The ABCs of Septic Systems

INGÉNOTECH
ASSAINISSEMENT | GÉNIE CIVIL

TABLE OF CONTENTS

PREFACE

INGÉNOTECH prepared **The ABCs of Septic Systems** with the goal of aiding the general public in understanding the Regulation respecting waste water disposal systems for isolated dwellings (Q-2, r.22).

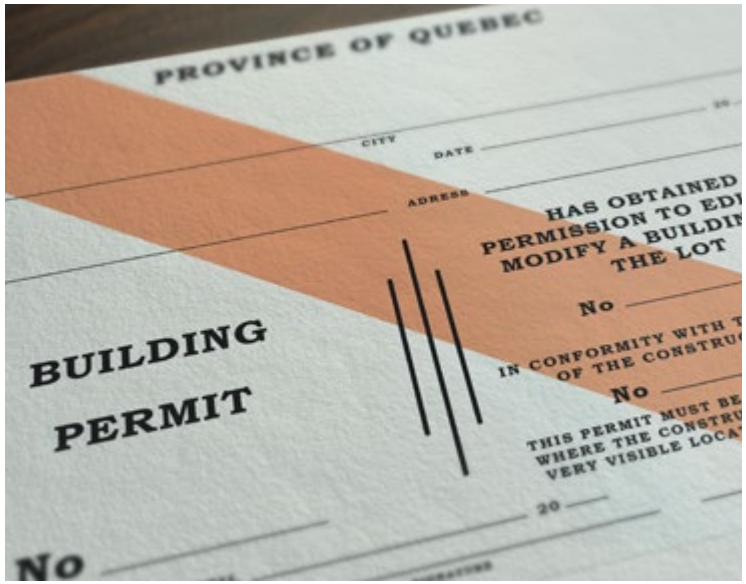
In particular, this document intends to clarify the terms and concepts used in the regulation surrounding septic tank systems. It is also meant to summarize the norms surrounding the construction and implantation of the most common septic systems.

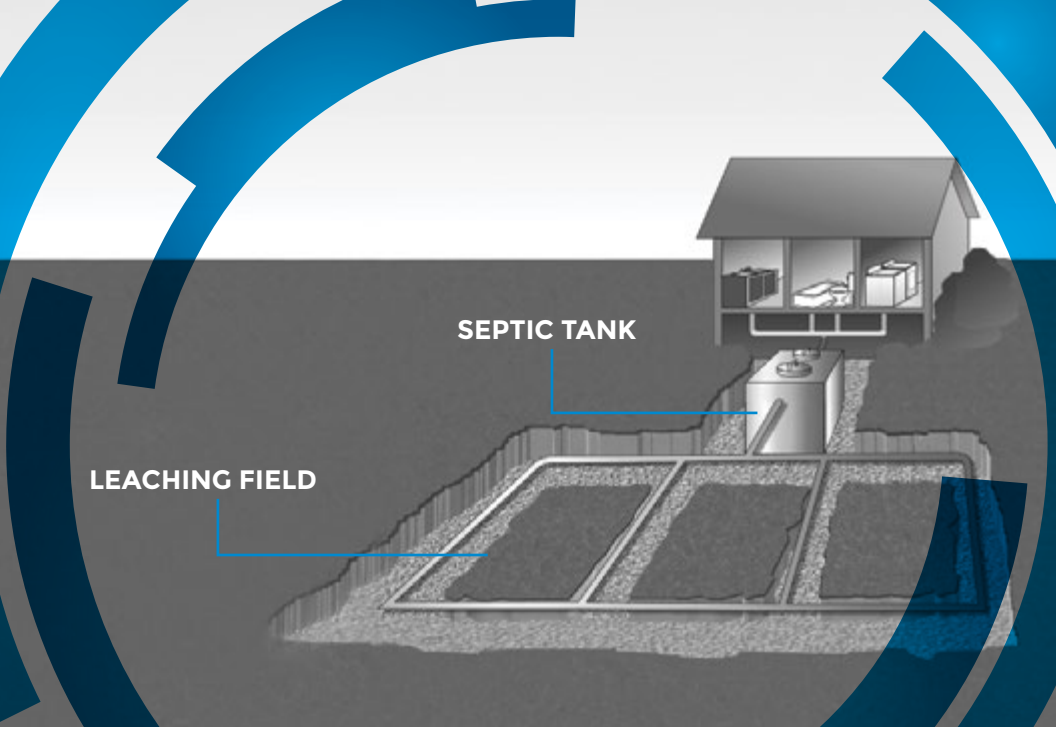
The ABCs of Septic Systems is provided for informational purposes only and may not be used in the design or construction of On-Site Wastewater Treatment Systems**.**

It is at all times mandatory to comply with the *Environment Quality Act (EQA)* and with all other applicable regulations.

To this effect, any project aiming to construct an on-site wastewater treatment system requires the obtention of a permit from the municipality in which the project is located.

The application for the permit must include a study of the characterization of the site and of its natural ground carried out by a person affiliated with a professional order competent in the matter.





INTRODUCTION

Wastewater treatment occurs through different chemical, physical, and biological processes and allows for each component of the wastewater to be evacuated with respects to the environment and public health.

The installation which most commonly serves to treat and evacuate wastewater is the “septic system,” which generally consists of a septic tank and a disposal area or “leaching field.”

The septic tank is an underground container which receives wastewater originating from a domestic household and allows for it to settle. The solids fall to the bottom of the tank while the lighter components float to the surface.

The disposal area then serves as a space for bacteria to break down the organic matter which wasn’t retained by the septic tank and for the evacuation of the treated water into the ground, to complete purification by seepage through the disposal site.

In order to guarantee that the system is adequate and works efficiently, the receiver site and soil must be permeable enough to allow for the infiltration of the wastewater into the ground to a certain depth.

SITE AND SOIL INVESTIGATION

The investigation of the characterization of a site and its natural ground, commonly known as a professional percolation test, uncovers the characteristics of the ground tested such as permeability, density, stratigraphy, etc.. The results of the test help determine which kind of septic system is most appropriate for the site, with regards to the *Regulation respecting waste water disposal systems for isolated dwellings (Q-2, r.22)*.

This study is crucial to the proper functioning of the future installation on a long-term basis, and given its complex nature, must be carried out by an experienced and accredited professional. The latter will perform a variety of tests, the main one being the measure of percolation time or of hydraulic conductivity, which helps determine the permeability of the soil.

Different methods and devices can be used to calculate permeability. At INGÉNOTECH, having compared the quality and accuracy of different testing methods in the past, we prefer the Guelph permeameter.

A normalized instrument explicitly used for this kind of investigation, the Guelph permeameter was developed to evaluate the speed at which water enters the ground in the potential receiver site. The soils tested can then be classified as “high permeability soil,” “permeable soil,” “low permeable soil,” or “impermeable soil.”

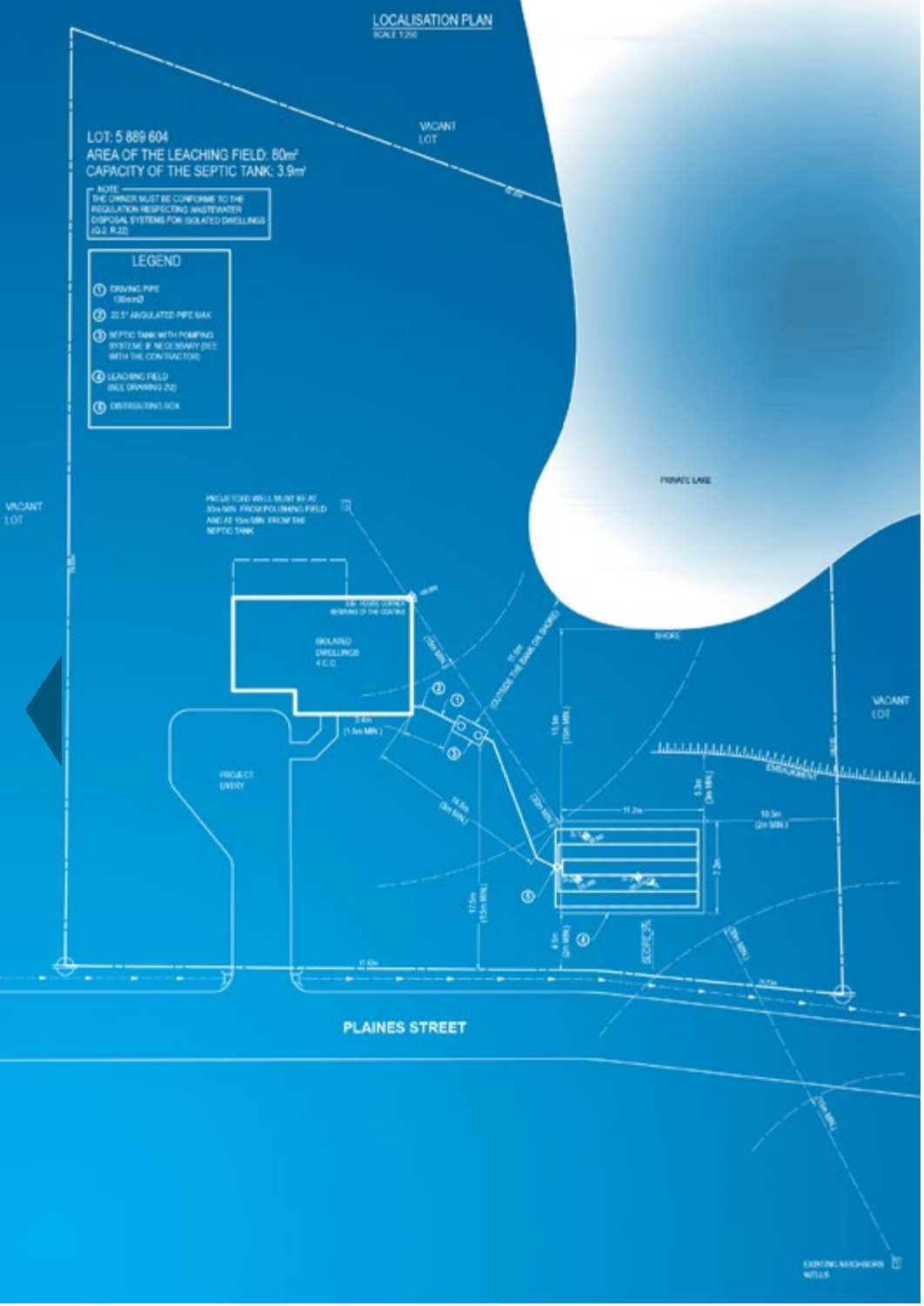
Overall, the site and soil investigation performed by INGÉNOTECH consists of the following elements:

- Justifications for the choice of the wastewater treatment system proposed ;

- Technical specifications describing in great detail the equipment which must be installed ;

- Construction plans for the installation, with schematics of the system’s location and detailed drawings ;

- Recommendations surrounding the use and maintenance of the septic system



exemple for localisation plan

WASTEWATER TREATMENT

Apart from special cases, wastewater originating from isolated domestic households must be treated through a specific series of steps in accordance with the *Regulation respecting waste water disposal systems for isolated dwellings (Q-2, r.22)*.

Thus, for a given case or project, the Regulation can push the consultant to recommend a specific type of septic installation or to otherwise suggest the impossibility of putting one in place.

Other than the traditional wastewater treatment devices described by the Regulation, the latter also enables the installation of the following treatment systems :

- Primary treatment system with a prefabricated septic tank;
- Advanced secondary treatment systems ;
- Tertiary treatment system.

These treatment systems, established independently or conjointly with a disposal area and soil absorption field, obey certain criteria in their conception, installation, use, and maintenance to attain the standards set by the BNQ.

A disposal area, or drain field, always contains purifying elements which filter the water evacuated from the septic tank. The construction of a soil absorption field is very similar to that of a drain field, however, the soil absorption field simply serves as an extension to the drain field, evacuating the newly treated wastewater in an advanced secondary system.

Finally, if the conditions of the site do not enable the construction of a soil absorption field, the evacuation of the treated wastewater may be done through a tertiary treatment system.

In brief, if the conditions permit it, the Regulation encourages the set up of an onsite wastewater treatment system consisting of a primary installation (septic tank) followed by a drain field. Nonetheless, if this isn't feasible, other alternatives can be considered.

The analysis of a competent consulting firm such as INGÉNOTECH is crucial in the selection of a treatment channel that is adapted to the needs of the client and to the conditions of the site, and which will conform to the laws and regulations in effect.

NORMS SURROUNDING THE LOCATION OF SEPTIC INSTALLATIONS

The *Regulation respecting waste water disposal systems for isolated dwellings (Q-2, r.22)* defines the location standards to abide by depending on whether or not the system is impervious.

Watertight system

By definition, a system is watertight if the effluent is only evacuated through a pipe intended for this purpose, such as :

- Basic primary wastewater treatment system (septic tank);
- Advanced secondary treatment systems with an impervious floor;
- Tertiary systems with an impervious floor.

Permeable system

Permeable systems, on the other hand, consist of:

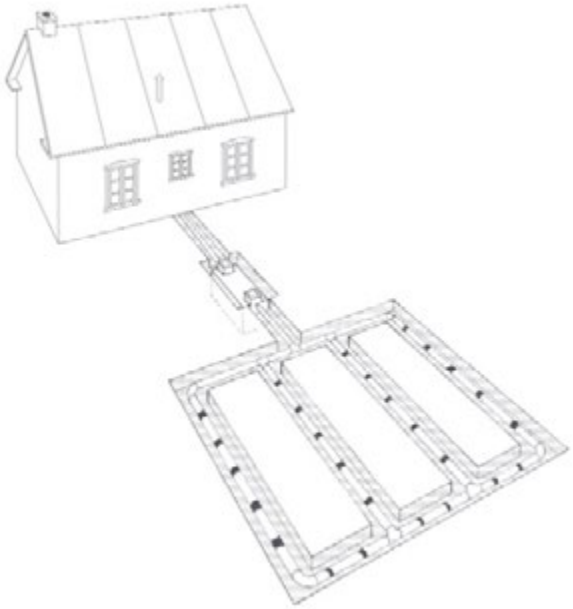
- Classic and modified treatment units, otherwise known as drain fields;
- Aboveground sand filter;
- Standard sand filter;
- A polishing field or soil absorption field;
- An evacuation field;
- Any other advanced secondary treatment or tertiary systems that is non-watertight.

Non watertight system and watertight system must be located in a place :

- Free from the circulation of motorized vehicles;
- Where it is not likely to be submerged ;
- That is accessible for maintenance and drainage;
- That abides by the distance norms shown in the following table.

Reference point	Minimal distance (m)	
	Watertight system	Non-watertight system
Category 1 or 2 underground water extraction systems (see art. 51 of the RPEP)	Outside of the immediate vicinity or safe zone (see paragraph 1, art. 54, of the RPEP)	S.O.
Category 3 underground water extraction systems (see art. 51 of the RPEP)or uncategorized and sealed underground water extraction systems	S.O.	15
Other underground water extraction systems and surface water extraction systems	15	30
Lake or waterway	Away from the shore	15
Swamp or pond	10	15
Water line for domestic use	1,5	2
Underground drainage line	S.O.	5
Property limit	1,5	2
Domestic household	1,5	5
Top of a slope or embankment	S.O.	3
Tree	S.O.	2

The following pages detail the most common onsite wastewater treatment systems.



SOIL ABSORPTION FIELDS

A soil absorption field is an underground spreading device installed consisting of a series of shallow trench filters.

As an example, for a domestic household with three bedrooms and with the appropriate soil conditions for this system, the project would require a receiver site with a minimal area of 180 m2 (approximately 1 940 ft2) to distributed and treat the wastewater originating from a septic tank. To be able to put this system we cannot cut tree.

Necessary conditions for its construction :

The effluent of a basic wastewater treatment system (septic tank) can be led to a soil absorption field if the following conditions are found :

- Natural soil of the receiver site must be high permeable soil or permeable soil;

- The depth of any rock, underground waters, or soil type that is impermeable or low permeable must be at least at 1.2 meters under the surface of the receiver;

- The slope of the receiver site is lower than 30%.

IF THE WASTEWATER ORIGINATING FROM A SEPTIC TANK MUST BE LED TO A LEACHING FIELD AND IF THE SOIL ABSORPTION FIELDS CANNOT BE INSTALLED, A SEEPAGE BED MUST BE PUT INTO PLACE NEAR THE SEPTIC TANK.
(SEE THE FOLLOWING, PAGES 12 AND 13).

SEEPAGE BEDS

LA seepage beds is an underground spreading device which works in much the same way the standard leaching chamber does. However, it functions based on an absorbent bed rather than trench filters.

As an example, for a domestic household with three bedrooms and with the appropriate soil conditions for this system, the project would require a receiver site with a minimal area of 60 m2 (approximately 645 ft2) to distributed and treat the wastewater originating from a septic tank. The law allows to cut tree.

Necessary conditions for its construction :

The effluent of a basic wastewater treatment system (septic tank) can be led to a seepage beds if the following conditions are found:

- It is impossible to construct a soil absorbing fields;

- Natural soil of the receiver site is high permeable soil or permeable soil;

- The depth of any rock, underground waters, or soil type that is impermeable or low permeable must be at least at 1.2 meters under the surface of the receiver;

- The slope of the receiver site is lower than 10%.

IF THE WASTEWATER ORIGINATING FROM A SEPTIC TANK MUST BE LED TO A LEACHING FIELD AND NEITHER A SOIL ABSORBING FIELDS OR A SEEPAGE BEDS CAN BE CONSTRUCTED, A SEEPAGE PIT MUST BE PUT INTO PLACE NEAR THE SEPTIC TANK.
(SEE THE FOLLOWING, PAGES 14 AND 15).

SEEPAGE PITS

The seepage pits are essentially created by digging a hole in the ground and securing its lateral walls with a structure constructed on the site or prefabricated. The main advantage of a seepage pits is found in that it occupies a smaller area of the receiver site.

As an example, for a domestic household with three bedrooms and with the appropriate soil conditions for this system, the project would require a receiver site with a minimal area of 30 m2 (approximately 320 ft2) to distributed and treat the wastewater originating from a septic tank.

Necessary conditions for its construction :

The effluent of a basic wastewater treatment system (septic tank) can be led to a seepage pits if the following conditions are found :

- If it's not impossible to set up a soil absorption fields or seepage beds;

- Natural soil of the receiver site must be high permeable soil ;

- The depth of any rock, underground waters, or soil type that is impermeable, low permeable or permeable must be at least at 3 meters under the surface of the receiver;

- The slope of the receiver site is lower than 30%.

- The domestic household is isolated and has 3 bedrooms at most.

IF THE WASTEWATER ORIGINATING FROM A SEPTIC TANK MUST BE LED TO A LEACHING FIELD AND NEITHER A SOIL ABSORBING FIELDS , A SEEPAGE BEDS OR A SEEPAGE PITS CAN BE CONSTRUCTED, AN ABOVE-GROUND SAND-FILTER BEDS MUST BE PUT INTO PLACE NEAR THE SEPTIC TANK.
(SEE THE FOLLOWING, PAGES 16 AND 17).

ABOVE-GROUND SAND-FILTER BEDS

Above-ground sand-filter beds were designed to treat wastewater when the characteristics of the soil do not permit the construction of a soil absorption fields, a seepage beds or a seepage pits as previously described.

The wastewater first goes through a sand filter placed above the surface of the receiver site and is then further filtered in the layer of soil underlying the land's surface.

As an example, for a domestic household with three bedrooms and with the appropriate soil conditions for this system, the project would require a receiver site with a mini-mal area of 39 m2 (approximately 420 ft2) to distributed and treat the wastewater originating from a septic tank.

Necessary conditions for its construction :

The effluent of a basic wastewater treatment system (septic tank) can be led to an above-ground sand-filter beds if the following conditions are found:

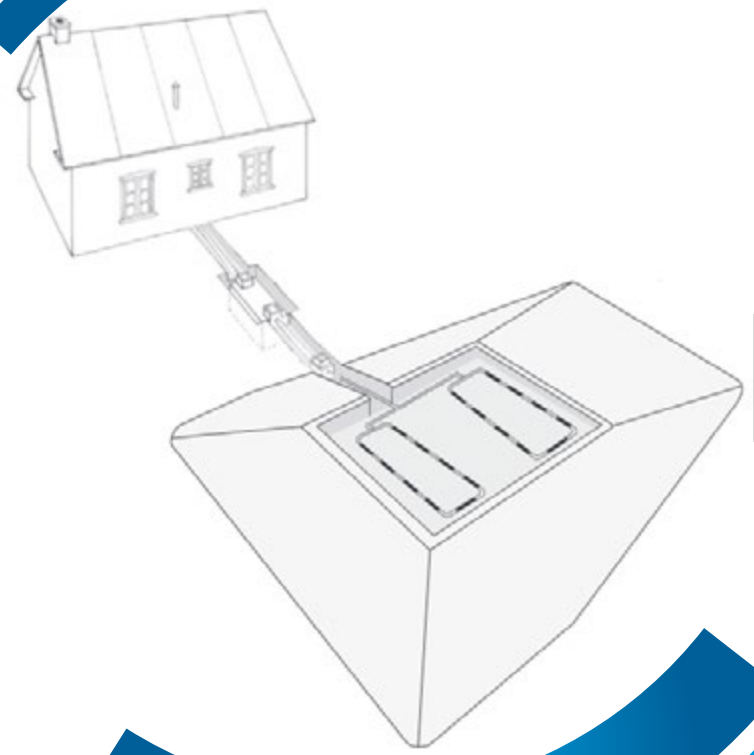
- It is impossible to set up a standard or modified leaching field ;

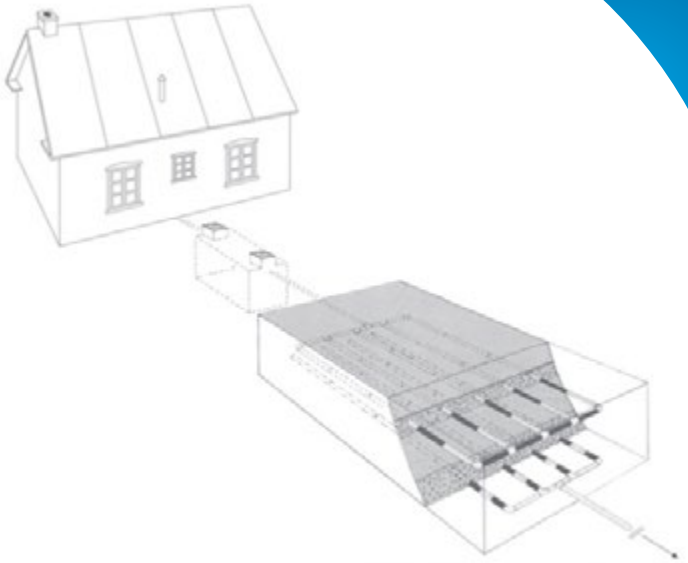
- Natural soil of the receiver site is high permeable, perme-able, or low permeable ;

- The depth of any rock, underground waters, or soil type that is impermeable must be at least at 0.6 meters under the surface of the receiver;

- The slope of the receiver site is lower than 10%.

IF THE WASTEWATER ORIGINATING FROM A SEPTIC TANK MUST BE LED TO A LEACHING FIELD AND NEITHER A SOIL ABSORBING FIELDS , A SEEPAGE BEDS A SEEPAGE PITS, OR A ABOVE-GROUND SAND-FILTER BEDS CANNOT BE CONSTRUCTED, A STANDARD SAND FILTER BEDS MUST BE PUT INTO PLACE NEAR THE SEP-TIC TANK. (SEE THE FOLLOWING, PAGES 18 AND 19).





STANDARD SAND FILTER BEDS

The standard sand filter beds is device which relies on the replacement of a layer of natural soil by a filter material (sand) to treat wastewater.

The effluent of a standard sand filter must be evacuated into a polishing field or, if it's impossible to discharge the effluent in such a way and if the conditions allow for it, into a river.

As an example, for a domestic household with three bedrooms and with the appropriate soil conditions for this system, a standard sand filter beds with a minimal area of 39 (approximately 420 ft2) would be required to distributed and treat the wastewater originating from a septic tank. To allow for the evacuation of the treated wastewater into soils that are low permeable and if the conditions permit it, a polishing field with a minimal area of 81 m2 (approximately 870 ft2) can be constructed after the standard sand filter.

Necessary conditions for its construction:

The effluent of a basic wastewater treatment system (septic tank) can be led to a standard sand filter beds if the following conditions are found :

- It is impossible to set up a soil absorption field or seepage beds ;

- Natural soil of the receiver site is low permeable or impermeable ;

- The rock level is at least 0.6 m below the surface of the receiving ground

- The slope of the receiver site is lower than 15%.

IF THE WASTEWATER ORIGINATING FROM A SEPTIC TANK MUST BE LED TO A LEACHING FIELD AND NEITHER A SOIL ABSORBING FIELDS , A SEEPAGE BEDS A SEEPAGE PITS, AN ABOVE-GROUND SAND-FILTER BEDS, A STANDARD FILTER BEDS CANNOT BE CONSTRUCTED, A POLISSING FILD BED ATTACHED TO A SECONDARY TRAITEMENT SYSTEM MUST BE PUT INTO PLACE NEAR THE SEPTIC TANK.
(SEE THE FOLLOWING, PAGES 20 TO 23).

SECONDARY TREATMENT SYSTEMS

Secondary treatment systems are conceived to ensure that more constraining discharge standards than those required for a primary treatment systeme are complied with. They therefore evacuate treated wastewater in sites where a leaching field or sand filter cannot be constructed.

Four wastewater treatment systems are certified as being advanced secondary systems :

- BIONEST MODEL;
- BIOFILTRE ECOFLO AND BIOFILTRE ECOFLO-C + FAS ;
- ENVIRO SEPTIC SYSTEM;
- HYDRO-KINETIC MODEL.

The effluent of a secondary treatment system must be evacuated into a polishing field or, if it's impossible to discharge the effluent in such a way and if the conditions allow for it, into a river.

As an example, for a domestic household with three bedrooms with a low permeable soil and with the appropriate soil conditions for the installation of a polishing field, the latter would require a receiving site with a minimal area of 81 m2 (approximately 870 pi2) to complete the treatment of the wastewater evacuated from the secondary treatment system.

Necessary conditions for its construction :

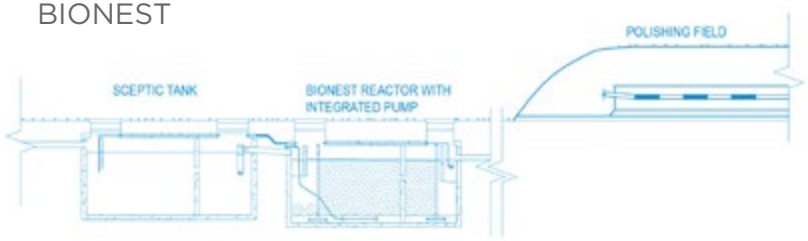
The effluent of an advanced secondary wastewater treatment system can be led to a polishing field if the following conditions are found :

- Natural soil of the receiver site is high permeable, permeable or low permeable ;

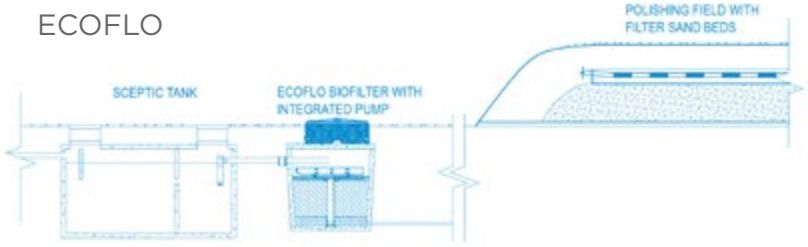
- The depth of any rock, underground waters, or soil type that is impermeable must be at least at 0.3 meters under the surface of the receiver (0.6 meters in the case of very permeable soil) ;

- The slope of the receiver site is lower than 30%.

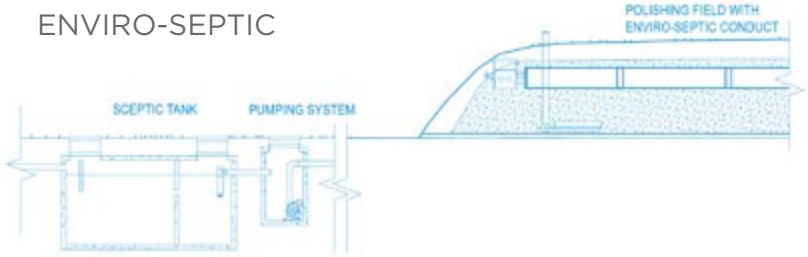
BIONEST



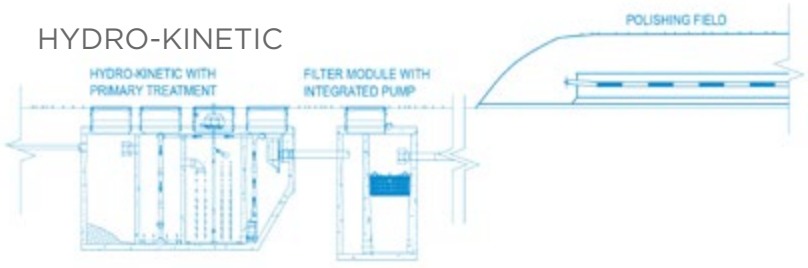
ECOFLO



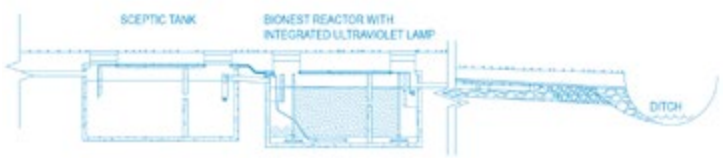
ENVIRO-SEPTIC



HYDRO-KINETIC

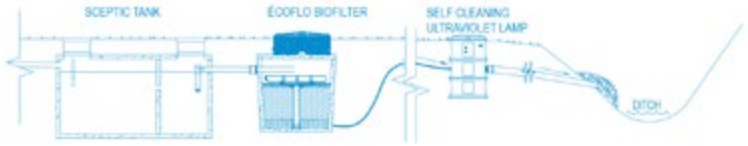


BIONEST WITH ULTRAVIOLET LAMP (U.V.)

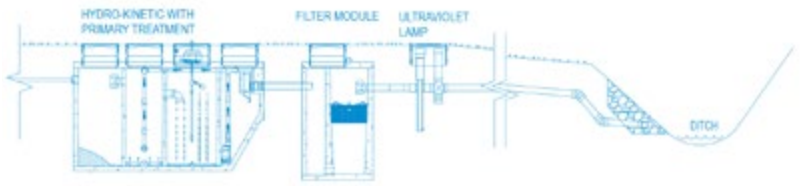


ECOFLO BIOFILTER WITH DESINFECTION FILTER

ECOFLO BIOFILTER WITH ULTRAVIOLET FILTER (DIUV)



HYDRO-KINETIC WITH ULTRAVIOLET (U.V.)



TERTIARY TREATMENT SYSTEMS

Tertiary treatment systems are conceived to attain a superior level of treatment for total phosphore and/or fecal coliforms than that obtained by advanced secondary treatment systems.

Several wastewater treatment systems are certified as being tertiary treatment systems :

- BIONEST MODEL WITH UV DISINFECTION;

- BIOFILTRE ECOFLO WITH DISINFECTION FILTER AND OTHER TERTIARY TREATMENT SYSTEMS BY PREMIER TECH AQUA;

- HYDRO-KINETIC MODEL WITH DISINFECTION UNIT AND/OR A PHOSPHORUS REMOVAL UNIT;

- BIOFILTRE WATERLOO WITH UV DISINFECTION

.

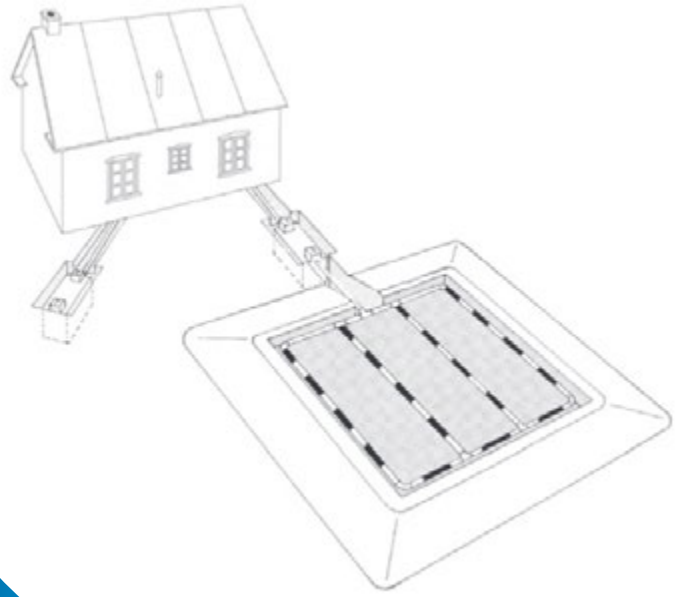
Although it is possible for these systems to be installed upstream from a polishing field for wastewater evacuation through absorption, they are specifically used to allow for the direct release (see other environmental discharges) of the treated wastewater into the environment

OTHER ENVIRONMENTAL DISCHARGES

When conditions prevent the creation of a polishing field, the effluent of a standard sand filter beds or originating from an advanced secondary treatment system can be released into a waterway (river) which allows for a certain ratio of dilution (1/300) and which is not located upstream from a lake, swamp, or pond.

If these conditions are not gathered, the effluent of a tertiary treatment system with phosphorus removal and/or disinfection can be discharged into a river or ditch following a specific procedure.

WHEN CONDITIONS PRECLUDE THE CONSTRUCTION OF ANY OF THE DEVICES SEEN ABOVE, A DISPOSAL FACILITY WHICH WILL BE PERIODICALLY EMPTIED CAN BE CONSTRUCTED
(SEE THE FOLLOWING, PAGES 24 TO 25).



HAULED SEWAGE SYSTEMS

Installations which require periodic emptying are only authorized to serve existing domestic households and hunting or fishing camps, and only if it is impossible to construct any other treatment system seen above.

This facility consists of the following equipment:

- A holding tank (sealed tank) destined only to accumulate the wastewater coming from bathrooms (black water) ;

- A septic tank paired with a disposal field which serve to channel and evacuate through absorption in the soils the grey water.

Necessary conditions for its construction :

Installations which require periodic emptying can only be built if the following conditions are met:

- It is impossible to construct any of the treatment systems previously described,

- The depth of any rock must be at least at 0.3 meters under the surface of the receiver site;

- The slope of the receiver site is lower to 30%.

WHEN CONDITIONS PREVENT THE CONSTRUCTION OF A HAULED SEWAGE SYSTEMS, OR ANY OTHER FACILITY PREVIOUSLY DESCRIBED, A HOLDING TANK ALLOWING FOR THE COMPLETE DRAINING OF WATER MUST BE INSTALLED.

CONCLUSION

When it comes to onsite sewage disposal systems for isolated domestic households, the owner and the contractor do not always get to choose which septic system must be put into place.

Numerous factors need to be taken into consideration before a recommendation can be issued and plans and detailed plans and estimates regarding the construction of a septic system can be made :

- The number of bedrooms in the domestic household (the residence's wastewater output) ;

- The constraints surrounding the location of the site and its neighbors;

- The supply of drinking water ;

- The available area and the slope of the fields;

- The permeability of the natural soil ;

- The thickness of the soil layer in relation to the depth of subterranean water levels, rock, or a limiting soil layer ;

- Etc.

The construction cost of a septic system can vary considerably depending on the criteria previously mentioned and, in a general way, on the complexity of the case :

- $ 5 000 to 15 000 for a conventional septic system consisting of a septic tank and followed by a leaching field or above-ground sand-filter beds;

- $ 10 000 to 20 000 for advanced secondary systems connected to a polishing field;

- $ 12 000 to 35 000 for tertiary treatment systems allowing for the release into the environment of the treated wastewater.

Regardless of the type of construction, the design work is a mandatory step to ensure the smooth progress of the project and the installation of a septic tank that is both high-functioning and durable.

Given our experience, our expertise and the availability of our employees, INGÉNOTECH is a valued partner for the realization of any project delving in wastewater treatment in residential areas.

REFERENCES

Regulation respecting waste water disposal systems for isolated dwellings (Q-2, r.22)

Guide Technique – Traitement des eaux usées des résidences isolées, édition révisée mars 2015, MDDELCC, 224 pages

http://www.mddelcc.gouv.qc.ca/eau/eaux-usees/residences-isolees.htm

NOTES

INGÉNOTECH

ASSAINISSEMENT | GÉNIE CIVIL

Résidentiel | Commercial | Municipal | Industriel

819 238.8324 | 1 844.905-tech (8324)

ingenotech.ca

Estrie | Montérégie

Centre-du-Québec