



## State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Nonpoint Pollution Control

Division of Water Quality

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[http://www.state.nj.us/dep/dwq/bnpc\\_home.htm](http://www.state.nj.us/dep/dwq/bnpc_home.htm)

CHRIS CHRISTIE  
*Governor*

KIM GUADAGNO  
*Lt. Governor*

BOB MARTIN  
*Commissioner*

**March 17, 2017**

Mr. Dave Scott  
Technical Product Manager  
Hydro International  
94 Hutchins Drive  
Portland, ME 04102

Re: Revised MTD Lab Certification  
Downstream Defender Stormwater Treatment Device by Hydro International  
On-line Installation

### **TSS Removal Rate 50%**

Dear Mr. Scott:

This revised certification letter supersedes the Department's prior certification dated August 18, 2015. This revision was completed to reflect the updated Manufactured Treatment Device (MTD) scaling methodology as agreed upon by the manufacturers' working group on September 19, 2016. In part, the updated scaling for hydrodynamic MTDs is based on the depth of the reference (tested) MTD from the top of the false floor utilized during removal efficiency testing, not from the physical bottom of the unit. Based on the above decision, Table A-2 of the NJCAT Technology Verification report located at <http://www.njcat.org/uploads/newDocs/DDVerificationReport11117.pdf> has been revised, and Table 1 noted below has been added.

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Hydro International has requested an MTD Laboratory Certification for the Downstream Defender Stormwater Treatment Device.

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal

rate and the required maintenance plan. The NJCAT Verification Report dated August 2015 (Revised January 2017) with the Verification Appendix for this device is published online at <http://www.njcat.org/verification-process/technology-verification-database.html>.

**The NJDEP certifies the use of the Downstream Defender Stormwater Treatment Device by Hydro International at a TSS removal rate of 50% when designed, operated and maintained in accordance with the information provided in the Verification Appendix and the following conditions:**

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.
2. The Downstream Defender Stormwater Treatment Device shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.
3. This Downstream Defender Stormwater Treatment Device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhance removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.
4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at [www.njstormwater.org](http://www.njstormwater.org).
5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the Downstream Defender Stormwater Treatment Device, which is attached to this document. However, it is recommended to review the maintenance manual at [https://hydro-int.com/sites/default/files/operations\\_maintenance\\_manual.pdf](https://hydro-int.com/sites/default/files/operations_maintenance_manual.pdf) for any changes to the maintenance requirements.
6. Sizing Requirements:

The example below demonstrates the sizing procedure for the Downstream Defender Stormwater Treatment Device:

Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a Downstream Defender Stormwater Treatment Device. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was based on the following:

time of concentration = 10 minutes  
 $i=3.2$  in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)  
 $c=0.99$  (runoff coefficient for impervious)  
 $Q=ciA=0.99 \times 3.2 \times 0.25=0.79$  cfs

Given the site runoff is 0.79 cfs and based on Table 1 below, the Downstream Defender Model 4-ft with a MTFR of 1.12 cfs would be the smallest model approved that could be used for this site that could remove 50% of the TSS from the impervious area without exceeding the MTFR.

The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1 and Table A-2.

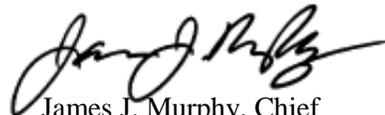
Table 1 Downstream Defender Models

Model	Manhole Diameter (ft.)	Treatment Chamber Depth (ft.)	Maximum Treatment Flowrate, MTR (cfs)
4-ft	4	3.33	1.12
6-ft	6	4.83	2.52
8-ft	8	6.42	4.49
10-ft	10	7.92	7.00
12-ft	12	9.42	10.08

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Mr. Shashi Nayak of my office at (609) 633-7021.

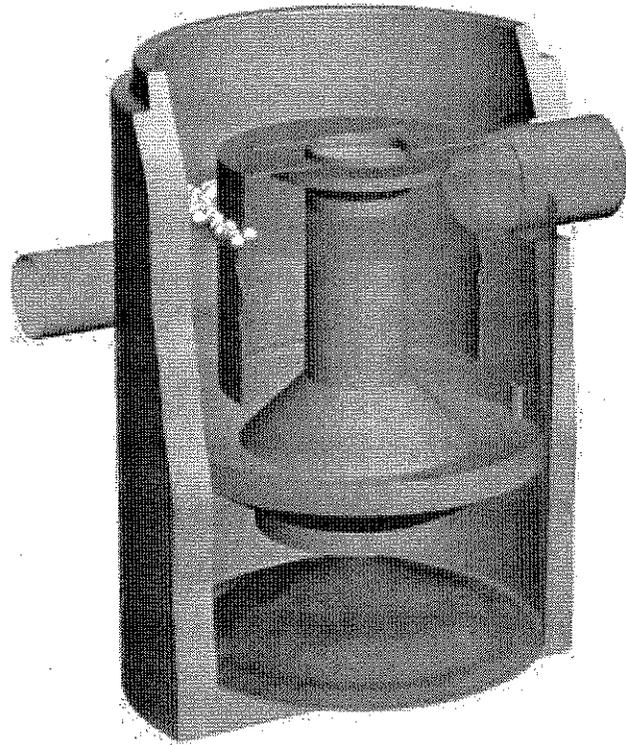
Sincerely,



James J. Murphy, Chief  
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

C: Chron File  
Richard Magee, NJCAT  
Vince Mazzei, NJDEP - DLUR  
Ravi Patraju, NJDEP - BES  
Gabriel Mahon, NJDEP - BNPC  
Shashi Nayak, NJDEP - BNPC



# Downstream Defender<sup>®</sup>

Stormwater Treatment System

Operation and Maintenance Manual

## Table of Contents

- 3     **Downstream Defender by Hydro International**
  - Benefits of the Downstream Defender
  - Applications
  - Downstream Defender Components
  
- 4     **Operation**
  - Introduction
  - Pollutant Capture and Retention
  - 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

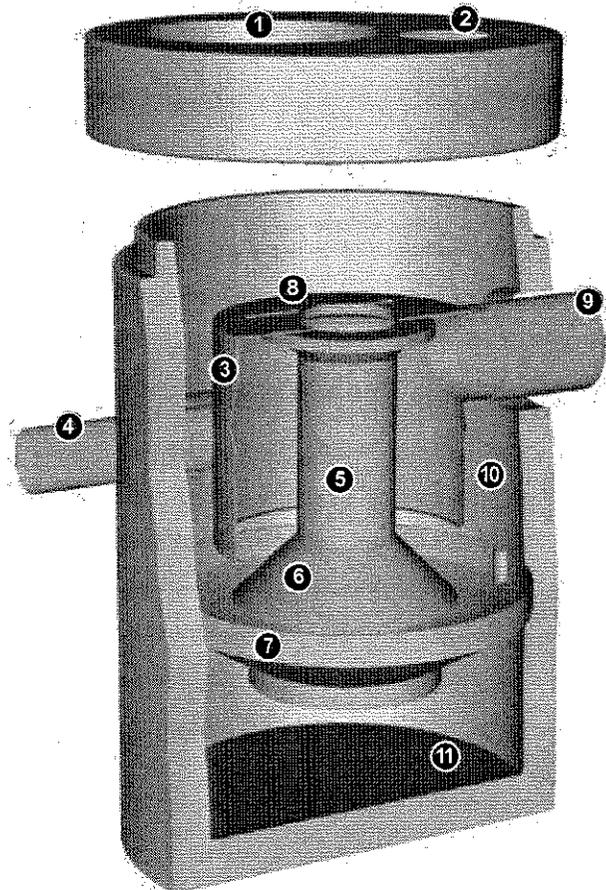
- Removes sediment, floatables, oil and grease
- No pollutant washouts
- Small footprint
- No loss of treatment capacity between clean-outs
- Low headloss
- Efficient over a wide ranges of flows
- Easy to install
- Low maintenance

### 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





## 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.

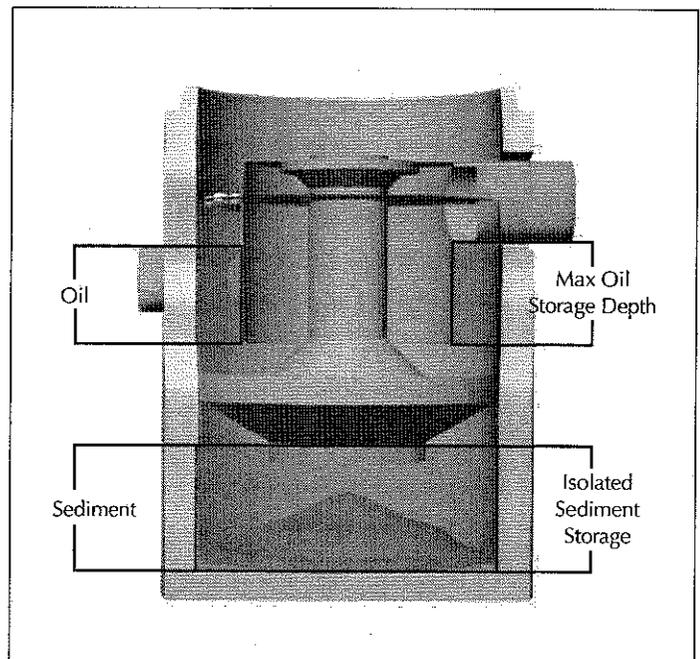


Figure 1: Pollutant storage volumes of the Downstream Defender

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.

**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

Table 1

<b>Downstream Defender Pollutant Storage Capacities and Max. Cleanout Depths</b>					
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.



Figure 4

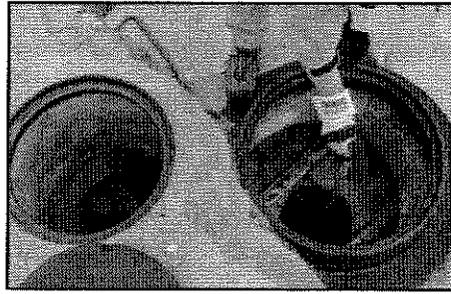


Figure 5

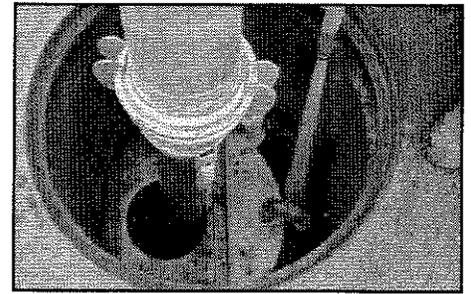


Figure 6

## 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. Figure 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 Figure 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. Figure 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.

7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

## FLOATABLES AND SEDIMENT CLEANOUT

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

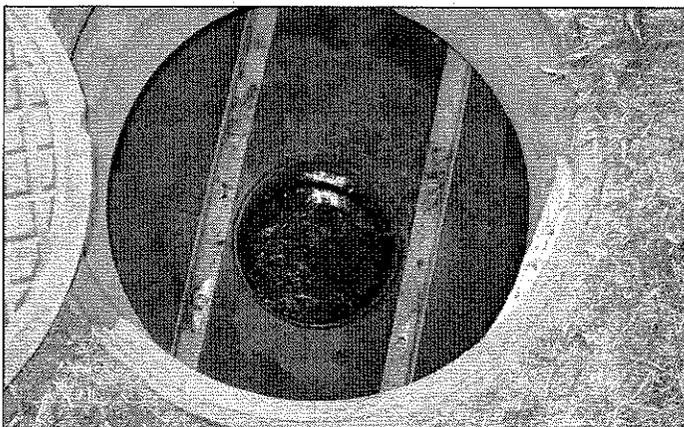


Figure 7: View over Center Shaft into sediment storage Zone



Figure 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

**FLOATABLES AND SEDIMENT CLEAN OUT 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 (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. Figure 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 (page 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. Figure 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.

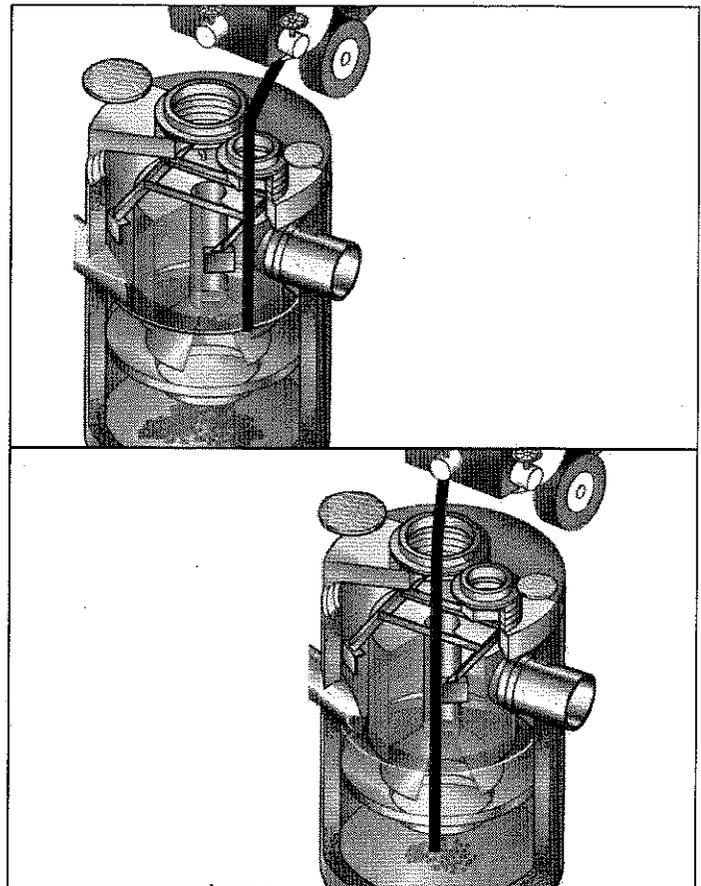


Figure 9: Floatables and sediment are removed with a vactor hose

**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.



## Downstream Defender Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE:    /    /

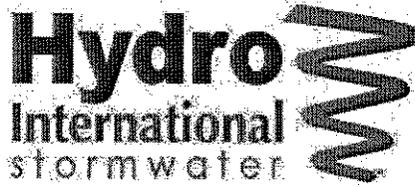
MODEL (CIRCLE ONE):    4-FT                  6-FT                  8-FT                  10-FT                  CUSTOM





NOTES





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