AquaShield™ | TECH REPORT

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Evaluating the AQUA-SWIRL® Model AS-5 field test performance using TARP and TAPE criteria.

AQUA-SWIRL®

The New Jersey Corporation for Advanced Technology (NJCAT) has verified the results of a 27-month field testing program for the AQUA-SWIRL® Stormwater Treatment System to achieve greater than 80% net annual suspended sediment removal from stormwater runoff. Furthermore, the Washington Department of Ecology (Ecology) has issued the Conditional Use Level Designation (CULD) for AQUA-SWIRL® use as a standalone Basic (TSS) treatment device. This report compares the AS-5 field test results to performance evaluation criteria following both the Technology Acceptance Reciprocity Partnership Protocol for Stormwater BMP Demonstrations (TARP) and the Technical Assessment Protocol – Ecology (TAPE) guidelines. Both the TARP and TAPE evaluation criteria for manufactured treatment devices are widely recognized by stakeholders throughout the stormwater community.

AQUA-SWIRL® BENEFITS

- Meets or exceeds both TARP and TAPE performance evaluation criteria
- Provides 80% sediment removal efficiency on net annual or per storm event basis
- Can be used as a standalone device to meet water quality goals
- Proven long term functionality
- Offers flexible site design opportunities for new development and retrofit configurations

TEST SUMMARY & PRODUCT INFORMATION ▶

FIELD TEST SUMMARY

An independent field test of an off-line AQUA-SWIRL® Model AS-5 was performed following the TARP Tier II protocol between 2009 and 2011 at an urban shopping center in Silver Spring, Maryland. Analytical results from 18 storms and 15.16 inches of rainfall demonstrated an average annual removal efficiency of 84% for both Total Suspended Solids (TSS) and Suspended Sediment Concentration (SSC) as calculated by the sum of loads method. Average influent TSS and SSC concentrations were 132 and 145 mg/L, respectively. Average effluent sediment concentrations were low, 12 mg/L for TSS and 13 mg/L for SSC. Eight storms exhibited TSS concentrations greater than 100 mg/L with an average TSS removal efficiency of 86.6%. Influent TSS concentrations were less than 100 mg/L for 10 storms having effluent TSS concentrations less than 20 mg/L and an average removal rate of 85.5%. Influent particle size was 72% silt (< 63 microns, µm) as measured by the serial filtration method. Particles larger than 1,000 µm were excluded from all analyses. The peak water quality treatment flow rate was 41.2 gpm/ft² on an annual basis while maintaining 80% TSS removal efficiency on a per storm event basis up to approximately 23 gpm/ft².

TARP PERFORMANCE EVALUATION CRITERIA

Table 1 compares the essential elements of the TARP performance evaluation criteria to AS-5 field test results. TARP guidelines do not specify that a sediment removal efficiency goal be reached. Instead, test results are compared to protocol compliance for performance evaluations. It is clear that the AS-5 met or exceeded the TARP evaluation criteria while achieving over 80% net annual suspended sediment removal efficiency at a water quality treatment flow rate of 41.2 gpm/ft² against a clay-loam textured influent sediment.

Table 1.
Comparison of TARP Evaluation Criteria and AS-5 Testing Results

TARP Evaluation Criteria	AS-5 Test Results
Minimum 15 storms	18 storms
Minimum 15 inches of rainfall	15.16 inches of rainfall
Minimum storm size 0.1 inch	0.11 to 4.40 inches
Minimum inter-event period 6 hours	Met criterion
Average influent TSS concentration 100-300 mg/L	Average TSS 132 mg/L, SSC 145 mg/L
Average influent particle size < 100 µm	72% < 63 µm (silt), average < 100 µm
Minimum 6 flow-composite samples/storm	Up to 24
Sample minimum 60% storm flow volume	60%
Two storms > 75% of design treatment capacity	Two storms ≥ 75% of 41.2 gpm/ft²

TAPE PERFORMANCE EVALUATION CRITERIA

In contrast to TARP performance criteria, TAPE guidelines specify three levels of performance criteria on a per storm basis according to the influent TSS concentration as listed below in Table 2. When influent TSS concentrations are low and between 20 and 100 mg/L, effluent TSS concentrations shall not exceed 20 mg/L. When influent TSS concentrations are 100 mg/L to 200 mg/L and greater, TSS removal efficiency shall be at least or greater than 80%. All TAPE performance criteria were exceeded by the AS-5 with two exceptions as shown in Table 2. The AS-5 achieved 80% sediment removal efficiency on a per storm event basis at a surface area loading rate up to 23 gpm/ft².

Table 2.
Comparison of TAPE Performance Criteria and Number of AS-5 Storms

Influent TSS Range	Performance Criteria	# AS-5 Storms
20 – 100 mg/L	Effluent ≤ 20 mg/L TSS	10
100 – 200 mg/L	≥ 80% TSS removal	3
> 200 mg/L	> 80% TSS removal	3

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