envirotech
Environmental and Engineering
Consultancy Services

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

'ON-SITE WASTEWATER MANAGEMENT REPORT'

For:

113 Orchard Street, Warriewood, NSW

CLIENT: Tony McLain

REFERENCE: REF-19-8578-A

DATE: 16 September 2019

David Quach BE (Civil)
Civil Engineer
ENVIROTECH PTY. LTD.

Howe Chen BE (Civil)
Civil Engineer
ENVIROTECH PTY. LTD.

COPYRIGHT © 2018

The information, including the intellectual property contained in this document is confidential and proprietary to ENVIROTECH PTY. LTD. It may be used only by the person, company or organisation to whom it is provided for the stated purpose for which it is provided. It must not be given to any other person, company or organisation without the prior written approval of the Director of ENVIROTECH PTY. LTD. ENVIROTECH PTY. LTD. reserves all legal rights and remedies in relation to any infringement of its rights in respect of confidential information.

Document Management				
Version	Date	Author	Reviewed	Author
A	16-Sep-19	DQ	16-Sep-19	HC

TABLE OF CONTENTS

INTRODUCTION

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

Objective

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

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

This study has been prepared in accordance with:

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

Scope of Works

The scope of works undertaken for this site evaluation included:

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

DESKTOP INFORMATION

Address	113 Orchard Hills, Warriewood
Council	*Northern Beaches LGA*
Proposed Development	Horse Stables
Intended Water Supply	*Town Water*
Design Wastewater Allowance	65 *L / day*
Equivalent Population (Proposed Residence)	*4 Horses (4 Stables)*
Design Wastewater Flowrate (Proposed Residence)	353.26 L / day*, refer to appendix B*
Rainfall Station	*Mona Vale Golf Club* - 0*66141*
Evaporation Station	*RIVERVIEW OBSERVATORY - 066131*

SITE ASSESSMENT

This 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'.

Landform Description

The landform is described by first dividing an area into landform elements of approximately 40-m diameter. A description of these elements is then provided. These landform elements define the boundaries of this site assessment.

Element	*Approx. Slope Tangent (%)*	*Slope Class*	*Morphological Type*	*Relative Inclination*		*Instability Risk*
1	19	Moderately Inclined	Simple Slope	Linear	Planar	Very Low

Vegetation

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

Element	*Growth Form*	*Height Class*	*Cover Class*	*Structural Formation*
A	Grass	Low	Dense	Closed Grassland
B	Tree	Tall	Dense	Closed Forest

Overland Flow

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

Landform element.	*Run-on*	*Run-off*	*Soil - Water Status*
1	Moderately Rapid	Slow	Moderately Moist

Site & Soil Disturbance

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

Nil.

Rocky Outcrops

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

Nil

Setbacks

The following setbacks from the effluent application area have been proposed after considering Appendix R of AS1547:2012 'On-site Domestic Wastewater Management'. This Appendix provides a recent guide on how to determine setbacks distances based on site-specific constraints identified in this site assessment.

The constraint factors associated with each site feature (refer to Table R1) have been qualitatively assessed using Table R2 and a suitable setback then chosen from within the range stated in Table R1.

Site Feature	*Setback Range*	*Constraint Factors*	*Proposed Setback*
Building, Driveways & Horse Arena	3 – 6	LOW	> 3 m (down-slope) > 6 m (up-slope)
Property Boundaries & Dwelling	6 - 12	LOW	> 3 m (down-slope) > 6 m (up-slope)

Site Assessment Discussion

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

Figure 1. – Indicative landform of proposed EDA

SOIL ASSESSMENT

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

The following properties were recorded for each soil horizon:

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

Erodability / Erosion Hazard

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

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

	Borehole 1
Erodability	Low
Erosion Hazard	Slight

Physical Properties: In summary, the soil profile is described below:

Bore Hole 1:

Soil Horizon	Depth	Colour	Mottles	Coarse Fragments %	Texture	Structure
A1	300	Dark Brown	NA	< 10	Sand	Massive
A2	650	Light brown	Grey	< 10	Light Clay	Weak
A3	1000	Orange	Red & Grey	< 10	Light Clay	Moderate

Excavation terminated at: 1000 mm

Reason: Auger Refusal at stiff clay layer

Bedrock Depth: > 1000 mm

Surface Condition: Firm

Figure 2. – Soil sample from BH 1

Chemical Properties

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

Borehole 1

Horizon	*PH*	*EC_e (µS/cm)*
A1	6.31	690
A2	5.85	172
A3	5.11	225

(Hanna Instruments, HI 98129, Ref 29713)

Phosphorus Adsorption Capacity (kg / ha): 6,405

Salinity & Drainage

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

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

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

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

Soil Assessment Discussion

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

ON-SITE WASTEWATER MANAGEMENT SYSTEM DESIGN

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

Wastewater Treatment:

This report proposes wastewater treatment using a septic tank as it will produce primary treated effluent suitable for absorption purposes.

Effluent Application:

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

1. **Absorption Bed**
2. Absorption Trench

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

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

Effluent Application Area Sizing

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

Proposed Design Loading Rate (DLR):

Imported Weakly Structured Sandy Loam 15 mm / day (Table M1, AS 1547:2012)

Minimum Absorption Areas:

Effluent Dispersal Area (EDA) = Flowrate (Q) / Design Loading Rate (DLR)

EDA = 353.26 L / Day / 15 mm / Day

= 25 m^2

Site Modifications Recommended

- Installation of manure traps within areas of washdown to capture manure, hair and straw and reduce quantities of solids entering the tank system. The below is an example of the type of manure trap to be installed.

Figure 3. – Manure Traps

- Excavate absorption bed building envelope up to 1m depth. A 1m perimeter surrounding the absorption bed shall also be excavated to a 1m depth. Refer to Appendix A for further detailing.
- Import a category 1 or category 2 soil (sand or sandy loam material) in order to achieve a higher design loading rate of 15mm/day.
- Due to the moderately inclined slope (19%), construct a retaining wall around the absorption bed. To be designed by geotechnical engineer or suitably qualified landscaper.

RECOMMENDATIONS

- Continued use of Exsiting Septic Tank with capacity to treat the design flowrate (353.26 L/d) to a primary treatment standard with disinfection. Detach Septic tank from house pipework and utilize the existing system for horse stables.

- Model, schematics and associated documentation of the above treatment type to be provided by client upon consultation with installer/plumber. Schematics and documentation of selected model to be attached upon submission with this report.

- Installation of an absorption system. This area shall be designated for effluent application only.

- EnviroTech recommends all of the following absorption types are suitable for installation on this site:

Absorption System Type	*Minimum area Required*
Absorption Bed	25 m^2

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

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

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

- Please refer to Appendix L for further detailed absorption bed descriptions and standard drawings for guidance during construction and installation.

LIMITATIONS

Envirotech 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 Envirotech, does so entirely at its own risk and without recourse to Envirotech for any loss or damage.

In preparing this report Envirotech 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 also as a result of anthropogenic influences. Such changes may occur after Envirotech's field testing has been completed.

Envirotech's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Envirotech 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, Envirotech should be advised and a plan outlining the need for potential action developed accordingly.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. Envirotech 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 Envirotech. This is because this report has been written as advice and opinion rather that instructions for construction.

envirotech
Environmental and Engineering Consultancy Services

Wastewater
Stormwater
Bushfire
Contamination
Ecology
Acoustic & Noise
Geotechnical
Occupational Hygiene

A: Unit 1, 23 Rowood Road, Prospect NSW 2148
P: PO Box 3086, EAST BLAXLAND NSW 2774
E: info@envirotech.com.au
F: (02) 8834 0760
T: 1300 888 324 | (02) 9896 1568

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

TITLE: SEPTIC + ABSORPTION BED		SHEET SIZE: A4	SCALE: 1:500 @ A4
CLIENT: MCLAIN	PROJECT: 113 ORCHARD STREET, WARRIEWOOD (NORTHERN BEACHES LGA)	SHEET: 1/1	DATE: 18/09/2019
		PROJECT REF / DRAWING NUMBER: DWG-19-8578-A	

Horse-Intensive Exercise

Max. head of Horse		4	head
Mature Live Weight (Avg.)		500	kg
Manure as % of Weight		0.78	
Manure Per Head		3.9	kg / head
Total Manure		15.6	kg / Day
TS of Solids (approx.)		15	%
Manure Passing Trap (liquid + 50% solids)		13.26	L/Day
BOD after primary treatment (ie 50% removed)		0.07898	
Urine as % of weight		4	%
Urine per head		20	L/Day
Total Urine		80	L /Day
Typical Hardstall Wash-down		65	L /Head
Total Wash-down volume	V1	260	L/Washdown

Washdown

Typical Hardstall Washdown Interval	1	times/day
Average Time in Hardstall /Day	12	hrs/day
Design Hosing Volume	1260	L/Washdown

		Direct Waste			**Washdown**
Horse	=	93.26	L	WD =	260
Total Non-washdown:		93.26	L	**Total Washdown**	260
Total influent:		353.26	L		

"Live.221 Characteristics and Volume of Effluent Produced by Livestock Vessels" (MLA and LiveCorp, 2003)

"Dairy Effluent: Designing a Trafficable Solids Trap" (Haughton, 2006)

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.

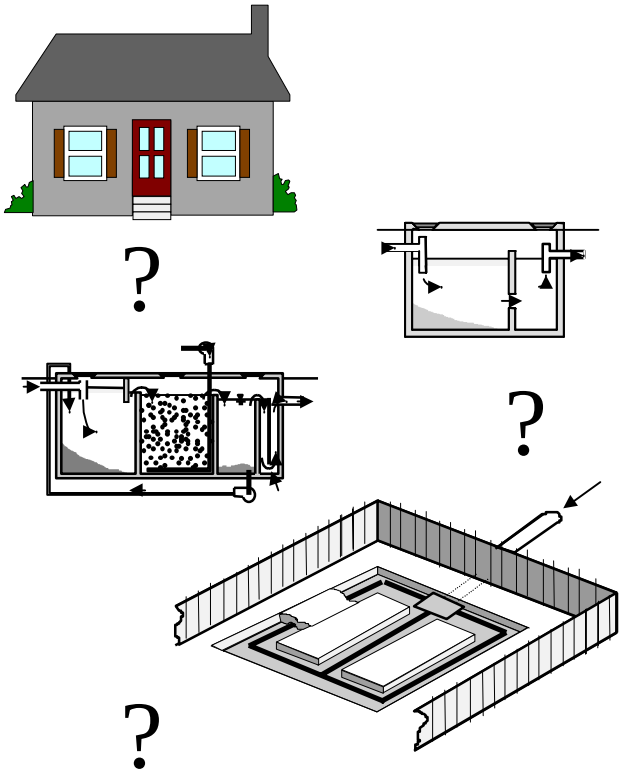
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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.

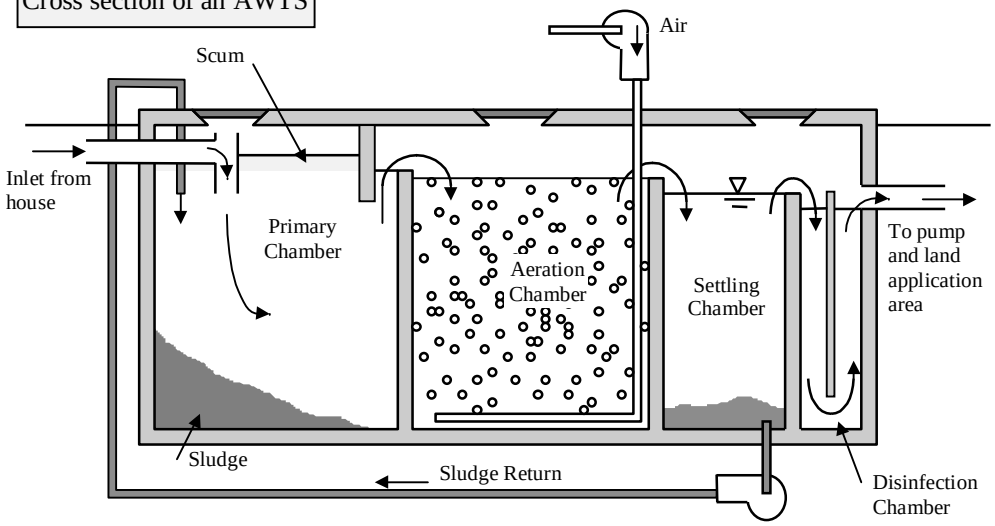
It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

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.

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.

Cross section of an AWTS



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.

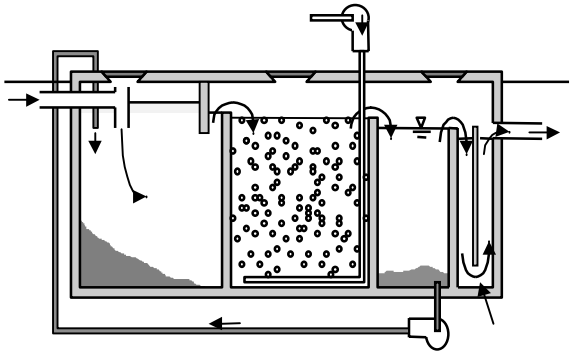
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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?

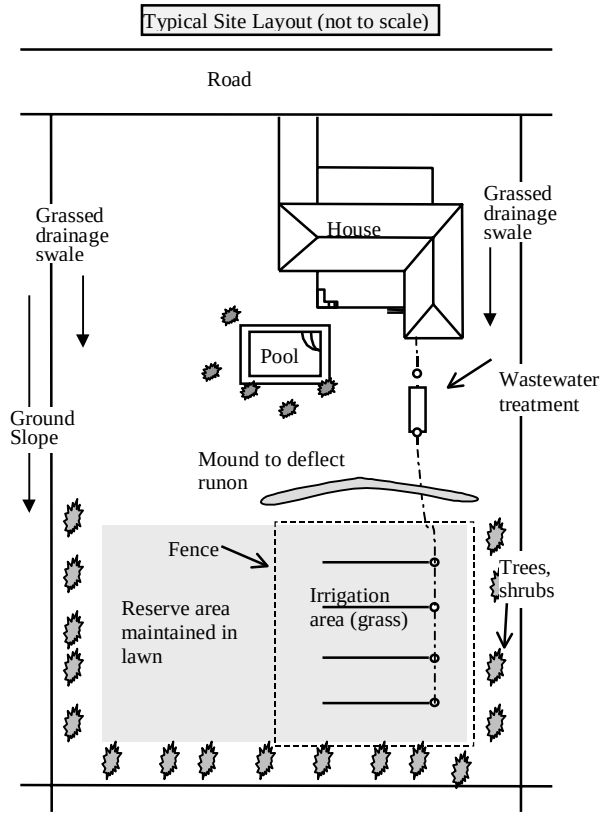
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

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.

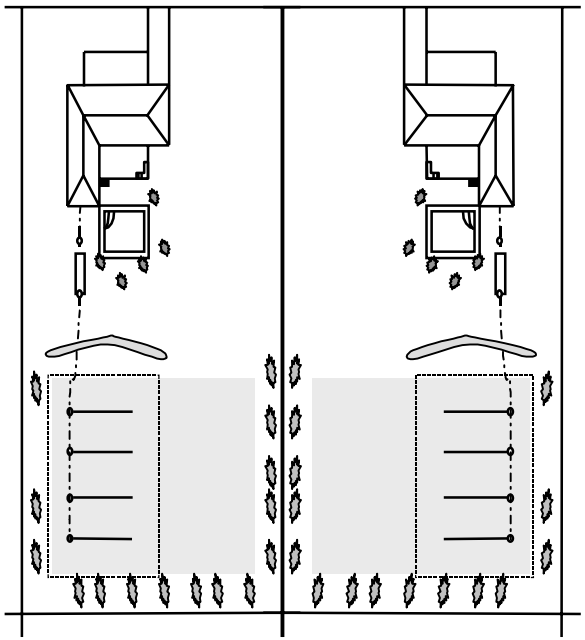
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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.

EnviroTech Pty. Ltd. - Copyright © 2003

Conventional Absorption Beds

TABLE L2
TYPICAL DIMENSIONS OF CONVENTIONAL TRENCHES AND BEDS

	Typical dimensions (mm)	Maximum (mm)	Minimum (mm)
Trench dimensions			
Width	300 – 450	600	200
Depth of aggregate	200 – 400	400	200
Depth of topsoil	100 – 150	150	100
Spacing between adjacent trenches (sidewall to sidewall)	–	N/A	1000
Bed dimensions			
Width	1000 – 4000	4000	1000
Depth of aggregate	300 – 600	600	300
Depth of topsoil	100 – 150	150	100
Spacing between adjacent beds (sidewall to sidewall)	–	N/A	1000

L5.3 Construction details

Typical details of construction are shown in:

Trenches	Figure L1 Conventional piped trench
	Figure L2 Self-supporting arch trench (two versions)
	Figure L3 Boxed trench
	Figure L4 Discharge control trench
Beds	Figure L5 Conventional bed
ETA/ETS trenches and beds	Figure L6 ETA/ETS bed details
	Figure L7 ETA/ETS trenches

CL5.3

In these figures:

(a) Filter cloth is placed in conventional trenches and beds to prevent soil incursion into the distribution aggregate;

(b) Brick or precast reinforced concrete trench sidewalls and the trench covers are usually at least 50 mm thick, to ensure stability of construction;

(c) The sand-fill media used in the discharge control trench for Category 1 soil (see L6.2), is the same as that used in mound construction (see N3.3);

(d) LPED lines are used to distribute effluent under manifold pressure dosing or automatic sequencing valve into either trenches or beds. (Note that LPED lines are used also in LPED shallow subsurface irrigation of primary effluent (see 5.5.3.5 and M5).

The layer of sand overlying the gravel distribution layer (see Figure L6 and L7) in both ETA/ETS trenches and beds enables effluent moisture and nutrients to rise by capillary action to the root systems of vegetation planted in the covering topsoil layer.

Accessed by UNIVERSITY OF WESTERN SYDNEY on 28 Oct 2015 (Document currency not guaranteed when printed)

COPYRIGHT © Standards Australia and Standards New Zealand

L5.4 Surface water

Surface water shall be diverted around the perimeter and up-slope of the land application area. Rainfall is shed from the mounded surface of the ETA/ETS system.

L6 EFFLUENT LOADING

L6.1 Gravity loading effluent

L6.1.1 *Trench or bed length*

Individual trench or bed lengths shall be limited to around 20 m. A longer trench or bed is possible if the installer can guarantee a level bottom over the proposed length. In such situations, the designer shall specify the maximum trench or bed length appropriate to the construction method to be used.

CL6.1.1

The total trench or bed length is normally divided into equal proportions. A distribution box ensures even flow to each trench or bed. Distribution boxes should be checked as part of performance monitoring inspections to confirm that an even flow of effluent is being directed to each distribution line.

L6.1.2 *Distribution pipe*

Effluent is distributed through a slotted or drilled distribution line laid parallel with the horizontal bottom of the trench or bed. The internal diameter of the pipe shall be not less than 80 mm.

CL6.1.2

Suitable shape, size, and density of slots or holes for plastic piping are covered in AS 2439.2.

L6.1.3 *Arches*

Pre-formed arches shall be slotted along the lower portion of the arch.

CL6.1.3

Slot width is typically 10 – 15 mm with an overall area of 10 000 mm^2/m.

L6.2 Discharge control trench effluent loading method for category 1 soil

Systems constructed in highly permeable Category 1 soils (see Note 1 of Table L1) may use an in-trench filter based upon bottom area loading at the rate for DLR soil Category 1. The trench can be constructed as in Figure L4 with the effluent pressure dose loaded, such as by siphon or pump, from the wastewater treatment unit. The sand-fill media shall be a medium sand with a grain size of 0.25 – 1.0 mm, a uniformity coefficient less than 4, less than 3% fines passing a 200 sieve (0.074 mm), free of clay, limestone and organic material. Polyethylene lining of the sides of the trench is required to ensure the dosed effluent passes through the full depth of the sand.

CL6.2

Although discharge control trenches are recommended for trench systems in Category 1 soils, their use in any particular situation will be subject to regulatory authority requirements for which alternative loading or land application systems may apply (such as drip irrigation of secondary treated effluent into the topsoil overlying the Category 1 soil).

The perforated line shown for dosing the discharge control trench in Figure L4 can also be an LPED line (Figure M3).

COPYRIGHT © Standards Australia and Standards New Zealand

Accessed by UNIVERSITY OF WESTERN SYDNEY on 28 Oct 2015 (Document currency not guaranteed when printed)

L6.3 Dose loading of effluent

Where pressure dose loading of effluent by siphon or pump is used, the designer shall determine trench or bed lengths and perforated pipe details appropriate to the system layout and the siphon or pump duties.

CL6.3

Dose loading of treated effluent by LPED lines and automatic sequencing valves is recommended as providing for more effective control in achieving uniform and even distribution over the design area (see 5.5.3.5). LPED avoids the spot loading inherent in perforated lines and provides more effective distribution of effluent along the full length of the trench or bed system.

L7 CONSTRUCTION TECHNIQUES

L7.1 Good construction technique

The following excavation techniques shall be observed so as to minimise the risk of damage to the soil:

(a) Plan to excavate only when the weather is fine;

(b) Avoid excavation when the soil has a moisture content above the plastic limit. This can be tested by seeing if the soil forms a 'wire' when rolled between the palms;

(c) During wet seasons or when construction cannot be delayed until the weather becomes fine, smeared soil surfaces may be raked to reinstate a more natural soil surface, taking care to use fine tines and only at the surface;

(d) When excavating by machine, fit the bucket with 'raker teeth' if possible, and excavate in small 'bites' to minimise compaction; and

(e) Avoid compaction by keeping people off the finished trench or bed floor.

In particular for trenches and beds:

(f) If rain is forecast then cover any open trenches, to protect them from rain damage;

(g) Excavate perpendicular to the line of fall or parallel to the contour of sloping ground; and

(h) Ensure that the inverts are horizontal.

CL7.1

Damage can be done by:

(a) Smearing, where the soil surface is smoothed, filling cracks and pores;

(b) Compacting, where the soil porosity is reduced; and

(c) Puddling, where washed clay settles on the base of the trench to form a relatively impermeable layer.

In particular, cohesive soils, or soils containing a significant quantity of clay, are susceptible to damage by excavation equipment during construction.

L7.2 Dispersive soil

Clay soils that have a tendency to be dispersive shall receive special design attention. During construction gypsum may be applied at 1 kg/m^2 to the base of the trench or bed to prevent the clay dispersing. The trench shall be closed in, as soon as possible to protect the gypsum from raindrop impact.

Accessed by UNIVERSITY OF WESTERN SYDNEY on 28 Oct 2015 (Document currency not guaranteed when printed)

COPYRIGHT © Standards Australia and Standards New Zealand

CL7.2

Gypsum should be used in consultation with a specialist soils consultant. It has been estimated that the gypsum will be effective for about 10 years at this application rate. Systems that need gypsum to operate will need the gypsum replenished. This would be indicated by soil analysis.

L7.3 Filling trenches and beds

After installation of pipework (see L8), inspection ports, if any, (see L9), and pre-commissioning tests, if any, (see L10), the distribution aggregate shall be carefully placed into the trench, so as to avoid damage to both the trench base and sidewalls and the pipework. Care shall also be taken when placing backfill over in situ distribution aggregate during or after heavy rainfall.

After placing the distribution aggregate, the trenches and beds shall be covered with soil that is less permeable than the surrounding natural soil. Except for ETA/ETS trenches and beds, a filter cloth shall be laid over the distribution aggregate to prevent ingress by the cover material (see Figures L1 to L4).

The trenches shall not be covered with an impermeable layer.

L8 INSTALLATION – PIPE LAYING

Gravity loading effluent distribution pipes and dose loading perforated pipes shall be laid to meet design requirements and the manufacturer's specified requirements. These requirements will differ, depending on the pipe material.

Detailed specifications shall cover:

(a) Approved types of piping system, materials, diameter, perforation size, spacing, and location;
(b) Pipe bedding and backfilling requirements; and
(c) Pipe laying requirements (normally pipes would be laid horizontal).

CL8

Pipe and fittings complying with AS 2439.2, AS 2698.2, AS/NZS 4129, AS/NZS 4130, or AS/NZS 1477 are suitable materials.

L9 INSPECTION

An inspection port shall be provided for boxed trenches and ETA/ETS systems. The inspection ports shall be installed so as to facilitate the monitoring of the effluent level in each trench.

If groundwater monitoring is planned, additional inspection ports and bores shall be installed on the site.

Ports shall be sealed.

CL9

If an inspection port is placed at the beginning of the land application system, solids carry-over from the septic tank can be monitored as well as the level of effluent in the trench.

Accessed by UNIVERSITY OF WESTERN SYDNEY on 26 Oct 2013 (Document currency not guaranteed when printed)

COPYRIGHT © Standards Australia and Standards New Zealand

L10 PRE-COMMISSIONING TESTS

A pre-commissioning test shall be carried out on pump dosed systems after all on-site components, including the pump, have been installed but prior to covering the effluent distribution system in the trench or bed (see also 6.2.5.2):

(a) Fill the pump chamber to 'pump-on' level with water;

(b) Start the pump;

(c) Check perforated lines to ensure that water flows uniformly from all squirt holes; and where LPED lines are installed, check that uniform distribution is being achieved along the length of the distribution line;

(d) Record time taken to pump from 'pump-on' level to the 'pump-off' level – desirably approximately 3 minutes;

(e) Follow the pump manufacturer's recommendations for commissioning pump;

(f) Check the pumping main to ensure there are no leaks and that the air-release valve is functioning;

(g) Check that the high-water-level alarm operates; and

(h) Where automatic sequencing valves are installed, check that the valve mechanism rotates consistently at each pump cycle.

Siphon dosed systems shall be subject to pre-commissioning tests by equivalent procedures.

L11 COMMISSIONING

The on-site system shall be inspected, checked, and commissioned according to 6.2.5.

L12 MARKING

The location of underground pipes and land application fields shall be marked.

CL12

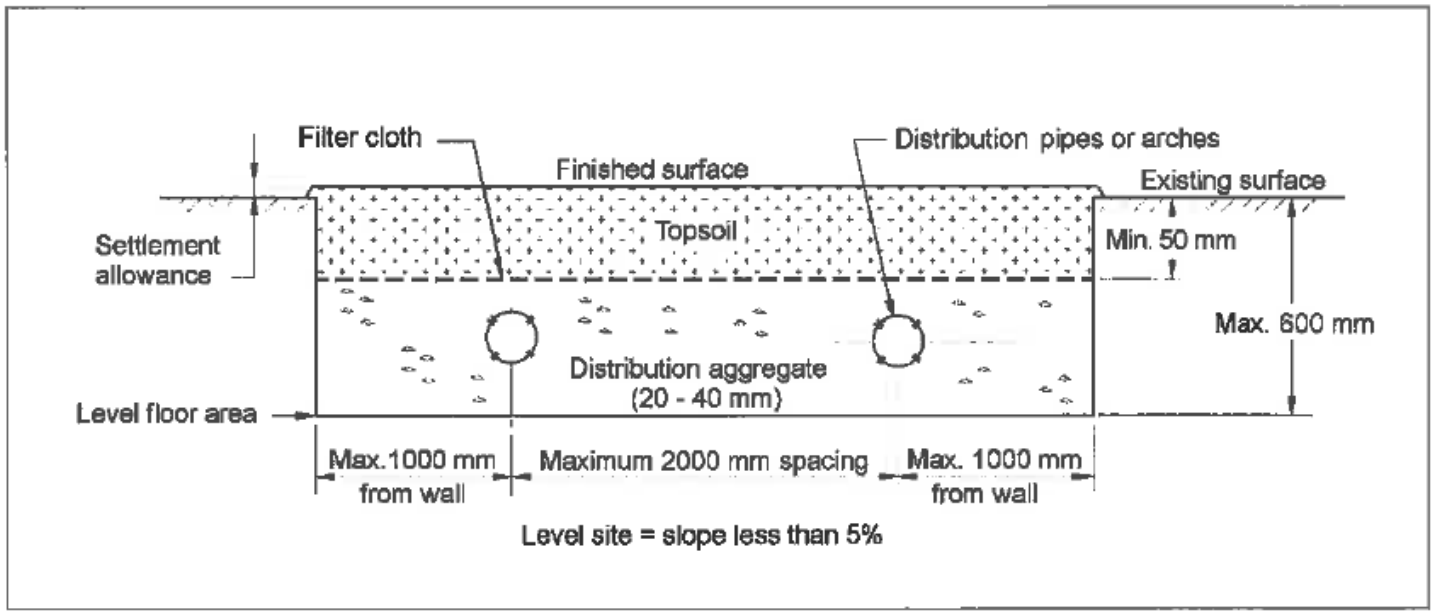
Marking tape to AS/NZS 2648.1 is suitable for underground use. The system's inspection ports and air vents can act as above-ground markers for parts of the system.

L13 REPORTING

An installation and commissioning report shall be produced to include the 'as-built' details following construction, the results of construction inspections, and the commissioning process. This report shall be provided to the property owner of the on-site system and, if required, to the regulatory authority (see 6.2.5.4).

Accessed by UNIVERSITY OF WESTERN SYDNEY on 28 Oct 2015 (Document currency not guaranteed when printed)

COPYRIGHT © Standards Australia and Standards New Zealand



NOTE: LPED lines can be used instead of distribution pipes when dose loading effluent into beds.

FIGURE L5 CONVENTIONAL BED