BEKKER

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Project No.: 63407
February 27, 2018

STRUCTURAL
CIVIL
AND
WATERPROOFING
ENGINEERS

FLOODING RISK ASSESSMENT

FOR THE

STEVENSON LIBRARY UPGRADE

THE SCOTS COLLEGE

29-53 VICTORIA ROAD

BELLEVUE HILL

February 27, 2018

This document has been prepared as part of the submission to Department of Planning for Consent Approval and does not form part of the Approved For Construction documentation

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CONTENTS

1- Flooding Risk Assessment

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FLOODING RISK ASSESSMENT
STEVENSON LIBRARY
SCOTS COLLEGE
29-53 VICTORIA ROAD
BELLEVUE HILL

Project Description:

The Scots College Council are preparing a submission to the Department of Planning for proposed works including the upgrade of the Stevenson Library building.

In support of the submission it is required to provide details under Section 17 of the EIS requirements regarding flooding risk.

> **17. Flooding**
> - Assess any flood risk on site (detailing the most recent flood studies for the project area) and consideration of any relevant provisions of the NSW Floodplain Development Manual (2005), including the potential effects of climate change, sea level rise and an increase in rainfall intensity.
> - Ensure that the finished floor levels are set equal to or above the Probable Maximum Flood (PMF).

This Flooding Risk Assessment provides the commentary on these requirements

Site Description:

The portion of the Scots College School site where the Stevenson Library is located lies to the east of Victoria Rd, the north of Cranbrook Rd and on the western side of Cranbrook Lane. This portion of the school site has a total area of 44,730 m^2. The site survey confirms the site area and that the site slopes approx. 2.2% from the southwest to the northeast of the site. The site contains the Main School building, the new Business Studies Centre and the Main Oval. The average ground level of the oval varies between RL54.9 and RL52.2.

The survey attached confirms that the Council Street Drainage Helio Plan which shows all of the surrounding Council in-ground drainage system pipes in the surrounding streets.

Along Victoria Road, on the western boundary, the street drainage consists of a 675mm dia pipe that runs down Victoria Road from the southerly Bellevue Hill

direction running north, across New South Head Road, to discharge into the waters of Double Bay approx. 600m northwest of the site. The low side of the site drains to the existing gully pit located in the Cranbrook Lane easement which drains through a 450mm dia pipe down the slope to Rose Bay then ultimately joining the Council drainage network draining into the waters of Rose Bay approx. 400mm to the north of the site.

FLOODING CONSIDERATIONS:

Woollahra Council have been active in preparing Flooding Assessments for the low-lying Council areas including Double Bay and Rose Bay. There are Flood studies provided on the Council website for both areas.

The Scots College School site is located within the Bellevue Hill Subcatchment Area of 'Woollahra Council's – Rose Bay Catchment Flood Study' document.
Web link is https://www.woollahra.nsw.gov.au/__data/assets/pdf_file/0003/119154/Rose_Bay_Flood_Study.pdf

Attached to this report are Councils plans showing background details of the Drains modelling used for their flood studies. These confirm the Council pipe system used in their calculations

Types Of Flooding Considerations:

For this site there are three basic types of flooding to consider

1. **Inundation Flooding** – this occurs in low-lying coastal or river estuary areas where flood waters cover the land as a result of a possible combination of the rise in sea tide levels in conjunction with heavy catchment rainfall in the estuaries and the overtopping of river banks or stormwater channels.
2. **Local Flooding** – local flooding occurs where there is insufficient drainage pipe capacity, drainage pipe blockage and/or intense short duration storms cause high overland stormwater flows in the streets which impact over properties on the low side of the water stream. Other commonly used terms are Flash flooding or Storm flooding
3. **Service Pipe Failure** – flooding which occurs mainly due to the fracturing of water supply mains or major stormwater pipes.

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WOOLLAHRA COUNCILS INUNDATION FLOODING MODELS

The Flood Maps from Rose Bay Flood Study – Woollahra Council (Fig 13b) confirm the Councils 100yr ARI Flood depths and contours. Refer to map attached.

The 100yr ARI inundation flooding RLs levels vary from RL 3.0 at the water level to RL13.0 and 14.0 at the upper reaches of the adjacent Rose Bay golf course.

On the western side, toward the School grounds, the flooding extends to around the intersection of Beresford Rd and Plumer St with inundation flooding levels around RL13.0

The State Government Floodplain Manual 2009 requirement for freeboard above the 100yr ARI Flood level is 500mm. Note that the floor level of the School at RL55.2 well above the 100yr ARI Flood level of RL13.0

Given that the school grounds are at RL55.0 there is no possibility of Inundation Flooding at The Scots School grounds.

LOCAL FLOODING

The Flood Maps from Rose Bay Flood Studies – Woollahra Council (Fig 14) confirm the Councils PMF (Probable maximum Flood) Flood depths and contours. Refer to maps attached.

Victoria Rd Overland Flows

The Council plans confirm that the peak overland flow along Victoria Road adjoining the site is approx 1 – 2 m^3/s and the site is not within the flood affected area for 100 Year ARI.

The plans show the upper reaches of Victoria Road drain into the catchment well to the south of the school (around 150m away) with a drainage easement running between house numbers 65 & 67 in Victoria Road down the slope to Rose Bay

The local street flooding at the corner of Cranbrook Road and Cranbrook Lane resulting from the discharge of this Victoria Road easement has an approx. flood

level of RL53.0. The State Government Floodplain Manual requirement for freeboard above the PMF is 300mm. Note that the floor level of the School at RL55.2 well above the PMF level of RL53.0

Again, given that the school grounds are at around RL55.0 there is almost no possibility of Local Flooding at The Scots School grounds with the occurrence of the event being described as "Most unlikely".

The only possibility of local flooding would be in the unlikely situation where the local Council drainage pipes would be blocked or clogged with debris and the street surface obstructed by cars and/or garbage wheelie bins as occurred in a freak event in Rose Bay in 1995.

The School and Council should ensure that this combination of events remains "most unlikely".

SERVICE FAILURE FLOODING

The failure of Sydney water main services has occurred in the Bellevue Hill area twice in the last 30 years.

Links to stories of these breaks are attached

Corner Bellevue Rd and Victoria R Bellevue Hill

Link: https://www.sbs.com.au/news/sydney-crater-causes-traffic-chaos

> ***"The water main ruptured at about 8pm (AEST) on Thursday night, leaving the massive crater at the intersection of Victoria and Bellevue roads, in the exclusive suburb of Bellevue Hill. "The ruptured main has left a 25-metre crater affecting the footpath and roadway on Victoria Road and also badly damaged a gas supply line," police said in a statement. "The torrent of water brought down a power pole and swept up to two motor vehicles into nearby Cooper Park, where the water also caused a landslip."***

The Scots College Oval Victoria Rd Bellevue Hill

Extract from Rose Bay Flood Study – Woollahra Council

- A mudslide was caused by a burst pipe on the playing field at Scots College, shown in Photo 12 sending mud down the gully to Cranbrook Road, and filling houses and cars with sand (Photo 14).

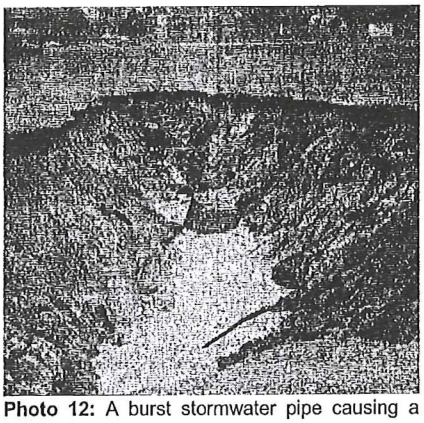

Photo 12: A burst stormwater pipe causing a mudslide at Scots College (source - SMH, 10/11/1989)

Sydney Water Corporation is responsible for the maintenance of their Watermain Services and have allegedly spent some $5m with Monash University in Victoria implementing a model for water main corrosion assessment. This program is to be predictive for water main failures.

Link: http://www.monash.edu.au/ross-tests/news/show/protecting-our-water-supply

> *"The project, launched Thursday 11 August at the Monash Club, is the largest international research collaboration led by Australia on water pipes and has world-wide significance as buried pipes provide around 70 per cent of the world's urban water supply.*
>
> *Leading the international research team is Monash University researcher, Associate Professor Jayantha Kodikara. Monash University and partners at University of Technology Sydney and University of Newcastle will develop cost effective advanced condition assessment and failure prediction models that can evaluate pipes before they burst.*
>
> *The five-year project, funded by seven Australian water authorities, the US Water Research Foundation, and UK Water Industry Research Ltd (UKWIR), will produce advanced techniques and technologies to accurately predict the remaining life of buried pipes and protect against pipe bursts".*

In light of this emphasis by Sydney Water on water main failure detection it is considered that a Sydney Water watermain failure affecting the Scots College school grounds is a "Most unlikely" occurrence.

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Matrix of Likelihood of flooding for the Scots College school

	PROBABLE	POSSIBLE	IMPROBABLE
INUNDATION FLOODING	**no**	**no**	**improbable**
LOCAL FLOODING	**no**	**Most unlikely**	
SERVICE FAILURE FLOODING	**no**	**Most unlikely**	

Definition: Most Unlikely - <0.01% probability

Improbable - <0.0001% probability

Yours faithfully,

BEKKER ENGINEERING DESIGN BURO PTY LTD

Paul Bekker BE. M IEAust. CP Eng. M ACEA

2 – Site & survey Details

2 – Site & survey Details

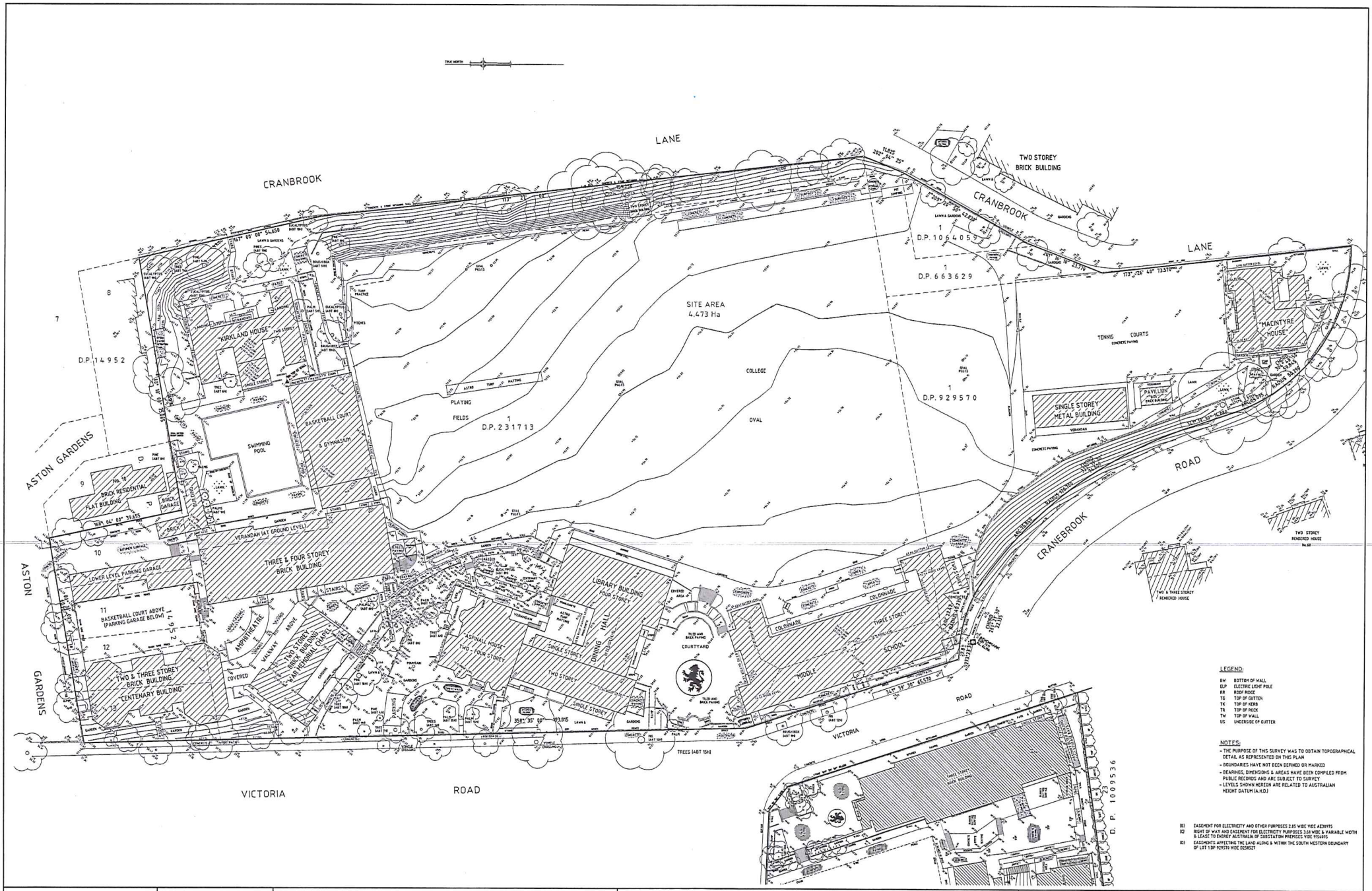
Google Maps


Seven Shillings Beach
St Mervyns Ave
Rose Bay Ave
Beresford Hall
New South Head Rd
Cranbrook Rd
Beresford Rd
Salisbury Rd
Balfour Rd
O'Sullivan Rd
Blackburn Gardens
Cranbrook School
Cranbrook School Gym
Victoria Rd
Aston Pl
Cranbrook Ln
College Ln
Powell Rd
The Scots College
Ginahgulla Rd
Fairfax Rd
Kambala Rd
Sheldon Pl
Crane Pl
Trahlee Rd
Bulkara Rd
Kulgoa Rd
Carrington Ave
Bernasconi's
Plumer Rd
Latimer Rd
Syl's Sydney

FIGURE 1
STUDY AREA

J:\Jobs\111009\Figures\Figure1Studyarea

Courtesy of Universal Press Pty Ltd



LEGEND:

BW	BOTTOM OF WALL
ELP	ELECTRIC LIGHT POLE
RR	ROOF RIDGE
TG	TOP OF GUTTER
TK	TOP OF KERB
TR	TOP OF RIDGE
TW	TOP OF WALL
US	UNDERSIDE OF GUTTER

NOTES:

- THE PURPOSE OF THIS SURVEY WAS TO OBTAIN TOPOGRAPHICAL DETAIL AS REPRESENTED ON THIS PLAN
- BOUNDARIES HAVE NOT BEEN DEFINED OR MARKED
- BEARINGS, DIMENSIONS & AREAS HAVE BEEN COMPILED FROM PUBLIC RECORDS AND ARE SUBJECT TO SURVEY
- LEVELS SHOWN HEREON ARE RELATED TO AUSTRALIAN HEIGHT DATUM (A.H.D.)

(B) EASEMENT FOR ELECTRICITY AND OTHER PURPOSES 2.85 WIDE VIDE AE38975
(C) RIGHT OF WAY AND EASEMENT FOR ELECTRICITY PURPOSES 3.61 WIDE & VARIABLE WIDTH & LEASE TO ENERGY AUSTRALIA OF SUBSTATION PREMISES VIDE 9568915
(D) EASEMENTS AFFECTING THE LAND ALONG & WITHIN THE SOUTH WESTERN BOUNDARY OF LOT 1 DP 929570 VIDE 8538327

AMENDMENTS:
- ADDITIONAL LEVELS ADJACENT TO ASPINALL HOUSE, WAR MEMORIAL CHAPEL & LIBRARY 9-2-2011

DRAWN: D.H.
SURVEYED: D.G.W.
DESIGNED:

CLIENT: THE SCOTS COLLEGE
C/- CONYBEARE MORRISON INTERNATIONAL PTY LTD

TITLE:
PLAN OF THE SCOTS COLLEGE
VICTORIA ROAD
BELLEVUE HILL
IN THE LGA OF WOOLLAHRA

DUNLOP THORPE & CO. PTY. LTD.
SURVEYORS
447 KENT STREET
SYDNEY 2000
DX 908 SYDNEY
ABN 74 003 612 150
PHONE (02) 9283 6677
FAX (02) 9283 6633
Email : dunthor@ozemail.com.au

REDUCTION RATIO	1:500
SIZE	A1
LEVEL DATUM	A.H.D.
DATE	24.07.2009
SHEET	1 OF 2 SHEETS
REFERENCE No.	16849

3. Woollahra Council information
a - existing Council stormwater drains

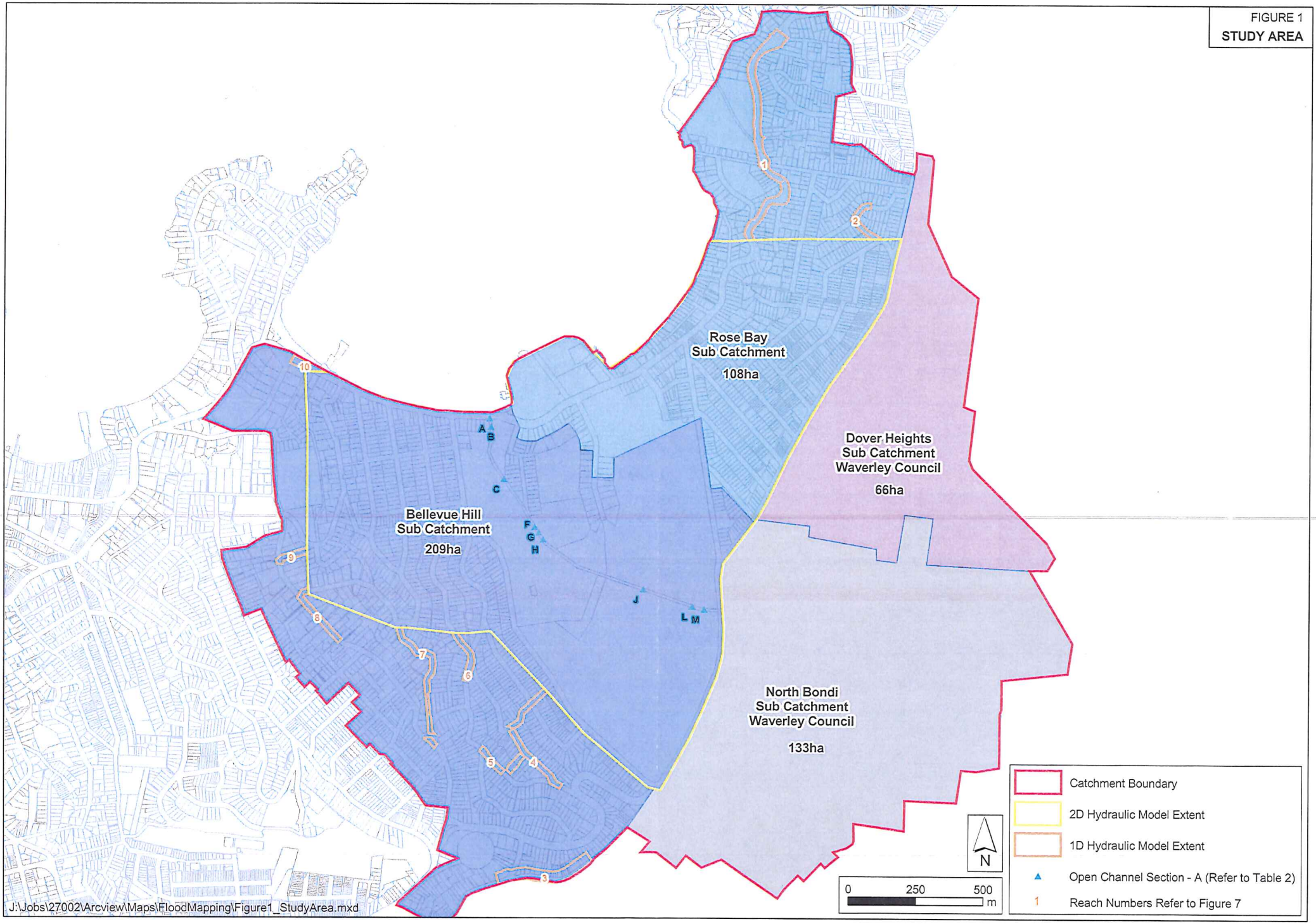


FIGURE 1
STUDY AREA
Rose Bay
Sub Catchment
108ha
Dover Heights
Sub Catchment
Waverley Council
66ha
Bellevue Hill
Sub Catchment
209ha
North Bondi
Sub Catchment
Waverley Council
133ha
A
B
C
F
G
H
J
L
M
1
2
3
4
5
6
7
8
9
10
N
0
250
500
m
Catchment Boundary
2D Hydraulic Model Extent
1D Hydraulic Model Extent
Open Channel Section - A (Refer to Table 2)
Reach Numbers Refer to Figure 7
J:\Jobs\27002\Arcview\Maps\FloodMapping\Figure1_StudyArea.mxd

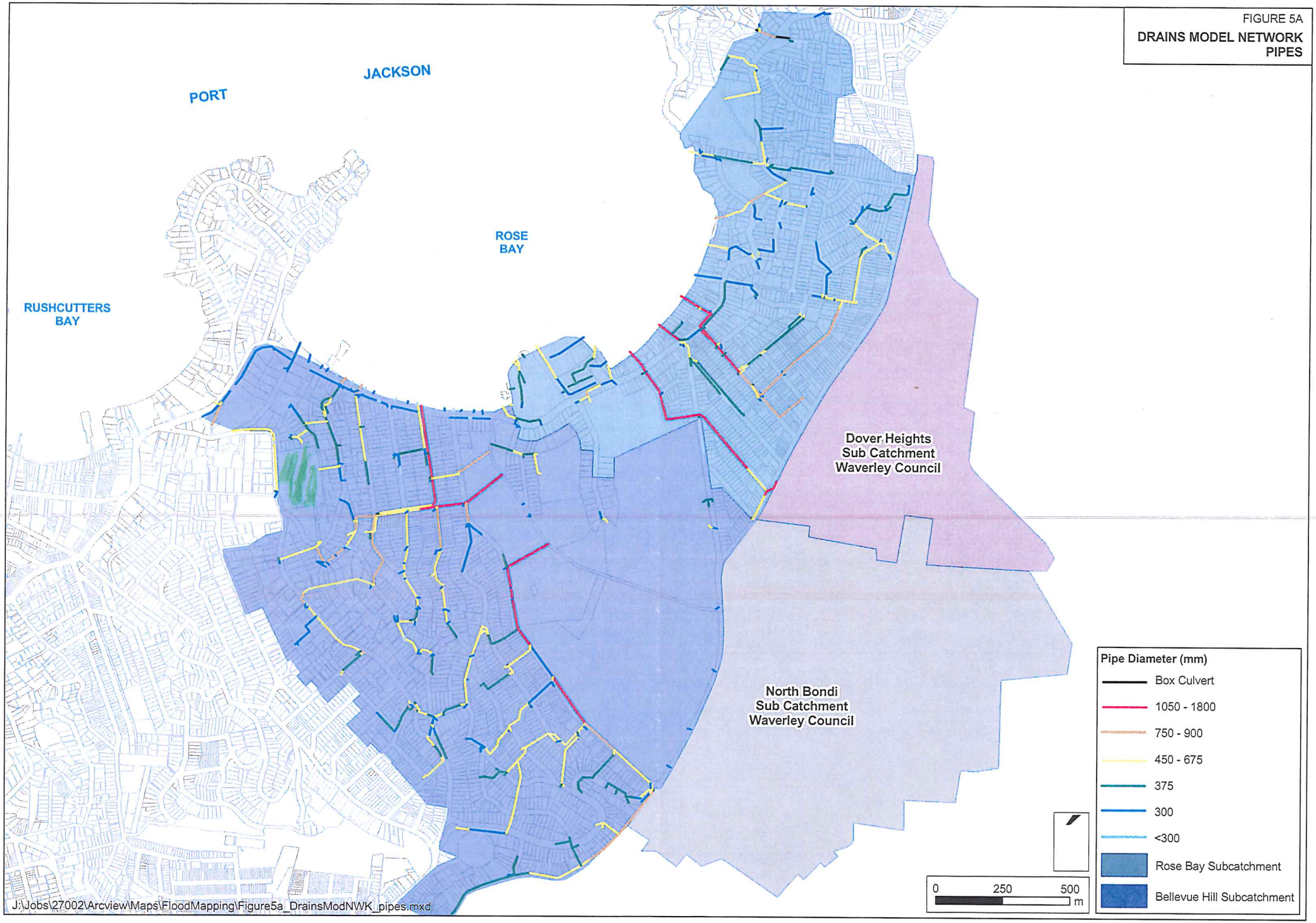


FIGURE 5A
DRAINS MODEL NETWORK PIPES
PORT JACKSON
ROSE BAY
RUSHCUTTERS BAY
Dover Heights Sub Catchment Waverley Council
North Bondi Sub Catchment Waverley Council
Pipe Diameter (mm)
Box Culvert
1050 - 1800
750 - 900
450 - 675
375
300
<300
Rose Bay Subcatchment
Bellevue Hill Subcatchment
0 250 500 m
J:\Jobs\27002\Arcview\Maps\FloodMapping\Figure5a_DrainsModNWK_pipes.mxd

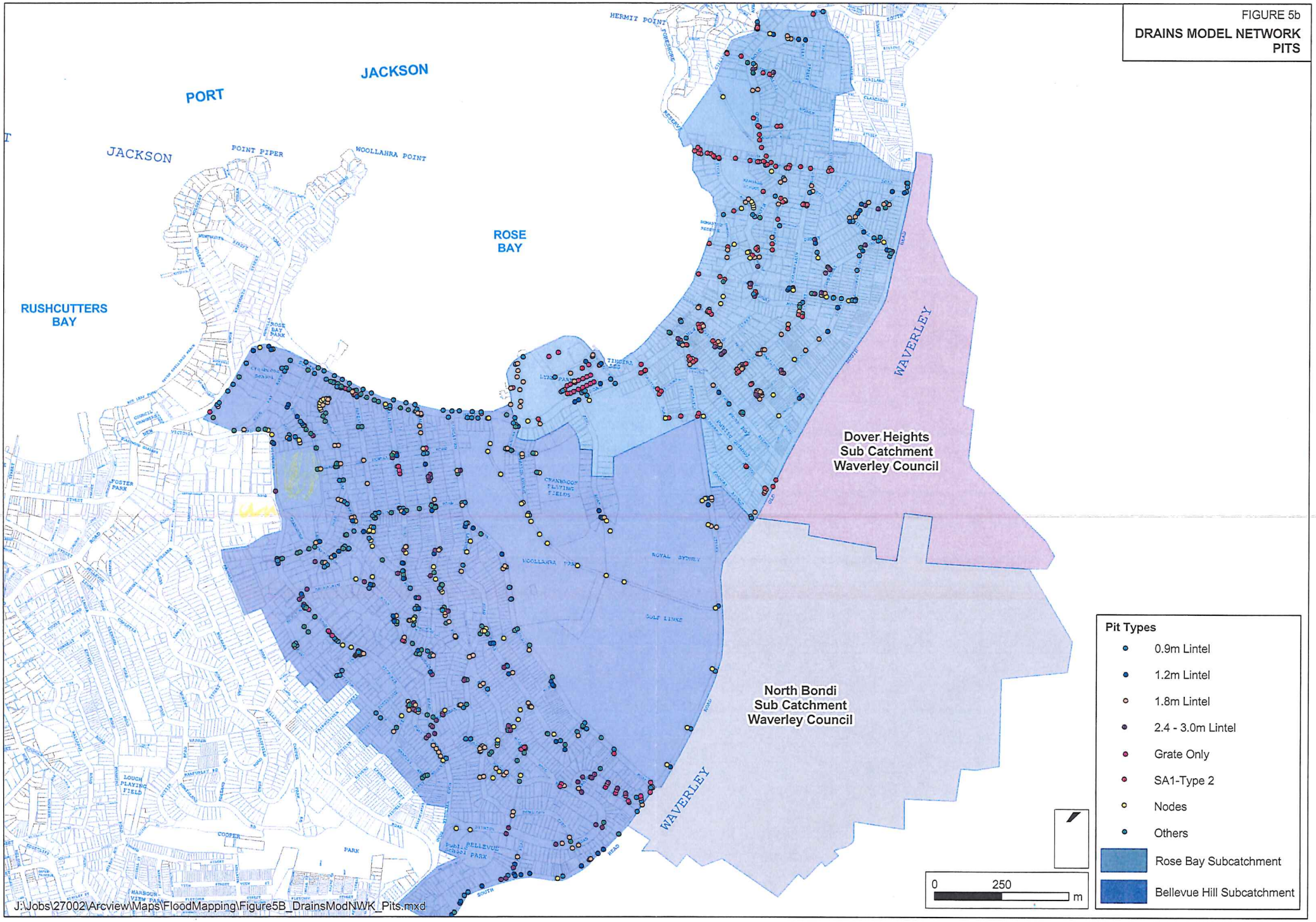
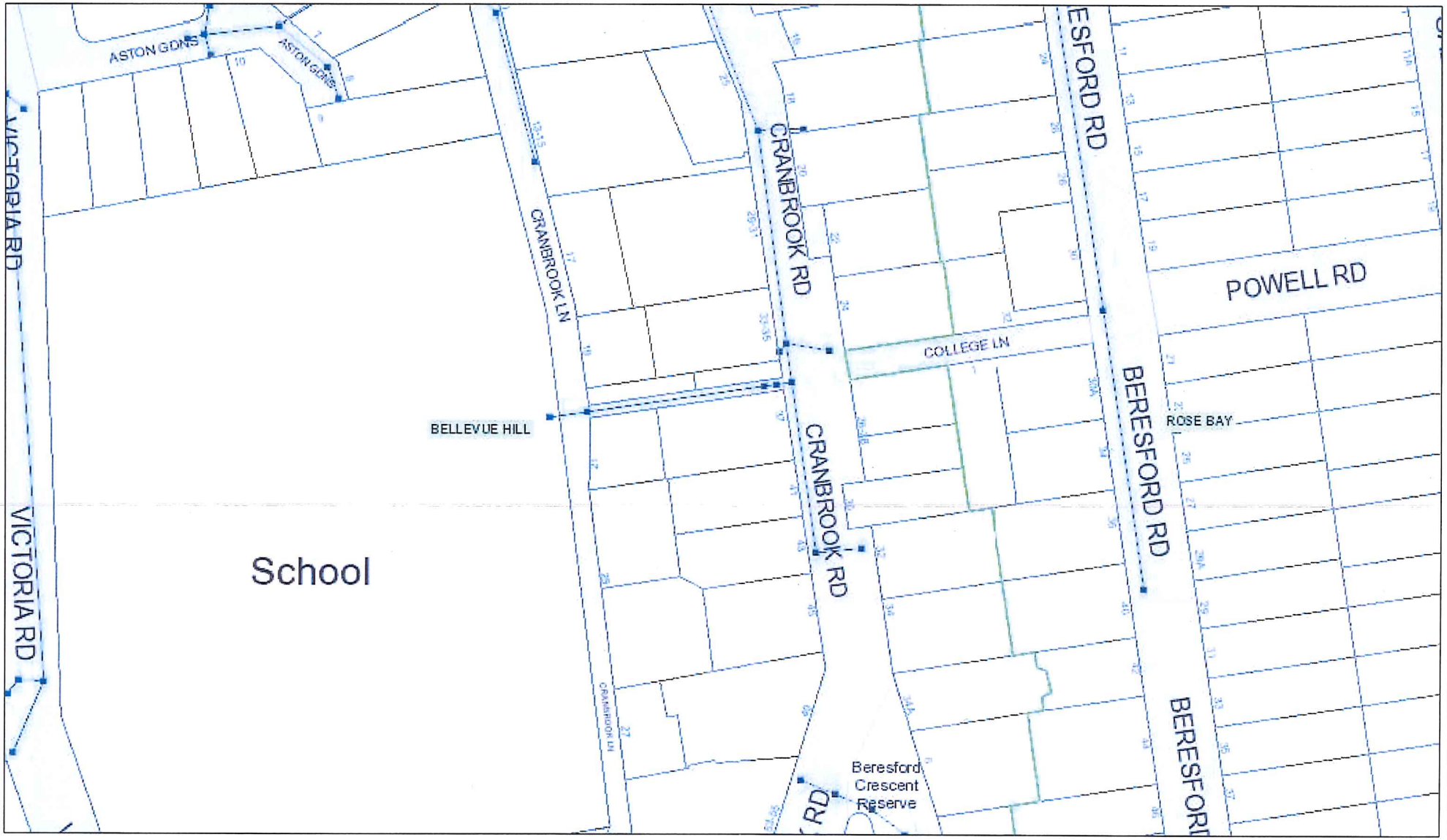


FIGURE 5b
DRAINS MODEL NETWORK
PITS
JACKSON
PORT
JACKSON
POINT PIPER
WOOLLAHRA POINT
HERMIT POINT
ROSE
BAY
RUSHCUTTERS
BAY
WAVERLEY
Dover Heights
Sub Catchment
Waverley Council
North Bondi
Sub Catchment
Waverley Council
WAVERLEY
Pit Types
0.9m Lintel
1.2m Lintel
1.8m Lintel
2.4 - 3.0m Lintel
Grate Only
SA1-Type 2
Nodes
Others
Rose Bay Subcatchment
Bellevue Hill Subcatchment
0
250
m
J:\Jobs\27002\Arcview\Maps\FloodMapping\Figure5B_DrainsModNWK_Pits.mxd

Figure 9: Main Double Bay Modelled Area showing Aerial Photograph



Woollahra Municipal Council provides this map for information and communication purposes only. Whilst every effort has been made to ensure that the information provided is accurate and complete, no warranty can be given that this map is free from errors or omissions. All users of this map are responsible for assessing the relevance and accuracy of the information. Aerial Photo © Sinclair Knight Merz 2014

Date: 10/08/2016

Scale @ A4
1: 1,596

0 15.96 31.92
Meters

N

4. Woollahra Council information

a – 100yr ARI Flood Levels & Contours

b – PMF ARI Flood Levels & Contours


FIGURE 13b
BELLEVUE HILL
100 YEAR ARI FLOOD DEPTHS AND CONTOURS
NOTE: Flood depths within the 1D channel areas are not shown
J:\Jobs\27002\Arcview\Maps\FloodMapping\Figure13b_100yearDepthandFlood.mxd
Study Area
Intermediate Contour (1m)
Major Contour (5m)
Peak Depth (m)
< 0.2
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8
> 0.8
0
100
200
m

FIGURE 14

PMF FLOOD DEPTHS AND CONTOURS