

AGRICULTURAL DEVELOPMENT

OUR INNOVATIVE AND SUSTAINABLE SOLUTIONS FOR FARMLAND DEVELOPMENT







OUR EXPERTISE



A UNIQUE KNOW-HOW BORN OF A PROUD HERITAGE

Soleno was founded in the late 1970s by brothers Germain and Roger Lazure. In 1989, the Lazure and Poirier families, both recognized for their expertise in the field of agricultural drainage in Quebec, decided to join forces to develop the foundations of the Soleno company that we know today.

Over the years, Soleno has developed exceptional knowhow in several markets while remaining true to its origins.

Because continuous innovation is an integral part of the company's values, Soleno today offers the most complete range of products for the agricultural drainage field.

OUR INNOVATIVE SOLUTIONS FOR YOUR LAND

Planning an agricultural landscaping project is a critical step in a comprehensive plan for stormwater and groundwater management, erosion control and yield improvement. The problems associated with poor water management on plots are numerous: delayed planting in the spring, difficult harvesting in the fall, soil settlement and compaction, and a threat to crop survival. This is why Soleno offers complete and tailormade solutions for agricultural management.

A good agricultural subsurface drainage must promote the gravitational evacuation of the water present in the agricultural land and allow control of the water table. With 3 types of perforations and filter jackets, Soleno offers the most complete range of agricultural products, allowing you to create the most effective combination according to the granulometric analysis of your soil. The filter sleeve plays a crucial role in preventing fine particles from migrating into the perforated drain pipe and causing drain clogging problems.

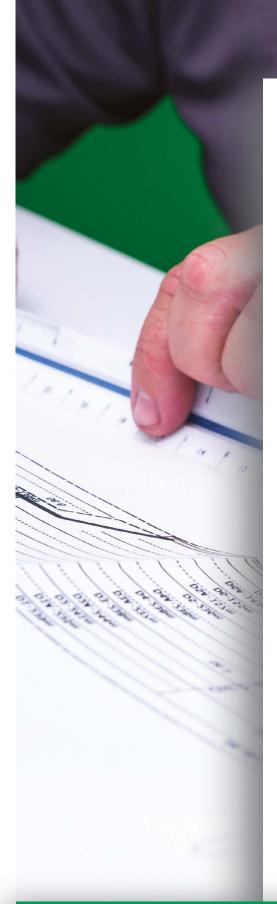
SUPPORT FOR AGRICULTURAL DEVELOPMENT

Actively involved in the agricultural field, Soleno participated as a major partner in the founding of the ALUS Montérégie program in 2016; a commitment of \$150,000 over five years. Launched by ALUS Canada and the Montérégie UPA federation, this program provides assistance and support to agricultural producers in improving water and air quality, and to encourage the implementation of management practices that increase biodiversity. Because sustainable development and future generations are constant preoccupations, Soleno annually encourages the next generation of farmers through various activities, and proudly supports the initiatives of Quebec farmers to reduce the environmental footprint of their daily activities. As a leader in sustainable solutions for stormwater control and management, Soleno is proud to invest in the future of agriculture.





PLAN YOUR PROJECT



STEPS BEFORE UNDERTAKING A DRAINAGE PROJECT

- 1 Select a contractor
- 2 Select a designer for the drainage plan
 - Perform topographic surveys
- 3 Perform permeability and iron ochre tests
- 4 Perform particle size analysis, according to the following recommendations:
 - Homogeneous soil:1 hole per 5 hectares
 - Non-homogeneous soil:3 holes per 5 hectares
- 5 Perform a soil profile
- 6 Design a drainage plan to understand:
 - The spacing and arrangement of the drains
 - The choice of filter materials and sheaths
 - Slopes and soil profiles
 - The sizing of manifolds
- 7 Establish a work budget, negotiate a contract for a turnkey project or shop for materials with the quantities and types of drains listed in the plan
- 8 Follow up with the contractor

Soleno is actively involved in the evolution of standards and good practices in the field of agricultural drainage, notably by collaborating on the new technical reference guide of the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation.

KNOW THE LAND YOU ARE CULTIVATING WELL

Particle size analysis is one of the key elements in developing a good drainage plan. It consists of analyzing the type of soil and the size of its particles in order to choose the ideal drainage outlet and the appropriate filtering liner. Soil samples are analyzed in a laboratory to determine certain factors: the percentage of clay and the D85. The D85 accurately indicates that 85% of the soil particles analyzed are finer than this diameter.

The soil profile is one of the key elements in the development of a drainage plan and is the responsibility of the designer. A soil profile will help assess the condition of the soils and diagnose or highlight problems. Visual recognition of color, compaction, perched water table or soil mixtures are examples.

The evaluation of this data facilitates the development of a detailed drainage plan. The contractor can then carry out the work with precision. Your Soleno representative can help you select a laboratory that can perform these analyses.





Our training courses, provided by a group of engineers and consultants specialized in agricultural drainage, have enabled us to train more than 800 people from the agricultural field. Soleno also collaborates with the ITAQ, the MAPAQ and Laval University for training in agricultural drainage.

UNDERGROUND AGRICULTURAL DRAINAGE

Our complete line of perforated drains, with or without filtering liners, promotes the gravitational evacuation of water present in agricultural land following precipitation and helps control the height of the water table. Depending on the results of a particle size analysis, the choice of the right filter liner to use will depend on the type of soil to be drained or the backfill material used.

COLLECTOR AND DRAIN OUTLET

Our drainage pipes, with or without a filtering liner, used as an underground collector, collect water from several lines of drains and convey it to the drainage outlet.

DRIVEWAY

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OUR APPLICATIONS

Our pipes, made of HDPE or steel, allow the installation of structures in a ditch, in order to allow the crossing of a public road to an adjacent property, while ensuring the free flow of water.

PEHD AND STEEL CULVERTS

Our culverts, made of HDPE or steel, allow for the construction of structures in a watercourse in order to allow for the crossing while ensuring the free flow of water and the free passage of aquatic wildlife.

The choice of product depends on the specified service life. When the durability of the infrastructure is the overriding factor, the HDPE culvert is preferred. The availability of diameters and hydraulic capacity («n» Manning coefficient, diameter and slope) must also be considered. Mainly used in rural, forestry and mining areas, steel culverts offer great flexibility in non-standard lengths and are an economical solution for large diameters.





TYPE 1 DRAIN

(NON-PERFORATED)

Non-perforated, single-wall, interior and exterior corrugated hose for agricultural subsurface drainage applications.

In the case of excessive slopes, the Type 1 drain is used to transport water to minimize the risk of erosion.

At the edge of a wooded area, since it is not perforated, the Type 1 drain is ideal because **it prevents roots from penetrating the drainage collector**.

The Type 1 drain is recommended for **gravity flow of water** to an outlet in a drain collector application.

PERFORATED DRAIN WITH OR WITHOUT FILTERING SHEATH

Single wall perforated flexible pipe, interior and exterior corrugated for agricultural subsurface drainage and collector applications.

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Available coated with a **filtering sheath or not**, according to the results of the granulometric analysis:

- Nonwoven polyester with 100 micron apertures
- Nonwoven polypropylene with 250 micron apertures
- Knitted polyester with 450 micron apertures

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Fits perfectly with our complete line of injection-molded accessories, guaranteeing a strong and durable assembly.





SMALL HOLE DRAIN

The perforation size of the small hole drain is

approximately 0.7 mm.



DRAIN TYPE 2

The perforation size of the Type 2 drain is 1.8 mm.



DRAIN TYPE 3

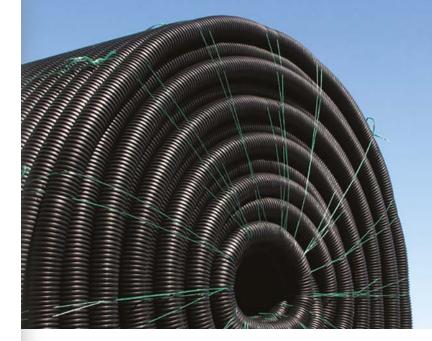
The perforation size of the Type 3 drain is 3.0 mm.

The Type 3 drain should always be sheated when installed in agricultural land because of the lack of clean stone fill.



MEGA 3 DRAIN (TYPE 3)

The perforation size of the Mega 3 drain **exceeds 3.0 mm**.



MEGA 3 DRAIN (TYPE 3)

In the presence of iron ochre, the shape and size of the Mega 3 apertures reduce the possibility of clogging and obstruction of the perforations, and facilitate cleaning when necessary.

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The Mega 3 drain should always be sheated when installed in agricultural soil, except when installed directly in black soil, due to the lack of clean stone backfill.

THE MEGA 3 DRAIN ALLOWS A MORE EFFICIENT AND FASTER AGRICULTURAL DRAINAGE!

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33% more perforated surface than the Type 3 drain:

the size and number of perforations of the Mega 3 drain allow it to capture and evacuate groundwater as quickly as possible.

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Increased protection during heavy rains, it allows you to be more secure against damage caused by excess water.

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Designed to provide maximum rigidity to the drain, while offering a larger perforation area than the Type 3 drain.



Our line of drains, from 4 to 10 in. (100 mm to 250 mm) in diameter, has been awarded the EcoDesigned Product Certification by the Council for Sustainable Industries.



OUR SHE

CHOOSE THE RIGHT FILTERING SHEATH

The filter liner plays a crucial role in preventing fine particles from entering the perforated drain pipe and causing drain clogging problems. Soils composed of different types of particles (silt, sand, clay, gravel or pebbles) may have low permeability. The granulometric analysis, recommended by Soleno, allows to define the filtration openings required for the filtering liner to be used before undertaking a drainage project.

ADVANTAGES AND BENEFITS OF A NONWOVEN FABRIC

Because of their threedimensional construction and filtration openings, nonwoven geotextiles are versatile and allow for the filtration of several types of soil, unlike a woven geotextile which is limited to one only.

The primary functions of nonwoven geotextiles in an agricultural drainage application are filtration and drainage.

Nonwovens are UV resistant.

Nonwoven geotextiles follow the movements of the drain while maintaining their physical, mechanical and hydraulic properties. Unlike a knitted fabric, they do not stretch or deform.

Nonwoven geotextiles offer excellent tear resistance.

Their composition prevents the infiltration of fine particles, thanks to its smaller openings.





100 MICRON NONWOVEN POLYESTER

Filtering sheath for perforated and sheated drain with 100 micron apertures

The nonwoven filter liner with its 100 micron apertures is recommended when the results of the particle size analysis clearly show a **very fine silt to very fine sand soil** or when a draining sand is used as backfill around the drain.



250 MICRON NONWOVEN POLYPROPYLENE

Filtering sheath for perforated and sheated drain with 250 micron apertures

The nonwoven filter bag with its 250 micron apertures is recommended when the results of the particle size analysis clearly show a **soil rich in fine and medium sand**.

Better performance for filtration and permittivity

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Better water flow than other products such as the 100 micron filter liner. The latter prevents silting in **very fine silt to sandy soil**.

Superior tensile strength, which leads to a reduced risk of tearing and ensures that the product retains its properties.

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Cleaning of drains is much easier than with 450 micron polyester sheath, which is often more difficult to clean because of silting.



450 MICRON KNITTED POLYESTER

Filtering sheath for perforated and sheated drain with 450 micron apertures

The knitted filter sleeve with its 450 micron apertures is recommended when the results of the granulometric analysis show a **soil of coarse** sand to gravel or pebbles.



CHOOSE THE BEST COMBINATION

The choice of the preferred combination (type of drain perforations and filter apertures in the filter liner) will depend on the results of the **particle size analysis**.

		PRESENCE OF			
TYPES OF SOIL	Less than 20	Between 21 and 120	Between 121 and 400	More than 400	IRON OCHRE*
Clay soil or sandy clay soil	$\binom{7}{2}$ 2				
Very fine silt to very fine sand soil		2	2		M3) 3
Soil rich in fine and medium sand		3 M3	3 M3 3		M3 3
Coarse sand to gravel soil				3 M3	M3

Soleno recommends that colorimetry and pH tests be performed to determine the degree of contamination due to iron ochre.

SEVERAL FACTORS INFLUENCE THE CHOICE OF PRODUCT TO USE. TO SELECT THE RIGHT DRAINAGE PRODUCT, CONSULT OUR ONLINE TOOL DRAINPARFAIT.COM



COMPLETE RANGE OF PERFORATED AND NON-PERFORATED DRAINS

Our drains are available in the following standard diameters and lengths:

DIAMETER							
LENGTHS	4 in (100 mm)	6 in (150 mm)	8 in (200 mm)	10 in (250 mm)			
98.4 ft (30 m)			(1)(2)(2)(2)(2)				
246.0 ft (75 m)							
393.7 ft (120 m)			$(\frac{1}{2})(\frac{2}{2})(\frac{2}{2})(\frac{2}{2})(\frac{2}{2})$	$(\frac{1}{2})(\frac{2}{2})(\frac{2}{2})(\frac{2}{2})(\frac{2}{2})$			
984.3 ft (300 m)		$(\frac{1}{2})(\frac{2}{2})(2)$ M3 M3					
1,968.5 ft (600 m)	$(\frac{1}{2})(\frac{2}{3})(\frac{3}{3})($						
3,937.0 ft (1,200 m)	$(\frac{1}{2})(\frac{2}{2})(1)(2)(3)$ $(\frac{3}{3})(M3)(M3)(M3)(3)$						

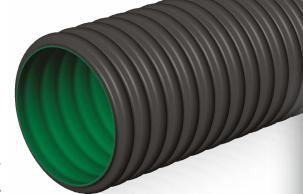
^{*12} in. (300 mm) diameter available upon request. ** Available in 30 and 45 m lengths, for 4 in. (100 mm) and 6 in. (150 mm) diameters, consult the price list available at **soleno.com/resource-center/**

LEGEND









SOLIFLEX

FLEXIBLE CORRUGATED DRAIN WITH SMOOTH INTERIOR - 25% MORE EFFICIENT THAN A TRADITIONAL CORRUGATED DRAIN*.

Offers a better Mannings coefficient (0.012) than standard corrugated drain, promoting rapid evacuation.

The smooth interior of the SoliFlex minimizes sediment build-up, while making cleaning much easier.

Available sheated with a nonwoven polypropylene filtering sheath with **250 micron apertures or not**, depending on the results of the particle size analysis.

Available with type 1 (unperforated), type 2 (1.8 mm apertures) and type 3 (3.0 mm apertures) perforations.

Certified to BNQ 3624 - 115 and compliant with the National Building Code.

*Calculated with a slope of 0.10%

ADVANTAGES AND BENEFITS

Fits perfectly with Soleno's standard range of exterior connection drainage accessories, guaranteeing a strong and resistant assembly.

Lightweight and durable HDPE pipe is easy to install and handle. The green interior distinguishes this drain from other standard corrugated drains and facilitates its inspection using a camera.

RECOMMENDATIONS

The SoliFlex Type 1 drain is recommended for **water conveyance** that does not require collection.

The SoliFlex Type 2 drain is recommended when the results of the particle size analysis clearly show a **clay or sandy clay soil**.

The SoliFlex Type 3 drain is recommended when **iron ochre** is **present** or when installed with a **clean stone backfill**.

The SoliFlex Type 3 - 250 microns drain is recommended when the results of the particle size analysis clearly show a **soil rich in fine and medium sand**.



FERROUS OCRE

Soleno recommends the use of SoliFlex Type 3 drain in case of iron ochre.

The **type 3** perforations allow the **slowing down of the obstruction of the apertures** caused by the presence of iron ochre.

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The smooth interior of the SoliFlex minimizes sediment accumulation and makes cleaning much **easier**.

The use of SoliFlex Type 3, in the presence of iron ochre, ensures a durable installation

THE PROBLEM

Farmers and agricultural installers are now concerned about a phenomenon that was, until recently, quite unknown: iron ochre.

Drain clogging problems and the ensuing annoyances are not new. However, in recent years, research has revealed that a significant portion of drain clogging problems are caused in part by the presence of iron in aerated soils.

IRON OCHRE

Iron ochre is the result of a biochemical phenomenon. In contact with oxygen and water, the iron contained in the soil or the ferrobacteria present in the water table produce a gelatinous mass of iron hydroxide called iron

ochre. Gradually, this gelatinous sludge attaches itself to the walls of the drain and can cause clogging of the drainage pipes.

The vast majority of soils contain iron, but not all are equally affected by iron ochre. Several factors influence the progression of this phenomenon. The development of iron ochre is generally more rapid in fine sands, silty sands, organic soils and soils containing mineral matter.

Iron ochre deposits are identifiable by their ochre or orange color.



DRAINAGE OUTLET

SOLENO NOW OFFERS THREE MODELS OF DRAIN OUTLETS IN ITS LINE OF ACCESSORIES, THE DRAIN OUTLET WITH A FORK OR ROUND STAINLESS STEEL GRATE AND THE DRAIN OUTLET WITH A NON-RETURN VALVE. ALL OUR DRAIN OUTLETS SHARE THE SAME DISTINCTIVE ADVANTAGES.

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Available in diameters from 4 in (100 mm) to 10 in (250 mm).

Allows gravity flow of water and prevents animals and debris from clogging the outlet.

Optimal rigidity and flow allowing drainage water to exit.

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High load-bearing capacity.

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Made of HDPE, our drainage outlets are resistant and light. Fits perfectly with our complete line of fittings and accessories with the inclusion of our double bell clips, allowing for a quality installation.





SOLFLO MAX UNPERFORATED

NON-PERFORATED DOUBLE-WALLED RIGID PIPE, SMOOTH INTERIOR AND CORRUGATED EXTERIOR FOR UNDER-PAVEMENT APPLICATION.

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Available in diameters from 12 in (300 mm) to 60 in (1500 mm).

The optional bevel cut, in an HDPE culvert application, allows for increased water flow through the culvert during storm events.

Unperforated Solflo Max pipe is ideal for HDPE culvert and driveway applications.



Our Solflo Max non-perforated, 210 kPa pipe has been awarded the EcoDesigned Product Certification by the Council for Sustainable Industries.



ADVANTAGES AND BENEFITS

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Solflo Max pipes are **exceptionally long-lasting and resistant** to abrasion, corrosion and corrosion and freeze/thaw cycles.

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Thanks to the length of the pipes, the **installation time** and the **number of ioints are reduced**.

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Fits perfectly with our full line of fittings and accessories designed to meet field requirements or conform to network requirements.

STEEL PIPE

GALVANIZED CORRUGATED METAL PIPE, AN ECONOMICAL SOLUTION USED IN STEEL CULVERT AND ROAD DRAINAGE APPLICATIONS.

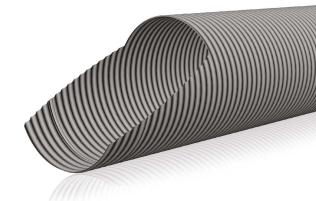
Very high flexibility in **non-standard lengths** up to 60 ft (18 m) for diameters of 144 in (3600 mm) and smaller, allowing for a reduction in the number of joints.

Cost-effective solution in large diameters allowing savings in transportation due to optimization of the loading space.

The end of the pipes are ground to provide annular corrugations that allow the use of collars for the assembly of successive lengths on a project. **Spiral end, bevel** cut and **arched** pipes are also available on request.

Due to their flattened shape, arched pipes minimize the height of the embankment while conveying an additional volume of water with a low flow rate.

Resistant to CL-625, H-25 and HS-25 loads.



Factory-welded lifting lugs available on request.

The use of steel pipe is recommended for a steel **culvert** or driveway application.

STEEL ACCESSORY

Soleno manufactures steel collars with **3, 5 or 9 corrugations**, which allow the elongation of two steel pipes by restoring the corrugation parallel to the pipe end.

Steel collars ensure a strong and durable connection.



Easy to install thanks to the addition of bolts provided as needed according to the diameter of the pipe.





OVERHEAD AND UNDERGROUND VENTILATION DUCTS

UNDERGROUND HEAT EXCHANGER

A surface geothermal system that preheats or refreshes air from outside a building before it is distributed to the inhabited spaces.

AERIAL VENTILATION

Use of a duct to draw in and exhaust stale air from a building.

HAY DRYER AND VENTILATION OF PIG FARMS Water tank from the drainage

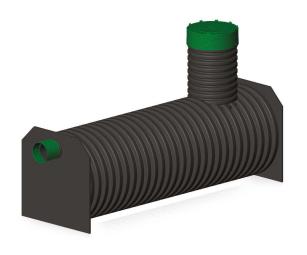
Water tank from the drainage system for temporary storage and groundwater control application.

POTATO WAREHOUSE VENTILATION

Culverts buried under a concrete slab in which openings allow ventilation of the underside of the plants.

TANK FOR PUMPING STATION

Water tank from the drainage system for temporary storage and groundwater control application.



TX-170

NEEDLED NONWOVEN GEOTEXTILE, MAINLY USED FOR CIVIL ENGINEERING WORKS

Made of polypropylene, the TX-170 is primarily used for its **separation** function.

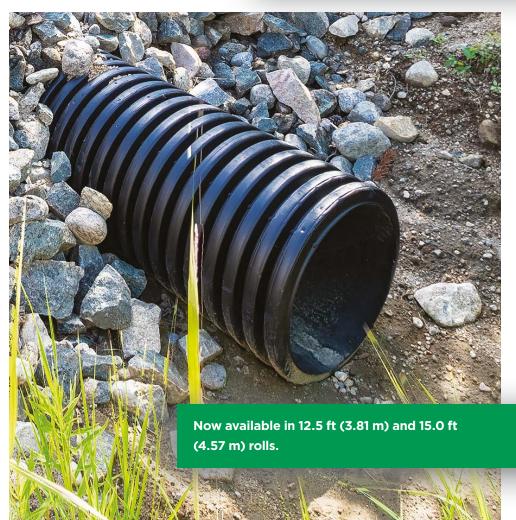
Better permeability than woven geotextile, due to its three-dimensional construction and filtration openings.

The TX-170 helps increase the loadbearing capacity of the soil and reduce rutting. Certified by the BNQ according to BNQ 7009-210/and grade S2-P1. Complies with the MTQ's CGCC.

Equivalent to OPSS 1860, nonwoven, Class II and Table 601-1 of the New Brunswick Specification, N3.

TX-90 and TX-300 are also available, the choice of geotextile will be made according to the desired mechanical and hydraulic properties.

OUR GEOTEXTILE







SOLENO OFFERS A COMPLETE LINE OF DRAINAGE FITTINGS AND ACCESSORIES, WITH INTERIOR OR EXTERIOR CONNECTIONS, TO MATCH OUR LINE OF DRAINS. THE MAJORITY OF OUR ACCESSORIES ARE MADE OF RESIN, WHICH IS INJECTION MOLDED IN THE FACTORY.

Our new accessories now fit all types of pipes thanks to a universal connection. The clips permanently lock the accessory to the drain pipe. The universal connection bell allows for better retention and a better flow section. Quick and easy to install, they complete the largest range of agricultural accessories available on the market.

IMPROVEMENTS:

Guide skis reduce the movement of the smallest diameter without preventing the nesting of larger ones.

Internal diameter with 3 levels of tightening to adjust to the different diameters on the market, whether imperial or metric.

Tightening to avoid particle penetration.

The elongated socket reduces the risk of tearing.

The clips permanently lock the accessory to the drain pipe.

Increased rigidity.



LEGEND

* Refers to the diameters affected by the improvements



Internal end cap 4 in (100 mm)* and 6 in (150 mm)



Exterior end cap 4 in (100 mm)* 6 in (150 mm)*



90 degree elbow 4 in (100 mm)*



External reducer
4 in (100 mm) x 3 in (75 mm)
6 in (150 mm) x 4 in (100 mm)*
8 in (200 mm) x 6 in (150 mm)
10 in (250 mm) x 8 in (200 mm)



Inner sleeve 4 in (100 mm)* to 8 in (200 mm)



Reducing tee
4 in (100 mm) x 4 in (100 mm) x 3 in (75 mm)
6 in (150 mm) x 6 in (150 mm) x 4 in (100 mm)*
8 in (200 mm) x 8 in (200 mm) x 6 in (150 mm)
8 in (200 mm) x 8 in (200 mm) x 4 in (100 mm)



Y-tee 4 in (100 mm)* and 6 in (150 mm)



Tee-Wye 4 in (100 mm)* and 6 in (150 mm)



Double bell snap 4 in (100 mm) to 10 in (250 mm)



Extensible tapeBlack: 2 in x 108 ft (52 mm x 35,65 m)
White: 2 in x 164 ft (48 mm x 50 m)



Split coupler 4 in (100 mm)* to 10 in (250 mm)



Large hole plastic grate, reinforced with stainless steel inserts 4 in (100 mm) to 8 in (200 mm)



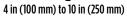
Stainless steel fork grate 4 in (100 mm) to 15 in (375 mm)



Stainless steel interior grate 8 in (200 mm) to 48 in (1200 mm)



Stainless steel grate







Vertical drain (small or large holes) 5 in (125 mm) to 10 in (250 mm)



Vertical drain tee 5 in (125 mm) to 10 in (250 mm)



Vertical drain reducer 6 in (150 mm)



Tap tee (regular) 4 in (100 mm), connects to 6 in. (150 mm) drain



Tap tee (long) 4 in (100 mm), connects to 8 in (200 mm) to 12 in (300 mm) drain



Drainage flag Orange, blue or yellow



Drainage outlet sign Red, UV resistant



Sign post



Side gate valve







AVAILABLE AND SPECIALIZED TEAM

At Soleno, the excellence of our solutions is based on our specialized consulting service and on the expertise we have developed over the years with contractors, farmers, agri-installers and professionals in the agricultural sector who are responsible for implementing a drainage plan.

Our customer service team, supported by highly efficient transportation management, ensures the smooth execution of all projects.



OUR PRODUCTS AND SOLUTIONS ARE DESIGNED AND MANUFACTURED TO THE HIGHEST STANDARDS.



SOLENO IS
CERTIFIED ISO 9001
(Saint-Jean-sur-Richelieu plant only)



SOLENO HAS OBTAINED its **ECO**RESPONSIBLE Certification - Level 2. **Performance** in sustainable development from the **ECO**RESPONSIBLE^{MC} Program. (Saint-Jean-sur-Richelieu plant only)

SOLENO IS A MEMBER OF THE FOLLOWING ORGANIZATIONS:



