

Objectives for the Florida Crystals Concept

- a. **Balances enhancements against community impacts;** *The Florida Crystals concept uses about 40% of the USSC cane lands but keeps the Clewiston mill in production.*
- b. **A project we can realistically pay for without sacrificing CERP and Northern Everglades projects;** *The concept capital cost is less than 20% of the cost of a 100,000-acre deep storage facility. Adding our concept project to CERP and the Northern Everglades projects is a stretch, but it is realistically affordable.*
- c. **Complements the CERP and Northern Everglades projects;** *By adding almost 50,000 acres of STAs (S-5A basin & converting Talisman from deep storage to STAs) and by adding a 46,000-acre managed flow way outlet to the Lake allowing redirection to the southern Everglades of water now damaging the northern estuaries, Florida Crystals concept responds to the new understandings of ecosystem needs identified in the feedback loops designed into CERP.*
- d. **Meets the vision and goals for the USSC transaction provided by Governor Crist on February 3, 2008;** *You will see in Galen's presentation that the Florida Crystals concept performs very well when measured against the vision and goals provided by Governor Crist.*

Water Resources Advisory Commission February 19, 2009

River of Grass

Potential Project Configuration in
the Everglades Agricultural Area

Goals (from 2/03/09 SFWMD presentation to WRAC)

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

River of Grass - Goals

- Increase the availability of water storage to reduce harmful freshwater discharges from Lake Okeechobee to Florida's coastal rivers and estuaries.
- Increase the availability of treatment to enhance the delivery of cleaner water to the Everglades.
- Prevent harmful phosphorus flows from entering the Everglades.
- Eliminate the need for "back-pumping" water into Lake Okeechobee.

storage and

Lake Okeechobee and

and to redistribute more water to the south to restore the southern Everglades.

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Goals (from 2/03/09 SFWMD presentation to WRAC)

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

River of Grass - Goals (continued)

- Improve the U.S. Army Corps of Engineers' options for managing Lake Okeechobee within a more desirable ecological range.
- Provide additional water storage alternatives to relieve some pressures on the Herbert Hoover Dike ~~during its~~ rehabilitation.
- Support continued regional agriculture as well as economic diversification, where viable.

while continuing to pursue timely

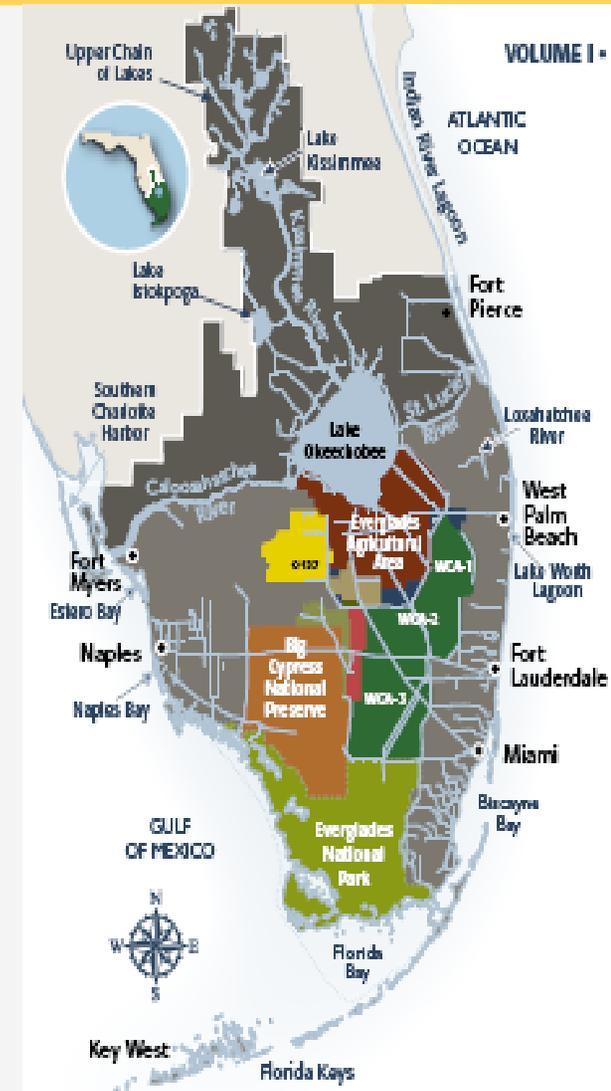
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Everglades Ecosystem

- North of Lake
- **Central Everglades (EAA)**
- Southern Everglades

LEGEND

	CANALS
	NORTHERN EVERGLADES
	WATER CONSERVATION AREAS
	STORMWATER TREATMENT AREAS
	MICCOSUKEE INDIAN RESERVATION
	SEMINOLE INDIAN RESERVATION
	ROTENBERGER AND HOLEY LAND
	WILDLIFE MANAGEMENT AREAS



- Addresses several goals:
 - Increase availability of water storage
 - Prevent harmful phosphorus flows from entering Lake Okeechobee and the Everglades
 - Improve USACE options for managing Lake Okeechobee within more desirable ecological range

Lake Okeechobee Watershed Construction Project

Phase II Technical Plan

SFWMD; February 2008

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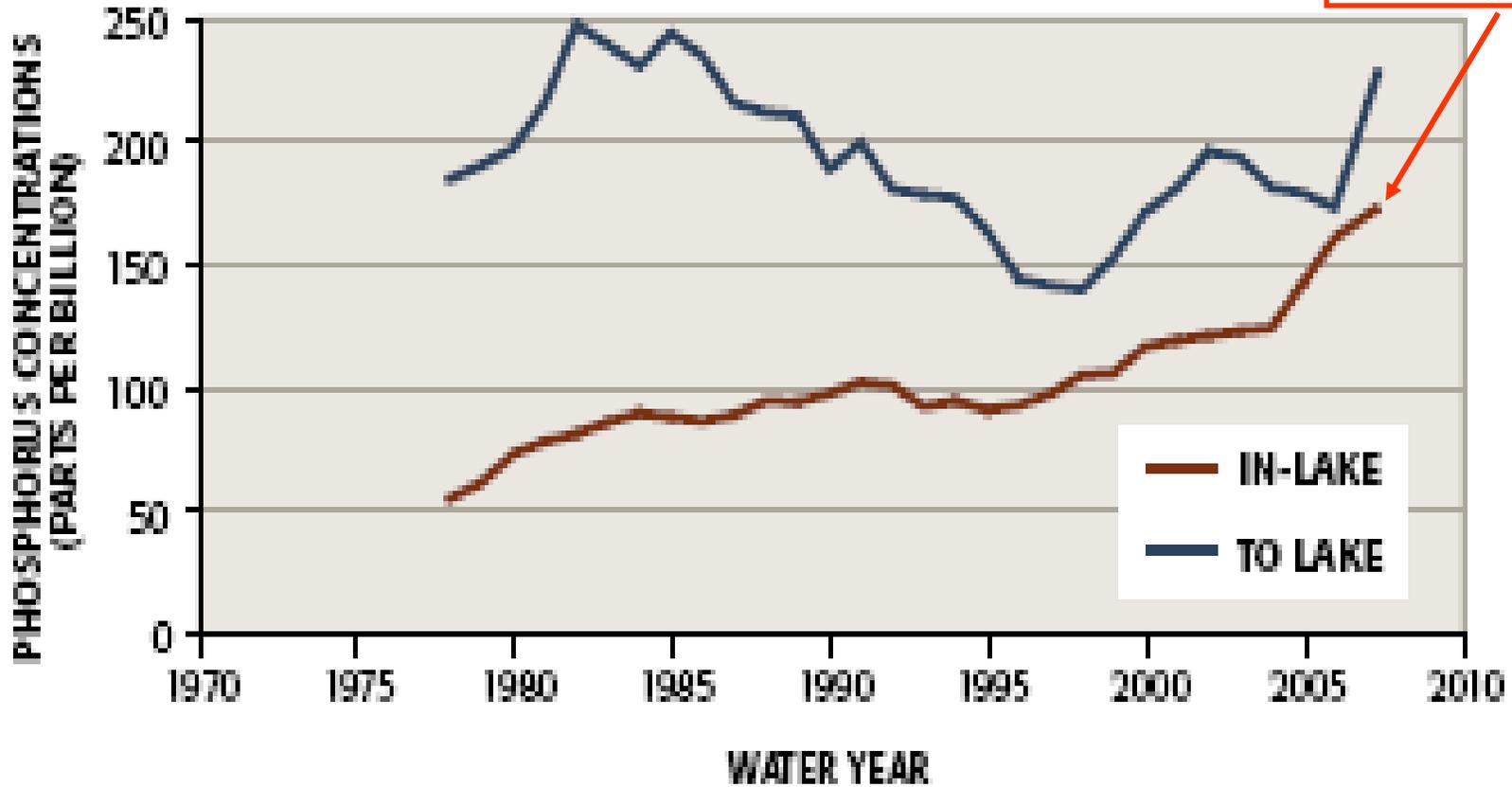
Components of the multi-phase preferred Plan include:

- Implementing agricultural management practices on more than 1.7 million acres of farmland;
- Adopting new regulations that will reduce the impacts of development on water quality and flow;
- Building treatment wetlands to clean water flowing into the lake;
- Using other innovative “green” nutrient control technologies to reduce phosphorus loads from the watershed; and
- Creating between 900,000 and 1.3 million acre-feet of water storage north of the lake through a combination of above-ground reservoirs, underground storage and alternative water storage projects on public and private lands.

Phosphorus in Lake Okeechobee

Graphic taken from 2008 SFER, SFWMD

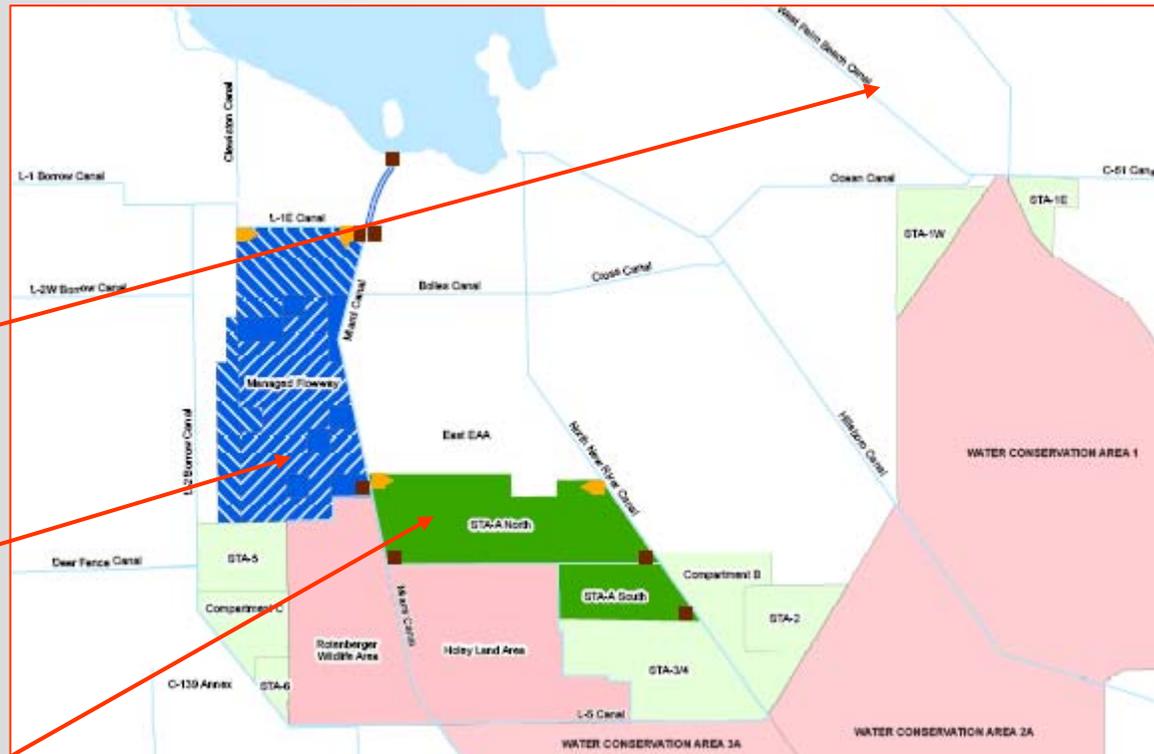
TOTAL PHOSPHORUS INFLOW AND LAKE CONCENTRATIONS WITH FIVE-YEAR MOVING AVERAGE



Approx.
175 ppb

Conceptual Plan in EAA

- Three Basic Elements
 - Additional STA in S-5A Basin
 - 14,000 eff. acres
 - Managed Flow Way
 - 45,000 eff. acres
 - Convert Talisman Compartment A to new STA
 - 35,200 eff. acres



Goal – Eliminate the need for “back-pumping” water into Lake

- Back-pumping to Lake Okeechobee from basins south of Lake
 - South and east shore Chapter 298 districts and 715 Farms
 - S-2
 - S-3
 - L-8 Basin
 - S-4

Current Back Pumping to Lake

Source	Ave. Annual Volume (ac-ft)	Ave. Annual TP Load (kg)	FWM TP Concentration (ppb)	Data Source
East Beach WCD	487	278	462	(1)
East Shore WCD/715 Farms	3,801	479	102	(1)
South Shore DD	344	43	102	(1)
South Florida Conservancy District	1,363	190	113	(1)
S-5A Basin (S-352)	1,697	341	163	(1)
S-2/S-6/S-7 Basin (S-2)	17,826	2,197	100	(1)
S-8/S-8 Basin (S-3)	5,129	518	82	(1)
L-8 Basin (C-10 Culvert)	57,008	6,971	99	(1)
S-4 Basin (S-4)	44,898	12,935	234	(2)
Totals	132,553	23,952	147	

(1) *Revised-Updated STA Inflow Data Sets for the 2010 Period*: Gary Goforth, Inc.; October 30, 2007
(assumed CERP A-1 reservoir in place)

(2) *S-4 Basin Feasibility Study*; Burns & McDonnell; September 8, 2008

Average annual volume 133 kAF, average annual TP load 24 mt

Modified Back Pumping to Lake

Source	Ave. Annual Volume (ac-ft)	Ave. Annual TP Load (kg)	FWM TP Concentration (ppb)	Data Source or Remarks
East Beach WCD	487	278	462	(1)
East Shore WCD/715 Farms	3,801	479	102	(1)
South Shore DD	344	43	102	(1)
South Florida Conservancy District	1,363	190	113	(1)
S-5A Basin (S-352)	0	0	---	(1), (4)
S-2/S-6/S-7 Basin (S-2)	17,826	2,197	100	(1)
S-8/S-8 Basin (S-3)	0	0	---	(1)
L-8 Basin (C-10 Culvert)	0	0	---	(1), (4)
S-4 Basin (S-4)	7,243	2,068	231	(3)
Totals	31,064	5,255	137	

- (1) *Revised-Updated STA Inflow Data Sets for the 2010 Period*: Gary Goforth, Inc.; October 30, 2007 (assumed CERP A-1 reservoir in place)
- (2) *S-4 Basin Feasibility Study*; Burns & McDonnell; September 8, 2008
- (3) *S-4 Basin Feasibility Study*; Burns & McDonnell; September 8, 2008; divert to managed flow-way
- (4) Redirect to new STA in S-5A Basin

Average annual volume 31 kAF, average annual TP load 5 mt

Reduced Back Pumping

- Approaches 75% reduction in average annual back pumping volume from basins south of Lake
- Approaches 80% reduction in average annual TP load to Lake in back pumping from basins south of Lake
 - From about 24 mt/yr to about 5 mt/yr
- **Not eliminated, but greatly reduced**
 - **Need to further evaluate additional opportunities during more detailed planning**

- Approximate average annual volumes
 - St. Lucie: 90k-140k acre-feet/year from Lake
 - Caloosahatchee: 220k-300k acre-feet/year from Lake
 - Lake Worth (West Palm Beach Canal): 33k-135k acre-feet/year from L-8 and C-51 West basins
 - Approx. 102k acre-feet/year to be sent to WPB WCA and L-8 rock pits
 - Leaves 33k acre-feet/year unaddressed
- Total of approx. 340k-470k acre-feet/year
- Volume estimates summarized above were developed assuming EAA A1 storage reservoir and ECART in place
 - Approx. 320k acre-feet/year to EAA A1 reservoir

Lake Okeechobee Discharges

Graphic Taken from Draft 2009 SFER, SFWMD

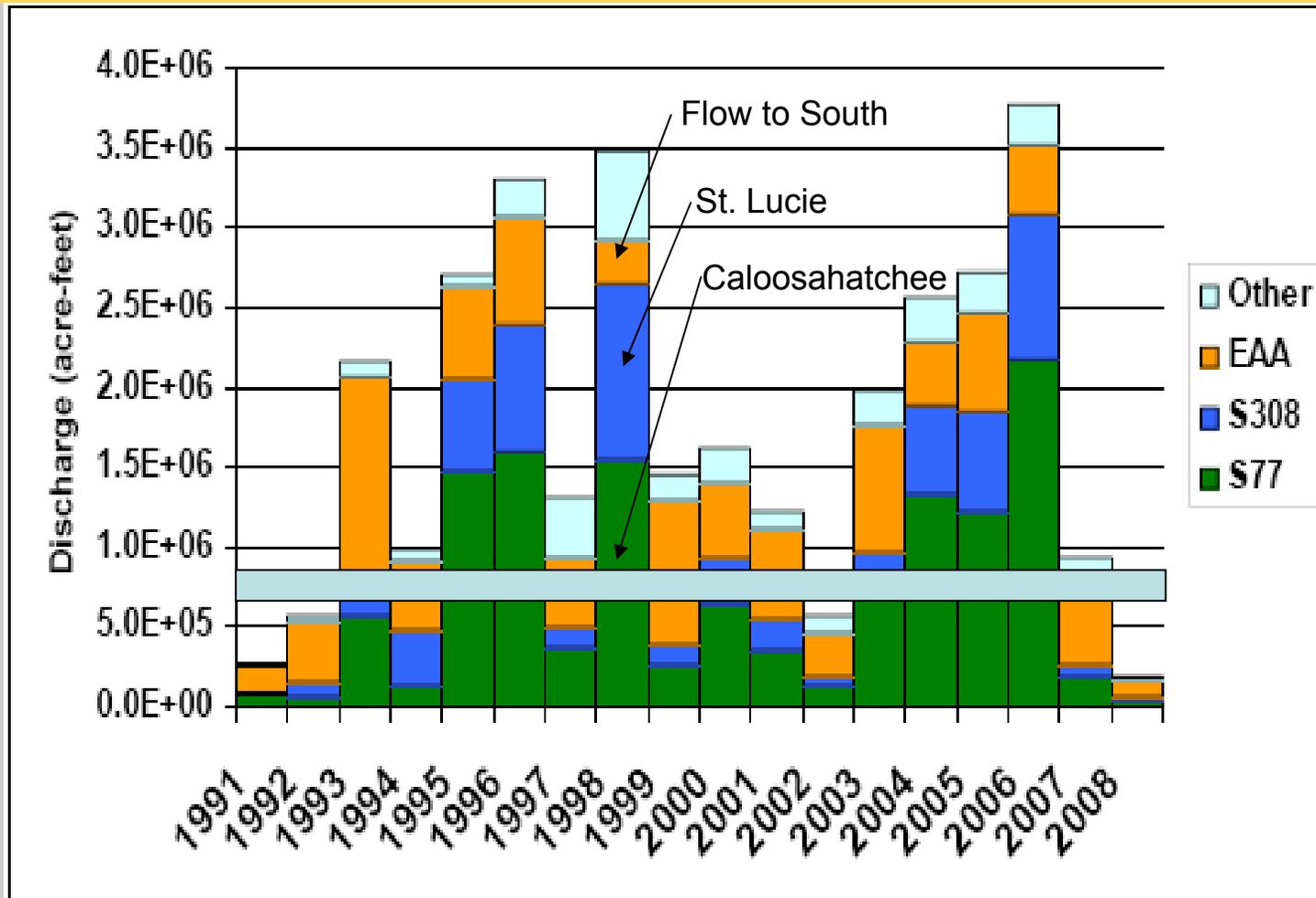


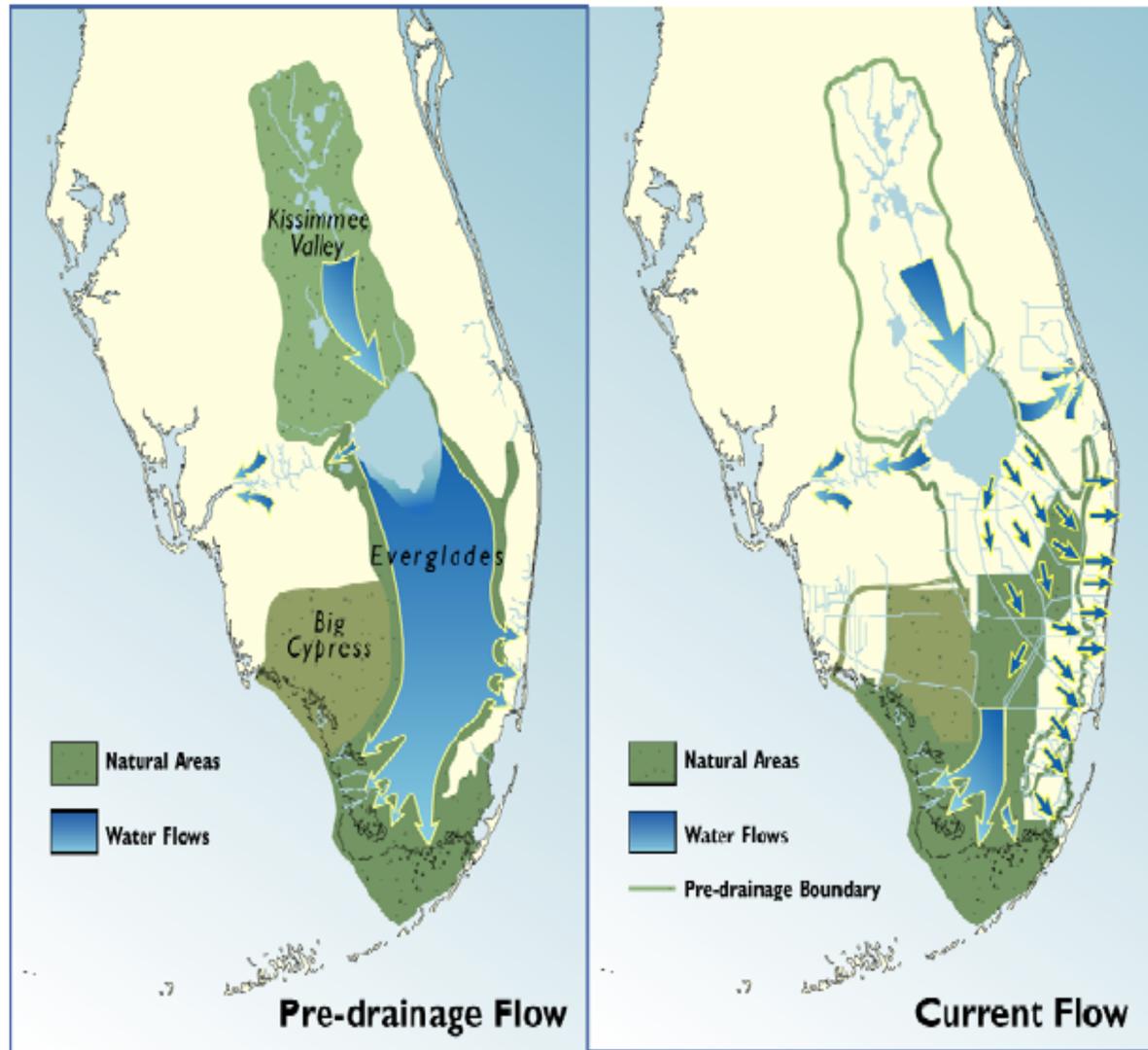
Figure 10-6. Discharges from Lake Okeechobee from WY1991 to WY2008.

Goal – Increase availability of storage and treatment

In EAA, suggest focus on additional treatment (and conveyance):

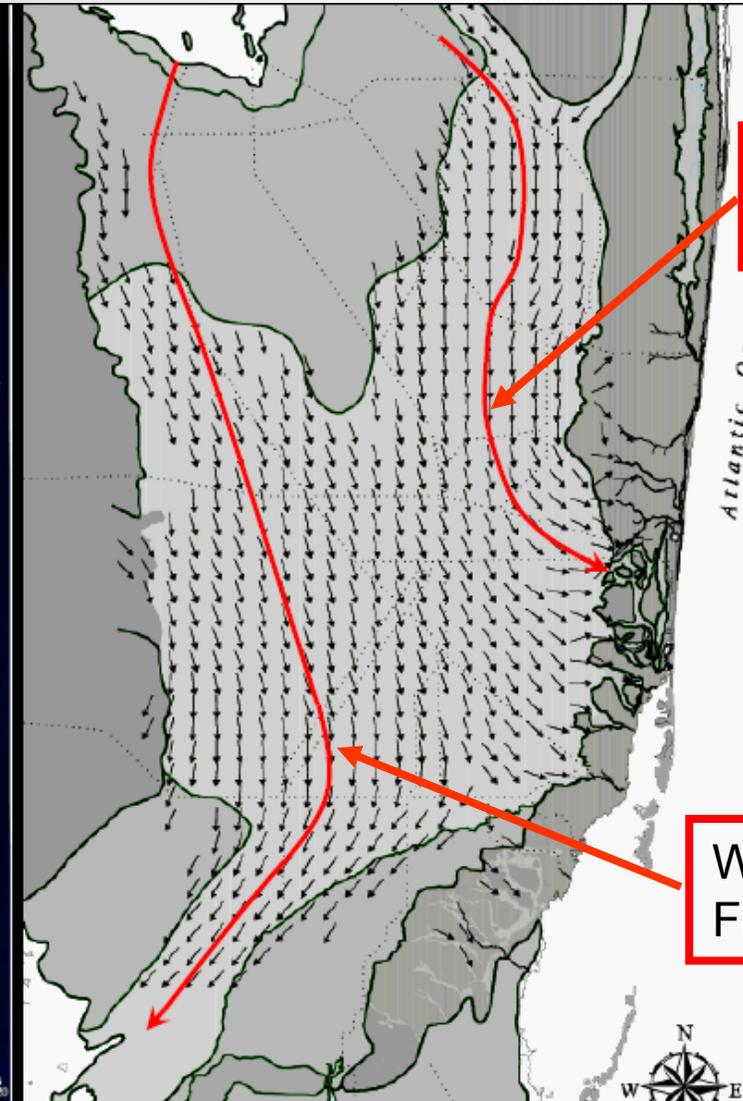
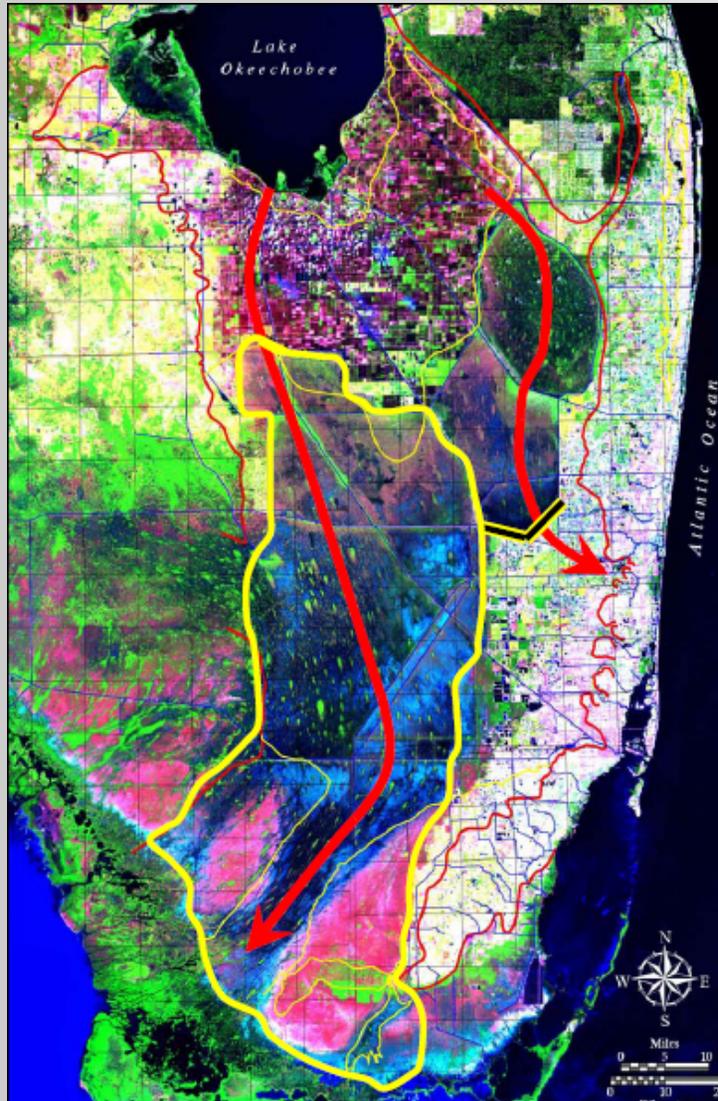
- Enhance the delivery of cleaner water to the Everglades
- Prevent harmful phosphorus flows from entering the Everglades
- Increase capacity to deliver larger volumes of flow to the south

How Things Have Changed



From *Large-Scale Ecological Drivers of Hydrologic Restoration for the Everglades*; Hydrologic Targets Workshop; January 2009

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Eastern
Flow Path

Western
Flow Path

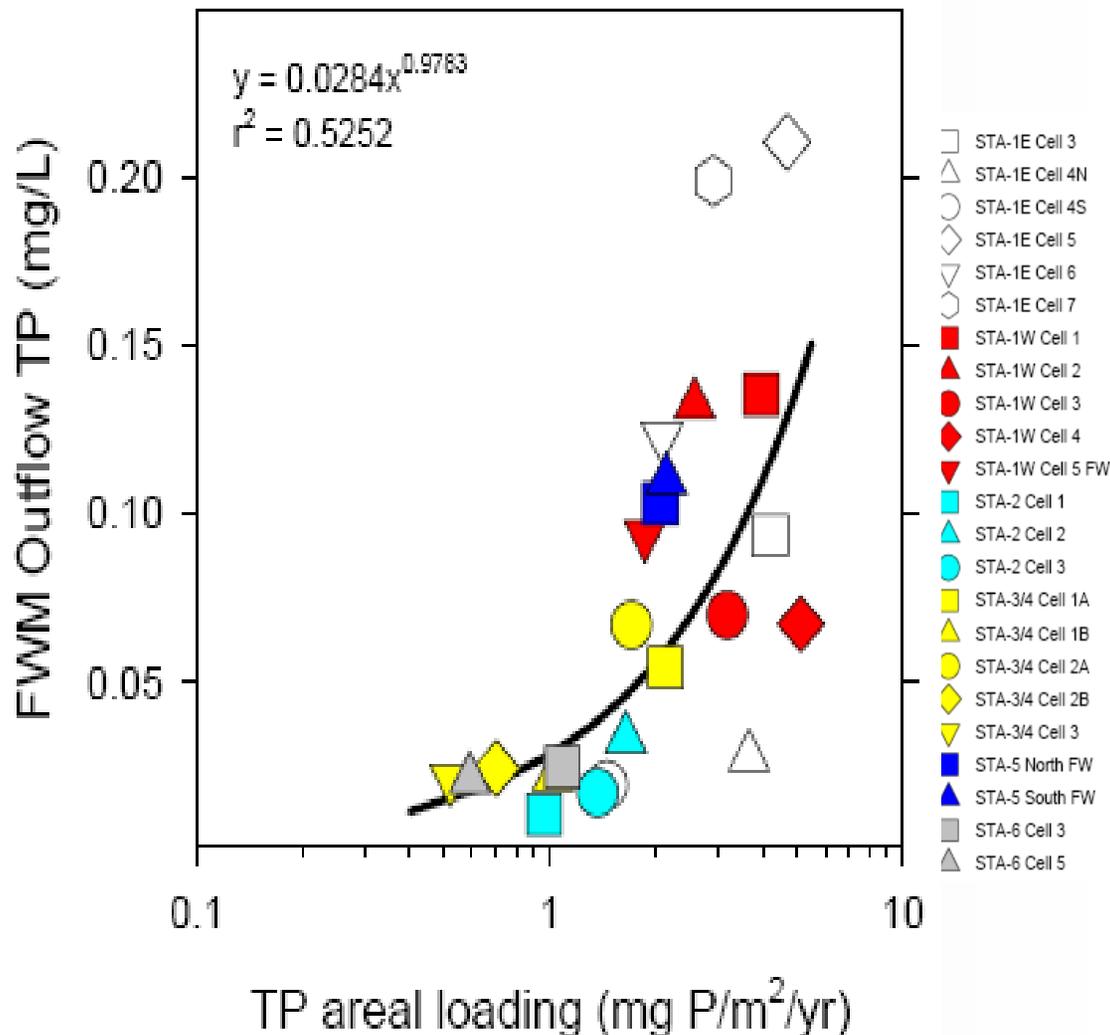
Phosphorus Removal in STAs

Graphic taken from Draft 2009 SFER, SFWMD

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- For this conceptual analysis, used ave. TP loading to STAs of 1.0 g/m²/yr



- Flows to Arthur R. Marshall Loxahatchee NWR, then to WCA-2A. Can include:
 - C-51 West Basin runoff
 - L-8 & C-51 West Basin runoff
 - Including current “back pumping” to Lake
 - S-5A Basin runoff
 - Flows to C-51 East not captured under current design
 - “Flow-through” releases to West Palm Beach Canal

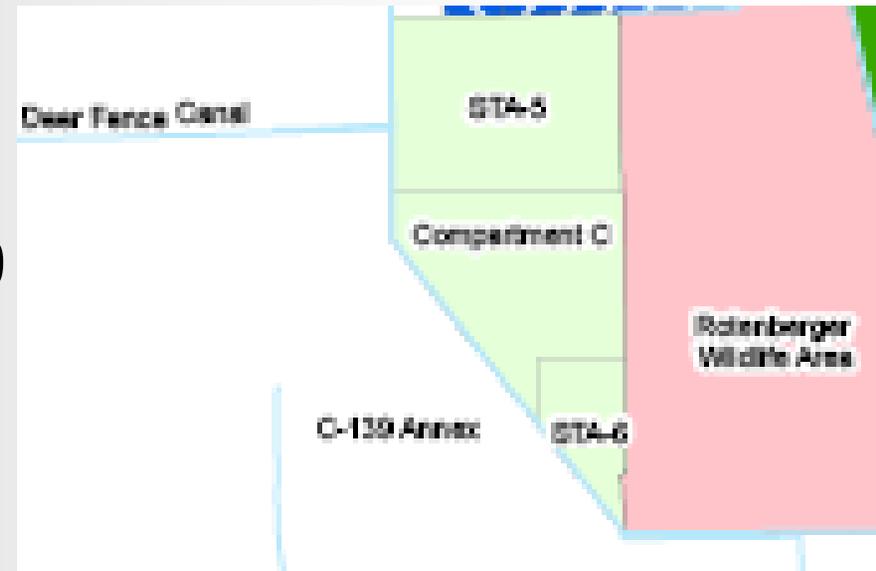
- Flows to Loxahatchee NWR
- Existing treatment area 11,802 acres
 - Need to either divert substantial flow (ECART), or add substantial treatment area
 - Substantial flow diversion a concern for Department of the Interior
- Additional area needed approx. 14,000 acres
 - For overall phosphorus loading rate of approx. 1 g/sq.m./yr.; some additional diversion still necessary
- Not intended for Lake flood control releases

Eastern Flow Path

Grouping	STA or other description	Effective Treatment Area (ac)	Ave. Annual Inflow Volume (ac-ft)	Ave. Annual Inflow TP Load (kg)	FWM Inflow Concentration (ppb)	Data Source	Remarks	
Eastern	STA-1E	5,132	193,818	41,864	175	(1)	Table 9-3	
	STA-1W	6,670	243,172	54,409	181	(1)	Table 9-3	
	Subtotal	11,802	436,990	96,273	179			
	Average Annual Phosphorus Loading Rate						2.02	Assumed 2010 conditions, with ECART diversion limited to hold STA-2 loading rate = 1.0 g/m ² /yr
	Eliminate L-8 discharge to Lake			57,008	6,971	99	(1)	"L-8 Basin to Lake" from Table 9-1; assume redirected to new STA in S-5A Basin
	Include "Flow-thru" Releases at S-352	65 mgd Increase		21,054	3,439	132	(1)	
	Capture L-8 and C-51W flows to C-51E			32,614	4,842	121	(1)	
	Add'l. STA	14,000	(33,490)	(6,723)	163			S-5A Runoff Reduced for area converted to use in new STA
	Subtotal	14,000	77,186	8,529	90			
	Total	25,802	514,176	104,802	165			
	Average Annual Phosphorus Loading Rate						1.01	
	Add'l. ECART Diversion			(4,469)	(1,000)	182		Minimum additional diversion to attain 1.0 g/m ² /yr
	Revised Total	25,802	509,707	103,802	165			
	Average Annual Phosphorus Loading Rate						1.00	g/m ² /yr

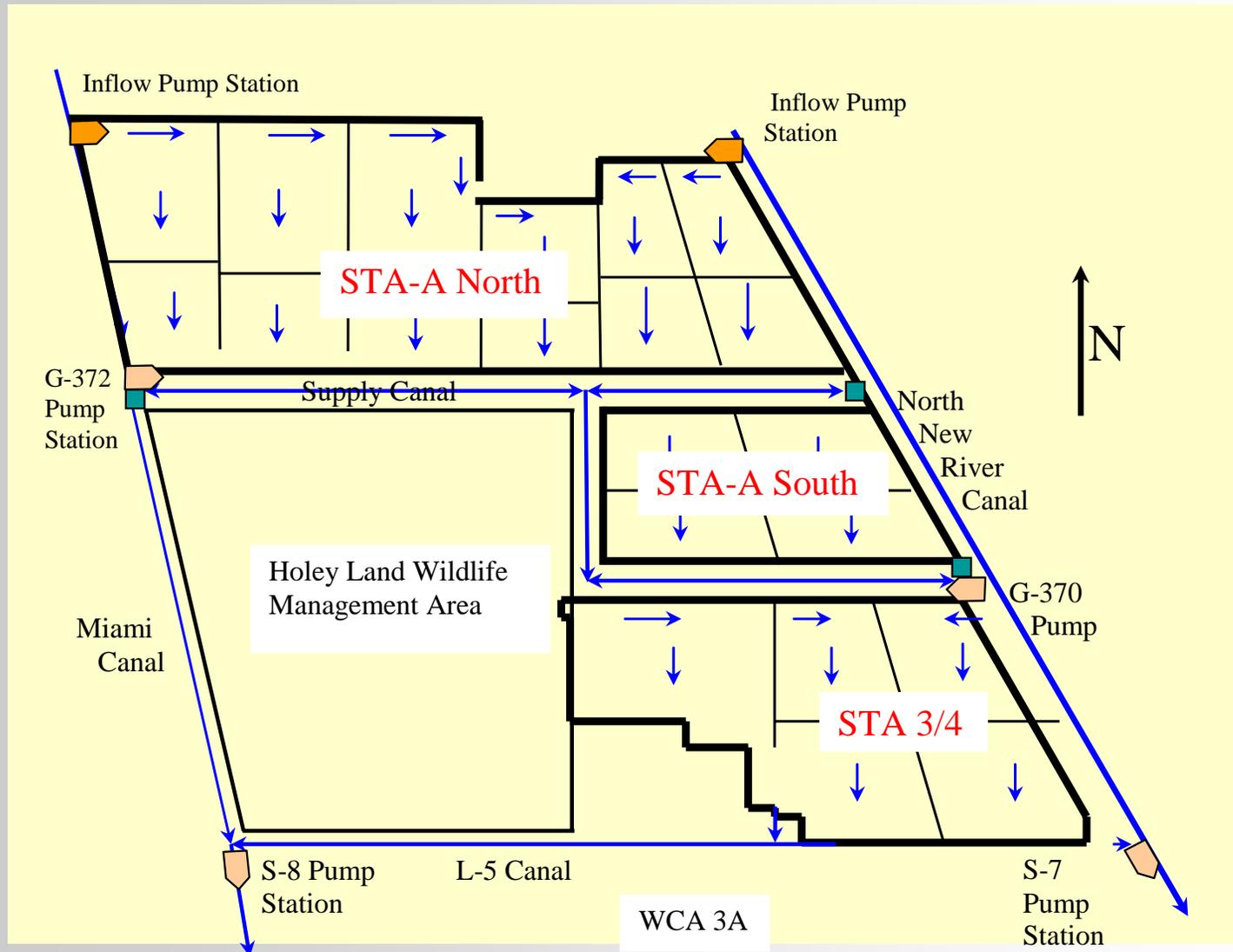
(1) Revised-Updated STA Inflow Data Sets for the 2010 Period: Gary Goforth, Inc.; October 30, 2007
(assumed CERP A-1 reservoir in place)

- STA-5, STA-6 and Compartment C
 - Total effective treatment area = 13,694 acres
- Treats Runoff from C-139 Basin and C-139 Annex
 - 211.5k ac-ft, 52.9 kg TP per year
- TP Loading Rate 0.96 g/m²/yr ✓



- Presently Planned
 - Existing STA-2, STA-3/4: 22,881 acres
 - Compartment B (when in operation): 8,620 acres
- Talisman lands (A-1 and A-2 Reservoirs)
 - Adds approximately 34,500 acres if used as treatment
 - Permits substantial additional flows to south from Lake Okeechobee
 - Flow-way along Miami Canal and increased capacity of North New River needed to deliver increased flows; additional treatment possible in **managed flow-way** but not considered as such in current analysis

STA-Expansion on Talisman



- Addition of new STA on Talisman Compartment A allows up to 0.5 million acre-feet/year of additional Lake release at Lake TP concentration of 175 ppb and unit TP loading rate of 1.0 g/m²/yr
 - Roughly equal to upper end of range of volumes available from reducing releases to coastal rivers and estuaries
- Total average annual inflow to STAs in Western flow path = 1.89 million acre-feet/year

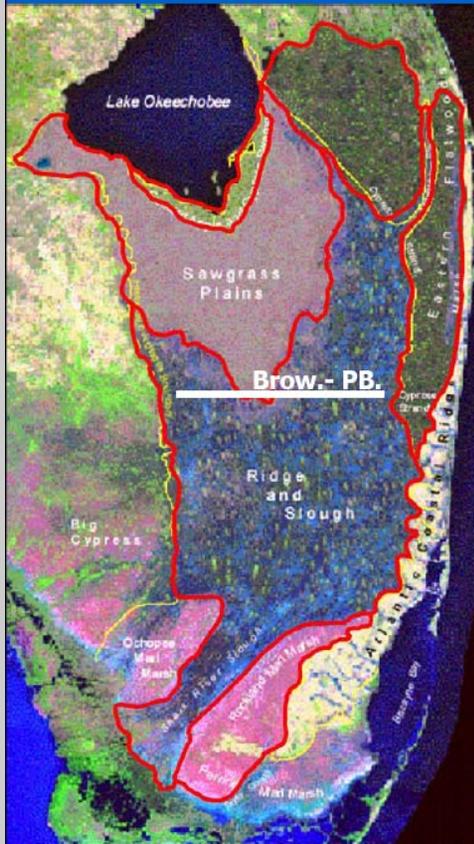
Western Flow Path

Grouping	STA or other description	Effective Treatment Area (ac)	Ave. Annual Inflow Volume (ac-ft)	Ave. Annual Inflow TP Load (kg)	FWM Inflow Concentration (ppb)	Data Source	Remarks	
Western	STA-2	6,338	182,713	25,664	114	(1)	Table 9-3	
	Compartment B	8,620	225,073	28,509	103	(1)	Table 9-3	
	STA-3/4	16,543	219,918	26,013	96	(1)	Inflows adjusted to remove outflows from EEASR-A1 shown in Table 9-1 of same reference	
	New STA on Talisman Lands	34,500	540,013	63,885	96	(1)	Total inflow volume and load to A-1 Reservoir	
	ECART Add'l.		4,469	1,000	182		Additional volume and load diverted from S-5A Basin through ECART	
	S-4 Basin Diversion		51,394	14,880	235	(2)	Volume and load for reduced backpumping at S-4	
	S-3 Elimination		5,129	518	82	(1)	Eliminate back-pumping at S-8	
	Include Flow-thru Releases at S-351 and S-354		64,715	7,800	98	(1)	Table 9-1	
	Reduce runoff for conversion of EAA-A2		(34,729)	(3,535)	83		S-3/S-8 Basin Runoff reduction for conversion of EAA-A2 (19,000 acres); 6,000 acres actually in S-2/S-7	
	Reduce runoff for area converted to managed flow-way		(82,253)	(8,371)	83		S-8/S-3 Runoff Reduced for area converted to use in new STA; approx. 45,000 net acres	
	Total	66,001	1,176,442	156,363	108			
	Average Annual Phosphorus Loading Rate						0.59	g/m2/yr
	Add'l. Lake Release		500,000	107,798	175		Computed for 1.00 g/m2/yr loading at Lake concentration of 175 ppb	
	Revised Total	66,001	1,676,442	264,161	128			
Average Annual Phosphorus Loading Rate						0.99	g/m2/yr	

(1) Revised-Updated STA Inflow Data Sets for the 2010 Period: Gary Goforth, Inc.; October 30, 2007; (assumed A-1 reservoir in place)

(2) S-4 Basin Feasibility Study; Burns & McDonnell; September 8, 2008

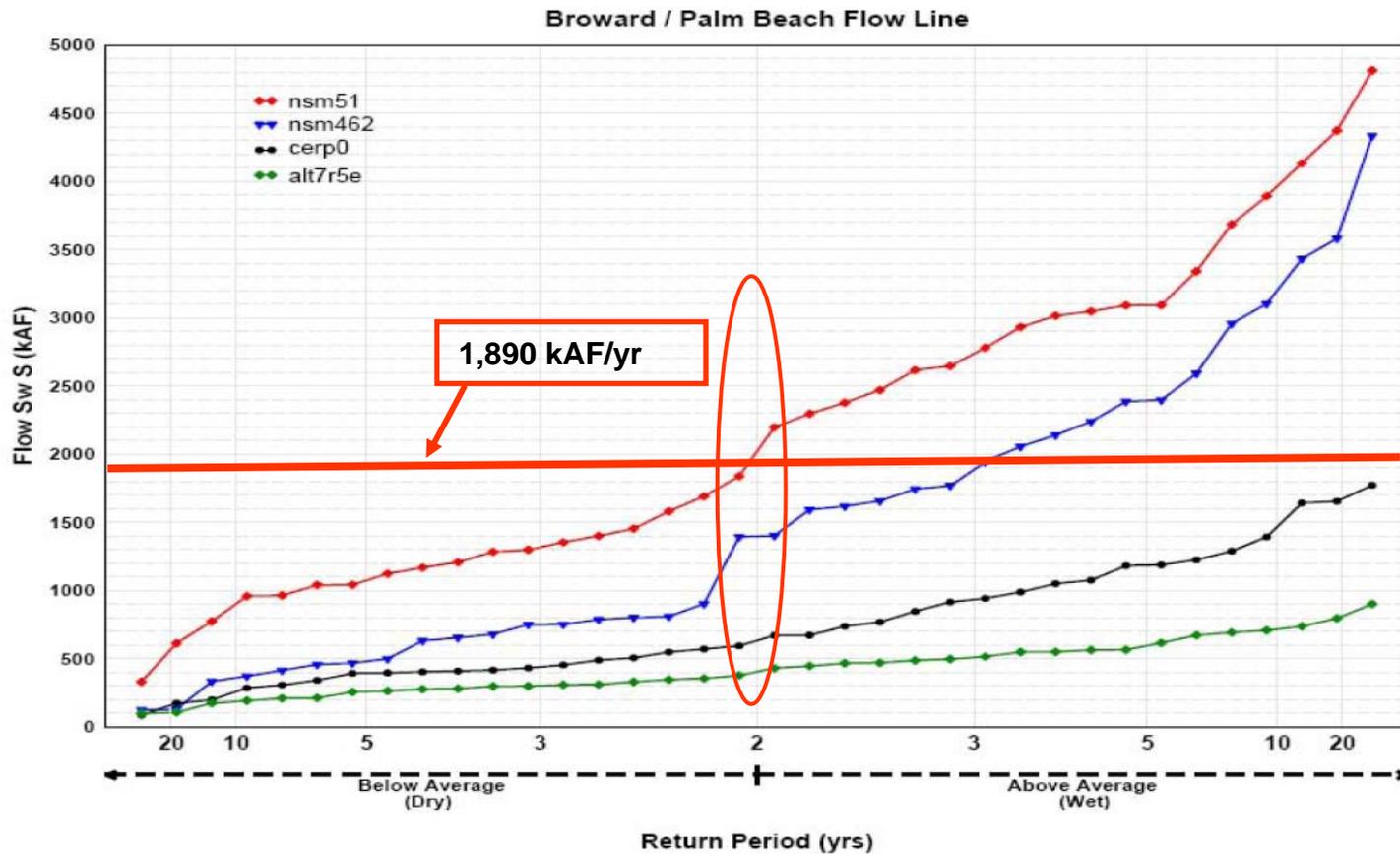
Flows through the Central Everglades



Pre-Drainage System (1850's)

- Flows across the Broward-Palm Beach flow line represent the combined contributions of Lake Okeechobee outflows and localized runoff from the historic sawgrass plains in the northern Everglades.
- This flow transect approximates the flows that would be needed to support the WCA 3 Decompartmentalization and Sheetflow Enhancement project envisioned in CERP.
- This flow line is the location of the primary flow target in the DOI Vision document, since it describes the flows that would be needed as we reconnect the WCAs and ENP, and remove the major obstructions to flow.
- There are no measured flows available for this location, so we can only examine the differences in the modeled flow estimates.
- The NSM predicted overland flows through the Central Everglades transect are: (1965-2000 simulation period).
 - NSM 4.6.2 Avg. annual flow 1.5 million ac-ft.
 - NSM 5.1 Avg. annual flow 2.1 million ac-ft.
- For comparison, modeled overland flows for the Central Everglades under managed conditions are:
 - Alt7R5 Avg. annual flow 400,000 ac-ft. (900K EAA)
 - CERP0 Avg. annual flow 630,000 ac-ft. (725K EAA)

Flows through the Central Everglades



- Open up flow restriction along Miami Canal to increase discharge capacity to south
- Initial sizing approx. 47,000 acres gross, 45,000 acres net
- At 4' Depth, approx. 180,000 ac-ft “storage”, but flow-through operation is real target

- Use only for Lake releases to the south exceeding available capacity in canals and (expanded) STAs
 - Fill and then drain; flow through to extent possible consistent with conditions in receiving STAs
- Intent: Use combination of increased conveyance, treatment, and dynamic storage to replace pulse release capacity when Lake is in “operational band”

Allowable Releases to Tide (2008)

2008 LORS

Part D: Establish Allowable Lake Okeechobee Releases to Tide (Estuaries)

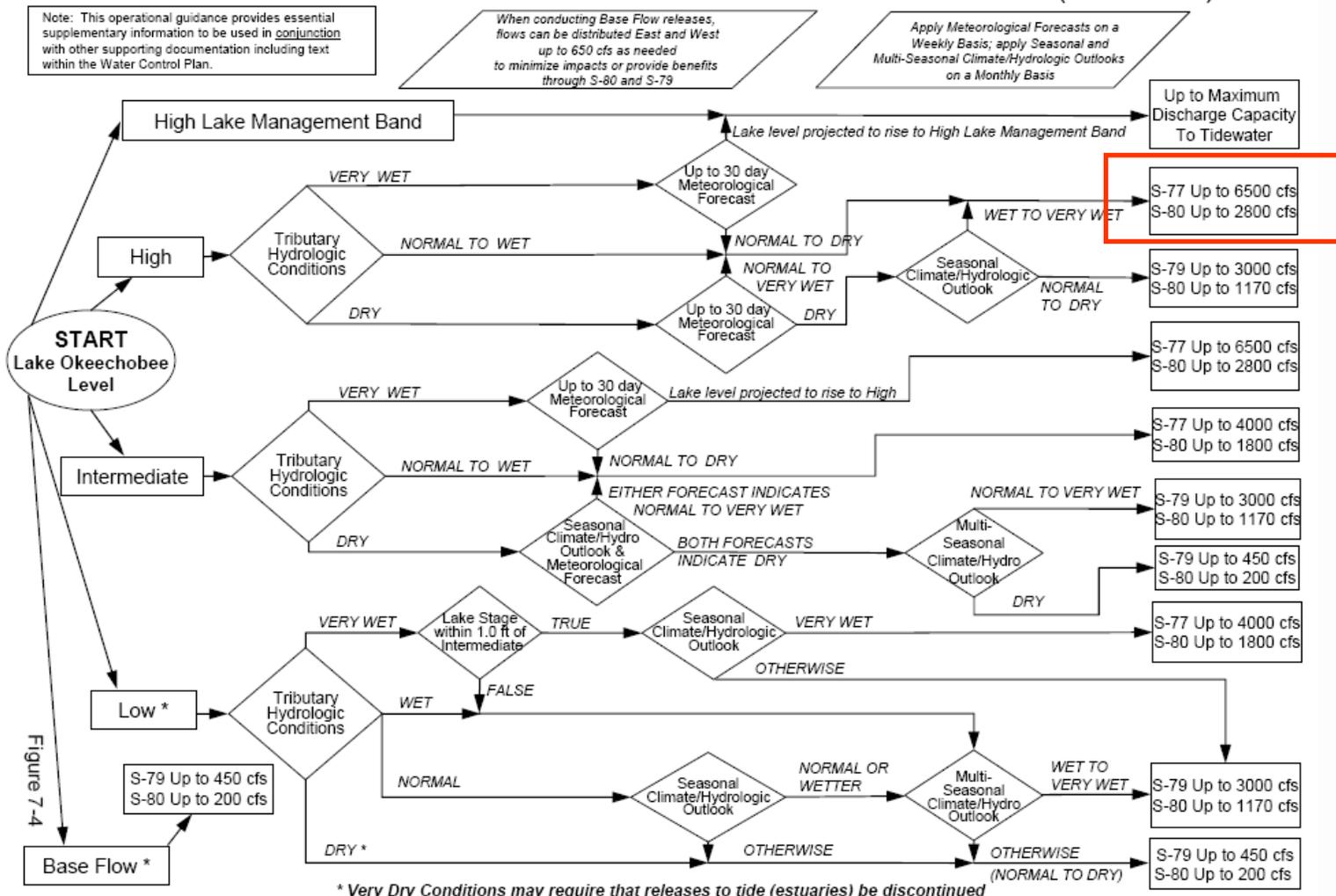


Figure 7-4

Pulse Releases to St. Lucie Canal and Caloosahatchee River

Pulse Releases - Three Levels

Table 7-11 Master Water Control Plan for Lake Okeechobee

Day of Pulse	Level I		Level II		Level III	
	St. Lucie S-80 (cfs)	Caloos. S-77 (cfs)	St. Lucie S-80 (cfs)	Caloos. S-77 (cfs)	St. Lucie S-80 (cfs)	Caloos. S-77 (cfs)
1	1200	1000	1500	1500	1800	2000
2	1600	2800	2000	4200	2400	5500
3	1400	3300	1800	5000	2100	6500
4	1000	2400	1200	3800	1500	5000
5	700	2000	900	3000	1000	4000
6	600	1500	700	2200	900	3000
7	400	1200	500	1500	600	2000
8	400	800	500	800	600	1000
9	0	500	400	500	400	500
10	0	500	0	500	400	500
Average Flow	730	1600	950	2300	1170	3000
Volume (Ac-Ft)	14,480	31,736	18,843	45,621	23,207	59,505
*Equivalent Depth (ft)	0.03	0.07	0.04	0.10	0.05	0.13

*Volume-Depth conversion based on average lake surface area of 467000 acres

Managed Flow Way

- 10-day average flow rate for “Level III” release = 4,170 cfs = 82,712 acre-feet (less for lower-level releases)
- At 180,000 acre-feet storage, could accept equivalent of 2+ full pulse releases without discharge from flow way
- “Flow-through” discharge from flow way dependent on conditions in STAs

Managed Flow Way

- Ideally, discharge from Lake Okeechobee to flow way by gravity (conceptual construction cost estimate assumes major pumping station; planning focus should be on gravity flow into flow way whenever possible)
- Releases from flow way would pass through expanded STA system
- If maximum steady flow of 3,600 cfs (equivalent to capacity of G-372, inflow pumping station to STA-3/4) is assumed, then
- For 500,000 ac-ft in average year, 70 days of discharge at 3,600 cfs

Appears to be within reason...

Estimated Capital Cost

Conceptual Opinion of Construction Cost (Jan. 2009 \$)		
Component		Est. Cost (\$ Million)
Managed Flow Way		\$350
New STA in S-5A Basin		190
S-4 Basin Diversion		35
New STA on Talisman Lands		400
Subtotal, Estimated Construction Cost		\$975
Planning, Engineering, Design, Prog. Management, Permitting	25%	\$244
Subtotal		\$1,219
Contingency	25%	\$305
TOTAL ESTIMATED CAPITAL COST		\$1,523

(Above estimates exclude land costs)

- October, 2008 presentation to SFWMD Governing Board focused on two possible project configurations:
 - Add'l STA of 12,000-45,000 acres
 - Reservoir storage in EAA, between 800k and 1,200k acre-feet
 - Storage depth between 12' and 15'
 - Project footprints occupied between 90,000 and 100,000 acres

- Capital cost of October, 2008 storage and treatment options discussed before Governing Board:
 - Reference: *Conceptual Opinion of Probable Construction Costs for Storage and Treatment Additions in the Everglades Agricultural Area*
 - Prepared for Florida Crystals by Burns & McDonnell; February 3, 2009.
 - Estimated total capital cost:
 - For 800k AF storage, \$5.3-\$5.4 billion
 - For 1,200k AF storage, \$8.4-\$9.1 billion
 - Both include Talisman Compartment A as STA

Goal: Relieve pressures on Herbert Hoover Dike

- Fixing the Dike should logically be a priority
 - Safety
 - Expands Lake management options
- However,

Herber Hoover Dike Rehabilitation Project



Rehabilitation Schedule

- **Continue Reach 1 construction**
- **Budgets**
 - Spending this FY: \$54.8 million
 - FY 2009: \$77.4 million
 - FY 2010: Unknown
- **Completion dates**
 - Reach 1: 2008 – 2013
 - Reaches 2 and 3: 2011 – 2020
 - Reach 7: 2020 – 2024
 - Reaches 4, 5, 6 and 8: 2025 – 2030

U.S. Army Corps of Engineers
Jacksonville

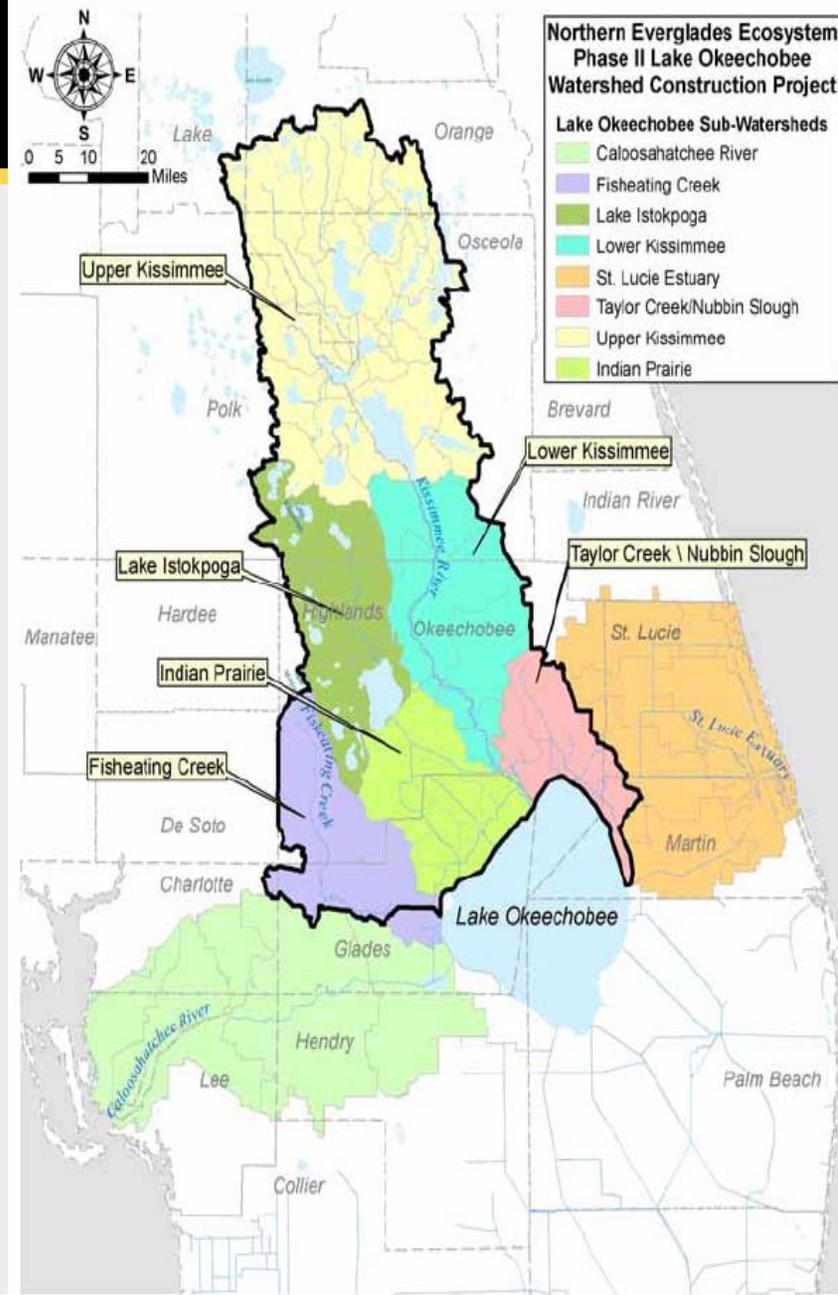
- A sense of urgency is needed
 - The Lake, the estuaries and the Everglades continue to degrade
- Estimated cost for this alternative << less than cost for major storage reservoirs in the EAA
 - Should result in significantly shorter completion schedule

- Conceptual configuration:
 - Leaves open all potential locations for intermodal facility identified at Jan. 22 WRAC meeting
 - Does not infringe on Vulcan mine
 - Preserves local economy by providing for continued operation of Clewiston Mill

- Gross area occupied by “new” facilities
 - Managed Flow Way = 47,000 acres
 - STA-1N = 15,000 acres
 - Total = 62,000 acres
- Roughly 2/3 the area occupied by either of the two storage & treatment options discussed at October meeting of SFWMD Governing Board

Northern Everglades

- System Needs
 - Pollutant Load Reduction (esp. phosphorus)
 - Storage
 - Reduce Harmful Releases to Estuaries
 - Allow the Lake to be managed for the health of the Lake while performing its function for flood control and water supply
- Focus of Lake Okeechobee Watershed Protection Project, Phase II Technical Plan



- Everglades Agricultural Area
 - Additional Conveyance (deliver more water to the Everglades)
 - Additional Treatment (presently a significant constraint on additional deliveries to Everglades)
- Water Conservation Areas
 - Distribution of flow in space and time
- Everglades National Park and Florida Bay
 - More water when and where needed

River of Grass - Vision Statement



- Maximize restoration opportunities for the South Florida ecosystem by acquiring strategically located lands, establishing a managed system of water storage and treatment, and restoring a historic hydrologic connection to benefit America's Everglades, Lake Okeechobee, and the St. Lucie and Caloosahatchee rivers and estuaries.

3

