ON-SITE WASTEWATER ASSESSMENT FOR PROPOSED 4 LOT SUBDIVISION OF LOT 6 DP 1128635 11 WESTMINSTER PLACE, RAZORBACK

LGA: WOLLONDILLY SHIRE COUNCIL

OWNER: MR SAM CAVANAGH

PROJECT MANAGER/SURVEYOR: JEFF BULFIN, PRECISE PLANNING

16 October 2015

Our ref: 1597ww

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Prepared by

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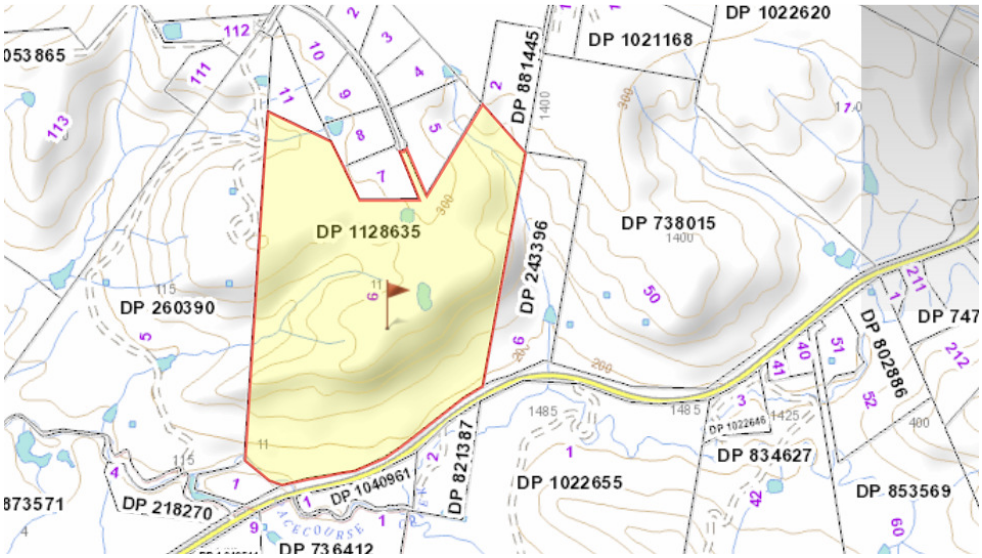
1. INTRODUCTION

This report was prepared by Harris Environmental Consulting for Mr Sam Cavanagh, the owner of Lot 6 DP 1128635, 11 Westminster Place, Razorback. The owner proposes to subdivide the 54ha property to create five lots, which includes 4 x 4ha residential lots and a residual 38ha lot. The residual lot has an existing approval for a residential dwelling.

Figure 1 Location of property

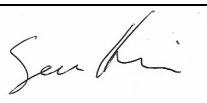


2. ASSESSMENT CRITERIA

Harris Environmental Consulting prepared this On-Site Wastewater Assessment to address the requirements of:

- Wollondilly Shire Council's DCP for On-Site Sewage Management and Greywater Re-Use, (May 2011);
- On-site Sewage Management for Single Households (Department of Local Government, 1998); and
- Standards Australia (2012) Australian/New Zealand Standard 1547:2012 On-Site Domestic Wastewater Management, Standards Australia;

3. SITE INFORMATION

Owner/contact details:	Mr Sam Cavanagh
Site address	11 Westminister Place, Razorback
Folio No:	Lot 6 DP 1128635
Size of property	Lot 1 = 4.09ha Lot 2 = 4.28ha Lot 3 = 4.02ha Lot 4 = 4.01ha Lot 5 = 38.92ha
Local Government Area	Wollondily Shire Council
Catchment	Drains to racecourse Creek, a tributary of Stonequarry Creek and Nepean River.
Water supply	Town water
Wastewater design load	Assume 4 bedroom/8 person equivalent household, flow @ 145 litres person per day (BASIX requires standard water reduction fixtures) = 1160 litres/day
Assumed method of treatment	AWTS
Assumed method of effluent disposal within Effluent Management Area (EMA)	Lot 1,2 & 4 = Spray irrigation Lot 3 = Subsurface irrigation
Date site assessed:	15/10/2015
Date report prepared:	16/10/2015
Site assessor:	 Sean Harris Msc Env Science (UOW), Grad dip Nat Res (UNE), BscAppSc, Agriculture (HAC)

4. SITE ASSESSMENT

Weather conditions	Dry at time of site assessment
Climate	Camden (Brownlow Hill) Rainfall Station (median annual 698.65mm) Badgerys Creek (median 1557mm)
Flood potential	NA, irrigation area above 1 in 20 year flood level; minor limitation.
Exposure	Lot 4: Northeasterly aspect/ minor tree cover to cast shade; minor limitation Lot 1,2 & 3: Northwesterly aspect/ minor tree cover to cast shade; minor limitation
Slope in proposed EMA	Lot 1: 12% in, minor limitation Lot 2: 5%, minor limitation Lot 3: 5%, minor limitation Lot 4: 12%, minor limitation
Landform	Undulating grazing land; minor limitation
Run-on and seepage	Minor potential for runon and seepage; minor limitation

Erosion potential	No evidence of sheet or gully erosion; minor limitation
Evidence of fill	Naturally occurring soils; no evidence of fill within the site of proposed irrigation area, minor limitation
Domestic groundwater use	No groundwater bores within 100m+
Required buffer distance available from EMA to:	Permanent waters : 100m+ Intermittent waters : 40m+ Boundary (up-slope/down-slope): 3-6m Buildings (up-slope/down-slope): 3-6m
Surface rock	Minor surface rock on Lot 4 only; minor limitation
Area available for effluent disposal	1500m^2 Effluent Management Area available on Lots 1,2 & 4 (Category 1). Lot 3 has required irrigation area only (Category 2)

5. SOIL ASSESSMENT

Methods	Crowbar/shovel	
Depth to high soil watertable (m)	Groundwater not encountered at either site	
Soil profile Lot **1**	**Layer 1**	
	depth	0 – 300mm
	colour	dark brown
	texture	silty clay loam
	coarse fragments	no coarse fragments
	soil structure	moderately structured
	moisture	dry
	Layer 2	
	depth	300 – 500mm
	colour	dark brown
	texture	clay loam
	coarse fragments	no coarse fragments
	soil structure	well structured
	moisture	dry
	mottles	na
	Layer 3	
	depth	500 – 1000mm
	colour	tan/olive brown
	texture	heavy clay
	coarse fragments	no coarse fragments
	soil structure	massive
	moisture	dry
	mottles	na

Soil profile Lot **2**	**Layer 1** depth colour texture coarse fragments soil structure moisture **Layer 2** depth colour texture coarse fragments soil structure moisture mottles	 0 – 300mm dark brown silty clay loam no coarse fragments moderately structured dry 300 – 1000mm red brown clay loam no coarse fragments massive dry na
Soil profile Lot **3**	**Layer 1** depth colour texture coarse fragments soil structure moisture **Layer 2** depth colour texture coarse fragments soil structure moisture mottles	 0 – 300mm dark brown silty loam no coarse fragments well structured - compacted dry 200 – 1000mm grey heavy clay no coarse fragments well structured dry 5% orange
Soil profile Lot **4**	**Layer 1** depth colour texture coarse fragments soil structure moisture **Layer 2** depth colour texture coarse fragments soil structure moisture mottles	 0 – 300mm dark brown silty clay loam no coarse fragments well structured dry 300 – 1000mm red bown heavy clay no coarse fragments moderately structured dry na
Surface rock	Minor surface rock on Lot 4; minor limitation	
Bulk density	No evidence that plant growth is restricted, minor limitation.	

Design Irrigation Rate (mm/day) for layer 1	***Design Irrigation Rate:*** secondary treated effluent in regards to the DIR adopted from Table 4.2A1 of ASNZ1547 (2012) for a clay loam topsoil = 20mm
pH (soil/water)	pH 5-5.5; minor limitation.
Electrical conduct (1:5) (dS/m)	<4, indicating salinity is not a constraint; minor limitation
Emerson Aggregate Test (EAT)	3(1) minor limitation
Soil landscape	Picton Soil Landscape

Photo 1 Lot 1 Landscape

Photo 2 Lot 1 Soil profile

Photo 3 Lot 2 proposed irrigation area

Photo 4 Lot 2 Soil profile

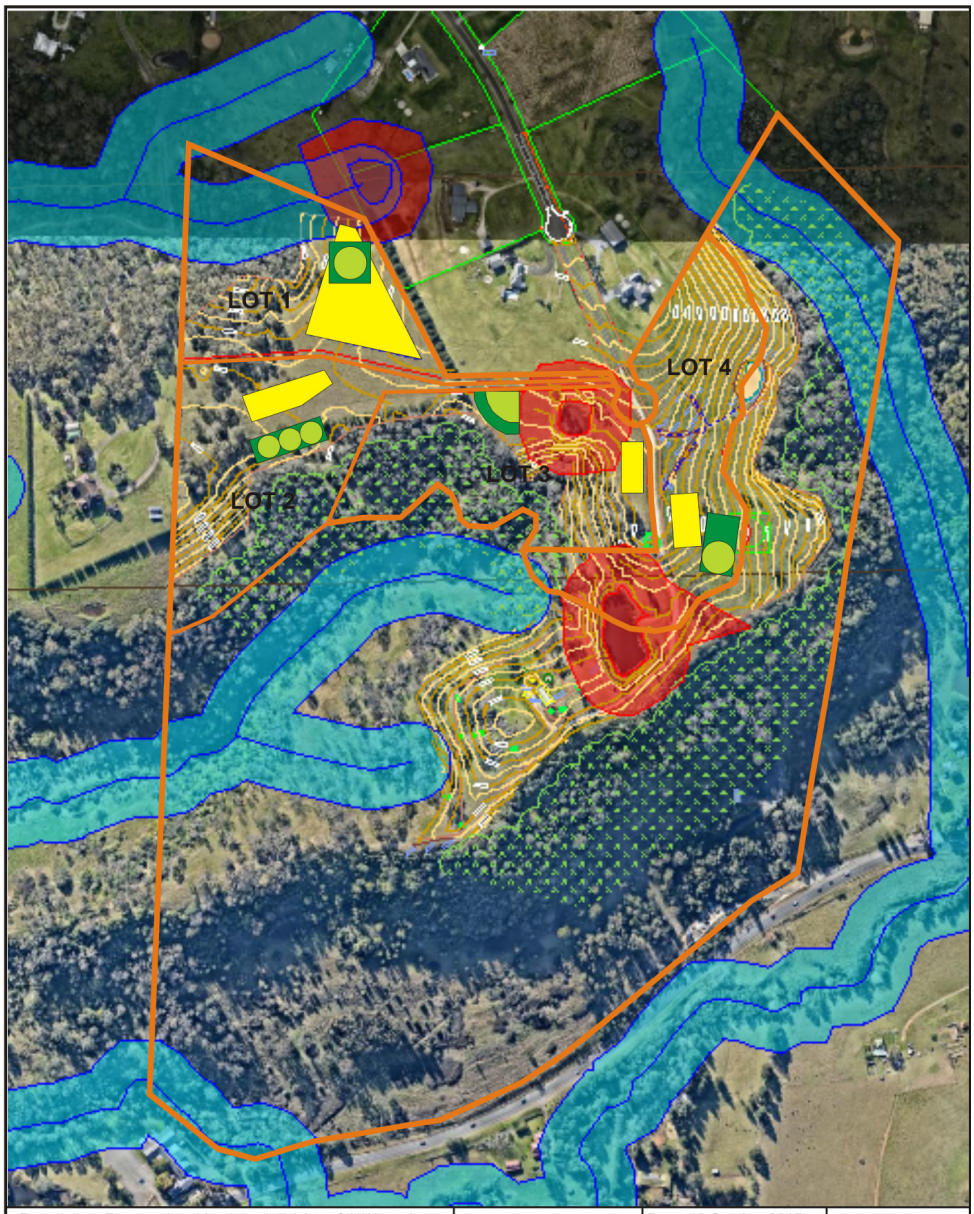
Photo 5 Lot 3 Soil profile

Photo 6 Lot 3 Soil profile

Photo 7 Lot 4 proposed irrigation area

Photo 8 Lot 4 soil profile

Figure 2 General Site Plan



Description: Proposed residential subdivision of 11Westminster Place, Razorback	Owner: Sam Cavanagh	Date: 16 October 2015	Our Ref:1597ww

Site Features:

- Proposed Building Envelope
- Available 1500m² effluent management area
- Proposed 736m² effluent management area
- 40m buffer from drainage lines
- 40m buffer from dams
- Property boundary
- Drainage depression

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Figure 3 Lot 1 Site Plan

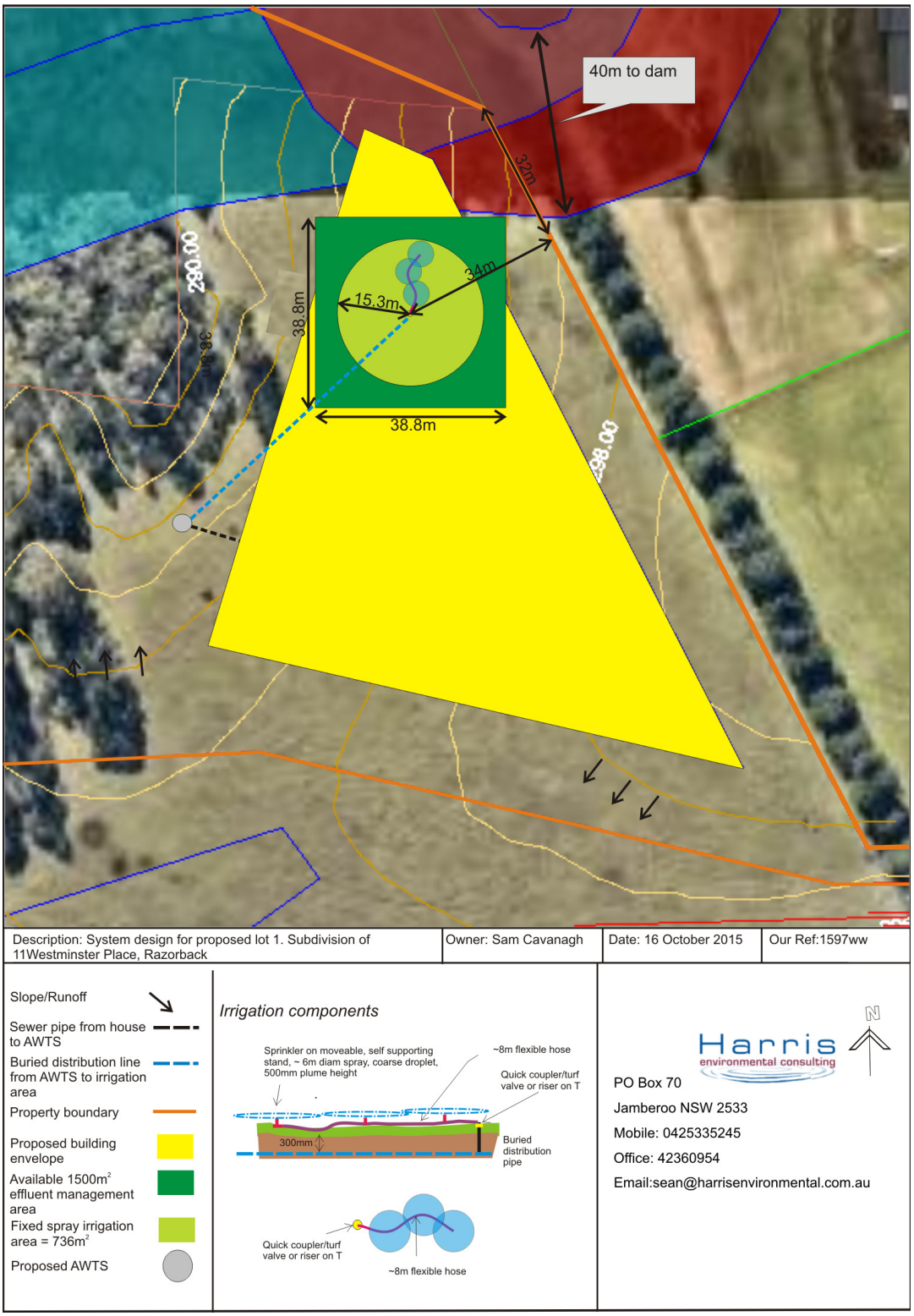
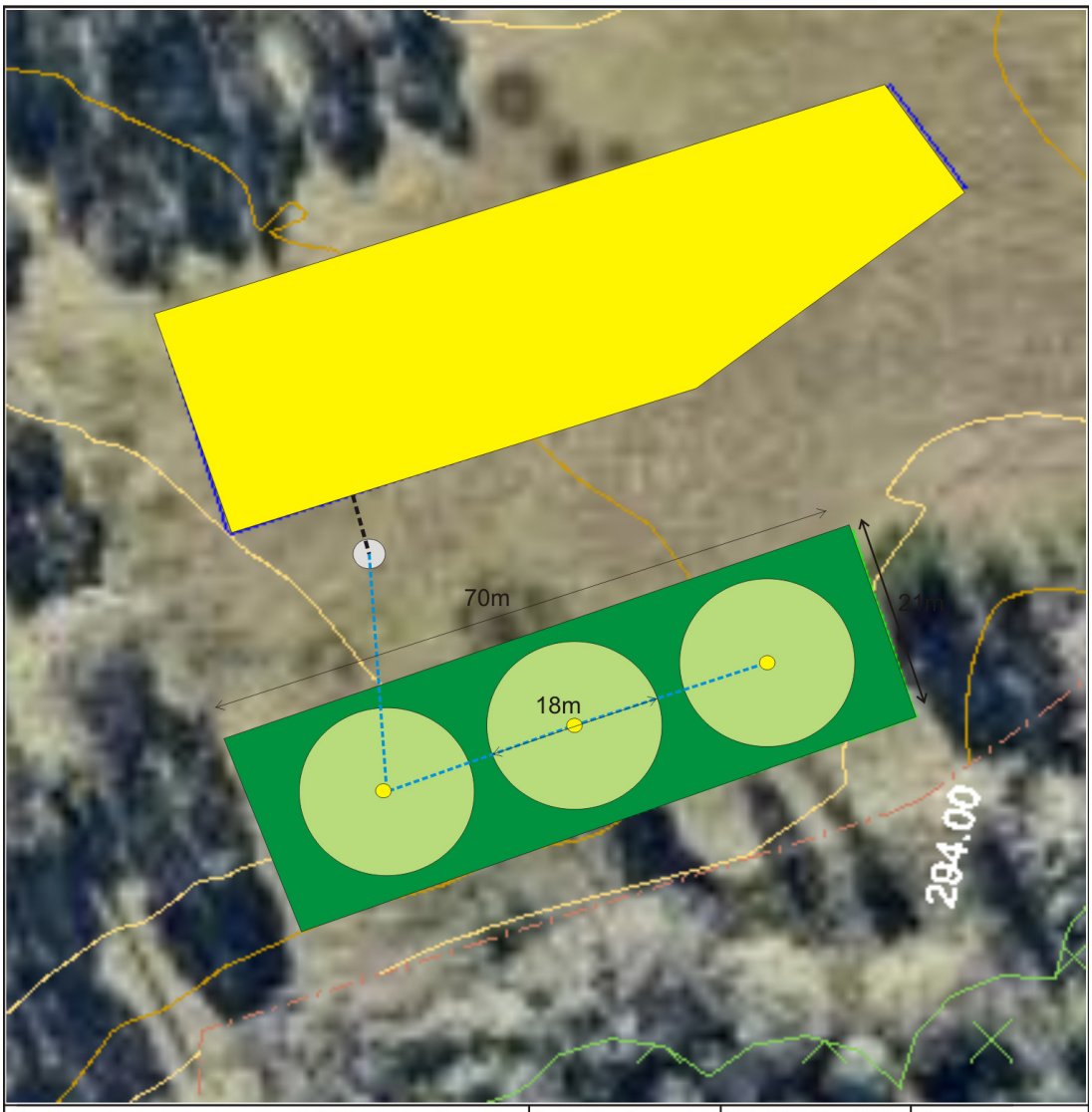


Figure 4 Lot 2 Site Plan



Description: System design for proposed lot 2. Subdivision of 11Westminster Place, Razorback	Owner: Sam Cavanagh	Date: 16 October 2015	Our Ref:1597ww

Slope/Runoff 2%

Sewer pipe from house to AWTS

Buried distribution line from AWTS to irrigation area

Property boundary

Proposed building envelope

Available 1500m² effluent management area

Fixed spray irrigation area = 736m²

Proposed AWTS

Irrigation components

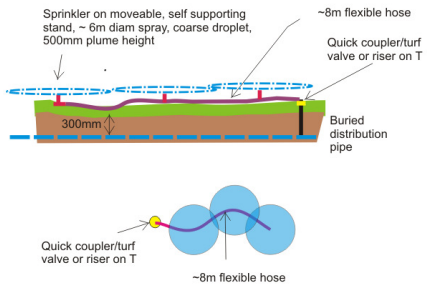


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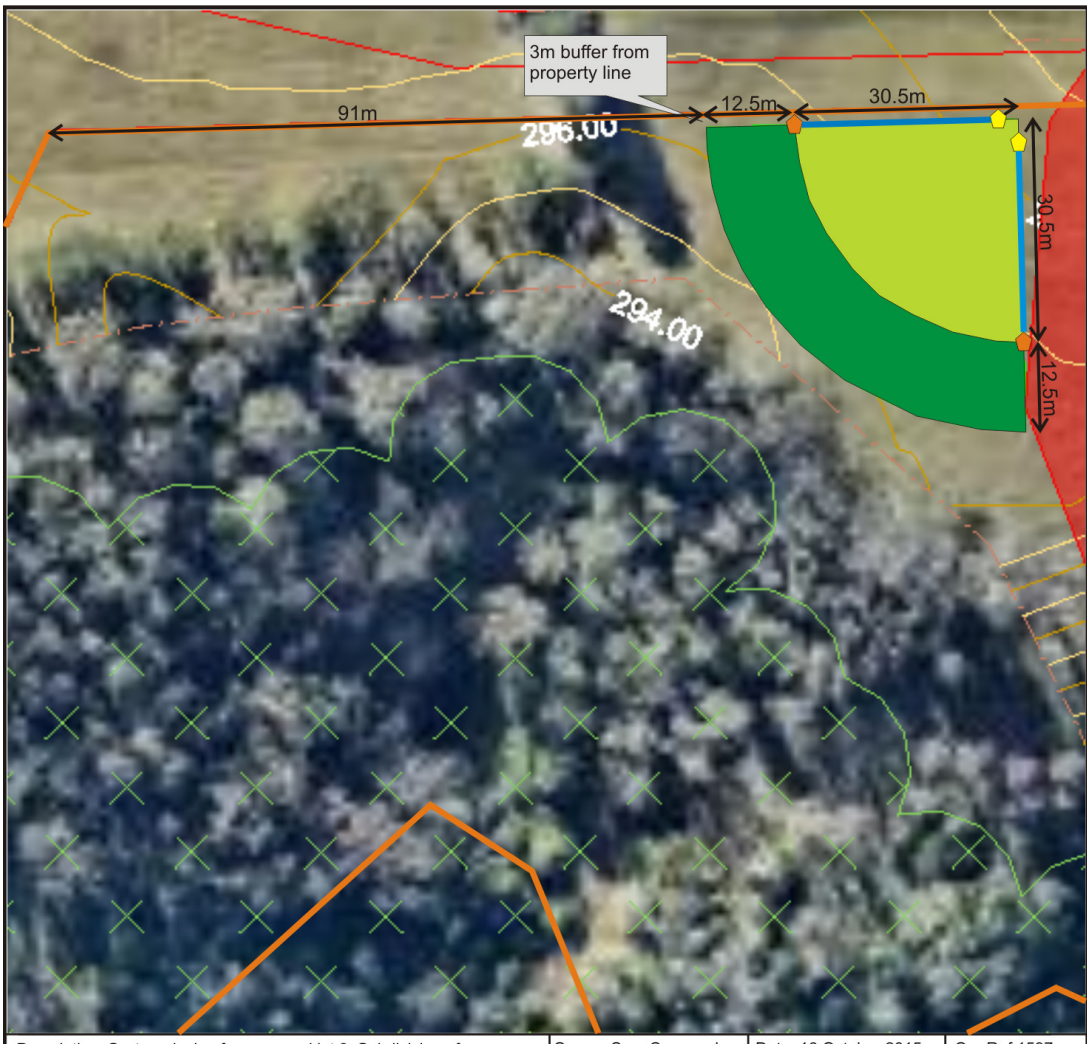
Figure 5 Lot 3 Site Plan



Description: System design for proposed lot 3. Subdivision of 11Westminster Place, Razorback	Owner: Sam Cavanagh	Date: 16 October 2015	Our Ref:1597ww

Site Features:

Disc filter or 100 -150 micron filter

Automatic water rotor or gate valve

Air release valves at high points

Check valves for periodic flushing

Proposed Building Envelope

Available 1500m² effluent management area

Proposed 736m² effluent management area

Property boundary

40m buffer from dams

Concept drawing of components shown in drawing

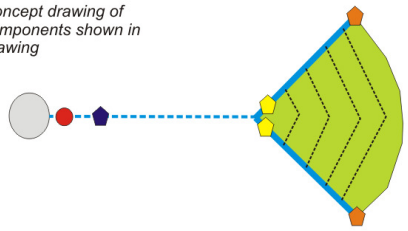


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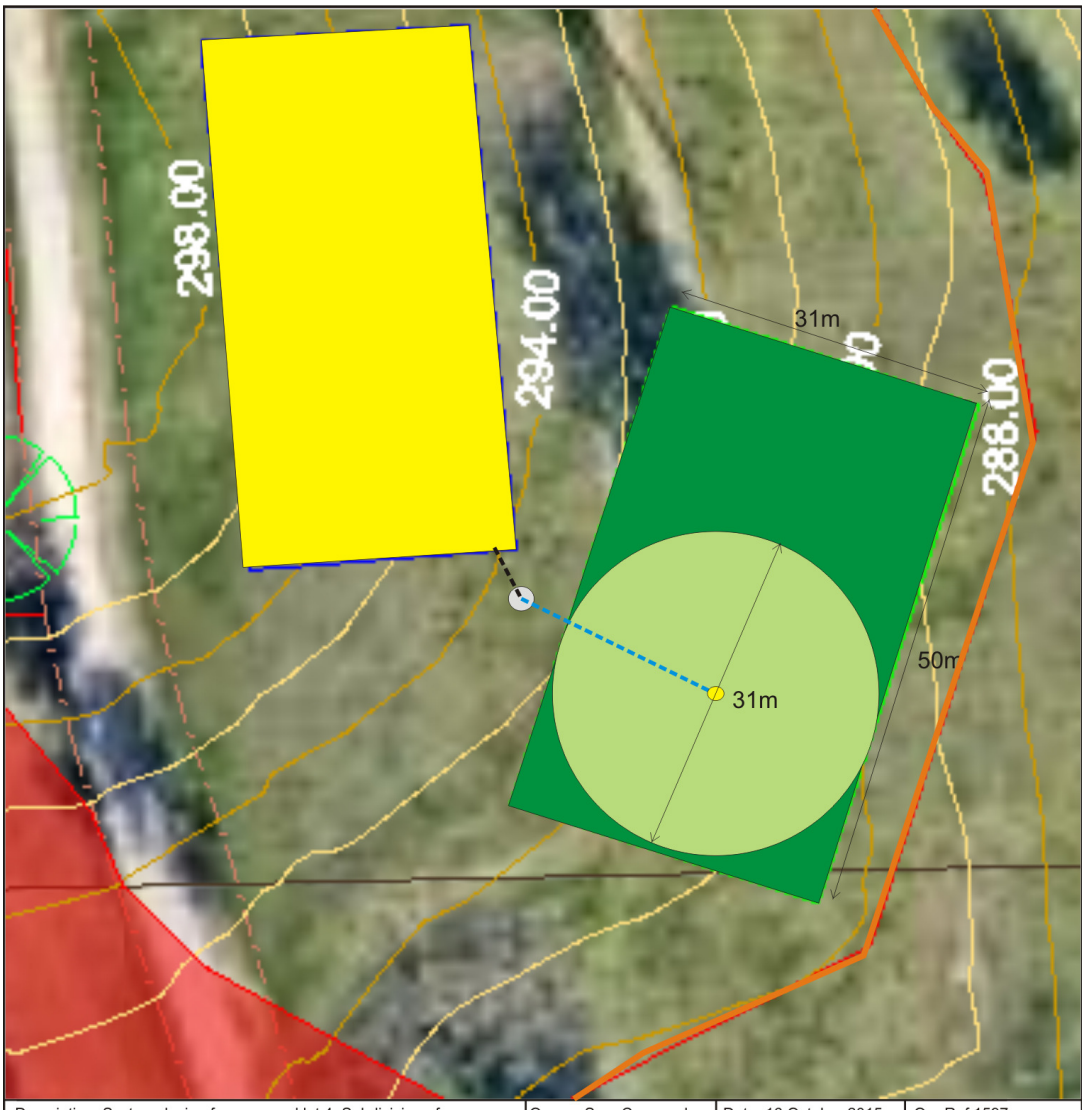
Figure 6 Lot 4 Site Plan



Description: System design for proposed lot 4. Subdivision of 11Westminster Place, Razorback	Owner: Sam Cavanagh	Date: 16 October 2015	Our Ref:1597ww

Slope/Runoff 2%

Sewer pipe from house to AWTS

Buried distribution line from AWTS to irrigation area

Property boundary

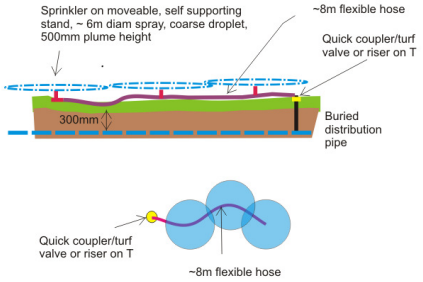
Proposed building envelope

Available 1500m² effluent management area

Fixed spray irrigation area = 730m²

Proposed AWTS

Irrigation components



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6. SUMMARY OF SOIL AND SITE CONSTRAINTS

6.1 An AWTS is proposed for all 4 lots. Lots 1,2 & 4 have 1500m^2 available for spray irrigation, but Lot 3 does not. Either spray or subsurface irrigation is proposed for Lots 1,2 & 4. Only subsurface irrigation is allowed on Lot 3.

7. METHOD OF WASTEWATER TREATMENT

7.1 A domestic AWTS (capacity for 10 persons) is required for each lot. The owner must provide Council with the AWTS manufacturer's specifications of the Sewage Management Facility. (Information on proposed AWTS can be obtained from the manufacturer or NSW Heath Register of Accredited Sewage Management Systems at http://www.health.nsw.gov.au/publichealth/environment/water/waste_water.asp).

7.2 The AWTS manufacturer will provide the necessary plans and specifications including NSW Health Accreditation, tank dimensions and capacity, operation and maintenance details, plus Licensed Plumber's name, address, phone number and license number.

7.3 The AWTS will be installed and maintained in accordance with Section 5 of the guidelines 'On-site Sewage Management for Single Households' (Department of Local Government, 1998) and AS/NZS 1547-2012 'On-site Domestic Wastewater Management' (Standards Australia, 2012);

7.4 Upon approval from Wollondilly Shire Council, the owner is to enter into a servicing contract with an approved servicing agent for the life of the system. Copies of the written service reports should be lodged with Wollondilly Shire Council following each quarterly service

7.5 **The proposed location of the AWTS is conceptually shown on the Site Plan but there are other locations that are equally suitable, so this should not be considered a fixed location.** The AWTS must be positioned on a stable, level base and be downslope of the building so there is sufficient fall from drainage outlets in the dwelling. The location of AWTS shown on the Site Plan was selected because:

- it is downslope of the buildings from where wastewater is generated;
- at least 2.5m away from the building
- at least 5m from the property boundary
- at least 6m downslope from any in ground water storage tanks.

7.6 AWTS installation must comply with the manufacturer's recommendations, AS/NZS 3500.2:2003 Plumbing and Drainage Part 2 Sanitary Plumbing and Drainage' and Council requirements.

7.7 The sewer pipe between the house, AWTS and irrigation area must be buried at a depth that provides protection against mechanical damage or deformation, in accordance with 'AS/NZS 3500(Set):2003 Plumbing and Drainage Set'. Table 1 shows the minimum pipe depth for trafficable areas.

Table 1 Minimum pipe depth for trafficable areas

Location	Minimum depth of cover (mm)
Where subject to heavy vehicular traffic	500
Where subject to light vehicular traffic	450
Elsewhere	300
Source:'AS/NZS 3500:2003 Table 3.4 Minimum Cover for Buried Piping'	

8. AREA REQUIRED FOR EFFLUENT DISPOSAL

8.1 The required irrigation area has been sized for each lot based on the following design parameters for the proposed development:

- 4 bedroom/8 person house;
- Aerated Wastewater Treatment System (AWTS);
- Town water supply @ 145L/person.

8.1 The design wastewater load is 1160L/day. The irrigation area needed to manage 1160L/day was calculated using the monthly water (hydraulic) and nutrient balance.

8.2 The water balance (nominated area method) adopts an application rate of 20mm/week or 2.9mm/day for these loam top soils. Using this method, an irrigation area of 537m^2 is required. Wet weather storage is not required.

8.3 The phosphorus balance assumes the AWTS will reduce Total Phosphorus to 12mg/L, an assumed P-sorption of 500mg/kg which equates to 6500kg/ha/annum. It is estimated that these soils will be effective to retain 0.3% of predicted sorption. Crop uptake is assumed to be 30kg/ha/annum, which equals 8mg/m^2/annum. Based on these variables, the phosphorus balance requires 736m^2.

8.4 The nitrogen balance assumes the AWTS will reduce Total Nitrogen to 27mg/L. Vegetative uptake for the improved, managed pastures is assumed to be 150kg/N/ha/year, which is equivalent to a loading rate of 51mg/m^2/day. Based on these variables, the nitrogen balance requires 610m^2.

8.5 The primary irrigation area is the larger of the three methods (most limiting), which is 736m^2.

9. METHOD OF IRRIGATION

9.1 **Wollondilly Council Category 1** assessment requires a property to have **1500m^2 of land suitable for spray irrigation in order for spray irrigation to be used.** Lot 1, 2 & 4 has 1500m^2 available for spray irrigation but only 736m^2 is required to be installed for a 4 bedroom house. For Lot 3, 736m^2 of subsurface irrigation is required. The method for installing each method is described in the Appendix.

10. IN HOUSE WATER MANAGEMENT

10.1 This assessment assumes standard water conservation practices in accordance with the requirements needed to comply with BASIX. This assumes that water efficient choices are made when purchasing and installing:

- clothes washing machines
- dishwashers
- flow controllers
- toilet (lavatory equipment)
- showers
- taps for use over a kitchen sink, bathroom basin, laundry tub etc
- urinal equipment.

10.2 For further information on the Water Efficient Labelling Scheme, which is recognised by BASIX as the measure of an efficient product, go to *http://www.savewater.com.au/products/product-labelling.*
http://www.waterrating.gov.au/

11. SUMMARY

The purpose of this assessment is to assess whether on site wastewater management can be undertaken on the proposed lots to achieve the relevant assessment criteria. This assessment finds that on site wastewater management can be undertaken at the location adjacent to each indicative building site.

The assessment was based on the use of an Aerated Wastewater Treatment System, assumed 4 bedroom residence and town water supply.

- Required irrigation area for all 4 lots is 736m^2;
- Spray irrigation is suitable for Lots 1, 2 & 4;
- Only subsurface irrigation is suitable for Lot 3;

12. REFERENCES

Department of Local Government (1998) *On-site Sewage Management for Single Households*. NSW Government.

Standards Australia (2012) Australian/New Zealand Standard 1547:2012 *On-site domestic wastewater management*. Standards Australia.

NSW Health Septic Tank Accreditation Guidelines (2001).

Wollondilly Shire Council's DCP for On-Site Sewage Management and Greywater Re-Use, (May 2011)

Appendix I Installation of Spray Irrigation

a) The irrigation area should be split into 2 or 3 zones to allow each zone to be operated independently. Within each zone, a 10 to 20m length of 19mm poly pipe is fitted with three low plume wobbler sprinklers (or similar), mounted on 300mm fixed risers and spaced a suitable distance for the sprinklers being used. The poly pipe and sprinklers are manually moved from riser (turf valve) to the next.

b) The buried distribution line should be 300mm deep with the riser/ turf valves spaced to suit the length of the poly pipe being used and throw of the sprinklers.

c) Sprinkler should be fitted with nozzles sized to achieve even distribution within each zone.

d) To avoid manually management of the irrigation pipe, the zones can be automated using a water rotor (or similar). This will allow the treated wastewater to be switched to a number in a continuous sequential manner without electrical or mechanical control. Water flowing through the water rotor turns an impellor, which through gearing opens internal valves to deliver an equal amount of water to each outlet. Sprinklers will need to be permanently set up in each zone.

e) The grass within the irrigation area should be mown on a regular basis to ensure sprinklers can be seen through grass and any breakage or leaks can be seen and repaired;

f) The effluent disposal area shall be clearly identified within the property by post or some other means.

g) All stormwater and seepage from higher levels shall be diverted away from the effluent disposal area using a dish drain or similar.

h) Fruit or salad vegetables should not be irrigated with effluent

i) The irrigation area should not be used for recreational purposes or used for parking a car.

j) Horse and cattle should not be kept within the effluent disposal area.

k) Buffer distances are 6m if area up gradient and 3m if area down gradient of swimming pools, property boundaries and driveways; 15m buffer to buildings.

l) A warning sign complying with AS1319:1994 – Safety signs for the occupational environment should be located at the boundary of the designated area in one or two places, clearly visible to property uses, with wording such as, RECYCLED WATER, AVOID CONTACT, DO NOT DRINK'.

Example of turf valve, flexible 19mm poly pipe and a single wobbler (top right) and traditional spray head (bottom).

Appendix II Subsurface irrigation

i) The irrigation area should be split into zones of 200 to 300m^2.

ii) Each zone is to receive an even proportion of wastewater, using a sequencing valve, such as a water rotor or similar.

iii) Immediately after the AWTS, a disc filter or a 100 to 150 micron filter is to be installed (ie, before the sequencing valve). The filter must be cleaned regularly (at least every 3 months).

iv) The distribution pipe from the AWTS to the water rotor shall consist of a 25mm uPVC or polythene pipe, buried 300mm underground. Where vehicles pass over the line, it should be 450mm for light traffic and 500mm for heavy traffic.

v) Pressure compensating subsurface drip line is used with emitters and laterals at approximately 800mm spacing's (min 600mm, maximum of 1000mm depending on soil type) and buried to a depth of 100mm below finished ground level (in accordance with ASNZ1547:2012).

vi) The drip line is to be impregnated with root inhibitor or include a tech filter that dispenses a root inhibitor (a chemical injector assembly or impregnated emitter tube) to protect drip line from root ingress.

vii) Air release valves should be located at the highest point and flush valves at the lowest point of each sub-surface zone and shall be contained within a durable protective housing with a lilac lid to indicate wastewater.

viii) Additional air/vacuum valves, pressure-reducing valves and non return / tube non-leakage valves are to be included into the design as needed. ie., where the effluent irrigation area is located above the treatment system or pump well, a non return valve.

ix) The system must have capacity to enable flushing to remove any suspended solids and organic growth that may accumulate.

x) The effluent irrigation system should be tested to ensure there is uniform effluent delivery to all parts of the irrigation area.

xi) The effluent management area must be fenced off from livestock and vehicles.

xii) The irrigation area should be vegetated with grass before commissioning. The grass within the irrigation should be mown on a regular basis and dispose of clippings outside the irrigation area.

Appendix III Water Balance

Nominated Area Water Balance for Zero Storage

Site Address: **11 WESTMINSTER PLACE, RAZORBACK**

INPUT DATA

Design Wastewater Flow	Q	1160	L/day
Design DIR (from AS/NZ 1547,2000)	DIR	20	mm/week
Daily DIR		2.9	mm/day
Nominated Land Application Area	L	535	m sq
Rainfall Data	Picton Council depot median		
Evaporation Data	Badgerys Creek monthly averages		

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D	\	days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Rainfall	R	\	mm/month	67.1	68.5	68.3	49.8	31.8	42.9	25.9	25.1	37.8	49.5	55.5	53.2	761
Evaporation	E	\	mm/month	202	157	136	105	81	63	81	96	120	152	183	220	**1557**
Crop Factor	C			0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	
INPUTS																
Precipitation	(P)		mm/month	67.1	68.5	68.3	49.8	31.8	42.9	25.9	25.1	37.8	49.5	55.5	53.2	761
Effluent Irrigation	(W)	(Q x D) / L	mm/month	67.2	60.7	67.2	65.0	67.2	65.0	67.2	67.2	65.0	67.2	65.0	67.2	**791.40187**
Inputs		(P+W)	mm/month	134.3	129.2	135.5	114.8	99.0	107.9	93.1	92.3	102.8	116.7	120.5	120.4	1366.8
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	162	126	109	74	57	44	57	67	96	122	146	176	**1234.2**
Percolation	B	(DIR/7)xD	mm/month	88.6	80	88.6	85.7	88.6	85.7	88.6	88.6	85.7	88.6	85.7	88.6	**1042.9**
Outputs		ET+B	mm/month	250.2	205.6	197.4	159.2	145.3	129.8	145.3	155.8	181.7	210.2	232.1	264.6	**2277.1**
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage	S	(P+I)-(ET+B)	mm/month	-115.9	-76.4	-61.9	-44.4	-46.3	-21.9	-52.2	-63.5	-78.9	-93.5	-111.6	-144.2	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Largest M	**(V)**		mm	**0.00**												
		(V x L)/1000	m^3	**0.0**												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	197	224	276	370	461	537	461	406	298	252	208	182	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: **537.3** m^2

Appendix IV Nitrogen Balance

	NITROGEN BALANCE		
	SITE ADDRESS	**11 WESTMINSTER PLACE, RAZORBACK**	
	1. DETERMINE THE DAILY N LOAD		
(a)	Effluent concentration TN	27	mg/L
(b)	Daily hydraulic load	1160	L/day
(c)	(a) x (b) =	31320	mg/day
	2.DETERMINE THE ANNUAL N LOAD		
(d)	(c) x 365 days	11,431,800	mg
	3. ALLOW 20% LOSS THROUGH DENITRIFICATION, VOLATIZATION, MICROBIAL ATTACK ETC		
	(d) x 0.8	9,145,440	mg/yr
(e)	Annual N load	9,145	kg/yr
	3. ALLOW FOR PLANT UPTAKE	shurbs and some trees (managed)	
(f)	Vegetation N Uptake	150	kgN/ha/yr
(g)	Which equates to (c) / (h)	51	$mg/m^2/day$
	5. DIVIDE THE ANNUAL N LOAD X APPLICATION RATE		
(g)	(e) / (f)	0.0610	ha
(h)	**MINIMUM AREA FOR P UPTAKE UNDER MANAGED LAWN**	**610 m^2**	

Appendix V Phosphorus Balance

PHOSPHORUS BALANCE								
SITE ADDRESS	**11 WESTMINSTER PLACE, RAZORBACK**							
Daily hydraulic load	1160	L/day						
Effluent P Concentration	12	mg/L						
Design Life of System	50	years						
Crop P uptake	30	kg/ha/yr	which equals	8	$mg/m^2/day$			
P sorption of soils								
P-sorption result	500	mg/kg	which equals	6500	kg/ha			
			which equals	0.65	mg/m^2			
Bulk density	1.3	g/cm^2						
Depth of soil	1	m						
% of Predicted P-sorp	0.3	Decimal						
Nominated EMA	736	m^2						
Daily P Load	0.0139	kg/day	→	Phosphorus generated over life of system			254.04	kg
Daily Uptake	0.006052174	kg/day	→	Phosphorus vegetative uptake for life of system			0.150	kg/m^2
Measured p-sorption capacity	0.65	kg/m^2						
Assumed p-sorption capacity	0.195	kg/m^2	→	Phosphorus adsorbed in 50 years			0.195	kg/m^2
Site P-sorption capacity	143.59	kg	→	Desired Annual P Application Rate			2.9	kg/yr
MINIMUM AREA FOR P UPTAKE	**736**	**m^2**						