

# VERIFICATION STATEMENT

## GLOBE Performance Solutions

Verifies the performance of

### The Stormwater Management StormFilter®

Developed by CONTECH Engineered Solutions LLC  
Scarborough, Maine, USA

Registration: **GPS-ETV\_VR2023-06-30\_TAPE**

In accordance with

### ISO 14034:2016

**Environmental Management —  
Environmental Technology Verification (ETV)**



John D. Wiebe, PhD  
Executive Chairman  
GLOBE Performance Solutions

June 30, 2023  
Vancouver, BC, Canada



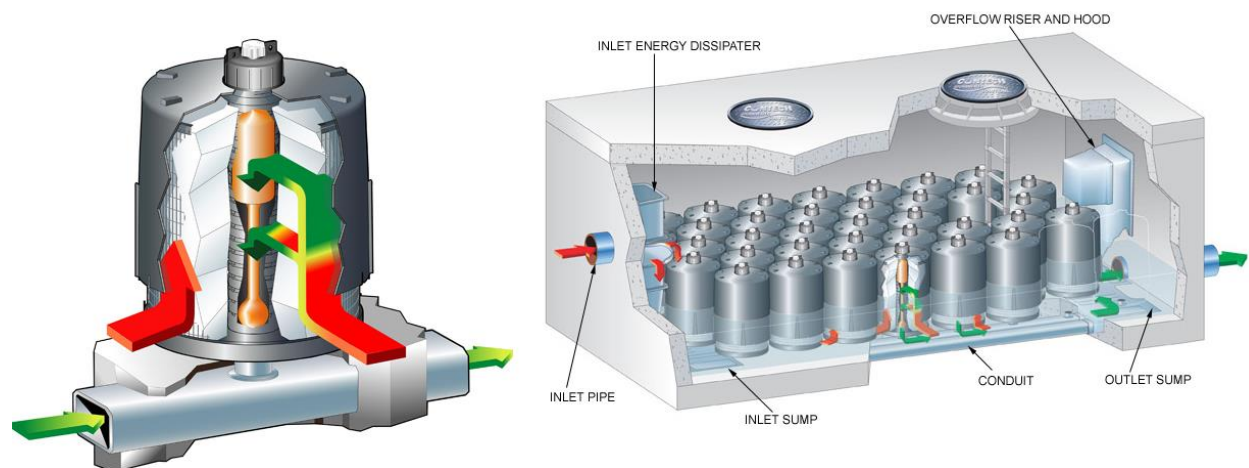
Verification Body  
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## Verification Overview

This Environmental Technology Verification (ETV) of The Stormwater Management StormFilter® (StormFilter) is the second part of a two-part verification process and entails the verification of performance claims (#3 – 9) based on field testing data collected in accordance with The Washington State Department of Ecology emerging stormwater treatment technologies, in accordance with guidelines identified by Ecology (2011) in the Technology Assessment Protocol – Ecology (TAPE). This complements the first part of the verification which verifies performance test data collected in accordance with the New Jersey Department of Environmental Protection (NJDEP) *Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device* (January, 2013).

## Technology description and application

The Stormwater Management StormFilter® (StormFilter) is a manufactured treatment device that is provided by Contech Engineered Solutions LLC (Contech). The StormFilter improves the quality of stormwater runoff before it enters receiving waterways through the use of its customizable filter media, which removes non-point source pollutants. As illustrated in **Figure I**, the StormFilter is typically comprised of a vault or manhole structure that houses rechargeable, media-filled filter cartridges. Stormwater entering the system percolates through these media-filled cartridges, which trap particulates and remove pollutants. Once filtered through the media, the treated stormwater is discharged through an outlet pipe to a storm sewer system or receiving water.



**Figure I Individual StormFilter Cartridge (Left) and Typical Vault StormFilter Installation (Right)**

Depending on the treatment requirements and expected pollutant characteristics at an individual site, the per cartridge filtration flow rate and driving head can be adjusted. The flow rate is individually controlled for each cartridge by a restrictor disc located at the connection point between the cartridge and the underdrain manifold.

Driving head is managed by positioning of the inlet, outlet, and overflow elevations. The StormFilter is typically designed so that the restrictor disc passes the design treatment rate once the water surface reaches the shoulder of the cartridge which is equivalent to the cartridge height. Since the StormFilter uses a restrictor disc to restrict treatment flows below the hydraulic capacity of the media the system

typically operates under consistent driving head for the useful life of the media. Site specific head constraints are also addressed by three different cartridge heights (low drop (effective height of 12 inches), 18, and 27 inches) which operate on the same principal and surface area specific loading rates.

The StormFilter requires a minimum of 1.8 ft, 2.3 ft and 3.05 ft of drop between inlet invert and outlet invert to accommodate the low drop, 18 and 27 inch cartridges, respectively, without backing up flow into the upstream piping during operation. When site conditions limit the amount of drop available across the StormFilter then flow is typically backed up into the upstream piping during operation to ensure sufficient driving head is provided. If desirable the StormFilter can be designed to operate under additional driving head.

The StormFilter is offered in multiple configurations including plastic, steel, and concrete catch basins; and precast concrete manholes, and vaults. Other configurations include panel vaults, CON/SPAN®, box culverts, and curb inlets. The filter cartridges operate consistently and act independently regardless of housing which enables linear scaling.

The StormFilter cartridge can house different types of media including perlite, zeolite, granular activated carbon (GAC), CSF® leaf media, MetalRx™, PhosphoSorb® or various media blends such as ZPG™ (perlite, zeolite and GAC). All of the media use processes associated with depth filtration to remove solids. Some media configurations also provide additional treatment mechanisms such as cation exchange, and/or adsorption, chelation, and precipitation. This verification is specific to a field evaluation of the StormFilter with PhosphoSorb® media.

## Performance conditions

The data and results published in this Verification Statement were obtained from the field testing conducted on The Stormwater Management StormFilter® device, in accordance with the requirements outlined by the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology, (WADOE, 2011). Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the State of Washington Department of Ecology.

## Performance claim(s)

### Performance Claim 3 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 89% removal of total suspended solids at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

### Performance Claim 4 (TAPE)

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 79% removal of total phosphorus at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 5 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 23 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 56% removal of total nitrogen at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 6 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 77% removal of total copper at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 7 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 75% removal of total zinc at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 8 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 70% removal of total lead at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

**Performance Claim 9 (TAPE)**

During field testing under the Washington State TAPE Protocol (2011) which was composed of 21 qualifying storm events, The Stormwater Management StormFilter®, with PhosphoSorb® media, demonstrated at least 80% removal of total aluminium at a range of treated flow rates up to the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm. This performance claim was verified at a 95% level of confidence.

## Performance results

### Performance Claim 3 (TAPE):

Raw data summarizing the percent removal of total suspended solids (TSS) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent TSS (mg/L)	Average Effluent TSS (mg/L)	Percent Removal (%)
LPR021012	182	63.0	65.4
LPR021412	539	32.0	94.1
LPR021712	387	48.0	87.6
LPR022012	246	5.0	98.0
LPR022412	512	43.0	91.6
LPR031012	360	27.0	92.5
LPR031212a	150	18.0	88.0
LPR032912b	370	47.0	87.3
LPR052412	510	43.0	91.6
LPR060112	780	16.0	98.0
LPR060412	580	32.0	94.5
LPR060712	570	120.0	79.0
LPR110612	40.0	10.0	75.0
LPR112312	110	5.0	95.5
LPR113012	230	17.0	92.6
LPR051713	94.0	6.0	93.6
LPR052113	389	24.0	93.8
LPR062513	308	21.0	93.2
LPR013014	170	17.0	90.0
LPR030314	280	95.0	66.1
LPR030814a	173	26.0	85.0
LPR011815	529	72.8	86.2
LPR020215	397	67.0	83.1
<b>Sum</b>	2022		
<b>N (COUNT)</b>	23		
<b>Median</b>	91.6		
<b>STDEV.s</b>	8.99		
<b>VAR.s</b>	80.7		
<b>Z (alpha)</b>	1.65		
<b>Z (beta)</b>	1.29		
<b>Hypothesized median</b>	89.0		

**Performance Claim 4 (TAPE):**

Raw data summarizing the percent removal of total phosphorus (TP) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent TP (mg/L)	Average Effluent TP (mg/L)	Percent Removal (%)
LPR021012	0.141	0.104	26.2
LPR021412	0.220	0.062	71.8
LPR021712	0.310	0.067	78.3
LPR022012	0.163	0.026	84.1
LPR022412	0.424	0.070	83.5
LPR031012	0.140	0.049	65.0
LPR031212a	0.150	0.037	75.3
LPR032912b	0.280	0.081	71.1
LPR052412	0.170	0.070	58.8
LPR060112	0.200	0.035	82.5
LPR060412	0.210	0.043	79.5
LPR060712	0.170	0.140	17.6
LPR110612	0.068	0.025	63.2
LPR112312	0.082	0.025	69.5
LPR113012	0.170	0.025	85.3
LPR051713	0.282	0.029	89.9
LPR052113	0.558	0.050	91.1
LPR062513	0.583	0.045	92.2
LPR013014	0.317	0.053	83.3
LPR030314	0.417	0.133	68.1
LPR030814a	0.261	0.051	80.3
LPR011815	0.649	0.124	80.9
LPR020215	0.693	0.100	85.6
<b>Sum</b>	1683		
<b>N (COUNT)</b>	23		
<b>Median</b>	79.5		
<b>STDEV.s</b>	18.5		
<b>VAR.s</b>	343.7		
<b>Z (alpha)</b>	1.65		
<b>Z (beta)</b>	1.29		
<b>Hypothesized median</b>	79.0		

**Performance Claim 5 (TAPE):**

Raw data summarizing the percent removal of total nitrogen (TN) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent TN (mg/L)	Average Effluent TN (mg/L)	Percent Removal (%)
LPR021012	1.06	0.265	75.1
LPR021412	1.20	0.531	55.9
LPR021712	1.58	0.638	59.5
LPR022012	0.696	0.265	61.9
LPR022412	1.11	0.265	76.0
LPR031012	1.72	0.265	84.5
LPR031212a	0.760	0.400	47.4
LPR032912b	1.23	0.265	78.5
LPR052412	1.85	0.400	78.4
LPR060112	2.40	0.872	63.7
LPR060412	1.06	0.327	69.1
LPR060712	0.579	0.555	4.1
LPR110612	0.569	0.555	2.5
LPR112312	0.515	0.515	0.0
LPR113012	1.22	0.515	57.6
LPR051713	1.37	0.250	81.8
LPR052113	0.531	0.248	53.4
LPR062513	0.619	0.253	59.2
LPR013014	0.240	0.212	11.8
LPR030314	0.530	0.230	56.6
LPR030814a	0.432	0.080	81.5
LPR011815	0.180	0.110	38.9
LPR020215	2.32	0.370	84.1
<b>Sum</b>	1281		
<b>N (COUNT)</b>	23		
<b>Median</b>	59.5		
<b>STDEV.s</b>	27.0		
<b>VAR.s</b>	727		
<b>Z (alpha)</b>	1.65		
<b>Z (beta)</b>	1.29		
<b>Hypothesized median</b>	56.0		

**Performance Claim 6 (TAPE):**

Raw data summarizing the percent removal of total copper (Cu) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent Cu (mg/L)	Average Effluent Cu (mg/L)	Percent Removal (%)
LPR021012	No data	No data	-
LPR021412	No data	No data	-
LPR021712	0.032	0.006	81.3
LPR022012	0.014	0.001	92.9
LPR022412	0.032	0.005	84.4
LPR031012	0.019	0.003	84.2
LPR031212a	0.012	0.003	75.0
LPR032912b	0.023	0.004	82.6
LPR052412	0.050	0.050	0.0
LPR060112	0.040	0.003	92.5
LPR060412	0.021	0.003	85.7
LPR060712	0.028	0.010	64.3
LPR110612	0.006	0.003	50.0
LPR112312	0.006	0.001	83.3
LPR113012	0.016	0.002	87.5
LPR051713	0.016	0.003	81.3
LPR052113	0.027	0.006	77.8
LPR062513	0.029	0.005	82.8
LPR013014	0.021	0.004	81.0
LPR030314	0.019	0.006	68.4
LPR030814a	0.018	0.002	88.9
LPR011815	0.055	0.010	81.8
LPR020215	0.044	0.007	84.1
<b>Sum</b>	1610		
<b>N (COUNT)</b>	21		
<b>Median</b>	82.6		
<b>STDEV.s</b>	20.06		
<b>VAR.s</b>	403		
<b>Z (alpha)</b>	1.65		
<b>Z (beta)</b>	1.29		
<b>Hypothesized median</b>	77.0		



**Performance Claim 7 (TAPE):**

Raw data summarizing the percent removal of total zinc (Zn) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent Zn (mg/L)	Average Effluent Zn (mg/L)	Percent Removal (%)
LPR021012	No data	No data	-
LPR021412	No data	No data	-
LPR021712	0.151	0.034	77.8
LPR022012	0.076	0.011	85.8
LPR022412	0.191	0.031	84.0
LPR031012	0.120	0.022	81.7
LPR031212a	0.068	0.017	75.0
LPR032912b	0.160	0.029	81.9
LPR052412	0.250	0.250	0.0
LPR060112	0.230	0.012	94.8
LPR060412	0.130	0.015	88.5
LPR060712	0.170	0.048	71.8
LPR110612	0.022	0.014	36.4
LPR112312	0.049	0.010	79.6
LPR113012	0.110	0.016	85.5
LPR051713	0.068	0.010	85.2
LPR052113	0.126	0.021	83.5
LPR062513	0.120	0.017	85.5
LPR013014	0.108	0.026	76.1
LPR030314	0.095	0.029	69.8
LPR030814a	0.088	0.013	84.8
LPR011815	0.151	0.039	74.4
LPR020215	0.192	0.038	80.2
<b>Sum</b>	1582		
<b>N (COUNT)</b>	21		
<b>Median</b>	81.7		
<b>STDEV.s</b>	20.69		
<b>VAR.s</b>	428		
<b>Z (alpha)</b>	1.65		
<b>Z (beta)</b>	1.29		
<b>Hypothesized median</b>	75.0		

**Performance Claim 8 (TAPE):**

Raw data summarizing the percent removal of total lead (Pb) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent Pb (mg/L)	Average Effluent Pb (mg/L)	Percent Removal (%)
LPR021012	No data	No data	-
LPR021412	No data	No data	-
LPR021712	0.013	0.003	73.7
LPR022012	0.005	0.001	79.6
LPR022412	0.015	0.003	77.3
LPR031012	0.009	0.002	78.5
LPR031212a	0.006	0.002	71.9
LPR032912b	0.012	0.003	75.0
LPR052412	0.025	0.025	0.00
LPR060112	0.016	0.005	68.8
LPR060412	0.013	0.001	90.8
LPR060712	0.013	0.005	62.3
LPR110612	0.001	0.001	0.0
LPR112312	0.002	0.001	50.0
LPR113012	0.005	0.001	80.0
LPR051713	0.004	0.001	74.8
LPR052113	0.009	0.009	0.336
LPR062513	0.009	0.002	82.5
LPR013014	0.006	0.001	80.5
LPR030314	0.007	0.003	62.1
LPR030814a	0.005	0.001	71.5
LPR011815	0.015	0.003	81.4
LPR020215	0.011	0.002	81.0
<b>Sum</b>	1342		
<b>N (COUNT)</b>	21		
<b>Median</b>	74.8		
<b>STDEV.s</b>	28.05		
<b>VAR.s</b>	787		
<b>Z (alpha)</b>	1.65		
<b>Z (beta)</b>	1.29		
<b>Hypothesized median</b>	70.0		

**Performance Claim 9 (TAPE):**

Raw data summarizing the percent removal of total aluminium (Al) by The Stormwater Management StormFilter®, with PhosphoSorb® media, at the design hydraulic loading rate of 1.67gpm/sq ft. of media surface for a standard height cartridge of 45.72 cm for 23 qualifying storm events (bootstrapped data).

Sample ID	Average Influent Pb (mg/L)	Average Effluent Pb (mg/L)	Percent Removal (%)
LPR021012	No data	No data	-
LPR021412	No data	No data	-
LPR021712	9.15	1.86	79.7
LPR022012	2.62	0.319	87.8
LPR022412	9.65	1.99	79.4
LPR031012	6.20	1.10	82.3
LPR031212a	4.30	0.810	81.2
LPR032912b	6.40	1.70	73.4
LPR052412	9.70	1.30	86.6
LPR060112	11.0	0.370	96.6
LPR060412	12.0	1.00	91.7
LPR060712	9.60	4.10	57.3
LPR110612	1.30	0.300	76.9
LPR112312	1.20	0.190	84.2
LPR113012	3.00	0.440	85.3
LPR051713	1.44	0.134	90.7
LPR052113	3.24	0.358	89.0
LPR062513	3.94	0.466	88.2
LPR013014	3.45	0.796	76.9
LPR030314	2.64	1.13	57.2
LPR030814a	1.67	0.342	79.5
LPR011815	5.32	1.17	78.0
LPR020215	3.85	1.20	68.8
<b>Sum</b>	1691		
<b>N (COUNT)</b>	21		
<b>Mean (AVE)</b>	80.5		
<b>STDEV.s</b>	10.13		
<b>VAR.s</b>	103		
<b>Z (alpha)</b>	1.65		
<b>Z (beta)</b>	1.29		
<b>Hypothesized mean</b>	80.0		

## Verification

This verification was completed in June 2020 by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies (“CAWT”), contracted by GLOBE Performance Solutions, applying the International Standard **ISO 14034:2016 Environmental management – Environmental technology verification (ETV)**. Data and information provided by Contech Engineered Solutions LLC to support the performance claim included the following:

- Performance test report “The Stormwater Management StormFilter®- PhosphoSorb® at a Specific Flow Rate of 1.67 gpm/ft<sup>2</sup> – Performance Evaluation Report” prepared by Contech Engineered Solutions, November 8, 2017. This report is based on a field testing program conducted by Contech personnel at a roadway site in Zigzag, Oregon between January 2012 and February 2015. Testing was conducted in accordance with the 2011 version of the Washington Department of Ecology TAPE (TAPE, 2011).

## What is ISO 14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the International Organization for Standardization (ISO). The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

**For more information on the  
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### Limitation of verification - Registration: GPS-ETV\_2023-06-30\_TAPE

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