



First Defense®

Enhanced vortex separation designed to treat runoff at the source.

Product Profile

The First Defense® is an enhanced vortex separator that provides effective and economical stormwater treatment for small urban catchments or larger areas where multiple treatment units are used instead of end-of-pipe solutions. It accommodates large pipe sizes and includes an integral high flow bypass to convey a wide range of flows without washing out previously captured sediment, floatable trash and hydrocarbons.

Components

- | | |
|--|-------------------------------|
| 1. Inlet Grate (optional) | 6. Internal Bypass |
| 2. Inlet Chute | 7. Outlet Chute |
| 3. Inlet Pipe (optional) | 8. Outlet Pipe |
| 4. Floatables Draw Off Slot (not pictured) | 9. Oil and Floatables Storage |
| 5. Precast Vortex Chamber | 10. Sediment Storage Sump |

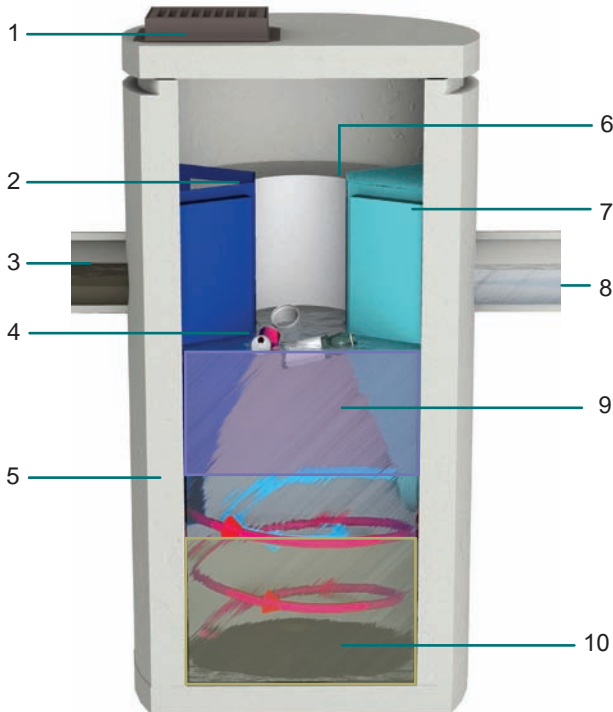


Fig.1 The First Defense® has internal components designed to efficiently capture pollutants and prevent washout at peak flows.

Applications

- Small to medium size catchments
- Residential and commercial developments
- Source control for parking lots and maintenance yards, gas stations, streets, highways, airports and transportation hubs
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate, single inlet pipe or dual inlet pipes
- Integral high-flow bypass eliminates need for upstream diversion structure
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site assembled and ready for installation

How it Works

The First Defense® has internal components designed to remove and retain gross debris, total suspended solids (TSS) and hydrocarbons (Fig.1).

Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime (magenta arrow) that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow (blue arrow). Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An integral bypass conveys infrequent peak flows directly to the outlet chute, eliminating the need for, and expense of, external bypass control structures. Floatables are diverted away from the bypass into the treatment chamber through the floatables draw-off slot.

First Defense®

Maintenance

The First Defense® needs minimal maintenance, but like all structural best management practices maintenance is necessary for the long-term protection of the environment. Pollutants captured by the First Defense® are stored in the sump and on the water surface of the vortex chamber. Periodic removal of these captured pollutants ensures that the high treatment flow rates, pollutant capture rates and the retention of stored pollutants are sustained.

The First Defense® pollutant storage volumes are large enough to hold the typical annual pollutant load. As pollutant accumulation rates will be site-dependent, the required clean-out frequency is determined through post-installation inspections. Storage capacities for the 4-ft and 6-ft models are provided below in Table 1.

Maintenance inspections and cleanout are conducted above ground. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.2). Neither man-entry nor removal of the internal components is necessary for inspection or maintenance. As a result, dangers related to confined-space-entry are avoided. For more, refer to the comprehensive First Defense® Operation and Maintenance Manual at <http://www.hydro-int.com/us/products/first-defense>.

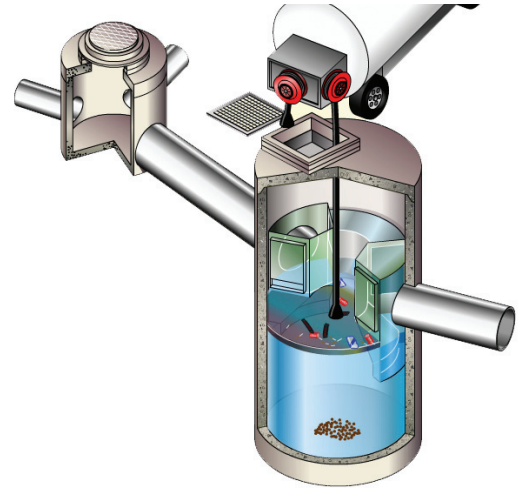


Fig.2 Maintenance is performed with a standard sump vac.

First Defense® Sizing & Design

Design Options for Inlet Configuration

For maximum flexibility the First Defense® can be designed to accommodate a variety of inlet configurations (Fig.3a - 3c).

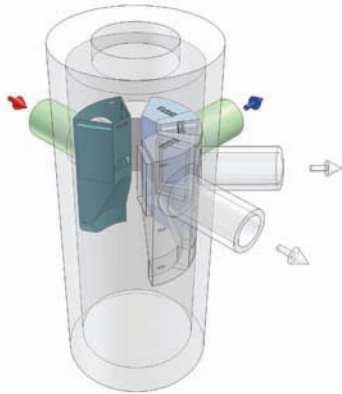


Fig.3a Flexible inlet / outlet angle.

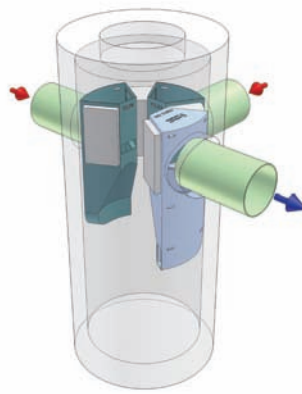


Fig.3b Dual inlet pipes.

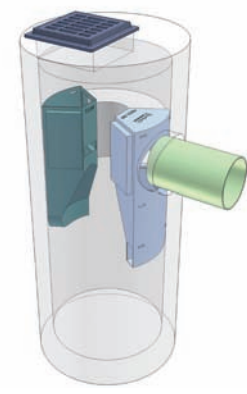


Fig.3c Surface inlet grate.

Table 1. First Defense® Models and Design Criteria.

Model Number and Diameter	Typical Treatment Flow Rates for TSS Treatment		Peak Online Flow Rate	Maximum Pipe Diameter	Oil Storage Capacity	Sediment Storage Capacity	Minimum Distance from Outlet Invert to Top of Rim	Standard Distance from Outlet Invert to Sump Floor
	106µm ¹	230µm ²						
(ft / m)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd ³ / m ³)	(ft / m)	(ft / m)
4 / 1.2	0.7 / 20	1.2 / 34	6.0 / 170	18 / 450	180 / 681	1.0 / 0.76	3.5 / 1.07	6.5 / 1.98
6 / 1.8	2.2 / 6.3	3.8 / 108	18.0 / 510	24 / 600	420 / 1,590	3.10 / 2.37	4.0 / 1.22	8.5 / 2.59

¹Flow rate for >90% removal TSS for target particle size based on D₅₀ = 106 micron.

²Flow rate for 80% removal TSS for target particle size based on D₅₀ = 230 micron.