

First Defense[®]

Stormwater Treatment System

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DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's First Defense. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc has a policy of continuous product development and reserves the right to amend specifications without notice.

First Defense® by Hydro International

Capturing more than 25 years of separation design experience, the First Defense® is Hydro International's latest addition to its family of hydrodynamic vortex separators intended for stormwater applications. It has been developed with ease of installation and maintenance at the forefront without sacrificing performance or design flexibility.

All internal components are housed in either a 4-ft or 6-ft diameter precast manhole that is designed to withstand traffic loads. Each model can be used as a catch basin inlet or standard manhole with solid cover so that runoff can enter from an overhead grate, inlet pipe or both without diminishing performance.

The First Defense has internal components that are designed to generate rotational flow within the device without requiring a tangential inlet. Flow within the precast chamber is controlled to prevent turbulence and its unique reverse-flow outlet intake ensures a longer retention time by preventing short-circuiting. An internal bypass prevents high flow re-suspension and washout and eliminates the need for additional bypass structures. The internals can easily be adjusted to change the angle between the inlet and outlet for storm drain directional changes and dual inlets are possible. This simplifies grading and site design so that flow can be conveyed from isolated locations within the same site without increasing the number of structures.

For removal of fine sediment and associated pollutants, oil spills, trash and debris, the first choice in stormwater treatment systems is the First Defense.

FIRST DEFENSE COMPONENTS

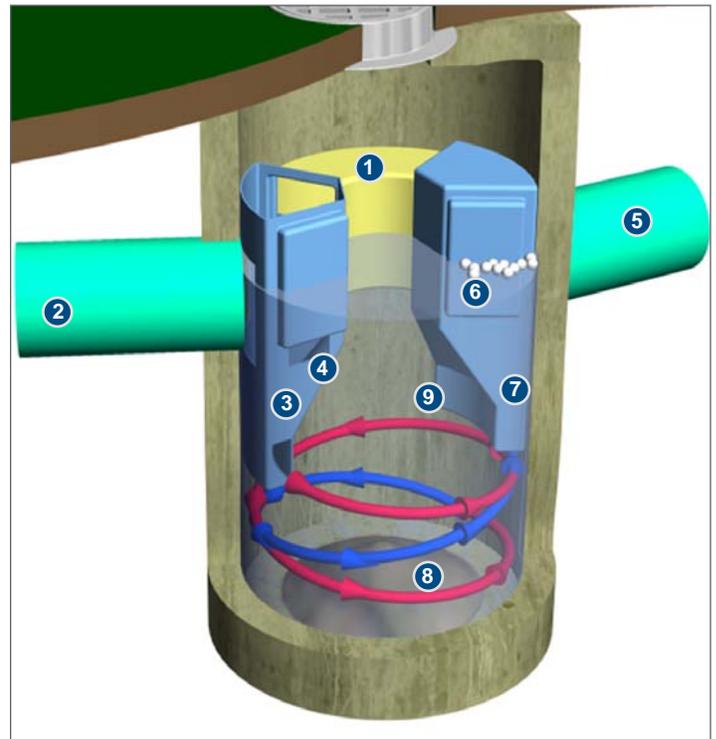
1. Built-In Bypass
2. Inlet Pipe
3. Inlet Chute
4. Floatables Draw-off Port
5. Outlet Pipe
6. Floatables Storage
7. Outlet Chute
8. Sediment Storage
9. Reverse-flow Outlet Intake

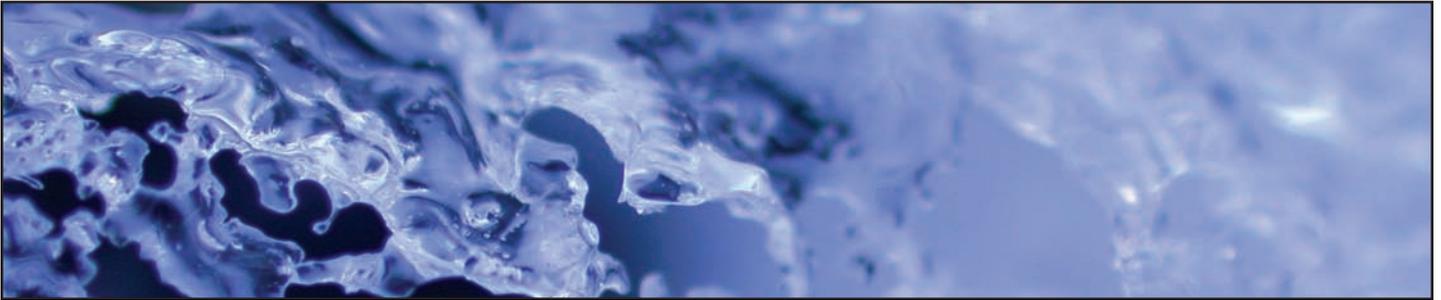
BENEFITS OF THE FIRST DEFENSE

- Compact and flexible design
 - Can be used as a catch basin inlet and directional change manhole
 - Optional one or two inlets
 - Does not require a bypass structure
- Hydrodynamic Vortex Separation
 - Extended and structured flow path
 - Minimal headloss
 - Reduces turbulence and re-suspension
 - Reverse-flow outlet intake prevents short-circuiting
 - Improved efficiency for all flows
- Delivered Pre-assembled for easy and fast installation
- Simple to inspect and maintain
- Independently verified

APPLICATIONS

- New developments and retrofits
- Utility yards
- Streets and roadways
- Parking lots
- Pre-treatment for filters, infiltration and storage
- Industrial and commercial facilities
- Wetlands protection





Operation

INTRODUCTION

The First Defense operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

POLLUTANT CAPTURE AND RETENTION

The internal components of the First Defense have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume. The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow internally-bypassed storm events. Accessories such as oil absorbant pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

WET SUMP

The sump of the First Defense retains a standing water level between storm events. The water in the sump prevents stored sediment from solidifying in the base of the unit. The clean-out procedure becomes more difficult and labor intensive if the system allows fine sediment to dry-out and consolidate. Dried sediment must be manually removed by maintenance crews. This is a labor intensive operation in a hazardous environment.

Maintenance

OVERVIEW

The First Defense protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense. The First Defense will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in **Table 1**.

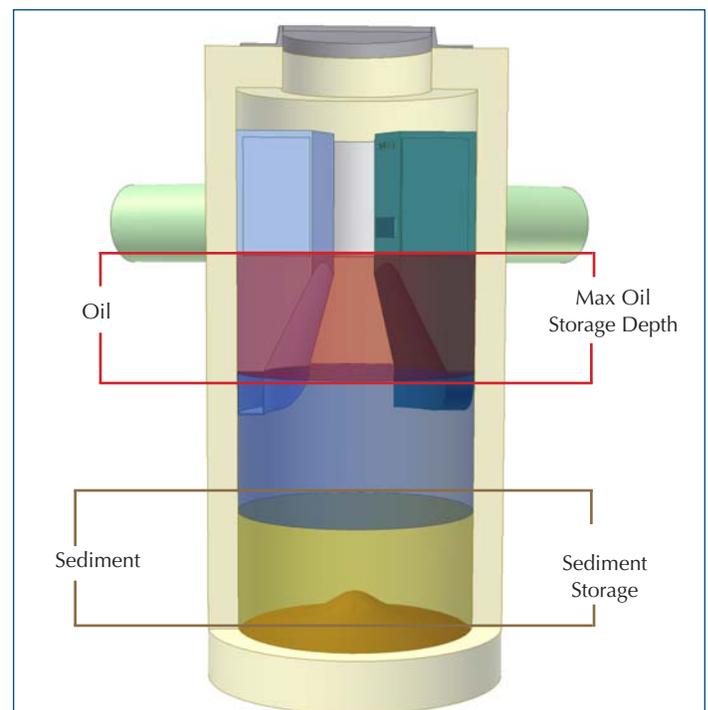


Figure 1: Pollutant storage volumes in the First Defense

The First Defense allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense, nor do they require the internal components of the First Defense to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

DETERMINING YOUR MAINTENANCE SCHEDULE

The frequency of cleanout is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil/floatables removal, for a 6-ft First Defense typically takes less than 30 minutes and removes a combined water/oil volume of about 800 gallons.

INSPECTION PROCEDURES

Inspection is a simple process that does not involve entry into the First Defense. Maintenance crews should be familiar with the First Defense and its components prior to inspection.

SCHEDULING

- It is important to inspect your First Defense every six months during the first year of operation to determine your site-specific rate of pollutant accumulation.
- Typically, inspection may be conducted during any season of the year.

RECOMMENDED EQUIPMENT

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge Judge®)
- Trash bag for removed floatables
- First Defense Maintenance Log

Table 1

First Defense Pollutant Storage Capacities and Maximum Cleanout Depths					
Unit Diameter	Total Oil Storage	Oil Clean-out Depth	Total Sediment Storage	Sediment Clean-out Depth	Max. Liquid Volume Removed
(feet)	(gal.)	(inches)	(gal.)	(inches)	(gal.)
4	180	<23.5	202	26	202-342
6	420	<23.5	626	36	626-1046

NOTE

The total volume removed will depend on the oil accumulation level. Oil accumulation is typically much less than sediment, however, removal of oil and sediment during the same service is recommended.

INSPECTION PROCEDURES

1. Set up any necessary safety equipment around the access port or grate of the First Defense as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Figure 2 shows the standing water level that should be observed.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the outer annulus of the chamber.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.
6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

FLOATABLES AND SEDIMENT CLEANOUT

Floatables cleanout is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Figure 2).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

SCHEDULING

- Floatables and sump cleanout are typically conducted once a year during any season.
- Floatables and sump cleanout should occur as soon as possible following a spill in the contributing drainage area.

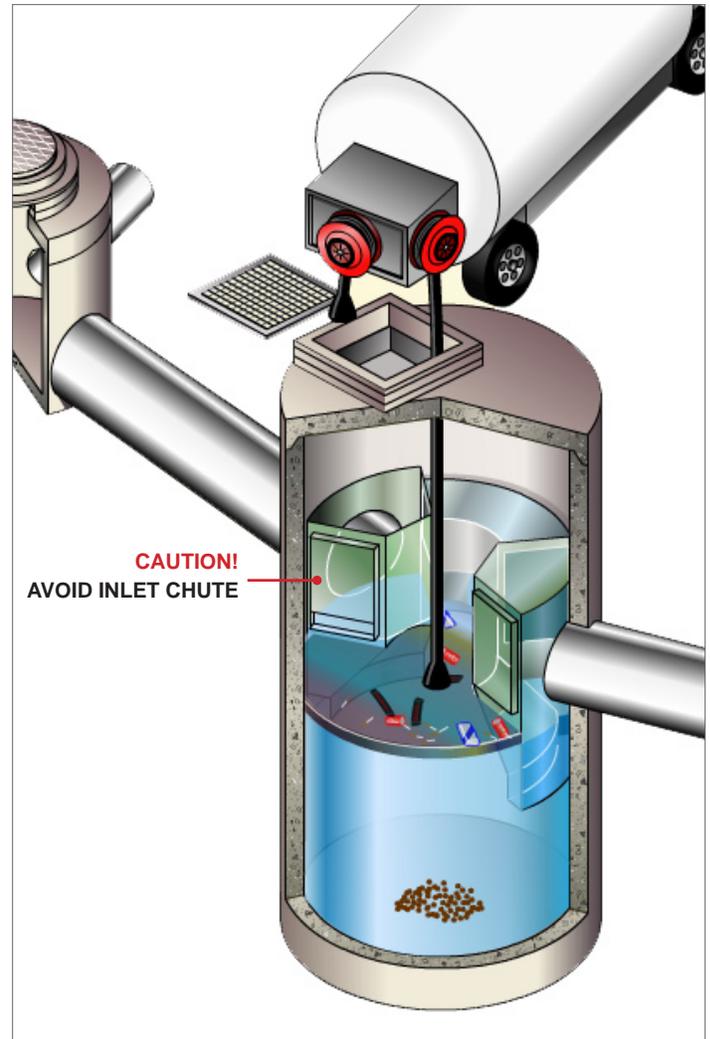


Figure 2: Floatables are removed with a vactor hose

RECOMMENDED EQUIPMENT

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense Maintenance Log

FLOATABLES AND SEDIMENT CLEAN OUT PROCEDURES

1. Set up any necessary safety equipment around the access port or grate of the First Defense as stipulated by local ordinances. Safety equipment should notify passing

pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Remove oil and floatables stored on the surface of the water with the vector hose (Figure 2) or with the skimmer or net (not pictured).
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).
6. Once all floatables have been removed, drop the vector hose to the base of the sump. Vector out the sediment and gross debris off the sump floor (Figure 3).
7. Retract the vector hose from the vessel.
8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.
9. Securely replace the grate or lid.

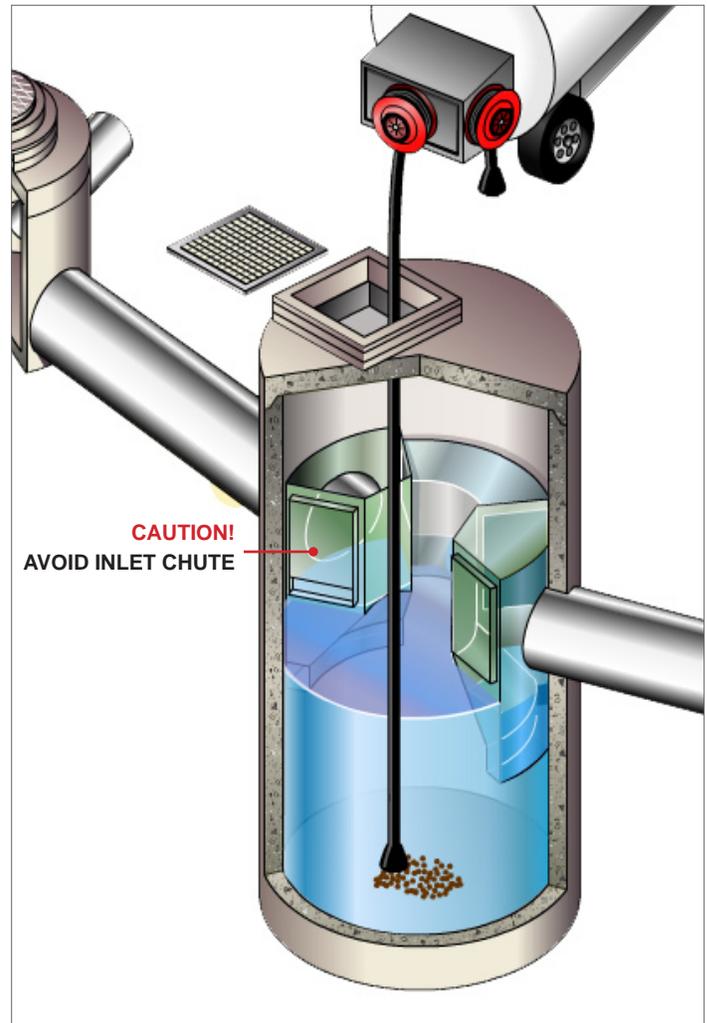


Figure 3: Sediment is removed with a vector hose

Maintenance at a Glance

ACTIVITY	FREQUENCY
Inspection	<ul style="list-style-type: none"> - Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	<ul style="list-style-type: none"> - Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	<ul style="list-style-type: none"> - Once per year or as needed - Following a spill in the drainage area

NOTE: For most cleanouts it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils/floatables and the sediment storage volume is required.



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