

# REVIEW of

Final Report Baffle Box Effectiveness  
Monitoring Project, DEP Contract No.  
S0236

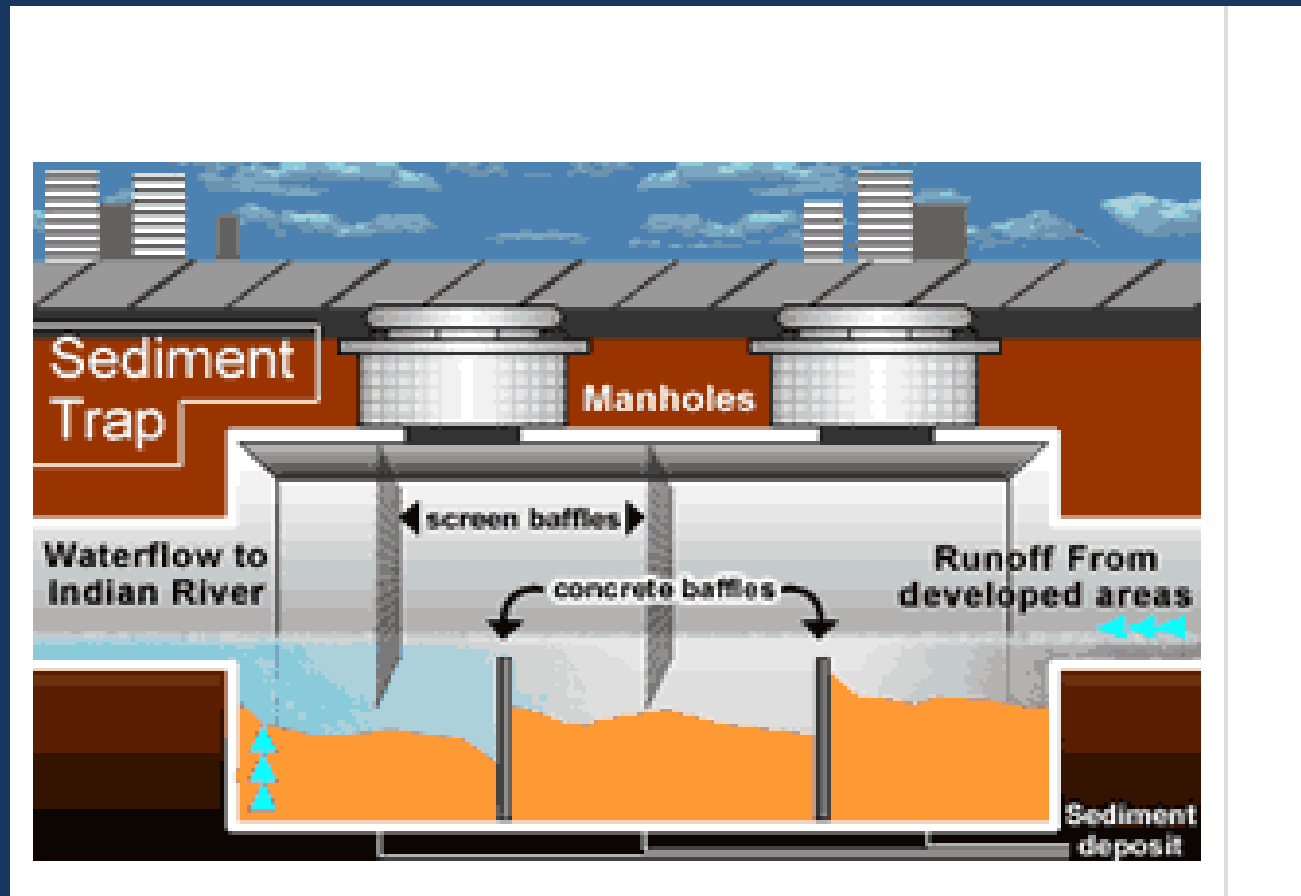
Prepared by GPI Southeast  
For FDEP and Sarasota Board of County  
Commissioners

(Focus of review is on nutrient removal efficiencies)

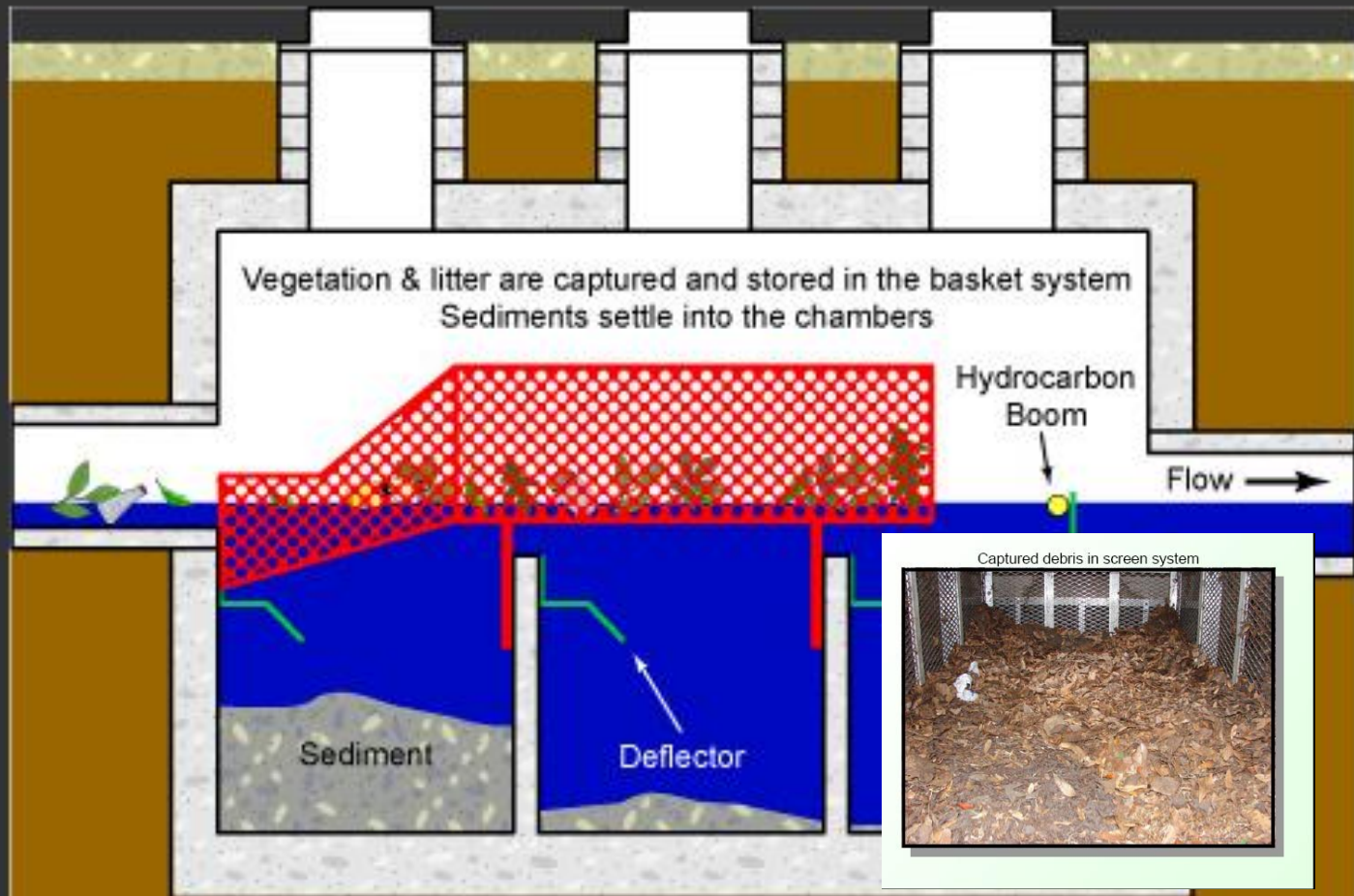
# Purpose of project

- Hired contractor to evaluate the pollutant Removal efficiency of type 1 and type 2 baffle boxes. 2 year study.
  - Type 2 boxes have a horizontal sieve screen to separate leaves, trash, other organic debris and sediment above water column.
  - 2 type 1 boxes tested, Stuart
  - 2 type 2 boxes tested, Sarasota and Rockledge

# Example Type 1 baffle box

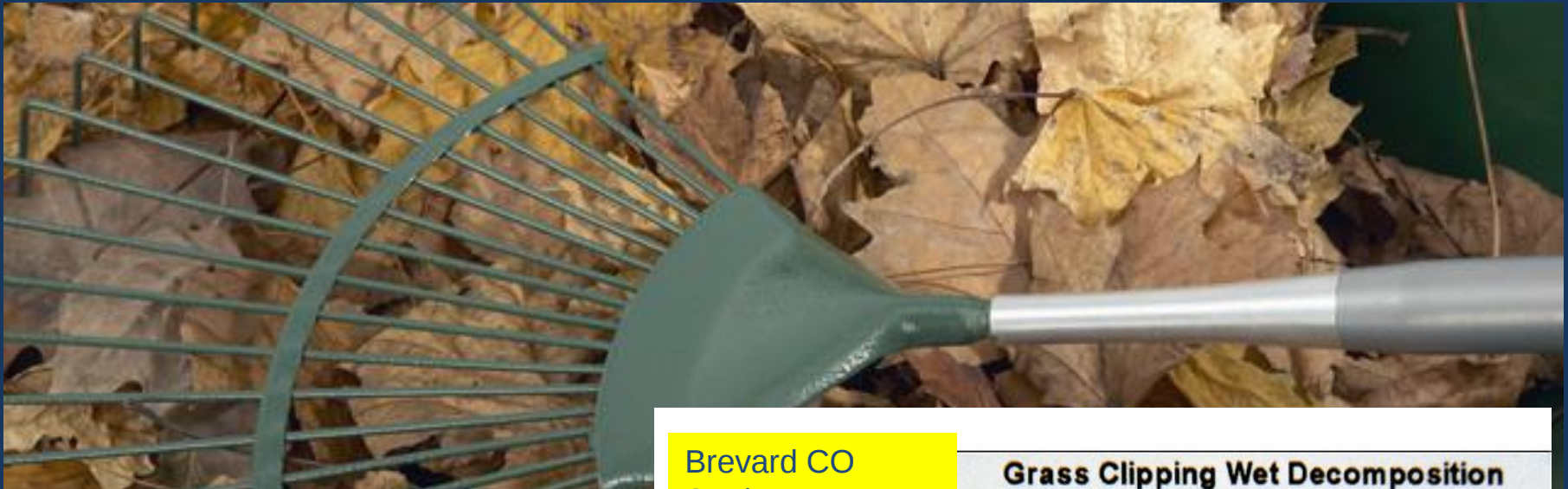


# Example Type 2 Baffle Box



**Nutrient Separating Baffle Box - During Storm Events**  
Shown with riser rings with surfacing rings/covers or frames/grates

# Its all about the leaf litter!



## Brevard CO Study – separate paper

### Decomposition Study of Grass and Leaves

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#### Abstract

A significant source of nutrient input to water bodies is from grass clippings and leaves (yard debris) washed into drainage systems during storms. Brevard County Surface Water Improvement conducted a study to determine the nutrient release rates from grass clippings and leaves in order to better understand the chemistry and resultant pollutant loading mechanisms.

Sixty-grass samples of mixed freshly cut St. Augustine grass (*Stenotaphrum secundatum*) and oak leaves (*Quercus sp.*) were placed into opaque containers. Coarsely filtered storm/ditch water was added to fill the containers to the 6-line marks. Samples were allowed to go anaerobic, typical of wet swamp best management practice (BMP) structure conditions, and tested periodically after soaking and processing. At intervals of 0, 1, 5, 9, 14, 22, 34, 50, 70, 130, and 180 days, triplicate bucket sets were agitated to simulate mixing from decomposer activity, then poured through a Number 35, US Standard Soil sieve, and the liquid analyzed. The solids that remained in or on the sieve were analyzed, and the results compared to those of the corresponding liquid phase.

The results presented depict "typical" east-central Florida lawn and leaf litter decomposition and nutrient release rates. This information may be useful in the selection or site design of BMP's for treating nutrients in stormwater, and determining cleaning frequency.

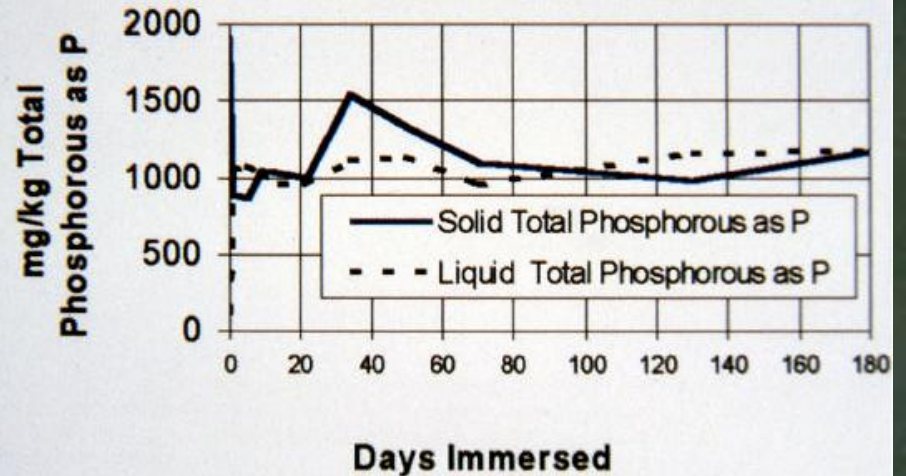
#### Introduction

Sediment carried by stormwater may reduce the ability of light to penetrate water thereby hindering the growth of marine plants, also possibly covering and smothering the plants, resulting in a die off. Leaves, grass clippings and organic matter from yards increase oxygen demands and may contribute nutrients to algae blooms that may result in fish kills. Brevard County has taken a pro-active stance to reduce sediment and nutrient contributions whenever possible through incentivizing areas that currently have little or no stormwater treatment provided. Several treatment methods currently utilized by the County include baffle boxes and stormwater inlet devices that retain these materials before they enter surface waters.

Baffle boxes often receive constant groundwater flows and retain standing water in the chambers where the sediment and debris are collected. The question has been posed whether organic constituents may leach out of the collected materials only to be carried to surface waters during the next storm event or by background flows. A significant source of nutrient input to water bodies is from grass clippings and leaves washed into drainage systems during storms. Brevard County Surface Water Improvement conducted this study to determine the nutrient release rates from grass clippings and leaves in order to better understand the chemistry and resultant pollutant loading mechanisms. The goal of this experiment was to identify variations in the concentrations of constituents, with an ultimate goal of determining a timetable for cleaning of applicable BMP structures to prevent the release of targeted pollutants.

#### Materials and Methods

## Grass Clipping Wet Decomposition Mixed Leaves and Grass Total Phosphorous as P



## Project Details

- Type 2 boxes located with at least 44% tree Canopy – largely oak
- Primarily residential landuse with curb and gutter
- Total drainage areas varied, different type soils

| Site             | Baffle Box Type | Drainage Basin (ac) | Curb and Gutter | Tree Coverage (%) | Upstream BMP |
|------------------|-----------------|---------------------|-----------------|-------------------|--------------|
| Parkway Blvd     | 1               | 23.28               | No              | 9                 | Swales       |
| Lincoln Lane     | 1               | 102.91              | No              | 7.5               | Ponds        |
| Little John Lane | 2               | 16.18               | Yes             | 44                | N/A          |
| Oriole Drive     | 2               | 21                  | Yes             | 86.8              | N/A          |

# Sampling Approach

- Water column – used for flow weighted EMC
- Bottom chamber material –determine total accumulated mass and perform chemical and physical analysis
- Strainer screen materials – quantify total volume and mass of captured material, physical and chemical analysis
- Analyzed as EMC and mass based efficiency to address sampling entire range of particle size and more accurate evaluation of efficiency.
- Full range of parameters beside nutrients includes metals and PAHs in sediment

# Project Results

| Site                        | Baffle Box Type | TN Mass Removal Efficiency (%) | TP Mass Removal Efficiency (%) | TN EMC Removal Efficiency (%) | TP EMC Removal Efficiency (%) | Fecal Coliform EMC Removal Efficiency (%) |
|-----------------------------|-----------------|--------------------------------|--------------------------------|-------------------------------|-------------------------------|-------------------------------------------|
| Parkway Blvd, Stuart        | 1               | 0.03                           | 0.06                           | 5.60                          | -15.30                        | -4.2                                      |
| Lincoln Lane, Stuart        | 1               | 1.00                           | 4.50                           | -8.30                         | 1.50                          | -89                                       |
| <b>Average Type 1</b>       |                 | <b>0.50</b>                    | <b>2.30</b>                    | <b>-1.35</b>                  | <b>-6.90</b>                  | <b>-47</b>                                |
| Little John Lane, Rockledge | 2               | 28.10                          | 19.40                          | -11.30                        | -8.20                         | -249                                      |
| Oriole Drive, Sarasota      | 2               | 10.00                          | 11.60                          | 30.60                         | 21.60                         | 13.1                                      |
| <b>Average Type 2</b>       |                 | <b>19.05</b>                   | <b>15.50</b>                   | <b>9.65</b>                   | <b>6.70</b>                   | Should be -118.8<br><b>-1188</b>          |

# Project Recommendations

- The pollutants targeted for reduction are nutrient based, and
- There are no upstream BMPs such as ponds, exfiltration trenches, swales, inlet traps, or other filtration unit processes, and
- The streets in the watershed have curb and gutters, and
- The tree canopy coverage in the watershed exceeds 25%.

# Concerns

- High fecal coliform counts
- BMP increases fecal numbers
- Should be taken into consideration in Urban areas with bacterial TMDLs
- Maintenance/cleaning of units important

## DEP thoughts

- Still a useful BMP in urban area where choices are limited
- Grant funding possible

**Final Draft Report  
Baffle Box Effectiveness Monitoring Project  
DEP Contract No. S0236**

*For*

Florida Department of Environmental Protection

*And*

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APPLIED  
ENVIRONMENTAL  
TECHNOLOGY



This project was funded by an Urban BMP Research Grant from the Bureau of Watershed Restoration, Department of Environmental Protection. Total project cost was \$347,272, of which DEP provided \$347,272, or 100%

# Other studies

## Nutrient Separating Baffle Box - Removal Efficiencies

### Numeric Reductions (mg/L)

| Study                             | Total Suspended Solids mg/L |          |                    | Total Phosphorus mg/L |          |                    | Total Nitrogen mg/L |          |                    |
|-----------------------------------|-----------------------------|----------|--------------------|-----------------------|----------|--------------------|---------------------|----------|--------------------|
|                                   | Influent                    | Effluent | Removal Efficiency | Influent              | Effluent | Removal Efficiency | Influent            | Effluent | Removal Efficiency |
| Dillard & Associates - Field Test | N/A                         | N/A      | 93.3%              |                       |          |                    |                     |          |                    |
| Pandit - Physical Modeling        | N/A                         | N/A      | 89.8%              |                       |          |                    |                     |          |                    |
| Sunset Park Baffle Box            | 81.16                       | 28.9     | 66.9%              | 1.809                 | 1.022    | 46%                |                     |          |                    |
| Lubnow - Harvey's Lake            | 918                         | 128      | 86.3%              | 0.47                  | 0.32     | 32%                |                     |          |                    |
| Royal - Indianland                | 32.9                        | 7.8      | 76.9%              | 1.48                  | 0.44     | 70%                |                     |          |                    |
| Royal - Mico                      | 18.66                       | 8.825    | 47.9%              | 0.066                 | 0.0426   | 23%                |                     |          |                    |
| Pastore - Pine St                 | 110                         | 31       | 71.8%              | 0.33                  | 0.19     | 42%                | 3.6                 | 1.3      | 63%                |
| Pastore - 6th St                  | 86                          | 27       | 68.2%              | 0.31                  | 0.21     | 32%                | 1.8                 | 0.99     | 38%                |
| Pastore - 7th St                  | 44                          | 27       | 38.6%              | 0.22                  | 0.18     | 18%                | 2.3                 | 1.3      | 43%                |

| Study             | Zinc mg/L |          |                    | Lead mg/L |          |                    | Copper mg/L |          |                    |
|-------------------|-----------|----------|--------------------|-----------|----------|--------------------|-------------|----------|--------------------|
|                   | Influent  | Effluent | Removal Efficiency | Influent  | Effluent | Removal Efficiency | Influent    | Effluent | Removal Efficiency |
| Pastore - Pine St | 0.072     | 0.044    | 39%                | 0.0085    | 0.0062   | 27%                | 0.012       | 0.0094   | 22%                |
| Pastore - 6th St  | 0.088     | 0.038    | 57%                | 0.014     | 0.0065   | 54%                | 0.017       | 0.01     | 41%                |
| Pastore - 7th St  | 0.057     | 0.041    | 28%                | 0.0066    | 0.0051   | 23%                | 0.014       | 0.011    | 21%                |

| Study                  | BOD (mg/L) |          |                    |
|------------------------|------------|----------|--------------------|
|                        | Influent   | Effluent | Removal Efficiency |
| Sunset Park Baffle Box | 18.981     | 4.126    | 75%                |
| Royal - Indianland     | 1.88       | 1.4      | 26%                |
| Royal - Mico           | 1.68       | 1.7      | -7%                |

Dillard & Associates Consulting Engineers - Field Test for SunTree Nutrient Separating Baffle Box - Test Report - Feb 2006

Pandit & Gopalakrishnan - Florida Institute of Technology - Physical Modeling of a Stormwater Sediment Box - 1999 - [Independent Test](#)

Sunset Park Baffle Box - Brevard County Surface Water Improvement - St. John's River Water Management District - 1998 - [Independent Test](#)

Lubnow & Miller - Princeton Hydro - The Design, Installation, and Effectiveness of a Structural BMP for Harvey's Lake - 2003 - [Independent Test](#)

Royal & Vanderbleek - Brevard County Surface Water Improvement Div - Sediment Control Project, Indianland/Mico - 1994 - [Independent Test](#)

Pastore - Blue Water Environmental - Atlantic Beach Monitoring Study: Pine St, 6th St, 7th St - 2004

<http://suntretech.com/Products/Nutrient+Separating+Baffle+Box/Reports/default.aspx>