Report Summary
By EcoSense International Inc.

"EVALUATION OF PERFORMANCE EFFICIENCIES OF CASSELBERRY GROSS POLLUTANT SEPARATORS"
Final Report -- September 2014

Based on monitoring and research analysis prepared by
The City of Casselberry, FL & Environmental Research and Design, Inc. for the
Florida Department of Environmental Protection

Baffle Box Removal Efficiency Study for Lake Jesup Watershed

PROJECT DESCRIPTION AND BACKGROUND

Lake Jesup Watershed is located in Seminole County Florida serving as the main drainage basin for residential, urban, agricultural areas and roadway land uses, where occupied by 33,570 residents (estimated from 2010 consensus year). The water body was identified by FDEP as impaired by nutrients (Phosphorus and Nitrogen) based on State of Florida TMDLs water quality standard. As a result, the Basin Management Action Plan (BMAP) was mandated statewide to restore water quality in Florida. Lake Jesup Watershed is interconnected with smaller basins and ponds/rivers that contribute to the total nutrient and sediment loading. This document provides a summary of the removal efficiency evaluation on the baffle box and CDS technologies studied in City of Casselberry in the "*Baffle Box with Media Filtration Installation, Effectiveness Evaluation, and Association Education for the Lake Jesup Watershed"*. The report was prepared by the City of Casselberry in March 2014 and as of this writing was still in the "final draft" stage. It compares the performance of three EcoVault® baffle boxes from EcoSense® International Inc., one Nutrient Separating Baffle Box™ form Suntree Technologies, one CDS® (continuous deflective separation) unit from Contech® Engineered Solutions and five inlet filter baskets. A brief analysis of the performance of each unit is presented. The study encompasses a full 6-month period of data collection; June through December 2013. The purpose of this summary is to outline key differences in removal efficiency for the three types of GPS (gross pollution separator) units. Data collected for the inlet basket filters has been purposely omitted.

DESCRIPTIONS OF THE INSTALLED GPS TECHNOLOGIES

The GPS technologies evaluated in this study include systems manufactured by Suntree Technologies, Contech Industries and EcoSense International. A brief description of each technology is given in the following sections.

Lake Concord Site: Suntree Technologies, Nutrient Separating Baffle Box™

Second Generation Baffle Box features:

- Concrete Structure, Rectangular Box
- Deflector Shields provided on both sides of the internal walls/chambers
- Floating Storm Boom and associated skimmer
- (2) Internal baffles
- Elevated Debris Collection Basket
- Shallow Excavations
- Internal Bypass

San Pablo Avenue Site: CDS unit, Contech Engineered Solutions Continuous Deflective Separator with Screening

CDS® Unit features:

- Concrete Structure, Cylindrical
- Tangential Pipe Connections
- Swirl Concentration with associated centrifugal forces
- Screening
- Oil Baffle
- Separation Slab (isolates sump area)
- Deep Excavations
- Internal Bypass

San Pablo Site: EcoSense International EcoVault®

Special Conditions: Author notes that this structure was constantly surcharged with high water levels from lake conditions. A bleeder valve was installed but found ineffective.

EcoVault® Baffle Box features:

- Concrete Structure, Rectangular Box
- Re-suspension prevention panels
- F.O.G (floatables-oil-grease) Baffle
- Elevated Debris Collection System
- Shallow Excavations
- Ported Baffle Wall
- Filter Weir
- 0448 Baffle Buddy Filter (2)
- Internal Bypass

Gee Creek Site: EcoSense International EcoVault®

EcoVault® Baffle Box features

- Concrete Structure, Rectangular Box
- Re-suspension prevention panels
- F.O.G (floatables-oil-grease) Baffle
- Elevated Debris Collection System
- Vault-Ox® Infusion System
- Internal Bypass
- Ported Baffle Wall
- Filter Weir
- 0261 Baffle Buddy Filter (2)
- Shallow Excavations

Lake Hodge Site: EcoSense International EcoVault®

EcoVault® Baffle Box features

- Concrete Structure, Rectangular Box
- Re-suspension prevention panels
- F.O.G (floatables-oil-grease) Baffle
- Elevated Debris Collection System
- Vault-Ox® Infusion System
- Internal Bypass
- Ported Baffle Wall
- Filter Weir
- 0261 Baffle Buddy Filter (2)
- Shallow Excavations

COMPARISON OF REMOVAL EFFICIENCIES
[Data taken from tables 4-16, 4-17, 4-18, 4-25, 4-26 4-33]

GPS UNIT	SITE	FLOW Mean/Max	TOTAL PHOSPHORUS	TSS	ZINC	COPPER	FECAL COLIFORM	TOTAL NITROGEN
Suntree NSBB™	Lake Concord	3/8 cfs	2.6%	66%	NA	NA	NA	1.6%
CDS®	San Pablo	2/5 cfs	9.3%	92%	NA	NA	NA	4.2%
EcoVault®	Lake Hodge	10/22 cfs	57%	80%	70%	40%	77%	14%
EcoVault®	Gee Creek	10/23 cfs	41%	78%	79%	64%	74%	2%
[1]EcoVault®	San Pablo	5/12 cfs	11%	63%	16%	15%	30%	14%

[1]High water conditions reduce effective head pressure on filters resulting in near zero flow through filters. High water conditions above debris screens result in nutrient release from captured organic debris.

Discussion from section 4.4.3

"Excellent removal efficiencies for total phosphorus were obtained in both the Lake Hodge and Gee Creek EcoVault® sites. Each of these sites was equipped with the outlet filter as well as the Vault-Ox® inserts. The level of phosphorus removal observed in these units is generally much greater than is commonly observed in typical GPS devices. The EcoVault® system without the Vault-Ox® insert, along with the Suntree baffle box and CDS unit, exhibited removal efficiencies ranging from approximately 3-9% which is typical of the range of values commonly observed for GPS units. The combination of the outlet filter system and the Vault-Ox® (concepts which are unique to the EcoVault® system) appear to substantially enhance phosphorus load reductions compared with the other devices."

Discussion from section 4.4.1.1.5

"A summary of observed mass removal efficiencies for total nitrogen, total phosphorus, and TSS in the EcoVault® units is given in Table 4-26. In general, removal efficiencies for total nitrogen were relatively low in value, ranging from approximately 2-14%. A substantially higher removal efficiency was observed for total phosphorus, ranging from 41-57% at the Osceola Trail sites, decreasing to 11% at the San Pablo EcoVault® site. The reduced mass removal for total phosphorus observed at this site is thought to be associated with the periodic flooded conditions which occurred in the unit. Mass load reductions for TSS were very good in each of the three units, ranging from 78-90%."

Discussion from sections 4.4.1.2.4

"As indicated on Table 4-25, positive mass removals were obtained in each of the three units for each of the evaluated metals based upon a comparison of inflow and outflow loadings. Relatively similar removal efficiencies for copper, iron, and zinc were obtained in the Lake Hodge and Gee Creek EcoVault® sites. However, somewhat lower removal efficiencies were obtained at the San Pablo site which was submerged during portions of the study and also did not contain the Vault-Ox® inserts. Since metals were not measured on the solids collected from the sumps, there is no way to determine if the observed

removals for metals occurred as a result of sedimentation of solids or filtration of dissolved metals within the outlet filter. However, the San Pablo unit (which exhibited substantially lower metal removal efficiencies) also had an outlet filter system similar to the Gee Creek and Lake Hodge sites, suggesting that the filter system may not be a significant factor in removal. The Lake Hodge and Gee Creek sites also had the Vault-Ox® inserts which maintained oxidized conditions within the unit, and may have caused some of the metals to precipitate out as either oxides or hydroxides, accumulating into the sump. If this assumption is true, then the Vault-Ox® insert appears to substantially enhance the overall effectiveness of the system for stormwater metals."