

Treating All Roadway Stormwater Runoff to Remove Contaminants

Florida Keys Marine Science Conference & Workshop
Marriott Coral Springs, October 27-30, 2025

Sandy Walters, Eco Legacy Solutions, LLC



Roadway Stormwater Contains Contaminants

SEDIMENTATION = Particulates

- pavement wear, vehicles, atmospheric deposition, maintenance activities, septic tank leakage

NUTRIENTS = Nitrogen & Phosphorus

- atmospheric deposition, fertilizer application, septic tank leakage, roadway runoff, decaying plant matter

HEAVY METALS = Lead, Copper, Zinc, Iron, Cadmium, Nickel, Manganese

- variety of vehicle-related sources plus fungicides and insecticides

HYDROCARBONS = Petroleum

- spills, leaks, antifreeze and hydraulic fluid, asphalt surface leachate

BACTERIA = Fecal coliform and streptococci

- domestic animals, birds, septic tank leakage

PFAS Found in Roadway Sweepings from 6 Cities Sampled

Gainesville, Orlando, Pensacola, Tampa, Daytona Beach and **Key West**

Long- and Short-Chain PFAS found

Key West had highest concentration of long chain PFAS

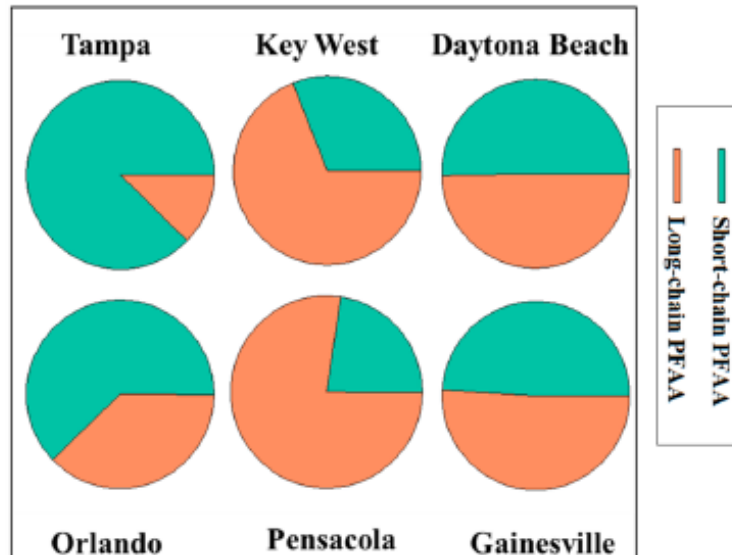
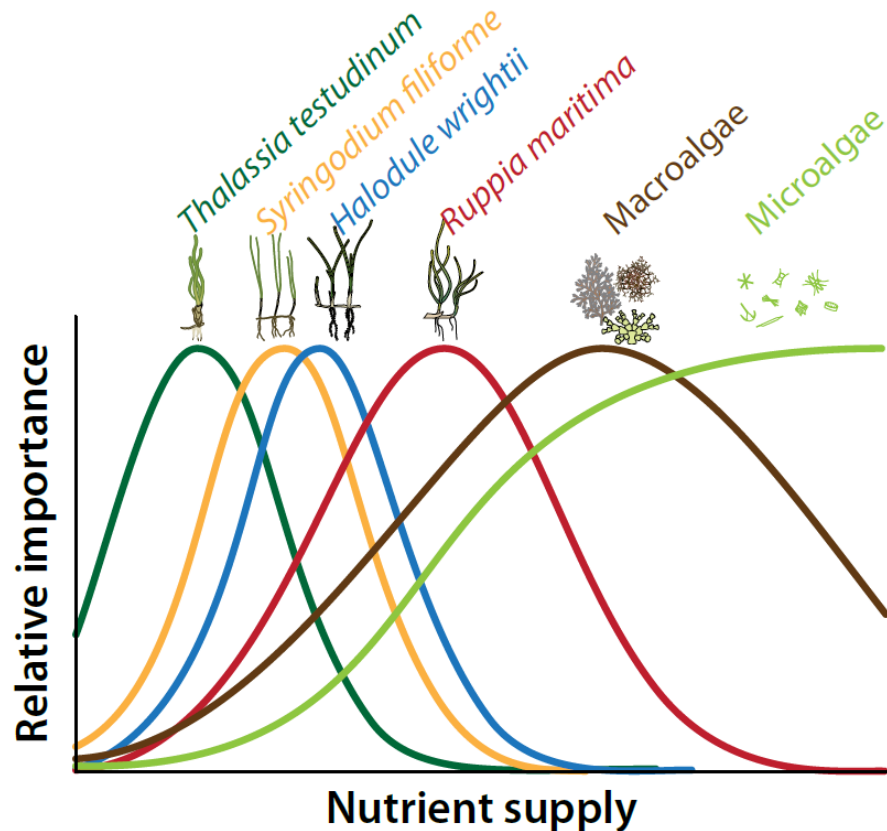


Figure 5. Pie chart of distribution of short chain and long chain PFAA in six urban areas. Gainesville ($n = 56$), Orlando ($n = 15$), Key West ($n = 15$), Pensacola ($n = 12$), Tampa ($n = 13$), Daytona Beach ($n = 6$).

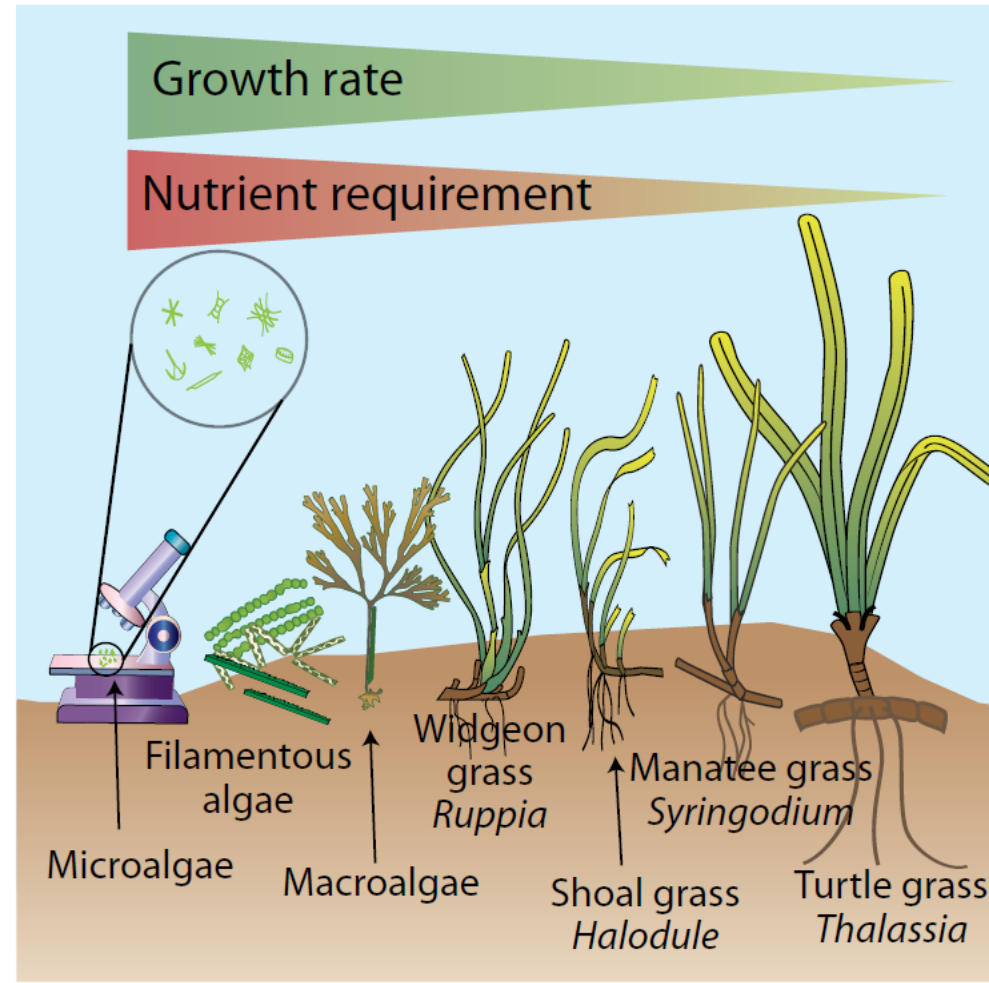
Source: Ahmadireskety et al, Per- and Polyfluoroalkyl Substances (PFAS) in Street Sweepings, Environ. Sci. Technol, 2022, 56, 6069-6077.

Focus on Nutrients

- **EPA 1998 Fact Sheet**
high concentration of nutrients are *primary cause of Florida water impairment*
- **Nutrient levels cause habitat shifts**
seagrasses provide example



Source of figures: *Tropical Connections: South Florida's Marine Environment*, 2012



Extreme Effects of Excess Nutrients

- **Algae blooms with toxic effects**

A Microcystis bloom in a residential canal at Normandy Court in Cape Coral during July 2018 (Photo credit: Brian Lapointe, Ph.D.)



- **Oxygen depletion causing fish kills**

CNN — Florida may be the fishing capital of the world, but you'd never know it from the latest scenes around the state's Indian River Lagoon. March 25, 2016.



- **Manatees starving from seagrass dieoff**

The Guardian — Emaciated manatees in Florida's Suwannee River (Jason Gulley, August 26, 2021)



Florida's Stormwater Regulation

- **Florida was first state to establish stormwater treatment standards**
Rule in effect in 1982 specified level of pollutant load reduction
for all new development
- **Created stormwater standards equal to wastewater at that time**
“Secondary treatment” of 80% reduction in total suspended solids (TSS)
with cost much higher for greater reduction
- **Florida statute in 1990 mandated increased regulation**
“The rule provides that one of the primary goals of the program is to maintain, to the degree possible, during and after construction and development, the **predevelopment stormwater characteristics of a site**. The rule also provides a specific minimum performance standard for stormwater treatment systems: **to remove 80% of the post-development average annual stormwater pollutant loading of pollutants that cause or contribute to violations of water quality standards**. This performance standard is significantly different than the original one used in Florida's stormwater treatment rules.”

New Florida Stormwater Regulation

New rule will go into full effect on December 28, 2025

Many projects are “grandfathered”

- Legally in existence prior to 2013 and still compliant with permit
- Legally exempt activities
- Modifications of grandfathered permits “including new activities within the originally permitted project area that lessens or does not increase impacts.”

Projects can be exempted

- Not increasing impervious surface more than 10%
- If not within specially protected watershed or upstream of an Outstanding Florida Water (OFW) so Keys projects cannot be exempted
- Are smaller than original project and also reduce pollutant loading

Project evaluation involves

- Calculating pre- and post-project nutrient loading
- Meeting required performance standards for all nutrient loading
in excess of pre-project conditions

Extreme Effects of Excess Nutrients

- **Algae blooms with toxic effects**

A Microcystis bloom in a residential canal at Normandy Court in Cape Coral during July 2018 (Photo credit: Brian Lapointe, Ph.D.)



- **Oxygen depletion causing fish kills**

CNN — Florida may be the fishing capital of the world, but you'd never know it from the latest scenes around the state's Indian River Lagoon. March 25, 2016.



- **Manatees starving from seagrass dieoff**

The Guardian — Emaciated manatees in Florida's Suwannee River (Jason Gulley, August 26, 2021)



Adopted March 9, 2023

Resolution by Florida Keys National Marine Sanctuary's Water Quality Protection Program Steering Committee

A Resolution of the Florida Keys National Marine Sanctuary Water Quality Protection Program Steering Committee urging inclusion of stormwater treatment in roadway improvement projects in the Florida Keys.

The Water Quality Protection Program (WQPP) Steering Committee for the Florida Keys National Marine Sanctuary urges the Florida Department of Transportation and the Federal Highway Administration to fund stormwater treatment for roadway improvement projects in the Florida Keys **including those that do not increase impervious surface**. A 1999 EPA report identified stormwater, particularly runoff from roadways, as the second leading contributor of nitrogen and phosphorus into the nearshore waters behind wastewater, which has since been a major focus of infrastructure improvements. Sanctuary water quality is a primary focus of federal and State management and protection in the Florida Keys, with stormwater treatment being identified as a top priority in 2020 by the WQPP Steering Committee. Therefore, **treatment of roadway runoff must be a priority to reduce contaminant loading into the nearshore waters**. This also addresses the Florida Keys Reasonable Assurance Document to meet federal and State water quality standards and protect the world-class marine environment that the Florida economy depends upon.



The Keys are full of roads with no stormwater treatment

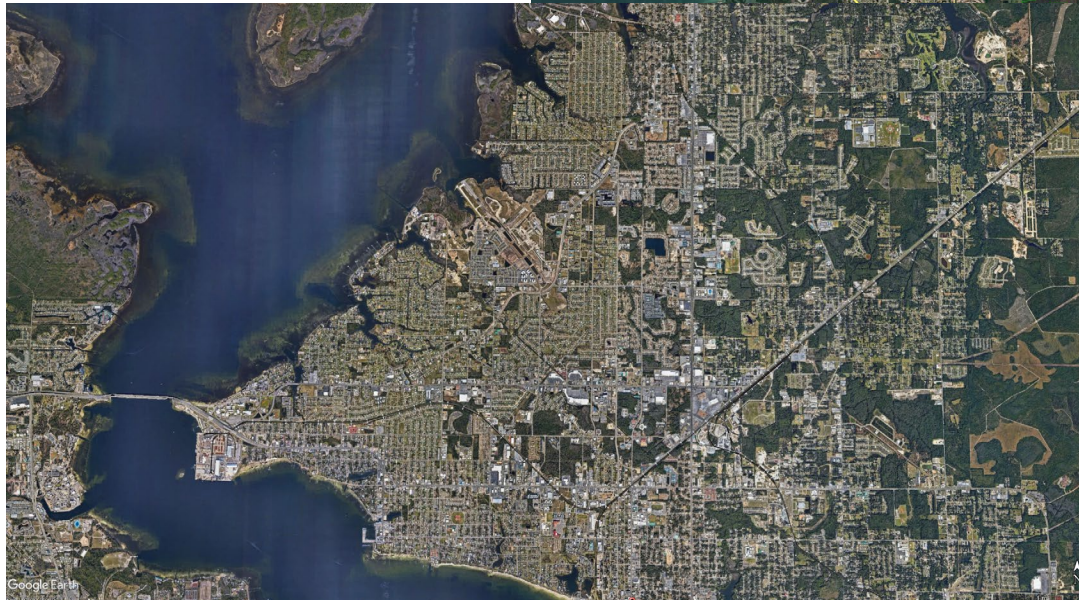
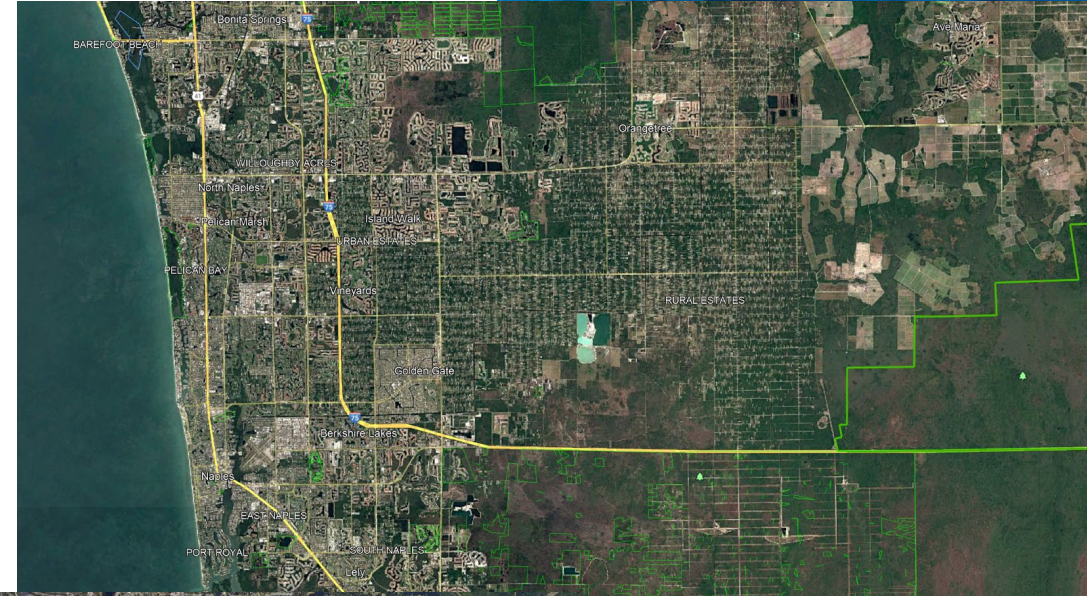
- Big Pine, Little Torch and Ramrod keys have many rural roads with no stormwater treatment as they pre-date rules requiring its installation
- Koehn's Subdivision had road flooding but improvements not required to install stormwater treatment



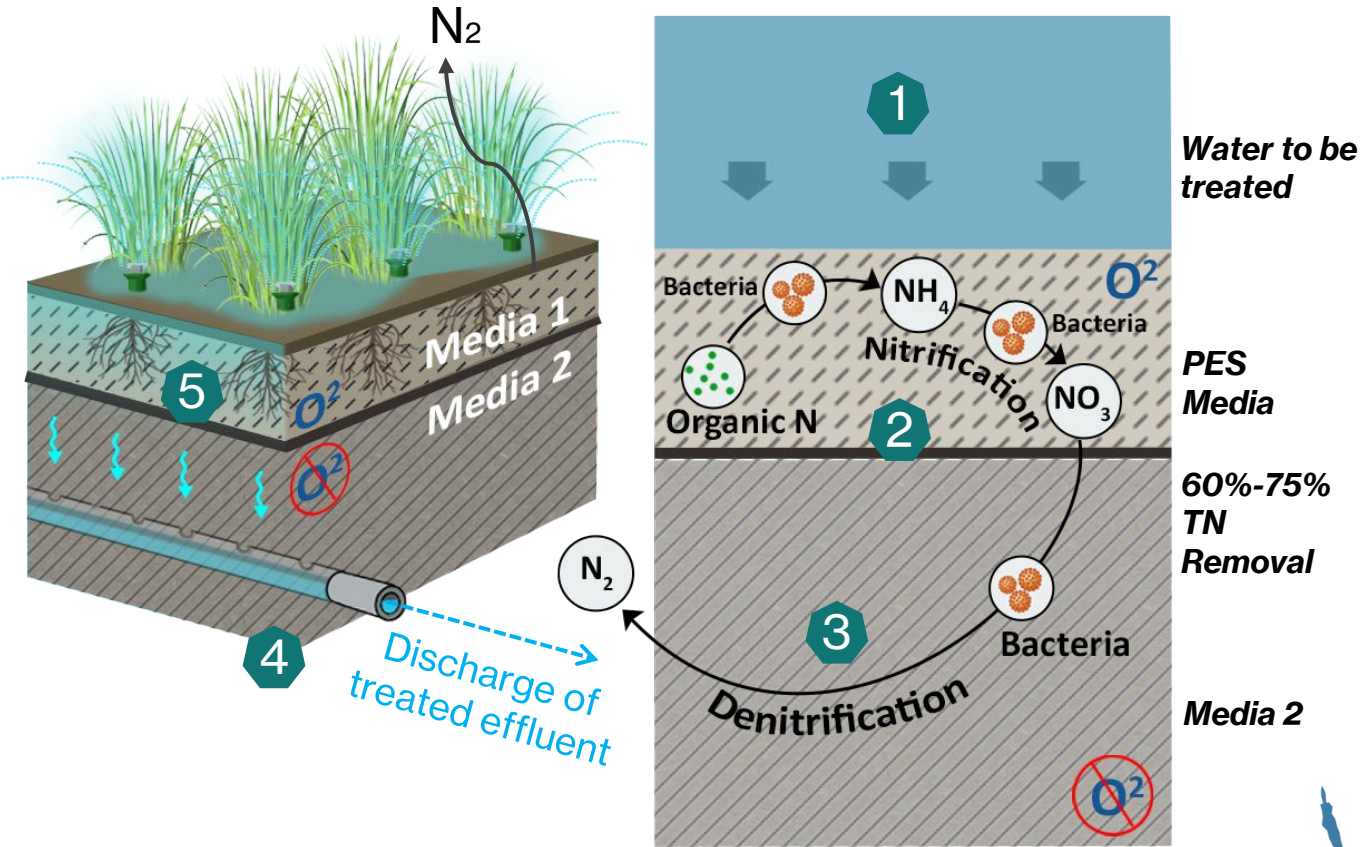
Treatment of existing roadway nutrient sources is needed – not just new

- Local governments work hard to limit existing roadway footprint increases due to lack of funding for stormwater treatment, even when needed
- **Regulation of only new nutrient sources has clearly not been enough**
- The rest of Florida has plenty of areas with roadways that predate 2013
- Florida local governments should join the Keys and encourage funding to address **existing and new** roadway water quality impacts!
- Would benefit flood control too

*Right: Collier County. Below:
Panama City area.*



New Technology Is Available



Industry-leading Removal Rates

- **Total Phosphorus:** > 80%
- **Total Nitrogen:** > 50%
- **Total Suspended Solids:** 95%
- **Metals:** 80%

Sustainable
Water Infrastructure
Group, LLC



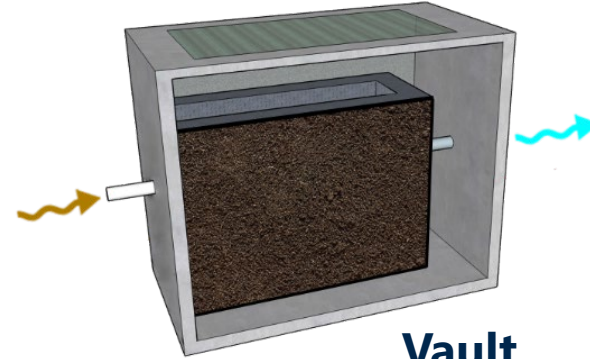
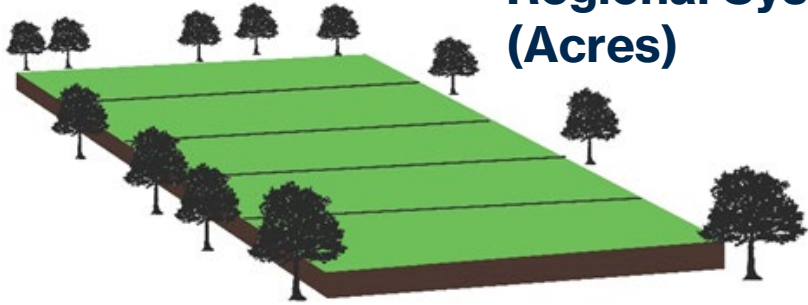
swig-llc.com

- 1** Water is distributed onto and passes vertically through two layers of patented media (think "Brita" filter)
- 2** The first media layer is aerobic and transforms organic nitrogen and ammonia into nitrate. This layer can be modified to include a phosphorus removal (PES) option.
- 3** The second media layer is anoxic and transforms nitrate into harmless nitrogen gas which is released to the atmosphere
- 4** Treated effluent is collected via underdrain pipe(s) and discharged into receiving waters
- 5** Robust plant growth with deep roots maintains media porosity and creates dense wildlife habitat
- 6** No media replacement required for ONE. Combined PES + N systems require replacement of first media layer

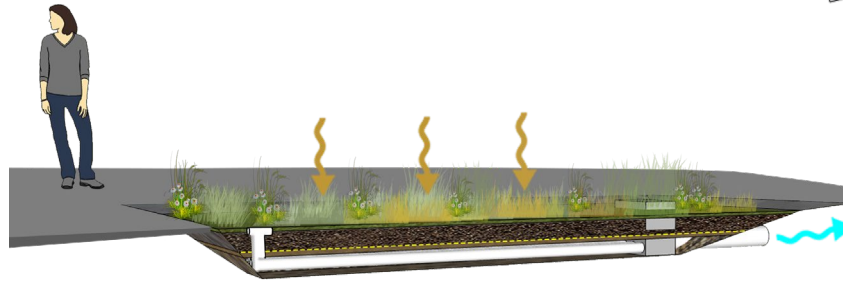


Stormwater Media Systems

**Regional Systems
(Acres)**



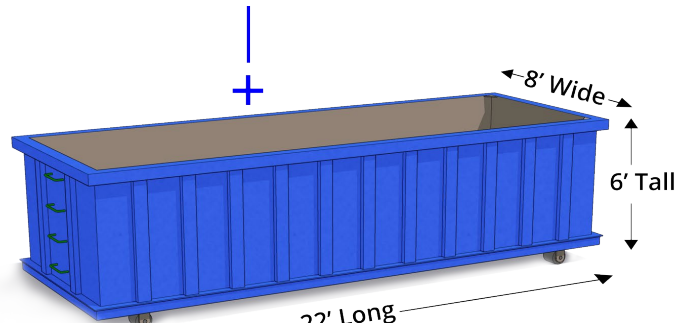
Vault



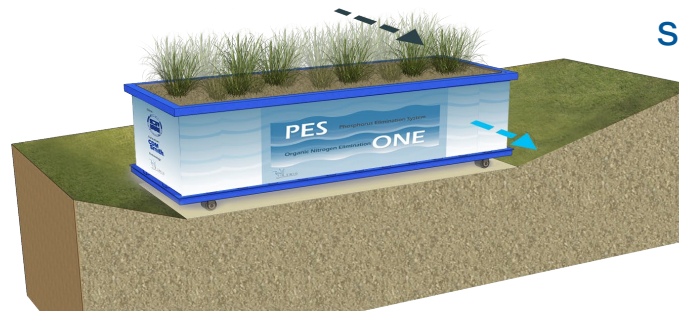
Rain Garden

Sustainable
Water Infrastructure
Group, LLC

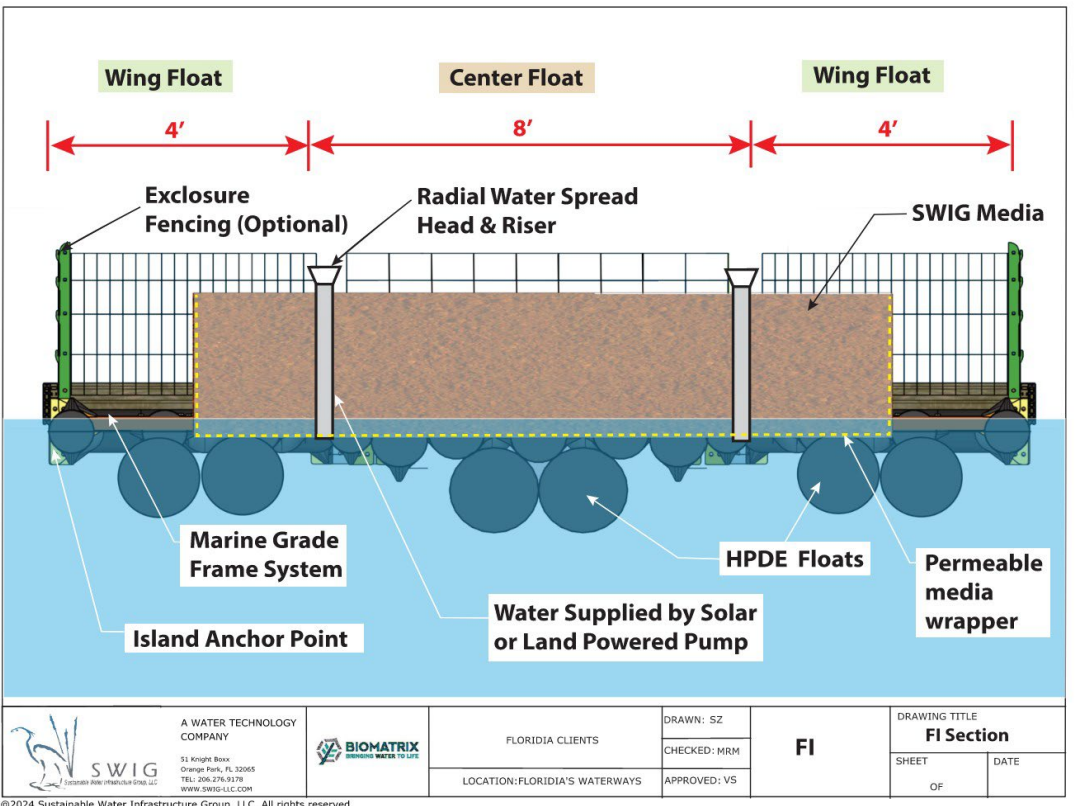
swig-llc.com



Module



Stormwater Media Systems



This should be our goal

From this



to this!

