

Assessment of Proprietary and Nonproprietary Products for Pretreatment of Larger Discharges

The Center for Watershed Protection recently completed work on an EPA Chesapeake Bay Program grant that involved developing an end-of-pipe stormwater retrofit concept solution for a highly urban 700-acre catchment in the District of Columbia. As a component of this project, the Center assessed the feasibility and capability of several proprietary and non-proprietary stormwater treatment practices that could be applied to the site. Key caveats associated with the assessment include:

- The purpose of this write-up is for information purposes only and is not intended to identify preferred practices. The Center does not offer any express endorsements for the reviewed products.
- The information presented is largely based on literature provided by vendors and their websites. In limited instances it was possible to check product literature against independent testing information.
- The reviewed practices do not represent a comprehensive assessment of all available products in the marketplace for the specific application. Exclusion of any product is not to be taken as a negative review of the product or technology.
- Where many vendors/manufacturers have a variety of practice sizes to offer, this review primarily focused on the specifications associated with the larger available units.

The primary focus of the assessment was to investigate the capability of the various products at removing trash and floatables and treating oil and grease. Treatment of other common urban runoff pollutants was also noted. In general, practices were assessed for maximum hydraulic capacity, maintenance regime, removal capability, cost, propensity to clog, installation requirements and other feasibility.

In addition to a short summary paragraph with contact information for each practice, two summary tables were prepared to facilitate side-by-side comparisons. The first summary table presents general design characteristics and the second table presents cost and maintenance considerations.

It is important to remember the context that was used for the evaluation of products, namely the removal of floatables and hydrocarbons under significant flow conditions. Practices are presented in alphabetical order.

REVIEW OF TREATMENT DEVICES

BaySaver

The BaySaver Separation System is designed to remove and store sediment, organic material, oil and grease, and floating debris carried by stormwater runoff.

Pollutant Removal

The BaySaver removes oil and grease, a minimal amount of trash, and some sediment.

Design

The BaySaver treats up to 11 cfs. The largest available unit has an oil capacity of 868 gallons, is installed below grade, and has a footprint of 300 square feet.

Maintenance

Maintenance requirements are a full pump-out at least once a year, and regular inspections. Pumpouts are done using a vactor truck.

Cost

The estimated cost is \$16,000 to \$18,000 per unit, and \$5,000 for installation. Maintenance costs are estimated at \$2,000 per cleanout.

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CDS Technologies

Continuous Deflective Separation (CDS) technology was developed in Australia and uses a solids/liquids separation technology to remove floatables and pollutants from combined sewer overflows and stormwater. It uses a non-blocking, indirect screening technique.

Pollutant Removal

The CDS unit captures and retains 99% of trash. The only time trash goes by the CDS is at peak flows above the design capacity. CDS also removes oil and grease with the use of sorbents; however, CDS is not effective at removing oil that is suspended and emulsified within the storm water flow. With the use of sorbents, CDS removes 80 to 90% of oil and grease. Polypropylene or co-polymer sorbents were the most effective in testing. The CDS also removes sediment (coarse fraction); although, no removal performance was specified in the product documentation.

Design

The largest CDS unit treats up to 300 cfs, has a sump capacity of 14.1 cubic yards, is installed below grade, and has a 41-foot diameter footprint.

Maintenance

The unit should be inspected for proper operation at least once a year, and the screen should be power washed at this time. Cleanouts should be performed after major storms, and when sump is 2/3 to 3/4 full. Sorbents should be removed and replaced when fully discolored. Cleanouts involve removing settleables from the sump and floatables from the surface. Three methods of cleanout include: a vactor truck, removable basket (4-10 ton capacity), and an underflow pump.

Cost

The estimated construction and installation cost per CDS unit is between \$200,000 and \$300,000 for the larger units.

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Downstream Defender

The Downstream Defender is a treatment device designed to capture settleable solids, floatables, and oil and grease from stormwater runoff.

Pollutant Removal

The Downstream Defender removes oil and grease, a minimal amount of trash, and sediment and grit. The Swirl-Cleanse technology can be used with the Downstream Defender for optimum trash removal.

Design

The Downstream Defender treats up to 13 cfs. The largest unit has an oil capacity of 1,050 gallons, a sediment capacity of 8.7 cubic yards, is installed below grade, and has a 10-foot diameter. The Downstream Defender can be custom-sized to treat larger flows.

Maintenance

Inspections and cleanouts are required regularly over the first year to determine an appropriate cleanout schedule. After the first year, cleanout and inspections should occur at least twice a year. Cleanouts are done using a vactor truck.

Cost

The estimated cost per unit is \$30,000, not including installation cost.

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MultiChamber Treatment Train

The MultiChamber Treatment Train (MCTT) is a nonproprietary device that was developed to treat runoff from hotspots (i.e., land uses with higher than average concentrations of urban runoff pollutants), and it consists of three chambers: a screening chamber, a settling chamber, and a filtration chamber.

Pollutant Removal

The MCTT removes oil and grease, sediment, grit, metals, and a limited amount of trash.

Design

The MCTT treats up to 2.5 acres, is installed below grade, and takes up about 0.5 to 1.5% of the impervious area treated.

Maintenance

The maintenance requirements for the MCTT are to inspect, clean the catch basin, and renew sorbent pillows every 6 months, and to replace the sand/peat filter media every 3-5 years.

Cost

The estimated costs are \$10,000 to \$20,000 per one quarter acre of drainage area.

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Netting Trash Trap

The Netting Trash Trap is a modular floatables collection system located at the stormwater outfall that uses the energy of the overflow stream to drive the floatables into disposable mesh nylon bags.

The Netting Trash trap was first used at the Fresh Creek outfall, a tributary to Jamaica Bay in New York City. The outfall drains 880 acres, and flow rate averaged 150 cubic feet per second. The system consisted of two 8-foot long mesh bags attached to each outfall barrel. Over an 8-month study period, 8,500 pounds of floatables were removed using the netting system. The efficiency of the nets ranged from 90 to 95% for floatable capture. All captured floatables and used nets were disposed as municipal waste by the City of New York. A second demonstration project was installed in Newark, New Jersey at two different sites: Peddie Outfall near Newark Airport and Saybrook Outfall on the Passaic River. Both systems were designed to lift during intense storm events when discharge flow velocity exceeded 7 feet per second. The floatable capture efficiency for these New Jersey sites ranged from 93 to 97%.

Pollutant Removal

The Netting Trash Trap removes 90 to 97% of trash, and may have limited removal of some sediment. Standard nets hold up to 25 cubic feet of floatables and a weight of 500 pounds each.

Design

High velocity nets are more expensive but required for flow greater than 7 fps. A bypass is required for velocities greater than 7 to 10 fps. This system works under a range of weather conditions, although ice may prevent bag changing. A typical 6-bag system is 16 feet wide and 8 feet long. The Netting Trash trap has a minimum life expectancy of 20 years.

Maintenance

At least once a month net removal, trash cleanup, and net replacement is recommended. Inspections are required after large storms. The maintenance schedule will depend on the number

and frequency of storms, as well as the capacity of the system and the pollutant load. Cleanout requires a boom truck crane capable of lifting 1,000 pounds and a carting container. Access to the site will be necessary, and the trash must be hauled to a landfill.

Cost

The estimated costs for a 6-bag system with 60 replacement bags is \$150,000 to \$200,000. Each replacement bag costs \$95. Estimated maintenance costs for a 2-bag system are \$1500 per month.

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Stormceptor

The Stormceptor is a pollution prevention device that removes oil and sediment from stormwater, and stores them for safe and easy removal.

Pollutant Removal

Independent studies have documented oil and grease removal of up to 43.2% for the Stormceptor. Product literature suggests removals of as high as 98%. Sediment removal (coarse fraction) also occurs, but to a limited extent (i.e., reported removals of less than 25%).

Design

The Stormceptor treats up to 2.5 cfs or 11 impervious acres. The largest model has an oil capacity of 1100 gallons, a sediment capacity of 725 cubic feet, is installed below grade, and has a footprint of about 14 feet in diameter.

Maintenance

The Stormceptor requires a full pump-out at least once a year, regular inspections, and should be cleaned out when accumulation reaches 15% of the operating storage volume. Cleanout is done using a vactor truck and a high pressure hose to clean the manhole.

Cost

The estimated capital costs per unit is up to \$35,000, while cleanout costs are \$250 per cleanout, and disposal costs are \$300 to \$500 per cleanout.

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StormFilter

The StormFilter is a passive flow-through stormwater filtration system consisting of a concrete vault that houses rechargeable cartridges filled with a variety of filter media.

Pollutant Removal

The StormFilter has reported removals of 80 to 85% for oil and grease, and also removes sediment, soluble heavy metals, soluble nutrients, and a minimal amount of trash.

Design

One StormFilter cartridge treats 15 gpm, therefore 30 cartridges will treat 1 cfs. A 9-cartridge unit can have a 72 square foot footprint, and a 30-cartridge unit can have a 128 square foot footprint. The CSF leaf media or perlite filter media are the best choices for oil and grease removal.

Maintenance

Three inspections per year are required to determine cleanout frequency and to adjust the flow valve. When fine sediment on the cartridges is less than 1 inch, backflush the cartridges with water. When fine sediment is greater than 1 inch, replace the cartridges and clean out the vault. A vactor truck is used for the cleanout, and a pump and water truck is used for backflushing.

Cost

A 9-cartridge unit costs \$15,500, and each replacement cartridge is \$90. The estimated annual maintenance costs for this unit is \$650.

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StormTreat

The StormTreat system is an engineered wetland cell and filter that captures and treats the first flush of runoff.

Pollutant Removal

StormTreat removes oil and grease, bacteria, sediment, heavy metals, nutrients, and a minimal amount of trash,

Design

The StormTreat system consists of six sedimentation chambers and a constructed wetland. To treat one inch of rainfall, two units are required for each impervious acre. The unit capacity is 1,400 gallons. It is installed at the surface, and has a 9.5 foot diameter and 4 foot height.

Maintenance

An annual inspection is required, which includes removing and replacing the burlap grit screening bags, and removing, cleaning and reinstalling the filters. The sediment is cleaned out via suction pump once every 3 to 5 years.

Cost

The estimated cost per unit is \$6,700, with a \$500 cost for additional materials, and \$100 to \$1,500 installation fee, depending on the site conditions.

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Vortechs Stormwater Treatment System

The Vortechs Stormwater Treatment System is a technology designed for removal of floating pollutants and settleable solids from surface runoff.

Pollutant Removal

The Vortechs system reports removals of 43.2 to 97.8% for oil and grease, has limited removal of trash, and removes grit, sediment, and metals.

Design

The Vortechs system treats up to 25 cfs. The largest unit has an oil capacity of 2500 gallons, a sediment capacity of 7 cubic yards, is installed below grade, and has a footprint of 216 square feet.

Maintenance

Six to twelve inspections are required in the first year, monthly inspections are required during heavy soil loadings. When sediment depth reaches 2 feet, the system should be cleaned out using a vactor truck or a clam shell scoop for sediment and oil-absorbent pads for oil and grease.

Cost

The estimated costs per unit ranges up to \$40,000, with installation costs at 25% of the unit cost. Maintenance costs are estimated at \$400 per cleanout.

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Table 1. Comparison of Design Characteristics of Proprietary Products

Product	Flow or Area Treated	Trash Removal	Oil and Grease Removal	Other Pollutant Removal	Storage Capacity	Installed Location	Maximum Footprint
BaySaver	up to 11 cfs	minimal	yes	sediment, organics	868 gallons	below grade	300 ft ²
CDS	up to 300 cfs	99%	80 – 90%	sediment	14.1 yds ³	below grade	41 ft diameter
Downstream Defender	up to 13 cfs	minimal	yes	sediment, grit	1050 gallons + 8.7 yds ³	below grade	10 ft diameter
MCTT	up to 2.5 acres	minimal	yes	sediment, grit, metals	no data	below grade	0.5 – 1.5% of impervious area
Netting Trash Trap	requires bypass for velocities > 10 fps	90 - 97%	no	minimal	25 ft ³ per net	above grade	16' x 8' for 6 bag system
Stormceptor	up to 2.5 cfs	minimal	43 – 98%	sediment	1,100 gallons + 725 ft ³	below grade	14 ft diameter
StormFilter	30 cartridges treat 1 cfs	minimal	80 – 85%	sediment, metals, nutrients	no data	below grade	128 ft ² for 1 cfs
StormTreat	2 units per impervious acre	minimal	yes	bacteria, sediment, metals, nutrients	1400 gallons	at surface	9.5 ft diameter
Vortechs	up to 25 cfs	43 – 98%	43 – 98%	grit, sediment, metals	2500 gallons + 7 yds ³	below grade	216 ft ²

Table 2. Comparison of Cost and Maintenance Requirements for Proprietary Products

Product	Capital Cost	Maintenance Cost	Maintenance Requirements	Maintenance Equipment
BaySaver	\$16,000 to \$18,000 + \$5000 for installation	\$2000 per cleanout	pumpout annually, regular inspections	vactor truck
CDS	\$200,000 to \$300,000	no data	inspect, pumpdown and wash regularly, cleanout when sump is 2/3 to ¾ full, replace sorbents when discolored	vactor truck, removeable basket or underflow pump and sorbents
Downstream Defender	\$30,000 + installation costs	no data	inspect and cleanout regularly, more often in first year	vactor truck and high pressure hose
MCTT	\$10,000 to \$20,000 per quarter acre of drainage	no data	inspect, clean and replace sorbents every 6 months, replace filter media every 3-5 years	no data
Netting Trash Trap	\$150,000 to \$200,000 for a 6-bag system	\$1500/month for 2-bag system	monthly inspections, net removal and replacement, take trash to landfill	boom truck crane with 1000 lb capacity and carting container
Stormceptor	\$35,000	\$250 per cleanout, \$300 to \$500 for disposal	pumpout annually, inspect regularly, cleanout when 15% full	vactor truck and high pressure hose
StormFilter	\$15,500 for a 9-cartridge unit	\$650/year for 9-cartridge unit	inspect 3 times/year, backflush when sediment is <1 inch, replace cartridges when sediment is > 1"	vactor truck or pump and water truck
StormTreat	\$6700 + \$500 for materials + \$100 to \$1500 for installation	no data	inspect, replace bags, and clean filters annually, remove sediment every 3-5 years	standard septic system pump
Vortechs	\$40,000 + 25% for installation	\$1500 per cfs treated, \$400 per cleanout	6-12 inspections in first year, cleanout when sediment is 2 ft deep	vactor truck or clam shell scoop and sorbent pads

Note: data in the above tables is for the larger units available