



Innovative Nature-based Media Filtration Technology Overview

**Florida Keys National Marine Sanctuary
Water Quality Committee Meeting**

March 4, 2026



**Vincent Seibold, P.E., MBA
Director of Operations
Sustainable Water Infrastructure Group, LLC**

Company Overview

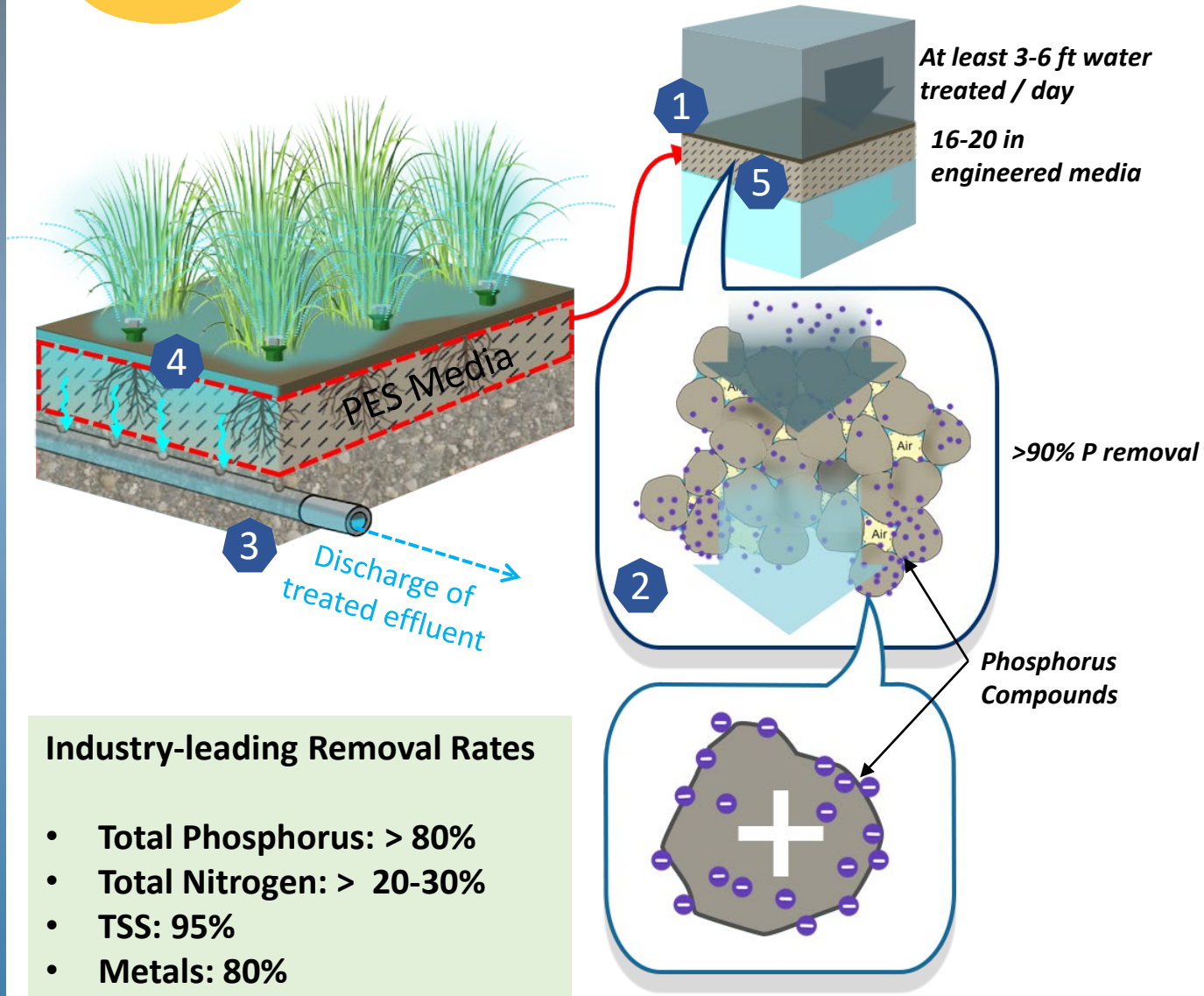
- Water Technology Company
- Working Florida since 2017
- Unique features of system:
 - Flexible deployment (point and non-point)
 - Speed of project delivery (<1 year)
 - Passive, easy to operate systems, no chemicals
 - Meet surface water quality standards (NPDES)
 - Reliably remove:
 - Phosphorus Elimination System (PES) 
 - PES+N (Nitrogen) 
 - PES+C (Color) 
 - Monitored systems, verified removal results
 - Alternative delivery, “pay for performance”
 - Spent media to be recycled for AG applications



- Scalable & Cost efficient
- Designed to last up to 25years
- Documented removal:
 - TP, TN, Color, E. Coli, TSS, Metals, PAHs, Toxic Anions, PFAS

Technology – Phosphorus Elimination System (PES) - Overview

PES



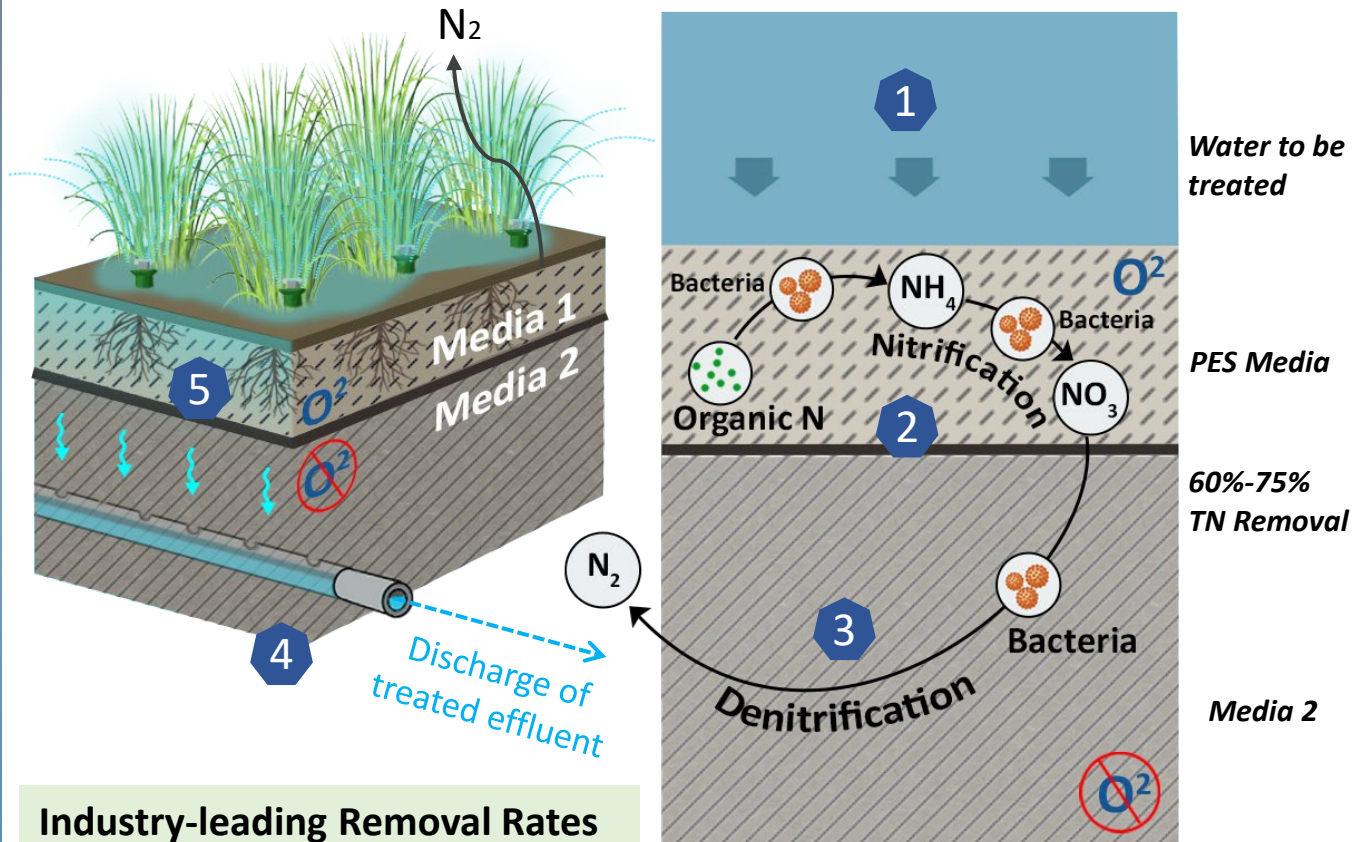
- 1 Water is distributed onto and passes vertically through a layer of patented media (think "Brita" filter)
- 2 Patented media has an exceptionally high capacity to adsorb and irreversibly bind phosphorus (P)
- 3 Treated effluent is collected via underdrain pipe(s) and discharged into receiving waters
- 4 Robust plant growth assist in P removal and creates dense wildlife habitat
- 5 The media is designed for a specific lifetime (10 to 20 years) and can be replaced to extend project lifetime. Spent media is an excellent soil amendment

Industry-leading Removal Rates

- Total Phosphorus: > 80%
- Total Nitrogen: > 20-30%
- TSS: 95%
- Metals: 80%

PES + Nitrogen System- Overview

PES + N

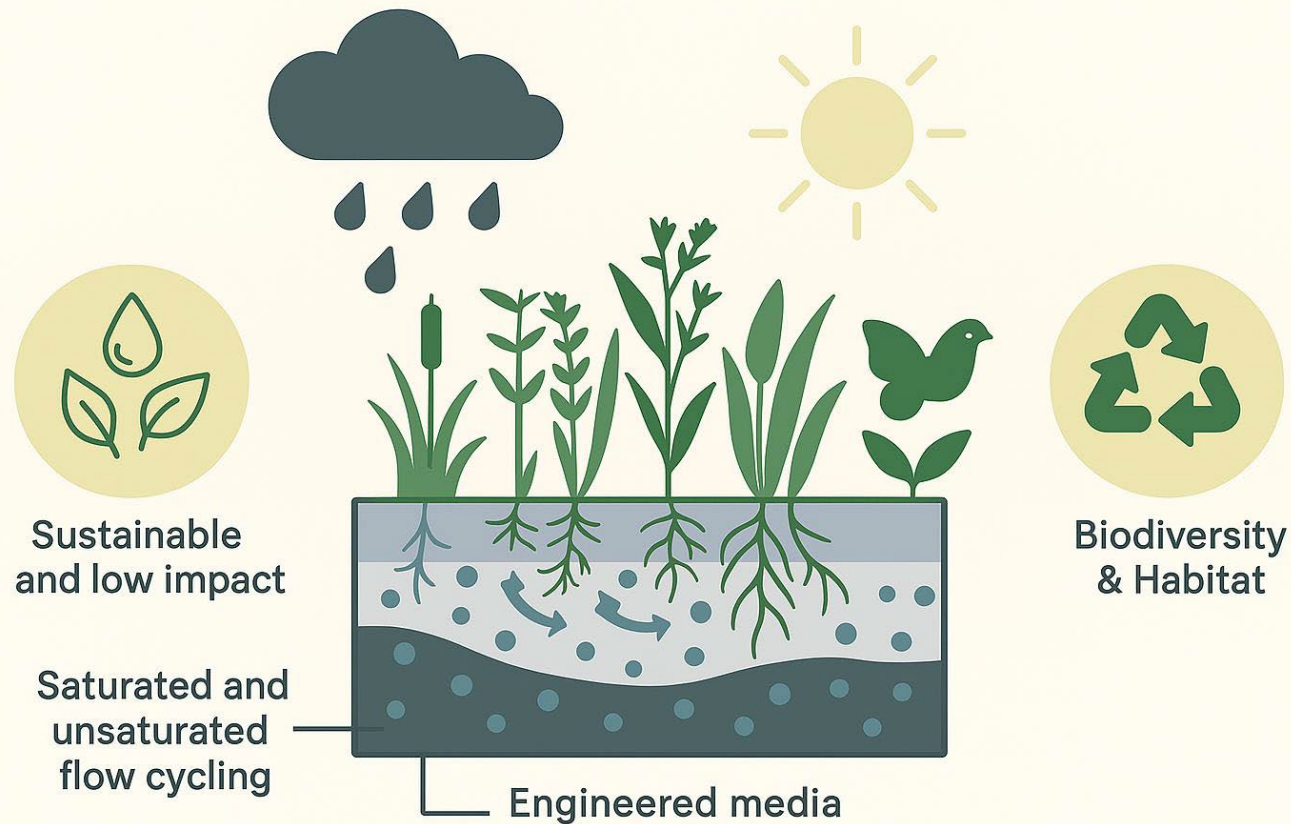


Industry-leading Removal Rates

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

- 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

How SWIG's Passive-Media System Qualifies as a Nature-Based Solution



✓ Ecosystem-Based Approach

- Mimics natural filtration using engineered media and wetland plants
- Enhances nutrient transformation through flow cycling

✓ Sustainable and Low Impact

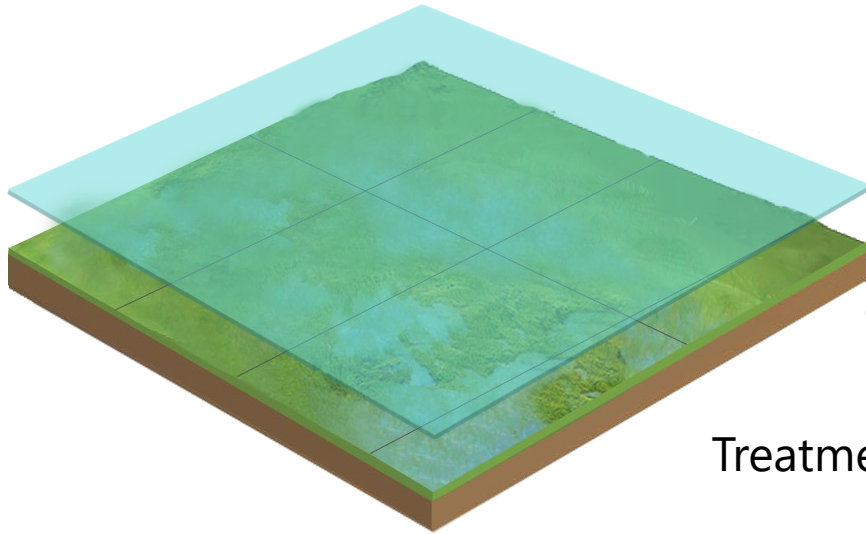
- Passive operation without chemicals
- Made from recycled, non-toxic materials
- Spent media reused in agriculture

✓ Supports Biodiversity & Habitat

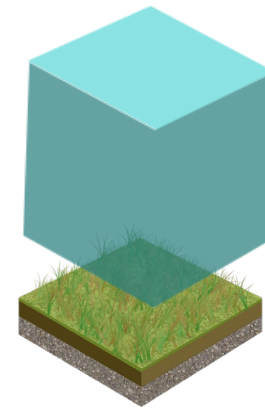
- Native vegetation creates wildlife habitat
- Provides ecological function in compact footprints

How is it different from treatment wetlands?

Same Volume at much
higher HLR



Treatment Wetlands



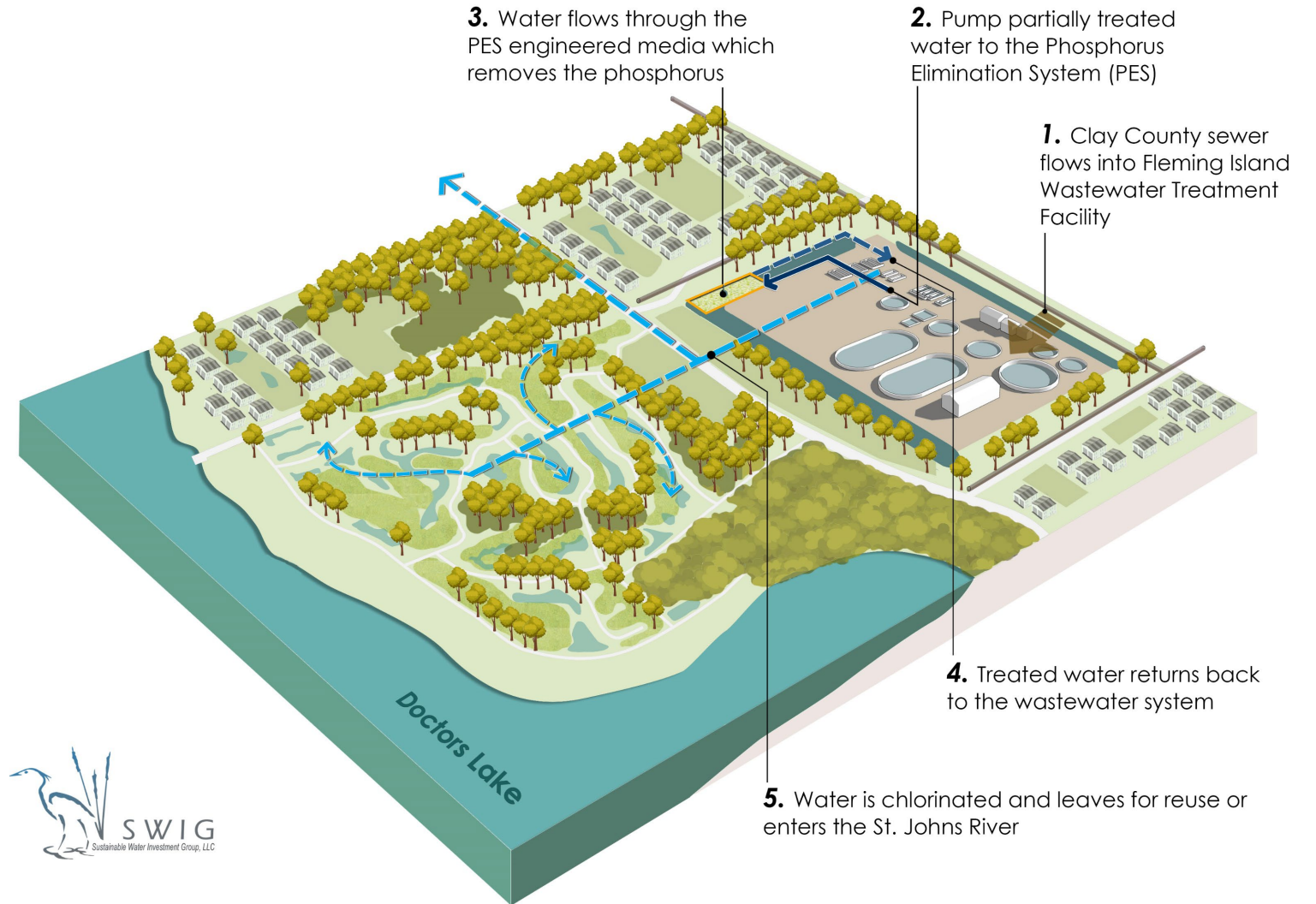
Compressed Treatment
Footprint

Bolt-on Regional System

PES

- 1.1-acre footprint
- ~1.4 mgd treated
- 7,500 lbs. of P removed
- Direct monitoring

Doctors Lake Phosphorus Removal Process Diagram



Doctors Lake Advanced Phosphorus Removal

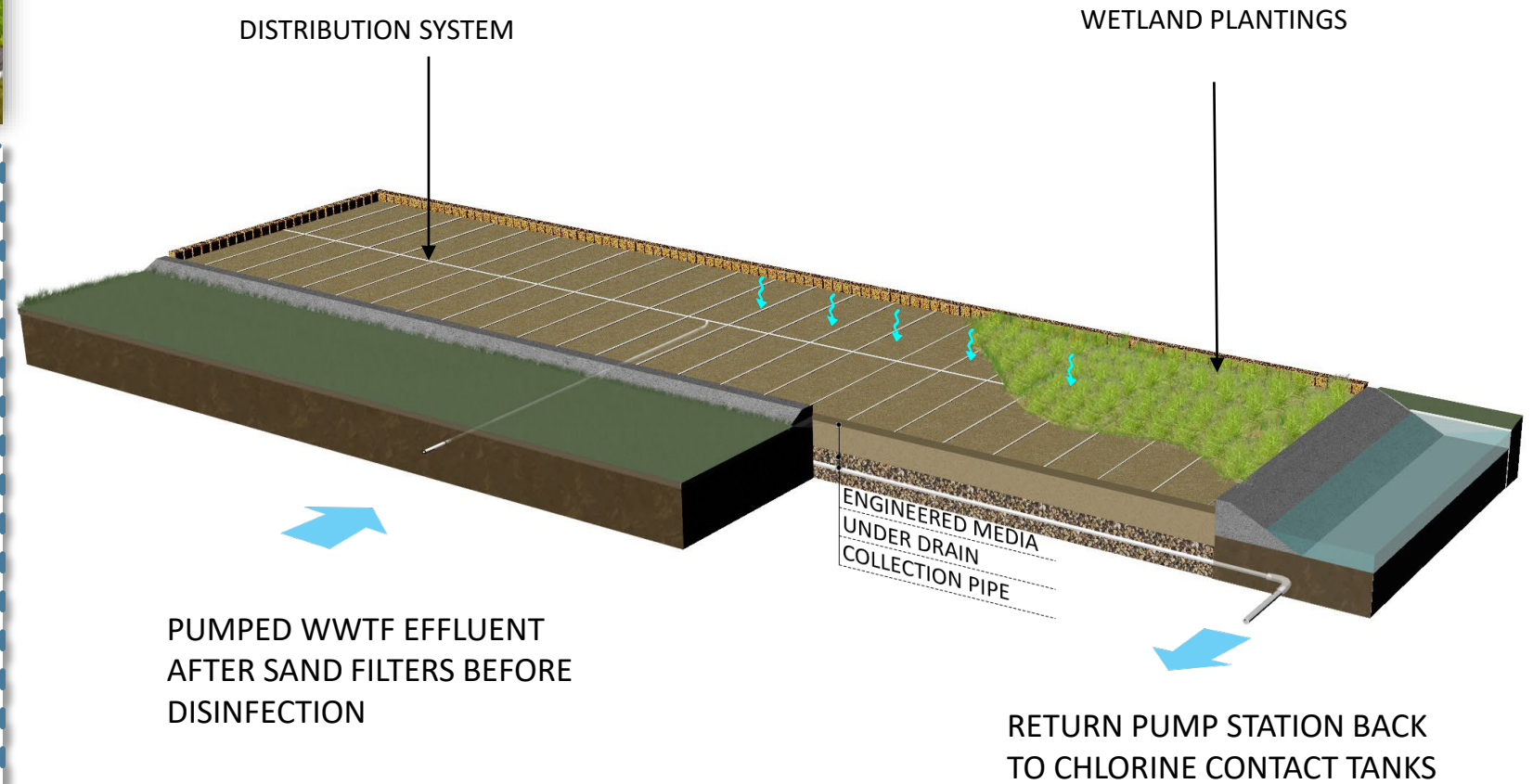
PES



Cells are dosed in sequence, allowing flow regime to cycle between saturated and drained.

Wetland plantings facilitate TP removal and improve media infiltration rates.

Treated PES effluent collected in under drain is then pumped back into WWTP.



Location: **Clay County, FL**
Client: **St. Johns River WMD**

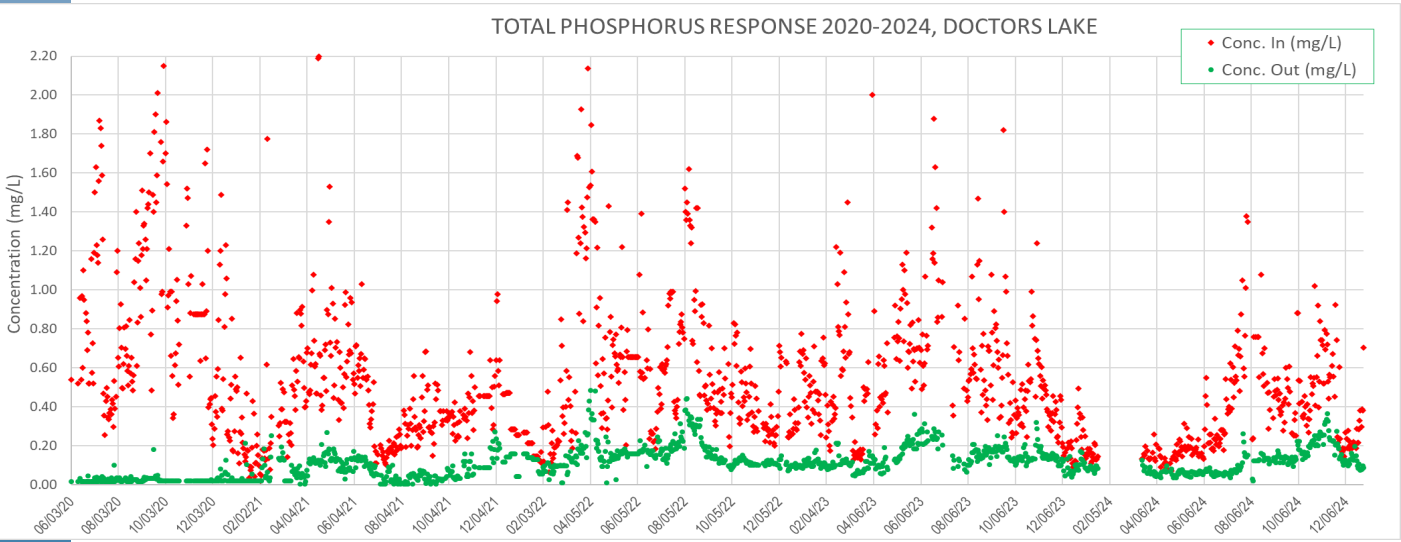


Location of SWIG PES (~ 1.1 acre / 46,000 square feet)

Technology Performance

PES

Period: 06/11/2020 - 12/31/2024



Total P removed:

7,230 lbs.

Average Daily Flow:

1.4 MGD (2.17 cfs)

Average Daily Influent P:

0.58 (mg/L)

Average Daily Effluent P:

0.110 (mg/L)

Lifetime removal rate of 81.1%

Annual Vegetation Harvest and Plant Response



October 2023



March 2024



May 2024
(regeneration from existing roots stock)



Project:

- Recharge the Upper Floridan Aquifer with up to 10 MGD
- Secondary benefit is restoration of historic lake water levels.

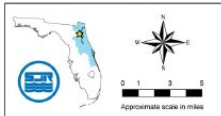
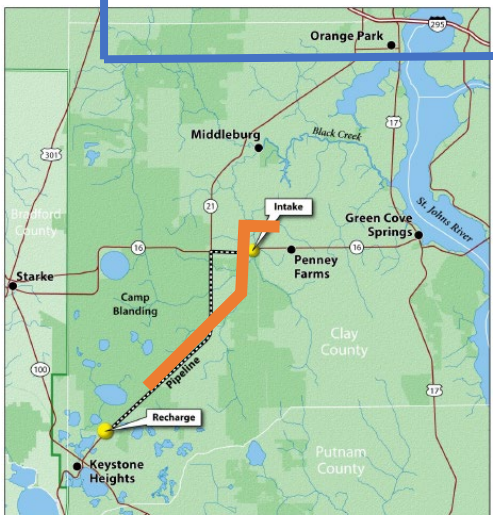
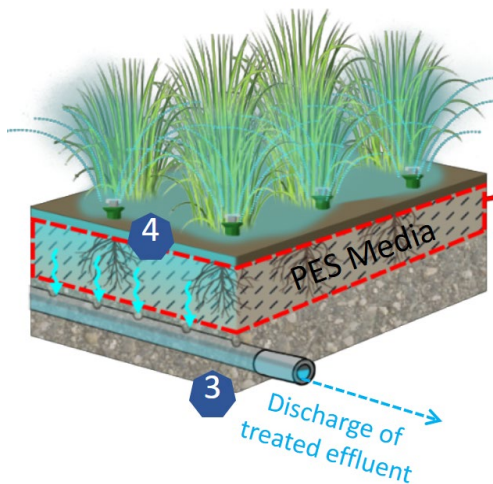
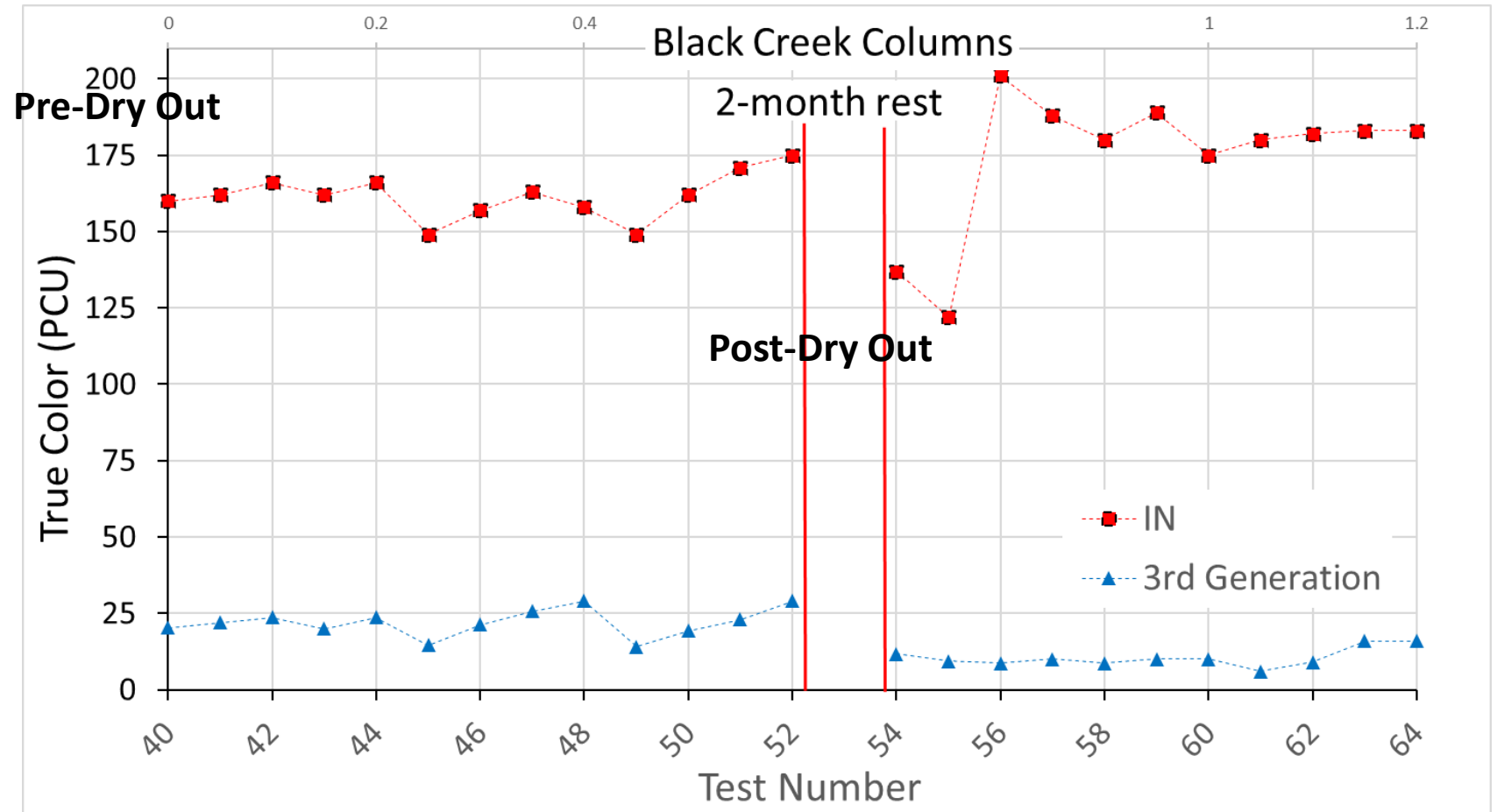


Figure 1
Black Creek
Water Resource
Development
Project

The St. Johns River Water Management District projects and uses this information for its own purposes and this information may not be suitable for other purposes. This information is provided as a public information and is not to be used for any other purpose. For more information on this data, contact the St. Johns River Water Management District, Geographic Information Systems, 1000 N. Highway 17, Suite 100, Palmdale, Florida 33757-1000. Tel: (813) 323-4500.

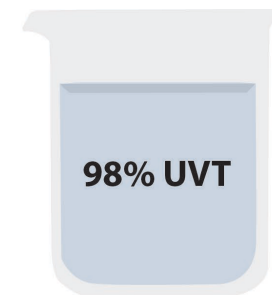
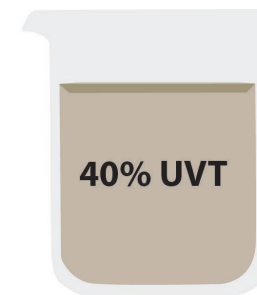
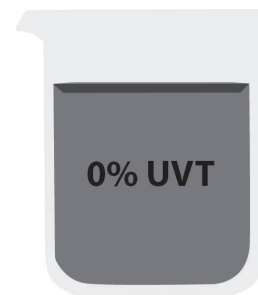
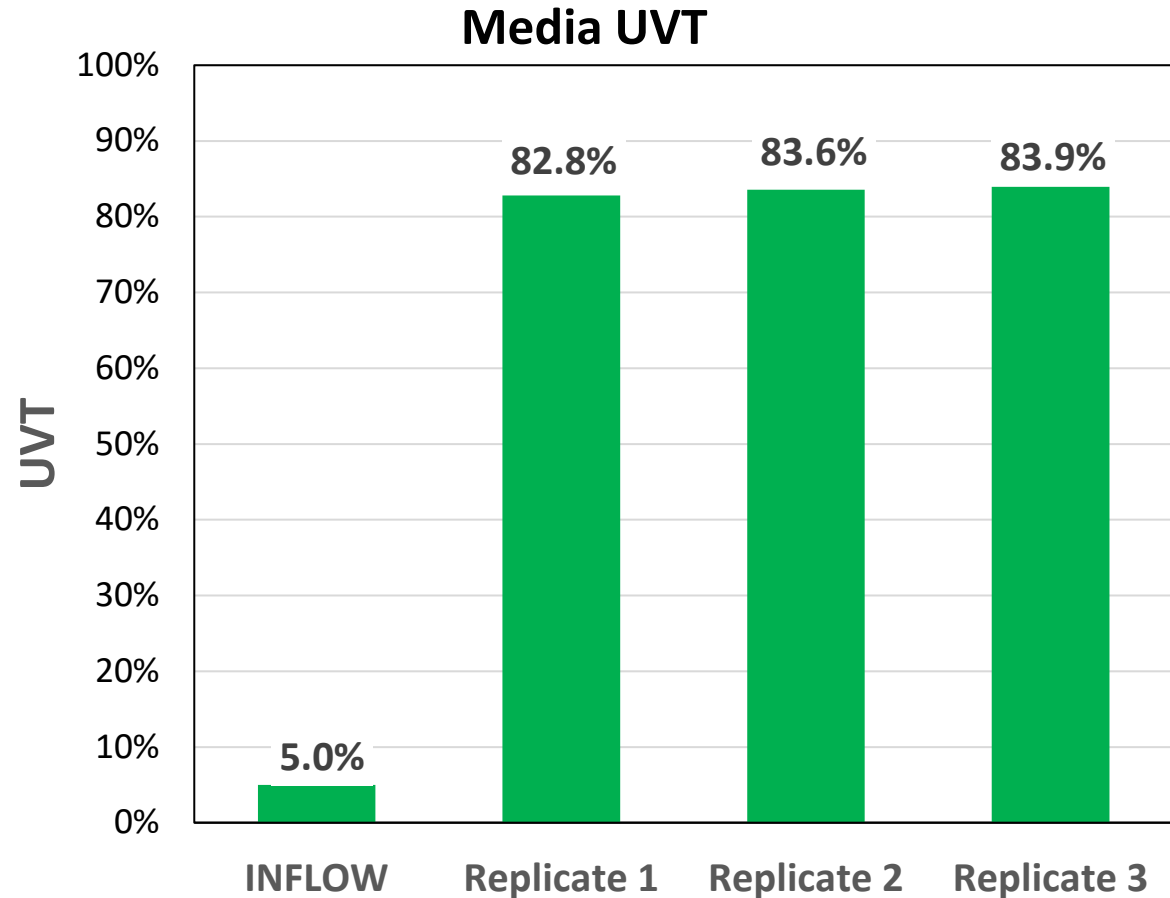


**August 2024****January 2026**

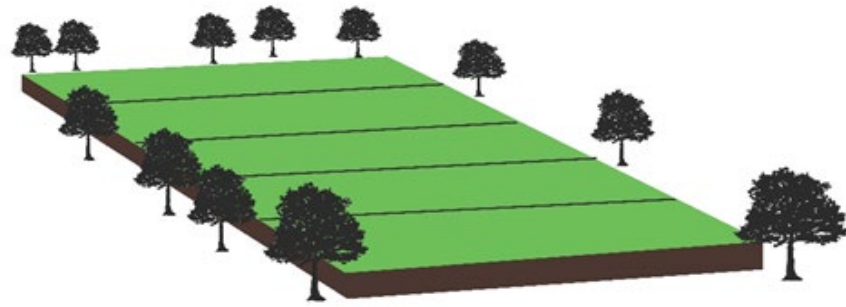
- **Pre-Dry Out:** Discharging at 23 -26 PCU; 84 to 86% removal
- **Post 2-month Dry-Out:** Average color declining to 10-12.5 PCU, 93-94%, removal

Ultraviolet Transmittance (UVT) Improvements attained through Color removal:

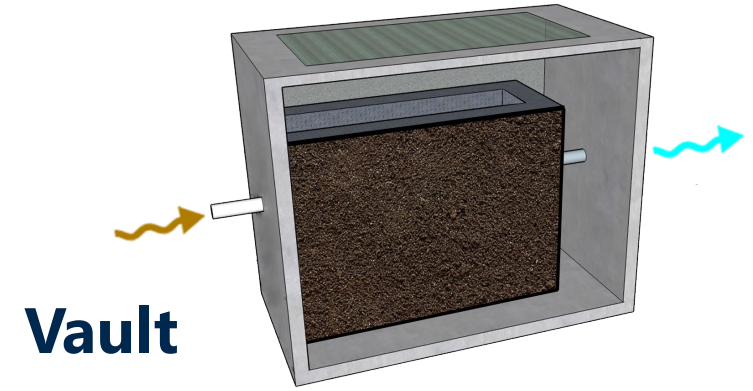
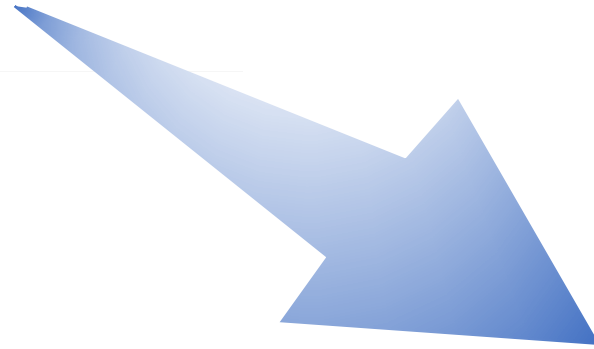
- High UVT is essential for the UV disinfection process.
- Minimum UVT of 70% to 75% is needed for disinfection.
- Passive PES+C media treatment achieves high UVT of 84%.
- Since TOC also removed along with color, chlorination is effective and safe.
- This makes the PES+C an ideal pretreatment system for ASR injection wells and Drinking Water Systems.



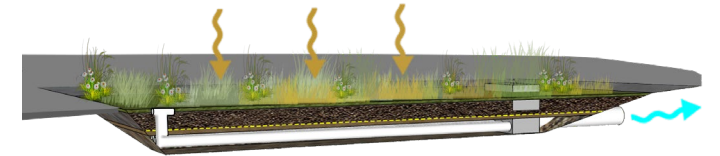
From Field to Filters: SWIG Tech Reimagined for Stormwater



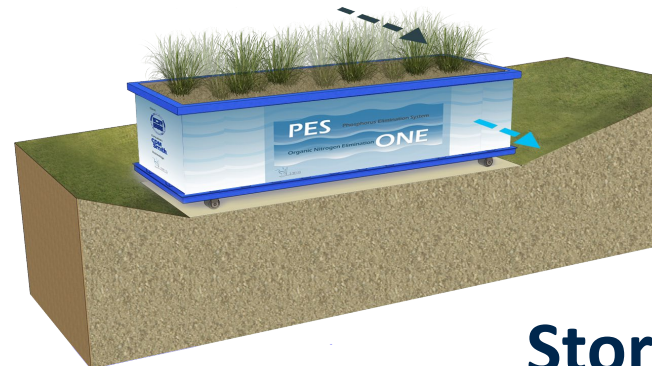
**Regional Systems
(Acres)**



Vault



Rain Garden



Module

Stormwater Media Systems

Applications

Point-source

Wastewater Treatment



Agriculture: Crops



Agriculture: Animals



Stormwater: Urban



Stormwater: Suburban



Fossil-fuel combustion



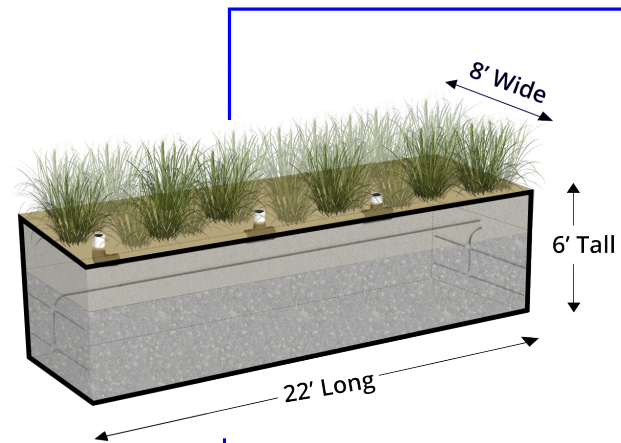
Roadways



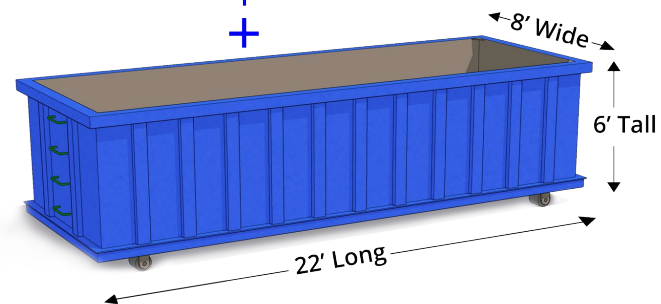
Non-point source

Urban Module

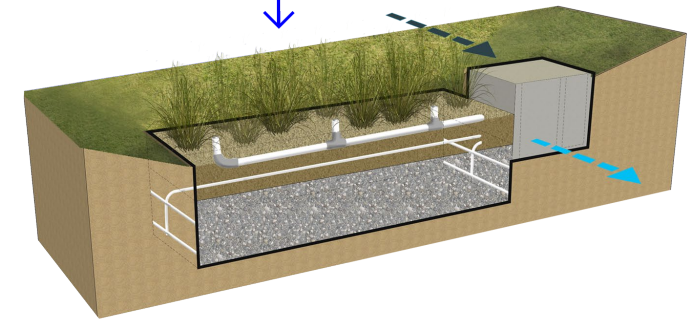
- Small/compact footprint for tight urban spaces.
- Technology can be containerized for mobile solution.



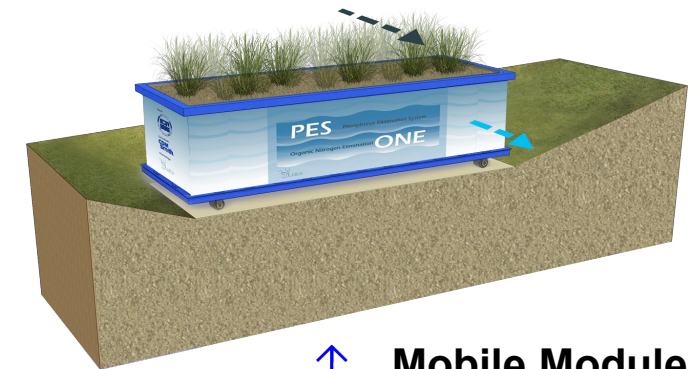
Module Section



Container



Wedging Module

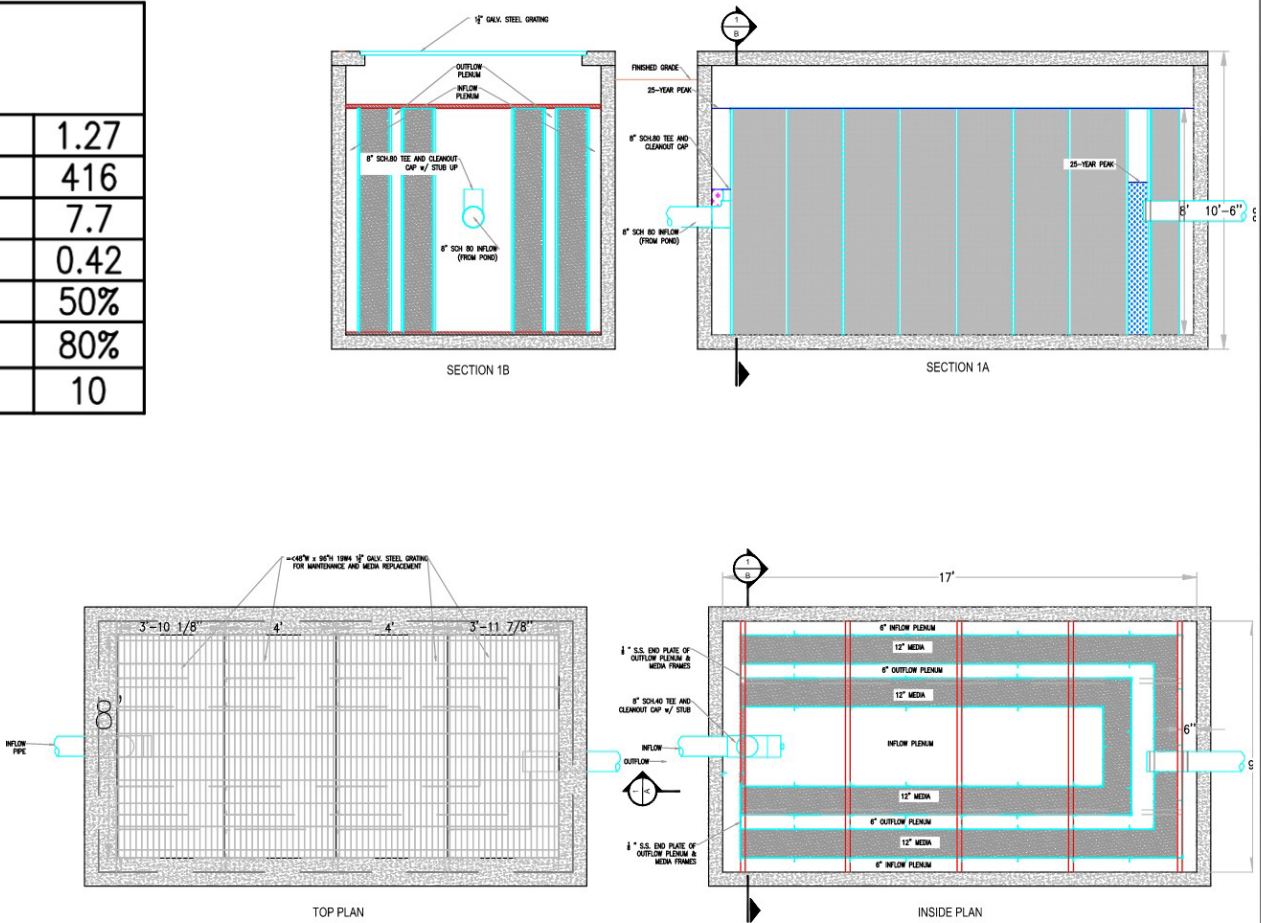


Mobile Module

PERFORMANCE DATA	
MAX. FLOW RATE (CFS)	1.27
MEDIA SURFACE AREA (SF)	416
MEDIA VOLUME (CY)	7.7
LOADING RATE (GPM/SF)	0.42
MIN. NITROGEN REMOVAL RATE	50%
MIN. PHOSPHORUS REMOVAL RATE	80%
EST. MEDIA LIFE (YRS)	10

INSTALLATION NOTES:

1. VAULT SYSTEM TO BE INSTALLED DOWNSTREAM FROM WET DETENTION/RETENTION POND.
2. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
3. MANUFACTURER RECOMMENDS A 6" - 12" THICK LEVEL STONE BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATION.
4. ALL PIPES MUST BE FLUSH WITH THE INTERIOR SURFACE OF CONCRETE, UNLESS OTHERWISE NOTED.
5. ALL GAPS AROUND PIPES SHALL BE SEALED WATERTIGHT WITH A NON-SHRINK GROUT PER MANUFACTURER'S STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED INDUSTRY PIPE CONNECTION STANDARDS.



A WATER TECHNOLOGY
COMPANY

51 Knight Box
Orange Park, FL 32065
TEL: 205.276.9178
WWW.SWIG-LLC.COM

DRAWN: SZ

CHECKED: MRM

APPROVED: MRM

SWIG 9'x17' PES VAULT

DRAWING TITLE

PLAN VIEW & SECTION VIEW

SHEET

1 OF 1

SCALE

DATE

04/29/2025

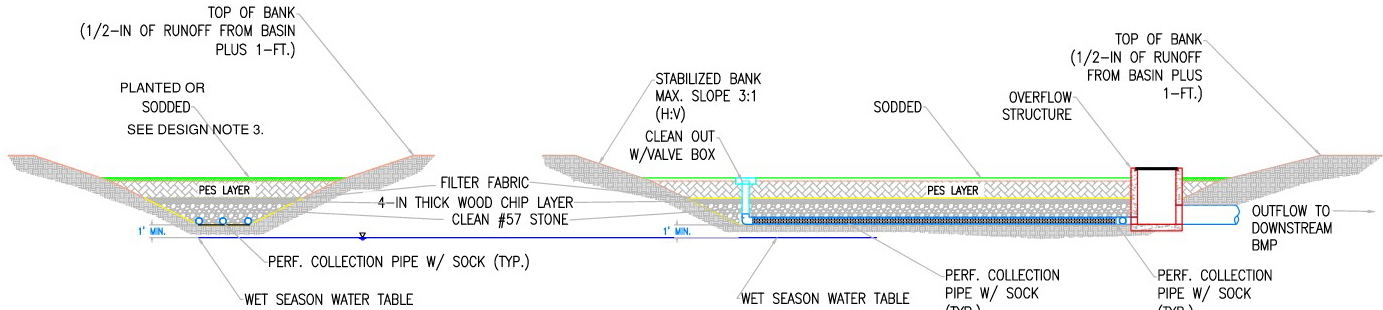
PERFORMANCE DATA	
MAX. FLOW RATE (GPM/SF MEDIA)	0.42
PERMEABILITY (IN/HR)	40
POROSITY (%)	20
MIN. MEDIA THICKNESS (IN)	18
MIN. NITROGEN REMOVAL RATE (%)	10
MIN. PHOSPHORUS REMOVAL RATE (%)	40
EST. MEDIA LIFE (YRS)	10

INSTALLATION NOTES:

- CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO CONSTRUCT THE SYSTEM IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
- #57 STONE TO BE PRE-WASHED BEFORE INSTALLATION.
- SOD TO BE INSTALLED ALONG SLOPES AND BOTTOM OF PRE-TREATMENT AREA.

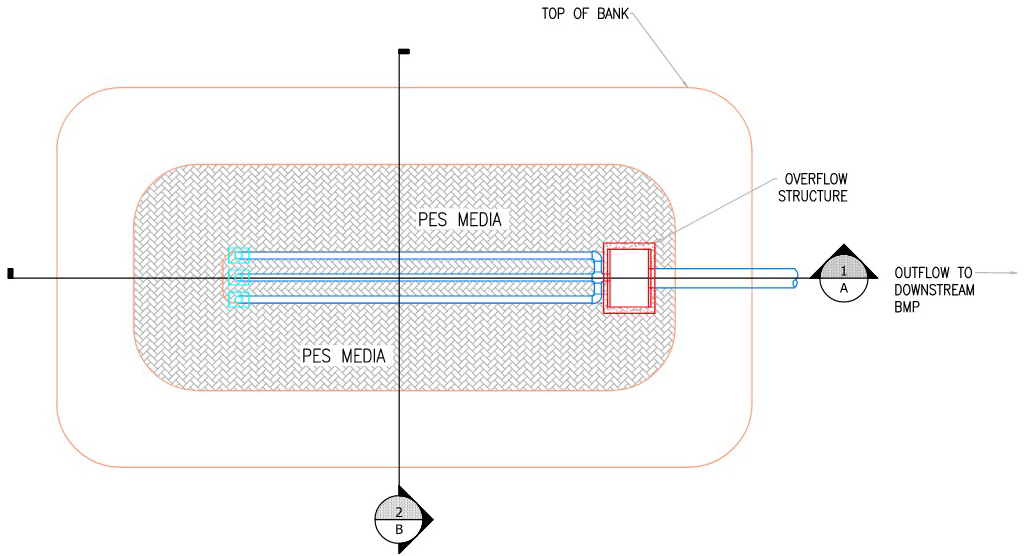
DESIGN NOTES:

- THIS SYSTEM IS INTENDED TO TREAT 1/2-INCH OF RUNOFF FROM A COMMERCIAL/INDUSTRIAL DEVELOPMENT.
- DISCHARGE FROM THIS SYSTEM SHOULD BE DIRECTED TO ANOTHER BMP FOR ATTENUATION AND FURTHER TREATMENT.
- BOTTOM OF DETENTION AREA TO BE PLANTED IN COMPLIANCE WITH LOCAL ORDINANCE AND REGULATIONS. CONTACT MANUFACTURER FOR MORE INFORMATION.
- LENGTH AND WIDTH OF DETENTION AREA DEPENDENT ON SITE DESIGN AND CONDITIONS.



SECTION 1B

SECTION 1A



PLAN VIEW



A WATER TECHNOLOGY
COMPANY

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WWW.SWIG-LLC.COM

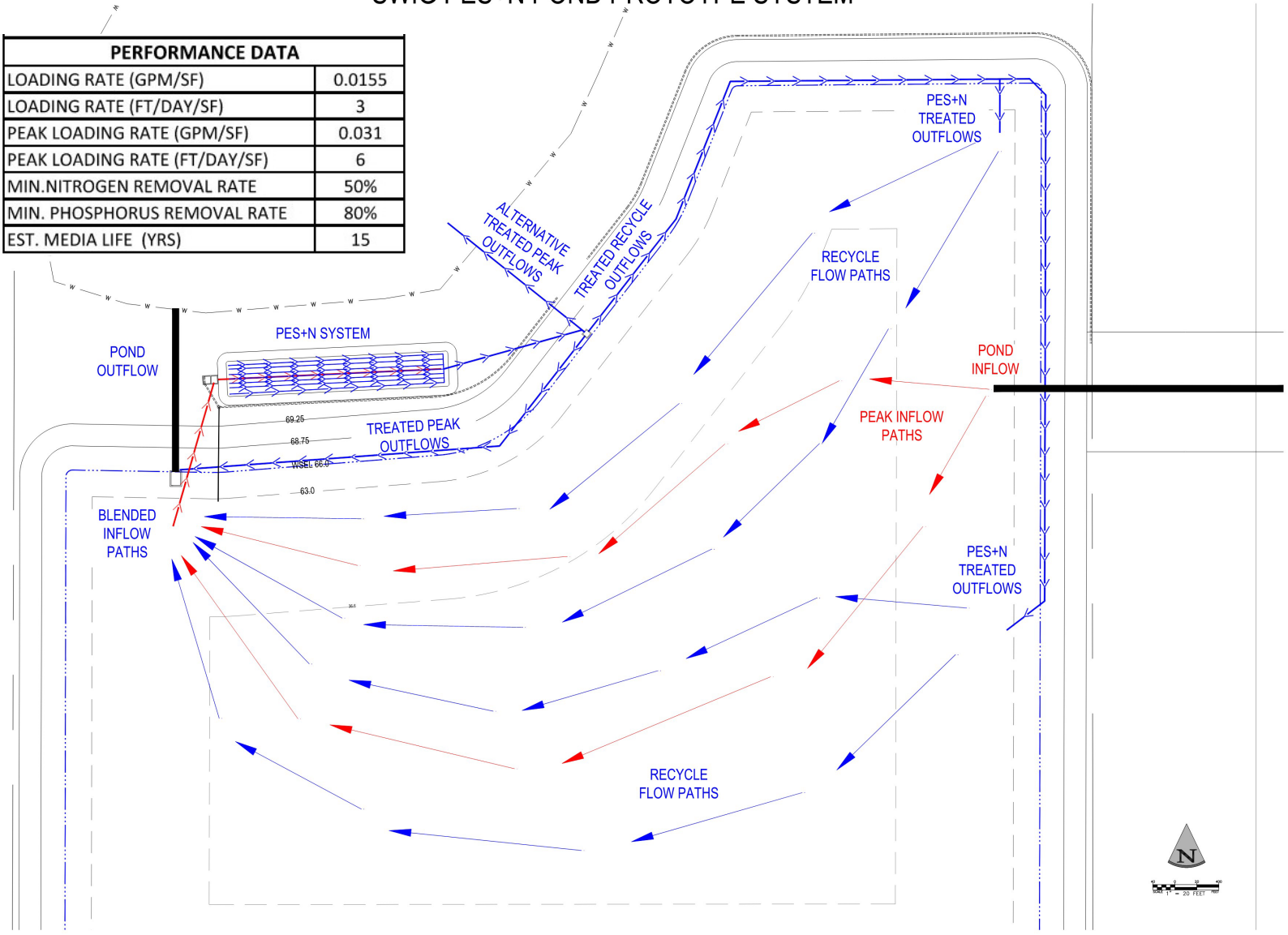
DRAWN: SZ
CHECKED: MRM
APPROVED: MRM

SWIG PES RAINGARDEN

DRAWING TITLE	SCALE
PLAN VIEW & SECTION VIEW	
SHEET	DATE
1 OF 1	04/28/2025

SWIG PES+N POND PROTOYPE SYSTEM

PERFORMANCE DATA	
LOADING RATE (GPM/SF)	0.0155
LOADING RATE (FT/DAY/SF)	3
PEAK LOADING RATE (GPM/SF)	0.031
PEAK LOADING RATE (FT/DAY/SF)	6
MIN.NITROGEN REMOVAL RATE	50%
MIN. PHOSPHORUS REMOVAL RATE	80%
EST. MEDIA LIFE (YRS)	15





3201 1st Ave. S. Suite 202
Tomball, TX 77375
TEL: 281.358.9378
EMAIL: MARK@SWIG-LLC.COM
WWW.SWIG-LLC.COM

POND CIRCULATION
PLAN

SWIG PES+N POND
PROTOTYPE SYSTEM

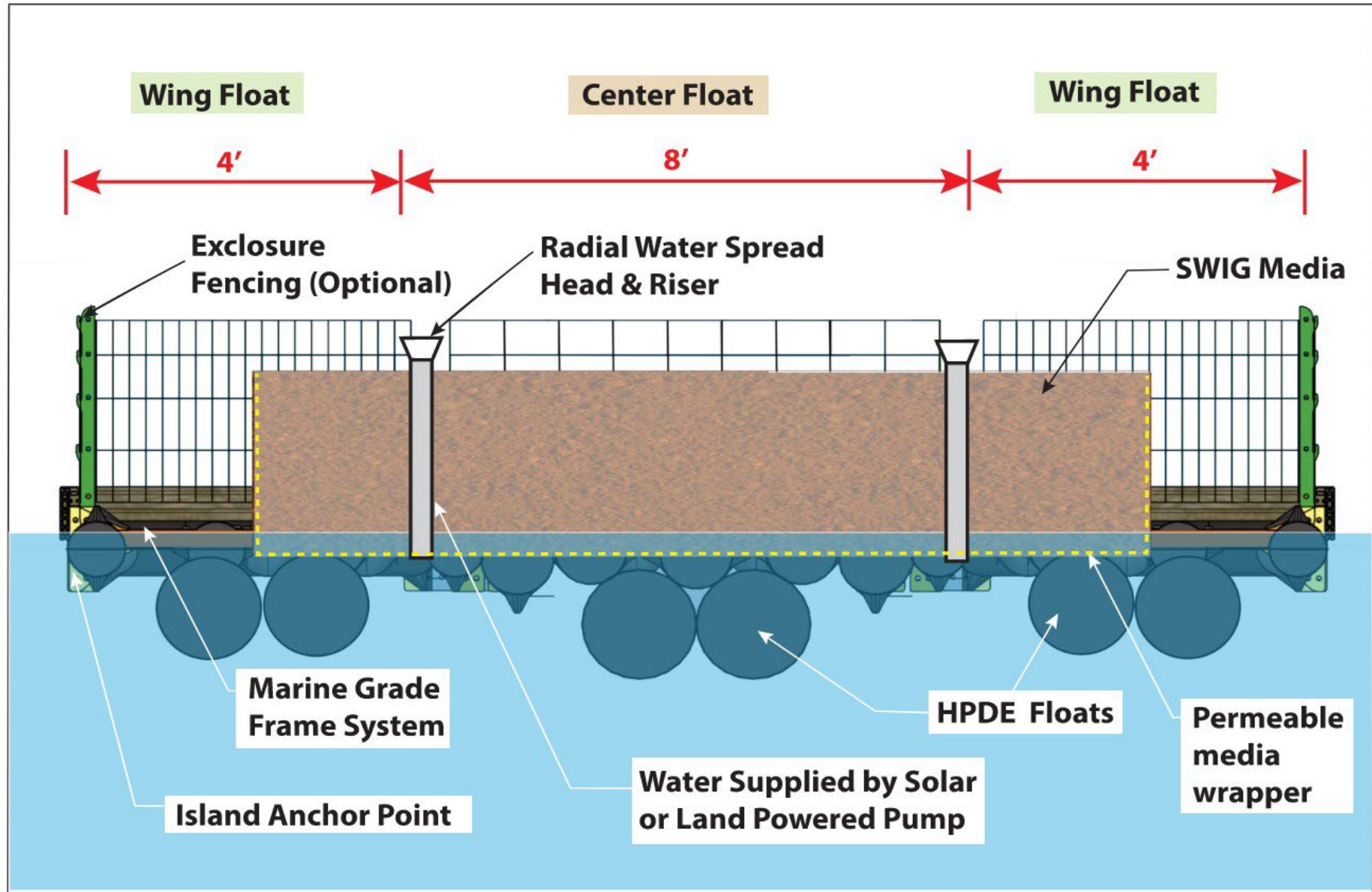
26189 CR 48A, MOUNT DORA, FL 32757

DESIGNED: BL	BL
DRAWN: BL	BL
CHECKED:MRM	MRM
APPROVED: VS	VS

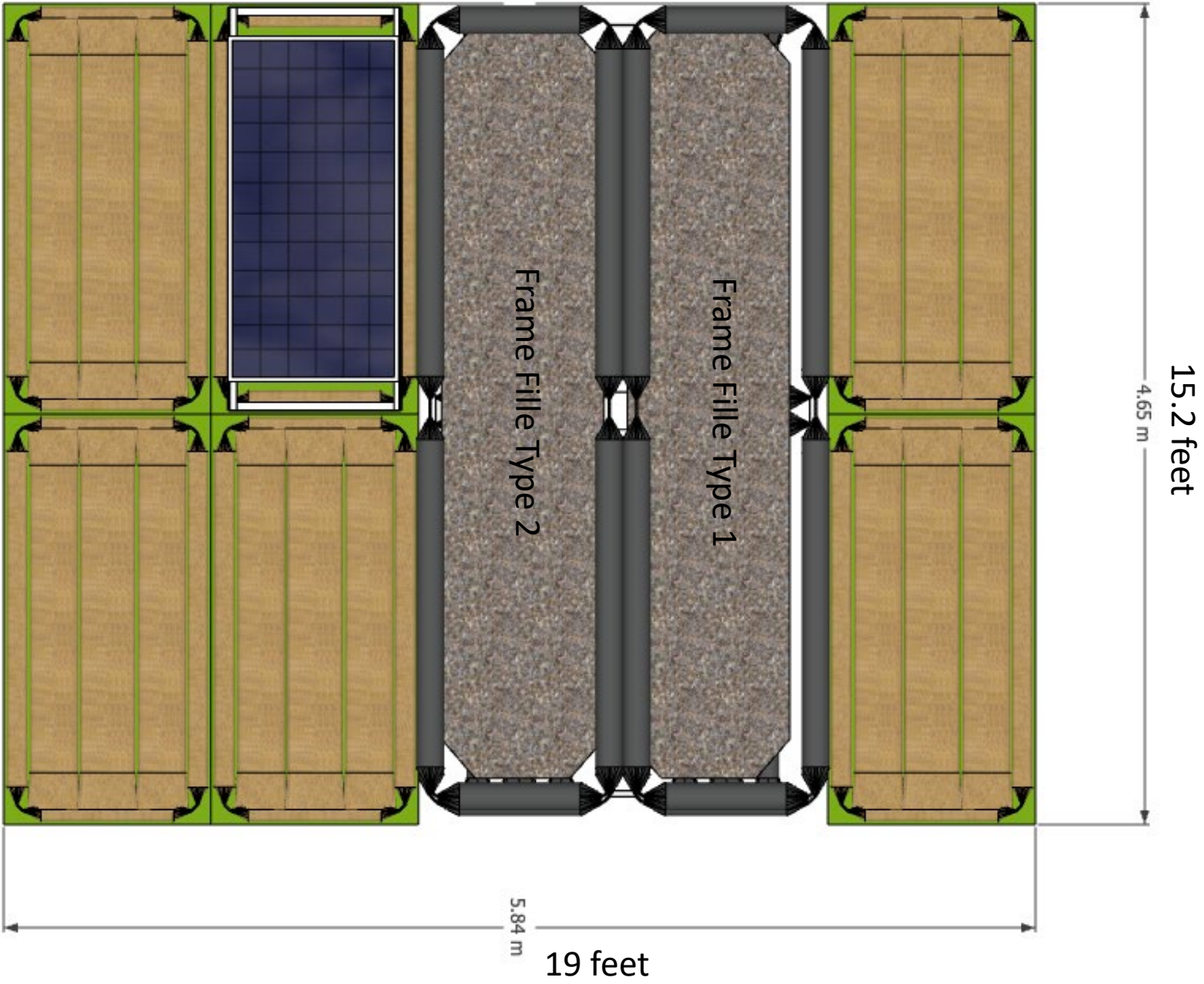
PROJECT #	LOCATION	DATE	SCALE	CLASS/SHEET
LJF 1	TBD	JANUARY 10, 2024	1" = 20 FT	DRAFT

1 OF 4





 SWIG Sustainable Water Infrastructure Group, LLC	A WATER TECHNOLOGY COMPANY 51 Knight Boxx Orange Park, FL 32065 TEL: 206.276.9178 WWW.SWIG-LLC.COM	 BIOMATRIX BRINGING WATER TO LIFE	FLORIDIA CLIENTS LOCATION: FLORIDIA'S WATERWAYS	DRAWN: SZ	FI	DRAWING TITLE FI Section	
				CHECKED: MRM		SHEET	DATE
				APPROVED: VS		OF	





 A WATER TECHNOLOGY COMPANY 51 Knight Boxx Orange Park, FL 32065 TEL: 206.276.9178 WWW.SWIG-LLC.COM		FLORIDIA CLIENTS	DRAWN: SZ	FI	DRAWING TITLE FI-Golf Course	
			CHECKED: MRM		SHEET	DATE
		LOCATION:FLORIDIA'S WATERWAYS	APPROVED: VS		OF	



 A WATER TECHNOLOGY COMPANY 51 Knight Boxx Orange Park, FL 32065 TEL: 206.276.9178 WWW.SWIG-LLC.COM		FLORIDIA CLIENTS	DRAWN: SZ	FI	DRAWING TITLE FI-IRL Canal	
			CHECKED: MRM		SHEET	DATE
		LOCATION:FLORIDIA'S WATERWAYS	APPROVED: VS		OF	



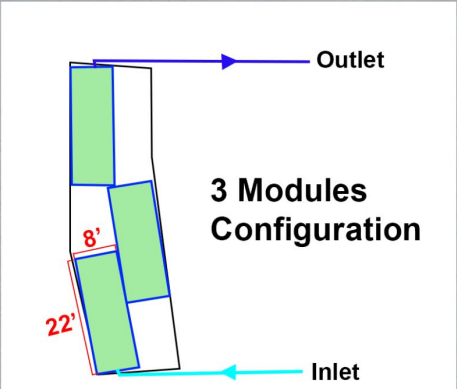
 A WATER TECHNOLOGY COMPANY 51 Knight Boxx Orange Park, FL 32065 TEL: 206.276.9178 WWW.SWIG-LLC.COM		FLORIDIA CLIENTS	DRAWN: SZ	FI	DRAWING TITLE FI-Stormpond	
			CHECKED: MRM		SHEET	DATE
		LOCATION:FLORIDIA'S WATERWAYS	APPROVED: VS		OF	

Lake Morton - City of Lakeland

- Peace River Watershed
- 40-acre surface area
- 150-acre urban watershed

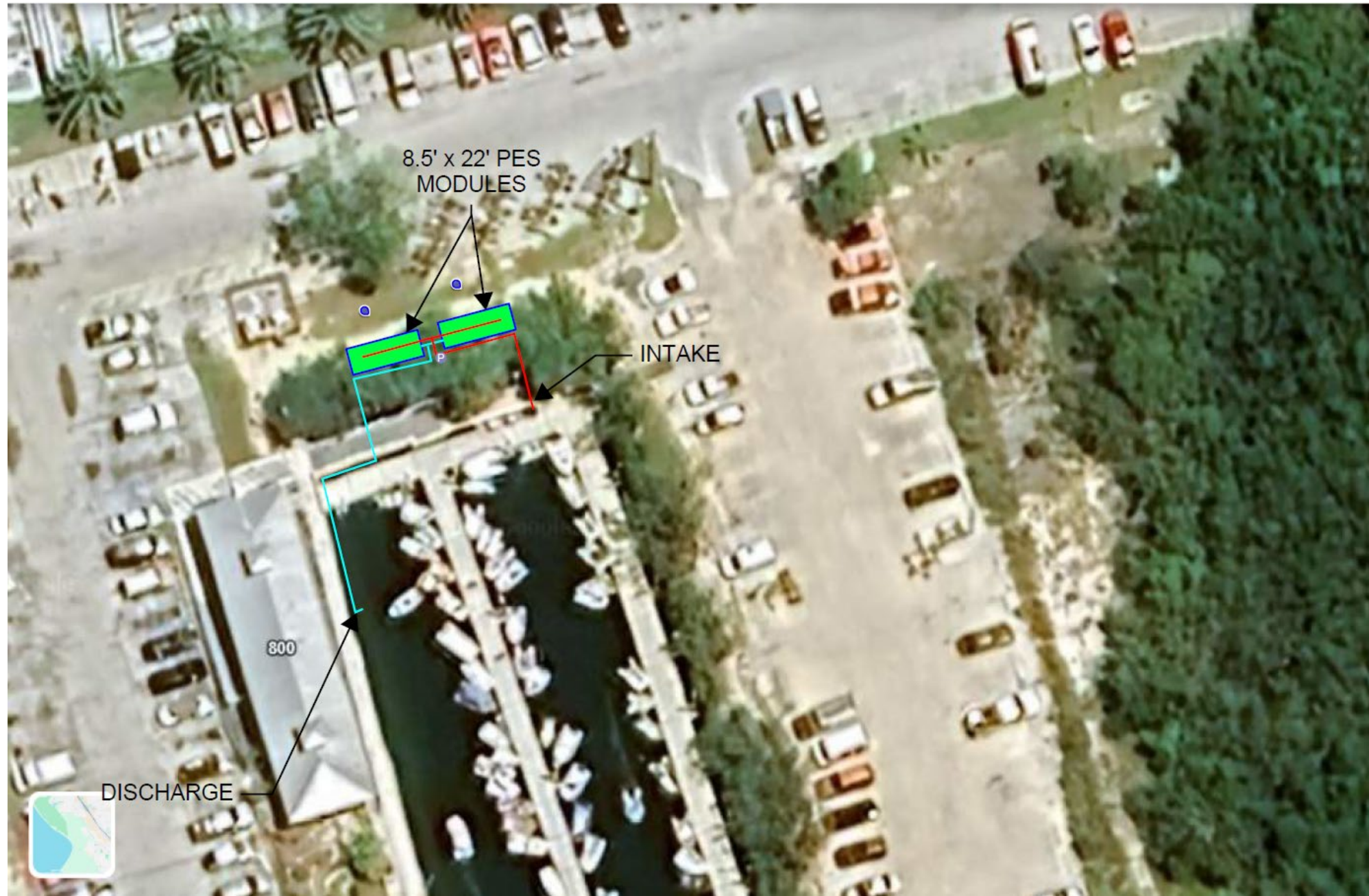
FDEP Verified Impaired

- Approved 4e Nutrient Reduction Plan on October 26, 2021
 - Chlorophyll A
 - Total P
 - Total N



INNOVATIVE TECHNOLOGY FOR HARMFUL ALGAL BLOOMS GRANTS
Modular Enhanced Nutrient Removal System Using Passive Treatment Media

City of Marathon – City Marina Canal Nutrient Removal Demonstration Project



City of Marathon – City Marina Canal Nutrient Removal Demonstration Project



Manufactured In Florida



**MADE IN
FLORIDA**

Custom Media Formulation



USEPA Research Project into SWIG Technology - Experiment

Experimental Setup

- Three replicate 15 cm columns were fabricated with PES media, overlying a layer of wood chips and then coarse LESA stone.
- The wood chips and stone layers are intended for denitrification (DNF) observations, which are in addition to the EPA experiment.



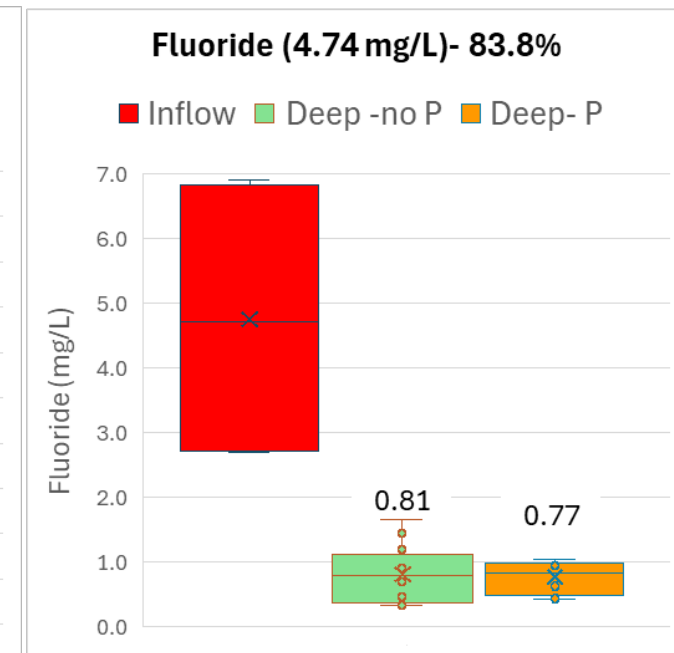
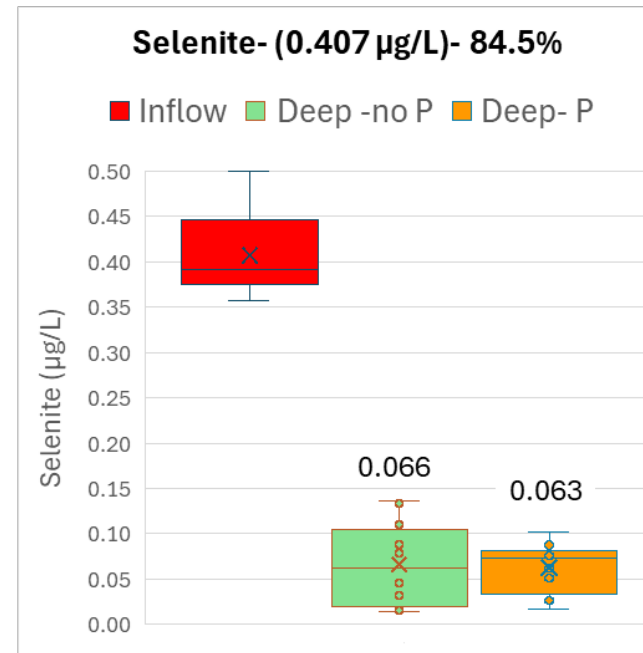
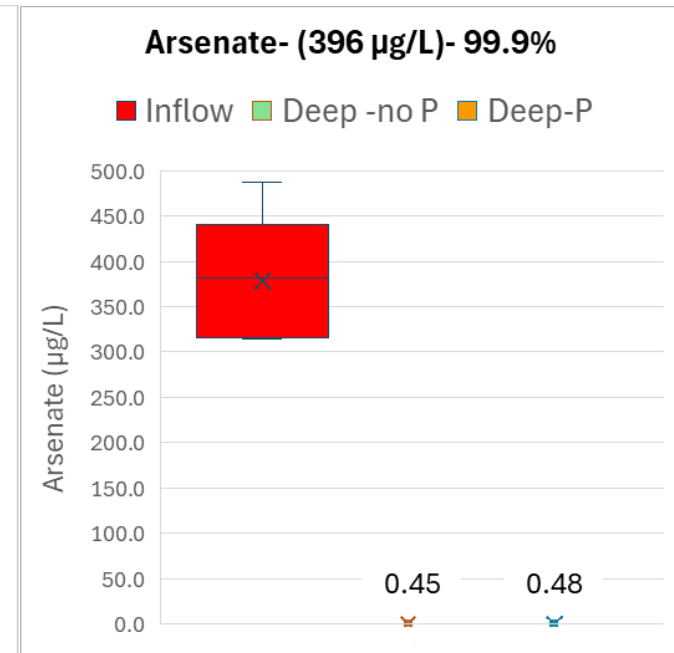
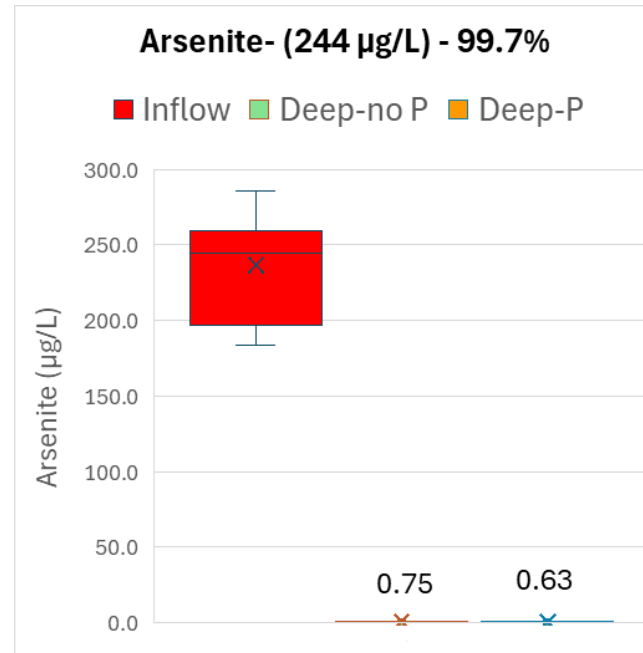
Experimental Setup with Supply Tank, Columns and Collection tanks



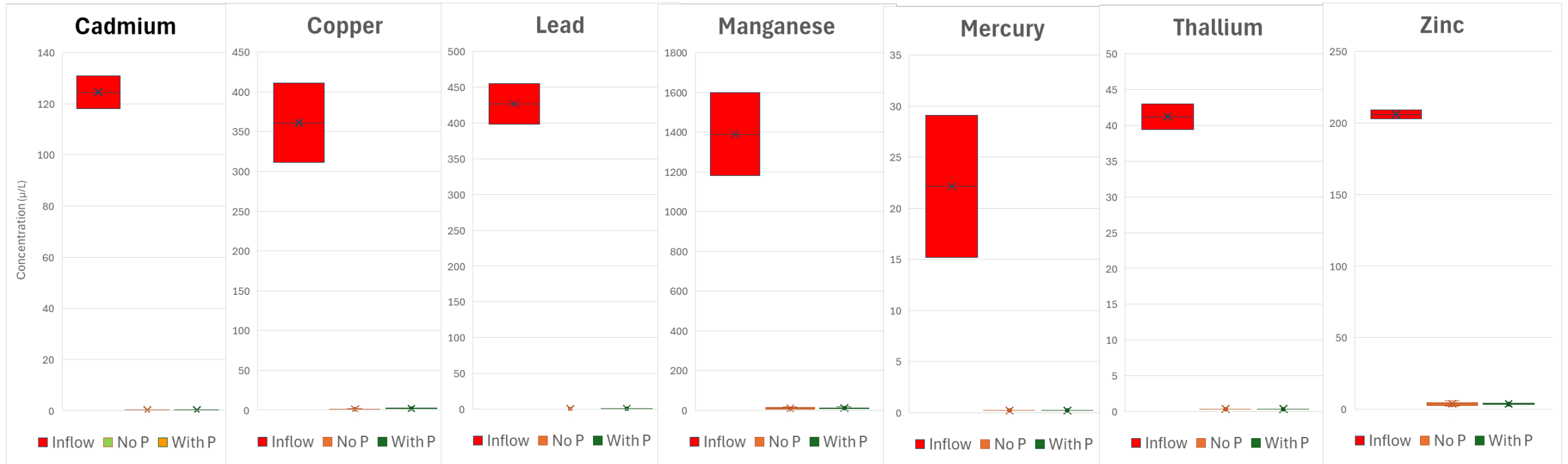
Supply Tank with Feed Pump and Bubbler to keep inflows agitated

Toxic Anion Removal

- **Negatively charged toxic anions such as arsenite, arsenate, selenite and fluoride removed by charge attraction to positively charged WTRs.**
- **Arsenite, the most toxic and difficult to remove arsenic anion, is completely removed to below the detection limit, as is arsenate.**
- **Given inflows over 380-880 times higher, such a high arsenic adsorption percentage has never been reported, even in complex materials such as nanotubes.**
- **Selenite and fluoride removals also quite substantial.**

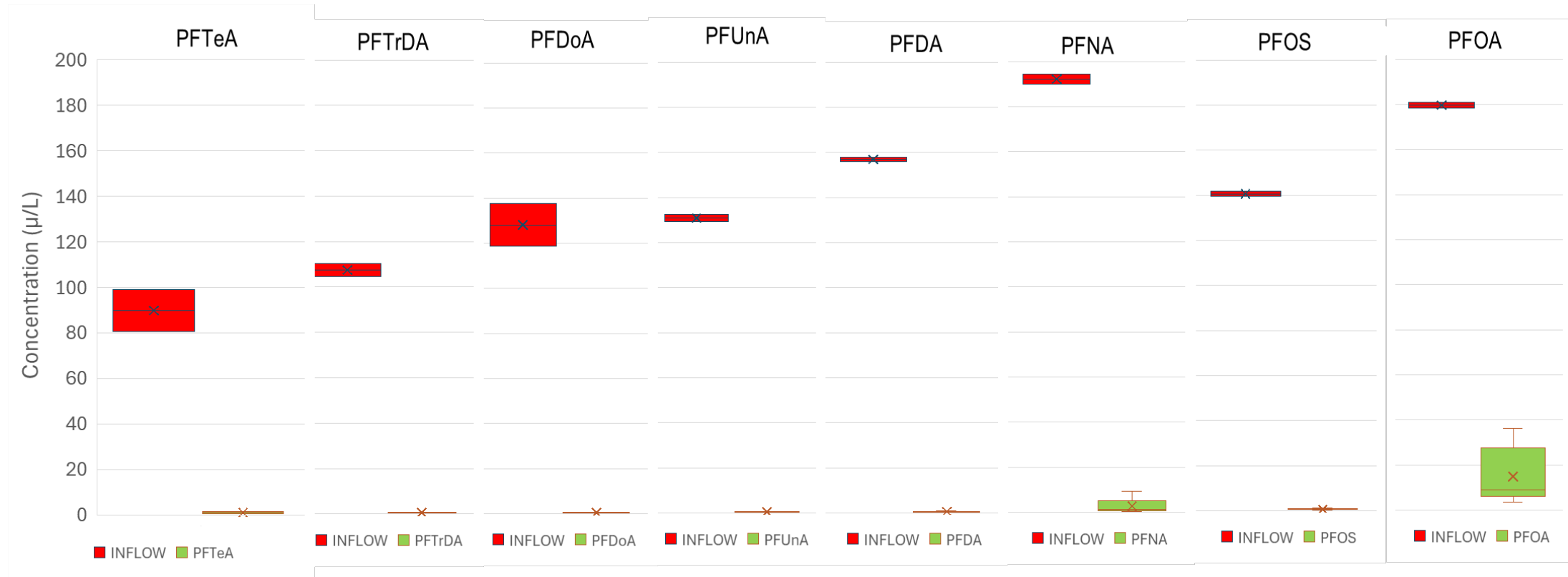


Toxic Metals Removal



- Positively charged metals are very effectively adsorbed onto negatively charged cation exchange sites in the media.
- Cadmium, lead, mercury and thallium outflows were all below detection limit. Removals range from 99.1% to 99.9%
- Slight detection of copper, manganese and zinc results in removals ranging from 98.7% to 99.1%.
- All outflows are well below all applicable MCLs.

Long Chain PFAS Removal (> 7 carbon atoms)

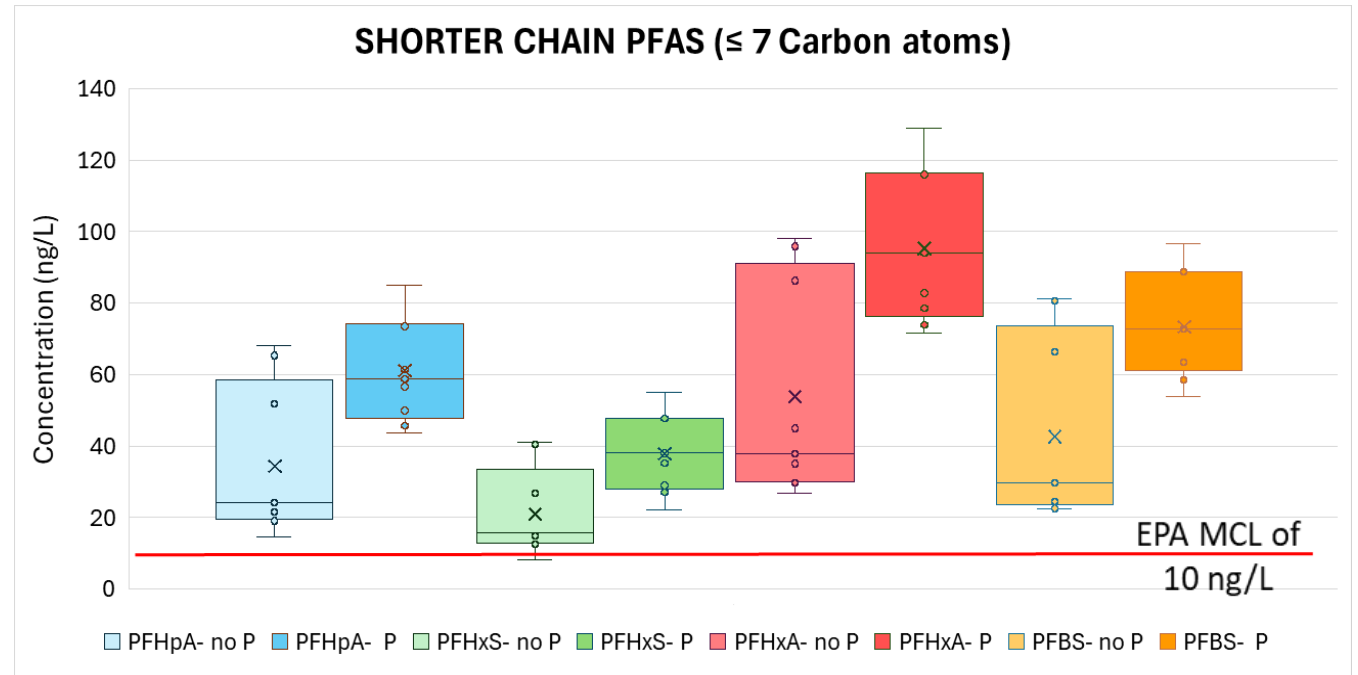


- Applied at landfill leachate concentrations, removal of longer chain PFAS was virtually complete, with many long chain PFAS outflows below the detection limit. So actual removals would be even better.
- Applied at nearly 6 feet hydraulic loading rate (HLR) per dose over 6 doses, this PFAS load represents a year's worth of wastewater loading.
- This gives considerable confidence that these results would continue if loaded at typical natural or wastewater concentrations.

Shorter Chain PFAS Removal (≤ 7 carbon atoms)

- Removal of short chain PFAS is much more difficult due to their much lower binding attraction than long chain PFAS.
 - Still, PES removal of even short chain PFAS was also effective at lower inflow concentrations.
 - However, at much higher landfill leachate inflows and loads, shorter chain PFAS removal not as effective.
 - This is because available PFAS sites were preferentially occupied by the longer chain PFAS.
- TP increases PFAS discharge due to TP competing for binding sites.
 - Results suggest that, in areas of high TP load, a series of two PES+C systems might be necessary.

SHORT CHAIN PFAS REMOVAL	INFLOW	OUTFLOW	REDUCTION
Perfluorohexanoic acid (PFHxA)	21.20	3.60	83.0%
Perfluoroheptanoic acid (PFHpA)	1.91	0.85	55.6%
Perfluorooctanoic acid (PFOA)	6.12	0.86	86.0%
Perfluorodecanoic acid (PFDA)	0.62	0.29	53.4%
Perfluorobutanesulfonic acid (PFBS)	6.00	3.03	49.5%
Perfluoropentanoic acid (PFPeA)	45.40	3.71	91.8%



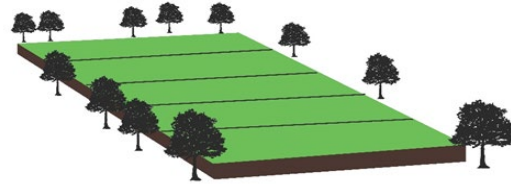
Innovative Tech - Surface Water/Aquifer Recharge

Black Creek Example

Surface Water



NDPES Permit



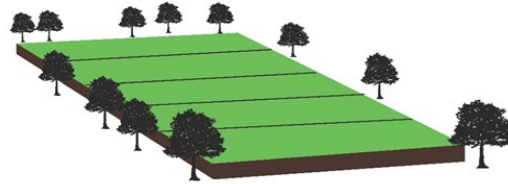
PES Treatment



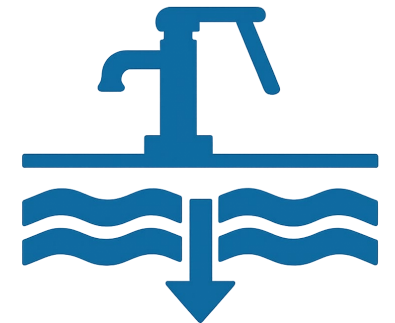
Reclaimed Water



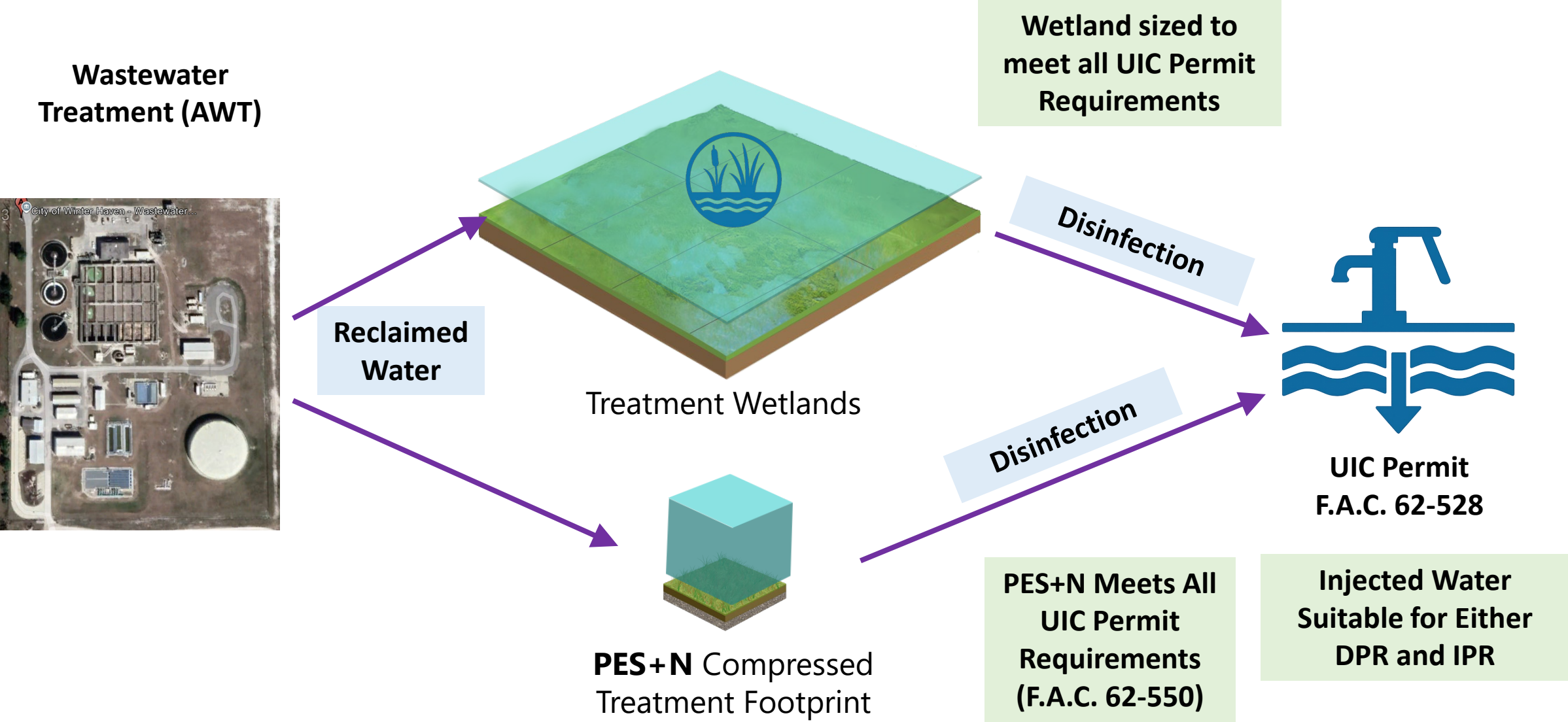
UIC



PES Treatment



Innovative Tech - Building flexibility in Systems that have Tight Operational Limits



Takeaways

SWIG technologies can clean large volumes of water below non-detect for many of the world's worst water pollutants:

- **Removes Phosphorus, Nitrogen, Tannins, Fecals, Metal, Flouride, PFAS and E.Coli**
- **Cost efficient – lower cost than competitors (including O&M)**
- **Scalable – any size from small drainage boxes to 10's of acres**
- **Sustainable/non-toxic/no chemicals – Storm and Drought proof**
- **Uses recycled materials and spent material is reused**
- **Carbon sequestration through wetland plant harvesting**
- **Short Permit/Construction Time – minimal permitting and simple construction**
- **Flexible in application – can be used as bolt on or solo**
- **Fully Monitored (no guessing)**
- **Designed for longevity (can last 10 – 25 years as wanted)**



QUESTIONS?



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