



January 2005
(Updated December 2007)

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) TREATMENT

For

CONTECH Stormwater Solutions Inc.
Stormwater Management StormFilter[®]

Ecology's Decision:

Based on the CONTECH Stormwater Solution Inc. (CONTECH) application submissions and recommendations by the Technical Review Committee (TRC), Ecology hereby issues a General Use Level Designation (GULD) for the Stormwater Management StormFilter[®]:

- As a basic stormwater treatment practice for total suspended solids (TSS) removal,
- Using ZPG[™] media (zeolite/perlite/granular activated carbon), with the size distribution described below,
- Sized at a hydraulic loading rate of 1 gpm/ft² of media surface area, per Table 1, and
- Internal bypassing needs to be consistent with the design guidelines in CONTECH's current product design manual.

Table 1. StormFilter Design Flow Rates per Cartridge

Effective Cartridge Height (inches)	12	18	27
Cartridge Flow Rate (gpm/cartridge)	5	7.5	11.3

This designation has no expiration date, but it may be amended or revoked by Ecology, and is subject to the conditions specified below.

Ecology's Conditions of Use:

The StormFilter shall be designed, installed, and maintained to comply with these conditions:

1. StormFilter systems containing ZPG (zeolite/perlite/granular activated carbon) media are approved for basic treatment at the hydraulic loading rate of 1 gpm/ft² of media surface area, per Table 1, at the 15-minute water quality design flow rate (as specified in Ecology's most recent Stormwater Manual), as

calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model (e.g. MGS Flood). Note that if single event methods are used to estimate runoff flowrates, Figures 9.6a and 9.6b in Volume V of the 2005 Stormwater Management Manual for Western Washington should be used to adjust the peak single event flow rate for calculation purposes. This is done by dividing the peak 10 minute flow rate predicted by the single event method by the ratio indicated in Figure 9.6a for on-line designs, or Figure 9.6b for off-line designs. The 6-month, 24-hour rainfall amount for the project site must be known to identify the appropriate ratio. The adjusted flow rate is then divided by the approved cartridge flow rate (Table 1) to compute the number of cartridges necessary. Note: This method is not applicable for Eastern Washington.

2. For StormFilter systems to be located downstream of a stormwater detention facility, the StormFilter size shall be calculated using both the flow-based and mass-based methods as described in the CONTECH *Product Design Manual Version 4.1 (April 2006)*, or most current version, and the designer shall select the result yielding the larger number of cartridges.
3. StormFilter systems shall be installed in such a manner that flows exceeding the water quality treatment rate are bypassed or will not resuspend captured sediments. StormFilter systems shall be designed in accordance with the performance goals in Ecology's most recent Stormwater Manual and CONTECH's *Product Design Manual Version 4.1 (April 2006)*, or most current version, unless otherwise specified. The design, pretreatment, land use application, and maintenance criteria in CONTECH's Design Manual must be closely followed.
4. Pretreatment of TSS and oil and grease may be necessary, and shall be provided in accordance with the most current versions of the CONTECH's *Product Design Manual (April 2006)* or the applicable Ecology Stormwater Manual, and using the performance criteria and pretreatment practices provided on Ecology's "Evaluation of Emerging Stormwater Treatment Technologies" website.
5. StormFilter systems are typically designed to be maintained on an annual basis, which shall serve as the default maintenance frequency. Maintenance includes removing accumulated sediment from the vault, and replacing spent cartridges with recharged cartridges.

In lieu of annual maintenance, inspections can be used to determine a site-specific maintenance schedule and/or requirements. When inspections are performed, the following findings shall serve as maintenance triggers:

- a) Accumulated vault sediment depths exceed an average of 2 inches, or
- b) Accumulated sediment depths on the tops of the cartridges exceed an average of 0.5 inches, or
- c) Standing water remains in the vault between rain events.

Note: If excessive floatables (trash and debris) are present, perform a minor maintenance consisting of gross solids removal, not cartridge replacement.

- 6. CONTECH shall maintain readily available those reports listed under “Application Documents” (above) as public, as well as the documentation submitted with its previous conditional use designation application. CONTECH shall provide links to this information from its corporate website, and make this information available upon request, at no cost and in a timely manner.**
- 7. ZPG™ media used shall conform with the following specifications:**

Each cartridge contains a total of approximately 2.6 cubic feet of media. The ZPG™ cartridge consists of an outer layer of perlite that is approximately 1.3 cubic feet in volume and an inner layer, consisting of a mixture of 90% zeolite and 10% granular activated carbon, which is approximately 1.3 cubic feet in volume.

Perlite Media: Perlite media shall be made of natural siliceous volcanic rock free of any debris or foreign matter. The expanded perlite shall have a bulk density ranging from 6.5 to 8.5 lbs per cubic foot and particle sizes ranging from 0.09” (#8 mesh) to 0.38” (3/8” mesh).

Zeolite Media: Zeolite media shall be made of naturally occurring clinoptilolite. The zeolite media shall have a bulk density ranging from 44 to 50 lbs per cubic foot and particle sizes ranging from 0.13” (#6 mesh) to 0.19” (#4 mesh). Additionally, the cation exchange capacity (CEC) of zeolite shall range from approximately 1.0 to 2.2 meq/g.

Granular Activated Carbon: Granular activated carbon (GAC) shall be made of lignite coal that has been steam-activated. The GAC media shall have a bulk density ranging from 28 to 31 lbs per cubic foot and particle sizes ranging from a 0.09” (#8 mesh) to 0.19” (#4 mesh).

Applicant: CONTECH Stormwater Solutions Inc., Manufacturer and Vendor

Applicant’s Address: 11835 NE Glenn Widing Dr.
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Application Documents:

The applicant’s master report, titled, “The Stormwater Management StormFilter Basic Treatment Application for General Use Level Designation in Washington”, Stormwater Management, Inc., November 1, 2004, includes the following reports:

- (Public) “Evaluation of the Stormwater Management StormFilter Treatment System: Data Validation Report and Summary of the Technical Evaluation Engineering

Report (TEER) by Stormwater Management Inc., October 29, 2004” Ecology’s technology assessment protocol requires the applicant to hire an independent consultant to complete the following work:

1. Complete the data validation report.
2. Prepare a TEER summary, including a testing summary and conclusions compared with the supplier’s performance claims.
3. Provide a recommendation of the appropriate technology use level.
4. Recommend relevant information to be posted on Ecology’s website.
5. Provide additional testing recommendations, if needed.”

This report, authored by Dr. Gary Minton, Ph. D., P.E., Resource Planning Associates, satisfies the Ecology requirement.

- (Public) “Performance of the Stormwater Management StormFilter Relative to the Washington State Department of Ecology Performance Goals for Basic Treatment,” is a summary of StormFilter performance that strictly adheres to the criteria listed in the Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology (TAPE).
- “Heritage Marketplace Field Evaluation: Stormwater Management StormFilter with ZPG Media,” is a report showing all of the information collected at Site A as stated in the SMI Quality Assurance Project Plan (QAPP). This document contains detailed information regarding each storm event collected at this site, and it provided a detailed overview of the data and project.
- “Lake Stevens Field Evaluation: Stormwater Management StormFilter with ZPG Media,” is a report that corresponds to Site E as stated in the SMI QAPP. This document contains detailed information regarding each storm collected at this site, and includes a detailed overview of the data and project.
- (Public) “Evaluation of the Stormwater Management StormFilter for the removal of SIL-CO-SIL 106, a standardized silica product: ZPG at 7.5 GPM” is a report that describes laboratory testing at full design flow.
- “Factors Other Than Treatment Performance.”
- “State of Washington Installations.”

Above-listed documents noted as “public” are available by contacting CONTECH.

Applicant's Use Level Request:

That Ecology grant a General Use Level Designation for Basic Treatment for the StormFilter using ZPG™ media (zeolite/perlite/granular activated carbon) at a hydraulic loading rate of 1 gpm/ft² of media surface area in accordance with Ecology's 2005 Stormwater Manuals.

Applicant's Performance Claim:

The combined data from the two field sites reported in this TEER (Heritage Marketplace and Lake Stevens) indicate that the performance of a StormFilter system configured for inline bypass with ZPG media and a hydraulic loading rate of 1 gpm/ft² of media surface area meets Ecology performance goals for Basic Treatment.

Technical Review Committee Recommendations:

The TRC, based on the weight of the evidence and using its best professional judgment, finds that:

- StormFilter, using ZPG media and operating at no more than a hydraulic loading rate of 1 gpm/ft² of media surface area, is expected to provide effective stormwater treatment achieving Ecology's Basic Treatment TSS removal performance goals, as demonstrated by field and laboratory testing performed in accordance with the protocol; and, StormFilter[®] is deemed satisfactory with respect to factors other than treatment performance (e.g., maintenance; see the protocol's Appendix B for complete list).

Findings of Fact:

- Influent TSS concentrations and particle size distributions were generally within the range of what would be considered "typical" for western Washington (silt to silt loam).
- Thirty-two (32) storm events were sampled at two sites for storms from April 2003 to March 2004, of which twenty-two (22) were deemed "qualified" and were therefore included in the data analysis set.
- Statistical analysis of these 22 storm events verifies the data set's adequacy.
- Analyzing all 22 qualifying events, the average influent and effluent concentrations and aggregate pollutant load reduction are 114 mg/L, 25 mg/L, and 82%, respectively.
- Analyzing all 22 qualifying events based on the *estimated average* flow rate during the event (versus the *measured peak* flow rate), and more heavily weighting those events near the design rate (versus events either far above or well below the design rate) does not significantly affect the reported results.
- For the 7 qualifying events with influent TSS concentrations greater than 100 mg/L, the average influent and effluent concentrations and aggregate pollutant load reduction are 241 mg/L, 34 mg/L, and 89%, respectively. If the 2 of 7 events that exceed the maximum 300 mg/L specified in Ecology's guidelines are excluded, the average influent and effluent concentrations and aggregate pollutant load reduction are 158 mg/L, 35 mg/L, and 78%, respectively.
- For the 15 qualifying events with influent TSS concentrations less than 100 mg/L, the average influent and effluent concentrations and aggregate pollutant load reduction are 55 mg/L, 20 mg/L, and 61%, respectively. If the 6 of 15 events that fall below the minimum 33 mg/L TSS specified in Ecology's guidelines are excluded, the average influent and effluent concentrations and aggregate pollutant load reduction are 78 mg/L, 26 mg/L, and 67%, respectively.

- For the 8 qualifying events with peak discharge exceeding design flow (ranging from 120 to 257% of the design rate), results ranged from 52% to 96% TSS removal, with an average of 72%.
- Due to the characteristics of the hydrographs, generally the field results reflect flows below (ranging between 20 and 60 percent of) the tested facilities' design rate. During these sub-design flow rate periods, some of the cartridges operate at or near their *individual* full design flow rate (generally between 4 and 7.5 GPM for an 18" cartridge effective height) because their float valves have opened. Float valves remain closed on the remaining cartridges, which operate at their base "trickle" rate of 1 to 1.5 GPM.
- Laboratory testing using U.S. Silica's Sil-Co-Sil 106 fine silica product showed an average 87% TSS removal for testing at 7.5 GPM per cartridge (100% design flow rate).
- Other relevant testing at I-5 Lake Union, Greenville Yards (New Jersey), and Ski Run Marina (Lake Tahoe) facilities shows consistent TSS removals in the 75 to 85% range. *Note that I-5 Lake Union was operated at 50%, 100%, and 125% of design flow.*
- SMI's application included a satisfactory "Factors other than treatment performance" discussion.

Note: Ecology's 80% TSS removal goal applies to 100 mg/l and greater influent TSS. Below 100 mg/L influent TSS, the goal is 20 mg/L effluent TSS.

Technology Description:

The Stormwater Management StormFilter[®] (StormFilter), a flow-through stormwater filtration system, improves the quality of stormwater runoff from the urban environment by removing pollutants. The StormFilter is used to treat runoff from a wide variety of sites including, but not limited to: retail and commercial development, residential streets, urban roadways, freeways, and industrial sites such as shipyards, foundries, etc.

Operation:

The StormFilter is typically comprised of a vault that houses rechargeable, media-filled, filter cartridges. Various media may be used, but this designation covers only the zeolite-perlite-granulated activated carbon (ZPG[™]) medium. Stormwater from storm drains is percolated through these media-filled cartridges, which trap particulates and may remove pollutants such as dissolved metals, nutrients, and hydrocarbons. During the filtering process, the StormFilter system also removes surface scum and floating oil and grease. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharged to an open channel drainage way.

A bypass schematic for flow rates exceeding the water quality design flow rate is shown on page 7.

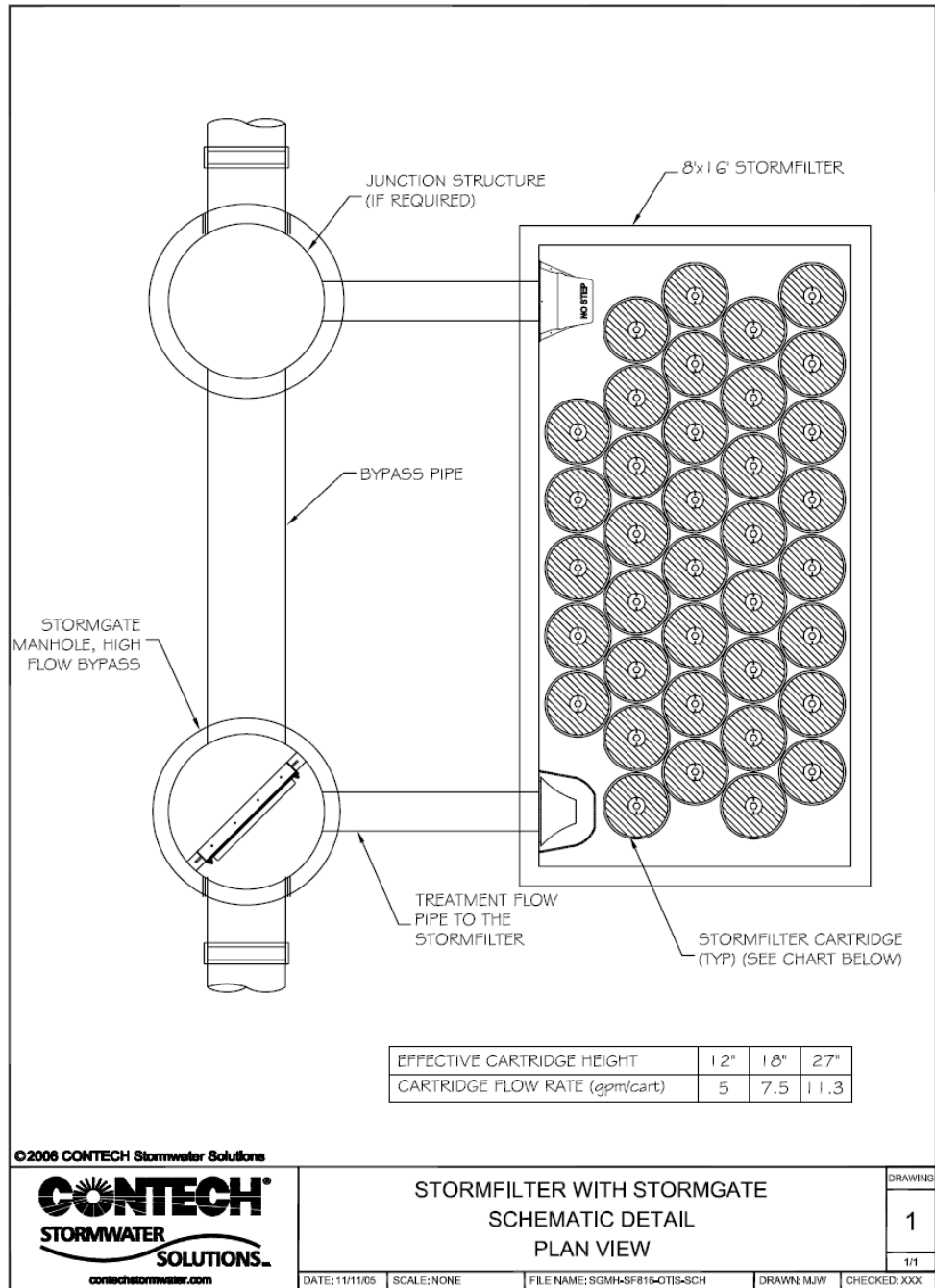


Figure 1. Stormwater Management StormFilter Configuration with Bypass

StormFilter Configurations:

The StormFilter is offered in multiple configurations: precast, high flow, catch basin, curb inlet, linear, volume, corrugated metal pipe, dry-well, and CON/Span form. Most configurations use pre-manufactured units to ease the design and installation process. Systems may be either uncovered or covered underground units.

The typical precast StormFilter unit is composed of three sections: the energy dissipater, the filtration bay, and the outlet sump. As Stormwater enters the inlet of the StormFilter vault through the inlet pipe, stormwater is directed through the energy dissipater into the filtration bay where treatment will take place. Once in the filtration bay, the stormwater begins to pond and percolate horizontally through the media contained in the StormFilter cartridges. After passing through the media, the treated water in each cartridge collects in the cartridge's center tube from where it is directed into the outlet sump by a High Flow Conduit under-drain manifold. The treated water in the outlet sump is then discharged through the single outlet pipe to a collection pipe or to an open channel drainage way. In some applications where heavy grit loads are anticipated, pretreatment by settling may be necessary.

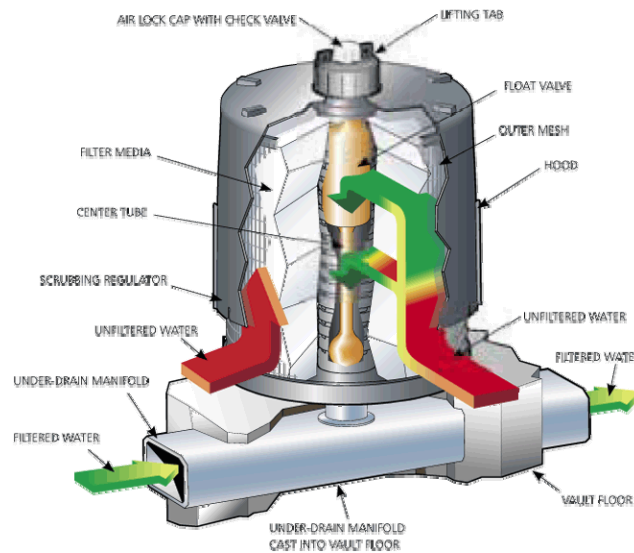


Figure 2. The StormFilter Cartridge

Cartridge Operation:

As the water level in the filtration bay begins to rise, stormwater enters the StormFilter cartridge. Stormwater in the cartridge percolates horizontally through the filter media and passes into the cartridge's center tube, where the float in the cartridge is in a closed (downward) position. As the water level in the filtration bay continues to rise, more water passes through the filter media and into the cartridge's center tube. The air in the cartridge is displaced by the water and purged from beneath the filter hood through the one-way check valve located in the cap. Once the center tube is filled with water there is enough buoyant force on the float to open the float valve and allow the treated water to flow into the underdrain manifold. As the treated water drains, it tries to pull in air behind it. This causes the check valve to close, initiating a siphon that draws polluted water throughout the full surface area and volume of the filter. Thus, the entire filter cartridge is used to filter water throughout the duration of the storm, regardless of the water surface elevation in the filtration bay. This continues until the water surface elevation drops to the elevation of the scrubbing regulators. At this point, the siphon begins to break and air is quickly drawn beneath the hood through the scrubbing regulators, causing energetic

bubbling between the inner surface of the hood and the outer surface of the filter. This bubbling agitates and cleans the surface of the filter, releasing accumulated sediments on the surface, flushing them from beneath the hood, and allowing them to settle to the vault floor.

Adjustable cartridge flow rate:

Inherent to the design of the StormFilter is the ability to control the individual cartridge flow rate with an orifice-control disc placed at the base of the cartridge. Depending on the treatment requirements and on the pollutant characteristics of the influent stream as specified in the CONTECH *Product Design Manual*, the flow rate may be adjusted through the filter cartridges. By decreasing the flow rate through the filter cartridges, the influent contact time with the media is increased and the water velocity through the system is decreased, thus increasing both the level of treatment and the solids removal efficiencies of the filters, respectively (de Ridder, 2002).

Recommended research and development:

Ecology encourages CONTECH to pursue continuous improvements to the StormFilter. To that end, the following actions are recommended:

- Determine, through laboratory testing, the relationship between accumulated solids and flow rate through the cartridge containing the ZPG™ media. **Completed 11/05.**
- Determine the system's capabilities to meet Ecology's enhanced, phosphorus, and oil treatment goals.
- Develop easy-to-implement methods of determining that a StormFilter facility requires maintenance (cleaning and filter replacement).

Contact Information:

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