Operations and maintenance

StormFilter® EnviroPod Treatment Train





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Device deta	ils		
Location of	Device		
GPS Coord	N:	E:	D P Number:
Relevant Co	uncil		
Company			
Contact		Email	Ph
Engineer			
Contact		Email	Ph
SFEP Treatr	ment		
2			
Frequency of	of Inspection/Maintenanc	e	Maintenance Estimated Annual Cost
	Inspections (time/year)	Major Maintenance	StormFilter
StormFilter	(unie/year)	Maintenance	EnviroPod
otornin inter			TOTAL
EnviroPod			

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The Stormwater Management StormFilter[®]

For almost two decades the Stormwater Management StormFilter[®] has helped meet the most stringent stormwater quality requirements.

The system has been continually tested and refined, to ensure it achieves maximum reliability and performance.

As a best management practice (BMP) system, it removes the most challenging target pollutants – including fine solids, soluble heavy metals, oils and total nutrients (including soluble) – by using a variety of media to achieve site-specific pollutant removal objectives.



StormFilter® overview

1.1 Description

StormFilter is a passive, flow-through stormwater filtration system consisting of vaults that house rechargeable cartridges filled with a variety of filter media, and is installed in-line with storm drains. The StormFilter works by passing stormwater through media-filled cartridges, which trap particulates and adsorb materials such as dissolved metals and hydrocarbons. After being filtered through the media, the treated stormwater flows into a collection pipe or discharges into an open channel drainage way. StormFilter is offered in three different configurations: cast-in-place, precast and linear. The precast and linear models utilise pre-manufactured vaults. The cast-in-place units are customised for larger flows and may be either covered or uncovered underground units.

1.2 Operation

1.2.1 Purpose

The StormFilter is a passive stormwater filtration system designed to improve the quality of stormwater runoff from the urban environment before it enters receiving waterways.

Through independent third party studies, it has been demonstrated that the StormFilter is highly effective for treatment of first flush flows, and fast-paced flows, during the latter part of a storm. In general, StormFilter's efficiency is highest when pollutant concentrations are highest. The primary target pollutants for removal are: sediments (TSS), soluble metals, soluble phosphorus, nitrates, and oil and grease.

1.2.2 Sizing

The StormFilter is typically sized to meet design water quality objectives, which are subject to legislation regulated by local government authorities and other relevant environmental bodies. MUSIC modelling software is used to determine pollutant loads from a site, influenced by a number of factors such as site area, imperviousness and land use. Pollutant load reduction capabilities, based on third party testing, allows the number of StormFilter cartridges required to achieve the relevant objectives to be established. Cartridges are designed to treat a peak flow between 0.7 and 1.6 litres/ second, depending on the cartridge size used. For example, 10 standard sized cartridges (460mm) are able to treat 11 L/s, as each filter can treat 1.1 L/s.

Because of the highly porous nature of the granular filter media, the flow through a newly installed cartridge is restricted to 1 L/s (average 460mm), using a restrictor disc, to ensure adequate pollutant-media contact time.



Photo 27 Filter cartridge

1.2.3 Basic function

The StormFilter is designed to siphon stormwater runoff through a filter cartridge containing media. The variety of media available can be designed to act as a mechanical filter to remove sediments, as an ion exchanger to remove dissolved heavy metals, and as an absorber to remove oils and greases.

1.2.4 Priming system function

The treated stormwater collects in the centre tube of the cartridge, which is equipped with a self-priming siphon system. (Figure 1 illustrates this system.) The key component of the system is the plastic float, consisting of a ball located at the base leading up to a larger portion, which provides increased buoyancy. Initially the ball rests in a seat, effectively closing off the port to the drainage manifold.

As a result, the filter fills the centre drainage tube until the water level has risen high enough to purge the air from the filter cartridges and displaces the float. At a water depth of 22 inches the float pulls loose and allows the filtered water to drain out through the manifold. This effectively "primes" a siphon within the drainage tube and greatly increases the potential across the filter. The priming system increases StormFilter's ability to be loaded with sediment. A related feature is the cartridge "hood". This hood maintains the siphon effect by preventing air from being drawn into the cartridge until the external water level drops below the bottom of the hood.

Cartridges are connected to the manifold with a plastic connector. These can be either quarter turn connectors or in the older systems, threaded connectors.

StormFilter is also equipped with flow spreaders that trap floating debris and surface films, even during overflow conditions. Depending on individual site characteristics, some systems are equipped with high and/or low flow bypasses. High flow bypasses are installed when the calculated peak storm event generates a flow that overcomes the overflow capacity of the system. This is especially important for precast systems. Low flow bypasses are sometimes installed to bypass continuous inflows caused by ground water seepage, which usually do not require treatment. All StormFilter units are designed with an overflow. The overflow operates when the inflow rate is greater than the infiltration capacity of the filter media.

1.2.5 Maintenance overview

The primary purpose of the StormFilter is to filter out and prevent pollutants from entering our waterways. Like any effective filtration system, these pollutants must be removed periodically to restore the StormFilter to its full efficiency and effectiveness. Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. To assist the owner with maintenance issues, Stormwater360 provides detailed Operation and Maintenance Guidelines with each unit.

Stormwater360 can provide maintenance services completely, or in part. Available services include tracking of installed systems, advising the system's owner of maintenance needs, and notification of the regulatory agency once the system has been maintained.

Maintenance is usually performed in the dryer periods to rejuvenate the filter media and prepare the system for the next rainy period. Maintenance activities can also be required in the event of a chemical spill or excessive sediment loading due to site erosion or extreme storms. It is good practice to inspect the system after severe storm events.



Figure 1 Filter cartridge

StormFilter[®] maintenance and performance expectations

To ensure the optimal and ongoing performance of the StormFilter, the system requires systematic inspection, cleaning and maintenance. This maintenance regime falls into two categories – ongoing minor inspection and maintenance, and major cleaning and maintenance. The maintenance frequency is largely determined by the conditions of each site, and the amount of sedimentation in the stormwater runoff that flows through the system. Unexpected events such as chemical spills, erosion or extreme storm activity require immediate inspection of the system, together with removal of debris or contaminated sediment, and where appropriate, replacement of the media cartridges.



While some maintenance activities can be completed by hand, others require specialised equipment such as an inductor truck with a vacuum hose. In all cases, it is important that maintenance staff are properly trained in the functioning of the StormFilter system and have a good knowledge of the correct procedures for disposing contaminated sediment as well as the methods for removing and installing StormFilter media cartridges.

At all times, appropriate safety equipment must be used, and Occupational Health And Safety (OH&S) guidelines adhered to.

2.1 Types of maintenance

Presently, procedures have been developed for two levels of maintenance:

- Inspection and/or minor maintenance
- Major maintenance.

Inspection/minor maintenance activities are combined since the minor maintenance does not require special equipment and typically little or no materials are in need of disposal. Inspection/minor maintenance typically involves opening the flow restricting valves (to pre-set levels) and cleaning up vegetation and debris. Major maintenance typically includes cartridge recharging. Major maintenance may involve disposal of materials that require consideration of regulatory guidelines. Depending on the particular unit configuration and equipment used, major maintenance may require an understanding of OSHA rules. **Table 1** summarises the primary activities associated with StormFilter maintenance.

Table 1: StormFilter

Facility component requiring maintenance	Maintenance activity	When maintenance activity is required	Expected facility performance after maintaining
StormFilter cartridges and containment structure	Litter and debris removal	Floatable objects or other litter is present in the filter. Remove to avoid hindrance of filtration and eliminate unsightly debris and litter.	Permanent removal from storm system.
StormFilter cartridges and containment structure	Cartridge replacement and sediment removal	Media has been contaminated by high levels of pollutants, such as after a spill.	New media is able to effectively treat stormwater.
Drainage system piping	Flushing with water	Drainage system is obstructed by debris or sediment.	Outflow is not restricted.

2.2 Maintenance activities

2.2.1 Maintenance activity timing

Two scheduled inspections/maintenance activities should take place during the year. During the minor maintenance activities (routine inspection, debris removal), the type of major maintenance required is determined and, if required for disposal, samples of the sediments and media are obtained.

The next scheduled date is to perform major maintenance activities (replacement of the filter cartridges and associated sediment removal). In addition to the scheduled activities, it is important to check the condition of the filter after major storms to check for damage caused by high flows and to check for high sediment accumulation, which may be caused by localised erosion in the drainage area. It may be necessary to adjust maintenance activity scheduling depending on the actual operating conditions encountered by the system.

2.2.2 Maintenance activity frequency

The primary factor controlling timing of maintenance for the StormFilter is sedimentation. A properly functioning system will remove solids from water by trapping these particulates within the porous structure of the media. The flow through the system will naturally decrease as more and more solids are trapped. Eventually the flow through a system will be low enough to require replacement of the cartridges. Sediment should be removed from upstream trapping devices on an as-needed basis to prevent material from being re-suspended and discharged to the system.

Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction should be inspected and maintained more often than those in fully established areas. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after large storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual filter.

2.3 Maintenance crew requirements

Table 2 lists the anticipated crew requirements formaintenance operations. Removal of water and sedimentsduring major maintenance activities can be accomplishedusing either a pump and water truck or a vacuum truck. All

applicable occupational health and safety (OH&S) and disposal regulations should be followed. A general description of the maintenance activities follows.

	Inspection/Minor Maintenance	Major Maintenance: Sediment Removal	Major Maintenance: Cartridge Replacement
Labourer	1		1
Skilled Worker	1	1	1
Vacuum/Water Truck Operator		1	0/1
Total	2*	2*	2/3*
Special Requirements	Knowledge of Proper StormFilter Function	Knowledge of Disposal Requirements	Knowledge of Cartridge Removal and Installation Procedures

Table 2 Anticipated Crew Requirements

* May require OH&S trained person if/when vault entry occurs.

2.4 Maintenance methods

2.4.1 Minor maintenance/inspection (twice a year)

Minor maintenance typically will involve the steps below, however if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately.

Steps for Minor Maintenance/Inspection

- 1 Maintenance to be performed by a skilled worker familiar with StormFilter units.
- If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open access covers. Also set up appropriate safety equipment for work near roadways.
- 3 Inspect the external condition of the unit and take notes concerning defects/problems.
- 4 Open the access covers to the vault and allow the system to air out for 5-10 minutes.
- 5 Without entering the vault, inspect the inside of the unit, including components.

- 6 Take notes about the external and internal condition. This includes inspecting pit penetrations, walls, lids, ladders and grates etc.
- Give particular attention to recording the level of sediment build-up on the floor of the vault and on top of the internal components. If flow is occurring, note the level of water and estimate the flow rate per drainage pipe. Record all observations.
- 8 Remove large loose debris and litter using a pole with a grapple or net on the end.
- 9 Close and fasten the access cover, and remove safety equipment.
- 10 Finally, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loadings of other materials to the system.
 - In the case of a spill, workers should abort maintenance activities until the proper guidance has been obtained.

2.4.2 Major maintenance inspection (once a year)

The primary goal of the major maintenance inspection is to assess the condition of the cartridges relative to the level of sediment loading. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, large amounts of sediments should be present and very little flow will be discharging from the drainage pipes. It is likely that the cartridges need to be replaced. Major maintenance inspection will typically involve the steps below. However, if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately. In the case of a spill, the worker should abort maintenance activities until the proper guidance has been obtained.

Steps for Pre-Major Maintenance Inspection

- 1 Maintenance to be performed by a skilled worker familiar with StormFilter units.
- If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open doors. Also, set up appropriate safety equipment for work near roadways.
- 3 Inspect the external condition of the unit and take notes concerning defects/problems.
- 4 Open the access covers to the vault and allow the vault to air out for 5-10 minutes.
- 5 Without entering the vault, give the inside of the unit, including components, a general condition inspection.
- 6 Take notes about the external and internal condition.
- 7 Give particular attention to recording the level of sediment build-up on the floor of the vault, and on top of the internal components.
- 8 Remove large loose debris and litter using a pole with a grapple or net on the end.
- If the visit is during a storm, make the flow observations discussed above.
- 10 Close and fasten the access cover, and remove safety equipment.
- 11 Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
- 12 Review the condition reports from the previous minor and major maintenance visits and schedule for cartridge replacement if needed.

2.4.3 Major maintenance: sediment removal and cartridge replacement (and emergency)

Major maintenance/filter cartridge replacement typically involves the steps below. However, if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately. In the case of a spill, the worker should abort maintenance activities until the proper guidance has been obtained.

Depending on the configuration of the particular system, a worker may be required to enter the vault to perform some tasks. If vault entry is required, OH&S rules for general confined space entry must be strictly adhered to. Filter cartridge replacement should occur during dry weather and it may be necessary to plug the filter inlet pipe if base flows exist. Standing water present in the vault should be regarded as polluted and contained during this operation by temporarily capping the manifold connectors.

Please note: Confined space entry may be required on StormFilter systems. In this case, please ensure that appropriate Confined Space entry training and subsequent certification has been undertaken and is valid, and work procedures are strictly adhered to. If you are unsure, do not enter the vault and contact Stormwater360 immediately.

Steps For Cartridge Replacement Maintenance

- Depending on the particular unit, one or two utility workers and a hauling truck operator will deliver the replacement cartridges to the site. Information concerning how to obtain the replacement cartridges is available from Stormwater360.
- If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open doors. Also, set up appropriate safety equipment for work near roadways.
- 3 Inspect the external condition of the unit and take notes concerning defects/problems.
- 4 Open the doors to the vault and allow the system to air out for 5-10 minutes.
- 5 Without entering the vault, give the inside of the unit, including components, a general condition inspection.
- 6 Make notes about the external and internal condition.
- 7 Give particular attention to recording the level of sediment build-up on the floor of the vault and on top of the internal components.
- 8 Ensuring safe working procedures are met, off load the replacement cartridges (16-39kgs each) and set aside.
- 9 Remove the top cap (threaded), upper seal and float from the cartridge. Repeat procedure for every cartridge within StormFilter vault. Place items in a large plastic container to be lifted form the vault.
- 10 Using a cordless drill and 8mm hex head, remove the three screws located around the top perimeter of the cartridge hood. Place screws in the large plastic container and, once full or completed, remove plastic container from vault.
- 11 Move the vacuum truck near the StormFilter vault on the down-wind side. Be sure that the truck is not too close to the vault so that fumes will not enter the vault. Make sure that the last 500mm of the nozzle is approximately 100-125mm in outside diameter.
- 12 Feed vacuum nozzle into cartridge bay and start vacuum truck. Remove cartridge hood and place nozzle directly onto filter media. Completely remove media from each cartridge and repeat process for every cartridge in vault.
- 13 Once completed disconnect cartridges from vault floor and place hood back on cartridges

- 14 Using the appropriate lifting cap, attach the cable and remove the cartridge (up to 10kgs. each) from the vault. It is strictly prohibited to have personnel standing under suspended cartridges. Care must also be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner unless Stormwater360 is performing maintenance activities and damage is not related to discharges to the system.
- 15 Set the used cartridge aside or load onto the hauling truck.
- 16 Repeat steps 14 to 15 until all cartridges have been removed.
- 17 Remove deposited sediment from the floor of the vault. This can be accomplished by using the vacuum truck
- Once the sediments are removed, it is necessary to assess the condition of the vault, particularly the manifold and the connectors. These are short sections of 2-inch schedule 50 PVC, or threaded schedule 80 PVC that should protrude above the floor of the vault. If required, apply a light coating of FDA approved silicon grease to the outside of the exposed portion of the connectors. This ensures a watertight connection between the cartridge and the drainage pipe. Replace any damaged connectors.
- 19 Using the boom, crane, or tripod, lower and install the new cartridges (typically 30kg for standard 460 cartridges). Once again, take care not to damage connectors.
- 20 Close and fasten the access cover, and remove safety equipment.
- 21 Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loadings of other materials to the system.
- 22 Finally, dispose of the residual materials in accordance with applicable regulations. Make arrangements to return the used cartridges to Stormwater360.

2.4.4 Related maintenance activities (performed on an as-needed basis)

StormFilter units are often just one of many components in a more comprehensive stormwater drainage and treatment system. The entire system may include catch basins, detention vaults, sedimentation vaults and manholes, detention/ retention ponds, swales, artificial wetlands, and other miscellaneous components. In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/ repair of upstream facilities should be carried out prior to StormFilter maintenance activities. In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil and grease loading, and discharges of inappropriate materials.

2.5 Typical equipment required for maintenance activities

Typical equipment required for conducting maintenance is shown in Table 3. Some of the materials listed are suggestions rather than requirements. It should be noted that there is more than one way to accomplish some tasks. Owners with available labour and equipment resources may desire to use alternative methods. However, it is advisable that guidance from Stormwater360 be obtained prior to using alternative techniques.

Table 3 Maintenance Equipment Requirements

Maintenance equipment requir	ed	
Minor maintenance	Pre-major maintenance inspection	Major maintenance cartridge replacement
 Safety equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats Work clothes: Rubber boots, overalls, and gloves Door bolt, wrench, proprietary lifters (e.g. Gatic) and miscellaneous Tools Tape measure Flashlight Grapple or net pole Record keeping forms Litter/debris container 	 Safety equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats Work clothes: Rubber boots, overalls, and gloves Door bolt, wrench, proprietary lifters (e.g. Gatic) and miscellaneous Tools Tape measure Flashlight Grapple or net pole Record keeping forms Litter/debris container 	 Safety equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats Work clothes: Rubber boots, overalls, and gloves Door bolt, wrench, Pentasocket and miscellaneous Tools Tape measure Flashlight Grapple or net pole Record keeping forms Vacuum truck Replacement cartridges Cartridge hauling truck Crane, tripod and hoist, or other lifting device (150kg minimum capacity) Shovels Extra 50mm PVC cartridge connectors Spare flow restrictor discs Litter/debris container Vault inlet pipe plug Dolly PVC Pipe cutter Ladder Cartridge installation and removal sling

*Confined space equipment may be required for vault entry. This equipment must be used by personnel with the appropriate OH&S training. This equipment typically includes: Atmospheric testing devices, atmospheric purging and ventilating devices, and entry, exit, and rescue assisting devices.

2.6 Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in a manner that will not allow the material to affect surface or ground water. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily travelled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations.

It is not appropriate to discharge these materials back to the stormwater drainage system. Part of arranging for maintenance to occur should include coordination of disposal of solids (landfill coordination) and liquids (municipal vacuum truck decant facility, local wastewater treatment plant, on-site treatment and discharge). Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals. Stormwater360 will determine disposal methods or reuse of the media contained in the cartridges. If the material has been contaminated with any unusual substance, the cost of special handling and disposal will be the responsibility of the owner.



SFEP StormFilter & Enviropod Maintenance Data Sheet



Date:	Location:	GPS COORD:
System size:	Type: O Cast-in-place O Precast O	Linear
Number of Cartridges:	Type of Cartridge: • 460mm O 690m	m O 310mm
Filter Media: O ZPG O Perlite		
Type of EnviroPods:		Number of EnviroPods:
Personnel:		

STORMFILTER SYSTE	EM OBSE	RVATIONS	3			
Last service:						
Sediment Depth on Vaul	lt Floor:					
Structural Damage:						
Cartridges submerged:	O Yes	O No	How deep:			
Comments:						

ENVIROPOD SYSTEM OBSERVATIONS
Last service:
Amount of Sediment in Basket:
Structural Damage:
Comments:

DRAINAGE AREA REPORT			
Excessive Oil and Grease Loading	O Yes	O No	Source:
Sediment Accumulation on Pavement	O Yes	O No	Source:
Erosion of Landscaped Areas	O Yes	O No	Source:
Comments:			

STORMFILTER CARTRIDGE MAINT	ENANCE	ACTIVITIE	S
Remove Litter and Debris	O Yes	O No	Details:
Sediment Removed from Vault Floor	O Yes	O No	Details:
Quantity of Sediment Removed (estimate	e?):		
Replace Cartridges	O Yes	O No	Details:
Minor Structural Repairs	O Yes	O No	Details:
Residuals (debris, sediment) Disposal M	lethods:		
Notes/Problems:			

ENVIROPOD MAINTENANCE ACT	TIVITIES		
Number of Bags Replaced:	Clogged EnviroPods/Bags:	O Yes	O No
Comments:			

SFEP Treatment Train Inspection Data Sheet



It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, large amounts of sediments should be present, very little flow will be discharging from the drainage pipes, and it is likely that the cartridges need to be replaced during major maintenance.

Date:	Location:	GPS COORD:		
System size:	Type: O Cast-in-place O Precast O Linear			
Number of Cartridges:	Type of Cartridge: O 460mm O 690mm O 310mm			
Filter Media: O ZPG O Perlite				
Type of EnviroPods:	Number of EnviroPods:			
Personnel Attending Inspection:				

STORMFILTER SYSTEM OBSERVATIONS				
Last service:				
Sediment Depth on Vault Floor:				
Structural Damage:				
Cartridges submerged: O Yes O No How deep:				
Comments:				

ENVIROPOD SYSTEM OBSERVATIONS
Last service:
Amount of Sediment in Basket:
Structural Damage:
Comments:

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The second se			
Excessive Oil and Grease Loading	O Yes	O No	Source:
Sediment Accumulation on Pavement	O Yes	O No	Source:
Erosion of Landscaped Areas	O Yes	O No	Source:
Comments:			

Next steps

Learn more

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