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REGISTERED SURVEYORS AND DEVELOPMENT CONSULTANTS

Ref: 4034

6th September, 2012

IMPACT OF WARRIEWOOD VALLEY STRATEGIC REVIEW HYDROLOGY STUDY ON PROPOSED DEVELOPMENT OF 120-122 MONA VALE ROAD, WARRIEWOOD

Cardno prepared a Hydrology Study in November 2011 which was intended to determine the suitability of undeveloped land for future development in terms of flooding and water management within the Warriewood Valley.

Some of the sites investigated in the report are directly affected by the 100 year flood event and Probable Maximum Flood (PMF) events. The subject land is not affected by either of these apart from the local flood generated by the local catchment.

Within the report the site is defined as Category A under a classification system devised by the Department of Planning and Infrastructure and Council.

Category A land is that land

- which is located above the PMF plus Climate change allowance level.
- which may be subject to overland flow
- which allows for flood evacuations with minimum risk to life and no possibility of flood entrapment or flood isolation

Table 11-1 "OSD and WQ Requirements for Sectors Outside of the Floodplain" shows the following figure in relation to the subject land:

120 Mona Vale Road

Developable Area:	8.3 hectares
OSD Basin Size:	3,060m^3
Water Quality Basin Area:	4,150m^2

The OSD basin size has been calculated using a rate of 368m^3 per hectare of developable area and the Water Quality Basin using a rate of 5% of the developable area. The formula used to determine these parameters was set out in an earlier report prepared by Lawson and Treloar in

2001 (Warriewood Valley Water Management Specification). These parameters are very conservative and assume medium density development with 50% impervious area.

However, as much of the subject site will not be developed and will remain unchanged the calculations based on the entire site area are in our opinion not valid and instead should be based on the proposed lot design.

There are distinct catchments within the property as shown on the plan titled "Catchment Areas for the Proposed Subdivision of 120-122 Mona Vale Road, Warriewood". Some of the future developed area and much of the undeveloped area will drain directly to Narrabeen Creek which forms part of the south western boundary of the subject land. A developable area of 3.13 hectare, being a combination of residential lots and roads west of Boundary Street and proposed lots east of Boundary Street will drain to the head of a small watercourse which eventually drains to Narrabeen Creek (Catchment A). A further 2.54 hectare of developable area comprising lots and roads can be directed to an existing pipeline under Boundary Street approximately 120 metres south of Mona Vale Road (Catchment B).

Based on these areas the required OSD storage volume and Water Quality area would be as follows:

Catchment A	OSD Volume: 1152 m^3	Water Quality Basin Area: 1,565m^2
Catchment B	OSD Volume: 935 m^3	Water Quality Basin Area: 1,270m^2

Therefore it is proposed to have two separate areas for on-site detention.

Area A will achieve the required OSD storage in the following way:

1. The 39 residential lots will each have a 5 cubic metre OSD tank within their property. This gives a total volume of 195 cubic metres.
2. Two tanks will be constructed underground within No.4 Boundary Street having a combined volume of 957 cubic metres. Indicative locations for these tanks are shown on the plan titled "Plan showing proposed OSD and Water Quality Basins for Proposed Subdivision of 120-122 Mona Vale Road, Warriewood"

Area B will achieve the required OSD storage in the following way:

1. The 30 residential lots will each have a 5 cubic metre OSD tank within their property. This will give a combined volume of 150 cubic metres.
2. There is an area above the proposed subdivision road running north-south within the proposed open space that can be utilised for an OSD basin. It is estimated that storage of approximately 190 cubic metres could be achieved here.
3. There is an existing dam on the property located within the gully adjacent to Boundary Street. There is additional area north west of the dam adjacent to the pipe located under Boundary Street which could be utilised as an OSD basin. The existing dam would form the primary storage area with a spillway leading to the lower area. The area proposed for this purpose does not contain any trees. The combined total volume which could be achieved is 595 cubic metres.

The ten lots which drain directly to Narrabeen Creek would have individual OSD tanks or basins based on the proposed impervious area for each lot in accordance with Council's DCP.

With regard to areas set aside for Water Quality these are shown on the plan titled "Plan showing proposed OSD and Water Quality Basins". It is proposed to utilise bio-swales as the primary method for achieving the acceptable quality of water leaving the site. A typical section showing how the bio-swales can be incorporated into the proposed road reserves is also shown on this plan. In accordance with the areas required for Water Quality there is a combined total area of 2,631 m^2 contained within the proposed bio-swales. In addition there is a further 204m^2 proposed in individual water quality basins on twelve of the larger lots. This will control the quality of the water which will flow directly into Narrabeen Creek.

The volume and area proposed to be set aside for OSD and Water Quality respectively is more than what would be required under the Pittwater 21 DCP. The DCP sets the OSD requirements for sites where there is an increase of over 1000 square metres of impervious area at 60 litres per square metre of additional impervious area. The impervious area currently on the site as a result of structures is 2,170 m^2. This does not include any driveways or tracks in use. As we are proposing 79 lots and if we assume an average impervious area of 280 m^2 per lot then the increase in total impervious area would be 1.995 ha plus approximately another 3500m^2 in roads requiring OSD of 1407 cubic metres. This proposal allows for a possible 2087 cubic metres which is 26.4 cubic metres per lot.

Naturally when a DA is approved and the civil design is prepared a full model and calculations will be undertaken for OSD requirements.

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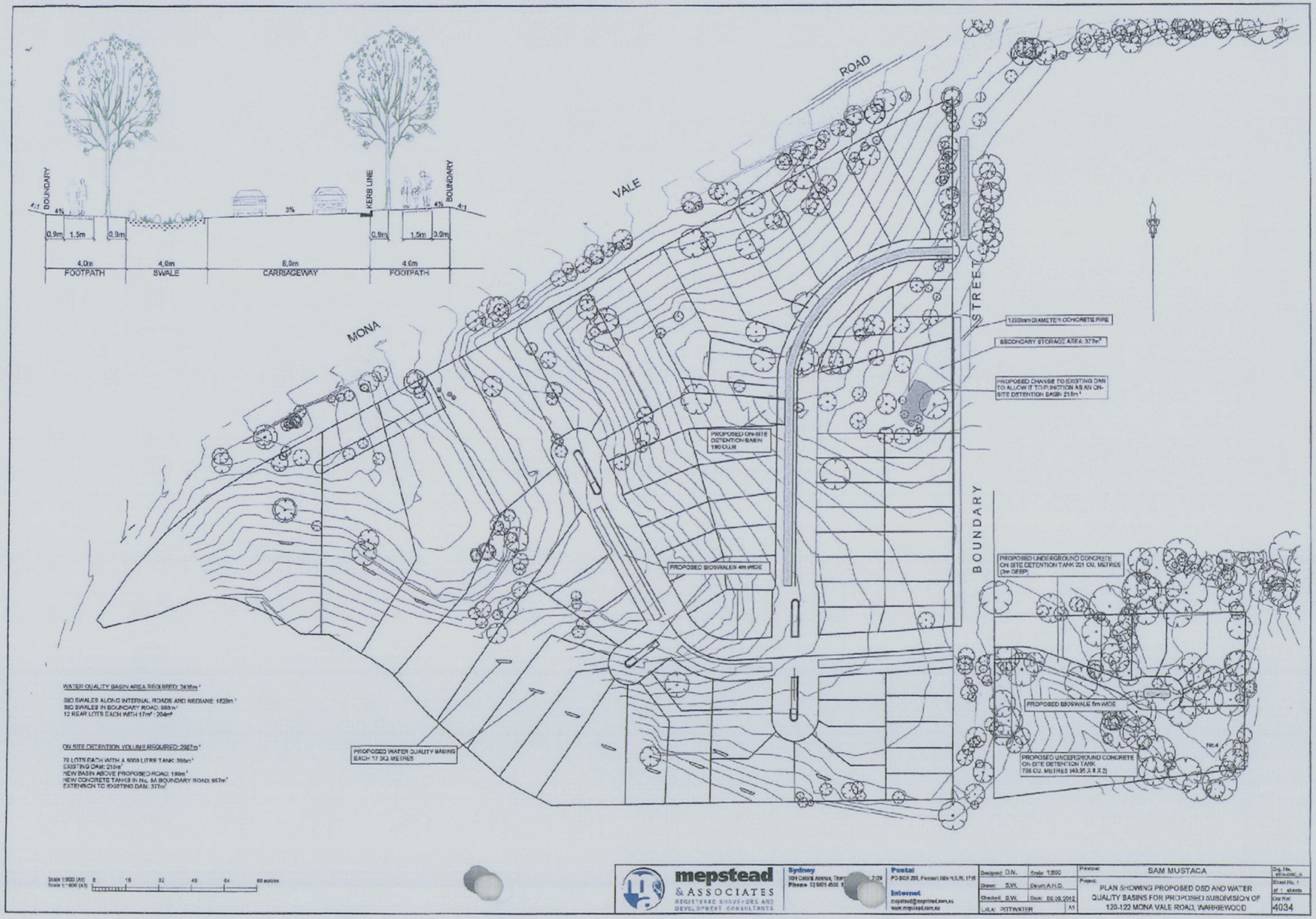
Scale: 1:600
Date: 6.09.12
L.G.A. PITTWATER
A1

Principal: SAM MUSTACA
Project: CATCHMENT AREAS FOR PROPOSED SUBDIVISION OF 120-122 MONA VALE ROAD WARRIEWOOD

Dwg. No. eSEACATCH01
Sheet No. 1 of 1 sheets
Cust Ref. 4034


BOUNDARY
4:1
4%
0.9m
1.5m
0.9m
4.0m
FOOTPATH
4.0m
SWALE
3%
8.0m
CARRIAGEWAY
KERB LINE
4.0m
FOOTPATH
BOUNDARY
4:1
MONA VALE ROAD
BOUNDARY
1200mm DIAMETER CONCRETE PIPE
SECONDARY STORAGE AREA: 377m³
PROPOSED CHANGE TO EXISTING DAM TO ALLOW IT TO FUNCTION AS AN ON-SITE DETENTION BASIN 218m³
PROPOSED ON-SITE DETENTION BASIN 190 CUM
PROPOSED SWALES 4m WIDE
PROPOSED UNDERGROUND CONCRETE ON SITE DETENTION TANK 221 CU. METRES (3m DEEP)
PROPOSED SWALE 5m WIDE
PROPOSED UNDERGROUND CONCRETE ON SITE DETENTION TANK 738 CU. METRES (49.95 X 8 X 2)
PROPOSED WATER QUALITY BASINS EACH 17 SQ METRES
WATER QUALITY BASIN AREA REQUIRED: 2635m²
BIO SWALES ALONG INTERNAL ROADS AND MEDIANS: 1828m²
BIO SWALES IN BOUNDARY ROAD: 585m²
12 REAR LOTS EACH WITH 17m² : 204m²
ON SITE DETENTION VOLUME REQUIRED: 2987m³
70 LOTS EACH WITH A 6000 LITRE TANK: 395m³
EXISTING DAM: 218m³
NEW BASIN ABOVE PROPOSED ROAD: 190m³
NEW CONCRETE TANKS IN No. 64 BOUNDARY ROAD: 957m³
EXTENSION TO EXISTING DAM: 377m³
Scale 1:800 (A1)
Scale 1:1600 (A3)
0
16
32
48
64
80 metres
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L.G.A.: PITTWATER
A1
Principal: SAM MUSTACA
Project: PLAN SHOWING PROPOSED OSD AND WATER QUALITY BASINS FOR PROPOSED SUBDIVISION OF 120-122 MONA VALE ROAD, WARRIEWOOD
Dwg. No. 4034-OSD_0
Sheet No. 1
of 1 sheets
Our Ref. 4034