Independent Review of CDS 2015 Evaluation Testing for Online Applications in the State of New Jersey

Report by
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Introduction

FB Environmental Associates, Inc. (FB Environmental), was hired by Contech Construction Products, Inc., (Contech) in 2010 to serve as an independent reviewer of testing conducted on the CDS 2015 test unit for online applications in New Jersey. This test evaluated sediment retention performance for the CDS 2015 under flow conditions established by the New Jersey Department of Environmental Protection (NJDEP) for online approval. The specific requirements are identified in Section F of the *Protocol for Manufactured Hydrodynamic Sedimentation Devices for Total Suspended Solids Based on Laboratory Analysis*[1]. FB Environmental served as a third-party, independent observer. Our role was to observe all testing and sample collection, review data records and calculations, and state whether tests conformed to the written protocol provided by Contech.

The CDS 2015 is a stormwater treatment device intended to remove pollutants, including suspended solids, from stormwater. Flow up to the treatment design capacity is guided by a diversion weir into a separation chamber for treatment. The primary methods used to remove pollutants are swirl concentration, a continuous deflective separation screen, and an oil baffle. Flows which exceed the treatment design capacity flow around the separation chamber. A diagram of a CDS unit is shown in Figure 1.

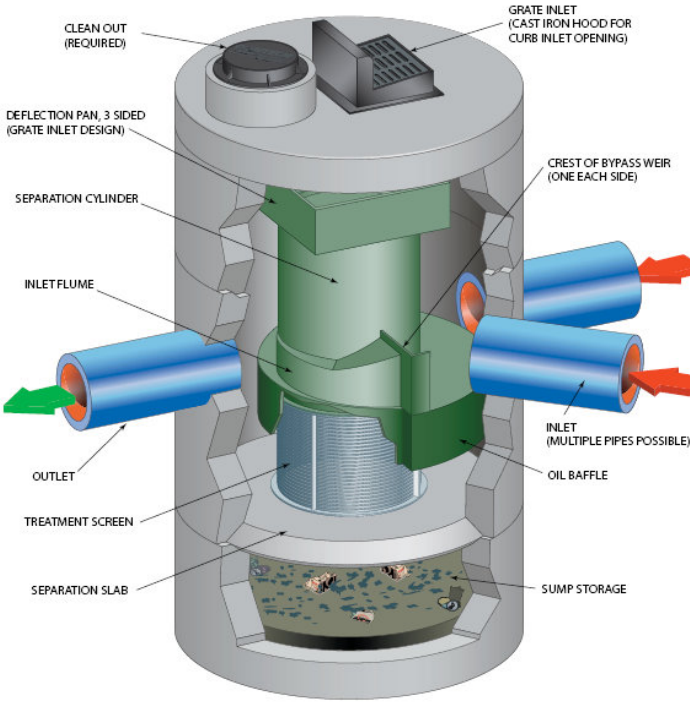

Figure 1: Design and construction of the CDS unit.
(Figure courtesy of Contech Construction Products, Inc.)

[1] Protocol for Manufactured Hydrodynamic Sedimentation Devices for Total Suspended Solids Based on Laboratory Analysis. Aug. 5, 2009, Revised Dec. 15, 2009. http://njstormwater.org/pdf/hydrodynamic_protocol_12_15.pdf

Test Contaminant

The particle size distribution of the test contaminant was developed in accordance with that specified by the NJDEP (Table 1) for use in optional online scour testing. This silica-based surrogate has a specific gravity 2.65 g/cc and a particle size distribution ranging between 1000 µm and 50 µm. A comparison of the test contaminant and that specified by the NJDEP is illustrated in Figure 2. The particle size distribution of the contaminant developed for this test was established through sieve analysis by Sevee and Maher Engineers[2]. The gradation of the developed test contaminant falls within the NJDEP specified 10% error range.

Table 1: Particle size distribution requirements for New Jersey online location scour testing

Range of particle size (µm)	Percent (by mass) of particles > or = 52 µm
500-1000	10%
250-500	10%
100-250	55%
50-100	25%
8-50	0%
2-8	0%
1-2	0%

1. The material shall be hard, firm, and inorganic with a specific gravity of 2.65(+5%). The various particle sizes shall be uniformly distributed throughout the material prior to use.

2. This distribution is to be used in a MTD's influent flow for TSS Removal Efficiency Test Runs as described above. A variation of ± 10% in each individual percentage is permissible provided that the individual percentage of the particles from 1 to 50 microns are not decreased and the net variation over all ranges shown in Table 1 above is 0%.

3. This distribution is to be used to preload the a MTD's sedimentation chamber for Maximum Treatment Flow Rate Scour Testing and Online Location Scour Testing as described above. A variation of ±10% in each individual percentage is permissible provided that the net variation over all ranges shown in Table 1 above is 0%.

(Source: New Jersey *Protocol for Manufactured Hydrodynamic Sedimentation Devices for Total Suspended Solids Based on Laboratory Analysis Dated August 5, 2009, and Revised December 15, 2009*)

[2] Sevee & Maher Engineers Inc. 4 Blanchard Road, P.O. Box 85A Cumberland Center, Maine

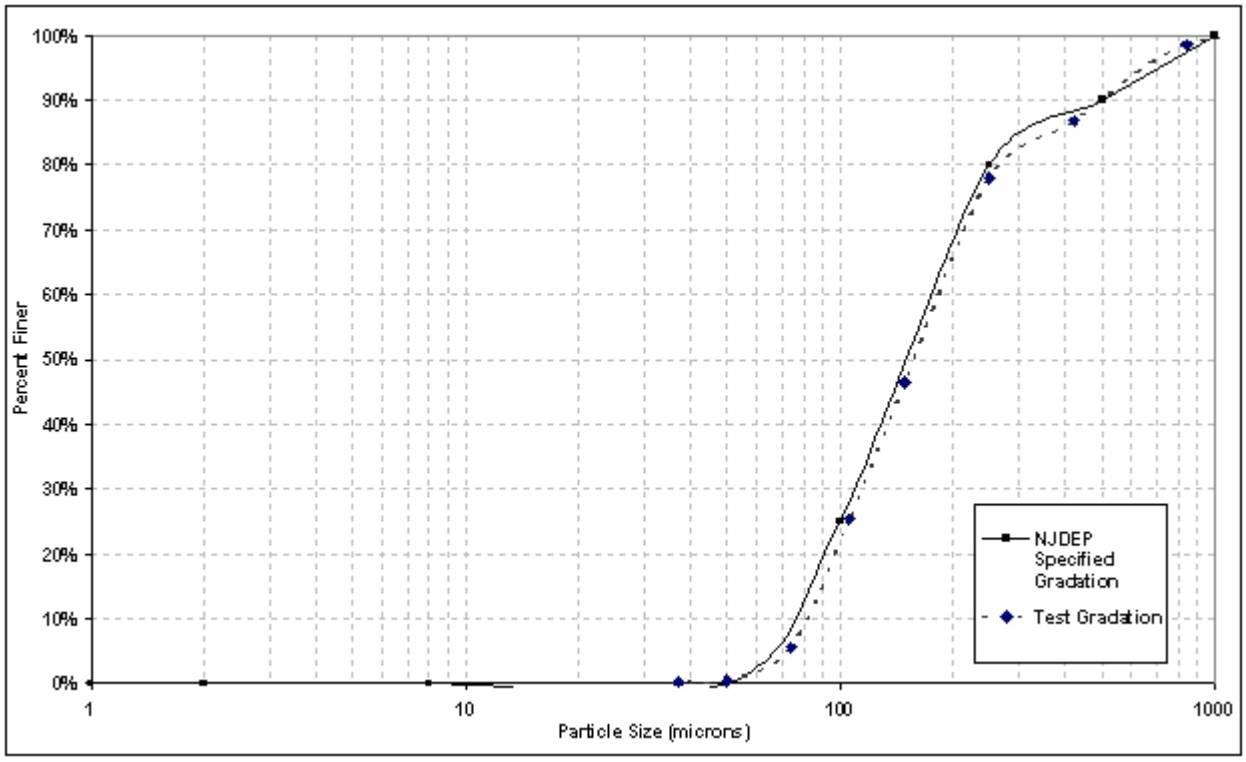

Figure 2: Particle size distribution comparison between developed test contaminant, as measured by Sevee & Maher Engineers, and NJDEP specified gradation.

Methods

Test Apparatus and Preparation

A CDS 2015 unit was tested in Contech's Scarborough, Maine, laboratory to evaluate online sediment retention according to NJDEP, Section F, Optional Testing for On-Line Installation. This unit consists of a 5 ft diameter welded aluminum cylindrical structure with a maximum depth of 4.7 ft between the floor of the sump and the invert of the inlet pipe. The sump was filled with the surrogate contaminant until the 50% sediment storage capacity of the test unit was obtained. The 50% sediment storage capacity is defined as a sediment depth of 12 inches and a vertical distance of 44 in from the surface of the sediment to the invert of the influent pipe.

To prepare the system for testing, the CDS 2015 was filled with clean water at low velocity to minimize disturbance of the sediment until the water level simulated dry weather operating conditions. During testing, the flow through the test system[3] was monitored and recorded using a SeaMetrics Online Magmeter (Model WMX104) coupled with SeaMetrics model EX201 flow computer.

[3] An overview of the layout of the test apparatus is depicted in Figure 1.

Operational Procedure

The test was conducted in two phases, and was repeated at two different flow rates. The first phase consisted of introducing flow into the CDS 2015 until the system was stabilized at a minimum rate of 1.4 cfs (200% of WTFR). At this flow rate the system has an expected residence time of 42.1 seconds based on 58.9 cubic feet of wet volume in the CDS 2015 (volume of sediment sump excluded). The system remained in operation for 15 minutes (the greater of 15 minutes or five residence times) as specified by NJDEP. Actual flow rates were recorded at one minute intervals. After this trial, the remaining sediment in the sump was quantified through volumetric analysis. Since less than 10% of the volume was determined to have been displaced, the secondary phase of the testing procedure began.

The second phase of testing consisted of first filling the CDS 2015 to the dry weather operating condition. Once this condition was established, flow was introduced through the influent line and stabilized at a minimum of 1.4 cfs. Once stable, this flow rate was maintained for a minimum of 30 minutes (the greater of 30 minutes or 10 detention times). The initial set of effluent and corresponding background samples were collected 5 minutes into the 30 minute interval and continued with additional sampling at 5 minute intervals until 6 sets were obtained. Actual flow rates were recorded as each sample was taken. Sample analysis was carried out by Maine Environmental Laboratory[4] in accordance with standard method APHA 2540D (TSS).

The entire testing process was repeated at a minimum flow rate of 2.8 cfs (400% of WTFR). The method and duration of the second test were identical to the first: 15 minutes for the first phase, and 30 minutes for the second phase. After the first phase, it was verified that less than 10% of the sediment volume had been displaced. As in the first test, actual flow rates were recorded at one minute intervals during the first phase, and five minute intervals during the second.

[4] Maine Environmental Laboratory, P.O. Box 1107, One Maine Street, Yarmouth, Maine 04096-1107

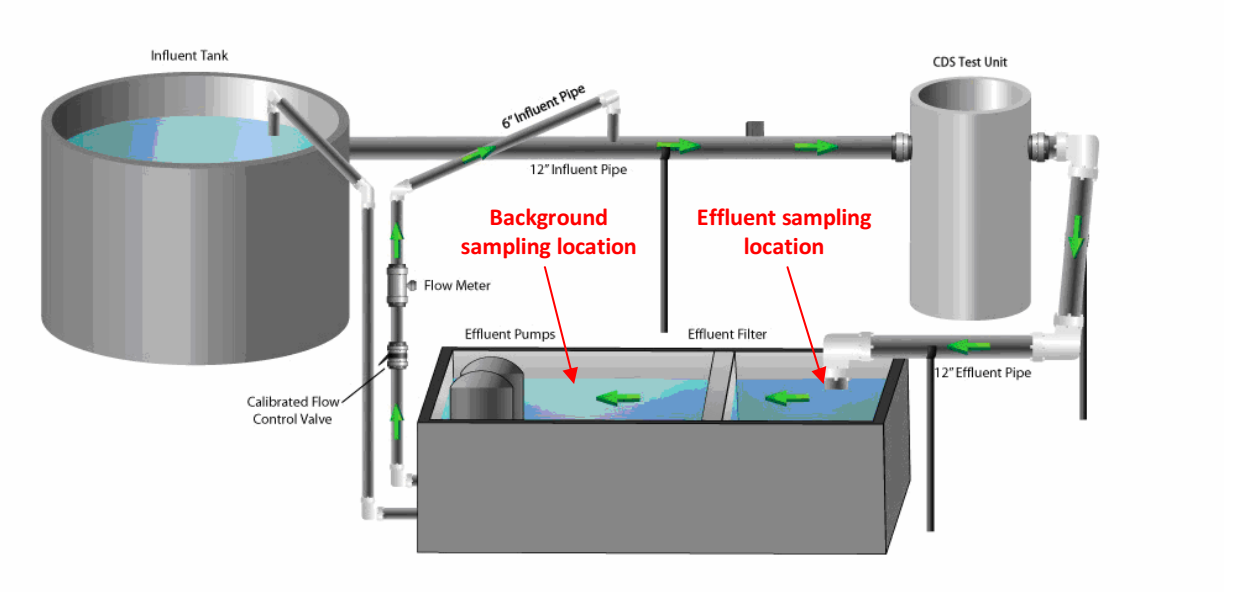

Figure 3: Diagram of the test facility, with flow pathways indicated by arrows. The CDS 2015 unit. (Figure courtesy of Contech Construction Products, Inc.)

Effluent was sampled directly by sweeping a 1000-mL sample bottle through the free discharge from the effluent pipe. Effluent from the CDS outlet pipe freely discharged into the catch tank and was pumped back to the influent line after passing through filter bags. The effluent filter consisted of a plate containing eighteen 7-in dia. x 34-in long, 50-µm nominal-rated, polypropylene felt filter bags. Background samples were collected by dipping a 1000 ml bottle into the furthest bay of the catch tank downstream from the filters.

Results and Discussion

Two tests, consisting of two phases each, were carried out on November 12, 2010. During phase one of the first test, actual flow rates were recorded at one minute intervals and indicate an average flow of 1.69 cfs (241% WTFR), and a minimum flow of 1.62 cfs (231% WTFR) (Table 2). The volume of sand before the test was measured as 18.6 cubic feet (14 inches deep by 54 inches diameter). After the test, the depth of sand was unchanged at 14 inches, indicating no measurable displacement of volume had occurred. During phase two, actual flow rates were measured at five minute intervals, concurrent with each sample. Average flow was 1.67 cfs (239% WTFR), and minimum flow was 1.59 (227% WTFR). Throughout the test, the minimum target flow rate of 1.4 cfs (200% WTFR) was exceeded throughout.

During the second test, the same frequency of flow measurements was maintained. The average flow in phase one was 3.13 cfs (447% WTFR), and the minimum flow was 3.09 cfs (441% WTFR) (Table 3). The volume of sand was unchanged at 18.6 cubic feet (14 inches deep by 54 inches diameter). After the test, the depth of sand was measured at 14 inches, again indicating that no measurable displacement of volume had occurred. The average flow in phase two was

3.13 cfs (447% WTFR), and the minimum was 3.01 cfs (430% WTFR). The target minimum flow of 2.8 cfs (400% WTFR) was exceeded throughout the second test.

TSS analysis of the samples collected in tests one and two was conducted on November 15, 2010, and results are presented in Tables 2 and 3, respectively. All background sediment concentrations were below the reporting limit (4 mg/L) and were not used to adjust effluent concentrations. All effluent concentrations were found to be below reporting limit, as well.

Table 2: Test 1 TSS results. Targeted minimum flow was 1.4 cfs (200% of WTFR).

	Time (minutes)	Flow (cfs)	Effluent TSS (mg/L)	Background TSS (mg/L)
Phase 2	5	1.67	ND	ND
	10	1.64	ND	ND
	15	1.59	ND	ND
	20	1.69	ND	ND
	25	1.62	ND	ND
	30	1.62	ND	ND
	Average Flow	**1.67**		

Table 3: Test 2 TSS results., Targeted minimum flow was 2.8 cfs (400% of WTFR).

	Time (minutes)	Flow (cfs)	Effluent TSS (mg/L)	Background TSS (mg/L)
Phase 2	5	3.15	ND	ND
	10	3.20	ND	ND
	15	3.01	ND	ND
	20	3.18	ND	ND
	25	3.09	ND	ND
	30	3.08	ND	ND
	Average Flow	**3.13**		

Conclusion

The scour testing conducted on the CDS 2015 indicates that there was no observable re-suspension of the test contaminant under either the 200% or 400% of WTFR scenario for the CDS 2015 unit under the stated test conditions. A representative from FB Environmental, an independent, third-party reviewer, observed all laboratory testing. Original analytical reports from Maine Environmental Laboratory were examined as well. FB Environmental reviewed sample plans, verified measurements, witnessed all sample collections, checked data against signed laboratory analysis reports. The data collected are complete, and the results are deemed to accurately represent the retention of solids within the CDS 2015 under the stated conditions.

I have reviewed and approve this report, entitled "Independent Review of CDS 2015 Evaluation Testing for Online Applications in the State of New Jersey."

Fort Bell — January 6, 2011

Principal of FB Environmental 97A Exchange St., Portland ME — Date