Hydro International First Defense®
OK – 110 Scour and Removal Efficiency Confirmation Tests
November 9-10 2010

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On November 9-10, 2010, I witnessed scour and removal efficiency confirmation tests for the First Defense® System from Hydro International. Both tests utilized OK-110 silica sand provided by U.S. Silica. The tests were performed in the laboratory of the Hydro International office on Hutchins Drive in Portland, Maine.

Test Set-Up

Testing was conducted in the 4-ft diameter free-standing First Defense® installation. The maximum sediment storage volume is 26 inches in depth, or 1 cubic yard. The tests were performed at ½ the maximum sediment storage volume measuring 13 inches in depth, or 0.5 cubic yards of sediment. The 13 inch depth was met through the installation of a 10 in false bottom and an additional average sediment depth of OK-110 sand of 3 in minimum. The system design and internal polypropylene components were the same as found in commercial units.

For both tests a 8" Flygt submersible pump delivered flows at variable rates from a 23,000-gallon clean water reservoir to a pipe network that included a series of butterfly valves for throttling the flow rate to the First Defense® from 10-40 liters/second (158.5 - 634 gpm). The test manhole had a 12-inch inlet and outlet pipe that received water from and discharged water to the reservoir. A schematic of the First Defense® system is shown in Figure 1.

OK-110 silica sand was fed into the inflow pipe from an elevated 55-gallon slurry barrel. The OK-110 is kept in a relatively uniform suspension in the slurry tank using an inverted drill with a propeller mixer attachment. A Watson Marlow peristaltic pump connected to the 55-gallon drum pumps slurry through a one inch plastic line into a 12-inch stand pipe located a few feet upstream of the First Defense® inlet (see Figure 2).

Figure 1: Schematic of Test Set-up

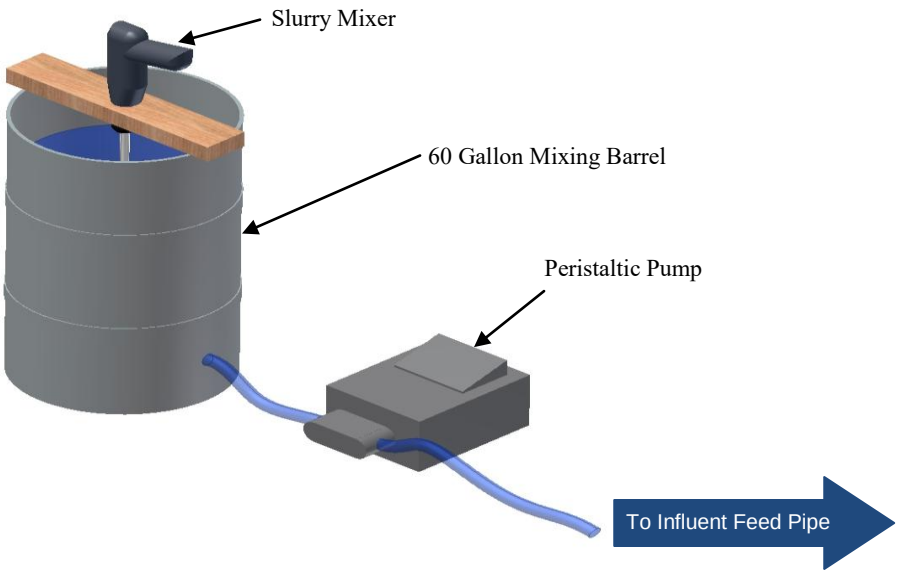
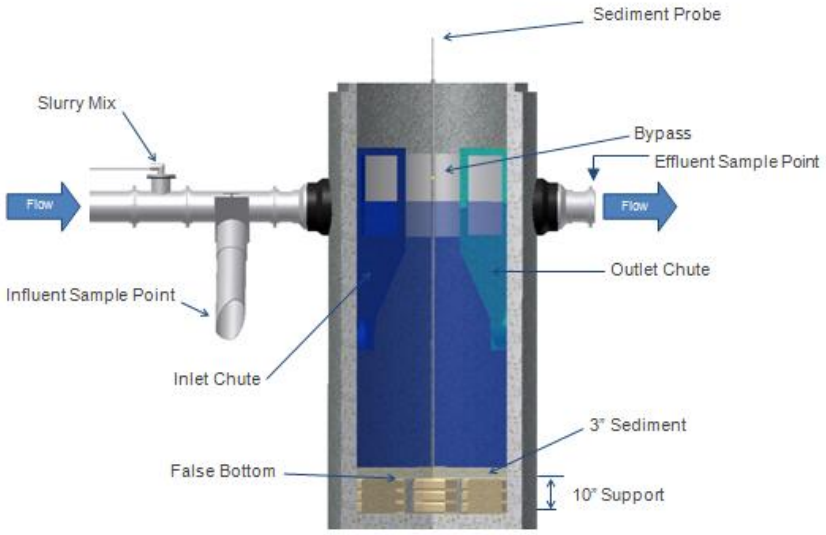


Figure 2: Schematic of First Defense



Scour Test Procedure

The scour test methodology was prepared after review of test protocol and/or test requirements from several sources including:

1. NJDEP's Protocol for Manufactured Hydrodynamic Sedimentation Devices for Total Suspended Solids Based on Laboratory Analysis, Dated August 5, 2009 and Revised December 15, 2009.
2. CONTECH's VortSentry® HS Performance Testing with OK-110, prepared by Heather Tetreault (used to obtain MASTEP rating of "2")
3. City of Knoxville, TN Post-Construction Water Quality Control for Proprietary Flow-Through Best Management Practices (BMP's) (testing requirements)
4. Hydro International Test Procedures

Observed testing sequence consisted of the following:

1. Scour Testing at 125% of Maximum Treatment Flow Rate (MTFR)
2. Scour Testing at 200% of the MTFR
3. SSC/TSS Removal Efficiency Testing at 50% MTFR
4. SSC/TSS Removal Efficiency Testing at 75% MTFR
5. SSC/TSS Removal Efficiency Testing at 100% MTFR

The test unit sump was preloaded with an equivalent of 13 or more inches of OK-110 Silica Sand to 50% of the maximum sediment storage volume (includes a 10 in false bottom and no less than an averaged sediment depth of 3 in.).

The scour test was conducted in two parts, for two separate flow rates (125% and 200% of the MTFR) each of which were witnessed and observed in its entirety.

Part I consisted of operating the test unit with clear water at 125% of the expected MTFR for no less than 15 minutes. When flow was stopped, a dipstick was utilized to measure sediment depth at several points (13 in total see figure x for a schematic of sediment sampling locations within the system sump) averaging the no less than 90% of the original preloaded sediment depth (3 inches). See figure 3 for sampling location schematic.

Figure 3: Sampling Location Schematic

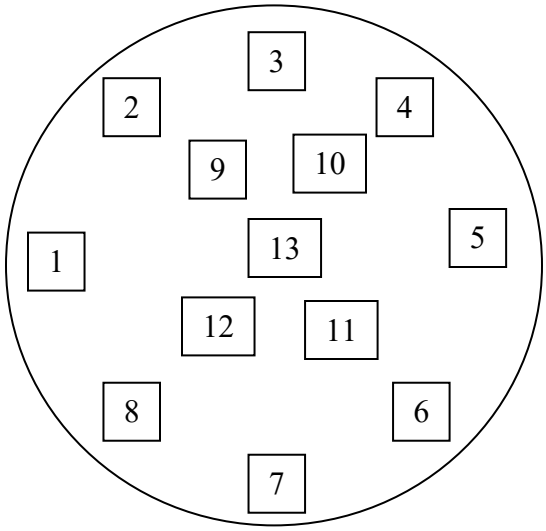


Table 1: Sediment level results from the Part I of the scour test at 125% MTFR

	Pretest storage sediment level	Post test storage sediment level
1	2.25	2.25
2	2.00	2.50
3	2.25	2.25
4	4.00	4.25
5	4.25	5.00
6	5.25	5.50
7	6.25	6.25
8	3.00	3.00
9	4.75	4.50
10	4.00	4.00
11	4.25	5.00
12	5.25	5.00
13	4.50	4.75
Average	4.00	4.17

Results indicate that post test levels average no less than 90% of the original preloaded sediment depth.

Table 2: Sediment level results from the Part I of the scour test at 200% MTFR

	Pretest storage sediment level	Post test storage sediment level
1	2.50	2.0
2	2.75	2.75
3	2.25	2.25
4	4.25	4.25
5	4.75	4.75
6	5.50	5.50
7	6.00	6.00
8	3.50	3.25
9	4.75	4.75
10	4.50	4.00
11	4.25	5.00
12	5.00	4.75
13	4.50	4.25
Average	4.19	4.12

Results indicate that post test levels average no less than 90% of the original preloaded sediment depth.

Signed: 

Date: December 21, 2010