CENTRAL EVERGLADES PLANNING PROJECT

Evaluating the Effects of CEPP Project Alternative Plans Using Performance Measures and Ecological Planning Tools

GEER Conference 2015 Session 9

Linking Hydrology to Ecology in Restoration Planning, Design, and Implementation

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U.S. Army Corps of Engineers, Jacksonville District

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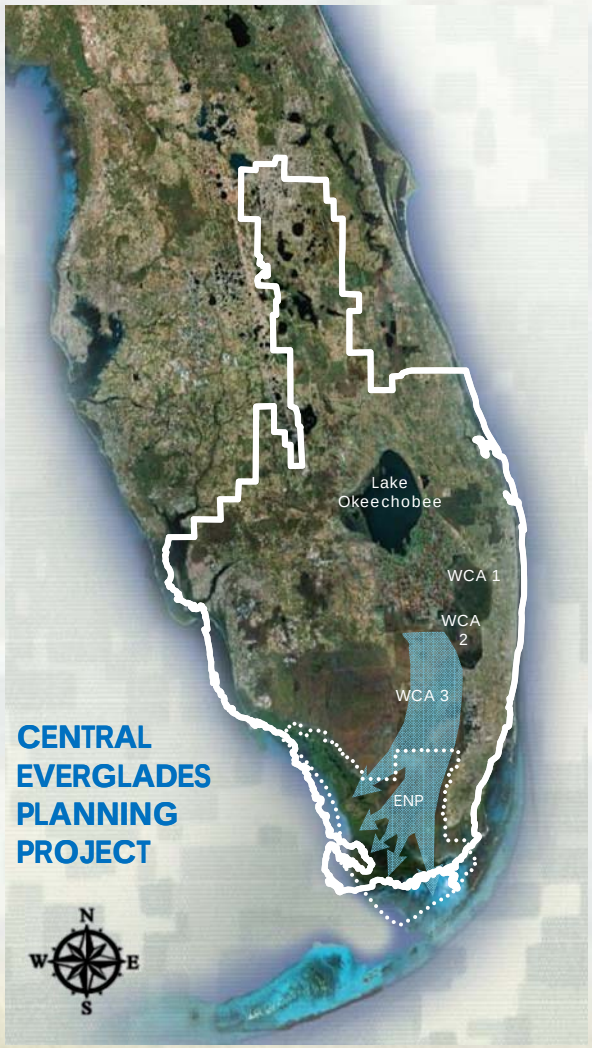
CEPP ALTERNATIVE EVAULATION



CENTRAL EVERGLADES PLANNING PROJECT

Planning Model

- Developed by the Jacksonville District with support from multiple Federal & State agencies
- Quantified ecological benefits (*i.e.* Habitat Units [HU]) to support plan evaluation, comparison, & selection of the recommended plan
- Supplemented with species-specific ecological planning tools

HYDROLOGIC PERFORMANCE MEASURES

U.S.ARMY

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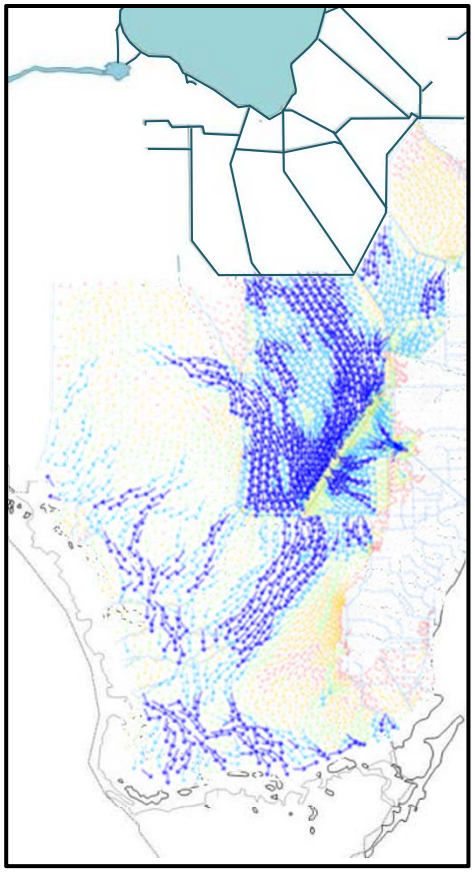
CEPP ALTERNATIVE EVAULATION

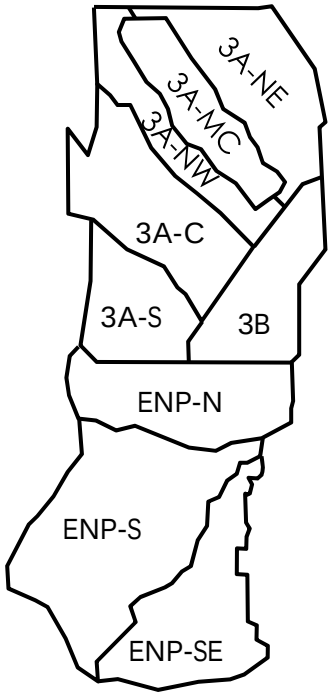
1 RUN HYDROLOGIC MODELS OF ALTERNATIVES



OUTPUT:
WATER DEPTHS, DURATIONS, DISTRIBUTION, TIMING

2 CALCULATE % OF TARGETS ACHIEVED PER ZONE

PERFORMANCE MEASURES

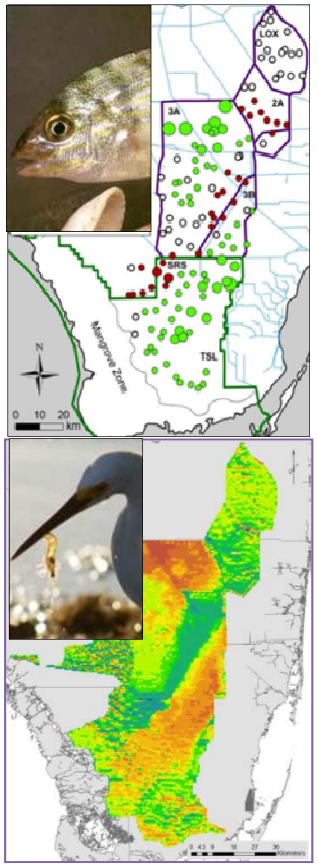


OUTPUT: HABITAT UNIT (HU)

- USACE metric used for environmental benefits
- Habitat quality over a geographic area; scores assigned: 0 = worst, 1 = best

Quantity = Acres
Quantity x Quality = HU

3 ASSESS ADDITIONAL ECOLOGICAL EFFECTS



EXAMPLE:
SMALL FISH
FOOD
WADING BIRD

OUTPUT:
HABITAT SUITABILITY

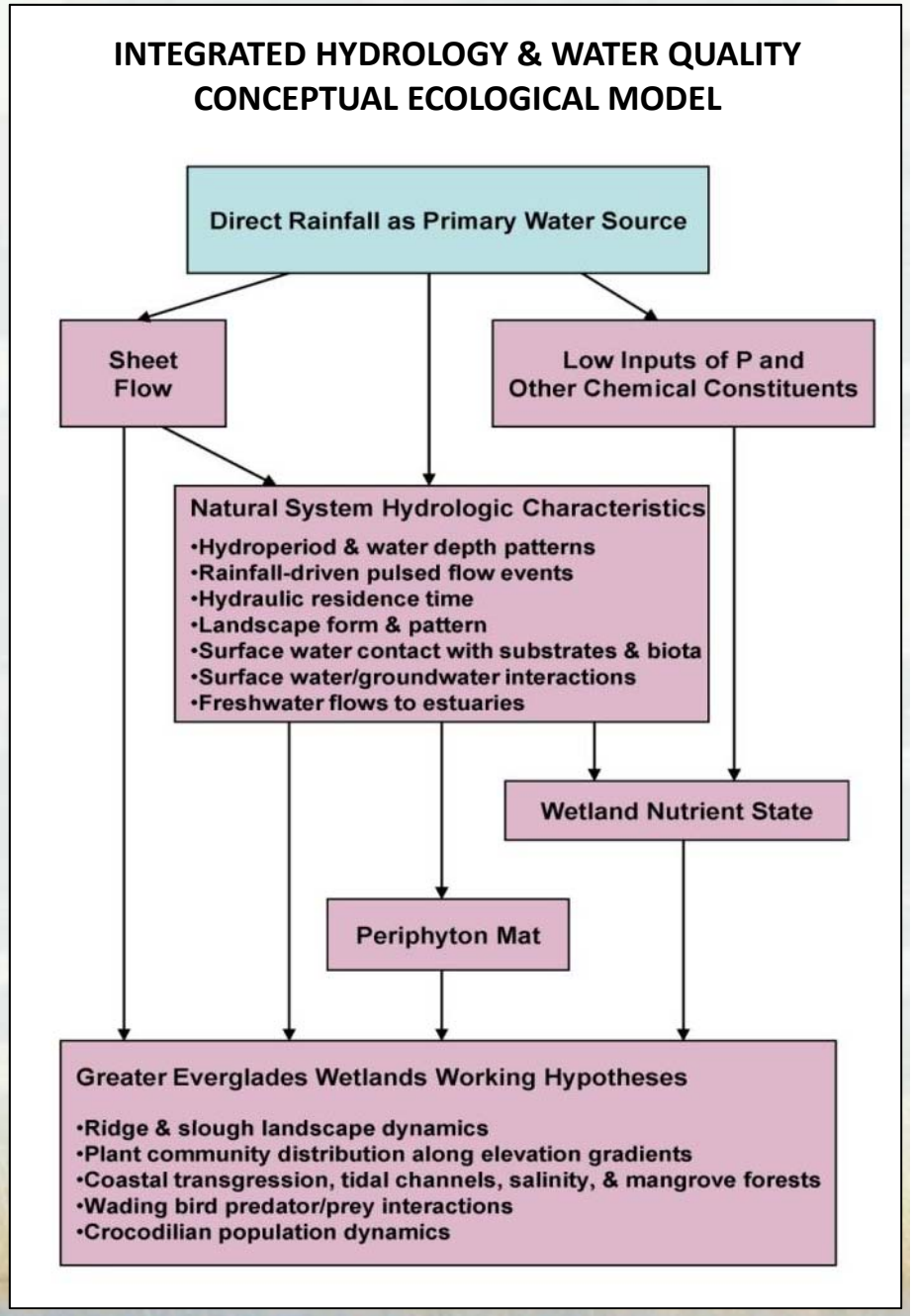
CEPP PERFORMANCE MEASURES

Performance Measures (PM)

- Indicators of conditions in the natural system determined to be characteristic of a healthy, restored ecosystem
  - Used to measure response of stressors &/or ecological attributes to restoration actions (alternative plans)
- Included RECOVER (Restoration, Coordination & Verification Team) system-wide PMs for use in CERP projects
  - RECOVER has an established process to review/accept PMs
  - Helped expedite USACE review of CEPP planning model (provided the additional level of peer review required by USACE policy)
- PMs were chosen according to project objectives

CEPP PERFORMANCE MEASURES

- Developed from Conceptual Ecological Models
- Based on Peer-Reviewed Scientific Relationships
- Each PM has a predictive metric & a desired target (based on output from regional hydrologic models)
- PM targets primarily based on Natural System Model (NSM) output
  - NSM simulates the hydrologic response of a pre-drained Everglades
  - Targets vary by study area location



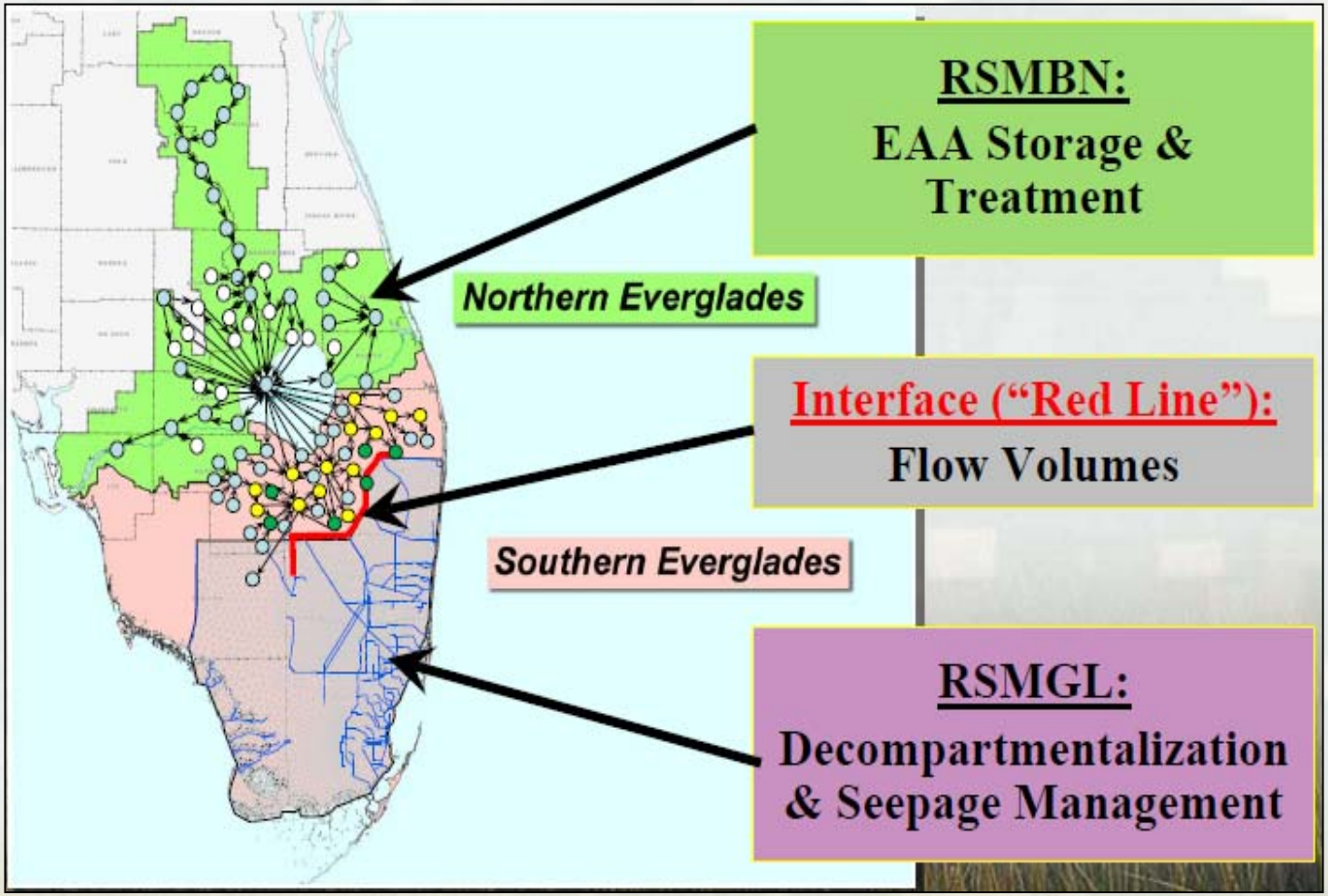
CEPP PERFORMANCE MEASURES

PLANNING REGION	HYDROLOGIC PERFORMANCE MEASURE	DESCRIPTION
Northern Estuaries	**Salinity Envelopes**	Measure of flow events correlated to be representative of median salinities favorable to marine fish, shellfish, oyster and SAV; based on frequency of flows from S-79 and S-80
Greater Everglades	**Hydrologic Surrogate for Soil Oxidation**	Measure of cumulative drought intensity to reduce exposure of peat to oxidation
	Inundation Pattern in Greater Everglades Wetlands	Measure of the number and duration of inundation events used to calculate the percent period of record of inundation
	Number and Duration of Dry Events in Shark River Slough	Measure of the number of times and mean duration in weeks that water drops below ground
	Sheet flow in the Everglades Ridge and Slough Landscape	Measure of the timing and distribution of sheet flow across the landscape.
	Slough Vegetation Suitability	Measure to evaluate the hydrologic suitability for slough vegetation
Southern Coastal Systems	**Salinity in Florida Bay**	Measure to evaluate salinity optima for plant & animal species common to historical communities in Florida Bay

CEPP PROJECT OBJECTIVES

PLANNING REGION	HYDROLOGIC PERFORMANCE MEASURES	OBJ 1: RESTORE SEASONAL HYDROPERIODS & FRESHWATER DISTRIBUTION TO SUPPORT A NATURAL MOSAIC OF WETLAND & UPLAND HABITAT IN THE EVERGLADES SYSTEM	OBJ 2: IMPROVE SHEET FLOW PATTERNS & SURFACE WATER DEPTHS & DURATIONS IN THE EVERGLADES SYSTEM TO REDUCE SOIL SUBSIDENCE, FREQUENCY OF DAMAGING FIRES, DECLINE OF TREE ISLANDS, & DECREASE SALT WATER INTRUSION	OBJ 3: REDUCE WATER LOSS OUT OF THE NATURAL SYSTEM TO PROMOTE APPROPRIATE DRY SEASON RECESSION RATES FOR WILDLIFE UTILIZATION	OBJ 4: RESTORE MORE NATURAL WATER LEVEL RESPONSES TO RAINFALL TO PROMOTE PLANT & ANIMAL DIVERSITY & HABITAT FUNCTION	OBJ 5: REDUCE HIGH VOLUME DISCHARGES FROM LAKE OKEECHOBEE TO IMPROVE THE QUALITY OF OYSTER & SAV HABITAT IN THE NORTHERN ESTUARIES
Northern Estuaries	Salinity Envelopes					X
Greater Everglades	Hydrologic Surrogate for Soil Oxidation	X	X	X		
	Inundation Pattern in Greater Everglades Wetlands	X	X	X	X	
	Number & Duration of Dry Events in Shark River Slough	X	X	X	X	
	Sheet flow in the Everglades Ridge & Slough Landscape	X	X		X	
	Slough Vegetation Suitability	X	X			
Southern Coastal Systems	Salinity in Florida Bay	X	X		X	

REGIONAL HYDROLOGIC MODELS



METHODOLOGY FOR QUANTIFYING PROJECT BENEFITS

STEP 1

Normalize Performance Measures to Common Scale

STEP 2

Combine Performance Measures & Calculate Zone Scores

STEP 3

Calculate Zone Habitat Units

STEP 4

Compare Alternatives

STEP 1:

- Raw performance measure are linearly re-scaled between 0 & 100 for each alternative
- Performance is measured as % of target achieved

STEP 2:

- Project area was divided into zones to determine benefit spatial distribution:
  - Northern Estuaries – Greater Everglades – Florida Bay
- Performance measures were combined for each alternative to produce a net benefits score per zone (Habitat Suitability Index) between 0 & 1

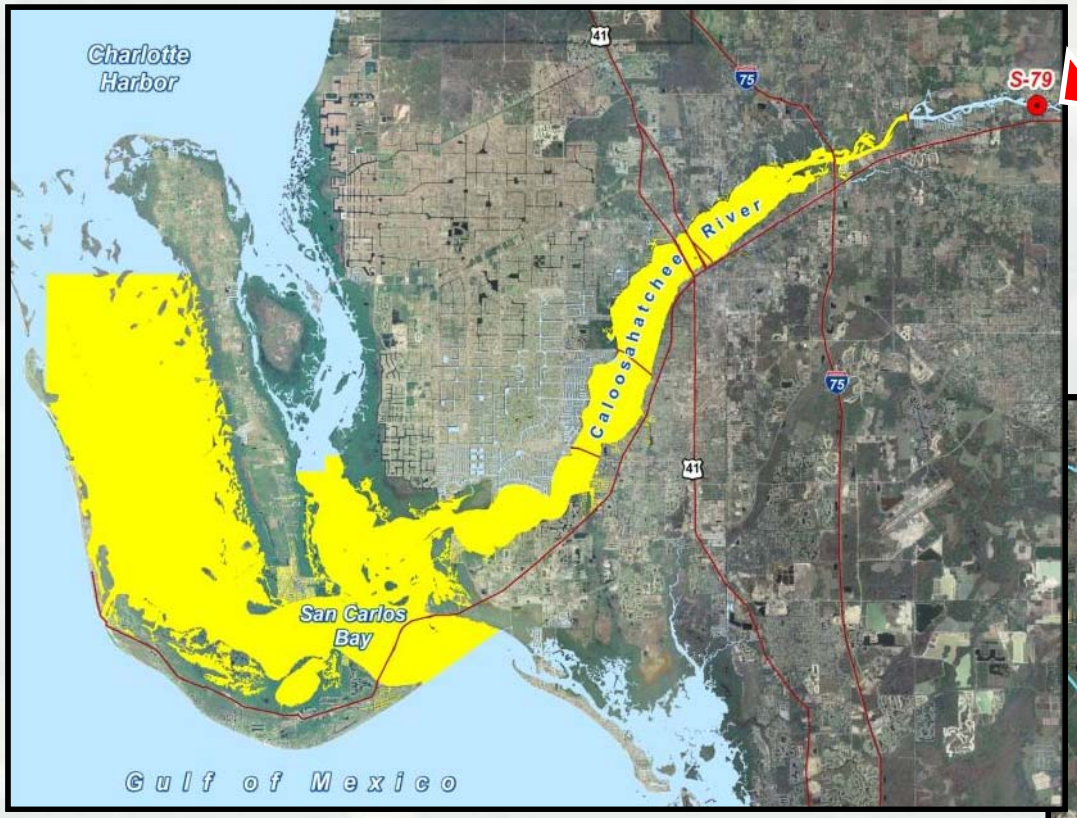
STEP 3:

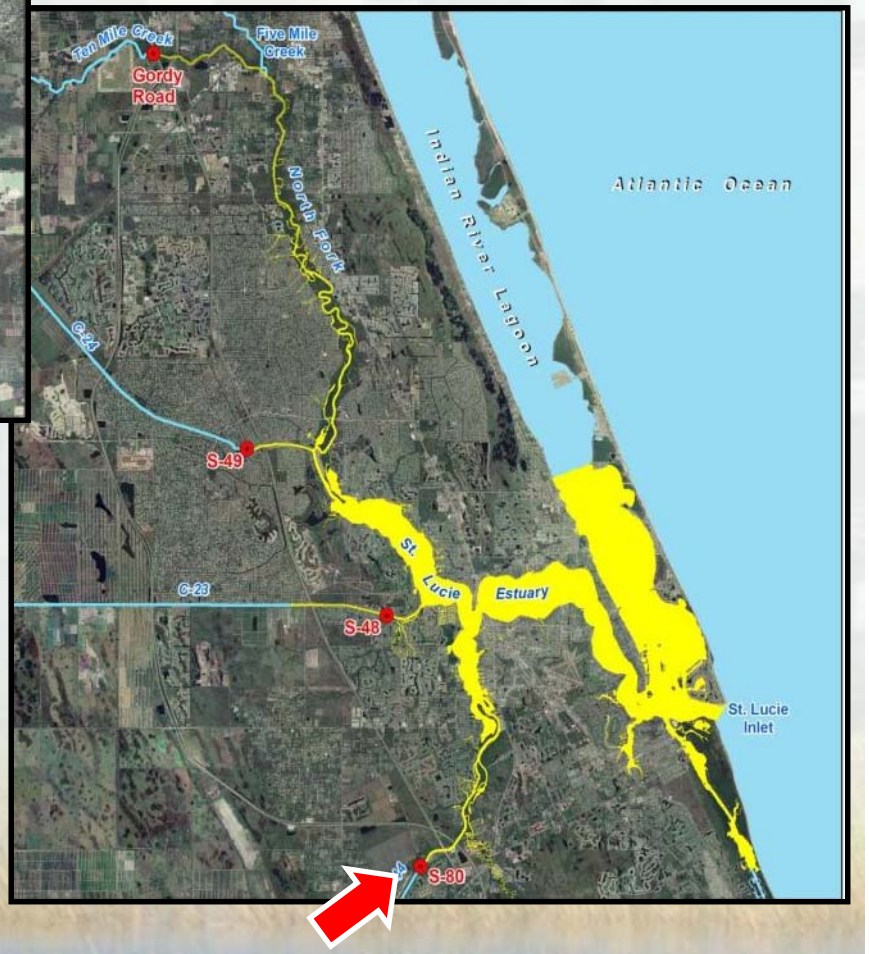
- The 0 to 1 benefits score for each zone (for an alternative) was multiplied by the acreage of the zone generating a zone Habitat Unit value

STEP 4:

- Habitat Unit Lift = Alternative – No Action Alternative

METHODOLOGY FOR QUANTIFYING PROJECT BENEFITS: NORTHERN ESTUARIES

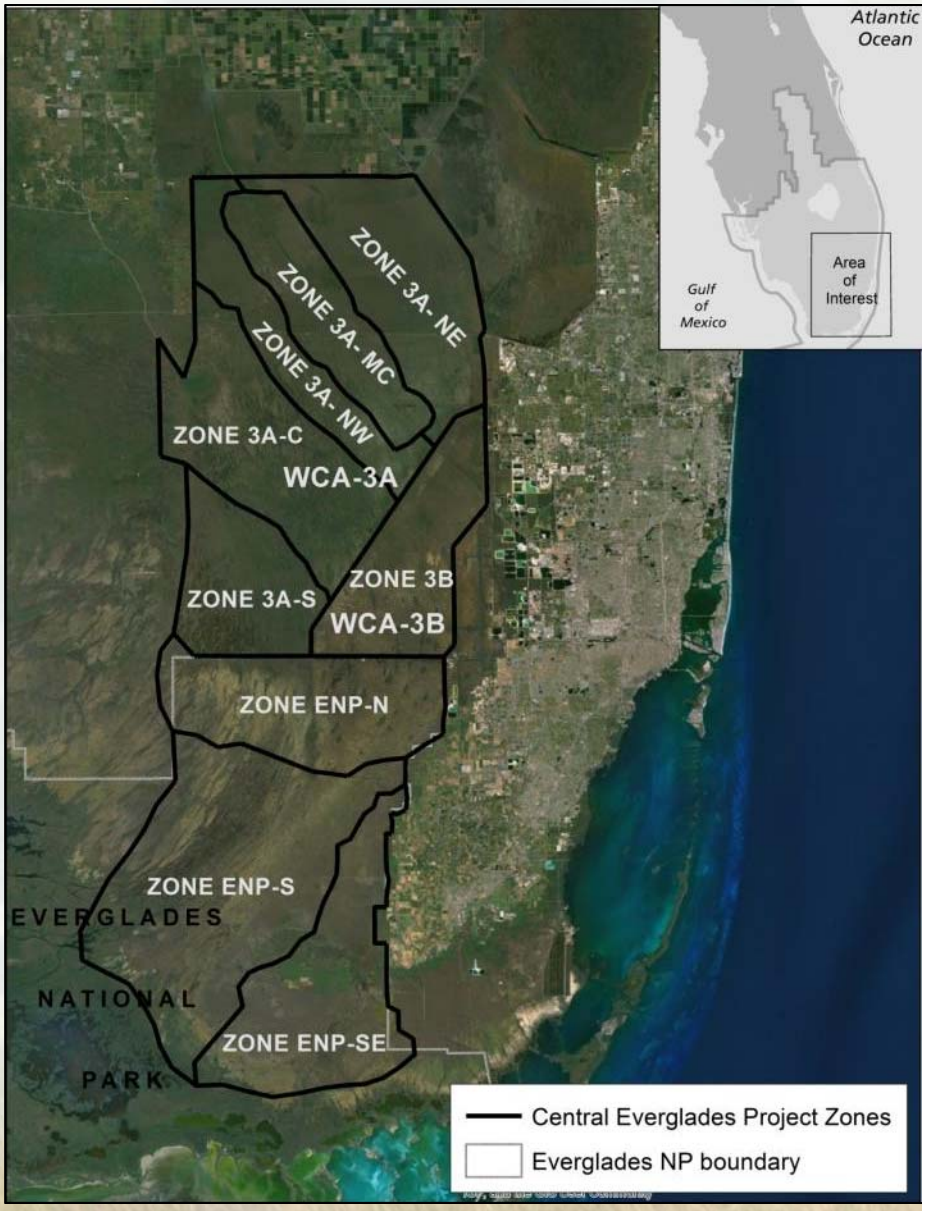




- Northern Estuaries: PMs measure suitability for oyster & SAV habitat based on target flows from S-79 & S-80
- **85,973 acres:** Estimate of the maximum area of potential benefit for Caloosahatchee Estuary Zone CE-1 & St. Lucie Estuary Zone SE-1

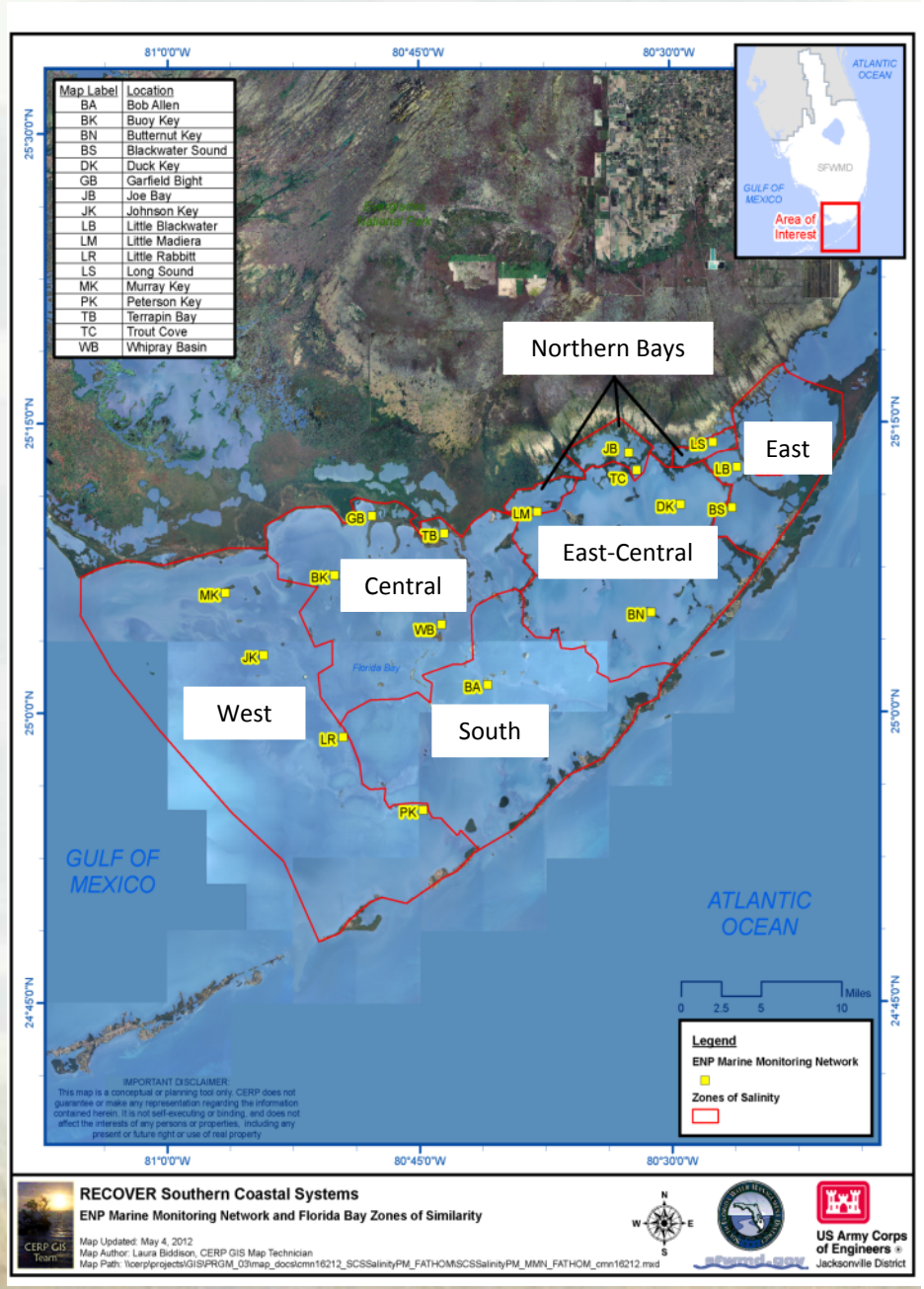
METHODOLOGY FOR QUANTIFYING PROJECT BENEFITS: GREATER EVERGLADES

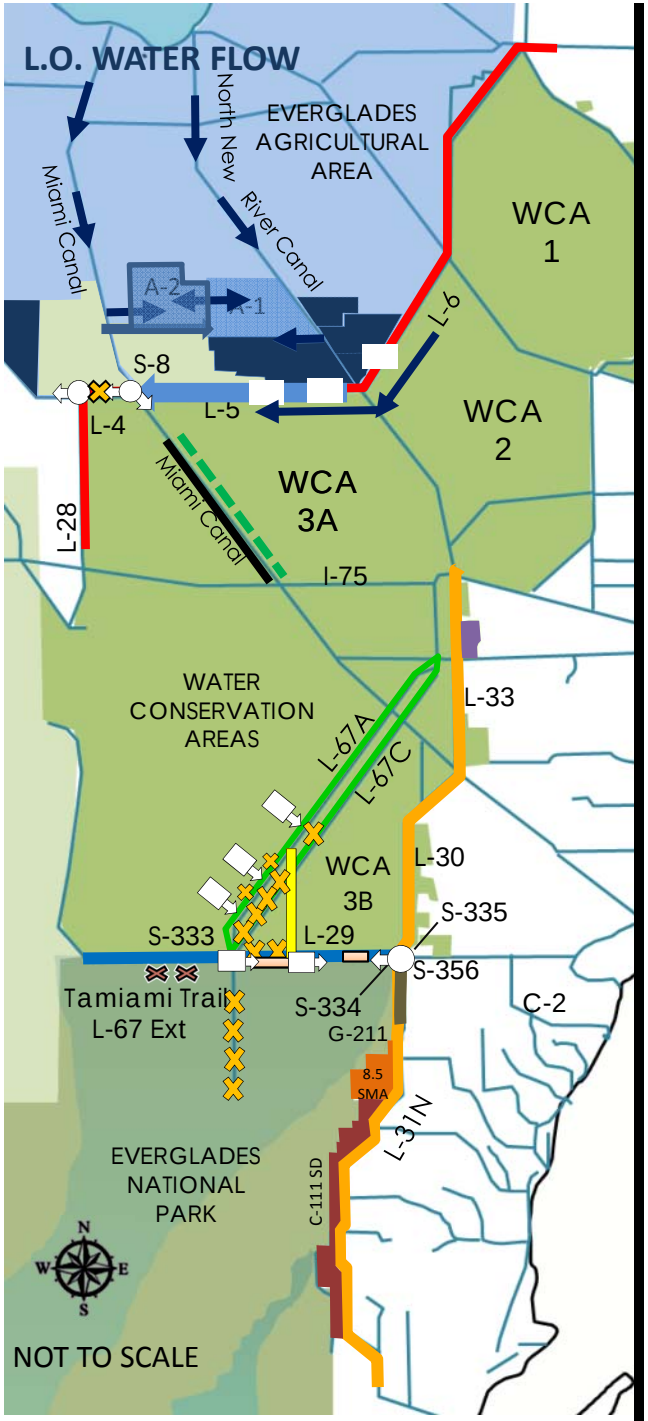
- PMs measured the depth, distribution, & duration of surface flooding, & timing & distribution of flows based on targets at indicator regions &/or transects
- WCA 3A, WCA 3B, & ENP were divided into 9 zones
- Zones delineated to capture the spatial extent of the structural components & were based on differences in existing conditions within the study area
- **1,076,247 acres:** Estimate of the maximum area of potential benefit for WCA 3A, WCA 3B, & ENP



METHODOLOGY FOR QUANTIFYING PROJECT BENEFITS: FLORIDA BAY

- PMs within Florida Bay were used to evaluate salinity optima for plant & animal species common to historical communities in Florida Bay based on targets at marine network monitoring stations
- Florida Bay was divided into six zones of similarity
- Zones delineated based on water quality characteristics
- **476,096 acres:** Estimate of the maximum area of potential benefit for Florida Bay





CEPP RECOMMENDED PLAN

STORAGE AND TREATMENT

- A flow equalization basin, or shallow reservoir, that will be integrated with the state's water quality treatment facilities to increase the amount of clean water flow to the Everglades from Lake Okeechobee

DISTRIBUTION/CONVEYANCE

- Increasing the L-5 canal capacity and modification to the S-8 pump station to convey water west
- Construction of a 360 cfs pump station to maintain water supply to the Seminole Tribe and western basin
- Removal of 2.9 miles of the L-4 levee to distribute inflow to WCA-3A and backfilling 13.5 miles of the Miami Canal

DISTRIBUTION/CONVEYANCE

- Construction of 8 miles of new levee and removal of 12 miles of existing levees to create a flowway through WCA-3B;
- Two 500 cfs gated culvert structures will provide inflow to the flowway and an 1150 cfs spillway will provide deliveries directly to eastern Shark River Slough;
- A 1,230 cfs spillway will maintain flow to the east of the flowway
- Additional 500 cfs gated culvert structure outside of the flowway to rehydrate the eastern portions of WCA-3B
- Removal of 5.5 miles of the L-67 extension levee and canal; and 6 miles of the Old Tamiami Trail within ENP

SEEPAGE MANAGEMENT

- A 1,000 cfs pump station and 4.2 miles of seepage barrier wall along the protective levee south of Tamiami Trail

Note: System wide operational changes and adaptive management considerations will be included in project

FEB · STA · Pump · Old Tamiami Trail Removal
Backfill · Levee Removal · Gated Structure
Seepage Barrier · Canal Improvement · Levee

CEPP RECOMMENDED PLAN

ECOSYSTEM BENEFITS: %TARGETS ACHIEVED BY ZONE

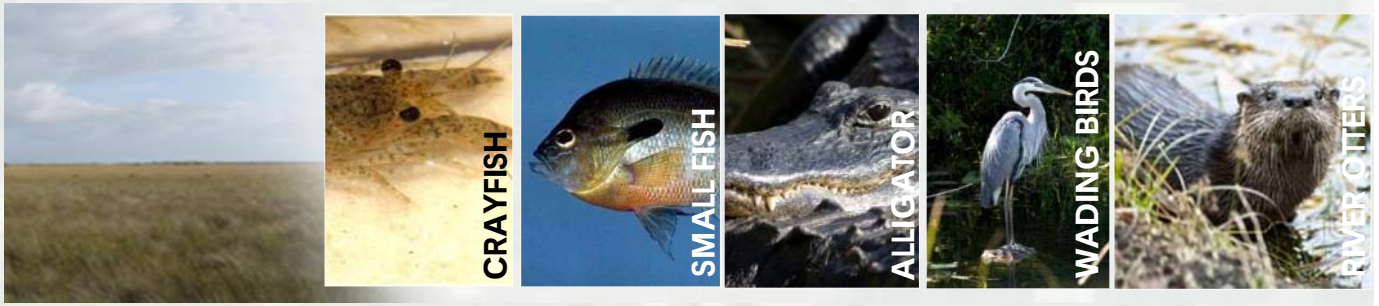
≥75% 50-74% <50%

WCA 3: 495,000 ACRES IMPROVED

ZONE	FWO	PLAN
Northeast WCA 3A	24	74
Northwest WCA 3A	43	77
Miami Canal	35	70
Central WCA 3A	77	81
WCA 3B	57	69

EVERGLADES NATIONAL PARK (ENP): 499,000 ACRES IMPROVED

Northern ENP	44	79
Southern ENP	53	71
Southeast ENP	60	62



FLORIDA BAY / CALOOSAHATCHEE & ST. LUCIE ESTUARIES: 476,000 / 86,000 ACRES IMPROVED

Florida Bay West	13	26
Florida Bay Central	10	18
Florida Bay South	15	29
Florida Bay E. Central	23	39
Florida Bay North	16	21
Florida Bay East	23	26
Caloosahatchee Estuary	48	55
St. Lucie Estuary	16	55

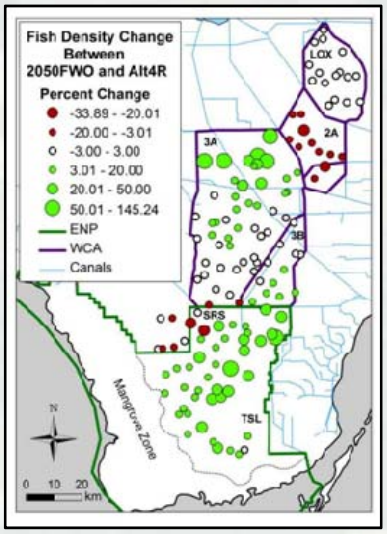
CEPP RECOMMENDED PLAN

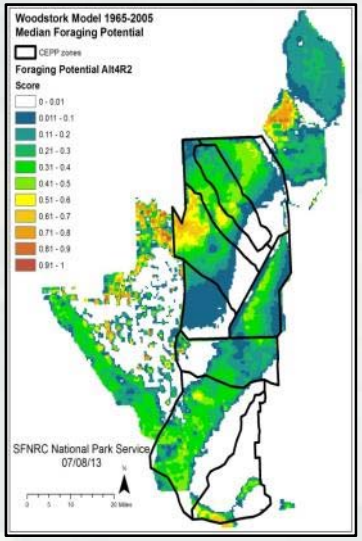
Project Region (Zone)	Habitat Units			
	Existing Condition Baseline	Future Without Project Condition	Recommended Plan	HU Lift
Caloosahatchee Estuary	2,839	34,070	39,038	4,968
St. Lucie Estuary	2,099	2,399	8,247	5,848
Total Northern Estuaries	**4,938**	**36,469**	**47,285**	**10,816**
Northeast WCA 3A	44,451	29,634	91,372	61,738
WCA 3A Miami Canal	32,847	27,373	54,746	27,373
Northwest WCA 3A	30,970	30,266	54,198	23,932
Central WCA 3A	108,414	105,669	111,159	5,490
Southern WCA 3A	69,247	68,423	68,423	0
WCA 3B	55,697	48,842	59,125	10,283
Northern ENP	57,557	55,054	98,847	43,793
Southern ENP	124,068	126,454	169,400	42,946
Southeast ENP	79,711	81,062	83,764	2,702
Total Greater Everglades (WCA 3 and ENP)	**602,962**	**572,777**	**791,034**	**218,257**
Florida Bay West	23,693	20,534	41,068	20,534
Florida Bay Central	9,025	8,205	14,769	6,564
Florida Bay South	16,614	14,659	28,341	13,682
Florida Bay East Central	21,984	20,225	34,295	14,070
Florida Bay North Bay	2,154	2,028	2,661	633
Florida Bay East	9,440	8,685	9,818	1,133
Total Florida Bay	**82,910**	**74,336**	**130,952**	**56,616**
Total All Regions	**690,810**	**683,582**	**969,271**	**285,689**

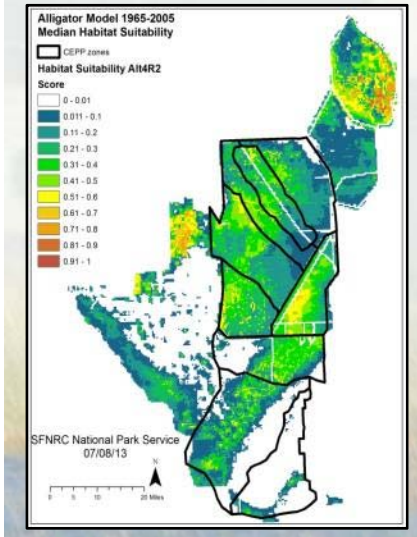
ECOLOGICAL PLANNING TOOLS

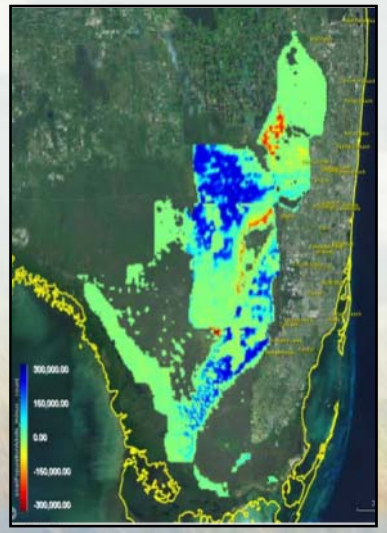
ASSESSMENT OF ADDITIONAL ECOLOGIC EFFECTS:

Wood Storks, American Alligator & Crocodile, Freshwater Fishes, Apple Snails, Juvenile Sea Trout, Pink Shrimp









Ecological Planning Tools

- Used by the RECOVER system-wide Science Team, per 2003 CERP Programmatic Regulation Guidance
- Used within the NEPA assessment to evaluate the environmental effects of CEPP alternatives

Demonstrate Species Specific Benefits

- More frequent use of northern WCA 3A, WCA 3B, & southern ENP for wood storks
- Improvements to alligator habitat suitability throughout WCA 3A & ENP
- Better conditions for apple snail in WCA 3A, WCA 3B, & ENP

ACKNOWLEDGMENTS

USACE & SOUTH FLORIDA WATER MANAGEMENT DISTRICT
CEPP PROJECT DELIVERY TEAM MEMBERS

AGENCY & UNIVERSITY STAFF CONTRIBUTED TO ECOLOGICAL PLANNING TOOLS

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QUESTIONS?