Laboratory Testing Guidelines for Certification of Manufactured Stormwater BMPs

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Outline

- Goals and Objectives
- Members Affiliations
- Tasks Done
- Draft Laboratory Testing Guidelines

Goals and Objectives of Laboratory Testing

- To assess the efficiency of hydrodynamic separators and filters for physical separation of particles (the full spectrum of stormwater-borne non-dissolved solids) from stormwater runoff.
- The guidelines are intended to include testing for scouring of the removed particles under high flow conditions.

Subcommittee Members

- Bannerman (WIDNR)
- Karimipour (NY DEC)
- Kayhanian (UC Davis)
- Mohseni (UofM/SAFL/Barr)
- Mailloux (Alden Lab)
- de Bruijn (Terre Hill Stormwater Systems
- McDonald (Kristar)
- Miller (AquaShield)
- Osei (Hydro International)
- Perry (Imbrium Systems)

Tasks Done

1. Reviewed a number of existing and draft protocols and standards:
    1. TAPE 2001, Washington Department of Ecology
    2. NJDEP 2003, New Jersey
    3. WDC & WDNR 2007, Wisconsin
    4. Draft ASTM Standard
    5. Ohio DOT, Laboratory Testing Specifications for Manufactured Water Quality Structure
    6. City of Indianapolis, Laboratory Testing Protocol for Manufactured Stormwater Treatment Systems prepared
    7. Hydro International, Indirect and Direct Methods

FEATURE	NJCAT/NJDEP	WA DOE	WI DNR
Specified Test Material	5% - 500-1000 µm 5% - 250-500 µm 30% - 100-250 µm 15% - 50-100 µm 25% 8-50 µm 15% 2-8 µm 5% 1-2 µm (d50 ~67 µm)	OK-110 (d50 ~110 µm)	0.90 lb F-95 1.2 lb OK-110 0.25 lb Sil-Co-Sil 250 4.0 lb Sil-Co-Sil 106 1.0 lb Sil-Co-Sil 52 2.0 lb Min-U-Sil 40 1.0 lb Min-U-Sil 30 1.0 lb Min-U-Sil 15 4.0 Min-U-Sil 10 (d50 ~8 µm)
Target Influent Concentration	100, 200, 300 mg/l	100, 200 mg/l max.	150-250 mg/l
Flow Increments	25%, 50%, 75%, 100% and 125% of unit's rated treatment capacity	50%, 75%, 100% and 150% of unit's rated treatment capacity	5%, 20%, 50% and 100% of unit's rated treatment capacity
# of Tests	3 for each flow rate and concentration (15 total)	2 for each flow rate and concentration (8 total)	1 for each flow rate and concentration for 2 models min. (8 total)
Preloaded Sediment for Resuspension Test	Specified test material at 50% and 100% of unit's rated sump capacity	Specified test material at 100% of unit's rated sump capacity	15% ASTM C33 Conc. Sand 10% NJ 0 Sand 20% NJ 4 Sand 15% #12 Sand 10% #15 Sand 15% F60 Grade Sand 10% 20/40 Oil Frac 5% HI-50
Resuspension Test	2 tests at maximum hydraulic operating rate w/preloaded sediment & clean water	Maximum flow without negative removal efficiency w/preloaded sediment	30 min or $5t_r$ 5 paired grab samples Max. +25 mg/l effluent w/clean water

FEATURE	NJCAT / NJDEP	WA DOE	WI DNR
Min. Performance	70% as SSC/50% as TSS at rated treatment capacity	80% removal as TSS at rated treatment capacity	Flow limited to 83% of allowable based on resuspension test
Sampling Method	Not specified	Not specified (grab samples or compositing inferred)	Total mass fed & collected in separator + 5 grab samples for influent/effluent SSC & TSS + PSD from all
# of Models	One	One	Two minimum (Ratio between surface areas of primary settling chambers of at least 2.5)
PSD Analysis	None specified	Optional laser diffraction	Feed per ASTM C117, C136 and D422 Influent/Effluent residuals per same methods for >63 µm, Coulter counter for <63 µm
Temperature	73-79 °F max.	None specified	50-80 °F
Other Aspects			False floor allowed to simulate 50% sediment load – system run clean Recommended 5 lbs of accumulated sediment in unit

Tasks Done

2. Prepared Four Chapters:
   - Terminology
   - Removal Efficiency Testing of Hydrodynamic Separators
   - Sediment Retention Testing of Hydrodynamic Separators
   - Testing Filters

Terminology

- The necessity of this chapter
- Roger Bannerman prepared the first draft using the Wisconsin protocol and everyone provided input and comments
- Examples:
  - *Maximum recommended sediment storage depth*: This is the maximum depth of sediment accumulation recommended by the manufacturer to maintain acceptable sediment removal efficiency and scour losses.
- It is not yet finalized

Removal Efficiency Testing of Hydrodynamic Separators

- Task Group:
  - Roger Bannerman, Hans de Bruijn, and Mark Miller

1. Points finalized:
   1. Not assigning any expected removal efficiency
   2. Third party testing or the presence of an observer and the qualification of the observer
   3. A semi-balance method would be the conventional method testing, and sampling of influent and effluent is only allowed if it is shown by the laboratory that it gives accurate and repeatable results

Removal Efficiency Testing of Hydrodynamic Separators

1. Points finalized (continued …)
    4. If sampling is allowed, then only SSC analysis will be conducted on samples, i.e. no TSS analysis of samples.
    5. Not using a particle size distribution but using several relatively discrete particle sizes.
    6. Developing a performance function for the tested device.

2. Points remained for further discussion
    1. Number of tests
    2. Accuracy and repeatability of test results

Sediment Retention Testing of Hydrodynamic Separators

- Task Group:
  - Jon McDonald, Kwabena Osei and Omid Mohseni

1. Points finalized:
   1. Not using a wide particle size distribution but using two or three relatively discrete particle sizes or very narrow particle size distributions
   2. Preloading the sump to 50% max. recommended sediment storage depth and running water with no influent.
   3. Building a false floor and preloading the sump to 100% max. recommended sediment storage depth.

Sediment Retention Testing of Hydrodynamic Separators

1. Points finalized (continued …)
    4. Use of load cells to weigh the entire system prior and after each test would be the conventional method and sampling of influent and effluent would be only allowed if it is shown by the laboratory that it gives accurate and repeatable results
    5. Water temperature needs to be set between 64 and 68 F
2. Points remained for further discussion
    1. Number of tests
    2. Minimum duration of a test
    3. Accuracy and repeatability

Filtration Laboratory Testing

- Task Group:
  - Scott Perry, Shohreh Karimipour, Jim Mailloux and Masoud Keyhanian

1. Points finalized:
   1. Not assigning any expected removal efficiency
   2. Not using a wide particle size distribution but using two or three relatively discrete particle sizes or very narrow particle size distribution (organic and inorganic)
   3. Using very fine particle sizes, e.g. largest would be 38 microns (note: which becomes the smallest particles for hydrodynamic separators)

Filtration Laboratory Testing

2. Points remained for further discussion
    1. Number of tests
    2. Type of tests (removal efficiency vs. a characteristic variable(s), removal efficiency over time, scour tests, etc.)
    3. Crucial parameters in efficiency of filters (area vs. volume of filter)

Questions?