Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

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Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

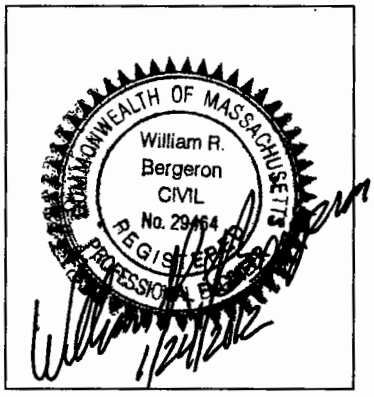
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



William R Bergeron P.E. 1/24/2012
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☑ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- [x] No disturbance to any Wetland Resource Areas
- [x] Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- [ ] Reduced Impervious Area (Redevelopment Only)
- [x] Minimizing disturbance to existing trees and shrubs
- [ ] LID Site Design Credit Requested:
  - [ ] Credit 1
  - [ ] Credit 2
  - [ ] Credit 3
- [ ] Use of "country drainage" versus curb and gutter conveyance and pipe
- [ ] Bioretention Cells (includes Rain Gardens)
- [ ] Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- [ ] Treebox Filter
- [ ] Water Quality Swale
- [ ] Grass Channel
- [ ] Green Roof
- [x] Other (describe): Groundwater recharge systems

Standard 1: No New Untreated Discharges

- [x] No new untreated discharges
- [x] Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- [x] Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☑ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☑ Soil Analysis provided.

☑ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☑ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☑ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☑ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

☐ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☑ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☑ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☑ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☑ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☑ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

☑ The ½" or 1" Water Quality Volume or

☑ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☑ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☑ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☑ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☑ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☑ Name of the stormwater management system owners;
- ☑ Party responsible for operation and maintenance;
- ☑ Schedule for implementation of routine and non-routine maintenance tasks;
- ☑ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☑ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☑ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

William R. Bergeron

From: Galkowski, Lawrence H. [LGalkowski@cemexusa.com]
Sent: Tuesday, September 13, 2011 7:37 AM
To: William R. Bergeron
Cc: Lyons, Jim; Justin Arnott; Carrasco, Ernie
Subject: Stormceptor Flow Rates
Attachments: Stormceptor Flow Info - MA.pdf

Mr. Bergeron,

Based on the suggested methodology identified by the MASS DEP to calculate a WQV to a WQF using the Claytor Schuler method, we have enclosed information identifying design flow rates for each of our units where 80% TSS removal can be achieved on an annual basis.

While the DEP has identified this particular methodology, it is unclear as to its actual status as a required calculation. To our knowledge, this methodology was published in November 2010 and then shortly after rescinded and was being further reviewed. As of this date, I do not believe that the DEP has re-published this method as a preferred method. The attached information was prepared in response to the DEP's actions and will be submitted to MASTEP for review and inclusion on the Stormceptor STC listing.

I welcome the opportunity to discuss this matter further with you.

Lawrence H Galkowski, PE
Regional Engineer

Rinker Materials
413-246-7144

The attached TSS Calculation Worksheets use 75% TSS removal for the Stormceptors.

Stormceptor®

The calm *during* the storm

When it rains, oils, sediments and other contaminants are washed from paved surfaces directly into our storm drains and waterways. Non-point source pollution associated with stormwater runoff accounts for approximately 80% of water pollution in North America. In and effort to protect our water resources, regulatory agencies are responding with new and evolving regulations.

Evolving with regulatory standards

Stormceptor continues to meet regional requirements

- As regulatory requirements shift focus to flow, Stormceptor sizing methods also shift focus to flow.
- Patented technology captures and treats water quality flowrate while eliminating concerns of scour or resuspension.

Remaining a leader in stormwater quality

Stormceptor performance achieves industry leading accolades

- Stormceptor achieves first on-line stormwater treatment device approval from the New Jersey Department of Environmental Protection.
- Performance testing verifies a high degree of TSS capture and retention without scour at high flows.
- Maintains continuous positive treatment of total suspended solids (TSS) year-round, regardless of flowrate.

Available Models

	Stormceptor Model	Internal Manhole Diameter or Equivalent ID[1] (ft)	Typical Depth[2] Below Pipe Invert (in)	Design Flow Rate[3] (cfs)	Typical Hydrocarbon Capacity (US Gal)	Maximum Sediment Capacity ft^3	
Stormceptor STC	STC 450i	4	68	1.3	86	46	←
	STC 900	6	63	3.4	251	89	←
	STC 1200	6	79	3.4	251	127	
	STC 1800	6	113	3.4	251	207	
	STC 2400	8	104	5.4	840	205	
	STC 3600	8	144	5.7	840	373	
	STC 4800	10	140	8.8	909	543	
	STC 6000	10	162	9.1	909	687	
	STC 7200	12	148	12.1	1,079	839	
	STC 11000	2 x 10	140	19.4	2,792	1,089	
	STC 13000	2 x 10	162	20.6	2,792	1,374	
	STC 16000	2 x 12	148	27.8	3,055	1,677	

1. Structure diameter represents the typical inside diameter of the concrete structure.
2. Depth Below Pipe and Maximum Sediment Capacity for certain models can vary to accommodate specific site designs. Call your local Stormceptor representative.
3. Design Flow Rate is based on capture, treatment, and retention of d50 ~ 100 micron particle size. Stormceptor STC has been independently verified not to scour or resuspend TSS.

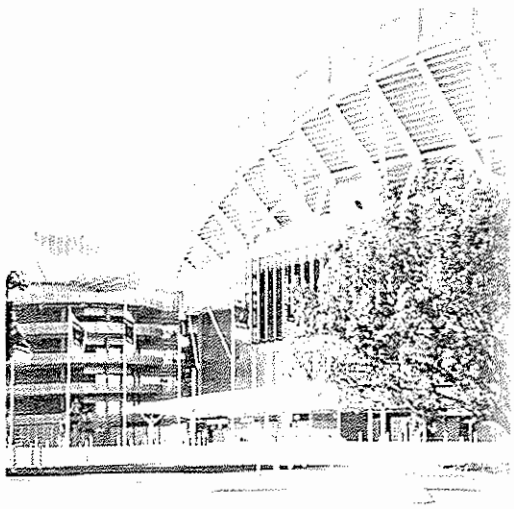
For more information, visit our website or contact: **Lawrence H Galkowski, PE, Regional Engineer**
New England Area email: lgalkowski@cemexusa.com cell: 413-246-7144

www.rinkerstormceptor.com (800) 909-7763

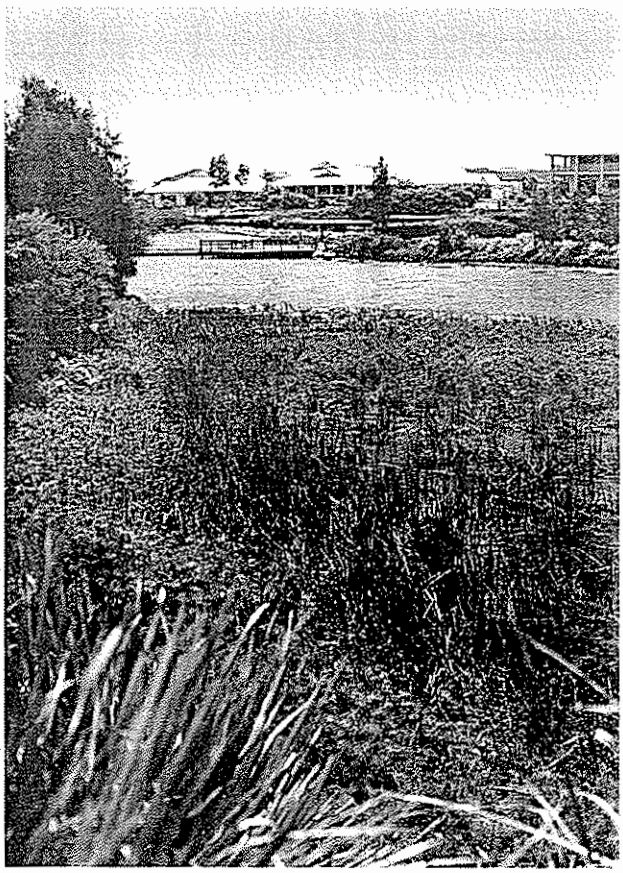
Rinker MATERIALS™

Stormceptor®

Stormceptor® is a hydrodynamic source control device for the capture and retention of a range of contaminants from stormwater runoff generated from impervious surfaces such as parking lots, industrial and commercial sites, roads and highways, marinas, airport facilities, sea port facilities, gas stations, defense establishments, high/medium density residential developments and similar impervious/paved surfaces. These contaminants include free and floating oils, grease, hydrocarbon and petroleum products, fine suspended solids, including the fine fraction between 10 - 100 µm that typically dominate the total suspended solids load and a range of sorbed contaminants that are transported by the fine suspended solids such as heavy metals, nutrients, hydrocarbon and petroleum products. **Stormceptor®** is a unique product, since it provides careful control of flow rates and operational velocities to prevent the resuspension and loss of fine suspended solids material and emulsification of collected hydrocarbons during infrequent high flow rates.



Stormceptor® *is a simple, compact and proven technology for capturing and retaining a range of entrained stormwater contaminants*



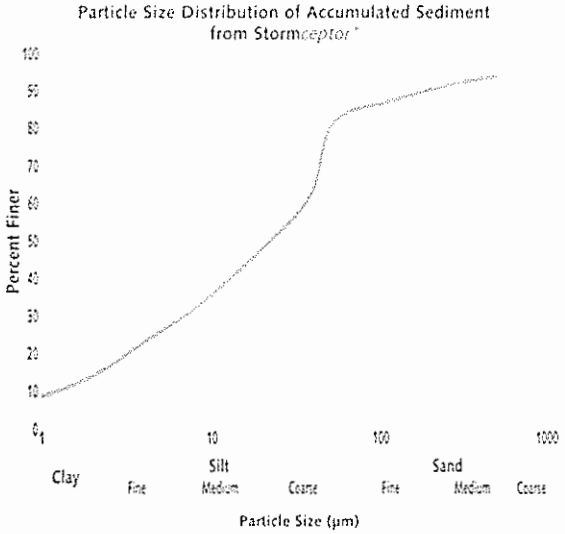
Stormceptor® *delivers water quality treatment for a range of development activities.*

Stormceptor® is generally designed using a calibrated continuous rainfall and pollutant export simulation based on actual rainfall data to remove 75%-95% of the total suspended solids load. The design is focused on delivering a water quality outcome, rather than simply diverting a flow rate. The latter is considered by Rinker Materials to be poor performance indicator for a water quality improvement device, as it has little or no correlation with water quality outcomes.

The performance of the **Stormceptor®** product to deliver a water quality outcome has been extensively verified by independent third party regulatory authorities under field conditions. These conditions implicitly take into consideration the varying hydrologic, hydraulic and pollutant export conditions that exist in the real world. Therefore Rinker Materials, consultants, local authorities and customers can proceed with development proposals with a high degree of confidence regarding the water quality outcomes from specifying and using the **Stormceptor®** product.

Key Benefits / Features

Stormceptor® is a unique stormwater management product which can demonstrate superior performance in terms of the capture and retention of hydrocarbons and total suspended solids. Many proprietary products are gross pollutant traps and are therefore focused on the capture of large litter items. These products are generally unsuitable for the typical Stormceptor® applications, since they fail to adequately control flow rates and operational velocities which are required to be minimized to first capture fine suspended solids and hydrocarbons and then retain these over a range of subsequent hydrologic conditions. The main features of the Stormceptor® product which provide this superior level of performance include the following:



From field validation monitoring the total suspended solids load exported from urbanized catchments, commonly comprise 80% of material with a particle size less than 60 µm.

Table 1 - Scouring Velocities for Various Sediment Particle Sizes

Description of Sediment		Particle Diameter (µm)	Scouring Velocity (ft/s)	(m/s)
Coarse	Pebbles	2000	2.36	0.72
	Course Sand	1000	1.67	0.51
	Medium Sand	500	1.18	0.36
		250	0.82	0.25
Fine	Fine Sand	125	0.59	0.18
	Coarse Silt	62	0.43	0.13
		31	0.30	0.09
	Medium Silt	16	0.20	0.06

Metcalf and Eddy, 1991. "Wastewater Engineering: Treatment Disposal and Reuse"

Storm[illegible] effectively captures and retains total suspended solids and petroleum hydrocarbons

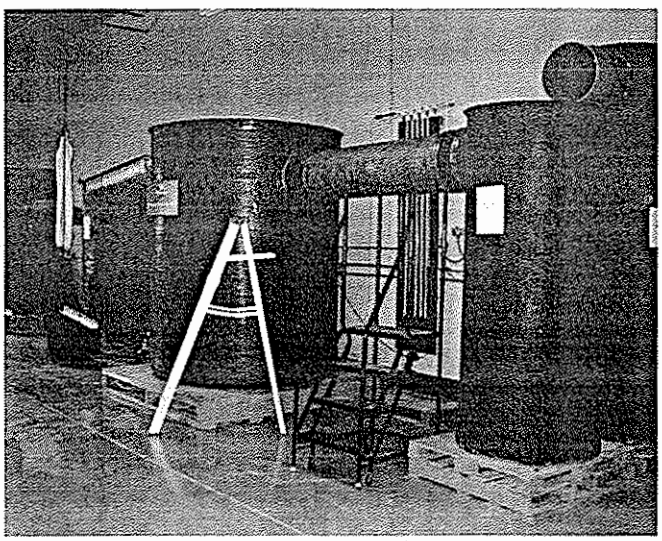
- Stormceptor® is generally sized to capture and retain 75-95% of the total suspended solids load.
- The average maximum velocity generated within the treatment chamber of Stormceptor® at the maximum nominated treatment flow rate is less than 0.023ft/s.
- This very low velocity facilitates the capture and retention of very fine suspended solids with typical sediment samples containing 80% of particles less than 60 µm in size.
- The table below indicates how this operational velocity compares with published scouring velocities for various sediment particle sizes. In many cases gross pollutant traps generate excessive operational velocities between 0.98 - 4.92 ft/s, which facilitates the capture of large visual litter items, but leads to relatively poor performance with respect to the total suspended solids load.
- The very fine suspended solids have been identified as the most damaging to ecological health within waterways and estuaries and act as a primary carrier for contaminants such as heavy metals and hydrocarbon products.
- During peak flow events, Stormceptor® continues to carefully control flow rates by a unique orifice which guarantees the retention of previously deposited fine material.
- Stormceptor® has been proven under independent testing to retain 98% of the free (floating) oil concentration and has been shown under field conditions to achieve 99.6% removal and limit outlet hydrocarbon concentrations to 10ppm (depending on input concentrations) during rainfall events.
- Stormceptor® is effective at intercepting and capturing emergency spills, can be configured to collect over 15,000 gallons of petroleum products and has been proven to achieve this outcome in many real world spill situations.

The performance of Stormceptor® has been extensively verified.

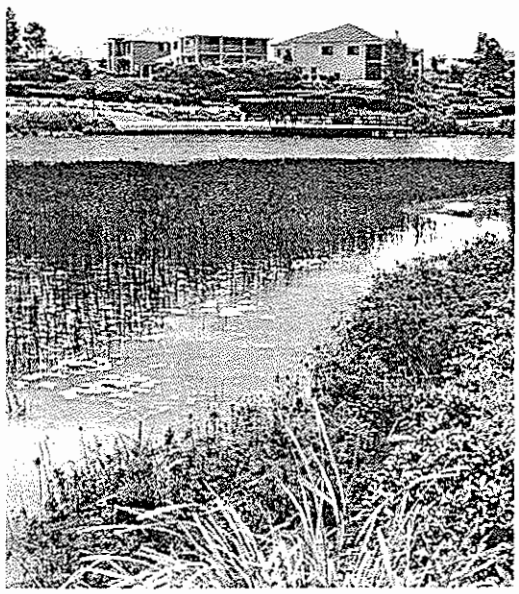
- Stormceptor® performance has been independently verified across a total of some 50 individual rainfall events with rainfall intensities varying from 0.04 to 5.15 In/hr and flows varying up to six times (500%) the nominated treatment flow rates for the units (i.e. units in bypass under high flow conditions) - in other words across a wide range of hydrologic conditions.
- Where regulatory agencies operate independent environmental technology verification (ETV) programs, Stormceptor® has been tested by the authorities and the performance verified and certified by the regulatory authorities.
- Laboratory testing that is utilized to demonstrate the performance of the product has been completed on full scale models at full treatment flow rates to alleviate issues associated with scaling results from small scaled down laboratory model testing.
- Complete test reports, test summaries and raw data for these performance validation tests are available upon request.

Stormceptor® reduces overall municipal costs by capturing contaminants at source.

- Stormceptor® is a source control product and is often installed within individual, private commercial and industrial properties.
- A distributed stormwater management approach across a catchment, which treats contaminants at the source alleviates the burden of local authorities at the end of pipe.
- Requiring private entities to manage their runoff within their site is a more cost effective management tool for the community and local authorities.
- Where utilized in conjunction with ponds and wetlands, Stormceptor® will extend the service life of the wetland by capturing the majority of the particulate matter, thus allowing the wetland to focus more on dissolved pollutants and extending the frequency of dredging/removing sediment accumulation within a wetland environment.
- Stormceptor® is inexpensive to service and maintain.



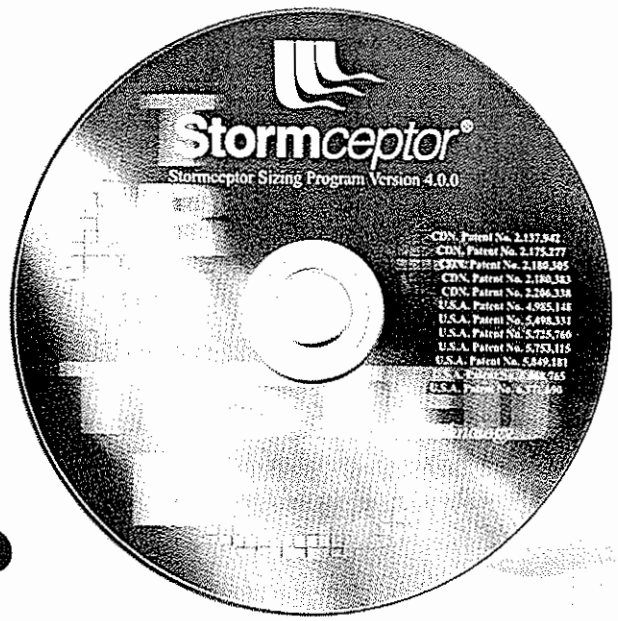
Full scale research and development hydraulics laboratory with full time laboratory technicians developing the next advancement in the Stormceptor® product and continually evolving the current product range.



The use of Stormceptor® as a source control device on high risk land use activities across the catchment will often lead to cost effective outcomes for municipal authorities charged with the responsibility of managing downstream water quality.

Stormceptor® is easy to design

- Stormceptor® Sizing Program v4.0.0 (available on CD) enables a specifier to size the unit on the basis of local hydrology (historical rainfall records)
- The Expert Design System utilizes a continuous rainfall - runoff simulation similar to other popular pollutant export and catchment modeling packages such as SWMM/XP-AQUALM (WP Software) and MUSIC (CRC for Catchment Hydrology, 2002). Continuous runoff modeling is more appropriate to analyzing water quality solutions than adopting a design event flow rate approach, which has no correlation with water quality outcomes.
- Stormceptor® is sized to achieve a water quality outcome, expressed as a percentage of total suspended solids removal and is therefore directly comparable to regulatory water quality outcomes or objectives.
- The performance of Stormceptor® is easily incorporated within other numeric modeling following use of the Expert Design System to assess the performance of an overall stormwater management solution, within which Stormceptor® operates in conjunction with other best management practices.

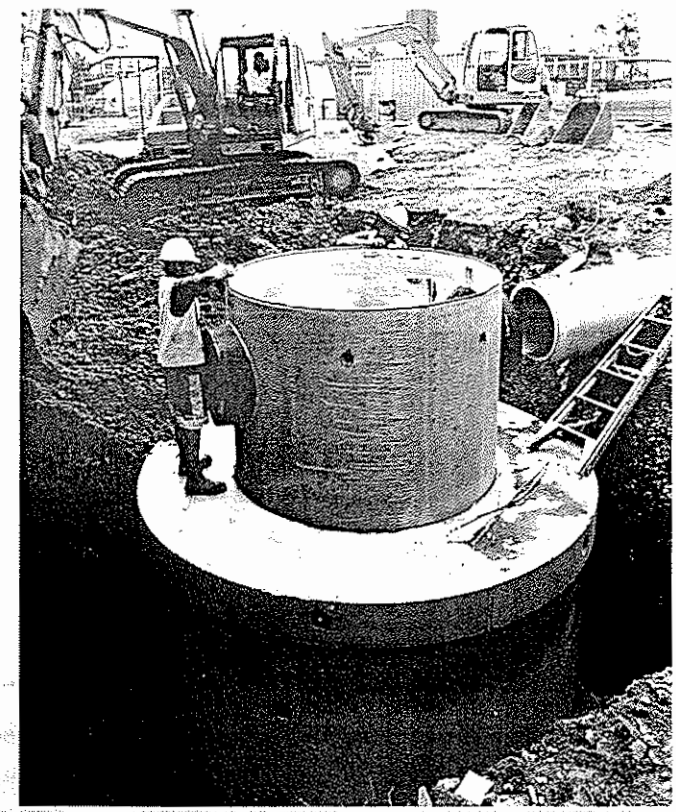


Stormceptor® is easy to install

- The modular precast concrete construction facilitates easy and rapid installation
- Non-shrink grout or rubberized Kor'N'Seal boots may be used to connect the inlet and outlet to the Stormceptor® unit.
- The product is suitable for new and retrofit projects. Stormceptor® system's small footprint is beneficial to avoid conflicts with existing utilities.
- Stormceptor® may be used as a bend structure and can accommodate mutiple inlets.

A proven performance record

- Stormceptor® is the market leader - with over 15,000 units installed worldwide.
- Extensively adopted across the United States, Canada and Australia
- Stormceptor® has a certified 50 year design life with all components complying with relevant American Standards.

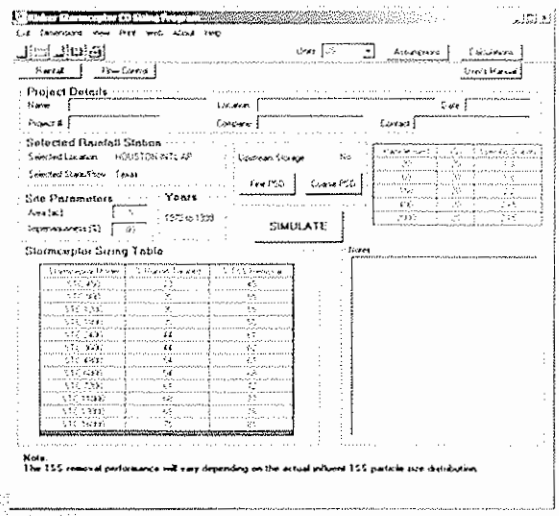


STC4800 Stormceptor® ready for back filling and pipe connection. Note Kor 'N' Seal boots ready to accommodate inlet/outlet pipes.

Model Selection and Performance

Stormceptor® Design Software

The **Stormceptor®** product is designed and specified using a calibrated continuous rainfall/runoff pollutant export model supplied by Rinker Materials. The software operates similar to commercially available models such as SWMM, MUSIC (CRC for Catchment Hydrology, 2002) and XP-AQUALM (WP Software, 1992). **Stormceptor®** is sized to achieve a water quality outcome as reflected by the percentage of total suspended solids (by mass) that is retained. This approach allows a more direct comparison of the performance from the various **Stormceptor®** units with the water quality outcomes required by regulatory authorities. The product may be designed to achieve up to 98% retention of the total suspended solids load, but generally, regulators worldwide are targeting the removal of 75-85% of the total suspended solids load. **Stormceptor®** is not sized using hydraulic design event considerations such as treatment flow rates, since this parameter provides little correlation with water quality outcomes.



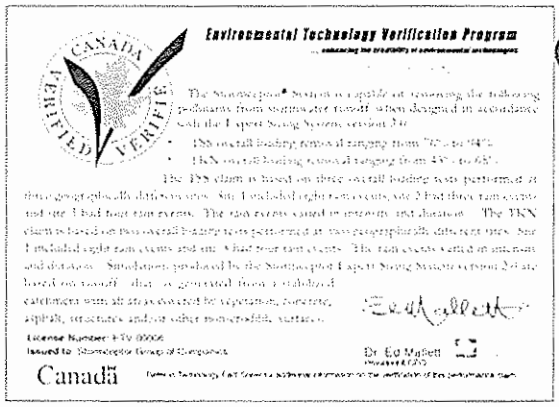
Stormceptor® Design Software *is simple to use and comes complete with historical rainfall records for many locations around America.*

The adoption of a continuous simulation approach is the recommended approach for the modeling of water quality and stormwater management systems as reflected in the commercially available modeling packages. The software is packaged with historical rainfall data from many locations across America covering the major metropolitan and regional centers and may be updated with site-specific rainfall data if available.

The software parameters (hydrology and pollutant export) have been calibrated against field data generated from typical **Stormceptor®** applications. Across all monitoring sites, the correlation coefficient between the software results and the field data is 95%. Consultants, local authorities and customers can therefore proceed with development proposals with a high degree of confidence regarding the likely water quality outcomes from the **Stormceptor®** product.

Stormceptor® Performance

The performance of the **Stormceptor®** product to deliver a water quality outcome has been extensively verified under field conditions and in many cases certified by regulatory authorities under Environmental Technology Verification (ETV) programs. These conditions implicitly take into consideration the varying hydrologic, hydraulic and pollutant export conditions that exist in the real world.



Certification of **Stormceptor®** *Performance by Environment Canada in Accordance with the Canadian Environmental Technology Verification (ETV) Program.*

Total Suspended Solids

Stormceptor® is primarily designed using total suspended solids (TSS) as an indicator of overall ecological health. Regulators that have specified the mass removal of TSS are generally targeting the retention of 75-85% of the total suspended solids load. It is important to note that TOTAL Suspended Solids considers all particle sizes as noted below. Caution should be exercised where data is presented that only considers a certain range of particle sizes, since this is not a true measure of total suspended solids, nor is it a true measure of the water quality outcomes desired by regulators.

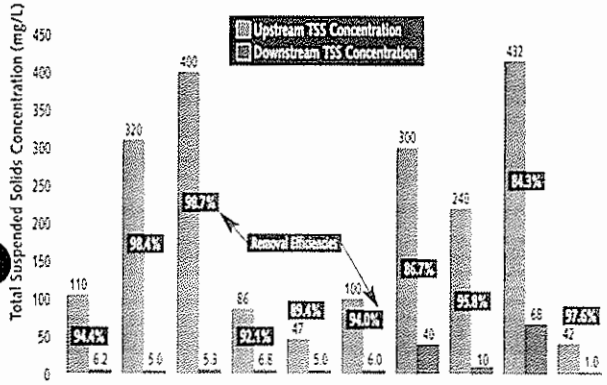
The performance of Stormceptor® across a wide range of hydrologic conditions is indicated in the following graph, which shows the concentration of total suspended solids upstream and downstream of various Stormceptor® units during rainfall events, sampled using automatic samplers. The mass removal efficiency is also indicated, which demonstrates the ability of the product to deliver a superior water quality outcome.

Total Suspended Solids

The performance of Stormceptor® is primarily based on retaining TOTAL Suspended Solids over a long term period across a range of hydrologic conditions. The term total suspended solids refers to the total mass of particulate matter which may be removed from solution by filtration, usually specified as the matter which is retained on a 0.45µm pore-diameter filter. Total suspended solids is therefore a measurement of all particle sizes that are present within the sample.

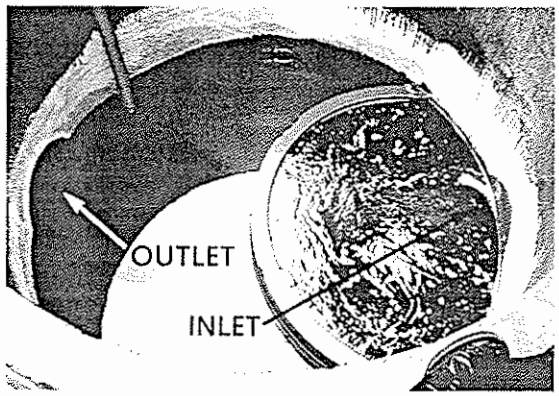
In order to achieve high removal efficiencies of TSS, products must be able to capture and retain fine particles less than 60µm in diameter, since these generally comprise the majority of the mass load in stormwater runoff. Products marketed on the ability to remove a certain percentage of material down to 150µm (say) will not perform in terms of a Total Suspended Solids measure. All monitoring data for Stormceptor® reports true Total Suspended Solids and for this reason will out perform many other products.

Performance of Stormceptor® to Retain Total Suspended Solids During Field Validation Testing by Regulatory Authorities



Oil/Total Petroleum Hydrocarbon Capture

The performance of the Stormceptor® product to capture and retain floating oils and petroleum/hydrocarbon products has been demonstrated under both full scale/full flow laboratory verification testing and data collected by regulators under field conditions. Stormceptor® is one of the few products available that can demonstrate the capture of total petroleum hydrocarbons (TPH) under field conditions during wet weather events.



Total Petroleum Hydrocarbon Capture at Full Treatment Flow Rate at Coventry University in Accordance with the European Standard EN 858-1:1994.

Dry Weather Capture Versus Hydrocarbon Removal During Rainfall Events

An important distinction exists between the capture of petroleum hydrocarbons during dry weather and during wet weather events. Dry weather capture reflects the ability of products to capture emergency spills under no flow conditions (i.e. no rainfall occurring at the time of the spill) as opposed to retaining hydrocarbon products being flushed from a catchment during rainfall. In general, it is relatively easy to capture dry weather spill events provided sufficient storage capacity has been provided. However, the removal of oils and petroleum hydrocarbons during rainfall and from runoff is more difficult and requires careful attention to operational velocities and turbulence generated within proprietary devices.

Several proprietary devices are marketed on the ability to capture oils and petroleum hydrocarbons from data generated during dry weather spill events. However, the majority are unable to replicate this capture performance during rainfall, since excessive operational velocities will emulsify collected oils and transport/export them out of the unit.

Stormceptor® will catch and retain dry weather emergency spills of oils and hydrocarbon/petroleum products and may be configured for highway/freeway and industrial applications to provide capture of products from tanker incidents and other emergency spill situations with capacities to cater for spills ranging between 5,283-15,580 gallons.

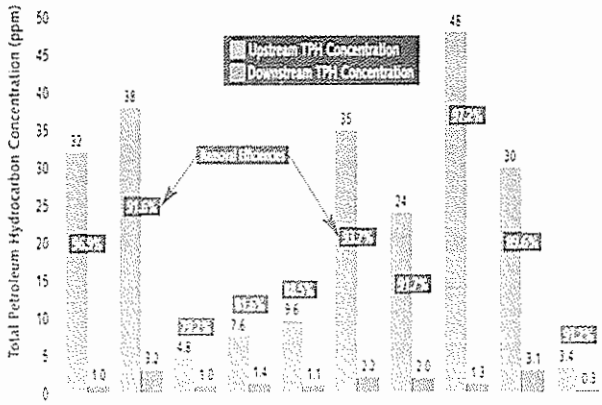
Capture and Retention of Oils/Petroleum Hydrocarbons During Wet Weather

Unlike many alternative solutions, Stormceptor will also capture oils and petroleum hydrocarbons during wet weather events and retain this material within a protected storage zone until subsequent cleaning of the unit. This ability is primarily the result of carefully controlled flow rates, very low operational velocities and the provision of the secure storage zone removed from the active flow path through the unit, where oils and petroleum hydrocarbons will be retained under quiescent conditions.

The following graph shows a range of field verifications where regulators have tested the performance of the Stormceptor® product to capture and retain oils and petroleum hydrocarbons during rainfall events. As shown, Stormceptor® has the ability to limit the outlet concentrations under 10 ppm for "normal" concentrations exported from urbanized land uses. Where influent concentrations reduce below 10 ppm, Stormceptor® will further retain sufficient hydrocarbons to achieve an outlet concentration generally below 1 ppm. Duncan[1] (1999) reports concentrations of hydrocarbons (oil and grease) from various land uses ranging from 0.5 ppm to 200 ppm, with the higher concentrations being generated from transportation activities.

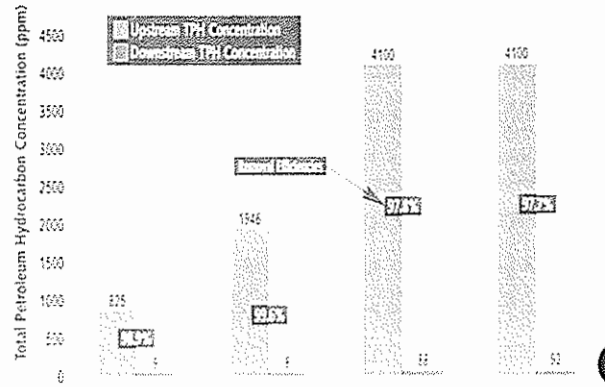
Minton[2] (2002) further reports mean concentrations ranging from 0.57 ppm to 69 ppm. As shown below, under these "normal" influent concentrations, Stormceptor® will limit the outlet concentrations below 10 ppm retaining in excess of 90% of the total hydrocarbon load during wet weather events.

Performance of Stormceptor® to Retain Total Petroleum Hydrocarbons During Field Validation Testing by Regulatory Authorities



The following chart shows the performance of Stormceptor® to retain hydrocarbons in situations containing very high influent concentrations. As shown, up to an influent concentration about 2000 ppm, Stormceptor® will continue to limit the outlet concentrations below 10 ppm and achieve very high retention efficiencies around 99%. The last two results also indicate very high retention efficiencies around 98% from a full-scale laboratory test. These results were generated with a very high hydrocarbon influent concentration as shown, introduced to the unit constantly with a continuous full (maximum) treatment flow rate, which reflects relatively extreme field conditions.

Performance of Stormceptor® to Retain High Concentrations of Total Petroleum Hydrocarbons During Field Validation Testing by Regulatory Authorities



Product Range

The most commonly installed unit is the In-Line **Storm***ceptor*®. It is designed with single or multiple inlets and a single outlet, and is available in eight different unit sizes, ranging from 900 to 7,200 gallon storage capacities. Each unit is constructed from precast concrete components and a patented fiberglass insert that separates the upper (by-pass) and lower (separation/holding) chambers. In areas where oil or hydrocarbon/petroleum spills accumulate in substantial volume between cleaning, the fiberglass insert provides dual wall containment to ensure trapped hydrocarbons are safely stored inside the treatment chamber.

Normal Operating Conditions

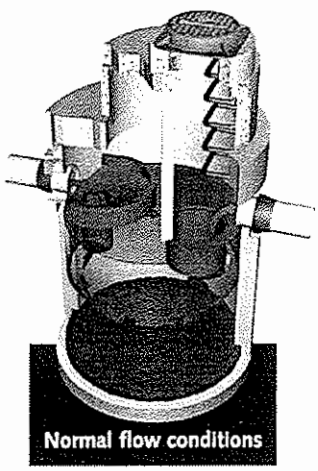
Under normal (frequent) operating conditions (more than 85% of all storm events), stormwater flows into the upper by-pass chamber and is diverted by a semi circular weir, down into the separation/holding chamber. Flow entering the lower chamber is carefully controlled by an orifice plate to prevent excessive operational velocities, and maximize capture and retention of hydrocarbons and suspended solids. This downward flow is directed, by right-angle outlets, tangentially around the circular walls of the chamber to maximize the flow path and detention time. Flow continues around the circumference of the unit, exits the lower chamber through the riser pipe and rejoins the piped drainage sytem. Fine and coarse suspended solids settle to the floor of the chamber, under very low velocity quiescent conditions, while the petroleum products rise and become trapped beneath the fiberglass insert.

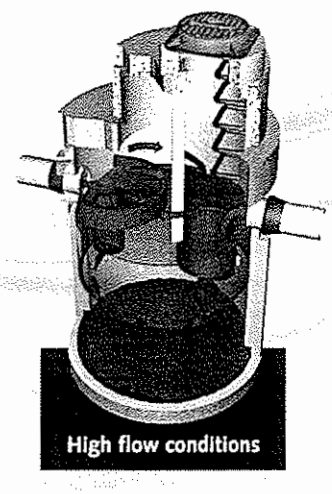
By-Pass Operating Conditions

During infrequent high flow events (less than 15% of all storm events), peak stormwater flows will pass over the diverting weir and continue through the by-pass chamber into the downstream stormwater system. This by-pass activity creates pressure equalization across the by-pass chamber, between the inlet and outlet, causing a slight throttling of the flow entering the lower treatment chamber which guarantees retention of fine material previously deposited. A portion of incoming suspended solids continues to be diverted by the weir into the lower chamber where it is stored, along with previously collected solids and hydrocarbons. **Storm***ceptor*® is unique in the market place since it is the only product which places emphasis on carefully controlling flow rates and operational velocities during all hydrologic conditions, thus preventing scouring, resuspension and ultimate loss of suspended solids during high flows.

The In-Line **Storm***ceptor*® has been proven in full scale laboratory and field validation tests to capture and retain over:

- 80% of total suspended solids, including the fine fraction classified as material having a particle size less than 60 µm, which has been shown to comprise the majority of the total mass load.
- 98% of free and floating oils, grease, hydrocarbons and petroleum products under both dry weather, emergency spill situations and during wet weather rainfall periods.
- Removal and retention of a range of contaminants sorbed or attached to the fine suspended solids, material including hydrocarbons, petroleum products and heavy metals.





Inlet Stormceptor

Taking the place of traditional inlet structures, the Inlet **Storm***ceptor*® is ideal for small drainage areas such as truck loading bays, small parking lots, electrical transformer stations and fuel storage pads. Its unique design allows for runoff to enter the structure in several configurations:

i) Grated inlet with a single outlet pipe at the head of the drainage system.

ii) Grated inlet with inlet and outlet pipes to form a grated in-line device.

iii) Small in-line configuration without the grated inlet.

The Inlet **Storm***ceptor*® is manufactured with a 48 inch diameter precast concrete shaft. Like the conventional In-Line **Storm***ceptor*®, a sloped fiberglass insert separates the upper (by-pass) and lower (separation/holding) chambers. The insert extends into the treatment chamber providing dual wall containment of free oils, hydrocarbons and petroleum products.

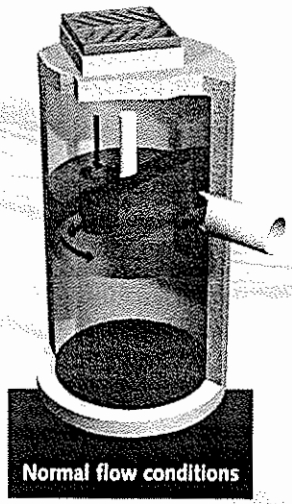
Normal Operating Conditions

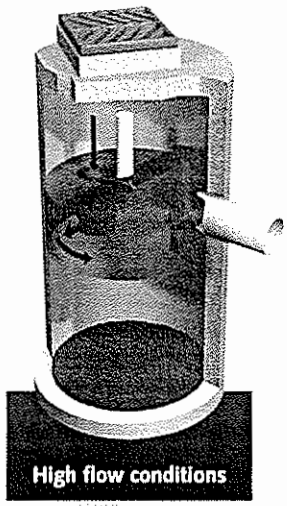
Under normal (frequent) operating conditions (more than 85% of all storm events), stormwater enters the upper by-pass chamber either via the grated inlet or from an upstream pipe (or both) and is diverted, through the drop pipe into the separation/holding chamber. Flow entering the lower chamber is carefully controlled through a combination of the head and the orifice opening to prevent excessive operational velocities and maximize capture and retention of hydrocarbons and suspended solids. This flow is directed, by a right angle drop pipe configuration tangentially around the circular walls of the chamber. Flow continues around the circumference of the unit, exits the lower chamber through the riser pipe and rejoins the piped drainage system. Fine and coarse suspended solids settle to the chamber floor, under very low velocity quiescent conditions, while the petroleum products rise and become trapped beneath the fiberglass insert.

By-Pass Operating Conditions

During infrequent high flow events (less than 15% of all storm events), peak stormwater flows will pass over the diverting weir into the downstream drainage system. This by-pass feature creates pressure equalization across the by-pass chamber, causing a slight throttling of the flow entering the lower treatment chamber which guarantees retention of fine material previously deposited. A portion of incoming suspended solids will continue to be diverted into the lower chamber. **Storm***ceptor*® is unique in the market place since it is the only product which places emphasis on carefully controlling flow rates and operational velocities during all hydrologic conditions, thus preventing scouring, resuspension and ultimate loss of suspended solids during high flows.

The Inlet **Storm***ceptor*® is an excellent alternative to normal drainage practices, as it saves the cost of providing a traditional inlet structure upstream of a conventional treatment device in small drainage areas.



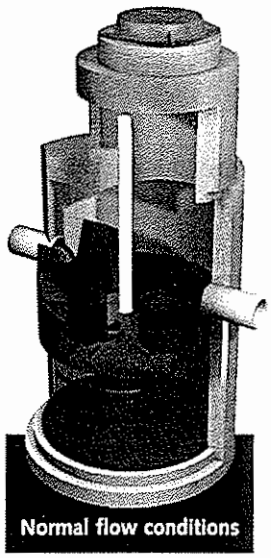


Submerged Storm

The Submerged **Storm***ceptor* is designed to remove hydrocarbons and suspended solids from stormwater runoff in partially submerged pipes. The primary application for the Submerged **Storm***ceptor* is where a relatively permanent tailwater from a downstream wetland, lake, pond, waterway or canal causes the piped drainage system to be partially submerged. The precast concrete sections are manufactured in easily assembled components and available in all the same sizes as the standard **Storm***ceptor* (450 to 16,000 gallon storage capacity). A customized fiberglass insert (similar to the standard In-Line **Storm***ceptor*®) separates the upper (by-pass) and lower (separation/holding) chambers.

Normal Operating Conditions

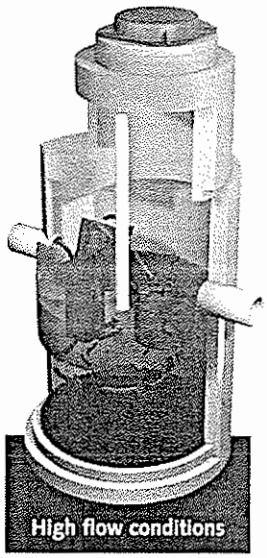
The Submerged **Storm***ceptor*® operates much like the In-Line **Storm***ceptor*®. The submerged design includes a customized weir height (depending on the average water level in the downstream pipe and annual water level fluctuation) and two inlet drop pipes. The lower drop pipe is always submerged. This drop pipe transports suspended solids and bedload sediment into the separation chamber. The higher drop pipe is located at the average submergence elevation and transports lighter material (free oil/TPH) into the separation chamber by forcing the development of a vortex, which "sucks" floating hydrocarbons into the lower chamber. The Submerged **Storm***ceptor*® utilizes the same flow control features of the standard In-Line units.



The orifice plate combined with the pressure (head) between the upstream and downstream pipes carefully controls flow entering the lower chamber to prevent excessive operational velocities and maximize capture and retention of hydrocarbons and suspended solids. The Submerged **Storm***ceptor* is effective for free oil and suspended solids removal under partially submerged conditions.

By-Pass Operating Conditions

During infrequent high flow events, water is conveyed over the internal by-pass weir directly to the downstream drainage system. By-passing high flows prevents the generation of high velocities within the lower chamber thus guaranteeing the retention of previously deposited material.



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MASTEP Technology Review

Technology Name: Stormceptor

Studies Reviewed: Final NJCAT Technology Verification Stormceptor STC900 September 2004, Coventry University Study, 1996; Technology Assessment, University of Massachusetts, 1997.

Date: November 23, 2007

Reviewer: Jerry Schoen

Rating: 2

Brief rationale for rating: This rating is primarily based on the 2005 NJCAT Technology Verification study. In general, this was a well-conducted test, which in large part followed NJDEP test guidelines for laboratory studies. MASTEP considers NJDEP laboratory test guidelines to be essentially the equivalent of TARP field protocols. Issues of concern: the study measured suspended sediment concentration (SSC) rather than total suspended solids (TSS). Although SSC is considered by many scientists to be the preferred method, it is at odds with Massachusetts stormwater regulations, which are based on TSS treatment. Comparing SSC and TSS results is considered an inexact science. The test was conducted with higher influent sediment concentrations than is preferred, but results were fairly consistent across all ranges studied. The particle size distribution also appears to be higher than the target test range. There are additional field studies that in general support the results obtained in this laboratory studies. These studies do not satisfy TARP protocols, but they do not contradict results obtained in the NJCAT study.

TARP Requirements Not Met*:

- Measurements in TSS.
- Influent sediment concentration is 100 – 300 mg/l: actual was 153-460.
- No documentation of a Quality Assurance Project Plan
- Third party studies are preferred. This was conducted by Stormceptor personnel, with sample analyses conducted by an external laboratory.

* Criteria also based on NJDEP laboratory testing guidelines.

6. Technical Evaluation Analysis

6.1 Verification of Performance Claims

Based on the evaluation of the results from laboratory studies, sufficient data is available to support the Stormceptor® Claim: The Stormceptor® System Model STC 900 provides 75% "Bulk TSS" removal efficiency (as per NJDEP treatment efficiency calculation methodology) for laboratory simulated stormwater runoff with an average influent concentration of 295 mg/L and an average d_{50} particle size of 97 microns. TSS removal testing was conducted with sediment pre-loaded in the lower chamber to 50% sediment capacity for the STC 900.

6.2 Limitations

6.2.1 Factors Causing Under-Performance

If the Stormceptor® System is designed and installed correctly, there is minimal possibility of failure. There are no moving parts to bind or break, nor are there parts that are particularly susceptible to wear or corrosion. Lack of maintenance may cause the system to operate at a reduced efficiency, and it is possible that eventually the system will become totally filled with sediment.

6.2.2 Pollutant Transformation and Release

The Stormceptor® System will not increase the net pollutant load to the downstream environment. However, pollutants may be transformed within the unit. For example, organic matter may decompose and release nitrogen in the form of nitrogen gas or nitrate. These processes are similar to those in wetlands but probably occur at slower rates in the Stormceptor® System due to the absence of light and mixing by wind, thermal inputs and biological activity. Accumulated sediment should not be lost from the system at or under the design flow rate.

6.2.3 Sensitivity to Heavy Sediment Loading

Heavy loads of sediment will increase the needed maintenance frequency.

6.2.4 Mosquitoes

Although the Stormceptor® System is a self contained unit, the design does incorporate standing water in the lower chamber, which can be a breeding site for mosquitoes. Although no information has been presented by Stormceptor® in their submittal to NJCAT to address this concern, a flap valve can be installed at the terminal end of the outlet pipe to prevent mosquitoes from entering the unit from the downstream side.

Location: RES 01

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Street Sweeping	0.05	1.00	0.05	0.95
Deep Sump Catch Basin	0.25	0.95	0.237	0.713
Stormceptor Model 1800	0.764	0.713	0.544	0.169

Total TSS Removal = 0.831

Project: Johnson Woods Condominiums, Reading, MA
Prepared By: WRB
Date: 3/23/04

COMMONWEALTH OF MASSACHUSETTS
William R. Bergeron
CIVIL
No. 29464
REGISTERED PROFESSIONAL ENGINEER
3/23/04

William R. Bergeron PE

*** Equals remaining load from previous BMP (E)**

Location: REB 02

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Street Sweeping	0.05	1.00	0.05	0.95
Deep Sump Catch Basin	0.25	0.95	0.237	0.713
Stormceptor Model 3600	0.76	0.713	0.541	0.172

Total TSS Removal = 0.828

Project: Johnson Woods Condominums, Reading, MA
Prepared By: WRB
Date: 3/23/04

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3/23/04

*** Equals remaining load from previous BMP (E)**

Location: RES 03

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Street Sweeping	0.05	1.00	0.05	0.95
Deep Sump Catch Basin	0.25	0.95	0.237	0.713
Forebay	0.25	0.713	0.178	0.535
Pocket Wetland	0.70	0.535	0.374	0.161

Total TSS Removal = 0.839

Project: Johnson Woods Condominiums, Reading, MA
Prepared By: WRB
Date: 3/23/04

COMMONWEALTH OF MASSACHUSETTS
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3/23/04

* Equals remaining load from previous BMP (E)

Location: RES-04

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Street Sweeping	0.05	1.00	0.05	0.95
Deep Sump Catch Basin	0.25	0.95	0.237	0.713
Forebay	0.25	0.713	0.178	0.535
Extended Detention	0.70	0.535	0.374	0.161

Total TSS Removal = 0.839

Project: Johnson Woods Condominiums, Reading, MA
Prepared By: WRB
Date: 4/22/04

COMMONWEALTH OF MASSACHUSETTS
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4/22/04

*** Equals remaining load from previous BMP (E)**

Location: RES-05

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Street Sweeping	0.05	1.00	0.05	0.95
Deep Sump Catch Basin	0.25	0.95	0.237	0.713
Stormceptor Model 900	0.75	0.713	0.5375	0.1755

Total TSS Removal = 0.8245

Project: Johnson Woods Condominium Phese II, Reading, Ma.
Prepared By: WRB
Date: 1/24/2012

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1/24/2012

* Equals remaining load from previous BMP (E)

Location: RES-06, 07, 08

TSS Removal Calculation Worksheet

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Street Sweeping	0.05	1.00	0.05	0.95
Deep Sump Catch Basin	0.25	0.95	0.237	0.713
Stormceptor Model 450i	0.75	0.713	0.5375	0.1755

Total TSS Removal = 0.8245

Project: Johnson Woods Condominium Phase II, Reading, Ma.

Prepared By: WRB

Date: 1/24/2012

COMMONWEALTH OF MASSACHUSETTS
William R. Bergeron
CIVIL
No. 34467
REGISTERED PROFESSIONAL ENGINEER

William R. Bergeron PE

1/24/2012

* Equals remaining load from previous BMP (E)