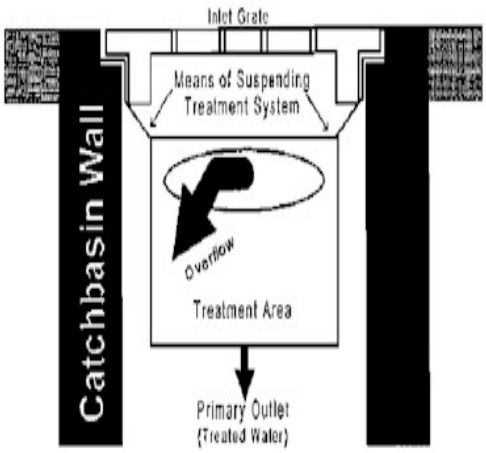
BMP 6.6.4: Water Quality Filters & Hydrodynamic Devices



A broad spectrum of BMPs have been designed to remove non point source pollutants from runoff as a part of the runoff conveyance system. These structural BMPs vary in size and function, but all utilize some form of settling and filtration to remove particulate pollutants from stormwater runoff, a difficult task given the concentrations and flow rates experienced. Regular maintenance is critical for this BMP. Many water quality filters, catch basin inserts and hydrodynamic devices are commercially available. They are generally configured to remove particulate contaminants, including coarse sediment, oil and grease, litter, and debris.

s

- Choose a device that (collectively) has the hydraulic capacity to treat the design storm
- Evaluation of the device chosen should be balanced with cost
- Hydraulic capacity controls effectiveness
- Most useful in small drainage areas (< 1 Acre)
- Ideal in combination with other BMPs
- Regular maintenance is necessary

Stormwater Functions

Volume Reduction: None
Recharge: None
Peak Rate Control: None
Water Quality: Medium

Water Quality Functions

TSS: 60%
TP: 50%
NO3: 20%

Other Considerations

- See Manufacturers specifications for estimated pollutant removal efficiencies.

Description

Water Quality Inlets are stormwater inlets that have been fitted with a proprietary product (or the proprietary product replaces the catch basin itself). They are designed to reduce large sediment, suspended solids, oil and grease, and other pollutants, especially pollutants conveyed with sediment transport. They can provide "hotspot" control and reduce sediments loads to infiltration devices. They are commonly used as pretreatment for other BMPs. The manufacturer usually provides the mechanical design, construction, and installation instructions. Selection of the most appropriate device and development of a maintenance plan should be carefully considered by the Designer.

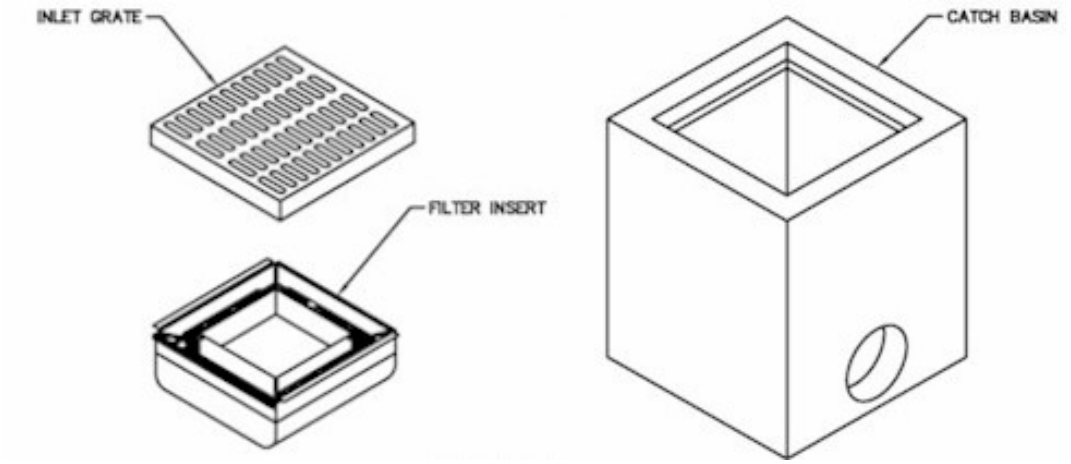
The size of a water quality inlet limits the detention time and the hydraulic capacity influences the effectiveness of the water quality insert. Most products are designed for an overflow in large storm events, which is necessary hydraulically and still allows for a "first flush" treatment.

Regular maintenance according to application and manufacturer's recommendations is essential for continued performance.

Variations

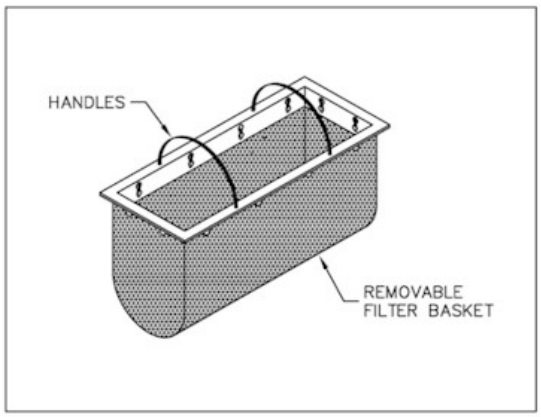
Tray types

Allows flow to pass through filter media that is contained in a tray located around the perimeter of the inlet. Runoff enters the tray and leaves via weir flow under design conditions. High flows pass over the tray and into the inlet unimpeded.



Bag types

Insert is made of fabric and is placed in the drain inlet around the perimeter of the grate. Runoff passes through the bag before discharging into the drain outlet pipe. Overflow holes are usually provided to pass larger flows without causing a backwater at the grate. Certain manufactured products include polymers intended to increase pollutant removal effectiveness.

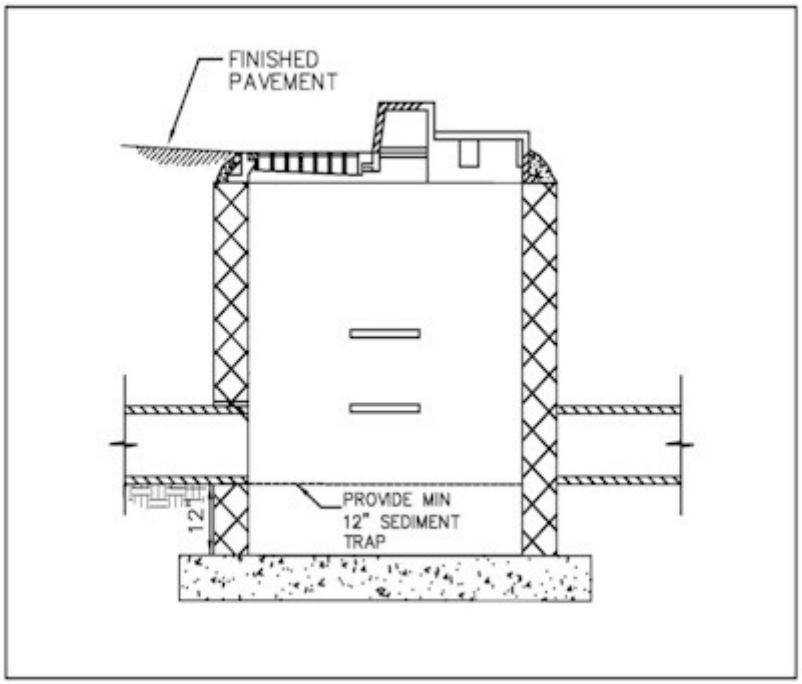


Basket types

The insert consists of “basket type” insert that sets into the inlet and has a handle to remove basket for maintenance. Small orifices allow small storm events to weep through, while larger storms overflow the basket. Primarily useful for debris and larger sediment, and requires consistent and frequent maintenance.

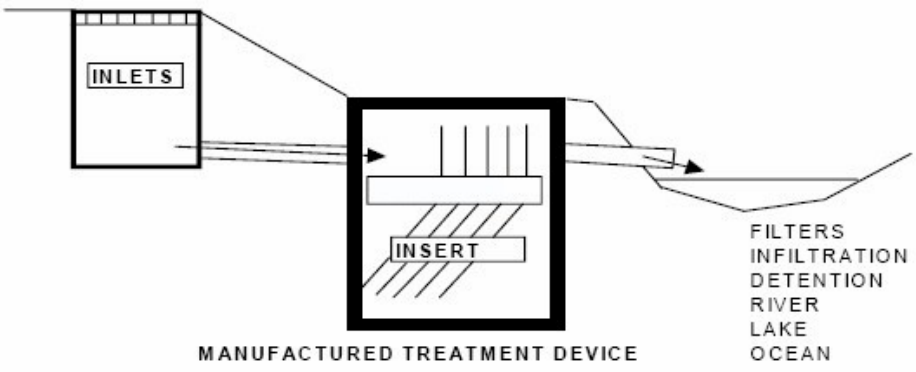
Simple, "sumps" in inlets

Space created in inlets below the invert of the pipes for sediment and debris to deposit, usually leaving 6-inches to 12-inches at the bottom of an inlet. Small weep holes should be drilled into the bottom of the inlet to prevent standing water for long periods of time. Regular maintenance is required.



Description - Hydrodynamic Devices

Hydrodynamic Devices are not truly inserts, but separate flow through devices designed to serve in concert with inlets and storm sewer. A variety of products are available from different manufacturers. The primary purpose is to use various methods to remove sediments and pollutants. These methods include baffle plate design, vortex design, tube settler design, inclined plate settler design or a combination of these. Ideally, the flow through device should remove litter, oil, sediment, heavy metals, dissolved solids and nutrients. Removal ability varies as a result of loading rate and design. Clays and fine silts do not easily settle out unless they are coagulated with some kind of chemical addition or polymer. These devices work most effectively in combination with other BMPs, either as a pre-treatment or as a final treatment at the end of a pipe.



Applications

Any existing or proposed inlet where the contributing runoff may contain significant levels of sediment and debris, for example: parking lots, gas stations, golf courses, streets, driveways, industrial or commercial facilities, and municipal corporation yards. Commonly used as pretreatment before other stormwater BMPs.

Design Considerations

1. Match site considerations with manufacturer's guidelines/specifications (i.e. land use will determine specific pollutants to be removed from runoff).

2. Prevent re-suspension of particles by using small drainage areas and good maintenance.

3. Retrofits should be designed to fit existing inlets.

4. Placement should be accessible to maintenance.

5. If used as part of Erosion & Sedimentation Control during construction, insert should be reconfigured (if necessary) per manufacture's guidelines.

6. Overflow should be designed so that storms in excess of the device's hydraulic capacity bypass the treatment and is treated by another quality BMP.

Detailed Stormwater Functions

Volume Reduction Calculations
N/A

Peak Rate Mitigation Calculations
N/A

Water Quality Improvement
See manufacturers specifications and tests.

Construction Sequence

1. Stabilize all contributing areas before installing and connecting pipes to these inlets.

2. Follow manufacturer's guidelines for installation. Do not use water quality inserts during construction unless product is designed primarily for sediment removal. (Some products have adsorption components that should be installed post-construction.)

Maintenance Issues

Follow the manufacturer's guidelines for maintenance, also taking into account expected pollutant load and site conditions. Inlets should be inspected weekly during construction. Post-construction, they should be emptied when over half full of sediment (and trash) and cleaned at least twice a year. They

should also be inspected after runoff events. Maintenance is crucial to the effectiveness of this BMP. The more frequent a water quality insert is cleaned, the more effective it will be. One study (Pitt, 1985) found that WQI's can store sediment up to 60% of its sump volume, and after that, the inflow resuspends the sediments into the stormwater. Some sites have found keeping a log of sediment amount date removed helpful in planning a maintenance schedule. Environmental Technology Verification (ETV) Program and the Technology Acceptance and Reciprocity Partnership (TARP) may be available to assist with the development of a monitoring plan. These programs are detailed in Section 6.3.

Disposal of removed material will depend on the nature of the drainage area and the intent and function of the water quality insert. Material removed from water quality inserts that serve "Hot Spots" such as fueling stations or that receive a large amount of debris should be handling according to DEP regulations for that type of solid waste, such as a landfill that is approved by DEP to accept solid waste. Water quality inserts that primarily catch sediment and detritus from areas such as lawns may reuse the waste on site.

Vactor trucks may be an efficient cleaning mechanism.

Winter Concerns: There is limited data studying cold weather effects on water quality insert effectiveness. Freezing may result in more runoff bypassing the treatment system. Salt stratification may also reduce detention time. Colder temperatures reduce the settling velocity of particles, which can result in fewer particles being "trapped". Salt and sand are significantly increased in the winter, and may warrant more frequent maintenance. Sometimes freezing makes accessing devices for maintenance difficult

Cost Issues

Check with manufacturers for current prices.

Specifications

Follow manufacturer's instructions and specific specifications.

References

Brzozowski, C., 2003. "Inlet Protection – Strategies for Preserving Water Quality," Stormwater magazine.

Lee, F. "The Right BMPs? Another Look at Water Quality." Stormwater magazine.

New Hampshire Watershed Management Bureau, Watershed Assistance Section, 2002. "Innovative Stormwater Treatment Technologies BMP Manual."

Pitt, R. *Characterizing and Controling Urban Runoff through Street and Sewerage Cleaning.* US EPA, June 1985.