

# Procedure for Laboratory Testing of the Performance of a Stormwater Chamber System

## Test Setup

Two chambers were used for this study, a receiving chamber and a separation chamber. The two chambers were housed in a containment cell constructed out of wood, lined with an impermeable membrane. The dimensions of the test cell were 142" X 71" X 23.5" (3.58 m X 1.80 m X 0.60 m, L X W X H). The chambers were set up in the test cell in a manner consistent with a normal installation. The floor of the cell was covered with approximately 76 mm (3") of washed, crushed, clear stone which in turn was covered by one layer of woven geotextile fabric as required for the installation of the system. The two chambers sat next to each other, in parallel. Washed crushed stone filled in the space around the test units up to a height of approximately 51 mm (2") from the base. The test set-up is illustrated in Figure 1.

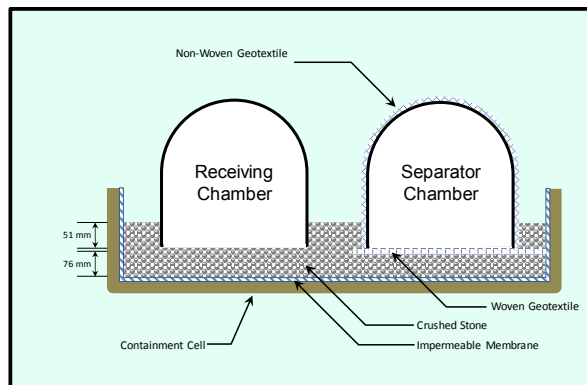


Figure 1 – Schematic of test cell

The laboratory test set-up was a water flow loop, capable of moving water at a rate of up to 900 L/min. The loop was comprised of water reservoirs, pumps, stand pipe, receiving tank and a flow meter, in addition to the test cell.

Fresh water was pumped from the storage tank through a flow meter to the stand pipe, and from there it flowed by gravity through an inlet pipe to the separation chamber in the test cell. Sediment was added at an addition port in the inlet pipe upstream of the separation chamber.

From the water supply tanks, water was pumped by a centrifugal pump. Flow measurement was done using an electromagnetic type flow meter with an accuracy of  $\pm 0.5\%$  of reading (1 – 200 gpm). The data logger was configured to record a flow measurement once every minute.

The influent pipe was 100 mm (4 inches) in diameter and sediment addition was done through a port at the crown of the influent pipe, 4 pipe diameters (406 mm) upstream of the containment cell. The sediment feeder was a volumetric screw feeder with vibratory hopper.

Water flow exited the receiving chamber and terminated with a free-fall into the Receiving Tank. Water was pumped from the Receiving Tank back to the storage tanks to complete the flow loop.

## **Sample Collection & Parameter Measurement**

Background water samples were collected in 1L jars from the standpipe. The sample was taken by submerging the jar below the surface of the water until full.

Effluent samples were also grabbed by hand. The effluent pipe drained freely into the Receiving Tank and the effluent sample was taken at that point. The sampling technique was to take the grab sample by sweeping a wide-mouth 1 L jar through the stream of effluent flow such that the jar was full after a single pass.

Effluent water temperature was taken using a data logger submerged into the receiving tank during each run and configured to take a temperature reading once every minute.

Run and sampling times were measured using NIST traceable stopwatches.

The sediment feed samples that were taken during the run were collected in 500 mL jars and weighed on an analytical balance.

## **Test Sediment**

The final test sediment particle size distribution (PSD) met the required tolerances of the Canada ETV Procedure for Laboratory Testing of Oil-Grit Separators (Rev. June 6, 2014 – Ver. 3.0). Three replicate samples of the test sediment blend were sent to a qualified 3<sup>rd</sup> party analytical laboratory for analysis of the sediment PSD in a manner consistent with ASTM method D422-63 (Reapproved 2007), “Standard Test Method for Particle-Size Analysis of Soils”. The samples were composite samples created by taking samples throughout the blending process and in various positions within the blending drum.

## **Removal Efficiency Testing**

The objective of this study was to establish a baseline for treatment performance (removal efficiency) over a range of flow rates up to 125% of the maximum treatment flow rate (MTFR) with an influent suspended sediment concentration (SSC) of 200 mg/L. Sediment removal efficiency testing was conducted at 25%, 50%, 75%, 100% and 125% MTFR. The sediment feed rate had a coefficient of variance (COV)  $\leq 0.10$  and the influent sediment concentration was maintained within  $\pm 20$  mg/L of target, based on the average sediment feed rate and water flow rate for the run. The water flow rates were held within 10% of target with a COV of 0.03 and water temperatures were maintained below 25 °C.

A minimum of eight influent background samples were taken at regular intervals. A minimum of 15 effluent samples were collected during each test run. The first sample was collected after a minimum of

3 detention times (DT), at which time a constant flow and sediment feed were established. The interval between sequential effluent samples was evenly spaced; however, when the test sediment feed was interrupted for measurement, the next effluent sample was collected after waiting at least 3 DT to re-establish equilibrium conditions.

The system detention time was determined empirically by measuring the height of water in the containment cell during clean water flow at the chosen flow rate. The wet volume of the system was calculated and the approximate volume of the stones was subtracted. The remaining volume was the estimated water volume in the containment cell, which was divided by the flow rate to give detention time.

The sediment feed rate was checked using six calibration samples taken at evenly spaced intervals over the duration of each test run. Each sample was collected over an interval timed to the nearest 0.01 second and was a minimum of 0.1 liters, or the collection interval did not exceed one minute, whichever came first. The COV of the samples was < 0.10. The feed rate samples were also used to calculate an influent concentration in order to double check the concentration calculated by mass balance.