# Technical Abstract
# Hydro DryScreen™ – Performance Testing

## Performance Verification of Sediment Removal Efficiency of a 3 Chamber Baffle Box.


### Abstract

The Hydro DryScreen™ is a next generation baffle box designed to effectively remove a wide range of solids from stormwater run-off. It augments the typical baffle box design, wherein vertical sump baffles are used to create a series of sediment settling chambers, with a patented flow-diffusing mechanism to improve sediment capture. It is a structural Best Management Practice (BMP) installed underground as a permanent part of the storm drain line to reduce the overall load of sediment associated oils, total suspended solids (TSS) and gross debris conveyed through the storm drains.

Flow modifying internal components, (Dia. 1) differentiate the Hydro DryScreen from other nutrient baffle boxes. The Hydro DryScreen has a unique flow splitting inlet that directs inflow to the side of the vault, (Dia. 2) improving efficiency, by spreading the flow over a greater area and avoiding direct flow to the outlet.

Capable of providing high pollutant removals for a wide range of flow rates with minimal headloss, the DryScreen is an economical solution for constrained sites, pretreatment, or large flows. Its proven efficiency ensures the longevity and simplifies the maintenance of storage, infiltration and filtration practices.


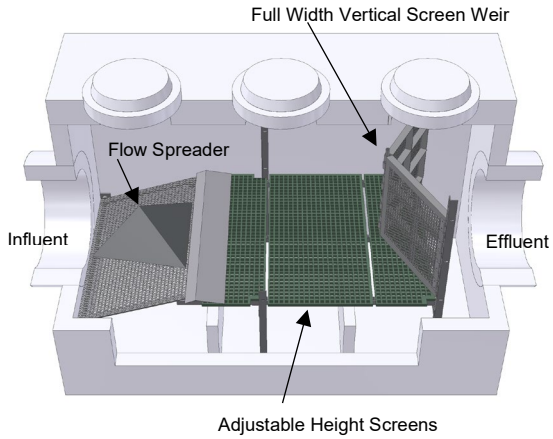


**Diagram 1. The unique internal components of the Downstream Defender enhanced pollutant removal performance and prevent washout.**

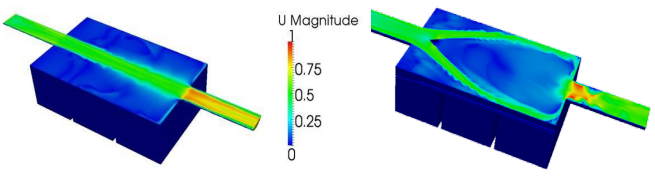


**Diagram 2. Model of flow distribution without Flow Spreader**

### Test Unit

The test unit (Fig. 1) was installed in Hydro International's laboratory facility in Portland, ME and measured 3 ft. (915 mm) by 6 ft. (1830 mm) inside dimensions. The inlet and outlet pipes were 12 in. (300 mm) diameter and sediment was injected into a standpipe approximately 18 in. (450 mm) upstream. The vertical screen gate was 18 in. (450 mm) tall and the gap at the outlet pipe was 9.5 in. (240 mm). Both sediment removal and screen blinding were tested.

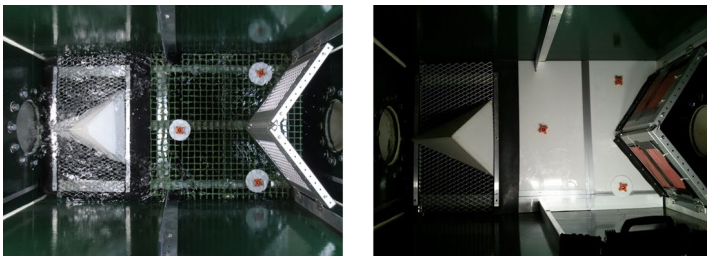

**Figure 1. Photos of test unit with open (left) and 80% blinded (right) screen.**

### Hydraulics

Head-discharge curves were measured with a static pressure tap in the inlet pipe, a rule in the upstream section of the vessel and a rule installed downstream of the vertical screens. To determine the hydraulic impact of screen blinding, a fully open screen system was compared to a system 80% masked with solid sheeting.

The resulting curves (Fig. 2) showed that the water level overtopped the downstream screens at 110 L/s (3.9 cfs) blinded and 120 L/s (4.2 cfs) with clear screens.

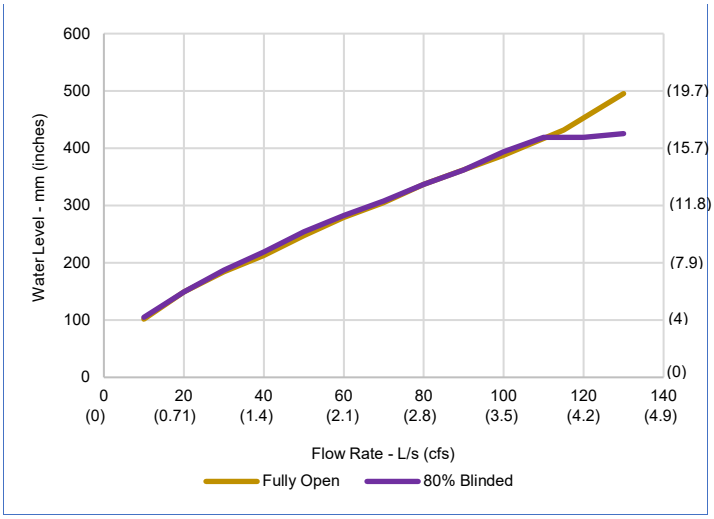


**Figure 2. Head loss chart for open and 80% blinded screen.**


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# Hydro DryScreen™

With 80% screen blockage the remaining open area is equal to the cross sectional area of the maximum permitted pipe size for each baffle box model size.

When the screens are tested fully open without any masking, the hydraulic curve appears to closely follow a theoretical orifice equation for entrance loss into a pipe using a Cd of 0.65.

## Test Sediment

Presently the most authoritative study of baffle box performance for sediment capture was done by Ashok Pandit Ph.D.,P.E., Physical Modeling Of A Stormwater Sediment Removal Box, June 1996. In that study two particle size distributions (PSD) were use – a fine blend of silts and clays and a coarse blend of fine to coarse sand. The Pandit study demonstrated that a baffle box consisting of 3 chambers is the most efficient design, but removal efficiency was low (<35%) for silt to clay sized sediment.

Based on the Pandit study, a test blend of sand sized material similar to that used in the Pandit study was produced using 25% Red Flint 45-55, 35% Granusil 5010, & 40% Red Flint 20-30 resulting in the PSD shown in Figure 3.

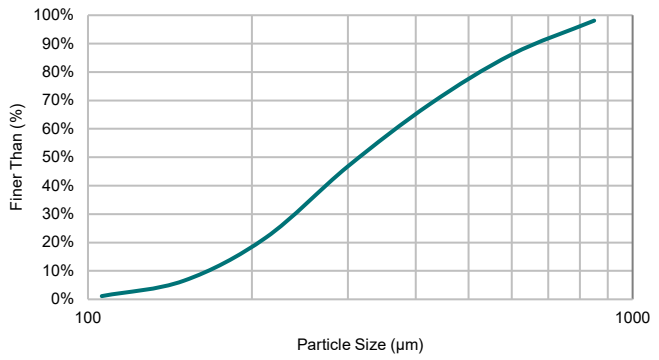


**Figure 3. Particle Size Distribution Chart of Test Sediment.**

## Sediment Removal

In order to provide removal data over a broad range of particle sizes captured material was collected and sieved in order to calculate removal efficiencies for PSD subsets down to 450 µm, 300 µm, 212 µm, 150 µm, and 106 µm. (Fig. 4)

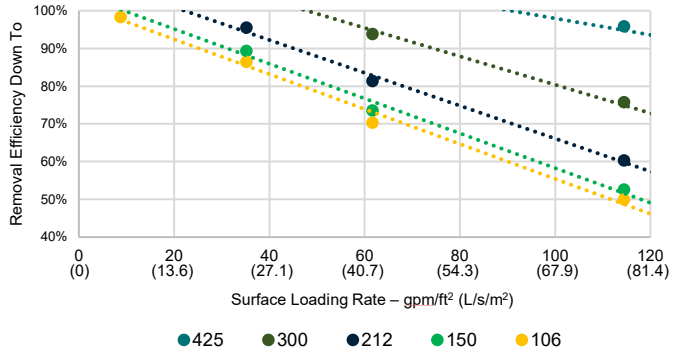


**Figure 4. Removal Efficiency for PSD down to the smallest listed size in microns.**

## Trash & Leaf Removal

A key part of nutrient baffle box design is the use of screens to remove bulk organic and inorganic material. Key to effective long term performance is that any removed material is stored dry and not allowed to sit for any extended period of time in a wet sump area. This prevents leaching and the potential for anaerobic conditions developing, with associated secondary pollutant generation.

The Hydro DryScreen uses horizontal and vertical screens that span the full width of the vault, maximizing flow and treatment screen area and storage volume. The horizontal screen is set above the outlet invert elevating the removed debris above static water levels.

## Hydro DryScreen Nutrient Baffle Box Sizing

Using the data collected a range of sizing options can be selected depending on the targeted particle size and outcome desired.

In is possible to target a total suspended solids (TSS) removal for a range of particle size distributions defined by the smallest particle size in that distribution. This is referred to as “Down To” sizing.

Table 1 gives the treatment flow rates for different DryScreen vault sizes, based on surface load rate scaling of the test unit, for a minimum 80% TSS removal down to the particle size listed.

For design purposes the selected model’s Treatment Flow Rate must be equal or greater to the site’s Water Quality Flow Rate for the site in question.

The peak flow rate and maximum pipe size must be considered to determine whether an online or offline configuration is appropriate. Refer to the Hydro DryScreen product information brochure for visit hydro-int.com/us/ for more information.

**Table 1. Typical Hydro DryScreen™ Capacities.**

| Hydro DryScreen(TM) | Maximum Treatment Capacity | Typical Treatment Flow Rate | Maximum Pipe Diameter | Screenings Storage Capacity | Sediment Storage Capacity |
|---|---|---|---|---|---|
| (ft) | (cfs) | (cfs) | (in) | ($yd^3$) | ($yd^3$) |
| 4 x 8 | 29 | 11 | 30 | 2.2 | 3.6 |
| 6 x 12 | 66 | 24 | 42 | 6.6 | 8 |
| 8 x 14 | 93 | 37 | 48 | 11.9 | 13.8 |
| 10 x 16 | 124 | 53 | 54 | 19.2 | 22.7 |
| 12 x 20 | 162 | 80 | 60 | 26.8 | 27.2 |
| (m) | (L/s) | (L/s) | (mm) | ($m^3$) | ($m^3$) |
| 1.2 x 2.4 | 821 | 311 | 762 | 1.7 | 2.7 |
| 1.8 x 3.7 | 1868 | 679 | 1067 | 5.0 | 6.1 |
| 2.4 x 4.3 | 2633 | 1047 | 1219 | 9.1 | 10.5 |
| 3.0 x 4.9 | 3510 | 1500 | 1372 | 14.7 | 17.3 |
| 3.7 x 6.1 | 4586 | 2265 | 1524 | 20.5 | 20.8 |

Sizing software can be downloaded from:
hydro-int.com/dryscreensizing

Hydro International