Tuesday, 21st December 2016

Warren Smith & Partners

35 YEARS OF SERVICE

Attention: Mr Mick O'Driscoll
Donald Cant Watts Corke (NSW) Pty Ltd
Level 1 14 Martin Place
Sydney, NSW 2000

Project No. 2016-5320001

Dear Mick,

RE: North Shore Private Hospital – 12 Frederick Street, St. Leonards
DA-2016/211 – Stormwater Management

Warren Smith & Partners has drafted this letter in response to Willoughby City Council's (Council) letter, dated 10th August 2016, in relation to the subject property. The items to be addressed are on-site detention (OSD) and overland flow as follows.

1. ON-SITE DETENTION

As it is intended to subdivide the site into two (2) lots, Council state that pursuant to Part C5 of Council's DCP and Technical Standards, an OSD system is required to be provided.

1.1 LOT 1

With reference to a meeting held with Council on 26th August 2016, it was noted that on-site detention (OSD) has been designed for the development within the Lot 1 sub-division and will be provided in the upcoming development application in accordance with Council's DCP and Technical Standards. Please find attached the following items: -

1. An extract from the development application report detailing the proposed OSD system for Lot 1, and;
2. Development application drawings C4.01 and C4.03 which provide further details on the proposed OSD system.

1.2 LOT 2

In relation to the Lot 2 sub-division, it was agreed that OSD requirements would be addressed by providing a concept OSD plan and that Council will consider and advise if a bond can be put in place in lieu of OSD. It was proposed that a bond be provided for a 3 to 5 year period and if the subdivision was not developed during this time, an OSD would subsequently be provided. Please find attached the following items: -

1. Lot 2 concept OSD calculations, and;
2. Concept sketch SK-01 illustrating an indicative layout for the OSD tank.

2. OVERLAND FLOW

In order to protect the private property from damage by any potential overland flow, Council has requested that an overland flowpath study be undertaken. Lyall & Associates (Lyall) has undertaken an overland flowpath study to assess patterns of overland flow in the vicinity of No. 12 Frederick Street.

A DRAINS model was used to assess the capacity of the existing piped drainage system and to determine the magnitude of surcharge flow for storms up to the 1% AEP storm event. HEC-RAS modelling software was used to assess the depth at which the stormwater which surcharges the existing piped system will be conveyed in the roads that border the property. Please refer to the Lyall Overland Flowpath Study attached.

A total of three (3) HEC-RAS models were undertaken as follows: -

- Reserve Road West
- Reserve Road East which extend along the south side of Frederick Street
- Westbourne Street

Please refer to Figure 2 in the Lyall study for a plan illustrating the above HEC-RAS models.

2.1 HYDRAULIC MODELLING RESULTS

A summary of the key findings of the investigation area are as follows: -

RESERVE ROAD WEST

- Overland flow does not overtop the crown of the road and contribute to flow along the eastern side of Reserve Road.

RESERVE ROAD EAST

- As the overland flow along the western side of Reserve Road does not surcharge to the eastern side for storm events up to the 1% AEP, flow along the eastern kerbline of Reserve Road is generated entirely by the 0.3 Ha catchment shown in Figure 1 of the Lyall study.

- Depths of overland flow along the eastern kerbline of Reserve Road are not sufficient to surcharge the road reserve adjacent to the property.

WESTBOURNE STREET

- Depth of overland flow are not sufficient to result in surcharge of the road reserve.

2.2 CONCLUSION

The hydrologic and hydraulic modelling undertaken has demonstrated that overland flow will be contained within the road reserve and therefore not discharge into the property during storms up to and including the 1% AEP storm event.

Please call if you wish to discuss.

Regards,

Michael Cahalane

Director - Water and Civil Engineering
Phone: 02 8234 8640
Mobile: 0433 522 569
Email: michael@warrensmith.com.au

Attachments Enclosed: -

1. Lot 1 Development Application Report Extract
2. Lot 1 Development Application Drawings C4.01 and C4.03
3. Lot 2 Concept On-Site Detention & Permissible Site Discharge Calculations
4. Lot 2 Sketch SK-01 OSD Location Plan
5. Lyall & Associates Overland Flowpath Study

4. PROPOSED STORMWATER SYSTEM

The development site has a total catchment area of approximately 6,194 m². The breakdown of the proposed catchment is presented in Table 2 below.

Table 2: Breakdown of Total Site Catchment

Catchment Areas	Area (m²)	Percentage of Total Area (%)
Roof	4,243	68.5
Impervious	1,839	29.7
Pervious	112	1.8
Total	**6,194**	**100**

4.1 PROPOSED DRAINAGE SYSTEM

It is proposed that a total area of 5,968m² will capture rainfall and reticulate to the OSD tank located below the lower ground carpark LG3. This area includes the roof, driveway and southern garden beds.

The remaining area totalling 226m², located along the western side of the proposed development, will bypass the stormwater drainage and OSD system and discharge on to Reserve Road. The bypass are amounts to 3.65% of the total development area which is classed as minimal.

It is proposed that the OSD tank will have a total volume capacity of 236kL. The stormwater drainage and OSD systems have been designed in accordance with AS3500 and the Willoughby City Council requirements.

4.2 ON-SITE DETENTION & PERMISSIBLE SITE DISCHARGE

The required on-site detention (OSD) volume and permissible site discharge (PSD) have been calculated in accordance with the Willoughby City Council's DCP, August 2006, *Attachment 20, OSD Technical Standard No.1*. Please refer to *Schedule 1* for the Willoughby City Council OSD Checklist.

4.2.1 OSD CALCULATION

The proposed development area has a total site area of approximately 6,194 m².

The volume of OSD storage has been calculated to be approximately 236 m³ and is in accordance with the OSD Technical Standard, *Table 1 – Site Storage Requirements per impervious area*. Please refer to Table 3 below for a summary of the OSD calculation.

Table 3: Option A - OSD Calculations

Zone	Volume of Storage Required per Cubic Metre (m³/100m²)	Area of Site (m²)	OSD Volume Required (m³)
3	3.8	6,194	235.37

4.2.2 PSD CALCULATION

The PSD has been calculated to be approximately 111 L/sec and is in accordance with the OSD Technical Standard, *Table 2 – Permissible Site Discharge per impervious area*. Please refer to Table 4 below for a summary of the PSD calculation.

Table 4: Option A - PSD Calculations

Zone	Permissible Site Discharge per Cubic Metre (L/sec/Ha)	Area of Site (Ha)	Maximum PSD (L/sec)
3	180	0.6194	111.49

The proposed OSD tank will be constructed with a sediment sump and a trash screen located immediately upstream of the outlet pipe. It is proposed that a minimum area of 0.60m x 0.60m and a minimum depth of 0.2m below the invert level of the outlet pipe will be provided for the sediment sump.

4.3 CONNECTION TO EXISTING DRAINAGE

It is proposed that stormwater will be discharged from the OSD tank, via a 168mm diameter orifice. The orifice size was calculated using the following equation.

Orifice Dia. (mm) = 21.8 x √ (PSD / (√ Head of Water (m) over the centreline of the orifice))

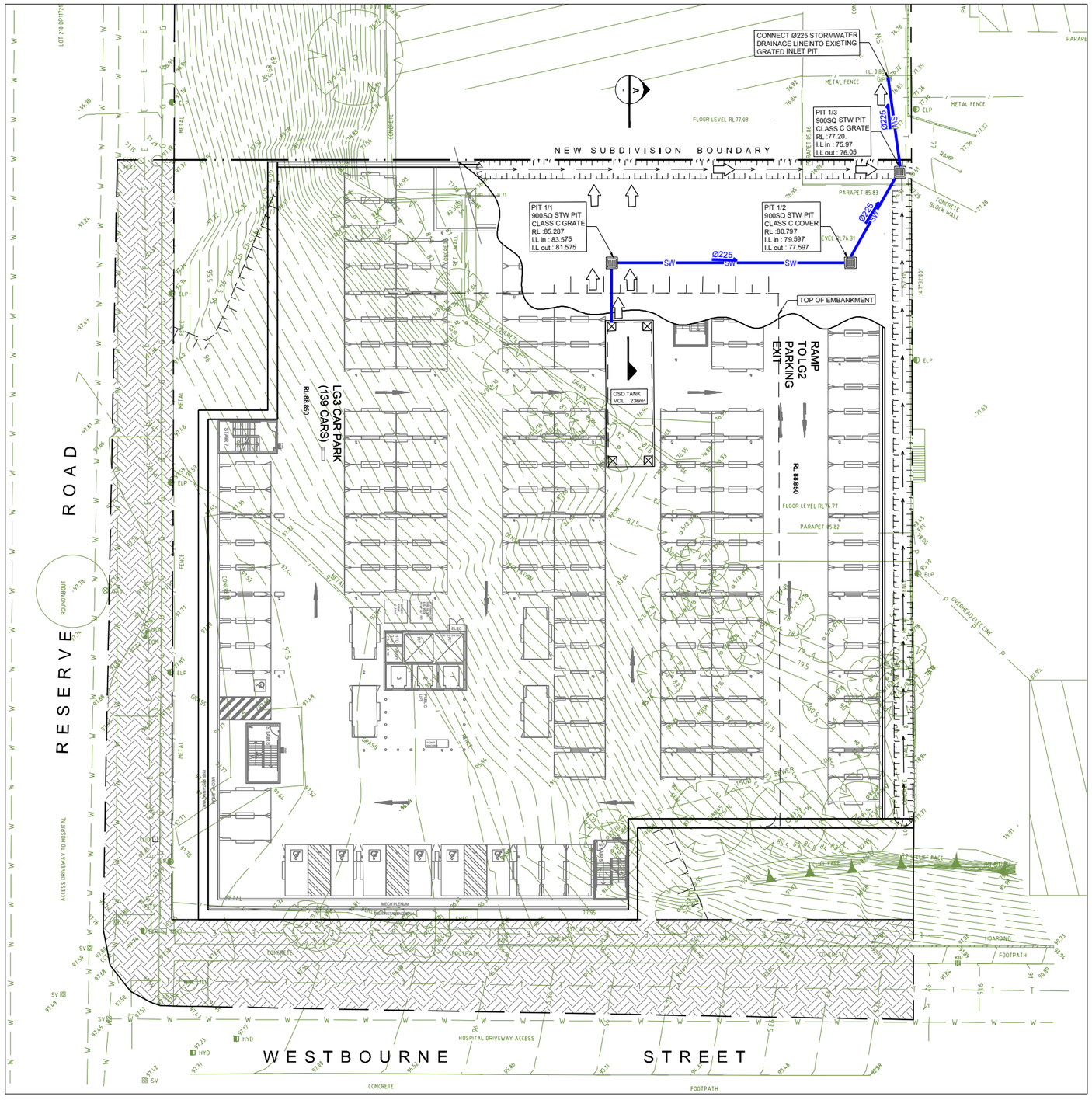
Orifice Dia. (mm) = 21.8 x √ (111 / (√ 3.466))

Orifice Dia. (mm) = 168

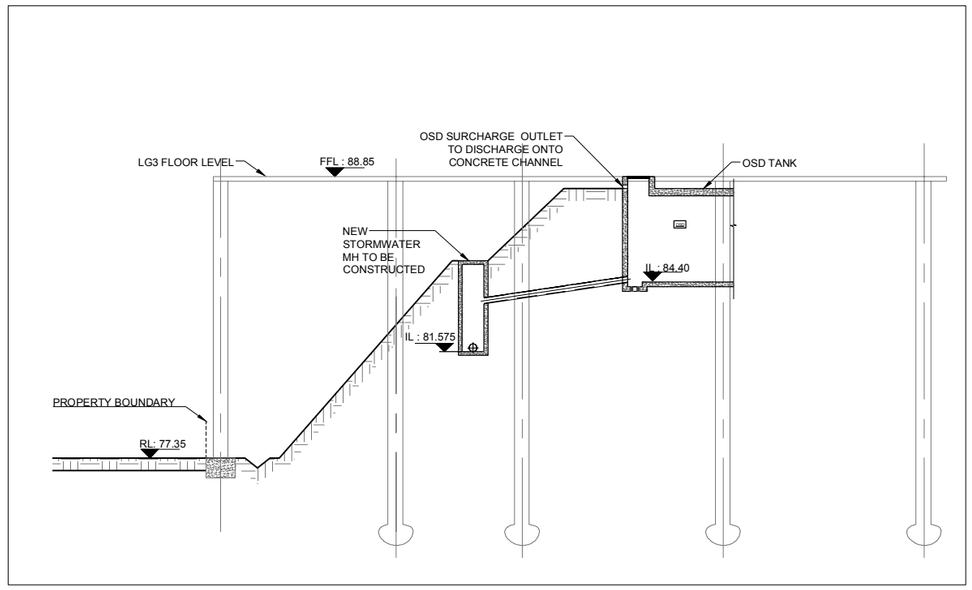
The discharge released through the orifice plate will reticulate via a new pit and pipe system connecting into an existing pit located at the norther eastern corner of the development area. This existing pit reticulates to the existing Council drainage infrastructure in Frederick Street via a pit and pipe system which runs along the eastern side of the property. Please refer to the WS+P DA Drawing Package for further details.

LEGEND

- SWALE
- 900 x 900 GRATED INLET PIT
- Ø225 — PIPE DIAMETER AND DIRECTION OF FLOW
- SW — STORMWATER PIPE
- OVERLAND FLOW



STORMWATER DRAINAGE LAYOUT
SCALE : 1:250



SECTION A - A
SCALE : NTS

DO NOT SCALE FROM DRAWINGS, CHECK & VERIFY ALL DIMENSIONS & LEVELS BEFORE COMMENCEMENT OF ANY WORK.

THIS DRAWING IS NOT TO BE COPIED IN PART OR WHOLE WITHOUT WRITTEN PERMISSION FROM WARREN SMITH AND PARTNERS.

NORTH

5.0 0 2.5 5.0 7.5 10.0m
PLAN SCALE 1:250 AT SHEET

ISSUE	AMENDMENT	DATE	ISSUE	AMENDMENT	DATE
A	PRELIMINARY ISSUE	09/05/16			

CLIENT
DEXUS PROPERTY GROUP

PROJECT
NORTH SHORE PRIVATE HOSPITAL

Warren Smith & Partners

Warren Smith & Partners Pty Ltd
1st Floor, 123 Clarence Street, Sydney 2000 NSW Australia
T 02 9299 1312 F 02 9290 1295 wsp@warrensmith.com.au
www.warrensmith.com.au ABN 36 300 430 126

CONSULTING ENGINEERS
Hydraulic Services Fire Protection Civil Engineering
Sydney Water Accredited Water Servicing Co-ordinator
- Design Project Management - Building Plan Approvals

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Lic No: QAC/RS10771

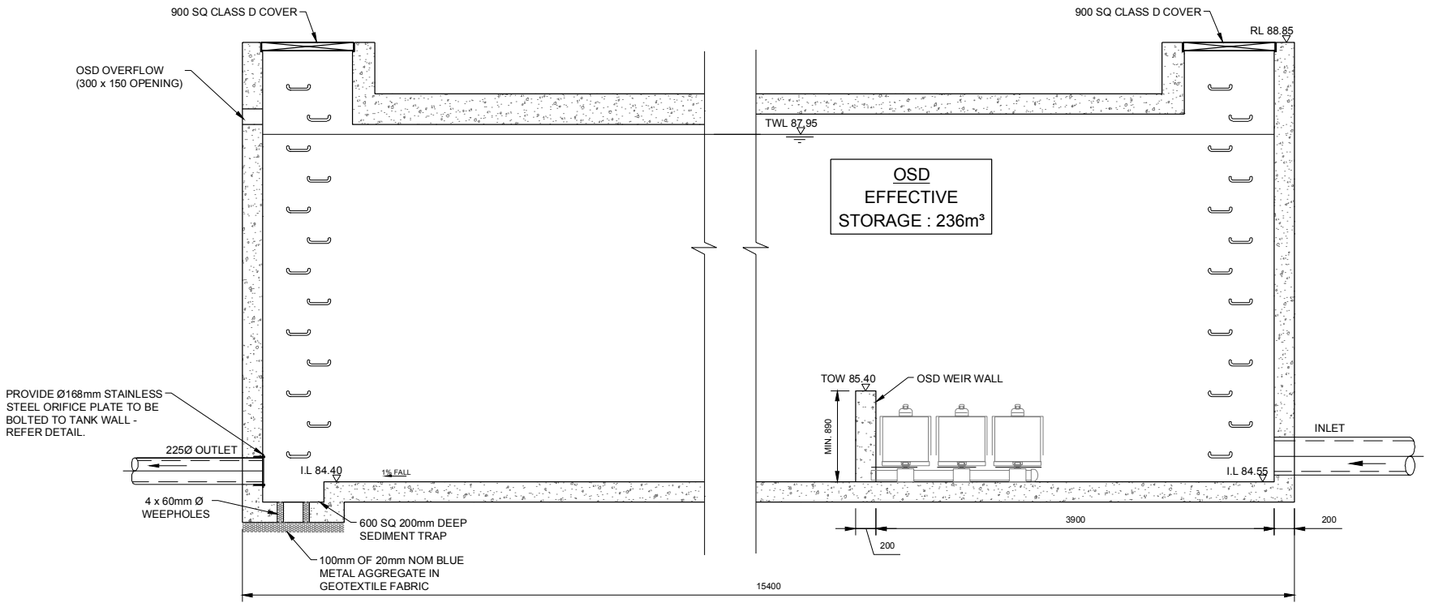
TITLE
STORMWATER DRAINAGE PLAN

SCALE	DRAWN	DESIGNED	CHECKED	APPROVED
AS SHOWN	P.G	L.S	L.S.	M.C.

JOB No.	DRAWING No.	ISSUE
5320001	C4.01	A

DATE	STATUS
09/05/2016	DEVELOPMENT APPLICATION

Plot Date



SECTION A-A
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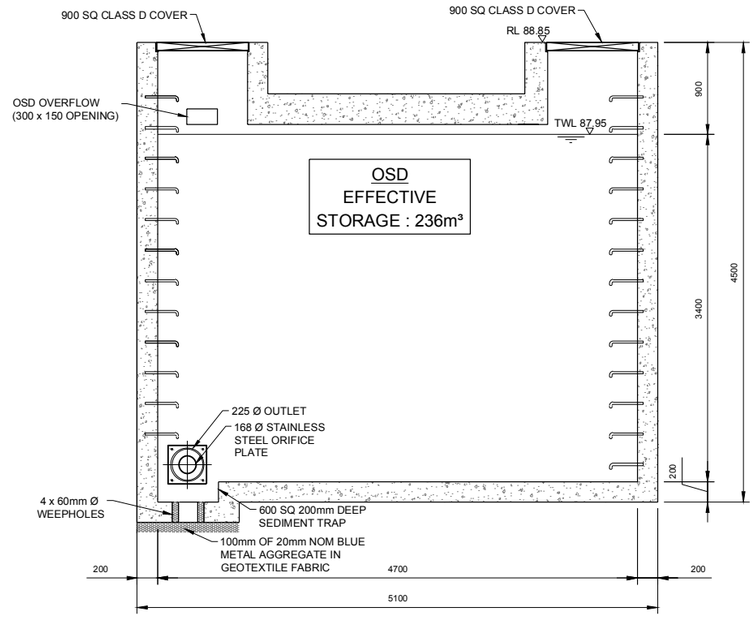

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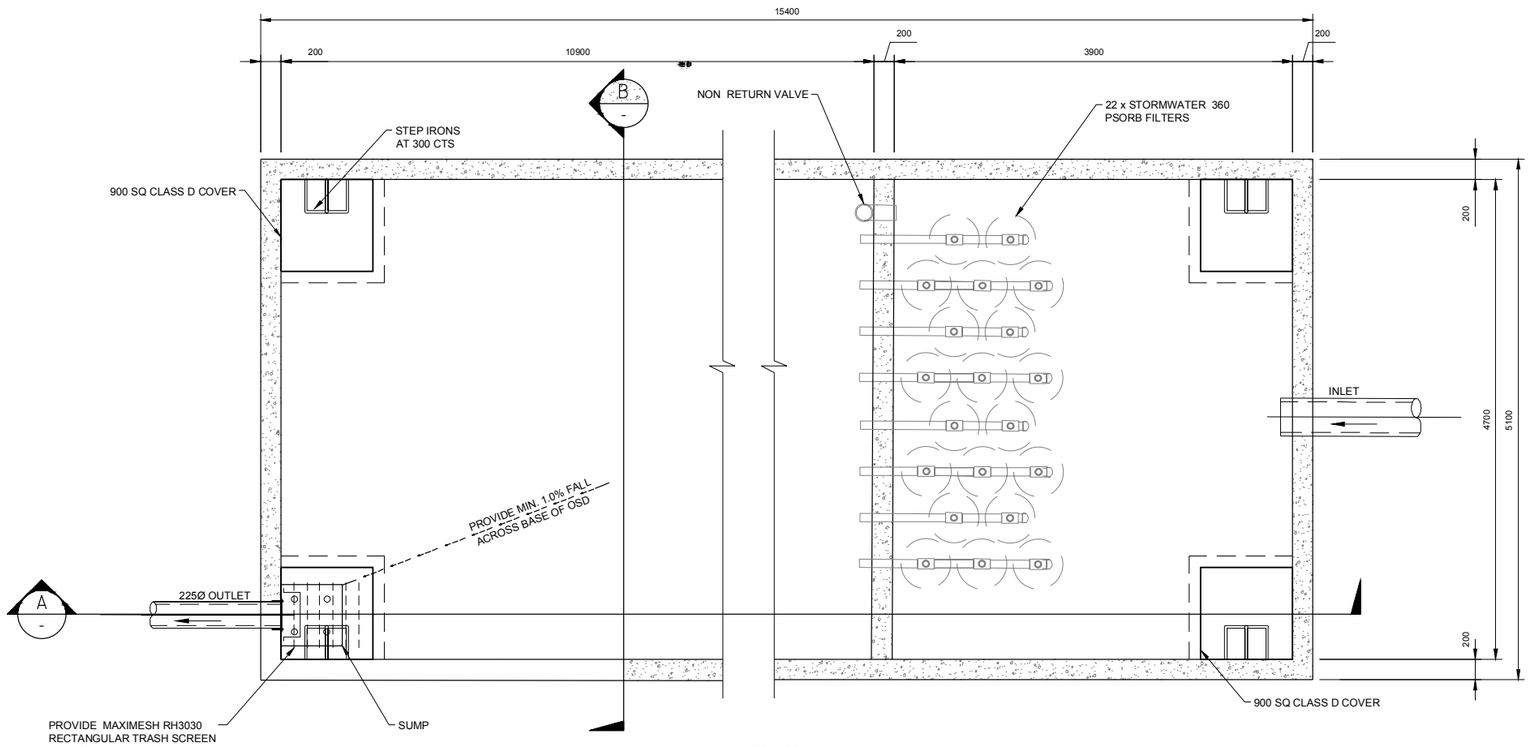
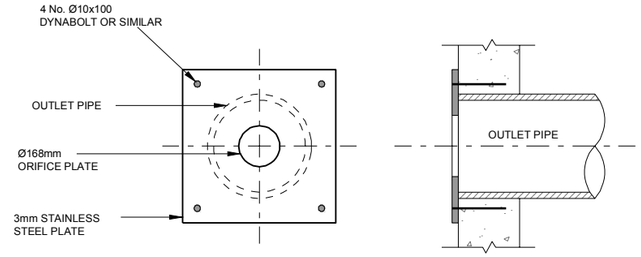
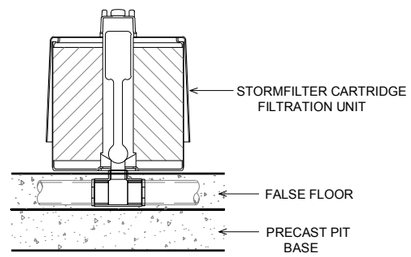


PLAN
SCALE 1:30





STORMFILTER CARTRIDGE DETAIL
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ISSUE	AMENDMENT	DATE	ISSUE	AMENDMENT	DATE
A	PRELIMINARY ISSUE	09/05/16			

CLIENT
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Warren Smith & Partners Pty Ltd
1st Floor, 123 Clarence Street, Sydney 2000 NSW Australia
T 02 9299 1312 F 02 9290 1295 wsp@warrensmith.com.au
www.warrensmith.com.au ABN 36 300 430 126

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TITLE
ON SITE DETENTION DETAILS

SCALE	DRAWN	DESIGNED	CHECKED	APPROVED
AS SHOWN	P.G	L.S	L.S.	M.C.

JOB No.	DRAWING No.	ISSUE
5320001	C4.03	A

DATE	STATUS
09/05/2016	DEVELOPMENT APPLICATION

Plot Date

LOT 2 CONCEPT ON-SITE DETENTION & PERMISSIBLE SITE DISCHARGE

The required on-site detention (OSD) volumes and permissible site discharge (PSD) for Lot 2 have been calculated in accordance with the Willoughby City Council's DCP, August 2006, Attachment 20, *OSD Technical Standard No.1*.

1.1 OSD CALCULATION

The sub-division Lot 2 area has a total site area of approximately 18,810 m².

The volume of OSD storage has been calculated to be approximately 715 m³ and is in accordance with the OSD Technical Standard, *Table 1 – Site Storage Requirements per impervious area*, please refer to Table 1 below for a summary of the OSD calculations.

Table 1: Option A - OSD Calculations

Zone	Volume of Storage Required per Cubic Metre ($m^3/100m^2$)	Area of Site (m^2)	OSD Volume Required (m^3)
3	3.8	18,810	714.78

1.2 PSD CALCULATION

The PSD has been calculated to be approximately 338 L/sec and is in accordance with the OSD Technical Standard *Table 2 – Permissible Site Discharge per impervious area*, please refer to Table 2 below for a summary of the PSD calculations.

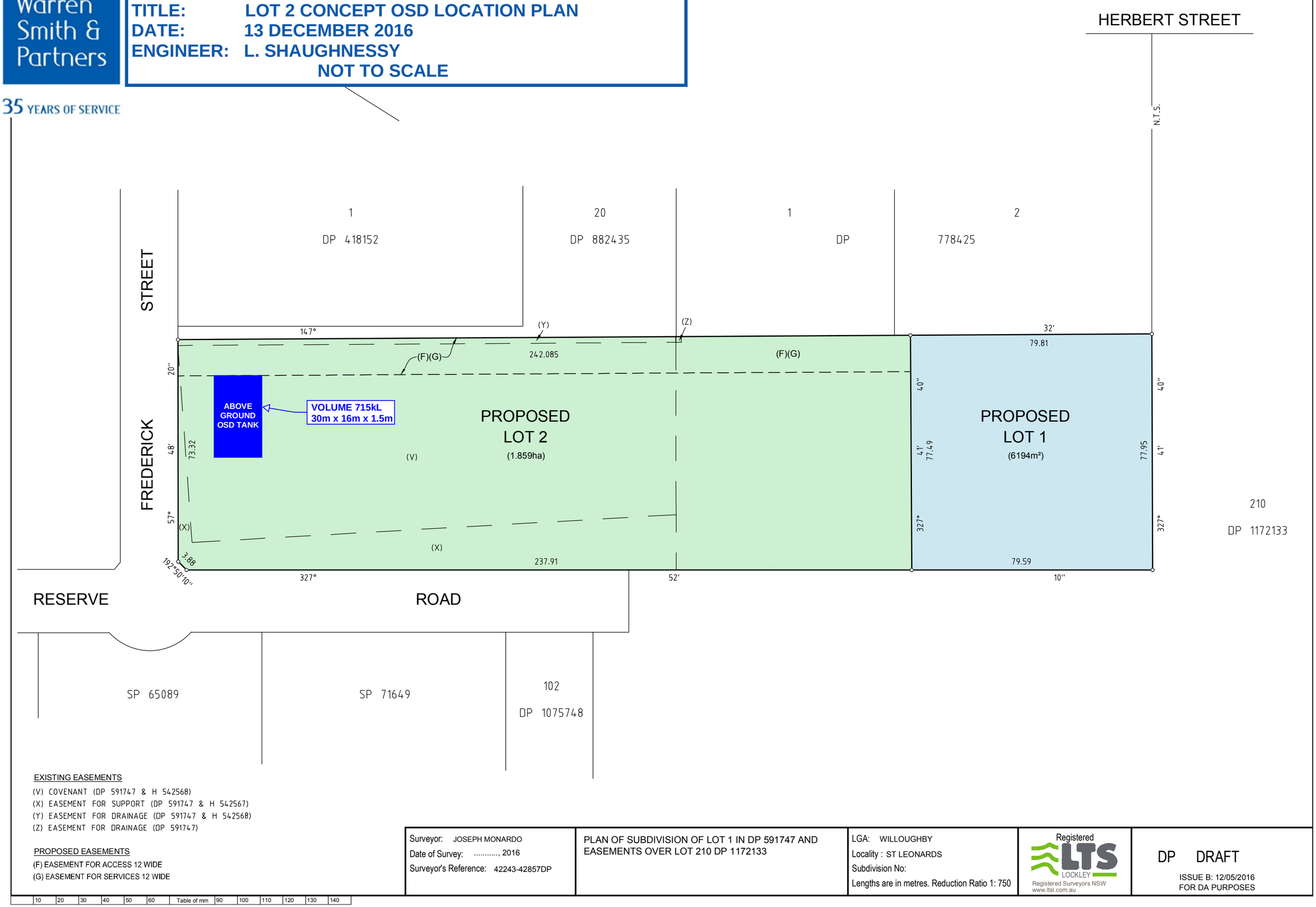
Table 2: Option A - PSD Calculations

Zone	Permissible Site Discharge per Cubic Metre ($L/sec/100m^2$)	Area of Site (m^2)	Maximum PSD (L/sec)
3	1.8	18,810	338.58

Warren Smith & Partners

35 YEARS OF SERVICE

PROJECT: NORTH SHORE PRIVATE HOSPITAL SUB-DIVISION
TITLE: LOT 2 CONCEPT OSD LOCATION PLAN
DATE: 13 DECEMBER 2016
ENGINEER: L. SHAUGHNESSY
NOT TO SCALE



EXISTING EASEMENTS

(V) COVENANT (DP 591747 & H 542568)
(X) EASEMENT FOR SUPPORT (DP 591747 & H 542567)
(Y) EASEMENT FOR DRAINAGE (DP 591747 & H 542568)
(Z) EASEMENT FOR DRAINAGE (DP 591747)

PROPOSED EASEMENTS

(F) EASEMENT FOR ACCESS 12 WIDE
(G) EASEMENT FOR SERVICES 12 WIDE

Surveyor: JOSEPH MONARDO Date of Survey: ....., 2016 Surveyor's Reference: 42243-42857DP	PLAN OF SUBDIVISION OF LOT 1 IN DP 591747 AND EASEMENTS OVER LOT 210 DP 1172133	LGA: WILLOUGHBY Locality : ST LEONARDS Subdivision No: Lengths are in metres. Reduction Ratio 1: 750	Registered LTS LOCKLEY Registered Surveyors NSW www.ltsl.com.au	DP DRAFT ISSUE B: 12/05/2016 FOR DA PURPOSES

10 20 30 40 50 60 Table of mm 90 100 110 120 130 140