

AQUA-FILTER™

Benefits of the AQUA-FILTER™ Treatment Train System

OBJECTIVE

Significant operational and performance benefits can be realized through the use of the treatment train design that is incorporated into the Aqua-Filter™ Stormwater Filtration System as documented by long term independent field testing of an Aqua-Filter™ Model AF-5.3. The Aqua-Filter™ treatment train system includes the Aqua-Swirl® hydrodynamic separator as the upstream (pretreatment) component followed by a filtration chamber as the downstream (secondary) component. The Aqua-Swirl® is designed to remove sediment, debris, floatables and free-floating oil, while the filtration chamber refines and polishes the stormwater quality prior to discharge by removing fine-grained particles. Testing results will be used to gain verification by the New Jersey Corporation for Advanced Technology (NJCAT) and subsequent certification by the New Jersey Department of Environmental Protection (NJDEP).

FIELD TESTING SUMMARY

Independent field testing over 26 months between March 2011 and May 2013 of an offline Aqua-Filter™ Model AF-5.3 system has been completed at an urban shopping center in Silver Spring, Montgomery County, Maryland. The tested Aqua-Filter™ includes an Aqua-Swirl® Model AS-5 and a three row filtration chamber using perlite filter media. A prior field testing program for the Aqua-Swirl® AS-5 component has been independently verified by NJCAT to achieve over 85% suspended solids removal on an annual basis. Aqua-Filter™ testing covered 21 qualifying storms having at least 0.1 inch of rain and 15.83 inches of total rainfall. The number of storms and total rainfall parameters exceed the TARP Tier II protocol requirement of at least 15 storms and 15 inches of rainfall. Analytical results by both the Total Suspended Solids (TSS) and Suspended Sediment Concentration (SSC) methods, as well as the sum of loads method; demonstrate that the Aqua-Filter™ AF-5.3 achieved over 90% suspended sediment removal efficiency on a net annual basis.

TYPES OF HYDRODYNAMIC SEPARATORS

The sum of loads calculations also demonstrate that over 1,000 pounds of sediment was removed from stormwater runoff by the Aqua-Filter™. The average influent TSS concentration of 135 mg/L meets the TARP protocol average sediment concentration range requirement of 100 to 300 mg/L. Influent particle size distribution (PSD) data from three storms indicate that the average influent particle size is less than 100 microns (µm) and meets the TARP protocol requirement. Influent sediment is classified as a clay loam. In addition, the average storm volume sample coverage of 80% exceeds the minimum 60% coverage requirement of the protocol. Aqua-Filter™ field testing supports a maximum water quality treatment flow rate (WQTFR) of 0.047 cfs/ft² (21.07 gpm/ft²) as well as a maximum inflow area per square foot of filter area of 0.033 acres/ft² of impervious area.

Testing was implemented with a fresh set of 36 perlite filter containers. All 36 filter containers were replaced in February 2012. Maintenance of the system was performed on an annual basis as required by the local stormwater management authority and in keeping with the recommended maintenance frequency for the Aqua-Filter™. No adverse operational conditions occurred during testing.

BENEFITS ACHIEVED

The Aqua-Filter™ system design provides the following benefits for the treatment of stormwater runoff as opposed to those filtration systems that rely solely on filtration and do not incorporate pretreatment:

Over 90% suspended sediment removal is provided by the Aqua-Filter™ on a net annual basis against fine-grained particulate. The treatment train serves to provide exceptional sediment removal including the fine-grained particulate at a loading rate up to 21 gpm/ft². The water quality treatment provided by the pretreatment Aqua-Swirl® chamber serves to extend the filter life cycle, thereby significantly reducing operating expenses associated with the replacement of filter media. An extended filter life cycle is afforded by the performance of the swirl chamber provides for cost-effective treatment by the Aqua-Filter™ treatment train system.

OVER 90%

Net amount of suspended sediment removal vs. fine-grained particulate.

The pretreatment Aqua-Swirl® chamber continues to achieve a high level of treatment to stormwater runoff when compared to those filtration systems that experience performance loss when the filter life cycle has extended beyond its performance claim capability. If the Aqua-Filter™ filtration chamber were to go into internal overflow mode due to an extreme flow rate condition, the swirl chamber would continue to provide significant treatment as demonstrated through NJCAT-verified field testing. This is opposed to those filtration systems that would be operating under external bypass conditions in similar conditions with little to no treatment being provided by the system. The swirl chamber has been verified by NJCAT in the field to capture and effectively retain fine-grained clay loam textured sediment. The low effluent concentrations from the swirl chamber (<20 mg/L) demonstrated a high level of performance and sediment retention across the range of flows experienced during the testing period. A lower average effluent concentration of 5 mg/L from the filtration chamber demonstrates the higher level of treatment achieved by the Aqua-Filter™ system.