LONG TERM OPERATIONS and MAINTENANCE PLAN FOR WEST END

130 West Street and 25 Spring Street Walpole, Massachusetts 02081 Assessor's Map: 33, Parcels: 398 and 399 Zoning District: Central Business District (CBD) November 2023

Prepared by:

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Owner Contact Information

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Overview

Following construction, the contractor shall inspect the Stormwater Management System and clean all construction sediment. Upon project completion, the site owner shall adhere to the following maintenance recommendations, and submit inspection reports and maintenance logs shall be to the Town of Walpole in accordance with their stormwater maintenance and inspection documentation requirements. In order to minimize the stormwater management system deterioration, the owner shall adhere to the following Long-Term Operation and Maintenance Plan as well as any additional requirements pertaining to inspection and maintenance measures for this site provided in Chapter 2, Volume 2: Structural BMP Specifications for the Massachusetts Stormwater Handbook.

Deep Sump Catchbasins

Deep Sump Catchbasins must be cleaned and maintained in accordance with the Massachusetts Stormwater Handbook, Volume 2, Chapter 2, Pages 2-5. Regular maintenance is essential. Deep sump catchbasins remain effective at removing pollutants only if they are cleaned out frequently. One study found that once 50% of the sump volume is filled, the catch basin is not able to retain additional sediments. Inspect or clean deep sump basins at least four times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary.

Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste. In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted. With prior MassDEP approval, catch basin cleanings may be used as grading and shaping materials at landfills undergoing closure (see

Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites) or as daily cover at active landfills. MassDEP also encourages the beneficial reuse of catch basin cleanings whenever possible. A Beneficial Reuse Determination is required for such use.

MassDEP regulations prohibit landfills from accepting materials that contain free-draining liquids. One way to remove liquids is to use a hydraulic lift truck during cleaning operations so that the material can be decanted at the site. After loading material from several catch basins into a truck, elevate the truck so that any free-draining liquid can flow back into the structure. If there is no free water in the truck, the material may be deemed to be sufficiently dry. Otherwise, the catch basin cleanings must undergo a Paint Filter Liquids Test. Go to www. Mass.gov/dep/recycle/laws/cafacts.doc for information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings.

Sediment Forebay

Sediment Forebays must be cleaned and maintained in accordance with the Massachusetts Stormwater Handbook, Volume 2, Chapter 2, Pages 13-16.

Sediments and associated pollutants are removed only when sediment forebays are actually cleaned out, so regular maintenance is essential. Frequently removing accumulated sediments will make it less likely that sediments will be resuspended. At a minimum, inspect sediment forebays monthly and clean them out at least four times per year. Stabilize the floor and sidewalls of the sediment forebay before making it operational, otherwise the practice will discharge excess amounts of suspended sediments. When mowing grasses, keep the grass height no greater than 6 inches. Set mower blades no lower than 3 to 4 inches. Check for signs of rilling and gullying and repair as needed. After removing the sediment, replace any vegetation damaged during the clean-out by either reseeding or resodding. When reseeding, incorporate practices such as hydroseeding with a tackifier, blanket, or similar practice to ensure that no scour occurs in the forebay, while the seeds germinate and develop roots.

Underground Infiltration Systems

Because subsurface structures are installed underground, they are extremely difficult to maintain. Once the system is in use, inspect it after every major storm for the first few months to ensure it is stabilized and functioning properly and if necessary, take corrective action. Inspect inlets and inspection ports at least twice a year, as well as after very major storm event. A major storm event is defined as a storm that is equal to or greater than the 2-year, 24-hour storm (generally 2.9 to 3.6 inches in a 24-hour period, depending in geographic location in Massachusetts). These inspections shall include observing the inlets, outlets, outlet control structures, and clean-out areas for build ups of sediment, litter, or organic debris to confirm correct operation of the system. Any accumulated material observed in the system shall be disposed of at an approved upland location. At the time of inspections, any deficiencies in the structural integrity of the system must be recorded.

Proprietary Water Quality Chambers (Stormceptors)

Following post-construction, Stormceptor inspections for the first year of operation shall occur after every storm event with greater than one inch of rainfall, immediately after oil, fuel or other chemical spills, and quarterly (four times per year). Inspections shall occur a minimum of two times per year for the following years. The Stormceptor device is required to be cleaned annually and whenever sediment depths reach 15% of the unit's total storage capacity.

If the system is not maintained regularly, sediment removal efficiency may be reduced, oil spills may not be properly captured, and clogging (resulting in flooding) may occur. The Stormceptor devices shall be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers, and catchbasins. Typically, maintenance cleaning of accumulated sediment is performed with a vacuum truck. If oil is present, oil is typically pumped into a separate containment using a small pump and tubing. The disposal of sediment or recovered pollutants shall be at an approved and permitted upland location. If any parts or pieces of the Stormceptor devices break or become damaged, the local supplier of authentic Stormceptor components must be contacted to replace broken parts. The "Stormceptor® STC Operation and Maintenance Guide" is required to be followed to insure proper function and performance.

Estimated Annual Stormwater System Maintenance Budget

- Remove and dispose accumulated sediment from catchbasins, manholes, forebays, and underground infiltration systems: 10 CY x \$100/CY = \$1,000
- Parking lot sweeping: 40 HSY x \$10/HSY x 4/year = \$1,600
- Total Estimated Annual Budget = \$2,600

Post Construction Site Management

The site owner shall manage the site in accordance with the following recommendations:

General Pollution Prevention Features

- The operation and maintenance of the stormwater system shall be conducted in accordance with this document
- Quarterly parking lot and driveway sweeping shall be conducted as referenced.
- Future maintenance of the driveway and parking lot areas shall prohibit the use of coal tar type sealants.

Overview

Pollution prevention techniques must, to the greatest extent practicable, be incorporated into all site designs, especially at commercial and light industrial sites, to minimize the potential impact those activities may have on stormwater runoff quality. Preventative source controls must also be applied in residential development, particularly in preventing floatables (trash and debris) from entering storm sewer drainage systems.

General Pollution Prevention Design Features

Inlets to stormwater management systems should incorporate trash racks wherever practicable. Storm drain marking (e.g., stenciling) to discourage dumping must also be provided at each inlet. Maintenance plans must include a schedule for regular maintenance and inspection of trash racks.

Solid Waste Containment

Proper containment of solid waste will prevent it from entering drainage systems and polluting waterway. Miscellaneous and wind-blown trash on both developed and undeveloped portions of the site shall be collected and disposed of in an appropriate fashion.

Parking Lot Sweeping

Street sweeping helps to remove sediment and debris from paved surfaces, reducing potential pollutant transport to waterbodies. Street and parking lot sweeping may also reduce the need for maintenance of pretreatment devices, such as catch basins. Debris collected from some streets and parking lots may be regulated as a hazardous waste. For these cases, debris must be disposed of in accordance with appropriate practice and applicable regulatory standards.

Deicing and Salt Storage

Deicing and sanding operations are often necessary for safety during winter storms; however, the materials used create water quality problems. Use deicing chemicals and sand judiciously. Consider the information in Table G-1 when selecting a deicer.

Media	Sodium Chlorid e (NaCl)	Sodium Calcium Chlorid Chloride e (NaCl) (CaCl ₂)		Sand (SiO2)
Soils	Cl complexes release heavy metals; Na can breakdown soil structure and reduce permeability		Ca and Mg can exchange with heavy metals.	Gradually will accumulate on soil.
Vegetation	Salt spray/splash c. scorch and brownin new plant growth u road; osmotic stres salt uptake; grass i than trees and woo	an cause leaf ng or dieback of ıp to 50 feet from s can result from s more tolerant dy plants.	Little effect.	Accumulates on and around low vegetation.
Groundwater	Mobile Na and Cl concentration level low flow during sp heavy metals from	ions readily reach g ls can temporarily ir ring thaws. Ca and soil.	roundwater, and acrease in areas of Mg can release	No known effect.
Surface Water	Can cause density small lakes having potentially leading bottoms; often con phosphorus, and tr impurities, often in greater than 5 ppm	stratification in closed basins, to anoxia in lake tain nitrogen, ace metals as concentrations	Depletes dissolved oxygen in small lakes and streams when degrading.	Accumulated sand alters stream geometry and habitat
Aquatic Biota	Little effect in large or flowing bodies at current road salting amounts; small streams that are end points for runoff can receive harmful concentrations of Cl; Cl from NaCl generally not toxic until it reaches levels of 1,000-36,000 ppm.		Can cause oxygen depletion.	Accumulation of particles to stream bottoms degrades habitat, clogs gills.

Table G-1 Comparison of Environmental Effects of Common Roadway Deice

Source: Adapted from Ohrel, 2000

Sand and deicing chemicals should be stored under cover so as to prevent their exposure to stormwater. Table G-2 provides recommendations appropriate for storage and use of deicers. Storage of these materials may be regulated as an industrial activity.

Activity	Recommendation
Storage	 Salt storage piles should be completely covered, ideally by a roof, and at a minimum, by a weighted tarp, and stored on impervious surfaces. The DEM Groundwater Quality Rules require that deicer materials be covered in areas where the groundwater is classified GAA or GA. Runoff should be contained in appropriate areas. Spills should be cleaned up after loading operations. The material may be directed to a sand pile or returned to salt piles. Avoid storage in drinking water supply areas, water supply aquifer recharge areas, and public wellhead protection areas.
Application	 Application rate of deicing materials should be tailored to road conditions (i.e., high versus low volume roads). Trucks should be equipped with sensors that automatically control the deicer spread rate. Drivers and handlers of salt and other deicers should receive training to improve efficiency, reduce losses, and raise awareness of environmental impacts.
Other	 Identify ecosystems such as wetlands that may be sensitive to salt. Use calcium chloride and CMA in sensitive ecosystem areas. To avoid over-application and excessive expense, choose deicing agents that perform most efficiently according to pavement temperature. Monitor the deicer market for new products and technology.

Table G-2 Recommendations to Reduce Deicer Impacts

Source: Adapted from Ohrel, 2000.

Snow Disposal

Improper snow disposal can be a threat to public health and the environment. Disposal should consider site selection, site preparation and maintenance, and emergency snow disposal locations and procedures.

Site Selection

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas away from water resources and wells. At these locations, snow meltwater can filter in to the soil, leaving behind sand and debris, which can be removed in the springtime. When selecting a site for snow disposal, adhere to the following guidelines:

- Avoid dumping snow into any waterbody, including rivers, reservoirs, ponds, lakes, wetlands, bays, or the ocean. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes.
- Do not dump snow within a Wellhead Protection Area (WHPA) of a public water supply well, or within 200 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater. In gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.
- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. In addition, a high volume of sand, sediment, and litter released from melting snow may be quickly transported through the drainage system into surface water.

Driveway and Parking Lot Sealants

Driveway and parking lot sealants are a major source of polycyclic aromatic hydrocarbons (PAHs) in our environment. There are two types of sealant: asphalt based and coal-tar based. Both types of sealant contain PAHs, but the coal-tar based sealants have a far higher concentration of PAHs (as much as 70 times higher than asphalt based). As the sealants wear down, small particles of sealant are washed off by stormwater into surface waters. PAHs have been found to be toxic to aquatic life, with bottom dwelling organisms most at risk since PAHs tend to attach to sediment rather than dissolve in water. Also, in recognition of the human health effects of PAHs, DEM has adopted the US EPA water column human health criteria for PAHs in the DEM Water Quality Regulations. Because of the high concentrations of PAHs in coal-tar based sealants, it is recommended that coal-tar based sealants <u>not</u> be used. For more information, see: US Geological Survey Fact Sheet 2005-3147, "Parking Lot Sealcoat: A Major Source of Polycyclic Aromatic Hydrocarbons (PAHs) in Urban and Suburban Environments."

Lawn, Garden, and Landscape Management

Lawns are a significant feature of urban landscapes. Estimates of turf and lawn coverage in the United States are as high as 30 million acres, which, if lawns were classified as a crop, would rank as the fifth largest in the country after corn, soybeans, wheat, and hay (Swann and Schueler, 2000). This large area of managed landscape has the potential to contribute to urban runoff pollution due to over fertilization, overwatering, over application of pesticides, and direct disposal of lawn clippings, leaves, and trimmings. Also, erosion from bare patches of poorly managed lawns contributes sediment to watercourses, and disposal of lawn clippings in landfills can reduce the capacity of these facilities to handle other types of waste. The following standards for grounds management shall be incorporated into stormwater management plans:

<u>Lawn conversion</u> – Grasses require more water and attention than alternative groundcovers, flowers, shrubs, or trees. Alternatives to turf are especially recommended for problem areas such as lawn edges, frost pockets, shady spots, steep slopes, and soggy areas. Vegetation that is best suited to the local conditions should be selected.

<u>Soil building</u> – Grounds operation and maintenance should incorporate soil evaluation every 1 to 3 years to determine suitability for supporting a lawn, and to determine how to optimize growing conditions. Consider testing soil characteristics such as pH, fertility, compaction, texture, and earthworm content.

<u>Grass selection</u> – Grass seed is available in a wide range of cultivated varieties, so homeowners, landscapers, and grounds managers are able to choose the grass type that grows well in their particular climate, matches site conditions, and is consistent with the property owner's desired level of maintenance. When choosing ground cover, consideration should be given to seasonal variations in rainfall and temperature. Table G-3 lists turfgrass types and their level of tolerance to drought:

Turfgrass Type	Drought Tolerance
Fine-leaved Fescues Tall Fescue Kentucky Bluegrass Perennial Ryegrass Bentgrasses	High Low

Table G-3 Drought Tolerance of Turfgrass Types

<u>Mowing and thatch management</u> – To prevent insects and weed problems, property owners should mow high, mow frequently, and keep mower blades sharp. Lawns should not be cut shorter than 2 to 3 inches, because weeds can grow more easily in short grasses. Grass can be cut lower in the spring and fall to stimulate root growth, but not shorter than 1 $\frac{1}{2}$ inches.

<u>Fertilization</u> – If fertilizing is desired, consider the following points:

- Most lawns require little or no fertilizer to remain healthy. Fertilize no more than twice a year once in May-June, and once in September- October;
- Fertilizers are rated on their labeling by three numbers (e.g., 10-0-10), which refer to their Nitrogen (N) Phosphorus (P) Potassium (K) concentrations. Fertilize at a rate of no more than ½ pound of nitrogen per 1000 square feet, which can be determined by dividing 50 by the percentage of nitrogen in the

fertilizer;

- The use of Phosphorous containing fertilizers on lawns and non-agricultural turf is not permitted in the State of Massachusetts, except under specific conditions listed in Massachusetts General Laws Part 1, Title XIX, Chapter 128, Section 65A. The use of Phosphorous containing fertilizer on this site is not recommended under any circumstances because of its close proximity to the Hawthorne Brook.
- Apply fertilizer carefully to avoid spreading on impervious surfaces such as paved walkways, patios, driveways, etc., where the nutrient can be easily washed into stormdrains or directly into surface waters;
- To encourage more complete uptake, use slow-release fertilizers that is those that contain 50 percent or more water-insoluble nitrogen (WIN);
- Grass blades retain 30-40 percent of nutrients applied in fertilizers. Reduce fertilizer applications by 30 percent, or eliminate the spring application of fertilizer and leave clippings on the lawn where they will degrade and release stored nutrients back to the soil; and
- Fertilizer should not be applied when rain is expected. Not only does the rain decrease fertilizer effectiveness, it also increases the risk of surface and ground water contamination.

<u>Weed management</u> – A property owner must decide how many weeds can be tolerated before action is taken to eradicate them. To the extent practicable, weeds should be dug or pulled out. If patches of weeds are present, they can be covered for a few days with a black plastic sheet; a technique called solarization. Solarization kills the weeds while leaving the grass intact. If weeds blanket a large enough area, the patch can be covered with clear plastic for several weeks, effectively "cooking" the weeds and their seeds. The bare area left behind after weeding should be reseeded to prevent weeds from growing back. As a last resort, homeowners can use chemical herbicides to spot- treat weeds.

<u>Pest management</u> – Effective pest management begins with maintenance of a healthy, vigorous lawn that is naturally disease resistant. Property owners should monitor plants for obvious damage and check for the presence of pest organisms. Learn to distinguish beneficial insects and arachnids, such as green lacewings, ladybugs, and most spiders, from ones that will damage plants.

When damage is detected or when harmful organisms are present, property owners should determine the level of damage the plant is able to tolerate. No action should be taken if the plant can maintain growth and fertility. If controls are needed, there are a variety of low-impact pest management controls and practices to choose from, including the following:

- Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off a plant with water, or in some cases vacuumed off of larger plants;
- Store-bought traps, such as species-specific, pheromone-based traps or colored

sticky cards, can be used;

- Sprinkling the ground surface with abrasive diatomaceous earth can prevent infestations by soft-bodied insects and slugs. Slugs can also be trapped by falling or crawling into small cups set in the ground flush with the surface and filled with beer;
- In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of. (Pruning equipment should be disinfected with bleach to prevent spreading the disease organism);
- Small mammals and birds can be excluded using fences, netting, tree trunk guards, and, as a last resort, trapping. (In some areas trapping is illegal. Property owners should check local codes if this type of action is desired); and
- Property owners can encourage/attract beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders that prey on detrimental pest species. These desirable organisms can be introduced directly or can be attracted to the area by providing food and/or habitat.

If chemical pesticides are used, property owners should try to select the least toxic, water soluble, and volatile pesticides possible. All selected pesticides should be screened for their potential to harm water resources. Although organophosphate pesticides, such as diazinon and chlorpyrifos, are popular because they target a broad range of pests and are less expensive than newer, less toxic pesticides, they rank among the worst killers of wildlife, and often pose the greatest health risk. Synthetic pyrethroids are more selective, and typically much less toxic than organophosphates, yet they can harm beneficial insects. When possible, pesticides that pose the least risk to human health and the environment should be chosen. A list of popular pesticides, along with their uses, their toxicity to humans and wildlife, EPA's toxicity rating, and alternatives to the listed chemicals, is available Audubon from The Guide to Home Pesticides. (http://www.audubon.org/bird/pesticides/).

<u>Sensible irrigation</u> – Most New England lawns will survive without irrigation. Grasses will normally go dormant in warm, dry periods (June-September) and resume growth when moister is more plentiful. However, if watering is desired, consider the following points:

Established lawns need no more than one inch of water per week (including precipitation) to prevent dormancy in dry periods. Watering at this rate should wet soil to approximately 4-6 inches and will encourage analogous root growth. If possible, use timers to water before 9:00 a.m., preferably in the early morning to avoid evaporative loss. Use drought-resistant grasses (see "grass selection" above) and cut grass at 2-3 inches to encourage deeper rooting and heartier lawns.

Appendix

Appendix A.	Stormwater Management Systems Inspection and Maintenance Log
Appendix B.	Stormceptor® STC Operation and Maintenance Guide
Appendix C.	Operation & Maintenance Guidelines for Cultec Stormwater Management Systems
Appendix D.	BMP Location Plan

Site:	
Site Address:	
Date:	
Inspector:	

Item		Inspection OK	Service Required	Service Performed	Supervisor Notified	
1.0 Catch basins - Inspect Quarterly		011	100 1000		1,0011100	
	1.1	Sediment and debris accumulation. If exceeds 1 foot depth, Service Required				
	1.2	Frame and grate in good condition				
	1.3	Inlet and outlet pipes free of debris				
	1.4	Integrity of catch basin structure				
	1.5	Describe service provided:				
2.0	Drai	n Manholes and Outlet Control	Structures- In	spect Quarterly	7	
	2.1	Sediment and debris accumulation. If within 6" of outlet pipe, service required				
	2.2	Frame and cover in good condition				
	2.3	Inlet and outlet pipes free of debris				
	2.4	Integrity of concrete manhole structure				
	2.5	Describe service provided:				

		Item	Inspection	Service	Service	Supervisor
3.0 Underground Infiltration Systems -		UK Inspect Twice	Required	Performed	Notified m Events	
5.0	3.1	Inspection ports or clean-	- mspeet 1 wice			
	5.1	outs free of accumulated				
		sediment trash or debris				
	2 2	Inlat and outlat nings from of				
	5.2	debris				
	33	No standing water after 72				
	5.5	hours of storm event				
	34	Outlet control structure				
	5.4	orifices free of obstructions				
	35	Describe service provided:				<u> </u>
	5.5	Describe service provided.				
4.0	Stor	mceptor Chambers - Inspect Q	uarterly (Also, 1	Refer to Owner	's Manual)	
	41	If sediment and debris				
		accumulation exceeds 15%				
		of the structure's total				
		storage volume the system				
		should be cleaned.				
	4.2	Energy and server in good				
	4.2	Frame and cover in good				
	12	Inlat and outlat minor from of				
	4.3	debris				
-	11	Integrity of structure				
	4.4	Describe service merrided				
	4.5	Describe service provided:				
5.0	Sedi	ment Forebays Inspect Twice	ner Vear			
5.0	5 1	Grassed areas are mowed				
	5.1	and free of wild woody				
		and free of white woody				
	5 7	Forebay is free from woody				
	5.2	growth and weeds				
	5 2	No standing water after				
	5.5	nroodont 72 hour dry				
		precedent /2 nour dry				
	5 /	Erosion and/or Subsidence				
	5.4	of side slopes and/or				
		or side slopes and/or				
1		emoankments		1		

Item		Inspection OK	Service Required	Service Performed	Supervisor Notified	
5.0	Sedi	ment Forebays – Inspect Twice	e per Year (con	tinued)		
	5.5	Inlet/outlet structures and/or inspection ports free of obstructions and/or sediment				
	5.6	Sediment and debris accumulation is 10% of total storage volume below outlet				
	5.7	Describe Service Provided:				
6.0	Mise	cellaneous				
	6.1	Parking lot sweeping,				
		quarterly per year				
	6.2	Trash and litter appropriately stored in dumpster enclosure or designated trash receptacles				
	6.3	Evidence of erosion within landscape areas or on embankments.				
7.0	6.4	Describe service provided: eral Comments:				
7.0						



Stormceptor[®] STC Operation and Maintenance Guide





Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences						
Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000			
Single inlet pipe	3 in. (75 mm)	1 in. (25 mm)	3 in. (75 mm)			
Multiple inlet pipes	3 in. (75 mm)	3 in. (75 mm)	Only one inlet pipe.			

Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 450i	In-Line Unit STC 900 to STC 7200	Series* STC 11000 to STC 16000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (450 mm)	33 inch (825 mm)	33 inch (825 mm)

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
- Top of grade elevation
- Stormceptor inlet and outlet pipe diameters and invert elevations
- Standing water elevation
- Stormceptor head loss, K = 1.3 (for submerged condition, K = 4)

Stormceptor®

OPERATION AND MAINTENANCE GUIDE Table of Content

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1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium[™] Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 693,164 707,133 729,096 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 2,137,942 2,175,277 2,180,305 2,180,383 2,206,338 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 5,498,331 5,725,760 5,753,115 5,849,181 6,068,765 6,371,690
- Stormceptor OSR Patent Pending Stormceptor LCS Patent Pending

2. Stormceptor Design Overview

2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18" (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

3. Key Operation Features

3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{sc} = \frac{H}{6_{H}} = \frac{Q}{A_{s}}$$

Where:

 v_{sc} = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

 $Ø_{\rm H}$ = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft3/s (m3/s)

 $A_s = surface area, ft^2 (m^2)$

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.

4. Stormceptor Product Line

4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

lable 1. Stormceptor Models				
Stormceptor Model	Total Storage Volume U.S. Gal (L)	Hydrocarbon Storage Capacity U.S. Gal (L)	Maximum Sediment Capacity ft³ (L)	
STC 450i	470 (1,780)	86 (330)	46 (1,302)	
STC 900	952 (3,600)	251 (950)	89 (2,520)	
STC 1200	1,234 (4,670)	251 (950)	127 (3,596)	
STC 1800	1,833 (6,940)	251 (950)	207 (5,861)	
STC 2400	2,462 (9,320)	840 (3,180)	205 (5,805)	
STC 3600	3,715 (1,406)	840 (3,180)	373 (10,562)	
STC 4800	5,059 (1,950)	909 (3,440)	543 (15,376)	
STC 6000	6,136 (23,230)	909 (3,440)	687 (19,453)	
STC 7200	7,420 (28,090)	1,059 (4,010)	839 (23,757)	
STC 11000	11,194 (42,370)	2,797 (10, 590)	1,086 (30,752)	
STC 13000	13,348 (50,530)	2,797 (10, 590)	1,374 (38,907)	
STC 16000	15,918 (60,260)	3,055 (11, 560)	1,677 (47,487)	

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.



Figure 1. Inline Stormceptor

Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.



Figure 2. Inlet Stormceptor

4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.



Figure 3. Series System

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

Table 2. Fine Distribution

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

- 1. Determination of real time hydrology
- 2. Buildup and wash off of TSS from impervious land areas
- 3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
 - » The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
 - » The distribution of TSS with the hydrology is properly and accurately considered in the sizing
 - » Particle size distribution is properly considered in the sizing
 - » The sizing can be optimized for TSS removal
 - » The cost benefit of alternate TSS removal criteria can be easily assessed
 - » The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

'Spill Capture' describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit's available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.



Figure 4. Oil level alarm

6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters



Figure 5. Maximum pipe diameters for straight through and bend applications

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.



Figure 6. Maximum bend angles

7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

Table 3. Recommended Drops Betwee	n Inlet and Outlet Pipe Inverts
-----------------------------------	---------------------------------

Number of Inlet Pipes	Inlet System	In-Line System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life- cycle maintenance cost.

7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss = k*1.3v2/2g).

However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation



Figure 7. Submerged Stormceptor

8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between "approved alternatives". The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system's performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product's performance claims.

8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system's design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program 57% removal of 1 to 25 micron particles
- Laval Quebec 50% removal of 1 to 25 micron particles

10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

- 1. Aggregate base
- 2. Base slab
- 3. Lower chamber sections
- 4. Upper chamber section with fiberglass insert
- 5. Connect inlet and outlet pipes
- 6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate
- 7. Remainder of upper chamber
- 8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and reinstalling the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

Particle Size	Specific Gravity	
Model	Sediment Depth inches (mm)	
450i	8 (200)	
900	8 (200)	
1200	10 (250)	
1800	15 (381)	
2400	12 (300)	
3600	17 (430)	
4800	15 (380)	
6000	18 (460)	
7200	15 (381)	
11000	17 (380)	
13000	20 (500)	
16000	17 (380)	
* based on 15% of the Stormceptor unit's total storage		

Table 4. Sediment Depths Indicating Required Servicing*

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

- 1. Check for oil through the oil cleanout port
- 2. Remove any oil separately using a small portable pump
- 3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
- 4. Remove the sludge from the bottom of the unit using the vacuum truck
- 5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.



SUPPORT

Drawings and specifications are available at www.ContechES.com. Site-specific design support is available from our engineers.

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Published by

CULTEC P.O. Box 280 878 Federal Road Brookfield, Connecticut 06804 USA www.cultec.com

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U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; U.S. Designs D613,819; D638,095; D668,318; Canadian Patent 2,450,565; 2,591,255; Canadian Designs 129144; 135983; 159073; 160977; and/or other U.S. or Foreign Patent(s) or Patent(s) Pending.

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For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at CT-CustomerService@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail CT-Tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT057 11-23 November 2023

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC. All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings. Actual designs may vary.



This manual contains guidelines recommended by CULTEC and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

- A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.
- **B.** If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access

This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.



2. StormFilter Access

Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

- **A.** The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.
- **B.** The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.
- **C.** Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.
- **D.** Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance

The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance

The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)



	Frequency	Action
Inlets and Outlets	Every 3 years	 Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	 Check inlet and outlets for clogging and remove any debris as re- quired.
CULTEC Stormwater Chambers	2 years after commis- sioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.
		• Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commis- sioning every 9 years following	Clean stormwater management chambers and feed connectors of any debris.
		Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.
		• Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after com- missioning	Clean stormwater management chambers and feed connectors of any debris.
		• Determine the remaining life expectancy of the stormwater man- agement chambers and recommended schedule and actions to reha- bilitate the stormwater management chambers as required.
		• Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.
		• Replace or restore the stormwater management chambers in accor- dance with the schedule determined at the 45-year inspection.
		Attain the appropriate approvals as required.
		Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1 st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC at 1-800-428-5832.



WQMP Operation & Maintenance (O&M) Plan

Project Name:_____

Prepared for:

Project Name: _____

Address:_____

City, State Zip:_____

Prepared on:

Date:_____

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

8.1.1 **Project Information**

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.



Appendix ____

BMP SITE PLAN

Site plan is preferred on minimum 11" by 17" colored sheets, as long as legible.



Project Name:	
Today's Date:	
Name of Person Performing Activity (Printed):	
Signature:	

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

CULTEC



Minor Maintenance

Frequency		Action
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
🗆 Month 1	Date:	
🗆 Month 2	Date:	
🗆 Month 3	Date:	
🗆 Month 4	Date	
🗆 Month 5	Date:	
🗆 Month 6	Date:	
🗆 Month 7	Date:	
🗆 Month 8	Date:	
🗆 Month 9	Date:	
🗆 Month 10	Date:	
🗆 Month 11	Date:	
Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
	[Notes
Spring	Date:	
🗆 Fall	Date:	
Spring	Date:	
Fall	Date:	
Spring	Date:	
🗆 Fall	Date:	
Spring	Date:	
Fall	Date:	
Spring	Date:	
🗆 Fall	Date:	
Spring	Date:	
🗆 Fall	Date:	
One year after commissioning		Check inlets and outlets for clogging and remove any debris, as required.
and every thi	rd year following	Notes
🗆 Year 1	Date:	
🗆 Year 4	Date:	
🗆 Year 7	Date:	
🗆 Year 10	Date:	
🗆 Year 13	Date:	
🗆 Year 16	Date:	
🗆 Year 19	Date:	
🗆 Year 22	Date:	



Frequency		Action	
Every 3 years		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.	
		Notes	
P Year 1	Date:		
🗆 Year 4	Date:		
🗆 Year 7	Date:		
Year 10	Date:		
🗆 Year 13	Date:		
🗆 Year 16	Date:		
🗆 Year 19	Date:		
I Year 22	Date:		
Spring and Fall		Check inlet and outlets for clogging and remove any debris, as required.	
		Notes	
Spring	Date:		
🗆 Fall	Date:		
Spring	Date:		
🗆 Fall	Date:		
Spring	Date:		
🗆 Fall	Date:		
Spring	Date:		
🗆 Fall	Date:		
Spring	Date:		
Fall	Date:		
Spring	Date:		
🗆 Fall	Date:		
2 years after commissioning		 Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. 	
		 Obtain documentation that the stormwater manage- ment chambers and feed connectors will function as anticipated. 	
	Γ	Notes	
□ Year 2	Date:		
	Frequency Every 3 years · Year 1 · Year 4 · Year 7 · Year 10 · Year 13 · Year 16 · Year 19 · Year 22 Spring and Fall · Spring · · Spr	FrequencyEvery 3 years• Year 1Date:• Year 4Date:• Year 7Date:• Year 10Date:• Year 13Date:• Year 16Date:• Year 22Date:• Year 22Date:Spring and FallDate:• FallDate:• SpringDate:• SpringDate:• SpringDate:• FallDate:• SpringDate:• SpringDate:• SpringDate:• Year 2Date:• Year 2Date:	



Major Maintenance

	Frequency		Action	
	9 years after commissioning every 9 years following		 Clean stormwater management chambers and feed connectors of any debris. 	
			 Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. 	
			 Obtain documentation that the stormwater man- agement chambers and feed connectors have been cleaned and will function as intended. 	
			Notes	
	□ Year 9	Date:		
	🗆 Year 18	Date:		
	🛛 Year 27	Date:		
bers	□ Year 36	Date:		
Cham	45 years after commissioning		 Clean stormwater management chambers and feed connectors of any debris. 	
mwater (Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. 	
EC Stor			 Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. 	
CULT			 Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. 	
			Attain the appropriate approvals as required.	
			 Establish a new operation and maintenance sched- ule. 	
			Notes	
	□ Year 45	Date:		

CULTEC STORMWATER CHAMBERS

Major Maintenance

	Frequency		Action	
	Monthly in 1 st year		 Check for depressions in areas over and surrounding the stormwater management system. 	
			Notes	
	🗆 Month 1	Date:		
	🗆 Month 2	Date:		
	🗆 Month 3	Date:		
	🗆 Month 4	Date:		
	🗆 Month 5	Date:		
	🗆 Month 6	Date:		
	🗆 Month 7	Date:		
	🗆 Month 8	Date:		
	🗆 Month 9	Date:		
	🗆 Month 10	Date:		
	🗆 Month 11	Date:		
	🗆 Month 12	Date:		
	Spring and Fall		 Check for depressions in areas over and surrounding the stormwater management system. 	
ite			Notes	
S	Spring	Date:		
Ţ	🗆 Fall	Date:		
oun n	Spring	Date:		
lo	🗆 Fall	Date:		
Sur	□ Spring	Date:		
•	🗆 Fall	Date:		
	Spring	Date:		
	🗆 Fall	Date:		
	□ Spring	Date:		
	🗆 Fall	Date:		
	Spring	Date:		
	🗆 Fall	Date:		
	Yearly		 Confirm that no unauthorized modifications have been performed to the site. 	
			Notes	
	D Year 1	Date:		
	🗆 Year 2	Date:		
	🗆 Year 3	Date:		
	🗆 Year 4	Date:		
	🗆 Year 5	Date:		
	🗆 Year 6	Date:		
	🗆 Year 7	Date:		

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.



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RETENTION • DETENTION • INFILTRATION • WATER QUALITY



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UDERGROUND INFILTRATION SYSTEM 1 6 ROWS OF 5 CULTEC R-150XLHDHD CHAMBERS BOTTOM STONE ELEV.=145.80 CHAMBER INV.=146.30 TOP OF SYSTEM ELEV.=148.34 MAP 33 PARCEL 366	PROJECT PROJECT 130 WES WALF ASSESS CENTI APPLICAN WES 259 TU SOU DRAWING	TITLE: WESSTEND ST STREET and 25 SPRING STREET POLE, MASSACHUSETTS 02081 SOR'S MAP 33, PARCELS 398 and 399 ZONING DISTRICT: TRAL BUSINESS DISTRICT (CBD) MT: ST END PARTNERS, LLC URNPIKE ROAD, SUITE 110 JTHBOROUGH, MA 01772
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