NJCAT TECHNOLOGY VERIFICATION

Hydro-Shield^{TM} Advance (HSA) Coarse Sediment Removal

Oldcastle Infrastructure

July 2026

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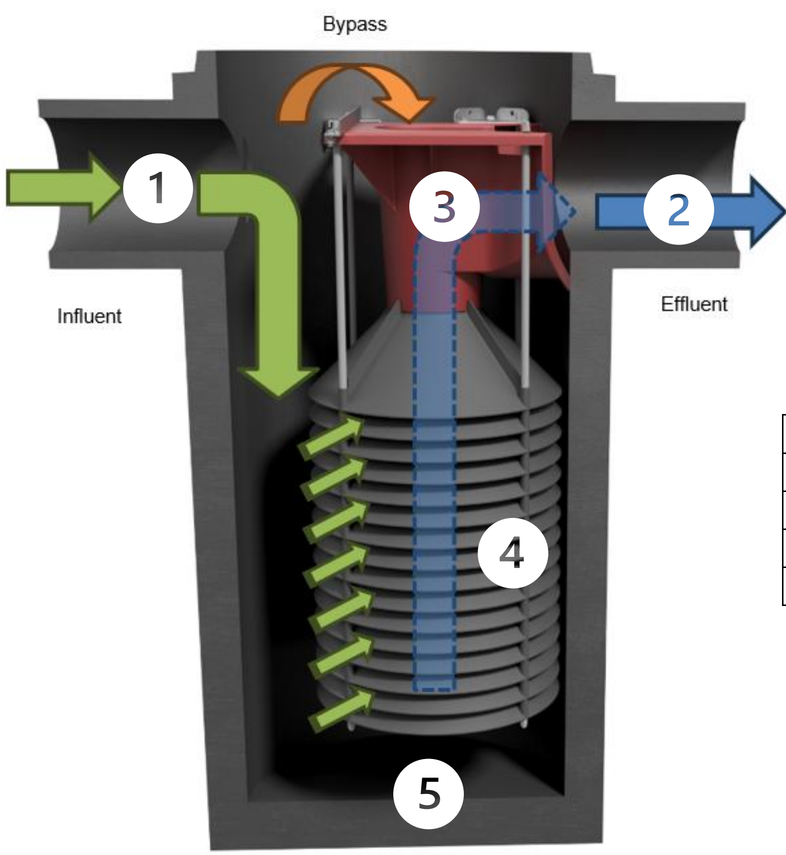
1. Description of Technology

The Hydro-Shield™ Advance (HSA) is a hydrodynamic separator designed and supplied by Oldcastle Infrastructure. The HSA is installed as part of typical drainage network systems to capture particulate pollutants that have entered the system from surface runoff. The HSA has a stack of inclined plates in which flow is directed upwards and any solids present fall to the surface of the plates, where they slide by gravity down to the bottom of the separator. Suspended sediment removal efficiency was the sole focus of this verification test.

The HSA chamber is typically a precast concrete manhole. The internal components are injection molded polypropylene. The internal components include a weir to divert higher flow rates over the treatment chamber to prevent captured particles from being resuspended and washed out. Stormwater enters the HSA through an inlet pipe. Suspended solids are captured in the sediment storage sump. Treated water exits the treatment chamber via an outlet chute and exits the HSA via an outlet pipe. An internal draindown allows the water levels within the system to reset between storm events. The inner components and flow path of the HSA are shown below in **Figure 1** and a top down view is shown in **Figure 2**.



1	Inlet Pipe
2	Outlet Pipe
3	Outlet Module
4	Treatment Module
5	Sediment Storage

Figure 1: Diagram Showing the Components of a Typical Hydro-Shield™ Advance

The unit shown represents a configuration with 16 cones (15 cone gaps)

Figure 2: Overhead View of Hydro-Shield^{TM} Advance Noting Draindown Component

2. Laboratory Testing

The New Jersey Corporation for Advanced Technology (NJCAT) verifies stormwater manufactured treatment device (MTD) performance. NJCAT requires that Total Suspended Solids (TSS) treatment devices that operate on hydrodynamic principles be tested according to the New Jersey Department of Environmental Protection (NJDEP) Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device dated January 1, 2021 (Last updated April 25, 2023. Henceforth referred to as "the Protocol"). **The test complied with all aspects of the Protocol except that the test sediment PSD was coarser than specified by the Protocol. As such, it is not eligible for NJDEP certification.**

The NJDEP Approval Process requires submittal of a Quality Assurance Project Plan (QAPP) to NJCAT for review and approval prior to testing to ensure that all laboratory procedures will be conducted in strict accordance with the NJDEP Protocol. The QAPP was submitted and approved by NJCAT in February 2026 prior to commencement of testing.

Testing was conducted in March-April 2026 by Oldcastle Infrastructure ("Oldcastle") at the company's full-scale hydraulic testing facility in Portland, Maine. Since testing was carried out in-house, Oldcastle contracted with FB Environmental Associates of Portland, Maine to provide NJDEP Protocol-required third-party oversight. NJCAT reviewed and approved the qualifications of the FB Environmental Associates representative who was present during all testing procedures. The test program was conducted in accordance with the 2023 NJDEP Protocol in two phases: removal efficiency testing and scour testing.

Testing was conducted with a full-scale 4-ft HSA 16-cone unit with commercially available internal components installed.

2.1 Test Setup

A schematic drawing of the laboratory setup is shown in **Figure 3**. Operating as a recirculating closed loop system, water from one of two 10,000-gallon supply tanks was pumped to the system via a Flygt submersible pump. Flow runs through a filter housing with 1-micron absolute filters before entering an 8-inch line that leads to 12-inch piping upstream of the test unit. The 12-inch effluent pipe from the test unit discharges freely into an 18-inch effluent pipework which discharges freely through a filter box fitted with 1-micron nominal filter bags to remove fine sediment that remained within the flow. The flow rate of the pump was controlled by a WEG CFW500 Adjustable Frequency Drive and measured by an EMCO Flow Systems 4411e Electromagnetic Flow Transmitter at flow rates under 1.8 cfs and an 8-inch Keyence FD-R200 flow meter above 1.8 cfs. A 1-inch background sampling port and ball valve were installed with a saddle clamp at the bottom of the line, 20 feet upstream of the HSA unit.

A three-way valve was located between the Flygt pump and the HSA unit which conveyed the flow to enter the HSA from either the 10-inch pump or a 4-inch Goulds pump. The 4-inch line runs through a similar filter housing with 1-micron absolute filters before entering a Badger Meter M2000 Electromagnetic Flow Meter. The 4-inch flow path was used for flow rates less than 0.35 cfs.

The water temperature within the tank was regulated by a Hayward 350FD pool heater. Water temperature was measured in the supply tank with a LASCAR EL-USB-TP-LCD sensor and logger. The sensor was placed near the 8-inch pump to provide a representative measurement of the water entering the test system. The sensor was placed near the 4-inch pump when used. Maximum temperature remained below 80° F for the duration of all tests. Temperature was recorded every 5 seconds. The original thermocouple calibration was confirmed by the independent observer.

During performance testing, test sediment was injected through an Auger Feeder Model VF-2 volumetric screw feeder upstream of the HSA unit. The auger was calibrated prior to each test.

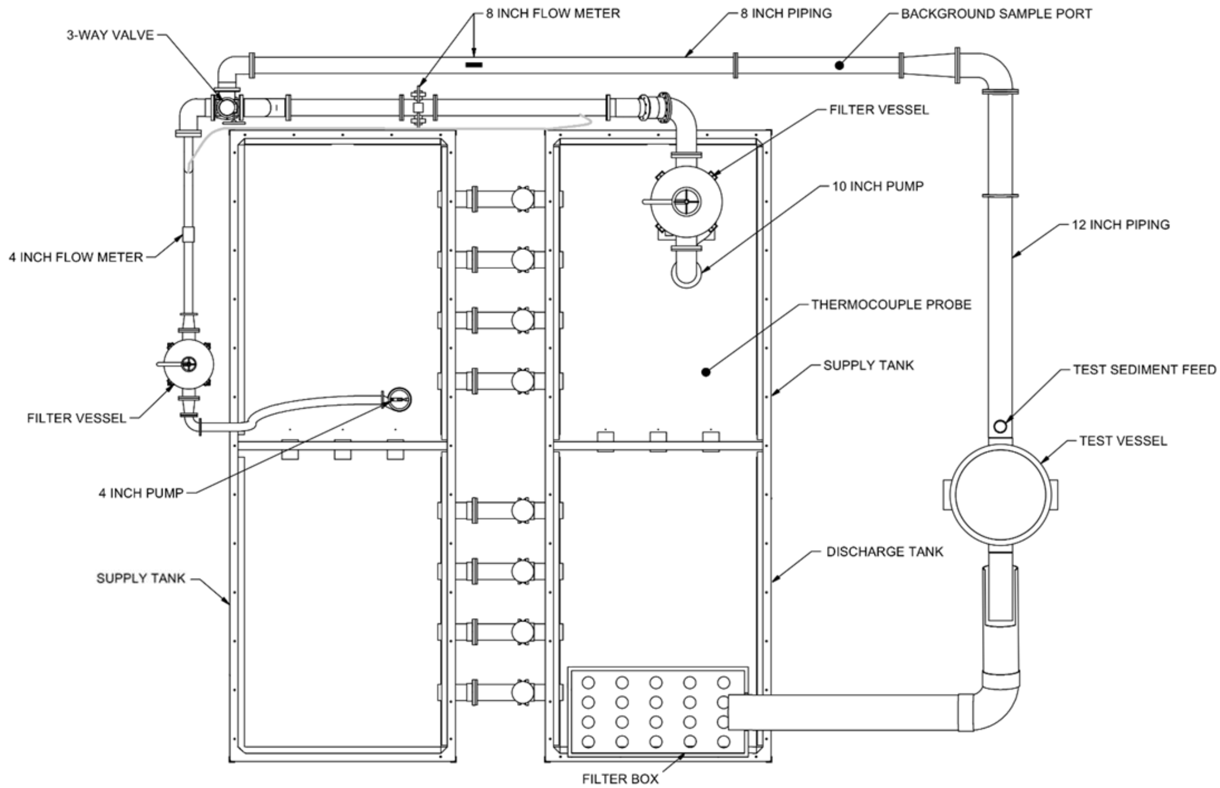


Figure 3: Laboratory Testing Arrangement Diagram

Test Unit Description

The laboratory arrangement was designed for a 4-ft HSA test unit comprised of full-scale, commercially available internal components installed in a 4-ft round plastic manhole chamber consistent in all key dimensions with the precast chambers used for commercial sales. The plastic chamber, shown below in **Figure 4**, is part of a modular system used to test a variety of different products. Features not applicable for the HSA have been sealed off with contoured plugs to maintain the correct manhole interior geometry. Both the inlet and outlet pipe diameters of the test unit were 12-inch schedule 40 PVC pipe. Both the inlet and outlet pipes were set at a 2% slope.

The plastic manhole chamber system can support a false floor at two different positions relative to the treatment module. The upper position allows for the simulation of a 50% full sump condition for use during removal efficiency testing. The lower position allows for 4 inches of sediment to be pre-loaded before scour testing. The test unit dimensions shown in **Figure 5** were confirmed by the independent observer prior to testing.

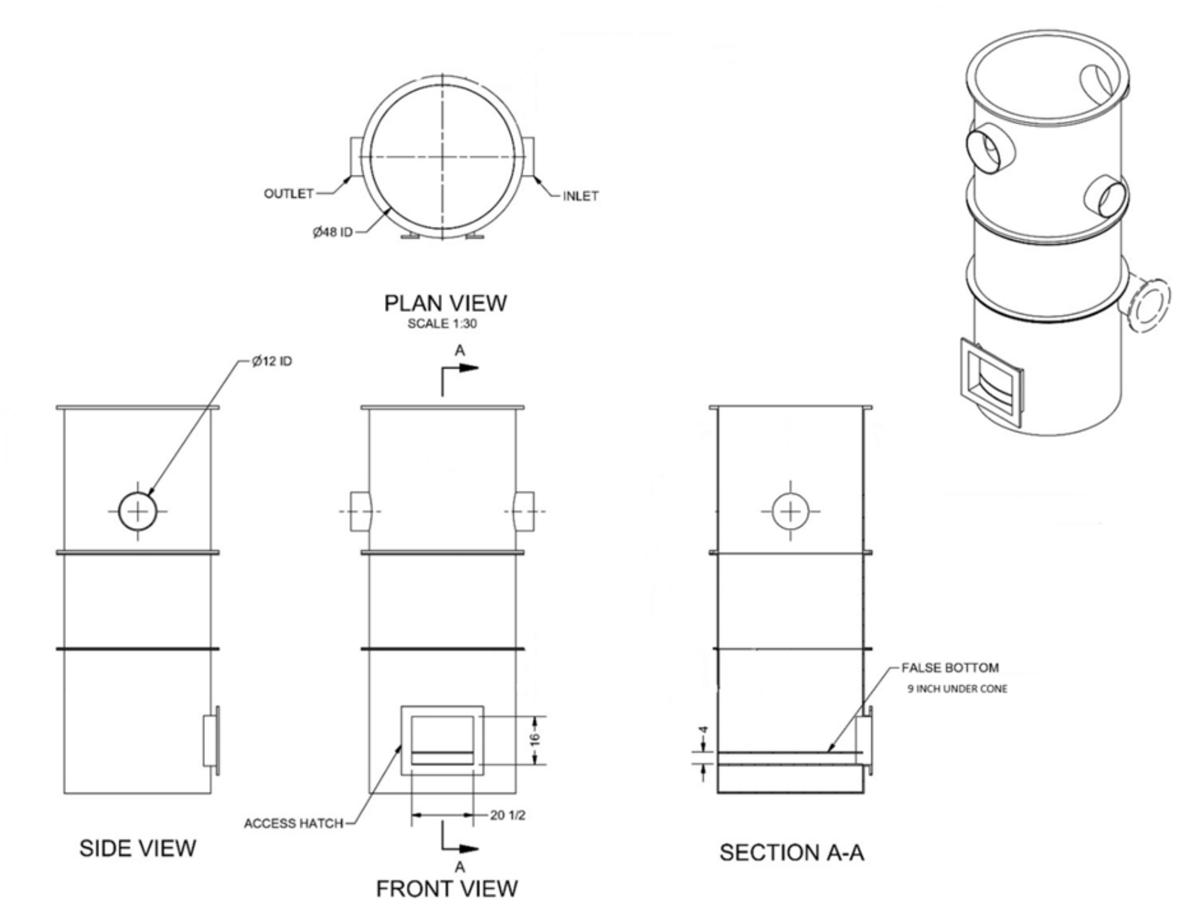


Figure 4: Test Vessel Configuration

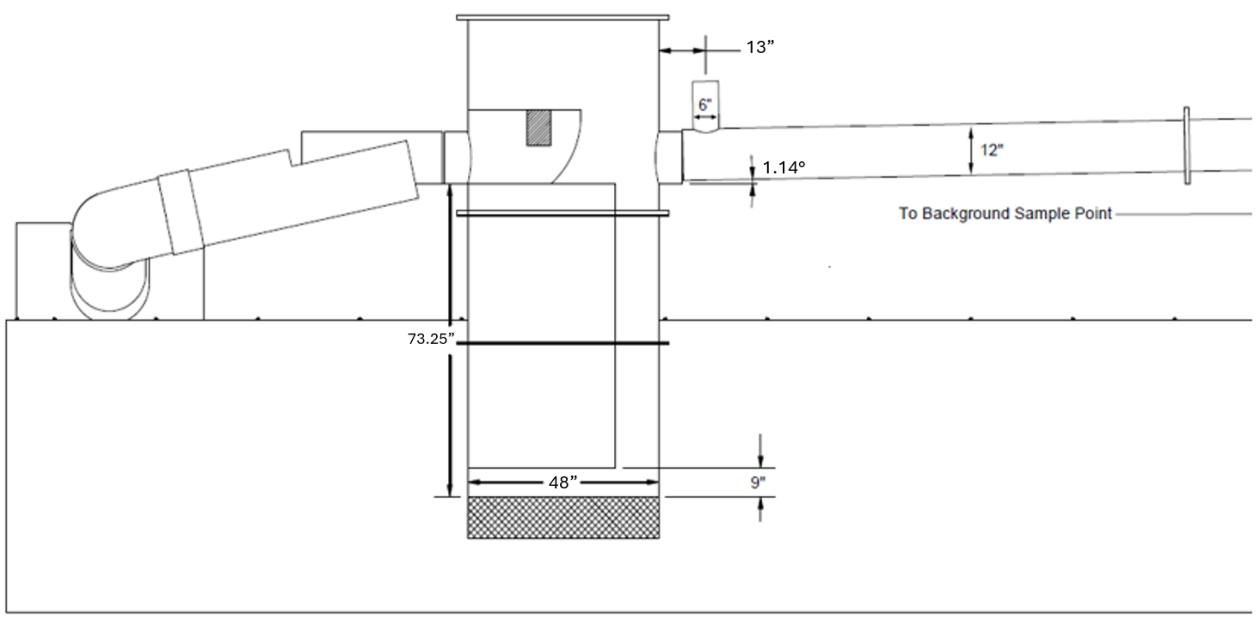


Figure 5: Key Dimensions of Test Vessel

2.2 Test Sediment

The test sediment for removal efficiency testing was a blend of commercially available silica sand grades supplied by AGSCO Corporation. The particle size distribution (PSD) was independently verified by GeoTesting Express of Acton, Massachusetts (A2LA, AASHTO, and USACE Accredited and certified for D6913 by the state of Massachusetts) to ascertain the distribution of the coarse sediment.

A gap in sediment custody after the 10% MTFR removal efficiency test required that the sediment was validated for a second time. **Table 1** and **Figure 6** show the particle size distribution as it was measured prior to the 10% MTFR test. The d_{50} of this analysis is 135 microns. **Table 2** and **Figure 7** show the particle size distribution as it was measured for all of the following RE test runs. The d_{50} of this analysis is 128 µm. It should be noted that the slightly coarser sediment for the 10% MTFR run does not represent a separate batch of test sediment, but only a duplicate analysis of the same batch used for the remainder of the test runs.

The moisture content of the test sediment was verified by GeoTesting Express, referencing ASTM D2216 "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass". The moisture content was found to be 0.1% or less for all samples.

Table 1: Particle Size Distribution of Removal Efficiency Sediment for 10% MTFR

Particle Size (µm)	% Finer[1]			Test Sediment Average
	Sample 1	Sample 2	Sample 3	
1000	100	100	100	100
500	100	100	100	100
250	98	99	98	98
150	63	60	72	65
100	11	14	16	14
75	4	4	6	5

[1]Where required, particle size data has been interpolated.

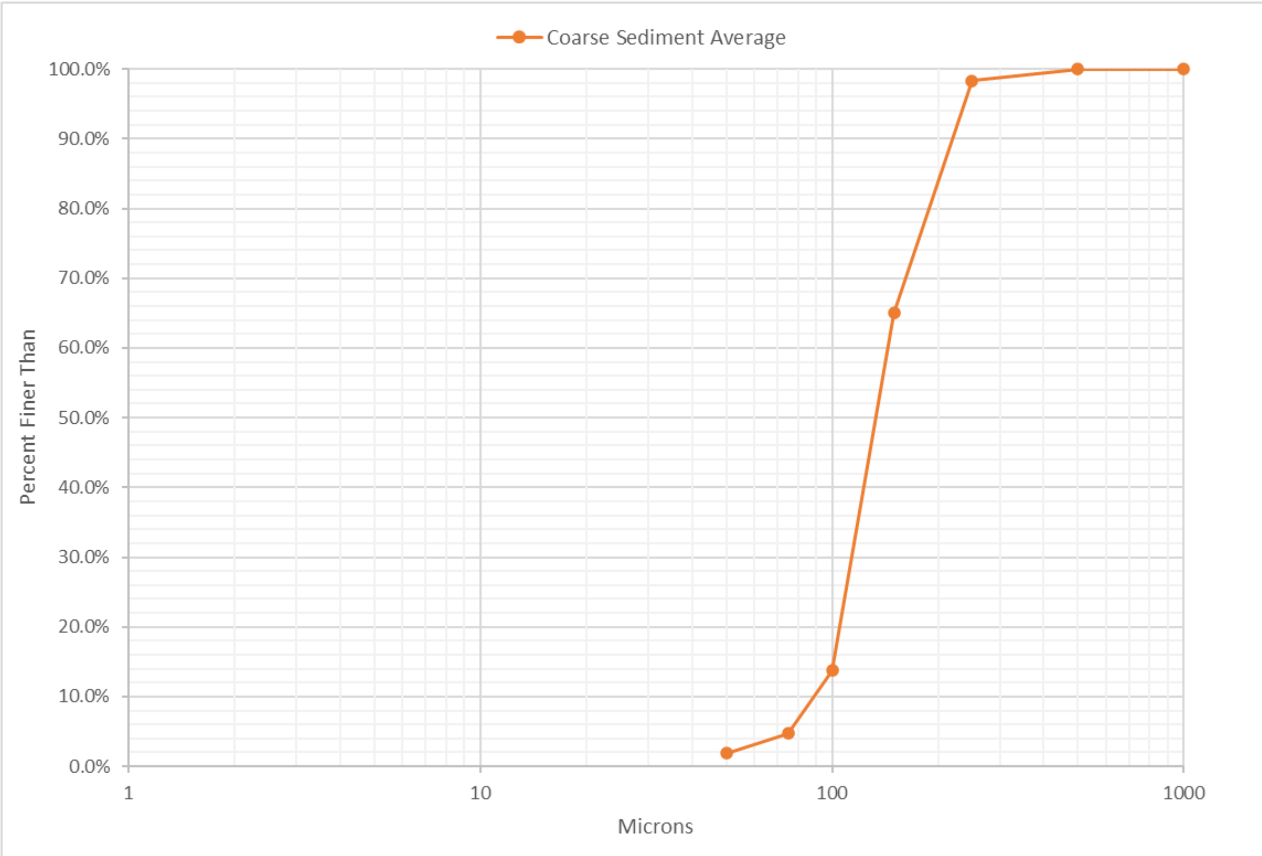


Figure 6: Average PSD of Removal Efficiency Sediment for 10% MTFR

Table 2: Particle Size Distribution of Removal Efficiency Sediment for Removal Efficiency Testing (Excluding 10% MTFR)

Particle Size (µm)	% Finer[1]			Test Sediment Average
	Sample 1	Sample 2	Sample 3	
1000	100	100	100	100
500	100	100	100	100
250	99	99	99	99
150	80	68	66	71
100	28	15	13	19
75	7	4	4	5

[1]Where required, particle size data has been interpolated.

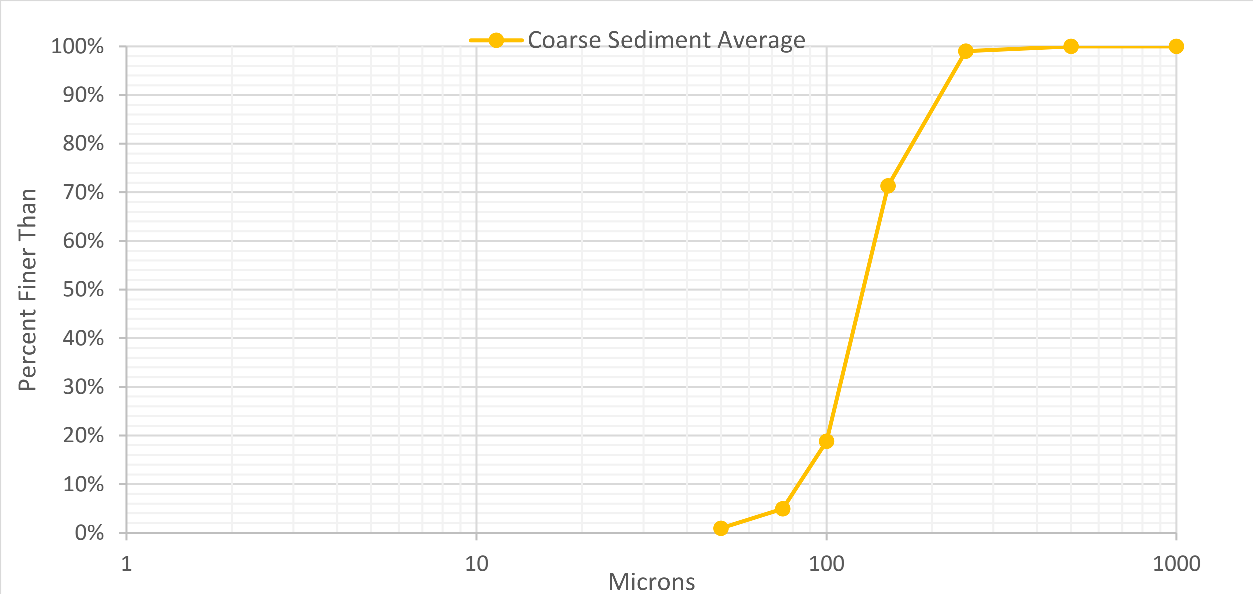


Figure 7: Average PSD of Removal Efficiency Sediment for Removal Efficiency Testing (Excluding 10% MTFR)

The scour sediment was blended by Oldcastle, and the particle size distribution was independently confirmed by GeoTesting Express in Acton, Massachusetts certifying that the supplied silica meets the specification described in Section 4A of the Protocol. Results of particle size gradation testing are shown in **Table 3** and **Figure 8** below.

The scour blend was stored in five-gallon buckets. The independent observer assisted in collecting three representative samples composited from each of the five-gallon buckets prior to testing. The buckets were sealed by the independent observer until they were used for testing. The d_{50} of sample 1 was 107 µm, sample 2 106 µm and sample 3 106 µm, resulting in a d_{50} of the blend of 106 µm. The scour test sediment was finer than the NJDEP protocol requirements. The moisture content was found to be 0.0% for all samples.

Table 3: Particle Size Distribution Results of Scour Sediment Samples

Particle Size (µm)	% Finer				Test Sediment Average	Diff. from Protocol
	Protocol	Sample 1	Sample 2	Sample 3		
1000	100	100	100	100	100	0.0
500	90	100	100	100	100	-10.0
250	55	98	98	99	98	-43.3
150	40	82	83	84	83	-43.0
100	25	49	50	50	41	-16.4
75	10	20	21	21	21	-10.7
50	0	7	7	7	7	-6.6

[1]Where required, particle size data has been interpolated.

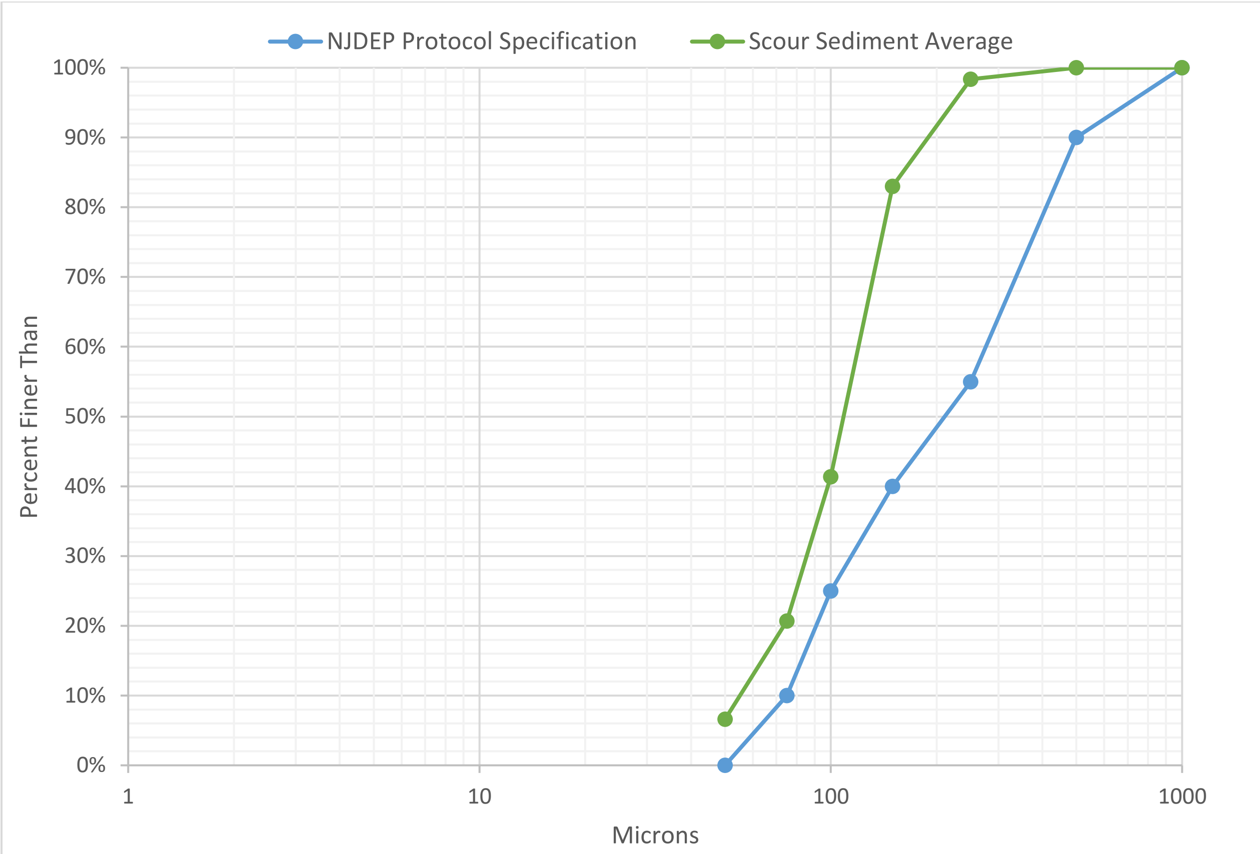


Figure 8: Average PSD of Scour Sediment Compared to NJDEP Protocol Specification

2.3 Sediment Removal Efficiency Testing

Removal efficiency testing was conducted using the Mass Capture Test Method in accordance with Sections 4B and 4C of the Protocol for Hydrodynamic Sedimentation Manufactured Treatment Devices (HDS MTDs). A total of seven flow rates were tested: 10%, 25%, 50%, 75%, 100%, 125%, and 150% of the target Maximum Treatment Flow Rate (MTFR).

When in use, data from the EMCO flow transmitter was logged every 5 seconds with a USB data logger. The output of the 8-inch Keyence FD-R200 flow meter was logged every 5 seconds with a Keyence NR-X100 data acquisition unit. All flow rates were within 10% of the targeted value and the coefficient of variance (COV) did not exceed 0.03. Flow continued for at least one detention time after the sediment feed was stopped to allow for sediment that would not normally be captured to pass through the MTD. The water temperature was recorded every 5 seconds to ensure that it did not exceed 80^{o} F.

Background samples were taken at the background sample port located upstream from the sediment injection point. A minimum of eight influent background samples were taken at evenly spaced intervals during each run. The Suspended Sediment Concentration (SSC) for background samples did not exceed 20 mg/L. Each collected sample was time stamped, sealed, and signed by the independent observer. All samples were analyzed by Apex Laboratory, Tigard, Oregon in accordance with ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentrations in Water Samples".

The test sediment feed rate and total mass of test sediment introduced during each test run was a known quantity and introduced at a rate within 10% of the targeted value of 200 mg/L influent concentration. A minimum of 25 lbs of sediment was fed into the unit during each test. The total sediment introduced to the system was calculated by weighing the sediment in the auger hopper before and after the test run with an Ohaus Defender 5000 bench scale. The times of sediment calibration samples, sediment feed start, feed stop, and flow start/stop were recorded every test run.

Six sediment feed calibration samples were taken from the injection point at evenly spaced intervals during each test. Calibration samples were taken by collecting the sediment at the outlet of the auger. Each sample was collected in a clean container over an interval timed to the nearest second. Each sample was weighed to the nearest 0.1 gram on an Ohaus Pioneer (Model PA1602) laboratory balance observed by the independent observer. The concentration coefficient of variance (COV) did not exceed 0.10.

After each test the test unit was decanted and the sediment allowed to settle. The residual mixture of water and test sediment was removed and placed into pre-weighed non-ferrous trays. The sediment was dried in house in a convection oven until a constant weight was obtained when cooled to room temperature, as determined by two successive measurements taken no less than two hours apart which show no more than a 0.1% difference in measured mass weighed to a precision of 10 grams. When present, any sediment remaining in the inlet pipe was separately cleaned out, dried, and weighed following the same procedure.

Removal efficiency was calculated for each % MTFR run per **Equation 1**.

$$Removal\ Efficiency\ (\%) = \left(\frac{Total\ Mass\ Collected\ in\ MTD}{Total\ Mass\ Input\ During\ Run}\right) * 100 \qquad \textbf{Equation 1}$$

2.4 Scour Testing

To simulate a 50% full sump condition, the HSA sump false bottom is 13 inches from the treatment module and was topped with 4 inches of scour test sediment. The sediment was levelled and then the test unit was filled with clear water to its normal operating depth. Scour testing began within 48 hours after the sump was pre-loaded with test sediment. All setup, measurements, testing, and sample collection procedures were observed by the independent observer.

Scour testing began by introducing flow and ramping up the flow rate until it reached a minimum of 200% of the MTFR within three minutes of starting. The flow rate remained constant at the target maximum flow rate for the remainder of the test duration. The flow rate was recorded at 5 second intervals.

A total of 15 effluent samples were taken over the duration of the test. Effluent samples were taken at 1, 3, and 5 minutes after the flow of clear water entered the test unit. Effluent samples were then taken every two minutes for an additional 12 samples (i.e., 7, 9, 11…29 minutes.) All 15 samples were used to determine average effluent concentration. The effluent samples were collected in 1L wide-mouth plastic bottles using the grab sampling method with a minimum volume of 500 milliliters.

Eight background samples were collected at evenly spaced intervals with each odd number effluent sample throughout the duration of the test. The background samples were drawn from the background sample port located upstream of the Hydro-Shield™ Advance. At the conclusion of the test, all the collected effluent and background water quality samples were placed into a delivery box, sealed, and transported to a courier for delivery. All samples were analyzed by Apex Laboratory in accordance with ASTM D3977-97. All adjusted effluent samples were included in the calculation of the average effluent concentration.

2.5 Quality Objectives and Criteria

Samples sent to the external lab were conveyed to the lab for analysis as soon as possible following each test. Auger sample weights analyzed in-house were observed by the third-party witness and were conducted immediately following sample collection.

A Chain of Custody form was used for externally analyzed samples to record sample containers and sampling date and time for each test. Copies of these forms are retained by Oldcastle. Sample bottles were labeled to identify the test number and sample type (background or effluent) which corresponded to the sample identification on the Chain of Custody form. All sample markings were verified by the third-party witness who transported all samples to the courier for delivery to the laboratory.

Data was recorded and retained in accordance with standard laboratory procedures used at Oldcastle. Hard copies of all original data sets are retained on-site.

The following quality criteria were used to compare results from individual tests:

- Background SSC concentrations not to exceed 20 mg/L
- Temperature of test water not to exceed 80°F
- Variation in calculated influent concentration not to exceed 10% of target concentration
- COV of dry calibration samples not to exceed 0.10
- Variation in flow rate not to exceed 10% of target flow rate
- COV of flow rate not to exceed 0.03

3. Performance Claims

Based on the laboratory testing conducted for the HSA, the following are the performance claims made by Oldcastle.

Total Suspended Solids (TSS) Removal Efficiency

The TSS removal rate of the HSA is dependent upon flow rate, particle density, and particle size. For the coarse particle size distribution and weighted calculation method required by the NJDEP HDS MTD protocol, the 4-ft HSA at a MTFR of 1.99 cfs will demonstrate at least 80% annualized weighted TSS removal efficiency. MTFRs and Sediment Removal Intervals for HSA Models are in **Table A-1** in the Appendix.

Effective Sedimentation Treatment Area (ESTA)

The effective sedimentation treatment area of the 4-ft 16 cone HSA is 12.6 sq. ft.

Projected Treatment Area

The projected treatment area equals the chamber area (ESTA) plus the projected cone area times the number of cone gaps (**Table A-1**).

Maximum Treatment Flow Rate (MTFR)

The MTFR for the 4-ft HSA was demonstrated to be 56.4 l/s (1.99 cfs, 893.2 gpm) which corresponds to a hydraulic loading rate of 8.37 gpm/sq. ft of projected treatment area.

Sediment Storage Depth and Volume

The maximum full sump sediment storage depth of the HSA is 18 inches. Available sump volume varies with each HSA model as diameter increases. The available sump volume for a 4-ft HSA model is 0.70 cubic yards. The maximum sediment storage depth is 9 inches, which corresponds to a 50% full sump capacity of 0.35 cubic yards for the standard model (see Appendix **Table A-2**).

Online or Offline Installation

Based on the results of the Scour Test shown in Section 4.2, the 4-ft HSA qualifies for online or offline installation.

Wet Volume and Detention Time

The detention time of the HSA depends on flow rate and model size. The detention time is calculated by dividing the treatment volume by the flow rate. The treatment volume is defined as the volume between the pipe invert and the top of the sediment storage zone. For the tested 4-ft HSA at the target MTFR of 2.25 cfs, the detention time is 45 seconds.

4. Supporting Documentation

The NJDEP Process (NJDEP 2021) for obtaining verification of a stormwater manufactured treatment device (MTD) from the NJCAT requires that “copies of the laboratory test reports, including all collected and measured data; all data from performance evaluation tests; spreadsheets containing original data from all performance tests; all pertinent calculations; etc.” be included in this section. This was discussed with NJCAT, and it was agreed that as long as such documentation could be made available by NJCAT upon request, it would not be prudent or necessary to include all this information in this verification report. This information is retained by Oldcastle and is available upon request

4.1 Removal Efficiency

Removal efficiency testing was executed on the 4-ft Hydro-Shield^{TM} Advance unit in order to establish the ability of the Hydro-Shield^{TM} Advance to remove the specified test sediment at 10%, 25%, 50%, 75%, 100%, 125%, and 150% of the target MTFR. The target MTFR was 63.7 l/s (2.25 cfs).

All results reported in this section were derived from test runs that fully complied with the requirements of the Protocol. None of the collection intervals of the calibration samples exceeded one minute in duration for any of the reported tests. The inlet feed concentration coefficient of variance did not exceed 0.10 for any flow rate trials. No background SSC concentrations exceeded the 20 mg/L maximum allowed by the protocol. At no point did the water temperature exceed 80 °F. Below in **Table 4** are the removal efficiencies for all of the test runs.

Table 4: Summarized Removal Efficiency from Captured Sediment

% Target MTFR	10	25	50	75	100	125	150
Total Mass Injected (lb)	30.220	30.445	30.455	30.675	30.615	30.355	31.070
Total Sediment Feed Calibration Samples (lb)	1.038	1.325	1.352	1.943	2.577	2.175	2.643
Sediment Retained in Inlet Pipe (lb)	0.035	1.587	0.269	0.432	0.026	0.022	0.026
Sediment Feed into MTD (lb)	29.147	27.533	28.834	28.300	28.012	28.158	28.401
Sediment Captured in MTD (lb)	28.656	26.429	25.904	18.131	14.965	8.951	5.582
Removal Efficiency (%)	98.3%	96.0%	89.8%	64.1%	53.4%	31.8%	19.7%

The removal efficiency curve is shown in **Figure 9** below and a summary of the removal efficiencies are displayed in **Table 5**. The removal efficiency curve R^2 value of 0.993 exceeded the minimum requirement of 0.95. The 4-ft HSA achieved an 80% annualized weighted SSC removal at an MTFR of 1.99 cfs (893.2 gpm).

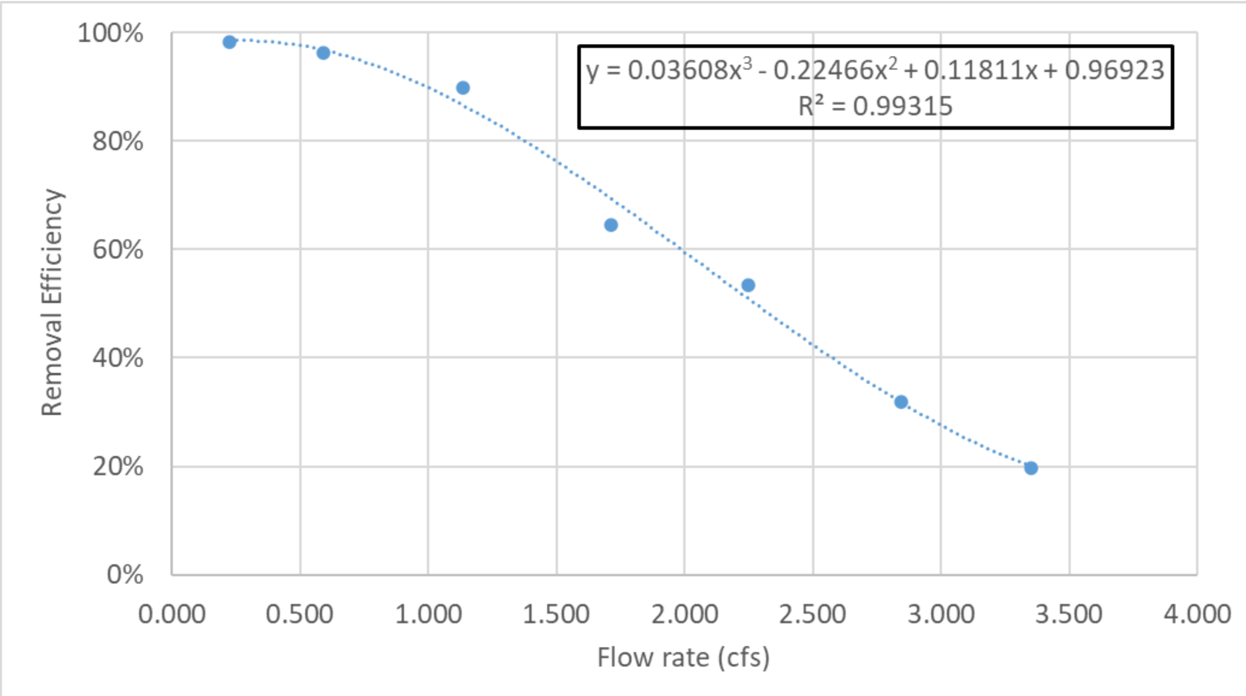


Figure 9: Removal Efficiency vs. Flow Rate

Table 5: Calculated Removal Efficiency Results Summary

% MTFR	Flow Rate (cfs)	Removal Efficiency (%)	Weighting Factor	Weighted Removal (%)
25	0.498	97.7	0.25	24.4
50	0.995	90.0	0.30	27.0
75	1.493	76.5	0.20	15.3
100	1.990	59.9	0.15	9.0
125	2.488	42.8	0.10	4.3
Annualized Weighted Removal Efficiency (%)				80.0

Individualized test results detailing the sampling schedule, flow, temperature, and sediment measurements are provided in the sections below.

4.1.1 10% MTFR

Table 6: Sampling Schedule - 10% MTFR

Elapsed Time (hh:mm:ss)	Sediment Feed Sample	Background Sample
00:00:00	1	1
00:24:11		2
00:33:52	2	
00:48:23		3
01:07:44	3	
01:12:34		4
01:36:46		5
01:41:36	4	
02:00:57		6
02:15:28	5	
02:25:09		7
02:49:20	6	8
MTD Detention Time = 7.07 minutes Sediment Calibration Sampling Time = 60 seconds Auger Off at 02:50:20		

Table 7: Flow - 10% MTFR

Units	Target Flow	Actual Flow	QA/ QC		
			±10%	COV	COV ≤ 0.03
cfs	0.23	0.23	PASS	0.003	PASS
l/s	6.40	6.40			

Table 8: Temperature - 10% MTFR

Maximum Temperature (°F)	QA/QC
	≤ 80 °F
74.6	PASS

Table 9: Background SSC - 10% MTFR

Sample ID	Concentration (mg/L)	QA/QC ≤ 20 mg/L
1	12.1	PASS
2	9.3	PASS
3	0.25[1]	PASS
4	0.25[1]	PASS
5	0.25[1]	PASS
6	0.25[1]	PASS
7	0.25[1]	PASS
8	0.25[1]	PASS

Note 1: Measurements below the method detection limit of 0.5 mg/L are reported as half of the MDL.

Table 10: Sediment Feed - 10% MTFR

	Mass (g)
Sample 1	76.32
Sample 2	79.78
Sample 3	80.86
Sample 4	81.62
Sample 5	81.43
Sample 6	70.73
Total	470.74
Average	78.46
QA/QC	
COV	0.054
COV ≤ 0.10	PASS

Table 11: Sediment Mass Balance - 10% MTFR

Pre Test Sediment Mass (lb)	85.000
Post Test Sediment Mass (lb)	54.780
Sediment Mass Used (lb)	30.220
Sediment Mass Used Adjusted for Feed Samples (lb)	29.182
Mass of Sediment Retained in Inlet Pipe (lb)	0.035
Mass of Sediment Captured (lb)	28.656
Water Volume During Sediment Addition (L)	63,104
Average Sediment Concentration (mg/L)	208.6
QA/QC	
Total Mass Added ≥ 25 lbs	PASS
Average Concentration within ±10% of 200 mg/L	PASS

4.1.2 25% MTFR

Table 12: Sampling Schedule - 25% MTFR

Elapsed Time (hh:mm:ss)	Sediment Feed Sample	Background Sample
00:00:00	1	1
00:09:46		2
00:13:40	2	
00:19:31		3
00:27:20	3	
00:29:17		4
00:39:03		5
00:41:00	4	
00:48:49		6
00:54:40	5	
00:58:34		7
01:08:20	6	8
MTD Detention Time = 2.83 minutes Sediment Calibration Sampling Time = 30 seconds Auger Off at 01:08:50		

Table 13: Flow - 25% MTFR

Units	Target Flow	Actual Flow	QA/ QC		
			±10%	COV	COV ≤ 0.03
cfs	0.57	0.59	PASS	0.010	PASS
l/s	16.0	16.73			

Table 14: Temperature - 25% MTFR

Maximum Temperature (°F)	QA/QC
	≤ 80 °F
75.1	PASS

Table 15: Background SSC - 25% MTFR

Sample ID	Concentration (mg/L)	QA/QC
		≤ 20 mg/L
1	5.0	PASS
2	14.7	PASS
3	0.8	PASS
4	0.25[1]	PASS
5	0.25[1]	PASS
6	0.25[1]	PASS
7	0.25[1]	PASS
8	0.25[1]	PASS

Note 1: Measurements below the method detection limit of 0.5 mg/L are reported as half of the MDL.

Table 16: Sediment Feed - 25% MTFR

	Mass (g)
Sample 1	91.73
Sample 2	100.30
Sample 3	101.48
Sample 4	101.51
Sample 5	101.62
Sample 6	104.26
Total	600.90
Average	100.15
QA/QC	
COV	0.043
COV ≤ 0.10	PASS

Table 17: Sediment Mass Balance - 25% MTFR

Pre Test Sediment Mass (lb)	85.000
Post Test Sediment Mass (lb)	54.555
Sediment Mass Used (lb)	30.445
Sediment Mass Used Adjusted for Feed Samples (lb)	29.120
Mass of Sediment Captured (lb)	26.429
Mass of Sediment Retained in Inlet Pipe (lb)	1.587
Water Volume During Sediment Addition (L)	66,084
Average Sediment Concentration (mg/L)	199.9
QA/QC	
Total Mass Added ≥ 25 lbs	PASS
Average Concentration within ±10% of 200 mg/L	PASS

4.1.3 50% MTFR

Table 18: Sampling Schedule - 50% MTFR

Elapsed Time (hh:mm:ss)	Sediment Feed Sample	Background Sample
00:00:00	1	1
00:04:53		2
00:06:50	2	
00:09:46		3
00:13:40	3	
00:14:39		4
00:19:31		5
00:20:30	4	
00:24:24		6
00:27:20	5	
00:29:17		7
00:34:10	6	8
MTD Detention Time = 1.42 minutes Sediment Calibration Sampling Time = 15 seconds Auger Off at 00:34:25		

Table 19: Flow - 50% MTFR

Units	Target Flow	Actual Flow	**QA/ QC**		
			±10%	COV	COV ≤ 0.03
cfs	1.13	1.13	PASS	0.006	PASS
l/s	32.0	32.13			

Table 20: Temperature - 50% MTFR

Maximum Temperature (°F)	QA/QC
	≤ 80 °F
73.5	PASS

Table 21: Background SSC – 50% MTFR

Sample ID	Concentration (mg/L)	QA/QC
		≤ 20 mg/L
1	0.25[1]	PASS
2	0.25[1]	PASS
3	0.25[1]	PASS
4	0.6	PASS
5	1.2	PASS
6	0.25[1]	PASS
7	1.4	PASS
8	1.1	PASS

Note 1: Measurements below the method detection limit of 0.5 mg/L are reported as half of the MDL.

Table 22: Sediment Feed - 50% MTFR

	Mass (g)
Sample 1	94.08
Sample 2	101.70
Sample 3	100.76
Sample 4	102.57
Sample 5	103.00
Sample 6	111.36
Total	613.47
Average	102.25
QA/QC	
COV	0.054
COV ≤ 0.10	PASS

Table 23: Sediment Mass Balance - 50% MTFR

Pre Test Sediment Mass (lb)	85.000
Post Test Sediment Mass (lb)	54.545
Sediment Mass Used (lb)	30.455
Sediment Mass Used Adjusted for Feed Samples (lb)	29.103
Mass of Sediment Captured (lb)	25.904
Mass of Sediment Retained in Inlet Pipe (lb)	0.269
Water Volume During Sediment Addition (L)	63,457
Average Sediment Concentration (mg/L)	208.0
QA/QC	
Total Mass Added ≥ 25 lbs	PASS
Average Concentration within ±10% of 200 mg/L	PASS

4.1.4 75% MTFR

Table 24: Sampling Schedule - 75% MTFR

Elapsed Time (hh:mm:ss)	Sediment Feed Sample	Background Sample
00:00:00	1	1
00:03:20		2
00:04:40	2	
00:06:40		3
00:09:20	3	
00:10:00		4
00:13:20		5
00:14:00	4	
00:16:40		6
00:18:40	5	
00:20:00		7
00:23:20	6	8
MTD Detention Time = 0.95 minutes Sediment Calibration Sampling Time = 15 seconds Auger Off at 00:23:35		

Table 25: Flow - 75% MTFR

Units	Target Flow	Actual Flow	QA/ QC		
			±10%	COV	COV ≤ 0.03
cfs	1.70	1.71	PASS	0.009	PASS
l/s	48.0	48.46			

Table 26: Temperature - 75% MTFR

Maximum Temperature (°F)	QA/QC
	≤ 80 °F
75.0	PASS

Table 27: Background SSC - 75% MTFR

Sample ID	Concentration (mg/L)	QA/QC ≤ 20 mg/L
1	0.25[1]	PASS
2	0.25[1]	PASS
3	0.7	PASS
4	0.25[1]	PASS
5	0.25[1]	PASS
6	0.6	PASS
7	0.25[1]	PASS
8	0.25[1]	PASS

Note 1: Measurements below the method detection limit of 0.5 mg/L are reported as half of the MDL.

Table 28: Sediment Feed - 75% MTFR

	Mass (g)
Sample 1	126.47
Sample 2	150.78
Sample 3	151.63
Sample 4	151.58
Sample 5	148.80
Sample 6	152.29
Total	881.55
Average	146.93
QA/QC	
COV	0.069
COV ≤ 0.10	PASS

Table 29: Sediment Mass Balance - 75% MTFR

Pre Test Sediment Mass (lb)	85.000
Post Test Sediment Mass (lb)	54.325
Sediment Mass Used (lb)	30.675
Sediment Mass Used Adjusted for Feed Samples (lb)	28.732
Mass of Sediment Captured (lb)	18.131
Mass of Sediment Retained in Inlet Pipe (lb)	0.432
Water Volume During Sediment Addition (L)	64,210
Average Sediment Concentration (mg/L)	203.0
QA/QC	
Total Mass Added ≥ 25 lbs	PASS
Average Concentration within ±10% of 200 mg/L	PASS

4.1.5 100% MTFR

Table 30: Sampling Schedule - 100% MTFR

Elapsed Time (hh:mm:ss)	Sediment Feed Sample	Background Sample
00:00:00	1	1
00:02:34		2
00:03:36	2	
00:05:09		3
00:07:12	3	
00:07:43		4
00:10:17		5
00:10:48	4	
00:12:51		6
00:14:24	5	
00:15:26		7
00:18:00	6	8
MTD Detention Time = 0.75 minutes Sediment Calibration Sampling Time = 15 seconds Auger Off at 00:18:15		

Table 31: Flow - 100% MTFR

Units	Target Flow	Actual Flow	QA/ QC		
			±10%	COV	COV ≤ 0.03
cfs	2.26	2.25	PASS	0.009	PASS
l/s	63.72	63.72			

Table 32: Temperature - 100% MTFR

Maximum Temperature (°F)	QA/QC
	≤ 80 °F
75.0	PASS

Table 33: Background SSC - 100% MTFR

Sample ID	Concentration (mg/L)	QA/QC
		≤ 20 mg/L
1	0.6	PASS
2	0.6	PASS
3	0.25[1]	PASS
4	0.25[1]	PASS
5	0.25[1]	PASS
6	0.25[1]	PASS
7	0.25[1]	PASS
8	0.25[1]	PASS

Note 1: Measurements below the method detection limit of 0.5 mg/L are reported as half of the MDL.

Table 34: Sediment Feed - 100% MTFR

	Mass (g)
Sample 1	175.39
Sample 2	194.55
Sample 3	196.81
Sample 4	197.52
Sample 5	193.70
Sample 6	210.97
Total	1169.02
Average	194.84
QA/QC	
COV	0.059
COV ≤ 0.10	PASS

Table 35: Sediment Mass Balance - 100% MTFR

Pre Test Sediment Mass (lb)	85.000
Post Test Sediment Mass (lb)	54.385
Sediment Mass Used (lb)	30.615
Sediment Mass Used Adjusted for Feed Samples (lb)	28.038
Mass of Sediment Captured (lb)	14.965
Mass of Sediment Retained in Inlet Pipe (lb)	0.026
Water Volume During Sediment Addition (L)	64,039
Average Sediment Concentration (mg/L)	198.6
QA/QC	
Total Mass Added ≥ 25 lbs	PASS
Average Concentration within ±10% of 200 mg/L	PASS

4.1.6 125% MTFR

Table 36: Sampling Schedule - 125% MTFR

Elapsed Time (hh:mm:ss)	Sediment Feed Sample	Background Sample
00:00:00	1	1
00:02:01		2
00:02:50	2	
00:04:03		3
00:05:40	3	
00:06:04		4
00:08:06		5
00:08:30	4	
00:10:07		6
00:11:20	5	
00:12:09		7
00:14:10	6	8
MTD Detention Time = 0.60 minutes Sediment Calibration Sampling Time = 10 seconds Auger Off at 00:14:20		

Table 37: Flow - 125% MTFR

Units	Target Flow	Actual Flow	QA/ QC		
			±10%	COV	COV ≤ 0.03
cfs	2.83	2.84	PASS	0.008	PASS
l/s	80.50	80.50			

Table 38: Temperature - 125% MTFR

Maximum Temperature (°F)	QA/QC
	≤ 80 °F
73.4	PASS

Table 39: Background SSC - 125% MTFR

Sample ID	Concentration (mg/L)	QA/QC ≤ 20 mg/L
1	0.25[1]	PASS
2	0.25[1]	PASS
3	0.25[1]	PASS
4	0.25[1]	PASS
5	0.7	PASS
6	0.25[1]	PASS
7	0.6	PASS
8	0.25[1]	PASS

Note 1: Measurements below the Method detection limit of 0.5 mg/L are reported as half of the MDL.

Table 40: Sediment Feed - 125% MTFR

	Mass (g)
Sample 1	139.22
Sample 2	164.78
Sample 3	160.06
Sample 4	161.87
Sample 5	172.33
Sample 6	188.49
Total	986.75
Average	164.46
QA/QC	
COV	0.098
COV ≤ 0.10	PASS

Table 41: Sediment Mass Balance - 125% MTFR

Pre Test Sediment Mass (lb)	85.000
Post Test Sediment Mass (lb)	54.645
Sediment Mass Used (lb)	30.355
Sediment Mass Used Adjusted for Feed Samples (lb)	28.180
Mass of Sediment Captured (lb)	8.951
Mass of Sediment Retained in Inlet Pipe (lb)	0.022
Water Volume During Sediment Addition (L)	64,400
Average Sediment Concentration (mg/L)	198.5
QA/QC	
Total Mass Added ≥ 25 lbs	PASS
Average Concentration within ±10% of 200 mg/L	PASS

4.1.7 150% MTFR

Table 42: Sampling Schedule - 150% MTFR

Elapsed Time (hh:mm:ss)	Sediment Feed Sample	Background Sample
00:00:00	1	1
00:01:43		2
00:02:24	2	
00:03:26		3
00:04:48	3	
00:05:09		4
00:06:51		5
00:07:12	4	
00:08:34		6
00:09:36	5	
00:10:17		7
00:12:00	6	8
MTD Detention Time = 0.50 minutes Sediment Calibration Sampling Time = 10 seconds Auger Off at 00:12:10		

Table 43: Flow - 150% MTFR

Units	Target Flow	Actual Flow	**QA/ QC**		
			±10%	COV	COV ≤ 0.03
cfs	3.39	3.35	PASS	0.007	PASS
l/s	96.0	94.90			

Table 44: Temperature - 150% MTFR

Maximum Temperature (°F)	QA/QC
	≤ 80 °F
71.7	PASS

Table 45: Background SSC - 150% MTFR

Sample ID	Concentration (mg/L)	QA/QC
		≤ 20 mg/L
1	0.6	PASS
2	0.25[1]	PASS
3	0.25[1]	PASS
4	0.25[1]	PASS
5	0.8	PASS
6	0.8	PASS
7	1.2	PASS
8	0.6	PASS

Note 1: Measurements below the method detection limit of 0.5 mg/L are reported as half of the MDL.

Table 46: Sediment Feed - 150% MTFR

	Mass (g)
Sample 1	201.90
Sample 2	188.75
Sample 3	196.39
Sample 4	195.93
Sample 5	195.59
Sample 6	220.35
Total	1198.91
Average	199.82
QA/QC	
COV	0.055
COV ≤ 0.10	PASS

Table 47: Sediment Mass Balance - 150% MTFR

Pre Test Sediment Mass (lb)	85.000
Post Test Sediment Mass (lb)	53.930
Sediment Mass Used (lb)	31.070
Sediment Mass Used Adjusted for Feed Samples (lb)	28.427
Mass of Sediment Captured (lb)	5.582
Mass of Sediment Retained in Inlet Pipe (lb)	0.026
Water Volume During Sediment Addition (L)	63,583
Average Sediment Concentration (mg/L)	202.8
QA/QC	
Total Mass Added ≥ 25 lbs	PASS
Average Concentration within ±10% of 200 mg/L	PASS

4.2 Scour Testing

Scour testing was performed according to Section 5 of the Protocol at 200% MTFR to verify its suitability for online use. For the 4-ft configuration HSA with an MTFR of 56.4 l/s (1.99 cfs) the average scour test flow rate must meet or exceed a flow rate of 112.8 l/s (3.98 cfs). The average flow rate for the scour test was 4.13 cfs which represents 208% of the MTFR. The sampling schedule is detailed in **Table 48**. The flow rate and associated quality checks are detailed in **Table 49**.

Table 48: Sampling Schedule - Scour

Elapsed Time (hh:mm:ss)	Sediment Effluent Sample	Background Sample
00:00:00		
00:01:00	1	1
00:03:00	2	
00:05:00	3	2
00:07:00	4	
00:09:00	5	3
00:11:00	6	
00:13:00	7	4
00:15:00	8	
00:17:00	9	5
00:19:00	10	
00:21:00	11	6
00:23:00	12	
00:25:00	13	7
00:27:00	14	
00:29:00	15	8

Table 49: Flow - Scour

Units	Target Flow	Actual Flow	QA/ QC		
			±10%	COV	COV ≤ 0.03
cfs	>3.98	4.13	PASS	0.009	PASS
l/s	>112.8	116.9			

The effluent, background, and adjusted SSC concentrations are reported in **Table 50**. The adjusted effluent concentration is calculated using **Equation 2** below.

$$Adj.Effluent\ \left(\frac{mg}{L}\right) = Effluent\ \left(\frac{mg}{L}\right) - Background\ \left(\frac{mg}{L}\right) \qquad \textbf{Equation 2}$$

The maximum adjusted effluent concentration was 1.4 mg/L at >200% of the MTFR, therefore, the HSA satisfies the criteria for online use.

Table 50: SSC – Scour

Sample ID	Effluent Concentration (mg/L)	Background Concentration (mg/L)	QA/QC ≤ 20 mg/L	Adjusted Concentration (mg/L)
1	2.4	4.0	PASS	0
2	5.0	5.2[1]	PASS	0
3	5.4	6.3	PASS	0
4	7.5	6.1[1]	PASS	1.4
5	5.5	5.9	PASS	0
6	5.6	6.0[1]	PASS	0
7	4.8	6.0	PASS	0
8	5.4	5.5[1]	PASS	0
9	4.8	4.9	PASS	0
10	4.5	5.4[1]	PASS	0
11	5.8	5.9	PASS	0
12	5.1	5.4[1]	PASS	0
13	4.7	4.8	PASS	0
14	4.9	4.8[1]	PASS	0.1
15	4.2	4.8	PASS	0

[1]The even numbered BG concentrations are the average of the before and after measured BG concentrations

4.3 Hydraulics

Prior to testing for sediment removal and scour, the head loss through the HSA was measured at flow rates spanning 8% to 150% of the target MTFR shown in **Table 51** and **Figure 10**. Measurements were taken with a clean test vessel, prior to the addition of any sediment, within the inlet pipe, outlet pipe, and the vessel. Measurements were taken to the nearest 1/16-inch using pressure taps and an engineer's scale. Bypass occurred at approximately 1.68 cfs.

Table 51: Water Elevation and Head Loss

Flow Rate		Water Elevation (inches)			Loss (inches)
l/s	cfs	Influent	Vessel	Effluent	
5	0.177	10.75	10.75	2.25	8.50
15	0.530	12.50	12.50	3.75	8.75
25	0.883	13.75	13.50	5.00	8.75
35	1.236	15.00	15.00	5.50	9.50
45	1.589	16.50	16.25	6.00	10.50
55	1.942	17.75	17.50	6.25	11.50
65	2.295	18.75	18.75	7.50	11.25
75	2.649	20.00	20.00	7.50	12.50
85	3.002	21.00	21.00	8.00	13.00
95	3.355	22.00	22.00	8.50	13.50

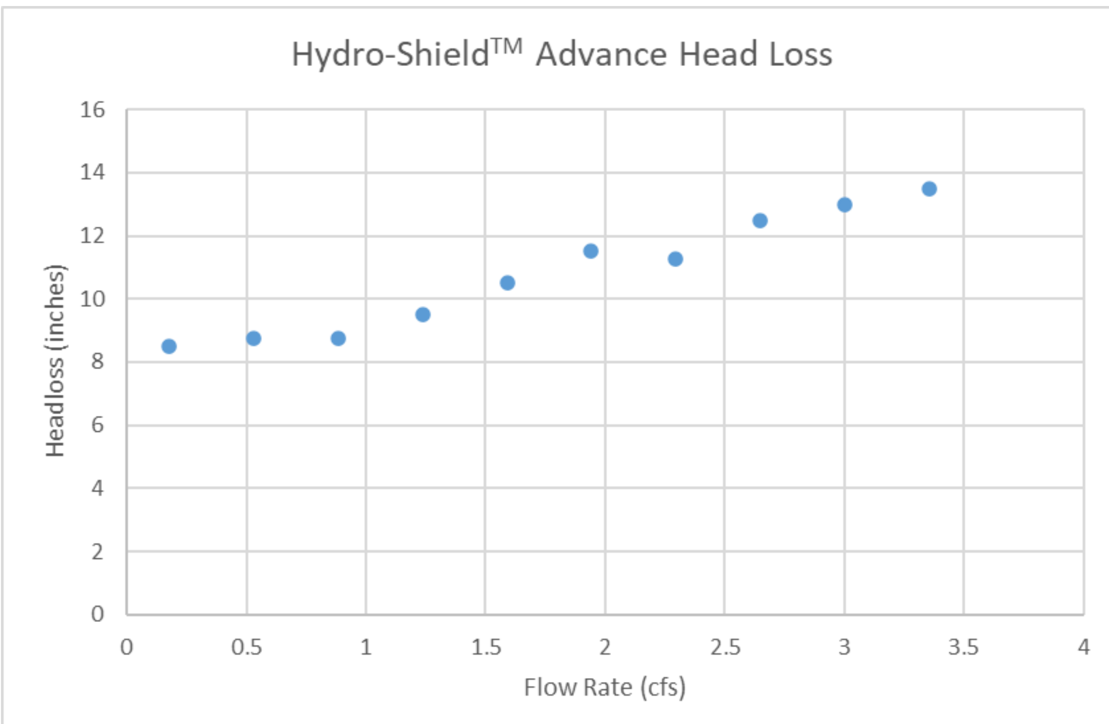


Figure 10: Hydro-Shield™ Advance Head Loss

4.4 Excluded Data

The first attempt at a scour test was stopped during the preload after a structural failure with the false bottom. The scour blend was fully removed from the unit and discarded. The test process then restarted from scratch with a repaired false bottom and new batch of scour blend.

5. Design Limitations

The HSA is an engineered system for which Oldcastle's engineers work with site designers to generate a detailed engineering submittal package for each installation. As such, design limitations are typically identified and managed during the design process. Design parameters and limitations are discussed in general terms below.

Required Soil Characteristics

The HSA is a flow-through system contained within a watertight manhole. Therefore, the HSA can be installed and function as intended in all soil types.

Slope of Drainage Pipe

Oldcastle recommends contacting our design engineers when the HSA is going to be installed on a drainage line with a slope greater than 10%. With steeply sloping pipe, site-specific parameters such as pipe size, online vs. offline arrangement of the HSA and the frequency of peak flow are taken into consideration by the Oldcastle team.

Maximum Treatment Flow Rate

The MTFR of the HSA is dependent upon model size. The recommended maximum treatment flow rate is dependent on HSA model size and other design and performance specifications. Oldcastle recommends contacting their engineering staff with questions about managing high peak flow rates.

Maintenance Requirements

The HSA should be inspected and maintained according to recommendations and guidelines set forth in the Operation and Maintenance manual at:

https://oldcastleinfrastructure.com/wp-content/uploads/2025/02/6_A_043_Hydro-Shield-Advance-Operations-and-Maintenance-Manual_WEB-1.pdf

A detailed discussion of inspection and maintenance requirements is discussed later in Section 6.

Operating Head

There is an operational head loss associated with each HSA unit. Site-specifics are evaluated to ensure an appropriate head for the system to function properly.

Installation Limitations

Pick weights and installation procedures vary slightly with model size. Oldcastle provides contractors with project-specific unit pick weights and installation instructions prior to delivery.

Configurations

The HSA was designed for online applications in which the inlet and outlet are tied directly into the main drainage line. Offline configurations can also be utilized.

Structural Load Limitations

Standard HSA units are designed for HS-20 loading. Contact Oldcastle engineering staff when heavier load ratings are required.

Pretreatment Requirements

The HSA has no pre-treatment requirements.

Limitations on Tailwater

Oldcastle recommends working with their engineering team if tailwater is present to increase the available driving head to ensure that the full water quality treatment flow rate is treated consistent with NJDEP protocol requirements.

Depth of Seasonal High Water Table

Although the functionality of the HSA is not impacted by high groundwater, Oldcastle recommends consulting their engineering staff to determine whether the addition of anti-flotation collars to the base of the HSA chamber is necessary to counterbalance buoyant forces.

6. Maintenance

Inspection and maintenance of the HSA are simple procedures conducted from the surface. An Operation and Maintenance Manual can be found at:

https://oldcastleinfrastructure.com/wp-content/uploads/2025/02/6_A_043_Hydro-Shield-Advance-Operations-and-Maintenance-Manual_WEB-1.pdf

Neither inspection nor maintenance requires purchasing spare parts or tools from Oldcastle. The HSA has appropriately located manhole lids to provide inspection and maintenance access to both the internal bypass chamber and vortex treatment chamber.

Inspection

The required frequency of cleanout depends on site use and other site-specific characteristics and should therefore be determined by inspecting the unit after installation. During the first year of operation, the unit should be inspected at least every six months to determine the rate of sediment and floatables accumulation. More frequent inspections are recommended at sites that would generate heavy solids loads, like parking lots with winter sanding or unpaved maintenance lots. A dipstick can be used to measure accumulated free-floating oil, while a sediment probe can be used to determine the level of accumulated solids stored in the sump.

Maintenance Procedures

The interval of required clean-out should be determined by post-installation inspection of pollutant accumulation rates. If post-installation inspection cannot be conducted for some reason, Oldcastle recommends the HSA be cleaned out at least once per year. There is typically no need for man entry during maintenance. Oldcastle recommends that proper confined space entry techniques be used when internal access is necessary.

Floatable trash and debris can be removed by lifting the floatable access lid and using a netted skimming pole or a vactor truck to skim accumulated material from the surface of the standing water. Accumulated oil must be removed from the surface using a vactor truck or sump vac. Accumulated sediment can be removed by lifting the central access lid and dropping a vactor hose down the center shaft to the sump. If regulations allow for the removal of solids and oils only, the entire sump liquid volume does not necessarily need to be removed from the HSA during maintenance. When all pollutants have been removed from the HSA, the manhole lids should be put securely back in place.

Sediment, floatables, and gross debris can generally be disposed of at the local landfill in accordance with local regulations. The toxicity of the residues produced will depend on the activities in the contributing drainage area. Analytical testing of the captured residues may be warranted if they are considered potentially hazardous. In all cases, local regulators should be contacted about disposal requirements. When observed, oil accumulation should be removed and disposed of properly even if no other maintenance is required.

7. Statements

The following signed statements from the manufacturer (Oldcastle Infrastructure), third-party observer (FB Environmental Associates), and NJCAT are required to complete the NJCAT verification process. In addition, it should be noted that this report has been subjected to external review and all comments and concerns have been satisfactorily addressed.

Oldcastle Infrastructure
A CRH COMPANY

7000 Central Park, Suite 800
Atlanta, GA 30328

oldcastleinfrastructure.com

June 8, 2026

Dr. Richard Magee, Sc.D., P.E., BCEE
Executive Director
New Jersey Corporation for Advanced Technology
c/o Center for Environmental Systems
Stevens Institute of Technology
One Castle Point on Hudson
Hoboken, NJ 07030

Re: Manufacturers Statement of Compliance

Dear Dr. Magee:

Oldcastle Infrastructure has completed coarse sediment "OK110" verification testing for the Hydro-Shield™ Advance Plus. These tests were in accordance with the *"New Jersey Department of Environmental Protection (NJDEP) Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device"* (April 25, 2023) with a modification to the particle size gradation of the test sediment. As required by the *"NJDEP Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology (NJCAT)"*, this letter serves as Hydro International's statement that all procedures and requirements identified in the aforementioned protocol and process document were met or exceeded.

Specifically, a four-foot diameter Hydro-Shield™ Advance Plus was tested at Oldcastle Infrastructure's laboratory in Portland, Maine for hydraulic characterization, sediment scour and sediment removal efficiency. To ensure that all procedures and methods were met, a test plan was completed and submitted to NJCAT for review and approval, all testing and sample collection was conducted under the direct supervision of independent observers employed by FB Environmental Associates and all collected samples were sent to either of two independent and certified laboratories: GeoTesting Express for particle size analysis or Apex Laboratories for measuring suspended solid concentrations. With this in mind, the preparation of the verification report and the documentation contained therein fulfill the submission requirements of the process document and protocol.

If you have any questions or comments regarding the verification please do not hesitate to contact us.

Sincerely,

Jeremy Fink, PE
Director of Product Development

STATEMENT OF WITNESS | THIRD-PARTY OBSERVER

TO: Andrew Gwinn, Oldcastle Infrastructure
FROM: Forrest Bell, FB Environmental Associates
SUBJECT: **Third Party Witness of Oldcastle Infrastructure Hydro-Shield™ Advance Testing**
DATE: June 2, 2026
CC: Elliott Boardman, Erik Phenix, FB Environmental Associates

STATEMENT OF THIRD-PARTY OBSERVER

FB Environmental served as the third-party observer for tests performed on the Hydro-Shield™ Advance hydrodynamic separator system, at alternative configurations of inlet and outlet piping, by Oldcastle Infrastructure in November 2025 through April of 2026 to achieve certification through the New Jersey Department of Environmental Protection (NJDEP) according to the New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device (April 2023). The test was performed by Oldcastle Infrastructure staff at their laboratory located at 94 Hutchinson Drive in Portland, Maine. A member of our staff verified compliance with the laboratory test protocol above, and our staff member was physically present to observe the full duration of all testing procedures including sample and equipment calibrations.

We have also reviewed the data, calculations, and conclusions associated with the removal efficiency testing in report produced by Oldcastle Infrastructure titled Hydro-Shield™ Advance, dated May 2026. We state that they conform to what we saw during our supervision as a third-party observer.

Forrest Bell

______________________________ 6/2/2026________________________

Forrest Bell ~ FB Environmental Associates Date

STATEMENT OF DISCLOSURE | THIRD-PARTY OBSERVER

TO:	Andrew Gwinn, Oldcastle Infrastructure
FROM:	Forrest Bell, FB Environmental Associates
SUBJECT:	**Third-Party Observer Statement of Disclosure under New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device**
DATE:	June 2, 2026
CC:	Elliott Boardman, Erik Phenix, FB Environmental Associates

STATEMENT OF DISCLOSURE - THIRD-PARTY OBSERVER

FB Environmental has no financial conflict of interest regarding the test results of the stormwater device testing outlined in the report titled *Hydro-Shield™ Advance* produced by Oldcastle Infrastructure, dated May 2026.

DISCLOSURE RECORD

FB Environmental has provided the service of third-party observers for tests performed by Oldcastle Infrastructure in November 2025 through April 2026. The tests assessed the removal efficiency of the Hydro-Shield™ Advance hydrodynamic separator system. Beyond this, FB Environmental and Oldcastle Infrastructure have no relationships that would constitute a conflict of interest. For example, we have no ownership stake, do not receive commissions, do not have licensing agreements, and do not receive funds or grants beyond those associated with the testing program.

Forrt Bell

______________________________ 6/2/2026______________________________

Forrest Bell ~ FB Environmental Associates Date

Rutgers EcoComplex
1200 Florence Columbus RD
Bordentown, NJ 08505-4200

June 30, 2026

Mr. Jeremy Fink, PE
Director Product Development
Oldcastle Infrastructure
7000 Central Park, Suite 800
Atlanta, GA 30328

Dear Mr. Fink,

Based on my review, evaluation and assessment of the testing on the Oldcastle Infrastructure hydro-Shield™ Advance (HSA) Sediment Removal stormwater treatment system conducted at Oldcastle Infrastructure's full-scale hydraulic testing facility in Portland, Maine under the observation of a 3rd party independent witness, FB Environmental Associates of Portland, Maine, the test protocol requirements contained in the *"New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device"* (NJDEP HDS Protocol), dated January 1, 2021 (updated April 25, 2023) were met with **one exception**: the sediment test particle size distribution (PSD) was coarser than specified in the NJDEP protocol. Consequently, the verification report does not qualify for NJDEP certification.

Test Sediment Feed -The mean PSD (d50) of the test sediment utilized for removal efficiency testing was significantly coarser than the PSD criteria established by the NJDEP HDS protocol (128 µm vs 75 µm).

Removal Efficiency Testing – The Oldcastle Infrastructure HSA Coarse Sediment Removal stormwater treatment system achieved an annual weighted removal efficiency of 80% of the test sediment (d_{50} of 128 µm) for a MTFR of 893 gpm (1.99 cfs).

Scour Testing – The maximum adjusted effluent concentration was 1.4 mg/L at >200% (208%) of the MTFR, therefore, the HSA satisfies the criteria for on-line and off-line use.

All other criteria and requirements of the NJDEP HDS Protocol were met. These include flow rate measurements COV <0.03; test sediment influent concentration COV <0.10; test sediment influent concentration within 10% of the targeted value of 200 mg/L; influent background concentrations <20 mg/L; and water temperature <80 °F.

Sincerely,

Richard S. Magee, Sc.D., P.E., BCEE

8. References

ASTM (2017). *Standard Test Methods for Particle-Size Distribution (Gradation of Soils Using Sieve Analysis,* Annual Book of ASTM Standards, D6913/D6913M-17, Vol. 4.09.

ASTM (2019). *Standard Test Methods for Determining Concentrations in Water Samples*, Annual Book of ASTM Standards, D3977-97, Vol. 11.02.

NJDEP (2021). *New Jersey Department of Environmental Protection Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology.* Trenton, NJ. August 4, 2021.

NJDEP (2021). *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device. Trenton, NJ. January 1, 2021.*

VERIFICATION APPENDIX

Introduction

- Manufacturer – Oldcastle Infrastructure, 94 Hutchins Drive, Portland, ME 04102. *General Phone: (207)756-6200. Website: https://oldcastleinfrastructure.com/*
- MTD – Typical Hydro-Shield™ Advance (HSA) Design Specifications are shown in **Table A-1**.
- TSS Removal Rate – 80%
- Online and offline installation

Detailed Specification

- HSA maximum treatment flow rates (MTFRs), sediment storage amounts and sediment removal intervals per NJDEP sizing requirements are attached as **Table A-1**.
- Standard HSA dimensions are attached as **Table A-2**.
- Pick weights and installation procedures vary with model size. Oldcastle provides contractors with project-specific unit pick weights and installation instructions prior to delivery.
- Maximum recommended sediment depth prior to cleanout is 9 inches for all model sizes.
- For a reference maintenance plan, download the Operation & Maintenance Manual at:

  https://oldcastleinfrastructure.com/wp-content/uploads/2025/02/6_A_043_Hydro-Shield-Advance-Operations-and-Maintenance-Manual_WEB-1.pdf
- Under N.J.A.C. 7:8-5.5, NJDEP stormwater design requirements do not allow a hydrodynamic separator such as the HSA to be used in series with another hydrodynamic separator to achieve an enhanced total suspended solids (TSS) removal rate.

Table A-1: MTFRs and Sediment Removal Intervals for HSA Models

HSA Model	Manhole Diameter (ft)	80% Coarse TSS Maximum Treatment Flow Rate (cfs)	Total Projected Treatment Area[1] (ft^2)	Hydraulic Loading Rate (gpm/ft^2)	50% Max Sediment Storage Volume (ft^3)	Required Sediment Removal Interval[2] (months)
4-ft Shallow	4	0.59	31.41	8.37	9.4	115
6-ft Shallow	6	1.32	70.69	8.37	21.2	115
8-ft Shallow	8	2.34	125.66	8.37	37.7	115
4-ft Standard	4	1.29	69.09	8.37	9.4	52
6-ft Standard	6	2.90	155.53	8.37	21.2	52
8-ft Standard	8	5.16	276.44	8.37	37.7	52
4-ft Plus	4	1.99	106.77	8.37	9.4	34
6-ft Plus	6	4.48	240.37	8.37	21.2	34
8-ft Plus	8	7.97	427.22	8.37	37.7	34

[1]Total Projected Area = Chamber Area + Projected Cone Area * Cone Gaps

[2]Required sediment removal interval was calculated using the equation specified in Appendix B Part B of the NJDEP Laboratory Protocol for HDS MTDs:

$$\text{Sediment Removal Interval (months)} = \frac{\text{(50\% HDS MTD Max Sediment Storage Volume * 3.57)}}{\text{(MTFR * TSS Removal Efficiency)}}$$

Table A-2: Standard Dimensions for HSA Models

HSA Model	Maximum Treatment Flow Rate (cfs)	50% Max Sediment Storage Volume (ft^3)	Chamber Depth (ft)	Treated Chamber Depth[1] (ft)	Sediment Sump Depth (ft)	Aspect Ratio Treatment Depth: Diameter	Maximum Pipe Diameter (inch)
4-ft Shallow	0.59	9.4	3.88	3.13	1.5	0.78	18
6-ft Shallow	1.32	21.2	4.68	3.93	1.5	N/A	24
8-ft Shallow	2.34	37.7	6.07	5.32	1.5	0.67	30
4-ft Standard	1.29	9.4	5.38	4.63	1.5	1.16	18
6-ft Standard	2.90	21.2	6.18	5.43	1.5	N/A	24
8-ft Standard	5.16	37.7	8.62	7.87	1.5	0.98	30
4-ft Plus	1.99	9.4	6.88	6.13	1.5	1.53	18
6-ft Plus	4.48	21.2	7.67	6.92	1.5	N/A	24
8-ft Plus	7.97	37.7	11.17	10.4	1.5	1.30	30

[1]Treated Chamber Depth is the chamber depth minus 1/2 the sediment sump depth. Larger models (>250% MTFR of the tested unit) must be geometrically proportionate to the tested unit (4-ft model). A variance of 15% is allowable. For units <250% MTFR (6-ft model) the depth must be equal or greater than the depth of the unit treated.