THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection Agency | **NSF International**

ETV Joint Verification Statement

TECHNOLOGY TYPE:	**STORMWATER TREATMENT TECHNOLOGY**	
APPLICATION:	**SUSPENDED SOLIDS AND ROADWAY POLLUTANT TREATMENT**	
TECHNOLOGY NAME:	**THE STORMWATER MANAGEMENT STORMSCREEN® TREATMENT SYSTEM**	
TEST LOCATION:	**GRIFFIN, GEORGIA**	
COMPANY:	**STORMWATER MANAGEMENT, INC.**	
ADDRESS:	**12021-B NE Airport Way** **Portland, Oregon 97220**	PHONE: **(800) 548-4667** FAX: **(503) 240-9553**
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NSF International (NSF), in cooperation with the U.S. Environmental Protection Agency (EPA), operates the Water Quality Protection Center (WQPC), one of six centers under the Environmental Technology Verification (ETV) Program. The WQPC recently evaluated the performance of the Stormwater Management StormScreen® (StormScreen) manufactured by Stormwater Management, Inc. (SMI). The system was installed in a city-owned right-of-way near downtown Griffin, Georgia. Paragon Consulting Group (PCG) performed the testing.

EPA created ETV to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by accelerating the acceptance and use of improved and more cost-effective technologies. ETV seeks to achieve this goal by providing high quality, peer-reviewed data on technology performance to those involved in the design, distribution, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations; stakeholder groups, which consist of buyers, vendor organizations, and permitters; and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

TECHNOLOGY DESCRIPTION

The following description of the StormScreen was provided by the vendor and does not represent verified information.

The StormScreen is a device that removes trash, debris, and large suspended particulates at high flow rates. The StormScreen consists of an inlet bay, cartridge bay, and outlet bay, housed in a 16-ft by 8-ft precast concrete vault. The inlet bay serves as a grit chamber and provides for flow transition into the cartridge bay, where the water is screened and discharged through flumes to the outlet bay and the outlet pipe.

The StormScreen is equipped with 20 cartridges (four discharge flumes with five cartridges per flume). The cartridges are equipped with screens with a standard opening size of 2.4 mm. The cartridges screen water by combining direct screening with many of the hydraulic aspects of the siphonic, radial-flow cartridge system patented by SMI. Water in the cartridge bay passes through the cartridge screen and into a tube in the center of the cartridge. When the center tube fills, a float valve opens and a check valve on top of the cartridge closes, creating a siphon that draws water through the screens. The treated water drains into the discharge flume to the outlet bay, where it exits the system through the discharge pipe. The system resets when the cartridge bay is drained and the siphon is broken. Screened solids accumulate in the debris sump in the cartridge bay. Each cartridge has a design flow capacity of 0.5 cfs (224 gpm), so the unit as a whole has a design flow capacity of 10 cfs (4,488 gpm).

Flows exceeding the capacity of the StormScreen are diverted by an SMI StormGate™ installed upstream of the StormScreen. The StormGate™ has a field-adjustable weir in a precast cylindrical concrete vault. Flows with a depth lower than the weir elevation are diverted to the StormScreen, while flows with a depth greater than the weir elevation are discharged to a bypass pipe. The weir at this installation was set at an elevation to direct a 10 cfs flowrate to the StormScreen.

SMI claims that the StormScreen will function at design flow when up to 85 percent occluded, and will remove all particles greater than 2.4 mm in diameter. The StormScreen performance for pollutant removal is dependent on site conditions, sediment loading, particle size distribution, and environmental variables.

VERIFICATION TESTING DESCRIPTION

Methods and Procedures

The test methods and procedures used during the study are described in the *Test Plan for The Stormwater Management StormScreen, TEA-21 Project Area, Griffin, Georgia* (NSF International and PCG, June 2003) (test plan). The City of Griffin requires that all storm drain systems be sized to pass peak flows from a 25-yr storm without causing surface flooding. For a 25-yr storm, a 5.42-min time of concentration was determined for the drainage basin, generating a peak runoff of 46.80 cfs. The rational method was used to calculate the peak flows for the system.

Verification testing consisted of collecting data during a minimum of fifteen qualified events that met the following criteria:

- The total rainfall depth for the event, measured at the site, was 0.2 in. (5 mm) or greater;
- Flow through the treatment device was successfully measured and recorded over the duration of the runoff period;
- There was a minimum of six hours between qualified sampling events; and
- Visual observations were noted for the inlet bay, cartridge chamber, and effluent chamber.

The ETV protocol for stormwater treatment technologies does not include any specific quantitative measurements for technologies, such as the StormScreen, claiming trash and debris removal. The only approach for verification of this type of technology is to use visual observations by the testing organization, documented with photographs and field observations logs. This information along with basic flow data is the basis for evaluating technologies claiming trash and debris removal.

Automated flow monitoring equipment was installed to measure the total flow entering the StormGate™, and the treated flow exiting the StormScreen. In addition to the flow data, visual observations of the inside of the unit and operation and maintenance (O&M) data were recorded.

VERIFICATION OF PERFORMANCE

Verification testing of the StormScreen lasted approximately nine months, and fifteen events were evaluated.

Test Results

The fifteen events used for this verification test covered a wide range of storms with total rainfall amounts varying from 0.22 in. to 3.06 in. The storms also varied in peak intensity from 0.12 in./hr to 21.6 in./hr. Some storms were short and intense, while others were longer and less intense. The precipitation data for the fifteen rain events are summarized in Table 1.

Table 1. Rainfall and StormScreen Performance Data Summary

Event Number	Start Date	Start Time	Rainfall Amount (in.)	Rainfall Duration (hr:min)	Runoff Volume (ft^3)[1]	Peak Flow Rate (gpm)		Volume Bypassed (Percent of Inlet Flow)
						Inlet	Outlet	
1	05/21/03	16:35	2.16	12:25	29,000	3,780	320	20
2	06/03/03	05:50	0.40	03:40	3,610	2,580	380	0[2]
3	07/03/03	17:10	0.45	00:15	4,210	1,630	160	62
4	08/12/03	17:10	0.22	00:10	2,020	1,590	360	15
5	09/04/03	13:50	0.22	01:30	2,170	630	520	0[2]
6	09/22/03	14:45	3.06	06:15	30,800	3,730	410	69
7	10/07/03	23:30	0.53	06:10	4,660	1,450	340	24
8	10/26/03	10:10	0.28	09:30	2,750	890	350	0[2]
9	11/05/03	15:45	0.74	01:55	6,350	2,430	340	69
10	11/19/03	01:25	1.52	03:20	15,600	5,250	590	74
11	11/27/03	15:55	0.74	06:30	9,520	550	540	0[2]
12	12/10/03	02:20	0.54	04:05	6,200	430	300	0[2]
13	12/14/03	00:20	0.34	02:20	4,230	1,160	140	63
14	01/05/04	13:10	0.47	05:35	4,970	1,210	250	69
15	01/17/04	20:35	0.44	04:45	4,290	630	320	0

[1] Runoff volume was measured at the inlet monitoring point.
[2] Some water may have bypassed. However, the elevation/level data at the inlet indicate bypass did not occur since the water level did not exceed the weir elevation. Volume differences are most likely due either to possible outlet meter negative bias or inlet meter positive bias during surcharge conditions.

The flow data and observations indicated that the maximum flow through the StormScreen during the verification testing was considerably lower than the design flow capacity. In at least nine events, some bypass occurred at runoff flowrates less than the anticipated design capacity of the StormScreen unit. The flow data from the StormScreen outlet shows that the unit was typically treating between 150 to 250 gpm when the system was flowing at a steady rate. Each event had a peak discharge rate (typically 300 to 600 gpm) that was higher than the steady rate, but still significantly below the design flow capacity of 4,488 gpm (10 cfs). These peak rates were preceded or followed by periods of time (5 to 30 min) when the unit was running at a fairly steady rate as it processed the water that had entered and accumulated in the StormScreen and StormGate™. The StormScreen appeared to process more water when the levels in the StormGate™ were higher, indicating more water was entering the StormScreen.

An accumulation of trash and debris was observed in the cartridge bay after every event. Furthermore, sediment and a hydrocarbon sheen were observed in the fore bay and cartridge bay after most events. The cartridge hoods were covered with sediment and debris, and the estimated sediment depth continued to increase over the nine months that flow measurements and observations were collected. By the end of the test, the screens were occluded by a significant quantity of organic detritus and fine clay.

After the verification testing was complete, SMI conducted a test on the StormScreen to try to determine why the design flowrates were not achieved during the ETV study. The first was conducted at the time the StormScreen was cleaned out, in the presence of the testing organization (TO) and NSF. It involved thorough cleaning of cartridges for one of the four discharge flumes, and running potable water into the cartridge bay. The maximum flowrate through the cleaned discharge flume was approximately 0.8 cfs (360 gpm), or 3.2 cfs (1,440 gpm) for four discharge flumes. This peak flow rate is greater than any peak rates measured during verification test, but is significantly lower than SMI's rated peak flow capacity of 10 cfs (4,488 gpm). However, the potable water supply was shut off at the request of the City of Griffin before the water in the vault reached the maximum elevation where the flume would discharge at its maximum flowrate.

An additional study was performed by SMI on a StormScreen installed at their Portland, Oregon, facility. This study was conducted with no oversight by the TO or NSF; therefore, the findings do not represent ETV-verified data. The study first established a relationship between the discharge rate and the water elevation in the cartridge bay. Then, clean water was pumped into the StormScreen cartridge bay at the design flow rate. A detailed description of the testing procedures and results is included in the vendor comments section of the verification report.

Based on the findings of the ETV test and the vendor's subsequent studies, the occlusion of the cartridge screens by organic detritus and fine clay apparently resulted in the decrease in the StormScreen's flow capacity at this installation. SMI concluded that a more frequent maintenance schedule, including cleaning the cartridge screens, would have been required to achieve a higher flow capacity for this application.

System Operation

The StormScreen was installed on May 9, 2002, prior to the planned start of ETV verification testing, and operated for one year prior to the start of verification testing. The StormScreen was cleaned in February 2003 after nine months of operation and prior to the start of the verification test in May 2003. There were no apparent mechanical problems with the unit.

On May 13, 2004, SMI, under the supervision of PCG, conducted a thorough cleanout of the StormScreen, including an assessment of all the retained solids. The assessment revealed that 4,020 lb (wet weight) were retained. The retained material had a mean moisture content of 71% by weight, resulting in a calculated dry weight total of 1,160 lb of retained solids.

Quality Assurance/Quality Control

NSF personnel completed a technical systems audit during testing to ensure that the testing was in compliance with the test plan. NSF also completed a data quality audit of 100% of the test data to ensure that the reported data represented the data generated during testing. In addition to QA/QC audits performed by NSF, EPA personnel conducted an audit of NSF's QA Management Program.

Original signed by *Sally Gutierrez* *September 2, 2005*	*Original signed by* *Thomas Stevens* *September 7, 2005*
Sally Gutierrez Date Director National Risk Management Laboratory Office of Research and Development United States Environmental Protection Agency	Thomas G. Stevens, P.E. Date Program Manager ETV Water Quality Protection Center NSF International

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA and NSF make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable federal, state, and local requirements. Mention of corporate names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products. This report is not an NSF Certification of the specific product mentioned herein.

Availability of Supporting Documents

Copies of the *ETV Verification Protocol, Stormwater Source Area Treatment Technologies Draft 4.1, March 2002,* the verification statement, and the verification report (NSF Report Number 05/20/WQPC-WWF) are available from:

ETV Water Quality Protection Center Program Manager (hard copy)
NSF International
P.O. Box 130140
Ann Arbor, Michigan 48113-0140

NSF website: http://www.nsf.org/etv (electronic copy)
EPA website: http://www.epa.gov/etv (electronic copy)
Appendices are not included in the verification report, but are available from NSF upon request.