C-43 West Basin Storage Reservoir (WBSR)
Water Quality Component (WQC) Siting Evaluation Update

April 15, 2021

Meeting Format

Zoom Meeting Functions

I. Question and Answer (Q&A) – 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.

Agenda Overview

- Project Background
- Siting Constraints and Opportunities
- Water Conveyance for Alternatives
- Water Quality Time Series Data, Evaluation, and Results
- Load Calculations, Results, and WQC Targets
- Updated WQC Sizing
- Cost Estimate for Full-scale Stormwater Treatment Area (STA)
- Inline (In-Reservoir) Alum Treatment

Georgia Vince,
J-Tech

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

Consultant Team

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

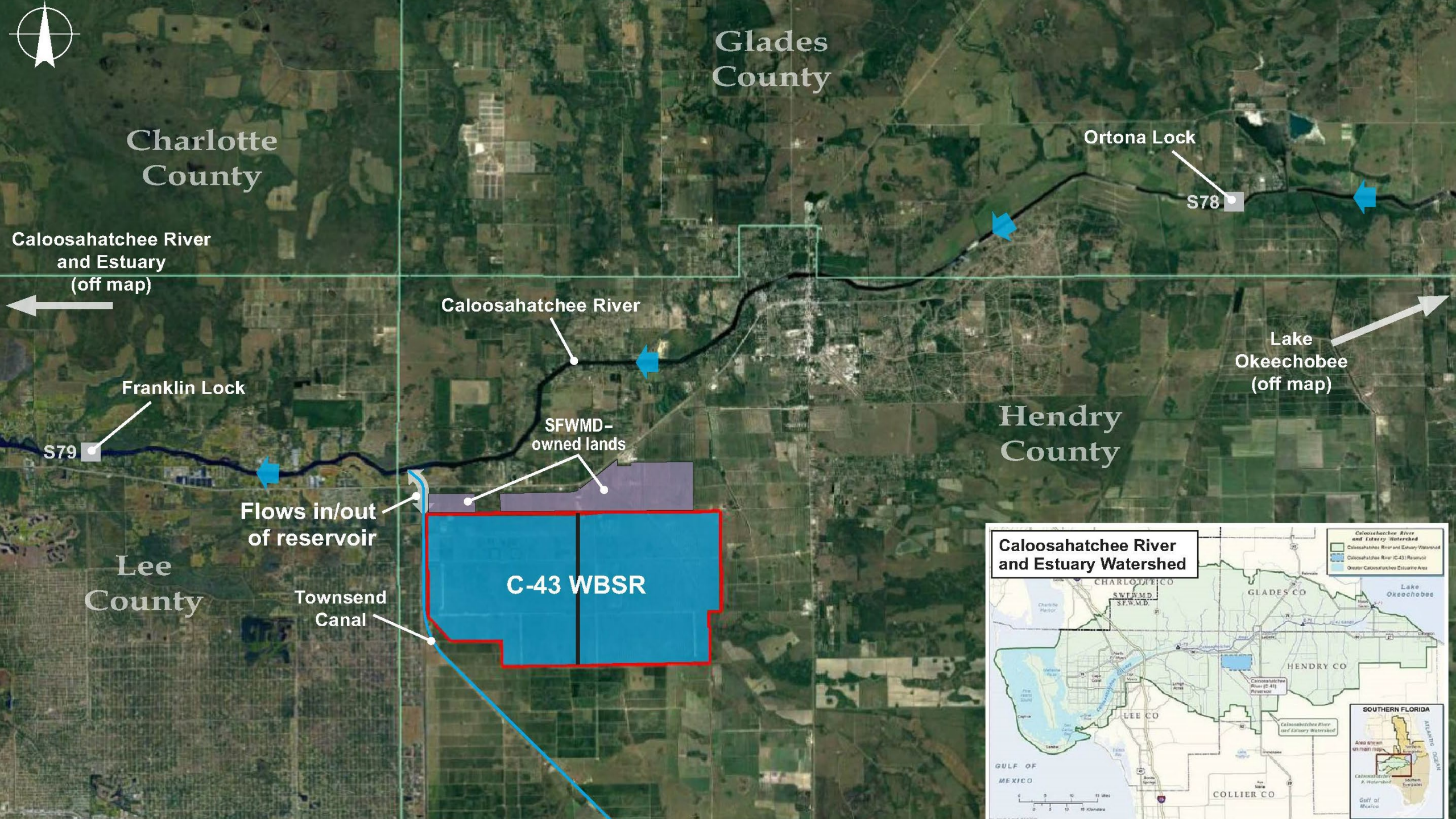
J-Tech
An alliance of Jacobs and Tetra Tech

Wetland Solutions Inc

Project Background

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 West Basin Storage Reservoir (WBSR)


Glades County
Charlotte County
Ortona Lock
S78
Caloosahatchee River and Estuary (off map)
Caloosahatchee River
Lake Okeechobee (off map)
Franklin Lock
S79
SFWMD–owned lands
Hendry County
Flows in/out of reservoir
C-43 WBSR
Lee County
Townsend Canal
Caloosahatchee River and Estuary Watershed
CHARLOTTE CO
GLADES CO
HENDRY CO
LEE CO
COLLIER CO
GULF OF MEXICO
SOUTHERN FLORIDA

C-43 WBSR Feasibility Study Objectives

- Primary Objective: Identify opportunities to provide additional treatment and improve water quality in, and leaving the C-43 Reservoir
- Evaluate alternative treatment technologies with emphasis on Nitrogen removal
- The goal of the Feasibility Study was to identify at a minimum three alternatives
- Compatible with the objectives of the C-43 WBSR Project

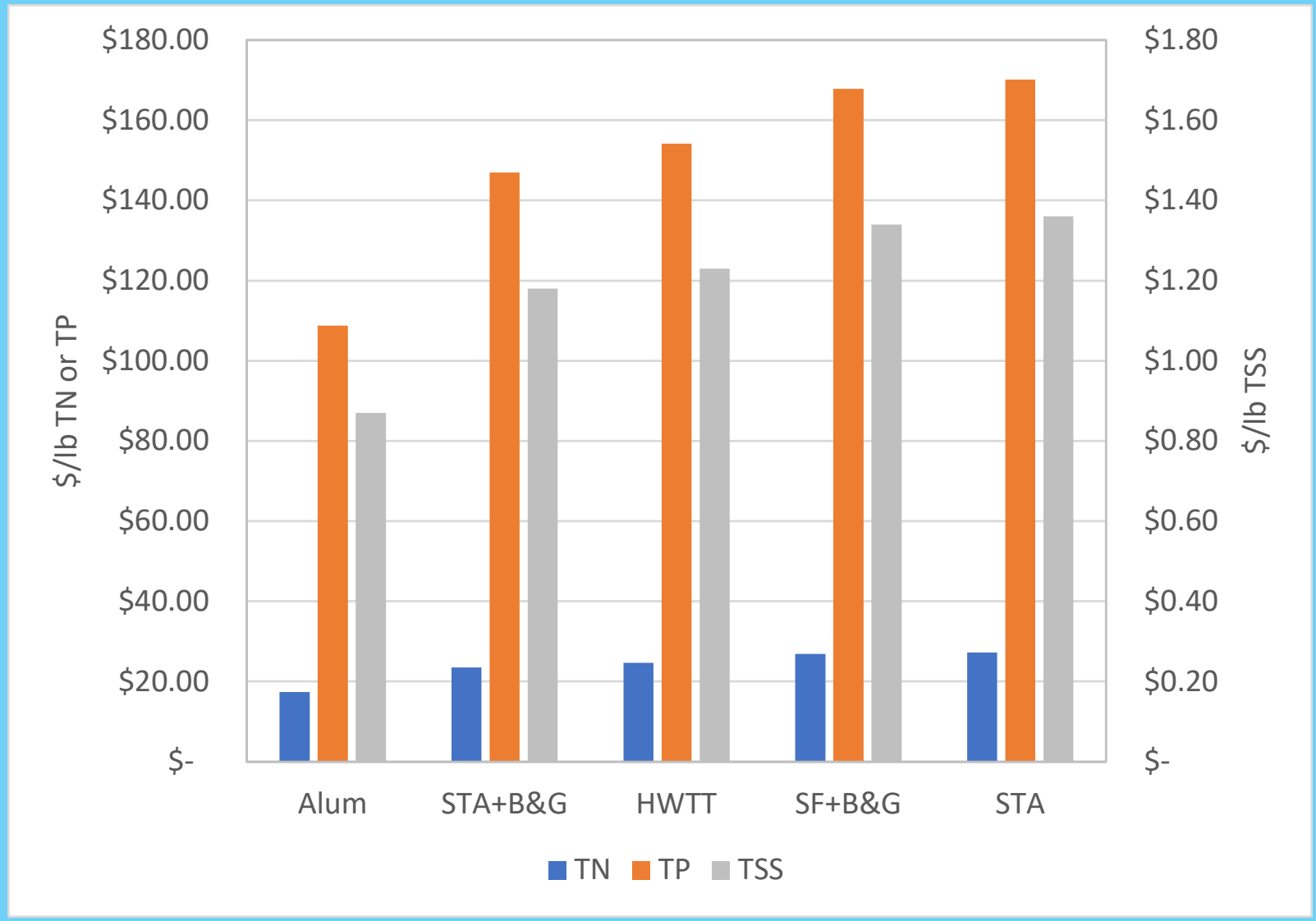
Feasibility Study Factors Evaluated

- 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

Feasibility Study Constraints

- Cannot affect the congressionally approved C-43 WBSR Project purposes, benefits, infrastructure, construction schedule, or operation, including Minimum Flows and Levels (MFL) requirements
- Project lands were not specifically identified for the Study alternatives
- 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)

WQFS Cost Benefit Results



1. Alum
2. STA + Bold & Gold®
3. HWTT
4. Sand Filter + Bold & Gold®
5. STA

Georgia Vince, J-Tech

Recommended Alternatives

1. Alum Treatment
2. STA with Bold & Gold®
3. HWTT
4. Sand Filter with Bold & Gold®
5. 5,000-acre STA

Final Study available:

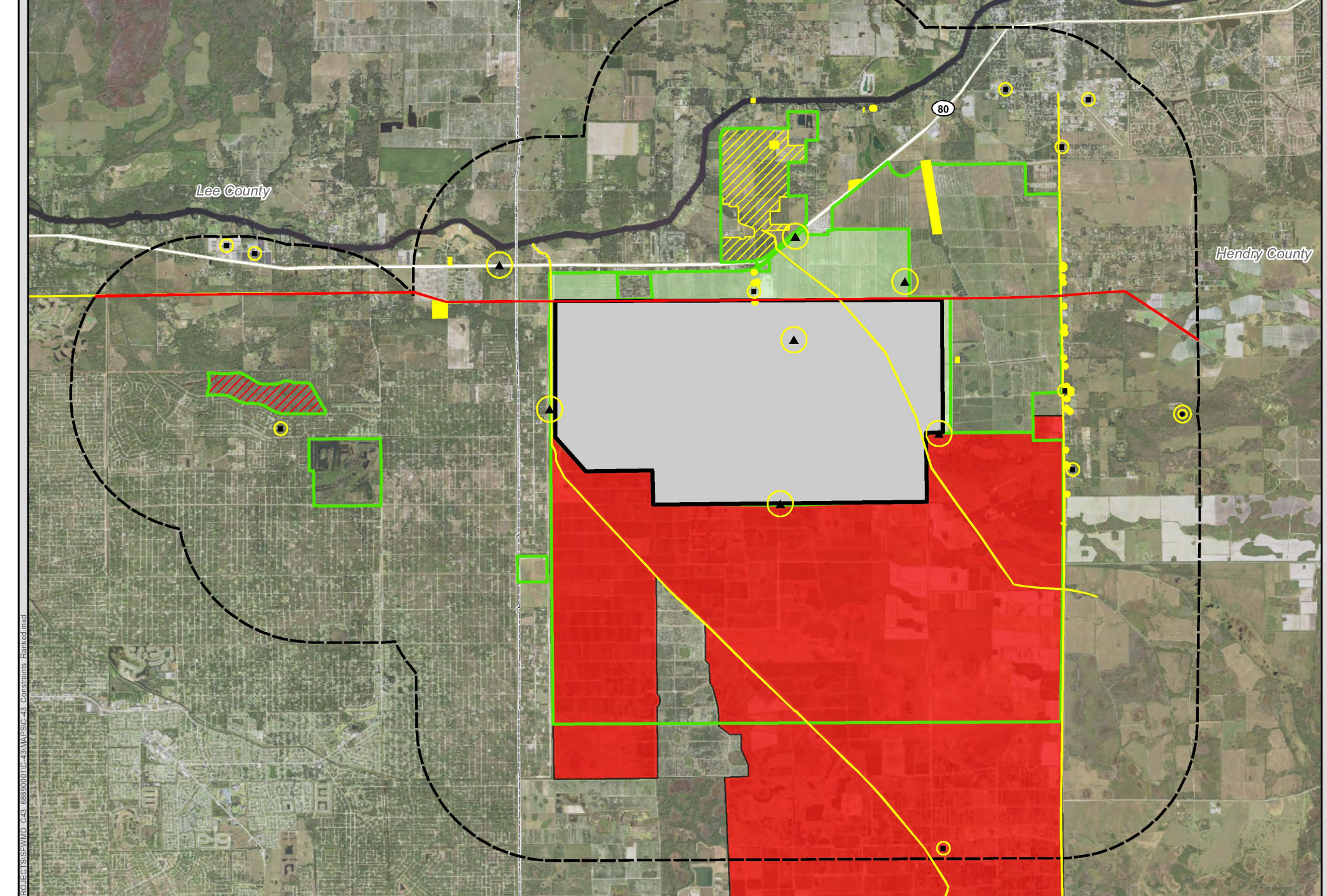
https://www.sfwmd.gov/content/c43waterqualitystudy

Water Quality Component Siting Evaluation (Phase II)

Constraints and Opportunities

Opportunities and Constraints

- Siting Evaluation was completed March 25, 2021
- Desktop analysis of available data
  - The character of the resource relative to its compatibility with the proposed WQC
- "Opportunity" areas are those that are compatible with the proposed project such as SFWMD-owned lands, rights-of-way, or existing water conveyance features
- "Avoidance" areas are sensitive areas where environmental impacts or land use conflicts can be minimized or mitigated using specific measures
- "Exclusion" areas represent the greatest potential for environmental, social, and/or economic impacts and generally are excluded as siting options



Project Opportunities and Constraints

Hendry and Lee Counties, FL

- C-43 Reservoir
- SFWMD Lands
- Consolidated Ownership 2-mile Buffer

Project Area Opportunity

- Consolidated Ownership

Constraints - May Require Mitigation

- Eagle Nest with 330-foot and 660-foot Buffers
- Caracara Nest (2021) and 300-meter Buffer
- DEP Cleanup Site and 500-foot Buffer
- Historical/Cultural Resource
- PUD Zoning

Constraints - Avoidance

- Major Transmission Lines
- Rodina Planned Development
- Protected Lands

Map Extent Covered by Consultation Areas for the Following Species:
Caracara
Everglades Snail Kite
Florida Bonneted Bat
Manatee

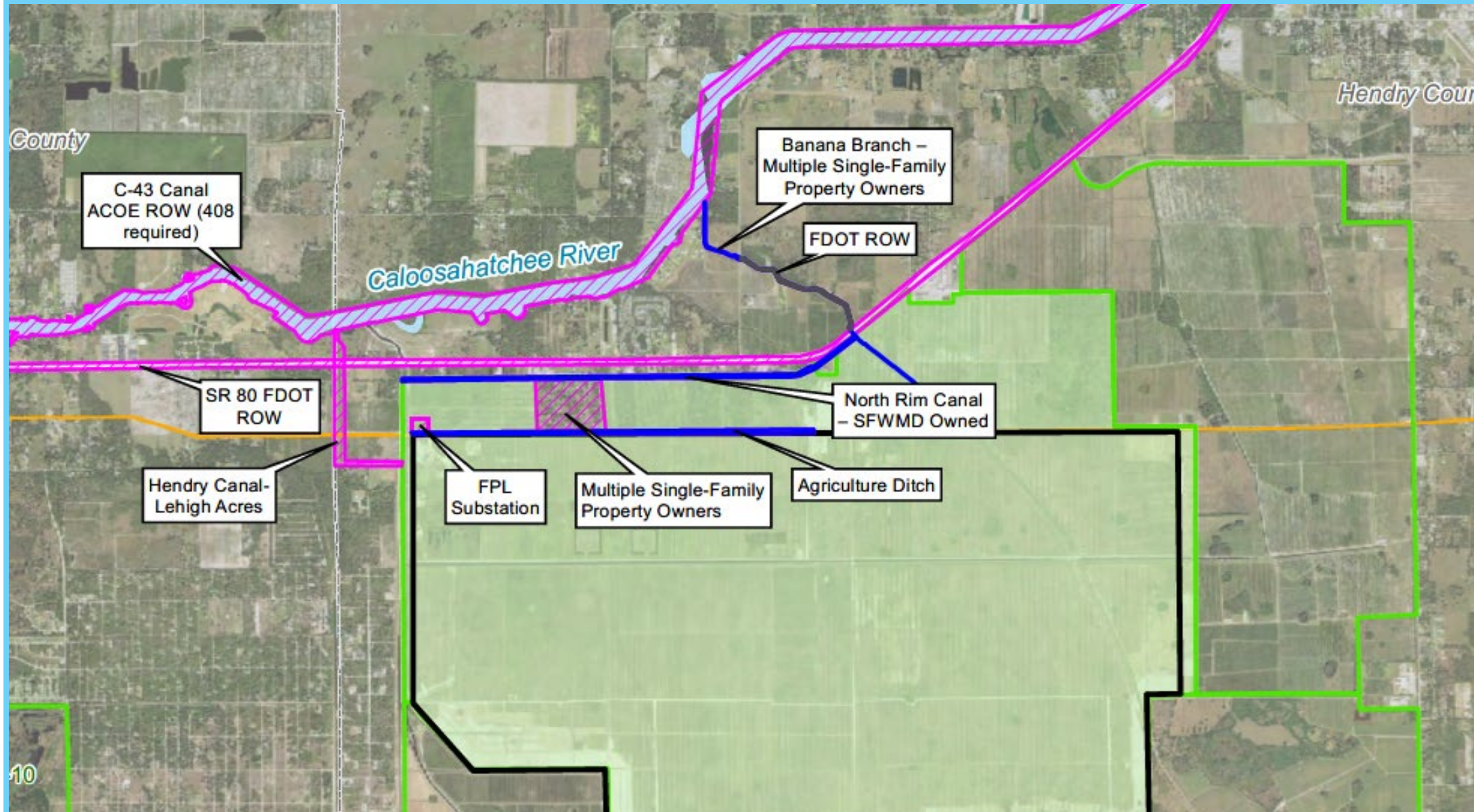
Map Extent Covered by Species Range for the Following Species:
Eastern Indigo Snake
Florida Panther
Wood Stork Foraging Area

N

0 0.5 1 2
Miles

PROJECTS\SFWMD_C43_686900010\C-43\MAPS\C-43_Constraints_Ranked.mxd

Easements and ROW to Consider



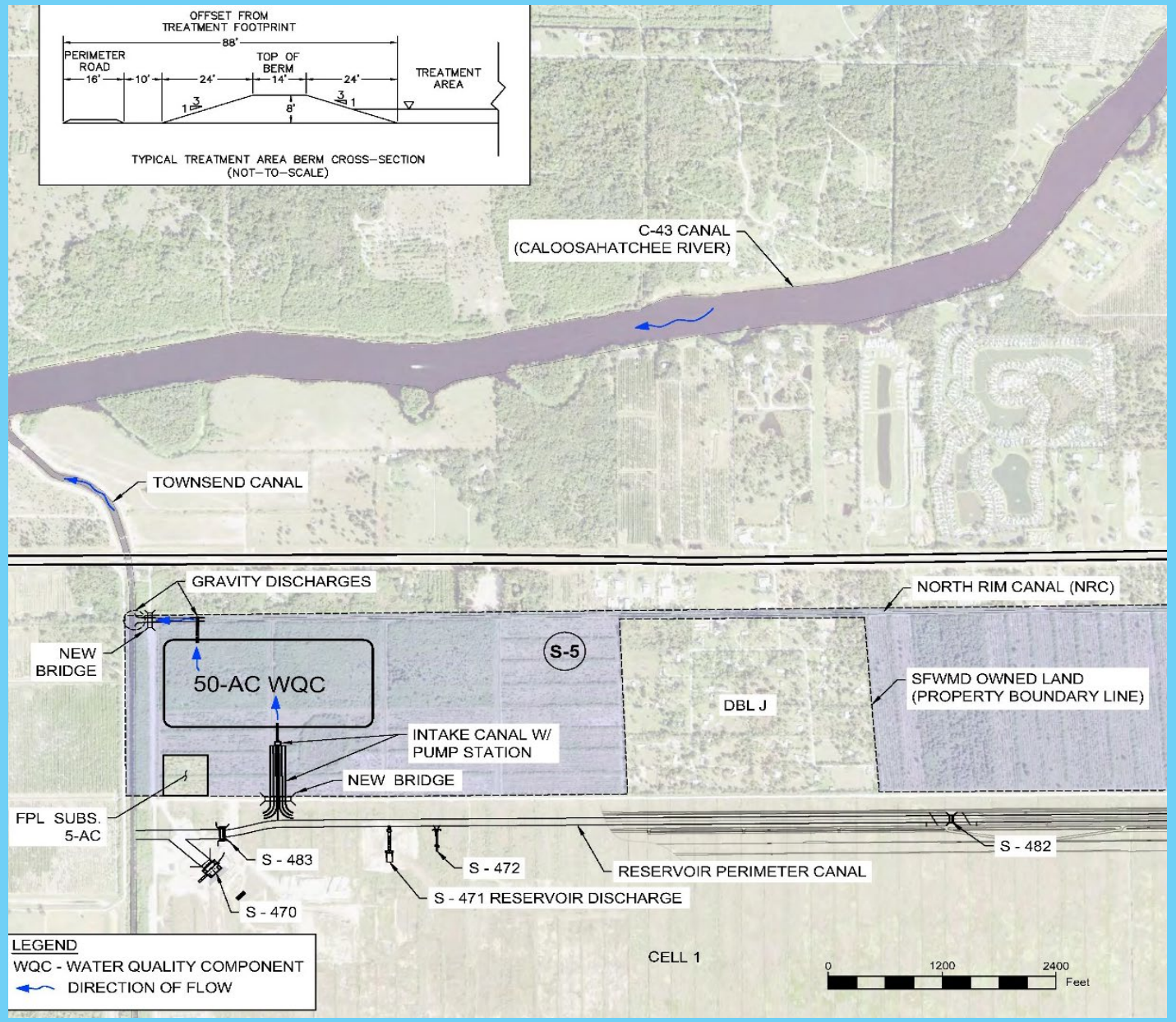
Siting Evaluation Summary

- Limited lands to the north and south of the reservoir due to planned developments
- Lands directly to east and west of the reservoir are privately owned agriculture lands
- Public Lands farther to the west were evaluated, and ruled out due to multiple challenges including lack of excess water and affects to the reservoir meeting the MFL
- Conveyance restrictions to the west of the reservoir, alternatives are not cost-effective
- Consultation for protected species will be required for all alternatives
- SFWMD-owned lands provide the best opportunity for siting the WQC

WQC Water Conveyance for Alternatives

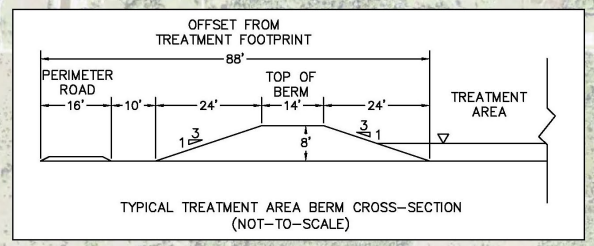
Option 1 – Offline Alum Treatment Facility

Shawn Waldeck, J-Tech



Option 2 – Sand Filter and B&G Combination

Shawn Waldeck,
J-Tech



C-43 CANAL
(CALOOSAHATCHEE RIVER)

BANANA BRANCH CANAL

TOWNSEND CANAL

OUTPARCEL PROPERTY
BOUNDARY LINE

ROAD 80

EOC

GRAVITY DISCHARGE

CANAL IMPROVEMENTS NEEDED

NORTH RIM CANAL

NEW BRIDGE

S-5

GRAVITY
DISCHARGE

S-4

DBL J

298-AC WQC

COPPER
STORAGE

FPL
SUBST.
5-AC

SFWMD OWNED LAND
(PROPERTY BOUNDARY LINE)

PROPOSED WQC
PERIMETER EARTHEN BERM

INTAKE PUMP STATION

S - 482

S - 483

S - 470

S - 472

RESERVOIR PERIMETER CANAL

SITE ACCESS BRIDGE

S - 474

S - 473

TOWNSEND CANAL

S - 471
RESERVOIR
DISCHARGE

NEW INTAKE CANAL
CONVEYANCE

CELL 1

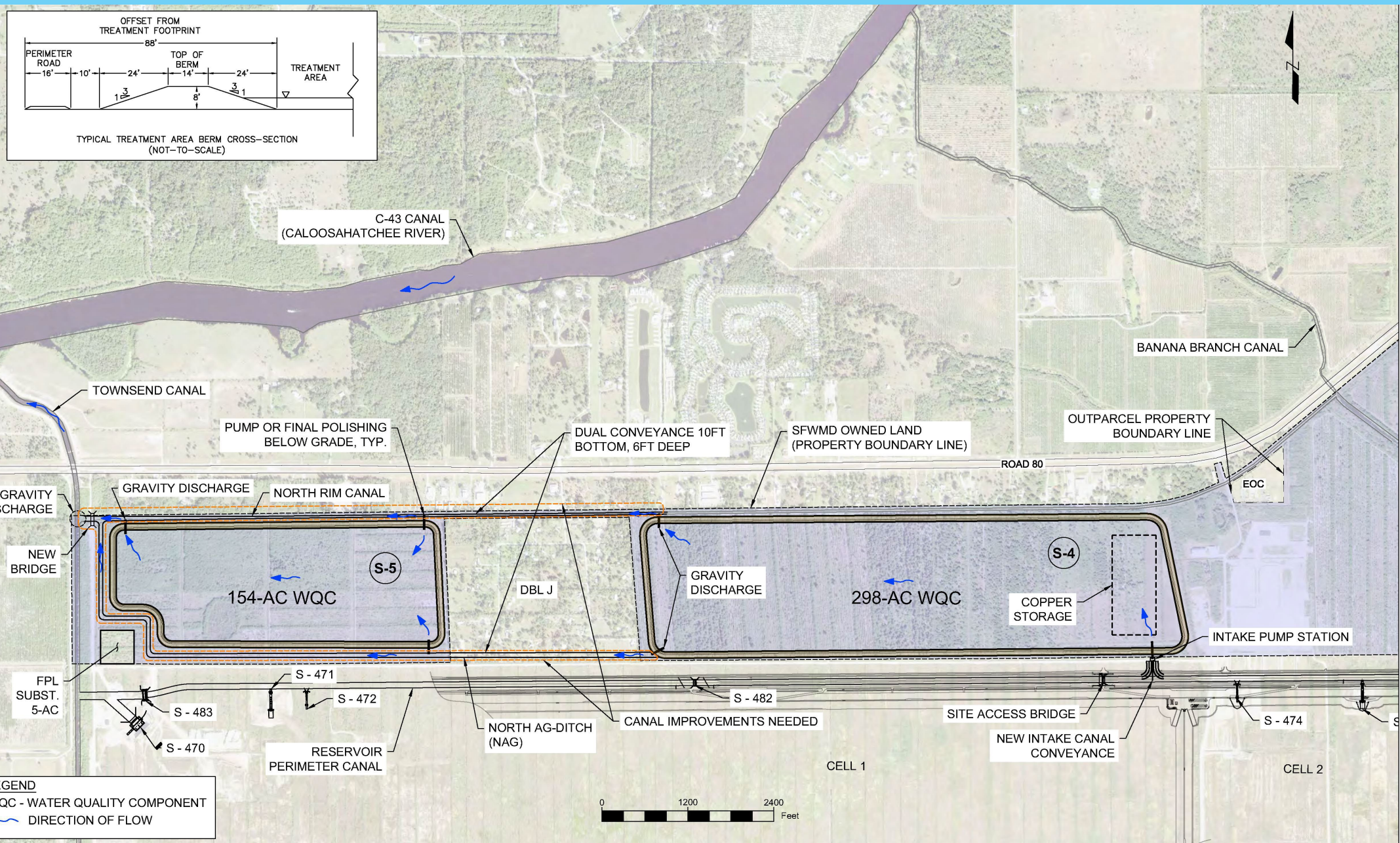
CELL 2

LEGEND
WQC - WATER QUALITY COMPONENT
DIRECTION OF FLOW

0 1200 2400
Feet

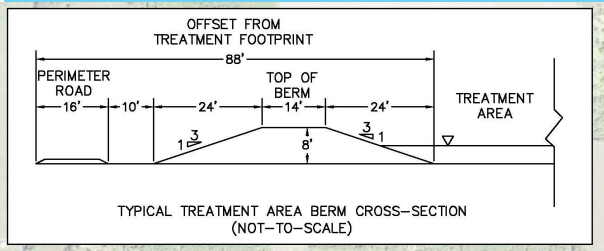
Option 3 –Hybrid Wetland Treatment Technology

Shawn Waldeck,
J-Tech



Option 4A – STA and B&G, North Rim Canal Discharge

Shawn Waldeck,
J-Tech



C-43 CANAL
(CALOOSAHATCHEE RIVER)

BANANA BRANCH CANAL

SFWMD OWNED LAND
(PROPERTY BOUNDARY LINE)

TOTAL AREA: 1,936-AC

TOWNSEND CANAL

AERIAL PIPE CROSSING
PUMPED DISCHARGE PIPES

GRAVITY DISCHARGE

DISCHARGE INTO
TOWNSEND CANAL

CANAL IMPROVEMENTS NEEDED

ROAD 80

NORTH RIM CANAL

EOC

S-2

862-AC WQC

BANANA BRANCH CANAL

NEW BRIDGE

S-5

S-4

OUTPARCEL PROPERTY
BOUNDARY LINE

168-AC
WQC

INTAKE PUMP STATION

AERIAL PIPE CROSSING

DBL J

FPL SUBS. 5-AC

RESERVOIR PERIMETER CANAL

S - 483

S - 482

SITE ACCESS BRIDGE

S - 474

S - 473

S - 481C

S - 480

S - 472

S - 481B

S - 470

S - 471

RESERVOIR PERIMETER CANAL

PROPOSED BYPASS
PERIMETER
MAINTENANCE ROAD

S - 481A

PROPOSED INTAKE CANAL

CELL 1

CELL 2

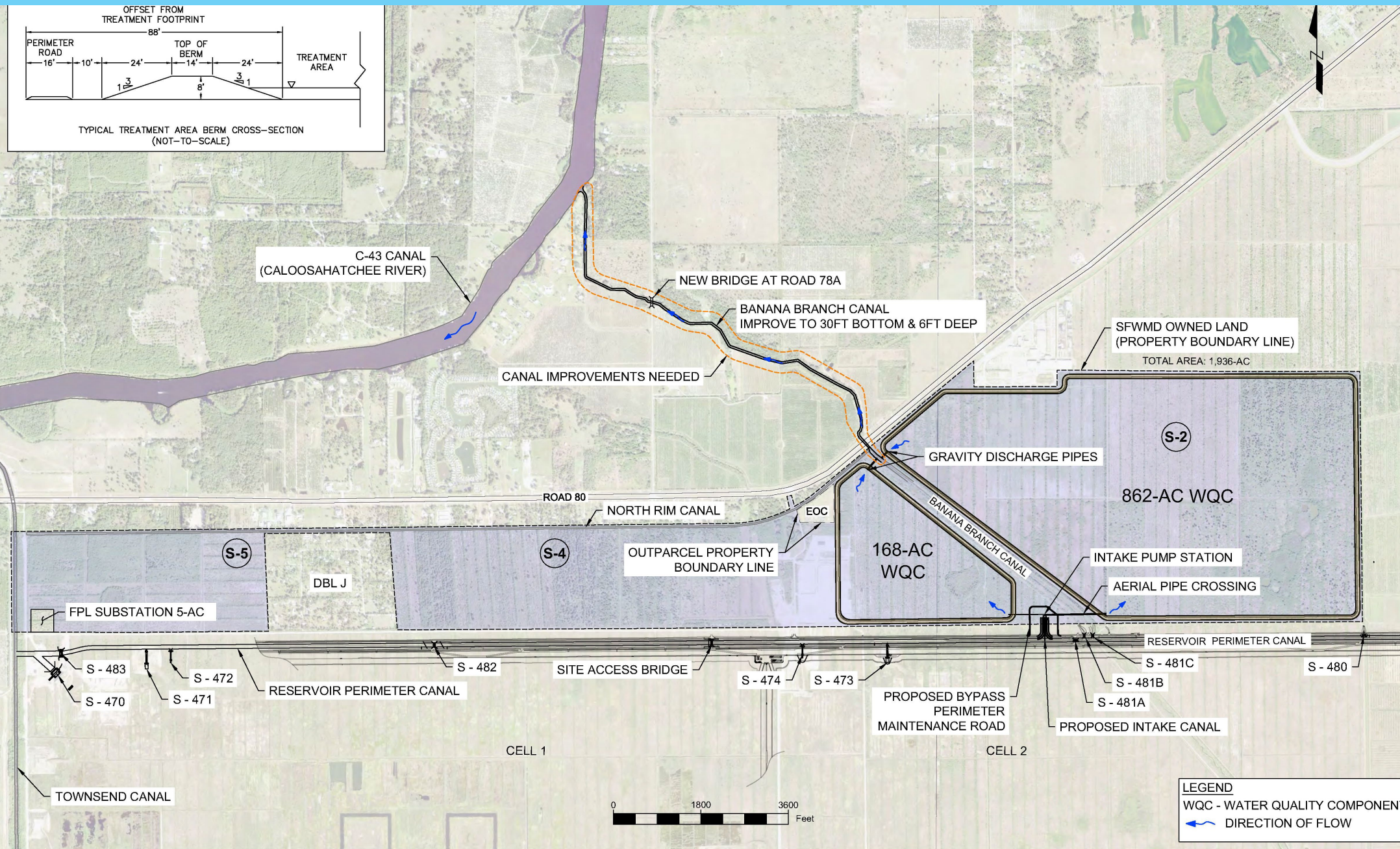
TOWNSEND CANAL

0 1800 3600
Feet

LEGEND
WQC - WATER QUALITY COMPONENT
DIRECTION OF FLOW

Option 4B – STA and B&G, Banana Branch Discharge

Shawn Waldeck,
J-Tech



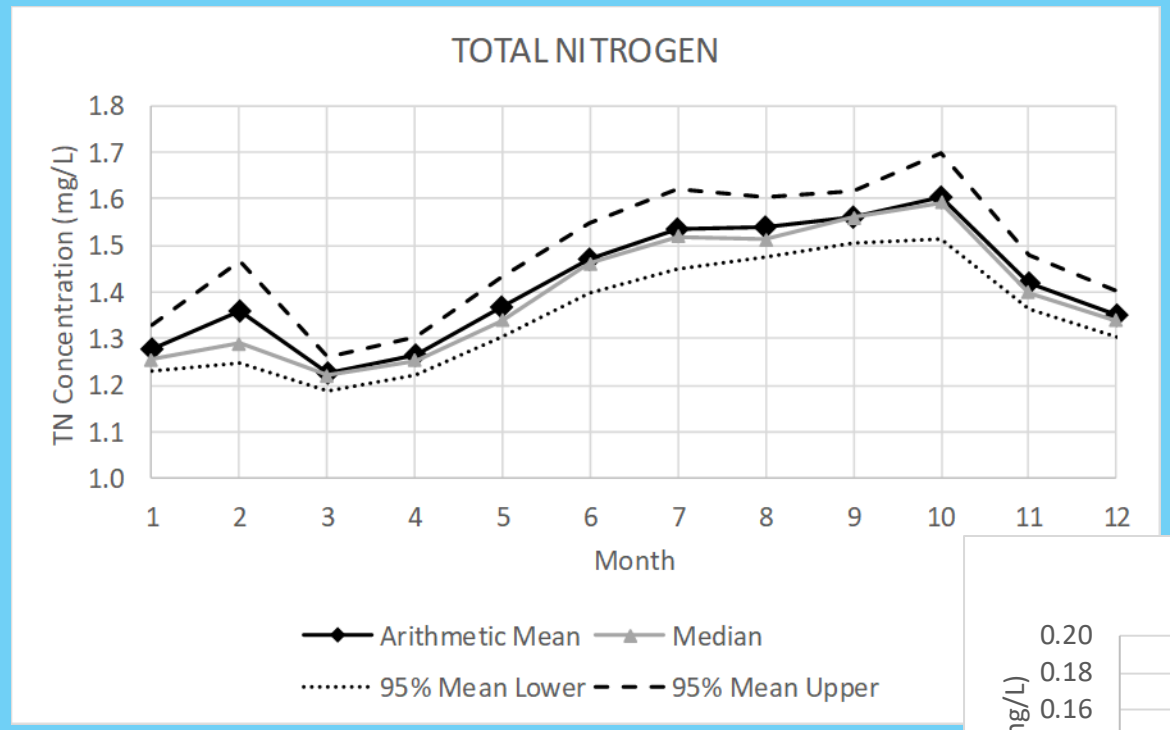

Questions?

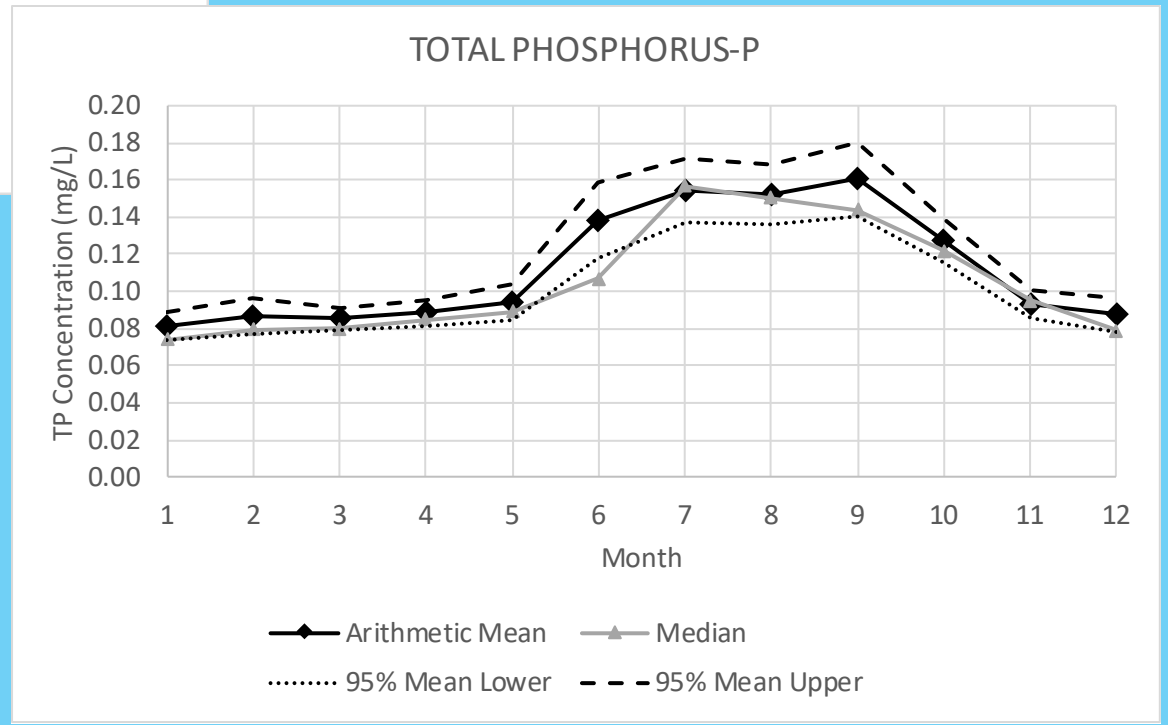
WBSR Inflow and Outflow Water Quality

Water Quality Analysis

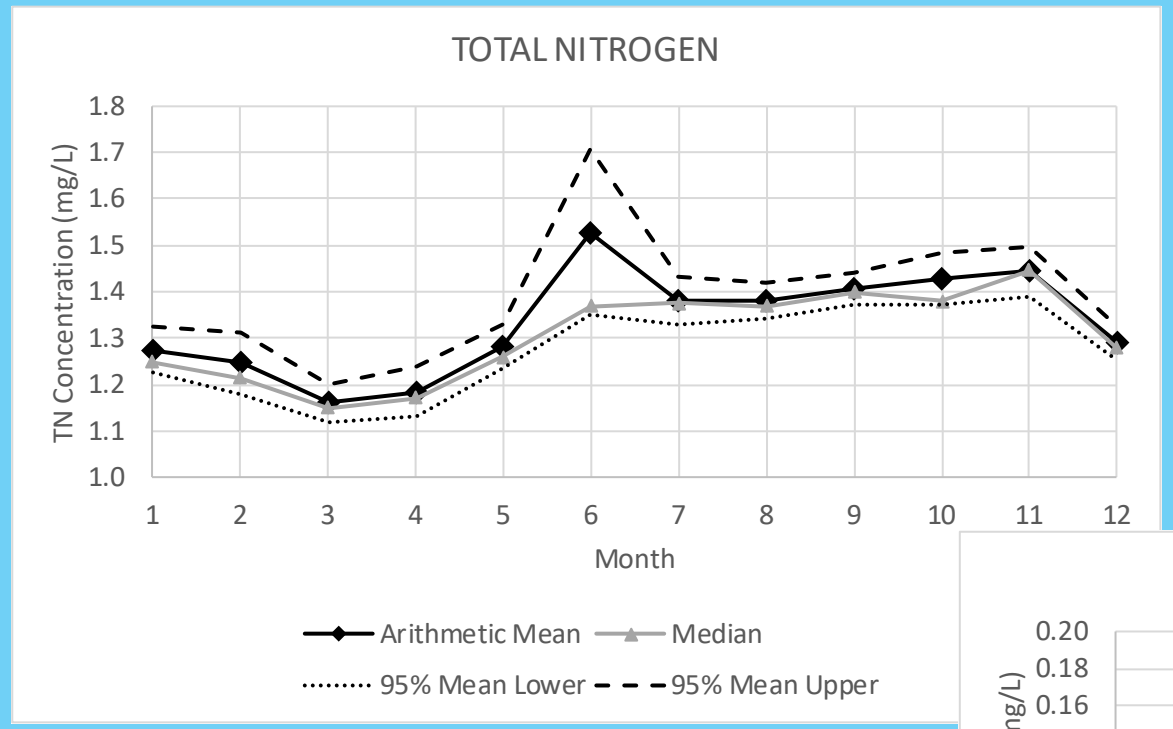
- S-78 monthly median time series is recommended as the inflow concentration to the reservoir
  - S-78 is located upstream of the reservoir and is more representative of the water quality to the reservoir
    - Several tributaries do contribute to the river between S-78 and Townsend Canal
  - Monthly summary best represents the seasonal trends in water quality
  - Median values best fit the data distribution
- S-79 monthly median time series is recommended as the target for WQC treatment
  - Ensures that the quality of water returned to the river will be the same or better than the ambient water quality in the river

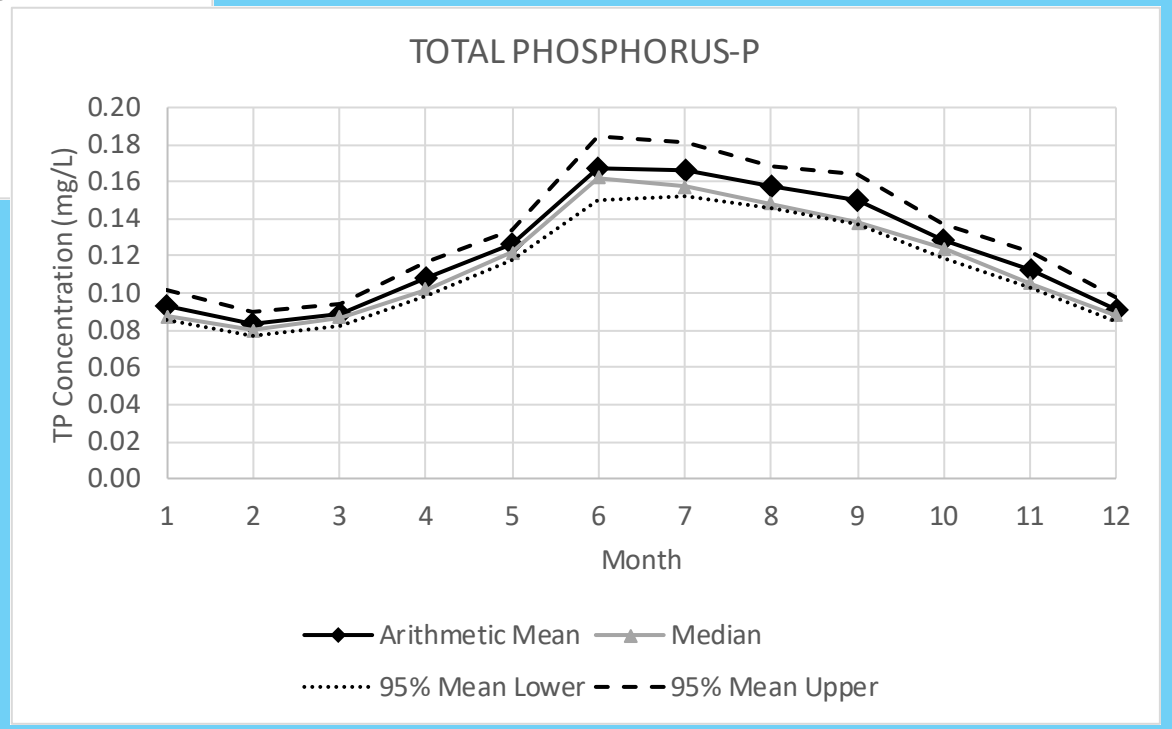
S-78 Time Series





S-79 Time Series






Marcy Frick, J-Tech

Water Quality Targets for the WQC

- Updated water quality treatment targets from the Feasibility Study
- Based on S-79 median dry season (November–April) TN, TP, and TSS concentrations
  - Most conservative values
  - During time of year when reservoir would likely be releasing

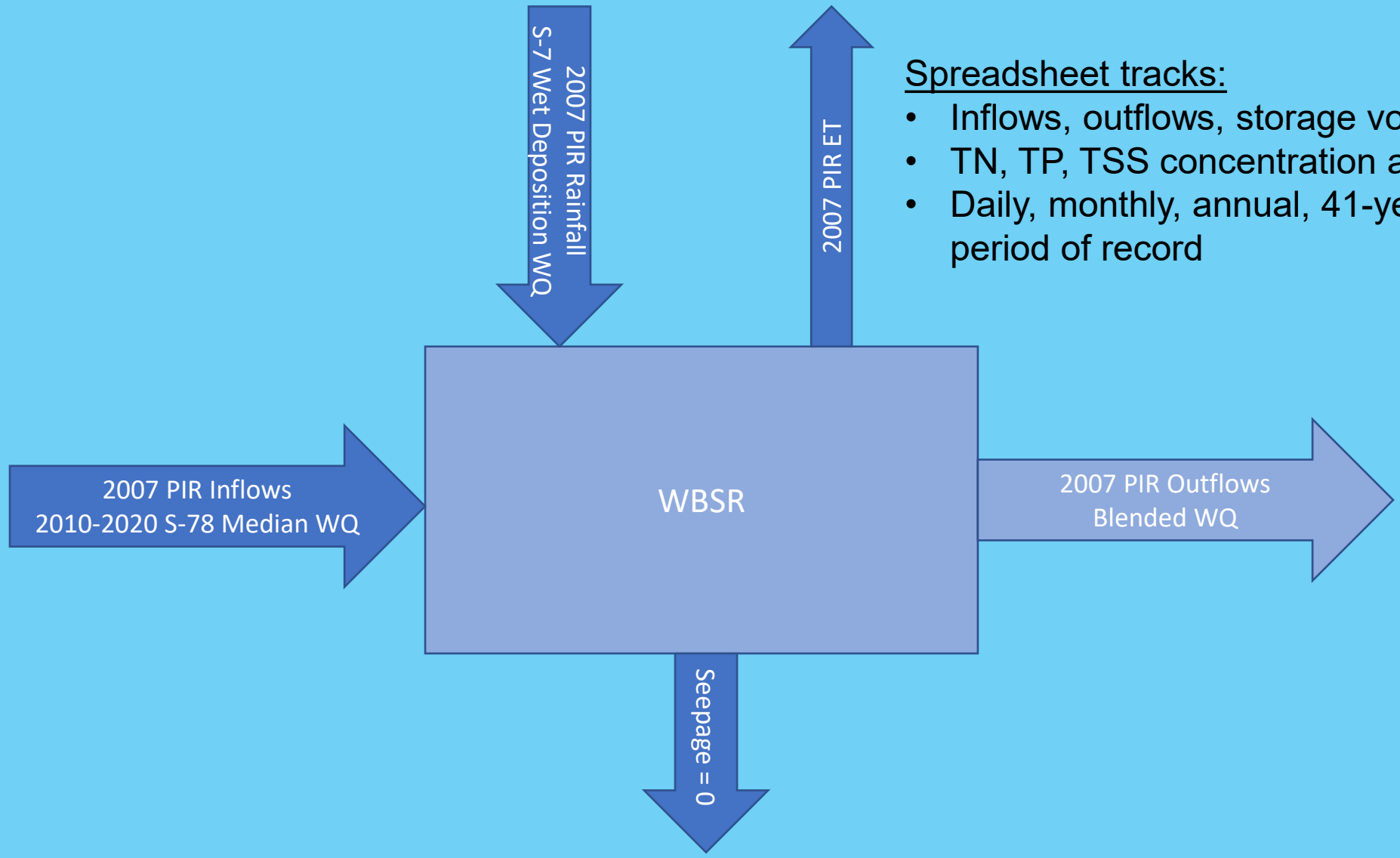
Parameter	Target
Total Nitrogen (TN)	1.23 mg/L
Total Phosphorus (TP)	0.088 mg/L
Total Suspended Solids (TSS)	1.50 mg/L

WBSR Inflow and Outflow Water Quality

C-43 WBSR Spreadsheet Model

- Purpose:
  - Estimate WBSR inflow water quality to size inline alum system
  - Estimate WBSR outflow water quality to size downstream treatment systems
  - Spreadsheet manages storage effects of prescribed inflows/outflows on water quality
  - Option to modify inflow water quality to represent inline alum system performance
- Limitations:
  - Spreadsheet is not a mechanistic reservoir water quality model
  - Spreadsheet relies on 2007 PIR hydrology time series and WBSR operational rules

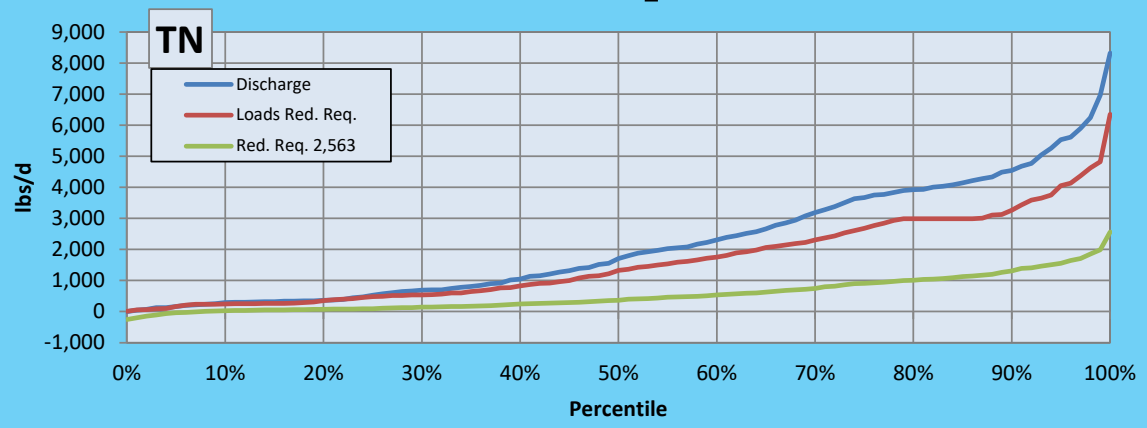
C-43 WBSR Spreadsheet Model



Spreadsheet tracks:

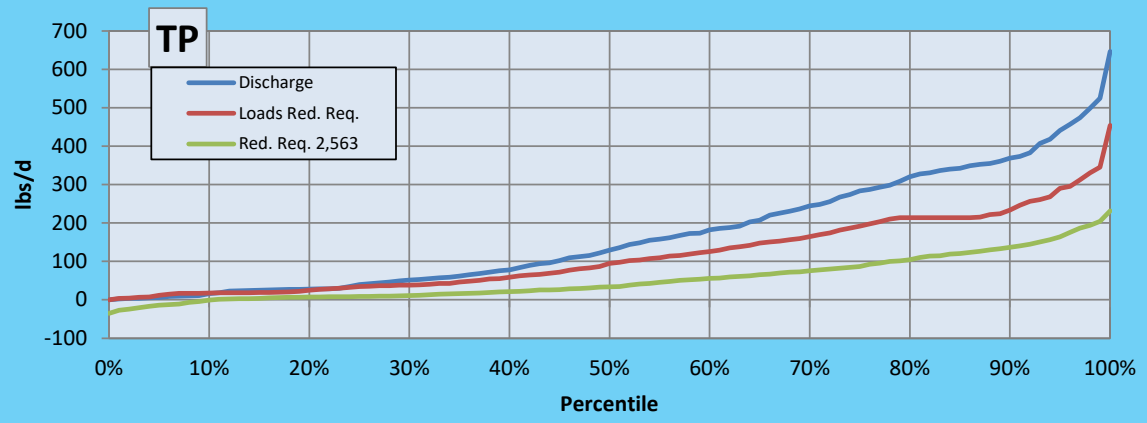
- Inflows, outflows, storage volume,
- TN, TP, TSS concentration and mass
- Daily, monthly, annual, 41-year period of record

C-43 WBSR Spreadsheet Model Output



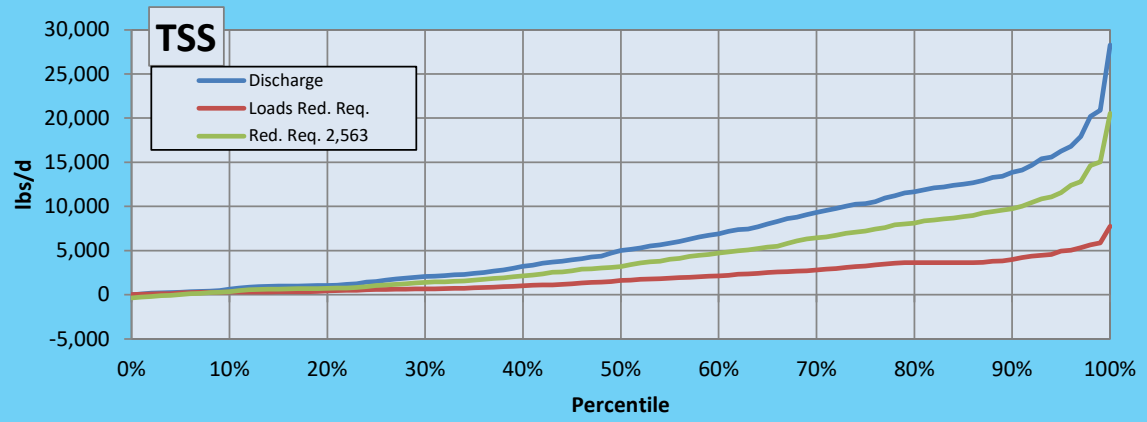
TN Summary (lbs/d)

	Loads		
Percentile	Discharge	Target	Red. Req.
100%	8,316	6,347	2,563
90%	4,542	3,264	1,311
75%	3,668	2,676	909
50%	1,704	1,324	366
25%	530	479	94
10%	289	248	24
0%	2.6	4.1	-258



TP Summary (lbs/d)

	Loads		
Percentile	Discharge	Target	Red. Req.
100%	646	454	231
90%	369	234	136
75%	283	191	87
50%	129	95	33.8
25%	40	34	8.6
10%	16	18	-1
0%	0.1	0.3	-36



TSS Summary (lbs/d)

	Loads		
Percentile	Discharge	Target	Red. Req.
100%	28,265	7,740	20,525
90%	13,852	3,981	9,745
75%	10,327	3,263	7,201
50%	4,998	1,615	3,178
25%	1,504	584	1,046
10%	631	303	332
0%	1.6	4.9	-349

WQC Sizing Analysis


Chris Keller, WSI

Recommended Alternatives from WQFS

- 50-ac off-line alum treatment
- 600-ac HWTT
- 1,000-ac STA with 104-ac parallel Bold & Gold® treatment
- 200-ac sand filter with 104-ac parallel Bold & Gold® treatment

Alternative	Capital Cost ($ millions)	Annual O&M Costs ($ millions/year)	Net Present Value 20-year ($ millions)
Off-line Alum Treatment	$51.8	$5.67	$115.5
HWTT	$47.8	$8.53	$163.8
STA with Bold and Gold®	$134.6	$1.58	$156.1
Sand Filter with Bold and Gold®	$152.4	$1.91	$178.3
Full-Scale STA	$148.1	$2.41	$180.8

Note: The full-scale STA was retained for further evaluation based on stakeholder input during the Water Quality Feasibility Study.


Chris Keller, WSI

Updated Alternatives Summary

Alternative	TP Discharge (mg/L)	TN Discharge (mg/L)	TSS Discharge (mg/L)	Area Change	Recommend Update from WQFS
Alum (offline)	0.086	1.00	3.33	No change	Reduced alum dose from 0.30 mg/L or 1,500 gallons per day (gpd) to 0.25 mg/L or 1,250 gpd.
HWTT	0.080	1.23	2.35	Adjusted	Reduced total system area from 660 ac to 525 ac.
STA + Bold and Gold®	0.059	1.22	2.12	Adjusted	Assuming vendor removal rates for Bold and Gold®, system meets TN and TP targets. STA meets all targets. Media filter bed area increased to 105 ac.
Sand filter + Bold and Gold®	0.056	1.19	1.95	Adjusted	Assuming vendor removal rates for Bold and Gold®, system meets TN and TP targets. Media filter bed area increased to 105 ac.
STA (5,000-ac)	0.081	1.17	1.50	No change	System meets all targets.


Questions?

Updated Full-scale STA Cost Estimate

Georgia Vince, J-Tech

Updated Full-scale STA Cost Estimate

- Full-scale STA = 5,000 ac
- Requires 450 cfs pump station
- Conveyance to available lands may cover long distances requiring long and deep canals.
- Discharge through existing features would require significant conveyance improvements
- Significant land acquisition (STA footprint and lands for conveyance improvements)

Updated Full-scale STA Cost Estimate

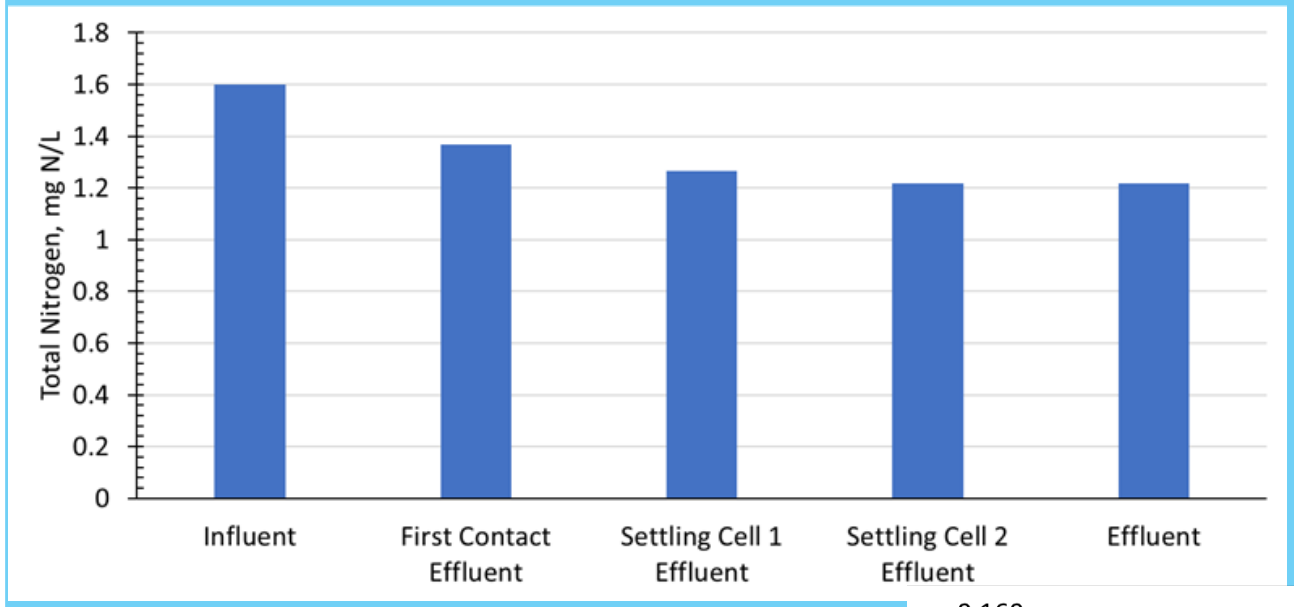
- Feasibility Study did not include the cost for the land acquisition required for the full-scale (5,000 acre) STA
- STA efficiency is limited in treating dissolved organic nitrogen
- Significant grading needed for STA near the C-43 WBSR
- Updated cost estimate for construction and land acquisition is approximately $300 million
- Socio-economic concerns related to purchase of this much land
- Therefore, the full-scale STA will not move forward to Conceptual Design

Inline Alum Treatment Update

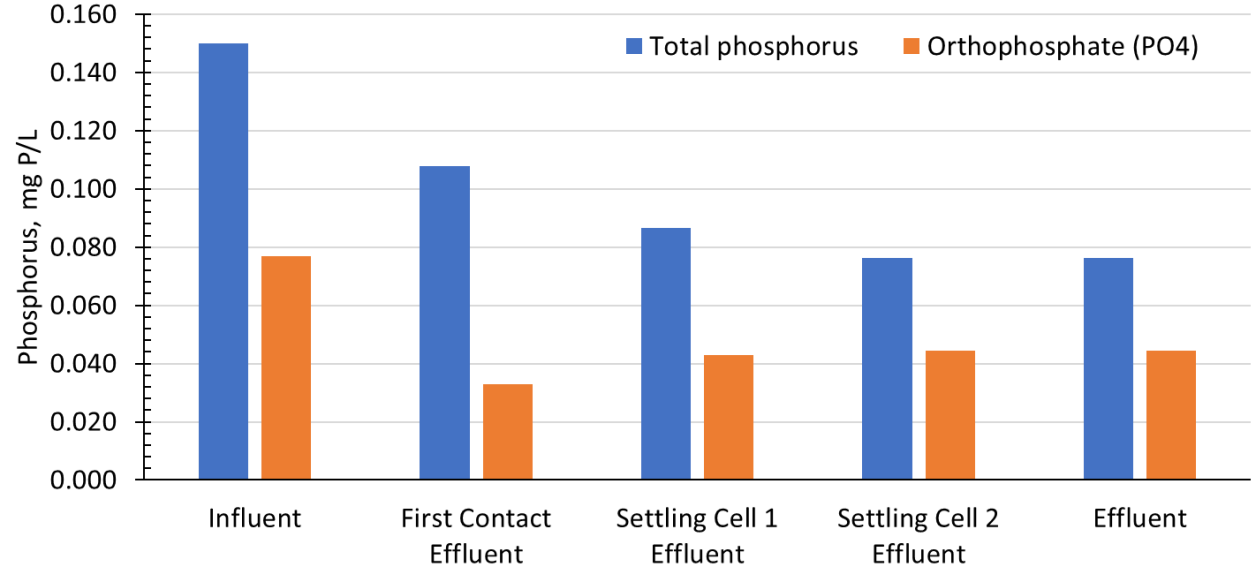
Literature Review

- Selected case histories from Florida and other states
- 20 years of study
- Effectiveness has been proven for alum application
- 20-40% TN reduction
- 60-90% TP reduction
- No toxic responses
- No effect to reservoir components/materials at proposed concentrations
- Similar results noted for alum sulfate and aluminum chlorohydrate

Nutrient Reductions



- Alum Dosing: 0.6 mg Al / L
- 6.8 gpm of alum solution during pumping



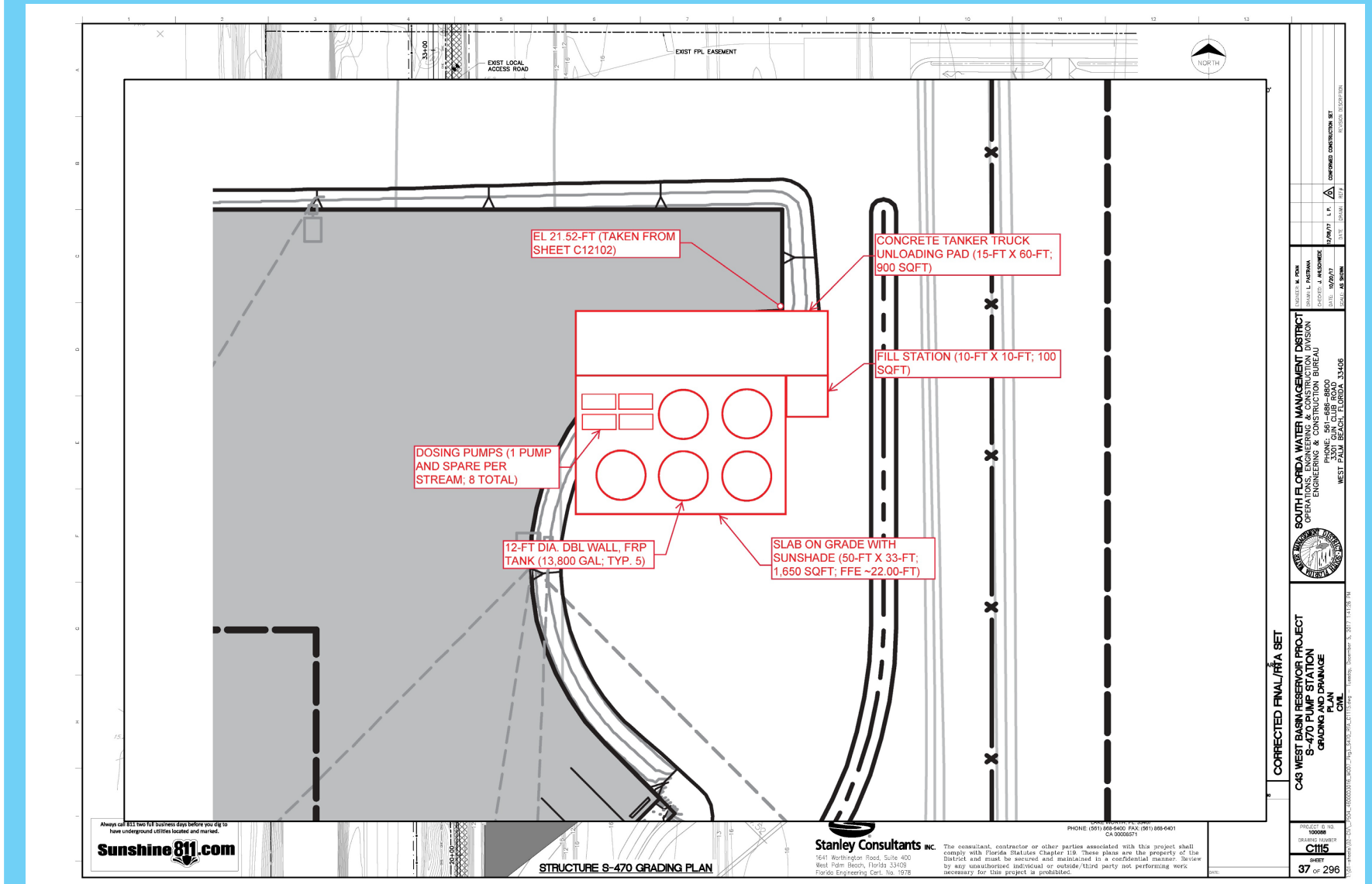

Jim Bays,
J-Tech

Residuals

- Residual accumulation low
  - Less than 0.3 cm/year in Cell 1
  - Half that in Cell 2
- Consolidation of floc in first 30 days
- 60–90 days for stabilization
- 100 years = 13 inches accumulation
- Long-term fate is crystallization within the sediments

Conceptual System Placement (Preliminary)

Jim Bays,
J-Tech

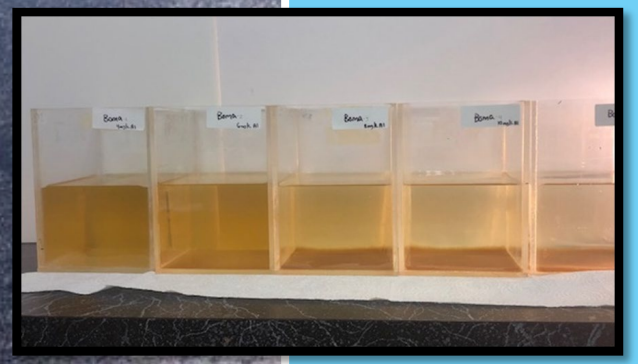


Cost Estimate Inline Alum System

- The estimated cost for construction is $3.5 – $6.5 million
- Annual O&M costs are estimated between $400,000 and $700,000:
  - Cost and delivery of alum, operational maintenance, mechanical replacement, general site upkeep and reporting
- Includes monitoring costs
- Net Present Value (50 years) is estimated between $30 million and $46 million

Summary & Next Steps

WQATT Pilot Study Update



- Bold & Gold® Patented Media
  - Low-flow study complete
  - High-flow study results are still being evaluated
  - Nutrient removal results are comparable
  - TN removal average of 30%
- Aluminum Sulfate (Alum) Jar Test
  - Dosing for maximum nutrient removal was between 12–14 mg/L
  - TN removal average of 43% wet season and 51% dry season
  - Alum pH decrease of 6.5, which is a manageable effect
  - Alum more effective than aluminum chlorohydrate (ACH)

Georgia Vince, J-Tech

Phase II Summary

- Siting Analysis Report Completed – focusing on SFWMD owned lands
  - Water Conveyance Evaluation
  - Water Quality Targets
  - Updated Sizing of the Alternatives
  - Full-scale STA Cost Estimate – 5,000 acre STA not progressing to conceptual design phase
- Inline (in-reservoir) Alum Injection – proceeding to design phase


Georgia Vince, J-Tech

Water Quality Component Next Steps

- In-Line Alum Design Kick-off – April 19, 2021
- Draft Conceptual Design Submittal – April 30, 2021
- Final Conceptual Design Submittal – July 1, 2021
- WQC Selection Memo – August 20, 2021
- Final Public Meeting – TBD September 2021
- The selected WQC Plan, if funded, will move forward to detailed design under a separate contract
- Goal of project construction to be completed and operating concurrently with full operation of the reservoir


Questions?

SFWMD Project Manager: Kim Fikoski

kfikoski@sfwmd.gov

Project Website:

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