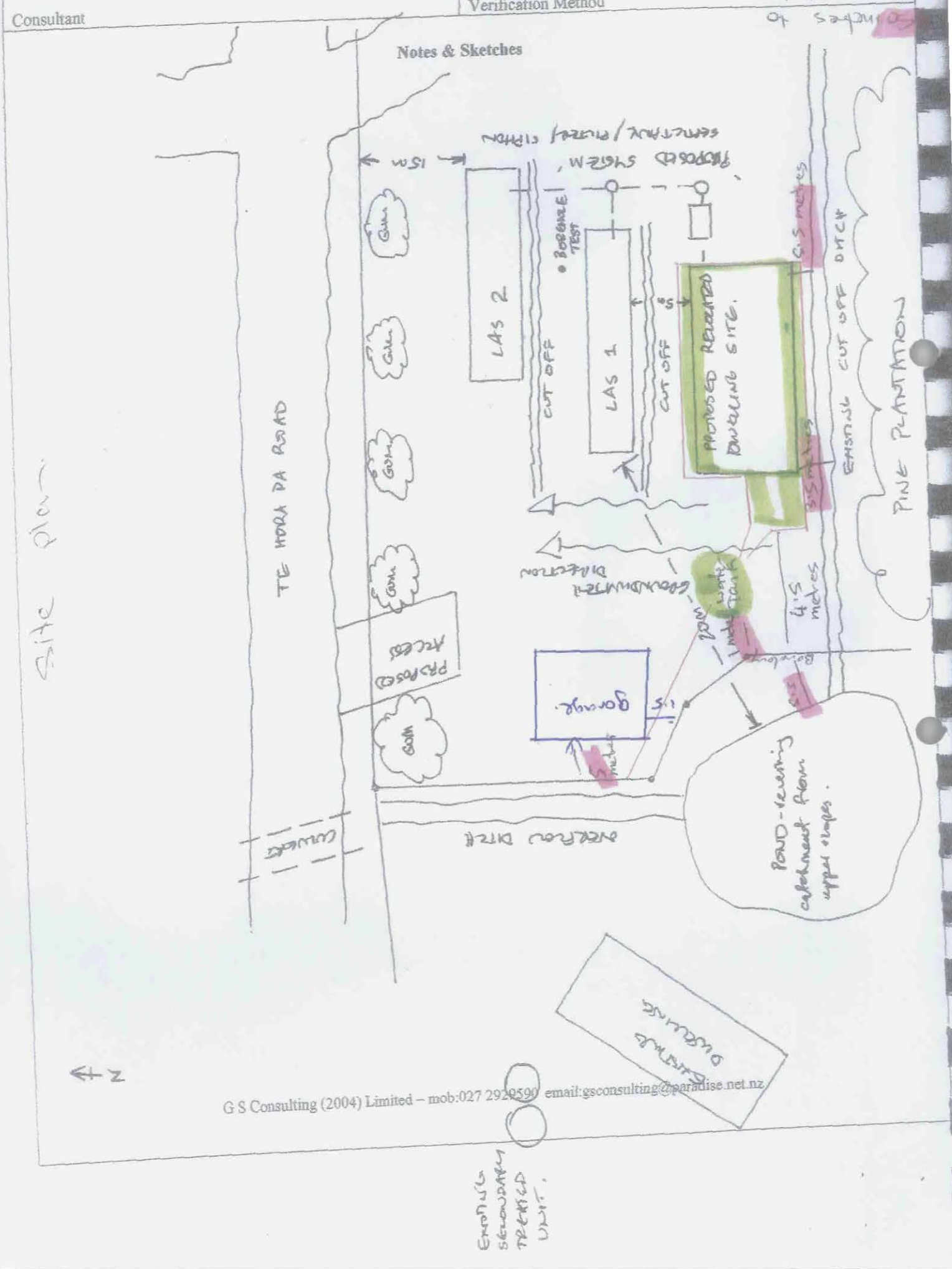
Client	Project Number
Contact Number	Project Location
Date	Project Type
Consultant	Verification Method

Notes & Sketches



File Reference: 87 Te Hora Pa Road, Canvastown

GSC

GS CONSULTING LIMITED
Plumbing & Drainage System Consultancy

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24 August 2007

Application Officer
Marlborough District Council
Seymour Street
BLENHEIM

ONSITE WASTE WATER & LAND APPLICATION SYSTEM REPORT FOR LAND AT Lot 2 DP 383203 being 87 Te Hora Pa Road, Canvastown.

1. Introduction

1.1. G S Consulting Limited has been employed to assess best suitable option for Wastewater & land application for land at Lot 2 DP 383203 being 87 Te Hora Pa Road, Canvastown.

1.2. The project is a relocated 3 bedroom dwelling in the Marlborough District and a daily flow rate of 840 litres/day for 6 persons.

1.3. The Onsite Wastewater & Land Application system shall comply with AS/NZS 1547:2000 and Onsite Waste-water Systems: Design and Management Manual TP58 Third Edition ARC Technical Publication 2004.

2. Design Population and Flow

2.1. The system capacity for this project based on two persons per bedroom is a total of 6 persons.

2.2. Potable water will be supplied by supply tank. The volume of wastewater using tables in AS/NZS 1547:2000 is 140 litres per person. Water reduction measures for this project are nil.

2.3. The daily design flow allowance for this project is 840 litres/day.

3. Site/Soil Evaluation

3.1. The total lot area is 0.6679 hectares, with a 300 square metres available for land application. The land application site is located to best utilise the sites ability to use natural soil filtration/treatment and evapo-transpiration capabilities.

PO Box 771, Nelson
Mobile 027 292 9590
Email gsconsulting@paradise.net.nz

3.2. The adjacent waste water and land application systems are primary waste water systems with deep trench land application systems which appear to show no sign of failure, all clear of natural water resource. Secondary system installed by owner on adjacent property is operating OK. System has irregular use, so performance still under review.

3.3. The rainfall intensity for the area is 90mm. The annual rainfall for the area based on NIWA recordings is 1450mm.

3.4. The land is being used for rural residential and was previously used for pasture. Ground cover is grass. The vegetation is pine plantation, gum trees and native saplings. There is no proposed landscaping for this project.

3.5. The average slope of the land is 15 - 18°. The predominant slope faces North. The slope is shaped linear convergent. Slope stability has not been assessed by G S Consulting (2004) Limited.

3.6. Surface water direction runs toward the road. Cut off drains are required. There is no potential for flooding on this property.

3.7. The separation distances to the following features are: natural water resource being overflow ditch from pond is 20 metres; closest boundary is 15 metres; groundwater is 2 metres estimated; there are no wells or bores; there are no embankments or retaining walls; buildings is 5 metres; pasture animals are 100 metres.

3.8. The soil type is Clay Loam being Category 4 with an imperfect indicative drainage type and a design loading rate for Evapo-transpiration system of 10mm/day.

3.9. The key constraints arising from the site and soil evaluation are the location of the pond and overflow ditch will not be an issue due to ground water direction runs clear of these. Imperfect drainage indicated, however high percentage of stones will create better drainage. Large cut off drain existing but with imperfect drainage, cut off drains are still required just above the land application system.

3.10. The design responses to the key constraints are install cut off drains about land application system. Use wide bed system to increase basal area. Dose load with siphon, to apply small regular doses.

4. Assessment of Environmental Effects

4.1. The effects on the environment within the property are an increase of nutrients to the soil, however due to application and separation, both vegetation and groundwater will not be affected.

4.2. The effects on the environment beyond the property and the cumulative effects on the environment are not anticipated beyond the boundary, apart from an increase of groundwater to lower area. Note this system will have no cumulative effects on lower level waste water systems.

4.3. Note that the design responses to the key restraints on this property will address any effects on the environment.

5. Design for Land Application System

5.1. The land application system selected is effluent bed. The system will be dose loaded with small regular doses of 140 litres in total, up to 6 (six) times per day. The reason for the land application system is the soil type and available area layout.

5.2. The land application system separation to boundary is 5 metres.

5.3. The special design features to address the constraints are siphon dosing regime applying small regular doses.

5.4. The land application system is calculated at 84 square metres. The reserve are will be 84 square metres. The width will be 2 metres.

5.5. The factors of safety for this design are 100% reserve area, cut off drains and a conservative design loading rate.

6. Design for Pre-treatment System

6.1. The primary treated size of tank is 4500 litres. Effluent filter is required however secondary treatment is not required.

6.2. The tanks will be required to be located within 30 metres of road access for maintenance.

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7. Construction and Installation Notes

Septic Tank Design Notes

7.1.1.1. The septic tank used is a small anaerobic oxidation plant, which removes suspended solids from the wastewater and breaks them down anaerobically. The resultant effluent is low in settled solids but high in biological oxygen demand (BOD) and requires biological treatment before release to the environment.

7.1.1.2. Other solids settle to the bottom of the tank, whilst most fats, oils and greases float, and the middle zone of wastewater within the tank overflows to the disposal beds. No enzymes are to be added to the system but natural bacteria are permitted. These bacteria can be added to the system, reducing the amount of sludge and therefore increasing the time between the pumping out of the tank, and reducing the smell of the tank.

7.1.1.3. For longevity of the on-site sewage management system the following maintenance regime should be employed by the owner/occupier of the dwelling. Bleach, bleach-based products, whiteners, nappy soakers and spot removers shall not be disposed into the on-site system. They shall be disposed of by other means.

7.1.1.4. The effluent filter is to be checked three monthly initially and cleaned as required by the manufacturer and the contents of the septic tank pumped out on average every three (3) to five (5) years. Generally speaking households of meat eaters would need to pump out their septic every 3 to 5 years and vegetarians every 4 to 6years.

7.1.1.5. Ensure that the septic tank is mosquito and fly proof. Hygiene products, condoms, tampons, sanitary napkins, disposable nappies and cotton buds and the like shall not be disposed of via the on-site disposal system. They should be disposed of into garbage bins in sealed plastic bags.

7.1.1.6. Only the recommended amounts of disinfectants should be used. Biodegradable products for septic systems are recommended.

7.1.1.7. The septic tank should be serviced annually including the assessment of sludge and scum levels, and checked for blockages of the outlet and inlet square junctions on a regular basis, at least annually.

7.1.1.8. No vehicular, stock or pedestrian access should be made across the disposal field

7.1.1.9. Vegetation from the land application area needs to be harvested to promote young growth and the area may need to be replanted with new plants every five years, depending on plant condition. This work should be undertaken during dry season

7.1.1.10. Effluent from disposal system should not be discharged to the stormwater system or over the ground The effluent distribution pipes and aggregate are to be inspected for blockage etc. and flushed clean or replaced as required.

Warning Signs

i. If any of the following signs of system failure occur contact the plumber who installed the system:

ii. Surface ponding and run-off of treated wastewater

iii. Degradation of soil structure - e.g. sheet and rill erosion, surface crusts, or hard surfaces are evident

iv. Poor vegetation growth

v. Unusual odours.

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vi. Wastewater is backing back up into the house.

vii. Drain pipes that gurgle or make noises when the air bubbles are forced back through the system.

Effluent Filter

7.1.1.11. A biotube or zabel effluent filter is a plastic tube type filter used to reduce suspended solids to a level of about 30 ppm or less and reduce the potential for carry over of suspended solids into the disposal area. This will help prevent the voids in the disposal bed from clogging. There are more advanced filters coming onto the market and it could be argued that these are treatment systems. However, it should be noted that an effluent filter does not provide secondary treatment of the effluent.

8. Attachments

A: WWLA Design Report Site and Soil Evaluation
B: Loading Certificate
C: Design Calculations
D: GSC Producer Statement Design and Inspection Schedule
E: Site Plan provided by owner
F: Land Application Cross Section Detail
G: General WWLA Maintenance Guidelines
H: Key Do's and Don'ts
I: General Problem Solving
J: Household Cleaners Effects on Soils
K: Detergent Chemical Properties
L: Household Cleaners Chemicals Substitutes
M: Percentage Water Use
N: Water Use Saving
O: Plants Suitable for Land Application Area

References:

AS/NZS 1546.1:1998 Onsite Domestic Wastewater Treatment Units Part 1: Septic Tanks

AS/NZS 1546.3:2001 Onsite Domestic Wastewater Treatment Units Part 3: Aerated Wastewater Treatment Systems

AS/NZS 1547:2000 Onsite Domestic Wastewater Management

Onsite Wastewater Systems: Design and Management Manual Third Edition ARC Technical Publication TP58

USEPA Onsite Wastewater Treatment Systems Manual 2002

New Zealand Building Code

Gary Stevens
Plumbing & Drainage Consultant

WASTEWATER DESIGN REPORT - SITE/SOIL EVALUATION

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	SITE EVALUATOR	G Stevens
	DATE	22/8/07
1.0	Type of Design Report	Primary
1.1	Name - Contact	J Smith / Mischesky
	Architect - Contact	
	Size of property	0.6679 ha
	Legal Description	Lot 2 DP 383203
	Street Address	87 Te Hora Po Road, Canvastown
	Grid Reference	E N
1.2	Zone + Building Type (no. x bdrm)	Relocated 3 bdrm
	Region	MDC.
2.1	System capacity	6 persons
2.2	Water supply	Supply Tank.
	Volume	140 litres per person
	Water reduction measures	none
2.3	Daily Design Flow Allowance	840 litres per day
3.1	Total Area	0.6679 ha
	Size available for LA	300 sq/m
3.2	Adjacent WWLA systems & performance:	Primary system with deep trench LAS – not sign of failure, all clear of natural water resource. Secondary system installed by owner on adjacent property. operating OK. System has irregular use, so performance still under review
~~3.3~~	Geology from Soil Maps / Geotech Report	
	Map/Author	
	Site stability Report	
	Author	
3.4	Weather on SSE Day	Fine 10°
	Weather previous 7 days	Fine some rain maybe 2mm.
	Rainfall intensity	90 mm
	Rainfall annual - previous 12 months	1450 mm
	Evaporation annual	No info.
	Site Aspect	North.
	Pre-dominant wind direction	North east.
3.5	Land use	Rural Residential - previously pasture.
	Ground cover	grass
	Vegetation	pine plantation, gum trees, saplings (native)
	Proposed Landscaping	none.

3.6	Slope average Slope predominant Slope shape	15–18° degrees North. Linear convergent
3.7	Surface Water direction Cut off drains req? Potential for flooding? Winter ground water Summer ground water	~~[illegible]~~ toward to road YES/~~NO~~ ~~YES~~/NO est. 2 meters est. 3.5 meters
3.8	Natural water resource Closest boundary Groundwater estimated/measured Wells or Bores Embankments or retaining walls Buildings Pasture animals Other	overflow ditch from pond 20 meters 15 meters 2 meters N/a meters N/a meters 5 meters 100 meters n/a meters
3.9	Soil type Category Indicitive drainage Land application type preliminary	Clay loam 4 ~~Rapid/Well/Moderate~~/Imperfect/~~Poor/V Poor~~ Deep Trench
	Design loading rate & reason: Although 10 metres from overflow ditch the grd water direction indicates (effluent) ground water would run towards road, not toward ditch.	10 mm per day
3.10	Key constraints arising from SSE: (environmental concerns, nutrient loading etc.) location of pond and overflow ditch will not be an issue due to ground water direction. imperfect drainage indicated however high percentage of stones will create better drainage, large cut off drain existing but with poor drainage cut off drains still rqd.	
3.11	Design responses to key constraints: Install cut off drains around lots. use wide bed system to increase basal area. dose load with siphon, to apply small regular doses.	
4.1	Effects on the environment within property: An increase of nutrients to the soil, however due to deep application and separation, both vegetation and groundwater will not be affected.	
4.2	Effects beyond property & cumulative effects: No cumulative effects anticipated beyond the boundary. Other than increase of groundwater to lower area.	

5.1	Land Application System Type Confirmed: Effluent Bed Cross Section Detail : Doses 6 x 140 litres/dose Reason For LAS: soil type	RECEIVED 19 FEB 2008 MARLBOROUGH DISTRICT COUNCIL
5.2	Land Application System separation to boundary	5 meters
5.3	Special design features to address constraints: Syphon dosing regime applying small regular doses.	
5.4	Land application system calculated at Reserve area Width	84 square meters 84 square meters 2 meters
5.5	Factors of safety for this design: 100% reserve area, cut-off drains, conservative DLR.	
	For Primary Treated size of Tank	4500 litres
	For primary treated systems is secondary treatment required, ie sandfilter/wetland	~~YES~~/NO TYPE: Nil

Attachments

√	WWLA Design Report SSE
√	Loading Certificate
	Wastewater system O & M guidelines
√	Design calculations
√	GSC Producer Statement Design
√	Site Plan provided by
√	Land Application Cross Section Detail (5.1)
	Photographs
	Advantages of Compost Systems
	Advantages of UV Filter
✓	Tank Capacities Single
	Tank Capacities Dual
	Effluent quality Ranges
✓	General Problem Solving
✓	General WWLA Maintenance Guidelines
✓	Key Do's and Don'ts
	Key Package Treatment Plant O & M
✓	Household Cleaners Effects on Soils
✓	Detergent Chemical Properties
✓	Household Cleaners Chemicals Substitutes
✓	Percentage Water Use
✓	Water Use Saving
✓	Plants Suitable for Land Application Area
	Land Disposal System vs Soil Part 1 and 2
	Method for Calculating Design Area for Types
	Performance Values for Primary & Secondary Sys

~~Hynds/Septech/BioCycle/Primary/Other~~
Ret or Bore Supply/Roof Tank Supply

Flow Design Allowance - litres/person/day (2.2), Number of persons (2.1)

Design Loading Rate - (3.9) Highlight Soil Category, Soil Texture, Land Application System (5.1) DLR, Indicative Drainage (3.9)

Design Area Sizing - Q (2.3), DLR (3.9) & W (5.4)

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Client name: Project name: Excavation no: Logged by:

Suburb: Lot number: Map sheet name: Grid reference: E N

Street address: Surface level: R L

Date of inspection:

Pit/borehole no:

Slope: % Land form element: Ground cover: Surface condition: Indicative drainage:

Surface stones: Vegetation: Water table depth:

Land surface notes: Parent material:

Layer	Lower depth mm	Horizon	Moisture condition*	Colour (moist)	Field texture	Coarse fragments % volume	Structure	Modified Emerson	Soil category	Sample taken (Y/N)	Consistency	Permeability	Other assessment
1	250		DRY	Brown	CL	20	MODERATE	4	4	N			
2	700		MOIST	YBrown	CL	40	MODERATE	4	4	N			
3	1500			YBrown									
4													
5													

Use another form if >5 layers or major horizons.

*Describe moisture condition as: dry, moist, very moist, saturated.

Notes/comments/observations:

Overall Soil Category assigned:

Soil appears favourable for:

(List system types) Maximum depth of system: Checked by:

GSC FIELD TEXTURE ANALYSIS

PROCEDURE

- Individually take a small quantity of soil in the palm of your hand 9approximately one tablespoon full);
- Spray soil with water,
- Knead until the ball of soil just fails to stick to your fingers (similar to your days with plasticine);
- The bolus should be about the size of a golf ball;
- Continue kneading and moistening until there is no apparent change in the feel of the soil;

NOTE: Should too much water be added, add some more soil.

- Appreciate the feel of the soil (plastic, silty, smooth, sandy) while you are kneading it;
- When the bolus is well formed, squeeze the soil between your thumb and forefinger in an attempt to form a ribbon of soil over your forefinger) this procedure will be demonstrated);
- Continue to form a ribbon until the soil breaks away;
- Compare the length of the broken ribbon with the Table 2
- Record your findings in Table 1; and
- Repeat for each of the samples.

Table 1 - Record of Field Texture Determination

Soil	Grittiness	Stickiness	Plasticity	Stain	Ribbon (mm)	Grade (Table)
1	MODERATE	SLIGHT	MODERATE	SLIGHT	25	SCL
2	MODERATE	MODERATE	MODERATE	SLIGHT	35	CL
3						
4						
5						
NONE SLIGHT MODERATE VERY EXTREMELY						
Grit – sand grains impart a gritty feeling to the soil, sand grains may be visible						
Stickiness – the adhesive forces between different materials, ie soil and hand. Press the soil between your thumb and forefinger, observe adherence to fingers.						
Plasticity – property which allows soil to be deformed rapidly, without rupture, without elastic rebound and without volume change – can be moulded into any form by pressure try to roll the wet soil into a thin ribbon about 2-4 mm diameter. Plastic soils roll to 2mm ribbons about 40 mm long.						
Stain – some soils leave an obvious stain on the hand from organic materials (black) or minerals such as iron (red).						

Table 2 - Field Texture Grade

Field Texture Grade		Behaviour of moist bolus	Ribbon length (mm)	Approx clay content %
S	**Sand**	Coherence nil to very slight, cannot be moulded; sand grains of medium size; single sand grains stick to fingers	Nil	<5%
LS	**Loamy sand**	Slight coherence; sand grains of medium size; can be sheared between thumb and forefinger to give minimal ribbon of about 5 mm	About 5	About 5%
CS	**Clayey sand**	Slight coherence: sand grains of medium size; sticky when wet; many sand grains stick to fingers; discolours fingers with clay stain.	5-15	About 5-10%
SL	**Sandy loam**	Bolus coherent but very sandy to touch; will form ribbon; dominant sand grains of medium size are readily visible	15-25	10-20%
L	**Loam**	Bolus coherent and rather spongy; smooth feel when manipulated but with no obvious sandiness or silkiness; may be somewhat greasy to touch if much organic matter present	25	About 25%
ZL	**Silty loam**	Coherent bolus; very smooth to often silky when manipulated	About 25	About 25%
SCL	**Sandy clay loam**	Strongly coherent bolus, sandy to touch; medium size sand grains visible in finer matrix	25-40	20-30%
CL	**Clay loam**	Coherent plastic bolus; smooth to manipulate	40-50	30-35%
CLS	**Clay loam sandy**	Coherent plastic bolus; medium sand grains visible in finer matrix	40-50	30-35%
ZCL	**Silty clay loam**	Coherent smooth bolus; plastic and often silky to touch	40-50	30-35%
LC	**Light clay**	Plastic bolus; smooth to touch; slight resistance to shearing between thumb and forefinger	50-75	35-40%
LMC	**Light medium clay**	Plastic bolus; smooth to touch; slight to moderate resistance to ribboning shear	75	40-50%
MC	**Medium clay**	Smooth plastic bolus; handles like plasticine and can be moulded into rods without fracture; has moderate resistance to ribboning shear	>75	45-55%
HC	**Heavy clay**	Smooth plastic bolus; handles like plasticine; can be moulded into rods without fracture; has firm resistance to ribboning shear	>75	50% +

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Table 3 - SOIL AGGREGATE STABILITY

Emerson's test conducted with distilled water. For effluent disposal purposes use effluent (detergent and water)

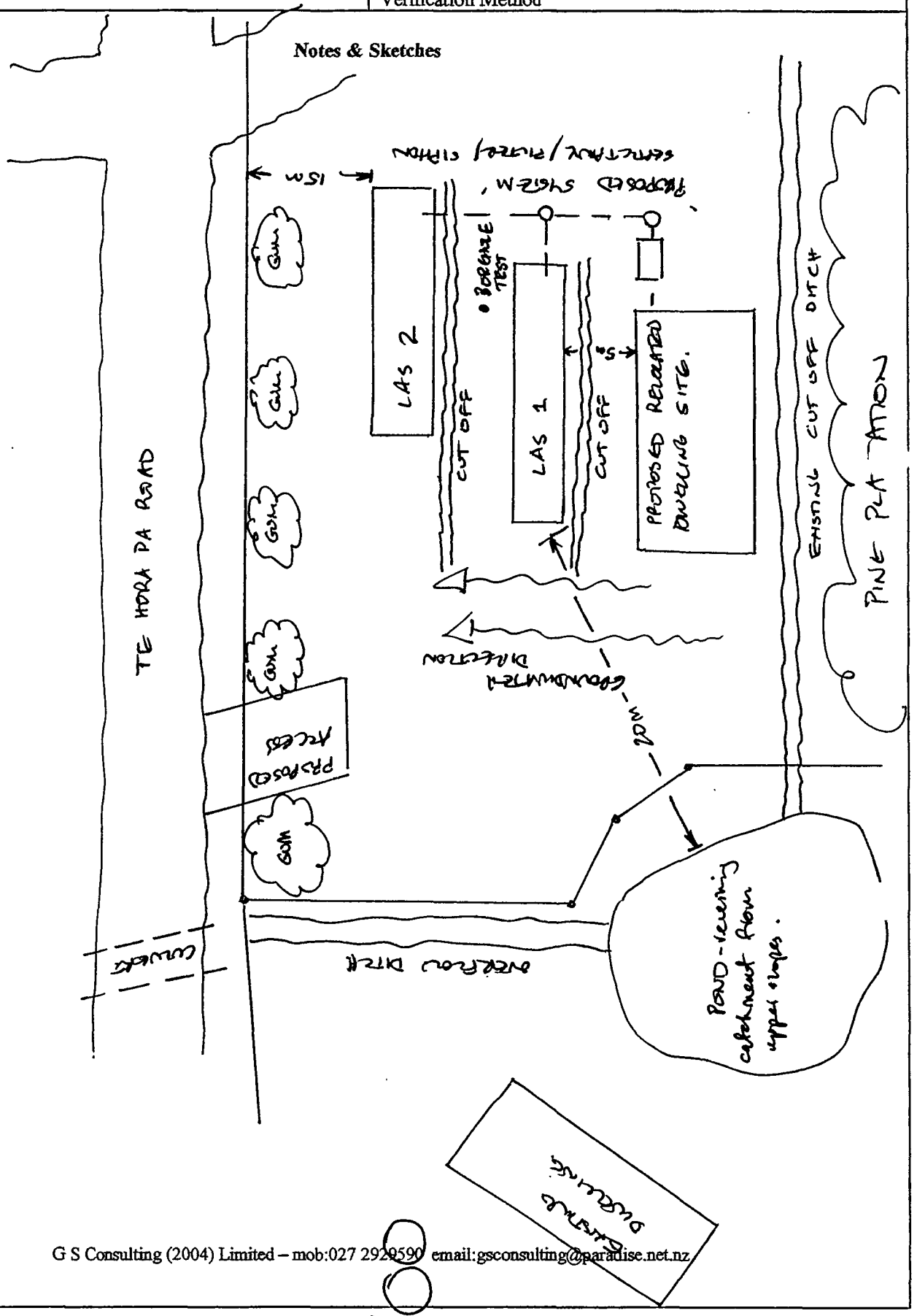
Emerson's Class	Visual Assessment	Description	Suitability for effluent disposal	Results
1	Slaking and severe (complete) dispersion	The soil peds slump and a cloud appears around the soil mass, covering bottom of beaker. Subsequent wetting and drying causes crusting, blocking of soil pores decreases permeability. Very poor micro-structure stability. Susceptible to tunnel erosion. Soils high in exchangeable sodium. Add organic matter, treat with gypsum – determine rate in lab.	Unsuitable, high ESP, unstable, will require amelioration	
2	Slaking and some (partial) dispersion	The soil peds slump and an easily recognized veil of dispersed particles is seen. Becomes more apparent with movement of water. Some decrease in permeability from blockage of pores. Poor micro-structure stability. Add organic matter, treat with gypsum – determine in lab tests.	Poor, some loss of permeability, requires amelioration	
3	No dispersion of air-dried ped Complete or partial dispersion of remoulded soil	Dispersion of remoulded soil, these soils set hard but do not shrink on drying so a crust can form from dispersed soil. Moderate micro-structure stability. Adding gypsum reduces dispersion caused by shearing. Ideal for dam building, because soil can be compacted when wet.	Soil severely affected by digging, ploughing	
4	No dispersion	Soil can be remoulded up to field capacity without dispersion when placed in water. Good micro-structure stability. Soil unlikely to crust, resistant to erosion. Contain calcite or gypsum. Good permeability.	Ideal, not affected by digging	
5	Dispersion after shaking in 1:5 suspension after 5 min.	Remoulded soil: no dispersion under normal agricultural practices because water content outside field capacity. Usually high Ca, Mg. Good permeability.	Ideal	
6	1:5 suspension flocculation after 5 min	After shaking in 1:5 suspension begins to flocculate within 5 min. complete flocculation, will usually have good soil structure and high permeability.	Ideal, good permeability	
7	No slaking, some swelling	Peds remain coherent but swell. Soil is water stable, high permeability.	Ideal	
8	No slaking, no swelling	Peds remain coherent, no swelling, soil is water stable, high permeability.	Ideal	

It is recommended that the degree of slaking be further rated as 1, 2 or 3 (1=slight, 2=about half slaked and 3=fully slaked.

When remoulding the soil sample, the soil is rolled into a small 3-5mm ball with a plastic spatula or other non-metallic device. DO NOT use the soil bolus you made in the texture analysis. The small amount of salt from your hands and the excess working may cause the soil to behave differently.

Client	Project Number
Contact Number	Project Location
Date	Project Type
Consultant	Verification Method

Notes & Sketches



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GSC Waste Water System Loading Certificate

Monday, September 03, 2007

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Issued To:	J Smith - Mischesky
Location:	87 Te Hora Pa Road, Canvastown
Legal Description:	Lot 2 DP 383203
Territorial Authority:	Marlborough District Council

Occupancy:	6 persons
Daily Flow Rate:	840 litres/day
Design Loading Rate:	10 mm/day

Waste Water System Type:	Primary Treated Septic tank c/w effluent filter
Total Working Volume:	4800 litres
Max Daily Flow Rate:	1600 litres/day
Design Daily Flow Rate:	840 litres/day

Land Application System Type:	deep trench effluent bed
Design Loading Rate:	10 mm/day
Application Area:	84 sq metres
Application System Length:	42 metres
Reserve Area:	84 metres

System Designer:	G S Consulting (2004) Limited
System Installer:	TBA
Maintenance Contractor	Owner & TBA
Maintenance Frequency:	Annual

Specific Notes: System to be checked annually for efficient working order.

Typical Domestic Wastewater Flow Design Allowances with Water Tank Supply

Source	*litres/person/day*	*Number*	*Total FD Allowance*
Households with standard fixtures (including auto w/m)	140	6	840
Households with standard water reduction fixtures	115		0
Households with full water reduction facilities	80		0
Households with extra wastewater producing facilities	170		0
Households (*black water only*)	50		0
Households (*grey water only*)	90		0
Motels/Hotels			
⇒ Guests, resident staff	140		0
⇒ Non resident staff	30		0
⇒ Reception rooms	20		0
⇒ Bar trade per customer	20		0
⇒ Restaurant per diner	20		0
Community Halls			
⇒ Banqueting	20		0
⇒ Meetings	10		0
Restaurants per diner			
⇒ Dinner	20		0
⇒ Lunch	15		0
Tea rooms per customer			
⇒ Without restrooms	10		0
⇒ With restrooms	15		0
School pupils plus staff	30		0
Rural factories, shopping centres	30		0
Camping grounds			
⇒ Fully serviced	100		0
⇒ Recreation areas	50		0

Total Flow Design Allowance **840**

Using Soil Category/Design Loading Rate (DLR) values to determine the size of the selected Land Application System

Soil Category	Soil Texture	Structure	Indicative Permeability (*K* sat) (m/d) *(note 5)*	DLR trenches and beds *(note 1,2)*			DLR *(note 16)*	DLR	Design Irrigation Rate (DIR) (mm/wk) *(note 15)*	Indicative drainage class *(note 8)*
				Primary Treated Effluent		Second *(note 4)*	ETA/ETS Beds/trenches (mm/d) *(note 11)*	Mounds (basal area) (mm/d) *(note 13)*		
				Conservative Rate (mm/d) *(note 3&6)*	Maximum Rate (mm/d) *(note 3&7)*	(mm/d)				
1	Gravels and sands	Structureless (Massive)	>3.0	20 *(note 9)*	35	50	*(note 12)*	32	35	Rapidly drained
2	Sandy loams	Weakly structured	>3.0	20	35	50	*(note 12)*	24	35	Well drained
		Massive	1.4-3.0	15	25	50		24	35	
3	Loams	High/moderately structured	1.5-3.0	15	25	50	*(note 12)*	24	28	Moderately well drained
		Weakly structured or massive	0.5-1.5	10	15	30		16	28	
4	Clay loams	High/mod structured	0.5-1.5	10	10	30	12	16	25	Imperfectly drained
		Weakly structured	0.12-0.5	6	10	20	12	8	25	
		Massive	0.06-0.12	4	5	10	5	*(note 14)*	25	
5	Light clays	Strongly structured	0.12-0.5	5	8	12	8	8	20	Poorly drained
		Mod structured	0.06-0.12	*(note 10)*	5	10	5	*(note 14)*	20	
		Wk structured or massive	<0.06	*(note 10)*	*(note 10)*	8	5	*(note 14)*	20	
6	Medium – heavy clays	Strongly structured	0.06-0.5	*(note 10)*	*(note 10)*	*(note 10)*	5	*(note 14)*	15	Very poorly drained
		Mod structured	<0.06	*(note 10)*	*(note 10)*	*(note 10)*	5	*(note 14)*	15	
		Wk structured or massive	<0.06	*(note 10)*	*(note 10)*	*(note 10)*	5	*(note 14)*	15	

Design Area Sizing

Trench and Bed dimensions shall be determined from the relationship:

$$L = \frac{Q}{DLR \times W}$$

Where

	Insert here!
Q = design daily flow in l/day	840
DLR = Design Loding Rate in mm/d	10
W = Width in metres	2

L = 42.00 metres — 4 x 20.25 m beds

Area 84 sq m

Producer Statement – Design

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30 August 2007

Producer Statement - Design number SM-01 has been issued by ***Gary Wipere Rei Stevens*** of **GS Consulting (2004) Limited** to J Smith-Mischesky to be supplied to Marlborough District Council in respect of the following project:

Project Description	On-site waste water & land application system
Street Address	87 Te Hora Pa Road, Canvastown, Marlborough
Legal Description	Lot 2 DP 383203

GS Consulting Limited has been engaged by J Smith-Mischesky to provide design services in respect of the requirements of AS/NZS 1547:2000 for work only as specified.

The design has also been prepared in accordance with Verification Method and Acceptable Solutions of the New Zealand Building Code.

The work is described on G S Consulting (2004) Limited Report on Waste Water & Land Application System and drawings and the specification and other documents according to which the building is proposed to be constructed.

As an independent design professional covered by a current policy of professional Indemnity Insurance to a minimum value of $1,000,000 **I believe on reasonable grounds** that subject to:

(i) The site verification of the following design assumptions [refer inspection schedule where required], and

(ii) All proprietary products meeting the performance specification requirements, the drawings, specifications, and other documents according to which the building is proposed to be constructed comply with the relevant provisions of the building code.

Gary Stevens
Plumbing & Drainage Consultant

Inspection Schedule

This inspection schedule must accompany Producer Statement of Design number SM-01 issued by G S Consulting (2004) Limited.

The following inspections are required to verify the proposed work has been completed as described on G S Consulting (2004) Limited Report on Waste Water & Land Application System and drawings and the specification and other documents according to which the building is proposed to be constructed.

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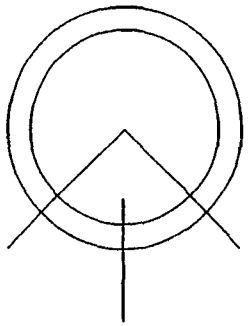
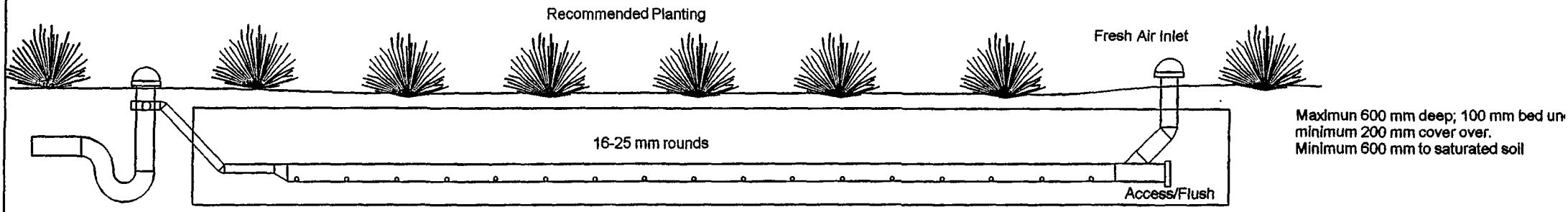
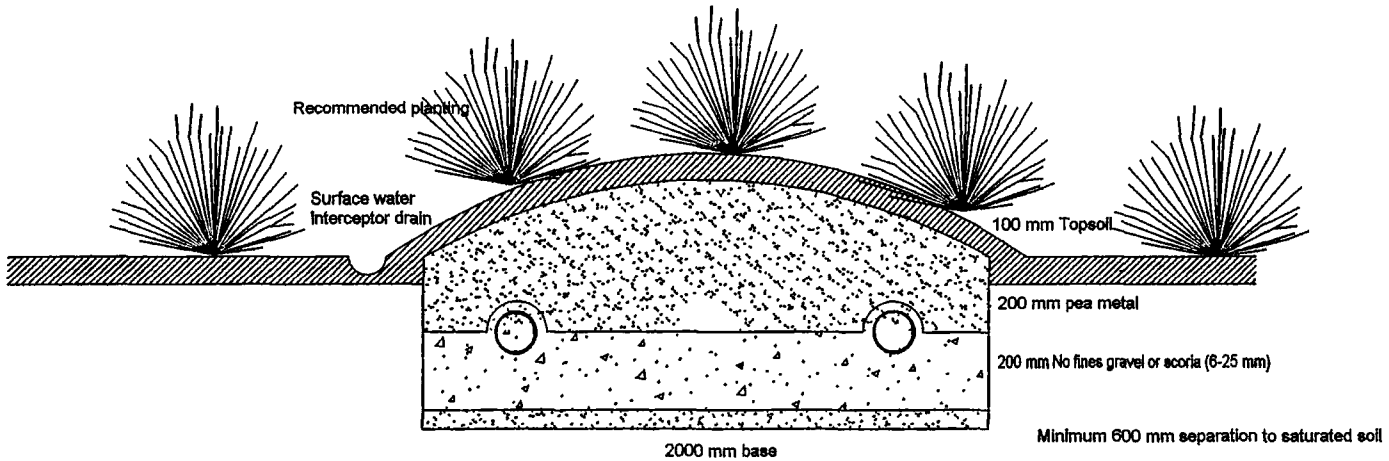
1. Inspect Installation of Primary tank effluent filter and siphon chamber.
2. Inspect installation of effluent trenching.
3. Check operation & Maintenance schedule is appropriate for this system.

Even Distribution System





ETA-04 Typical Cross Section of effluent distribution trench/bed G S Consulting (2004) Limited February 2007 Copyright



Dwg No. ETA-06 ETA/ETS Bed Detail on Flat Scale 1:20 Drawn by GS G S Consulting Limited February 2007

Note: All changes to the detail must be approved by G S Consulting Limited prior to construction, gsconsulting@paradise.net.nz 027 2929590

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WASTEWATER SYSTEMS MAINTENANCE GUIDELINES

HOW TO AVOID PROBLEMS WITH ON-SITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS – Key Maintenance Requirements

Domestic wastewater is wastewater generated in domestic dwellings, institutions, commercial and residential facilities, which predominantly originates from bathrooms, kitchens, and laundries. On-site disposal and is the discharge of wastewater to land within the property boundaries of its place of origin. The traditional on-site treatment system consists of a septic tank and a soil absorption field. A septic tank system includes all tanks, beds, drains, pipes, fittings, appliances and land used on the site in connection with the system. The septic tank through which effluent/domestic wastewater is passed, is the primary stage in any treatment process. It allows solid:liquid separation and retention of the settled solids and floating scum and the settled solids that then undergo anaerobic bacterial digestion.

To be effective, septic systems must be adequately sized to accommodate the wastewater flows from the buildings being served and have been properly installed and maintained. The longer the resident time within the septic tank the better for providing optimum adequate separation and to reduce resuspension of solids when there are new plug flows into the tank. Tanks of 4 to 5 days peak flow volume are ideal.

Many conventional septic tank systems fail due to a variety of caused. A key reason is that they are undersized for wastewater flow volumes from modern facilities, connection of garbage grinders, and lack of maintenance. Lack of maintenance can lead to build up of sludge and scum in septic tanks, which can result in lack of separation in the tank, solids carryover, increased odours of raw sewage, clogged absorption fields. Problems with the land disposal area can also be a result of hydraulic overloading caused by increased occupancy and/or greater water use.

Malfunctioning on-site wastewater treatment and disposal systems can contribute to environmental pollution and can become potential health risks. Ignoring system maintenance requirements will lead to signs of system failures which can then lead to further significant problems such as health risks from pathogens, odours, contamination of groundwater and surface water, attraction of flies and rodents, and decreased property value. Proper maintenance of septic systems not only lessens environmental pollution and aesthetic value of a property, but also lessens potential costs that could be incurred when a damaged system needs to be repaired or replaced.

MAINTENANCE AND ENHANCEMENT OF EXISTING ON-SITE SEPTIC SYSTEMS:

All Septic Tank owners are strongly encouraged to:

- **PUMP-OUT SEPTIC TANK**

- Check the respective depths of sludge, liquid wastewater and scum in the septic tank at least once per year.
- Pump out the tank once the combined depth of sludge and scum occupies 50% of the tank depth. For a standard household, this should be in the order of once every 3 to 5 years. (This may be required more frequently where houses are fully occupied and/or there is no outlet filter and for tanks serving public toilets, and less frequently, up to once every 5 years or longer, where occupancy is low or intermittent, and/or where an effective outlet filter has been maintained).

- **INSTALL AND MAINTAIN AN OULET FILTER**

- These are required to be installed on all new septic tank systems and are STRONGLY recommended to be retrofitted to old septic tanks. They are often the most effective and cheapest option for improving the performance and life of a wastewater system. They ensure all solids of 3mm diameter or greater are retained and biodegraded within the septic tank, and do not access or clog the soakage lines. Supplier details can be obtained from your local council).
- Check the biomat build up on the filter regularly, at least once per month, and clean it as required to avoid excessive build up affecting filter performance.
- To clean the filter, remove it from the septic tank and hose down, discharging the rinse water back into the septic tank, or elsewhere into dense vegetation where it will not cause any nuisance, and reinstate the filter into the septic tank.

- **AVOID USE OF TOXIC SUBSTANCES**

- Non-biodegradable chemicals, e.g. don't use drain cleansers or disinfectants.
- Sanitary napkins, other hygienic products, dental floss, kitty litter, etc.
- Oil and fat flushed into the system.
- Detergents (toxic detergents and other household cleaners should be avoided as they kill the bacteria in the septic tank)
- Do not use or minimise the use of garbage disposal units.
- Compost food scraps or put them in the rubbish.

- **MINIMISE WATER USAGE / IMPROVE WATER CONSERVATION**

- Particularly important on sites where area available for wastewater disposal and the system's capacity constrained, where any seepage or run off could access natural water and affecting water quality or where disposal areas may be accessed by children.
- Install water reduction fixtures on water outlets and/or low flush toilets. (This is particularly important on small sites and/or where there is high occupancy in the dwelling where the disposal system capacity is threatened).
- Do not leave taps running for long periods.
- Install push button taps on public facilities.
- Fix water leaks.
- Do not connect rain gutters or stormwater drains to septic tanks.

- **ENHANCE EVAPOTRANSPIRATION AND DISCOURAGE ACCESS TO DISPOSAL AREAS**

- Densely plant the disposal area, maintain plantings and check regularly for even wastewater distribution and even plant growth.
- Where the disposal area is grassed, it should be regularly mowed to optimize growth and prevent the grass from becoming rank.
- Do not pave the disposal area.
- Use planting, low chain, signage and/or a small fence to discourage access in public areas.
- Use signs, low fences and plantings to prevent any vehicle or stock access.

Records should be kept of all maintenance undertaken on the wastewater systems, particularly when contractors are involved. This includes tank pump outs, tank inspections, and access openings. ***Do not*** add or alter any part of your system without Council approval.

ON-SITE WASTEWATER SEPTIC TANKS.

KEY DOS & DON'TS FOR THE HOUSEHOLDER

All wastewater (toilets, shower, sinks, laundry) produced on the site is discharged to an o-site wastewater treatment and land disposal system. The wastewater treatment system is a fragile biological process and therefore requires care by all residents.

You can help maintain an effective wastewater system on your site, by ensuring no toxic chemicals are put down the sinks or toilets and use only environmentally friendly cleaning products. Toxic chemicals, drugs (e.g. antibiotics) kill the bacteria in the treatment system. These organisms are required to treat wastewater and if healthy populations are not maintained, the system will fail resulting in poorly treated wastewater discharging into the soil, odours, increased maintenance requirements and eventually the expense of upgrading the system. You ' 'ld also minimise your water use as much as possible to protect the system from overloading.

Below is a list of hints for caring for your wastewater system.

DO

- **Minimise your water use.**
- **Minimise the length of showers.**
- **Use showers in preference to baths.**
- **Use bio-degradable soaps and cleaners.**
- **Check all your cleaning products to see if they are suitable for septic tanks.**
- **Minimise use of strong toilet cleaners.**
- **Scrape all plates and dishes to remove as much fat and grease as possible. Clean with paper towels and place in the rubbish.**
- **Report/fix all leaking taps as soon as possible.**
- **Use phosphate free/low phosphorus based laundry detergents.**

DO NOT

- **Don't pour any toxic/strong chemicals (paint, oil, grease, paint thinners, pesticides down any drains).**
- **Don't flush any products down the toilet, other than standard toilet paper.**
- **Don't discard any drugs down the sink or toilet.**
- **Don't use strong cleaners.**
- **Don't tip chlorine cleaners or disinfectant based products into the system.**
- **Don't use huge amounts of cleaners.**
- **Don't use chemical drain cleaning products.**
- **Don't do all your laundry on one day.**
- **Don't install in-sink garbage grinders. If a grinder exists, don't discharge high volumes of scraps, especially carbohydrates or fats/oils down it.**
- **Don't put coffee grounds down the sink.**

ON-SITE WASTEWATER TREATMENT & DISPOSAL SYSTEMS

GENERAL PROBLEM SOLVING GUIDE

The following is a list of suggested actions in the event of actual problems with your system:

Problem	Solution
Odour	• Insert activated carbon filters into the septic tank vents. In the case of an aerobic treatment plant, contact supplier and ensure system is sufficient aerated.
Septic tank bacter breakdown	• Use soft soap solutions or biodegradable cleaners for cleaning. • Use only detergents low in alkaline salts, phosphorous, and chlorine levels. • Avoid heavy use of detergents and the use of disinfectants and other household cleane as they affect the bacterial action within septic tanks. • Do not discharge any pharmaceutical medication or disinfectants into the wastewater system. • Minimise discharge of food waste and fats and oils into kitchen sink/garbage grinders
Septic tank overflow/odours	• Engage drain layer/contractor to investigate any blockages immediately. • Pump out the septic tank. • Decrease water usage until problem is remedied. • Mitigate by installing high level alarms, 24 hour storage in new tanks and 12 hour storage in existing tanks as a warning system. • Mitigate initial problems by removing inspection covers annually to check depth of th scum mat and sludge. The tank should be cleaned out when combined depth of scum and sludge occupy half the tanks volume or at least every 3 years. (Tea leaves and oth kitchen wastes should be composted as they are slow to break down, filling your syste more rapidly).
Blocked filter	• Cleaning is required. (This often only involves a quick hose down of the filter. It should then be undertaken regularly at a frequency of once 2 weeks to 3 months depending upon the type of filter in place).
Clogged disposal system	• Pump out the tank and the disposal lines. • Inspect and/or consider reconstruction of disposal system and/or individual lines. • Upgrade the system to improve treatment system such as a pressure compensating dri irrigation system.
Overflow on disposal field	• Pump out septic tank and reduce water usage in immediate term. • Increase the disposal field area. • Re-locate the disposal area further away from the house and trees or on the northern side of the house to increase evaporation (i.e. provide good exposure to sun and wind) • Ensure the wastewater disposal area is densely planted to increase evapotranspiration. • Restrict/avoid access to the field.
Excessively high volume wastewate discharge/Unknow	• Install a water meter. • Install water reduction fixtures. • Decrease water usage.

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usage	• Increase the disposal field area.
Rainfall run-off causing water-logging of disposal field	• Check that no roof downpipes discharge to gully traps or on land where it could drain onto the disposal area. • Install stormwater cut-off drains upslope of disposal area (such drains need to be maintained over time).
Potential impact o groundwater/surfa water	• Ensure all wastewater drainage lines, and irrigation pipes are located at least 15m fron any watercourse. • Regular system maintenance. • Regular pump outs. • Install outlet filters. • Clean filter. • Avoid the use of phosphorous based household detergents.
Continuing resolved Problems	• Engage a consultant experienced in wastewater treatment and disposal systems. • Upgrade the whole system. • Enter into a maintenance contract with a wastewater systems contractor/drainlayer/system supplier with a high level of experience in wastewater treatment and disposal system maintenance and operation.

WHO TO CONTACT IF YOUR SYSTEM IS FAILING OR YOU OBSERVE A FAILING SYSTEM:

- Engage an environmental or geotechnical consultant experienced in wastewater treatment and disposal systems.
- An Environmental Health Officer at your local council.

HOUSEHOLD CLEANING CHEMICALS

EFFECTS ON DISPOSAL SYSTEM RECEIVING SOILS

Use of many cleaning chemicals in facilities served by on-site disposal systems can result in high concentrations of the constituents in those cleaning agents being discharged into the receiving soils. These chemicals and constituents have a massive impact on the quality and condition of the receiving soils over time.

Many of the chemicals can disrupt soil structure and decreased hydraulic conductivity while others can act as bactericides, destroying the essential micro-organisms required to achieve the high level of biodegradation in the treatment and disposal systems. This then increased the potential environmental impacts of the contaminants in the receiving environment.

Improved wastewater treatment technologies can only assist so much in reducing the composition and concentration of some cleaning agents, not the strong acids and strong alkaline agents.

The following matters need to be considered when using cleaning agents in a domestic situation:

- Laundry powders are often extremely high in sodium which will destroy the salt balance in the soils. Check the labels.
- Greywater consisting of washing machine wash cycle discharge water can have an alkaline pH of up to 10. Although this will be diluted in a septic tank, it will impact on micro-organism populations and also lead to effects on soils structure.
- Wastewater flows from dishwashing machines can have an impact on wastewater treatment systems, not only in terms of wastewater flow volumes and additional organic waste, but more importantly in terms of the strong cleaning chemicals.
- Highly corrosive cleaners (such as toilet and drain cleaners) that have precautionary labels warning users to minimise direct contact, are an indication that they can adversely affect the wastewater treatment system. Up to 1 cup of bactericides such as bleach can be sufficient to impact on all the micro-organisms/bugs in a septic tank, severely affecting tank performance for some time.
- All cleaning chemicals must be used with care and in all cases, the less that is discharged, the better this will be for the receiving soils in the long term.
- The best solution of optimizing the long term effectiveness of the soils within a wastewater disposal field is to minimise the use and discharge of strong cleaning chemicals at source.

Ingredient	Use	Impact
Alkyl benzene sulfonates (ABS)	Common surfactant in laundry detergents, cleaners.	Very slow to biodegrade; the manufacturing process can release carcinogens and toxins to environment.
Alkyl phenoxy polyethoxy ethanols (also nonyl phenols)	Used as surfactant in laundry detergents, cleaners.	Slow to biodegrade in the environment; linked with chronic health problems.
Butyl cellosolve (also, butyl oxitol, ethylene glycol monbutyl, butoxyethanol, ethylene glycol)	Used as solvent in spray cleaners, all-purpose cleaners.	A toxic synthetic – can irritate mucous membranes and cause liver and kidney damage.
Chlorine – also as hypochlorite, sodium hypochlorite, sodium dichloroisoctanurate, hydrogen chloride and hydrochloric acid	Household bleaching agent.	Most frequently involved in household and industrial poisonings. Reacts with organics in the environment to form carcinogenic toxins, the most well known being dioxin. Serious impact on small wastewater treatment plants.
EDTA: ethylene-diamino-tetra-acetate	A builder used as phosphate substitute in detergents.	Slow to biodegrade.
Formaldehyde	Not a common ingredient these days but may be found in deodorisers, disinfectant, germicides,	Extremely potent; carcinogenic and respiratory irritant; serious impact on small wastewater treatment plants.

	chemical toilet additives, particle board.	
Methanol	Used as solvent in glass cleaners.	Acutely toxic and can cause blindness.
Phosphates	Used in detergents and cleaners as a builder and deflocculating agent.	Non-toxic but major cause of eutrophication in receiving aquatic ecosystem, causing serious ecological imbalance.
Polycarboxylates	Laundry and dishwasher detergents as an anti-redeposition agent.	Not much known; non-biodegradable and petroleum based.

ON-SITE WASTEWATER TREATMENT & DISPOSAL SYSTEMS:

SUBSTITUTES FOR HOUSEHOLD CLEANING CHEMICALS

Use of the following readily biodegradable substitutes for common potentially harmful household cleaning chemicals will reduce the stress on a septic system, significantly enhance the performance of the whole system and increase the life of the disposal field, while reducing the potential effects of the receiving soils.

GENERAL CLEANERS:
Use soft soap cleaners and bio-degradable cleaners and those low in chlorine levels.

AMMONIA-BASED CLEANERS:
Instead sprinkle baking soda on a damp sponge. For windows, use a solution of 2 – Tbs white vinegar to 1 – litre of water. Place the mixture into a spray bottle.

DISINFECTANTS:
In preference use Borax: ½ cup in 4 – litres of water.

DRAIN DECLOGGERS:
Avoid declogging chemicals. Instead use a plunger or metal snake, or remove and clean trap.

SCOURING CLEANERS AND POWDERS:
Instead sprinkle baking soda on a damp songe or add 4 – Tbsp baking soda to 1 – litre warm water. It's cheaper and won't scratch.

TOILET CLEANERS:
Sprinkle on baking soda, then scrub with toilet brush.

LAUNDRY DETERGENT:
Choose one with a zero phosphate content and low in alkaline salts (in particular, a low sodium level) and no chlorine.

Use of the following alternatives to standard chemicals is less likely to be of any consequence to the performance of the on-site wastewater system, but are included for completeness only:

CARPET/UPHOLSTERY CLEANERS:
Sprinkle dry cornstarch or baking soda or commercial dry cleaning spray, then vacuum. For tougher stains, blot with white vinegar in soapy water.

FURNITURE/FLOOR POLISHES:
To clean, use oil soap and warm water. Dry with soft cloth. Polish with 1 part lemon juice to 2 parts oil (any kind) or use natural products with lemon oil or beeswax in mineral oil.

METAL CLEANERS:
Brass and copper: scrub with a used half of lemon dipped in salt. Stainless steel: scouring pad and soapy water. Silver: rub gently with toothpaste and wet cloth.

OVEN CLEANERS:
Sprinkle salt on drips, then scrub. Use baking soda and scouring pads on older spills.

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Typical Percentage Domestic Water Use by Fixtures

Fixture	Typical % Range (Ref 3)	Typical % Range (Ref 2)
Toilet (Note 1)	**26.7 (22.6 – 30.6)**	**30 (20 – 40)**
Shower/Bath (Note 2)	**16.8 (11.8 – 20.2)**	**20 (15 – 25)**
Washing Machine	**21.7 (17.8 – 28.0)**	**20 (15 – 25)**
Dishwasher	**1.4 (0.9 – 2.2)**	**7 (5 – 10)**
Taps	**15.7 (12.4 – 18.5)**	**10 (8 – 12)**
Leaks & Other Domestic Usage	**16**	**13 (10 – 17)**

Sources: Crites & Tchobanoglous (1998) and USEPA (2002) [Refs 2 & 3].

Note:

1. Toilet use based on United States examples using on average 11 to 22.5litres/flush [Ref 2]. Lower percent flows are representative of New Zealand toilet systems, as suggested in Section 6.3.2, this can range from in the order of
2. Average shower water use is dependent upon individual showering habits and the length of showering. When estimates are being made it is important to allow a factor of safety and over rather than under estimate potential water usage.

Household water use	Appliances/fixture per capita daily flow (litres/person/day)				
	Toilet	**Washing machine**	**Shower**	**Washbasins, kitchen, bathroom, laundry**	**Total per captia flow (L/p/d)**
Standard household fixtures: 11/5.5 litre dual-flush cistern, top-load washing machine	38	22	90	30	180
Full water-reduction fixtures: 6/3 litre dual-flush cistern, front-load washing machine, low flow showers, aerator faucets	22	13	45	15	95
% saving	42.1	40.9	50.0	50.0	47.2

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LIST OF WATER TOLERANT PLANTS SUITABLE FOR ON-SITE WASTEWATER DISPOSAL SYSTEMS

GENERAL MATTERS TO CONSIDER WHEN PLANTING A LAND DISPOSAL AREA:

Plants that are suitable for planting in moist conditions, such as those associated with wastewater land disposable fields need to be selected on the basis of both their tolerance for such moist conditions and for their potential for high level of growth/high transpiration of moisture in such conditions.

Standard lawn grass is a proven effective high transpiration plant species in such conditions, as are a large number of other plant species seen in typical domestic gardens.

Consideration needs to be given to effects of roots from plants and from trees in particular on wastewater distribution pipe networks/emitter lines in land application systems. Potential for root intrusion/disruption to the pipe system must be considered prior to selection and planting of a plant or tree species.

Advise on such matters for particular plant species can be obtained from garden centre specialists and landscaping consultants.

Grasses, ground covers, and other plants

***Astelia grandis* (swamp astelia)**

Large clump forming plant with bright green, flax-like foliage. Female plants produce upright panicles of orange berries in the centre of the plant. This endemic species will not tolerate eutrophic conditions and prefers peat soils.

***Blechnum novaezealandiae* (kiokio)**

Large, robust fern growing to 1 or even 2m, hardy species that tolerates most conditions, but does best in well drained, shady area.

Carex

There are many members of this genus which grow naturally in damp to wet areas. They all have quite fine drooping foliage and are vigorous in moist conditions. Most prefer very light shade. The following species have been identified for their suitability.

Carex dissita

Endemic species with dull green to reddish tufts often 0.5m tall (although this can vary). Tolerates a range of swampy habitats, but is also noted to grow on drier soils under forest cover.

Carex flagellifera

Endemic species with dense spreading reddish-brown tuffs to 0.5m tall. Prefers damp soil and full sun, but is noted to thrive in a variety of habitats including boggy pasture.

Carex geminata

Robust and vigorous endemic species that grows to 1.5m tall. Thrives in a range of wet habitats. Suitable for a larger area.

Carex lessoniana

Robust and vigorous endemic species that grows to 1.5m tall. Similar to *C.geminata* in that the species is spreading and suitable for a larger wet area.

***Carex secta* (purei, makura)**
Endemic species that exhibits tall spreading tussocks. Has been noted to grow to 3m tall, widespread in swampy area. Useful in the creation of bird habitat.

Carex virgata
Endemic species that forms dense, light green tussocks up to 1m tall. Thrives in a variety of habitats including swamps, drain margins, seepages and wet pastures. Useful in the creation of bird habitat.

***Cortaderia fulvida* (toetoe)**
Branching from the base and forming a clump to 4m high. Long strap-shaped leaves with red-orange coloured veins, flower heads cream yellow. New shoots exhibit pale waxy cover on lower parts (unlike pampas grass). Prefers good drainage and semi-shade. Will struggle to compete if dried out in summer.

***Cyperus ustulatus* (toetoe upoko-tangata, giant umbrella sedge)**
Vigorous leafy sedge growing to 1m in open damp places. Tolerates immersion in standing water within a range of habitats from seepages to wetlands.

***Dicksonia squarrosa* (wheki, tree fern)**
Tree fern up to 7m tall that exhibits tolerance of wet open ground, and floods. Found to shelter and accumulate with other native plants. The base of the fern attracts biodiversity. Useful application to streambank and seepage habitats.

***Elatostema rugosum* (parataniwha)**
Herbaceous plant up to 0.5m tall that spreads by rhizomes. Bronze coloured foliage with serrated edge. Grows on moist sites in light to heavy shade. Intolerant of dry habitats.

Hypolepis dicksonioides
Large fern that prefers fertile moist, but well-drained ground, grows vigorously and spores into planted areas with abundance. Does however, die back during winter.

***Phormium tenax* (harakeke, flax)**
Fast growing clump-forming flax with large stiff leaves, to 3m. Full exposure and sun. Moist to wet conditions. Does not have deep or wide roots. Easily propagated from split fans or grown from seed. Atrracts birds, especially Tui.

Trees and shrubs

Consideration needs to be given to the effects of roots land application on wastewater distribution pipe networks. This problem can be more significant for large tree species.

***Carpodetus serratus* (putaputaweta, marbleleaf)**
Lowland forest tree up to 7m tall. Large bunches of cream coloured flowers appear in spring followed by black berries.

Coprosma areolata
Species that grows to 4m tall. Low tolerance to drought, with medium to high fertility.

***Coprosma robusta* (karamu, shining karamu)**
Shrubs or small trees growing to 3m+, with glossy green leaves. Masses of orange-red fruit in autumn are attractive to birds. Hardy plant.

***Coprosma tenuicaulis* (swamp coprosma)**
Endemic species that grows to 3m tall. Leaves pale green with slender branches. Will tolerate a range of swampy to boggy habitats including standing water.

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***Cordyline australis* (ti kouka, cabbage tree)**

Palm-like in appearance with large heads of linear leaves and panicles of scented flowers. Sun to semi-shade. Prefers damp to moist soil. Grows eventually to 12m+ height.

***Dacrycarpus dacrydioides* (kahikatea, white pine)**

Tree that grows to 40m. Moderately growing species, which prefers wetland and boggy environments. Application of this species must consider the possible impact of its root systems on the wastewater disposal field.

***Geniostoma rupestre* (hangehange)**

Common forest shrub with pale green glossy foliage, growing to 2-3m. Tiny flowers give off strong scent in spring. Looks best in sunny position where it retains a bushy habit, and prefers well-drained soil.

***Hebe stricta* (koromiko)**

Shrub or small tree growing to 2-5 in height. Natural forms have white to bluish flowers. Plant in full sun. Tolerates exposure. (NB Many cultivars and hybrids are available commercially, but these are all unsuitable for use near existing natural vegetation.)

***Laurelia novae-zelandiae* (pukatea)**

Large upright tree (to 30m) with attractive bright green foliage and distinctive whitish bark. Fast growing and able to handle a wide variety of soils. It will tolerate periodic flooding, breathing roots develop in water logged soils. Can be grown from seed. Tolerant of some sun and frost. Not tolerant of wind.

***Leptospermum scoparium* (manuka)**

Shrub or small tree growing to 4m+ in height. Ubiquitous shrub varying in form throughout New Zealand. Ideal to provide shelter for other plants as it is quick growing and hardy. Requires full sun. Hardy and tolerant of difficult conditions, including waterlogging and drought.

***Melicytus ramiflorus* (mahoe)**

A fast growing yet long lived tree to 7m height. Prefers well drained fertile soils. Tolerates some frost, wind and sun. Birds are attracted to the blue berries.

***Pennantia corymbosa* (kaikomako)**

Slow growing species that will reach 12m in moist, fertile sites. Useful species application in bank stabilization or wetland habitats.

***Plagianthus betulinus* (ribbonwood)**

Fast growing species to 15m. Similar application to that of *Pennantia corymbosa.*

***Rhopalostylis sapida* (nikau)**

New Zealand's only native palm, with red berries attractive to birds. Requires light shade, plenty of moisture and protection from wind when young. Grows well in areas of permanent dampness.

***Syzygium maire* (maire tawake)**

Attractive and moderately growing wetland tree to 15m with bronze foliage, large bunches of reddish fruit and distinctive whitish bark. Requires a sheltered sunny position. Tolerates some frost.

***Vitex lucens* (puriri)**

Fast growing to 20m in fertile, open but sheltered conditions. Will struggle with poor drainage during adolescence.