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|---|---|---|
| **Ref.:** | WAB0029 | (total= 6 pg.) |
| **To:** | Chairman Dr. Wayne Stobo and Members,<br>Halifax/Halifax County Watershed Advisory Board (**WAB**), HRM | |
| **From:** | S. M. Mandaville (Professional Lake Manage.), Chairman & Exec. Director | |
| **Date:** | November, 08, 2000 | |
| **Subject:** | **More info about the CDS (Continuous Deflective Separation) in-situ stormwater treatment unit** | |

Subsequent to our WAB meeting of October, 00, I contacted Walt Stein P.E., Manager of Project Development, CDS Technologies, Inc., California, who had been very open and liberal with specs as well as independent studies of the CDS systems in the USA and the country of origin of the CDS system, Australia. Many of you already have copies of some select documents among many he supplied me.

This time I asked him if CDS units could be installed in open channels, i.e., drainage ditches which are not paved. His answer is below in his email of November 08, 00, and he said the CDS units are quite suited to such applications. Kindly read his email in full. In addition he sent me two attachments of brief reports on removal of fines, and I am quite impressed with the fines removal efficiencies which has been reported so far. Kindly read and digest.

Date: Wed, 8 Nov 2000 08:56:39 -0800
From: Walt Stein <wstein@cdstech.com>
To: "S.M. Mandaville" <limnos@chebucto.ns.ca>
Cc: John Greer <jgreer@shawpipe.com>
Subject: RE: CDS suitable in unpaved ditch outflows?

Good Day S.M.

Sorry about the delayed response.

**The answer is yes we can be installed on open channel applications. Open channel applications are ideal for CDS units. We have just a few open channel applications here in the US and many more in Australia. However, given that your primary interest seems to be in the removal of TSS, I want to emphasize that we are only an enhanced swirl concentrator (vortex unit) combined with the performance of a unique non-blocking screen. We don't pump water up-hill or provide an effluent water quality that can only realistically be achieved through a wastewater treatment plant. People need to be looking at a logical treatment train process to best address that wide range of water quality constituents found in urban storm water runoff. I mention these performance/efficiency caveats, because I don't want to allow the development of un-attainable treatment expectations. A CDS unit will remove TSS from storm water, more at lower flows.**

**The CDS unit can be over-sized to provide an increased TSS capture efficiency, but please understand that if you really want to get a all of the TSS (silts/clays) then a treatment train process will be required rather than looking to one stand alone technology to address this issue.**

**I'm attaching two documents that you may find useful when considering a CDS unit to remove TSS and fines. The first document is a short synopsis of the fines separation studies done at Portland State University, Oregon and the second is a CDS sizing discussion that I just sent to an engineer in Alaska. The Alaska project wants to target fines removal and may serve to support more detailed discussions about the capability of our technology to realistically address TSS removal.**

Respectfully,
Walt

# TSS Removal Efficiency

Professor Scott Wells of Portland State University and Professor Michael Stenstrom of UCLA recently carried out medium/fine sediment removal efficiency evaluations. Professor Wells' work focused on determining the CDS unit's removal efficiency for a range of medium/fine particles normally found in storm water. The medium/fine particles used in this evaluation had size distributions and specific gravities that attempted to represent the majority of the mass of fine sediments typically found in storm water runoff. Professor Wells' work expanded upon earlier work done by Professor Stenstrom at UCLA.

The following table lists the sediment removal efficiency as determined by Dr. Scott Wells of Portland State University for a CDS Unit equipped with a 2400-micron (µm) screen. The sand particles used in this evaluation had specific gravities (SG) of approximately 2.65.

**MEDIUM/FINE SEDIMENT REMOVAL**
(Indirect Screening – 2400-Micron Screen)
Particle Removal Efficiency*

| Particle Size (ìm) | Particle Removal Efficiency (%) | |
|---|---|---|
| | 125 gpm (8 l/s) | 270 gpm (17 l/s) |
| >2400 | 100 | 100 |
| 2400 – 850 | 100 | 100 |
| 850 – 600 | 100 | 100 |
| 600 – 425 | 100 | 98 |
| 425 – 300 | 96 | 80 |
| 300 – 150 | 76 | 42 |
| 150 - 75 | 42 | 12 |

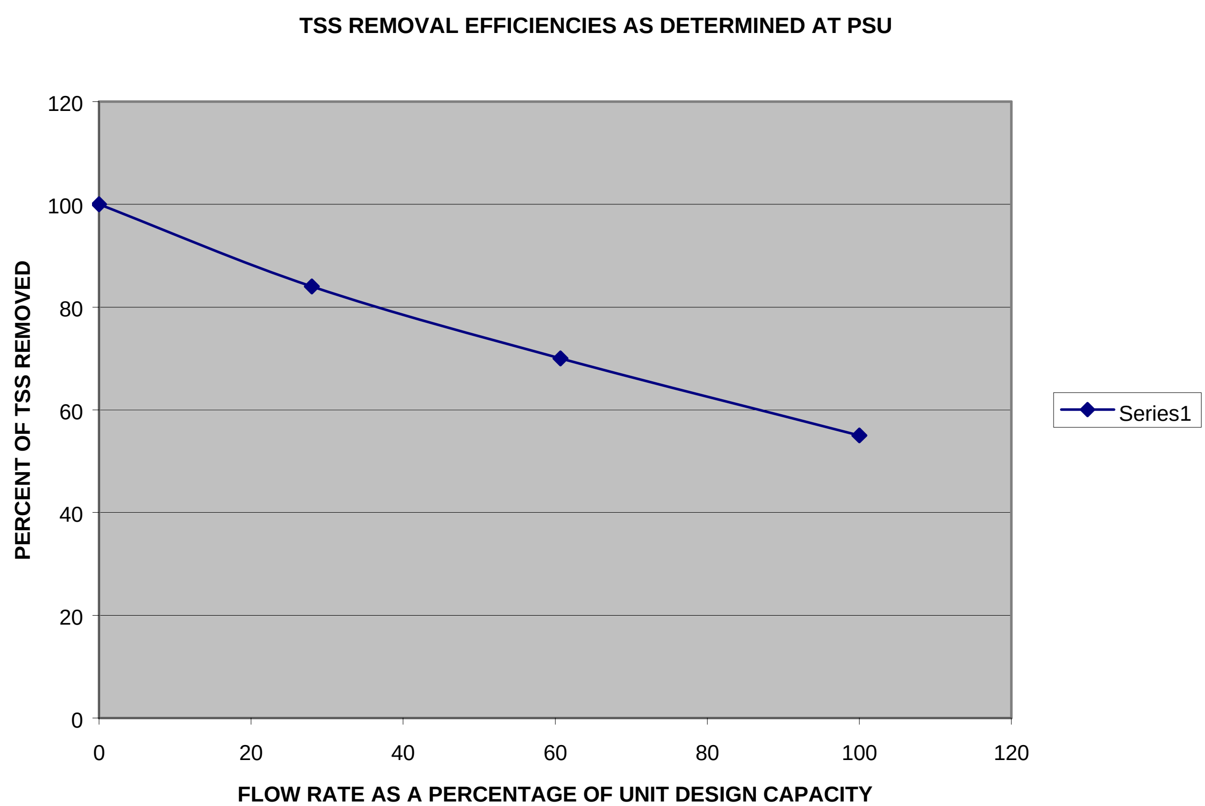
*Particle SG = 2.65

A CDS unit equipped with the 2400 µm screen has the same hydraulic capacity, as a CDS unit equipped with the 4700 µm screen.

It is worth noting that the work done by Professor Wells identified more that 80% TSS removal using the sediments that represented typical TSS in the greater Portland area when operating at 125 gpm flow rate. The removal efficiency does deteriorate at the higher flow rate to about 70%, which is to be expected. Recognizing that the typical storm hydrograph follows a pattern where a large volume will fall below the relative range where 80% removal has been achieved, it is to be expected that on an average annual basis, removals should exceed 70% where TSS possess similar characteristics of the sediments tested by Portland State University.

## Sizing for a Specific TSS Removal Goal

Form PSU TSS removal efficiency work outlined above, it was determined that CDS units using 2400-micron screens could achieve 84% TSS removal when operating at 28% of its rated hydraulic capacity, and 70% removal when operated at 60.7% of its rated capacity. The following graph further illustrates the TSS removal efficiencies of various flow rates as determined at Portland State.




From this graph, the treatment hydraulic capacity of a CDS unit can be determined to provide the greatest potential to achieve a specific TSS efficiency removal goal.

# Project: C Street OGS Outfall Upgrade, Anchorage, AK

## Performance

Based on the following design criteria:

| | | |
|---|---|---|
| 320-acre | = | Catchment Area (Commercial & Residential mix) |
| 2-yr, 6-hour | = | Design Water Quality Storm Event |
| 32-cfs | = | $Q_{wq}$ (design water quality flow to be treated) |
| 100-micron & > | = | Sediment Removal Efficiency Goal |

As a preliminary measure, CDS is proposing two preliminary storm water treatment configurations designed to provide the greatest potential to achieve an 80% removal efficiency of total suspended solids. Given that presently I've no detailed information of the speciation or particle distribution of the fines that are typically generated from the 320-acre commercial and residential catchment area, the sizing of the CDS units has been done utilizing the results of a CDS fine solids separation evaluation completed by Professor Scott Wells at Portland State University. A "TSS REMOVAL EFFICIENCY" abstract is attached highlighting the PSU evaluation and the basis on which the following CDS units have been sized.

### CDS Treatment #1 – 80 %

To achieve an 80% fine particle separation efficiency goal, each of the proposed CDS units in this configuration has been sized to operate at approximately 38% of their hydraulic treatment capacities when processing the specified "design treatment flow" for the watershed. Sizing the units to operate at 38% provides the greatest potential for these units to achieve a TSS removal efficiency goal of 80% or greater.

Table 1.
80 % TSS Removal Goal

| $Q_{wq}$ (cfs) | TSS Removal Goal 80% | CDS Operating Capacity for 80% TSS Removal | Ultimate CDS Design Flow (cfs) | Proposed CDS Unit(s) |
|---|---|---|---|---|
| 32 | 80% | 38% | 84 | (2x) PSW100_80<br>50 cfs capacity each |

Each of the proposed PSW100_80 units has a design treatment flow of 50 cfs and would most likely be configured in parallel, on either side of a flow splitting diversion box structure.

## CDS Treatment #2 – 70 %

Upon a more in depth evaluation of the 100-micron and greater particles, it may be determined that a 70% removal of the TSS would potentially achieve a satisfactory removal efficiency of the 100-micron and greater particles. A CDS unit operating a 60.7% of its design capacity should be able to remove 70% of the fine particles. The following table list several CDS configurations that should achieve a 70% or greater fine particle removal goal.

Table 2.
70 % TSS Removal Goal

| $Q_{wq}$ (cfs) | TSS Removal Goal 80% | CDS Operating Capacity for 80% TSS Removal | Ultimate CDS Design Flow (cfs) | Proposed CDS Unit(s) |
|---|---|---|---|---|
| 32 | 70% | 60.7% | 53 | PSW100_100 64 cfs capacity |
| 32 | 70% | 60.7% | 53 | (2x) PSW70_70 26 cfs capacity each |
| 32 | 70% | 60.7% | 53 | PSW100_80 50 cfs capacity |

### General Solids Separation Efficiency

It should be understood that at a minimum, these CDS storm water treatment units will ensure the permanent removal of 100% of the floatables as well as 100% of the solids equal to or larger than the 2.4 mm screen opening for flows up to and including their full hydraulic treatment capacities. There is no attenuation of this minimum removal efficiency for floatables, neutrally buoyant and gross solids 2.4 mm in size and greater. In the area of gross pollutant removal efficiencies, studies show that CDS units remove 93% of all particles which are one-third the size of the screen opening and 53% of all particles one-fifth the size of the screen opening. The patented screening process of these CDS units provides a minimum assured removal efficiency that cannot be achieved by any other storm water treatment system. Once pollutants are captured in a CDS unit, they cannot escape

### Oil and Grease Control/Capture

Additionally, the CDS unit will be equipped with an oil baffle to control oil and grease in the storm water runoff. With the addition of oil sorbents to the separation chamber, the permanent oil and grease capture efficiency is increased to 80 to 90% rate. The combination of a conventional oil baffle and particulate sorbents is a unique feature of a CDS storm water treatment unit.