

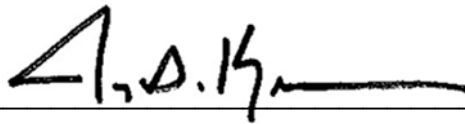
STORMWATER MANAGEMENT FACILITIES
OPERATION AND MAINTENANCE MANUAL

FOR

APARTMENTS AT VERONA
BLOCK 2301
LOTS 11, 12, 14-17, PORTION OF 18, AND 19
TOWNSHIP OF VERONA
ESSEX COUNTY, NJ

Prepared by

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Date: October 28, 2021



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This manual is intended to provide guidance and instruction to the landowner(s) for the proper operation and maintenance of the Stormwater Management Facilities and has been prepared using the NJDEP's "Stormwater Management Facility Maintenance Manual", New Jersey Best Management Practices (BMP) Manual, dated February 2004, last revised March 2021, the New Jersey's Department of Environmental Protection's (NJDEP) regulations at N.J.A.C. 7:8 "Stormwater Management" and the Freehold Township "Stormwater Control Ordinance".

The maintenance plan and any future revision in accordance with N.J.A.C. 7:8-5.8 shall be recorded upon the deed of record for the property. The person responsible for maintenance shall maintain a detailed log of all the preventative and corrective maintenance for the structural stormwater management measures, including a record of all inspections and copies of all maintenance-related work orders. The person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and deed as needed. The person responsible for maintenance shall retain and make available upon request by any public entity with administrative, health, environmental or safety authority over the site, the maintenance plan and all documentation required by the plan.

Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including repairs or replacement to structures; removal of sediment, debris or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

The person responsible for maintenance shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

This Manual consists of three parts: The first part includes a narrative introduction, a description of facilities and a list of project contacts. The second part provides the operation and maintenance instructions for the facilities and equipment. The third part contains appendices, which include a Maintenance Work Order Checklist, Maintenance Log, Inspection Checklist, and an Inspection Log for routine inspection of and maintenance tasks for the proposed stormwater management facilities.

Part I – Introduction

A. Description of Stormwater Management Facilities

The proposed stormwater management facilities for the development are located within Block 2301, Lots 11, 12, 14-17, portion of 18, and 19 in the Township of Verona, Essex County, New Jersey. The stormwater management facilities and associated components have been designed to provide peak flow rate attenuation, water quality and recharge of stormwater run-off from the project area. These stormwater management facilities are to be maintained by the facility operator of the Apartments at Verona development, from now on called Owner, for whom this Operations and Maintenance Manual has been prepared.

The stormwater management facilities were designed to meet the requirements set forth in the New Jersey Best Management Practices (BMP) Manual, dated February 2004, last revised March 2021, the requirements as imposed by the New Jersey Department of Environmental Protection (NJDEP) within N.J.A.C. 7:8 and the Freehold Township Stormwater Control Ordinance.

Bio-Retention Basins #1 & #2

The bio-retention basins were designed to provide temporary storage of stormwater runoff after precipitation events and provide water quality for stormwater prior to its release to the downstream receiving waters. The basins have outlet structures which retain and attenuate runoff inflows and promotes the settlement of pollutants. The bio-retention basins also have a specific blended soil mix for the bottom 24” of material to enhance infiltration and is planted with woody vegetation and special seed mixture throughout to provide improved stormwater quality treatment.

The bio-retention basins have been designed to aid in addressing both the stormwater quantity and quality impacts from the proposed development, promoting pollutant removal through sedimentation and biological processing through uptake and filtration by the vegetation. The multi-stage outlet structures are utilized to retain the water quality design storm events while the higher stages are used to attenuate the peak rates of run-off from the larger design storm events.

The bio-retention basins are also equipped with an underdrain system beneath their bottom to allow for the draining of any retained stormwater below the lowest orifice of the outlet structure. The underdrains are equipped with a valve at their discharge end within the outlet structure, which shall be left closed during routine operation. To allow for the additional drainage of any retained stormwater for maintenance or access purposes, the valve may be opened temporarily until the basin is evacuated.

Underground Storage System

An underground storage system was designed to provide temporary storage of stormwater runoff from the development after precipitation events. The underground storage system is comprised of multiple 42” diameter corrugated high-density polyethylene (CHDPE) pipes within a stone envelope, located entirely below grade. This storage system has an outlet structure that detains and attenuates runoff inflows. The multi-stage outlet structure is utilized to attenuate the peak rates of run-off from the design storm events prior to their discharge into the stormwater collection system within Pine Street. The

underground storage system is also equipped with stormwater manholes at its extents for routine inspection and maintenance purposes.

Manufactured Treatment Device #401

The manufactured treatment device (MTD) is a pre-fabricated stormwater treatment structure which was designed to capture sediments, metals, hydrocarbons, floatable and/or other pollutants in stormwater run-off. The specified MTD utilizes settling and vortex separation to help reduce total suspended solids (TSS) and pollutants within the stormwater run-off, providing the necessary treatment required by the NJ BMP Manual.

Perforated C.H.D.P.E. Recharge Pipes

There are three (3) oversized 36” diameter perforated CHDPE pipes within a stone envelope which will provide infiltration of the run-off from a portion of the roof of Building A. Each infiltration pipe has been designed to retain the volume of the water quality design storm from their contributory drainage area and provide sufficient capacity to recharge the deficit of the average annual recharge volume.

B. Project Contacts

This Section must be updated periodically to reflect the name(s) and telephone numbers of the Inspector and Contractor who are appointed by the owner.

Current Property Owner	Township of Verona 600 Bloomfield Avenue Verona, NJ 07044
Responsible Representative	Verona LIHTC Urban Renewal, LLC 5 Commerce Way, Suite 204 Hamilton, NJ 609-751-9664
Verona Township Engineer	Michael DeCarlo, Engineering Manager Township of Verona Public Works WWTP, 10 Commerce Court Verona, NJ 07044 973-857-5246
Design Engineer	Jay S. Kruse, P.E. ESE Consultants, Inc. 100 Willow Brook Road, Suite 200 Freehold, NJ 07728 732-272-0532
Inspectors	TBD

Designated Contractor	TBD
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Licensed Professional Engineer	TBD
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Officers	TBD
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C. Map/Details of Facilities

This section shall be periodically updated to incorporate additional plans and sketches that are developed for the operations, maintenance, inspection or rehabilitation of the basin. The Inspector shall review available plans prior to conducting an inspection. See Appendix A-1 for Map/Details of Facilities.

Part II – Operation and Maintenance

A. Inspection and Maintenance of Stormwater Management Facilities

Bio-retention Basins #1 & #2

The bio-retention basins provide both permanent and temporary storage of runoff during rain events. The basins should fully drain within 72 hours after a storm event. The bio-retention basins have been designed to provide water quality treatment. Without proper routine inspection and maintenance, the basins may lose their capabilities to function as intended. Inspections and maintenance of the overall basins should occur as outlined in the following sections with inspection of the planting beds occurring at least twice annually to determine if the permeability of the beds have decreased.

Underground Storage System

The underground storage system provides temporary storage of runoff during rain events. This system should fully drain within 72 hours after a storm event. The calculated maximum drain time for the underground storage system is 29± hours. The underground storage system has been designed to attenuate the 2, 10 and 100 year storm runoff volumes. Without proper routine inspection and maintenance, the system may lose its capabilities to function as intended. Inspections and maintenance of the overall system should occur as outlined in the following sections.

Manufactured Treatment Devices

The primary function of the MTD is to mechanically trap debris and sediment within the structure. Therefore, the primary maintenance requirement for an MTD is that of inspection of the physical components of the structure and removal of accumulated sediment. Generally, this involves routine inspection (at least four times annually and after every significant storm event) of the interior of the structure for clogging or excessive debris accumulation and removal of sediment/debris within the structure by licensed and authorized vendor in accordance with the frequency outlined in the manufacturer's operation and maintenance manual. For MTDs utilizing filtration devices or modules, the filtration media shall be inspected and replaced in accordance with the specific guidance as provided in the manufacturer's operation and maintenance manual. See Appendix A-6 for the respective operation and maintenance manuals for the site's MTDs.

Note, entry into the MTD should only be performed by licensed and experienced personnel. Any inspection of the structure by general personnel should occur via visible observation from the surface.

Perforated C.H.D.P.E. Recharge Pipes

The perforated CHDPE pipes will provide infiltration of the run-off from a portion of the roof of Building A. Without proper routine inspection and maintenance, the recharge pipes may lose their capabilities to function as intended. Inspections and maintenance of the overall system should occur as outlined in the following sections.

The following are maintenance procedures that are to be performed on a routine basis:

1. Preventative Maintenance Procedures

The purpose of preventative maintenance inspections is to ensure that the stormwater management aspects of the stormwater management facilities remain operational and safe at all times, while minimizing the need for corrective or emergency maintenance.

a. Sediment Removal and Disposal

All Stormwater Management Facilities components should be evaluated for excessive deposition of sediment. Accumulated sediment should be removed before it threatens the storage volume of the bio-retention basins, underground storage system, recharge pipes and MTDs collectively referenced as “stormwater management facilities” for the remainder of this manual, unless individually referenced.

Sediment removal should be provided by evacuating all standing water from the stormwater management facilities before desilting activities are performed. This may be accomplished by means of pumping the water out of the stormwater management facilities or opening valves/plugs provided at the lowest elevation of the outlet structure. A pump would be rented as applicable for this procedure. Inspection for excessive sediment should be performed on a quarterly basis as well as after every storm exceeding one inch of rainfall. If stable soil conditions exist around the stormwater management facility areas, sediment deposition should not be a problem. Normal sediment removal should be approximately a ten (10) year cycle for basin type facilities, with the exception of MTDs. The frequency for removal of sediment and/or replacement of media filters within MTDs should occur in accordance with the manufacturer’s operation and maintenance instructions. Should a recurrent problem develop, the inspector should identify the upstream sources of sediment and recommend required stabilization measures.

Disposal of sediment should be done at a suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations.

Bio-retention Basins #1, #2 and Underground Storage System

The primary location for debris and particularly sediment accumulation will occur at the inflow points, trash racks, outlet structures, and riprap or gabion aprons of the bio-retention basins and underground storage system.

Perforated C.H.D.P.E. Recharge Pipes

The primary location for debris and particularly sediment accumulation will occur at the inflow points and bottom of the 36” pipes.

Manufactured Treatment Devices

MTDs are designed to capture and/or filter sediment within an isolated chamber via hydrostatic separation or media modules. The primary location for debris and particularly sediment accumulation will occur in the designated receptacle area within the MTD. Typically, MTDs are constructed with access ports for inspection of sediment and debris accumulation. The frequency for removal of sediment and/or replacement of media filters should occur in accordance with the manufacturer's operation and maintenance instructions which are located in Appendix A-6.

b. Removal and Disposal of Trash Debris

All stormwater management facilities components must be inspected for clogging and debris accumulation, this will reduce the chance of components becoming clogged and inoperable during storm events. Additionally, removal of trash and debris will prevent possible damage to vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash should be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations. These tasks should be performed on a quarterly basis as well as after every storm exceeding one inch of rainfall.

c. Maintenance of Adjacent Vegetated Areas

Grass areas, trees, shrubs adjacent to the stormwater management facilities require periodic fertilizing, de-thatching and soil conditioning in order to maintain healthy growth and to provide bank stabilization. The application of fertilizers should follow manufacturer's instructions to reduce run-off into the stormwater management facilities. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, stormwater flow, or other causes. Mowing and or trimming of vegetation must be performed on a regular schedule based on specific site conditions. Grass should be mowed at least once a month during the growing season. Adjacent vegetated areas must also be inspected at least annually for erosion and scour. The stormwater management facilities must be inspected for unwanted tree growth at least once a year.

During the first growing season, when establishing or restoring vegetation, biweekly inspections of vegetation health should be performed until the vegetation is established. Once the vegetation is established, inspections of vegetation health, density and diversity should be performed at least twice annually. The vegetative cover should be maintained at 85%. If vegetation has greater than 50 percent damage, the area should be reestablished in accordance with the original specifications and the inspection requirements presented above.

All use of fertilizers, mechanical treatments, pesticides and other means to ensure optimum vegetation health must not compromise the intended purpose of the stormwater management facilities. All vegetation deficiencies should be addressed without the use of fertilizers and pesticides whenever possible.

d. Structural Components

All structural components must be inspected for cracking, subsidence, spalling, erosion, and deterioration at least annually. All outlet valves are to be inspected and exercised at least four times annually.

e. Drain or Drawdown

When necessary, the stormwater management facilities shall be drained for inspection and maintenance by integrated appurtenances (valves and gravity drain pipes) or mechanical means (pumps and vacuum trucks). The normal draining time as previously referenced in Item A should be used to evaluate the stormwater management facilities' actual performance. If significant increases or decreases in the normal drain time are observed, the stormwater management facilities' outlet structure and both ground water and tailwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements. The maximum allowable drain time per the NJ BMP Manual for stormwater management facilities is 72 hours.

f. Elimination of Potential Mosquito Breeding Habitats

The most effective mosquito control program is one that eliminates potential breeding habitats. Almost any stagnant pool of water can be attractive to mosquitos, and the source of a large mosquito population. A maintenance program dedicated to eliminating potential breeding areas is certainly preferable to chemical means of controlling mosquitoes. The most important maintenance function, which can be performed in this case, is to make sure that all obstructions to natural flow patterns are removed before the stagnant water condition can develop. To maintain water quality, oxygen levels, control mosquito breeding, and prevent stagnation, an adequate and regular inflow of surface and/or ground water is necessary.

g. Inspection

A "regular" inspection of stormwater management basins must be performed by a licensed New Jersey professional engineer at least once every four (4) years. A regular inspection requires a visual inspection to detect any signs of deterioration in material, developing weaknesses or unsafe hydraulic or structural behavior. The primary purpose of these inspections is to ascertain the operational condition and safety of the facility, particularly the condition of embankments and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled Preventative and Aesthetic Maintenance Procedures, and will help to identify where changes in the extent and scheduling of the procedures are warranted. Finally, the regular inspections should also be used to determine the need for and timing of Corrective Maintenance procedures.

The NJDEP may at its discretion require the owner or operators to perform a "formal" inspection of stormwater management basins. A formal inspection must be performed by a licensed New Jersey professional engineer and requires the reevaluating the safety and integrity of the embankment and appurtenant structures to determine if the structure meets current design criteria. A formal inspection also includes a field inspection and a review of the records on project design, construction and performance. For good cause, the NJDEP may require the

owner or operator to perform an inspection of any type at any time. All inspections must be performed from March through December.

For MTDs, routine inspections should occur at least four times annually and after every significant storm event. Additional inspection requirements are provided in the operation and maintenance manuals for the site's MTDs provided in Appendix A-6.

h. Reporting

The recording of all maintenance work and inspections provide valuable data on the facility condition. Review of this information will also help to establish more efficient and beneficial maintenance procedures and practices. All recorded information should be directed to the owners of the stormwater management facilities for review and subsequent follow-up on recommendations. The reports shall indicate the results of the inspection, documenting the conclusions and recommendations. Reports must be submitted to the county and/or municipal engineer having jurisdiction over the dam structure. Unless requested by the NJDEP, reports shall not be submitted to the NJDEP.

2. Corrective Maintenance Procedures

a. Removal of Debris and Sediment

Sediment, debris and trash which threaten the discharge capacity of the stormwater management facilities should be removed immediately and disposed of properly. Equipment and personnel must be available to perform the removal work on short notice. As noted previously, it is recommended that all water be evacuated from the stormwater management facilities before any significant amount of sediment or settled debris or trash is removed from the stormwater management facilities. The lack of an available disposal site should not delay the removal of trash, debris, and sediment. Temporary disposal sites should be utilized if necessary.

b. Structural Repairs

Structural damage to the MTD, inlet structures and headwalls from vandalism, flood events, or other causes must be repaired promptly. Equipment, materials and personnel must be available to perform these repairs on short notice. The immediacy of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the facility. The analysis of structural damage and the design and performance of structural repairs should only be undertaken by the consulting professional engineer.

c. Extermination of Mosquitoes

If neglected, the stormwater management facilities can readily become an ideal mosquito breeding area. Extermination of mosquitoes will usually require the services of the County Mosquito Commission. If mosquito control in the facility becomes necessary, the preventative maintenance program should also be re-evaluated, and more emphasis placed on control of mosquito breeding habitats.

d. Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil from the erosive forces of wind and water. Where a re-seeding program has not been effective in maintaining a non-erosive vegetative cover, or other factors have exposed soils to erosion, corrected steps should be initiated to prevent further loss of soil and any subsequent danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including rip-rap, gabion lining, sod, seeding, concrete lining and re-grading. When establishing or restoring vegetation, biweekly inspections of vegetation health, density and diversity should be performed during the growing season. If vegetation has greater than 50 percent damage, the area should be re-established in accordance with the original specifications and the inspection requirements presented above. All use of fertilizers, mechanical treatments, pesticides and other means to assure optimum vegetation health must not compromise the intended purpose of the stormwater management facilities.

e. Fence Repair

Fences are damaged by many factors, including vandalism and storm events. Timely repair will maintain the security of the stormwater management facility.

f. Elimination of Trees, Brush, Roots and Animal Burrows

The stability of stormwater management facilities/berms can be impaired by large roots and animal burrows. Additionally, burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed from stormwater management facilities to prevent their destabilization and the creation of seepage routes, with the exception of the bio-retention basins. Bio-retention basin plantings are installed within the basin bottoms and sideslopes to aid in water quality and should not be removed unless diseased or dying. Any plantings removed within the bio-retention basin should be replaced with in-kind species or mix.

Installed plantings should be routinely trimmed and manicured and loose material removed. Invasive vegetation and roots should also be completely removed to prevent their decomposition within the stormwater management facilities/berm. Root voids and burrows should be plugged by filling with material similar to the existing material, and capped just below grade with stone, concrete or other material. If the plugging of the burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or to make critical areas of the facility unattractive to them. All vegetated areas should be inspected at least annually for unwanted growth, which should be removed with minimum disruption to the remaining vegetation and stormwater management facilities subsoil.

g. Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of outlet structures, stormwater inlets and emergency spillways. Providing the equipment, material and personnel to monitor and remove snow and ice from these critical areas is necessary to assure the continued functioning of the facility during the winter months.

3. Aesthetic Maintenance Procedures

a. Graffiti Removal

The timely removal of this obvious eyesore will restore the aesthetic quality of the stormwater management facilities and MTD. Removal can be accomplished by painting or otherwise covering it, or removing it with scrapers, solvents or cleansers. Timely removal is important to discourage further graffiti and other acts of vandalism.

b. Grass Trimming/Landscape Maintenance

Although time consuming, trimming of grass within and around the stormwater management facilities and proper care of landscape plantings around structures and fences will provide for a neat and attractive appearance of the facility.

c. Control of Weeds

Although a regular grass maintenance program will keep weed intrusion to a minimum, some weeds will invariably appear. Periodic weeding, either chemically or mechanically, will not only help to maintain a healthy turf, but will also keep grassed areas looking attractive. Application of chemicals should be monitored closely so as not to affect the health of the bio-retention basin. Excessive growth of weeds within the stormwater management facilities can also be unattractive and can be controlled mechanically as discussed in the previous section.

4. Summary of Maintenance Procedures

1. Functional Maintenance
2. Preventative Maintenance
3. Sediment Removal and Disposal
4. Removal and Disposal of Trash and Debris
5. Maintenance of Adjacent Vegetated Areas
6. Structural Components
7. Drain or Drawdown Duration
8. Elimination of Mosquito Breeding Habitats
9. Inspection
10. Reporting
11. Corrective Maintenance
12. Removal of Debris and Sediment
13. Structure Repairs
14. Extermination of Mosquitoes
15. Erosion Repair
16. Fence Repair
17. Elimination of Trees, Brush, Roots and Animal Burrows
18. Snow and Ice Removal
19. Aesthetic Maintenance
20. Graffiti Removal
21. Grass Trimming
22. Control of Weeds

B. Inspection/Maintenance Equipment and Materials

The following is a list of required inspection equipment for routine O&M procedures and inspections:

1. Routine Inspection Equipment

1. A clipboard, a pencil and the inspection checklist, which is included in Appendix A-4.
2. A standard 6-foot collapsible ruler.
3. A camera – Photographs of observed portions of the stormwater management facility will provide a measure of performance when comparing past and present maintenance practices or conditions.
4. A probe – Any stiff, light stick or rod with a blunt tip of sufficient strength to penetrate soil. The probe can provide information on conditions below the surface of the stormwater management facility such as the depth and softness of a saturated area.
5. A weed whacker – Can be used to clear non-visible areas and to perform routine maintenance.

The following is a list of the equipment and materials that may be required to maintain stormwater facilities:

2. Grass Maintenance Equipment

1. Riding Mowers
2. Hand Mowers
3. Gas Powered Trimmers
4. Gas Powered Edgers
5. Seed Spreaders
6. Fertilizer Spreaders
7. De-Thatching Equipment
8. Pesticide and Herbicide Application Equipment
9. Grass Clipping and Leaf Collection Equipment

3. Vegetative Cover Maintenance Equipment

1. Saws
2. Pruning Shears
3. Hedge Trimmers
4. Wood Chippers
5. Aquatic Weed Harvester (owned/operated by subcontractor)

4. Transportation Equipment

1. Trucks for Transportation of Materials
2. Trucks for Transportation of Equipment
3. Vehicles for Transportation of Personnel

5. Debris, Trash and Sediment Removal Equipment

1. Loader
2. Backhoe
3. Grader

4. Dredging Equipment
5. Portable Pump/Pumps for Dewatering (See Appendix A6-Drawdown Calculations for required pump rate)
6. Vacuum Truck
7. Street Sweeper

6. Miscellaneous Equipment

1. Shovels
2. Rakes
3. Picks
4. Wheel Barrows
5. Fence Repair Tools
6. Painting Equipment
7. Gloves
8. Standard Mechanics Tools
9. Tools for Maintenance of Equipment

7. Materials

1. Topsoil
2. Fill
3. Seed
4. Soil Amenities (Fertilizer, Lime, etc.)
5. Chemicals (Pesticides, Herbicides etc.)
6. Mulch
7. Paint Removers (for Graffiti)
8. Spare Parts for Equipment

8. Materials for Immediate Use if Warranted by the Inspection

Sources of the following materials should be identified for immediate use if warranted by the inspection.

1. Native soil mixed silty sand material for filling erosion rills and gullies.
2. Topsoil mixture (fertilizer – after analyzing soil conditions) and seed.
3. Large stone rip rap for emergency repairs caused by erosion.
4. Biodegradable geo-fabric netting and stakes to prevent seed and topsoil from blowing away.

9. Inspections and Inspection Checklist

Prior to performing inspections, the Inspector must observe the water level in the stormwater management facility and the outlet side of the facility. No amount of water should flow over the spillway of a stormwater management facility during an inspection. This allows the Inspector to freely observe the spillway. If the inspection identifies a need for immediate maintenance of the spillway, the stormwater management facility water level should be lowered an additional amount by having the Owner pump out the facility to the level required.

The most effective means of conducting the inspection is to treat each stormwater management facility component as an individual element, inspect it thoroughly and fill out the checklist prior to moving on to the next element. The checklist sequence for inspection of Stormwater Management Facilities and stormwater drainage easements is as follows:

1. **The crest:** Walk along the top of the stormwater management facility from one end to the other and look for erosion, puddles or settlements, cracks in the top of the facility, animal burrows, etc.
2. **The upstream embankment:** Walk along the upstream face of the stormwater management facility and to the water's edge and observe erosion, puddles or wet areas, slumps, woody vegetation, scouring, bare and exposed soils or animal burrows. (Look below the waterline for any irregularities or animal burrows.)
3. **The downstream embankment:** Walk along the downstream face of the stormwater management facility in a zigzag, top to bottom fashion to observe erosion, puddles or wet areas, slumps, woody vegetation, scouring, bare and exposed soils or animal burrows. Look below the waterline for any irregularities or animal burrows.
4. **Spillways:** Observe the spillways for the crest. Note any cracking, subsidence, spalling, erosion and deterioration.
5. **The basin:** Stand on the upstream face on the crest and look upstream to observe any irregular conditions within the basin that may ultimately impact the performance of the basin negatively. Observe the accumulation of sediment in the basin bottom and any ponding water. Any noticeable sediment or standing water (after the maximum 72 hour drain time) should be noted and addressed.
6. **The fountain (if applicable):** Observe the fountain performance to ensure proper aeration and proper maintenance per manufacturer specifications of this component, such as cracks, insufficient pressure or insufficient performance.
7. **The downstream area:** Walk along the bed of the downstream channel, outflow pipe or other discharge structure and riprap apron to observe any unusual conditions which may affect the performance of the basin, such as debris, vegetation or excessive sedimentation.
8. **Plant health:** Walk throughout the stormwater management easement and assess the health of the native vegetation and look for any signs of dead/dying plants, deer or animal damage to plant material, disease or insect problems, exotic invasive vegetation (consult the local USDA NRCS office for information regarding exotic invasive vegetation, and removal techniques).

The inspection checklist included in this section should be copied and completed every time a regular inspection is performed. In general, routine inspections should be performed at least 4 times annually. After each inspection, the Inspector will report to the owner, who will direct maintenance operations as necessary. Copy of the same shall be forwarded to the Municipality. Record of all correspondence shall be maintained within in the Manual

10. Operation and Maintenance and Routine Maintenance Checklist

The Owner is responsible for maintenance of the stormwater management facilities. There are three (3) categories of maintenance: immediate maintenance, corrective maintenance and continuing maintenance. Accordingly, each of the maintenance conditions will be determined during the regular inspection, as performed by the Inspector appointed by the Owner. The cost of maintenance will be the responsibility of the owner. This portion of the report also contains a section on technical guidance describing corrective action.

1. **Immediate maintenance:** demands immediate attention, requires notification to the Municipality. Immediate maintenance usually requires construction equipment and professional guidance. Immediate maintenance is characterized by the following:

- a. A severe slope failure.
- b. A breach or a near breach caused by severe progressive erosion.
- c. Overtopping of the crest by upstream or downstream waters.
- d. Increasing uncontrolled seepage through the embankment of any basins.
- e. A blocked spillway or outfall.
- f. A significant amount of dead and or dying vegetation.
- g. A large infestation of harmful insect/pest populations.
- h. A significant amount of volunteer exotic invasive vegetation.
- i. Large areas of erosion and or scouring resulting in bare/exposed soils.
- j. Structural damage (cracking, spalling, penetration, etc.) of MTD

2. **Corrective maintenance:** should be performed as soon as possible after an inspection. Corrective maintenance consists of the following:

- a. Clearing of trees, shrubs and underbrush on a basin embankment crest or near the spillway.
- b. Filling eroded areas or gullies and seeding to stabilize the area.
- c. Removal of burrowing animals and filling the holes.
- d. Maintenance pruning of dead wood from trees and shrubs.
- e. Replacing/replanting minimal amounts of vegetation.
- f. Over seeding and or replanting to fill small voids of herbaceous vegetation.
- g. Corrective maintenance will be performed by the owner with some technical guidance.

3. **Continuing maintenance:** will occur on a regular basis and can be performed during the regular inspections or in accordance with the maintenance schedule outlined in Part II, Section G of this manual. Continuing maintenance includes:

- a. Observation of any wet areas, springs or potential seepage into the embankments.
- b. Removing small shrubs or underbrush on a basin embankment.
- c. Filling small eroded gullies.
- d. Filling of ruts along crest.
- e. Removing accumulated trash and debris.
- f. Removal of burrowing animals and their dens from the stormwater management facility.
- g. Over-seeding grasses areas.

- h. Observing and recording normal drain time during storm events.
- i. Observation of overall woody plant health within stormwater drainage easement.
- j. Observation of plant health and height of vegetation.

Continuing maintenance will be performed by the respective Owner on an ongoing basis. Some technical guidance for routine operations follow.

4. Technical Guidance

Burrowing animal control is critical to the proper operation of a stormwater management facility, especially basins. The technical maintenance tips provided in this section should be followed to insure proper basin operation. Rodents such as woodchucks, muskrats, ground squirrels, rabbits, moles and beavers endanger the structural integrity of the embankment. Animal burrows are easily recognized in the spring because fresh soil is generally found at the mouth of the burrows. Early detection and control in April is essential in controlling burrowing activity. Muskrats are nocturnal and can be found in marshy areas. Their burrows are difficult to detect since they tend to burrow below the waterline. Beaver activity will become apparent through visual observation of tree cuttings. Animals should be removed immediately upon detection. Woodchucks, squirrels, rabbits, moles and muskrats can be exterminated or flushed out with smoke. Beavers must be relocated. The animal burrow must be filled with soil or a mixture of water to 9 parts of soil and 1 part cement. The soil mixture should be placed as deep as possible and compacted with a pole.

During tree and shrub inspection, be sure to examine four characteristics of plant vigor: new leaves or buds, leaf size, twig growth, and absence of crown dieback (gradual death of the upper part of the tree). A reduction in the extension of shoots (new growing parts), such as buds or new leaves is a sign that the tree's health has changed. To evaluate, compare the growth of the shoots over the past three growing seasons. Determine whether there is a reduction in the tree's typical growth pattern. Further signs of declining tree and shrub health are trunk decay, crown dieback, or a combination of both. These symptoms often times indicate problems that began several years before. Loose bark and deformed growths, such as conks (mushrooms), are typically common signs of inner stem decay. Any abnormalities found during these inspections, including insect activity, spotted, deformed, discolored, or dead and dying leaves and twigs should be thoroughly noted and additional inspections may be necessary.

PART III –MAPS/DETAILS, CHECKLISTS AND LOGS

APPENDICES

A-1 SITE LOCATION MAP & MAP/DETAILS OF FACILITIES

A-2 MAINTENANCE WORK ORDER AND CHECKLIST

A comprehensive form for recording both required and completed maintenance work.

A-3 MAINTENANCE LOG

Provides a summary table for recording of all the maintenance work at the site.

A-4 INSPECTION CHECKLIST

Provides a comprehensive checklist of inspection items for use by the inspectors.

A-5 INSPECTION LOG

Provides a summary table for recording the results of all inspections of the basin.

A-6 MANUFACTURER’S INFORMATION FOR MANUFACTURED TREATMENT DEVICES

A-7 MAINTENANCE COST ESTIMATES FOR STORMWATER MANAGEMENT FACILITIES

APPENDIX A-1
SITE LOCATION MAP & MAP/DETAILS OF FACILITIES

APPENDIX A-2
MAINTENANCE WORK ORDER AND CHECKLIST

**Maintenance Work Order & Checklist
for
Stormwater Management Facilities**

Name of Facility: _____	
Location: _____	
Maintenance Crew: _____	Work Started date: _____ time: _____
Equipment: _____	Work Completed date: _____ time: _____
Weather: _____	Total Manhours of Work: _____

A. Preventive Maintenance

	Work Items	Items Required (X)	Items Done (X)	Comments and Special instructions
1	Grass Cutting			
A.	Bottoms			
B.	Embankments and Side Slopes			
C.	Perimeter Areas			
D.	Access Areas and Roads			
E.	Other:			
2	Grass Maintenance			
A.	Fertilizing			
B.	Re-Seeding			
C.	De-Thatching			
D.	Pest Control			
E.	Other:			
3	Vegetative Cover			
A.	Fertilizing			
B.	Pruning			
C.	Pest Control			
D.	Other:			
4	Trash and Debris Removal			
A.	Bottoms			
B.	Embankments and Side Slopes			
C.	Perimeter Areas			
D.	Access Areas and Roads			
E.	Inlets			
F.	Outlets and Trash Racks			
G.	Other:			
5	Sediment Control			
A.	Inlets			
B.	Outlets and Trash Racks			
C.	Bottoms			
6	Mechanical Components			
A.	Valves			
B.	Sluice Gates			
C.	Pumps			
D.	Fence Gates			
E.	Locks			
F.	Access Hatches			
G.	Other:			

**Maintenance Work Order & Checklist
for
Stormwater Management Facilities**

7	Elimination of Potential Mosquito Breeding Habitat			
A.	Pest Control			
8	Pond Maintenance			
A.	Aeration Equipment			
B.	Debris & Trash Removal			
C.	Weed Removal			
D.	Other:			
9	Other Preventative Maintenance			
A.				
B.				
C.				
Corrective Maintenance				
Work Items		Items Required (X)	Items Done (X)	Comments and Special Instructions
1	Removal of Debris & Sediment			
2	Structural Reports			
3	Dam, Embankment, & Slope Repairs			
4	Dewatering			
5	Pond Maintenance			
6	Control of Mosquitoes			
7	Erosion Repair			
8	Fence Repair			
9	Elimination of Trees, Brush, Roots, & Animal Burrows			
10	Snow & Ice Removal			
Aesthetic Maintenance				
Work Items		Items Required (X)	Items Done (X)	Comments and Special instructions
1	Graffiti Removal			
2	Grass Trimming			
3	Weeding			
4	Other:			
Remarks (Refer to Item No., If Applicable): <div style="text-align: right; margin-right: 100px;"> Work Order Prepared By: _____ Work Completed By: _____ </div>				

APPENDIX A-3
MAINTENANCE LOG

APPENDIX A-4
INSPECTION CHECKLIST

**Inspection Checklist
for
Stormwater Management Facilities**

Name of Facility: _____	Date: _____	Time: _____
Location: _____	Weather: _____	

CHECKLIST ITEMS

Facility Item	Good Condition (X)	Requires Attention but not Urgent (X)	Urgent (X)	Comments
1 Embankments and Side Slopes				
A. Vegetation				
B. Linings				
C. Erosion				
D. Settlement				
E. Sloughing				
F. Trash and Debris				
G. Seepage				
H. Aesthetics				
I. Other:				
2 Bottoms (Detention, Infiltration)				
A. Vegetation				
B. Erosion				
C. Standing Water				
D. Settlement				
E. Trash and Debris				
F. Sediment				
G. Aesthetics				
H. Other:				
3 Low Flow Channels (Detention)				
A. Vegetation				
B. Linings				
C. Erosion				
D. Settlement				
E. Trash and Debris				
F. Sediment				
G. Aesthetics				
H. Other:				
4 Ponds (Retention)				
A. Vegetation				
B. Shoreline Erosion				
C. Aeration Equipment				
D. Trash and Debris				
E. Sediment				
F. Water Quality				
G. Other:				
5 Inlet Structure (Basins & MTD)				
A. Condition of Structure				
B. Erosion				
C. Trash and Debris				
D. Sediment				
E. Aesthetics				
F. Other:				

**Inspection Checklist
for
Stormwater Management Facilities**

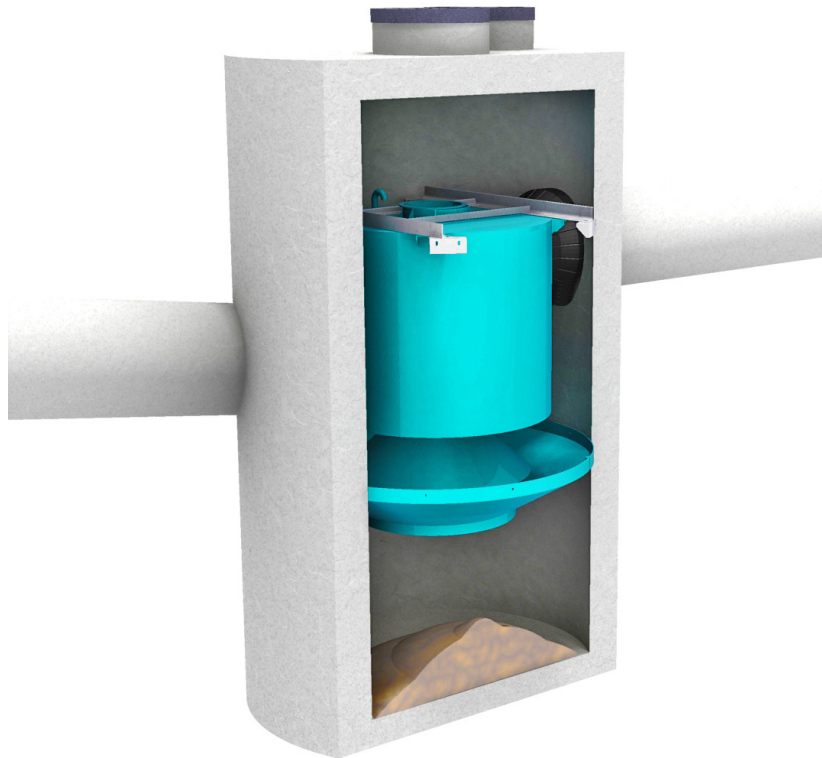
6	Outlet Structure (Basins & MTD)				
A.	Condition of Structure				
B.	Erosion				
C.	Trash and Debris				
D.	Sediment				
E.	Mechanical Components				
F.	Aesthetics				
G.	Other:				
7	Emergency Spillway				
A.	Vegetation				
B.	Lining				
C.	Erosion				
D.	Trash and Debris				
E.	Other:				
8	Perimeter				
A.	Vegetation				
B.	Erosion				
C.	Trash and Debris				
D.	Fences & Gates				
E.	Aesthetics				
F.	Other:				
9	Access Roads				
A.	Vegetation				
B.	Road Surface				
C.	Fence & Gates				
D.	Erosion				
E.	Aesthetics				
10	Miscellaneous				
	Effectiveness of Existing				
A.	Maintenance Program				
B.	Dam Inspections				
C.	Potential Mosquito Habitats				
D.	Mosquitoes				
E.					
F.					
G.					

Remarks (Refer to Item No., If Applicable):

Work Order Prepared By: _____
Work Completed By: _____

APPENDIX A-5
INSPECTION LOG

APPENDIX A-6
MANUFACTURER'S INFORMATION FOR
MANUFACTURED TREATMENT DEVICES



Operation and Maintenance Manual

Downstream Defender[®]

Vortex Separator for Stormwater Treatment

Turning Water Around ...[®]

Table of Contents

3	Downstream Defender® by Hydro International
	- Benefits of the Downstream Defender®
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	- Downstream Defender® Components
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	- Wet Sump
	- Blockage Protection
4	Maintenance
	- Overview
	- Determining Your Maintenance Schedule
5	Maintenance Procedures
	- Inspection
	- Floatables and Sediment Cleanout
8	Downstream Defender® Installation Log
9	Downstream Defender® Inspection and Maintenance Log

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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 Downstream Defender®. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc have a policy of continuous product development and reserve the right to amend specifications without notice.

Downstream Defender® by Hydro International

The Downstream Defender® is an advanced Hydrodynamic Vortex Separator designed to provide high removal efficiencies of settleable solids and their associated pollutants, oil, and floatables over a wide range of flow rates.

The Downstream Defender® has unique, flow-modifying internal components developed from extensive full-scale testing, CFD modeling and over thirty years of hydrodynamic separation experience in wastewater, combined sewer and stormwater applications. These internal components distinguish the Downstream Defender® from simple swirl-type devices and conventional oil/grit separators by minimizing turbulence and headlosses, enhancing separation, and preventing washout of previously stored pollutants.

The high removal efficiencies and inherent low headlosses of the Downstream Defender® allow for a small footprint making it a compact and economical solution for the treatment of non-point source pollution.

Benefits of the Downstream Defender®

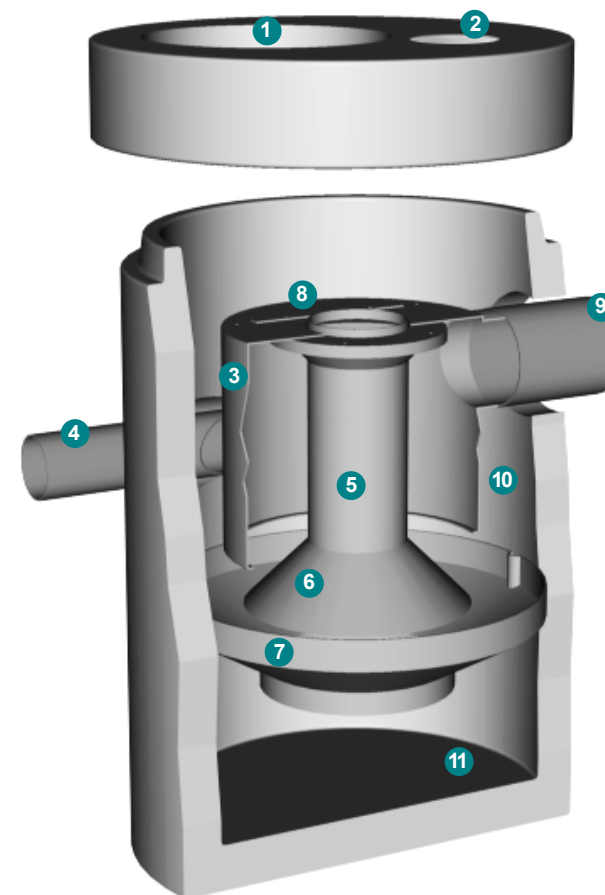
- Removes sediment, floatables, oil and grease
- No pollutant washouts
- Small footprint
- No loss of treatment capacity between clean-outs
- Low headloss
- Efficient over a wide ranges of flows
- Easy to install
- Low maintenance

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

Downstream Defender® Components

1. Central Access Port
2. Floatables Access Port (6-ft., 8-ft. and 10-ft. models only)
3. Dip Plate
4. Tangential Inlet
5. Center Shaft
6. Center Cone
7. Benching Skirt
8. Floatables Lid
9. Outlet Pipe
10. Floatables Storage
11. Isolated Sediment Storage Zone



HYDRO MAINTENANCE SERVICES

Hydro International has been engineering stormwater treatment systems for over 30 years. We understand the mechanics of removing pollutants from stormwater and how to keep systems running at an optimal level.

NOBODY KNOWS OUR SYSTEMS BETTER THAN WE DO



AVOID SERVICE NEGLIGENCE

Sanitation services providers not intimately familiar with stormwater treatment systems are at risk of the following:

- Inadvertently breaking parts or failing to clean/replace system components appropriately.
- Charging you for more frequent maintenance because they lacked the tools to service your system properly in the first place.
- Billing you for replacement parts that might have been covered under your Hydro warranty plan
- Charging for maintenance that may not yet have been required.

LEAVE THE DIRTY WORK TO US

Trash, sediment and polluted water is stored inside treatment systems until they are removed by our team with a vactor truck. Sometimes teams must physically enter the system chambers in order to prepare the system for maintenance and install any replacement parts. Services include but are not limited to:

- Solids removal
- Removal of liquid pollutants
- Replacement media installation (when applicable)



BETTER TOOLS, BETTER RESULTS

Not all vactor trucks are created equal. Appropriate tools and suction power are needed to service stormwater systems appropriately. Companies who don't specialize in stormwater treatment won't have the tools to properly clean systems or install new parts.



SERVICE WARRANTY

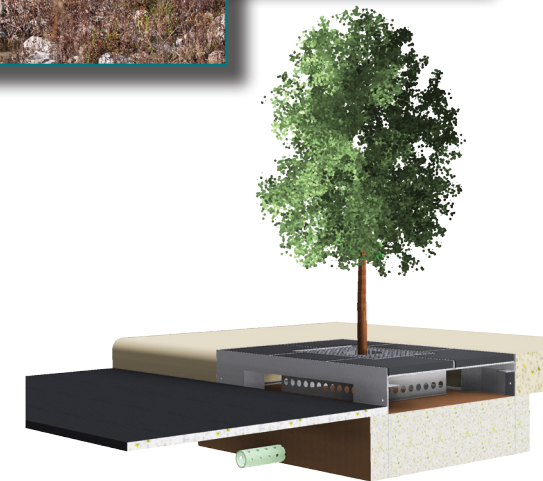
Make sure you're not paying for service that is covered under your warranty plan. Only Hydro International's service teams can identify tune-ups that should be on us, not you.

TREATMENT SYSTEMS SERVICED BY HYDRO:

- Stormwater filters
- Stormwater separators
- Baffle boxes
- Biofilters/biorention systems
- Storage structures
- Catch basins
- Stormwater ponds
- Permeable pavement



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LEARN MORE AT HYDRO-INT.COM/SERVICE



Operation

Introduction

The Downstream Defender® 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 Downstream Defender® has been designed to allow for easy and safe access for inspection/monitoring and clean-out procedures. Entry into the unit or removal of the internal components is not necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the Downstream Defender® have been designed to protect the oil, floatables and sediment storage volumes so that separator performance is not reduced as pollutants accumulate between clean-outs. Additionally, the Downstream Defender® is designed and installed into the storm drain system so that the vessel remains wet between storm events. Oil and floatables are stored on the water surface in the outer annulus separate from the sediment storage volume in the sump of the unit providing the option for separate oil disposal, and accessories such as adsorbant pads. Since the oil/floatables and sediment storage volumes are isolated from the active separation region, the potential for re-suspension and washout of stored pollutants between clean-outs is minimized.

Wet Sump

The sump of the Downstream Defender® 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.

Blockage Protection

The Downstream Defender® has large clear openings and no internal restrictions or weirs, minimizing the risk of blockage and hydraulic losses. In addition to increasing the system headloss, orifices and internal weirs can increase the risk of blockage within the unit.

Maintenance

Overview

The Downstream Defender® 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 Downstream Defender®. The Downstream Defender® 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 Downstream Defender® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

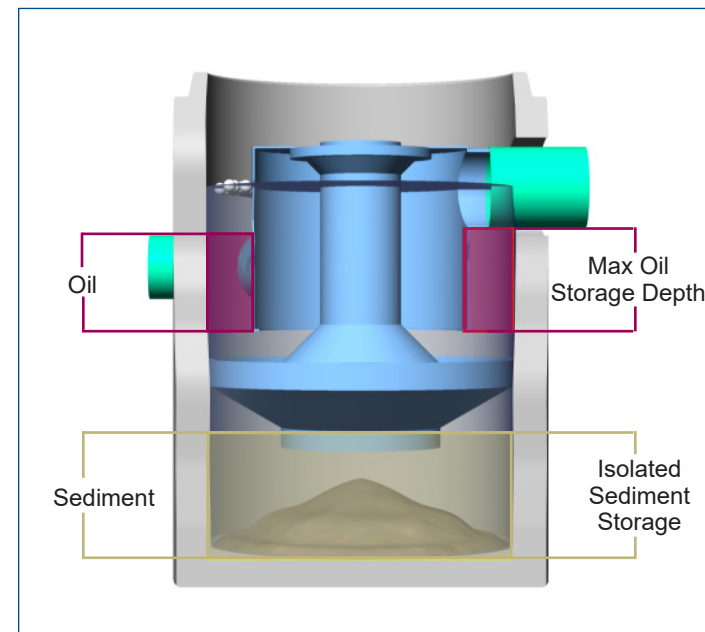


Fig.1 Pollutant storage volumes of the Downstream Defender®.

Inspection Procedures

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

Scheduling

- It is important to inspect your Downstream Defender® 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
- Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1

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
- Downstream Defender® Maintenance Log

The Downstream Defender® 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. On the 6-ft, 8-ft and 10-ft units, the floatables access port is above the outlet pipe between the concrete manhole wall and the dip plate. The sediment removal access ports for all Downstream Defender® models are located directly over the hollow center shaft.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the Downstream Defender®, nor do they require the internal components of the Downstream Defender® 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 Downstream Defender® typically takes less than 30 minutes and removes a combined water/oil volume of about 500 gallons.

Table 1. Downstream Defender® Pollutant Storage Capacities and Max. Cleanout Depths.

Unit Diameter	Total Oil Storage	Oil Clean-out Depth	Total Sediment Storage	Sediment Clean-out Depth	Max. Liquid Volume Removed
(feet)	(gallons)	(inches)	(gallons)	(inches)	(gallons)
4	70	<16	141	<18	384
6	216	<23	424	<24	1,239
8	540	<33	939	<30	2,884
10	1,050	<42	1,757	<36	5,546
12	1,770	<49	2,970	<42	9,460

NOTES

1. Refer to Downstream Defender® Clean-out Detail (Fig. 1) for measurement of depths.
2. Oil accumulation is typically less than sediment, however, removal of oil and sediment during the same service is recommended.
3. Remove floatables first, then remove sediment storage volume.
4. Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.



Fig. 4



Fig. 5



Fig. 6

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the lids to the manhole (Fig. 4). NOTE: The 4-ft Downstream Defender® will only have one lid.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. See Fig. 7 and 8 for typical inspection views.
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 (Fig. 5).
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.



Fig. 7 View over center shaft into sediment storage zone.

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 (Fig. 6).

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.
- If sediment depths are greater than 75% of maximum cleanout depths stated in Table 1, sediment removal is required.
- Floatables and sump cleanout should occur as soon as possible following a spill in the contributing drainage area.



Fig. 8 View of outer annulus of floatables and oil collection zone.

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 (6-inch flexible hose recommended)
- Downstream Defender® Maintenance Log

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the lids to the manhole (NOTE: The 4-ft Downstream Defender® will only have one lid).
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Using the Floatables Port for access, remove oil and floatables stored on the surface of the water with the vactor hose or the skimmer net (Fig. 9).
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 (Pg. 9).
6. Once all floatables have been removed, drop the vactor hose to the base of the sump via the Central Access Port. Vactor out the sediment and gross debris off the sump floor (Fig. 6).

7. Retract the vactor 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 or blockages.
9. Securely replace the grate or lid.

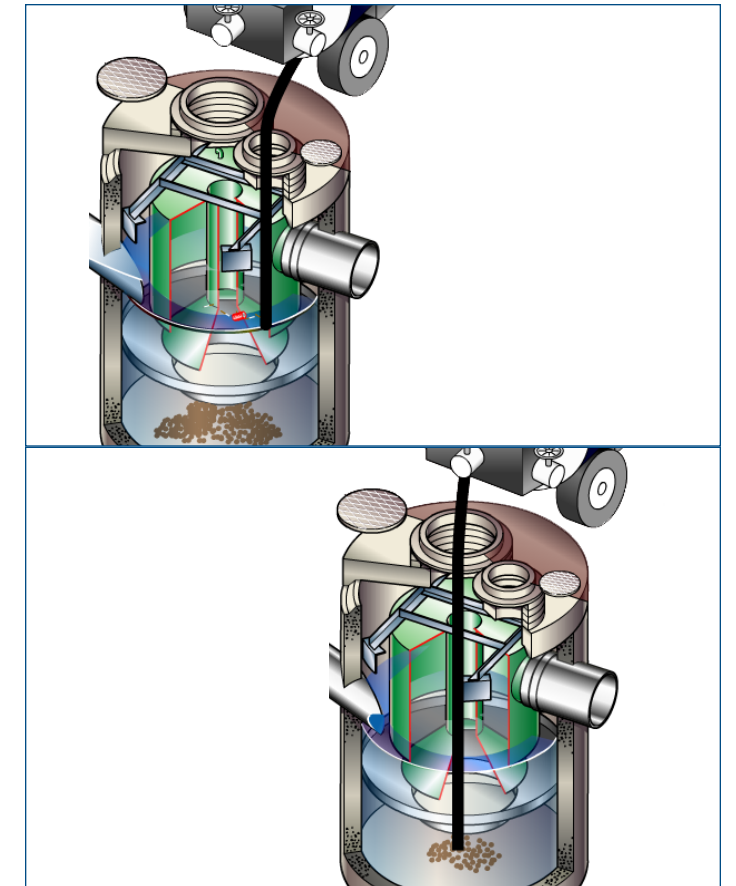


Fig. 9 Floatables and sediment are removed with a vactor hose

Maintenance at a Glance

Activity	Frequency
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- 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.

DO IT RIGHT THE FIRST TIME

LEARN MORE AT HYDRO-INT.COM/SERVICE



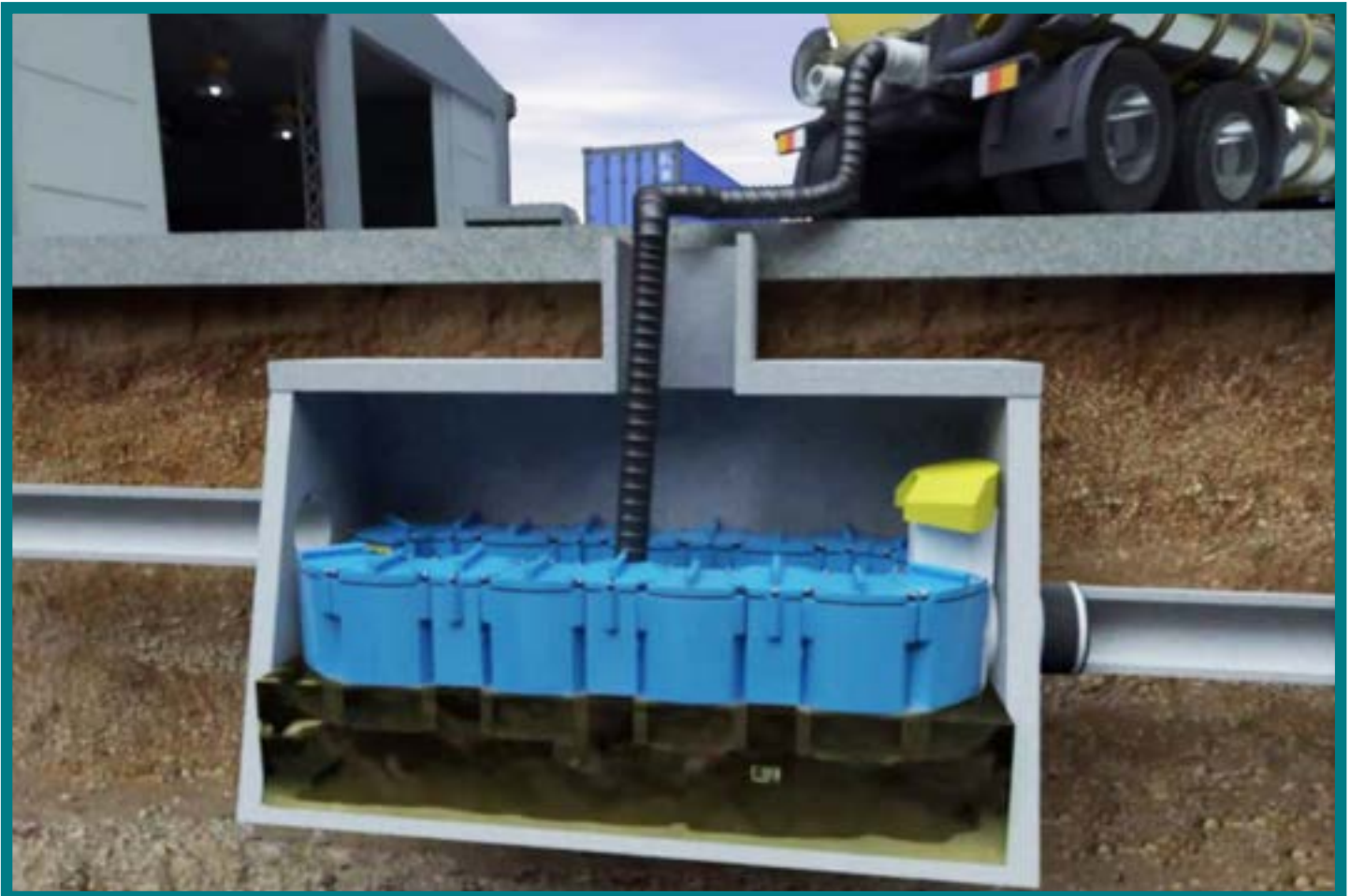
CALL 1 (888) 382-7808 TO SCHEDULE AN INSPECTION

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com



Operation and Maintenance Manual

Up-Flo® Filter

Filtration System for Stormwater Treatment

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

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16	Up-Flo® Filter Maintenance Log

IMPORTANT - ORDER REPLACEMENT PARTS FOR MAINTENANCE - IMPORTANT

Annual maintenance requires replacement of the Media Packs and the Drain Down Filter. Contact Hydro International to order replacements. Allow 2-4 weeks for delivery.

Office hours Monday thru Friday 8:00 A.M. to 5:00 P.M. EST

Toll free: 1-888-382-7808

Phone: 207-756-6200

Fax: 207-756-6212

Email: services@hydro-int.com

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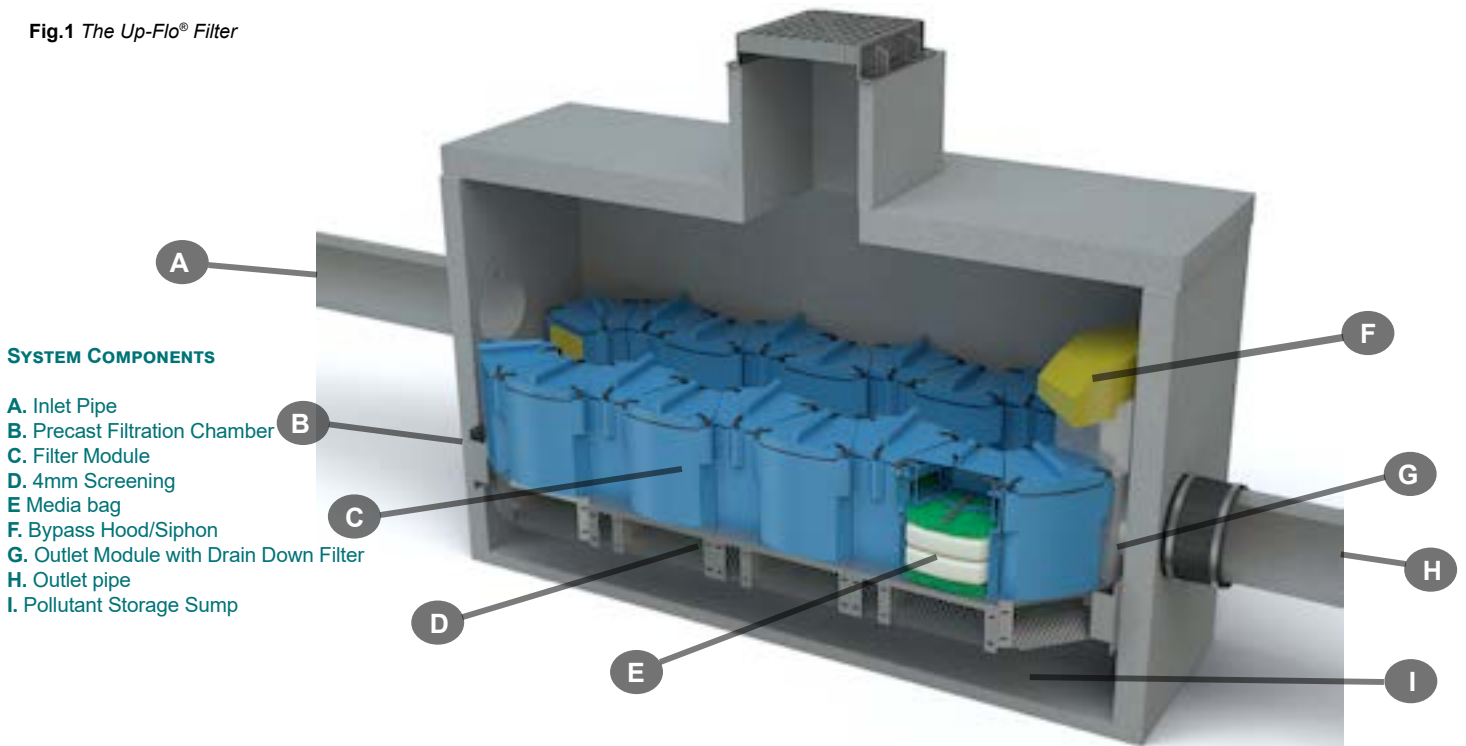
DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's Up-Flo® Filter. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International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

OVERVIEW & PRODUCT DESCRIPTION

The Up-Flo® Filter is a modular high-rate stormwater filtration device designed to capture trash, oil, sediment and remove fine pollutants such as dissolved and particulate metals and nutrients from stormwater runoff. Designed with efficiency, longevity and upkeep in mind, this high performance, low maintenance filter option that offers higher loading rates and longer media life for higher quality stormwater for longer periods between servicings.

In general, a minimum of two inspections are required per year to monitor sediment and gross pollutant accumulations. In order to achieve an annual TSS removal rate of 80% for the Up-Flo® Filter, the minimum maintenance frequency specified in the maintenance section for replacement of the Media Pack and removal of accumulated sediment from the sump is mandatory.

Fig.1 The Up-Flo® Filter



PRODUCT CONFIGURATIONS



Fig.2 The Up-Flo® Filter is installed in a) 4-ft (1.2m) round manholes or b) in rectangular precast vaults. Both configurations have a wide central opening in the Up-Flo® Filter.

HYDRO MAINTENANCE SERVICES

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BETTER TOOLS, BETTER RESULTS

Not all vacor trucks are created equal. Appropriate tools and suction power are needed to service stormwater systems appropriately. Companies who don't specialize in stormwater treatment won't have the tools to properly clean systems or install new parts.

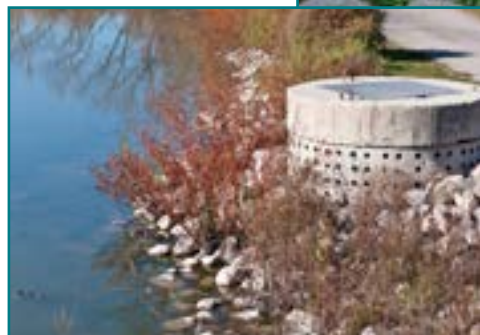


SERVICE WARRANTY

Make sure you're not paying for service that is covered under your warranty plan. Only Hydro International's service teams can identify tune-ups that should be on us, not you.

TREATMENT SYSTEMS SERVICED BY HYDRO:

- Stormwater filters
- Stormwater separators
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- Storage structures
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- Stormwater ponds
- Permeable pavement



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OPERATION

INTRODUCTION

The Up-Flo® Filter operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirements and is fabricated with durable non-corrosive components. Personnel are not required to operate the unit and maintenance is limited to periodic inspections, sediment and floatables removal, Media Pack replacement and Drain Down Filter replacement.

POLLUTANT CAPTURE

The Up-Flo® Filter is designed to operate as a “treatment train” by incorporating multiple treatment technologies into a single device. Trash and gross debris are removed by sedimentation and screening before they are introduced to the filtration media, preventing surface blinding of the filter media. The Up-Flo® Filter is a wet-sump device. Between storm events, oil and floatables are stored on the water surface separate from the sediment storage volume in the sump (see **Fig.1**). The high-capacity bypass siphon acts as a floatables baffle to prevent washout of captured floatable pollutants during high intensity events.

REDUCED CLOGGING

The Up-Flo® Filter has been designed to minimize the occurrence of clogging and blinding and employs a unique Drain Down Filter that allows the water level in the chamber to drop below the filter media between events. The Drain Down Filter mechanism creates a reverse flow that flushes captured pollutants off the surface of the Media Bag, helping to prevent blinding. By allowing the water to drain out, the Drain Down Filter also reduces the weight of the Media Bags. This makes the bags easier and safer to remove during maintenance operations.

OVERFLOW PROTECTION

The Angled Screens are designed to prevent ragging and blinding and are situated below the Filter Modules, sheltering them from the direct path of the influent. Coarse debris settles in the sump before the runoff flows up through the screens, protecting them from blinding. In the unlikely event of a blockage, the high capacity siphonic Bypass Hood is designed to convey high enough flow to minimize the risk of large storm creating upstream flooding.

BEST PRACTICES

Good housekeeping upstream of the Up-Flo® Filter can significantly extend Media Bag life. For example, sweeping paved surfaces, collecting leaves and grass trimmings, and protecting bare ground from erosion will reduce loading to the system. Media Packs should not be installed in the Filter Modules until construction activities are complete and site stabilization is effective.

DAMAGE DUE TO LACK OF MAINTENANCE

Delayed maintenance would result in clogged Media Bags and/or blinded Angled Screens. In that situation, the Up-Flo® Filter would go into bypass and there would be no treatment of the incoming stormwater. Because the Bypass Weir can easily convey all of the flow to the Outlet Module, there would be no lasting damage to the system. Replacement of the Media Bags and removal of sediment from the sump would restore the Up-Flo® Filter to its original treatment efficiency. Establishing and adhering to a regular maintenance schedule ensures optimal performance of the system.

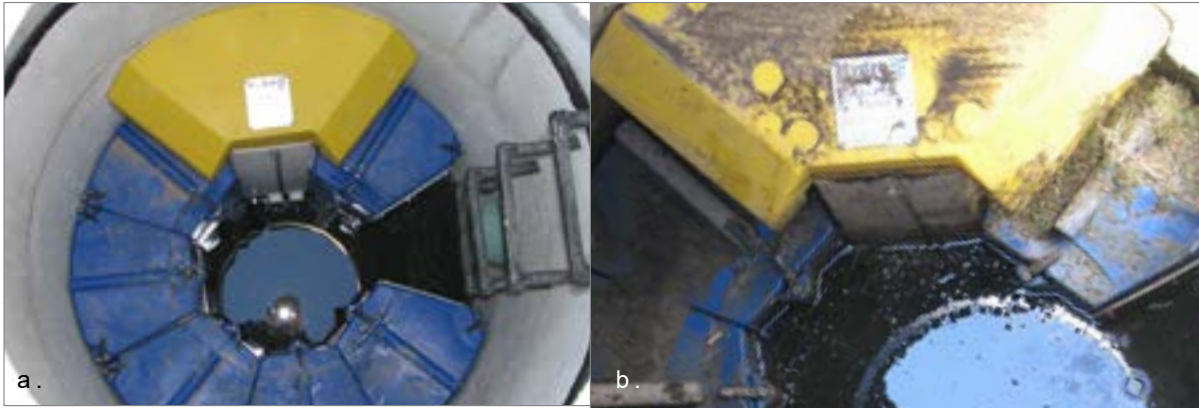


Fig.3 a) The water level in a properly functioning Up-Flo® Filter will drain down to the base of the Filter Modules. b) When the Drain Down Filter becomes clogged, the base of the Filter Modules will be submerged in standing water. Note, above right, that the Drain Down Filter is submerged in standing water.

INSPECTION & MAINTENANCE

OVERVIEW

The Up-Flo® Filter protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the proper functioning of the Up-Flo® Filter.

Maintenance activities can be categorized as those that may be performed from outside the Up-Flo® vessel and those that are performed inside the vessel. Maintenance performed from outside the modules includes removal of floatables and oils that have accumulated on the water surface and removal of sediment from the sump. Maintenance performed inside the vessel includes removal and replacement of Media Bags, Flow Distribution Media and the Drain Down Filter. A vactor truck is required for removal of oils, water, sediment, and to completely pump out the vessel to allow for maintenance inside. If you are not using Hydro International or a trained service provider you must follow OSHA Confined Space Entry procedures when entering the Up-Flo® vessel.

The Up-Flo® Filter design has a wide central opening between the Filter Modules for easy access to all of the components (see **Fig.3**). In the case of inspection and floatables removal, a vactor truck is not required. Otherwise, a vactor truck is normally required for oil removal, removal of sediment from the sump, and replacement of the Media Packs and Drain Down Filter. In most cases, entry into the Up-Flo® Filter vessel is required for replacement of the Media Packs and Drain Down Filter.

The minimum required frequency for replacement of the Media Pack is annually, whereas the minimum required frequency for removal of accumulated sediment from the sump is dependent on the Up-Flo® Filter configuration. Configurations with a larger sediment storage volume per module will require less frequent removal of accumulated sediment. Regardless, whenever sediment depth in the sump is found to be greater than 16 inches, sediment removal is required.



Fig.4 a) A new Media Bag of Hydro Filter Sand. b) A spent media bag of Hydro Filter Sand.

AT A MINIMUM, MEDIA BAGS MUST BE REPLACED AT LEAST ONCE A YEAR.

MAKE SURE YOUR SYSTEM WAS INSTALLED CORRECTLY

First Year Inspection and Maintenance

The frequency of inspection and maintenance can be determined in the field after installation. The frequency of ongoing maintenance needs is based on site characteristics such as contributing area, types of surfaces (e.g., paved and/or landscaped), site activities (e.g., short-term or long-term parking), and other site maintenance (e.g., sanding and sweeping). At a minimum, inspection and maintenance should be conducted at intervals of no more than six months during the first year of operation. Maintenance personnel should observe and record pollutant accumulations during the first year of service in order to benchmark the maintenance intervals that will later be established for the site. Pollutant accumulations should be measured or monitored using the following procedures:

- **Measurement of sediment depth in the sump:** A minimum of 8 inches (20 cm) should separate the Drain Down Filter inlet from stored sediment in the sump in order to minimize sediment migration into the Drain Down Filter. A simple probe, such as the Sludge-Judge®, can be used to determine the depth of the solids in the sump. In a typical 4-ft (1.2m) diameter manhole installation, the sediment depth should be no more than 16 inches (41 cm).
- **Maintenance personnel should then enter the structure, remove the Media Pack from one of the Filter Modules, and weigh the Media Bags.** Media Bags with a wet weight of approximately 40 lbs (18 kg) or more are an indication that the filter media has become full and that the Media Packs in all of the Filter Modules will require replacement (Fig.4). Minimum filtration rate is generally reached when the Media Bags have accumulated approximately 20 lbs (9 kg) of sediment. Determining the amount of accumulated sediment will be accomplished by removing both of the Media Bags from one of the Media Packs and weighing the bags separately. Since a new Media Bag weighs approximately 30 lbs (14 kg) wet, the difference in weight will approximately equal the weight of solids that have accumulated in the bag. A spent Media Bag weighs approximately 50 lbs (23 kg) wet.
- **Measurement of oil layer on water surface:** Since water in the Up-Flo® vessel drains down to an elevation below the bottom of the Filter Modules when the system is idle, the amount of accumulated oil must be minimized so that oil is not entrained in the Media Pack when stormwater begins to fill the vessel at the start of a storm event. Oil accumulation should be limited to 1.5 inches (4 cm) or less. Probes can be used to measure oil thickness.
- **Monitoring for Drain Down Filter clogging:** The water level in the Up-Flo® Filter should be monitored to ensure that the Drain Down Filter is operating properly. The Drain Down Filter is designed to lower the water level in the Up-Flo® vessel to an elevation below the bottom of the Filter Modules between storm events. Periodically conduct an inspection one to two days after a storm event during the first year of operation. Approximately 36 hours after a 1-in (2.5-cm) rainfall, the water level inside the vessel should have dropped to a point where it is equal with the base of the Filter Modules. If the water level has not reached that point, then the Drain Down Filter has either become clogged or blinded by trash or debris (Fig.5 a and b). If there is no evidence of trash or debris around the Drain Down Filter inlet, then it has likely become clogged with particles.
- **Monitoring for slime and debris covering the Flow Distribution Media or Angled Screens:** After removal of the Media Bags, the bottom Flow Distribution Media should be removed and inspected to determine if it is coated with slime or debris. Similarly, the Angled Screen should be inspected for blockages and ragging.

FIND OUT HOW FREQUENTLY YOUR SYSTEM NEEDS MAINTENANCE

Monitoring for floatables on the water surface: Similar to oil, the amount of accumulated floatables must be minimized to prevent trash and loose debris from becoming trapped on the Angled Screens when stormwater begins to fill the Up-Flo® vessel at the start of a storm event. Visual inspection is adequate to determine the amount of floatables. Floatables should be removed before they form a mat on the surface of the water.

The solids loading rate in the sump will be calculated by measuring the sediment depth in the sump and dividing the depth by the correlating interval of time since the sump was last cleaned. Similarly, starting with fresh Media Bags, the solids loading rate in the Media Packs will be calculated by weighing the Media Bags and dividing the weights by the correlating interval of time since they were installed. The wet weight of the heaviest bag will be used to determine the loading rate. As previously mentioned, a spent Media Bag weighs approximately 50 lbs (23 kg) wet. The spent Media Bag weight estimate was based on calculations of sediment loading in an Up-Flo® Filter that was run to exhaustion during laboratory testing.

The rate of oil accumulation will be calculated by measuring the thickness of the oil layer and dividing the thickness by the correlating interval of time since the sump was last cleaned. Ordinarily, oil thickness will not be measurable unless a spill has occurred. Consequently, any oil will typically be removed along with water when cleaning the sump.

Monitoring the Drain Down Filter for clogging, monitoring the Flow Distribution Media and Angled Screens for slime and debris, and monitoring the accumulation of floatables will provide an estimate of how long the Up-Flo® Filter can operate before its performance can become impaired by one of these factors.

Routine Inspection and Maintenance

After completion of the first year of operation, determining and then following the established inspection and maintenance intervals will keep pollutant loadings within their respective limits. Removal of oils and floatables, replacement of the Drain Down Filter, replacement of Flow Distribution Media (see Fig.9, pg 11), and cleaning of Angled Screens will occur at the same frequency as cleaning of the sump and replacement of Media Bags unless the first year of operation indicates otherwise. Keeping to the established maintenance intervals will keep treatment flow rates at, or above, the design flow rate. Typically, annual maintenance is adequate.

In addition to scheduled maintenance, occasional checks for Up-Flo® Filter clogging can be performed by removing the manhole cover during a storm, monitoring the water level in the manhole or vault, and determining whether the filter is in bypass. A properly-sized filter (on-line or off-line) that is in bypass during a storm that is producing runoff at, or below, the filter's design filtration rate needs maintenance.

DON'T WANT TO GO IT ALONE? CALL HYDRO AND WE'LL TAKE CARE OF INSPECTION, REPLACEMENT MEDIA AND CLEANOUT.

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INSPECTION & MAINTENANCE

ROUTINE INSPECTION

Inspection is a simple process that requires monitoring pollutant accumulations. Maintenance crews should be familiar with the Up-Flo® Filter and its components prior to inspection.

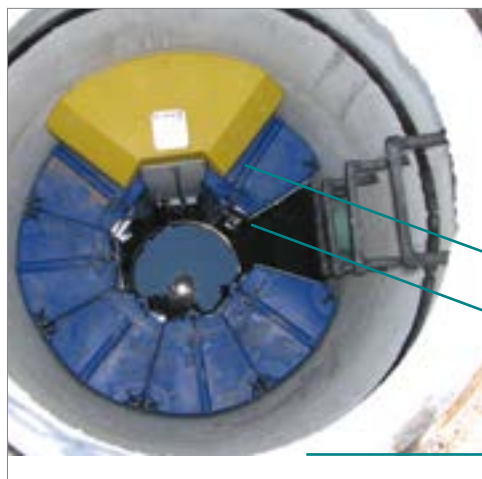
THE FOLLOWING INSTRUCTIONS ARE INTENDED FOR NON-HYDRO MAINTENANCE SERVICE PROVIDERS AND/OR THOSE INTENDING TO MAINTAIN THEIR OWN UP-FLO® FILTER:

SCHEDULING

- Inspection may be conducted during any season of the year but should occur shortly after a predicted rainfall to ensure components are operating properly.

NECESSARY EQUIPMENT

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Scale to measure the weight of the Media Bags
- Crow bar to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge-Judge®)
- Hydro International Up-Flo® Filter Maintenance Log
- Trash bags for removed floatables



Bypass siphon sits evenly on Outlet Module.

Standing water level is no higher than the base of the Filter Module. The Drain Down Filter will be visible if the water level is correct.

Filter Module Lids are closed.

ROUTINE INSPECTION PROCEDURES

1. Set up any necessary safety equipment (such as traffic cones) to provide access to the Up-Flo® Filter. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole or vault.
3. Without entering the vessel, look down into the chamber to inspect the inside and to determine whether the high-water level indicator has been activated. Make note of any irregularities. See Fig.6 for a typical Inspection View.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from 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. Maximum sediment depth is 16 inches (41 cm).
6. If the high-water level indicator has been activated after two consecutive storms, remove the Filter Module lid by turning the cam latch and remove the Filter Media Pack (*refer to page 11 Replacement Procedures*). Weigh the Media Bags from one or two modules. Media Bags should be replaced if the wet weight exceeds 40 lbs (18 kg).
7. 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 or a high standing water level (see Fig.6 for the standard standing water level).
8. Securely replace the grate or lid.
9. Remove safety equipment.
10. Contact Hydro International at (800) 848-2706 to discuss any irregularities noted during inspection.

Fig.6 Inspection view of the Up-Flo® Filter.

ROUTINE MAINTENANCE

Maintenance activities are grouped into two categories:

- **Activities *Not Requiring Man Entry Into the Up-Flo® Filter***
These activities include floatables removal, oil removal and removal of sediment from the sump.
- **Activities *Requiring Man Entry Into the Up-Flo® Filter***
Media Pack replacement and Drain Down Filter replacement.

Maintenance intervals are determined from monitoring the Up-Flo® Filter during its first year of operation. Depending on the site, some maintenance activities may have to be performed on a more frequent basis than others. In the case of floatables removal, a vactor truck is not required. Floatables and loose debris can be netted with a skimmer and pole.

A vactor truck is normally required for oil removal, removal of sediment from the sump, and to dewater the vessel for replacement of the Media Packs and Drain Down Filter (Fig.7). All inspection and maintenance activities would be recorded in an Inspection and Maintenance Log.

Completion of all the maintenance activities for a typical 4-ft (1.2m) diameter manhole installation takes less than one hour. Approximately 360 gallons of water and up to 0.6 yd³ (0.5 m³) of sediment may be removed in the process. In an installation equipped with six Filter Modules, 12 Media Bags (2 bags per module) would be removed and replaced. Assuming a spent Media Bag weight of 50 lbs (23 kg), up to 600 lbs (272 kg) of spent Media Bags would be removed. All consumables, including Media Bags, Flow Distribution Media, and replacement Drain Down Filters are supplied by Hydro International.

The access port located at the top of the manhole provides unobstructed access for a vactor hose and/or skimmer pole to be lowered to the base of the sump.

MAINTENANCE ACTIVITIES NOT REQUIRING MAN ENTRY

These activities include floatables removal, oil removal and removal of sediment from the sump.

SCHEDULING

- Floatables and sump cleanout may typically be done during any season of the year - before and after rainy season
- Floatables and sump cleanout should occur as soon as possible following a contaminated spill in the contributing drainage area

RECOMMENDED EQUIPMENT

- Safety Equipment (traffic cones, etc)
- Crow bar 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 preferred)
- Pressure nozzle attachment or other screen-cleaning device

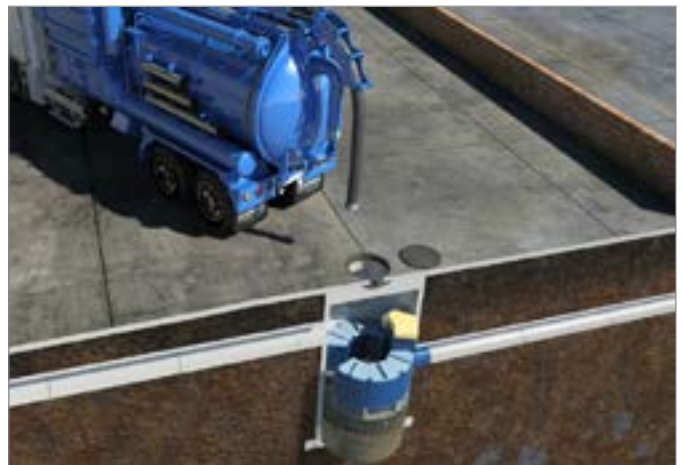


Fig.7 Sediment is removed from the sump with a vactor hose. Man entry is not required for this step.

NO MAN ENTRY REQUIRED: FLOATABLES, OIL AND SEDIMENT:

1. Set up any necessary safety equipment (such as traffic cones) around the access of the Up-Flo® Filter. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole or vault.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. If the standing water level in the sump is above the base of the Filter Modules (see Fig.8), tug the Pull Chain(s) to release the Drain Down Filter plug(s). Allow the excess water to drain out of the chamber.
5. Use the skimmer pole to fit the Drain Down Filter plug back into the open port.
6. Once all floatables and oil have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris from the sump floor. Up to 0.3 yd³ (0.2 m³) of sediment and 360 gallons (1,363 L) of water will be removed from a typical manhole Up-Flo® Filter during this process.
7. Retract the vactor hose from the vessel.
8. Inspect the Angled Screens for blockages and ragging. If present, remove the obstruction or ragging materials from the surface using a hose or other screen-cleaning device.
9. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables, oils, and gross debris removed, and the depth of sediment measured. Note any apparent irregularities such as damaged components or blockages.
10. Securely replace the grate or lid. Remove safety equipment.
11. Dispose of sediment and gross debris following local regulations.
12. Dispose of oil and sump water at a licensed water treatment facility or following local regulations.
13. Contact Hydro International at (800) 848-2706 to discuss any irregularities noted during cleanup.

These activities include replacement of the Media Packs and Drain Down Filter.

Unless the Up-Flo® Filter has been installed as a very shallow unit, it is necessary to have an OSHA-confined space entry trained person enter the vessel to replace Media Packs.

The access port located at the top of the manhole or vault provides access to the Up-Flo® vessel for maintenance personnel to enter the vessel and remove and replace Media Packs. The same access would be used for maintenance personnel working from the surface to net or skim debris and floatables or to vactor out sediment, oil, and water. Unless the Up-Flo® Filter has been installed in a very shallow configuration, it is necessary to have personnel with OSHA Confined Space Entry training performing the maintenance that occurs inside the vessel.

SCHEDULING

- Call Hydro International to order replacement Media Packs and Drain Down Filter prior to scheduling maintenance.
- Because Media Pack replacement requires entry into the Up-Flo® chamber, maintenance events should be scheduled during dry weather.
- Media Pack replacement should occur immediately after a contaminated spill in the contributing drainage area.

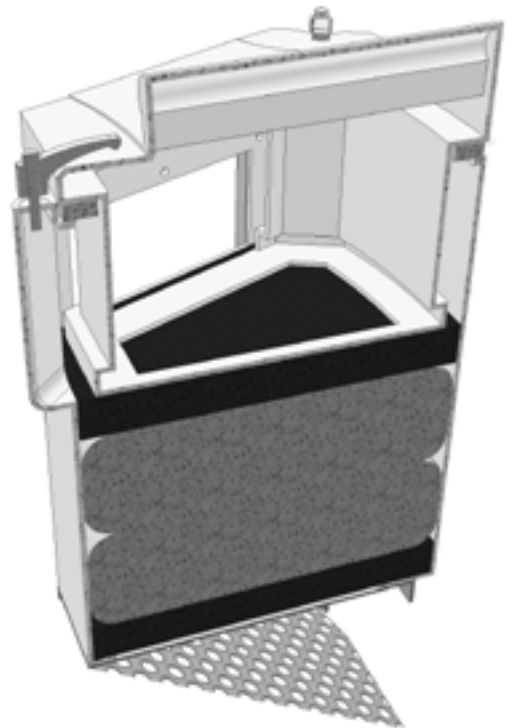


Fig.8 Cutaway view of the Filter Module

MAINTENANCE ACTIVITIES REQUIRING MAN ENTRY

Recommended Equipment

- Safety Equipment (traffic cones, etc.)
- Crow bar to remove grate or lid
- Pole with skimmer or net (if floatables removal is not to be done with vacator hose)
- Sediment probe (such as a Sludge-Judge®)
- Vacator truck (flexible hose preferred)
- OSHA Confined Space Entry Equipment
- Up-Flo® Filter Replacement Media Packs (available from Hydro International)
- Hydro International Up-Flo® Filter Maintenance Log
- Screwdriver (flat head)
- Replacement Drain Down Filter components supplied by Hydro International

Man Entry Required: Media Pack and Drain Down Filter

1. Follow Floatables and Sump Cleanout Procedures, 1 – 13.
2. Following OSHA Confined Space Entry procedures, enter the

Up-Flo® Filter Chamber.

3. Open the Filter Module by turning the three cam latches on the front and sides of the module. Remove the lid **1** to gain access to the Media Pack (Fig.9).
4. Remove and discard the spent Media Pack. The Media Pack contents include:
 - A top layer of **A** Flow Distributing Sheets
 - Two (2) Media Bags **B** equipped with nylon handles.
 - A bottom layer of **A** Flow Distributing Media.
5. Insert a new Media Pack, supplied by Hydro International.
 - First, insert a bottom layer of green Flow Distributing Media. Be sure that the media sits snugly and level at the bottom of the Filter Module.
 - Next, insert the first of two (2) replacement Media Bags. Smooth the bag out with your hands to make sure that the bag extends snugly to the walls and corners of the Filter Module.
 - Insert the second Media Bag, following the same procedure.
 - Insert the top layer of green Flow Distributing Media.

1. Filter Module Cover and Media Restraint
2. Replaceable Media Pack:
 - a) Flow distribution sheets
 - b) Filter Media Bags
3. Cam Latch
4. Conveyance Channel
5. Filter Module
6. Support Bracket / Angled Screen

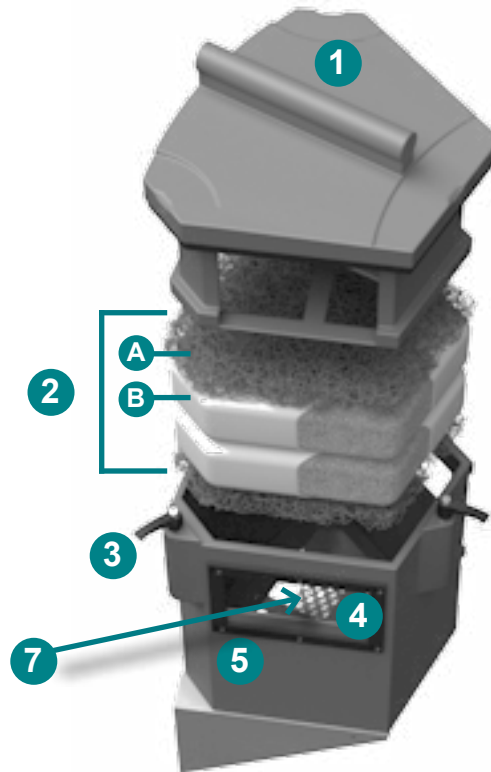


Fig.9 The Filter Module houses the Media Restraint and the Media Pack.

Be sure that the piece fits snugly against the walls and corners of the Filter Module.

- Put the lid on and secure the three latches. Check to make sure that the latches are closed properly.

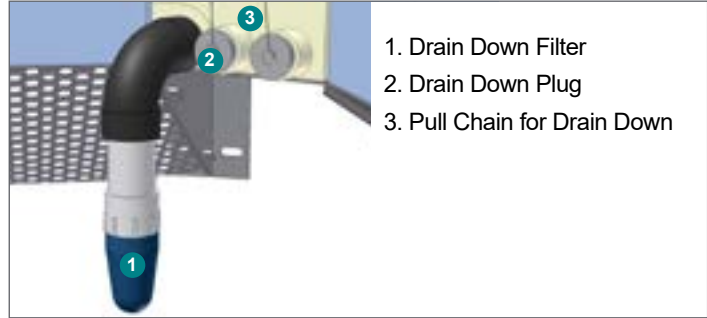
6. Use a screwdriver to unscrew the Drain Down Filter from the face of the Outlet Module (see Fig.10). **DO NOT DISCARD THIS PIECE.**

7. Install new Drain Down Filter supplied by Hydro International.

8. Exit the Up-Flo® Filter chamber and securely replace the grate ___ or lid.

9. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables, oil and gross debris removed, and the depth of sediment measured. Note the number of Media Packs replaced. Note any irregularities such as damaged components or blockages.

Fig.10 The Drain Down Filter.



1. Drain Down Filter
2. Drain Down Plug
3. Pull Chain for Drain Down

10. Remove safety equipment.

11. Dispose of spent media packs at your local landfill, following local regulations.

12. Return the spent Drain Down Filter to Hydro International.

13. Contact Hydro International to discuss any irregularities noted during annual maintenance.

Solids Disposal

Sediment, floatables, gross debris, and spent Media Bags can generally be disposed of at the local landfill in accordance with local regulations. The toxicity of the residues captured will depend on the activities in the contributing drainage area, and testing of the residues may be required if they are considered potentially hazardous.

Sump water can generally be disposed of at a licensed water treatment facility but the local sewer authority should be contacted for permission prior to discharging the liquid. Significant accumulations of oil removed separately from sump water should be transported to a licensed hazardous waste treatment facility for treatment or disposal. **In all cases, local regulators should be contacted about disposal requirements.**

MAINTENANCE AT A GLANCE

Activity	Frequency
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Floatables/Oils Removal	- Twice per year or as needed - Following a contaminated spill in the drainage area
Sediment Removal	- Every six to 12 months, depending on the Up-Flo® Filter Configuration - The maximum allowable sediment depth in any Up-Flo Filter configuration is 16 inches (41 cm) - Following a contaminated spill in the drainage area
Media Pack Replacement	- Once per year - Replacement is required anytime inspection reveals that the high-water level indicator has been activated after two consecutive storms and the subsequent weighing of the Media Bags shows a wet weight greater than 40 lbs - Following a contaminated spill in the drainage area
Drain Down Filter Replacement	- Once per year with Media Pack replacement - Replacement is required anytime inspection reveals that the water level inside the vessel has not reached a level equal with the base of the Filter Modules approximately 36 hours after a 1-inch (2.5 cm) rainfall - As needed, in the event of continuous base flow conditions

UP-FLO® FILTER INSTALLATION LOG



SITE REFERENCE NAME OR NUMBER FOR THIS UP-FLO® FILTER LOCATION:	
SITE NAME:	
SITE LOCATION:	
OWNER:	SITE CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

CONFIGURATION (CIRCLE ONE): **MANHOLE** **VAULT SYSTEM**

TOTAL NUMBER OF UP-FLO® FILTER MODULES: _____



UP-FLO® FILTER INSPECTION LOG

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions*: _____
 *(Stable, Under Construction, Needing Maintenance, etc.)

Inspection Frequency Key: A=annual; M=monthly; S=after major storms

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Debris Removal				
Adjacent area free of debris?	M			
Inlets and Outlets free of debris?	M			
Facility (internally) free of debris?	M			
Vegetation				
Surrounding area fully stabilized? (no evidence of eroding material into Up-Flo® Filter)	A			
Grass mowed?	M			
Water retention where required				
Water holding chamber(s) at normal pool?	A			
Evidence of erosion?	A			
Sediment Deposition				
Filtration Chamber free of sediments?	A			
Sedimentation sump not more than 50% full?	A			
Structural Components				
Any evidence of structural deterioration?	A			
Grates in good condition?	A			
Spalling or cracking of structural parts?	A			
Outlet/Overflow Spillway	A			
Other				
Noticeable odors?	A			
Any evidence of filter(s) clogging?	M			
Evidence of flow bypassing facility?	A			



Inspector Comments: _____

Overall Condition of Up-Flo® Filter**: Acceptable Unacceptable

**"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.

If any of the above Inspection Items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below or on the Maintenance Log provided on page 15 of the Up-Flo® Filter Operation & Maintenance Manual:

Maintenance Action Needed	Due Date

The next routine inspection is schedule for approximately: (date) _____

Inspected by: (signature) _____

Inspected by: (printed) _____



UP-FLO® FILTER MAINTENANCE LOG

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____
**(Stable, Under Construction, Needing Maintenance, etc.)*

Estimated volume of oil/floatable trash removed: _____

Sediment depth measured in sump prior to removal: _____

Number of Filter Modules fitted with new media packs: _____

Inspector Comments: _____

Overall Condition of Up-Flo® Filter: Acceptable Unacceptable
***"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.*

Maintained by: (signature) _____

Maintained by: (printed) _____

DO IT RIGHT THE FIRST TIME

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Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200

Fax: (207) 756-6212

stormwaterinquiry@hydro-int.com

www.hydro-int.com

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APPENDIX A-7
MAINTENANCE COST ESTIMATES FOR
STORMWATER MANAGEMEN FACILITIES

Engineer's Estimate					
Location:		Date:			
Municipality:		Project No.:			
Prepared by:		Reviewed by:			
20 Year Maintenance Cost Estimate					
Item No.	Description	Qty	Unit	Unit Price	Total
1	Inspection of Facilities (Quarterly)	80	EA.	\$ 500.00	\$ 40,000.00
2	Mow Grass Slopes (12 times per Year)	240	EA.	\$ 150.00	\$ 36,000.00
3	Vegetation Health Inspection (1 per Year)	20	EA.	\$ 150.00	\$ 3,000.00
4	Inspection of Structural Components (4 per Year)	80	EA.	\$ 250.00	\$ 20,000.00
5	Sediment Removal - Basins (at 10 Year Intervals)	2	EA.	\$ 10,000.00	\$ 20,000.00
6	Sediment Removal/Filter Change - MTDs (1 per Year)	20	EA.	\$ 2,000.00	\$ 40,000.00
7					
8					
9					
Estimated Construction Cost					159,000.00
% Contingency Cost					10%
Total Cost					174,900.00
Remarks:					

Engineer's Estimate					
Location:		Date:			
Municipality:		Project No.:			
Prepared by:		Reviewed by:			
Annual Maintenance Cost Estimate					
Item No.	Description	Qty	Unit	Unit Price	Total
1	Inspection of Facilities (Quarterly)	4	EA.	\$ 500.00	\$ 2,000.00
2	Mow Grass (12 times per Year)	12	EA.	\$ 150.00	\$ 1,800.00
3	Vegetation Health Inspection (1 per Year)	1	EA.	\$ 150.00	\$ 150.00
4	Inspection of Structural Components (4 per Year)	4	EA.	\$ 250.00	\$ 1,000.00
5	Sediment Removal/Filter Change - MTDs (1 per Year)	1	EA.	\$ 2,000.00	\$ 2,000.00
6					
7					
8					
9					
Estimated Construction Cost					\$ 6,950.00
% Contingency Cost					10%
Total Cost					\$ 7,645.00
Remarks:					