VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

SDD3 Oil Grit Separator®

Developed by Next Stormwater Solutions (8091200 Canada Inc.)
Salaberry-de-Valleyfield, Quebec, Canada

Registration: GPS-ETV_VR2019-10-31

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

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October 31, 2019
Vancouver, BC, Canada

Verification Body
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Technology description and application

The SDD3 (Figure 1) is an Oil-Grit Separator technology that uses both gravitational and centrifugal forces to capture and retain suspended sediments from stormwater runoff. The centrifugal forces are generated by the passive movement of influent stormwater through twin hourglass shaped cones within the technology. Suspended sediments are funneled towards the faster moving water column in the center of the vortex and eventually dropped out of suspension and deposited at the bottom of the unit, returning clean water back up through the exit hatch.

a) b)

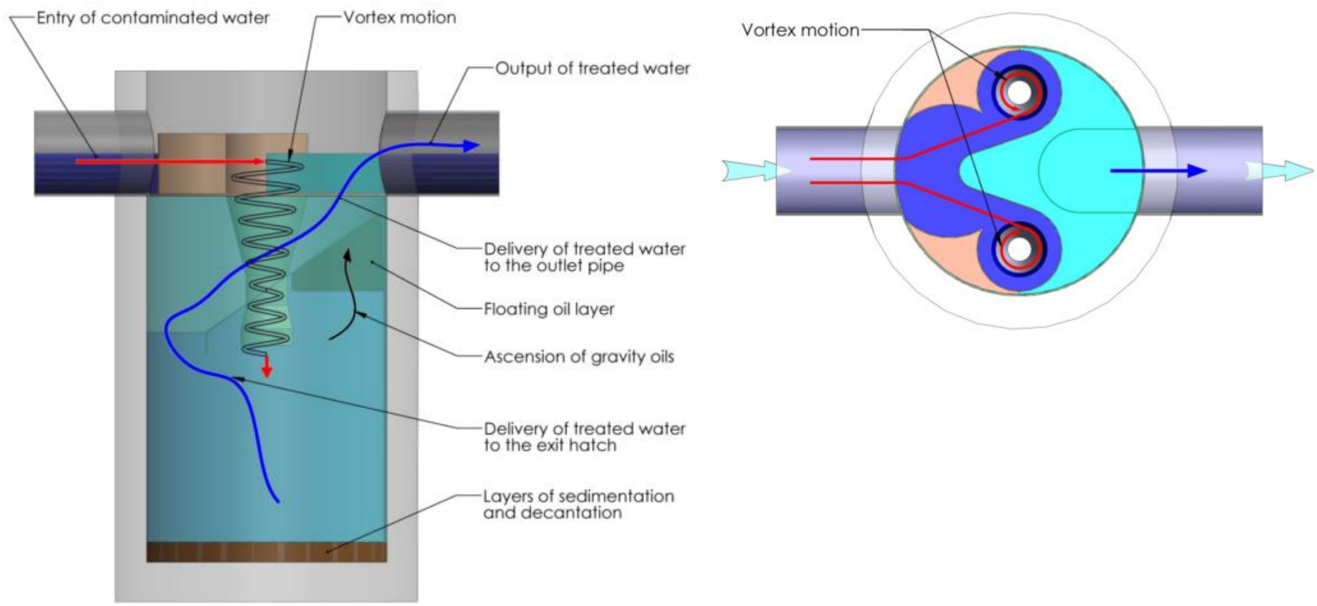

Figure 1. a) Cross sectional and b) Top view flow diagrams of NEXT Stormwater Solutions' SDD3 oil-grit separator technology.

The hour glass shaped cones are large at the top, narrow in the middle to accelerate the hydraulic vortex effect, and wide at the bottom to create a double vortex effect that optimizes particle separation. This design was also intended to reduce scour and re-suspension of previously captured sediment. For very high stormwater flows, excess water will bypass above the centrifuge plate and flow straight into the exit hatch without flowing downward through the cones. An angled baffle plate below the outlet is used to create an area for retaining light liquids such as oil. Periodic inspections of the unit are recommended once every 6 months and can be done through the unit's top hatch, which also gives access for cleaning out captured sediments and light liquids using a vacuum truck combined with a water pressure jet.

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the NEXT Stormwater Solutions SDD3 OGS device, model 900, in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) and a later revision to the light liquid testing procedure documented in Bulletin # CETV-2018-09-0001. The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program requirements. A copy of the Procedure and associated bulletins may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test[1]:

During the sediment capture test, the NEXT Stormwater Solutions' SDD3 OGS device with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removed 73, 67, 61, 53, 50, 52, 49 and 47 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, 1400 and 1800 L/min/m^2, respectively.

Scour test:

During the scour test, the NEXT Stormwater Solutions' SDD3 OGS device with preloaded test sediment reaching 50%[2] of the manufacturer's recommended maximum sediment storage depth, generated corrected effluent concentrations of 0, 9.3, 4.7, 24.3, and 10.5 mg/L during a continuous 30 minute test run with 5 minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light Liquid Retention test:

During the light liquid retention test, the NEXT Stormwater Solutions' SDD3 OGS device with surrogate low-density polyethylene beads preloaded into the device, representing a floating light liquid volume equal to a depth of 5 cm over the sedimentation area, retained 91 percent of loaded beads by mass during a continuous test at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2.

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 below indicates that the test sediment used for the capture (A3) and scour (A4) tests met this condition.

[1] The claims for the capture, scour and light liquid retention tests can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

[2] See variance section below

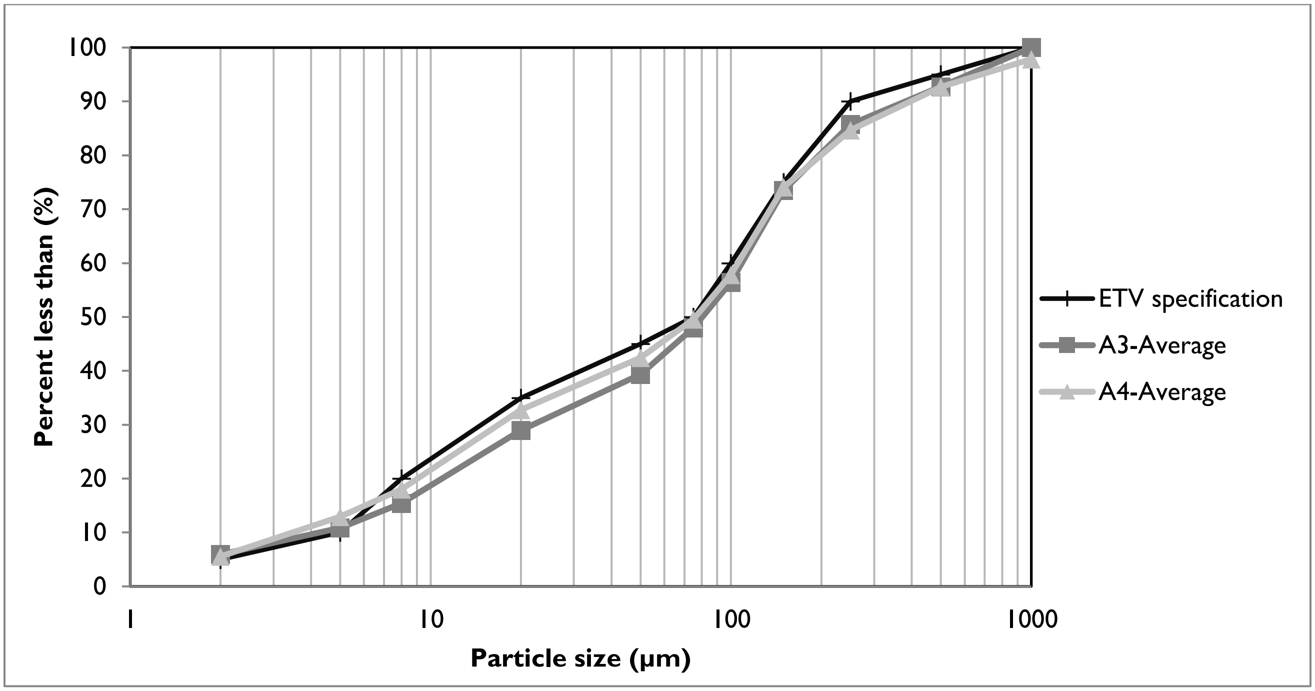

Figure 2. Test sediment particle size distribution (PSD) used for the capture (A3- Average) and scour test (A4 –Average) in relation to the specified PSD.

The capacity of the device to retain sediment was determined at eight surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration well below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the removal efficiencies were above 100% for certain particle size fractions (marked with asterisks in Table 1). These discrepancies are attributed to errors inherent to the analytical method used to measure PSD. Due to these errors, the removal efficiency results by particle size fraction should be interpreted with caution (refer to Bulletin # CETV 2016-11-0001 published on the Canadian ETV website at www.etvcanada.ca). The results for "all particle sizes" are based on measurements of the total injected and retained sediment mass, and are therefore not subject to PSD analysis errors.

Table 1. Removal efficiencies (%) at specified surface loading rates.

Particle size fraction (µm)	Surface loading rate (L/min/m²)							
	40	80	200	400	600	1000	1400	1800
500-1000	97.9	86.3	100*	91.3	93.6	100*	91.0	94.4
250 - 500	83.9	95.9	94.1	97.6	100*	96.9	100*	94.4
150 - 250	90.3	95.1	99.8	90.1	93.0	96.3	90.5	94.4
100 - 150	100*	100*	99.8	99.8	88.9	95.1	89.4	88.8
75 - 100	97.9	92.3	94.1	65.1	63.0	74.5	61.3	52.4
50 - 75	71.4	72.3	49.0	32.6	23.3	18.2	18.1	16.1
20 - 50	70.0	43.1	14.0	13.3	7.2	2.5	2.5	6.9
8 - 20	31.8	13.8	6.0	5.8	1.3	4.4	4.5	3.3
5 – 8	18.8	25.3	14.1	5.5	6.3	6.6	6.5	5.3
< 5	11.7	6.4	5.9	4.1	4.7	9.2	6.6	3.0
All particle sizes	**73**	**67**	**61**	**53**	**50**	**52**	**49**	**47**

* Removal efficiencies were calculated to be above 100%. Calculated values were between 102.7 and 117.5%. See text and Bulletin # CETV 2016-11-0001 for explanation

Figure 3 below compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the retained sediment at each of the tested surface loading rates. In general, the capture efficiency for fine particles decreased as surface loading rates increased.

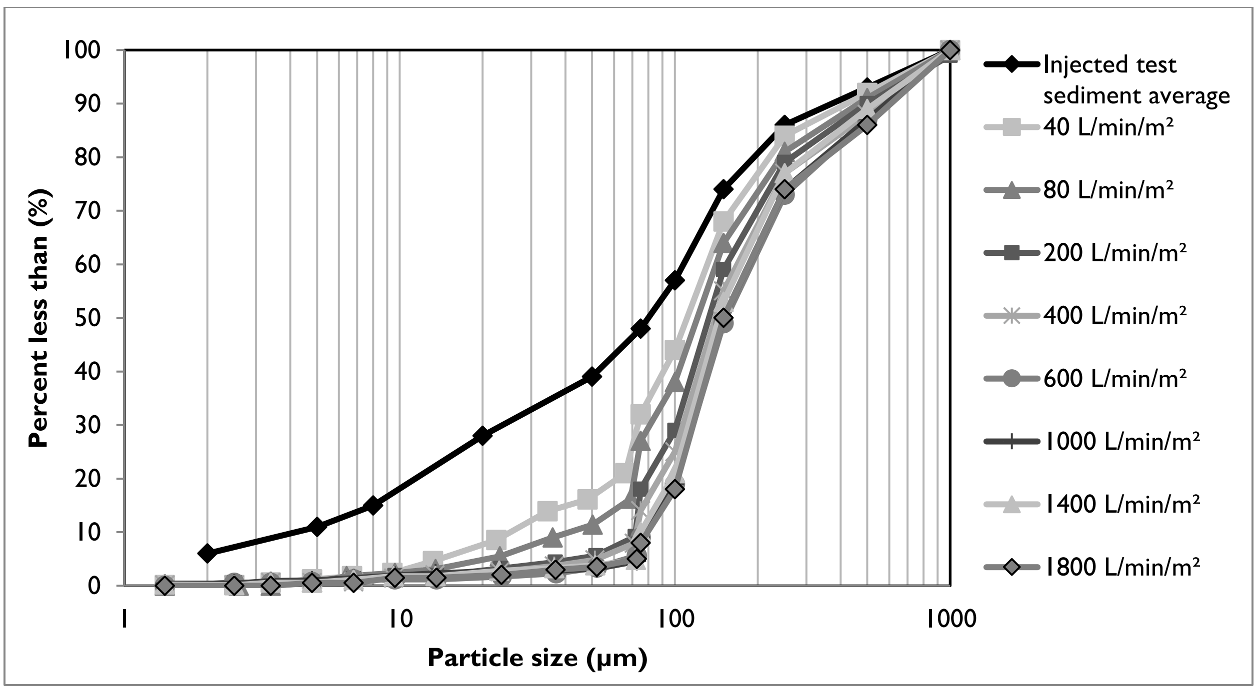

Figure 3. Particle size distribution of retained sediment in relation to the injected test sediment average.

Table 2 shows the results of the sediment scour and re-suspension test. This test involved preloading fresh test sediment into the sedimentation chamber of the device. The sediment was placed on a false floor to mimic a device filled to approximately 63% of the maximum recommended sediment storage depth, which was higher than the 50% stipulated in the *Procedure* (see variance section below). Clean water was run continuously through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water and the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test, as per the method described in Bulletin # CETV 2016-09-0001, published on the Canadian ETV website at www.etvcanada.ca. Results showed effluent concentrations of SSC were below 25 mg/L at the tested surface loading rates. Flows are bypassed at surface loading rates above 921 L/min/m^2 to help prevent sediment scour at high flow rates.

Table 2. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m^2)	Run time (min)*	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L)**	Average (mg/L)
1	200	1	1.10	0	0
		2		0	
		3		0	
		4		0	
		5		0	
2	800	1	1.50	14.96	9.28
		2		0.94	
		3		0.90	
		4		17.11	
		5		12.51	
3	1400	1	0.80	0	4.66
		2		0	
		3		0	
		4		0	
		5		23.32	
4	2000	1	0.80	18.08	24.25
		2		29.11	
		3		30.01	
		4		24.06	
		5		20.00	
5	2600	1	1.40	11.71	10.51
		2		18.01	
		3		7.98	
		4		7.86	
		5		7.01	

* The time taken to change between flow rates did not exceed 1 minute.

** The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the smallest 5% of sediment particles (i.e. d5) removed during the 40 L/min/m^2 capture test, minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 3. The test involved preloading 32.9 L (corresponding to a 5 cm depth over the collection sump area of 0.658 m^2) of surrogate low-density polyethylene beads (Dow LPDE 722) into the oil collection skirt and running clean water through the device continuously at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2). Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates. The effluent flow was screened to capture all re-entrained pellets throughout the test. Ninety-one percent of the beads were retained over the course of the test.

Table 3. Light liquid retention test results for the SDD3-900 unit

Surface loading rate (L/min/m^2)	Duration (minutes)	Amount of beads not captured during pre-loading			
		Mass (g)	Volume (L)*	% of mass not captured	% of mass retained
532	0 – 8.1	293	0.52	1.6	98.4
Surface loading rate (L/min/m^2)	**Duration (minutes)**	**Amount of beads re-entrained**			
		Mass (g)	**Volume (L)**	**% of pre-loaded mass re-entrained**	**Cumulative % of pre-loaded mass retained**
200	1.0 – 6.0	9	0.02	0.05	99.95
800	7.8 – 13.0	34	0.06	0.2	99.75
1400	14.7 – 20.0	1168	2.06	6.3	93.45
2000	20.8 – 26.1	133	0.23	0.7	92.75
2600	26.7 – 32.0	35	0.06	0.2	92.55
Total re-entrained		1379	2.44	7.4	---
Total re-entrained and not captured during pre-loading		1,672	2.95	9.0	---
Total loaded		18,616	32.88	---	---
Total loaded less the amount lost during pre-loading		18,323	32.36	---	---
Total loaded less the amount lost during pre-loading and re-entrainment testing		16,944	29.92	---	91.0

*Determined from average (n=3) measured bead bulk density of 0.5662 g/cm^3. The beads have a density of 0.9187 g/cm^3.

Variances from testing procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) and Bulletin # CETV-2018-09-0001 have been noted:

1. According to the testing Procedure of the scour test, the false floor is to be installed 10.2 cm below the 50% of the manufacturer's recommended maximum sediment storage depth and the test sediment is to be preloaded up to the 50% level. However, the SDD3-900 was tested with the false floor set at the 50% storage depth and sediments filled on top reaching 10.2 cm above the false floor simulating the device to be approximately 63% full as opposed to 50%. Simulating the device to be filled to a higher capacity with sediments closer to the outlet would likely increase rather than decrease scour. Hence the test is considered to be a conservative evaluation of the device's scour prevention performance.

2. As part of the capture test, evaluation of the 40 L/min/m^2 surface loading rate was split into 3 parts due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit. At the end of the first and second parts, the flow rates were maintained up until 3 water changes to prevent capture of particles that would have been washed out under normal circumstances. The amended procedure was reviewed and approved by the verifier prior to testing.

3. An inspection port (75 mm diameter x 560 mm) that was not present during the earlier sediment capture and scour tests was added to the unit during the light liquid retention test to monitor light liquid accumulation in the oil retention area of the unit. The inspection port diameter does not vary with unit size. The port was strategically placed away from the vortex to minimize influence on sediment capture. Hence, its effect on sediment capture and sediment re-entrainment was likely to be insignificant.

4. Flow rate transition times between the 200 to 800 and 800 to 1400 SLRs were longer than the target times of 1 minute. A control valve change between the first and second SLR also resulted in a short duration (<30 second) drop in flow rate. The slightly longer transition times and control valve change were not expected to have a significant effect on test results.

Verification

This verification was first completed in October 2016 by the Toronto and Region Conservation Authority, using the Canadian ETV Program's General Verification Protocol (March, 2000) and taking into account ISO/FDIS 14034:2015(E).

Data and information provided by NEXT Stormwater Solutions to support the performance claim included the following: Performance test report prepared by Centre des technologies de l'eau (CTE), and dated March 2016; the report is based on testing completed in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014).

A second performance test report, dated July 2019, was prepared by Centre des technologies de l'eau (CTE) for the light liquid retention test. The report is based on testing completed in accordance with the *Procedure for Laboratory Testing of Oil Grit Separators* (Version 3.0, June 2014) and a later revision to the light liquid testing procedure documented in Bulletin # CETV-2018-09-0001.

This ETV renewal, which is scheduled to occur every three (3) years following the initial verification is considered to meet the equivalency of an ETV verification completed using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***.

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

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