



# CANADIAN ENVIRONMENTAL TECHNOLOGY VERIFICATION

Enhancing the Credibility of Environmental Technologies

## TECHNOLOGY VERIFIED: CDS Hydrodynamic Separator®

### Performance Claim

#### Capture test<sup>a</sup>:

During the sediment capture test, the Contech CDS 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 74, 70, 63, 53, 45, 42, 32 and 23 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, 1400 and 1893 L/min/m<sup>2</sup>, respectively.

#### Scour test<sup>a</sup>:

During the scour test, the Contech CDS OGS device with preloaded test sediment reaching 50% of the manufacturer's recommended maximum sediment storage depth, generated corrected effluent concentrations of 1.8, 6.5, 8.2, 11.2, and 309.3 mg/L during a test run<sup>1</sup> with approximately 5 minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m<sup>2</sup>, respectively.

#### Light liquid re-entrainment test<sup>a</sup>:

During the light liquid re-entrainment test, the Contech CDS OGS device with surrogate low-density polyethylene beads preloaded within the oil collection skirt area, representing floating liquid to a volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.9, 98.6, 99.5, and 99.7 percent of loaded beads by volume during a test run<sup>b</sup> with 5 minutes duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m<sup>2</sup>, respectively.

<sup>a</sup> The claim 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)


<sup>b</sup> See variance #1 in "Variances from testing procedure" section

**VERIFIED\* PERFORMANCE:  
MARCH 2017**

**License Number:** ETV 2017-02

**Issued to:** CONTECH Engineered Solutions LLC

**Expiration Date:** March 31, 2020



**John D. Wiebe, PhD**  
Executive Chairman



Canada

## CANADIAN ETV VERIFIED



### CDS Hydrodynamic Separator®

Technology Fact Sheet for CONTECH Engineered Solutions LLC

### Technology description and application

The CDS® is a Stormwater treatment device designed to remove pollutants, including sediment, trash and hydrocarbons from Stormwater runoff. The CDS is typically comprised of a manhole that houses flow and screening controls that use a combination of swirl concentration and continuous deflective separation.

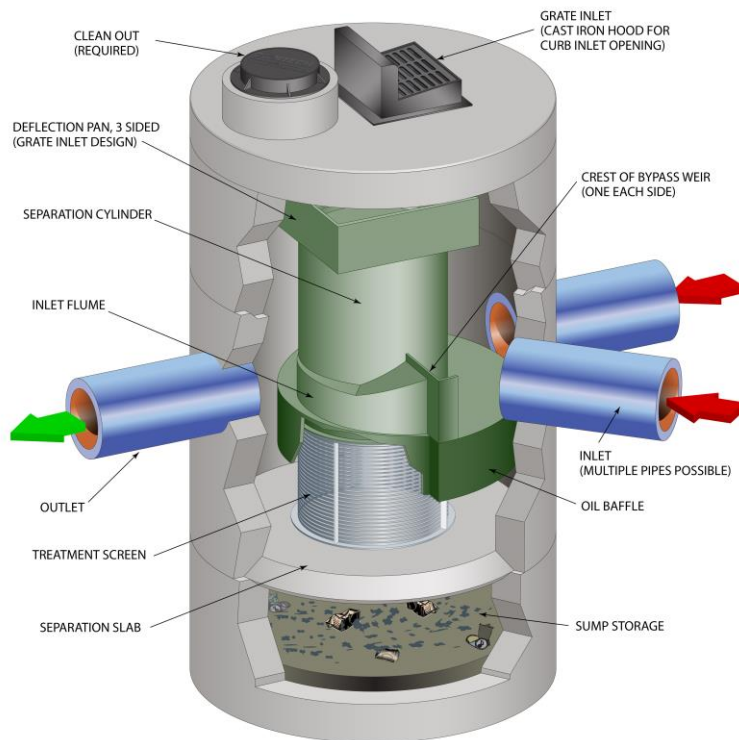


Figure 1. Graphic of typical inline CDS unit and core components.

When stormwater runoff enters the CDS unit's diversion chamber, the diversion pan guides the flow into the unit's separation chamber. The water and associated gross pollutants contained within the separation cylinder are kept in continuous circular motion by the energy generated from the incoming flow. This has the effect of a continuous deflective separation of the pollutants and their eventual deposition into the sump storage below. A perforated screen plate allows the filtered water to pass through to a volute return system and thence to the outlet pipe. The oil and other light liquids are retained within the oil baffle. Figure 1 shows a schematic representation of a typical CDS unit including critical components.

## Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Contech CDS-4 OGS device, in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014). 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 may be accessed on the Canadian ETV website at [www.etvcanada.ca](http://www.etvcanada.ca).

## Performance claim(s)

### Capture test<sup>a</sup>:

During the sediment capture test, the Contech CDS 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 74, 70, 63, 53, 45, 42, 32 and 23 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, 1400 and 1893 L/min/m<sup>2</sup>, respectively.

### Scour test<sup>a</sup>:

During the scour test, the Contech CDS OGS device with preloaded test sediment reaching 50% of the manufacturer's recommended maximum sediment storage depth, generated corrected effluent concentrations of 1.8, 6.5, 8.2, 11.2, and 309.3 mg/L during a test run<sup>b</sup> with approximately 5 minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m<sup>2</sup>, respectively.

### Light liquid re-entrainment test<sup>a</sup>:

During the light liquid re-entrainment test, the Contech CDS OGS device with surrogate low-density polyethylene beads preloaded within the oil collection skirt area, representing floating liquid to a volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.9, 98.6, 99.5, and 99.7 percent of loaded beads by volume during a test run<sup>b</sup> with 5 minutes duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m<sup>2</sup>, respectively.

## 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 indicates that the test sediment used for the capture and scour tests met this condition.

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<sup>a</sup> The claim 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 Testing of Oil Grit Separators (Version 3.0, June 2014)

<sup>b</sup> See variance #1 in "Variances from testing procedure" section below.

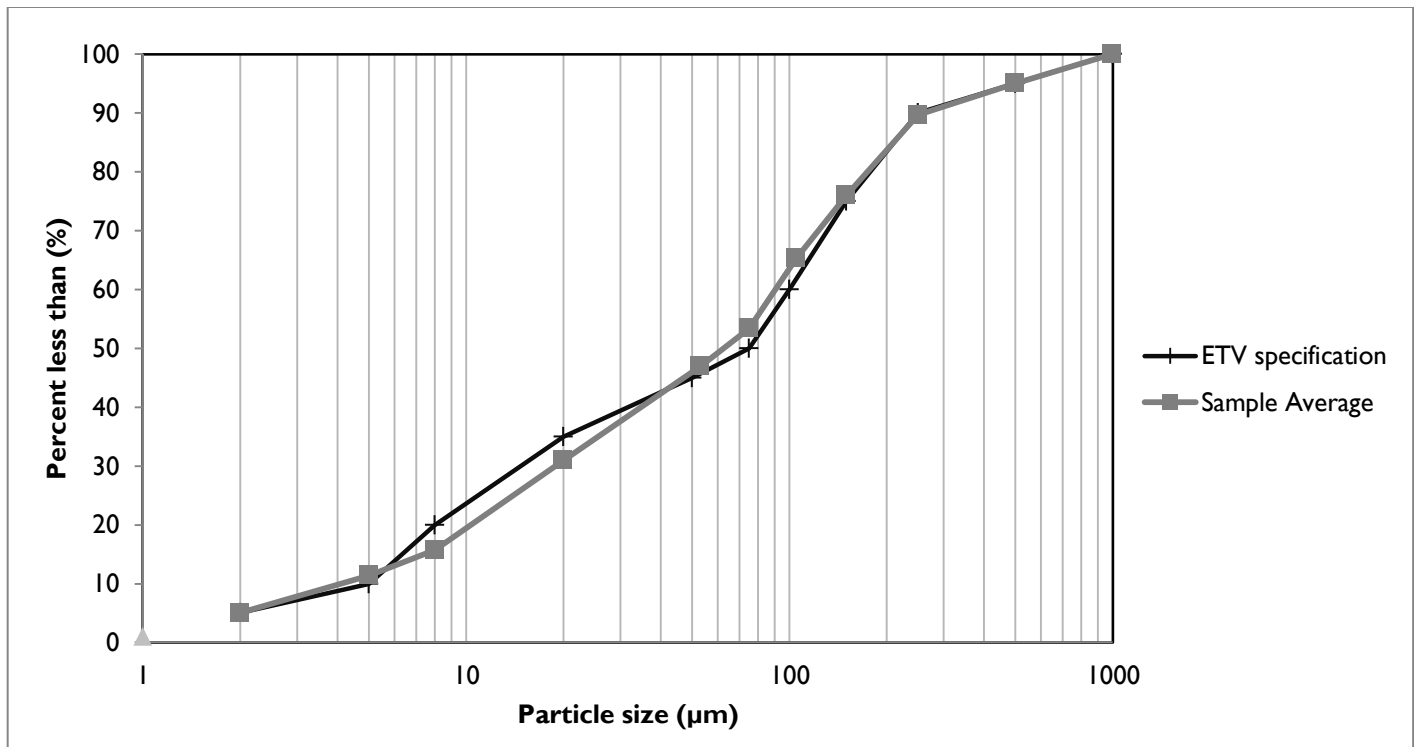


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

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 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 I).

In some instances, the calculated removal efficiencies were above 100% for certain particle size fractions (marked with asterisks in Table I). These discrepancies are not entirely avoidable and may be attributed to errors relating to the blending of sediment, collection of representative samples, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see [Bulletin # CETV 2016-11-0001](#)). The results for “all particle sizes by mass balance” in Table I are based on measurements of the total injected and retained sediment mass, and are therefore not subject to sampling or PSD analysis errors.

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

Particle size fraction ( $\mu\text{m}$ )	Surface loading rate (L/min/m <sup>2</sup> )							
	40	80	200	400	600	1000	1400	1893
>500	100	100*	66	79	97	100*	84	77
250 - 500	100*	100*	85	95	100*	91	100*	75
150 - 250	99	100*	100*	97	100	75	68	37
105 - 150	100	100*	100*	74	47	45	30	27
75 - 105	90	91	100*	61	33	36	26	18
53 - 75	71	27	54	100	42	44	15	16
20 - 53	65	51	20	8	10	8	5	4
8 - 20	28	22	9	7	1	1	2	1
5 - 8	30	9	0	8	2	0	1	0
<5	11	8	16	2	6	5	2	2
<b>All particle sizes by mass balance</b>	<b>73.5</b>	<b>70.3</b>	<b>63.4</b>	<b>52.6</b>	<b>45.1</b>	<b>41.5</b>	<b>32.4</b>	<b>23.0</b>

\* Removal efficiencies were calculated to be above 100%. Calculated values typically ranged between 101 and 175% (average 126%). Higher values were observed for the >500  $\mu\text{m}$  and 150-250  $\mu\text{m}$  size fractions during the 80 L/min/m<sup>2</sup> test run. See text and [Bulletin # CETV 2016-11-0001](#) for more information.

Figure 3 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. As expected, the capture efficiency for fine particles was generally found to decrease as surface loading rates increased.

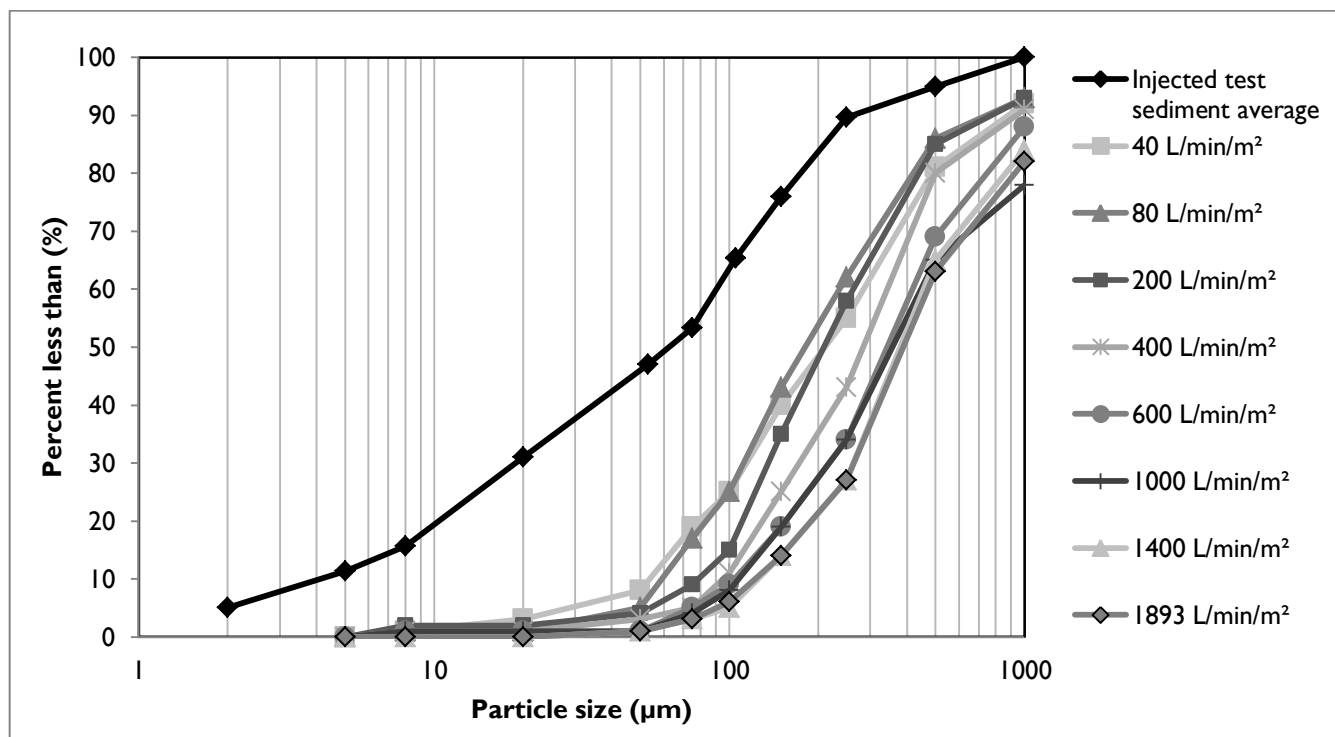


Figure 3. Particle size distribution of retained sediment in relation to the injected test sediment average.

# Environmental Technology Verification

Table 2 shows the results of the sediment scour and re-suspension test. This test involved preloading 10.2 cm of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Sediment was also pre-loaded to the same depth on the separation slab (see Figure 1) since sediment was observed to have been deposited in this area during the sediment capture test. Clean water was run through the device at five surface loading rates over a 36 minute period. The test was stopped and started after the second flow rate in order to change flow meters. 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<sup>2</sup> sediment capture test, as per the method described in [Bulletin # CETV 2016-09-0001](#).

Table 2. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m <sup>2</sup> )	Run time (min)	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L) <sup>†</sup>	Average (mg/L)
1	200	1.03	0.5	1.0	1.8
		2.03		1.6	
		3.03		1.8	
		4.03		1.8	
		5.03		2.6	
2	800	6.23	2.0	5.0	6.5
		7.23		6.7	
		8.23		9.4	
		9.23		5.4	
		10.23		5.9	
3	1400	11.43 <sup>‡</sup>	2.0	3.1	8.2
		12.43		11.0	
		13.43		14.6	
		14.43		7.1	
		15.43		5.2	
4	2000	17.20	3.2	7.3	11.2
		18.20		22.8	
		19.20		6.9	
		20.20		6.8	
		21.20		12.1	
5	2600	22.40	8.5	248.5	309.3
		23.40		83.0	
		24.40		438.9	
		25.40		338.7	
		26.40		437.5	

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

<sup>‡</sup> See variance #1 in "Variances from testing procedure" section below.

# Environmental Technology Verification

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 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m<sup>2</sup>) of surrogate low-density polyethylene beads within the oil collection skirt and running clean water through the device at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m<sup>2</sup>) over a 38 minute period. As with the sediment scour test, flow was stopped and started after the second flow rate to change flow meters. 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.

Table 3. Light liquid re-entrainment test results.

Target Flow (L/min/m <sup>2</sup> )	Time Stamp	Collected Volume (L)	Collected Mass (g)	Percent re-entrained by volume	Percent retained by volume
200	10:48:42	27 pellets	0.8	0.01	99.99
800	10:55:09	0.07	41	0.12	99.88
1400	11:06:59	0.8	439	1.37	98.63
2000	11:13:00	0.31	177	0.53	99.47
2600	11:19:00	0.18	98	0.31	99.69
Interim Collection Net		0.025	14.2	0.04	99.96
Total Loaded		58.3	33398	--	--
Total Re-entrained		1.385	770	--	--
Percent Re-entrained and retained		--	--	2.38	97.62

## Variations from testing Procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. It was necessary to change flow meters during the scour and light liquid re-entrainment test, as the required flows exceeded the minimum and/or maximum range of any single meter. After the loading rate of 800 L/min/m<sup>2</sup>, the flow was gradually shut down and re-initiated through the larger meter immediately after closing the valve controlling flows to the small meter. The transition time of 1-minute for each target flow was followed, resulting in an elapsed time of 3 minutes to reach the next target flow of 1400 L/min/m<sup>2</sup>. This procedure was approved by CETV prior to testing, in recognition that most particles susceptible to scour at low flows would not be in the sump at higher flows. Similarly, re-entrainment of the oil beads was not expected to be significantly affected by the flow meter change.
2. As part of the capture test, evaluation of the 40 L/min/m<sup>2</sup> 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 of the test, the flow rates were gradually shutdown 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. Inflow concentrations during the 40 L/min/m<sup>2</sup> surface loading rate varied from 162 mg/L to 246 mg/L, which is wider than specified  $\pm 25$  mg/L range in the Procedure.

# Environmental Technology Verification

## Verification

The verification was completed by Toronto and Region Conservation Authority, using the Canadian ETV Program's General Verification Protocol (March, 2000) and taking into account ISO 14034:2016. Data and information provided by Contech Engineered Solutions to support the performance claim included the following: Performance test report prepared by Alden Research Laboratory, Inc, and dated February 2015; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

## What is Canadian ETV?

Canadian Environmental Technology Verification (ETV) is delivered by GLOBE Performance Solutions under a license agreement from Environment Canada. Canadian ETV is designed to support Canada's environment industry by providing credible and independent verification of technology performance claims.



**For more information on the CDS Stormwater Treatment System<sup>®</sup> please contact:**

CONTECH Engineered Solutions LLC  
71 US Route 1, Suite F  
Scarborough, ME  
04074 USA  
Tel: 207-885-9830  
info@conteches.com  
www.conteches.com

**Canadian ETV Contact Information:**

c/o GLOBE Performance Solutions  
404 – 999 Canada Place  
Vancouver, BC  
V6C 3E2 Canada  
Tel: 604-695-5018 / Toll Free: 1-855-695-5018  
etv@globepformance.com  
www.etvcanada.ca

### Limitation of verification

Environment Canada, Canadian ETV and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.