envirotech
Environmental and Engineering
Consultancy Services

PO Box 3086 East Blaxland NSW 2774
P: 1300 888 324 F: 02 4739 3394
W: www.envirotech.com.au
E: info@envirotech.com.au

'ON-SITE WASTEWATER MANAGEMENT REPORT'

For:

Lot 1672 Capitol Hill Estate, MOUNT VERNON, NSW

CLIENT: Pazit Pty. Ltd.

REFERENCE: REF-79513-A

DATE: 13th March 2013

LIMITATIONS STATEMENT

EnviroTech Pty. Ltd. has undertaken the following report in accordance with the scope of works set out between EnviroTech Pty. Ltd. and the client. EnviroTech Pty. Ltd. derived the data in this report primarily from the site and soil assessment conducted on the date of site inspection. The impacts of future events may require future investigation of the site and subsequent data analysis, together with a re-evaluation of the conclusions and recommendations of this report.

In preparing this report, EnviroTech Pty. Ltd has relied upon, and assumed accurate, certain site information provided by the client and other persons. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. EnviroTech Pty. Ltd. accepts no liability or responsibility whatsoever for or in respect to any use or reliance upon this report by any third party.

Daniel Mathew B.Eng (Hons.)

Senior Environmental Engineer

ENVIROTECH PTY. LTD.

Document Management				
Version	Date	Author	Reviewed	Date
69212-A	19/10/2012	DM	Client	19/10/2012
69212-B	22/10/2012	DM		
79513-A	01/03/2013	DM		

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* Not included with Council Copy report

INTRODUCTION

EnviroTech Pty. Ltd. has been engaged by the client to undertake an 'onsite wastewater management study' at the above mentioned site address. This report presents the results of that study.

The proposed development is for decentralised on-site wastewater management systems to service a proposed thirty five (35) lot residential subdivision at the subject address. (See Appendix A).

Wastewater Sources

Domestic sewage (blackwater and greywater) typical of residential dwellings is the only wastewater source for this proposed development.

Blackwater includes wastewater from the kitchen, and toilets while greywater includes the wastewater of baths, showers, basins, laundries

Typical pollutant concentrations in domestic wastewater are as follows[1]:

Parameter	Loading	Greywater %	Blackwater%
BOD	200 – 300 mg/L	35	65
Suspended Solids	200 – 300 mg/L	40	60
Total Nitrogen	20 – 100 mg/L	20 - 40	60 - 80
Total Phosphorus	10 – 25 mg/L	50 - 70	30 – 50
Faecal Coliforms	$10^3 – 10^{10}$ cfu/100mL	Medium - high	High

[1] Environment and Health Protection Guidelines – Onsite Sewage Management for Single Households (1998)

Objective

The objective of the 'onsite wastewater management study' is to investigate the relevant site, soil, public health and economic factors that can impact on the selection, location and design of an on-site wastewater management system to determine:

- Whether or not the site is suitable for an on-site wastewater management system
- The best practical on-site wastewater management system for the specific site and proposed development.

This study has been prepared in accordance with:

- Australian Standard AS1547: 2012"On-site Domestic Wastewater Management"
- Dept. Local Government 1998, On-site Sewage Management for Single Households,
- Relevant Council Development Control Policies

Scope of Works

The scope of works undertaken for this site evaluation included:

- *Desktop Study:* An initial investigation to collate relevant information about the site and proposed development prior to the site inspection.
- *Site Assessment:* An on-site inspection by an engineer or scientist to record land surface, site features, identify potential site constraints and define the most appropriate land application area.
- *Soil Assessment*: A subsoil investigation by an engineer or scientist to record the soil profile and relevant soil properties within the land application area to determine potential soil limitations.
- *System Design:* An evaluation of the expected wastewater flowrate, site and soil limitations to select, size and position a waste treatment unit and land application system that will provide the best practical option.
- *Operation & Maintenance / Construction & Installation Guidelines*

DESKTOP INFORMATION

Address	*Lot 1672 Capitol Hill Estate, MOUNT VERNON, NSW*
Council	*Penrith City Council*
Proposed Development	New wastewater treatment systems for proposed thirty five (35) lot subdivision
Intended Water Supply Source	Town water
Equivalent Population	Up to 9 people (Up to 6 bedrooms per residence)
Design Wastewater Allowance	145 L / person / day[1]

1: Households with "full water-reduction facilities"

- Reduced flush 6/3 litre water closets,
- Aerator faucets,
- Front-load washing machines,
- Shower-flow restrictors
- Flow / pressure control valves on all water-use outlets

Design Wastewater Flowrates:

4-Bedroom Residence	870 L / day
5-Bedroom Residence	1088 L / day
6-Bedroom Residence	1305 L / day

Climate

Rainfall: Source: Bureau of Meteorology – St. Clair (Juba Close)

- Median Annual Precipitation: 640mm
- Median Monthly Precipitation (mm):

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
73.2	65	55.5	30	35	32	17.4	13.5	23	31	58.5	63

Evaporation: Source: Bureau of Meteorology – Badgerys Creek

- Mean Daily Evaporation (Annual Value): 4.0mm
- Mean Daily Evaporation (Monthly Values):

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.9	5.4	4.5	3.5	2.1	1.7	2.1	3.0	4.0	4.7	5.7	6.6

SITE ASSESSMENT

Location & Site Description

The site is situated within the Penrith City Council local government area. It is triangular in shape and covers an area of approximately 42 hectares. It is bounded by Capitol Hill Estate to the east and by rural residential properties on the other aspects. General ground surface is gently inclined hill-slopes to the south-west. The closest watercourse is Ropes Creek along the south western boundary.

Locality Plan

Vegetation

The vegetation is described by dividing the study area into vegetation elements. Each vegetation element has a unique set of properties.

Vegetation Element	*Growth Form*	*Height*	*Cover / Separation*
A	Closed Grassland	< 500 mm	Dense

Vegetation Element	*Exposure*	*Existing Erosion*		*Landform Element (s)*
		State	*Type*	
A	Excellent	Stabilised	-	1

Overland Flow

Run-on and run-off potential is largely determined by slope, surface cover and soil infiltration rate.

Landform element.	*Run-on*	*Run-off*
1	Slow	Slow

Soil Disturbance

The site assessor noted no areas of soil disturbance within the available land application envelope.

Rocky Outcrops

The site assessor noted no areas of rocky outcrops.

Setbacks

The following buffer distances are available between the proposed land application area and:

Permanent Watercourses:	> 100-m
Intermittent Watercourses / Dams:	> 40-m
Dwellings:	> 15-m
Paths & Walkways:	> 3-m
Property Boundaries:	
- Up-gradient: > 3-m	- Down gradient: > 6-m

Site Assessment Discussion

A range of site features that can commonly place limitations on on-site wastewater management have been assessed and classified. All features have been shown to place no major limitations to on-site wastewater management.

SOIL ASSESSMENT

The location of the borehole excavated during the site inspection is shown on the attached site plan. Physical and chemical soil properties were recorded on a soil profile log (see attached). On each property two boreholes are performed, the first analyses soil features listed below, and the second serves a confirmatory borehole. If soil properties found in the two boreholes on site differ, then both samples are taken for analysis.

The following properties were recorded for each soil horizon:

- Horizon depth and type
- Mottling
- Colour
- Structural stability
- Groundwater depth
- Bedrock depth
- Texture
- pH
- Phosphorus Sorption
- Electrical Conductivity
- Coarse Fragments

Physical Properties

In summary, the soil profile is described below:

Soil Horizon	Depth	Colour	Mottles	Coarse Fragments %	Texture
A	300	Dark Brown	-	< 10	Loam
B1	500	Brown	Red	< 10	Clay Loam
B2	1400	Red	Grey	< 10	Light Clay

Excavation terminated at: 1400 mm

Reason: Soil depth is minor limitation

Bedrock Depth: > 1400-mm

Water Table Depth: > 1400-mm

Topsoil soil-water status: Moderately moist

Surface Condition: Firm

Chemical Properties

Soil samples were collected from each major soil horizon and the relevant chemical properties are presented below:

Borehole 1

Horizon	*PH*	*Electrical Conductivity (mS/cm)*
A	5.40 - 5.57	10 - 33
B1	5.20 – 5.43	46 - 67
B2	5.10 – 4.97	70 - 104

Phosphorus Adsorption Capacity (kg / ha): 14,896

Erodability / Erosion Hazard

Soil erodability is the susceptibility of the topsoil to detachment and transport of soil particles. It is a characteristic of the soil surface and varies with time, soil / water status and land use. Soil erodability classification is stated as low, moderate or high.

Erosion hazard is the susceptibility of an area of land to the prevailing agents of erosion. It is a function of climate, soil erodability, vegetation cover and topography.

	Borehole 1
Erodability	Low
Erosion Hazard	Slight

Salinity & Drainage

Salinity is the concentration of water-soluble salts contained within a soil. Increases in soil salinity (i.e. salinisation) can occur as a result of irrigation water raising the level of an already saline groundwater. Management of potential salinisation problems involve

ensuring that salts introduced to the soil surface are removed (by crop uptake or subsoil leaching) and by ensuring the irrigation area provides adequate subsoil drainage to prevent raising of saline groundwaters into root zones.

Drainage is a statement describing the site and soil drainage that is likely to occur most of the year. It is influenced by soil permeability, water source, landform description, evapotranspiration, slope gradient and slope length.

The drainage of this site should be adequate for the leaching of salts and ensure the groundwater level does not reach the root zone.

A major adverse effect of high soil salinity is the restrictive effects on plant growth. However, for this site the soil salinity levels (as indicated by the electrical conductivity values) are low enough that the adverse effects on plant growth will be minimal.

Soil Assessment Discussion

A range of soil properties that commonly place limitations on on-site wastewater management have been assessed and classified. In accordance with the Environmental and Health Protection Guidelines all soil properties have been shown to present no major limitations to on-site wastewater management.

ON-SITE WASTEWATER MANAGEMENT SYSTEM DESIGN

The design process adopted here involves an evaluation of the expected wastewater flow, site limitations and soil limitations, to select, size and position a waste treatment unit and land application system that will provide the best practical option.

Wastewater Treatment:

This report proposes that wastewater treatment using a NSW Health accredited (or equivalent) Aerated Wastewater Treatment System (AWTS) as it will produce a high quality effluent produced suitable for irrigation purposes

Effluent Application:

This report proposes that effluent application be via a low-pressure irrigation system. EnviroTech recommends all of the following methods of irrigation (presented below as numbered options) are suitable for installation on this site.

1. Fixed / Semi-fixed Surface Spray Irrigation
2. Surface Drip Irrigation
3. Subsurface Drip Irrigation

Any irrigation system must be installed within the proposed irrigation shown on the site plan or within the 'available irrigation envelope' (if an envelope is shown on your site plan).

The client shall choose whichever of the following irrigation options best suits their needs. Before choosing which type of irrigation to install, the client must first consider:

+ Appendix E (Irrigation Descriptions & Standard Drawings)
+ Appendix F (Operation & Maintenance Guidelines).

<u>If Council prefers the client install one particular method of irrigation (i.e. only one of our recommended options be available to the client) then consultation between client and Council may be required.</u>

Effluent Application Area Sizing

A monthly nutrient balance and water balance were modeled to determine the minimum land application area with no wet weather storage requirements. The results were as follows:

Minimum Irrigation Areas:

Number of Bedrooms In Proposed Residence	Water Balance	Nitrogen Balance (Spray Irrigated on Slashed Grass)	Nitrogen Balance (Subsurface Irrigation Under Mown Lawn)	Phosphorus Balance (Spray Irrigated on Slashed Grass)	Phosphorus Balance (Subsurface Irrigation Under Mown Lawn
4	340m^2	696m^2	218m^2	315m^2	271m^2
5	425m^2	870m^2	272m^2	394m^2	339m^2
6	510m^2	1044m^2	326m^2	473m^2	407m^2

Site Modifications Recommended

Nil

RECOMMENDATIONS

For each proposed lot:

- Installation of a NSW Health accredited Aerated Wastewater Treatment System (AWTS) with capacity to treat the following design flowrates to a secondary treatment standard with disinfection:

4-Bedroom Residence	870 L / day
5-Bedroom Residence	1088 L / day
6-Bedroom Residence	1305 L / day

- Installation of a low-pressure effluent irrigation system. This area shall be designated for effluent application only.

- EnviroTech recommends all of the following irrigation types are suitable for installation on the proposed lots:

Number of Bedrooms In Proposed Residence	Fixed Surface Spray Irrigation	Subsurface Drip Irrigation
4	696m^2	340m^2
5	870m^2	425m^2
6	1044m^2	510m^2

- The following Lots include land that is within 40 metres of an intermittent watercourse along the south-western site boundary:

Lot 930	Lot 931
Lot 932	Lot 933
Lot 934	Lot 935
Lot 936	Lot 937
Lot 938	Lot 939
Lot 940	Lot 941

  Any proposed effluent irrigation area for the above Lots that is within 40 metres of this watercourse MUST be by 'Subsurface Drip Irrigation' method only.

- Before choosing which type of irrigation system to install, the client must consider:
  + Appendix E (Irrigation Descriptions & Standard Drawings)
  + Appendix F (Operation & Maintenance Guidelines).

- Once the client's septic application has been approved, the client shall choose whichever of the above options best suits their needs in consultation with Council.

- Further site-specific irrigation details (for example, accurate sprinkler and distribution line positioning within the proposed irrigation area), if required, may be determined in consultation with your plumber / irrigation installer.

- Each irrigation system must be installed within the proposed land application area shown on the site plan or within the 'available irrigation envelope' (if an envelope is shown on your site plan).

LEGEND

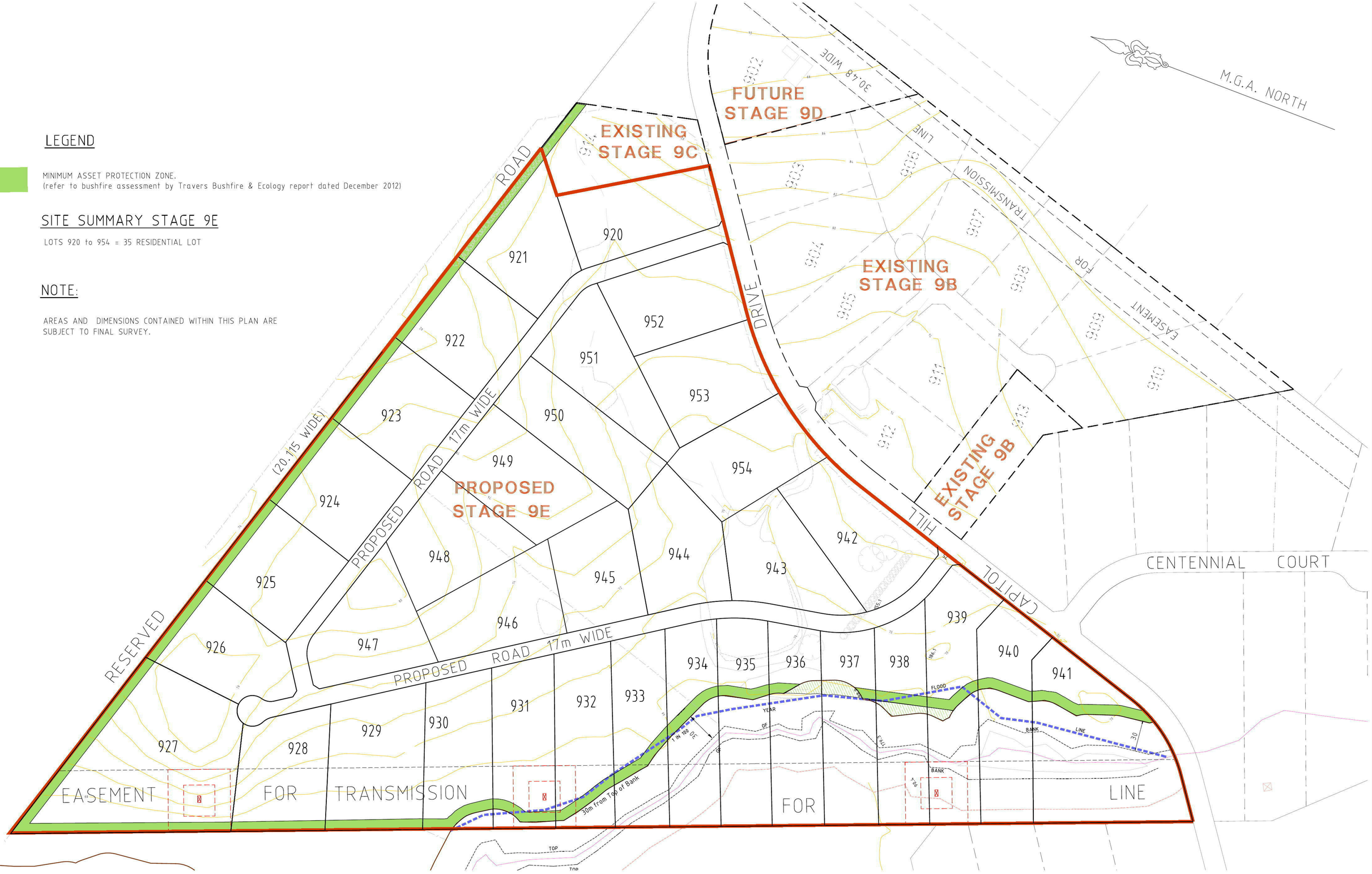
MINIMUM ASSET PROTECTION ZONE.
(refer to bushfire assessment by Travers Bushfire & Ecology report dated December 2012)

SITE SUMMARY STAGE 9E

LOTS 920 to 954 = 35 RESIDENTIAL LOT

NOTE:

AREAS AND DIMENSIONS CONTAINED WITHIN THIS PLAN ARE SUBJECT TO FINAL SURVEY.



REDUCTION RATIO
PLAN..... CROSS SECT. H.....
LONG SECT. H..... V.....
V.....

1:1000 @ A0 0 20 40 60 80 100 Metres

1000 DATUM: AHD.	DESIGN: LS	CHECKED: AA
SURVEY: RAA.	DRAWN: LS	DATE: 28/8/2012

1:1000 0 10 20 30 40 50 100 Metres				DISK No.	
SURVEY		ROADS		LAYOUT	SHEET 2
STADIA		DRAINAGE		AUTOCAD	23-210-09DA-H

RPS
RPS Australia East Pty Ltd
ACN 140 292 762
ABN 44 140 292 762
142 Sunnyholt Road
PO Box 6745
Blacktown NSW 2148
T +61 2 9853 0299
F +61 2 9831 3274
W rpsgroup.com.au

PAZIT PTY. LTD.

PROPOSED SUBDIVISION OF RESIDUE LOT 915 IN PREVIOUS APPLICATION IN THE SUBDIVISION OF LOT 1672 IN D.P. 855001 CAPITOL HILL – STAGE 9E

PENRITH CITY COUNCIL

AMENDMENTS

REF. No. 111244-ST.9E

SHEET 1 OF 3 SHEETS

NUTRIENT BALANCES

1) Nitrogen Balance

- Effluent nitrogen concentration $(mg/L)_1$:	20
- Design Wastewater Flowrate (L/d):	1088
- Critical Total Nitrogen Loading Rate: $(mg/m^2/d)_3$:	25
- Critical Total Nitrogen Loading Rate: $(mg/m^2/d)_4$:	80
- Minimum irrigation $area_{1\ (m2)}$:	**870**
- Minimum irrigation $area_{2\ (m2)}$:	**272**

2) Phosphorus Balance

- Phosphorus Sorption Capacity $(_{kg/Ha})$	13468
- Critical loading rate $_{(mg/m2/day)3}$	3
$P_{adsorbed\ (kg/Ha)}$:	4489
$P_{adsorbed\ (kg/m2)}$:	0.45
$P_{uptake\ (slashed\ grass)\ (mg/m2)}$	54750
$P_{uptake\ (slashed\ grass)\ (kg/m2)}$	0.05
$P_{uptake\ (mown\ grass)\ (mg/m2)}$	136875
$P_{uptake\ (mown\ grass)\ (kg/m2)}$	0.14

Phosphorus Generated Over the 50 year Design Period

- Effluent Phosphorus Concentration: $_{(mg/L)1}$	10
$P_{generated\ (kg)}$	199

Irrigation area required $_{(m2)}$:

- $P_{generated}$ / ($P_{adsorbed}$ + P_{uptake}):	**394**	for slashed grass
- $P_{generated}$ / ($P_{adsorbed}$ + P_{uptake}):	**339**	for mown grass

1: Typical AWTS Effluent Nutrient Concentrations
3: Spray Irigated on Slashed Grass
4: Subsurface Irrigated Under Mown Grass

Appendix D: WATER BALANCE / WET-WEATHER STORAGE REQUIREMENT-Nominated Area Method

Parameter	Symbol	Formula	Units	Value
Design Wastewater Flow	(Q)		L / day	1088
Design Soil Percolation Rate$_2$	(SPR)		mm / month	86
Nominated Irrigation Area$_1$	(A)		m2	425

Weather Station: Precipitation: St. Clair
Evaporation: Badgerys Creek

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Days in Month	(D)		days	31	28	31	30	31	30	31	31	30	31	30	31
Median Precipitation	(MP)		mm/month	73.2	65	55.5	30	35	32	17.4	13.5	23	31	58.5	63
Mean daily Evaporation	(E)		mm/day	5.9	5.4	4.5	3.5	2.1	1.7	2.1	3	4	4.7	5.7	6.6
Crop Factor	(C)			0.7	0.7	0.7	0.6	0.5	0.5	0.4	0.5	0.6	0.7	0.7	0.7
Evapotranspiration	(ET)	(E x C)	mm/month	128.0	105.8	97.7	63.0	32.6	23.0	26.0	41.9	66.0	94.7	119.7	143.2

Inputs	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Median Precipitation	(MP)		mm/month	73.2	65.0	55.5	30.0	35.0	32.0	17.4	13.5	23.0	31.0	58.5	63.0
Effluent Irrigation	(EI)	(Q x D / A)	mm/month	79.4	71.7	79.4	76.8	79.4	76.8	79.4	79.4	76.8	79.4	76.8	79.4
Inputs	(I)	(EI+MP)	mm/month	**152.6**	**136.7**	**134.9**	**106.8**	**114.4**	**108.8**	**96.8**	**92.9**	**99.8**	**110.4**	**135.3**	**142.4**
Outputs	**Symbol**	**Formula**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Evapotranspiration	(ET)	(E x C)	mm/month	128	106	98	63	33	23	26	42	66	95	120	143
Design Soil Percolation Rate$_2$	(SPR)		mm / month	86	86	86	86	86	86	86	86	86	86	86	86
Outputs	(O)	(ET+SPR)	mm / month	**214**	**192**	**184**	**149**	**119**	**109**	**112**	**128**	**152**	**181**	**206**	**229**

Storage	(I - O)			-61	-55	-49	-42	-4	0	-15	-35	-52	-70	-70	-87
Cumulative Storage	(M)			0	0	0	0	0	0	0	0	0	0	0	0

Storage Requirement	(V)	Largest M	mm	0
		(VxA) / 1000	m^3	0

1: Nominated Irrigation Area to be greater than or equal to the minimum irrigation area determined in the nutrient balances

2: Based on AS1547:2000 Design Irrigation Rates x 4.3 weeks / month