



StormFilter

Technical Design Guide

Table of Contents

Introduction.....	2
Operational Overview	2
Features	3
Media Options	3
Cartridge Options	4
Configurations	5
Performance and Select Approvals	6
Maintenance.....	7
Design Basics	7
1. Hydraulic Design	7
2. Water Quality Design.....	8
3. Mass Load Design	8

Introduction

The Ocean Protect StormFilter® is an underground stormwater treatment device comprised of one or more structures that house rechargeable, media-filled cartridges that trap particulates and adsorb pollutants from stormwater runoff such as total suspended solids, hydrocarbons, nutrients, metals, and other common pollutants.

With media options to target multiple or specific pollutants, multiple system configurations, and field and laboratory performance verified by the most stringent stormwater technology evaluation organisations, the StormFilter provides engineers with the most flexible and reliable manufactured treatment technology available.

Operational Overview

During a storm, runoff percolates through the filtration media and starts filling the cartridge central tube. The air inside the hood is purged through a one-way check valve as the water rises. When water reaches the top of the float, buoyant forces pull the float free and allow filtered water to exit the cartridge.

A siphon is established within each cartridge that draws water uniformly across the full height of the media profile ensuring even distribution of pollutants and prolonged media longevity.

As the storm subsides and the water level in the structure starts falling, a hanging water column remains under the cartridge hood until the water level reaches the scrubbing regulators at the bottom of the hood. Air then rushes through the regulators breaking the siphon and creating air bubbles that agitate the surface of the filter media causing accumulated sediment to settle on the treatment bay floor. This unique surface-cleaning mechanism helps prevent surface blinding and further extends cartridge life.

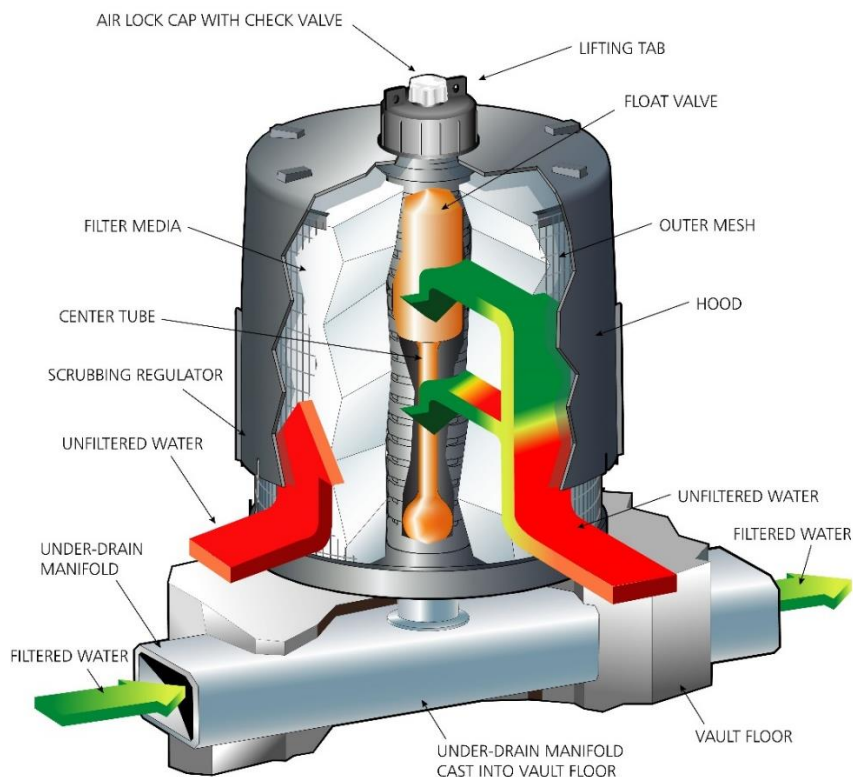


Figure 1: StormFilter cartridge components

Features

Media Options

The StormFilter system has the ability to operate with a variety of media options. These options are designed to target site or regulatory specific requirements. The current range of options is as follows:

- PhosphoSorb™
- ZPG™
- Perlite

PhosphoSorb™ (PSorb) media is the most advanced option available and is suited to most applications. Produced locally in Australia by Ocean Protect, PSorb achieves the optimum combination of pollutant removal and cost-effective treatment.

PSorb is a lightweight Perlite-based media coated in activated alumina. It removes Total Suspended Solids and Nutrients including some soluble forms of both Nitrogen and Phosphorus. PSorb media was developed to improve not only performance but also to provide a longer service life and to reduce OH&S risk by drastically reducing cartridge weight.

The other primary media option utilised by Ocean Protect is our ZPG™ media. It consists of Perlite, Zeolite and Granular Activated Carbon and was Ocean Protects original regulatory approved media for treating Total Suspended Solids and Nutrients.

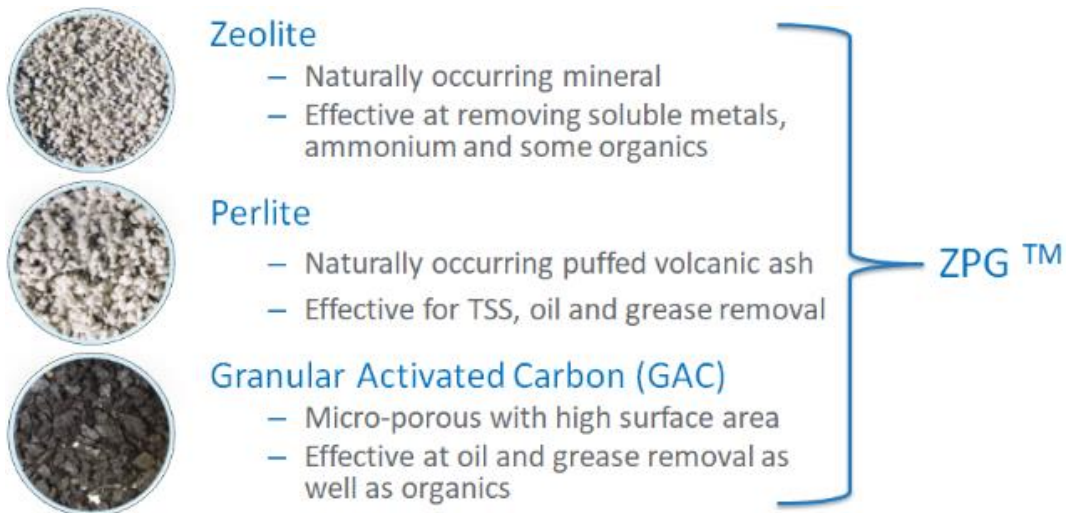


Figure 2: ZPG Media Overview

Cartridge Options

The StormFilter cartridge is available in three size options 310, 460 and 690 (Refer Table 1). The 690 StormFilter cartridge delivers most cost effective solution within these options. It has the highest flow rate and the largest filtration surface area and sediment capacity, however it requires a greater head loss and physical height to achieve this. In comparison the 460 and 310 cartridge options are best utilised when either physical height or head loss are a limiting factor.

The physical height of the cartridge must not be confused with the cartridge naming convention. Refer to table 1 for the physical cartridge height when needing to utilise the StormFilter cartridges in a shallow height unit.

The flow rate through each cartridge media option is controlled by a flow restrictor disc (orifice) that is located at the base of each cartridge. Reducing the flow rate across the uniform media depth increases pollutant removal and the Mass Load Capacity of each cartridge.

Cartridge Name / Siphon Height (mm)	690	460	310
Physical Height (H) mm	840	600	600
Typical Weir Height from outlet (Head Loss, mm)	920	690	540
Flow Rate ZPG (L/s)	1.60	1.10	0.70
Flow Rate PSorb (L/s)	0.90	0.46	0.39

Table 1: StormFilter cartridge details

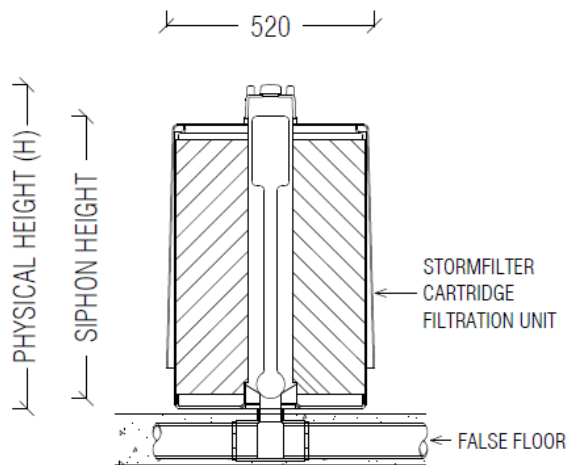


Figure 3: StormFilter cartridge dimensions

Configurations

The StormFilter cartridge system can be housed in a variety of ways such that it suits the site specific requirements for flowrate, hydraulics, accessibility and footprint restrictions. The standard configurations offered by Ocean Protect include pre-cast concrete tanks, detention and above ground pre-fabricated tanks.

Pre-cast concrete StormFilter systems can house the cartridges within manholes, pits or vaults. These systems are simple to install, as they arrive on site after being manufactured offsite to suit site specific requirements (pipe size, inlet/outlet orientation, levels etc.).



Figure 4: Pre-cast concrete manholes

Alternatively detention tanks constructed for water quantity requirements, can incorporate the StormFilter system into the design. Typically a separated water quality chamber (cartridge bay area) is constructed inside the larger tank. With this approach Ocean Protect performs the installation of the underdrain pipework manifold within the chamber, including the encasement of it in a concrete false floor.

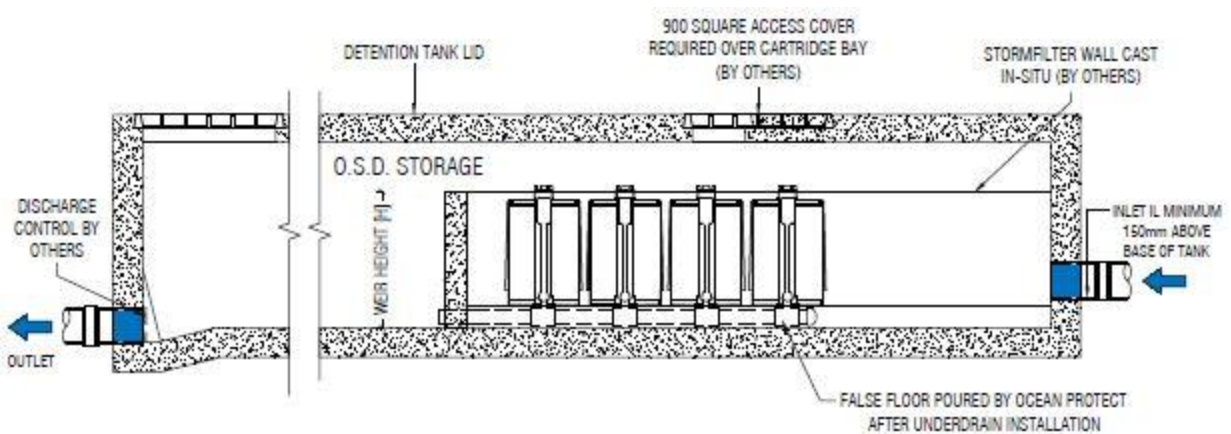


Figure 5: Detention system, sectional view

Above ground pre-fabricated tanks are also available, and are ideal for utilisation when treating downpipe flows. Often utilised when space is limited (boundary to boundary) they are available in both aluminium and HDPE and are custom built to suit the site specific requirements.



Figure 6: Aluminium StormFilter tank

Performance and Select Approvals

While laboratory testing provides a means to generate hydraulic and basic performance data, all filtration devices should also be complemented with long-term field data evaluations. As a minimum, field studies should generally comply with a recognised field testing protocol, for example, the Technology Acceptance Reciprocity Partnership (TARP) or the Technology Assessment Protocol – Ecology (TAPE) in the USA.

To be considered valid, all field monitoring programs should be peer reviewed by a reputable third party and replicate local pollutant concentrations including soluble fractions of nutrients together with rainfall. Ocean Protect has undertaken such field testing both locally in Australia and overseas, copies of the supporting articles are available upon request.

Globally there are over 220,000 StormFilter cartridges installed and since 2001 the StormFilter system has been successfully installed in a variety of applications to meet regulatory requirements set by authorities throughout Australia.

Specifically StormFilter has been accepted by some of the most stringent stormwater quality regulators around the globe including;

- Brisbane City Council
- Gold Coast City Council
- Blacktown City Council
- Washington State Department of Ecology (TAPE) GULD – Basic, Phosphorus
- New Jersey Department of Environmental Protection (NJ DEP)
- North Carolina Department of Environmental Quality (NC DEQ)
- Maine Department of Environmental Protection (ME DEP)

Please contact your Ocean Protect representative to obtain the StormFilter approval status in your area.

Maintenance

All stormwater quality improvement devices require routine maintenance. The question is how often and how much it will cost. Proper evaluation of long-term maintenance costs should be a consideration when selecting a treatment device. The StormFilter has been optimized to reduce long-term maintenance costs with proven, repeatable performance in the laboratory and in the field.

Reduce Life Cycle Costs

StormFilter has been designed for predictable maintenance intervals ranging from 1 to 3 years, resulting in fewer maintenance events and reduced life-cycle costs compared to other filtration devices.

Easy to maintain

All StormFilter structures provide access for inspection, media replacement, and washing of the structure. Visual indicators for maintenance are observable from the surface. Our Cartridge replacement program provides refurbished cartridges that are shipped to your site ready to install. Ocean Protect arranges for empty cartridges to be picked up and shipped back, reducing cartridge costs and environmental impact.

Maintenance support

Ocean Protect provides flexible options and contract terms. A detailed maintenance guide and mass load calculation spreadsheet is available upon request.

For further information please refer to the StormFilter Operations and Maintenance Manual ([click here](#)).

Design Basics

The design requirements of any StormFilter system is detailed in 3 typical steps.

1. Hydraulic Design
2. Water Quality Design
3. Mass Load Design

1. Hydraulic Design

All StormFilters must be designed to ensure that the hydraulic requirements of the system are met without adversely impacting the upstream hydraulics (limiting the likelihood of localised flooding). Table 1 (page 4) details the head loss for each cartridge size option. The designer must initially select a cartridge option and ensure the corresponding head loss can be catered for.

For a StormFilter system head loss does not have to equal head drop. If the head loss is not able to be fully achieved through a differential of height between the inlet and outlet pipes, then a minimum head drop of 100mm is required across the system with the balance of the head loss being impacted upstream. The minimum head drop is required to ensure that all inlet pipes enter the chamber above the concrete false floor.

StormFilter cartridges have a unique backflush mechanism that is passively activated at the end of each storm peak to increase the longevity of each cartridge. Consequently, captured pollutants are stored within the system and in order to minimise scour peak flows into the cartridge bay need to be limited. Specifically when peak flows surpass 80-100L/s StormFilter cartridges need to be arranged off-line.

It is also necessary to consider the impacts that tail water/submergence has on all stormwater treatment devices. In order to maintain an effective driving head for the StormFilter system the weir height should be adjusted accordingly. Please be aware that permanent submergence will blind all stormwater treatment devices utilising media. In the case of the StormFilter system, regardless of the storm intensity/duration the system will always drain relatively dry.

2. Water Quality Design

Ocean Protect recommends and uses the widely endorsed Model for Urban Stormwater Improvement Conceptualisation (MUSIC), which makes it easy to correctly sizing an appropriate StormFilter system for your site.

A complimentary design service which includes MUSIC modelling is provided by the Ocean Protect engineering team. Simply email your project details to design@oceanprotect.com.au or alternatively you can always call one of our engineers for a discussion or to arrange a meeting in your office. The team will provide you with an efficient design containing details of the devices required to meet your water quality objectives together with budget estimates, product drawings and the MUSIC (.sqz) file.

Alternatively, you can download the MUSIC treatment nodes for the Ocean Protect products from our website (www.oceanprotect.com.au).

When designing/modelling a StormFilter system for water quality purposes in MUSIC, two (2) treatment nodes are typically utilised in series. These are the detention/sedimentation node located immediately upstream of a generic treatment node.

For the detention node there are a number of parameters that need to be entered to ensure the node is representative of its effectiveness within the treatment train: surface area, extended detention depth, k-values, equivalent pipe diameter etc. For guidance on all of these variables please refer to the StormFilter design pack or contact Ocean Protect.

For the StormFilter system the generic treatment node is utilised with relevant removal efficiencies inserted. These parameters can vary based on the jurisdiction (authority) of your project, relevant details can be obtained from Ocean Protect. The high-flow bypass figure is adjusted within the node to represent the treatable flow rate required to obtain water quality targets. Once finalised this figure can be divided by the relevant cartridge flow rate to obtain the number of cartridges.

All details such as drawings, specifications and maintenance manuals can also be downloaded for integration into your project's documentation. Additionally the Ocean Protect team is available to review your model and provide additional assistance and guidance on the configuration of the StormFilter system(s) for your project.

3. Mass Load Design

At the completion of your water quality design process (as above) it is necessary that maintenance frequency is considered in order to prevent excessive ongoing maintenance requirements. Ocean Protect recommends a minimum maintenance frequency of 12 months.

All filtration devices occlude overtime, consequently they have a maximum sediment capacity (TSS load). By analysing the mean annual load figures for the StormFilter generic treatment node, the total annual retained TSS can be determined. To determine the minimum cartridge quantity required by mass load design, the annual retained TSS should be divided by the relevant cartridge sediment capacity. The Ocean Protect team can provide assistance and details on this process.

In determining the final cartridge quantity for your project, you must utilise the largest number of cartridges obtained from undertaking Water Quality and Mass Load design steps.