CALOOSAHATCHEE RIVER WATCH

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Caloosahatchee River (C-43) West Basin Reservoir

John C. Capece, PhD, CRCA Secretary

Presented on May 11, 2016

Updated May 25, 2016

20 years of service


As of Dec 2015, Riverwatch is a
Waterkeeper Alliance
AFFILIATE

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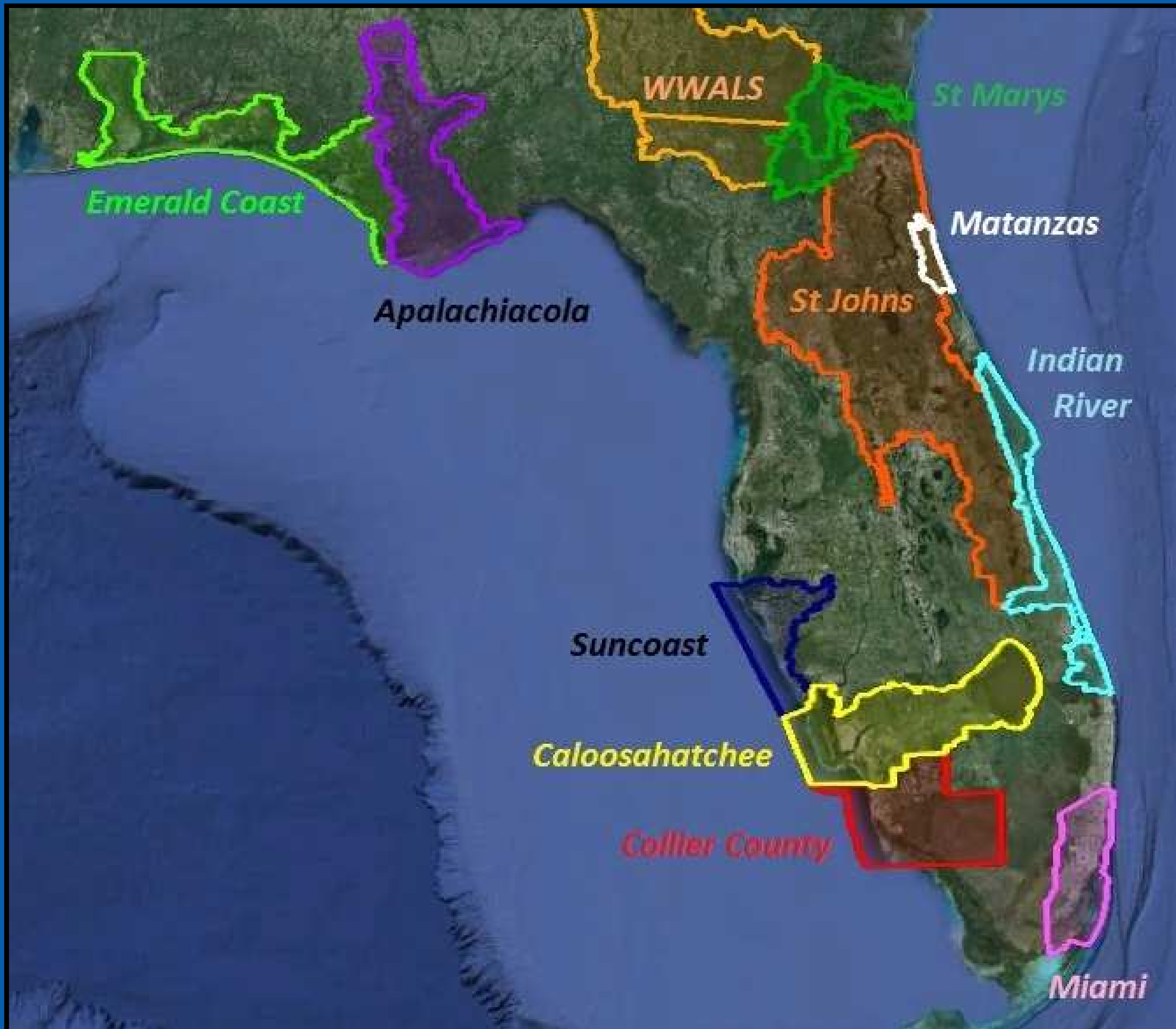

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Riverwatch Consideration of C-43 Reservoir

- Riverwatch (Caloosahatchee River Citizens Association) has followed the C-43 West Reservoir project since its initial discussion in the mid to late 1990's.
- We have debated the project many times during the past 20 years but not taken a clear position on the project.
- As it evolves into a Waterkeeper the organization needs to clarify its vision and positions on actions needed to enhance the watershed, river and estuary.
- Riverwatch is still in information gathering mode relative to its position on the C-43 West Reservoir project.

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Presentation Outline

- Project Context
- Project Benefits Valuation
- Alternatives
- Evolving Challenges

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The original CERP vision for the Caloosahatchee region included the reservoir as only one element in a set of interlocking projects (2 volume/salinity, 2 nutrient):

- **Water Storage Areas – 20 years later, still no primary reservoir despite 2011 goal.**
- **Aquifer Storage and Recovery – problems led to sidelining but with ongoing research.**
- **Water Treatment Areas – BOMA under investigation, but no solid plan yet for a WQ facility.**
- **Remove Organic Sediment Deposits from Caloosahatchee Estuary – increasingly bad.**

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Original CERP Purpose for the Reservoir (1996-1999)

Supply Source Shifting

- The original purpose of the reservoir was to shift the source of agricultural irrigation water supply from Lake Okeechobee to an in-basin reservoir.
- In the late 90's to early 2000's the reservoir mission evolved to a dual purpose – agricultural irrigation and estuary MFL (environmental flow augmentation).
- Florida Department of Agriculture continued to assert the importance of the original ag irrigation mandate.
- The Conservancy challenged in court any agricultural or other uses of the reservoir asserting it was for MFL.

- **Florida Department of Agriculture continued to assert the importance of an agricultural irrigation mandate for the CERP reservoir.**
- **Conservancy challenged uses other than the estuary and prevailed in court.**

Florida Department of Agriculture and Consumer Services
CHARLES H. BRONSON, Commissioner
The Capitol • Tallahassee, FL 32399-0800
www.doacs.state.fl.us

October 19, 2007

The Final PIR and EIS do not acknowledge the Yellow Book's original "source switch" function for the C-43 reservoir project, rather it rewrites the project's conceptual history to match the current outcome. An accurate account should be included of the original plan to switch basin irrigation demand from Lake Okeechobee to the basin run-off captured in the proposed C-43 reservoir as opposed to the current PIR's plan to capture excess basin run-off and Lake Okeechobee regulatory releases for estuary use exclusively. This change has implications beyond this particular project because other CERP projects use planning conditions based on the original concept of restricting Lake Okeechobee irrigation releases for agricultural water demand in the C-43 Basin.

Aquifer Storage and Recovery (ASR) Linkage

- The reservoir was to be filled with excess river flows during the wet season.
- The ASR system was to supplied using the surficial aquifer, pumped into deep groundwater storage.
- Presumably the river/reservoir water would be filtered through the shallow ground to improve water quality before being used by the ASR system.
- With the ASR project eliminated due to other water quality issues, the reservoir and its river water will be largely untreated relative to nutrients.

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February 2002

COMPREHENSIVE EVERGLADES RESTORATION PLAN

COMPREHENSIVE EVERGLADES RESTORATION PLAN

PROJECT MANAGEMENT PLAN

C-43 Basin Storage Reservoir

U.S. Army Corps of Engineers
Jacksonville District

South Florida
Water Management District

3.3.1 Assumption and Related Considerations

- Uncertainty in land availability.
- Potential water quality benefits by reducing nutrient loadings.
- Raw water ASR injection permittable.
- 70 percent recovery for injected ASR water.
- Size of injection bubble not limited.
- ASR facility sized to slightly exceed minimum flows to estuary.

3.3.2 Operational Constraints and Assumptions

Excess runoff from the C-43 Basin and Lake Okeechobee flood control discharges will be captured by the proposed C-43 reservoir(s). Water from the reservoir(s) will be used to provide environmental deliveries to the Caloosahatchee Estuary, to meet demands in the Caloosahatchee Basin and to pump water into the ASR wellfield for long-term (multi-season) storage. The source of water to be pumped into the ASR facility is surficial ground water adjacent to the reservoir. Water from the ASR facilities will be used to meet environmental demand of the estuary and meet basin demands. Any estuarine demands not met by basin runoff, the reservoir and the ASR system will be met by Lake Okeechobee, as long as lake stage is above 11.5 feet NGVD. Lake water is also used to meet the remaining basin demands subject to supply-side management.

The C-43 reservoir may be operated in conjunction with proposed Component DDD5, the Caloosahatchee Backpumping Facility, which includes a stormwater treatment area for water quality treatment. If the levels of water in the reservoir exceed 6.5 feet and Lake Okeechobee is in Zone E, then water is released and sent to the backpumping/treatment facility at 2000 cubic feet per second.

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- Essential elements of the reservoir water quality plan have been lost.
  - **Soil media** was to serve a **water quality treatment** function as part of the ASR system and estuary flow.
  - **Estuary organic sediments** removal element of the project has been lost over time.
  - Sediment removal may be somewhat pointless unless and **until incoming water quality is improved** so as to eliminate redeposition of sediments; hence the **importance of TMDL/BMAP progress**, which is slow and perhaps even uncertain.

Estuary Bottom Sediments

CAPE CORAL / FORT MYERS WEDNESDAY, MAY 4, 2016

THE NEWS-PRESS

MURKY WATER STILL LINGERS

CALOOSAHATCHEE RIVER

Jenna Beyer, an intern with the Sanibel-Captiva Conservation Foundation displays sediment taken from the bottom of the Caloosahatchee River just moments before. Rick Bartleson, of the SCCF says in perfect conditons, the bottom of the river should be sandy and full of sea grasses.

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Can the reservoir project really be functionally or cost effective without some of the original CERP elements?
Will improving salinity really help if nutrients still limit sea grasses and the aquatic ecosystem?
Phil Buchanan
FLORIDA

Reservoir Discharge Water Quality

- With or without algae blooms, if the waters released from the reservoir violate applicable standards then the releases could be challenged in court.
- One outcome could be the requirement for a new water quality improvement element for the reservoir, dramatically increasing the project costs (relative to current alternatives).
- Another outcome could be restrictions on releasing the reservoir waters to the estuary with its only practical alternative use being as an agricultural irrigation supply.

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Reservoir Seepage

- The reservoir will have a perimeter canal on 3 sides (north, south, east)
- Townsend Canal will be on the 4th side (west).
- Flow to the perimeter canal will be minimized by a impermeable core within the dike.
- What is the anticipated rate of seepage into this perimeter ditch and the Townsend Canal?
- What is the uniformity/integrity of the clay layer below the 5 mile by 3 mile reservoir site?

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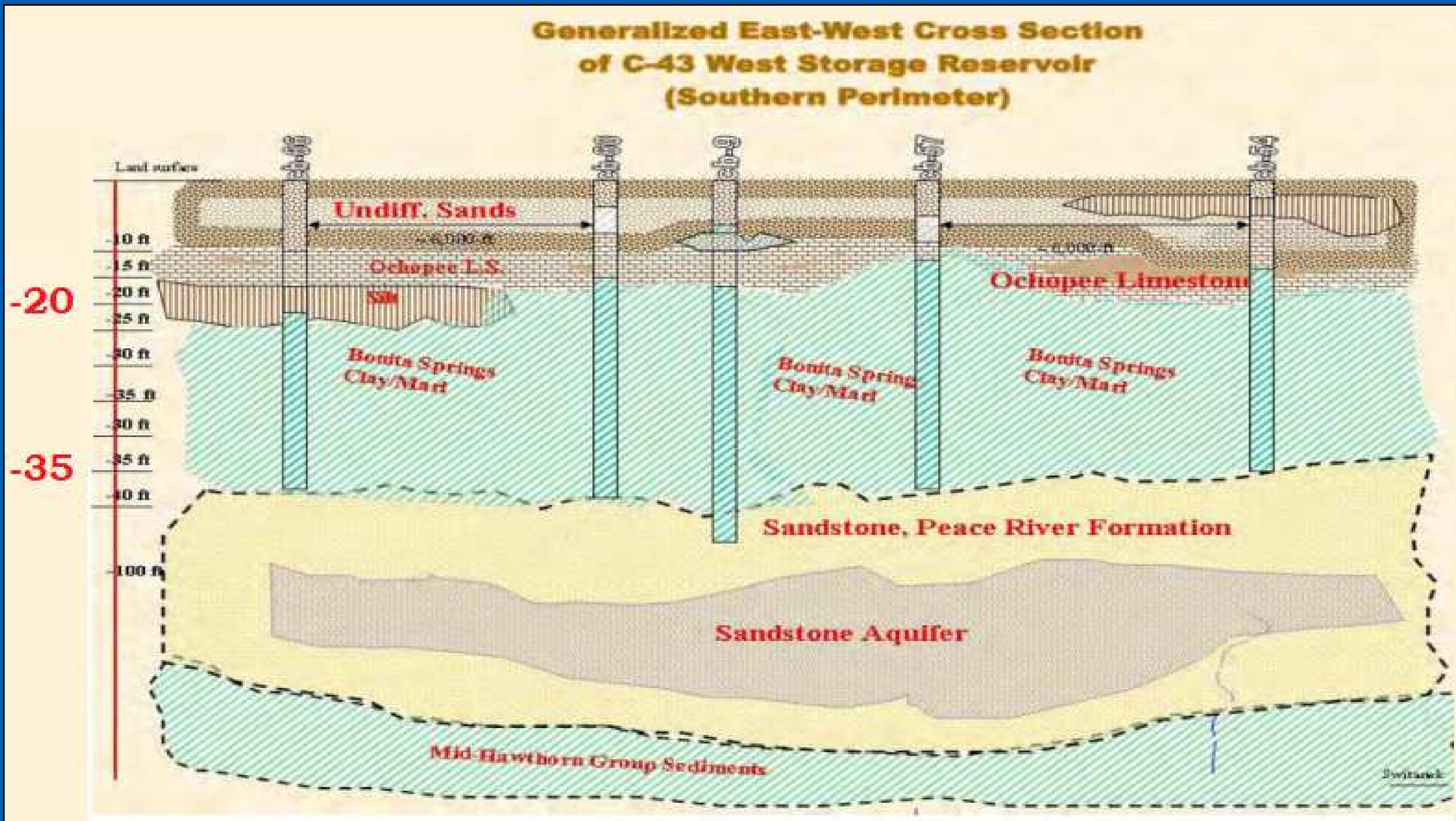
Clay Layer Integrity



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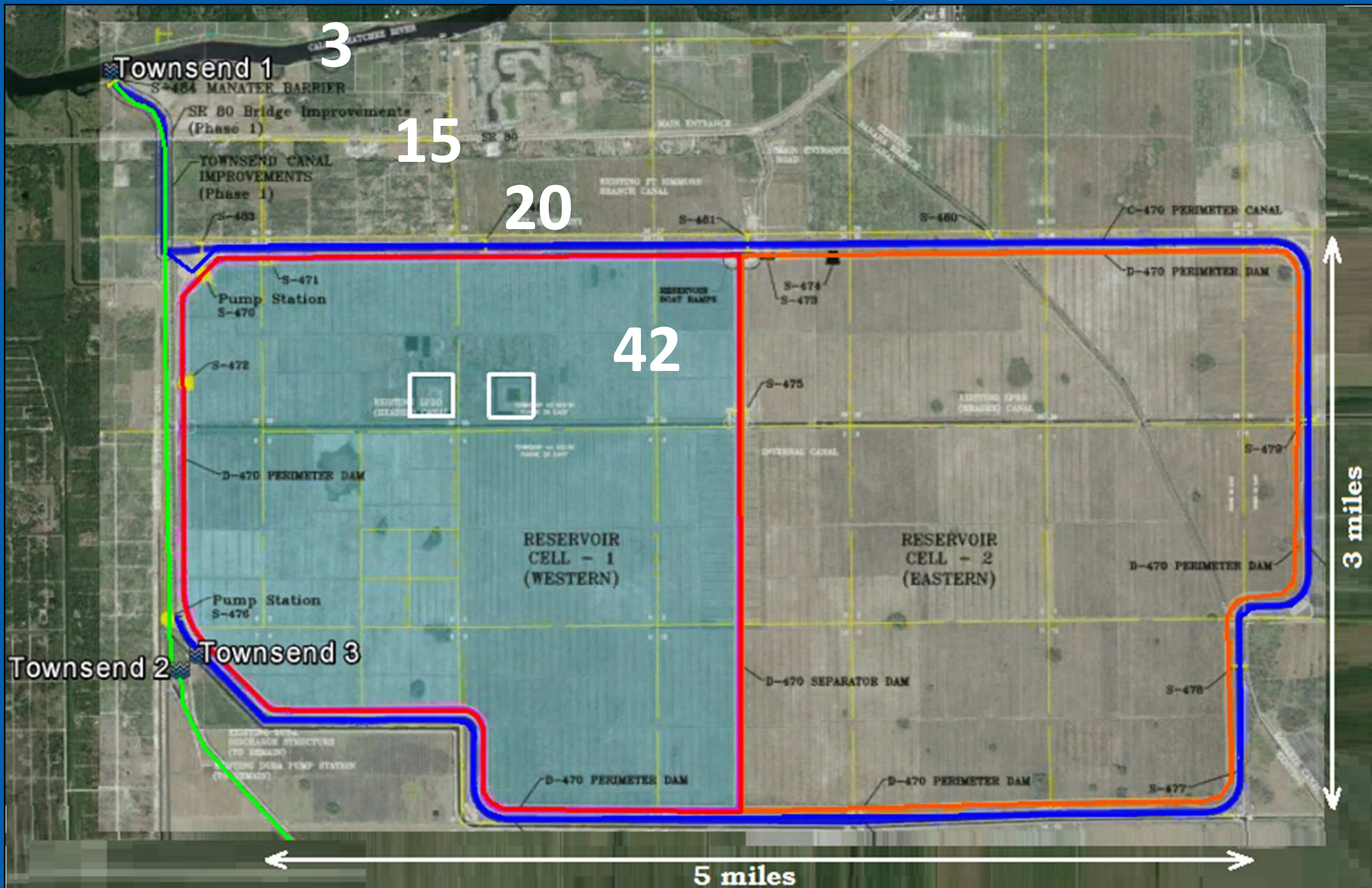
Reservoir Seepage



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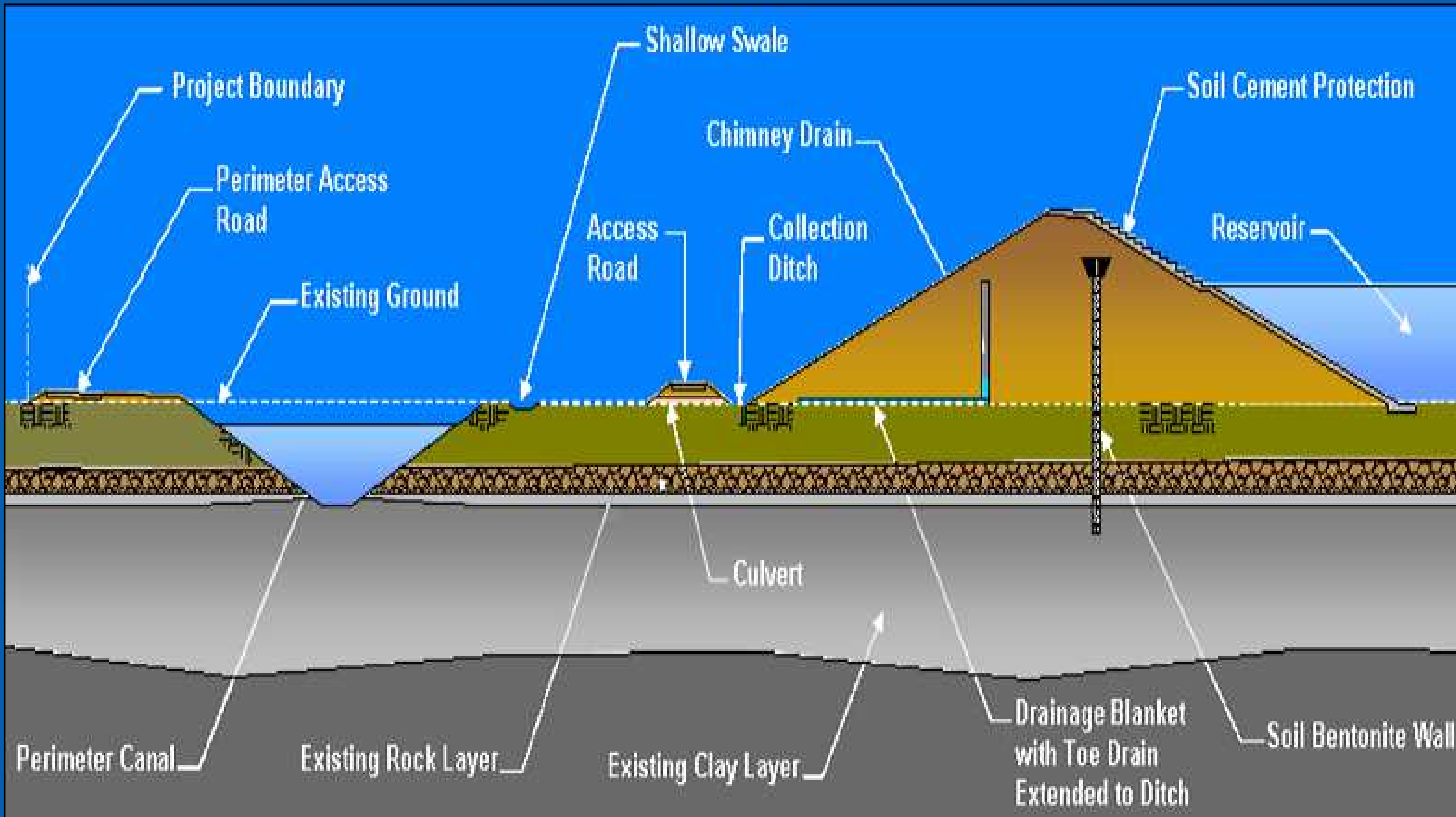
Reservoir Dike



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- Project Context
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- **Corps responses to the Assistant Secretary of the Army need to be reviewed relative to reservoir performance/outputs.**

November 2010 Addendum B

CENTRAL AND SOUTHERN FLORIDA PROJECT
CALOOSAHATCHEE RIVER (C-43) WEST BASIN STORAGE RESERVOIR
FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT
ADDENDUM B

ASA Comments:

1. The PIR lacks complete and valid feasibility-level engineering analyses to support project justification.
2. The PIR had an incomplete description of project's Hydraulic and Hydrologic (H&H) performance.
   - Failed to characterize the recommended plan's impacts on downstream flows, estuary conditions, or reservoir operations.
   - The PIR did not indicate amount of storage that would likely be beneficial for this basin, i.e. a target for restoring the estuary.
3. The report does not sufficiently assure that the right plan is recommended or that the plans would achieve their respective intended outputs to warrant Federal investment.
4. There is no indication that the Corps reviewed the H&H modeling. The modeling and analyses need to be revised and subjected to ATR and model review guidance.

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Currently Cited Project Benefits

- **Augmenting flow to the estuary is intended to benefit species used to determine estuary restoration:**
  - **Eastern Oyster – also known as Crassostrea virginica**
  - **Vallisneria – also known as tape grass or wild celery**
  - **Seagrasses – Halodule wrightii & Thalassia testudinum**
- **These species provide habitat for numerous estuarine organisms but all tape grass is basically gone from the estuary.**

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Current Cited Project Benefit Area

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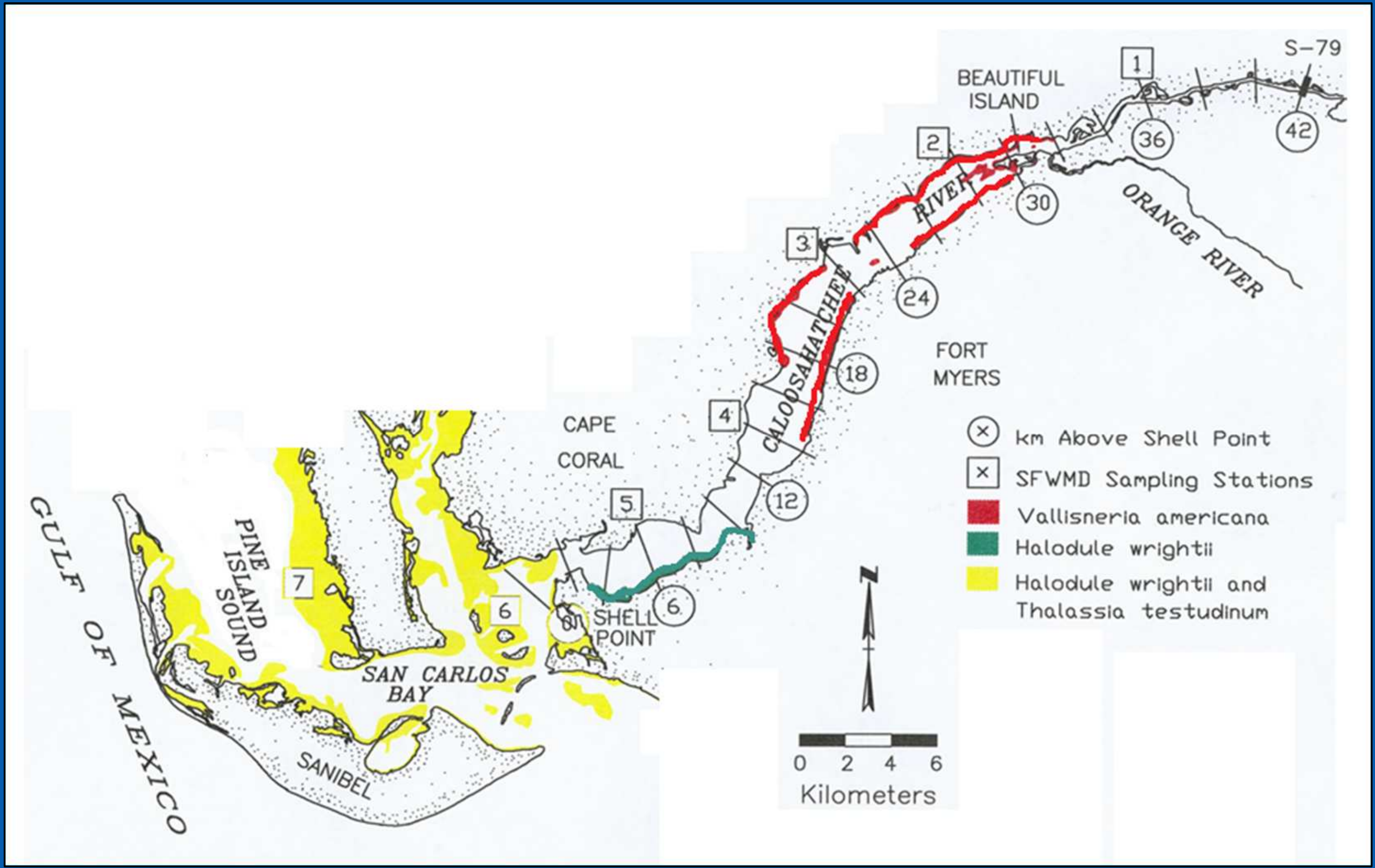
Extent of Sea Grasses Habitat



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Valuation of Effective Storage

Steps in determining the effective storage and determining the value of these benefits:

- **Effective storage** is the annual average improvement in desired S-79 flow envelope (650 to 2800 cfs)
- **Two estimates** of the S-79 flow improvements:
  - **Stanley Consultants (2005)** modeling of 170,000 ac-ft reservoir flows to S-79 reported by **55,000 ac-ft/year** improvement over “2050 scenario without reservoir” relative to 650 cfs.
  - **Stanley Consultants (200#)** monthly flow improvements during dry season months, but not directly relative to MFL reduction **75,000 ac-ft/year** with LORS 2008.

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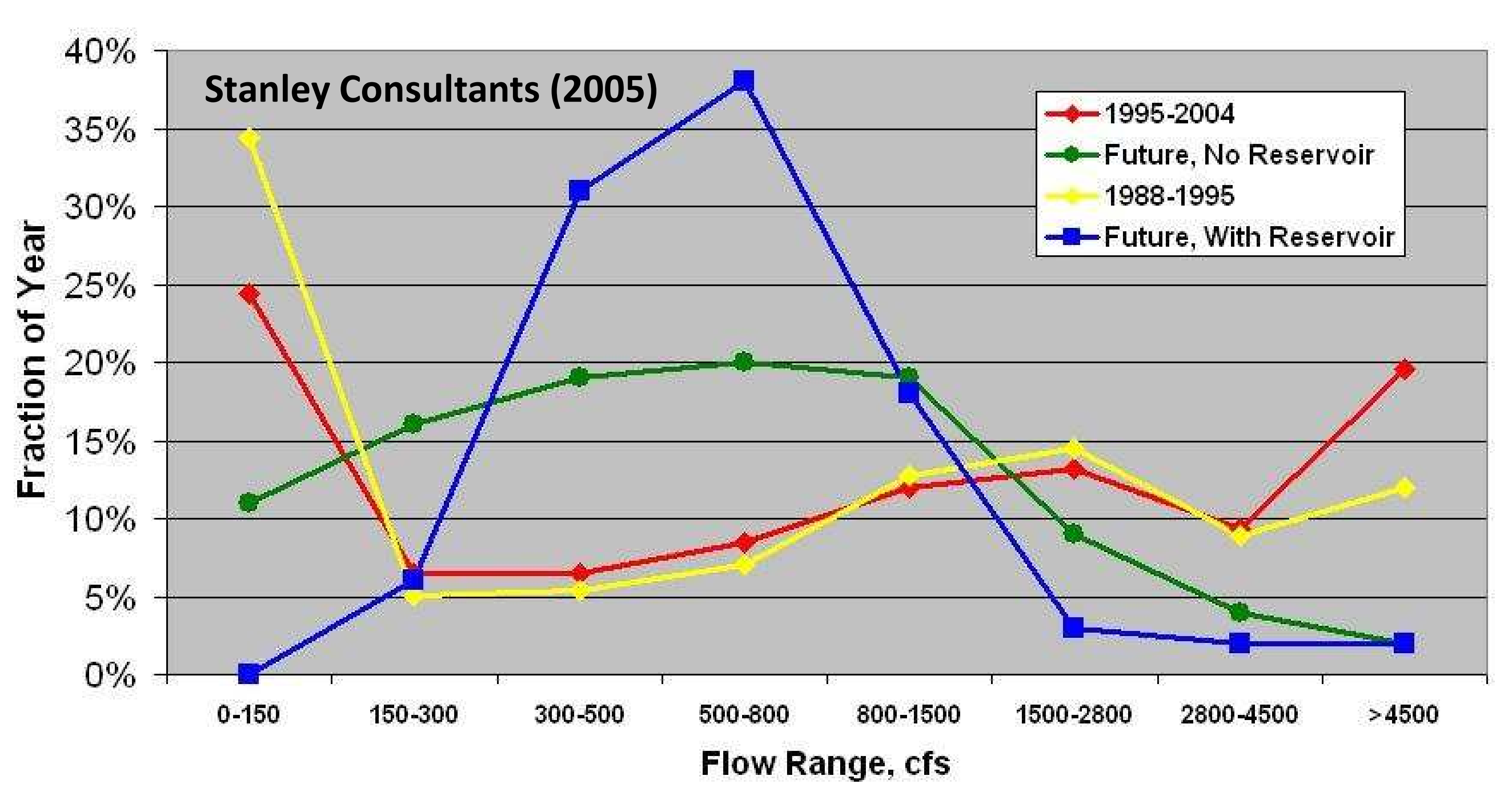
- **Assuming that salinity improvement benefits are not dependent on nutrient improvements, determine the cost effectiveness of the reservoir without the ASR component.**



- **Assumptions used in reservoir valuation estimates:**
  - **The graphic suggests that the reservoir provides 55,000 ac-ft / year improvement over "2050 scenario without reservoir" relative to 650 cfs.**
  - **Use an annualized project cost of $25,000,000 (some estimates are over $35,000,000 (CWRB briefing).**
  - **High flow reduction valuation from SFWMD IG report on dispersed storage program ($108/ac-ft private lands, $8/ac-ft public lands).**
  - **This yields an estimate of low flow augmentation costs at $454 per ac-ft with $8 high flow valuation and $433 per ac-ft with $108 high flow valuation.**

- Results show approximately $433 - $454 /ac-ft cost for low flow augmentation $1.33 to $1.40 per 1000 gallons.
- Many assumptions and many potential differences with SFWMD analysis. But this is the type of analysis Riverwatch and others have requested since 2005.

	A	B	C	D	E	F	G	H	I	J	K
1				cfs				cf/yr			
2	lower	upper	avg	deficit	sec/yr	w/o	w/	w/o	w/	5.4E+08	cf
3	0	150	75	575	3.2E+07	11	0	2.0E+09	0.0E+00	12,307	ac-ft
4	150	300	225	425	3.2E+07	16	6	2.1E+09	8.0E+08	103.1	$/ac-ft
5	300	500	400	250	3.2E+07	19	31	1.5E+09	2.4E+09	1.3E+06	$/yr
6	500	800	650	0	3.2E+07	20	38				
7	800	1500				19	18			2.4E+07	$/yr
8	1500	2800				9	3			433	$/ac-ft
9	2800	4500	3650	850	3.2E+07	4	2	1.1E+09	5.4E+08	0.01	$/cf
10	4500	10000	7250	4450	3.2E+07	2	2	2.8E+09	2.8E+09	0.0013	$/gal
11				excess						1.33	$/1000gal
12						100	100	5.6E+09	3.2E+09	2.4E+09	cf

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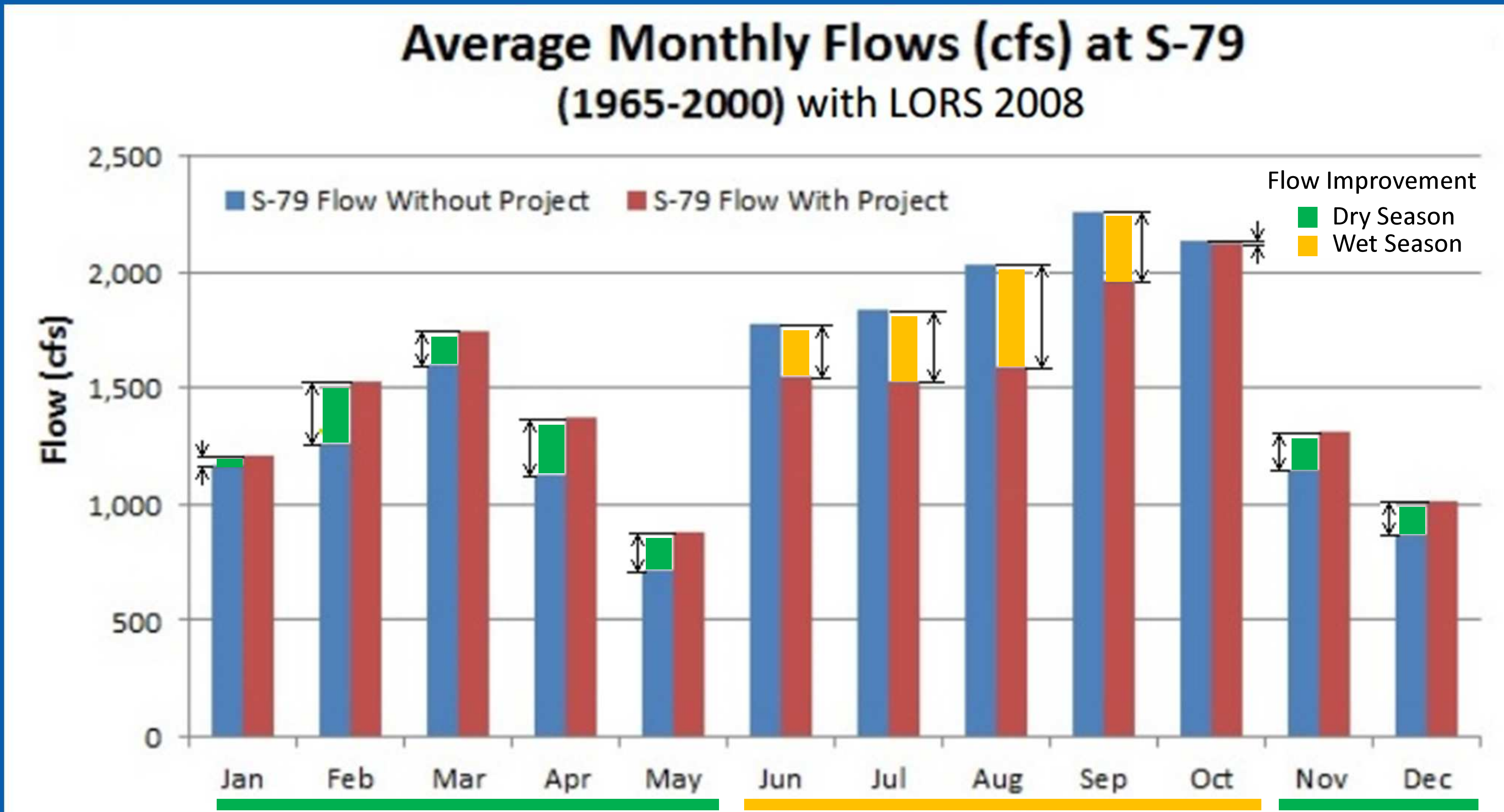
- **Average monthly S-79 flow with and without reservoir.**



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- **Assumptions used in reservoir valuation estimates:**
  - **The graphic suggests that the reservoir provides 75,000 ac-ft / year improvement over "S-79 flow with LORS 2008 and without reservoir."**
  - **Use an annualized project cost of $25,000,000 (some estimates are over $35,000,000.**
  - **High flow reduction valuation from SFWMD IG report on dispersed storage program ($108/ac-ft private lands, $8/ac-ft public lands)**
  - **This yields an estimate of low flow augmentation costs at $326 per ac-ft with $8 high flow valuation and $226 per ac-ft with $108 high flow valuation.**

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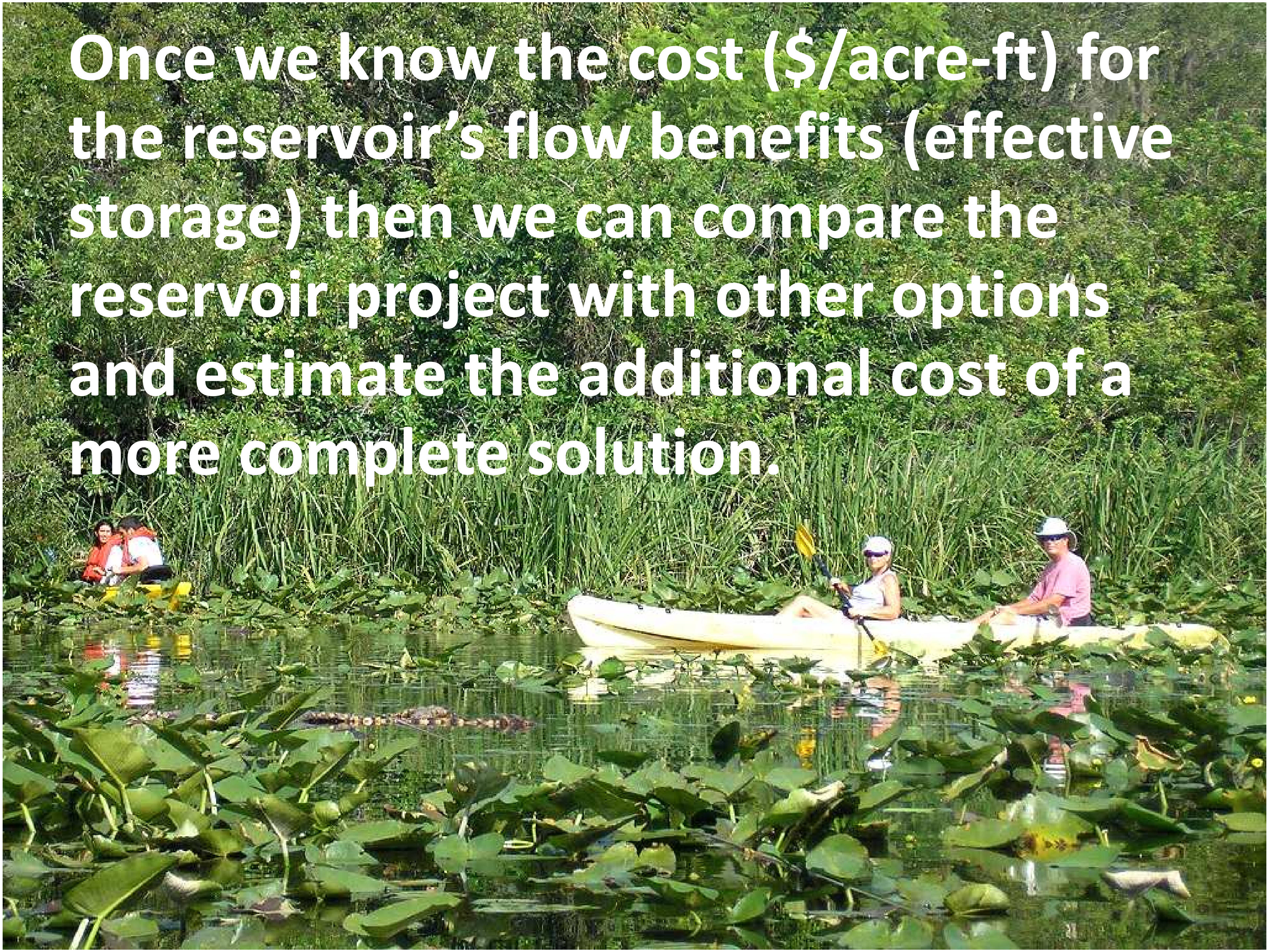
Once we know the cost ($/acre-ft) for the reservoir's flow benefits (effective storage) then we can compare the reservoir project with other options and estimate the additional cost of a more complete solution.



- Project Context
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Alternatives

- The reservoir would address far less than half the MFL deficit, even at the lower MFL level of 300 cfs (many assert the estuary needs 650 cfs).
- Thus additional projects are needed to address salinity alone even if the reservoir is build.
- The options are thus both alternatives & additions:
  - Water quality project addition to reservoir.
  - New lock on Caloosahatchee River.
  - Land purchases and reallocation of irrigation demand.

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Water Quality Project

- If the STA is far from the reservoir then it may not address legal issues associated with reservoir impaired waters releases.
- Uncertain that land for an adjacent STA or other treatment system would be available.
- Cost of C-43 West Reservoir project would be dramatically increased if an STA component were added.

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New Lock on C-43

- Some have proposed a new lock at the Hendry-Lee county line.
- The resulting new pool would be 100,000 ft (19 miles) long and 400 ft wide or 918 acres. Assuming an additional 3 feet of depth this comes to 2760 acre-feet.
- Assuming groundwater storage adjacent the pool equal to 10x direct storage, the yield is 30,000 acre-feet,.
- A full analysis would be required to determine actual potential storage and project feasibility.

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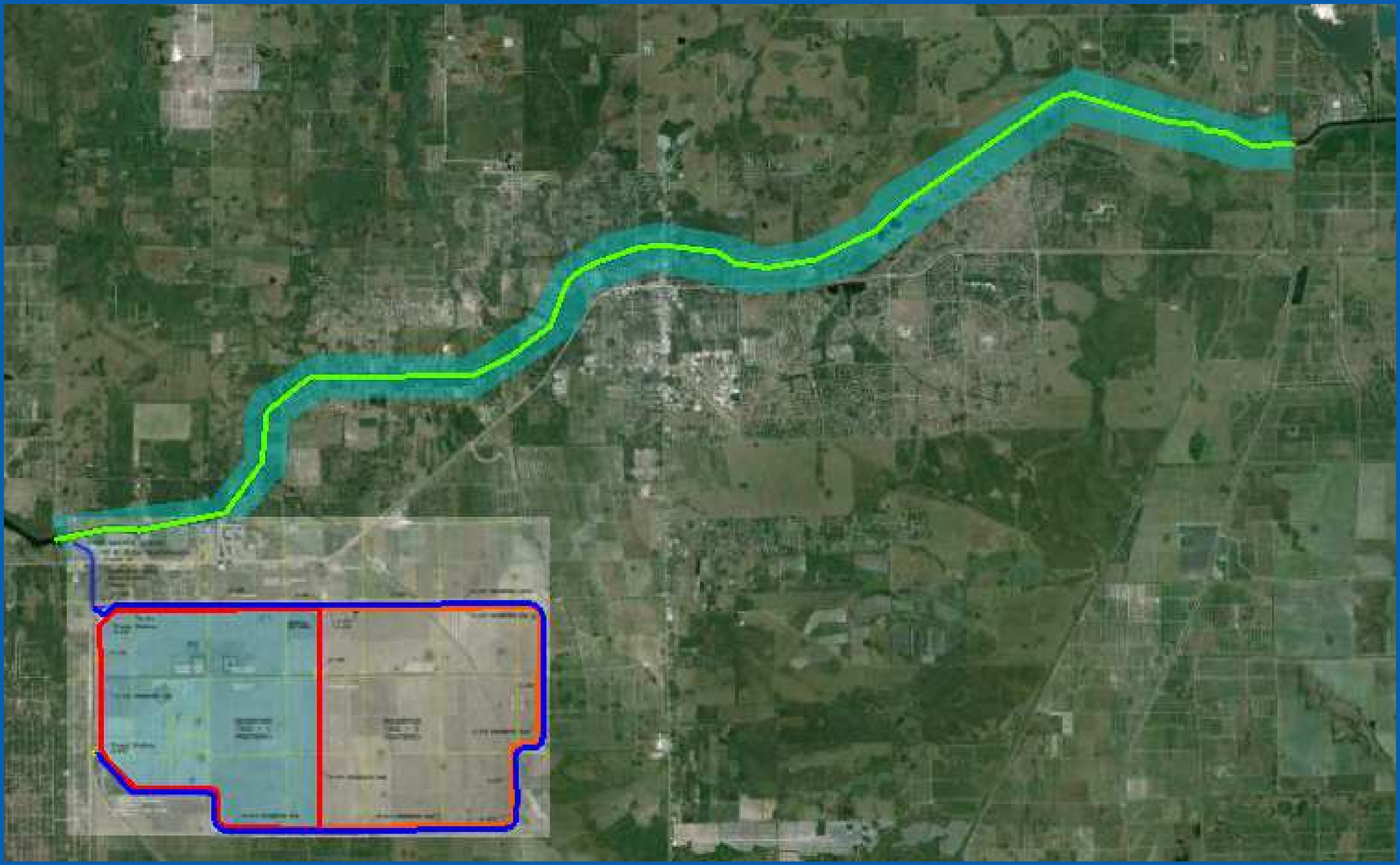
New Lock on C-43



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Land Purchases

- **Purchase of agricultural lands supplied with irrigation waters from Lake O could yield water reallocation of Lake O waters to Caloosahatchee Estuary MFL supply.**
- **Sugarcane lands are valued at $4000/acre (HendryProp.com).**
- **Sugarcane dry season (Nov-May) irrigation demand is approximately 22 inches (UF IFAS SS-AGR-155, 2011).**
- **To provide 55,000 ac-ft would require purchase of 30,000 acres at a value of $120 million.**
- **This would also reduce drainage & treatment demands that the sugarcane lands place on the STA's.**

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Land Purchases: Sugarcane Irrigation

UF-IFAS Publication #SS-AGR-155 (2011)

Table 2. Consumptive use, or ET (Evapotranspiration), of sugarcane for Everglades area of Florida.

Month	ET	NIR-80
January	1.4	0.5
February	1.1	0.5
March	2.5	0.9
April	3.4	1.8
May	4.8	1.7
June	6.0	1.2
July	6.5	1.6
August	6.7	1.7
September	5.1	0.7
October	5.2	2.2
November	3.2	1.7
December	2.6	1.5
Total	49.5	17.9

NIR-80 = Net irrigation at 80% rainfall probability. Divide by irrigation efficiency for gross irrigation requirements. For sugarcane, seepage irrigation is used and the efficiency is 30 to 50%.

Sugarcane 1		
55,000	ac-ft	Reservoir Dry Season Flow Improvements
22	inches	Sugarcane Irrigation Demand (Nov-May)
1.83	feet	Sugarcane Irrigation Demand (Nov-May)
30,000	acres	Sugarcane acres neded to deliver water
$4,000	per acre	Property Appraiser Valuation
$120,000,000		Land Purchase Costs

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Land Purchases – Irrigation Demand

CONSUMPTIVE USE AND SUPPLEMENTAL WATER
REQUIREMENTS OF CROPS GROWN IN THE
EVERGLADES AGRICULTURAL AREA

#140

Prepared by N. Khanal
Resource Planning Department
April 7, 1982

FINDINGS

1. The consumptive water use requirement of rice, sugarcane, pasture, citrus, and truck crops in the Everglades Agricultural Area is estimated to be 67.4, 49.5, 44.6, 44.6, and 45.9 inches, respectively.

2. A portion of the consumptive water use requirement is met by rainfall. Of the 52.36 inches of annual rainfall which the area receives, only a portion of it is effective in crop growing.

3. The net irrigation water required to grow rice in the area (3 crops/year) is calculated to be 30.73 inches. Citrus requires 13.26 inches; sugarcane, pasture, and truck crops need 12.7, 12.8, and 13.47 inches respectively of supplemental water.

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Land Purchases – Irrigation Efficiency

Irrigation Efficiency

The supplemental quantity of water calculated by use of the modified Blaney-Criddle method is the net quantity of water required at the root zone

IFAS has done extensive research on the efficiency of different methods of irrigation. They estimate that crown flood and furrow irrigation systems are only 50% efficient, and that seepage irrigation systems are from 30 to 50 percent efficient. The efficiency of sprinkler irrigation systems is estimated to be 75 percent and the drip irrigation system is estimated to be 90 percent efficient.

- **Sugarcane uses seepage method (30% to 50% efficient) so assume 40% efficient.**
- **Thus, 10 inches of dry season net irrigation converts to 24 inches of total water.**

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Land Purchases – Sugarcane Irrigation

Table 6. Effective Rainfall and Supplemental Water Requirements for Sugarcane Growing in the EAA

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
Average Rainfall (Inches)	1.76	2.01	2.47	1.94	5.56	9.16	7.65	7.05	7.18	4.17	1.70	1.71	52.36
Consumptive Use/ET	1.40	1.10	2.50	3.40	4.80	6.00	6.50	6.70	5.10	5.20	3.20	2.60	48.50
Eff. Rainfall for 3" of Application	.99	-	1.60	1.40	3.67	-	6.20	4.85	4.51	2.79	1.35	1.30	28.66
Average yrly Supplemental Water Reqmt. 10"	.41	-	.90	2.00	1.13	-	.30	1.85	.59	2.41	1.85	1.30	12.74
Volume needed to irrigate 1000 AC. (A/F) 375	34.1	-	75.0	166,7	94.1	-	25.0	154.1	49.1	200.8	154.1	108.3	1061.20

- Sugarcane uses seepage method (30% to 50% efficient) so assume 40% efficient.
- Thus, 10 inches of dry season net irrigation converts to 24 inches of total water.

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Land Purchases - Citrus

Table 5. Effective Rainfall and Supplemental Water Requirements for Citrus Growing in the EAA

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL
Average Rainfall	1.76	2.01	2.47	1.94	5.56	9.16	7.65	7.05	7.18	4.17	1.70	1.71	52.36
Consumptive USe/ET	2.10	2.60	3.60	4.50	5.30	4.40	4.90	4.80	4.00	3.60	2.70	2.10	44.60
Eff. Rainfall for 3" of Application	.98	1.30	1.68	1.46	3.70	4.88	4.78	4.51	4.26	2.53	1.00	1.00	32.08
Average yrly. Supplemental Water Reqmt. 13"	1.12	1.30	1.92	3.04	1.60	-	.12	.29	-	1.07	1.70	1.10	13.26
Volume needed to irrigate 1000 AC. (A/F) 1142	93.3	180.3	160.0	253.3	133.0	-	10.0	24.1	-	89.0	141.6	91.6	1104.20

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Land Purchases

- Many acres of sugarcane have been purchased previously by government agencies but leased back to former owners and other growers for continued sugarcane production.
- Halting sugarcane production on these government owner lands could free up significant irrigation allocations of Lake Okeechobee waters for MFL deliveries.
- A cost analysis of this alternative should be conducted.

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- **We have been discussing the C-43 West Reservoir for a full 20 years now.**
- **As a result, the realistic time horizon for Caloosahatchee and south Florida restoration plan (CERP) completion & full benefits realization is probably 50 years from now.**
- **Congressional Research Service says 30 years.**
- **But will the problems we face 30 to 50 years from now be the same as those we faced when planning CERP?**

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- **We first started discussing Kissimmee/Okeechobee problems and restoration in the 1970's.**
- **A 50-year restoration solutions horizon would place us almost 80 years after our initial discussions of our current south Florida water problems.**
- **Therefore we need to accept the necessity of thinking on the scale of 50 to 100 years and choose our investments accordingly.**

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- **We are beginning to experience the effects of climate change and sea level rise. Examples include the extreme winter rains of 2016.**
- **For 10 years I have advocated within Riverwatch that we support projects that have a dual function of addressing climate change / sea level rise as well as our current Caloosahatchee River and estuary issues.**

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- **The Corps of Engineers, EPA, SFWMD, FDACS, DEP, and all our local governments need to become more assertive and adopt a vision and approach commensurate with the challenges.**
- **Mitigating climate change serves the long term interests of the Caloosahatchee.**
- **Our short-term Caloosahatchee problems, while important are ultimately secondary. They need to be solved in parallel with climate change.**

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Summary

- 3 of the 4 original Caloosahatchee CERP projects are gone. A reservoir that partially addresses salinity without significant progress on nutrients may not achieve meaningful improvements for oysters and sea grasses.
- An on-site water quality component is needed, perhaps a large STA or a process similar to what pre-ASR surficial groundwater filtering intended.
- Without water quality component, reservoir discharges may be legally vulnerable yielding only an agricultural or municipal supply reservoir.
- Asst Secr of the Army concerns need to be explored.
- Other options may be more cost effective per acre-foot of flow.
- Adding the reservoir's required water quality component(s) would dramatically increase project costs and could change which option is more cost effective.
- Decades delay between problem identification and action plus the limited resources made available to problem solutions requires reassessment of which set of existing and emerging problems are more critical to address at this time.
- Riverwatch raised many of these issues in 2005. It needs to complete its search for answers, verify its technical information, and only then decide its position.

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Caloosahatchee River (C-43) West Basin Reservoir

John C. Capece, PhD, CRCA Secretary

Presented on May 11, 2016

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