ADVANCED ENVIRO-SEPTIC MD

MAKE WAY
ENVIRONMENTAL TECHNOLOGIES INC.

Enviro-Septic® System: Design and Installation Manual Province of Ontario

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Introduction

Context

The purpose of this manual is to provide information specific to the Province of Ontario for use in the design and installation of the Enviro-Septic® system.

The Building Materials Evaluation Committee (BMEC) authorization report specifies design criteria that must be followed in order to design and install an Enviro-Septic® system. The BMEC authorization takes precedence over any design criteria detailed in this manual.

The Ontario Building Code (OBC) must also be followed, and takes precedence over any design criteria in this manual.

Project of More than 10,000 Litres

This design manual is applicable to systems that have a daily sewage flow of 10 000 litres or less.

Systems that have a daily sewage flow of greater that 10 000 litres per day are governed by the Ministry of Environment (MOE).

Provincial Standards

This manual is applicable to the Province of Ontario. This design and installation manual is to be used in conjunction with Part 8 of the OBC.

Certification Required

The Province of Ontario requires that all designers and installers of septic systems must be certified by the Province. Designers and Installers of the Enviro-Septic® System must also be certified by the manufacturer or manufacturer's representative. Certification is obtained by attending the "Enviro-Septic® Designer and Installer Certification Course" presented by Make-Way Environmental Technologies Inc.

Technical Support

Make-Way Environmental Technologies Inc., the Ontario distributor of the Enviro-Septic® products provides technical support to all individuals using the Enviro-Septic® system. For questions about the Enviro-Septic® product or the information contained in this manual, please contact us at 1-866-625-3929.

Section A - Enviro-Septic® Basics

Background

Liquid that exits from a septic tank (primary treatment effluent) contains suspended solids that can cause traditional systems to fail prematurely. Solids can overload bacteria, cut off air required for aerobic bacterial activity, and/or clog the underlying soil, interfering with its ability to absorb liquid.

What our System Does

By utilizing simple, yet effective, natural processes the Enviro-Septic® System treats septic tank effluent in a manner that prevents solids from entering surrounding soils, increases system aeration, and provides a greater bacterial area (mat) than traditional systems.

Why our System Excels?

By utilizing simple yet effective natural processes, the Enviro-Septic® wastewater treatment system treats septic tank effluent in a manner that prevents suspended solids from clogging the underlying soil, increases system aeration, and provides a greater bacterial area ("biomat") than traditional leaching systems. No other passive wastewater treatment system design offers this functionality. Enviro-Septic® systems excel because they are more efficient, last longer, and have a minimal environmental impact.

System Components

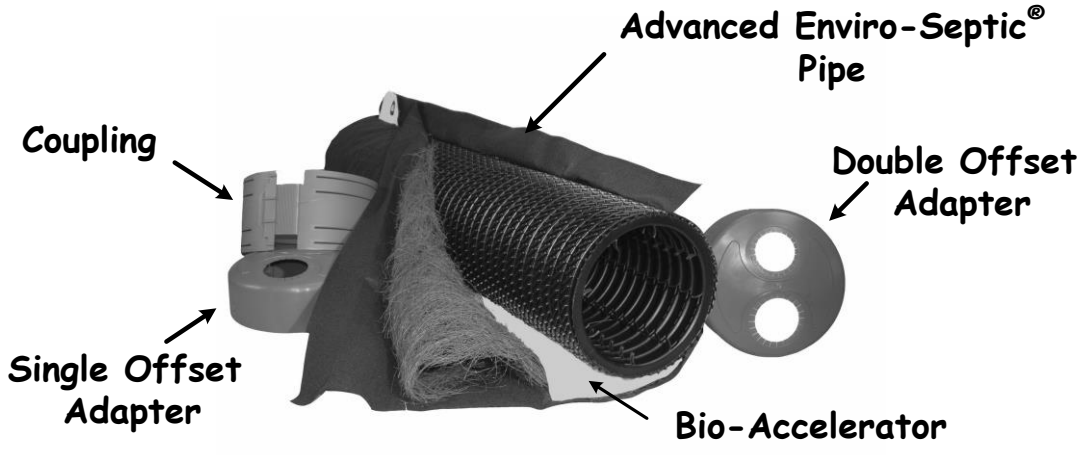


Fig. 1

Overview of Components and their Functions

The Advanced Enviro-Septic® pipe consists of:

- A 30 cm diameter, high-density plastic pipe which is corrugated and perforated. Skimmer tabs extend into the pipe at the point of each perforation.
- A dense mat of coarse, randomly oriented plastic fibres surrounds the outside of the pipe.
- The Bio-Accelerator™ geo-textile fabric layer partially covers the fibres on the lower half of the pipes. It is located between the pipe and the plastic fibres.
- The outer layer non-woven geo-textile fabric holds the other components in place and provides a protected surface on which a biomat develops.

The Advanced Enviro-Septic® pipes are surrounded by a bed of System Sand, which facilitates the process by wicking the liquid out of the pipes and ensuring that the system receives sufficient oxygen to support a healthy population of bacteria.

Pipe Cross-Section

The following schematic presents the four components of the Advanced Enviro-Septic® pipe.

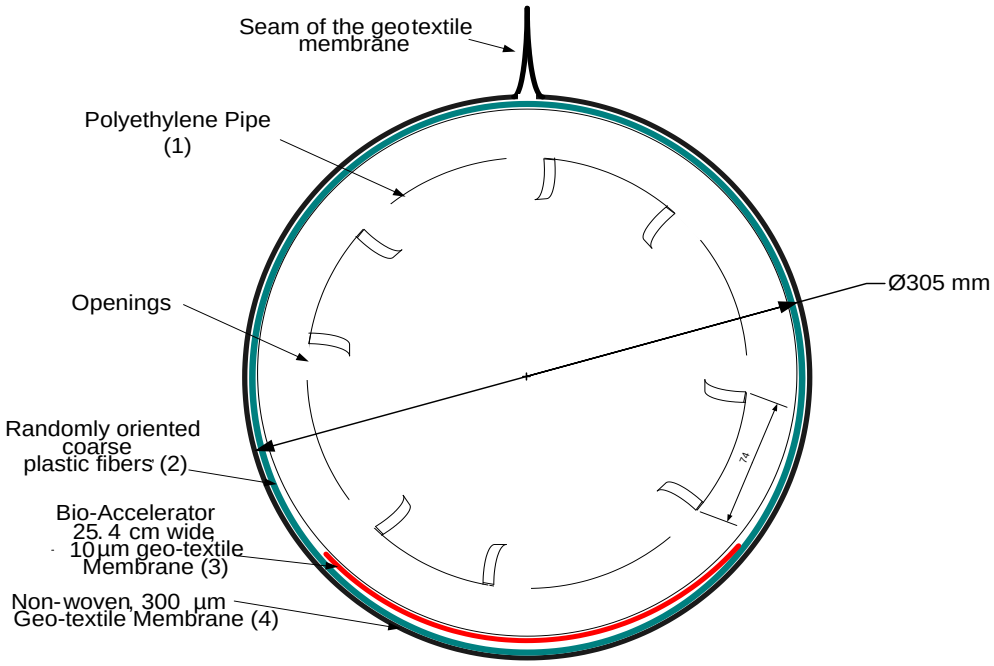


Fig. 2 – Pipe Cross-Section

Operating Principles

When effluent leaves the septic tank (primary treatment tank), it still contains some suspended material, fats and grease and other pollutants. The presence of these elements eventually causes clogging of traditional leaching fields. The Enviro-Septic® system facilitates the treatment of pollutants by using natural bacterial processes in a more efficient way. The cooling of the effluent in the pipes and the aerobic bacterial activity around the geo-textiles allow for the separation of suspended solids, which are retained inside the pipes. The combination of air flow and continually fluctuating liquid levels in the pipes increases the effectiveness of bacterial activity in the membranes. These processes create a system with an interior balance, prolonging the system's lifespan and allowing the system to treat the wastewater effectively before it is dispersed into the environment. The Enviro-Septic® Wastewater Treatment system is passive, requiring no electricity or complicated mechanical devices.

System Advantages

Here's a brief list of the advantages of The Enviro-Septic® System.

- Eliminates "septic mounds" through sloping system installations
- Adapts to difficult sites
- Installs more easily and quickly than traditional systems
- Eliminates the need for expensive washed stone
- Adapts easily to both commercial and residential sites
- No mechanical equipment for treatment performance
- Allows for gravity discharge with often no requirement for pumps
- Lower cost than comparable tertiary treatment systems

What it Looks Like

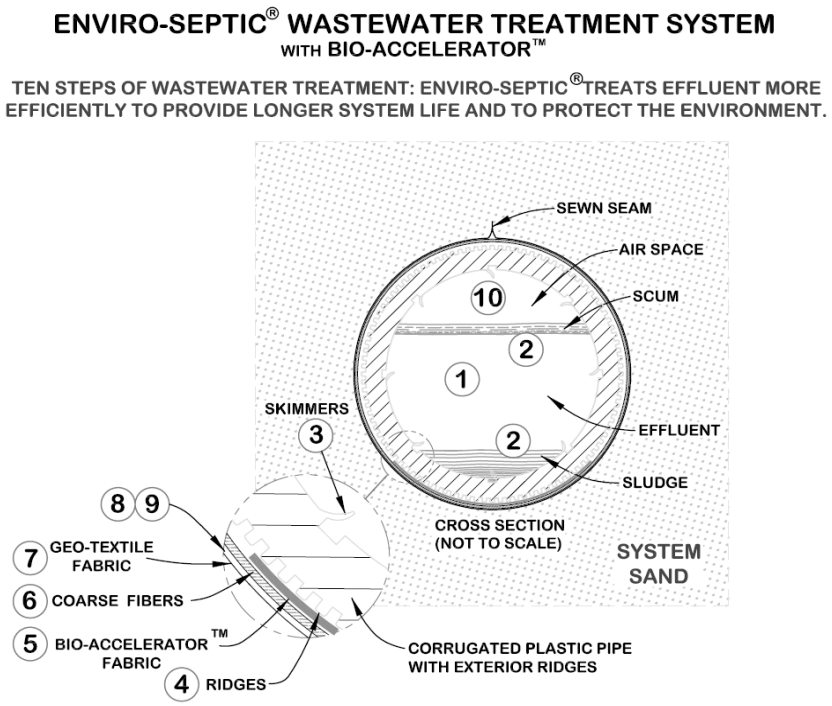


Fig. 3

How it Works

These are the basic stages that take effect in the Enviro-Septic® System.

Stage	What Happens
1	Warm effluent enters the pipe and is cooled to ground temperature.
2	Suspended solids and grease separate from the cooled liquid effluent.
3	Skimmers further capture grease and suspended solids from the effluent as it exits through perforations in the pipe.
4	Pipe ridges allow the effluent to flow uninterrupted around the circumference of the pipe and aid in cooling.
5	Bio-Accelerator fabric screens additional solids from the effluent and develops a biomat which provides treatment and ensures effluent distribution along the entire length of the pipes
6	A mat of coarse random fibers separates more suspended solids from the effluent.
7	Effluent passes into the geo-textile fabric and grows a protected bacterial surface.
8	Liquid exiting the geo-textile fabric is wicked away from the piping by the surrounding System sand. This enables air to transfer to the bacterial surface.
9	Bacteria grow on the fibrous mat and geo-textile surfaces to create a biomat and break down the sewage solids.
10	Bacterial efficiency is increased by the large air supply and fluctuating liquid levels which provide for optimum bacterial activity.

Enviro-Septic® Chain of Treatment

There are five (5) main components in the Enviro-Septic® chain of treatment. They are:

- Septic Tank
- Effluent filter.
- Distribution device
- Advanced Enviro-Septic® pipe and
- Enviro-Septic® system sand.

Treatment Components of the Enviro-Septic® System

The following Diagram displays the treatment components that are included in the Enviro-Septic® system.

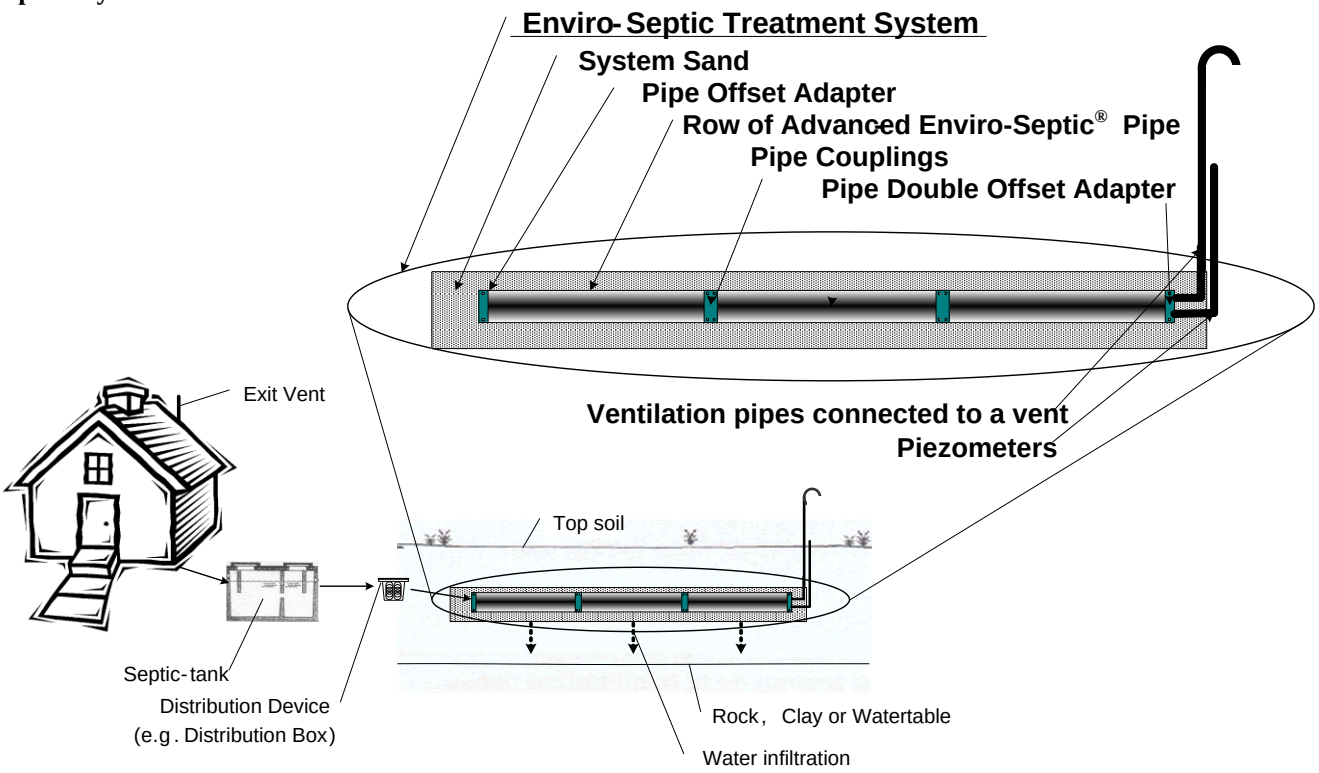


Fig. 4

Table 1 Components of Treatment System

Enviro-Septic® System Component	Function
Septic Tank	Used as primary Treatment
Effluent Filter	Used to prevent solids from passing out of the septic tank.
Pumping Station (optional)	Used between the Septic Tank and the distribution device when the effluent cannot be sent to the Advanced Enviro-Septic® pipe rows by gravity
Velocity Reducer	Always required when a pumping station is used[1]. Can be done with a minimum 3 m length 100 mm diameter watertight pipe placed horizontally or in an upwards slope towards the distribution box. Used to reduce the velocity of the septic tank effluent before arriving at the distribution device.
Distribution Device	Used to distribute the septic effluent between the rows of Advanced Enviro-Septic® pipe. For example, a distribution box with flow equalizers.
Enviro-Septic® Contact Area	Area of infiltrative surface, directly below the Enviro-Septic System, required to absorb the treated effluent into the underlying native soil.
Advanced Enviro-Septic® pipe rows	Used to treat and distribute the septic tank effluent over the Enviro-Septic® Contact Area. The Enviro-Septic® rows are comprised of the 3.05 metre lengths of Advanced Enviro-Septic® pipes, offset adaptors and couplings.
System Sand	Used to increase the development of microorganisms that treat waste water before it infiltrates into the soil. Also helps in providing air to the system.
Sampling Device	The sampling device is used to retrieve samples of the treated effluent from the Enviro-Septic® system.The sampling device is placed at the base of the Enviro-Septic® system.
Vents	The vents are to allow the circulation of air throughout the system. Venting occurs through a combination of a high and low vent to create a vacuum. The low (entry) vent is located at the end of the rows of Advanced Enviro-Septic® pipe and the high vent (exit) is located on the roof of the building. Other configurations may be used when the roof vent is not viable.
Piezometers	The piezometers are located at the end of each row or a combination of rows. They are used to monitor the system.

[1] The velocity reducer is not required with a Low Pressure Distribution System.

Section B - Definitions of Terms

Introduction

As you read through the information in this manual, you will encounter common terms, terms that are common to our industry, and terms that are unique to Enviro-Septic® systems. While alternative definitions may exist, this section defines these terms as they are used in this manual.

List of Terms

Here's a list of the terms defined in this section.

- Center to center spacing
- Combination system
- Coupling
- Design flow
- D-box
- Differential venting
- Distribution box
- Distribution box manifold
- Distribution Device
- Double offset adapter
- End cap
- End extension distance
- Enviro-Septic® Contact Area
- Advanced Enviro-Septic® pipe
- Equalizer™
- High and low vents
- Imported sand
- Infiltrative surface
- L/d
- Lateral extension distance
- Offset adapter
- Raised or partially raised system
- Row length
- Sloping system
- System Sand
- Uniform distribution
- Vertical Separation

Center to Center Spacing

Center to center spacing is the horizontal distance from the center of one Enviro-Septic® row to the center of the adjacent row. The abbreviation for this term is $\mathbf{E_{cc}}$.

Combination System

A combination system is a system incorporating two or more sections of Enviro-Septic® rows, each section receiving effluent from a distribution box.

Coupling

A coupling is a fitting that joins two pieces of Advanced Enviro-Septic® pipe together.

Design Flow

Design flow is the determined litres/day flow for sewage systems as dictated by the Ontario Building Code.

D-Box

D-Box is an abbreviation for distribution box.

Differential Venting

Differential venting is a method of venting an Enviro-Septic® system utilizing high and low vents.

Distribution Box

A distribution box is a device used to divide and/or control the septic tank effluent flow into the Enviro-Septic® rows of pipe.

Distribution Box Manifold

A distribution box manifold is a method of joining any number of distribution box outlets to a single pipe.

Distribution Device

A distribution device is a device used to divide and/or control the septic tank effluent flow. The distribution device can be a distribution box, or another flow splitting device.

Double Offset

A double offset adapter is an end cap fitted with two 100 mm offset holes at the 6 and 12

Adapter	o'clock positions.
End Cap	An end cap is a solid cap used to seal the end of an Enviro-Septic® pipe.
End Extension Distance	The end extension distance is the distance filled with additional sand material extending from the end of a row to the side of the treatment system. The abbreviation for this term is $\mathbf{E_e}$.
Enviro-Septic® Contact Area	The Enviro-Septic® contact area means the area of infiltrative surface, directly below the treatment system, required to absorb the treated effluent into the underlying native soil.
Advanced Enviro-Septic® Pipe	An Advanced Enviro-Septic® pipe is a single unit of pipe, 3.05 m in length, with an outside diameter of 30 cm and a storage capacity of approximately 220 litres. The set of membranes surrounding the pipe includes the Bio-Accelarator.
Equalizer™	An Equalizer™ is a plastic insert installed in the outlet lines of a distribution box to provide more equal effluent distribution to each outlet.
High and Low Vents	High and low vents are pipes used in differential venting.
Imported Sand	Imported sand is imported leaching bed fill having a 'T' time of 6 to 10 min/cm with less than 5% fine passing #200 sieve, that is imported to the site to raise the system to achieve vertical separation. This does not include the system sand which is part of the treatment system.
Infiltrative Surface	The infiltrative surface means the area of interface where effluent migrates downward from the Enviro-Septic® system and passes into the native soil or leaching bed fill.
L/d	Abbreviation for litres per day.
Lateral Extension Distance	The Lateral extension distance is the distance filled with system sand extending from the center of the last lateral row to the side of the Enviro-Septic System. The abbreviation for this term is $\mathbf{E_L}$.
Offset Adapter	An offset adapter is an end cap fitted with a 100 mm offset opening at the 12 o'clock position.
Raised or Partially Raised Enviro-Septic® System	Raised or Partially Raised Enviro-Septic® System means an Enviro-Septic® system in which any part of the system is above the natural ground elevation.
Row Length	The row length is the length of the Advanced Enviro-Septic® pipes that are connected together with the couplings. The abbreviation for row length is L_r.
Sloping System	A Sloping system is a system in which rows of Advanced Enviro-Septic® pipes are at different elevations.
System Sand	System sand is sand that has specific criteria and is used to surround the Advanced Enviro-Septic® pipe. See section F for sand criteria.
Uniform Distribution	The uniform distribution means the even dispersal of septic tank effluent between the rows of pipe and the equal distribution of the rows of pipe over the Enviro-Septic® Contact area.

Vertical Separation	The Vertical separation means the depth of unsaturated soil including any imported sand below the Enviro-Septic® treatment System as measured from the bottom of the system (system sand layer) to a limiting surface such as high ground water table, rock or soil with a percolation time greater than 50 min/cm.

Section C - Designing Steps for the Enviro-Septic® System

Context

In this section we will present the necessary steps required to design an Enviro-Septic® system. The necessary steps required are:

On site

- Determine the total daily sewage flow.
- Determine the available area for the treatment system.
- Determine the slope of the site.
- Evaluate the soils ability to evacuate the treated effluent from the site.

Determine the available options

- Discuss the treatment alternatives with the clients while taking into account the advantages and disadvantages of each of them.

Design the system dimensions and prepare the drawings.

These steps will be discussed in the following pages

Determine the Daily Sewage Flow

Reference: Ontario Building Code: code and guide for sewage systems - Ontario Regulation 122/98 article 8.2.1.3 p. 8-5

1. For Residential occupancies the total daily design sanitary sewage flow shall be at least the value in Column 2 as determine from table 8.2.1.3.A.
2. For all other occupancies the total daily design sanitary sewage flow shall be at least the value in Column 2 as determine from table 8.2.1.3.B.
3. Where the building contains more than one establishment, the total daily design sanitary sewage flow shall be the sum of the total daily design sanitary sewage flows for each establishment.
4. Where the occupancy is not listed in table 8.2.1.3 B the highest of the metered flow data from at least 3 similar establishments shall be acceptable to determine the total daily design sanitary sewage flow.

Note: the maximum daily sanitary sewage flow is 10 000 litres per day.

Setbacks

The setbacks for the Enviro-Septic® system are governed by the Ontario Building Code. The Advanced Enviro-Septic® pipes, as measured from the center of the pipes, shall meet the set back requirements outlined in Article 8.2.1.4 of Division B, of the Building Code.

Evaluating the Natural Soil Permeability

The soil's ability to infiltrate water is a critical key to a successful onsite septic system installation. The ability to infiltrate water will determine the size of the contact area which will distribute the treated effluent to the natural soils. The soils capacity to infiltrate water is determined by the percolation time (T) in min/cm.

Basic Profile of the Enviro-Septic System

The rows of Advanced Enviro-Septic® pipes must be installed in a layer of system sand following the specifications shown in Figure 5.

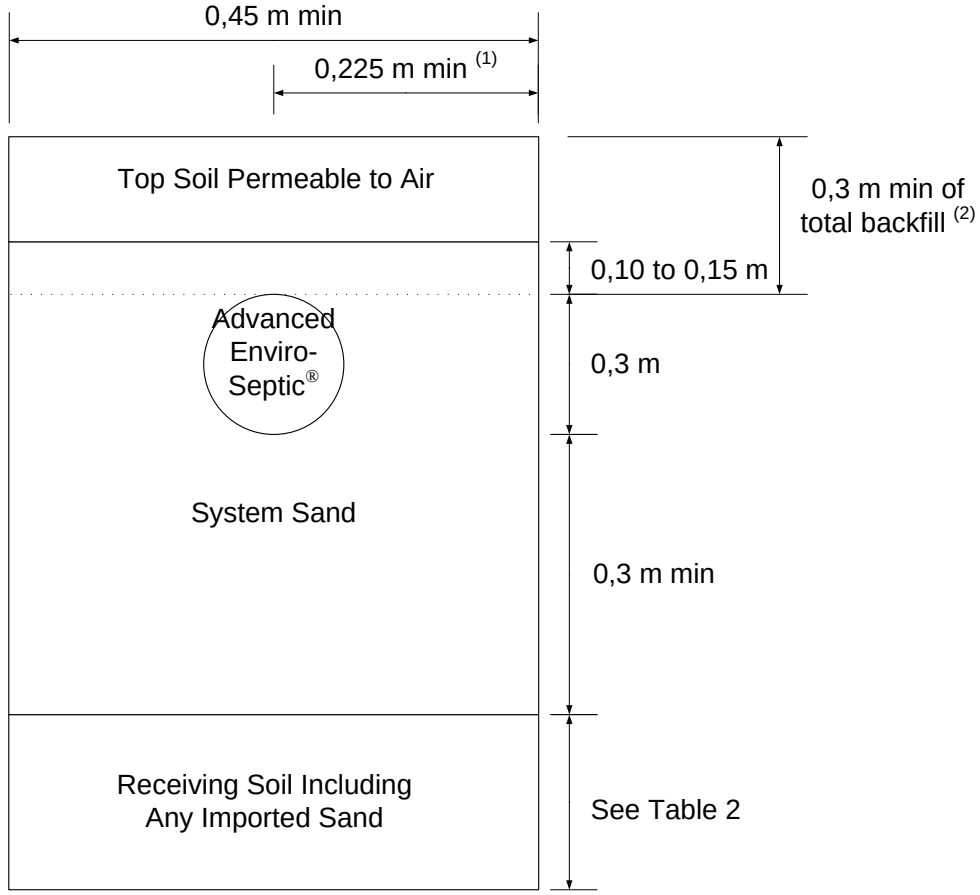


Fig. 5

Notes: (1) At the edge of the system, the minimum distance from the centre of the pipe to the edge of the system sand needs to be 0.45 m.

(2) The layer of the system sand above the Advanced Enviro-Septic Pipes added to the backfill on top of it needs to be as least 300 mm thick (i.e. If the sand layer above the pipes is 100 mm, the backfill needs to be 200 mm thick – 100 + 200 = 300 mm).

Separation

The Percolation time of the natural soil will determine the minimum clearances from the bottom of the Enviro-Septic® system (infiltration area) to the high groundwater table, bedrock or clay. The table below shows this in more detail.

Table 2

Minimum Vertical Separation as measured from the bottom of the Enviro-Septic System sand to	**Percolation Time (T) of natural soil**		
	T ≤ 6 min/cm	**6 < T ≤ 50 min/cm**	**T > 50 min/cm**
• High ground water table • Bedrock • Soil with a percolation time (T) greater than 50 cm/min.	≥ 600 mm	≥ 450 mm	≥ 600 mm

In ground or Above Ground System

Taking into consideration the properties of the soil, the depth of good soil before getting to the position of the high water table, the rock or soils with T time greater than 50 min/cm, determine if the system will be in ground, partially raised or above ground.

Sizing the System

The size of the contact area is determined using the formulas presented in the next section.

Adjust the configuration of the Enviro-Septic® system to fit the constrains of the site and to respect the minimum spacing requirements between pipes, the setbacks of the regulation and the minimum infiltrative surface required to properly evacuate the treated effluent.

Informing the Client

When a septic system is being planned, it is important to have a good discussion with the client to determine his/her expectations:

- Future home renovation or addition to the building.
- Any plans they have for the site i.e. Pool, garden, patio etc.
- Site aesthetics.
- Maintenance and annual costs associated with the Enviro-Septic System.

Section D - Enviro-Septic® Layout and Sizing

Procedure

The Enviro-Septic® system can be installed as an in ground system or as a raised system. The site conditions will determine how the system will be installed.

There are three main steps in sizing this system:

- Determine the pre-treatment sizing (septic tank).
- Determine the number of Advanced Enviro-Septic® pipes required.
- Determine the dimensions of the Enviro-Septic® System and the total footprint of this installation required to properly infiltrate and evacuate the treated effluent.

Pre-Treatment Sizing

The Enviro-Septic® system is designed to receive septic tank effluent for treatment and disposal. As such, the septic tank requires no specific upfront treatment for incoming sewage which is of domestic nature. All raw sewage will enter into a septic tank sized in accordance with Clause **8.2.2.3 of the Ontario Building Code**.

Specifically, the septic tank shall have a minimum of 2 days retention time for residential wastewater and 3 days retention time for non-residential sewage flows. The septic tank shall also have two compartments as required by the Code and be equipped with an effluent filter. Please note that the effluent filter used must not hinder the free passage of air travelling through the system. Please call your local distributor for more information.

At no time shall the tank be less than 3,600 L working capacity as stated in Clause 8.2.2.3.

Please contact Makeway Environmental for guidelines on all non-residential project (ex. restaurants).

Number of Advanced Enviro-Septic® Pipes

This step applies to all options for the Enviro-Septic® system. Each section of Advanced Enviro-Septic® pipe (AES) has the capacity to treat 90 L of wastewater per day or 30 litres per linear meter of pipe. Therefore, the formula to determine the minimum number of Advanced Enviro-Septic® pipe (N_{AES}) required is Q/90.

$$N_{AES} = Q/90 \qquad (1)$$

The number of Advanced Enviro-Septic™ pipe obtained must be rounded up at all time.

As each section of pipe is 3.05 m (10 feet) in length thus the total linear length of pipe is the number of pipes multiplied by the length.

Ex. For a 3 bedroom house: Q = 1600 L/d.
N_{AES} = 1600 / 90 = 17.78 AES.

Rounded up, it gives a minimum of 18 AES required. The minimum length of pipe is:
18 x 3.05 = 54.9 m of pipe.

Minimum / Maximum Length of Row

To maintain efficient effluent cycling, the minimum length of a row of Advanced Enviro-Septic® pipes is 6.1m and the maximum length is 30 m.

Enviro-Septic® Contact Area Sizing

The Enviro-Septic® contact area is the interface of the base of the Enviro-septic® system with the native soil.

The Enviro-Septic® contact area is obtained from the larger of two possibilities:

- Minimum evacuation surface (S_E): the minimum surface required to evacuate the water from the Enviro-Septic® system.

Or

- Minimum surface for spacing requirements (S_{SR}): the minimum surface calculated using the minimum spacing required between and around the length of a row of Advanced Enviro-Septic® pipes to properly install the system sand.

1st possibility – Minimum evacuation surface (S_E)

The minimum surface required to evacuated the treated effluent from the system is calculated from formula 2:

$$S_E = QT/400 \qquad (2)$$

Where:

- S_E is the area of contact in m² between the base of the sand layer and the underlying native soil,
- Q is the total daily design sanitary sewage flow in litres, and
- T is the percolation time of the underlying native soil in min/cm to a maximum of 50.

Table 3.1

The following table shows examples of maximum loading rates in relation to the native soil T-Time.

T of the native soil (min/cm)	Maximum Loading Rate (L/m²/day)
≤ 6	65
15	27
20	20
30	13
40	10
≥ 50	8

2nd possibility - Minimum surface for spacing requirements (S_{SR})

In some cases the minimum evacuation surface is not sufficient due to the spacing requirements for the Enviro-Septic® pipe. In these cases the area must be increased to accommodate the spacing requirements.

The area required is based on the number of rows within the system and the extension of system sand material around the limits of the pipes. The recommended minimum pipe spacing are the following:

Table 3.2

Acronym	Description	Minimum horizontal spacing (m)
$\mathbf{E_{CC}}$	Centre to centre spacing from one row of pipes to the next.	0.45
$\mathbf{E_L}$	Lateral extension distance from the center of the last lateral row of pipes to the limit of the Enviro-Septic® system.	0.45
$\mathbf{E_E}$	End extension distance from the end of a row of pipes to the limit of Enviro-Septic® system.	0.30

The Enviro-Septic® System is based on a standard rectangle. However, other special configurations can be permitted providing that the flow is properly distributed between pipes and over the infiltration area. Wherever possible the design should be based on Length > Width. The dispersal surface shall have the long dimension perpendicular to the direction in which effluent entering the soil will move horizontally.

Following the requirements of the Ontario Building Code it is recommended that no row be greater than 30 m in length.

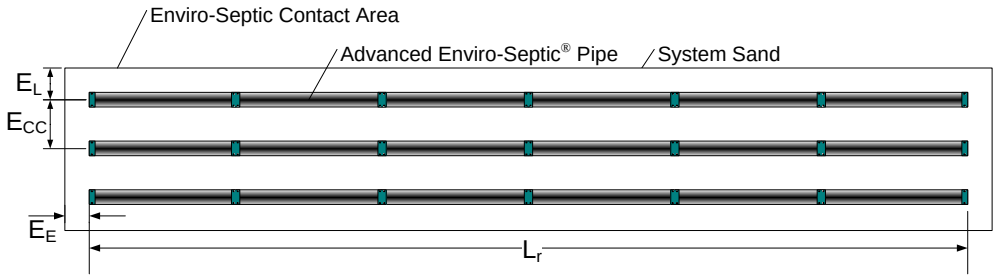


Fig. 6

Therefore the minimum surface for spacing requirement is:

$$S_{SR} = W_{SR} \times L_{SR}$$

$$L_{SR} = L_r + (2 \times E_E)$$

$$W_{SR} = (E_{cc} \times (N_r\text{-}1)) + (2 \times E_L)$$

$$S_{SR} = [L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] \qquad (3)$$

Where:

- S_{SR} is the minimum surface for spacing requirement
- L_{SR} is the length of the minimum surface for spacing requirement
- W_{SR} is the width of the minimum surface for spacing requirement
- N_r is the number of rows of Enviro-Septic® pipe

The Enviro-Septic® minimum contact area is the larger of S_E or S_R.

If $S_{SR} > S_{E,}$ $S_{CA} = S_{SR}$

If $S_{SR} < S_E$, $S_{CA} = S_E$

Design criteria Summary

The Enviro-Septic® System can be installed directly in ground or partially raised when the site conditions permit it. The percolation time of the native soil must be 50 min/cm or less.

When the site conditions do not allow the system to be installed in ground or partially raised, it can be installed above ground.

The vertical separations set out in the BMEC approval must also be met.

The table below displays the design criteria required for in ground, partially raised or above ground systems:

Table 4

Design criteria	Percolation Time (T) of native soil		
	T ≤ 6 min/cm	**6 < T ≤ 50 min/cm**	**T > 50 min/cm**
Type of installation	In ground, partially raised or above ground systems		Above ground systems
Minimum Enviro-Septic® Contact Area (m^2)	QT/400 or Min. AES Spacing requirement (Equation 3)		
System sand layer under Advanced Enviro-Septic® pipe	300 mm		
System sand layer above Advanced Enviro-Septic® pipe	100 to 150 mm		
Backfill permeable to air on top of the system sand	150 mm minimum[2]		
Minimum Vertical Separation as measured from the bottom of the Enviro-Septic System sand to: • High ground water table • Bedrock • Soil with a percolation time (T) greater than 50 cm/min.	≥ 600 mm	≥ 450 mm	≥ 600 mm

[2] The layer of the system sand above the Enviro-Septic Pipes added to the backfill on top of it needs to be as least 300 mm thick (i.e. If the sand layer above the pipes is 100 mm, the backfill needs to be 200 mm thick – 100 + 200 = 300 mm).

In Ground System Cross-Section

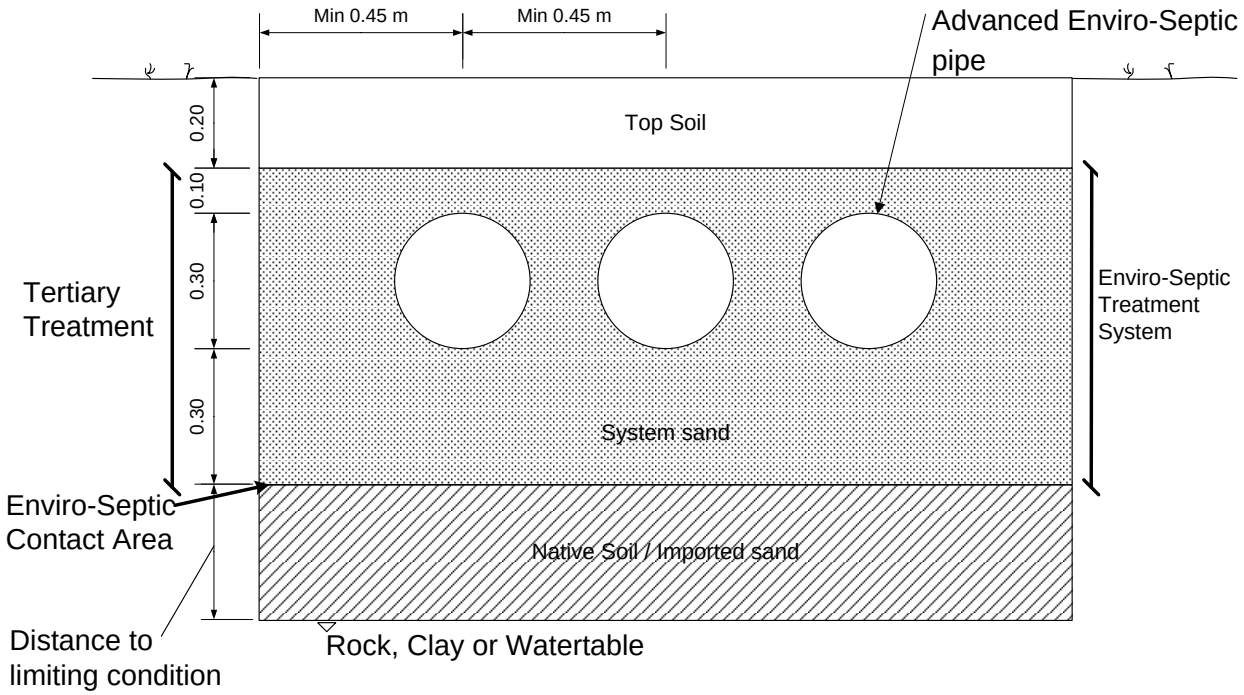


Fig. 7

Partially Raised System Cross-Section

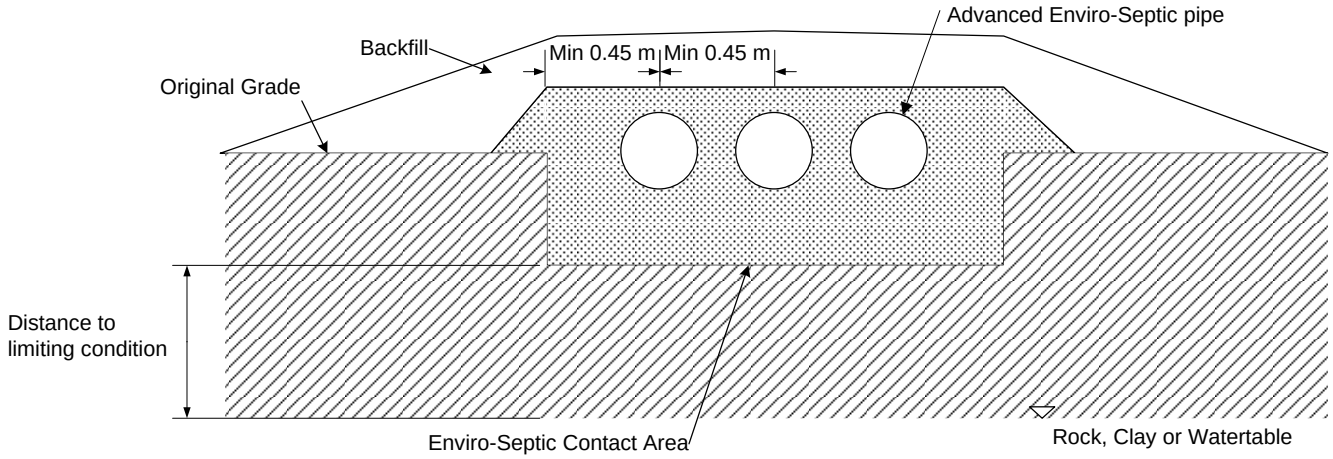


Fig. 8

Above Ground Systems

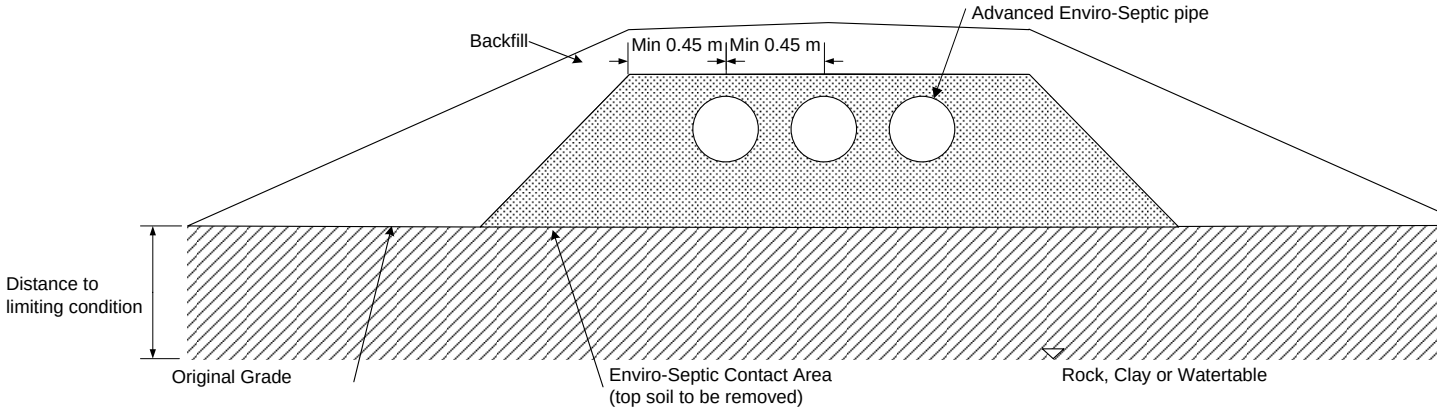


Fig. 9

Section E - General Design Criteria

Background

This section presents the basic design criteria for an Enviro-Septic® system.

Row Orientation

Rows of Advanced Enviro-Septic® pipes must be laid level and should run parallel to contours (perpendicular to sloping terrain) if possible.

If known, the Advanced Enviro-Septic® pipes should be placed perpendicular to the hydraulic gradient of the ground water.

Preferred Row Length

In general, fewer long rows are preferable to a greater number of short rows. Longer rows provide more efficient settling of solids. In addition, longer more narrow systems reduce the potential for ground water mounding.

Minimum/Maximum Row Lengths

The minimum row length is 6.1 m of Advanced Enviro-Septic® pipe and the maximum length is 30 metres.

3.05 Metre Increments Work Best

It is easier for the installer if systems are designed in 3.05 metre increments since Advanced Enviro-Septic® pipe is 3.05 metres in length. However, the pipe is easily cut to any length necessary with a sharp knife.

Row Elevations

For sloping systems, it is helpful to provide elevations on the design for each row of the system.

Septic Tank and D-Box Elevations

The pipe between the building and the septic tank should have a 2% minimum slope. The pipe coming out of a septic tank or a D-Box must have a downward slope of a minimum of 1%.

System Sand on the Installation Perimeter

Systems sloping 10% or less require the system sand area to extend a minimum of 30 cm around the perimeter of the Advanced Enviro-Septic® pipes.

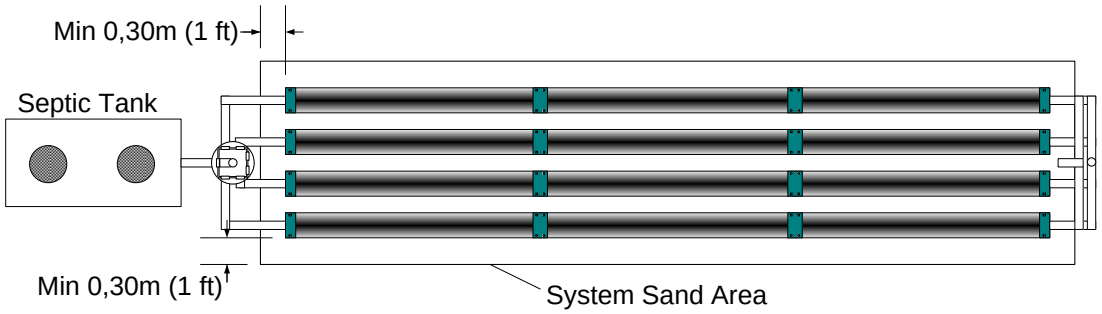


Fig. 10

Systems sloping greater than 10% require the system sand area to extend a minimum of 30 cm on three sides and 1.2 m beyond the Advanced Enviro-Septic® pipe on the down-slope side.

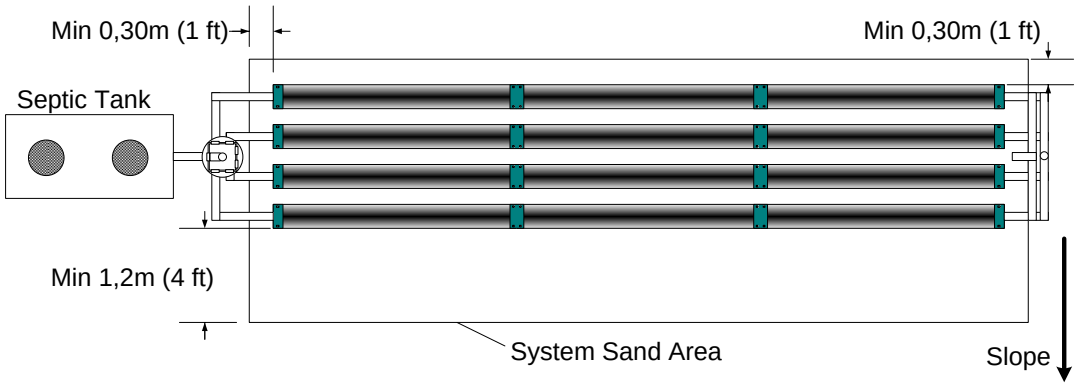


Fig. 11

Sloping Systems

The percentage of slope refers to the slope of the Enviro-Septic® system, not the existing terrain. The slope of the system and the existing terrain are not required to be equal. A sloping system can be designed in multiple sections, with more than one distinct slope and/or center-to-center pipe spacing in the same system. Maximum slope percentages are governed by jurisdiction specifications.

User Guide

The designer or installer must give the client an Enviro-Septic® user guide. The user guide describes in details the proper instructions and procedures that must be followed so that the Enviro-Septic® system continues to operate properly. The user guide has details on topics such as abusive substances, additives, and constant discharge. Suggested tank pumping and inspection schedules would also be beneficial.

Regulations in Effect

When designing an Enviro-Septic® system, it is important to ensure that the system is designed according to the Ontario building code and the BMEC authorization.

Section F - Sand and Fill Requirements

Introduction

This section describes the sand requirements for the Enviro-Septic® System.

System Sand

All Enviro-Septic® system configurations require system sand to surround the Advanced Enviro-Septic® pipes by at least

- 300 mm below the pipes
- 150 mm on both sides
- 100 mm above.

The system sand can be natural sand or filter sand that has been modified and it must meet the requirements stated below:

- Effective diameter (D_{10}) between 0.2 and 0.5 mm;
- Coefficient of Uniformity (Cu) $\leq$ 4.5;
- Less than 3% of material smaller than 80 µm; and
- Less than 20% of material larger than 2.5 mm.

The system sand required for the Enviro-Septic® treatment and distribution system falls into the sand spectrum of the Ontario Building Code filter sand but not the whole range. By comparison, Building Code filter sand material has an effective diameter of between 0.25 and 2.5 mm with a Coefficient of Uniformity of less than 4.5. There is no discussion of fines and large particle content. Therefore filter sand may meet the specifications of the system sand but it may need to be modified to meet the specifications as stated above. Figure 13 displays the limits of both specifications.

Contact your Enviro-Septic distributor for a list of system sand suppliers.

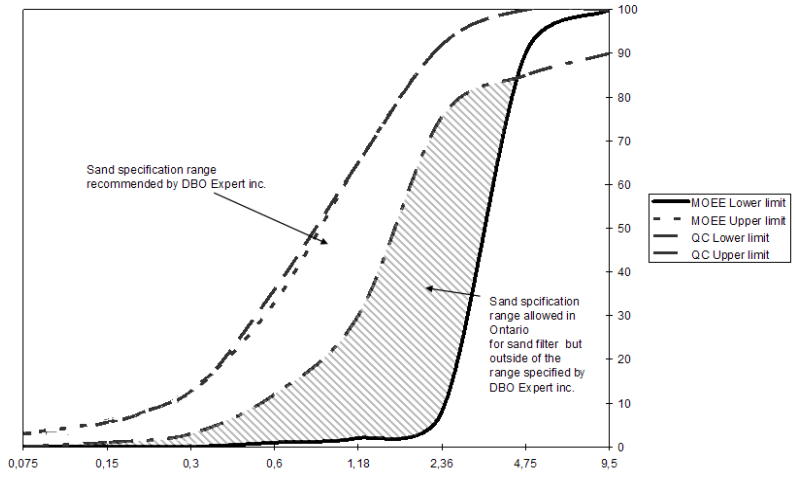


Fig. 12

Imported Sand Fill to Achieve Vertical Separation

For Above ground system, it is possible to achieve vertical separation by adding a layer of imported sand. Proper evaluation needs to be done to verify that the native soil layer will have the capacity to evacuate the treated water. The imported sand shall meet sentence 8.7.4.2 (2) of Division B, of the Ontario Building Code.

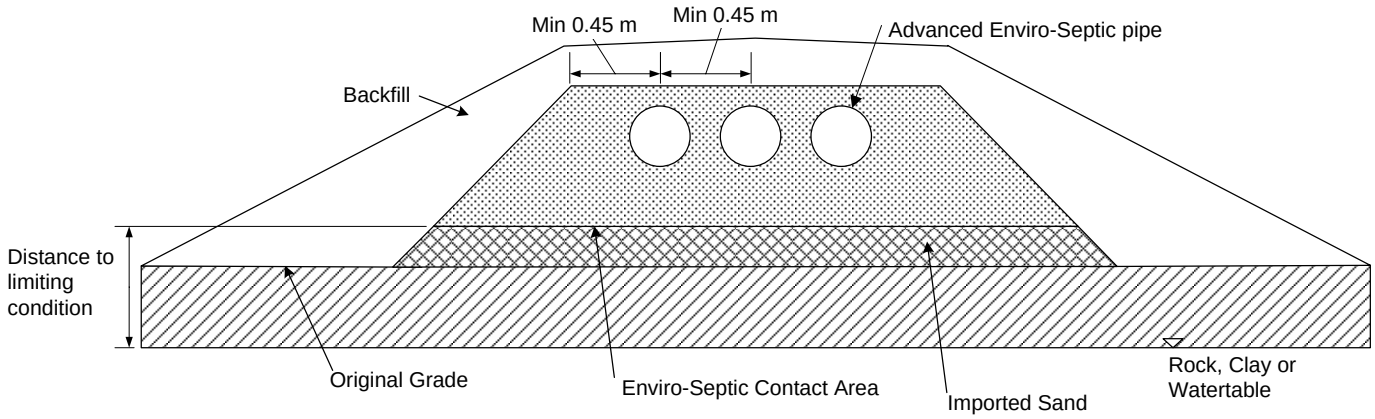


Fig. 13

Perimeter Sand Requirements

The System sand shall extend a minimum of 300 mm around the perimeter of the Advanced Enviro-Septic® pipe, for systems on ground sloping 10% or less.

The System sand shall extend a minimum of 300 mm on three (3) sides and 1200 mm beyond the Advanced Enviro-Septic® pipe on the down-slope side, for systems on ground sloping greater than 10%.

No System shall be installed in an area in which the original ground has a slope in excess of 25%.

Section G - System Configurations

Introduction

Enviro-Septic® systems may be designed as a standard rectangle or in a wide variety of unusual shapes such as curved, trapezoidal, or L-shaped to provide optimum design flexibility to address the challenges of each site. The following sections describe the variations of the flow splitting devices and the design rules associated with them as well as some different system configurations.

Row Orientation

Enviro-Septic® rows must be laid level and should run parallel to contours (perpendicular to sloping terrain) if possible.

System Using a Distribution Box (Parallel Distribution)

Definition

A distribution box system is a number of rows of Advanced Enviro-Septic® Pipes of equal length, each supplied evenly with effluent through a distribution box.

Equalizers™ Required

All distribution boxes that divide effluent flow in pump or gravity systems require an Equalizer™ or its equivalent in their outlets.

Note: To prevent movement, be sure distribution boxes are placed on a stable soil base or concrete pad.

D-Box Diagram

This is a top view of a basic system with a distribution box. This system has four rows of pipes.

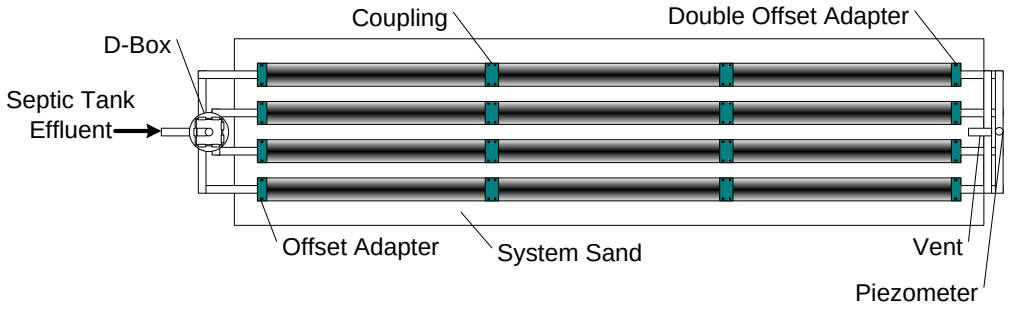


Fig. 14

D-Box Pipe Drop

This side view shows the minimum drop from a D-Box to a row of pipes. The minimum drop between the D-Box and the Enviro-Septic pipe needs to be 1% and at least 50 mm or 2 inches.

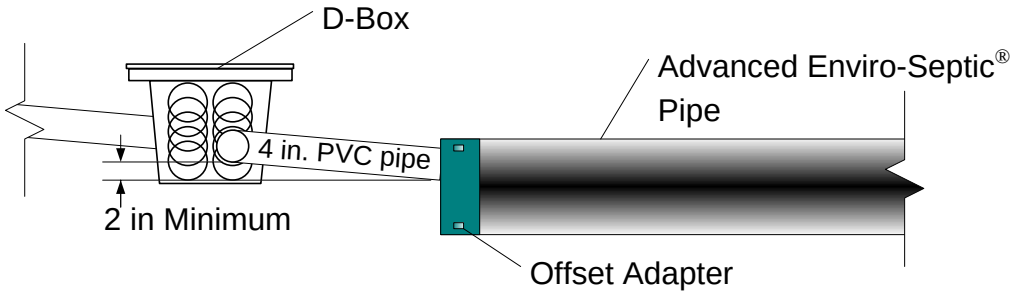


Fig. 15

Level in-Ground Top and side views of a level in-ground D-Box system.

Top view

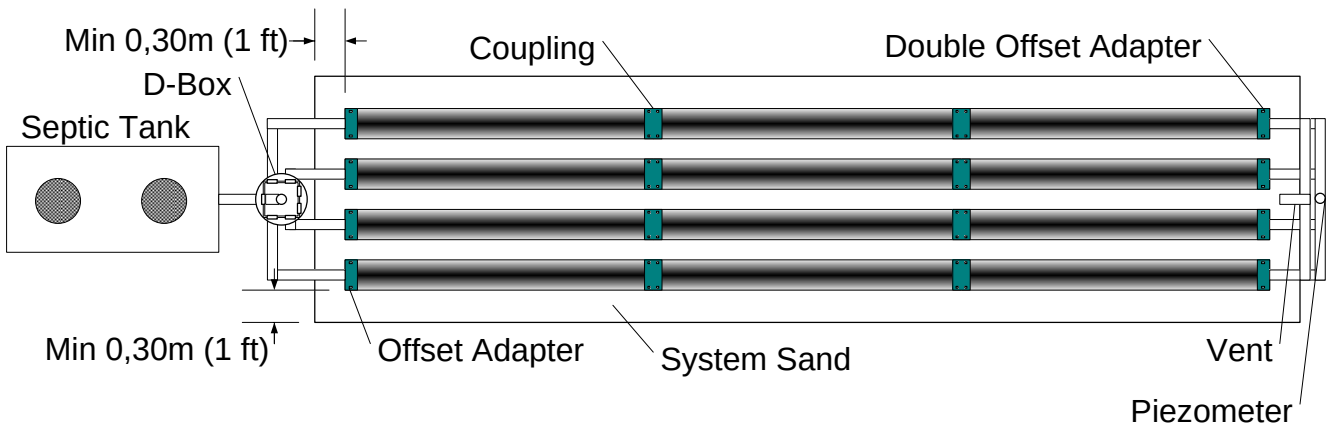
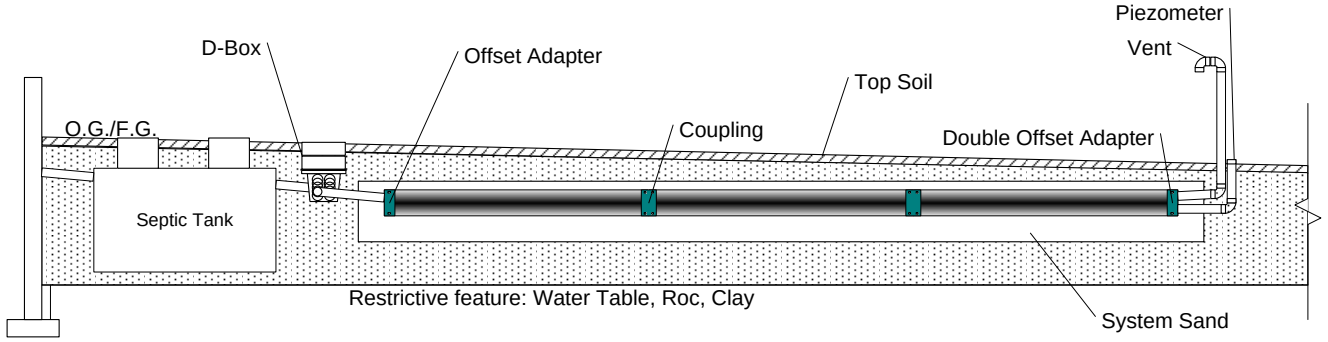


Fig. 16

Side view



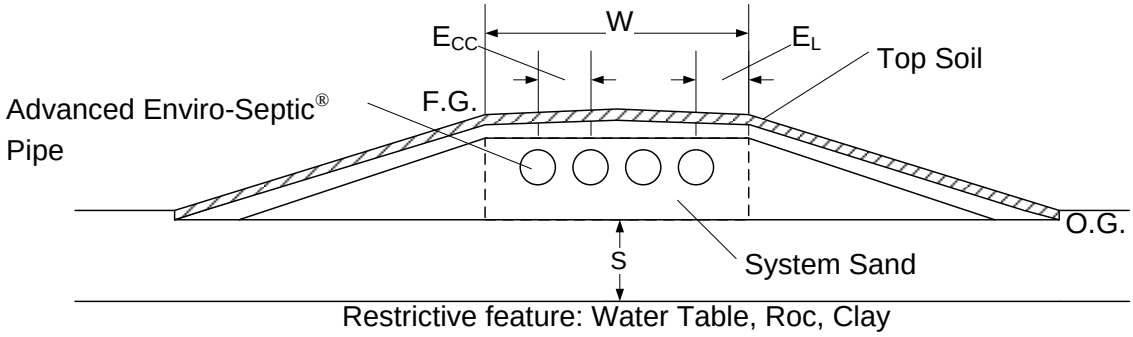
O.G. = Original Grade, F.G. = Final Grade

Fig. 17

Note: Placement of the septic tank may vary.

Level Raised Cross-section, side and top views of a level raised D-Box system.

Cross-section view



O.G. = Original Grade, F. G. = Final Grade

Fig.18

Side view

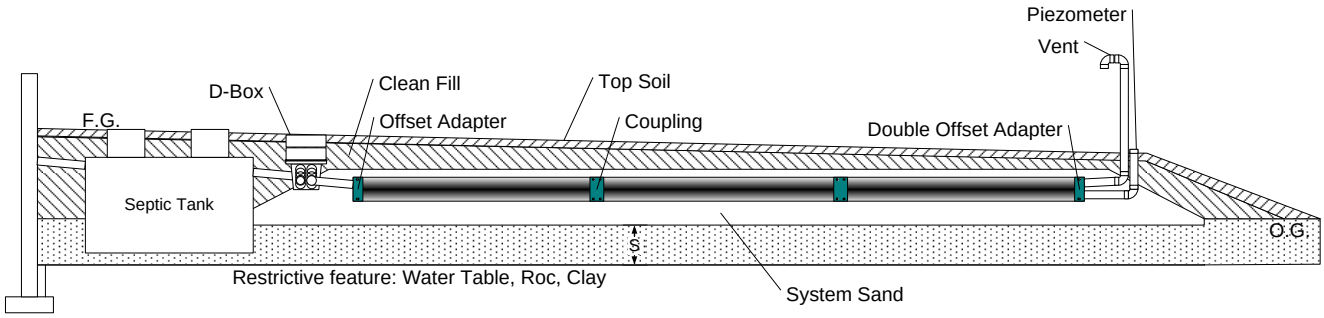


Fig. 19

Top View

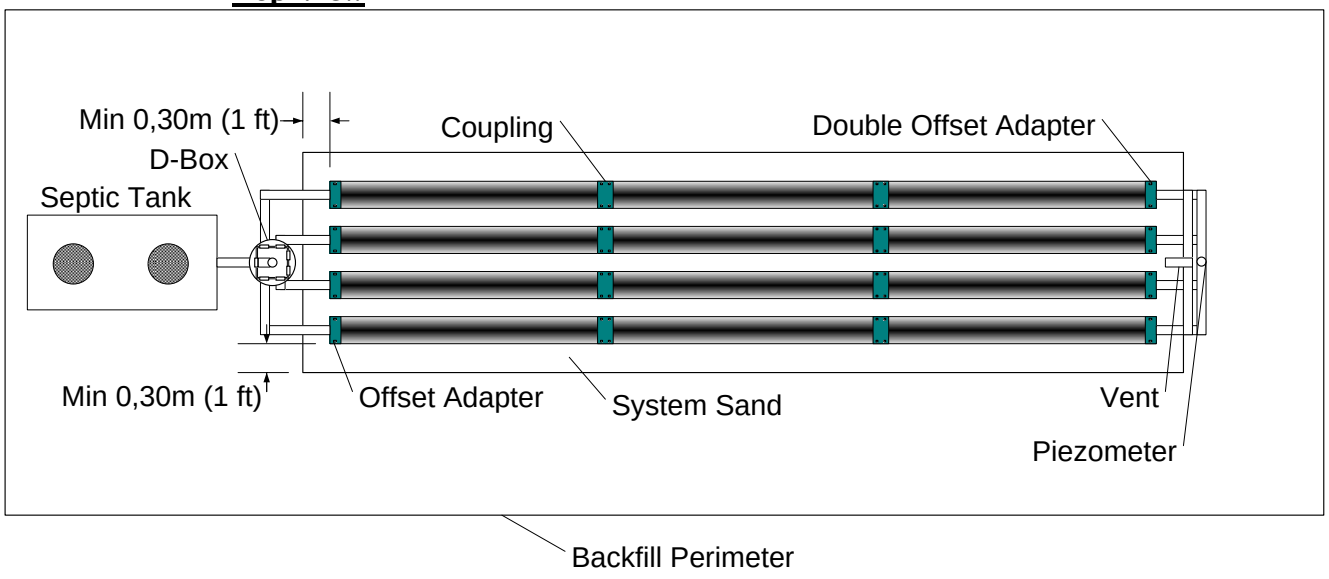


Fig. 20

Note: Placement of the septic tank may vary.

In-Ground Sloping

A system on a slope can be designed in several sections. Each section can be laid flat or follow the natural slope of the land.

Distribution of the Rows of Pipes

The Advanced Enviro-Septic® pipes must be placed level lengthwise. They are to be placed parallel to the level of the land (perpendicular to the slope).

In-Ground Sloping D-Box System

In-ground sloping D-Box system, cross-section and side views.

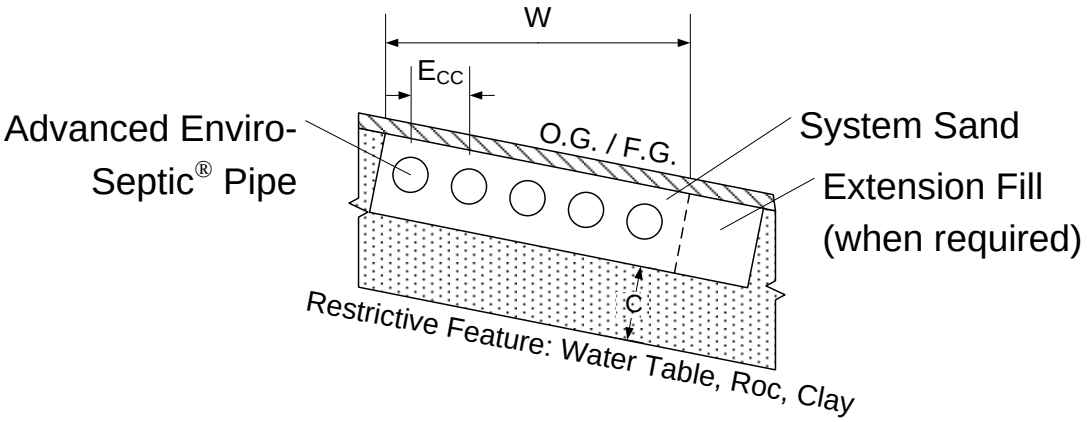


Fig. 21

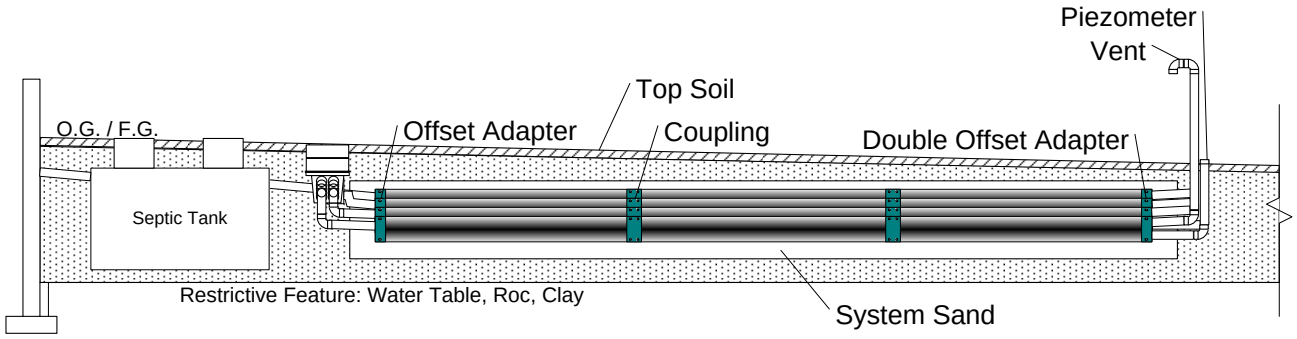


Fig. 22

Note: Placement of the septic tank may vary.

Raised Sloping Cross-section and top views of a Raised Sloping D-Box system.

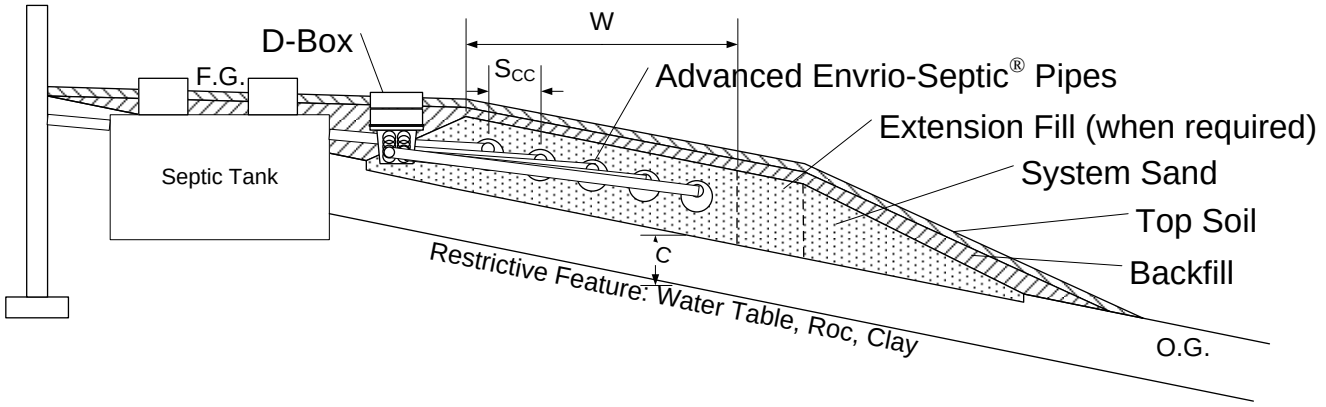


Fig. 23

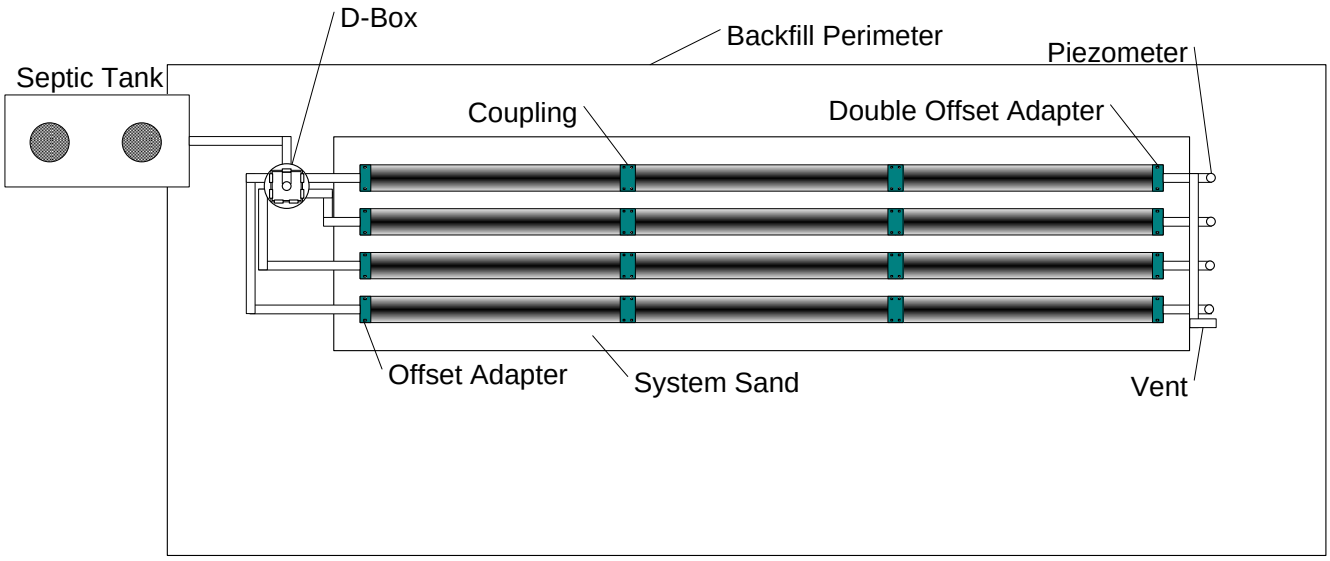


Fig. 24

Note: Placement of septic tank may vary.

Trench System

Level or Sloped Land

The rows of Advanced Enviro-Septic® pipes can be installed in trenches in a level or sloped land. Advanced Enviro-Septic® pipes placed in trenches must be surrounded by at least 150 mm (6 inches) of system sand (300 mm under the pipe). Minimum trench width required is 600 mm (24 inches). This width is the sum of 300 mm for the pipe, 150 mm of system sand on each side of the pipe. The trench is capped with 100 mm to 150 mm of system sand over which a minimum of 150 mm of backfill permeable to air.

Trench System

Plan view of a level in-ground trench system with 2 rows of pipes fed in parallel.

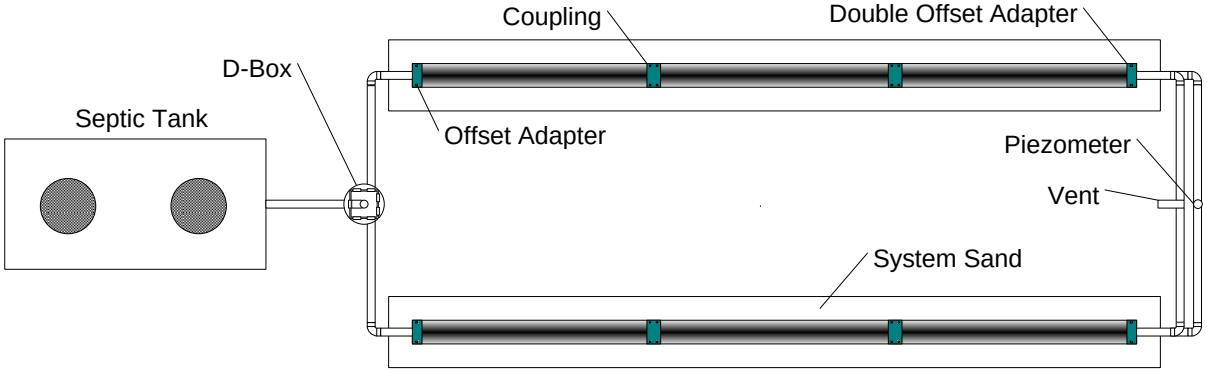


Fig. 25

Section H - Flow Distribution Device Configurations

Context

The Enviro-Septic® system uses multiple rows of Advanced Enviro-Septic® pipe in parallel to treat septic tank effluent. In order for the system to function properly the effluent must be distributed equally to each row of Advanced Enviro-Septic® pipe.

This can be done by using a distribution box with equalizers. Other techniques are used and are discussed within the next sections.

Where the total length of pipe required is 150 m or more, the sewage system shall have at least 1 pump or a siphon contained in a dosing tank.[3]

Distribution Box Device

A simple distribution box with equalizers can be used to distribute the septic tank effluent to each row. The distribution box should be accessible from grade.

For this type of installation the designer must consider the following:

- The dimensions of the distribution box to be used. The inlet should be 50 mm above the outlets of the box.
- The use of equalizers for each outlet is required to ensure proper distribution.
- Wherever possible, the use of a vertical tee is required on the inlet pipe. The tee is positioned in the middle of the box allowing water to fall down at the bottom and the air to circulate at the top.
- Place the distribution box in an area where the effluent will be able to flow by gravity.
- Try to minimize the length of the feed piping from the distribution box to each row.
- A minimum 1% downward slope is required for all piping (feed and aeration). The aeration pipe slope is toward the Advanced Enviro-Septic® pipe.

Fig. 26 – 7 hole D-Box with T in vertical position (left) and with internal insulation (right).

[3] See OBC 8.6.1.3. (1)

Equalizers are Mandatory

Any distribution box used to divide the septic tank effluent either from a pumping station or directly from the septic tank must be equipped with equalizers on every exit pipe.

Velocity Reduction/ Equalizer

If piping from the septic tank to the Advanced Enviro-Septic® pipe is excessively steep, a velocity reducer at the system inlet is necessary. A distribution box with a baffle or an inlet tee may be an adequate velocity reducer.

Note: An Equalizer™ is limited to a maximum of 38 litres/minute in gravity systems and 76 litres /minute in pumped systems.

System with a Pump Station

If the Advanced Enviro-Septic® pipes are above the septic tank outlet a pumping station will be required to distribute the septic tank effluent to the rows of Advanced Enviro-Septic® pipe.

A Velocity reduction device must be used to reduce the velocity of the effluent entering the distribution box. Section J and K describe the pumping station and ventilation requirement in more detail.

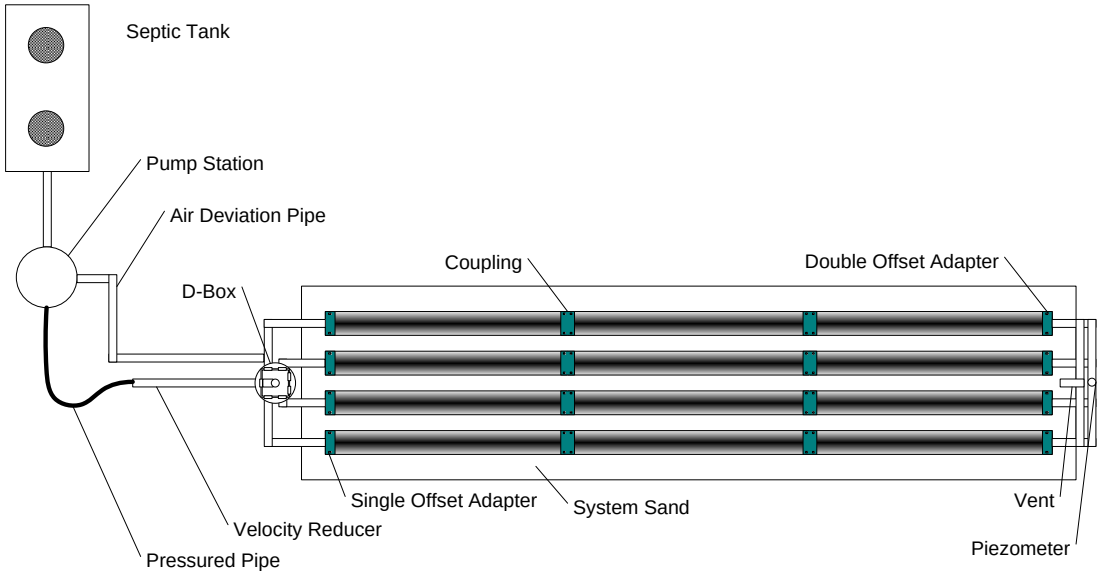


Fig. 27

Low Pressure Distribution System

The pumping station can be combined with flow restricting devices located on the feed piping to distribute the flow to each row. That is what we call "Low Pressure Distribution System". An air vent bypass or a high vent must be installed to permit the circulation of air. Section K explains the venting requirements in more detail.

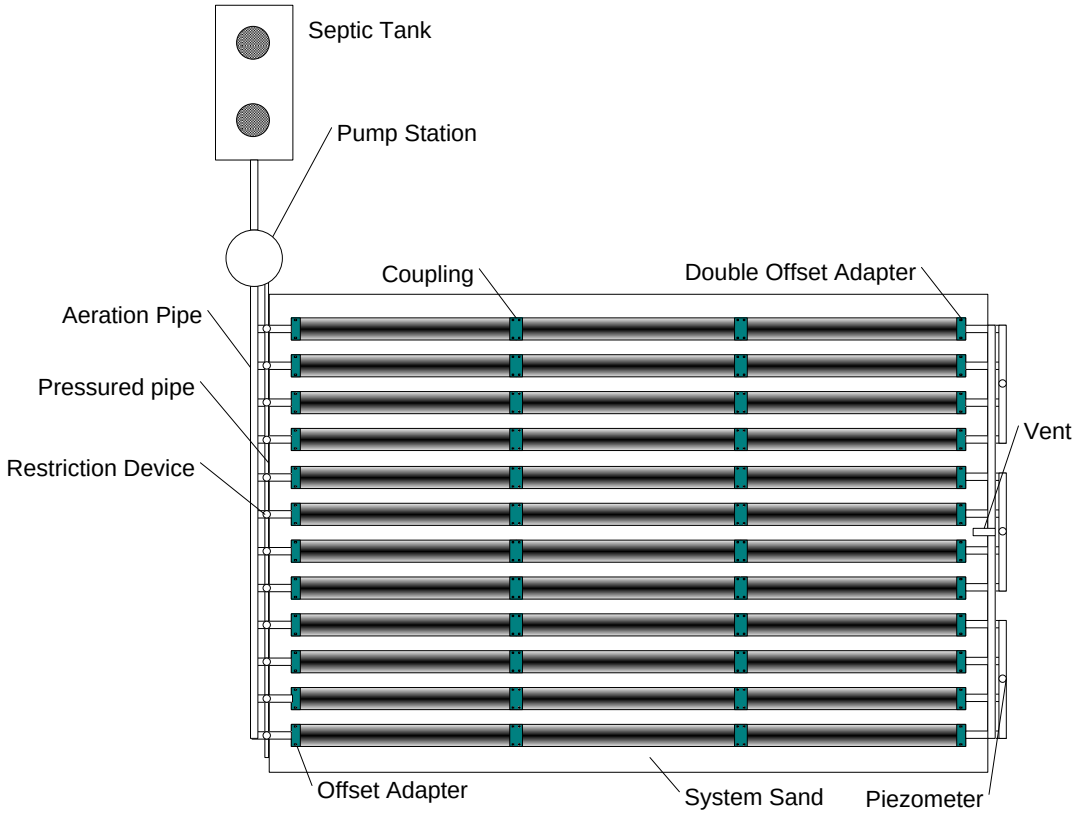


Fig. 28

Hybrid Low Pressure Distribution System

For systems with a large daily flow, a hybrid system can be used. It consists of a low pressure distribution system and the feed piping that sends effluent to a distribution box for each section.

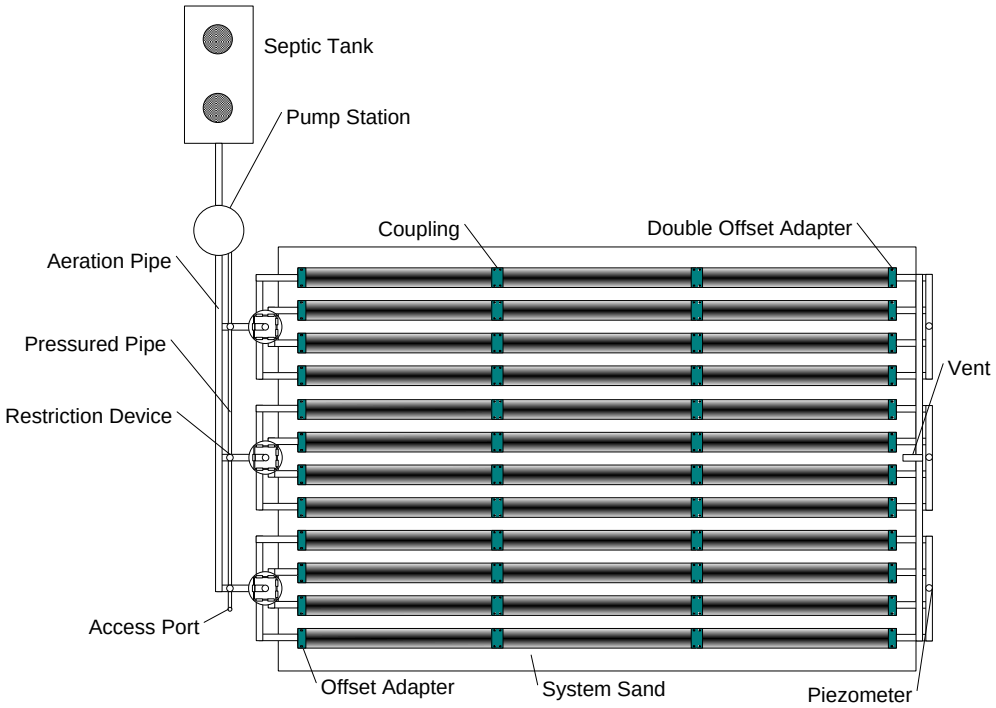


Fig. 29

Distribution Valve Hybrid System

Another variant consists of using distribution valve to distribute the water into 2 to 6 zones of Advanced Enviro-Septic® pipes. These mechanical distribution valves are available with 2 to 6 exit positions. With each cycle of the pump, the valve turns one position to allow the water to reach a new zone.

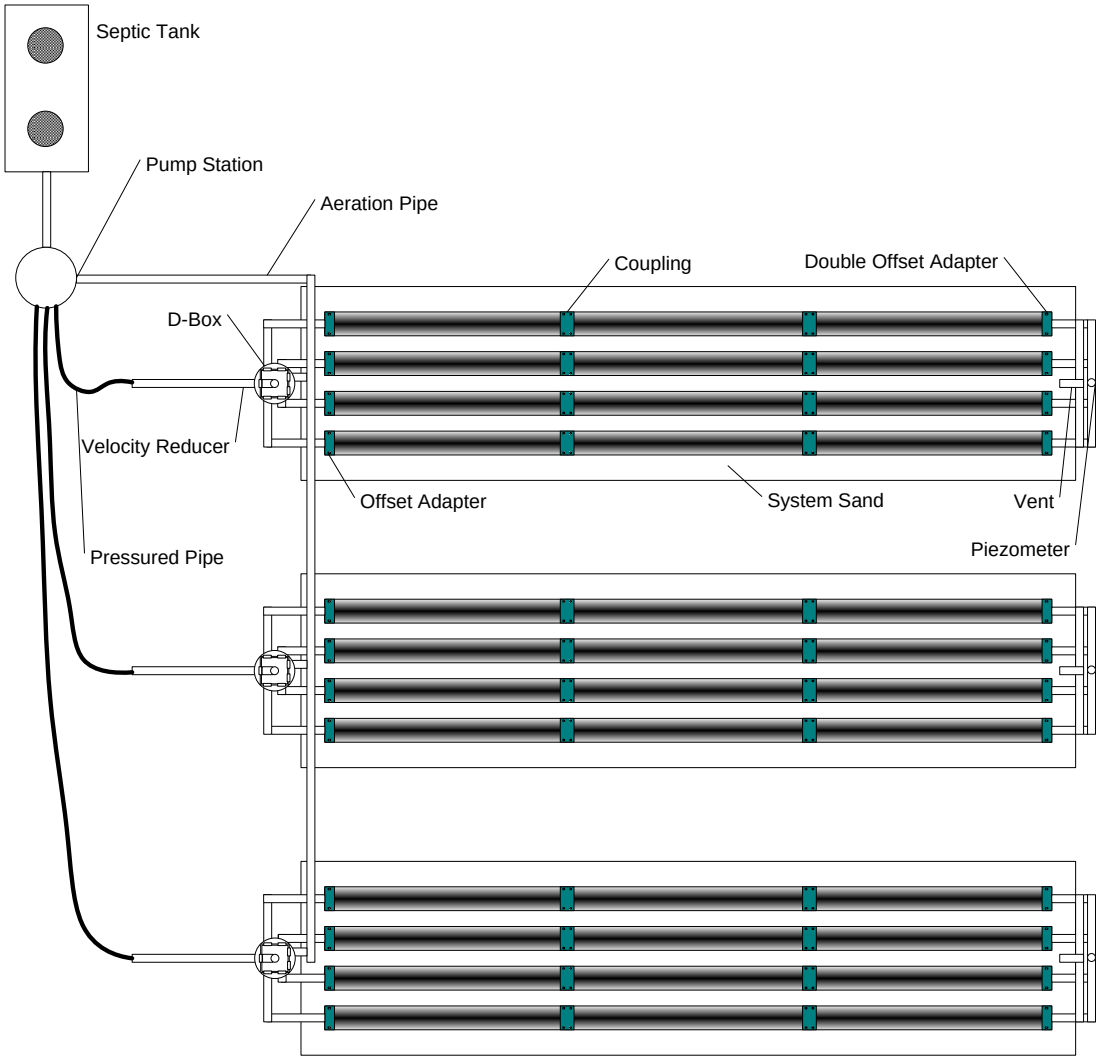


Fig. 30

Section I - Special Configurations

Introduction

Non-conventional system configurations may be used for difficult site conditions. They may take irregular shapes to accommodate site constraints.

Curved Configuration

Curved configurations work well around objects, setbacks, and slopes.

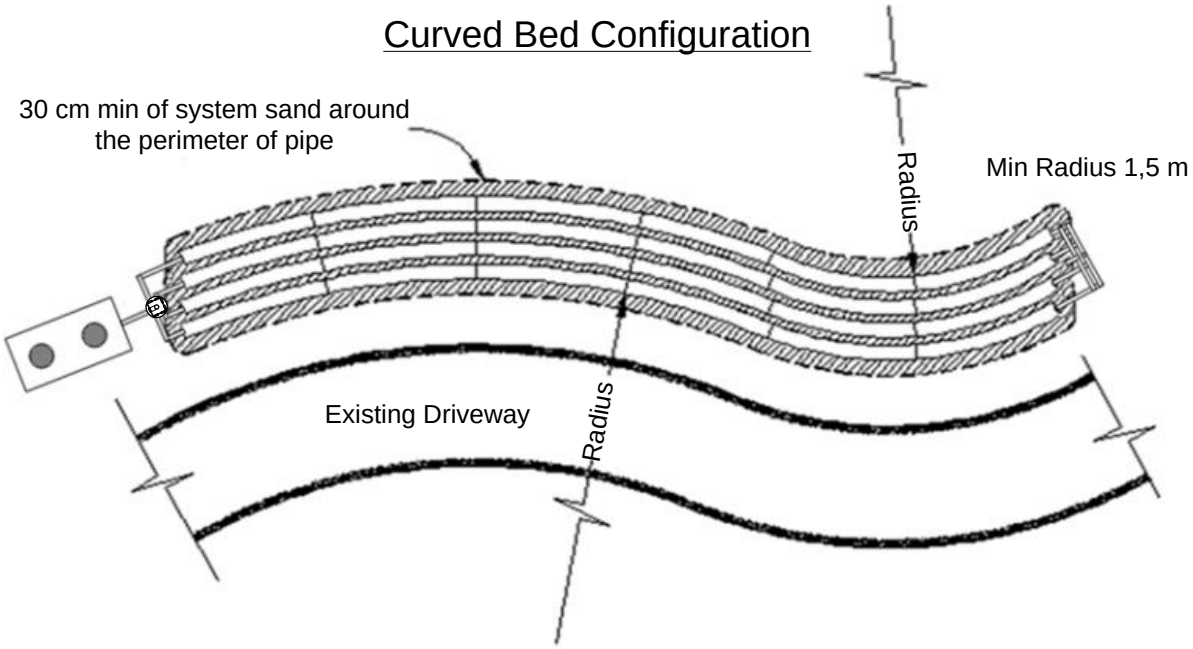


Fig. 31

Angled Configuration

Angular configurations can include one or more angles. Rows are angled by bending pipes. The shortest acceptable curve radius for Enviro-Septic® is obtained by bending a 3 metre pipe length at a right angle.

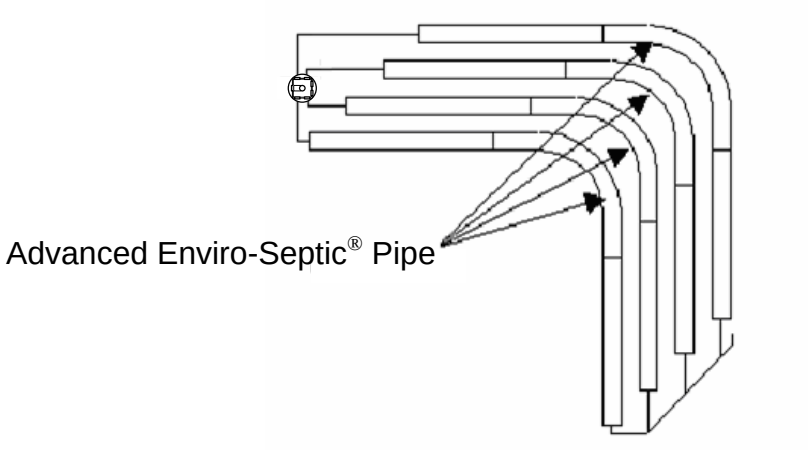


Fig. 32

Trapezoid Configuration

The following system uses a trapezoid configuration to get around an obstacle or to adapt to a slope.

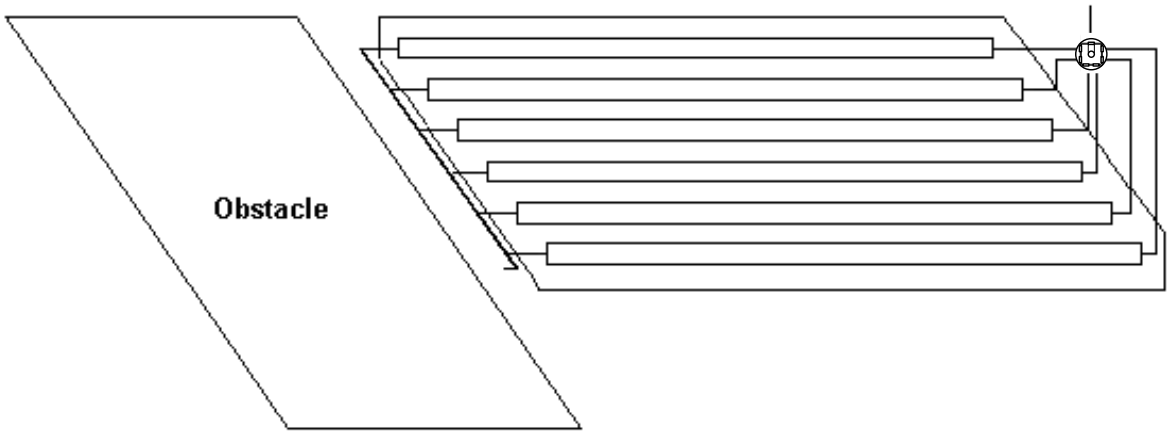


Fig. 33

Section J - Pump and Dosing System Requirements

Introduction

Pump systems typically supply effluent to Advanced Enviro-Septic® pipe using a pressured line, a distribution box and a velocity reducer when site conditions do not permit a gravity system.

Differential Venting

All pump systems must use differential venting.

Reference: See Section K, "Venting Requirements."

Velocity Control

Never pump Septic Tank effluent directly into the Advanced Enviro-Septic® pipes. Install a velocity reducer prior to the distribution box.

Pressurized lines must discharge into 100 mm pipe that is 3 metres long. The change in diameter reduces the pressure in the pipe. If the distribution box is not equipped with a baffle, then pipe must be terminated with a vertical tee fitting inside the D-Box.

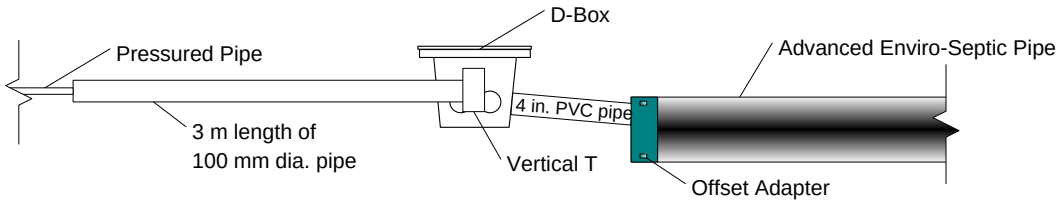


Fig. 34

Maximum Loading Rate per Pumped Cycle

The maximum volume of effluent pumped per cycle per length of Advanced Enviro-Septic® Pipe (3.05 m) is 40 litres.

Taking into consideration the daily design flow, the volume of water per cycle should be specified to have 6 to 8 cycles per day.

Maximum Flow in Litre per Minute

Equalizers

An equalizer used in a system with a pumping station cannot receive more than 75 litres per minute.

Rows

Each row in a system using a pump and a distribution box cannot receive a flow higher than 75 litres per minute.

Example

A system has 6 rows of 6 Advanced Enviro-Septic® pipes each for a total of 36 pipes.

What is the maximum volume allowed per pumping cycle?

Vol. Max / Cycle = number of pipes x 40L/pipe
= 36 x 40
= 1440 litres per cycle

What are the minimum and maximum volume per cycle that should be used?

System Capacity= Number pipes. x 90 L/pipe
= 36 x 90
= 3240 litres per day

Volume for 6 pumping cycles Cycle / Day
= System capacity / Number of cycle
= 3240 / 6
= 540 L/cycle

Volume for 8 pumping cycles Cycle / Day
= System capacity / Number of cycle
= 3240 / 8
= 405 L/cycle

Minimum volume per cycle: 405 L / pump cycle
Maximum volume per cycle: 540 L / pump cycle

What will be the flow per equalizer and per row if a distribution box with 6 exit equalizers is used and the flow of the pumping station is 4.5 litres per second?

FlowStation = 60 Sec/min x 4,5 L/sec
= 270 L/min

FlowEqualizer = FlowStation / Number Equalizer
= 270 L/min / 6 equalizers
= 45 L/min/equalizer (less than 75 L/min – OK)

Section K - Venting Requirements

General Rule

All Enviro-Septic® systems require the use of a vent pipe as well as appropriate aeration pipes. Locate vent openings to ensure air is drawn completely through each row or section of Advanced Enviro-Septic® pipe.

When to Vent

A 100 mm vent pipe is required for every 300 metres of Advanced Enviro-Septic® pipes. If necessary, a single 15 cm (6") vent opening may be installed in place of a maximum of three 100 mm (4") vent openings.

Many pipe rows can be connected together with the help of an aeration pipe, as shown in the following figure.

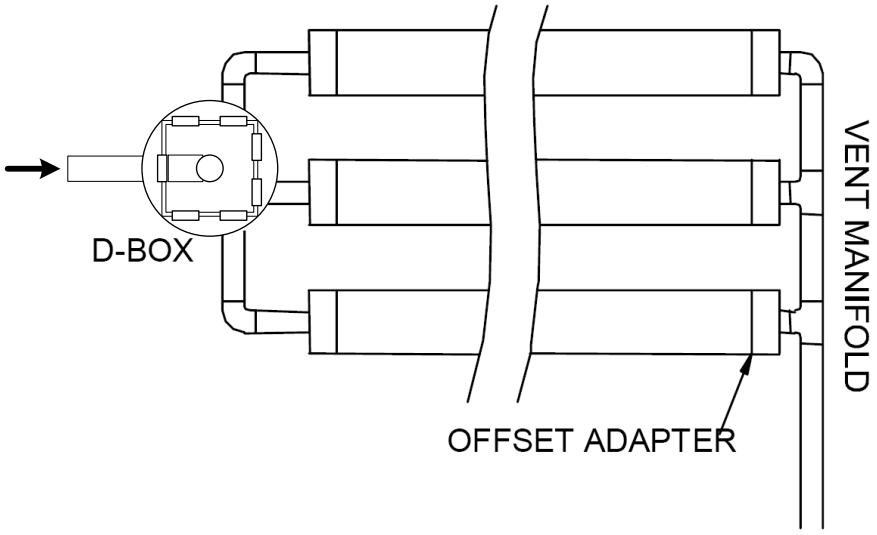


Fig. 35

Design Standards

The entry vent (located after the Advanced Enviro-Septic® pipes) must meet the following standards:

- Must be high enough to rise above snow during winter (min 2000 mm);
- Can be hidden among trees;

The entry vent must be at least 3000 mm lower than the exit vent.

All vents shall conform to the Ontario Plumbing Code.

Note: The aeration pipe connected to the vent must always pass through the upper opening of the double offset adapter.

Vent Piping Slope

Vent piping should slope 1% downward toward the Advanced Enviro-Septic® pipes to prevent moisture from collecting in the piping and blocking air passage.

Air Flow Circuit

The aeration circuit must be continuous between the entry and exit vent. The vent installed at the end of the rows of pipes acts as the entry point. The most common setup is when the air flows through the Advanced Enviro-Septic® pipes, the D-Box and the septic tank and finally exits through the vent pipe of the residence.

On systems that use a pumping station or low-pressure distribution, special considerations need to be taken to ensure that the air flows efficiently through the system. This leaves the designer with 2 options:

- install a shunt pipe between the treatment system and the pumping station;
- install an extra vent pipe (see next paragraph).

Vent Locations

Enviro-Septic® systems can be vented at the following areas:

Entry vent (Low) located downstream from the system, through the upper opening of a double offset adapter installed at the end of a section or row.

.

- The vent pipe is to be connected to the air manifold between two pipe rows.
- If the vent is located away from the Advanced Enviro-Septic® pipes, use an open T-shaped fitting at the base of the aeration pipe to prevent condensation build up.

Exit vent (High) located upstream from the treatment system.

- First choice is to use the rooftop vent pipe

Or:

- Vent pipe connected on the feed pipe between the house and the septic tank. This vent borders the exterior wall of the house and rises above the edge of the roof. It is not recommended to put a vent on the septic tank because of potential odour problems.

And if the use of a shunt pipe is impossible:

- Install a vent onto one of the distribution box outlets (if available) or close to the distribution box onto one of the feed pipes from the rows of Advanced Enviro-Septic® pipes.

The designer must make sure that there is a well-vented line between both high and low vent pipes.

Differential Venting

Differential venting is the use of high and low vents in a system. High vents are connected to the distribution box and low vents are connected to the opposite end of the system. This arrangement enhances the circulation of air throughout the entire system.

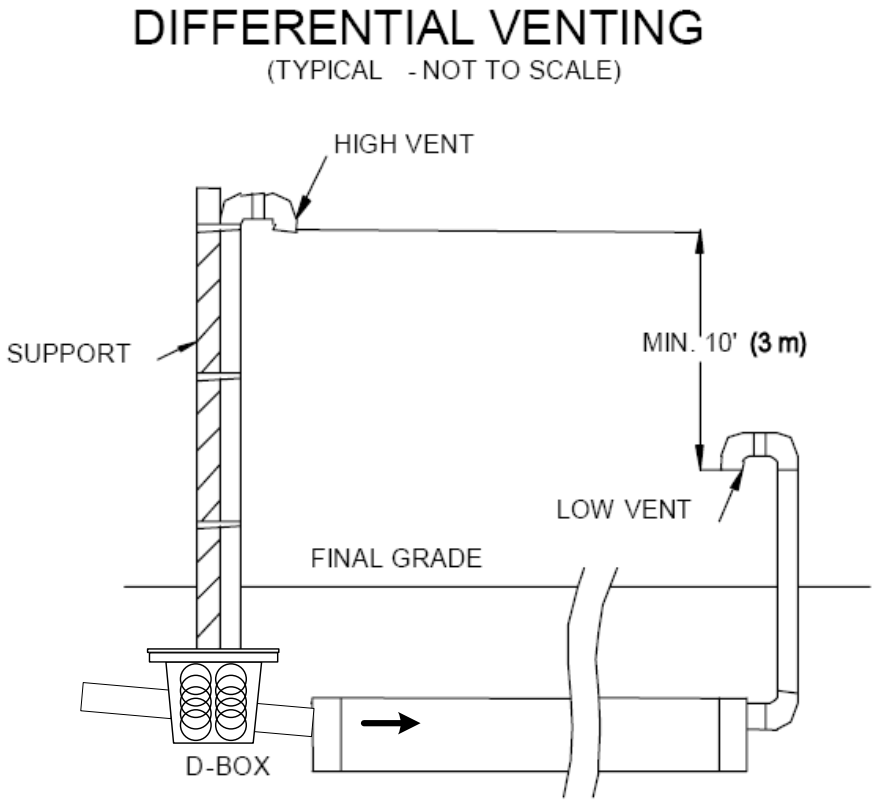


Fig. 36

Section L - Piezometers

Background

The piezometer serves two purposes:

- Allows the measuring of the water level in the pipes;
- Allows the pumping of water from the pipe row if the system needs to be regenerated.

It is preferable to install a piezometer at the end of each row of Advanced Enviro-Septic® pipes. It is also possible to install one piezometer per group of interconnected rows all at the same level.

Piezometer Design

Figure 39 shows a piezometer installed at the end of a row of Advanced Enviro-Septic® pipe.

The piezometer is to be capped at finish grade level.

The watertight cap at the end of the piezometer needs to be on at all times, except during follow-up or maintenance of the system.

Piezometer Model

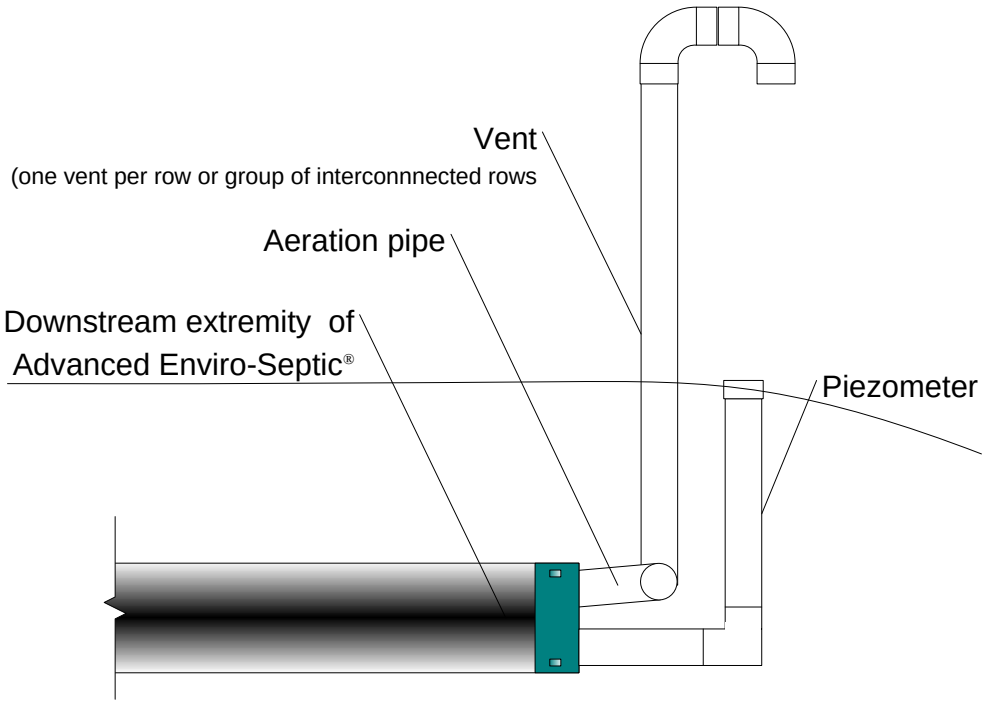


Fig. 37

Section M - Sampling device

Background

In some province or state regulation, it is required that each stand alone wastewater treatment system have a device to allow representative sampling of the quality of wastewater delivered to the system and of treated wastewater leaving the system.

In Ontario, influent sampling is not mandatory while effluent sampling is.

The following paragraphs discuss how to do sampling depending on what is needed.

Influent Sampling

Context

The Enviro-Septic® system has been in use in North America since the late 1980s and has been tested by independent agencies over the years.

The Standards Council of Canada has authorized the BNQ in Canada to create a standard of sewage wastewater treatment plants for the onsite sewage industry, and has authorized them to perform testing of technology and equipment in accordance with this standard. This standard was developed after and adds to the NSF-40 standard which was developed by NSF international[4].

The Enviro-Septic® technology has met and exceeded the wastewater treatment standards of NSF International and BNQ of Canada.

The testing conducted by an independent agency, the BNQ of Canada, reveals and confirms that the Enviro-Septic® system produces an effluent of better than 10 mg/l of BOD5 and TSS respectively when it receives domestic wastewater.

[4] NSF Standard 40 is for residential wastewater treatment systems. The NSF has a product certification accreditation from the Standards Council of Canada. This accreditation attest to the competency of services provided by NSF and compliance with established national and international standards for third-party certification. The NSF-40 is a standard for residential wastewater treatment systems.

Enviro-Septic® Influent Sampling

Influent sampling is only confirming that the facility is or is not generating sewage within the acceptable organic loading range and that the Enviro-Septic® received the influent it is design for and therefore produces a treated effluent meeting the regulation requirements.

The influent sampling is intended to demonstrate to the user of the system that their activities and behaviours in the facility are consistent with lawful generally accepted use and will not cause harm to the treatment system and the environment.

With such an option, sampling is conducted by drawing wastewater material from the "clear zone" near the exit of the septic tank. The sample is tested for BOD5 and TSS by a government approved laboratory facility. Sample material is to be handled, stored and transported in accordance with protocols and standards set by the testing laboratory.

The samples are tested to determine the organic load (mass loading) entering the Advanced Enviro-Septic® pipes. Results of the test that show a BOD5 of less than 200 mg/L and TSS of less than 100 mg/l respectively confirm acceptable user behaviour. Values greater than those limits indicated that the septic tank needs to be pumped out immediately or that the activities in the facility need to be reviewed and altered.

Hydraulic Loading

Hydraulic Loading (daily sewage flow rate) is another factor that needs to be monitored to show that the system is used properly and therefore will perform according to the levels expected.

On a single visit, it will be difficult for the outside laboratories to determine if the hydraulic loading is within the design flow. Other than observation that the system is not receiving flow from leaking facility fixtures or septic tank, the technician will not be able to evaluate the hydraulic loading to the system unless a flow measuring device is installed in the system.

If the Enviro-septic® system includes a pumping package within the treatment train, it can be used to install a flow measuring device. A water meter can also be installed on the main water entry to measure the amount of water use and give an idea of volume of waste water generated.

Influent Sampling and Hydraulic Loading Combination

The combination of influent sampling and hydraulic loading measurement indicate if the system is used within the limits it was design for. If the system works within these limits, it means that the installation is operating in similar conditions to the systems that were tested and certified. Therefore the system treats the wastewater at the level expected.

Effluent Sampling

Context

The Enviro-Septic® system requires the installation of an effluent sampling device. The following paragraphs describe the sampling device to be used.

Sampling Device Description

The sampling device includes two major components:

- Collector
- Sample port

The collector consists of a thermoformed trough in which a collector pipe is installed. The pipe is then covered with a layer of system sand.

The collector is installed in the system sand directly below a row of Advanced Enviro-Septic® pipe. The collected water is routed towards the sample port through a PVC pipe of 100 mm in diameter. The sample port is used to take the water samples for analysis. See Fig. 38 for a detailed diagram of the sampling device, explaining the 11 components of the system.

1. Sample port
2. Access pipe with an adjustable section that can be cut to adjust its height depending on the depth of the backfill
3. Lockable cover
4. Collector
5. Padlock or plastic seal
6. Polylok® pipe Adapter to connect ∅100 mm PVC pipe, one on each side
7. Adapter locking ring
8. PVC pipe
9. Fitting and adapter to connect the PVC pipe and the collector pipe
10. End cap for the collector pipe
11. Collector pipe for treated water

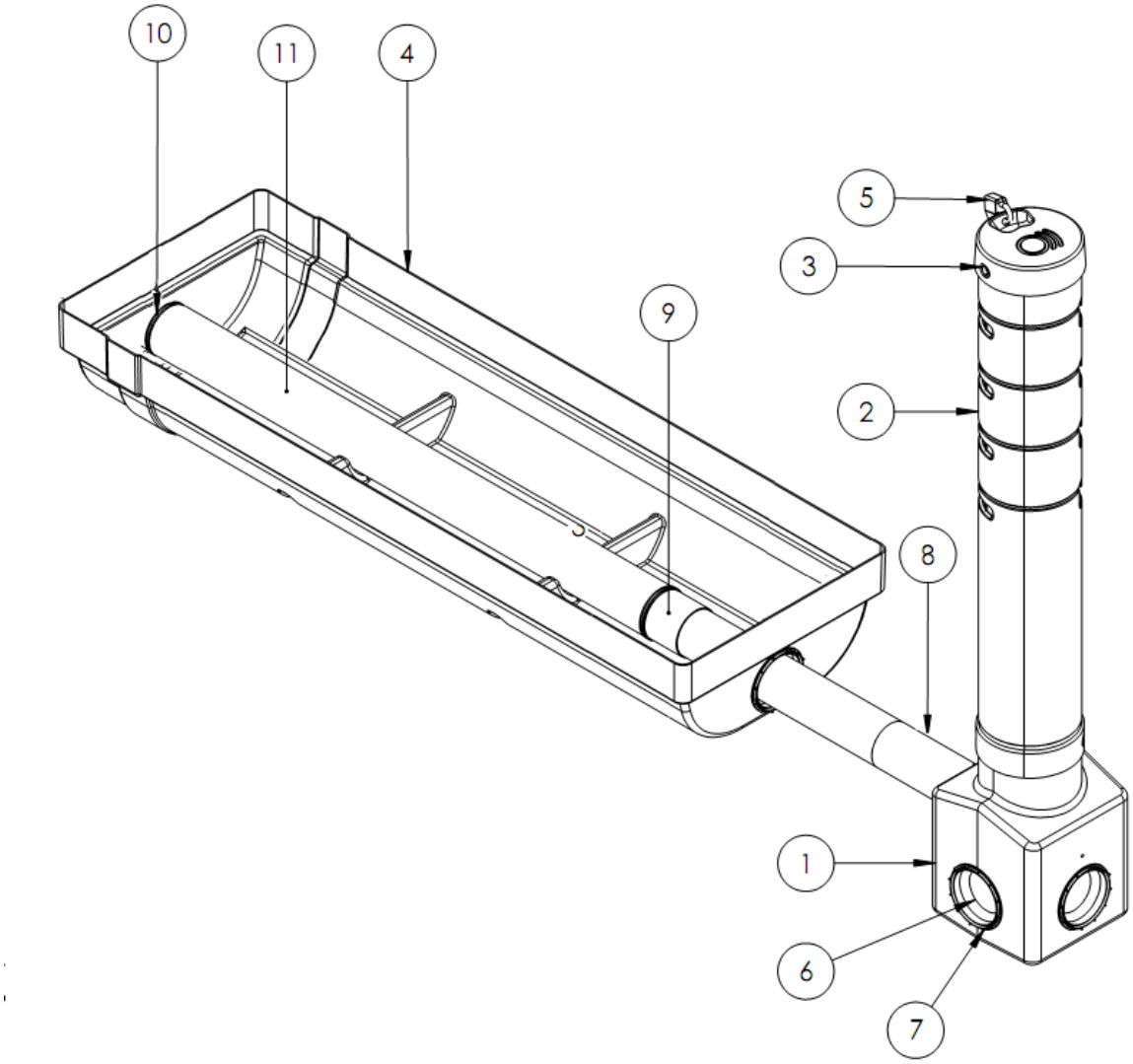


Fig. 38

Collector

The collector is installed in the layer of system sand directly below a row of Advanced Enviro-Septic® pipe. A collector pipe (drainage pipe) is placed at the bottom of the collector, held in place by half-moon mounts and stabilized with system sand. This pipe is connected to a PVC pipe with the help of an adapter. The PVC pipe exits the collector wall and is connected to the top opening in the base of the sample port.

Collector Pipe

The collector pipe to recuperate the water at the bottom of the collector is a 100 mm diameter Big 'O' perforated drainage pipe wrapped with filter sock[5] (or its equivalent – see Table 5). Filter sock is a one-piece polyester sock that fits over the corrugated

[5] The AOS (Apparent Opening Size) of the drainage pipe filter sock is 600 microns. While there are other styles of geotextile-wrapped pipes available on the market, they cannot be used in this application due to their opening sizes that range between 90 and 150 microns.

pipe to prevent sand fines from entering into the pipe.

The filter sock is held in place by an end cap at one end of the pipe and by an adapter connecting the collector pipe to the PVC pipe at the other end.

Table 5

Drainage Pipe Equivalents

	Drainage Pipe	**End Cap**	**Coupler**
Armtec	Big 'O' ∅100 mm with white filter sock[6] 	Internal end cap, ∅100 mm 	Internal coupling, ∅100 mm 
Soleno	Available on special order only[7]	1B0045, internal end cap, ∅100 mm 	1M0040, internal coupling, ∅100 mm 
Hancor	Heavy Duty ∅100 mm with black filter sock 	0433AA, internal end cap, ∅100 mm 	0417AA, internal coupling, ∅100 mm 

[6] This membrane is 100% polyester. Use of drainage pipe wrapped in non-woven (matted) membrane is not allowed.

[7] Soleno drainage pipe is normally wrapped in geotextile membrane only. Such membrane types cannot be used. Sock filter is available on request (special order).

Sample Port

The sample port is constructed in two sections: an access port and a water-tight base unit to which inlet and outlet pipes are connected. The two sections are fitted together with the help of a keyway at about one fourth of the assembly height.

The access port can be easily disconnected from the base unit to get better access to install pipes and adapters.

The base unit has three openings, each with a Polylok pipe adapter. The pipe from the collector is connected to the upper opening in the base unit. One of the two lower openings is used for a water return pipe. All inlet and outlet pipes must be inserted into the base unit by approximately 25 mm.

The upper end of the access port pipe has four guide notches (horizontal lines on the pipe circumference). During the installation, after the final backfill, the Contractor will shorten the height of the access port pipe, if necessary, by cutting it along one of these notches. The pipe opening must be above the final backfill level to prevent surface water from flowing into the pipe.

Polylok Pipe Adapter

Each of the three openings in the base unit of the sampling device is equipped with a Polylok pipe adapter. To use one of the adapters, the Contractor removes the ∅99 mm tear-out in the center of the adapter. This operation is similar to the one performed on the distribution box (see Installation Manual).

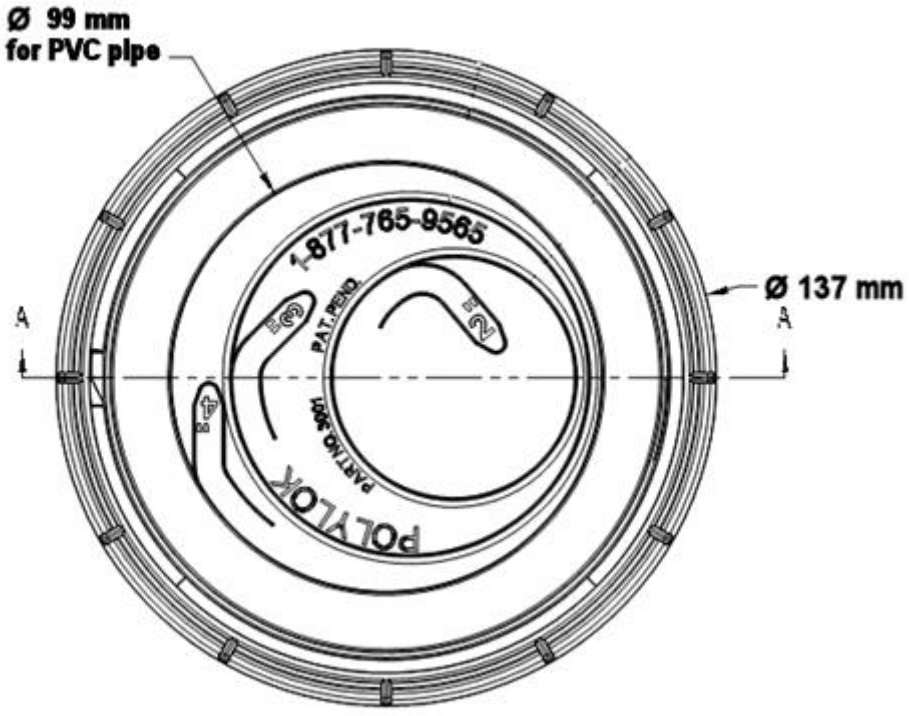


Fig. 39

Infiltration Pipe

If not extracted for samples, the collected water that goes through the sample port must be filtered into the soil, as needed. Therefore, the sampling device is equipped with an outlet opening to allow the water from the sample port to enter in the return and then infiltration pipe, which then routes the water to the receiving soil.

The infiltration pipe is made of ∅100 mm Big 'O' perforated drainage pipe wrapped in filter sock (or its equivalent – see Table 5).

Lockable Cover

The lockable cover is snapped in place by pushing its two inside knobs into the keyways of the access port pipe. Once installed, the cover is locked with a plastic seal.

Fill Material around the Collector

The collector is installed directly below a row of Advanced Enviro-Septic® pipe, to make it easier to collect the treated water. The vertical position of the collector is determined taking in account the need to:

- Drain the collected water, as needed;
- Create a step in the sample port to help in taking water samples.

The infiltration pipe is placed directly on the receiving soil and covered with a 100-mm layer of system sand, over which the collector is installed.

The collector is covered with a 300-mm layer of system sand.

Vertical Position of the Collector

Fig. 40 shows the position of the collector and of the bottom drain pipe as well as the thickness of fill material to be used with the sampling device for the Enviro-Septic® system. The collector should have a positive slope (≈ 1%) toward the sample port to facilitate the effluent movement in that direction.

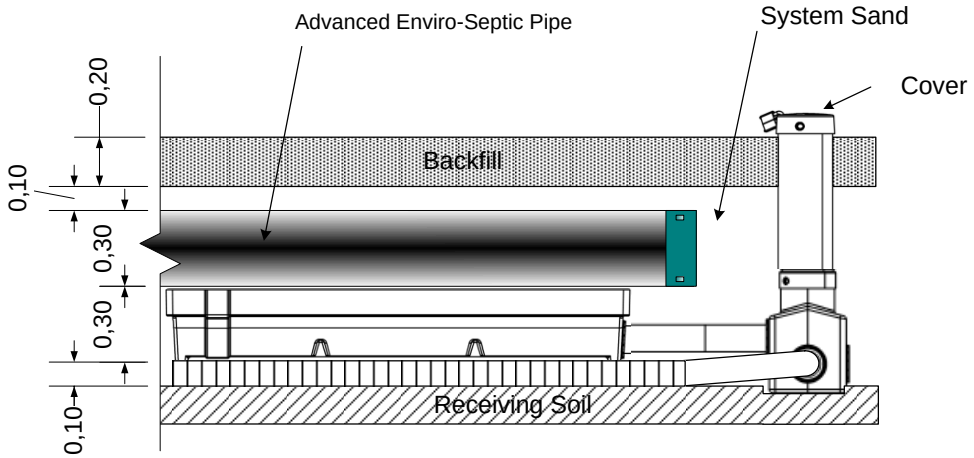


Fig. 40

Collector Position

The collector must be installed directly below a row of Advanced Enviro-Septic® pipe, with its center located at approximately one fourth of the length of the row of Advanced Enviro-Septic® pipe from the water inlet end. The collector should be located in such a way that it is at least 30 cm away from a coupling. See Fig. 41 – Fig. 44 for installation options.

Sample Port Position

The sample port may be located on the inside or outside of the perimeter of Enviro-Septic Contact Area or trench. The Designer should take into account the diameter of the sample port, which is 22.5 cm. Thus, it can be installed between rows of Advanced Enviro-Septic® pipe, provided their center-to-center spacing (E_{CC}) is more than 60 cm. See Fig. 41–Fig. 44 for installation options.

Position: Sample Port Outside of Enviro-Septic Contact Area, Uneven Number of Lines

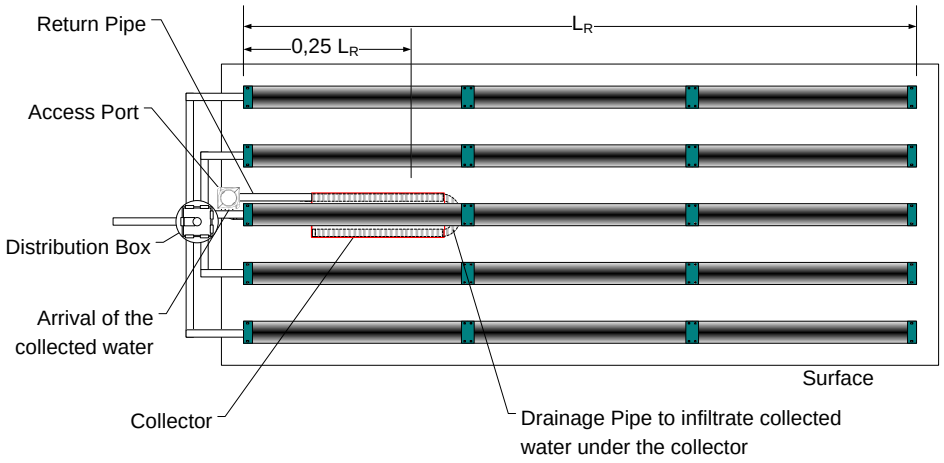


Fig. 41

Position: Sample Port Outside of the Enviro-Septic Contact Area, Even Number of Lines

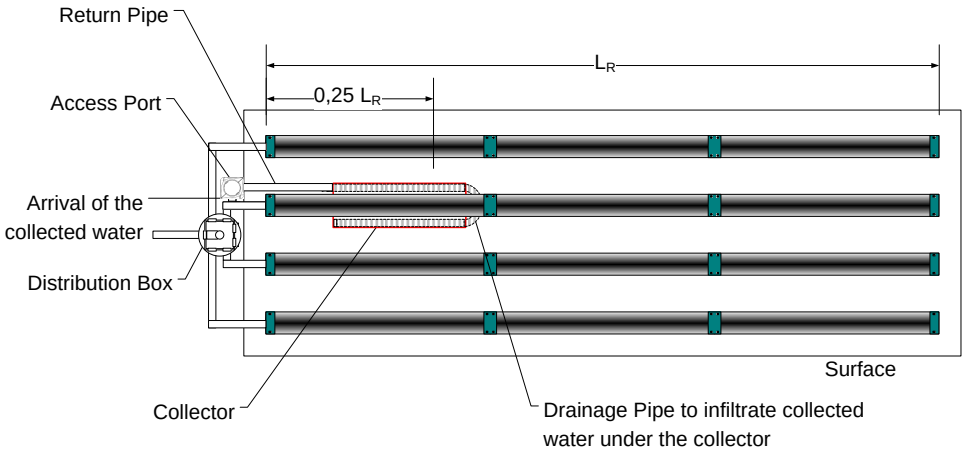


Fig. 42

Position: Sample Port on the Edge of the Enviro-Septic Contact Area

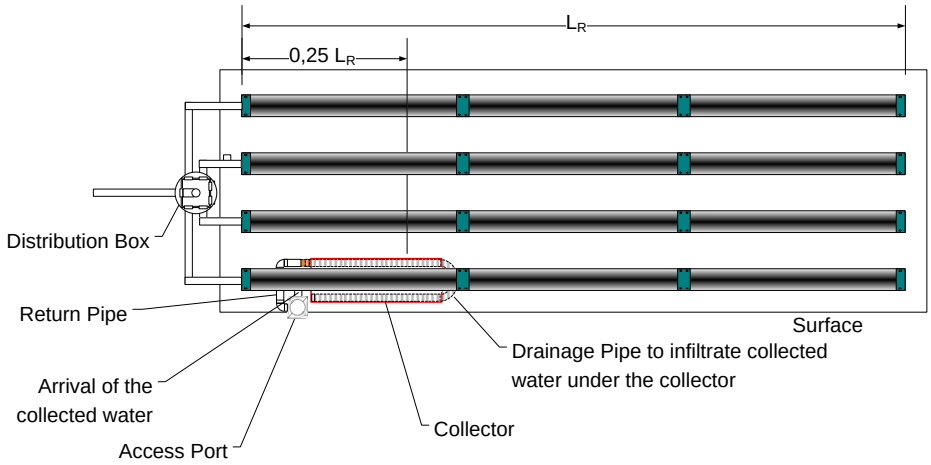


Fig. 43

Position: Sample Port Between Rows of Advanced Enviro-Septic® Pipe

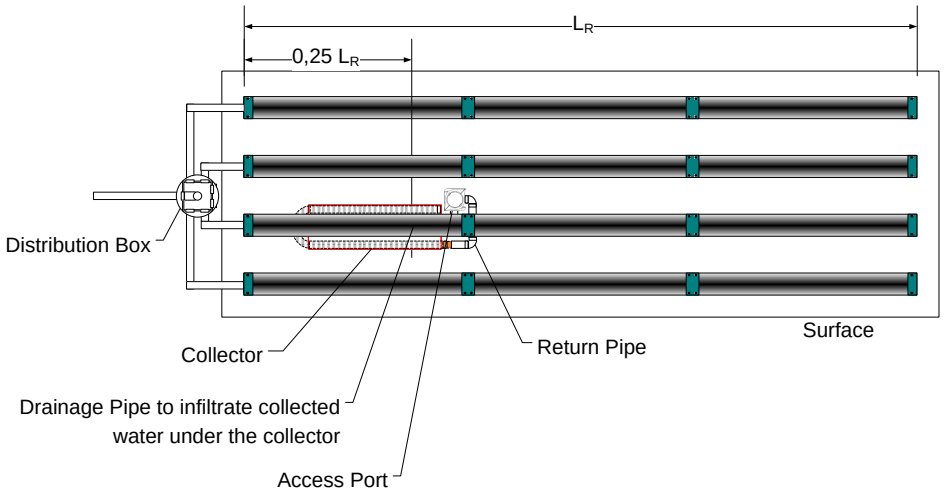


Fig. 44

Installation Guide

Section N – Description Tag, Handling and Storage

Background

The following paragraphs give information regarding the description tag found on each Advanced Enviro-Septic® pipe as well as rules to follow regarding the handling and storing of Enviro-Septic® products.

Further installation details are available in Section O.

Pipe Description Tag

Each Advanced Enviro-Septic® pipe used in an Enviro-Septic® system bears a descriptive tag similar to the one below in figure 45.

This tag is sewn onto the membrane covering the pipe. It must be present on each pipe at the time of installation. It must be left in place. It is made from non biodegradable material designed for use in soil.

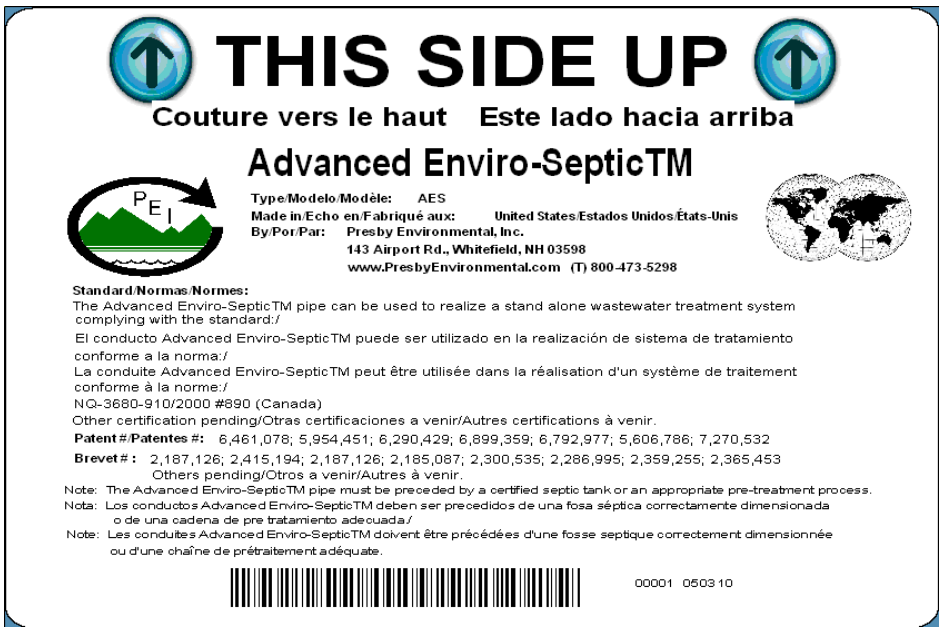


Fig. 45

System Tag

Each Enviro-Septic® system must be identified with a specific system tag. This tag will be installed in the sampling device access port. The number shown at the bottom of the tag will help to identify your system.

Handling

Advanced Enviro-Septic® pipes should be handled with care to avoid tearing the membrane or breaking the polyethylene pipe.

It is important not to contaminate the membrane of the pipe with sludge, grease, oil or other substances which may alter the properties of the product.

If the exterior membrane is dirty, wash it with a hose to return it to its' original permeability.

Storage

The outer fabric of the Advanced Enviro-Septic® pipe is ultra-violet stabilized. However, the protection breaks down after a period of time in direct sunlight. To prevent damage to the fabric, cover the pipe with an opaque tarp.

Store the pipe on high and dry areas to prevent surface water and soil from entering the pipes or contaminating the fabric prior to installation.

Section O – Sequential Installation Procedure

Sequential Procedure

Background

The following paragraphs present the necessary steps for the installation of an Enviro-Septic® System. The installation sequence of the components may vary according to the constraints of the installation site. For example, it might happen that the septic tank be installed after the Enviro-Septic® system.

Authorized Installer Required

All Enviro-Septic® installations must be done by an installer authorized by Makeway Environmental Technologies Inc. (Makeway is authorized by DBO Expert Inc to train and accredit installers). Authorization is obtained by attending a training session or by doing the first installation under supervision of Makeway Environmental Technologies Inc.

Steps to Follow

The installer must follow a series of steps in the construction of an Enviro-Septic® system:

- Obtain the plans, specifications and necessary authorizations.
- Follow the plans and specifications as filed with the authorities.
- Scarify the surface of the receiving soil.
- If required, install the waterproof membrane and the collection zone,
- If required, install the sampling device.
- If required, install the imported sand on the Enviro-Septic Contact Area.
- Install the system sand on the Enviro-Septic Contact Area.
- Install the Advanced Enviro-Septic® pipe rows.
- Place system sand between rows
- Pack system sand between rows by walking on top of the system sand between the rows.
- Cover the Advanced Enviro-Septic® pipes with system sand exposing the ends.
- Install the Distribution Box and the Equalizers™ or other distribution device for the septic tank effluent.
- Install the feed, ventilation pipes and the piezometers.
- Cover the system sand with clean top soil (no clay) permeable to air.

The installation of the septic tank should be done following the manufacturer's recommendations and OBC regulations. Time wise, depending on site conditions, the septic tank may be installed before or after the treatment system is installed.

Installation of a pumping station or low pressure distribution system should be done according to the installation guide for the system.

Diagram of Installation

The following diagram shows the components which must be installed to complete the Enviro-Septic® System.

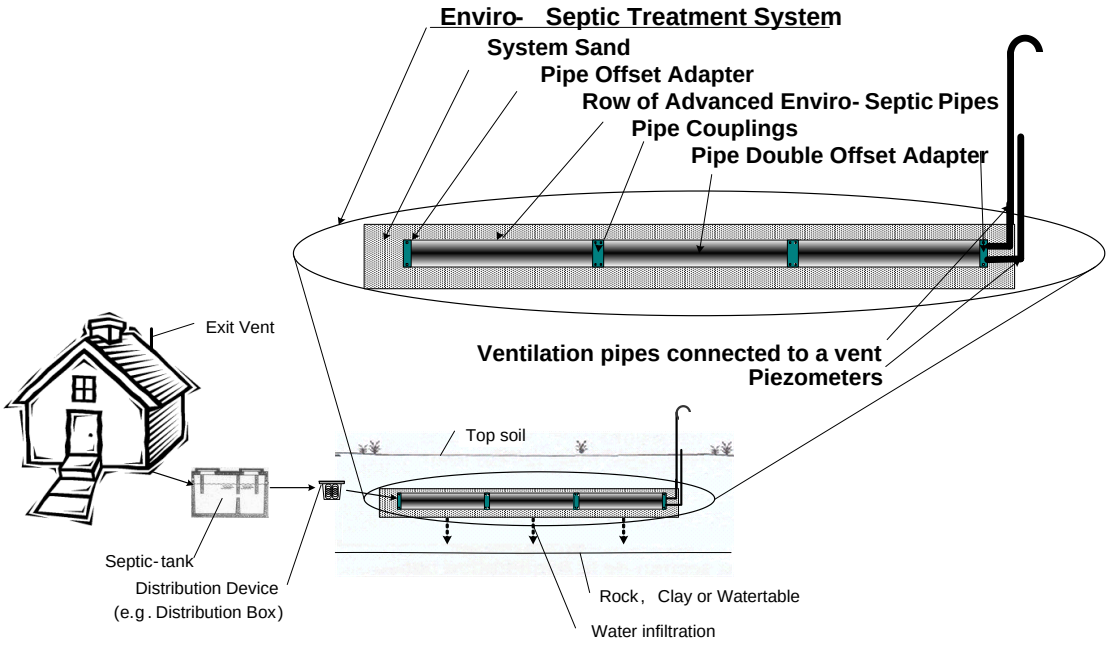


Fig. 46

List of Typical Materials

Treatment system

- Advanced Enviro-Septic® pipes
- Couplings
- Offset adapters
- Double offset adapters
- Distribution system (Ex; Distribution box with equalizers)
- Sampling device
- PVC pipes, 100 mm (4 inches) in diameter
- PVC 90° elbows and ``T`` adapters of 100mm (4 inches) diameter
- PVC Cleanout 100 mm (4 inches) in diameter
- System sand that meets specifications
- Air permeable top soil with no clay for final fill or side walls
- Pumping station (optional)

Collection zone (optional)

- Geotextile fabric
- Waterproof membrane
- Drainage Pipe equipped with the "sock" fabric (0,25mm nominal diameter openings)
- Adapters to connect drainage pipe to watertight pipes
- Watertight adapters for the pipe exiting the waterproof membrane.

Planning the Installation

Find the optimal order of steps for the installation :

- According to site constraints.
- Taking into account the movement of machinery.

The system sand must meet the following specifications:

- Effective diameter (D_{10}): $0.20 < D_{10} < 0.5$ mm.
- Coefficient of uniformity (D_{60}/D_{10}): $Cu < 4.5$
- Less than 3% silt; diameter < 80 μm (0.080 mm)
- Less than 20% particles with diameter > 2.5 mm.

Calculating the different elevations:

- 1% slope between:
  - the exit from the septic tank and the distribution box (gravitational feed)
  - the distribution box and the entry to the furthest pipe
- Typical incline of 125 mm in the septic tank.[8]
- Typical incline of 50 mm in the distribution box[4].
- Incline of 200 mm in the Enviro-Septic Pipe.
- Minimum separation between the interface of the system sand/receiving soil and the average high point of groundwater, rock or limiting soil in accordance with regulations in effect.
- 1% incline in the ventilation pipes leading to the vent (sloping toward the Advanced Enviro-Septic® pipes).

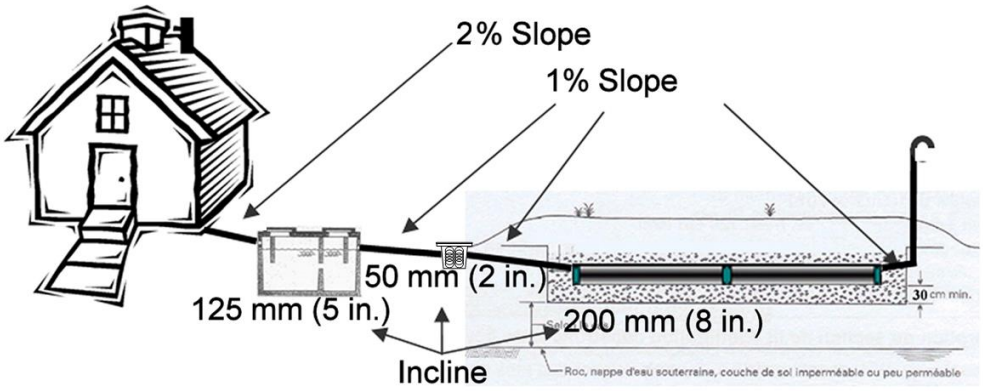


Fig. 47

[8] Septic tank and D-Box incline may vary depending on manufacturers.

Necessary Modifications to Plans and Estimates

When planning the installation, if the installer realizes that modifications must be made, he must communicate with the designer to discuss and obtain permission for make changes to the plan, filing or specifications. It is important that all the constraints analyzed by the designer be taken into account before making modifications.

Septic Tank

Install the septic tank in accordance with manufacturer's recommendations and OBC regulations. Minimum of 2 day retention in a 2 compartment tank. An effluent filter is required.

Preparation of the Installation Site

- Outline the surface to be excavated or scarified.
- Excavate the layer of soil required according to whether the installation will be partially or completely buried.
- Scarify the surface of the receiving soil where the system sand (or imported sand if required)will be spread out including the side walls. At the interface between sand and soil, the soil surface must not be smoothed or compacted. It must be grated or scarified to allow for a better water percolation between the sand and the receiving soil.
- As much as possible, conserve the existing conditions of the soil underneath. Avoid compaction of the soil as this will affect its permeability.

Note :

- Add the imported sand (when required) and the system sand the same day as the excavation.
- Avoid the accumulation of water in or on the system during the construction period.
- Do not do an installation in a ground that is saturated with water or in the presence of frost.

Soil Compaction

Minimize machine movement to avoid soil compaction and destruction of the soil structure under and around the system. Be especially careful not to compact soil on the down slope side of the system.

Sampling Device Installation

Introduction

The sampling device is to be installed on the surface of the scarified receiving soil. Its installation is done in four steps:

- Install the base unit of the sample port and the drainage pipe
- Add system sand over the drainage pipe
- Install the collector
- Add system sand over the sampling device assembly

The following paragraphs detail the steps for the installation of the sampling device.

List of Materials / Components

See the Table below for a list of materials /components required to complete the installation of the sampling device.

Table 6

List of Materials / Components – Sampling Device	
Items	**Quantity**
Sample port (base unit, access port, adapters and cover)	1
Collector	1
∅ 100 mm drainage pipe with filter sock	±5 m
∅ 100 mm cap (male) for drainage pipe	2
∅ 100 mm fitting to connect drainage and PVC pipe	2
∅ 100 mm PVC pipe • to connect the drainage pipe to the sample port • to connect the collector pipe to the sample port	Based on the distance
∅ 100 mm PVC elbow	Based on the port position
System sand in compliance with the requirements established for the Enviro-Septic® system	
Plastic Seal	1

Table 7

	Drainage Pipe Equivalents		
	Drainage Pipe	**End Cap**	**Coupler**
Armtec	Big 'O' ∅100 mm with white filter sock[9] 	Internal end cap, ∅100 mm 	Internal coupling, ∅100 mm 
Soleno	Available on special order[10]	1B0045, internal end cap, ∅100 mm 	1M0040, internal coupling, ∅100 mm 
Hancor	Heavy Duty ∅100 mm with black filter sock 	0433AA, internal end cap, ∅100 mm 	0417AA, internal coupling, ∅100 mm 

[9] This membrane is 100% polyester. Use of drainage pipe wrapped in non-woven (matted) membrane is not allowed.

[10] Soleno drainage pipe is wrapped in geotextile membrane only. Such membrane types cannot be used. The sock membrane is available on request (special orders).

Step 1 – Sample Port and Infiltration pipe

Once the receiving soil has been scarified, the Contractor installs the sampling device:

- Determine the position of the sample port and the infiltration pipe on the receiving soil.
- Calculate the length of the PVC return pipe and cut pieces to length.
- Add PVC elbows if required in the selected configuration.
- Cut a 3.6 to 4.5 m length of ∅ 100 mm drainage pipe with sock filter for the infiltration pipe.
- Cap one end of the pipe to keep filter sock in place.

Fig. 48

- At the other end of the pipe, install a coupling to hold the other end of the filter membrane.

  Note: Certain types of adapters are inserted directly in ∅ 100 mm PVC pipe. Others require a fitting, as illustrated below.

Fig.49

- Remove the access port section from the base unit of the sample port.
- Create a slight depression (125 mm to 140 mm) where the base unit and the return pipe are to be installed. Make sure the bottom of the base unit is level.
- Put the base unit in place.
- Remove the tear-out in the center of the Polylok® adapter of one of the two

lower openings in the base unit, in accordance with the plan configuration, along the ∅ 99 mm cutting line.

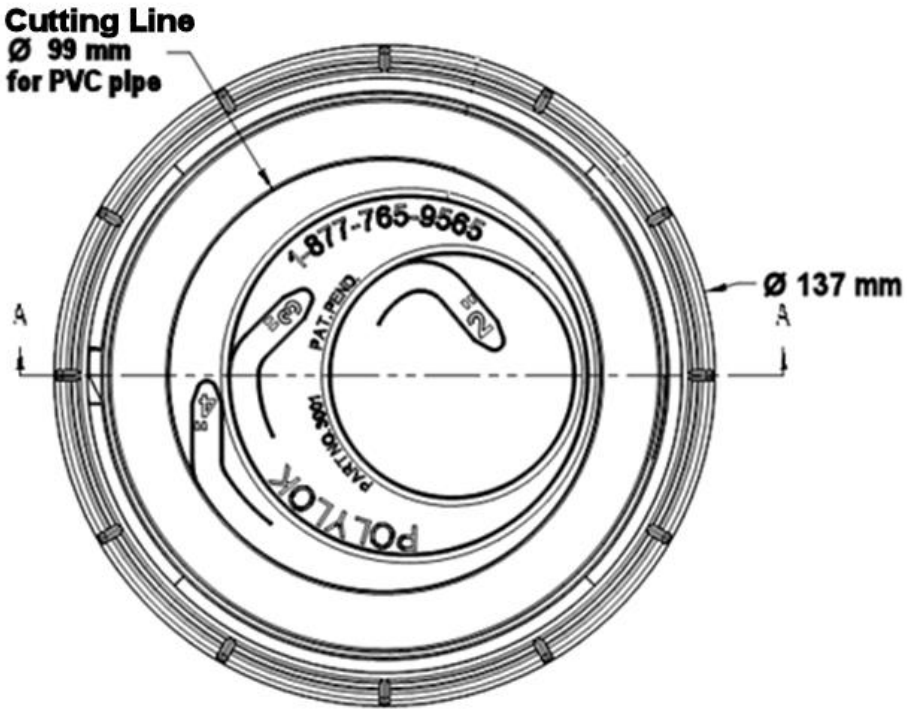


Fig. 50

- Slide the return pipe into the Polylok® adapter, rotating it to ease the installation. Make sure the pipe is inserted into the base unit by approximately 25 mm.
- Complete the installation of the drainage pipe as shown in Fig. 51.

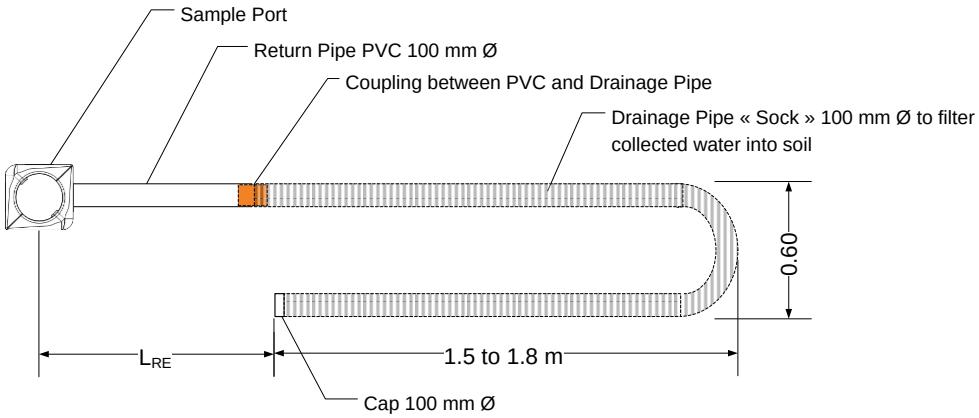


Fig. 51

Step 2 – Sand Fill Around the Return and Drainage Pipe

- Add a 100-mm layer of system sand around the base unit of the sample port, the return pipe and the drainage pipe. See Fig. 52.

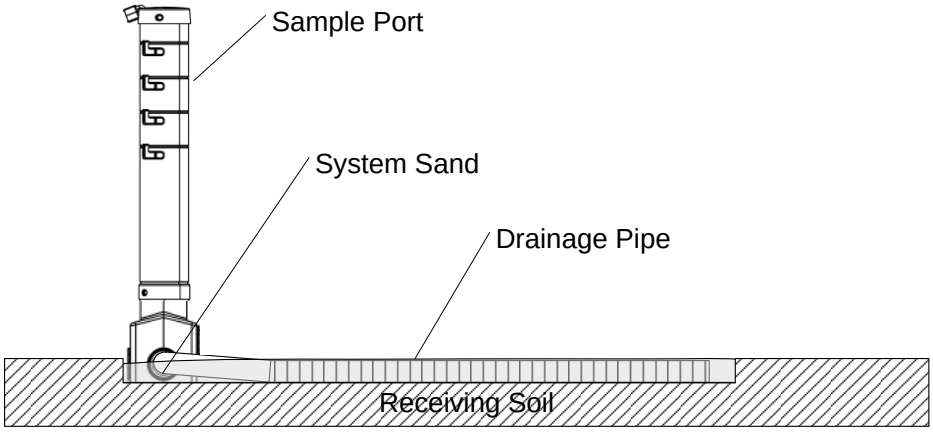


Fig. 52

Step 3 – Installation of the Collector

- Cut a 1.65 m length of ∅ 100 mm drainage pipe with filter sock for the collector pipe.
- Cap one end of the pipe to hold filter sock in place.
- At the other end of the pipe, install a coupling to hold the other end of the filter sock in place. Install a fitting onto the coupling if required.
- Cut a length of ∅ 100 mm PVC pipe to connect the collector to the base unit of the access port.
- Add PVC elbows, if required in the configuration.
- Remove the tear-out in the center of the Polylok® adapter of the upper opening in the base unit along the ∅ 99 mm cutting line.
- Slide the collector inlet pipe in the Polylok® adapter, rotating it to ease the installation. Make sure the pipe is inserted into the base unit by approximately 25 mm.
- Remove the tear-out in the center of the Polylok® adapter in the collector opening along the ∅ 99 mm cutting line.
- Slide the other end of the inlet pipe in the collector opening.
- Connect the collector pipe to the inlet pipe inside the collector.
- Place the collector pipe at the bottom of the collector.
- Give a positive slope (≈ 1%) to the collector in the direction of the sample port to facilitate the movement of the effluent in that direction.
- Complete the installation of the collector as shown in Fig. 53.

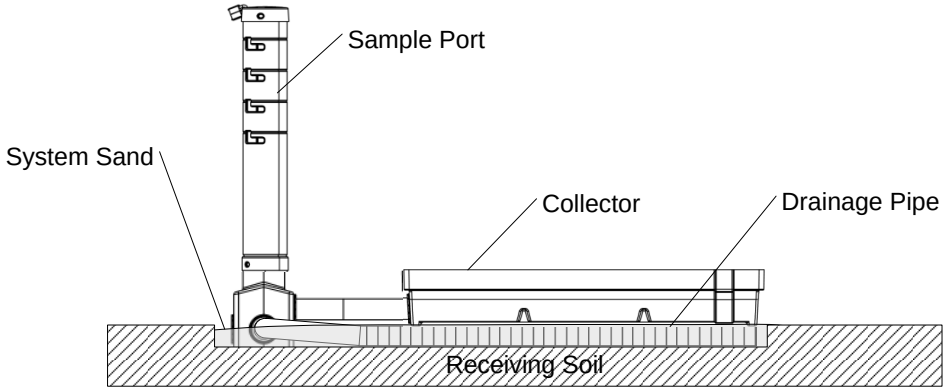


Fig. 53

Step 4 – Fill Material Around the Collector

- While holding the components in place, cover the base unit, the inlet pipe and the collector with system sand that meets the established selection criteria.
- Add system sand inside and outside the collector, ensuring that the collector retains its initial shape.
- Complete the installation of the sampling device as shown in Fig. 54.

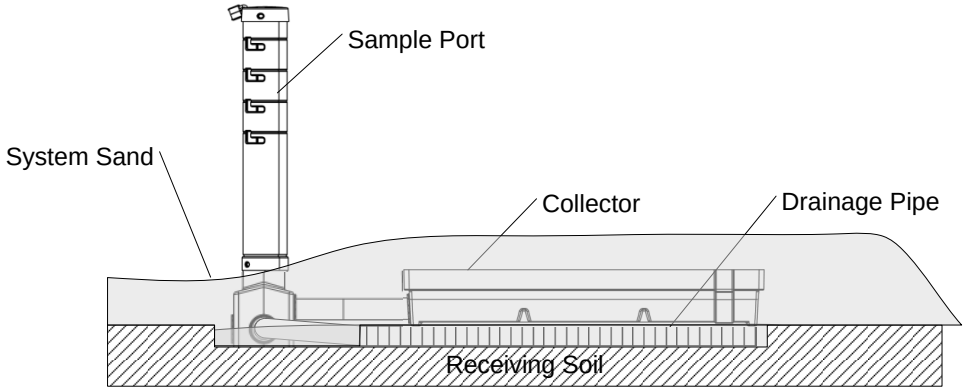


Fig. 54

Other Views of the Sampling Device

- See Fig. 55 through Fig.57 for other views of the sampling device once installed.

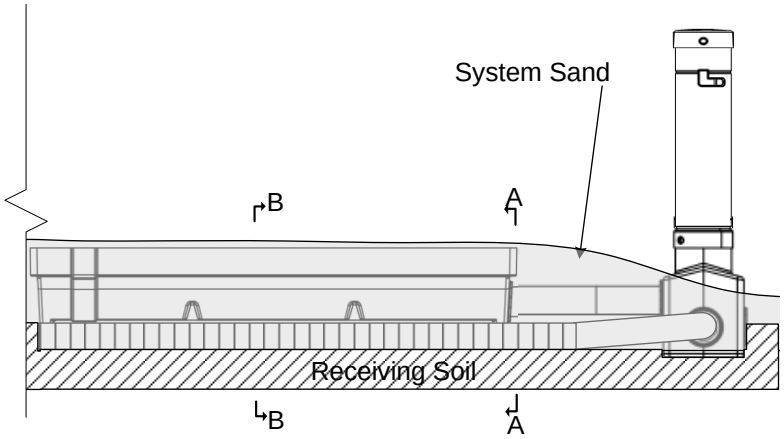


Fig. 55 – Position of cross-sections

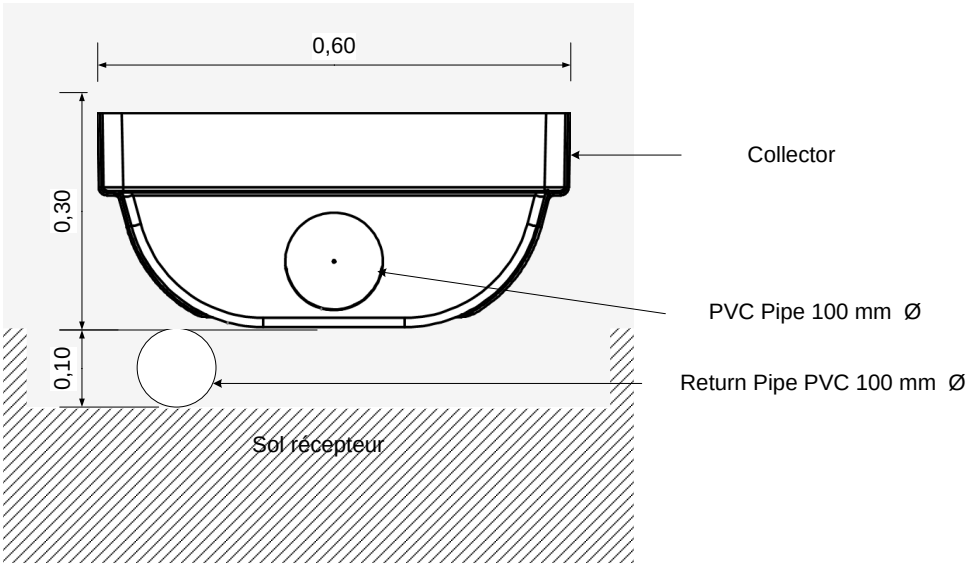


Fig. 56 – Cross-section AA

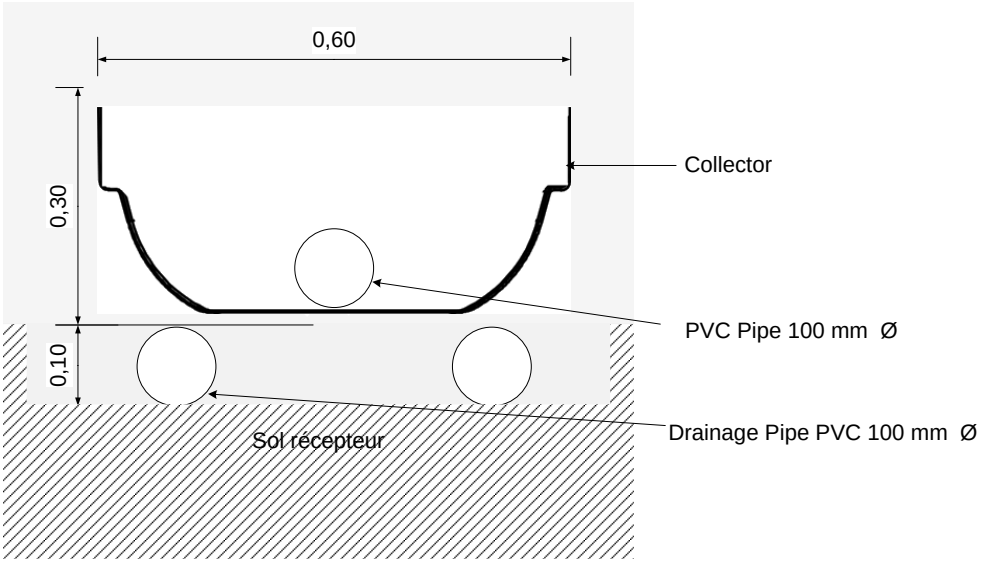


Fig. 57 – Cross-section BB

Sand Layer and Rows of Pipe

Preparing the Layer of System Sand under the Pipes

After having scarified the receiving soil and after having installed the sampling device (see previous paragraph):

- Add a layer of imported sand over the Enviro-Septic Contact Area if required.
- Add a layer of 0.30 m of system sand over the Enviro-Septic Contact Area.
- Level lengthwise the surface of sand which will receive the Advanced Enviro-Septic® pipes.

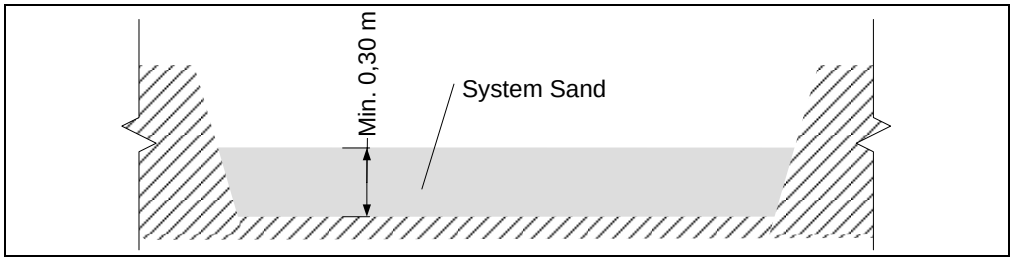


Fig. 58 – Cross-section of the system sand layer (without imported sand)

Installing the Advanced Enviro-Septic® Pipes

- Be sure that the surface of system sand over the Enviro-Septic Contact Area corresponds with the dimensions prescribed in the plan and that it is level the full length in the direction of the pipes.
- Arrange the pipes on the surface keeping in mind the number of rows needed, the number of pipes per row and the center to center spacing (E_{CC}), lateral extension distance (E_L) and end extension distance (E_E).
- The seam side of the geotextile fabric that covers the pipes must be upwards. The 250 mm wide white membrane (bio-Accelerator) must be situated at the bottom of the pipe.
- Assemble the Advanced Enviro-Septic® pipes using the coupling as shown in the plan.
- Level the rows of Advanced Enviro-Septic® pipe from one end to the other.

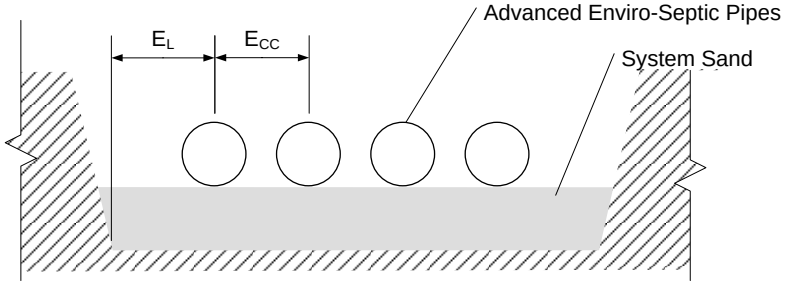


Fig. 59 – Cross-section of Advanced Enviro-Septic® pipes on the system sand (without imported sand)

Installing the Couplings

Couplings are used to join the Advanced Enviro-Septic® pipes and create rows. To put them in place the installer must:

Fig. 60 – Coupling installation

- Pull back the geotextile membrane at the ends of the two pipes to be connected.
- Place the two ends one or two centimetres apart making sure that the seam is on top of the pipes and that the two white membranes are at the bottom.
- Install the coupling on the two Advanced Enviro-Septic® pipes to be joined, being careful to insert the ridges of the couplings in the channels of the pipes.

- Close the upper part of the coupling by inserting the locking tab into the corresponding opening.
- Replace the geotextile membranes over the coupling.
- Keep seams upward.

Fig. 61 – Replacing the membranes over the coupling

Installing the Offset Adapters

Offset Adapters are used to connect the PVC pipe to the Advanced Enviro-Septic® pipes for both air and wastewater. An Offset Adapter must be installed at the end of each row. Offset Adaptors are available in single opening or double openings. Generally, a single offset adapter is used at the beginning of the row while the double offset adapter is installed at the opposite end where the piezometer and aeration pipes (connected to the vent) are located.

To put the offset adapters in place, the installer must :

- Pull back the geotextile membranes at the end of the pipe.
- Push the offset adapter in place so that the locking tabs located on the inside of the adapter locks into the corrugations of the Enviro-Septic pipe.
- In the case of the single offset adapter, the opening must be placed at the top position to facilitate the passage of air at all times.

Fig. 62 – Installation of the single offset adapter

- As for the double adapter, the openings must be vertically aligned (top and bottom).

Fig. 63 - Installation of the double offset adapter (old and new style)

- Replace the geotextile membranes over the adapter.

Row Spacers

While sand may be used to keep the pipes in place while covering, simple tools may also be constructed for this purpose. Here are two examples. One is made from rebar, the other from wood.

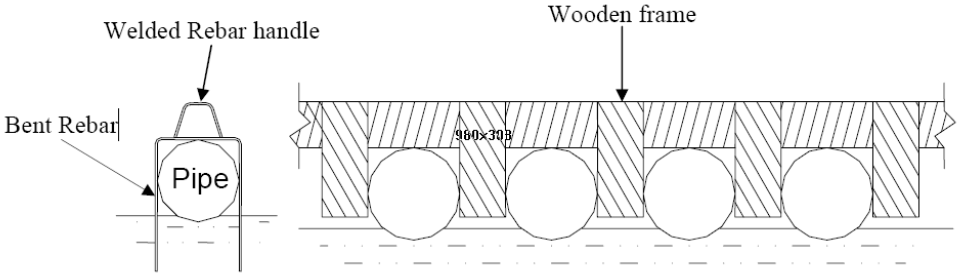


Fig. 64

Caution: Remove all tools used as row spacers before final covering.

Covering the Advanced Enviro-Septic® Pipes

Once the pipes are connected and the adapters properly in place, the installer must spread system sand on the pipes to keep them from moving.

Fig. 65 – Covering the Advanced Enviro-Septic® pipes

- First, add system sand over the couplings to stabilize the rows.
- Next, progressively add system sand along the length of the pipes up to their mid height.
- Push down the system sand by walking on both sides of the Advanced Enviro-Septic® pipes to fill gaps which may have been created under the pipes.

Fig. 66– Filling the void around the Advanced Enviro-Septic® pipes

- Completely cover the pipes with system sand and add an extra layer of a minimum of 100 mm on top of the pipes.

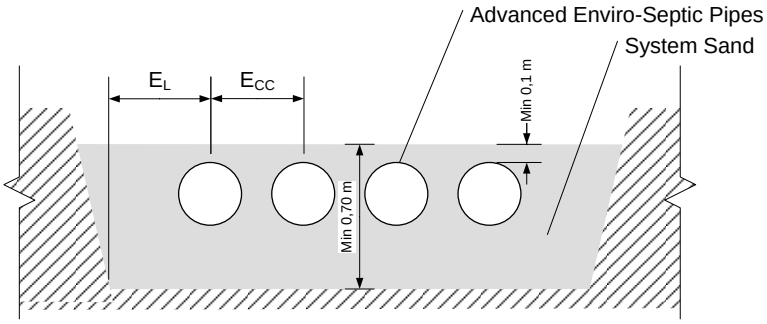


Fig. 67 – Cross-section of the installation.

Piezometers

For each double offset adapter (2 holes) :

- Cut a 100 mm PVC pipe 45 cm long (18 inches).
- Install it horizontally and insert it 100 mm into the bottom opening of the double offset adapter.
- Connect this pipe to a piezometer or to a manifold which will be linked to a piezometer (when one piezometer is used for several rows all at the same level).

For each piezometer :

- Connect each piezometer to the horizontal pipe using a 90^{o} short elbow or a "T" fitting, depending on whether the piezometer serves one or several rows of pipes.
- The piezometer is made of PVC pipe 100 mm in diameter. It needs to be as long as needed in order to be above the final fill or embankment (usually between 55 to 85 cm or 22 to 34 in).
- Add a green cap part of the Enviro-Septic kit on the extremity of each piezometer.

Fig. 68 – Piezometer installation

Vent

- Insert a pipe with a 1% incline, 100 mm into the top hole of each double offset adapter.
- Connect the pipes together using the appropriate fittings.
- Install the vent on the aeration manifold (max 300 m of Advanced Enviro-Septic® pipe per vent)
- Allow sufficient height (min 2000 mm) to avoid the vent opening being buried with snow during winter.

Fig. 69 – Aeration pipe and vent installation

- The PVC pipes must never be inserted more than 100mm (4 inches) into the Advanced Enviro-Septic® pipes.
- Be sure that the ventilation pipes have a 1% slope in the direction of the Advanced Enviro-Septic® pipes so that condensation can flow back to the system at all times.
- Make sure that there is a continuous air circulation between the entry vent located downstream of the Advanced Enviro-Septic® pipes and the exit vent of the residence's plumbing located on the roof.

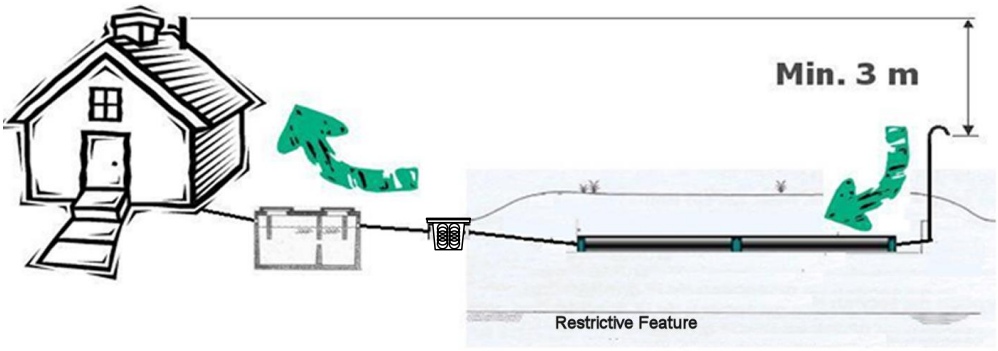


Fig. 70 – Air circulation

Gravitational feed system :

- There must always be a height difference of 3000 mm (10 feet) between the two vents.

System needing a pumping station :

- First choice: install a bypass pipe connecting the pumping station to the Enviro-Septic header manifold using a 100 mm diameter PVC pipe. Make sure to construct the bypass pipe with a high point in such a manner that only air but not water can travel back to the pump station.
- Second choice: install a second vent located on the distribution box or on the Enviro-Septic header manifold. The 3000 mm (10 feet) difference between the entry and exit vents is still required.

Pumping Station (optional)

If a pumping station is required, it must be installed according to the manufacturer's recommendations. The installer must be careful to follow the designer's specifications when programming the pumping cycles. The parameters to consider are:

- Minimum and Maximum volume per cycle.
- Maximum flow of the pump

Velocity reducer

If a pumping station is required to send the water up to the D-Box, a velocity reducer must be used to slow down the flow and encourage an even distribution of water through the equalizers. Install this device according to the plans, upstream from the D-Box.

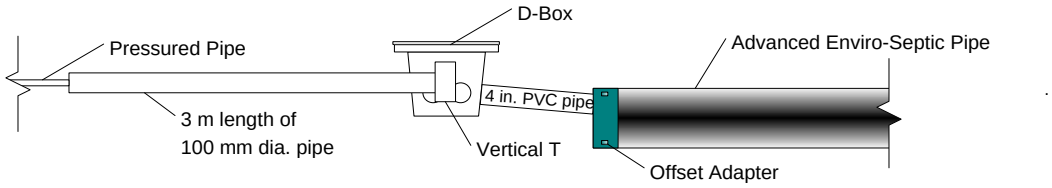


Fig. 71

D-Box Installation

The majority of residential Enviro-Septic® systems use a D-Box as a method of distributing the wastewater between the rows of pipes. The steps to install the distribution box are as follow:

- Create a stable horizontal base of compacted sand.
- Place the distribution box level on the sand surface.
- Correctly place the distribution box keeping in mind that the entry hole is higher than the exit holes. Whenever possible, make sure that the cover will be accessible from the surface for inspection purposes. Use raiser if needed.
- Keep a 1% slope between the exit hole of the septic tank and the entry hole of the distribution box.
- Cut out the plastic of the openings of the distribution box to be used according to the number of distribution pipes to be installed:
  - Cut part of the diameter of the opening with a knife.
  - Gently pull out the remaining part of the circle.
  - Do not try to push in the rubber circle as it may damage the gasket.
  - Repeat these steps for each opening to be used.
- Insert the 100 mm diameter PVC pipes into the distribution box :
  - Insert the pipe approximately 25 mm into the distribution box
  - Twist the pipe to insert it easily
  - Insert the inlet pipe a little further and add a vertical tee in the center position.

Fig. 72

Installation and Balancing of Distribution Box Equalizers™

Equalizers™ are inserted into each of the 100 mm PVC pipes exiting the D-Box. They are used to improve the D-Box performance by balancing the flow to each of the Enviro-Septic Pipes.

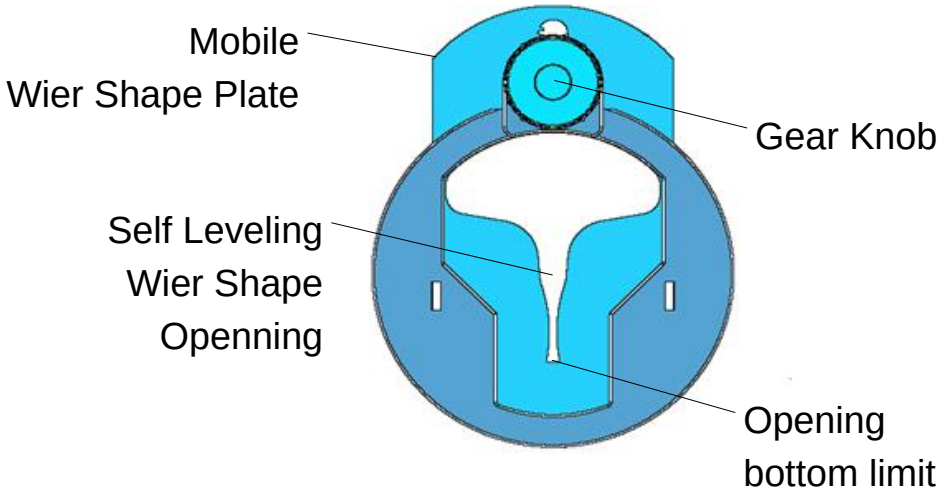


Fig. 73 - Equalizer

The Equalizers™ must be installed and adjusted as follows :

1. Insert one Equalizer unit into each D-Box outlet pipe with the adjustment knob positioned on top.

2. Rotate all adjustment knobs clockwise to the full UP position.

3. Add water into the D-Box until reaching the weir openings of the Equalizers. Using the water as a level, observe which outlet sits lowest in the D-Box and do not adjust the Equalizer fitted to that outlet. Rotate all remaining Equalizer knobs counter-clockwise, moving the weir plate DOWN to match the level of the lowest Equalizer and the water line. Fine tune by slowly adding water to make sure all weir opening outlets are at the same level.

CAUTION: If a D-Box is out of level more than 3/8" (9.5 mm), re-level the box and start again.

Feed, Distribution and Aeration Pipes

Use PVC watertight pipes 100 mm in diameter.

Place the bell opening of the pipes in the direction of the slope.

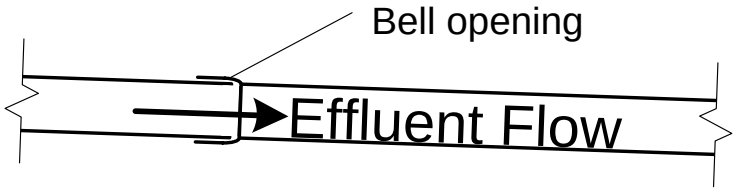


Fig.74

Insert the 100 mm PVC pipes into the Advanced Enviro-Septic® pipes. Use a minimum of 200 mm of pipe between the extremity of the Advanced Enviro-Septic® pipe and the elbow or T of the header manifold.

Fig.75

Fig. 76 – Feed Pipe sloped toward Advanced Enviro-Septic®

Make sure there is a minimum slope of 1% if the section of pipe outside the Advanced Enviro-Septic® pipe is more than 200 mm long. Keep a minimum of 1% slope between the distribution box and the opening of the single offset adapter.

If the slope is steep, make sure the water will be slowed down before entering the pipe to avoid too much movement at the beginning of the row.

Where frost is a concern, add insulation around the D-Box and over the feeding pipes as shown on the following figure.

Fig 77

Final Backfill and Grading

Cover the Advanced Enviro-Septic® pipes with a minimum of 300 mm (maximum 600 mm) of backfill permeable to air with no clay.

Of this 300 mm, the first 100 on top of the pipes must be system sand.

When part of the system is above ground, put the lateral embankment at the required slope as indicated in the plan.

Leave a slight slope on top of the bed. The final grade must permit rainwater to flow toward the exterior perimeter of the system.

Erosion Control

Protect the top of the bed by creating a slight slope to permit water runoff. Plant grassy vegetation to prevent erosion.

Completing the Installation

Starting the System

Be sure that all the installation steps have been followed to the satisfaction of the designer or engineer in accordance with this installation manual and the OBC regulation.

Fill the septic tank with fresh water.

Visualize the aeration circuit to be sure that it is continuous between the entry vent located at the end of the Advanced Enviro-Septic® pipes and the exit vent (min 3000 mm higher) generally located on the roof of the residence or building being served.

If need be, connect the electricity to the pumping station and make sure it is running properly according to manufacturer's directions.

The system is now ready to be used!

Leaving the Site

If the finished grade or landscaping is to be done by others, upon leaving the site, place a stake or several stakes as needed, that mark the finished grade. Also leave a note to explain that vehicular traffic is not allowed on the system.

Administrative File

Fill out the Enviro-Quality form, add the sieve analysis representative of the system sand used and send everything to Makeway Environmental Technologies Inc. in the prepaid postage envelope.

Give the Owner's Manual to the new Enviro-Septic® system owners or inform them that they will be receiving one directly from Makeway Environmental Technologies Inc. upon receipt of the Enviro-Quality form.

Use and Maintenance Guide

Section P – Daily Use

Background

The Enviro-Septic® system is a passive wastewater treatment attached growth technology. Properly installed, the system requires no particular action taken for daily use, intermittent use or after a prolonged absence.

Usage Directions

As with any septic system, attention should be paid to the nature of the wastewater to be treated. It is important that the users of the system follow the direction presented in the Owner's Manual. It gives a detailed list of things to do or not to do in and around the residence or building being served by the system. Not following the directions may lead to clogging or premature aging of the system. If this happens, actions can be taken to regenerate the biomat or to replace certain components if damage warrants it.

What to Do in Case of Problems

If, in the course of normal use of your treatment system, you notice any of the following phenomena:

- presence of abnormal odour in the residence, around the septic system or emanating from sources of drinking water,
- abnormally wet soil, presence of persistent puddles or odours in the area of the septic tank or the Enviro-Septic® system,
- reflux in the toilets or other sanitation devices in the home
- presence of abnormally abundant vegetation on the surface or around the septic tank or the Enviro-Septic® installation
- flooding of the land where the Enviro-Septic® system is installed
- erosion of the land fill on or around the Enviro-Septic® system
- alarm from the pumping station if such a device is part of your installation

… immediately contact your contractor or customer service at Makeway Environmental Technologies Inc. Please have available the information found on your warranty card before contacting anyone.

Section Q – Component Maintenance Program

Background

The Enviro-Septic® system requires only minimal maintenance. In fact, it is just a periodic follow-up. This follow-up could eventually lead to certain maintenance operations.

Note, however, that the septic tank, the pumping station, and the distribution device may need further maintenance according to regulations or directions of the manufacturer of these systems.

Locating the System

The following diagrams will help determine where the system has been installed. Refer to the original drawings for more details.

Enviro-Septic® system components installed below grade

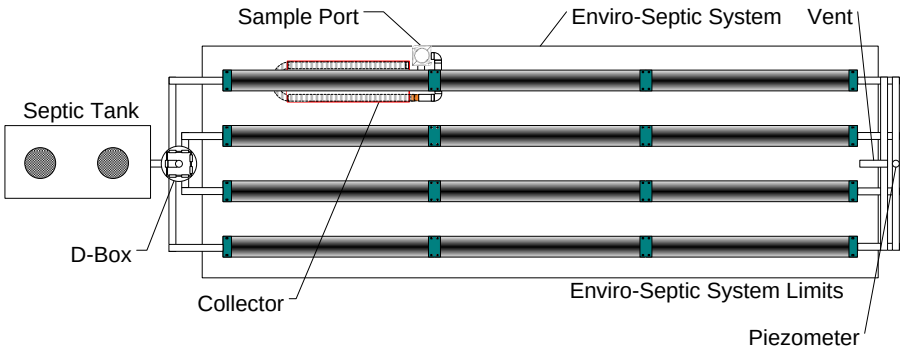


Fig. 78

Enviro-Septic® system components visible above grade

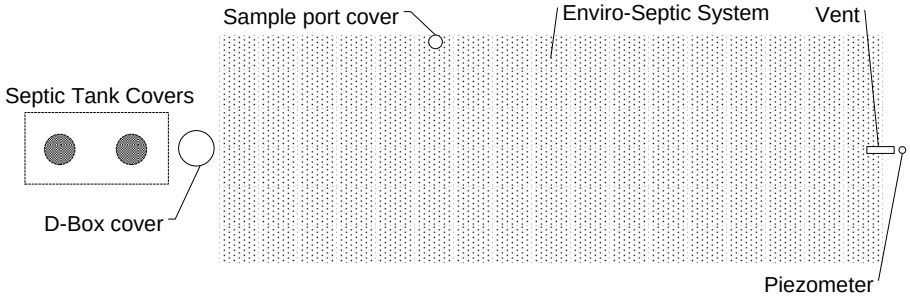


Fig. 79

Note: The positioning of the components may vary according to the configuration used. The broken lines represent the position of the septic tank, the D-Box and the Enviro-Septic® system. If a pumping station is being used an additional cover will be visible above grade.

Septic Tank Maintenance

The Septic tank as part of the Enviro-Septic® system must be emptied regularly according to applicable regulations. Generally it must be inspected every 2 to 4 years to determine when to empty the contents, depending if it is used on a regular or occasional basis. Some local regulations require a pump out program. Check with your local authorities if they have such a requirement. Use an authorized person as defined in regulations to conduct such an inspection.

When emptying the septic tank, the liquid and the solids are to be removed completely. The septic tank is then filled with fresh water.

At all times, the emptying of the septic tank must be done by a person with the proper training and pumping equipment.

It is the owner's responsibility to have the septic tank emptied according to regulations in effect. This work must always be done by a qualified person. It can be very dangerous to open a septic tank without first taking the necessary precautions.

Note: The owner must always be sure that the septic tank covers are properly secured in place. A poorly installed cover is a safety hazard.

Septic Tank Effluent Filter

The Septic tank effluent filter is mandatory. It must be maintained according to the inspection and maintenance procedure recommended by the manufacturer.

Please note that the effluent filter used must not hinder the free passage of air travelling through the system. The top of the effluent filter need to be open.

Distribution Boxes and Equalizers™

Under normal use, the D-Box does not require adjustment. The initial adjustment and the auto levelling (natural adjustment) capacity of the equalizers together maintain a good distribution of water in the rows of Advanced Enviro-Septic® pipes. However, a difference of more than 100 mm in the piezometers between the lowest water level and the highest, on two consecutive measuring, means that the Equalizers™ need adjustment. An authorized maintenance person needs to do this adjustment.

If an adjustment is necessary the technician must do the following:

- Clear and remove the cover of the distribution box.
- Take the Equalizers™ out of the outlet pipes and wash them under running water to remove any accumulation of grease or slime.
- Remove any sludge that has accumulated on the bottom or sides of the distribution box.
- Put the Equalizers™ unit back into each D-Box outlet pipe with the adjustment knob positioned on top.
- Rotate all adjustment knobs clockwise to the full UP position.
- Add water into the D-Box until reaching the weir openings of the Equalizers. Using the water as a level, observe which outlet sits lowest in the D-Box and do not adjust the Equalizer fitted to that outlet. Rotate all remaining

Equalizer knobs counter-clockwise, moving the weir plate DOWN to match the level of the lowest Equalizer. Fine tune by slowly adding water to make sure all weir opening outlets are at the same level.

CAUTION: If the D-Box is out of level more than 3/8" (9.5 mm), re-level the box and start again.

- Put the inside insulation (plastic D-Box) and the cover back on the D-Box being careful that it sits properly on all sides.
- Replace insulation or soil originally found on top or around the D-Box
- Make sure to return the site in its original condition.

Rows of Advanced Enviro-Septic® Pipes

Under normal use, the rows of Advanced Enviro-Septic® pipes need no maintenance.

It is normal to find a certain fluctuation of the water level in the pipes. However, if the water level is equal or higher than 260 mm, an Enviro-Septic® system rejuvenation may be needed. This procedure must be done by an authorized maintenance person (see Section U – System Rejuvenation and Expansion).

Sampling Device Maintenance

The Enviro-Septic® system has a sampling device. A 200 mm diameter sample port with access just above grade will be located on one side of the system, near the extremity of the rows fed by wastewater coming from the septic tank. (see figure 41 to 44).

The sampling device does not need maintenance. It is only necessary to make sure that the cover stays in place.

For more information on the use of the sampling device, consult the section R on the sampling procedure.

Piezometers

Other than making sure that the covers are in place, there is no maintenance to do on the piezometers.

Vent

The vent requires no maintenance. The owner must make sure that nothing hampers the air circulation. In the winter, the vent must be high enough so that the passage of air is not blocked by the snow. At all times, there must be a 3 meter difference in height between the entry vent at the end of the Enviro-Septic® system and the exit vent generally located on the roof of the building.

System Sand

With normal use of the Enviro-Septic® system, there is no maintenance necessary for the sand.

Pumping Station or Low Pressure Distribution System

In some cases, the constraints of the site or the wastewater distribution needs require the use of a pumping station or a low pressure distribution system. The owner is then responsible for respecting the manufacturer's directions for maintenance of this equipment.

A flow measuring device is an option on pumped systems.

Surface of the Fill on top of the Enviro-Septic® System

The surface of the fill on top of the Enviro-Septic® system must be covered with grass. The surface must be slightly sloped so that rain water will run off the system. The grass must also be cut regularly. Any depressions that are produced with time should be filled to avoid water accumulation or erosion on top of the system.

Maintenance Summary Table

The following table shows a summary of the follow up to be done for each of the Enviro-Septic® system components. Maintenance is to be conducted by an authorized person as defined in the regulation and authorized by Makeway Environmental Technologies Inc. as a maintenance provider for Enviro-Septic® systems.

Table 8 – Summary of Maintenance for Enviro-Septic® System Components				
Component	**Function**	**Steps to follow**	**Frequency**	**Responsibility**
Septic Tank	Primary sewage treatment	Periodic emptying	According to standards in effect	Owner (the work must be done by a qualified person)
Effluent filter	Retention of solids too large for the maximum opening of the filter.	According to manufacturer's direction.		
Distribution system A) Distribution box and Equalizers™ B) Low pressure distribution system	Distribute the water from the septic tank to the rows of Advanced Enviro-Septic® pipes.	A) according to the level of water in the piezometers. B) according to manufacturer's directions	A) as needed	A) owner
Rows of Advanced Enviro-Septic® pipes	Distribute and treat wastewater	See piezometers		
Piezometers	Indicate the water level in the pipes	Measures water level	Once or twice a year and as a preventative, before emptying the septic tank.	Qualified personnel
Sampling device	Verify the treatment performance of the Enviro-Septic® system	See sampling procedure section	Prior to each sampling	Qualified personnel
Sampling	Verify the treatment performance of the Enviro-Septic® system	See sampling procedure section	According to BMEC Authorization	Qualified personnel
Vent	Allows air passage through the Enviro-Septic® system	Verify that the opening is not obstructed	During annual inspection	Qualified personnel
System sand	Completes the treatment of the water and encourages its infiltration.	N/A	N/A	N/A
Pumping station (optional)	Lifts the water up to the Enviro-Septic® system	According to specifications and maintenance plan issued by system designer		

Section R – Method of Collecting and Evaluating Samples

Background

The Enviro-Septic® system has a sampling device which can be used to recover the treated water in order to analyze it. The following paragraphs describe how to sample the water in the system.

Materials

Here is a list of necessary materials for taking a sample of the Enviro-Septic® system effluent via the sampling device access tube :

- Flashlight
- Cooler and sampling containers as provided by an accredited laboratory.
- Sampling container attached to a rod to lower the container to collect the sample.

Sampling Procedure

1. Remove the cover from the sample port of the sampling device.
2. Using the rod, lower the container below the inlet pipe at the bottom of the sample port.
3. When water has accumulated in the container, retrieve it and filter the water into the laboratory containers using a 0.25 mm sieve to remove the large particles of sediment which could have fallen off the walls of the sampling device.[11]
4. Put the container on ice and repeat steps 2 and 3 until enough water has been collected to fill all the laboratory containers.
5. Place the analysis containers in the cooler to keep them cool.
6. Pour the unused liquid in the sample port.
7. Replace the covers and put a plastic tag on it. Be sure to leave the area in its initial condition.
8. Indentify properly the laboratory containers and take note in the book of the date and time of the sampling.
9. Quickly take the samples to the laboratory as specified by their measurement protocol.

[11] The sieve is used to obtain a representative result. It is actually less constraining than the sand that the water would have traveled through to get to the surface of the receiving soil had it not been intercepted by the collector of the sampling device.

Visual and Olfactory Techniques to Evaluate the Effluent

If the Enviro-Septic® system is functioning properly, the effluent taken from the sampler should be clear or slightly coloured (yellowish, brownish). Also, it should be relatively translucent. If it has any smell, it should not be strong.

Visual evaluation

Place the sample taken in a container with clear sides. Place the container on a white surface such as a sheet of paper. If the effluent has a dark color or is cloudy, it is a sign that the system might not be functioning normally.

Olfactory evaluation

Holding the open container in your hand, on a horizontal plane, make a slight circular movement making the water swirl inside the container. If a smell of ammonia (sharp bitter smell), of hydrogen sulphur (rotten egg smell) or any other strong smell is noticeable, it is a sign that the system may not be functioning normally.

If any of the potential problem signs is present, proceed to do a BOD, a total suspended solid and an E.-Coli. analysis.

Troubleshooting and Repair Guide

Section S - Component Inspection Procedure

Background

Even though the Enviro-Septic® system does not require any formal maintenance, an annual inspection is mandatory under BMEC authorization, and it is a good thing to ensure proper functioning of the system. The following paragraphs show which elements are to be verified.

Documentation

It is important to keep track of the evolution of the installation. This is why a good follow-up involves compiling data about the state of the system at the time of inspection. Appendix 1 shows a form which can be used for this purpose.

Installation Diagram

It is important to prepare a diagram of the position of the equipment underground. This diagram should show the following elements as well as any other elements that could assist in the location and identification of the system components:

- Tank, sample port and D-Box covers;
- pumping station cover (if present);
- direction of the Advanced Enviro-Septic® pipes;
- location and numbering of the piezometer openings;
- vent.

Here is an example of an Enviro-Septic® system diagram.

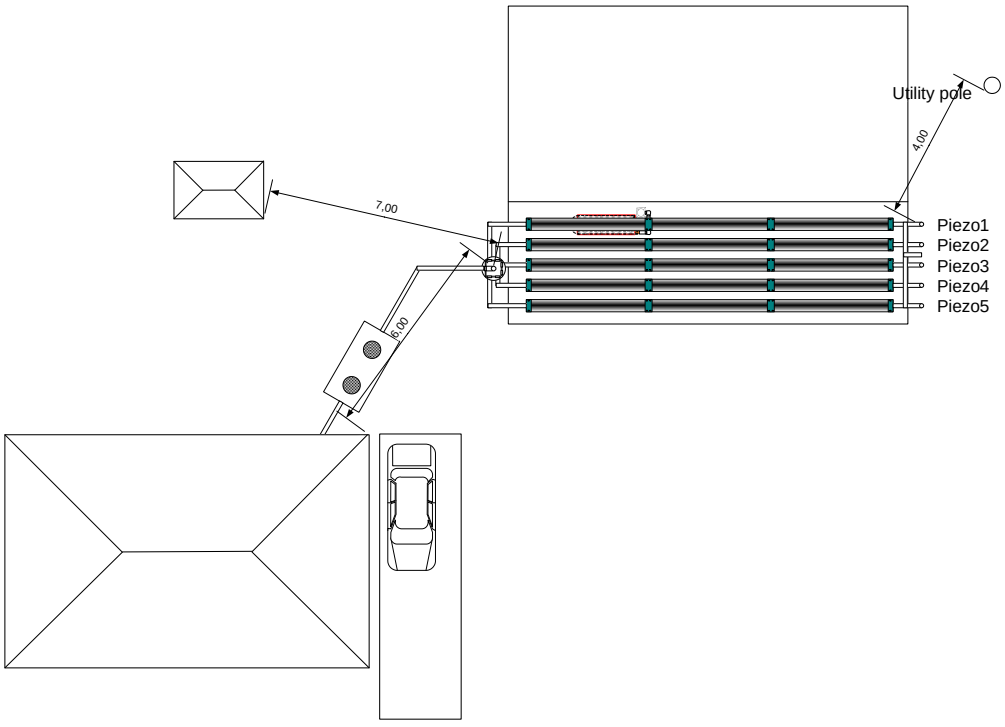


Fig. 80

Necessary Precautions

The water present in the septic tank, the pipes and the piezometers is wastewater. Resurgent water may also be contaminated, so certain precautions must be taken. The person doing the inspection of a septic installation must be properly protected. Work clothing, glasses and protective gloves are to be worn. The use of disposable gloves is recommended. In order to avoid possible contamination, avoid direct contact with wastewater.

Septic Tank

The Septic tank precedes the treatment system. It must be emptied frequently. A record of emptying must be kept by the owner.

At the time of inspection;

- Verify that the covers of the septic tanks are in place, secure and in good condition.
- Verify that water run-off cannot enter the septic tank by the cover or any infiltration point.
- Verify that the soil above and around the septic tank is stable and not spongy which could indicate the presence of a leak.

Visual Inspection

At the time of inspection of the treatment system :

- Verify that the ground is stable above and around the treatment system and that it is grass covered.
- Verify that the lateral embankment have an acceptable slope (not too steep) to avoid eventual erosion problems.
- Determine if there are any forewarnings of a problematic situation such as spongy or soaked ground, presence of unwanted plants, presence of resurgence or soil erosion.

It is suggested to take pictures of the state of the installation at the time of inspection and keep them on file.

Measuring the Water in the Piezometers of the Advanced Enviro-Septic® Pipes

The measurement of the water level in the rows of pipes is done via the piezometers found at the end of the Enviro-Septic® system.

Sequence in which to measure the water level

1- Remove the cover of the piezometer to be measured.
2- Slide a wooden stick or a meter stick into the piezometer so that its end is in the water that might be present at the bottom of the piezometer. Normally a wooden stick one meter long is sufficient. If however your piezometers are deeper, use a longer stick. A piece of string attached to your measuring stick may also be used to lower and raise the stick from the piezometers.
3- Using a ruler (or directly on the meter stick), determine the water level in the pipe by the level of wet surface on the stick. When having difficulty reading it, put fine sand on the stick before putting it into the piezometer. The sand will be mostly gone from the area submerge in water and the reading will be easier.

4- Take note of the water level in the piezometer.
5- Replace the piezometer cover.
6- Wipe the wet area of the stick (or ruler) with a disposable cloth.
7- Repeat these steps for each piezometer.
8- Clean the stick or ruler and the gloves if reusable. Discard disposable gloves and cloths in a closed plastic bag.
9- Record the results obtained in the piezometers section of the follow-up form (see Appendix B).

Other option: Instead of using a stick or meter stick, the reading can be taken using a plunging siphon. A plunging siphon is a small graduated tube used to remove a small quantity of liquid. The technician inserts the plunging siphon to the bottom of the piezometer, closes the top opening with his thumb, then removes the siphon from the piezometer to see the reading.

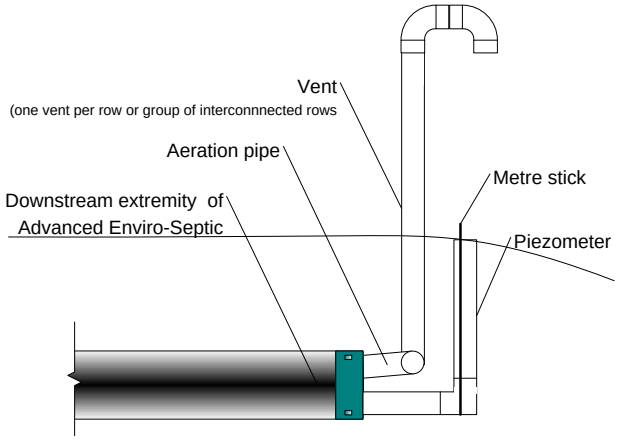


Fig. 81

Adjustment of the Distribution Box Equalizers

If the measurement of water level in the piezometers shows a variation of more than 100 mm between the lowest and the highest piezometers at two consecutive measuring, the Equalizers™ in the D-Box must be adjusted. Proceed to do the adjustment following the directions given in Section O.

Measuring the Water level in the Other Piezometers

Local regulations may require the installation of one or more piezometers to measure the level of the groundwater. These piezometers can be installed in the center of the treatment system or in the area surrounding it.

If these piezometers exist, take the reading of the water level in them and record the results on the follow-up form.

Section T - Replacement or Repair of Components

Sign of a System not Functioning Normally

If the Enviro-Septic® system presents any of the following phenomena, it is not functioning normally:

- abnormally wet soil, presence of persistent puddles or odours in the area of the septic tank or the Enviro-Septic® system
- Reflux in the toilets or other sanitation devices in the home
- presence of abnormally abundant vegetation on the surface or around the septic tank or the Enviro-Septic® installation
- flooding of the soil where the Enviro-Septic® system is installed
- erosion of the backfill on or around the Enviro-Septic® system
- Advanced Enviro-Septic® pipes filled with water
- alarm from the pumping station if such a device is part of your installation

Possible Causes

Several elements may be the cause of a system malfunction. They can be grouped into three major categories.

- Hydraulic Overloading (leaking fixture in the house, infiltration water in tank, D-Box or wastewater fed pipes, possible over use of water)
- Organic Overloading
- Inadequate air circulation
- Inadequate maintenance of septic tank
- Pollutant concentration higher than domestic wastewater

Each of these categories will be analyzed in detail in the paragraphs to follow.

Hydraulic Overloading

Possible causes of Over Loading

There is too large a volume of water going into the system.

The system sand does not meet the specifications and the water movement through the sand is restricted.

Table 9 shows the most foreseeable causes and their solutions.

Table 9 **Hydraulic Over Loading**

Problem	Possible Causes	Solutions
Volume of water from the residence is over the design flow	• The use of water in the residence is not as expected. The number of occupants is greater than planned. The activities in the residence are generating a larger water volume than normal or than was expected.	• Take readings on the water meter to measure the water flow used in the residence in order to show the client that his activities are generating too large a volume of water for the system. • Get the owner to modify the activities or habits of the occupants so as to respect the system's capacity. • Increase the capacity of the installation.
	• The plumbing in the residence is in poor condition and leaks are causing an increase in the normal flow.	• Repair the plumbing in order to avoid unwanted water entering the treatment system.
	• Unwanted water is seeping in to the system. To verify this condition, cut all known sources of water use in the residence and see if water continues to run into the septic tank. Here are a few examples of possible causes: • the exit of the building's drain pipes is connected to the treatment system. • the pipe for the swimming pool backwash is connected to the treatment system. • water runoff is getting into the septic tank via the cover or an unsealed joint. • The water from gutters or drainage trenches is being directed to the septic tank.	• Eliminate the unwanted water from the volume of wastewater to be treated. • Direct water from the drain pipe to the ditch or rain gutter. • Direct water from the swimming pool to the ditch or rain gutter. • Raise the cover or seal the joints so that groundwater cannot enter the septic tank. • Direct this water to the drain pipe, ditch or rain gutter.
Unwanted water entering directly into the treatment system	• The treatment system is made up of sand and Advanced Enviro-Septic® pipes. In certain conditions, it may be receiving water not coming from the septic tank. This water increases the hydraulic load imposed on the surface of the receiving soil. The infiltration capacity is overextended and water accumulates. Here are some examples of possible causes: • The system is not covered with soil and grass. • There is a depression in the surface on top of the system where water accumulates and then infiltrates. • The system is on a slope and streaming water or groundwater is infiltrating into it.	• Modifications must be made to redirect this water to the normal drainage ditches. A drainage trench is a possible solution. • Complete the covering making a slight slope towards the exterior of the system and cover with grass. • Fill the depression with dirt, leaving a slight slope toward the exterior of the system and cover with grass. • Make a drainage trench to intercept this water and direct it to a ditch.

Table 9 (continued) **Hydraulic Over Loading**

Problem	Possible Causes	Solutions
Rise in the groundwater table	• The addition of treated water to the receiving soil causes an increase in the level of the groundwater table the size of which depends on the site. In certain conditions this increase in level may come up to the treatment system.	• Increase the surface of the system to diminish the hydraulic load of the receiving soil and thus reduce the increase in the groundwater table. • Reduce the volume of wastewater generated, as the evacuation capacity of the soil is less than the flow foreseen in the design.

Deficient air circuit

The aeration circuit is important to the proper functioning of the Enviro-Septic® system, as it permits the passage of air necessary to feed the bacteria responsible for the treatment of wastewater. If the air is cut off, the bacteria develop anaerobically creating a danger of clogging. Therefore it is important to re-establish the aeration circuit if it is cut.

Table 10 shows the most foreseeable causes and their solutions.

Table 10 **Deficient Aeration Circuit**

Problem	Possible causes	Solutions
The air is cut off	• There is no entry vent.	• All systems must have at least one entry vent per 300 linear meters of pipes.
	• There is no exit vent or there is not 3 meters of height difference between the entry and exit vents.	• All systems must have an exit vent. At best, it should be placed on the roof of the residence or building and there must be a height difference between it and the entry vent of at least 3 meters.
	• There is a pumping station but no diversion pipe for air passage. • The slope of the aeration pipe is not toward the Enviro-Septic® system, so condensation accumulates and cuts off the air passage.	• A diversion pipe or high vent must be installed to ensure air passage. • The pipe must be adjusted correctly. This implicates having a 1% slope toward the Advanced Enviro-Septic® pipes or a drainage point for the condensation.
	• A vent is obstructed (Ex. by snow).	• Vents must be kept clear to permit air passage.

Denatured Wastewater

The Enviro-Septic® system is designed to treat water of a domestic nature. If the wastewater entering the system is not what was foreseen, the bacterial development may be affected thus decreasing the level of treatment or even increasing the danger of clogging.

Table 11 shows the most foreseeable causes and their solutions.

Table 11 **Denatured Wastewater**

Problem	Possible causes	Solutions
The water is too saturated	• The septic tank contains a lot of grease or sludge. It hasn't been emptied recently so the usable volume is reduced and a lot of sediment is passing into the treatment system.	• Have the septic tank emptied and explain to the owner the importance of doing this regularly.
	• The activities of the occupants are not as expected (Ex: restaurant, food production, etc.)	• Speak to the owner about this to discuss a change in activities or an upgrading of the treatment system.
	• The septic tank is very clean, but the owner puts additives in his water so a lot of solid ends up in the treatment system.	• Explain to the owner why he should stop using these additives.
	• There are a lot of non-assimilated elements in the septic tank.	• Determine and eliminate the source of the non-assimilated elements.
	• A garbage disposal unit is used in the residence.	• Ask the owner to remove this equipment as it is damaging to the installation.
The water is loaded with chemicals	• Paint or other chemical products have been discharged into the treatment system.	• Explain to the owner the importance of not putting these products in his wastewater.
	• The occupants use large quantities of cleansers.	• Recommend that the occupants use reduced phosphate cleansers and less of them.

Pumping Station

For any problems related to the pumping station refer to the manufacturer's instructions.

Replacement of One of the System Components

Minimal precautions must be taken if one of the system components needs to be replaced.

- Stop the generation of wastewater.
- Remove and properly dispose of the contaminated liquid.
- Remove the piece of equipment and replace it with an equivalent piece. If it is a section of Advanced Enviro-Septic® pipe that needs replacing, make sure to replace the sand properly around it. If the sand is contaminated, dispose of it properly and replace it with new sand.
- Verify that the connections are watertight when required and that the necessary slopes are present.
- Re-cover using the required layers of materials and cover with grass.

For replacement of the pumping station, verify with the manufacturer's directions.

Section U – Rejuvenation Process and Expansion

Introduction

This section covers procedures for rejuvenating failing systems and explains how to expand existing systems.

Definition: Failing System

System failures, almost without exception, are related to the conversion of bacteria from an aerobic to an anaerobic state. Flooding, improper venting, alteration or improper depth of soil, sudden use changes, introduction of chemicals or medicines, and a variety of other conditions can contribute to this phenomenon.

It is normal to find a certain level of water in the rows of Advanced Enviro-Septic® pipes. It is also normal to notice a fluctuation in the water level with time. But, when the system has been misused, a large level of clogging may occur around the pipes.

An elevated level of water for a long period may be a sign of clogging. Luckily, the Enviro-Septic® system has the ability to regenerate itself. In other words, it is possible to recreate practically the original conditions of the system.

When Should we Consider Rejuvenation

A rejuvenation process can be expected if the water level in the piezometers is above 260 mm (10.5 inches), and the sand around the pipes is not saturated with water. If the sand is saturated with water, you must first re-establish hydraulic balance in the system. After that, once the effluent is drained from the sand, a rejuvenation process should be done if the water level does not go down in the rows of pipes.

Three Types of Rejuvenation

There are three rejuvenation processes possible.

1. The natural rejuvenation happens through reduction in use of the septic installation for a period of a few days or weeks (ex. Period of absence for vacation). No intervention is required for this type of rejuvenation.
2. The forced rejuvenation consists of emptying the septic tank and removing the water from the rows of Advanced Enviro-Septic® pipes at the same time. This form of rejuvenation is the most common and the easiest to do.
3. The forced rejuvenation and cleaning consists of emptying the septic tank and the removal of water and any inorganic materials which have accumulated in the pipes over a number of years. This type of rejuvenation requires a more important intervention. It is required in the case where the system has been subjected to abuse or after many years of use.

Precautions to be Taken

The forced rejuvenation process must be done by a qualified person.

Exceptionally, when doing a forced rejuvenation, the septic tank is not filled with clear water as in the case of a normal emptying. This process must be done at a time when the level of the groundwater table is low and there is no danger that a hydrostatic pressure force on the septic tank.

The fact of not filling the septic tank gives the system 2 or 3 days rest even though the occupants of the residence are continuing their normal activities. Evidently, the tank can be filled with clear water if the rejuvenation process is done just before the occupants of the residence leave for a prolonged period of absence.

Preventive measure when emptying the septic tank

It is recommended to verify the water level in the piezometers a few days before normal emptying of the septic tank (see measuring water levels). If the water level is too high, it is possible to use the emptying of the septic tank to do a forced rejuvenation process.

Rejuvenating Failing Systems

Failing systems need to be returned from an anaerobic to an aerobic state. Most systems can be put back on line and not require costly removal and replacement by using the following procedure.

1. Determine the problem causing system failure and repair.
2. Drain the system through the piezometers installed at the extremities of the rows of Advanced Enviro-Septic® pipes or sections of rows of pipes. If the pipes need to be cleaned, pass a cleaning nozzle while pumping out the water and any dislodged debris. Under certain circumstances, this operation may require excavation at the ends of the rows of pipes. The ventilation pipes, piezometers and the offset adapters are then taken out for better access to the pipes and thus a more efficient cleaning.
3. If foreign matter has entered the system, flush the pipes.
4. Safeguard the open excavation.
5. Guarantee a passage of air through the system.
6. Allow all rows of pipes to dry for a minimum of 72 hours.
7. Re-assemble the system to its original design configuration.

System Expansion

Enviro-Septic® systems are easily expanded by adding equal lengths of pipe to each row of the original design or by adding additional equal sections.

Note: All system expansions need to meet the province and/or local regulations.

Re-usable Pipe

Enviro-Septic® components are not biodegradable and may be reused. In cases of improper installation it may be possible to excavate, clean, and reinstall all system components.

Closing Words

The information in this manual is subject to change without notice. Your suggestions and comments are welcome. Please contact us at:

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Website: www.enviro-septic.com

Appendix 1 - System Follow Up Form

Follow up report – Enviro-Septic® system

Coordinates: Last name: _____First name:_____
Address:_____
City:_____Postal Code _____
Date of report: _____

Photo taken :_____

Technician on site :_____ _____

Pipes: ☐ Traces of important water level fluctuation in the pipes
☐ Feed pipes slope problem

Vegetation: ☐ System not covered with grass.
☐ Presence of unwanted plants nearby

Odour: ☐ At the entry vent ☐ At the exit vent

Vent: ☐ No roof vent
☐ 3 meter differential not respected

Fill: ☐ Nonconforming slope. Too steep

Resurgence ☐ Visible resurgence

Sampling ☐ Cleaning of sampling device ☐ Sample taken

Distribution ☐ Adjustment of equalizers

Flow meter or water meter: _____ units:_____

Water level in the piezometers at the end of the rows of Enviro-Septic® pipes (mm)

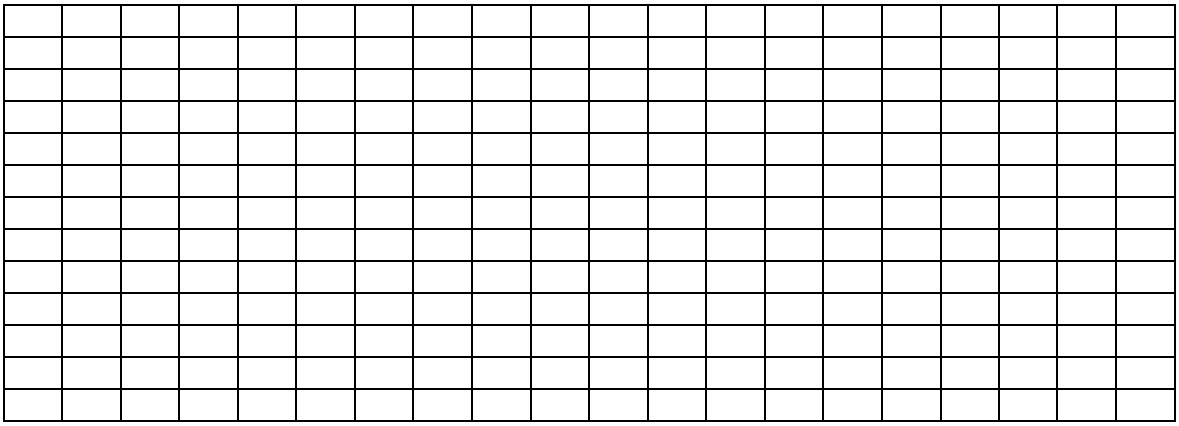
No 1	No 2	No 3	No 4	No 5
No 6	No 7	No 8	No 9	No 10
No 11	No 12	No 13	No 14	No 150
No 16	No 17	No 18	No 19	No 20

The technician must indicate on the diagram the position of the piezometers measured and the numbering used.

Water level in the other piezometers. For each piezometer:

No. _____
Bottom measurement of piezometer_____
Top measurement of piezometer_____

Installation diagram (1 square = 1 m):



Other notes:

Appendix 2 – Examples of In Ground Enviro-Septic Systems

Context

This section will show examples of how to design an in ground Enviro-Septic® system using the steps described in the design manual.

In Ground System – Scenario 1, 5 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 5 min/cm ($T \leq 6$ min/cm)
- Minimum Vertical Separation 0.60 m
- Distance between original grade and High water table, Bedrock or clay is 1.5 m or more.

The system can be designed as an in ground system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual are met.

Pre-treatment Design

All raw sewage will enter into a septic tank sized in accordance with Clause 8.2.2.3 of the Ontario Building Code. Specifically, the septic tank shall have a minimum of 2 days retention time for residential wastewater and 3 days retention time for non-residential sewage flows. The septic tank shall also have two compartments as required by the Code and be equipped with an effluent filter. At no time shall the tank be less than 3600 L working capacity as stated in Clause 8.2.2.3.

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d, $S_E = QT / 400$

$$S_E = (2000 \times 5) / 400$$
$$S_E = 25 \text{ m}^2$$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From table 3.2, the recommended minimum center to center pipe spacing is 0.45 m. With regards to E_L and E_E, (see figure 6) the recommended minimum distance is 0.45 m and 0.3 m respectively.

Following the requirements of the Ontario Building Code it is recommended that no row be greater than 30 m in length. Assuming we will use a configuration of 6 rows of 4 pipes, we have:

$$S_{SR} = [L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)]$$
$$S_{SR} = [12.2 + (2 \times 0.3)] \times [(0.45 \times (6 - 1)) + (2 \times 0.45)]$$
$$S_{SR} = 12.8 \times (2.25 + 0.9) = 40.32 \text{ m}^2$$

Since $S_{SR} > S_E$, we will use 40.32 m^2 as the minimum value for the Enviro-Septic® Contact area.

Note: The choice of the pipe and row configuration is done taking into consideration the site constraints. Note that the minimum surface required for spacing requirements will change slightly from one configuration to another. For our example, a configuration of 3 rows of 8 pipes per row would require a surface of 45 m^2.

System Layout

Now we have all dimensions.

$E_{CC} = 0.45$ m
$E_E = 0.30$ m
$E_L = 0.45$ m
$L_R = 12.2$ m
Length of System= $[L_R + (2 \times E_E)] = 12.8$ m
Width of System= $[(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 3.15$m
Enviro-Septic® minimum contact area = 40.32 m^2

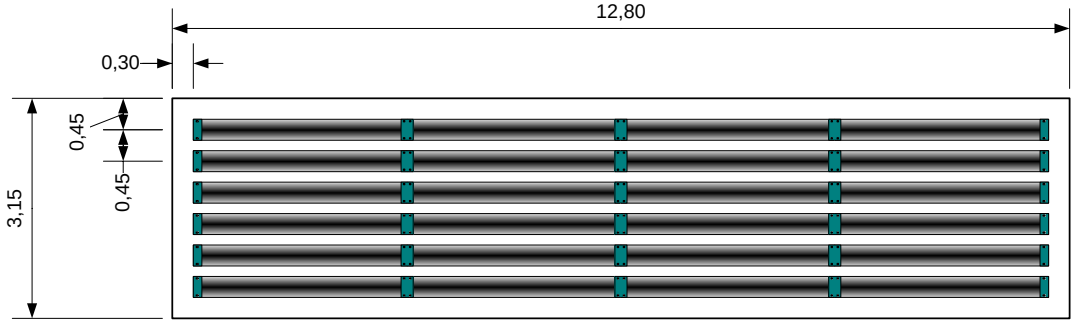


Fig. 82 - Top view of the system configuration

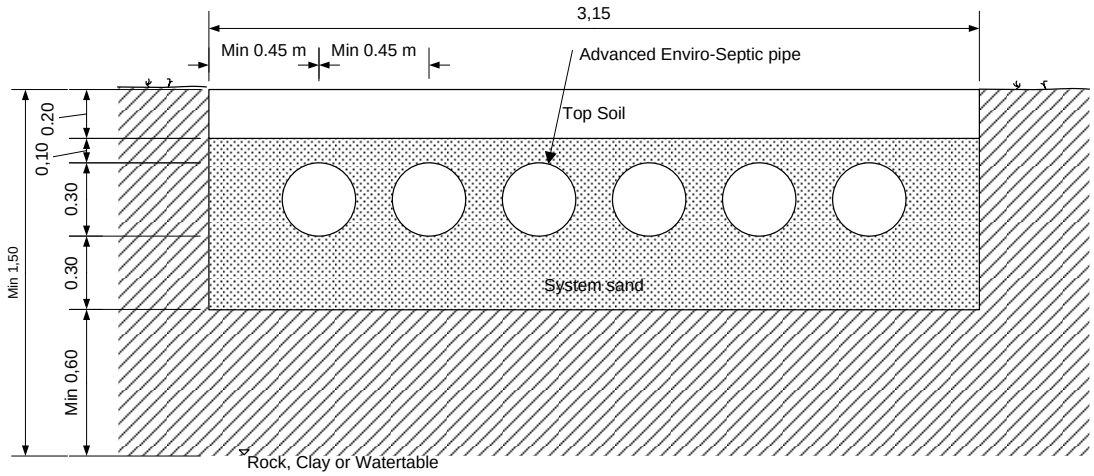


Fig. 83– Cross-section of the system configuration

In Ground System – Scenario 2, 20 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 20 min/cm ($6 < T \leq 50$ min/cm)
- Minimum Vertical Separation 0.45 m
- Distance between original grade and high water table, bedrock or clay is 1.35 m or more.

The system can be designed as an in ground system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual are met.

Pre-treatment Design

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Enviro-Septic® Pipe Sections

We need a minimum of one Advanced Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{ESP} = Q / 90$$
$$N_{ESP} = 2000 / 90 = 22.22$$
$$N_{ESP} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Advanced Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d, $S_E = QT / 400$

$S_E = (2000 \times 20) / 400$

$S_E = 100\ m^2$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From the previous example we already know that, using E_{CC} = 0.45 m, E_L = 0.45 m and E_E = 0.3 m respectively and assuming a configuration of 6 rows of 4 pipes, we have:

$$S_{SR} = 12.8 \times (2.25 + 0.9) = 40.32\ m^2$$

Since $S_{SR} < S_E$, we will use 100 m^2 as the minimum value for the Enviro-Septic® Contact area.

System Layout

Now, we need to determine the required spacing between the Enviro-Septic rows to spread the pipes over the minimum contact Area. Using the following formula

$L_R = 4 \times 3.05 = 12.2$ m

Length of System x Width of System = 100 m^2

$[L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 100\ m^2$

$[L_R + (2 \times (E_L - 0.15)] \times [(2E_L \times (N_r - 1)) + (2 \times E_L)] = 100\ m^2$

With those equation, we can determine the following values :

Enviro-Septic® minimum contact area = 100 m^2

E_L = 0.67 m (min 0,45 m)

E_{CC} = 1.25 m (min 0,45 m)

E_E = 0,5 m (min 0,3 m)

L_{System} = 13,2 m

W_{System} = 7.65 m

Enviro-Septic Contact Area = 100.2 m^2

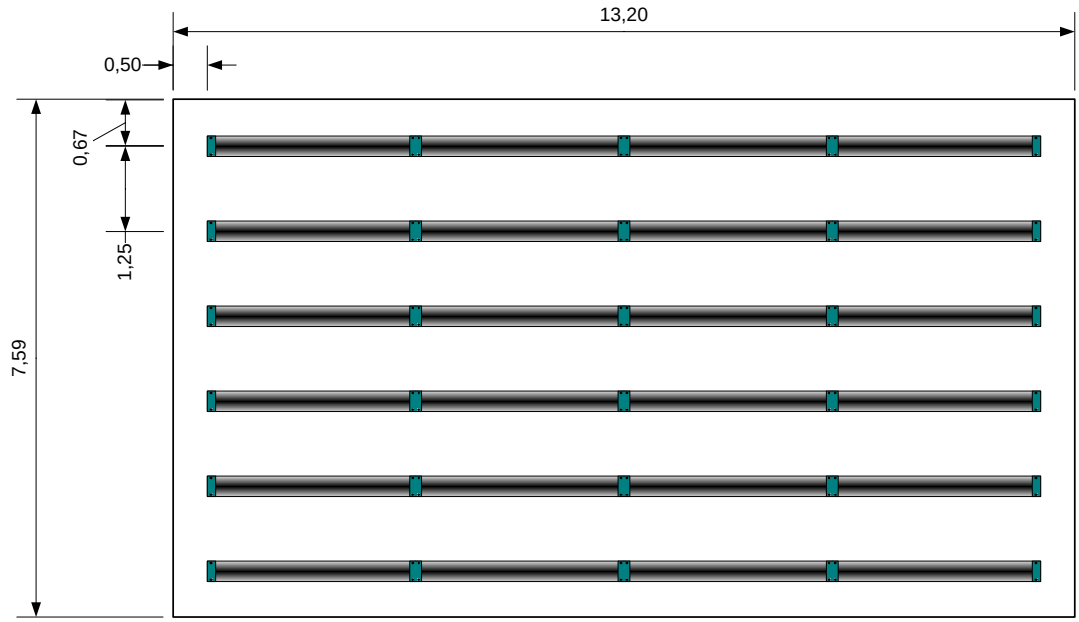


Fig. 84 - Top view of the system configuration

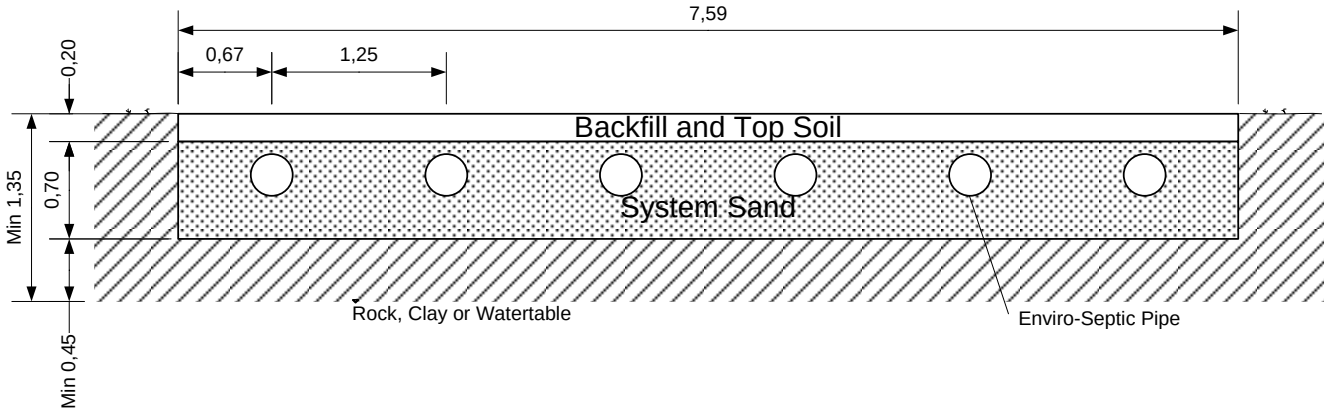


Fig. 85 – Cross-section of the system configuration

In Ground System – Scenario 3, 40 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 40 min/cm ($15 < T \leq 50$ min/cm)
- Minimum Vertical Separation 0.45 m
- Distance between original grade and high water table, bedrock or clay is 1.35 m or more.

The system can be designed as an in ground system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual are met.

Pre-treatment Design

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic™ Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23×3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d,

$$S_E = QT / 400$$
$$S_E = (2000 \times 40) / 400$$
$$S_E = 200 \text{ m}^2$$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From the previous example we already know that, using $E_{CC} = 0.45$ m, $E_L = 0.45$ m and $E_E = 0.3$ m respectively and assuming a configuration of 4 rows of 6 pipes, we have:

$$S_{SR} = 18.9 \times (1.35 + 0.9) = 42.525 \text{ m}^2$$

- Since $S_{SR} < S_E$, we will use 200 m^2 as the minimum value for the Enviro-Septic® Contact area.

System Layout

Now, we need to determine the required spacing between the Enviro-Septic rows to spread the pipes over the minimum contact Area. Using the following formula

$L_R = 6 \times 3.05 = 18.3$ m

Length of System x Width of System = 200 m^2
$[L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 200\ m^2$
$[L_R + (2 \times (E_L - 0.15)] \times [(2E_L \times (N_r - 1)) + (2 \times E_L)] = 200\ m^2$

With those equation, we can determine the following values :

Enviro-Septic® minimum contact area = 200 m^2
E_L = 1.25 m (min 0,45 m)
E_{CC} = 2.45 m (min 0,45 m)
E_E = 1.05 m (min 0,3 m)

L_{System} = 20.4 m
W_{System} = 9.85 m

Enviro-Septic Contact Area = 200.9 m^2

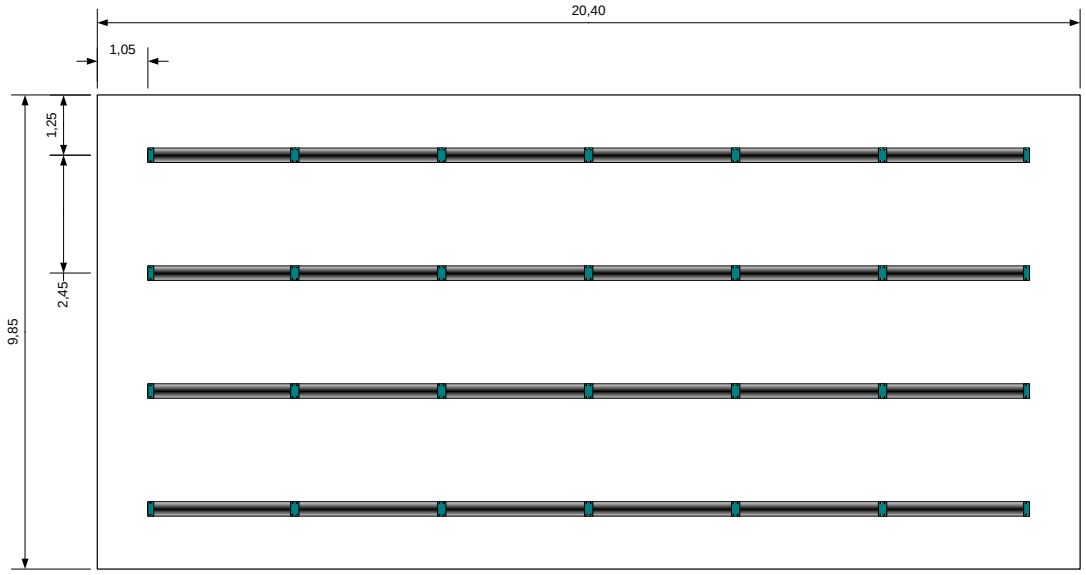


Fig. 86 - Top view of the system configuration

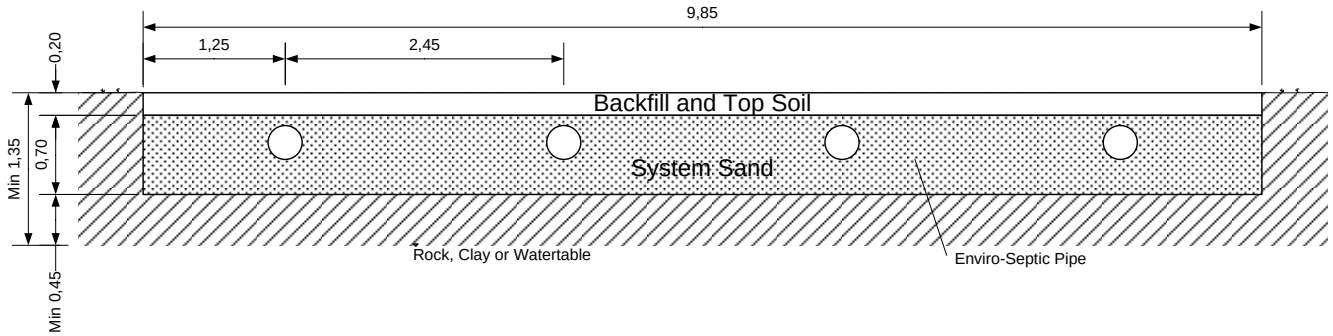


Fig. 87 – Cross-section of the system configuration

In Ground System – Scenario 4, 80 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 80 min/cm (T > 50 min/cm)

This system can't be designed as an in ground system because the percolation time of the native soil is slower than 50 min/cm.

Appendix 3 – Examples of Partially Raised Enviro-Septic Systems

Context

This section will show examples of how to design a partially raised Enviro-Septic® system using the steps described in the design manual.

Partially Raised System – Scenario 5, 5 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 5 min/cm ($T \leq 6$ min/cm)
- Minimum Vertical Separation 0.60 m
- Distance between original grade and high water table, bedrock or clay is 1 m (distance needs to be more than 0.6 m, but less than 1.5 m) .

The system can be designed as a partially raised system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual can be met by partially raising the system.

Pre-treatment Design

All raw sewage will enter into a septic tank sized in accordance with Clause 8.2.2.3 of the Ontario Building Code. Specifically, the septic tank shall have a minimum of 2 days retention time for residential wastewater and 3 days retention time for non-residential sewage flows. The septic tank shall also have two compartments as required by the Code and be equipped with an effluent filter. At no time shall the tank be less than 3600 L working capacity as stated in Clause 8.2.2.3.

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d, $S_E = QT / 400$
$S_E = (2000 \times 5) / 400$
$S_E = 25\ m^2$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From table 3.2, the recommended minimum center to center pipe spacing is 0.45 m. With regards to E_L and E_E, (see figure 6) the recommended minimum distance is 0.45 m and 0.3 m respectively.

Following the requirements of the Ontario Building Code it is recommended that no row be greater than 30 m in length. Assuming we will use a configuration of 6 rows of 4 pipes, we have:

$S_{SR} = [L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)]$
$S_{SR} = [12.2 + (2 \times 0.3)] \times [(0.45 \times (6 - 1)) + (2 \times 0.45)]$
$S_{SR} = 12.8 \times (2.25 + 0.9) = 40.32\ m^2$

Since $S_{SR} > S_E$, we will use 40.32 m^2 as the minimum value for the Enviro-Septic® Contact area.

Note: The choice of the pipe and row configuration is done taking into consideration the site constraints. Note that the minimum surface required for spacing requirements will change slightly from one configuration to another. For our example, a configuration of 3 rows of 8 pipes per row would require a surface of 45 m^2.

System Layout

Now we have all dimensions.

$E_{CC} = 0.45$ m
$E_E = 0.30$ m
$E_L = 0.45$ m
$L_R = 12.2$ m
Length of System= $[L_R + (2 \times E_E)] = 12.8$ m
Width of System= $[(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 3.15$m
Enviro-Septic® minimum contact area = 40.32 m^2

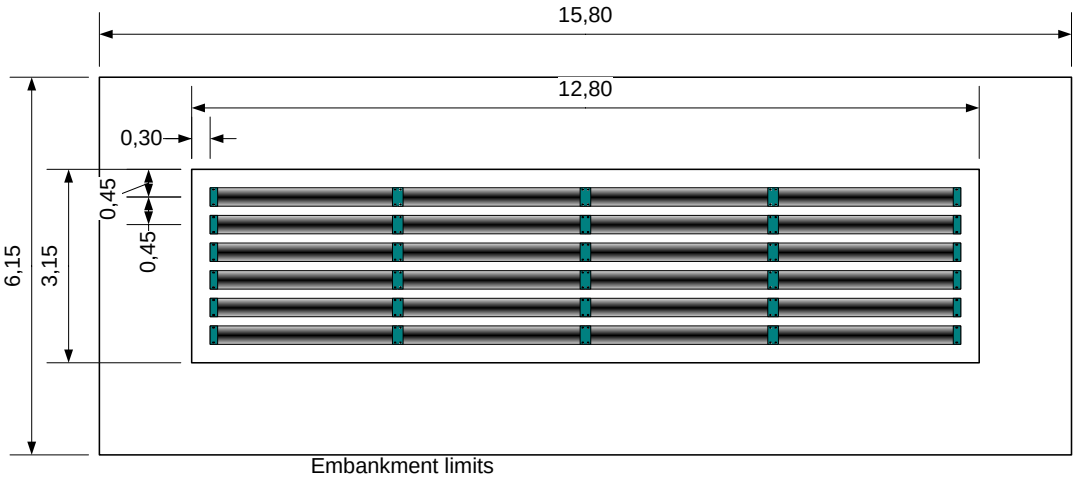


Fig. 88 - Top view of the system configuration

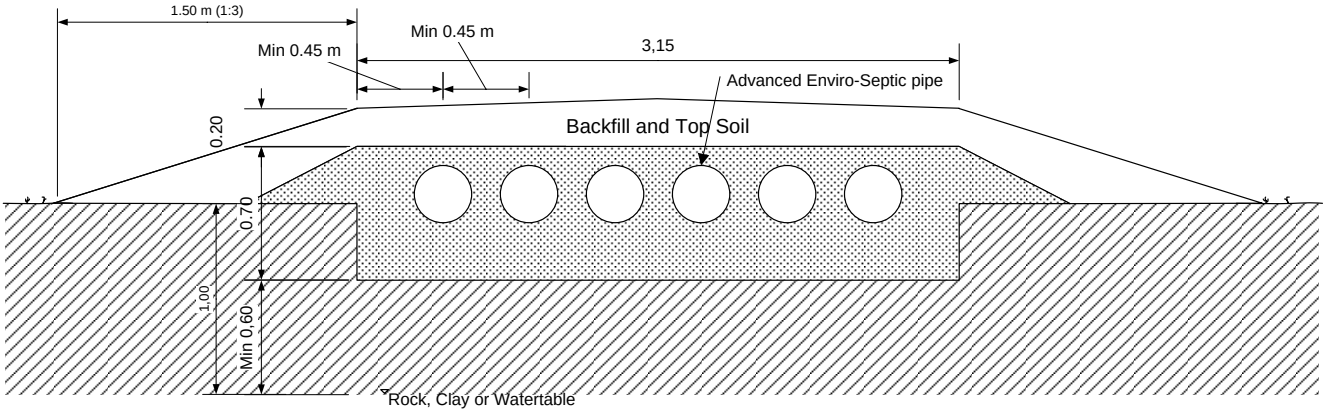


Fig. 89 – Cross-section of the system configuration

Partially Raised System – Scenario 6, 20 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 20 min/cm ($15 < T \leq 50$ min/cm)
- Minimum Vertical Separation 0.45 m
- Distance between original grade and high water table, bedrock or clay is 1 m (distance needs to be more than 0.45 m, but less than 1.35 m).

The system can be designed as a partially raised system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual can be met by partially raising the system.

Pre-treatment Design

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d,

$$S_E = QT / 400$$
$$S_E = (2000 \times 20) / 400$$
$$S_E = 100 \text{ m}^2$$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From the previous example we already know that, using E_{CC} = 0.45 m, E_L = 0.45 m and E_E = 0.3 m respectively and assuming a configuration of 6 rows of 4 pipes, we have:

$$S_{SR} = 12.8 \times (2.25 + 0.9) = 40.32 \text{ m}^2$$

- Since $S_{SR} < S_E$, we will use 100 m^2 as the minimum value for the Enviro-Septic® Contact area.

System Layout

Now, we need to determine the required spacing between the Enviro-Septic rows to spread the pipes over the minimum contact Area. Using the following formula

$$L_R = 4 \text{ x } 3.05 = 12.2 \text{ m}$$

Length of System x Width of System = 100 m^2

$$[L_R + (2 \times E_E)] \text{ x } [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 100 \text{ m}^2$$
$$[L_R + (2 \times (E_L - 0.15)] \text{ x } [(2E_L \times (N_r - 1)) + (2 \times E_L)] = 100 \text{ m}^2$$

With those equation, we can determine the following values :

Enviro-Septic® minimum contact area = 100 m^2

E_L = 0.67 m	(min 0,45 m)
E_{CC} = 1.25 m	(min 0,45 m)
E_E = 0,5 m	(min 0,3 m)

L_{System} = 13,2 m
W_{System} = 7.65 m

Enviro-Septic Contact Area = 100.2 m^2

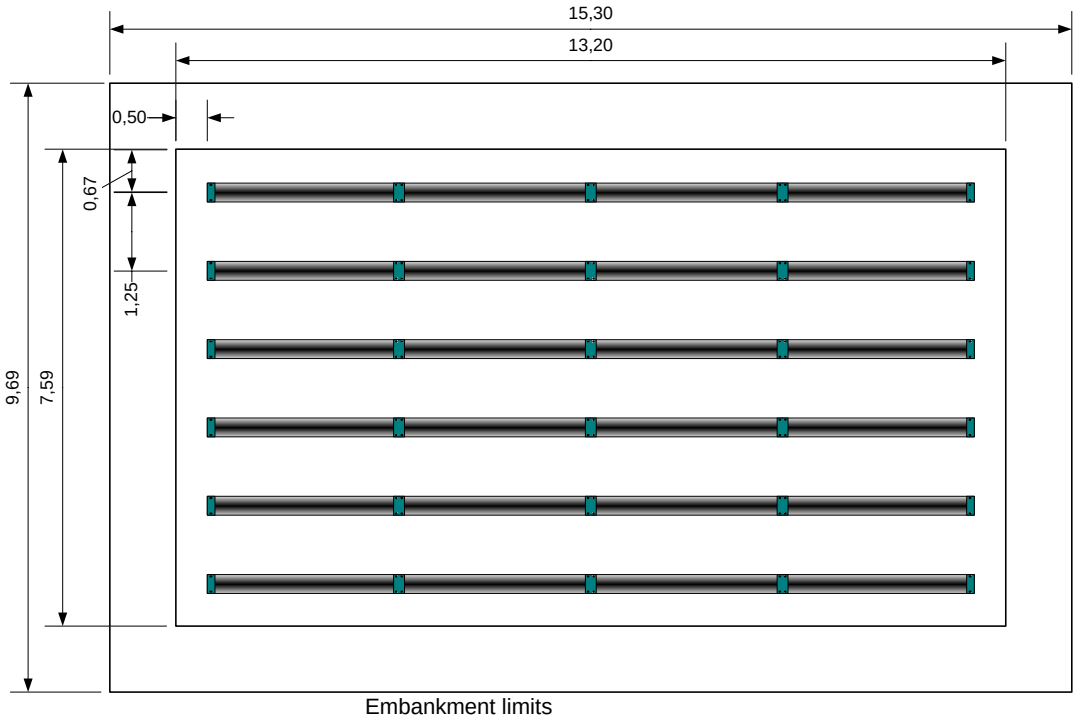


Fig. 90 - Top view of the system configuration

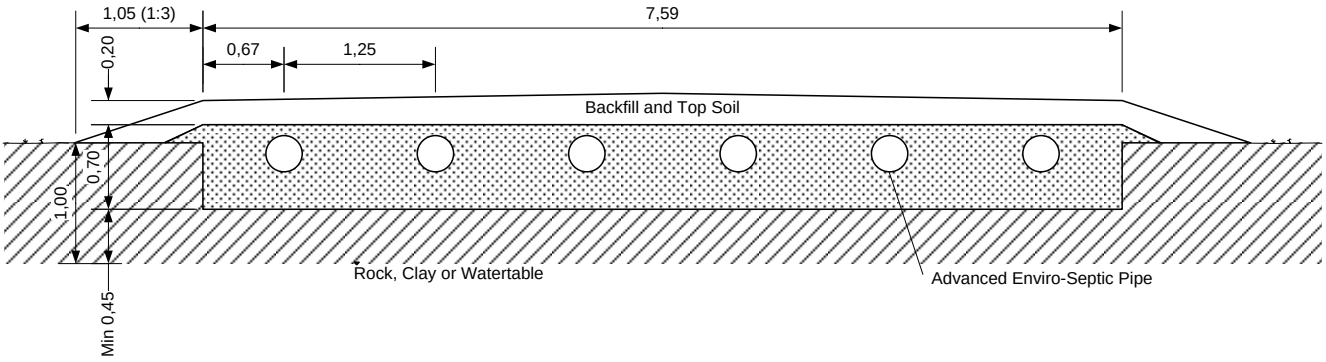


Fig. 91 – Cross-section of the system configuration

Partially Raised System – Scenario 7, 40 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 40 min/cm ($6 < T \leq 50$ min/cm)
- Minimum Vertical Separation 0.45 m
- Distance between original grade and high water table, bedrock or clay is 1 m (distance needs to be more than 0.45 m, but less than 1.35 m).

The system can be designed as a partially raised system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual can be met by partially raising the system.

Pre-treatment Design

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d,

$$S_E = QT / 400$$
$$S_E = (2000 \times 40) / 400$$
$$S_E = 200 \text{ m}^2$$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From the previous example we already know that, using E_{CC} = 0.45 m, E_L = 0.45 m and E_E = 0.3 m respectively and assuming a configuration of 4 rows of 6 pipes, we have:

$$S_{SR} = 18.9 \times (1.35 + 0.9) = 42.525 \text{ m}^2$$

- Since $S_{SR} < S_E$, we will use 200 m^2 as the minimum value for the Enviro-Septic® Contact area.

System Layout

Now, we need to determine the required spacing between the Enviro-Septic rows to spread the pipes over the minimum contact Area. Using the following formula

$L_R = 6 \times 3.05 = 18.3$ m
Length of System x Width of System = 200 m^2
$[L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 200\ m^2$
$[L_R + (2 \times (E_L - 0.15)] \times [(2E_L \times (N_r - 1)) + (2 \times E_L)] = 200\ m^2$

With those equation, we can determine the following values :

Enviro-Septic® minimum contact area = 200 m^2
E_L = 1.25 m (min 0,45 m)
E_{CC} = 2.45 m (min 0,45 m)
E_E = 1.05 m (min 0,3 m)

L_{System} = 20.4 m
W_{System} = 9.85 m

Enviro-Septic Contact Area = 200.9 m^2

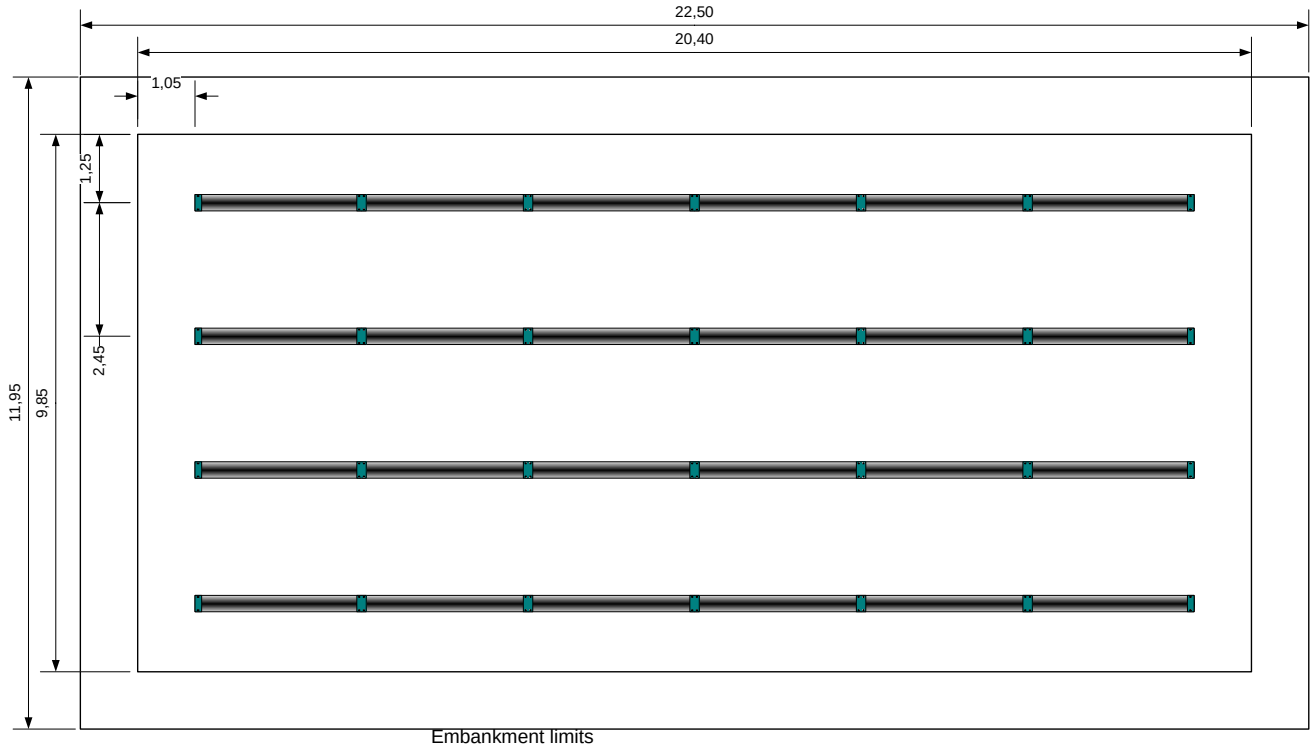


Fig. 92 - Top view of the system configuration

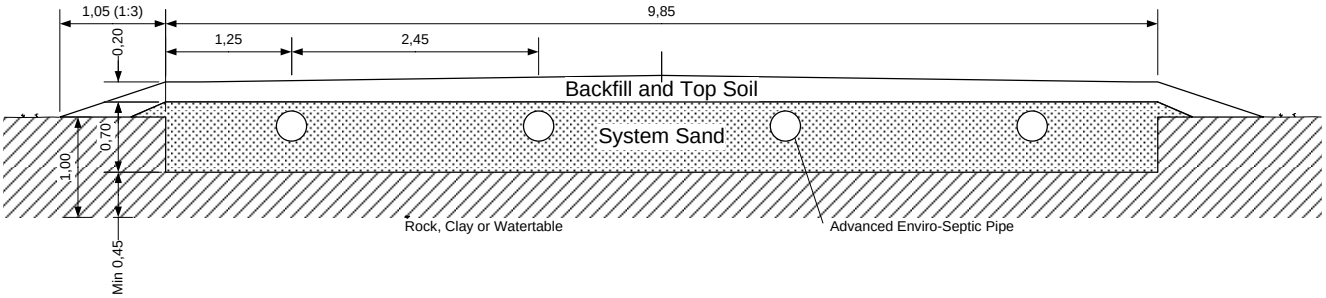


Fig. 93 – Cross-section of the system configuration

Partially Raised System – Scenario 8, 80 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 80 min/cm (T > 50 min/cm)

This system can't be designed as a partially raised system because the percolation time of the native soil is slower than 50 min/cm.

Appendix 4 – Examples of Fully Raised Enviro-Septic Systems

Context

This section will show examples of how to design a fully raised Enviro-Septic® system using the steps described in the design manual.

Fully Raised System – Scenario 9, 5 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 5 min/cm ($T \leq 6$ min/cm)
- Minimum Vertical Separation 0.6 m
- Distance between original grade and high water table, bedrock or clay is 0.6 m (distance needs to be more 0.6 m or more).

The system can be designed as a fully raised system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual can be met by fully raising the system.

Pre-treatment Design

All raw sewage will enter into a septic tank sized in accordance with Clause 8.2.2.3 of the Ontario Building Code. Specifically, the septic tank shall have a minimum of 2 days retention time for residential wastewater and 3 days retention time for non-residential sewage flows. The septic tank shall also have two compartments as required by the Code and be equipped with an effluent filter. At no time shall the tank be less than 3600 L working capacity as stated in Clause 8.2.2.3.

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d, $S_E = QT / 400$
$S_E = (2000 \times 5) / 400$
$S_E = 25\ m^2$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From table 3.2, the recommended minimum center to center pipe spacing is 0.45 m. With regards to E_L and E_E, (see figure 6) the recommended minimum distance is 0.45 m and 0.3 m respectively.

Following the requirements of the Ontario Building Code it is recommended that no row be greater than 30 m in length. Assuming we will use a configuration of 6 rows of 4 pipes, we have:

$$S_{SR} = [L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)]$$
$$S_{SR} = [12.2 + (2 \times 0.3)] \times [(0.45 \times (6 - 1)) + (2 \times 0.45)]$$
$$S_{SR} = 12.8 \times (2.25 + 0.9) = 40.32\ m^2$$

Since $S_{SR} > S_E$, we will use 40.32 m^2 as the minimum value for the Enviro-Septic® Contact area.

Note: The choice of the pipe and row configuration is done taking into consideration the site constraints. Note that the minimum surface required for spacing requirements will change slightly from one configuration to another. For our example, a configuration of 3 rows of 8 pipes per row would require a surface of 45 m^2.

System Layout

Now we have all dimensions.

$E_{CC} = 0.45$ m
$E_E = 0.30$ m
$E_L = 0.45$ m
$L_R = 12.2$ m
Length of System= $[L_R + (2 \times E_E)] = 12.8$ m
Width of System= $[(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 3.15$m
Enviro-Septic® minimum contact area = 40.32 m^2

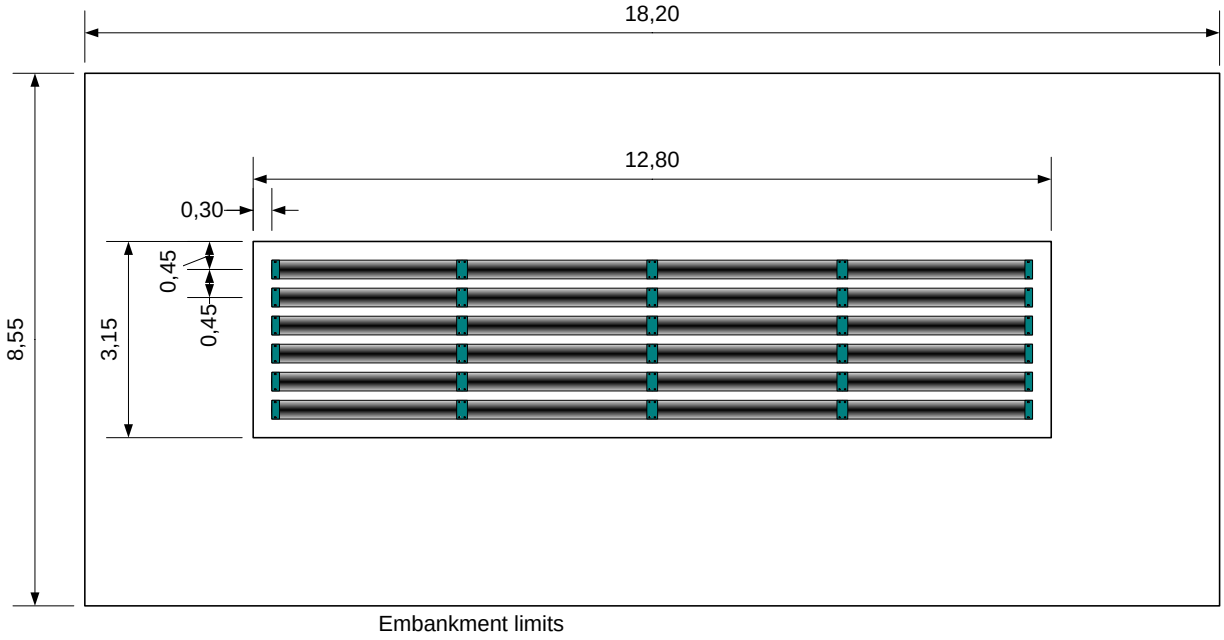


Fig. 94 - Top view of the system configuration

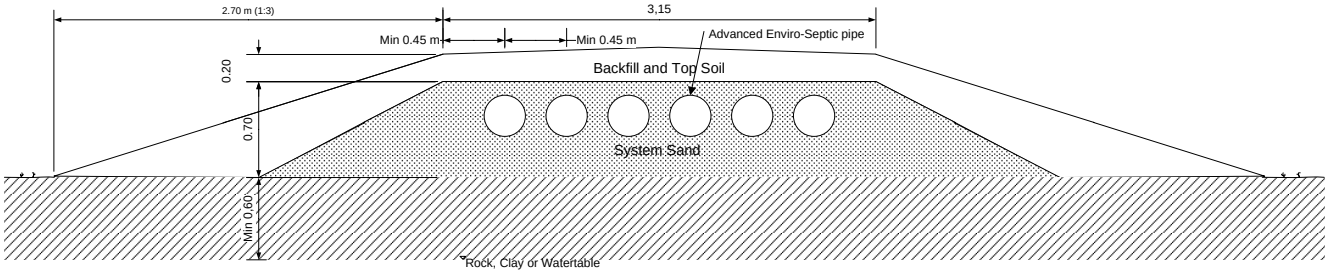


Fig. 95– Cross-section of the system configuration

Fully Raised System – Scenario 10, 20 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 20 min/cm ($6 < T \leq 50$ min/cm)
- Minimum Vertical Separation 0.45 m
- Distance between original grade and high water table, bedrock or clay is 0.45 m (distance needs to be more 0.45 m or more).

The system can be designed as a fully raised system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual can be met by fully raising the system.

Pre-treatment Design

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d,

$$S_E = QT / 400$$
$$S_E = (2000 \times 20) / 400$$
$$S_E = 100 \text{ m}^2$$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From the previous example we already know that, using $E_{CC} = 0.45$ m, $E_L = 0.45$ m and $E_E = 0.3$ m respectively and assuming a configuration of 6 rows of 4 pipes, we have:

$$S_{SR} = 12.8 \times (2.25 + 0.9) = 40.32 \text{ m}^2$$

- Since $S_{SR} < S_E$, we will use 100 m^2 as the minimum value for the Enviro-Septic® Contact area.

System Layout

Now, we need to determine the required spacing between the Enviro-Septic rows to spread the pipes over the minimum contact Area. Using the following formula

$$L_R = 4 \text{ x } 3.05 = 12.2 \text{ m}$$
$$\text{Length of System x Width of System} = 100 \text{ m}^2$$
$$[L_R + (2 \times E_E)] \text{ x } [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 100 \text{ m}^2$$
$$[L_R + (2 \times (E_L - 0.15)] \text{ x } [(2E_L \times (N_r - 1)) + (2 \times E_L)] = 100 \text{ m}^2$$

With those equation, we can determine the following values :

Enviro-Septic® minimum contact area = 100 m^2

$E_L = 0.67$ m	(min 0,45 m)
$E_{CC} = 1.25$ m	(min 0,45 m)
$E_E = 0,5$ m	(min 0,3 m)

L_{System} = 13,2 m
W_{System} = 7.65 m

Enviro-Septic Contact Area = 100.2 m^2

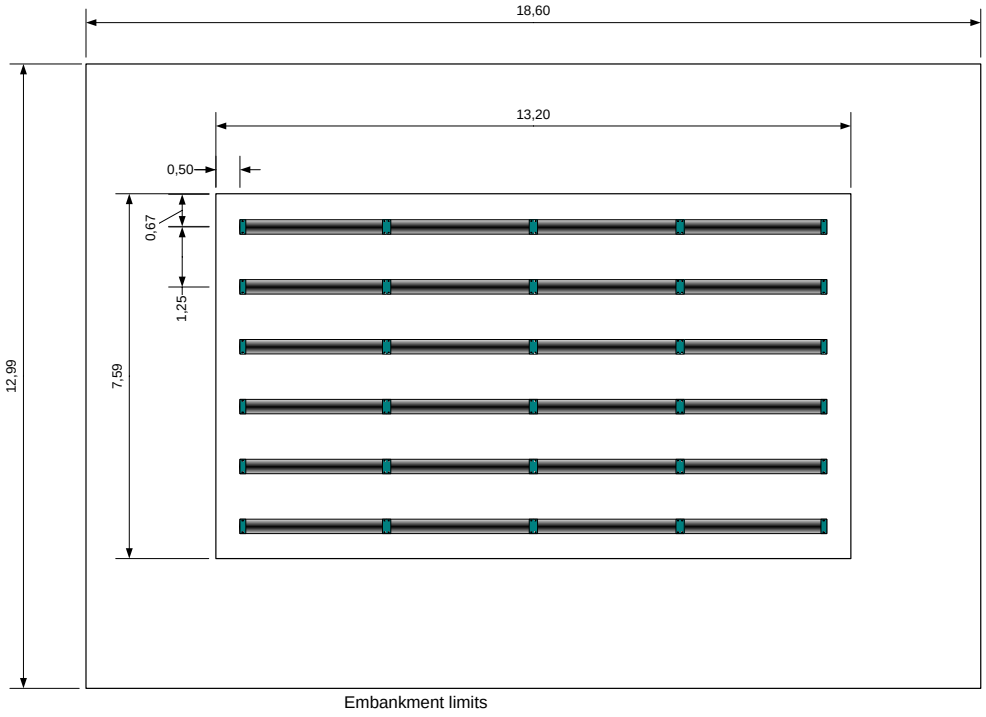


Fig. 96 - Top view of the system configuration

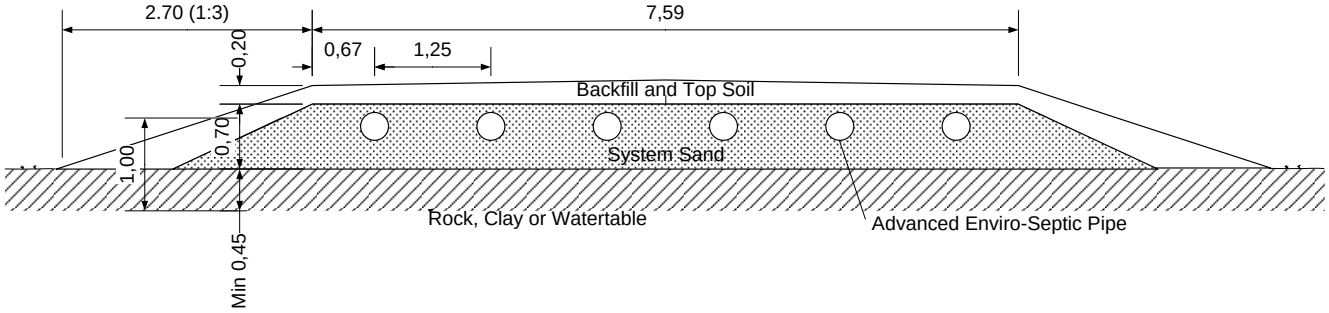


Fig. 97 – Cross-section of the system configuration

Fully Raised System – Scenario 11, 40 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 40 min/cm ($6 < T \leq 50$ min/cm)
- Minimum Vertical Separation 0.45 m
- Distance between original grade and high water table, bedrock or clay is 0.45 m (distance needs to be more 0.45 m or more).

The system can be designed as a fully raised system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual can be met by fully raising the system.

Pre-treatment Design

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d,

$$S_E = QT / 400$$
$$S_E = (2000 \times 40) / 400$$
$$S_E = 200 \text{ m}^2$$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From the previous example we already know that, using E_{CC} = 0.45 m, E_L = 0.45 m and E_E = 0.3 m respectively and assuming a configuration of 4 rows of 6 pipes, we have:

$$S_{SR} = 18.9 \times (1.35 + 0.9) = 42.525 \text{ m}^2$$

- Since $S_{SR} < S_E$, we will use 200 m^2 as the minimum value for the Enviro-Septic® Contact area.

System Layout

Now, we need to determine the required spacing between the Enviro-Septic rows to spread the pipes over the minimum contact Area. Using the following formula

$$L_R = 6 \text{ x } 3.05 = 18.3 \text{ m}$$

Length of System x Width of System = 200 m^2
$[L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 200\ m^2$
$[L_R + (2 \times (E_L - 0.15)] \times [(2E_L \times (N_r - 1)) + (2 \times E_L)] = 200\ m^2$

With those equation, we can determine the following values :

Enviro-Septic® minimum contact area = 200 m^2
E_L = 1.25 m (min 0,45 m)
E_{CC} = 2.45 m (min 0,45 m)
E_E = 1.05 m (min 0,3 m)

L_{System} = 20.4 m
W_{System} = 9.85 m

Enviro-Septic Contact Area = 200.9 m^2

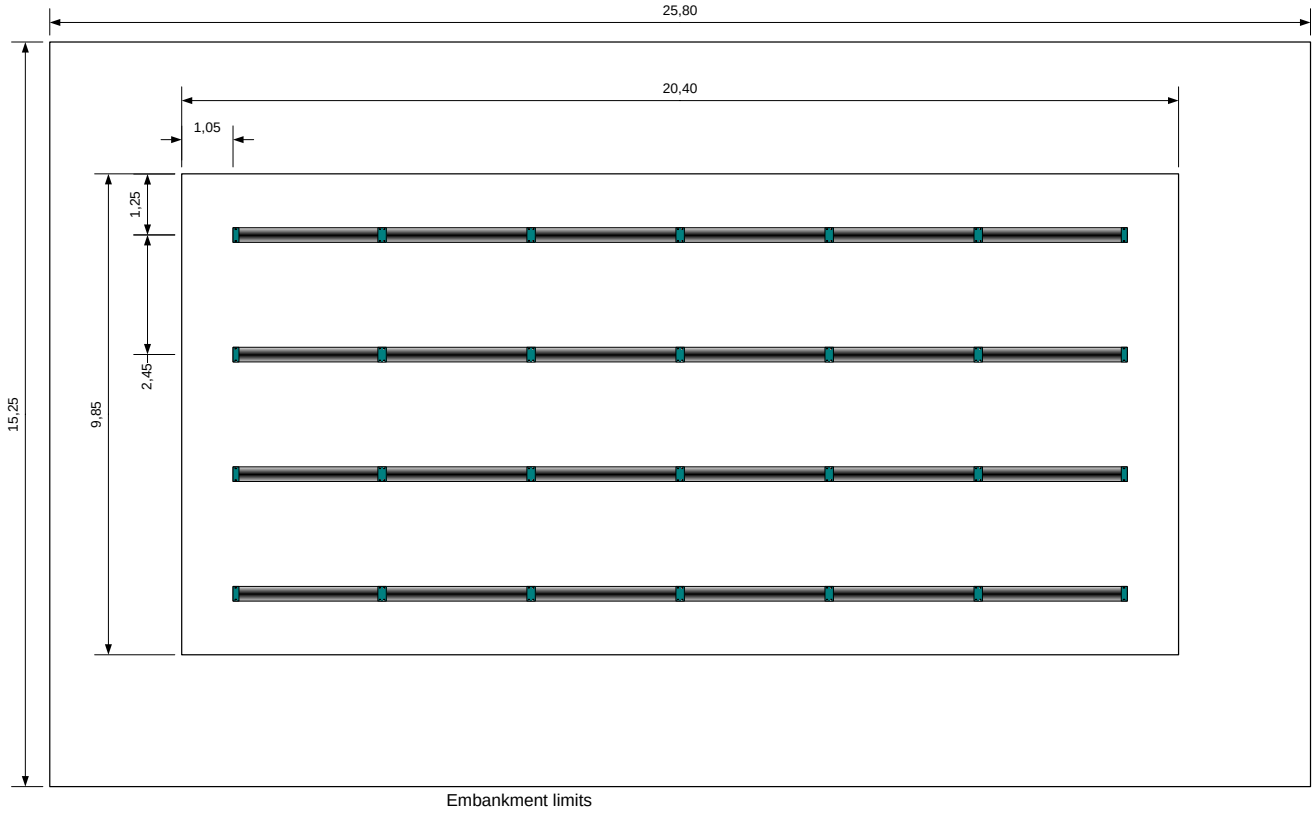


Fig. 98 - Top view of the system configuration

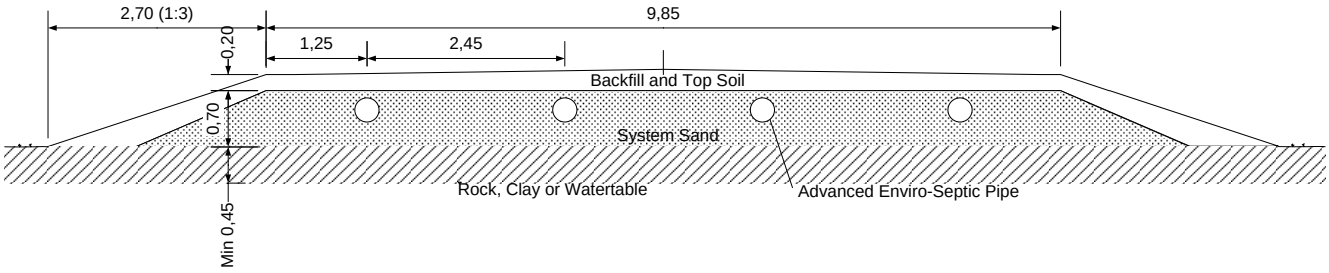


Fig. 99 – Cross-section of the system configuration

Fully Raised System – Scenario 12, 80 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 80 min/cm (T > 50 min/cm)
- Minimum Vertical Separation 0.6 m
- Distance between original grade and high water table, bedrock or clay is 0.6 m (distance needs to be 0.6 m or more).

The system can be designed as a fully raised system because the percolation time of the native soil is slower than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual can be met by fully raising the system.

Pre-treatment Design

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d, $S_E = QT / 400$ (Where T is set at 50)

$$S_E = (2000 \times 50) / 400$$
$$S_E = 250 \text{ m}^2$$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From the previous example we already know that, using E_{CC} = 0.45 m, E_L = 0.45 m and E_E = 0.3 m respectively and assuming a configuration of 4 rows of 6 pipes, we have:

$$S_{SR} = 18.9 \times (1.35 + 0.9) = 42.525 \text{ m}^2$$

Since $S_{SR} < S_E$, we will use 250 m^2 as the minimum value for the Enviro-Septic® Contact area.

System Layout

Now, we need to determine the required spacing between the Enviro-Septic rows to spread the pipes over the minimum contact Area. Using the following formula

$L_R = 6 \text{ x } 3.05 = 18.3 \text{ m}$

Length of System x Width of System = 250 m^2
$[L_R + (2 \times E_E)] \text{ x } [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 250 \text{ m}^2$
$[L_R + (2 \times (E_L - 0.15)] \text{ x } [(2E_L \times (N_r - 1)) + (2 \times E_L)] = 250 \text{ m}^2$

With those equations, we can determine the following values :

Enviro-Septic® minimum contact area = 250 m^2
E_L = 1.5 m (min 0,45 m)
E_{CC} = 3.0 m (min 0,45 m)
E_E = 1.35 m (min 0,3 m)

L_{System} = 21 m
W_{System} = 12 m

Enviro-Septic Contact Area = 250 m^2

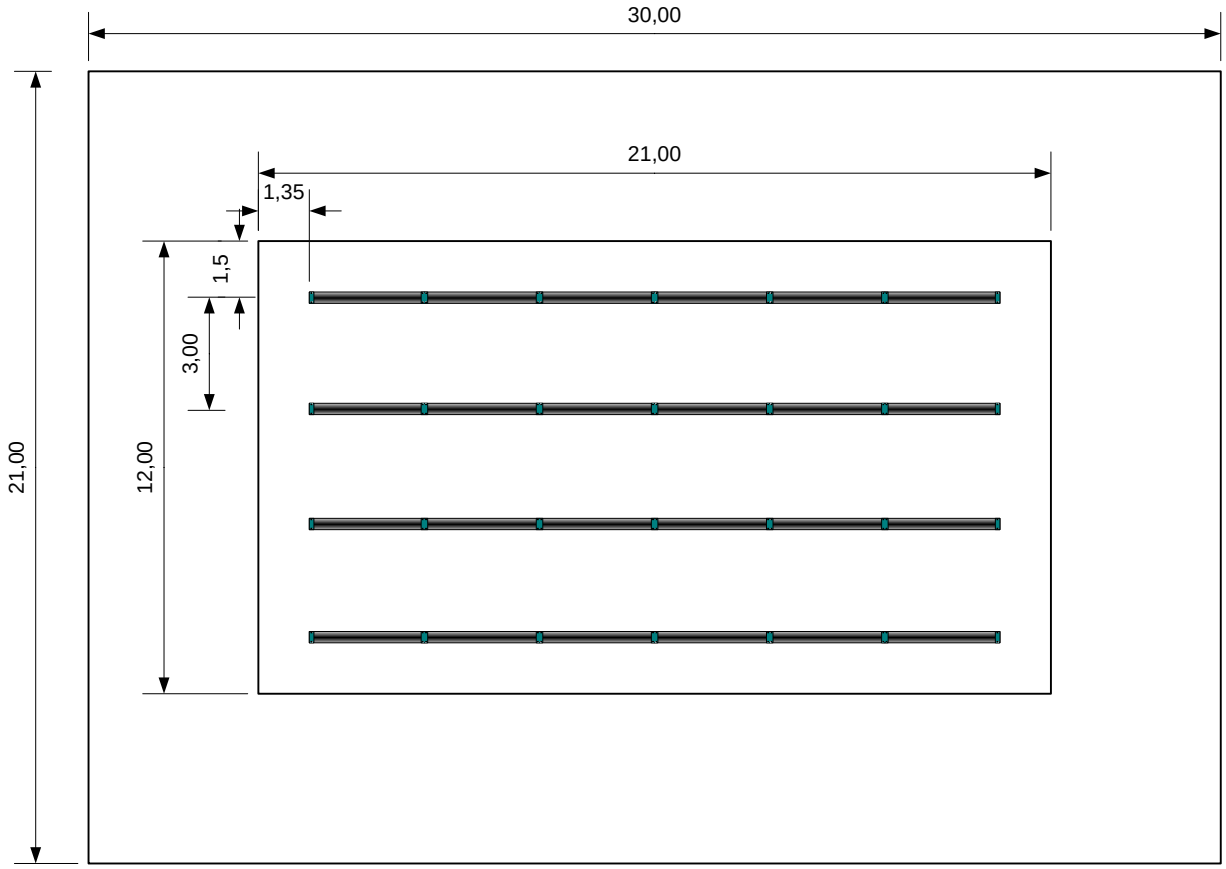


Fig. 100 - Top view of the system configuration

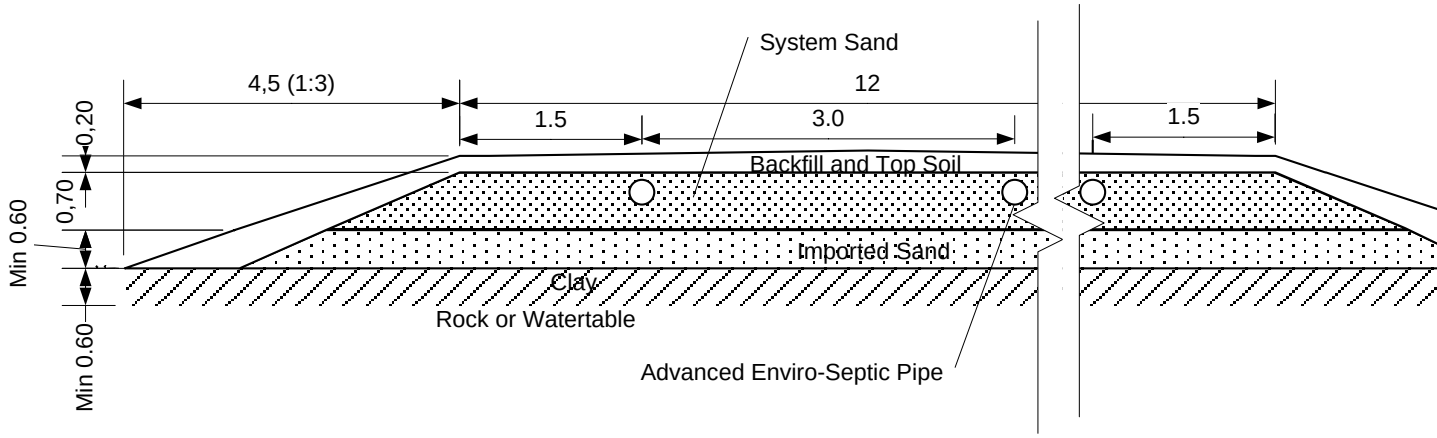


Fig. 101 – Cross-section of the system configuration

Fully Raised System – Scenario 13, 5% slope, 20 min/cm soil

Design Scenario

- Daily sanitary sewage flow = 2000 litres
- Percolation time of the native soil = 20 min/cm ($6 < T \leq 50$ min/cm)
- Minimum Vertical Separation 0.45 m
- Distance between original grade and high water table, bedrock or clay is 0.45 m (distance needs to be more 0.45 m or more).

The system can be designed as a fully raised system because the percolation time of the native soil is better than 50 min/cm and the clearances to the bedrock, high water table and clay set out in table 4 in section D of the manual can be met by fully raising the system.

Pre-treatment Design

For Q = 2000 L/d, the pre-treatment size will be:

- Residential wastewater, $V_{septic\ tank} = 2 \times Q = 4000$ L minimum.
- Non-residential wastewater, $V_{septic\ tank} = 3 \times Q = 6000$ L minimum.

Number of Advanced Enviro-Septic® Pipe

We need a minimum of one Enviro-Septic® pipe (3.05 metre long) for each 90L/day of septic tank effluent.

For Q= 2000 L/day, from equation (1) we get:

$$N_{AES} = Q / 90$$
$$N_{AES} = 2000 / 90 = 22.22$$
$$N_{AES} = 23 \text{ pipes minimum}$$

Total Length = 23 × 3.05 m = 70.15 m of Enviro-Septic® pipe

Minimum Enviro-Septic® Contact Area

The minimum contact area will be determined from the larger of the two possibilities.

From equation (2) we calculate the minimum surface required for evacuation:

For Q = 2000 l/d,

$$S_E = QT / 400$$
$$S_E = (2000 \times 20) / 400$$
$$S_E = 100 \text{ m}^2$$

From equation (3) we calculate the minimum surface for Enviro-Septic® spacing requirements. From the previous example we already know that, using E_{CC} = 0.45 m, E_L = 0.45 m and E_E = 0.3 m respectively and assuming a configuration of 4 rows of 6 pipes, we have:

$$S_{SR} = 18.9 \times (1.35 + 0.9) = 42.525 \text{ m}^2$$

- Since $S_{SR} < S_E$, we will use 100 m^2 as the minimum value for the Enviro-Septic® Contact area.

System Layout

Now, we need to determine the required spacing between the Enviro-Septic rows to spread the pipes over the minimum contact Area. Using the following formula

$$L_R = 6 \text{ x } 3.05 = 18.3 \text{ m}$$

Length of System x Width of System = 100 m^2
$[L_R + (2 \times E_E)] \times [(E_{cc} \times (N_r - 1)) + (2 \times E_L)] = 100\ m^2$
$[L_R + (2 \times (E_L - 0.15)] \times [(2E_L \times (N_r - 1)) + (2 \times E_L)] = 100\ m^2$

With those equation, we can determine the following values :

Enviro-Septic® minimum contact area = 100 m^2
E_L = 0.67 m (min 0,45 m)
E_{CC} = 1.25 m (min 0,45 m)
E_E = 0,5 m (min 0,3 m)

L_{System} = 18.9 m
W_{System} = 7.65 m

Enviro-Septic Contact Area = 100.2 m^2

Now, Because the system is in a slope, we will use a minimum lateral spacing between the first row of Advanced Enviro-Septic and the side of the contact area. On the lower side we will use a lateral spacing equivalent to the center to center spacing. This way, the same amount of sand is available on the downside of each row of pipe to allow the water to evacuate.

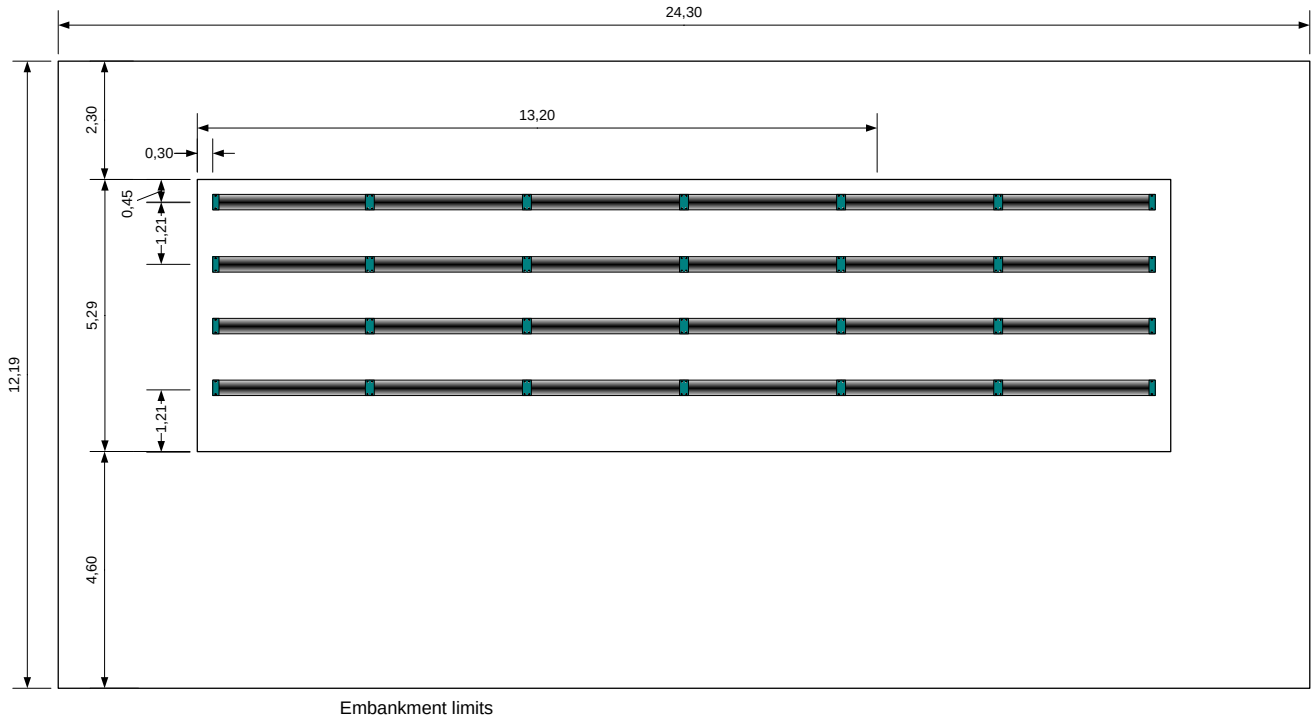


Fig. 102 - Top view of the system configuration

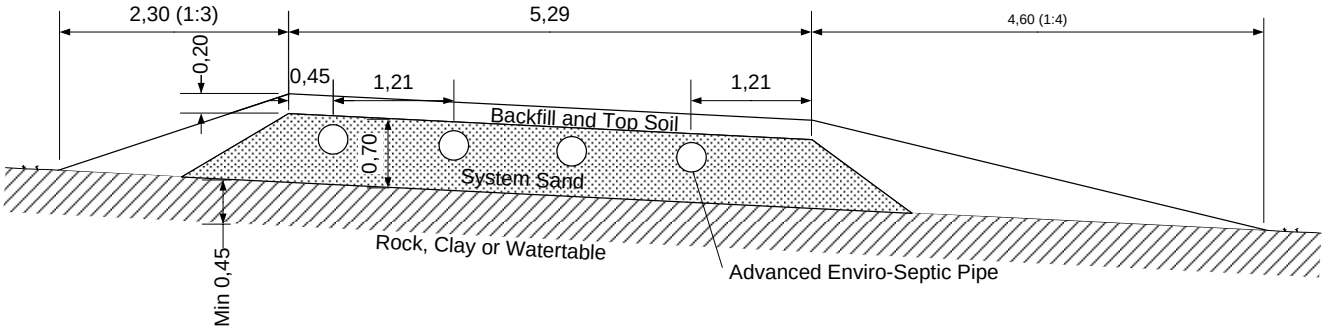


Fig. 103 – Cross-section of the system configuration