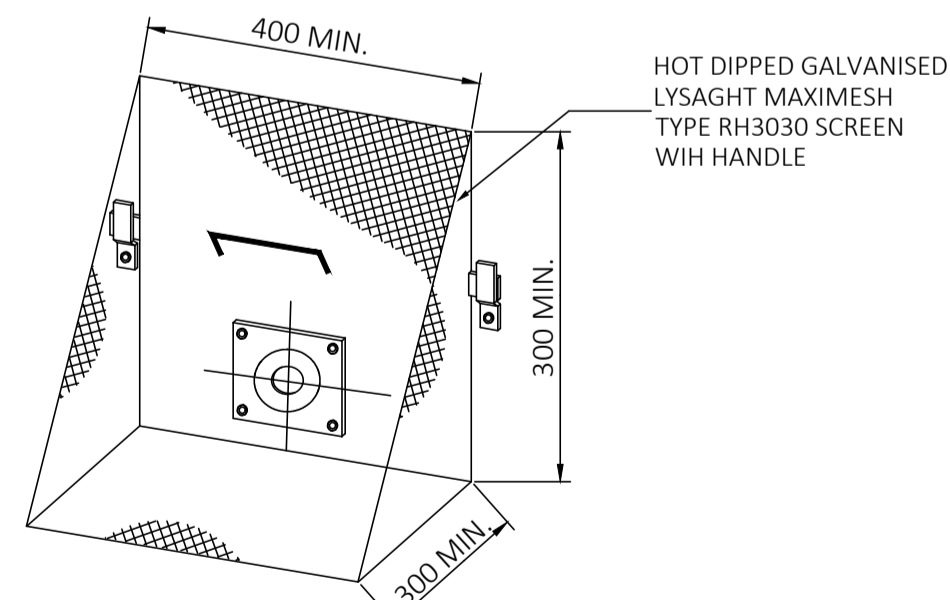


ON-SITE DETENTION TANK - PLAN
NOT TO SCALE

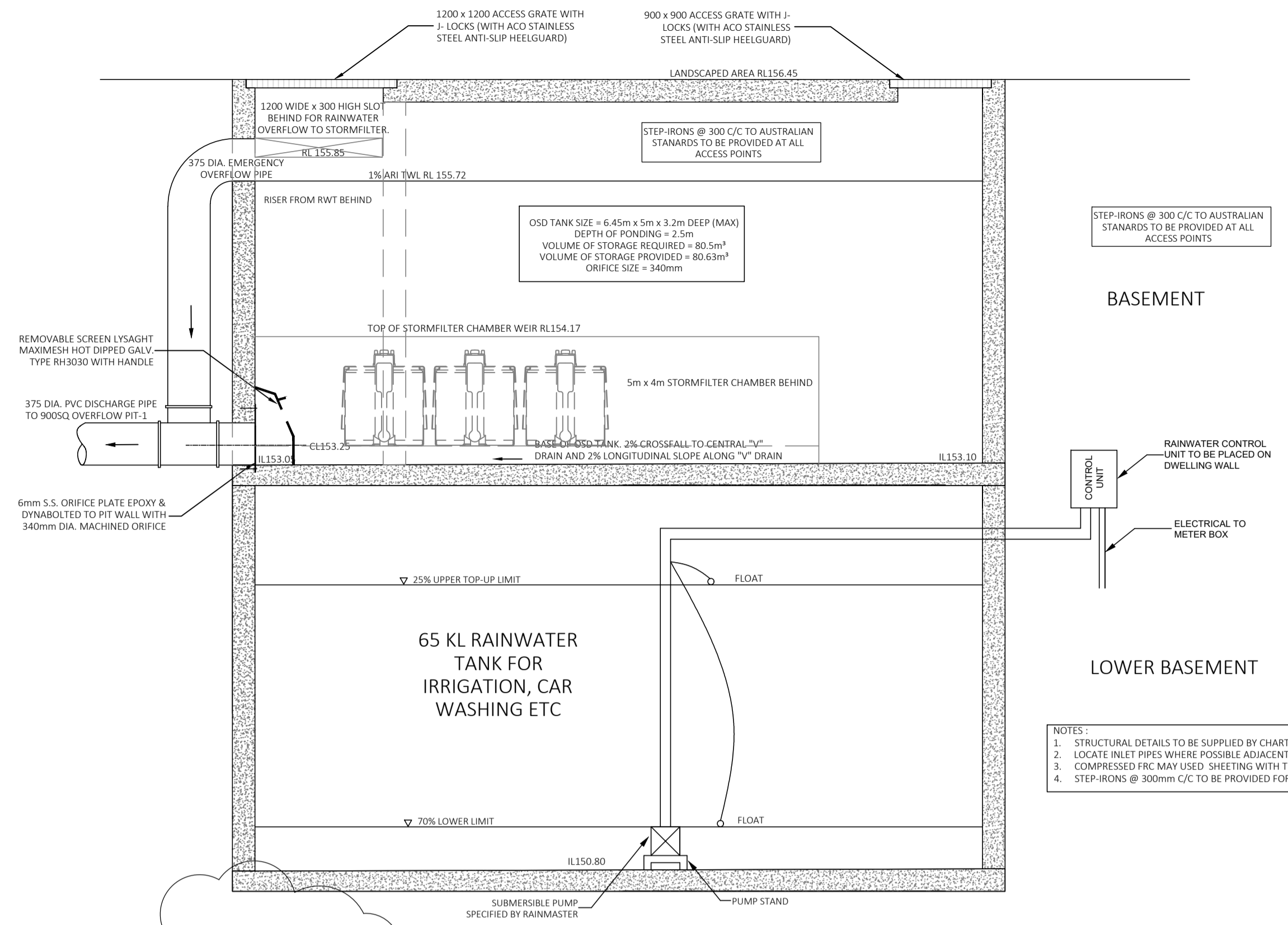
NOT FOR CONSTRUCTION

STEP-IRONS @ 300 C/C AT ALL ACCESSES (NOT SHOWN FOR CLARITY)

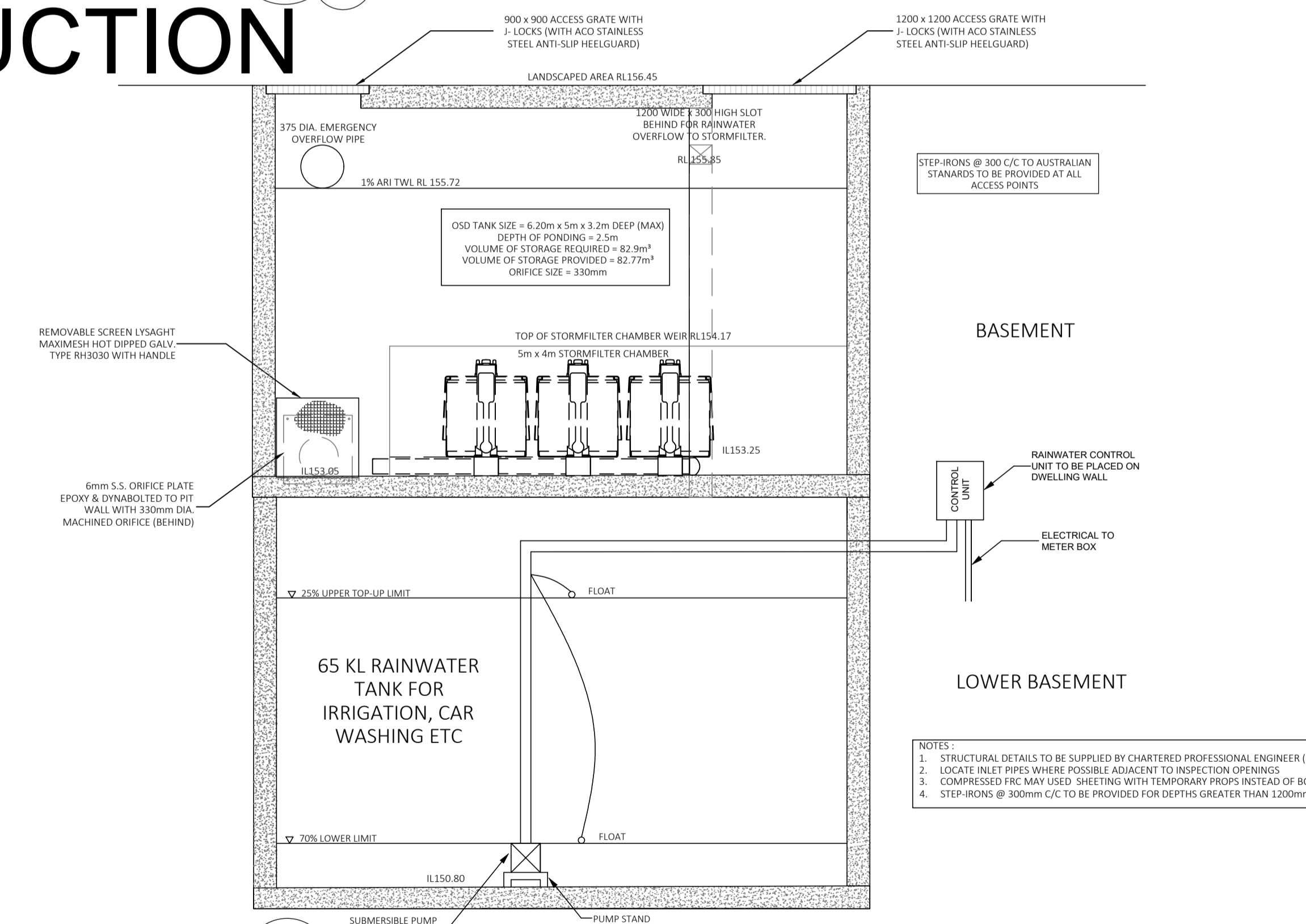
900SQ. AND 1200SQ. ACCESS GRATES TO MATCH FINISHED RLS. ALL ACCESSES TO OSD TO BE PROVIDED WITH STEP-IRONS @ 300 C/C AND GRATES TO HAVE ACO-HEELGARDS AND ARE LOCKABLE



TRASH SCREEN DETAIL
NOT TO SCALE



SECTION C - C THROUGH ON-SITE DETENTION TANK WITH DISCHARGE CONTROL PIT AND 65KL RAINWATER BELOW DETAIL
NOT TO SCALE



SECTION D - D THROUGH ON-SITE DETENTION TANK WITH DISCHARGE CONTROL PIT AND 65KL RAINWATER BELOW DETAIL
NOT TO SCALE

- NOTES:
1. STRUCTURAL DETAILS TO BE SUPPLIED BY CHARTERED PROFESSIONAL ENGINEER (STRUCTURAL).
 2. LOCATE INLET PIPES WHERE POSSIBLE ADJACENT TO INSPECTION OPENINGS.
 3. COMPRESSED FRC MAY BE USED SHEETING WITH TEMPORARY PROPS INSTEAD OF BONDECK.
 4. STEP-IRONS @ 300mm C/C TO BE PROVIDED FOR DEPTHS GREATER THAN 1200mm.

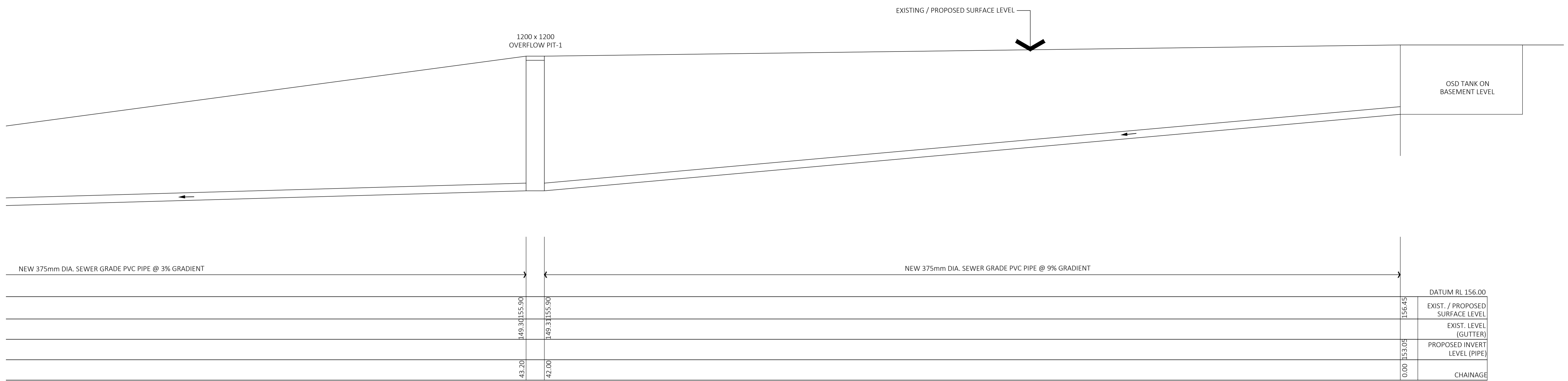
- NOTES:
1. STRUCTURAL DETAILS TO BE SUPPLIED BY CHARTERED PROFESSIONAL ENGINEER (STRUCTURAL).
 2. LOCATE INLET PIPES WHERE POSSIBLE ADJACENT TO INSPECTION OPENINGS.
 3. COMPRESSED FRC MAY BE USED SHEETING WITH TEMPORARY PROPS INSTEAD OF BONDECK.
 4. STEP-IRONS @ 300mm C/C TO BE PROVIDED FOR DEPTHS GREATER THAN 1200mm.

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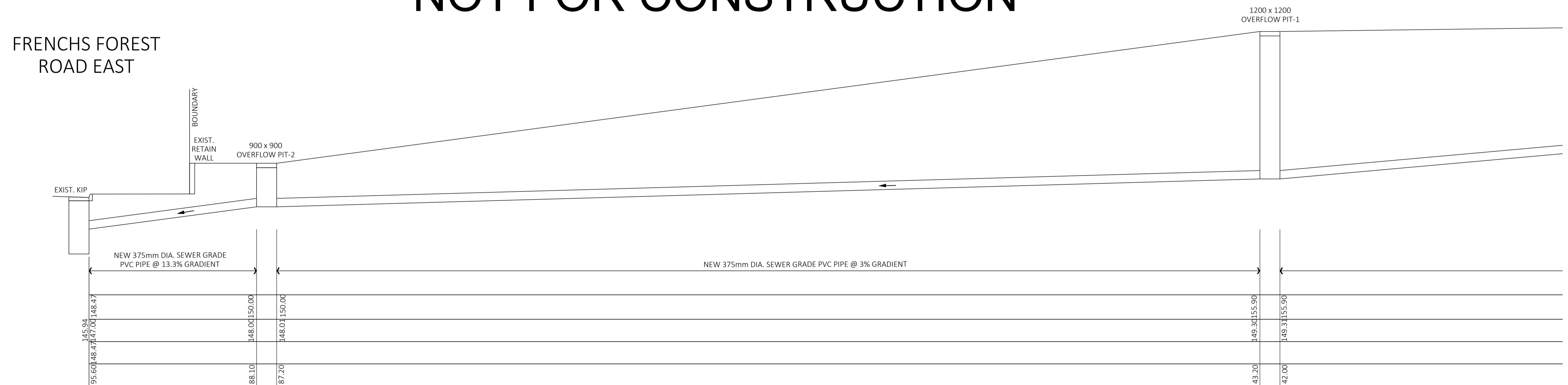
	Drawn & Designed By : R. Koh	Designed By : ING CONSULTING ENGINEERS PTY LTD P. O BOX 1543 BAULKHAM HILLS NSW 1755 F : (02) 8807 5656 M: 0433 778 109 E : ken@ingengineers.com.au	Project : Proposed Seniors Living (Stage 2)	Drawing Title : Notes & Details 2	
	Checked By : N. Evans		At : 5 Skyline Place Frenchs Forest NSW 2086	Date : January 2021	Scale : As Shown @ A1
B	Incorporate Council's Comments re WSUD	Approved By : Kenneth T. NG MIEAust CPEng NER APEC Engineer IntPE(Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)	Client : 284012021DA	Project No. : 284012021DA	Drawing & Sheet No./Issue : 28401-20/21 / B
A	Development Application				
Issue	Description	Date of Drawing			



OSD / PIPE LONGITUDINAL SECTION

SCALE 1 : 100

NOT FOR CONSTRUCTION



OSD / PIPE LONGITUDINAL SECTION (CONTINUE)

SCALE 1 : 100

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			Drawn & Designed By : R. Koh	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 Seniors Living (Stage 2) At 5 Skyline Place Frenchs Forest NSW 2086 Client	Drawing Title OSD and Discharge Pipe Long Section	
			Checked By : N. Evans			Date January 2021	Scale 1 : 100 @ A1
B	Incorporate Council's Comments re WSUD	20 Apr. 2021	Approved By : Kenneth T. NG MIEAust CPEng NER APEC Engineer IntPE(Aus) (Reg. No. 2206352) RPEQ Registered Certifier (Hydraulic (stormwater), Road & Drainage and Stormwater) NSW Fair Trading (Reg. No. BDC0827)			Project No. 284012021DA	Drawing & Sheet No./Issue 28401-21/21 / B
A	Development Application	28 Jan. 2021				Issue Description	Date of Drawing

Appendix 3

DRAINS Model Results

DRAINS results prepared from Version 2020.061

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Overflow Pit -1	150		0		5.9		None
Overflow Pit-2	148.7		0		1.3		None
KIP	147.12		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Lot1-Pre	0.282	0	0.282	5	5	0	AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1
Lot1-Post (ex bypass)	0.304	0.207	0.097	5	5	0	AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1
Bypass Area	0.01	0	0.01	5	5	0	AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.48 impervious + 1.08 pervious = 1.56 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 5 year, 5 minutes storm, average 154 mm/h, Zone 1	200.48	103.05 (51.4%)	57.36 (92.2%)	45.68 (33.0%)
AR&R 5 year, 10 minutes storm, average 120 mm/h, Zone 1	312.44	192.10 (61.5%)	92.10 (95.0%)	99.99 (46.4%)
AR&R 5 year, 15 minutes storm, average 101 mm/h, Zone 1	394.46	254.93 (64.6%)	117.55 (96.0%)	137.38 (50.5%)
AR&R 5 year, 20 minutes storm, average 88.0 mm/h, Zone 1	458.25	302.86 (66.1%)	137.35 (96.6%)	165.51 (52.4%)
AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1	514.22	341.37 (66.4%)	154.72 (97.0%)	186.65 (52.6%)
AR&R 5 year, 30 minutes storm, average 72.0 mm/h, Zone 1	562.39	374.24 (66.5%)	169.67 (97.2%)	204.58 (52.7%)
AR&R 5 year, 45 minutes storm, average 59.0 mm/h, Zone 1	691.29	468.67 (67.8%)	209.66 (97.7%)	259.01 (54.3%)
AR&R 5 year, 1 hour storm, average 50.0 mm/h, Zone 1	781.1	530.42 (67.9%)	237.53 (98.0%)	292.89 (54.4%)
AR&R 5 year, 1.5 hours storm, average 39.0 mm/h, Zone 1	913.9	617.64 (67.6%)	278.74 (98.3%)	338.90 (53.8%)
AR&R 5 year, 2 hours storm, average 32.5 mm/h, Zone 1	1015.43	682.72 (67.2%)	310.25 (98.5%)	372.47 (53.2%)
AR&R 5 year, 6 hours storm, average 16.0 mm/h, Zone 1	1499.56	959.86 (64.0%)	460.47 (99.0%)	499.39 (48.3%)
AR&R 5 year, 9 hours storm, average 12.3 mm/h, Zone 1	1729.28	1055.65 (61.0%)	531.75 (99.1%)	523.90 (43.9%)

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 3	0.241	6.32	153.19	150.001	utes storm, average 79.0 mm/h, Zone 1
Pipe 2	0.241	4.18	149.491	148.701	utes storm, average 79.0 mm/h, Zone 1
Pipe 1	0.241	7.46	148.124	147.124	utes storm, average 79.0 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	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
OF	0	0	1.939	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	154.28	38.3	0.241	0.241	0

CONTINUITY CHECK for AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
KO	135.31	135.31	0	0
OSD	201.34	201.21	0.14	0
Overflow Pit -1	201.21	201.2	0	0
Overflow Pit-2	201.2	201.19	0	0
KIP	201.19	201.19	0	0
K O	4.71	4.71	0	0

Run Log for Stage 2 run at 22:09:07 on 9/6/2021 using version 2020.061
 No water upwelling from any pit. Freeboard was adequate at all pits.
 Flows were safe in all overflow routes.

DRAINS results prepared from Version 2020.061

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Overflow Pit -1	150.21		0		5.69		None
Overflow Pit-2	148.91		0		1.09		None
KIP	147.14		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Lot1-Pre	0.392	0	0.392	5	5	0	AR&R 20 year, 25 minutes storm, average 105 mm/h, Zone 1
Lot1-Post (ex bypass)	0.411	0.276	0.135	5	5	0	AR&R 20 year, 25 minutes storm, average 105 mm/h, Zone 1
Bypass Area	0.014	0	0.014	5	5	0	AR&R 20 year, 25 minutes storm, average 105 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.48 impervious + 1.08 pervious = 1.56 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 199 mm/h, Zone 1	259.06	161.10 (62.2%)	75.54 (94.0%)	85.56 (47.9%)
AR&R 20 year, 10 minutes storm, average 156 mm/h, Zone 1	406.17	285.21 (70.2%)	121.19 (96.2%)	164.02 (58.5%)
AR&R 20 year, 15 minutes storm, average 132 mm/h, Zone 1	515.53	375.03 (72.7%)	155.12 (97.0%)	219.91 (61.8%)
AR&R 20 year, 20 minutes storm, average 116 mm/h, Zone 1	604.05	447.03 (74.0%)	182.59 (97.4%)	264.44 (63.5%)
AR&R 20 year, 25 minutes storm, average 105 mm/h, Zone 1	683.46	509.27 (74.5%)	207.23 (97.7%)	302.04 (64.1%)
AR&R 20 year, 30 minutes storm, average 96.0 mm/h, Zone 1	749.86	560.56 (74.8%)	227.84 (97.9%)	332.72 (64.3%)
AR&R 20 year, 45 minutes storm, average 78.0 mm/h, Zone 1	913.89	688.04 (75.3%)	278.74 (98.3%)	409.31 (64.9%)
AR&R 20 year, 1 hour storm, average 67.0 mm/h, Zone 1	1046.67	792.73 (75.7%)	319.94 (98.5%)	472.79 (65.5%)
AR&R 20 year, 1.5 hours storm, average 52.0 mm/h, Zone 1	1218.5	919.89 (75.5%)	373.26 (98.7%)	546.63 (65.0%)
AR&R 20 year, 2 hours storm, average 43.2 mm/h, Zone 1	1349.71	1015.10 (75.2%)	413.98 (98.8%)	601.13 (64.6%)
AR&R 20 year, 6 hours storm, average 21.1 mm/h, Zone 1	1977.67	1417.64 (71.7%)	608.83 (99.2%)	808.81 (59.3%)
AR&R 20 year, 9 hours storm, average 16.3 mm/h, Zone 1	2291.67	1560.83 (68.1%)	706.27 (99.3%)	854.57 (54.1%)

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 3	0.312	6.79	153.21	150.212	utes storm, average 105 mm/h, Zone 1
Pipe 2	0.312	4.51	149.521	148.912	utes storm, average 105 mm/h, Zone 1
Pipe 1	0.312	7.83	148.144	147.144	utes storm, average 105 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	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
OF	0	0	1.939	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	155.04	61.7	0.312	0.312	0

CONTINUITY CHECK for AR&R 20 year, 25 minutes storm, average 105 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
KO	218.96	218.96	0	0
OSD	282.68	282.5	0.19	0
Overflow Pit -1	282.5	282.49	0	0
Overflow Pit-2	282.49	282.48	0	0
KIP	282.48	282.48	0	0
K O	7.62	7.62	0	0

Run Log for Stage 2 run at 22:10:08 on 9/6/2021 using version 2020.061
 No water upwelling from any pit. Freeboard was adequate at all pits.
 Flows were safe in all overflow routes.

DRAINS results prepared from Version 2020.061

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Overflow Pit -1	150.4		0		5.5		None
Overflow Pit-2	149.1		0		0.9		None
KIP	147.16		0				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Lot1-Pre	0.479	0	0.479	5	5	0	AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1
Lot1-Post (ex bypass)	0.5	0.335	0.165	5	5	0	AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1
Bypass Area	0.017	0	0.017	5	5	0	AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.48 impervious + 1.08 pervious = 1.56 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 276.1 mm/h, Zone 1	359.54	261.08 (72.6%)	106.72 (95.7%)	154.36 (62.2%)
AR&R 100 year, 10 minutes storm, average 211.2 mm/h, Zone 1	549.89	428.30 (77.9%)	165.79 (97.2%)	262.51 (69.2%)
AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1	688.15	546.64 (79.4%)	208.69 (97.7%)	337.96 (71.2%)
AR&R 100 year, 20 minutes storm, average 153.4 mm/h, Zone 1	798.8	639.86 (80.1%)	243.03 (98.0%)	396.83 (72.0%)
AR&R 100 year, 25 minutes storm, average 136.9 mm/h, Zone 1	891.09	715.11 (80.3%)	271.66 (98.2%)	443.44 (72.2%)
AR&R 100 year, 30 minutes storm, average 124.4 mm/h, Zone 1	971.69	780.99 (80.4%)	296.67 (98.4%)	484.32 (72.3%)
AR&R 100 year, 45 minutes storm, average 99.58 mm/h, Zone 1	1166.72	939.91 (80.6%)	357.19 (98.7%)	582.72 (72.4%)
AR&R 100 year, 1 hour storm, average 84.46 mm/h, Zone 1	1319.43	1064.34 (80.7%)	404.58 (98.8%)	659.76 (72.5%)
AR&R 100 year, 2 hours storm, average 56.68 mm/h, Zone 1	1770.9	1434.30 (81.0%)	544.67 (99.1%)	889.63 (72.8%)
AR&R 100 year, 4.5 hours storm, average 35 mm/h, Zone 1	2460.47	1971.32 (80.1%)	758.64 (99.4%)	1212.68 (71.5%)
AR&R 100 year, 6 hours storm, average 29.63 mm/h, Zone 1	2777.28	2196.08 (79.1%)	856.95 (99.4%)	1339.12 (69.9%)
AR&R 100 year, 9 hours storm, average 23 mm/h, Zone 1	3233.83	2471.68 (76.4%)	998.63 (99.5%)	1473.05 (66.0%)

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 3	0.365	7.11	153.224	150.405	utes storm, average 136.9 mm/h, Zone 1
Pipe 2	0.365	3.12	149.685	149.105	utes storm, average 136.9 mm/h, Zone 1
Pipe 1	0.365	8.21	148.156	147.156	utes storm, average 136.9 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Chainage (m)	Max HGL (m)	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
OF	0	0	1.939	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	155.72	82.9	0.365	0.365	0

CONTINUITY CHECK for AR&R 100 year, 15 minutes storm, average 176.2 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
KO	245	245	0	0
OSD	293.11	293.06	0.05	0
Overflow Pit -1	293.06	293.06	0	0
Overflow Pit-2	293.06	293.05	0	0
KIP	293.05	293.05	0	0
K O	8.53	8.53	0	0

Run Log for Stage 2 run at 20:43:14 on 25/4/2021 using version 2020.061
 No water upwelling from any pit. Freeboard was adequate at all pits.
 Flows were safe in all overflow routes.

Appendix 4

Maintenance for SQUID and On-Site Detention

**Detailed below is the Maintenance Schedule for
Water Sensitive Urban Design Assets issued in respect to
5 Skyline Place Frenchs Forest NSW 2086.**

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 Oceanguard 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:		
Oceanguard	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 Tank in issued in respect to 5 Skyline Place Frenchs Forest NSW 2086.

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	