

## Conditional Interim Certification Findings

### NJDEP Technology Certification Program:

Bureau of Sustainable Communities & Innovative Technologies  
Division of Science, Research & Technology  
401 E State Street  
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### Stormwater Manufactured Treatment Device:

Aqua-Filter™ Stormwater Filtration Chamber by AquaShield™ Inc.

### Applicant Information:

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### Technology Description:

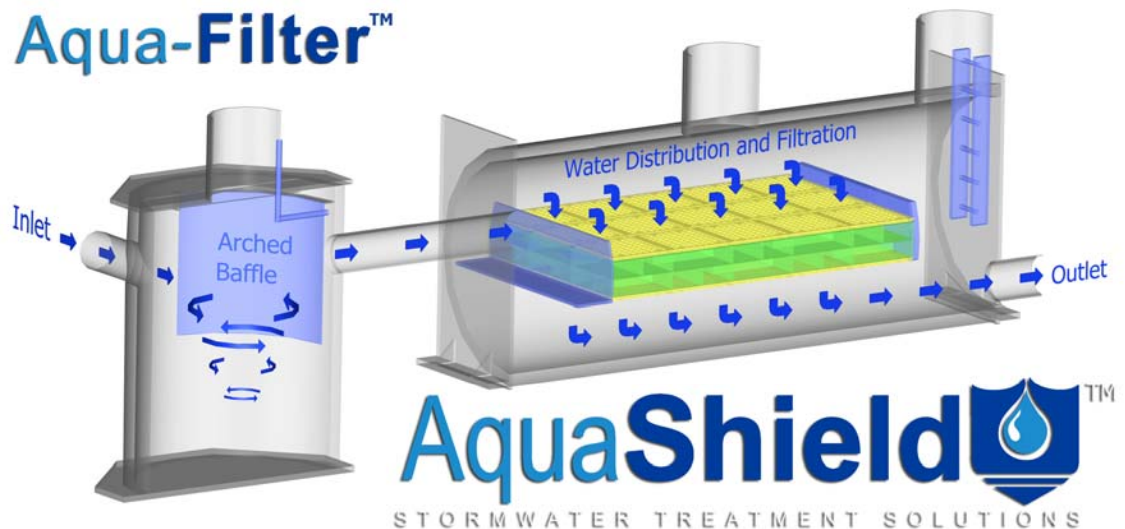
The Aqua-Filter™ Stormwater Filtration System is designed for sites that require advanced treatment of stormwater runoff discharging to sensitive receiving waters. The Aqua-Filter™ Stormwater Filtration System is a stand alone two-component structure, which utilizes a “treatment-train” approach for stormwater pollutant removal. This patented configuration begins with a Swirl Concentrator (using vortex enhanced sedimentation technology) designed for pre-treatment of stormwater runoff followed by a Filtration Chamber (using media filtration technology) capable of removing finer sediments and water-borne pollutants. A schematic of the Aqua-Filter™ Stormwater Filtration System is provided in Figure 1.

Each Filter Chamber has an inside diameter of approximately 72-inches (an outside diameter of 80.75-inches) containing rows of adjoining porous filters fixed horizontally in the chamber and positioned perpendicular to the water flow. There are 3 filter sections per row; each has a surface area of approximately 4-square feet, therefore supplying a total of 12-square feet per row of filters. There are open grids on the bottom of each filter section where four (4), 6-inch thick filters are placed to form 2 layers in a pattern to avert short-circuiting of the water flow. Accordingly, there are 12 filters and approximately 12-cubic feet of filter media per row. Similar 1-inch thick open grates are firmly fixed above the filters to facilitate distribution of the pretreated water across the filter bed. The length of a single Filter Chamber can be extended up to 35 feet to accommodate additional rows of filters increasing the filter surface area based on the calculated water

quality flow to be treated. Furthermore, the Filter Chambers have been customized in parallel designs to process exceptionally large water quality flow rates.

The Filter Chamber is designed to facilitate distribution of the pretreated water above the filter bed and control the flow rate to each row using proprietary post-filtration hydraulic restraints. Bulkheads are positioned at each end of the filter bed to evenly distribute and restrain incoming water, create gravitational pressure for water to permeate the filters, contain captured pollutants during peak flows and provide structural support. The bulkhead design allows a maximum 10-inch water level above the filters. The principles of the post-filtration flow are based on controlling flow through orifices. The post-filtration hydraulic restraints ensure each row of filters receives a maximum flow of 60 gpm (20 gpm per filter).

The Aqua-Filter™ Stormwater Filtration System operates under gravitational and hydrodynamic forces with no moving parts or valves, which simplifies the treatment process. The Aqua-Filter™ Stormwater Filtration System operates in an offline configuration, thereby treating the more frequent 6-month to 1-year design storms (or roughly 90% of the annual rainfall on a given site in New Jersey).



**Figure 1.** Aqua-Filter™ Stormwater Filtration System

New Jersey Corporation for Advanced Technology (NJCAT) Verified Claim:

At a flow rate of 20 gpm, the coarse perlite media filtration cartridge used in the Aqua-Filter™ Stormwater Treatment System has been shown to have an average TSS removal efficiency of 80.5% for SIL-CO-SIL 106 silica with a  $d_{50}$  particle size of 22 microns at influent concentrations of 90, 155, 176, and 280 mg/L in laboratory studies using simulated stormwater.

### Technology Limitations/Concerns:

- Lack of maintenance may cause the Aqua-Filter™ Filtration Chamber to become occluded with sediments, thus reducing the TSS removal efficiency of the system. Also, heavy solids loading without pretreatment may cause the cartridges to be occluded earlier thus requiring an increase in maintenance frequency.
- Occluded chambers may result in standing water, which can become a breeding site for mosquitoes.
- Inspections of the Aqua-Filter™ Filtration Chamber units must be performed as recommended by the manufacturer.

### NJDEP Conditional Interim Certification:

Based on the demonstrated laboratory performance with a material having an average particle size of 22 µm (SIL-CO-SIL 106), the NJDEP certifies that at a flow of 20 gpm the coarse perlite media within each filter section of the Aqua-Filter Filtration Chamber is capable of achieving a TSS removal efficiency of 80%. However, regardless of the number of filter sections used, the maximum TSS removal efficiency of the Aqua-Filter Filtration Chamber can not exceed 80%. **Please note that this Conditional Interim Certification is limited to the Aqua-Filter Filtration Chamber since the entire Aqua-Filter Stormwater Filtration System was not tested as a unit.** Table 1 contains the various filtration chamber configurations at the respective influent flow rates. The following **conditions** shall apply to the Conditional Interim Certification:

1. Since the Aqua-Filter™ Filtration Chamber was verified through laboratory performance data using a surrogate material, this device must be used with a pre-treatment device as part of a treatment train. The NJDEP has decided to adopt this conservative approach as a safety factor. However, upon the availability of acceptable **verified** field data, the NJDEP would consider revising this Interim Condition Certification to make the Aqua-Filter™ Filtration Chamber unit a stand-alone device. Presently, the selected pre-treatment device to be used with the respective Aqua-Filter™ Filtration Chamber units can only be approved by the Land Use Regulation Program and/or the Division of Watershed Management.
2. The maximum TSS removal rate for any treatment train, comprising a pre-treatment device and the Aqua-Filter™ Filtration Chamber unit, shall be 80%.
3. The Aqua-Filter™ Filtration Chamber unit shall be designed in accordance with New Jersey's water quality design storm, as required in the Stormwater Management Rules (N.J.A.C. 7:8).
4. A Quality Assurance Project Plan supporting the Technology Acceptance and Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstration (July, 2003), and New Jersey Tier II Stormwater Test Requirements, shall be submitted to the NJDEP and NJCAT within six (6) months from the date of the Conditional Interim Certification letter.
5. Field evaluation data that are consistent with the TARP Tier II Protocol and New Jersey Tier II Stormwater Test Requirements, which are available from NJCAT or

[www.state.nj.us/dep/dsr/bscit/Documents.htm](http://www.state.nj.us/dep/dsr/bscit/Documents.htm), shall be submitted to the NJDEP and NJCAT by July 31, 2007.

6. The appropriate devices satisfying site selection and sizing criteria must be consistent with the specifications as described in **Table 1**.

**Table 1. Aqua-Filter™ Stormwater Filtration Chamber Units Sizing Chart**

Number of Filtration Rows	Water Quality Filtered Flow Rates		Filtration Chamber Lengths (ft)	Approx. Treatment Train Length (ft)
	(cfs)	(gpm)		
1	0.13	60	9.6	16
2	0.27	120	12.0	18
3	0.40	180	14.3	21
4	0.53	240	16.6	24
5	0.67	300	18.7	28
6	0.80	360	21.0	31
7	0.94	420	23.6	34
8	1.07	480	25.9	36
9	1.20	540	28.2	38
10	1.34	600	30.5	40
11	1.47	660	32.8	42
12	1.6	720	35.6	45

If Aqua-Swirl™ Concentrator units are used as pre-treatment devices with the various Aqua-Filter™ Filtration Chamber units, then the models of the Aqua-Filter™ Stormwater Filtration System must satisfy the sizing requirements in Table 2.

**Table 2. Aqua-Filter™ Stormwater Filtration System Sizing Chart**

Aqua-Filter™ System Model	Water Quality Filtered Flow Rates		Filtration Chamber Lengths (ft)	Approx. Treatment Train Length (ft)
	(cfs)	(gpm)		
AF 3.1	0.13	60	9.6	16
AF 3.2	0.27	120	12.0	18
AF 3.3	0.40	180	14.3	21
AF 4.4	0.53	240	16.6	24
AF 4.5	0.67	300	18.7	28
AF 4.6	0.80	360	21.0	31
AF 5.7	0.94	420	23.6	34
AF 5.8	1.07	480	25.9	36
AF 6.9	1.20	540	28.2	38
AF 6.10	1.34	600	30.5	40
AF 6.11	1.47	660	32.8	42
AF 6.12	1.6	720	35.6	45

Furthermore, an Aqua-Filter™ Stormwater Filtration System is a combination of the Aqua-Swirl™ Concentrator and Aqua-Filter™ Stormwater Filtration Chamber unit. For example, the model AF 3.1 represents a combination of the Aqua-Swirl™ Concentrator model AS-3 with one row of Aqua-Swirl™ Filtration Chambers. Table 3 represents the various Aqua-Swirl™ Concentrator models, which were included in the verification report that received an Interim Conditional Certification from the NJDEP.

**Table 3. Aqua-Swirl™ Concentrator Models**

Aqua-Swirl™ Model	Swirl Chamber Diameter (ft)	Maximum Stub-Out Pipe Outer Diameter (in)		Water Quality Treatment Flow (cfs)	Oil/Debris Storage Capacity (gal)	Sediment Storage Capacity (ft <sup>3</sup> )
		On/Offline	CFD <sup>1</sup>			
AS-2	2.50	8	12	0.55	37	10
AS-3	3.25	10	16	0.9	110	20
AS-4	4.25	12	18	1.6	190	32
AS-5	5.00	12	24	2.2	270	45
AS-6	6.00	14	30	3.15	390	65
AS-7	7.00	16	36	4.3	540	90
AS-8	8.00	18	42	5.6	710	115
AS-9	9.00	20	48	7.1	910	145
AS-10	10.0	22	54	8.75	1130	180
AS-12	12.0	24	60	12.6	1698	270