Anderson
ENVIRONMENTAL CONSULTANTS PTY LTD

ON SITE EFFLUENT DISPOSAL REPOR FOR A PROPOSED DWELLING AND GREYHOUND FACILITYAT 38-44 KEECH ROAD

CASTLEREAGH

PENRITH CITY COUNCIL LOCAL GOVERNMENT AREA

Prepared by
Jason Anderson
Bachelor of Applied Science
(Conservation Technology-1992)
University of New England

April 2013

Anderson Environmental Consultants Pty Ltd ABN 34 126 481 418
PO BOX 690 Springwood 2777 Ph: 1300 302 507 Fax: (02) 8580 4731
jason@andersonenvironmental.com.au
www.andersonenvironmental.com.au

Contents

1. Introduction

1.1 Background

Anderson Environmental Consultants Pty Ltd was engaged to conduct a feasibility study in relation to on site effluent disposal for a proposed dwelling and greyhound facility at 38-44 Keech Road, Castlereagh, Penrith City Council Local Government Area. The proposal is for a 4 bedroom house and a small greyhound facility. Council indicate that although the house is a 4 bedroom house that they want the system sized for a 5 bedroom house.

1.2 Study Site

The study site represents a rural allotment with the house proposed at the front of the allotment and the greyhound facility at the back and in the existing shed.

1.3 Soils

The soils on the site are comprised by the Richmond Soil Landscape as described from Bannerman, S.M., and Hazelton, P.A. (1990) - Soil Landscapes of the Penrith 1:100000 Sheet. Soil Conservation Service of NSW. Sydney. This mapping appears accurate for this site.

RICHMOND (75km²)

Landscape — Quaternary terraces of the Nepean and Georges Rivers. Relatively flat (slopes <1%) and level. Splays, levees provide local relief of <3 m. Tree cover almost completely cleared, formerly a low open woodland (dry sclerophyll).

Soils — poorly structured orange to red clay loams, clays and sands. Texture may increase with depth. Ironstone nodules may be present. *Plastic clays (Uf6.12)* in drainage lines. *Krasnozems (Gn3.14, Gn4.34), red earths (Gn2.11)* and *red podzolic soils (Dr2.41)*, occur on terrace surfaces, with *earthy sands (Uc5.21, Uc1.23)* on terrace edges.

Limitations — high erosion hazard on terrace edges. Minor localised flooding.

1.4 Climatic Information

The data in the table below is from UWS Hawkesbury collected from between 1881 to 2012.

The data in the table below is from UWS Hawkesbury collected from between 1881 to 2012.

Climatic Summary for Closest Meteorological Stations to the Site

Month	Mean Rainfall (mm)	Mean Evap 'n (mm)
January	96.0	6.0
February	96.1	5.0
March	87.9	4.1
April	67.0	3.1
May	58.2	2.2
June	60.8	1.7
July	45.4	1.9
August	42.6	2.7
September	43.0	3.8
October	57.3	4.6
November	72.1	4.9
December	75.1	5.7
Year	802.3	45.7

1.5 Proposal

The proposal is based on a dwelling being constructed of 5 bedrooms. Australian Standard 1547:2012 on effluent disposal systems for domestic premises suggests a daily flow rate of not less than 200 litres per person per day based on bore water. This is less for tank water being approximately 120 litre/person/day. A five-six bedroom house is assumed therefore of making the volume of effluent to be disposed of approximately 1500 litres per day based on two adults and 5 children (7 persons). With water saving devices this can be reduced however for the purposes of this report the figure used was 1500 litres. Such water saving devices include low flow shower heads and dual flush toilets. The 1500 litre figure has been used to allow for usage at higher levels than what would normally be present. This accounts for the dog facility which has been estimated by the client to only use 50 litres of water per day. This figure therefore allows a large margin for the dog facility and indeed the house itself since it is a 4 bedroom house. The house itself as a 4 bedroom house would use approximately 800 litres of water per day so the system has been sized well above the normal requirement. This is considered adequate for this site and the dog facility.

1.6 Statutory Requirements

This study and report was undertaken to comply with Australian/New Zealand Standard 1547/2012 "On-Site domestic-wastewater management", and the Environmental and Health Protection Guidelines "On Site Management for Single Households" – Commonly called the "Silver Book" (February 1998).

2. Methodology

2.1 Site Assessment

The site was assessed according to Table 4 (page 63) in the "Silver Book". The classifications and ratings from this table were used in the Site Assessment. This involved a ground survey across the site. Once prospective areas for on-site disposal were identified the soil assessment was undertaken.

2.2 Soil Assessment

The soil assessment was carried out in accordance with AS 1547/2012. The soil assessment was carried out by the use of a 100 mm hand auger. The upper sections of the soil were removed with a spade. Two auger holes were bored in the preferred effluent disposal areas to determine any variability in soil profile. As the soils were consistent across the site the soil samples were pooled for analysis. Records were made in the field of Soil Colour (Munsell Colour), Soil Field Texture, Presence of Coarse Fragments, Presence of Water Table, and any notation of Shrink/Swell reactivity. Soil samples across the site were pooled for analysis.

3. Results

3.1 Site Assessment Results

Table 1: Site Assessment

Site Feature	Comment	Type of Limitation
Flood Potential	Above the 1 in 20 year flood contour.	Minor Limitation
Exposure	High sun and wind exposure.	Minor Limitation
Slope %	Approximately 2% slope.	Minor Limitation
Landform	Largely Level Land	Minor Limitation
Run-on and Upslope Seepage	None.	Minor Limitation
Erosion Potential	No signs of erosion potential present.	No Limitation
Site Drainage	No Fill appears to be present.	No Limitation
Buffer Distance	Adequate buffer distances present.	No Limitation
Land Area	Adequate suitable land area is available.	No Limitation
Rocks/Rock outcrops	None	No Limitation

Buffer Distances
Permanent Watercourses >100 metres
Intermittent Watercourses and Dams >40 metres
Dwellings >15 metres
Paths and Walkways >3 m
Property Boundaries (upslope >3 metres, downslope >6 metres)
Note: All buffer distances are available for all allotments

3.2 Soil Assessment Results

A Horizon 0 – 120 cm

Munsell Colour	7.5YR/4/4
Field Texture	Sandy Loam
Presence of Coarse Fragments	Nil
Presence of Water Table	Nil
Shrink /Swell reactivity	Nil

The following table of results has been adapted from Table 6 (page 68) of the "Silver Book" and Australian Standard 1547:2012.

Table 2: Soil Assessment Ratings

Soil Feature	Comment	Rating
Depth to Bedrock	> 70cm	Minor Limitation
Depth to High Episodic/Seasonal Watertable	None present at sampling depth	No Limitation
Soil Permeability Category	Clay Loam	Minor Limitation
Coarse Fragments	None	No Limitation.
Bulk Density	< 1.42g/mL Sandy Loam*	Minor Limitation
pH in CaCl	PH = 5.7	Moderate Limitation. Application of Lime at the rate of 300g/sqm will make this a Minor Limitation.
Electrical Conductivity (dS/m)	Low Salinity at 0.06	Minor Limitation
Sodicity (exchangeable sodium percentage)	0.18*	Minor Limitation
Cation Exchange Capacity	2.7	Major Limitation. Can be improved with incorporation of organic matter.
Phosphorus sorption (kg/ha)	6020kg/ha	Minor Limitation
Modified Emerson Aggregate test	Class 7	Minor Limitation

* = Expected Results based on other soil chemical assessments in the local area.

4. Calculation of the Irrigation Area, Water Balance and Storage Requirements

4.1 Nitrogen Loading (Area Requirement)

The following nitrogen loading calculation is based on the following;

- Total Nitrogen Concentration (TN) of 20mg/L in treated wastewater.
- A critical TN loading rate (L_n) of 25mg/m^2/day.

$$A = \frac{20 \text{ X } 1500}{25}$$

$$= 1200 \text{ m}^2$$

4.2 Phosphorus Loading (Area Requirement)

The following phosphorus loading calculation is based on the following;

- Total Phosphorus Concentration (TP) of 12mg/L in treated wastewater.
- A critical loading rate (L_p) of 3mg/m^2/day.
- A phosphorus sorption capacity of 6020kg/ha.

Determination of the amount of phosphorus that can be adsorbed without leaching over 50 years.

$$P_{adsorbed} = 6020 \text{ X } 1/3$$

$$= 2006 \text{ kg/ha}$$

$$= 0.2006 \text{ kg/m}^2$$

Determination of the amount of vegetation uptake over 50 years.

$$P_{uptake} = 3 \text{ X } 365 \text{ x } 50$$

$$= 54\,750 \text{ mg/m}^2$$

$$= 0.055 \text{ kg/m}^2$$

Determination of the amount of phosphorus generated over 50 years.

P generated = total phosphorus concentration X volume of wastewater produced in 50 years
= 12 X 1500 X 365 X 50
= 328.5 X 10^5
= 328.5 kg

Determination of irrigation area required.

Irrigation Area = $P_{generated}$ / ($P_{adsorbed}$ + P_{uptake})

= 328.2 / (0.2006 + 0.055)

= 1284 m^2

***Phosphorus is therefore the limiting nutrient, as its area required being 1284 m^2**, which is larger than the nitrogen area of 1200 m^2.*

4.3 Nominated Area Method Water Balance

The nominated area method water balance based on an irrigation area of 1284 square metres will require no wet weather storage. A wet weather storage of 4 m^3 should however be provided. The full results of these calculations are shown in Appendix 1.

5. Conclusion

This site is suitable for an on-site standard Aerated Septic system. Sub-surface irrigation should be used. The effluent volume of 1500 litres per day is much more than is actually likely to be generated however this figure has been used to allow for the requirement of a 5 bedroom house (even though the approved house is 4 bedrooms) and for the dog facility. The water from the dogs should first go through a coarse filter to filter out any hair and a small primary settling tank to remove any other matter. Dog faeces will be collected for disposal by hand and as such the nutrient loading on the system will be small from this source.

An ECOMAX type amended mound system would utilise a smaller area of approximately 750 square metres if the owners so decided. These are often used in sensitive areas and would be suitable for this site if the owners wished to have a greater area of land, which was not being used for effluent disposal.

References

Australian Standard 1547/2012. On-Site domestic-wastewater management. Standards Australia.

Environmental and Health Protection Guidelines – On-site Sewage Management for Single Households.

Bannerman, S.M., and Hazelton, P.A. (1990). Soil Landscapes of the Penrith 1:100000 Sheet. Soil Conservation Service of NSW. Sydney.

McDonald, R.C Isbell, R.F., Speight, J.C., Walker, J and Hoplins, M.S. (1990). Australian Soil and Land Survey: Field Handbook. Second Edition. Inkata Press Melbourne.

Appendix 1 – Water Balance Calculation

Table: 3 Monthly Water Balance for a Determination of Wet Weather Storage				Data from UWS Hawkesbury from 1881												
Design Wastewater Flow	(Q)	L/Day		1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0	
Design Percolation Rate	(R)	mm/wk		86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	
Land Area	(L)	m2		1284.0	1284.0	1284.0	1284.0	1284.0	1284.0	1284.0	1284.0	1284.0	1284.0	1284.0	1284.0	
Parameter	**Symbol**	**Formula**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Days in Month	(D)	-	days	31.0	28.0	31.0	30.0	31.0	30.0	31.0	31.0	31.0	31.0	30.0	31.0	365.0
Precipitation	(P)	-	mm/month	96.0	96.1	87.9	67.0	58.2	60.8	45.4	42.6	43.0	57.3	72.9	75.1	802.3
Evaporation	(E)	-	mm/month	6.0	5.0	4.1	3.1	2.2	1.7	1.9	2.7	3.8	4.6	4.9	5.7	45.7
Crop Factor	(C)	-	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	
Inputs																
Precipitation	(P)	-	mm/month	96.0	96.1	87.9	67.0	58.2	60.8	45.4	42.6	43.0	57.3	72.9	75.1	802.3
Effluent Irrigation	(W)	Q X D/L	mm/month	36.2	32.7	36.2	35.0	36.2	35.0	36.2	36.2	36.2	36.2	35.0	36.2	427.6
Inputs	(I)	(P + W)	-mm/month	132.2	128.8	124.1	102.0	94.4	95.8	81.6	78.8	79.2	93.5	107.9	111.3	1229.9
Outputs																
Evapo-transpiration	(ET)	E X C	mm/month	6.0	5.0	4.1	3.1	2.2	1.7	1.9	2.7	3.8	4.6	4.9	5.7	45.7
Percolation	(B)	(R/7 X D)	mm/month	380.9	344.0	380.9	368.6	380.9	368.6	380.9	380.9	380.9	380.9	368.6	380.9	4496.6
Outputs		(ET+B)	-mm/month	386.9	349.0	385.0	371.7	383.1	370.3	382.8	383.6	384.7	385.5	373.5	386.6	4542.3
Storage	(S)	(P + W) – (ET+B)														
(ET + B)	mm/month	convert -ve to 0	mm/month	-254.6	-220.2	-260.8	-269.6	-288.6	-274.4	-301.1	-304.7	-305.4	-291.9	-265.5	-275.2	
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	
Storage	(V)	Largest M	0.0													
	(V X L)/1000	m3	0.0													

Appendix 2 – Site Map