C-43 West Basin Storage Reservoir (WBSR) Water Quality Feasibility Study (Study)

July 16, 2020

Meeting Format

1) Zoom Meeting Functions

   I. Question and Answer – Type in Questions

   II. Raise Your Hand for Comments at end of Q&A session

   Note: If you call in only (not on the internet) press *9 to raise and lower hand and *6 to mute or unmute.

2) Public input using “Menti” Interactive Tool at end of presentation

Meeting Goals

1) Overview of Study Goals and Objectives
2) Update on Preliminary Draft Feasibility Study
   - ➢ Criteria Evaluation and Ranking of Technologies
   - ➢ Cost Benefit Analysis
3) Recommendations
4) Obtain Public Input for Study
   - ➢ Questions and Answers using “Menti” Interactive Tool

Working Group Members

- South Florida Water Management District (SFWMD)
- Florida Department of Environmental Protection (DEP)
- Hendry County
- Lee County
- City of Cape Coral
- City of Sanibel
- Lehigh Acres Municipal Services Improvement District (LAMSID)


Georgia Vince, J-Tech

C-43 WBSR Consultant Team

- J-Tech – A joint venture between Jacobs Engineering and Tetra Tech, Inc.
- Wetland Solutions, Inc (WSI)

Project Background

Georgia Vince, J-Tech

Executive Order 19-12, January 10, 2019

- Greater protection of Florida's environment and water quality
- Harmful algal blooms
- Provide additional treatment and improve the quality of water leaving the C-43 WBSR


Georgia Vince, J-Tech

C-43 WBSR Study Objectives

- Primary Objective: Identify opportunities to provide additional treatment and improve water quality leaving the C-43 Reservoir
- Evaluate treatment options
- The goal of the Study is to identify at a minimum three alternatives


Georgia Vince, J-Tech

Study Will Evaluate

- Pre-treatment (prior to entering C-43 WBSR)
- In-reservoir treatment
- Post-storage treatment
- Cost-effective and technically feasible technologies
- Conventional and/or innovative treatment technologies
- Biological, chemical, and physical water quality treatment technologies
- Scalable and “available” for long-term technologies
- Compatibility with the objectives of the C-43 WBSR Project


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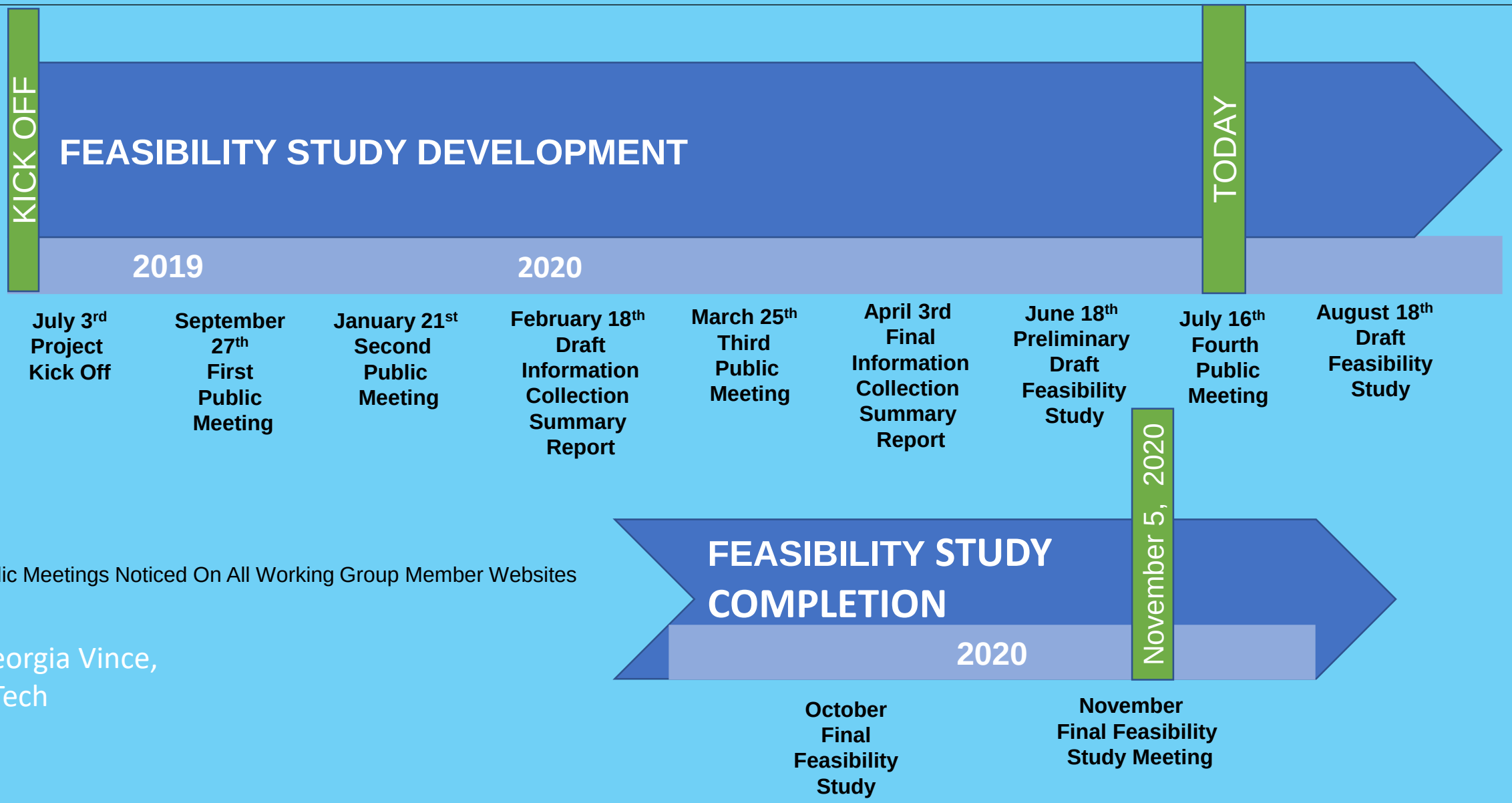
Study Constraints

- Cannot affect the congressionally approved C-43 WBSR Project purposes, benefits, infrastructure, construction schedule, or operation
- Available project lands have not been specifically identified for the Study
- The C-43 WBSR and the selected treatment component(s) are not intended to achieve compliance with the Caloosahatchee River and Estuary Total Maximum Daily Loads (TMDLs)

Project Schedule



Public Meetings Noticed On All Working Group Member Websites

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J-Tech

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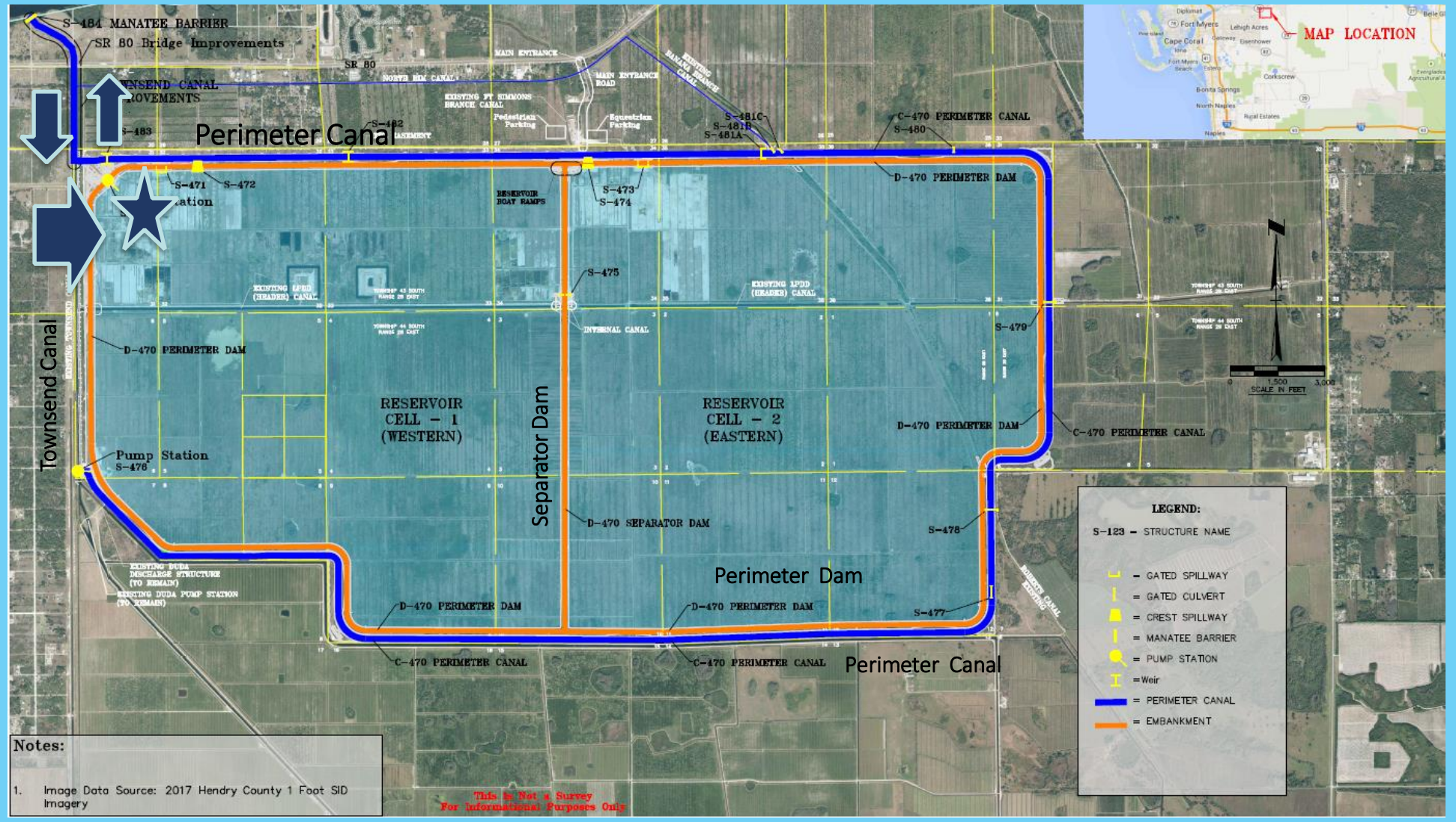
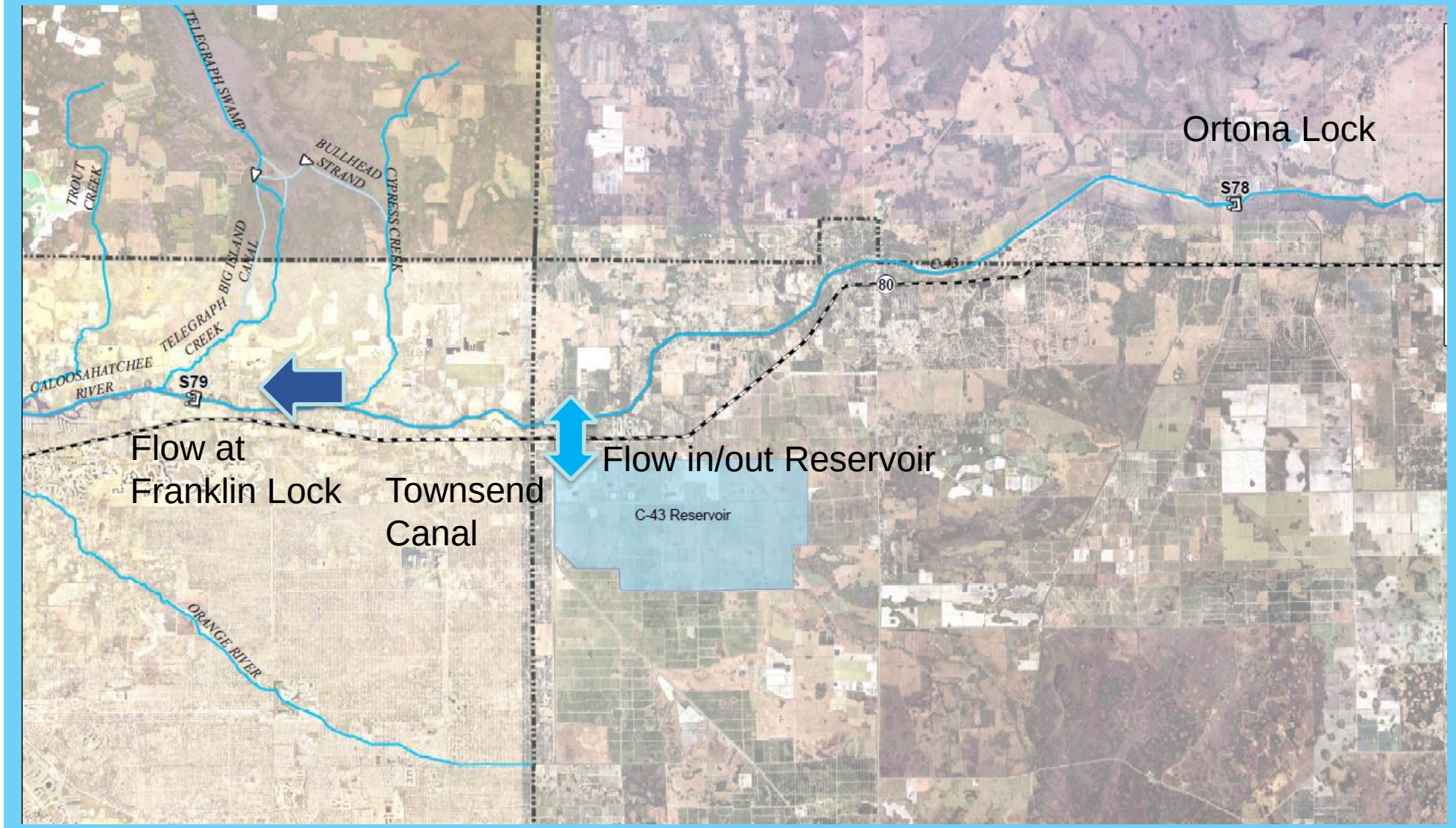
C-43 West Basin Storage Reservoir

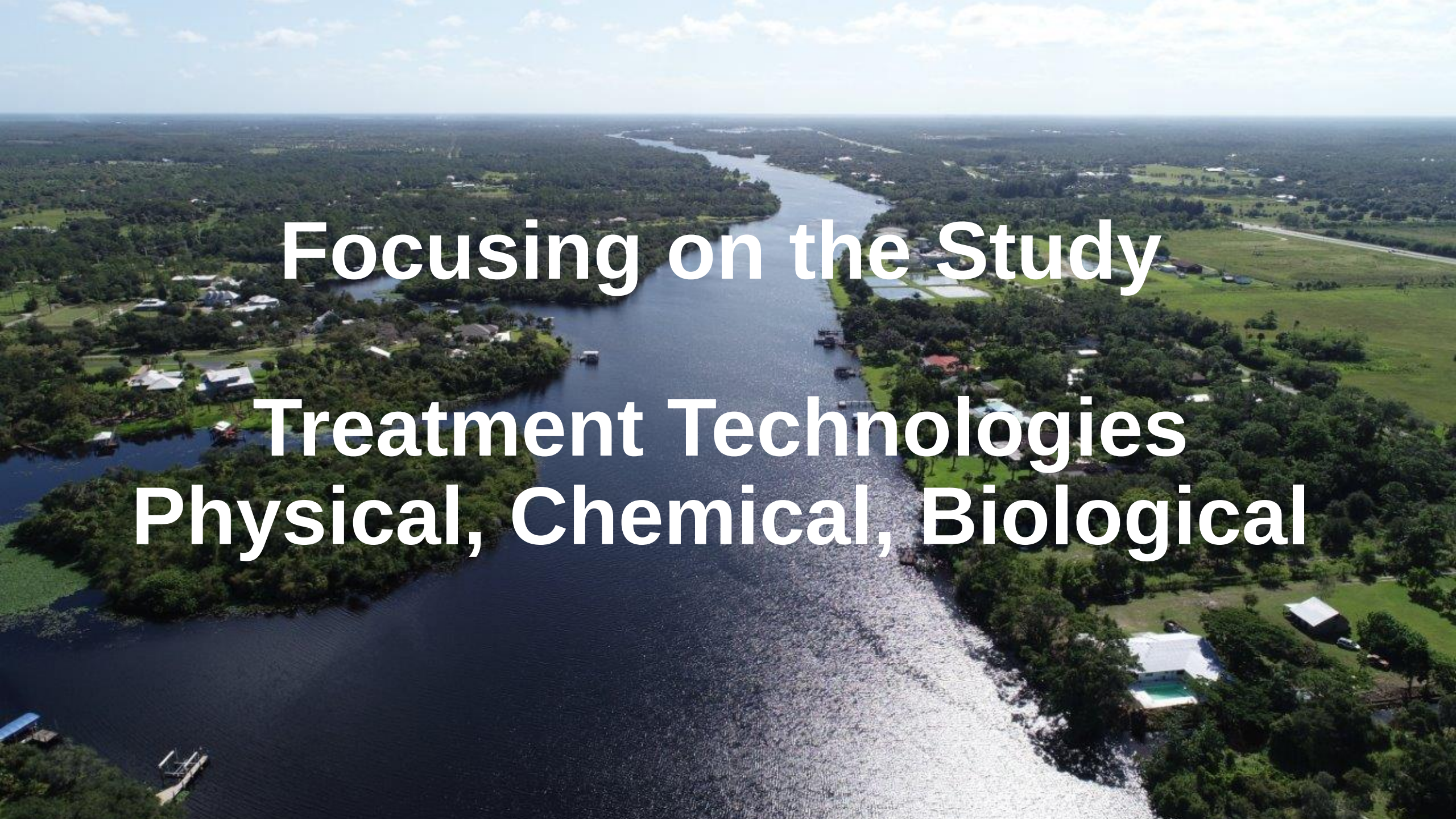


C-43 WBSR

- C-43 Reservoir project is a component of the Comprehensive Everglades Restoration Plan (CERP)
- Funded by annual state of Florida legislative appropriations and U.S. Army Corps of Engineers will credit all eligible project costs
- Captures excess basin runoff and Lake Okeechobee releases
- Improves quantity, timing, and distribution of freshwater flows to the Caloosahatchee Estuary, to help maintain proper salinity levels
- Maintains water supply for existing legal users

C-43 WBSR Operations




Focusing on the Study
Treatment Technologies
Physical, Chemical, Biological


Marcy Frick,
J-Tech

Treatment Technology Focus

Nitrogen

- Dissolved Organic Nitrogen
- Dissolved Bio-available Organic Nitrogen
- Dissolved Inorganic Nitrogen (Ammonia, Nitrate, Nitrite)
- Total Nitrogen (TN)

Phosphorus

- Particulate Phosphorus
- Soluble Reactive Phosphorus
- Total Phosphorus (TP)

Total Suspended Solids (TSS, Algae, Particulates)

Marcy Frick,
J-Tech

How to Treat?

Natural and Conventional Treatment Approaches

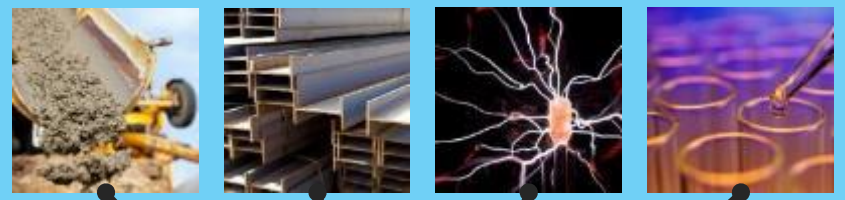
Natural Systems

Sun **Gravity** **Land** **Biomas**

Water Treatment $

Conventional Systems

Concrete **Steel** **Electrical** **Chemical**



Water Treatment $ $ $

Information Collection Summary Report

Performed literature review and assessed available technology based upon information sources:

- DEP Technology Library (http://fldeploc.dep.state.fl.us/tech_portal/tech_library_intro.asp)
- Working Group experience and case studies
- Other professionals with similar project experience
- Technology vendor submittals
- Public input
- Final Report made available April 3, 2020

Technology Evaluation Criteria

- Florida Case Study & Data Quality
- Nutrient Reduction
  - Scalable
- General Land Area
  - Compatible with C-43 WBSR system
- Treatment Residuals
- Energy Requirements
- Schedule for Implementation
- Operations & Maintenance (O&M) Requirements
- Costs: Capital, O&M, and Cost-benefit
- Regulatory Constraints
  - Cannot cause harm

Treatment Technology Highlights


Chris Keller, WSI

Constructed Treatment Wetlands

- Nutrient uptake, transformation, burial
- Many Florida applications
- Well-studied, good performance data
- 20-40% TN, 75-90% TP, >90% algae
- Large land area required
- Large capital cost
- Lower O&M cost
- Long-term residual accumulation
- Power for pump stations
- Pre-and post-storage


Stormwater Treatment Area




Chris Keller, WSI

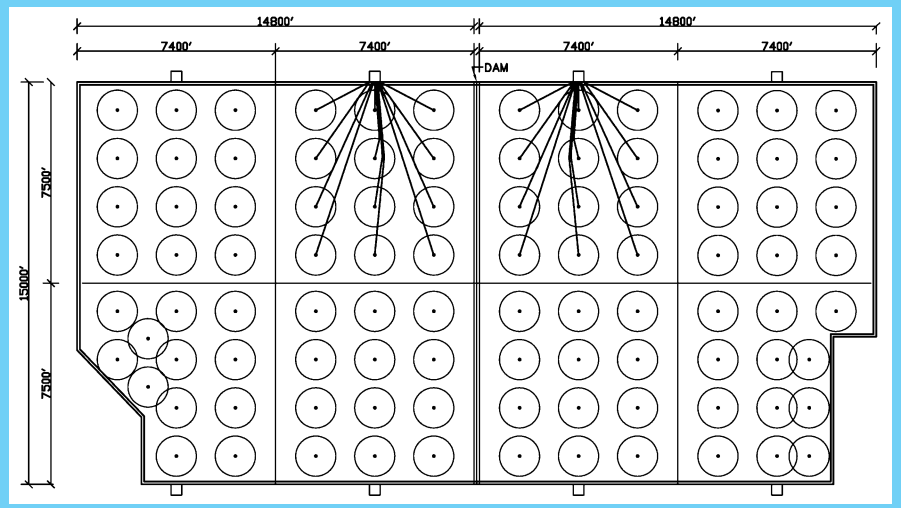
Sand Filtration

- Gravity separation of solids
- Several Florida applications
- Well-studied, good performance data
- 20-40% TN, 25-50% TP, >90% algae
- Large land area required
- Large capital cost
- Lower O&M cost
- Upper sand layer replacement (3-5 years)
- Power for pump stations
- Pre- and post-storage application

Aquifer restoration and recovery project, Mosaic

Aeration (Air Diffusion Systems)

- Reduces algal populations through mixing, reduces internal nutrient loading
- Several Florida applications
- Well-studied, good performance data
- 50-75% TN and TP
- Small land area (blowers, power)
- No residuals
- Moderate capital cost
- Moderate O&M cost
- Compressor and diffuser maintenance (annual)
- Power for blowers
- Treatment during storage




Chris Keller, WSI

Hybrid Wetland Treatment Technology (HWTT)

- Coagulation of nutrients, solids separation, wetland uptake, and sedimentation
- Several Florida applications
- Well-studied, good performance data
- 50-60% TN, 80-90% TP, >90% algae
- Reduced land area required
- Reduced capital cost
- Greater O&M cost than wetlands
- Residual (floc) removal and disposal
- Power for pumps, dosing, mixing
- Pre- and post-storage application


HWTT, Nubbin Slough


Jim Bays,
J-Tech

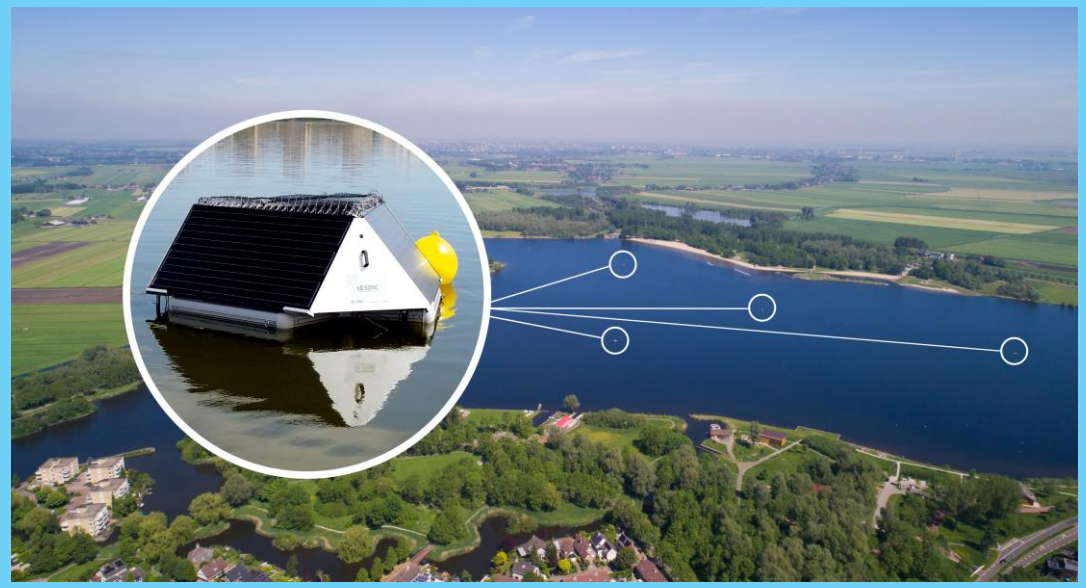
Coagulant Treatment (Alum)

- Coagulation of nutrients by particle charge neutralization and solids sedimentation in offline lagoons or within reservoir
- Multiple Florida applications
- Well-studied, good performance data
- 50-70% TN, 50-90% TP, >90% algae
- Reduced land area required
- Reduced capital cost
- Greater O&M cost
- Residual (floc) removal and disposal
- Power for pumps, dosing, mixing
- Pre- and post-storage; in-storage

Nutrient Reduction Facility
Lake County, FL

MPC-Buoy

- Reduces algal populations through sonic interference with cell flotation; may impact zooplankton
- Case studies are beginning
- Limited performance data in the U.S.; extensive data from Europe
- Up to 90% algae removal
- No additional land area
- No residuals
- Low capital cost
- Moderate O&M cost
- Transducer and buoy maintenance
- Treatment during storage



ElectroCoagulation

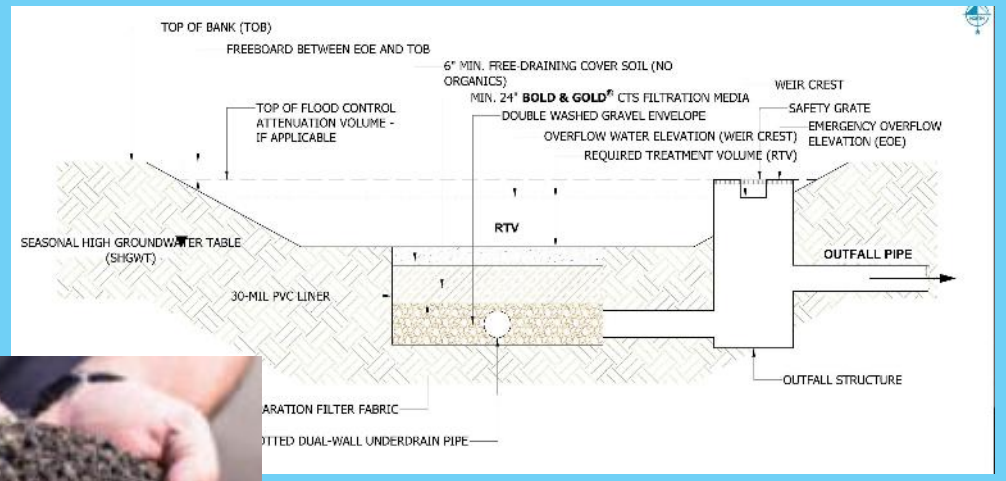
- Coagulation of nutrients by electrode particle charge neutralization and solids sedimentation
- Limited Florida case studies
- Limited performance data
- 60-90% TN, >90% TP, >90% algae
- Low land area required
- High capital cost
- High O&M cost
- Lower residual amount but still require disposal
- Power for electrodes, pumps, dosing, air
- Pre- and post-storage application

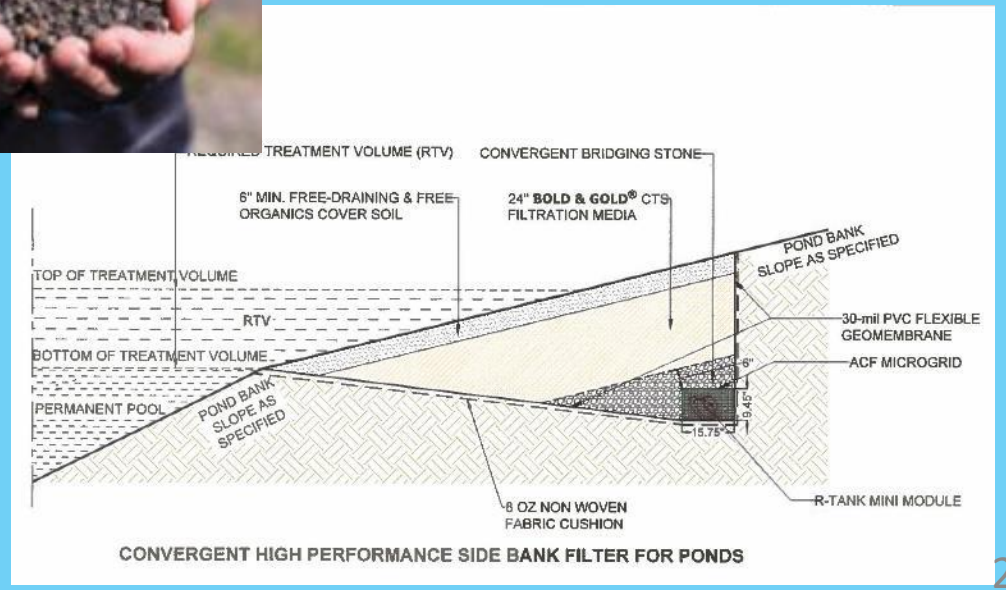
Powell Water Systems

Jim Bays,
J-Tech

Bold & Gold

- Sorption of nutrients to engineered media and filtration of solids in basin or basin side walls
- Many Florida applications
- Good performance data
- 75-95% TN, 50-90% TP
- Low land area required
- Moderate capital cost
- High O&M cost
- Spent media must be replaced (15 years)
- Pre- and post-storage application





Jim Bays,
J-Tech

Nutrigone Bioabsorptive Media ([BAM], Media Sorption)

- Sorption of phosphorus and denitrification of nitrogen on natural media
- Limited Florida applications
- Limited performance data
- 90% TN, >90% TP
- Moderate land area required
- High capital cost
- High O&M cost
- Spent media must be replaced (1-5 years) and residuals disposed; can be used for soil amendments
- Pre- and post-storage application

Aqua-Lutions®™

- Coagulation with chemicals and dissolved air flotation with micro-bubbles for solids separation
- Several Florida pilot studies
- Good performance data
- 65% TN, 90% TP, 80% algae
- Low land area required
- High capital cost
- High O&M cost
- High residual production requires removal and disposal; can be converted to fertilizer pellets
- Power for pumps, air, dosing, and flotation
- Pre- and post-storage application

Lake - *Pre-treatment*

AquaLutions™® - *Post-treatment*

Questions?

Please type any questions you may have in the Q&A feature of the Zoom meeting.

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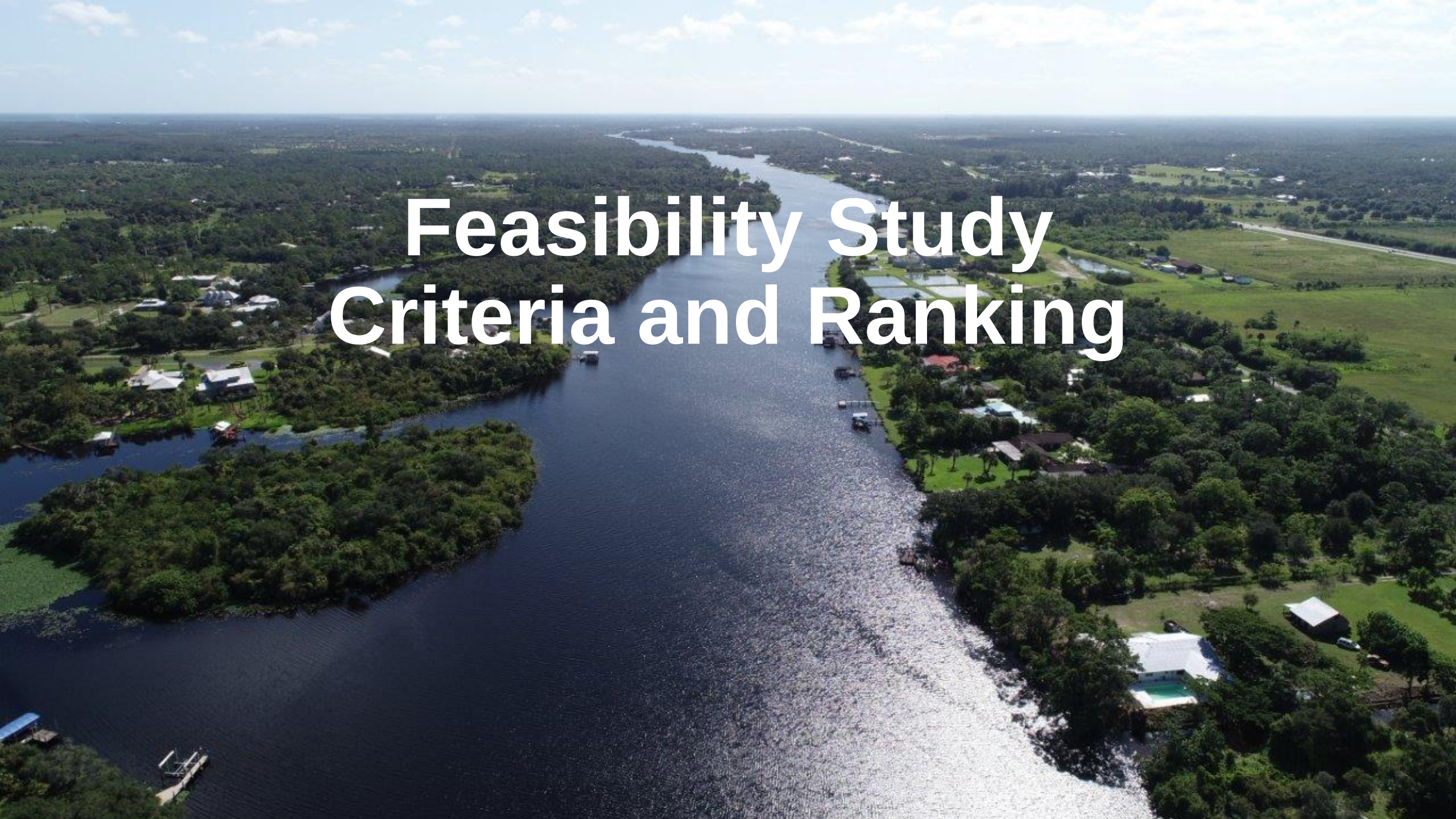


Feasibility Study Criteria and Ranking

Technology Criteria Ranking

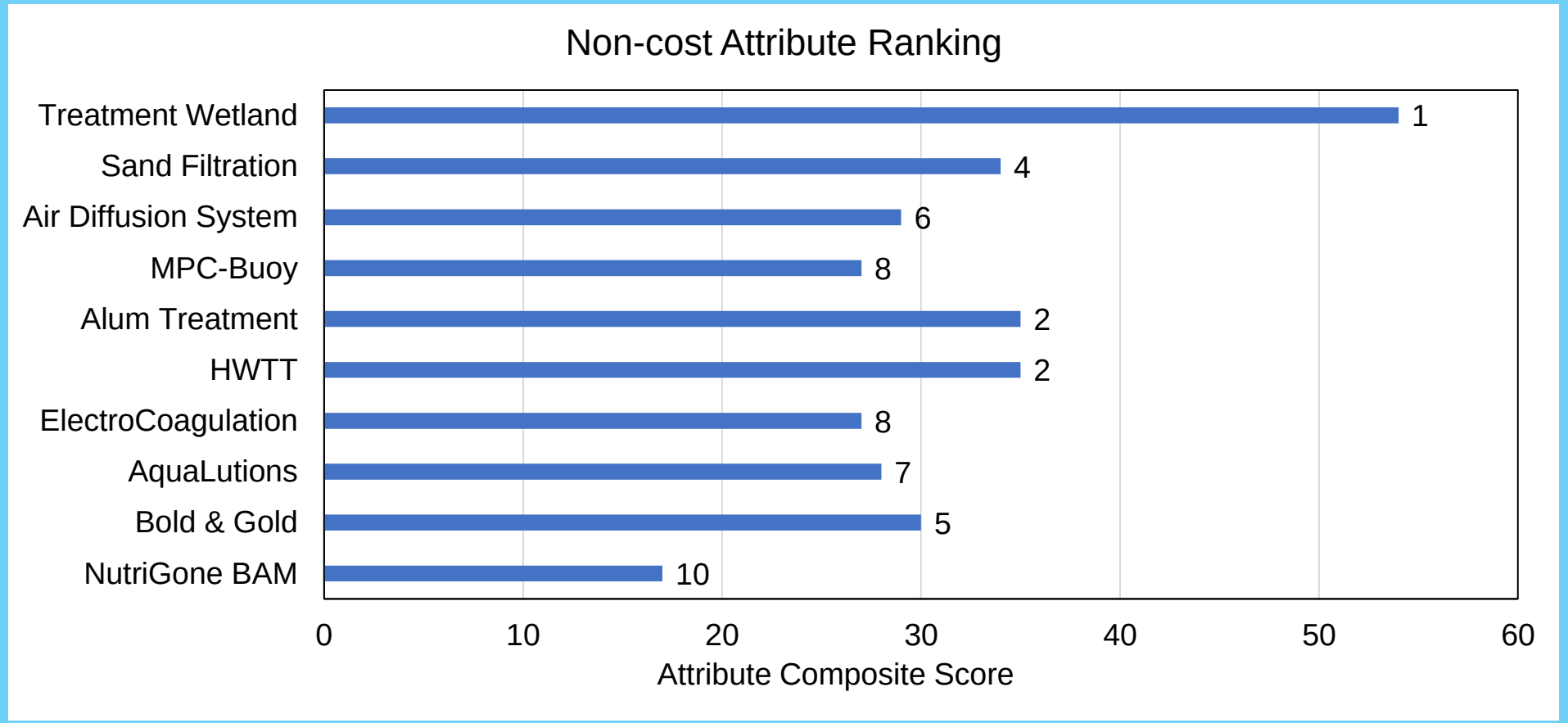
Criteria Ranking (high to low)	Weight (1-5)	Justification
Scalable	5	Experience with technology at a similar scale
Confidence in Performance Estimates	5	Must have a high confidence in removal estimates provided
Available Florida Case Study	4	Reduced risk based on reliability of data with Florida case studies; however, this Study supports innovation
Residuals Production	4	Preference for technology that does not produce residuals or require management
Habitat	3	Ancillary benefits to fish and wildlife by providing habitat
Ecosystem Services	2	Ancillary benefits to humans by providing recreational and aesthetic benefits
Energy Efficiency	2	Preference for technology with lower carbon footprint
Land Requirements	2	Footprint needed to provide for water quality treatment
O&M	2	Preference for technologies with less complexity of operations and less operator involvement
Schedule of Implementation	1	Time needed to construct and implement the treatment technology

Technology Criteria Ranking

Technology Scoring	Attribute										Score	Rank (Lower = Better)
	Scalable	Confidence in Performance Estimates	Available Florida Case Studies	Residuals Production	Habitat Value	Ecosystem Services	Energy Efficiency	Land Requirements	O&M	Schedule of Implementation		
Weight -->	5	5	4	4	3	2	2	2	2	1		
Treatment Wetland	2	2	2	2	2	2	2	0	2	0	54	1
Sand Filtration	1	1	1	2	1	0	2	0	2	1	34	4
Air Diffusion System	1	0	1	2	0	0	1	2	2	2	29	6
MPC-Buoy	1	0	0	2	0	0	2	2	2	2	27	8
Alum Treatment	1	2	2	0	1	0	1	2	1	1	35	2
HWTT	0	2	2	1	1	2	1	1	1	0	35	2
ElectroCoagulation	0	2	1	2	0	0	0	2	0	1	27	8
AquaLutions	1	2	1	1	0	0	1	1	0	1	28	7
Bold & Gold	0	1	2	2	0	0	1	1	2	1	30	5
NutriGone BAM	0	0	1	2	0	0	1	1	0	1	17	10

Scoring										
2	Proven at similar scale	High	n >= 5	No residual mgmt req	High	High	Highly eff	Low	Low	Short
1	Proven at moderate scale	Medium	1 < n < 5	Mod	Medium	Medium	Mod eff	Medium	Moderate	Moderate
0	Proven at small scale	Low	0	Large residual mgmt req	Low or None	Low or None	Low eff	High	Intensive	Long

Non-Cost Attribute Ranking




Chris Keller, WSI

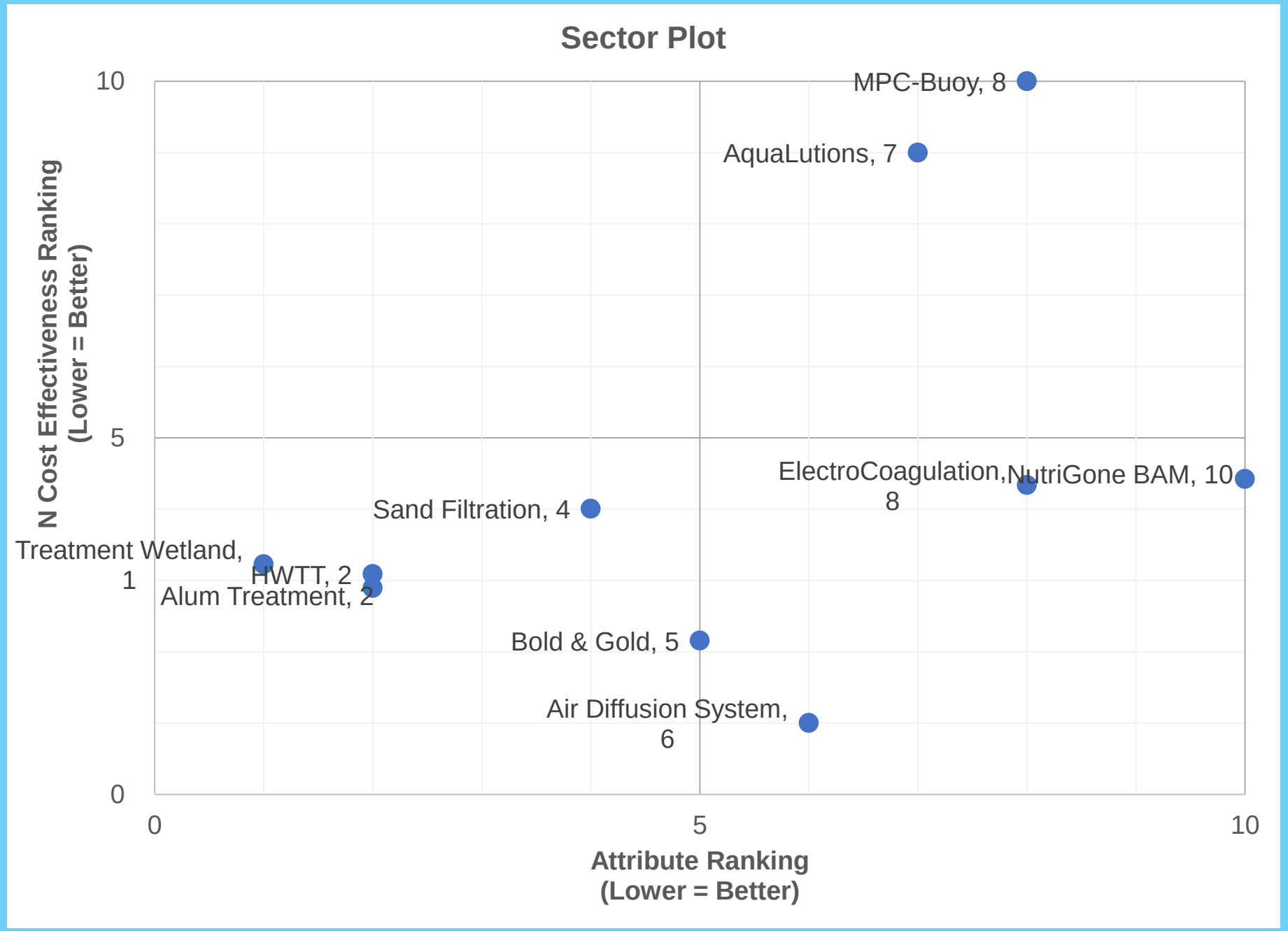
Design Criteria

- TN reduced from 1.5 mg/L to 1.0 mg/L
- TP reduced from 0.16 mg/L to 0.08 mg/L
- TSS reduced from 20 mg/L to 10 mg/L
- Flow = 457 cfs

Cost Effectiveness

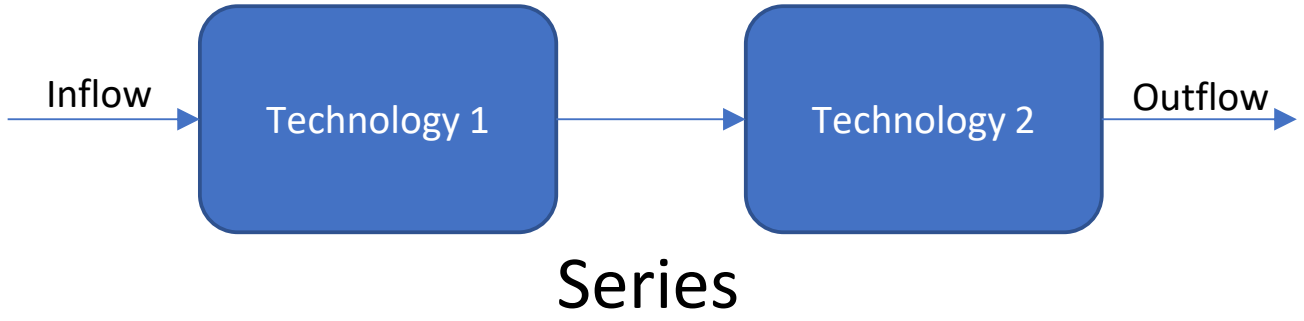
Technology	Attribute Ranking (Lower = Better)	Technology	N Cost Effectiveness Ranking (Lower = Better)	P Cost Effectiveness Ranking (Lower = Better)	TSS Cost Effectiveness Ranking (Lower = Better)	Overall
Treatment Wetland	1.00	Treatment Wetland	3.23	2.10	3.55	1
Sand Filtration	4.00	Sand Filtration	4.00	4.51	4.42	5
Air Diffusion System	6.00	Air Diffusion System	1.00	10.00	1.00	6
MPC-Buoy	8.00	MPC-Buoy	10.00	10.00	1.22	10
Alum Treatment	2.00	Alum Treatment	2.89	1.75	2.06	2
HWTT	2.00	HWTT	3.09	1.96	2.41	3
ElectroCoagulation	8.00	ElectroCoagulation	4.34	3.23	3.49	7
AquaLutions	7.00	AquaLutions	9.00	8.00	10.00	9
Bold & Gold	5.00	Bold & Gold	2.15	1.00	1.86	4
NutriGone BAM	10.00	NutriGone BAM	4.42	3.32	3.55	8


Chris Keller,
WSI

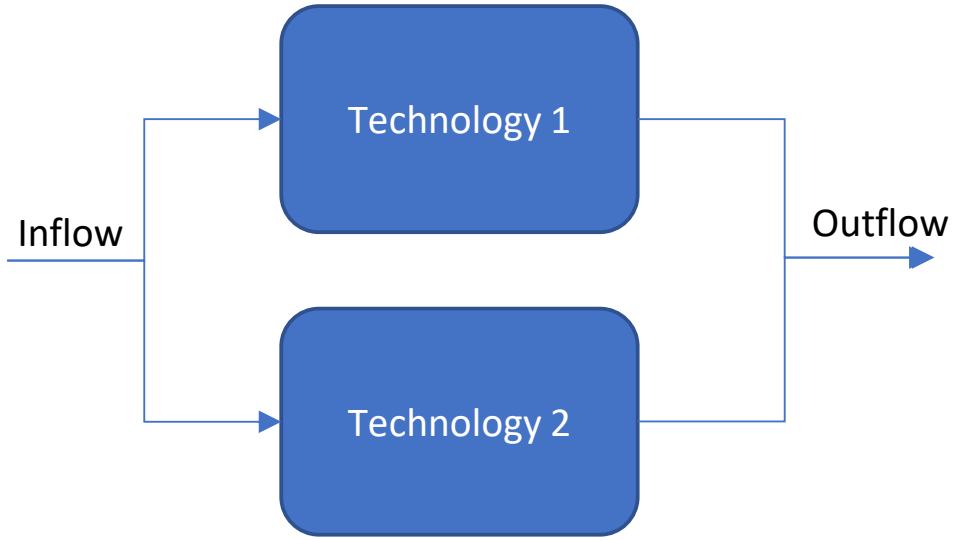

Sector Plot
N Cost Effectiveness Ranking
(Lower = Better)
Attribute Ranking
(Lower = Better)
10
5
1
0
0
5
10
MPC-Buoy, 8
AquaLutions, 7
ElectroCoagulation, 8
NutriGone BAM, 10
Sand Filtration, 4
Treatment Wetland, 1
HWTT, 2
Alum Treatment, 2
Bold & Gold, 5
Air Diffusion System, 6

Identification of Alternatives

- In series
- In parallel



Series



Parallel

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WSI

Technology Compatibility

Downstream Technology	Upstream Technology						
	Treatment Wetland	Sand Filtration	Alum	HWTT	Bold & Gold	ADS	ElectroCoagulation
Treatment Wetland	--	N	Y	Y	Y	Y	N
Sand Filtration	Y	--	N	N	Y	Y	N
Alum Treatment	N	N	--	N	Y	Y	N
HWTT	N	N	Y	--	Y	Y	N
Bold & Gold	Y	Y	N	N	--	Y	N
ADS	N	N	N	N	N	--	N
ElectroCoagulation	Y	Y	Y	Y	Y	Y	--

Feasibility Study
Cost Benefit Analysis

Identification of Alternatives

From Criteria Ranking:

1. STA
2. Alum
3. HWTT

Considered Combinations of Technologies:

4. Treatment Wetland and Bold & Gold (1,000\104 acres)
5. Sand Filtration and Bold & Gold (200\104 acres)

Additional Technologies:

6. ElectroCoagulation

Cost Benefit Analysis

Total Costs vs. Water Quality Benefits

- Costs:
  - Infrastructure (Small, Medium, Large)
  - Construction
  - O&M

- Benefits:
  - TN Removal
  - TP Removal
  - TSS Removal

Cost Benefit Analysis

Alternative	Capital Cost ($ millions)	Annual O&M Costs ($ millions/year)	NPV 20-year ($ millions)
Treatment Wetland	$147.98	$6.33	$233.98
Alum Treatment	$42.35	$4.89	$108.80
HWTT	$47.77	$8.53	$163.68
Treatment Wetland with Bold & Gold®	$134.57	$2.73	$171.64
Sand Filtration with Bold & Gold®	$152.37	$2.33	$184.00
ElectroCoagulation	$164.31	$5.99	$245.67

Cost Benefit Analysis

Alternative	Area (ac)	Treated Flow (cfs)	Unit Cost TN Removed (20-year)	Unit Cost TP Removed (20-year)	Unit Cost TSS Removed (20-year)
Treatment Wetland	5,000	457	$35.23	$220.19	$1.76
Alum Treatment	50	457	$16.28	$102.39	$0.82
HWTT	600	457	$24.65	$154.03	$1.23
Treatment Wetland with Bold & Gold®	1,000 Wetland 104 Bold & Gold®	91 Wetland 234 Bold & Gold® 325 Total	$25.84	$161.53	$1.29
Sand Filtration with Bold & Gold®	250 Sand Filter 104 Bold & Gold®	91 Sand Filter 234 Bold & Gold® 325 Total	$27.71	$173.16	$1.39
ElectroCoagulation	150	229	$36.99	$231.19	$1.85


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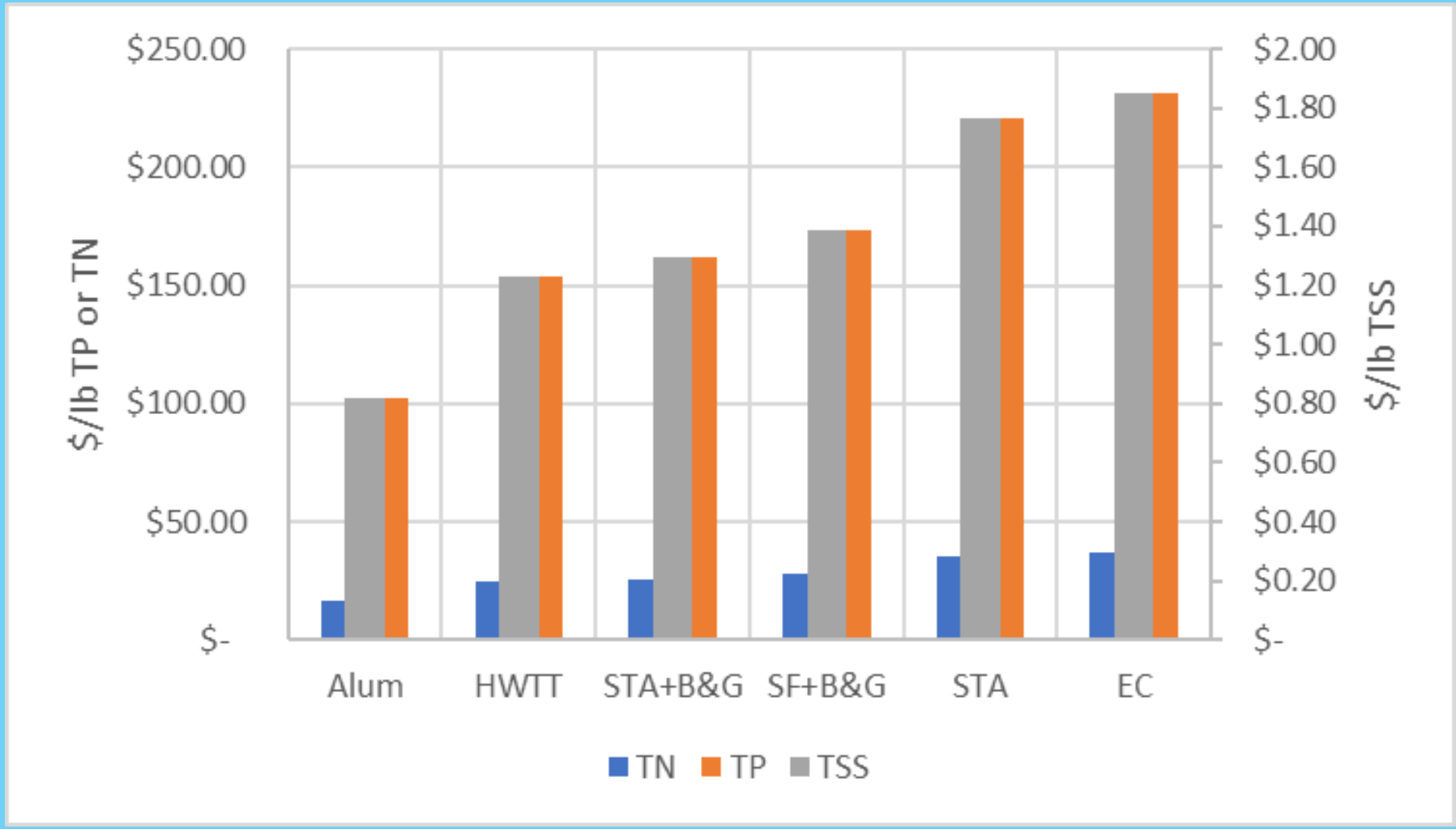
J-Tech

Results


$250.00
$200.00
$150.00
$100.00
$50.00
$-
$/lb TP or TN
$2.00
$1.80
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$-
$/lb TSS
Alum
HWTT
STA+B&G
SF+B&G
STA
EC
TN
TP
TSS

Recommended Alternatives

1. Alum Treatment
2. HWTT
3. Treatment Wetland with Bold & Gold®
4. Sand Filter with Bold & Gold®

Next Steps

Project Milestones

September 27, 2019	Public Meeting #1 – Fort Myers
January 21, 2020	Public Meeting #2 – Hendry County
March 25, 2020	Public Meeting #3 – Zoom Webinar
April 3, 2020	Information Collection Summary Report
July 16, 2020	Public Meeting #4 - Zoom Webinar
August 14, 2020	*Draft* C-43 WBSR Water Quality Feasibility Study
October 16, 2020	FINAL C-43 WBSR Water Quality Feasibility Study
November 5, 2020	Final Presentation of Study Results

Public Input and Project Website

C43waterquality@sfwmd.gov

https://www.sfwmd.gov/content/c43waterqualitystudy

Questions?

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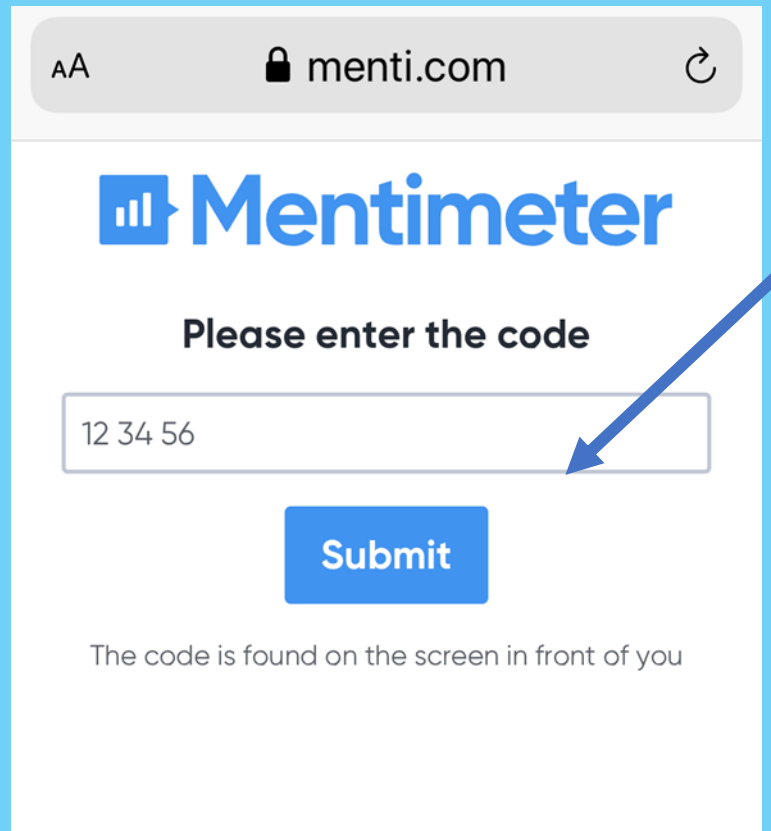
Menti.com - Instructions

Step 1. Open a new internet browser on your computer or smart phone

Such as: Internet Explorer, Safari, Google etc.
(To view all public input, leave the Zoom meeting window open)

Step 2. Type the web address “Menti.com” and hit “enter”



Step 3. Enter the Menti code in the box on your screen and click “Submit”

Today’s Code is 95 93 25

Answer the questions in Menti

See all the answers on the Zoom screen

PLEASE GO TO MENTI.COM NOW