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On-site Wastewater Management Report

19 Morgan Road, Dora
BELROSE, NSW

CLIENT:
David Conway

REFERENCE:
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INTRODUCTION

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

Objective

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

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

This study has been prepared in accordance with:

- Australian Standard AS1547: 2012" On-site Domestic Wastewater Management"

Scope of Works

The scope of works undertaken for this site evaluation included:

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

DESKTOP INFORMATION

Address	19 Morgan Road, BELROSE, NSW
Council	Northern Beaches Council
Proposed Development	Wastewater System to Service: - Proposed Residence
Intended Water Supply Source	Tank Water
Design Wastewater Allowance	120 L / day / person[1] Blackwater: 40% (48 L / day / person) Greywater: 60% (72 L / day / person)
Equivalent Population (Proposed Residence)	Up to 7 people (5 Bedrooms) Double Occupancy Bedrooms: 2 Single Occupancy Bedrooms: 3
Design Wastewater Flowrate (Proposed Residence)	TOTAL 840 L / day Blackwater: 336 L / DAY Greywater: 504 L / DAY
Rainfall Station	Belrose (Evelyn Place) 66188
Evaporation Station	Riverview Observatory 66131

[1] Ón-site Wastewater Domestic Wastewater Management'AS1547:2012, Standards Australia, 2012)

SITE & SOIL EVALUATION (SSE)

The objective of the SSE is to collect sufficient information on site characteristics and local environmental constraints to enable the best practicable option(s) to be employed for the design, installation, and operation of an on-site wastewater management system.

Performance Requirements & General Methodology

Our SSE process:

- Provides sufficient information to decide if an area is suitable,
- Provides site-specific identification of site & soil characteristics to be considered when designing a system,
- Provides a risk assessment of site & soil characteristics which may compromise the long-term effectiveness of a wastewater system,
- Provides a risk assessment of environmental & health risks,
- Specifies measures required to reduce & monitor such risks,

This SSE consisted of the following staged process, and was undertaken by a degree-qualified Environmental Engineer with 20-years' experience:

a) Site Survey

An on-site survey (i.e. foot traverse) is undertaken to record relevant site features and identify potential environmental constraints. The survey area comprises numbered 'landform elements' of similar topographic characteristics with a record provided for each element. Available land application areas and exclusion areas are defined within each landform elements.

b) Soil Assessment

A subsoil investigation is undertaken to examine and record the soil profile and soil characteristics within the available land application area, identify potential soil limitations and allocate appropriate soil categories and design loading rates.

Site Survey

The following relevant site features were recorded and given a rating in terms of their potential constraints to onsite wastewater management. The three ratings are minor limitation, moderate limitation, or major limitation. Only those site features that are rated as being a major limitation to onsite wastewater management are further discussed in the 'Site Assessment Discussion'.

Element	1
Approx. Slope (%)	< 5%
Slope Class	Very Gently Inclined
Morphological Type	Upper slope
Relative Inclination	Linear Planar
Instability Risk	Low
Run-on	Very Slow
Run-off	Very Slow
Soil - Water Status	Moderately Moist

Vegetation

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

Element	A
Growth Form	Grass
Height Class	Low
Cover Class	Very Sparse
Structural Formation	Sparse Grassland
Exposure	Excellent
Existing Erosion	Active
Erosion Type	Sheet, Rill
Landform Element(s)	1

Site & Soil Disturbance

The site assessor noted the following disturbance within the effluent application envelope:

Vegetation Clearing	Description: The proposed development footprint has been cleared of vegetation and topsoil.

Rocky Outcrops

The site assessor noted the following rocky outcrops within the effluent application envelope:

None	Description: No rocky outcrops observed within the proposed effluent application area.

Setbacks

Setbacks between an effluent application area and surrounding site features vary depending on local conditions and 'sensitive features'. Appendix R of AS1547:2012 'On-site Domestic Wastewater Management' provides a guide to determining setback distances to different site features based on a qualitative evaluation of 'site constraints of specific concern' and this is the approach we have adopted for this report.

Each site feature is allocated a 'setback distance range' and the determined setback distance is commensurate with the level of risk to public health and the environment. The risk is based on an evaluation of 'site constraint items of concern, corresponding sensitive features and how these interact to provide a pathway or barrier for wastewater movement.

A regulatory authority may reduce or increase setback distances at their discretion and may require additional information (e.g. effluent plume modelling) to support setback distances, or specific management practices (e.g. monitoring). These works are outside the scope of this report.

Table R1 and Table R2 from Appendix R, AS1547:2012 have been used in conjunction to determine setback distances for this site. An evaluation summary of setback distances to each relevant site feature including an assessed overall constraint value and the proposed setback distance is shown below.

Site Feature	*Setback Range*	*Overall Constraint Value*	*Proposed Setback Distance*
Property Boundaries	1.5 – 50	LOW	1.0
Buildings, Dwellings	2.0 – 6	LOW	1.0
Groundwater	0.6 – 1.5	LOW	0.6
Bedrock	0.5 – 1.5	LOW	0.5

Site Assessment Discussion

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

Vegetation

The dominant vegetation formation within the proposed land application area contains less than 50% grassland. Sparse or isolated grassland cover within the proposed land application area may cause the following:

- Increased soil erosion
- Increased run-off
- Reduced evapotranspiration
- Reduced nutrient uptake
- Reduced water percolation rates

The key to avoiding the above impacts is to establish a mid-dense to dense grassland cover (by seeding or turfing for example). A mid-dense (60-70%) perennial grassland cover should be suitable to protect the site against significant water erosion. It should also be suitable for the maintenance of the water and nutrient balance.

Lawn Establishment Tips

- Select a grass suited to the local area (including climate & sun exposure)
- Proper soil preparation:
  - * Remove debris (including rocks, & tree roots)
  - * Loosen compacted topsoil,
  - * Ensure topsoil has high organic matter,
- Rake grass seeds into the topsoil & mulch the seedbed
- Evenly Irrigate with effluent so that the soil is always moist but not excessively wet

SOIL ASSESSMENT

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

Excavation Summary

Borehole	**#1**	**#2**
Surface Condition	Loose	Loose
Excavation Depth (mm)	1200	600
Termination Reason	Bedrock	Bedrock
Bedrock Depth (mm)	1200	600
Water Table Depth (mm)	>1200	>600

Erodability / Erosion Hazard

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

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

	Borehole 1	*Borehole 2*
Erodability	Low	Low
Erosion Hazard	Slight	Slight

Bore Hole 1:

Soil Horizon	Depth	Colour	Coarse Fragments %	Texture	*PH*	*EC_e (µS/cm)*
A	200	Dark Brown	10 - 20	Clay Loam	5.67	56
B1	400	Brown	< 10	Clay Loam	5.22	42
B2	700	Pale Brown	< 10	Clay Loam	5.05	30
C	1200	Red Brown	< 10	Clay Loam	4.93	44

Phosphorus Adsorption Uptake (kg/Ha): 6760

Bore Hole 2:

Soil Horizon	Depth	Colour	Coarse Fragments %	Texture	*PH*	*EC_e (µS/cm)*
A	200	Dark Brown	10 - 20	Silty Loam	4.24	45
B1	500	Brown	< 10	Clay Loam	4.17	39
C	600	Red Brown	< 10	Clay Loam	4.11	27

Phosphorus Adsorption Uptake (kg/Ha): 3050

Salinity & Drainage

Salinity is the concentration of water-soluble salts contained within a soil. Increases in soil salinity (i.e. salinisation) can occur because of irrigation water raising the level of an already saline groundwater. Management of potential salinisation problems involve ensuring that salts introduced to the soil surface are removed (by crop uptake or subsoil leaching) and by ensuring the irrigation area provides adequate subsoil drainage to prevent raising of saline groundwaters into root zones.

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

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

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

Soil Assessment Discussion

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

ON-SITE WASTEWATER MANAGEMENT SYSTEM DESIGN

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

Given the land availability constraint for effluent application resulting from the proposed development footprint on this relatively small property, the proposed wastewater system requires separate treatment and effluent disposal of blackwater and greywater flows, combined with internal reuse of the treated greywater for toilet flushing.

Wastewater Treatment:

1) *Blackwater (336 L/d)*
   This report proposes wastewater treatment using a NSW Health accredited (or equivalent) Aerated Wastewater Treatment System (AWTS) as it will produce a high-quality effluent suitable for irrigation purposes.
2) *Greywater (504 L/d)*
   This report proposes wastewater treatment using a NSW Health accredited (or equivalent) Domestic Greywater Treatment System (DGTS) as it will produce a high-quality effluent suitable for internal reuse (e.g. toilet flushing) and irrigation purposes.

Effluent Disposal:

Selection:

This report proposes that effluent application be via a pressure dosed system. Enviro Engineers Australia recommends all the following method is suitable for installation on this site.

1. Pressure dosed absorption bed(s)

Sizing

- Allocated Soil Category from the Site & Soil Evaluation (SSE): 4
- Selected Design Loading Rate (DLR) (mm/d): 30
  (Secondary Treated Effluent)

The Bed / Trench dimensions have been determined using the following two methods. The adopted 'Minimum Absorption Bed / Trench area' is then chosen as the larger of the determined areas:

3) *Blackwater (Q = 336 L/d)*
   - Volumetric Flowrate (Q) divided by Velocity Parameter (DLR): 11.2m2
   - Effluent Disposal Area (EDA) Water Balance: 19 m2
   - Minimum Bed / Trench Area: 19 m2
   - Recommended dimensions:
     - Bed 1: 7.9m x 2.4m

4) *Greywater (Q = 504 L/d)*
   - Volumetric Flowrate (Q) divided by Velocity Parameter (DLR): 16.8m2
   - Effluent Disposal Area (EDA) Water Balance: 23 m2
   - Minimum Bed / Trench Area: 23m2
   - Recommended dimensions:
     - Bed 1: 5.1m x 2.5m
     - Bed 2: 6.7m x 1.75m

Construction & Installation:

Construction and installation of beds or trenches should only be undertaken by experienced persons and/or those familiar with of Appendix L of AS1547:2012, Ón-site Domestic Wastewater Management' (Standards Australia, 2012). The following clauses:

- L7 Construction Techniques,
- L8 Installation – Pipe Laying
- L9 Inspection
- L10 Pre-Commissioning Tests
- L11 Commissioning
- L12 Marking
- L13 Reporting The design process adopted here involves an evaluation of the expected wastewater flow, site limitations and soil limitations, to select, size and position a waste treatment unit and land application system that will provide the best practical option.

Site Modifications Recommended

- Establish a mid-dense to dense grassland cover (by seeding or turfing for example). A mid-dense (60-70%) perennial grassland cover should be suitable to protect the site against significant water erosion.

RECOMMENDATIONS

- Given the land availability constraint for effluent application resulting from the proposed development footprint on this relatively small property, the proposed wastewater system requires separate treatment and effluent disposal of blackwater and greywater flows, combined with internal reuse of the treated greywater for toilet flushing.

- Wastewater Treatment:
  Blackwater: Installation of a NSW Health Accredited Aerated Wastewater Treatment System (AWTS) with capacity to treat the design flowrate (336 L/d) to a secondary treatment standard with disinfection.
  Greywater: Installation of a NSW Health Domestic Greywater Treatment System (DGTS) with capacity to treat the design flowrate (504 L/d) to a secondary treatment standard with disinfection.

- The AWTS and DGTS specifications and accreditation certificates are to be provided by the manufacturer/supplier/installer and attached to this report prior to submission of this report to Council.

- Effluent Disposal
  Installation of pressure-dosed absorption bed(s) on area designated for effluent application only. The beds will comprise the following:
  - AWTS / Blackwater flow:
    - Bed Dimensions: 7.9m x 2.4m
  - DGTS / Greywater flow:
    - Bed Dimensions: 5.1m x 2.5m (Bed 1), 6.7m x 1.75m (Bed 2)

- Installation of standard water reduction fixtures include dual flush 11/5.5 litre water closets, shower-flow restrictors, aerator faucets and water conserving automatic washing machines

- Establish a mid-dense to dense grassland cover (by seeding or turfing for example). A mid-dense (60-70%) perennial grassland cover should be suitable to protect the site against significant water erosion.

LIMITATIONS

ENVIRO ENGINEERS Pty Ltd has prepared this report for the exclusive use of our client, for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of ENVIRO ENGINEERS , does so entirely at its own risk and without recourse to ENVIRO ENGINEERS for any loss or damage.

In preparing this report ENVIRO ENGINEERS has necessarily relied upon information provided by the client and/or their Agents. The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Under no circumstances can it be considered that these findings represent the actual state of the site at all points. Subsurface conditions can change abruptly due to variable geological processes and because of anthropogenic influences. Such changes may occur after ENVIRO ENGINEERS ’s field testing has been completed.

ENVIRO ENGINEERS 's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by ENVIRO ENGINEERS in this report may be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

Should any site conditions be encountered during construction that vary significantly from those outlined and discussed in this report, ENVIRO ENGINEERS should be advised and a plan outlining the need for potential action developed accordingly.

This report must be read in conjunction with all the attached notes and should be kept in its entirety without separation of individual pages or sections. ENVIRO ENGINEERS cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome, or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by ENVIRO ENGINEERS. This is because this report has been written as advice and opinion rather that instructions for construction.

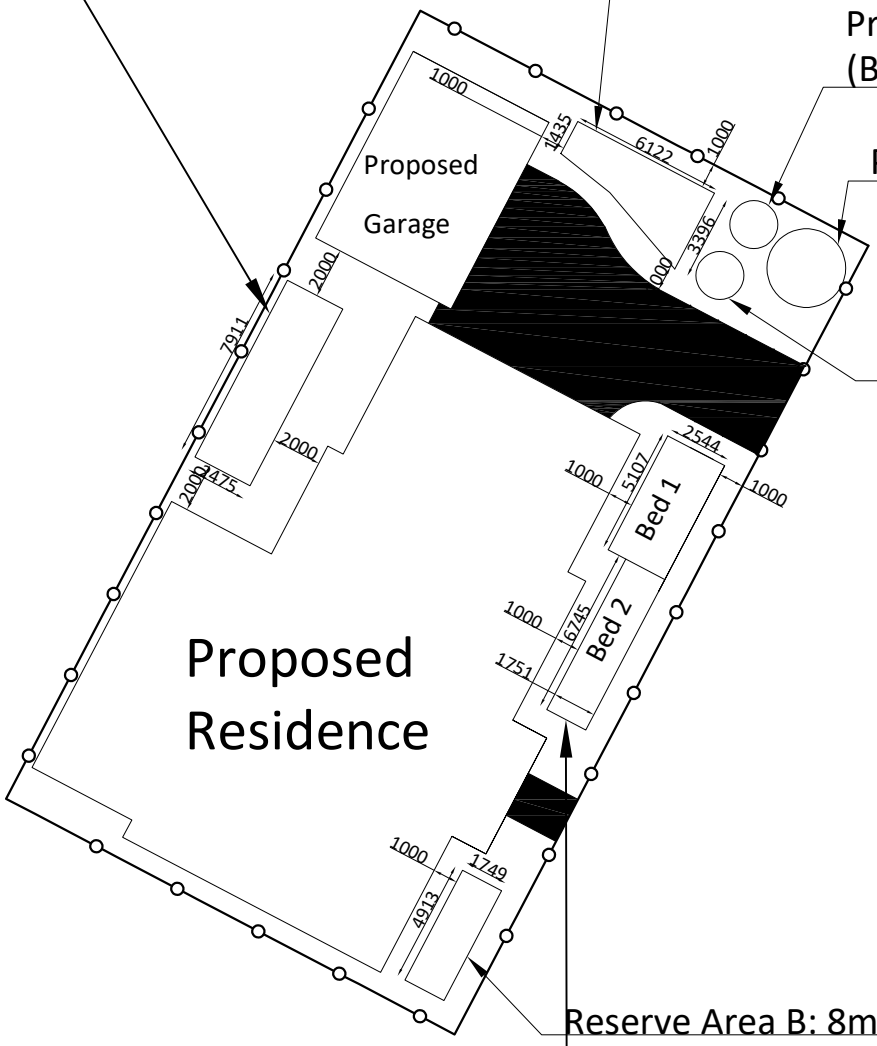
PROPOSED EFFLUENT DISPOSAL AREA
BLACKWATER EFFLUENT ONLY
AREA: 19m^2
(PRESSURE DOSED ABSORPTION BED)

Reserve Area A: 14m2

Proposed AWTS Tank
(Blackwater Treatment)

Proposed Water Tank

Proposed DGTS Tank
(Greywater Treatment)



Reserve Area B: 8m2

PROPOSED EFFLUENT DISPOSAL AREA
GREYWATER EFFLUENT ONLY
AREA: 23m^2
(2 PRESSURE DOSED ABSORPTION BEDS)

LEGEND: Site Boundary, Other Fences, Landform Element, Watercourses, Dams, Overland Flow Path, Surface Spray Sprinkler, Irrigation Pipework, Soil Borehole, Photo Location, Building Area, Land App. Area, Paved Area

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Wastewater | Contamination | Geotechnical
Stormwater | Ecology | Occupational Hygiene
Bushfire | Acoustic & Noise

TITLE: Wastewater System Layout Plan		SHEET SIZE: A4	SCALE: 1:300 @ A4
CLIENT: CONWAY	PROJECT: 19 Morgan Road, BELROSE, NSW	SHEET: 1/1	DATE: 17/06/20
		PROJECT REF / DRAWING NUMBER: DWG-200001-A	

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

BLACKWATER

Design Flow Rate	336	L/day
Bed Area	19	m2
DLR	30	mm/day

Weather Station:

Precipitation: 666188 Belrose (Evelyn Place)
Evaporation: 66131 RIVERVIEW OBSERVATORY

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Days in Month	(D)		days	31	28	31	30	31	30	31	31	30	31	30	31
Median Precipitation	(MP)		mm/month	86	123	103.8	73.6	73.8	119.8	64.4	44.6	55.5	50.6	80.2	83.7
Mean daily Evaporation	(E)		mm/day	6	5.1	3.9	3	2.2	1.9	2	2.8	3.8	4.7	5.3	5.9
Monthly Evaporation	(E)		mm/month	186	142.8	120.9	90	68.2	57	62	86.8	114	145.7	159	182.9
Crop Factor	(C)			0.7	0.7	0.7	0.6	0.5	0.5	0.4	0.5	0.6	0.7	0.7	0.7
Evapotranspiration	(ET)		mm/month	130.2	100.0	84.6	54.0	34.1	25.7	24.8	39.1	62.7	94.7	111.3	128.0
Infiltration Rate	(IR)		mm/month	570	570	570	570	570	570	570	570	570	570	570	570
Application Rate	(AR)		mm/month	548.21	495.16	548.21	530.53	548.21	530.53	548.21	548.21	530.53	548.21	530.53	548.21
Monthly variation in effluent depth			mm	-23.10	-18.13	-0.92	-6.96	6.27	19.14	6.23	-5.69	-16.34	-23.06	-24.70	-23.14

Effluent Depth in trench	Yr 1		mm	0.0	0.0	0.0	0.0	6.3	25.4	31.6	26.0	9.6	0.0	0.0	0.0
	Yr 2		mm	0.0	0.0	0.0	0.0	6.3	25.4	31.6	26.0	9.6	0.0	0.0	0.0
	Yr 3		mm	0.0	0.0	0.0	0.0	6.3	25.4	31.6	26.0	9.6	0.0	0.0	0.0

GREYWATER

Design Flow Rate	504	L/day
Bed Area	23	m2
DLR	30	mm/day

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Days in Month	(D)		days	31	28	31	30	31	30	31	31	30	31	30	31
Median Precipitation	(MP)		mm/month	86	123	103.8	73.6	73.8	119.8	64.4	44.6	55.5	50.6	80.2	0
Mean daily Evaporation	(E)		mm/day	6	5.1	3.9	3	2.2	1.9	2	2.8	3.8	4.7	5.3	5.9
Monthly Evaporation	(E)		mm/month	186	142.8	120.9	90	68.2	57	62	86.8	114	145.7	159	182.9
Crop Factor	(C)			0.7	0.7	0.7	0.6	0.5	0.5	0.4	0.5	0.6	0.7	0.7	0.7
Evapotranspiration	(ET)		mm/month	130.2	100.0	84.6	54.0	34.1	25.7	24.8	39.1	62.7	94.7	111.3	128.0
Infiltration Rate	(IR)		mm/month	570	570	570	570	570	570	570	570	570	570	570	570
Application Rate	(AR)		mm/month	548.21	495.16	548.21	530.53	548.21	530.53	548.21	548.21	530.53	548.21	530.53	548.21
Monthly variation in effluent depth			mm	-23.10	-18.13	-0.92	-6.96	6.27	19.14	6.23	-5.69	-16.34	-23.06	-24.70	-52.44

Effluent Depth in trench	Yr 1		mm	0.0	0.0	0.0	0.0	6.3	25.4	31.6	26.0	9.6	0.0	0.0	0.0
	Yr 2		mm	0.0	0.0	0.0	0.0	6.3	25.4	31.6	26.0	9.6	0.0	0.0	0.0
	Yr 3		mm	0.0	0.0	0.0	0.0	6.3	25.4	31.6	26.0	9.6	0.0	0.0	0.0

Appendix F: Operation and Maintenance Guidelines

ON-SITE SEWAGE MANAGEMENT SYSTEMS

If you live in or rent a house that is not connected to the main sewer then chances are that your yard contains an on-site sewage management system. If this is the case then you have a special responsibility to ensure that it is working as well as it can.

The aim of this pamphlet is to introduce you to some of the most popular types of on-site sewage management systems and provide some general information to help you maintain your system effectively. You should find out what type of system you have and how it works.

More information can be obtained from the pamphlets:

Your Septic System
Your Aerated Wastewater Treatment System
Your Composting Toilet
Your Land Application Area

You can get a copy of these pamphlets from your local council or the address marked on the back of this pamphlet.

It is important to keep in mind that maintenance needs to be performed properly and regularly. Poorly maintained on-site sewage management systems can significantly affect you and your family's health as well as the local environment.

What is an on-site sewage management system?

A domestic on-site sewage management system is made up of various components which - if properly designed, installed and maintained - allow the treatment and utilisation of wastewater from a house, completely within the boundary of the property.

Wastewater may be blackwater (toilet waste), or greywater (water from showers, sinks, and washing machines), or a combination of both.

Partial on-site systems - eg. pump out and common effluent systems (CES) - also exist. These usually involve the preliminary on-site treatment of wastewater in a septic tank, followed by collection and transport of the treated wastewater to an off-site management facility. Pump out systems use road tankers to transport the effluent, and CES use a network of small diameter pipes.

How does an on-site sewage management system work?

For complete on-site systems there are two main processes:

1. treatment of wastewater to a certain standard
2. its application to a dedicated area of land.

The type of application permitted depends on the quality of treatment, although you should try to avoid contact with all treated and untreated wastewater, and thoroughly wash affected areas if contact does occur.

Treatment and application can be carried out using various methods:

Septic Tank
Septic tanks treat both greywater and blackwater, but they provide only limited treatment through the settling of solids and the flotation of fats and greases. Bacteria in the tank break down the solids over a period of time. Wastewater that has been treated in a septic tank can only be applied to land through a covered soil absorption system, as the effluent is still too contaminated for above ground or near surface irrigation.

AWTS
Aerated wastewater treatment systems (AWTS) treat all household wastewater and have several treatment compartments. The first is like a septic tank, but in the second compartment air is mixed with the wastewater to assist bacteria to break down solids. A third compartment allows settling of more solids and a final chlorination contact chamber allows disinfection. Some AWTS are constructed with all the compartments inside a single tank. The effluent produced may be surface or sub-surface irrigated in a dedicated area.

Composting Toilets
Composting toilets collect and treat toilet waste only. Water from the shower, sinks and the washing machine needs to be treated separately (for example in a septic tank or AWTS as above). The compost produced by a composting toilet has special requirements but is usually buried on-site.

These are just some of the treatment and application methods available, and there are many other types such as sand filter beds, wetlands, and amended earth mounds. Your local council or the NSW Department of Health have more information on these systems if you need it.

Regulations and recommendations

The NSW Department of Health determines the design and structural requirements for treatment systems for single households. Local councils are primarily responsible for approving the installation of smaller domestic septic tank systems, composting toilets and AWTSs in their area, and are also responsible for approving land application areas. The NSW Environment Protection Authority approves larger systems.

The design and installation of on-site sewage management systems, including plumbing and drainage, should only be carried out by suitably qualified or experienced people. Care is needed to ensure correct sizing of the treatment system and application area.

Heavy fines may be imposed under the Clean Waters Act if wastewater is not managed properly.

Keeping your on-site sewage management system operating well

What you put down your drains and toilets has a lot to do with how well your system performs. Maintenance of your sewage management system also needs to be done well and on-time. The following is a guide to the types of things you should and should not do with your system.

DO

- ✓ Learn how your sewage management system works and its operational and maintenance requirements.
- ✓ Learn the location and layout of your sewage management system.
- ✓ Have your AWTS (if installed) inspected and serviced four times per year by an approved contractor. Other systems should be inspected at least once every year. Assessment should be applicable to the system design.
- ✓ Keep a record of desludgings, inspections, and other maintenance.
- ✓ Have your septic tank or AWTS desludged every three years to prevent sludge build up, which may 'clog' the pipes.
- ✓ Conserve water. Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.
- ✓ Discuss with your local council the adequacy of your existing sewage management system if you are considering house extensions for increased occupancy.

DON'T

- ✘ Don't let children or pets play on land application areas.
- ✘ Don't water fruit and vegetables with effluent.
- ✘ Don't extract untreated groundwater for cooking and drinking.
- ✘ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your system via the sink, washing machine or toilet.
- ✘ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✘ Don't put fats and oils down the drain and keep food waste out of your system.
- ✘ Don't install or use a garbage grinder or spa bath if your system is not designed for it.

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby waterway.

Your sewage management system is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

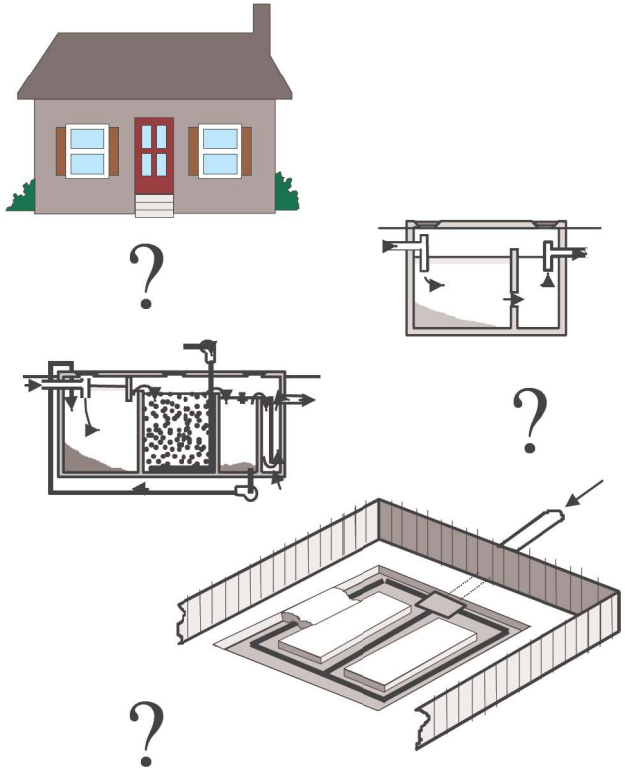
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained sewage management systems are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your management system you can do your part in helping to protect the environment and the health of you and your community.

For more information please contact:

Managing Wastewater In Your Backyard



Aerated Wastewater Treatment Systems (AWTS)

In unsewered areas, the proper treatment and utilisation of household wastewater on-site is critical in preserving the health of the public and the environment. AWTS have been developed as a way of achieving this.

What is an AWTS?

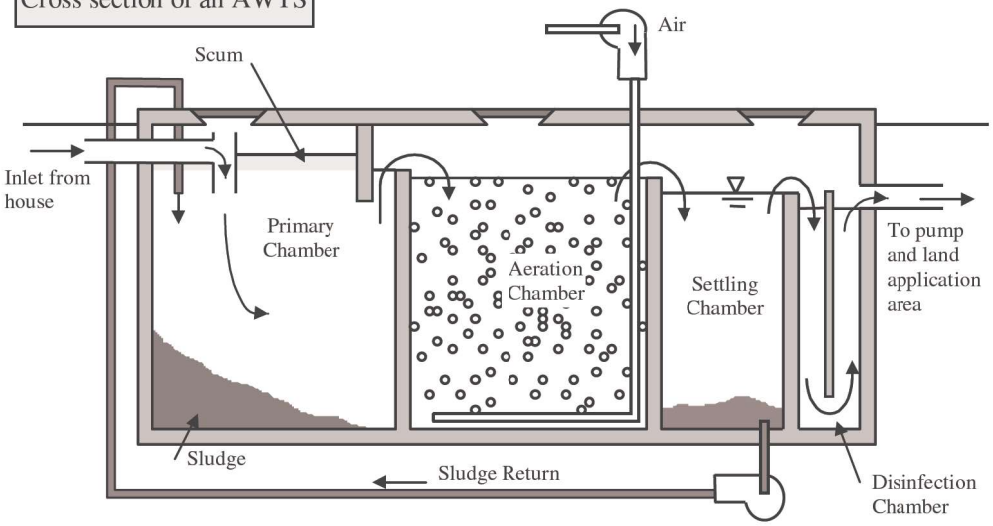
An AWTS is a purpose built system used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

How does an AWTS work?

Wastewater from a household is treated in stages in several separate chambers. The first chamber is similar to a conventional septic tank. The wastewater enters the chamber where the solids settle to the bottom and are retained in the tank forming a sludge layer. Scum collects at the top, and the partially clarified wastewater flows into a second chamber. Here the wastewater is mixed with air to assist bacteria to further treat it. A third chamber allows additional clarification through the settling of solids, which are returned for further treatment to either the septic chamber (as shown) or to the aeration chamber. The clarified effluent is disinfected in another chamber (usually by chlorination) before irrigation can take place.

Cross section of an AWTS



Bacteria in the first chamber break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the chamber and must be pumped out periodically.

Regulations and recommendations

Local councils are primarily responsible for approving the smaller, domestic AWTSs in their area. The Environment Protection Authority (EPA) approves larger units, whilst the NSW Department of Health determines the design and structural requirements for all AWTSs.

At present AWTSs need to be serviced quarterly by an approved contractor at a cost to the owner. Local councils should also maintain a register of the servicing of each system within their area.

AWTSs should be fitted with an alarm having visual and audible components to indicate mechanical and electrical equipment malfunctions. The alarm should provide a signal adjacent to the alarm and at a relevant position inside the house. The alarm should incorporate a warning lamp which may only be reset by the service agent.

Maintaining your AWTS

The effectiveness of the system will, in part, depend on how it is used and maintained. The following is a guide on good maintenance procedures that you should follow:

DO

- ✓ Have your AWTS inspected and serviced four times per year by an approved contractor. Assessment should be applicable to the system design.
- ✓ Have your system service include assessment of sludge and scum levels in all tanks, and performance of irrigation areas.
- ✓ Have all your tanks desludged at least every three years.
- ✓ Have your disinfection chamber inspected and tested quarterly to ensure correct disinfectant levels.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of pumping, inspections, and other maintenance.
- ✓ Learn the location and layout of your AWTS and land application area.
- ✓ Use biodegradable liquid detergents such as concentrates with low sodium and phosphorous levels.
- ✓ Conserve water.

DON'T

- ✗ Don't put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into your AWTS via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't use more than the recommended amounts of detergents.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't switch off power to the AWTS, even if you are going on holidays

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your AWTS. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system entering a nearby river, creek or dam.

Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.

Your AWTS is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

Warning signs

You can look out for a few warning signs that signal to you that there are troubles with your AWTS. Ensure that these problems are attended to immediately to protect your health and the environment.

Look out for the following warning signs:

- Water that drains too slowly.
- Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- Sewage smells, this indicates a serious problem.
- Water backing up into your sink which may indicate that your system is already failing.
- Wastewater pooling over the land application area.
- Black coloured effluent in the aerated tank.
- Excess noise from the blower or pumping equipment
- Poor vegetation growth in irrigated area.

Odour problems from a vent on the AWTS can be a result of slow or inadequate breakdown of solids. Call a technician to service the system.

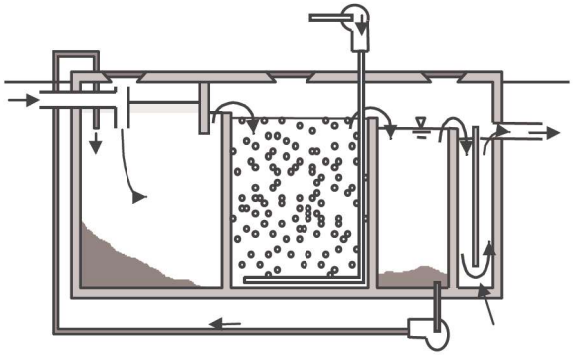
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained AWTSs are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your treatment system you can do your part in helping to protect the environment and the health of you and your family.

If you would like more information please contact:

Your Aerated Wastewater Treatment System



LAND APPLICATION AREAS

The reuse of domestic wastewater on-site can be an economical and environmentally sound use of resources.

What are land application areas?

These are areas that allow treated domestic wastewater to be managed entirely on-site.

The area must be able to utilise the wastewater and treat any organic matter and wastes it may contain. The wastewater is rich in nutrients, and can provide excellent nourishment for flower gardens, lawns, certain shrubs and trees. The vegetation should be suitably tolerant of high water and nutrient loads.

How does a land application area work?

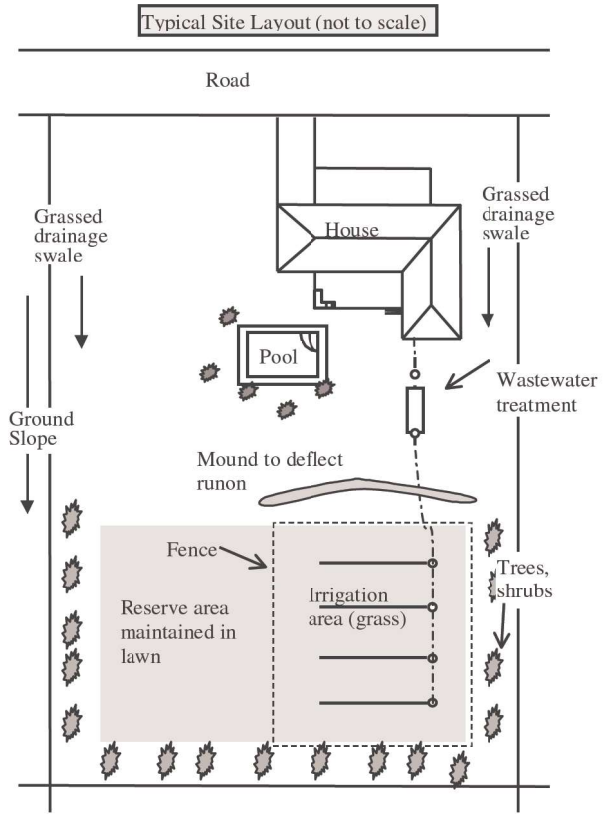
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

Soil absorption systems do not require highly treated effluent, and wastewater treated by a septic tank is reasonable as the solids content in the effluent has been reduced. Absorption systems release the effluent into the soil at a depth that cannot be reached by the roots of most small shrubs and grasses. They rely mainly on the processes of soil treatment and then transmission to the water table, with minimal evaporation and up-take by plants. **These systems are not recommended in sensitive areas as they may lead to contamination of surface water and groundwater.**

Irrigation systems may be classed as either subsurface or surface irrigation. If an irrigation system is to be used, wastewater needs to be pre-treated to at least the quality produced by an aerated wastewater treatment system (AWTS).

Subsurface irrigation requires highly treated effluent that is introduced into the soil close to the surface. The effluent is utilised mainly by plants and evaporation.

Surface irrigation requires highly treated effluent that has undergone aeration and disinfection treatments, so as to reduce the possibility of bacteria and virus contamination.



The effluent is then applied to the land area through a series of drip, trickle, or spray points which are designed to eliminate airborne drift and run-off into neighbouring properties.

There are some public health and environmental concerns about surface irrigation. There is the risk of contact with treated effluent and the potential for surface run-off. Given these problems, subsurface irrigation is arguably the safest, most efficient and effective method of effluent utilisation.

Regulations and recommendations

The design and installation of land application areas should only be carried out by suitably qualified or experienced people, and only after a site and soil evaluation is done by a soil scientist. Care should be taken to ensure correct buffer distances are left between the application area and bores, waterways, buildings, and neighbouring properties.

Heavy fines may be imposed under the Clean Waters Act if effluent is managed improperly.

At least two warning signs should be installed along the boundary of a land application area. The signs should comprise of 20mm high Series C lettering in black or white on a green background with the words:

RECLAIMED EFFLUENT
NOT FOR DRINKING
AVOID CONTACT

Depending on the requirements of your local council, wet weather storage and soil moisture sensors may need to be installed to ensure that effluent is only irrigated when the soil is not saturated.

Regular checks should be undertaken of any mechanical equipment to ensure that it is operating correctly. Local councils may require periodic analysis of soil or groundwater characteristics

Humans and animals should be excluded from land application areas during and immediately after the application of treated wastewater. The longer the period of exclusion from an area, the lower the risk to public health.

The householder is required to enter into a service contract with the installation company, its agent or the manufacturer of their sewage management system, this will ensure that the system operates efficiently.

Location of the application area

Treated wastewater has the potential to have negative impacts on public health and the environment. For this reason the application area must be located in accordance with the results of a site evaluation, and approved landscaping must be completed prior to occupation of the building. Sandy soil and clayey soils may present special problems.

The system must allow even distribution of treated wastewater over the land application area.

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- ✗ Don't erect any structures, construct paths, graze animals or drive over the land application area.
- ✗ Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- ✗ Don't plant trees or shrubs near or on house drains.
- ✗ Don't alter stormwater lines to discharge into or near the land application area.
- ✗ Don't flood the land application area through the use of hoses or sprinklers.
- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with the effluent.
- ✗ Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- surface ponding and run-off of treated wastewater
- soil quality deterioration
- poor vegetation growth
- unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- Λ Overloading the treatment system with wastewater.
- Λ The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- Λ The application area has been poorly designed.
- Λ Stormwater is running onto the area.

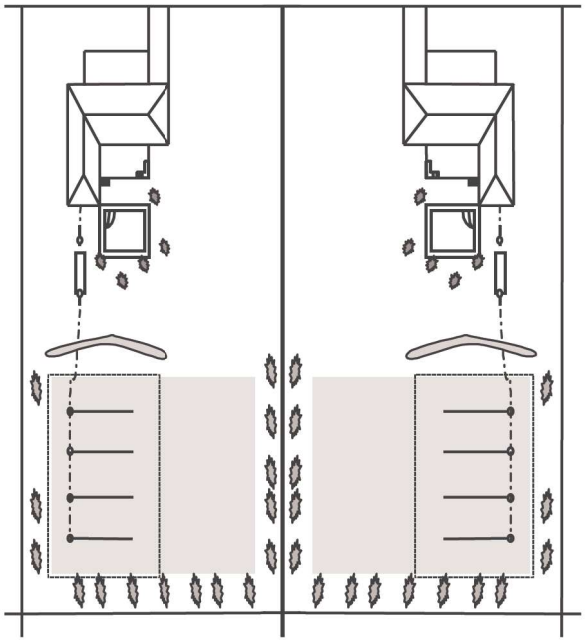
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area



APPENDIX G: WATER CONSERVATION

Whilst this report is based on AA rated plumbing fixtures, AA rated plumbing would further conserve limited water supplies and enhance performance of the irrigation, soil and plant systems. Water saving devices will reduce the volume of water that needs to be applied to the site, and thus reduce the risk of any runoff.

Using the following water saving devices, the average household's water consumption can be reduced from 900 litres to 750 litres per day:

- Dual flush 6/3 litre pan and cistern (average household savings of 93 L/day) *
- AAA rated shower heads to limit flows to 7 L/minute *
- AAA rated dishwasher (not more than 18 litres for each wash cycle) **
- AAA rated washing machine (not more than 22 litres per dry kg of clothes) **

* Source: Independent Pricing and Regulation Tribunal of NS (1996), Water Demand Management: A Framework for Option Assessment

** Source: Sydney Water Demand Management Strategy, October 1995

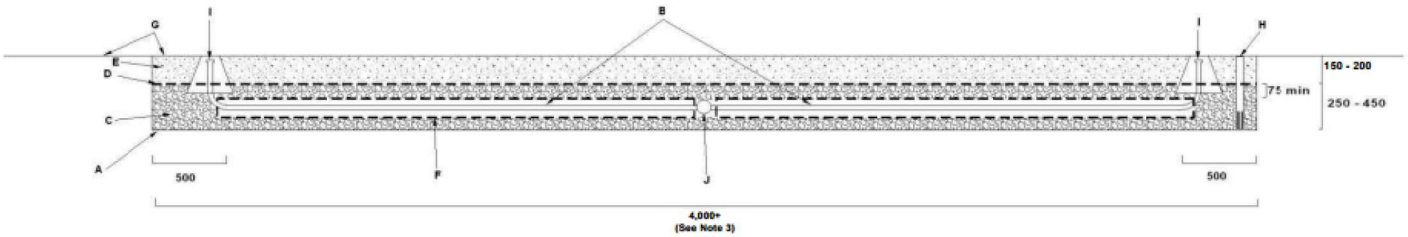
Low phosphate, low sodium detergents are recommended to help improve the effluent quality. Low sodium detergents ensure that the soil structure, and hence its absorption capacity, is maintained as close as possible to a natural condition. Sodium in laundry powders is used as a filler. Therefore, in general, liquid detergents are preferred over powder. Low phosphorus detergents ensure that optimum plant growth is maintained and that excess phosphorus is not leached into the environment.

Bleaches, disinfectants and other cleaning compounds can harm wastewater treatment systems, such as septic tanks, because they kill bacteria that colonise the system and help treat wastewater. Use these products sparingly and always check that they are safe for septic systems. Avoid placing oil, paint, petrol, acids, degreasers, photography chemicals, cosmetics, lotions, pesticides and herbicides in the wastewater system. Even small amounts of these products can harm the performance of the onsite effluent management system.

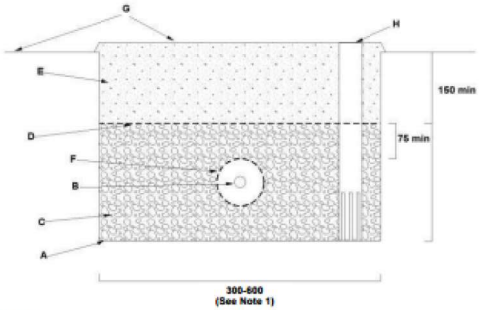
APPENDIX T - Pressure Dosed Beds

Source: *Design and Installing On-Site Wastewater Systems* (SCA, 2012)

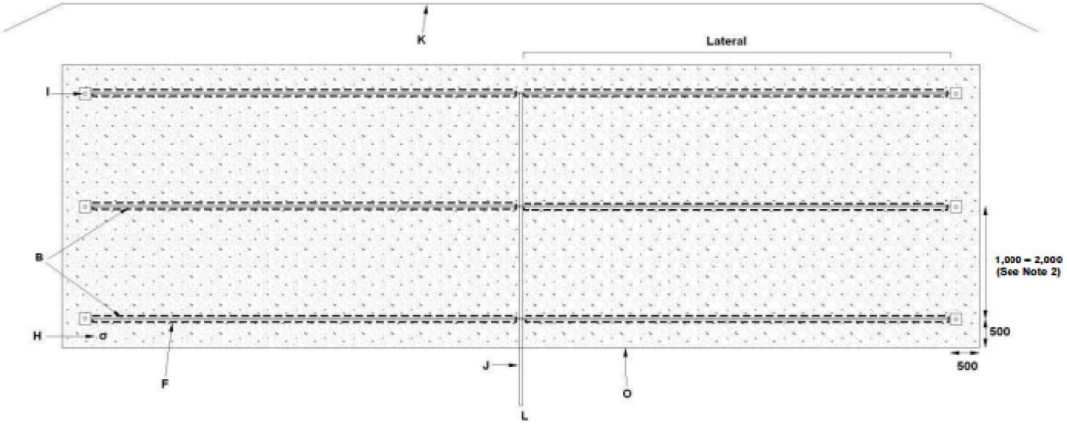
Cross Section: Pressure-dosed Bed



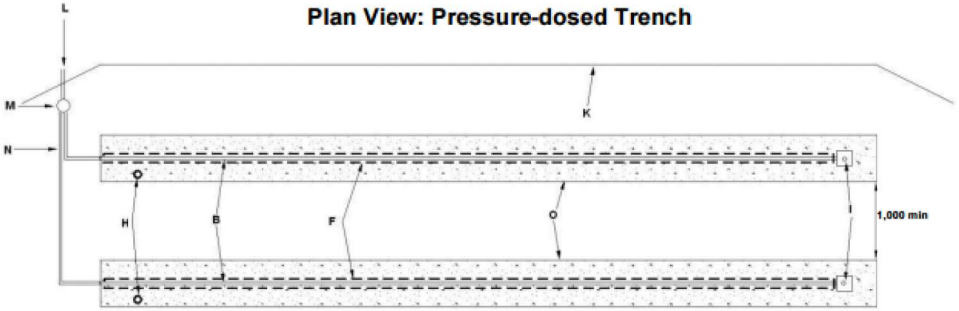
Cross Section: Pressure-dosed Trench



Plan View: Pressure-dosed Bed



Plan View: Pressure-dosed Trench



Pressure-dosed Trench / Bed Construction

A The base of the trench / bed must be level to ensure even distribution of effluent. Base levels should be checked with a dumpy / laser level.

B Pressure-dosing manifold consisting of 25 mm PVC pipe with 3 mm holes drilled (deburred) at 400 mm centres facing upwards. Where a dosing siphon is used in place of a pump, holes will need to be 4-5 mm depending on flow rate achieved. The total number and length of laterals will be determined by the required bed size (m^2) and the lateral spacings shown in this drawing.

C 20-40 mm distribution aggregate.

D Geotextile filter cloth.

E Clean local or imported topsoil (sandy loam to clay loam).

F 90 mm slotted PVC or agricultural pipe over manifold laterals.

G Grass must be established across the construction area as soon as possible. Trench / bed surface should be level or slightly mounded.

H Inspection port on downhill side of trench / bed. Made from 50 mm PVC pipe with perforations in the aggregate level of the trench / bed.

I Individual flush points for each lateral. May be a screw cap fitting on a 90 degree elbow level with the bed surface or a pressure controlled flush valve (such as those used for subsurface irrigation systems) inside an irrigation control box. Manual flushing should be carried out at least every 12 months.

J 40 mm PVC dosing manifold. Larger systems may require different pipe sizes and orifice reducers at lateral connection points.

K Upslope stormwater diversion drain (see Standard Drawing 9A for design detail). Sub-soil drainage may be necessary on particular sites.

L Pump dosed effluent from treatment system. The pump must be capable of delivering the total flow rate required for all laterals whilst providing a 1.5 m residual head (ie squirt height) at the highest orifice (with no more than 15% variation in squirt height across the whole bed). For beds with individual laterals no more than 10 m long, it is acceptable to adopt a flow rate of 3.5-4 L/min/lineal metre. Total dynamic head (including friction loss) will need to be determined on a site-specific basis.

M Hydraulically operated indexing valve that delivers effluent to a different trench / bed or set of laterals at each pump cut-in.

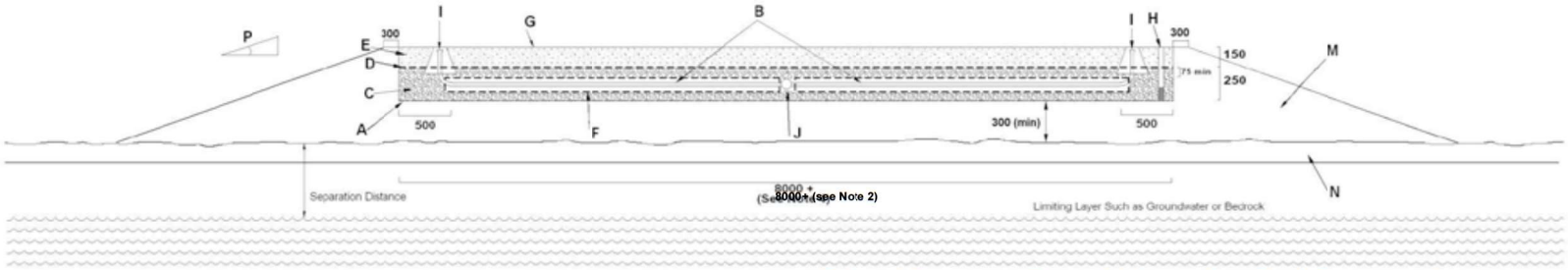
N 25 mm polyethylene or PVC dosing manifold.

O Trench / bed dimensions are an example only. The basal area of the land application area must be determined according to the procedures in AS/NZS 1547:2012 and this Manual. .A minimum bed length to width ratio of 3:1 must be adopted when developing individual designs and beds must be installed parallel to the site contours. The location and orientation of the area should be based on a site and soil assessment by a suitably qualified person. The system may comprise a single trench / bed or multiple smaller trenches / beds.

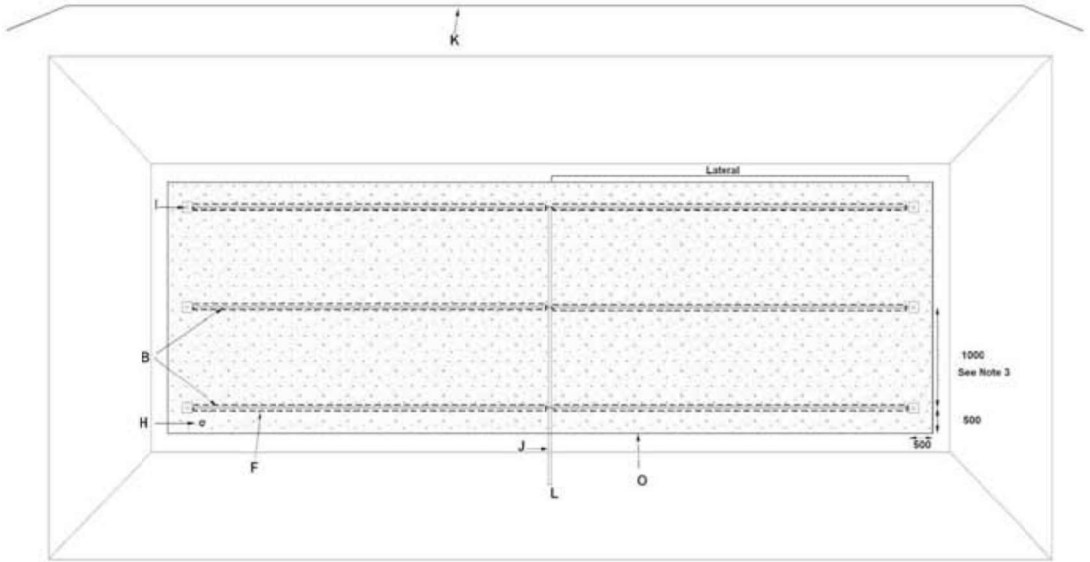
Notes

1. Trenches should optimally be 600 mm wide. Optimum width will balance storage requirements against footprint and required trench length.
2. Nominal lateral spacing of 2,000 mm for clay loams to light clays. 1,000 mm for sandy loams to sands.
3. Consideration should be given to ensuring all beds have a level base when determining an appropriate width. The distribution manifold must also be level. Beds longer than 30 m will require specialist hydraulic design.

Cross Section View



Plan View



Note 1 The layout and dimensions used in this drawing are for general guidance only. The location, configuration and layout of individual beds will need to be determined on a site-specific basis. The purpose of this drawing is to illustrate a typical configuration and specify minimum system components.

Note 2 Consideration should be given to ensuring all beds have a level base when determining an appropriate width. The distribution manifold must also be level. Beds longer than 30 m will require specialist hydraulic design.

Raised Pressure-Dosed Absorption Bed Construction

A The base of the trench must be level to ensure even distribution of effluent. Base levels should be checked with a dumpy / laser level.

B Pressurised dosing laterals consisting of 25 mm PVC pipe with 3 mm holes drilled (deburred) at 400 mm centres facing upwards. The total number and length of laterals will be determined by the required bed size (m^2) and the lateral spacings shown in this drawing. It is essential that effluent is distributed evenly across the distribution bed. A residual head (or squirt height) of 1.5 m should be achieved across the distribution laterals. The squirt height across the laterals must be tested prior to covering with agricultural / slotted pipe, with no more than 15% variation in height observed. Consideration must also be given to static head and friction loss when sizing pumps. A full hydraulic design must be carried out.

C 20-40 mm distribution aggregate.

D Geotextile filter cloth.

E Clean local or imported topsoil (sandy loam to loam).

F 90 mm slotted PVC or agricultural pipe over manifold laterals.

G Grass must be established across the construction area as soon as possible. The bed surface should be slightly mounded.

H Inspection port on downhill side of trench / bed. Made from 50 mm PVC pipe with perforations in the aggregate level of the trench / bed.

I Individual flush points for each lateral. May be a screw cap fitting on a 90 degree elbow level with the bed surface or a pressure controlled flush valve (such as those used for subsurface irrigation systems) inside an irrigation control box. Manual flushing should be carried out at least every twelve months.

J PVC or polyethylene dosing manifold. Larger systems may require different pipe sizes and orifice reducers at lateral connection points.

K Upslope stormwater diversion drain. Subsoil drainage may be necessary on particular sites.

L Pump dosed effluent from treatment system (minimum primary treatment with an outlet filter).

M The base of each absorption bed is to be raised to a height of 300 mm above the final ground surface (total bed height 700 mm). Compaction should be minimised when installing the bed. The fill must be a loam to sandy loam with minimal clay content.

N Prepare the site by clearing all shrubs, trees and boulders. Cut trees to ground level and then grind the stump out to a depth of 300 mm and backfill with permeable material such as the natural topsoil or sand (definitely not clay). Scarify the natural soils across the entire basal area to a minimum depth of 200 mm taking care not to compact the basal area in the process. This should extend to at least 1m beyond the perimeter.

O The bed dimensions shown are an example only. The basal area of the land application area must be determined based on the load and soil characteristics of the site. **A minimum bed length to width ratio of 3:1 must be adopted when developing individual designs and beds must be installed parallel to the site contours.** The location and orientation of the area should be based on a site by a suitably qualified person. The system may comprise a single bed or preferably multiple smaller beds.

P Batter slope 1(vertical):3 (horizontal) maximum.