



# Everglades Agricultural Area Storage Reservoir Feasibility Study

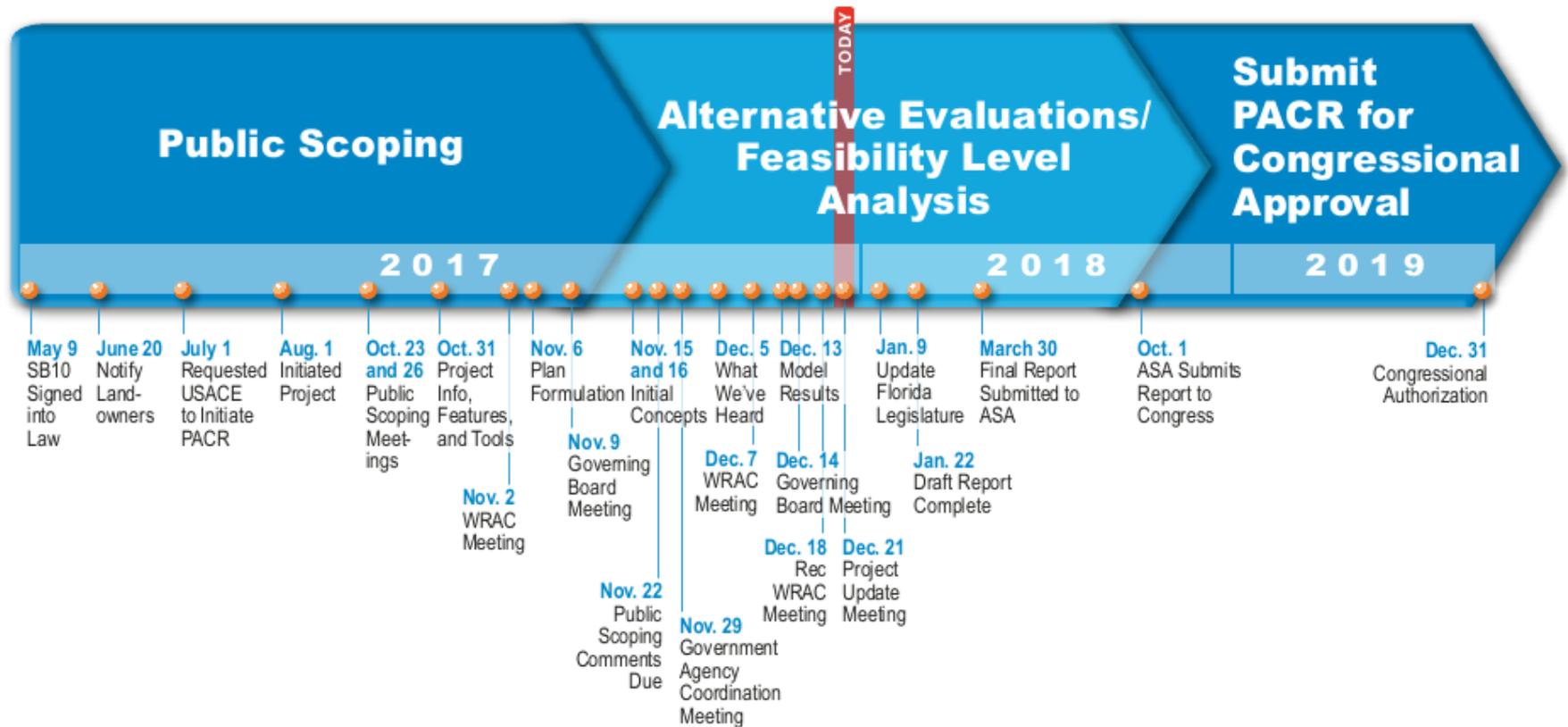
December 21, 2017

# Meeting Agenda

- Welcome and Introductions
- Project Schedule
- Modeling Results
- Project Benefits
- Next Steps
- Public Comment

# Project Schedule

## EAA Reservoir Timeline



## Project Opportunities and Objectives

- Reduce the high-volume freshwater discharges from Lake Okeechobee to the Northern Estuaries
- Identify storage, treatment and conveyance south of Lake Okeechobee to improve flows to the Everglades system
- Reduce ongoing ecological damage to the Northern Estuaries and Everglades system



St. Lucie Inlet

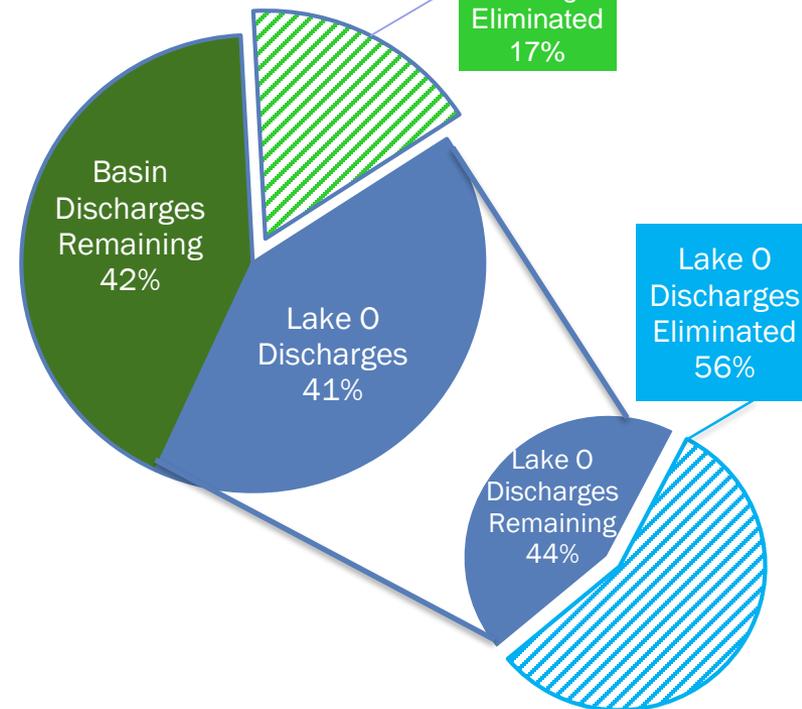
# Alternative R240A



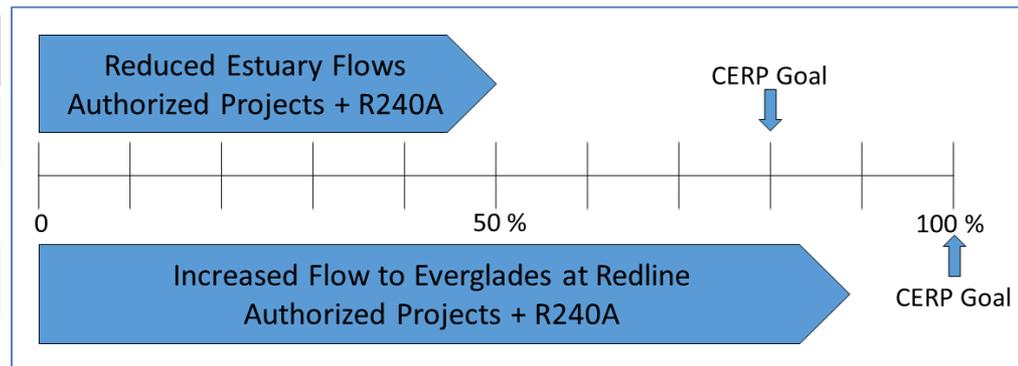
- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements

Region	R240 Habitat Unit Lift
Northern Estuaries	2,169
Greater Everglades	9,541
Florida Bay	9,100
<b>Total HU Lift</b>	<b>20,810</b>

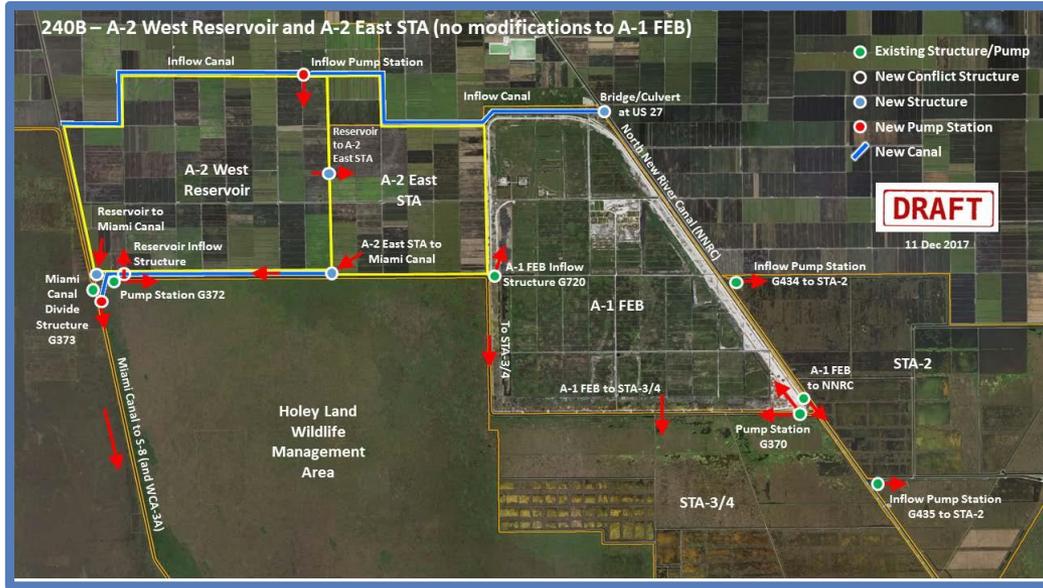
## % Northern Estuary Events Eliminated



## Improved Flow Conditions



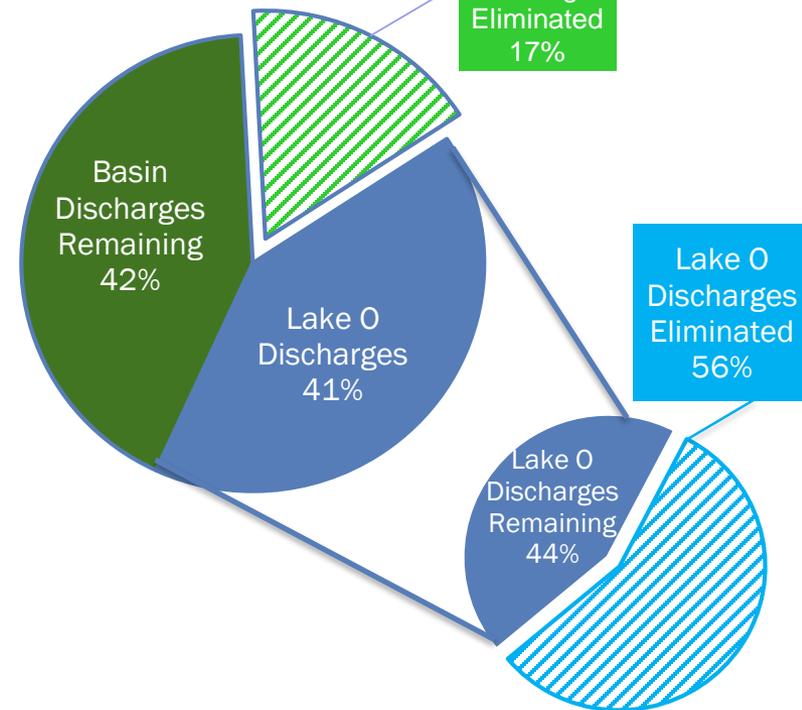
# Alternative R240B



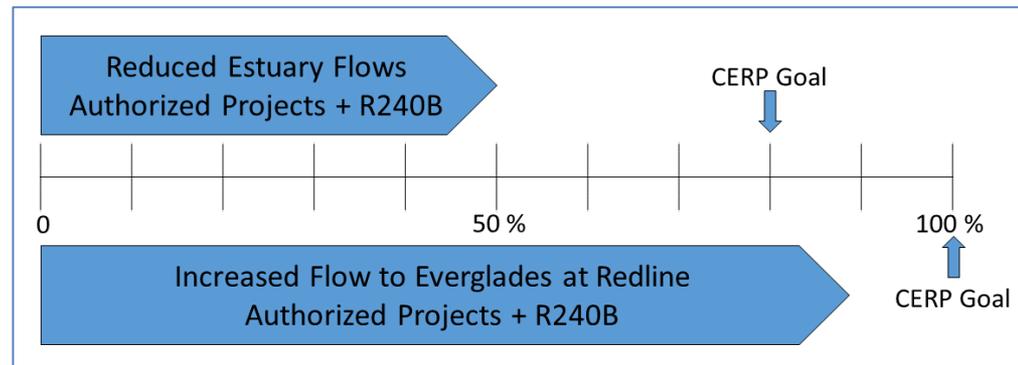
- ✓ Reduces discharges to Northern Estuaries
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Northern Estuaries	2,169
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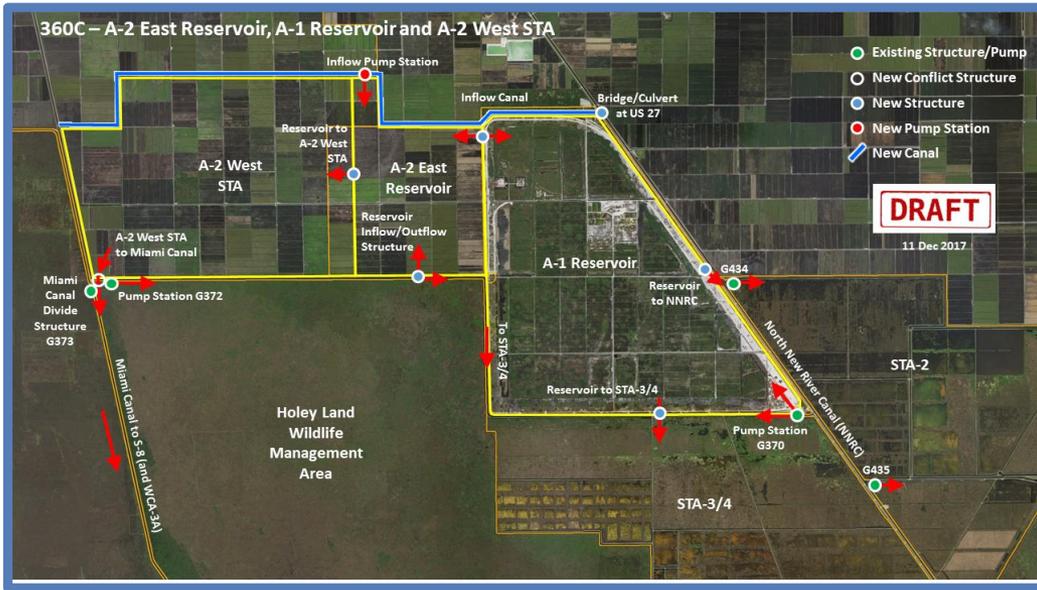
## % Northern Estuary Events Eliminated



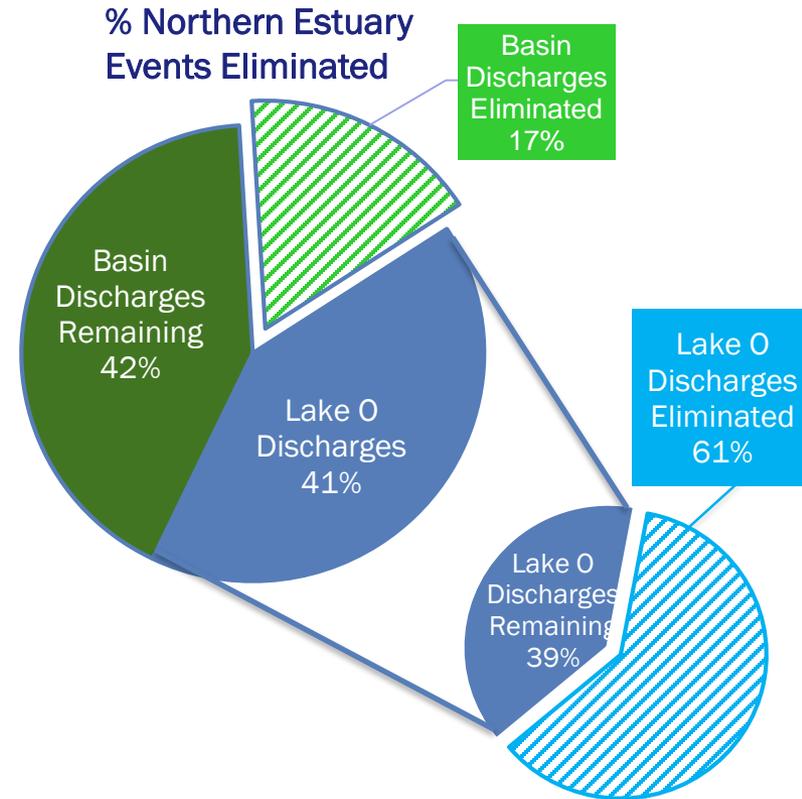
## Improved Flow Conditions



# Alternative R360C

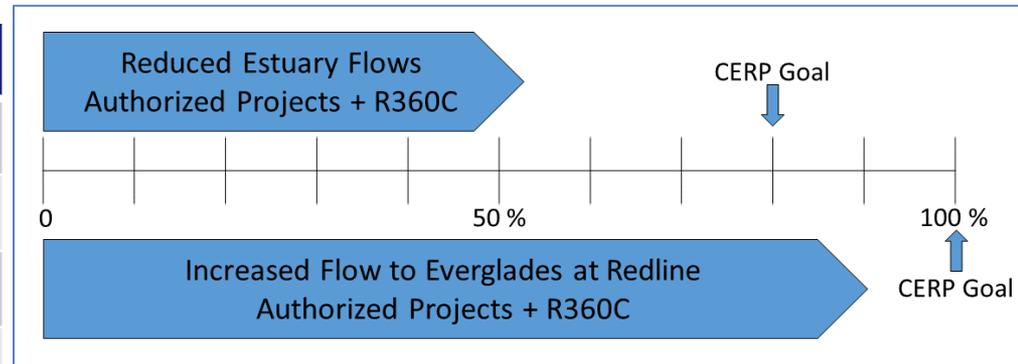


- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements



## Improved Flow Conditions

Region	R360 Habitat Unit Lift
Northern Estuaries	3,329
Greater Everglades	13,161
Florida Bay	9,900
<b>Total HU Lift</b>	<b>26,390</b>



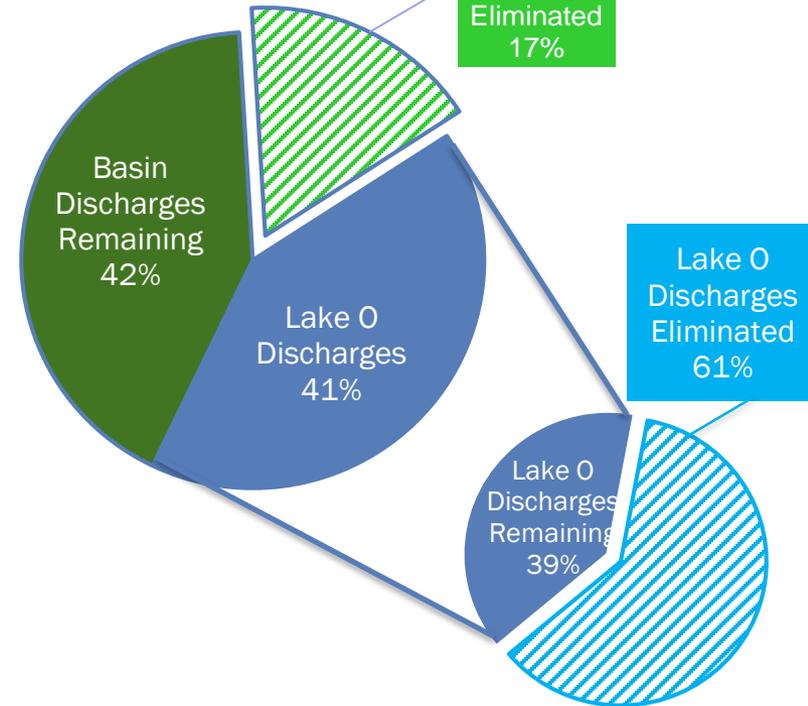
# Alternative R360D



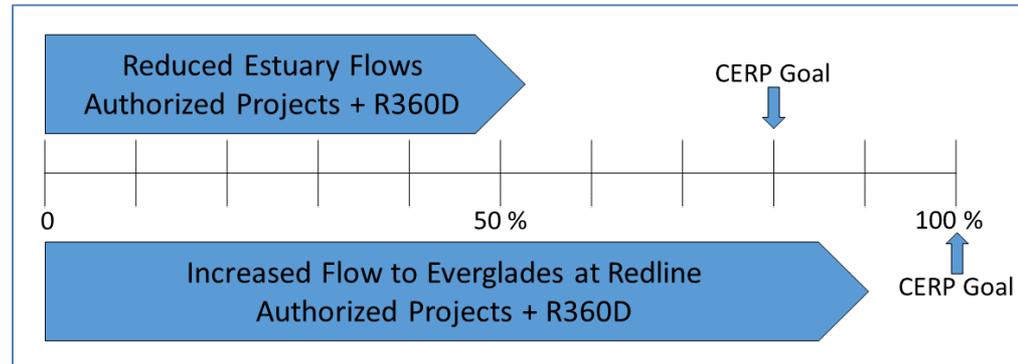
- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements

Region	R360 Habitat Unit Lift
Northern Estuaries	3,329
Greater Everglades	13,161
Florida Bay	9,900
<b>Total HU Lift</b>	<b>26,390</b>

## % Northern Estuary Events Eliminated



## Improved Flow Conditions



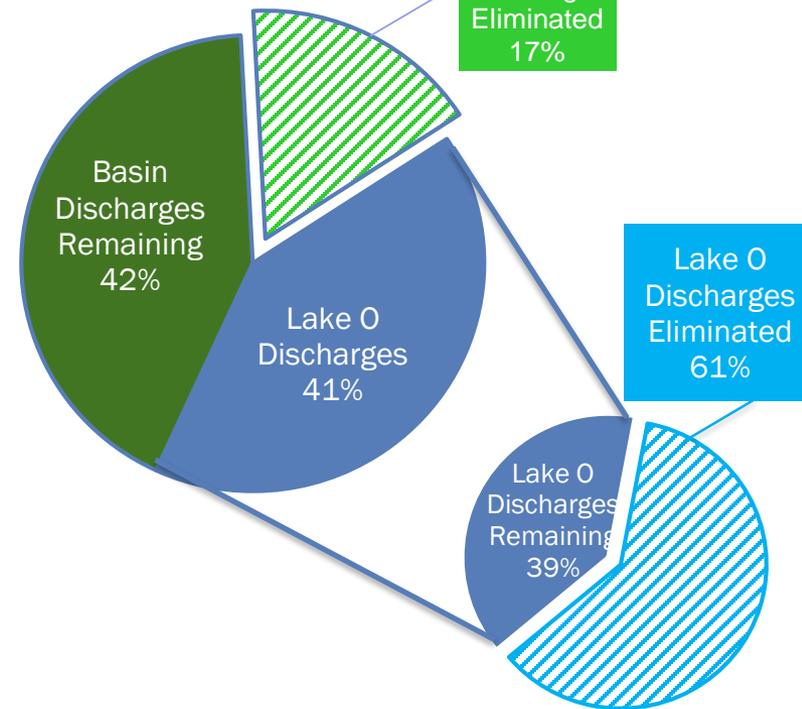
# Alternative C360C



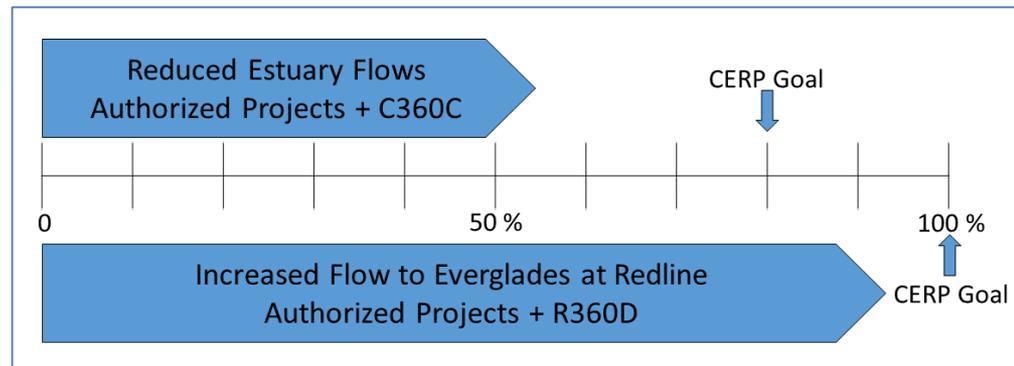
- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements

Region	C360 Habitat Unit Lift
Northern Estuaries	4,039
Greater Everglades	13,161
Florida Bay	9,900
<b>Total HU Lift</b>	<b>27,100</b>

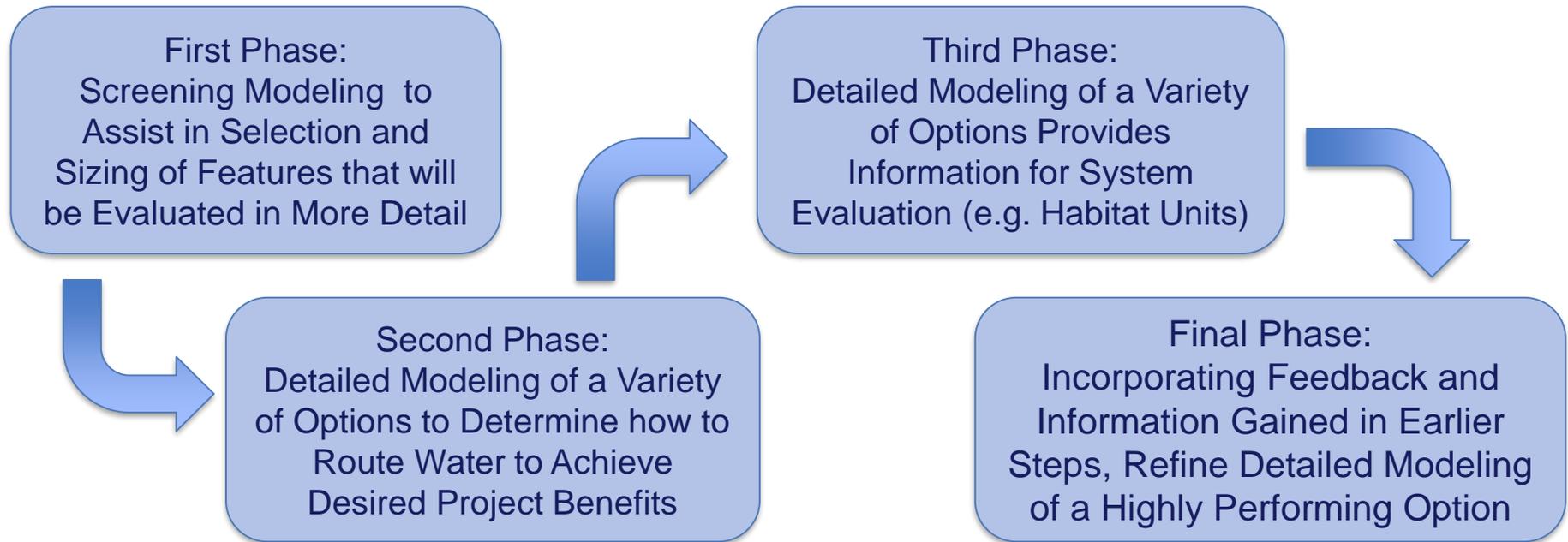
## % Northern Estuary Events Eliminated



## Improved Flow Conditions



# How Modeling Fits into Project Planning



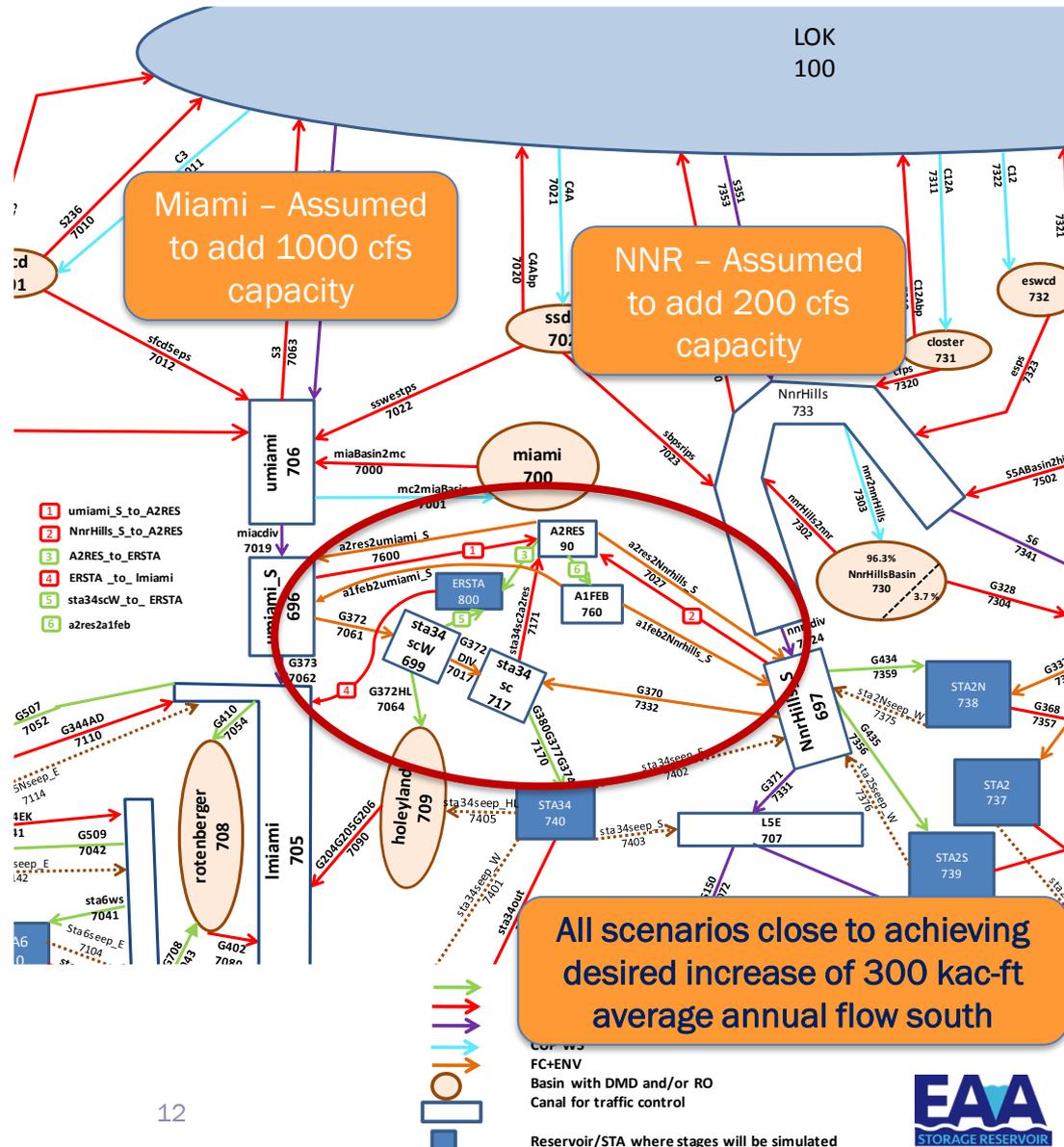
Along this path, there are many opportunities for refinement. Intermediate products serve the immediate need and then are enhanced, incorporating feedback and information as the process progresses.

# Modeling Scenarios

- R240 = 240 kac-ft reservoir + A1 FEB (configuration A or B)
  - Reservoir is ~ 10,100 acres effective area and ~ 23 ft depth (levee side-slopes accounted for in storage calculation)
  - 6,500 acre STA
  
- R360 = 360 kac-ft reservoir (no A1 FEB) (configuration C or D)
  - Reservoir is ~ 19,700 acres effective area and ~ 18 ft depth (levee side-slopes accounted for in storage calculation)
  - 11,500 acre STA
  
- C360 = 360 kac-ft reservoir (no A1 FEB)
  - Same as R360, but reservoir can also serve multiple purposes as identified in CERP Component G

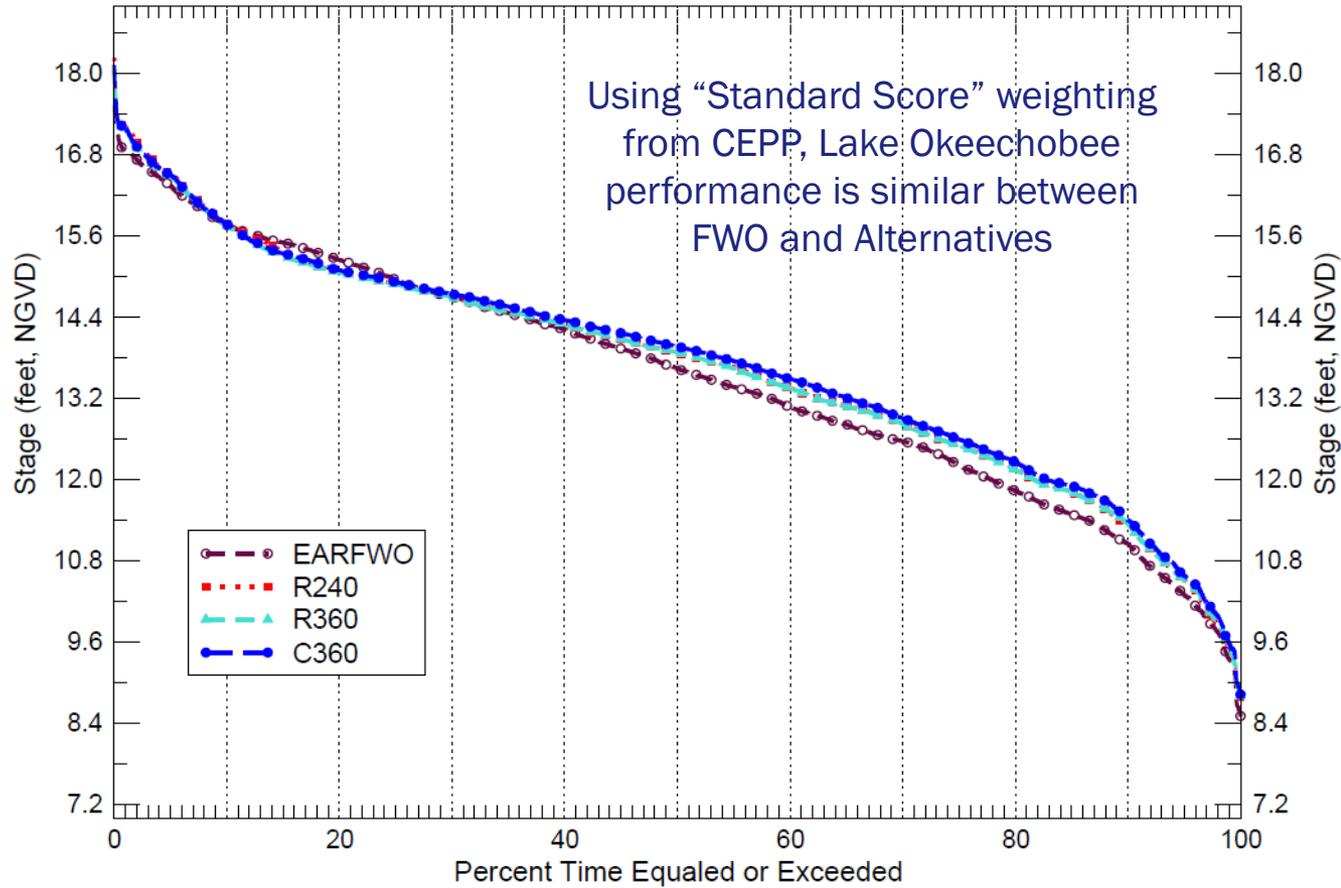
# Example RSM model setup and flow routing diagram for a potential EAA Storage Reservoir concept

Detailed view in the vicinity of the A1 & A2 parcels displayed; does not show entire model domain or study area

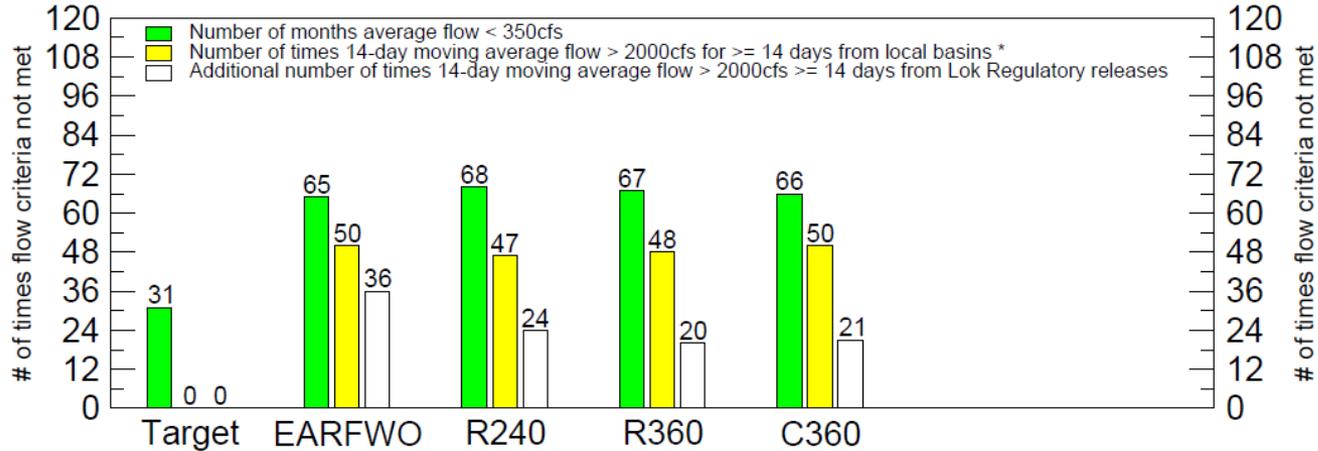




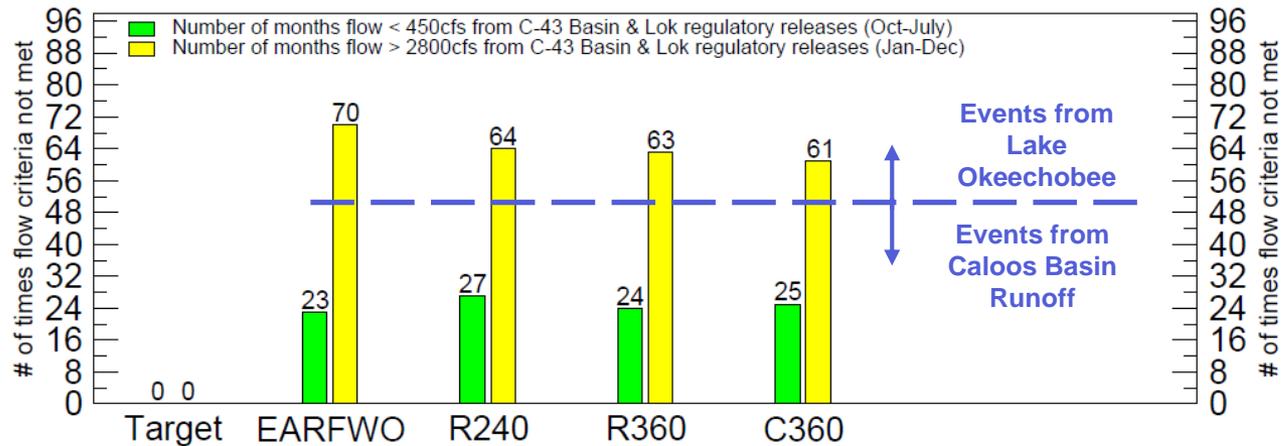
## Stage Duration Curves for Lake Okeechobee



### Number of times Salinity Envelope Criteria NOT Met for the St. Lucie Estuary (mean monthly flows 1965 - 2005)



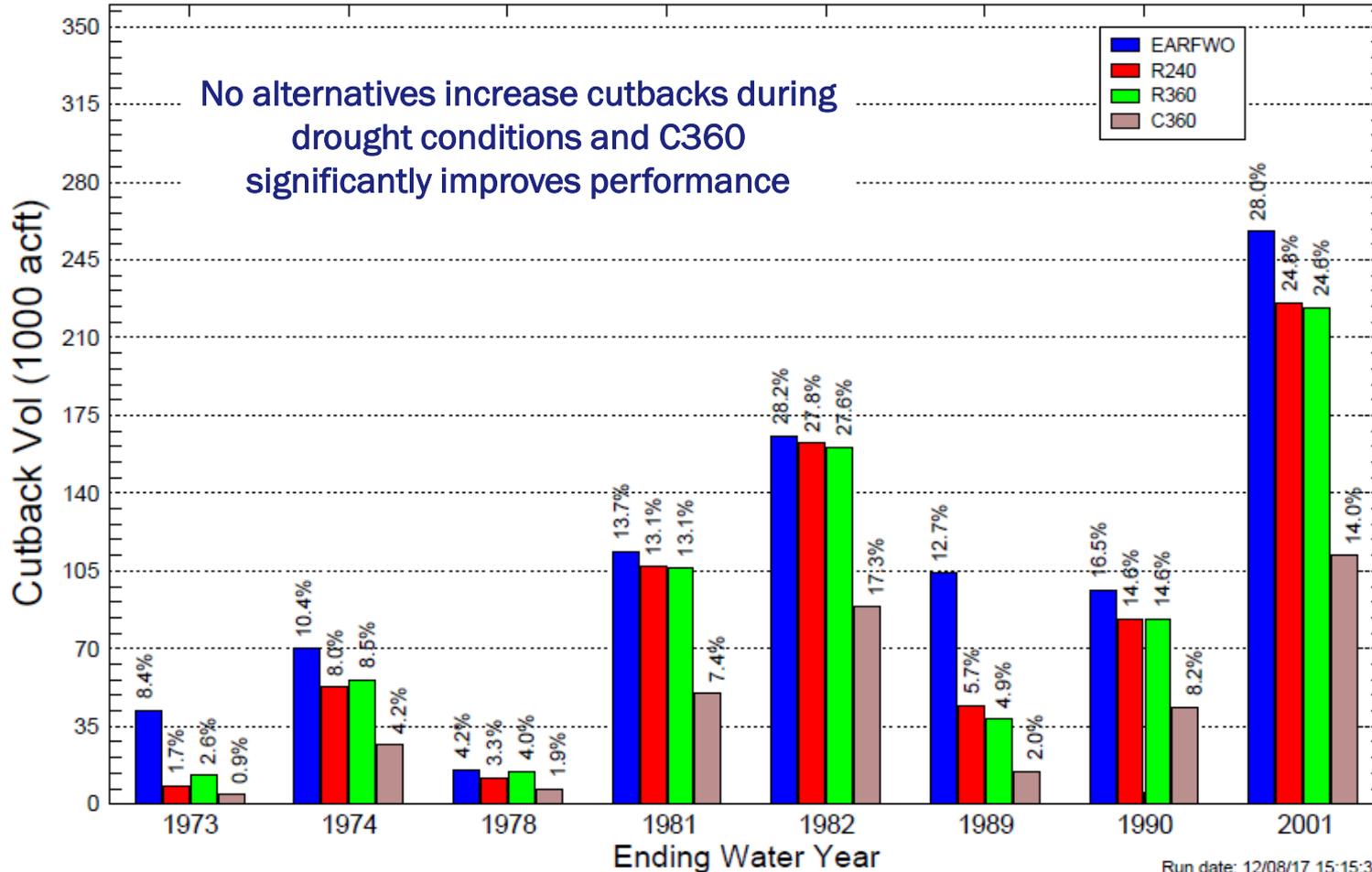
### Number of times Salinity Envelope Criteria NOT Met for the Caloosatchee Estuary (mean monthly flows 1965 - 2005)



All alternatives show reduced number of high discharge events to the Northern Estuaries that are caused by Lake Okeechobee

## Water Year (Oct-Sep) LOSA Demand Cutback Volumes

for the 8 Years in Simulation Period with Largest Cutbacks



Run date: 12/08/17 15:15:39

RSMBN

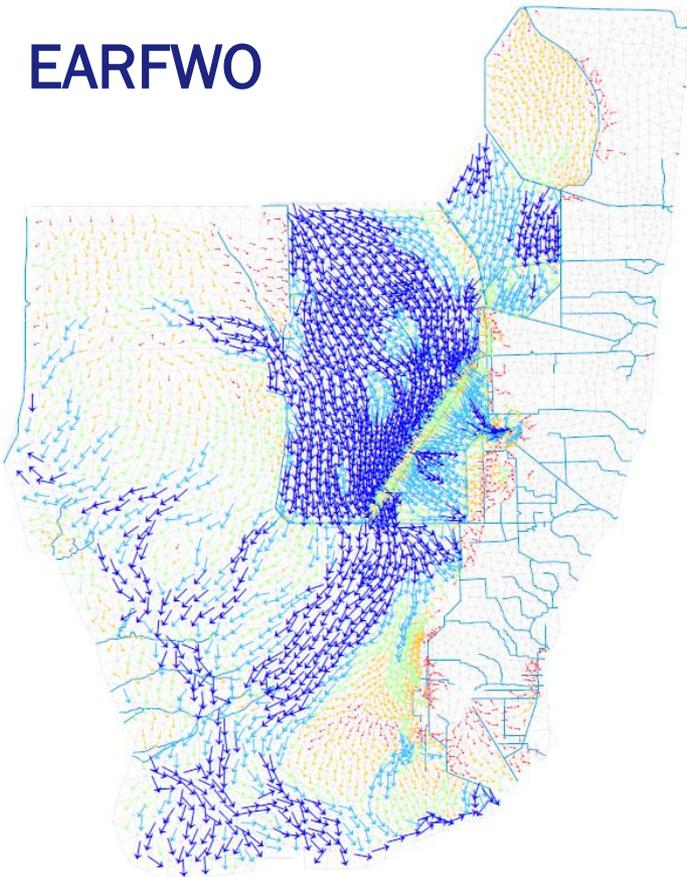
Script used: losa\_cutback\_yrs.scr V370

Filename: losa\_cutback\_yrs\_bar.agr

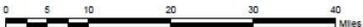


Average Annual Overland Vector  
1965-2005

**EARFWO**

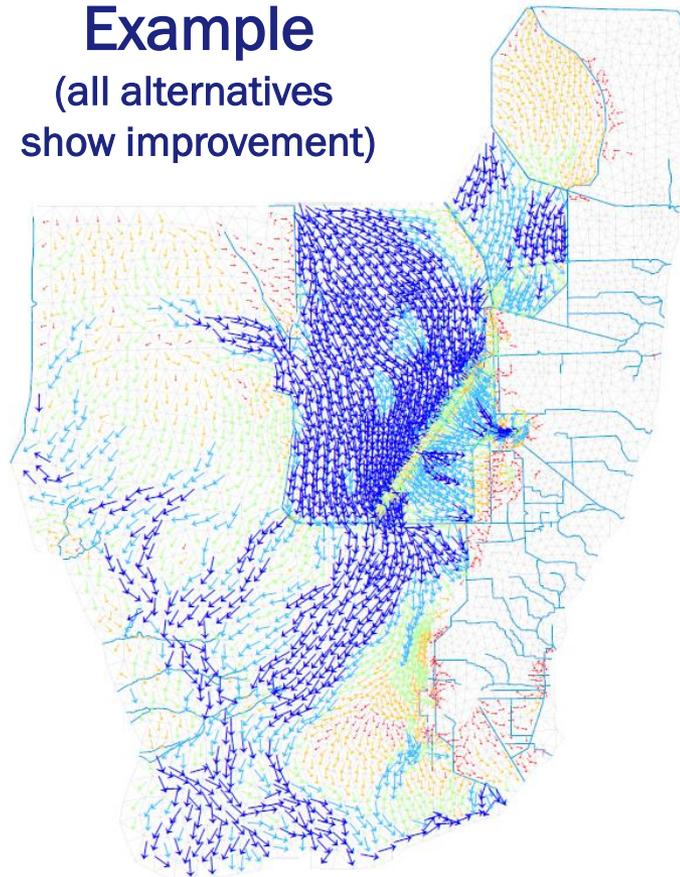


Run Name: R2M9L EARFWO  
Run Date: 2 November 2017



Average Annual Overland Vector  
1965-2005

**Example**  
(all alternatives  
show improvement)



Run Name: R2M9L R360  
Run Date: 14 December 2017



# EAA Storage Reservoir Modeling Data

- Modeling data is available via ftp at:  
<ftp://ftp.sfwmd.gov/pub/EAASR/>

The screenshot shows the website for the EAA Storage Reservoir Project. The header includes the South Florida Water Management District logo and navigation links: Careers, Contact Us, Locations, and a search bar. The main content area features a large heading for the project, a paragraph of introductory text, a map of the project area, and a section titled 'Modeling Results'. The 'Modeling Results' section contains text about the modeling process and two links: 'Modeling Results - Nov. 6, 2017 [FTP]' and 'Instructions for Accessing and Downloading Modeling Files from FTP Site [PDF]'. A blue arrow points from a text box on the right to the 'Modeling Results' section.

Link can also be found on  
[www.sfwmd.gov/EAAsreservoir](http://www.sfwmd.gov/EAAsreservoir)



## Ecological Benefits Expected

- Reduce Lake Okeechobee damaging discharges to the northern estuaries
  - Caloosahatchee and St. Lucie Estuary Flow Targets
- Increase flow to water conservation areas and Everglades National Park
  - Sheetflow in the Ridge and Slough landscape
- Improve wetland hydroperiod
  - Inundation duration in the Ridge and Slough landscape

## Ecological Benefits = Habitat Units (HU)

- USACE process
- Applied nation-wide for National Ecosystem Restoration
- Calculates environmental quality over an area, in acres, to describe environmental lift and to provide a standardized measure to compare alternatives
- Utilizes USACE Ecosystem Planning Center of Expertise approved and certified CEPP Planning Model

# Summary of Performance Measures (CEPP)

Planning Region	Performance Measure	Description
Northern Estuaries	Salinity envelope St. Lucie	Suitability for oyster and submerged aquatic vegetation habitat based on frequency of flows from S-80
	Salinity envelope Caloosahatchee	Suitability for oyster and submerged aquatic vegetation habitat based on frequency of flows from S-79
Greater Everglades	Hydrologic surrogate for soil oxidation	Cumulative drought intensity to reduce exposure of peat to oxidation
	Inundation pattern in Greater Everglades Wetlands	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	Number of times and mean duration in weeks that water drops below ground
	Sheet flow in the Everglades Ridge and Slough Landscape	Timing, distribution and continuity of sheet flow across the landscape
	Slough vegetation suitability	Hydrologic suitability for slough vegetation (hydroperiod, dry-down, dry and wet season depths)
Florida Bay	Salinity in FL Bay (dry and wet season)	Frequency of harmful high salinity and the magnitude of deviation from a pre-drainage salinity targets

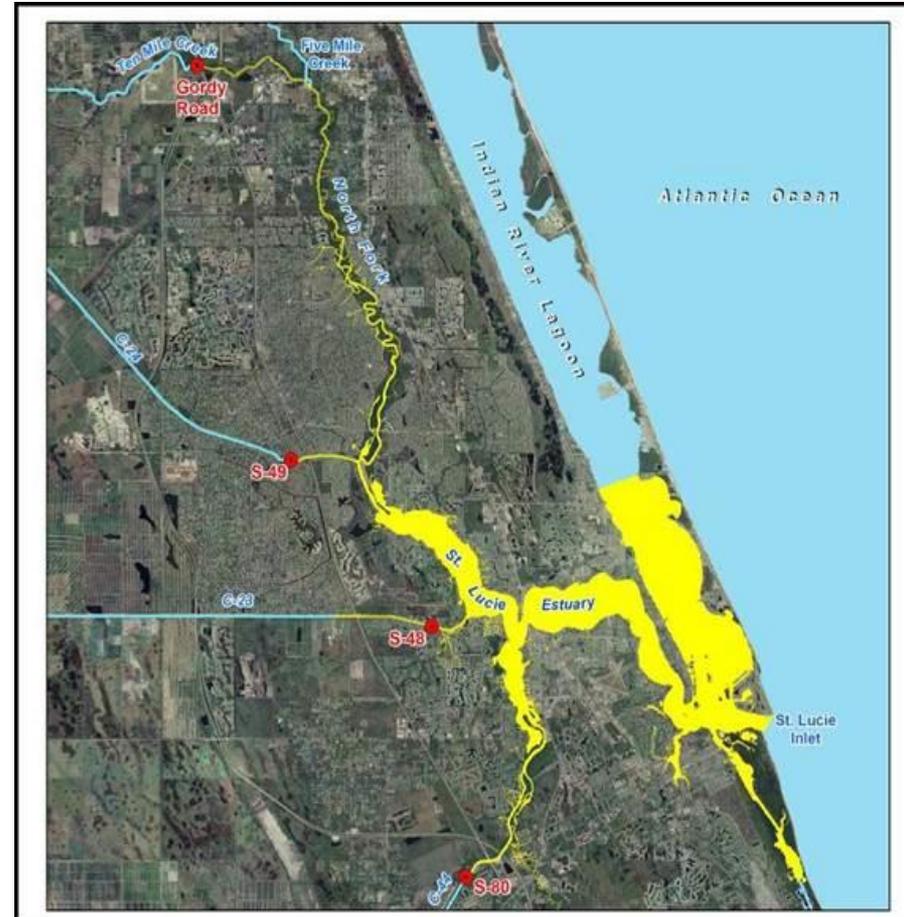
# Habitat Units are a Measure of Ecological Benefits

HABITAT UNITS - USACE Methodology  
Methodology for quantifying ecological benefits on the array of alternatives

## St. Lucie Estuary

14,994 acres

- Maximum acres of habitat impacted by watershed and lake flows based on hydrodynamic salinity models, therefore maximum area of potential improvements from the project



# Habitat Units are a Measure of Ecological Benefits

## HABITAT UNITS - USACE methodology

Methodology for quantifying ecological benefits on the array of alternatives

### Caloosahatchee Estuary

70,979 acres

- Maximum acres of habitat impacted by watershed and lake flows based on hydrodynamic salinity models, therefore maximum area of potential improvements from the project

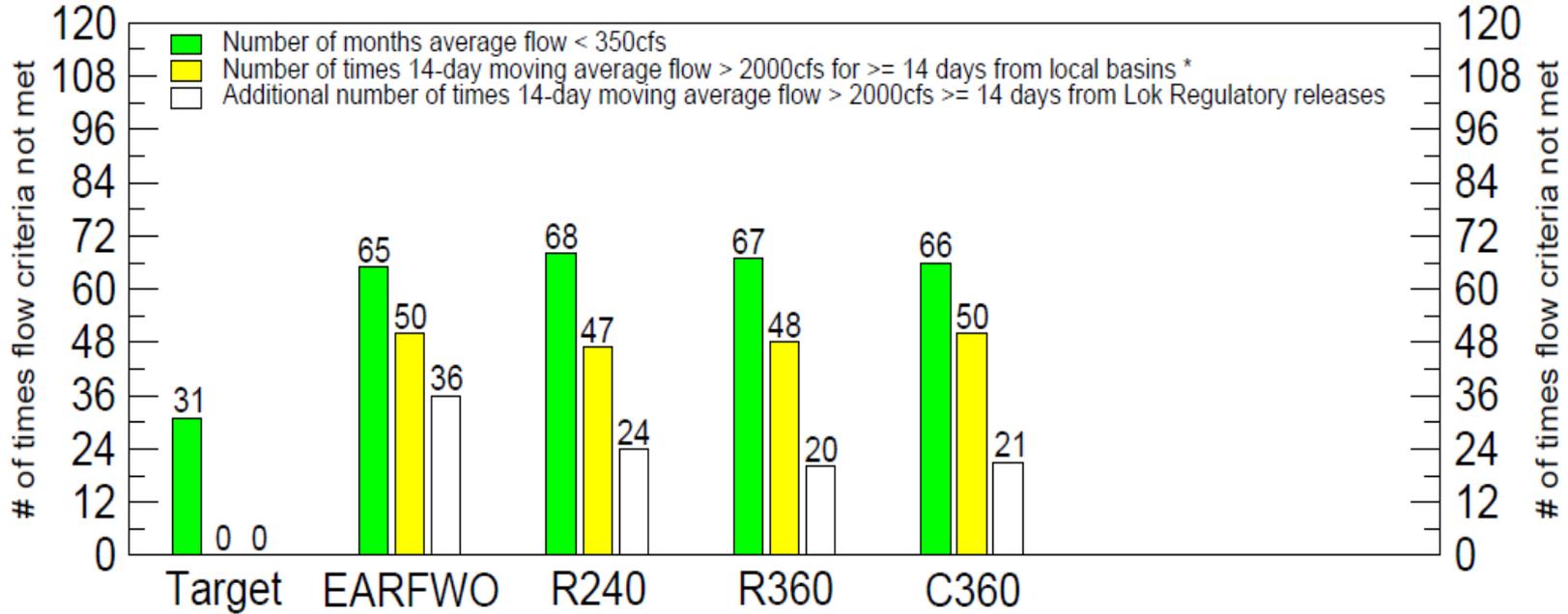




# St. Lucie Estuary Performance Measure

All Alternatives show reduced numbers of high flow discharges as compared to FWO

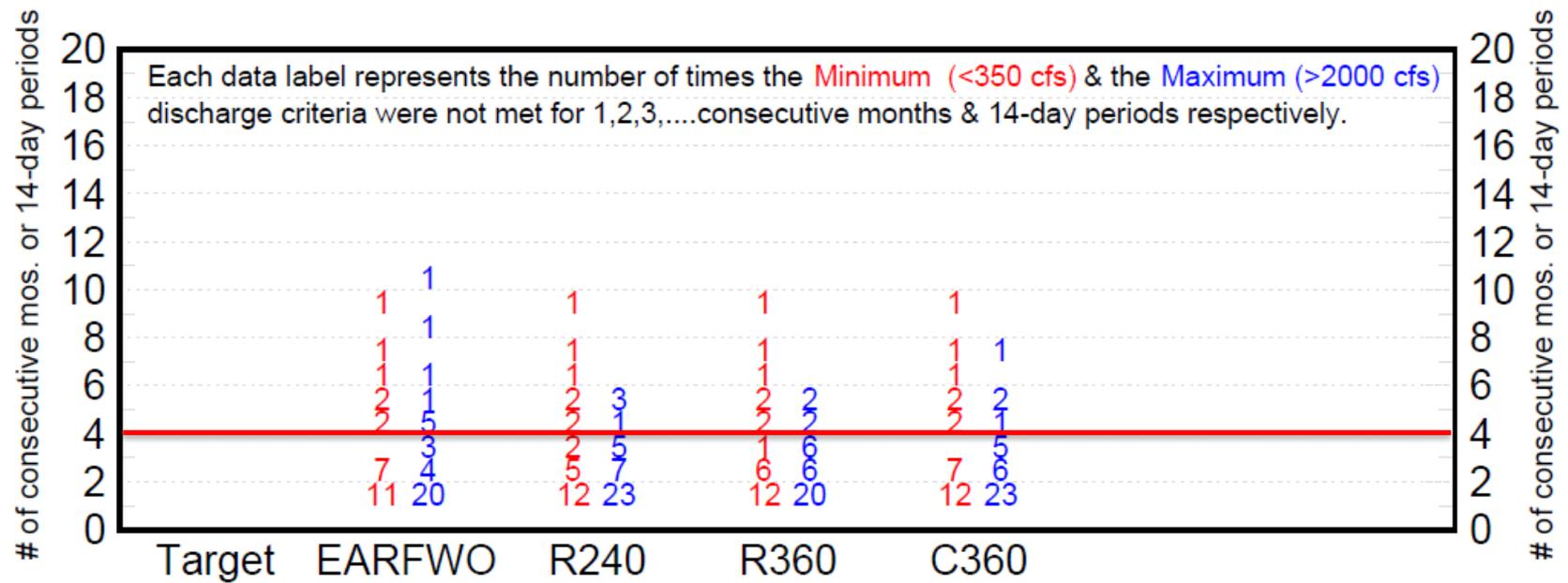
Number of times Salinity Envelope Criteria NOT Met for the St. Lucie Estuary (mean monthly flows 1965 - 2005)





# St. Lucie Estuary Performance Measure

Discharges > 2000 cfs for >42 consecutive days (3 back to back 14 day periods) reduced from 9 events in FWO to 4 events in all alternatives

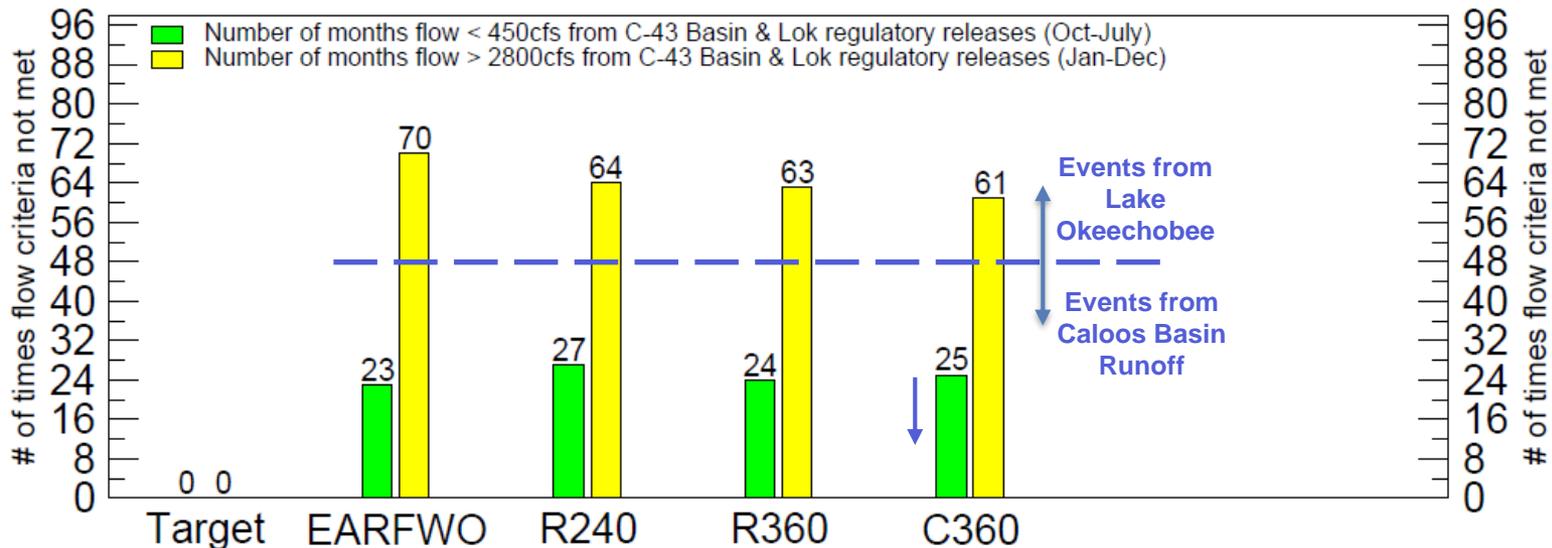




# Caloosahatchee Estuary Performance Measure

All Alternatives show reduced number of high flow discharges as compared to FWO

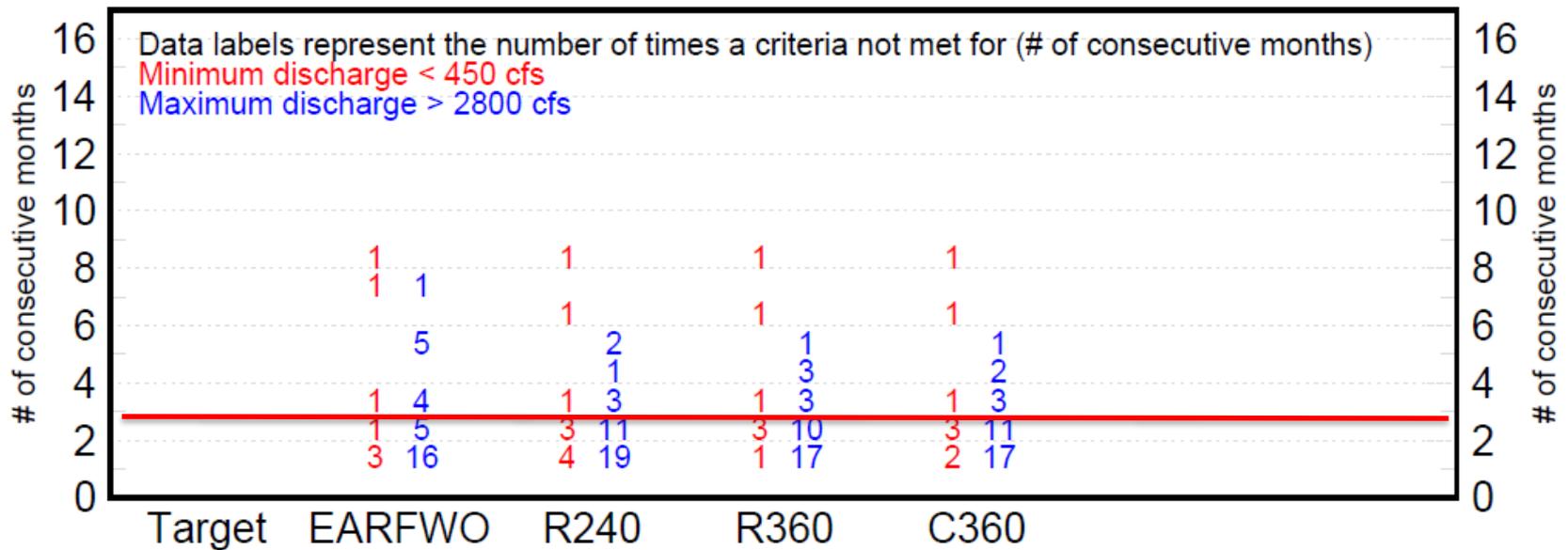
Number of times Salinity Envelope Criteria NOT Met for the Caloosahatchee Estuary (mean monthly flows 1965 - 2005)





# Caloosahatchee Estuary Performance Measure

Discharges >2800 cfs for 60 consecutive days reduced from 9 in FWO to 6-7 events in all Alternatives



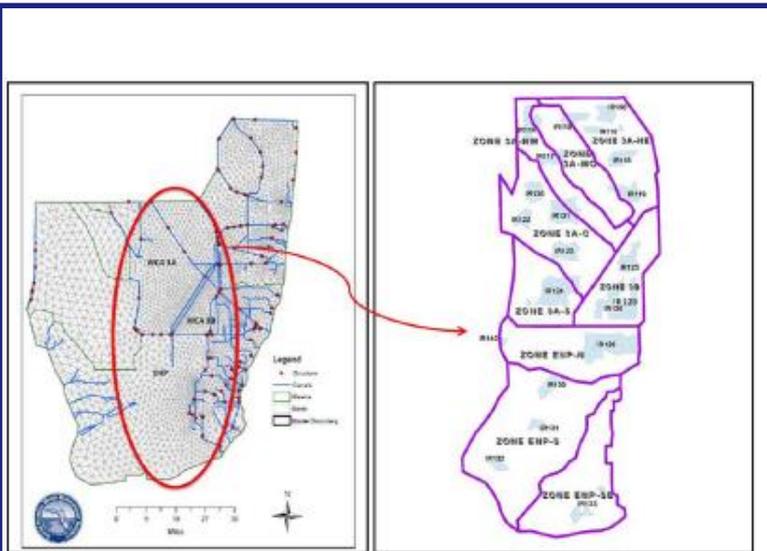


# Northern Estuaries Habitat Units

NE Habitat Units	Modeling Scenarios				
Project Region (Zone)	Existing Condition	FWO	R240	R360	C360
Caloosahatchee Estuary (CE-1)	2,839	39,038	40,458	41,168	41,878
St Lucie Estuary (SE-1)	1,349	8,247	8,996	9,446	9,446
<b>Total Northern Estuaries</b>	<b>4,188</b>	<b>47,285</b>	<b>49,454</b>	<b>50,614</b>	<b>51,324</b>

# Northern Estuaries Habitat Unit Lift

NE Habitat Units	Modeling Scenarios		
HU Lift Project Region (Zone)	R240	R360	C360
Caloosahatchee Estuary (CE-1)	+1,420	+2,130	+2,840
St Lucie Estuary (SE-1)	+749	+1,199	+1,199
<b>Total Northern Estuaries</b>	<b>+2,169</b>	<b>+3,329</b>	<b>+4,039</b>



## RSM Model Mesh

RSM Zones:

- 3A-NE
- 3A-NW
- 3A-MC
- 3A-C
- 3A-S
- 3B
- ENP-N
- ENP-S
- ENP-SE

HABITAT UNITS - USACE methodology  
Methodology for quantifying ecological benefits on the array of alternatives

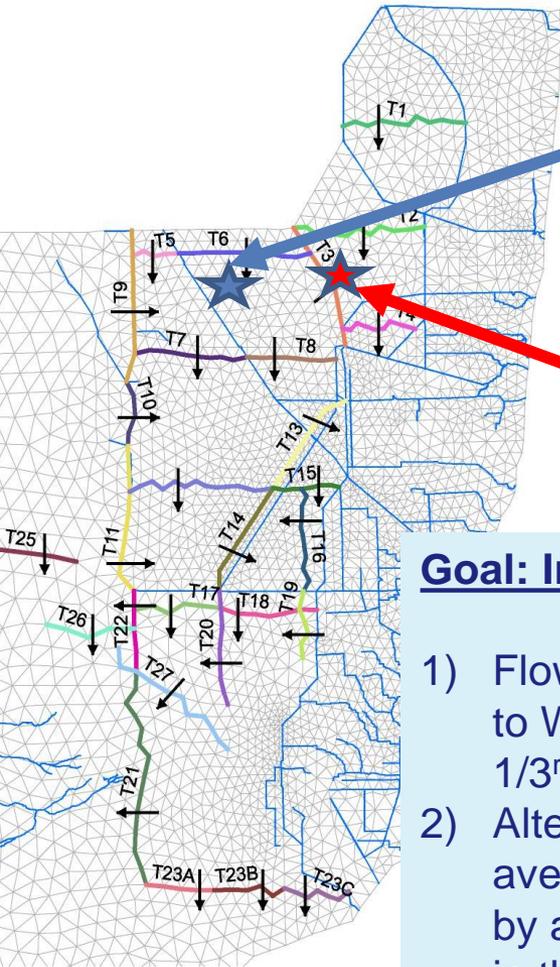
## Greater Everglades Indicator Regions, Zones and Transects

1,076,248 acres

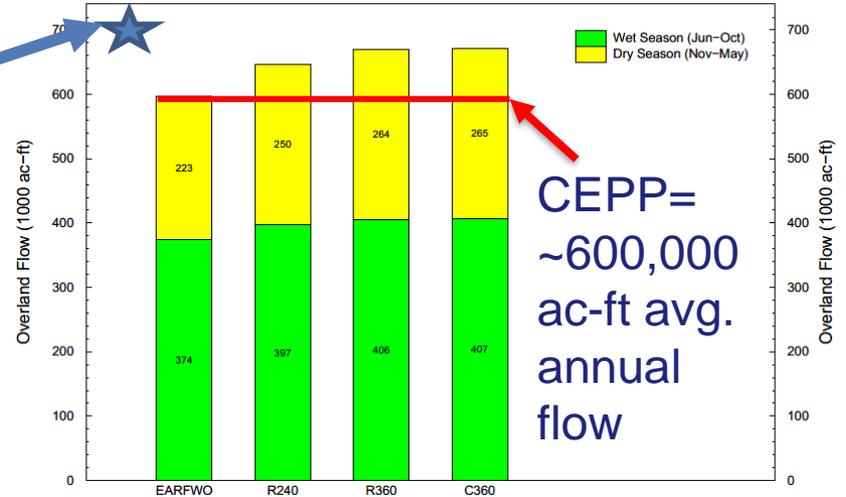
Indicator region - Depth, distribution and duration of surface flooding

Transects - timing and distribution of flows

# Transect Flows: Downstream of the "redline"

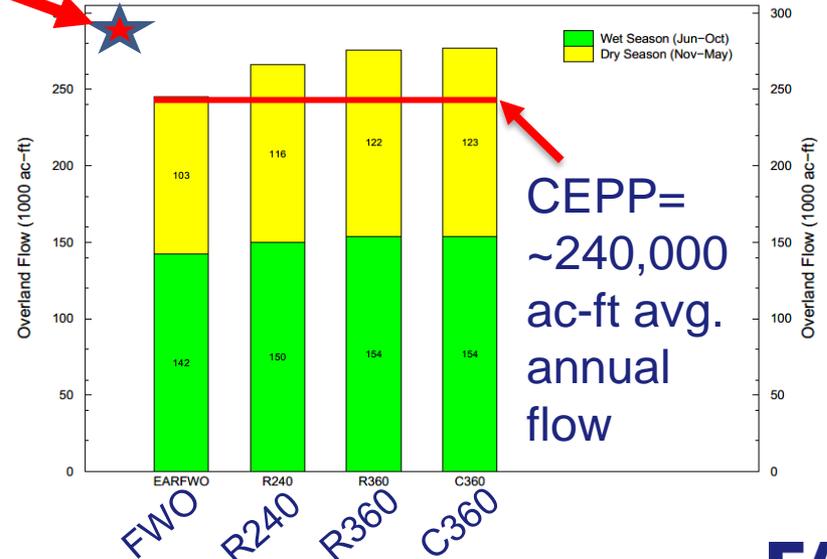


**Average Annual Overland Flow across Transect 5**  
Southward flows in Northern WCA-3A (west of Miami Canal)



CEPP=  
~600,000  
ac-ft avg.  
annual  
flow

**Average Annual Overland Flow across Transect 6**  
Southward flows in Northern WCA-3A (east of Miami Canal)

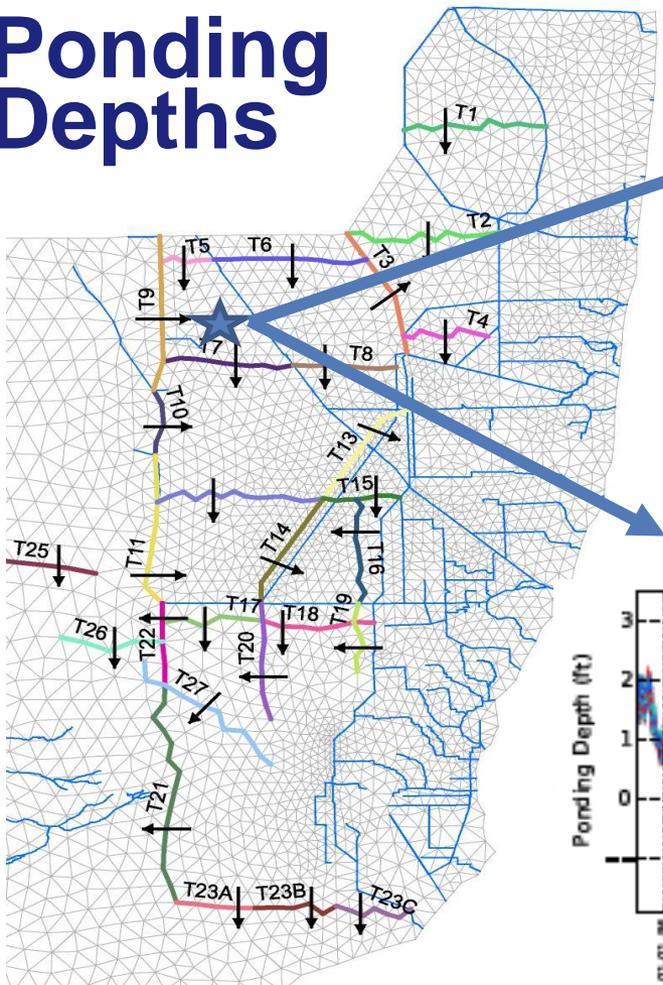


CEPP=  
~240,000  
ac-ft avg.  
annual  
flow

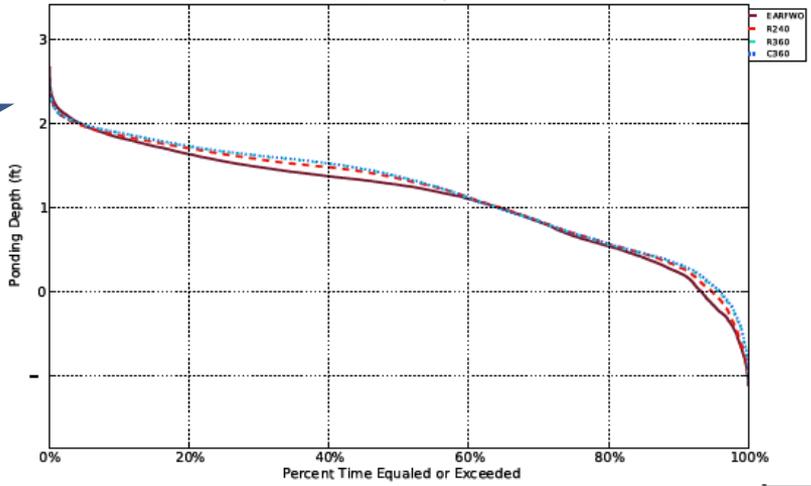
## Goal: Increase Flows

- 1) Flows distributed 2/3<sup>rd</sup> to WCA 3A-NW and 1/3<sup>rd</sup> to WCA 3A-NE
- 2) Alternatives increase average annual flows by approx. 66,000 ac-ft in the NW and 28,000 ac-ft in the NE.

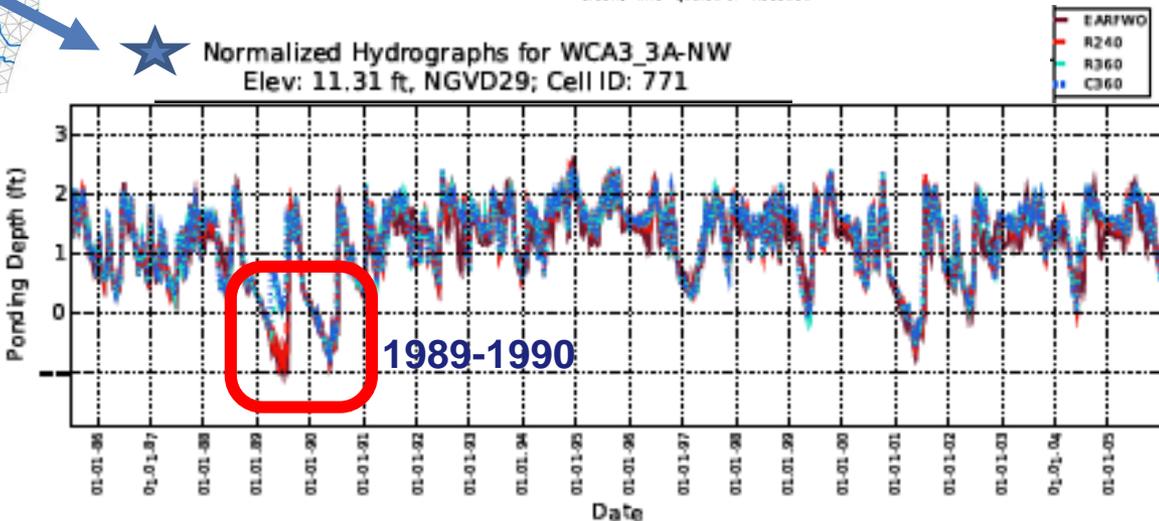
# Ponding Depths



Normalized Duration Curves for WCA3\_3A-NW  
Elev: 11.31 ft, NGVD29; Cell ID: 771

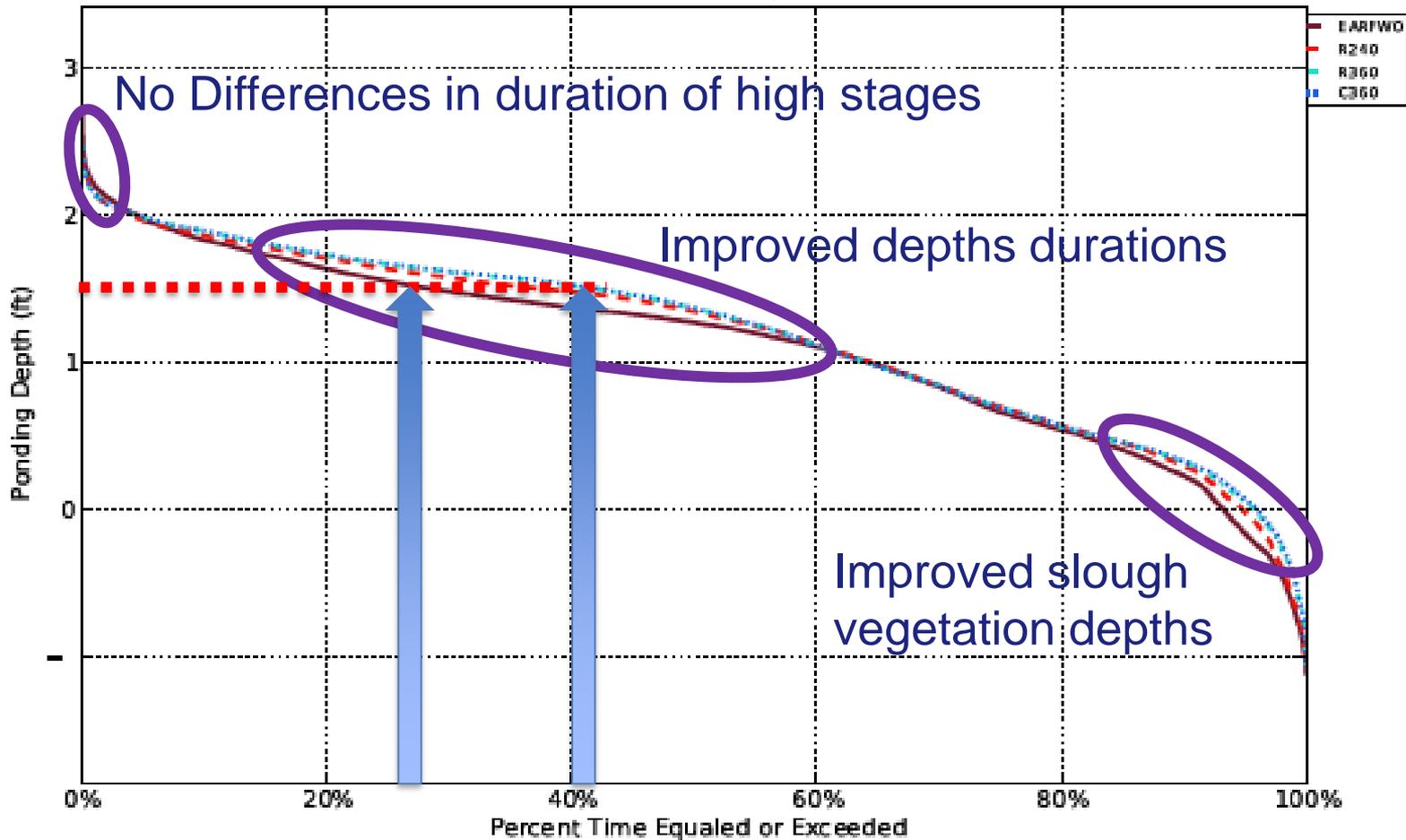


Normalized Hydrographs for WCA3\_3A-NW  
Elev: 11.31 ft, NGVD29; Cell ID: 771

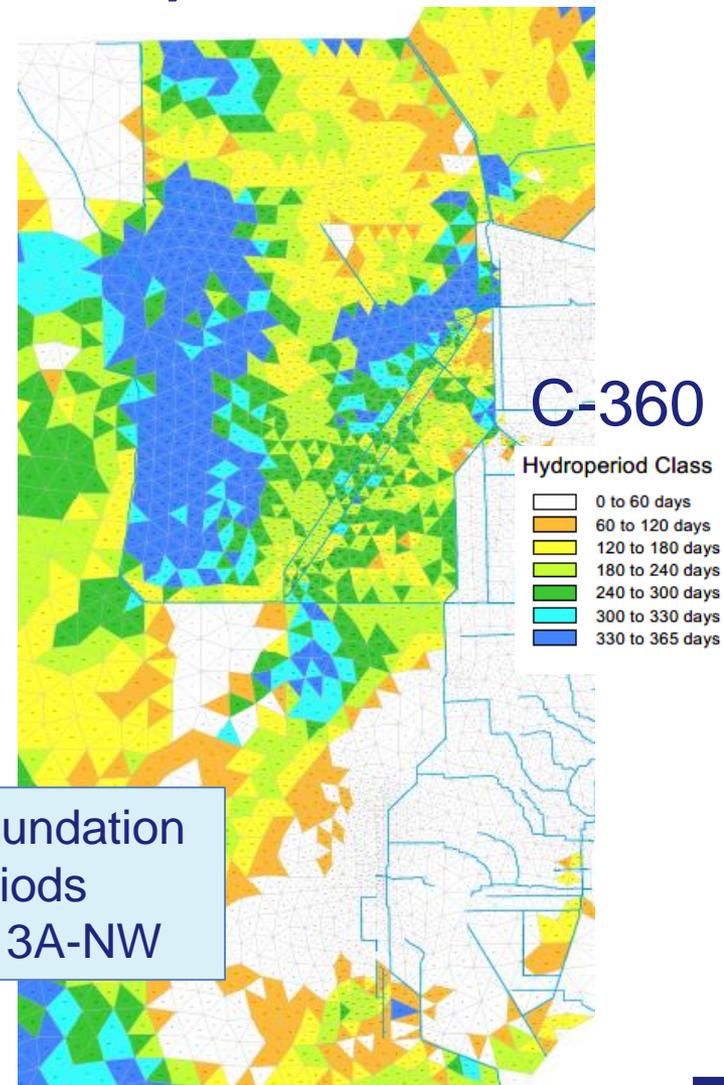
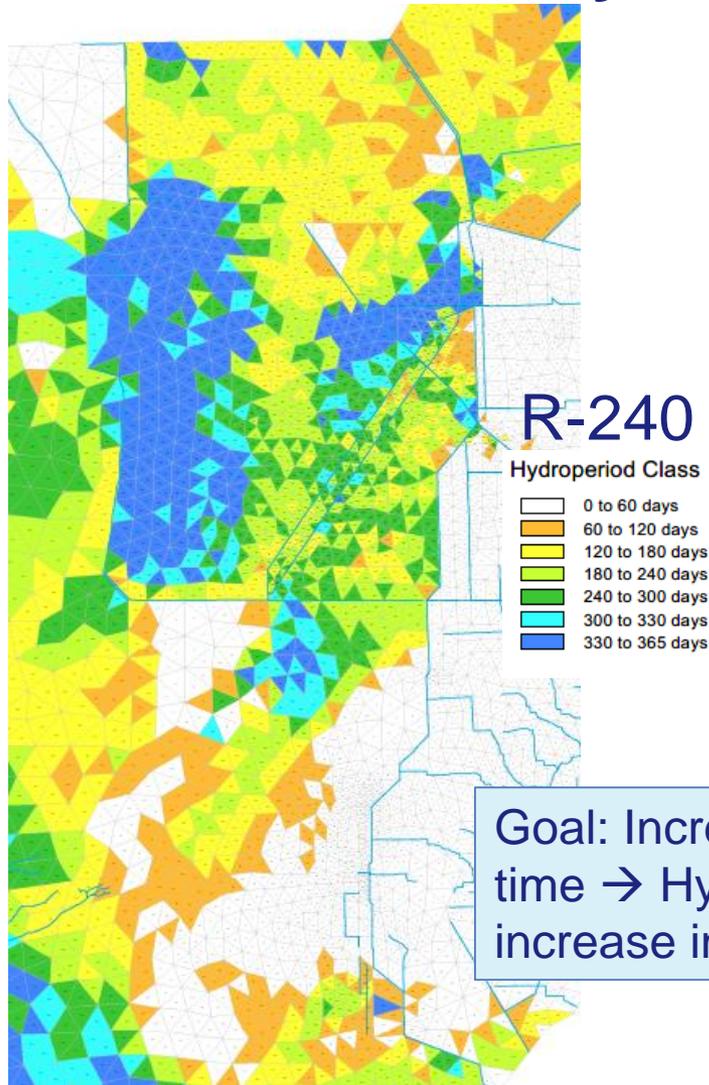


# WCA 3A-NW

Normalized Duration Curves for WCA3\_3A-NW  
 Elev: 11.31 ft, NGVD29; Cell ID: 771



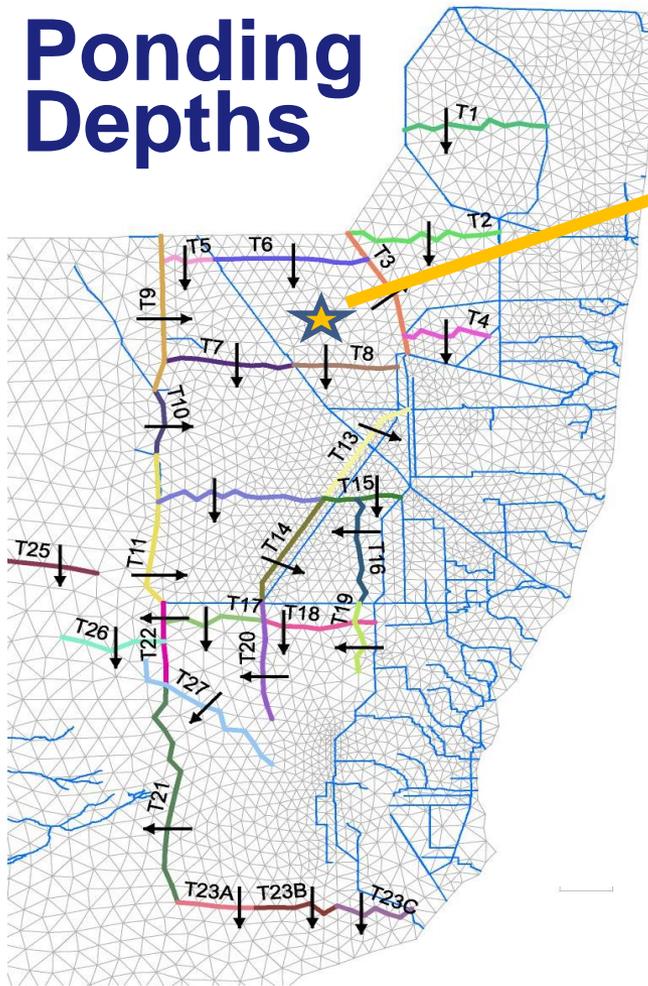
# Hydroperiod Performance Measure Dry Year (1989)



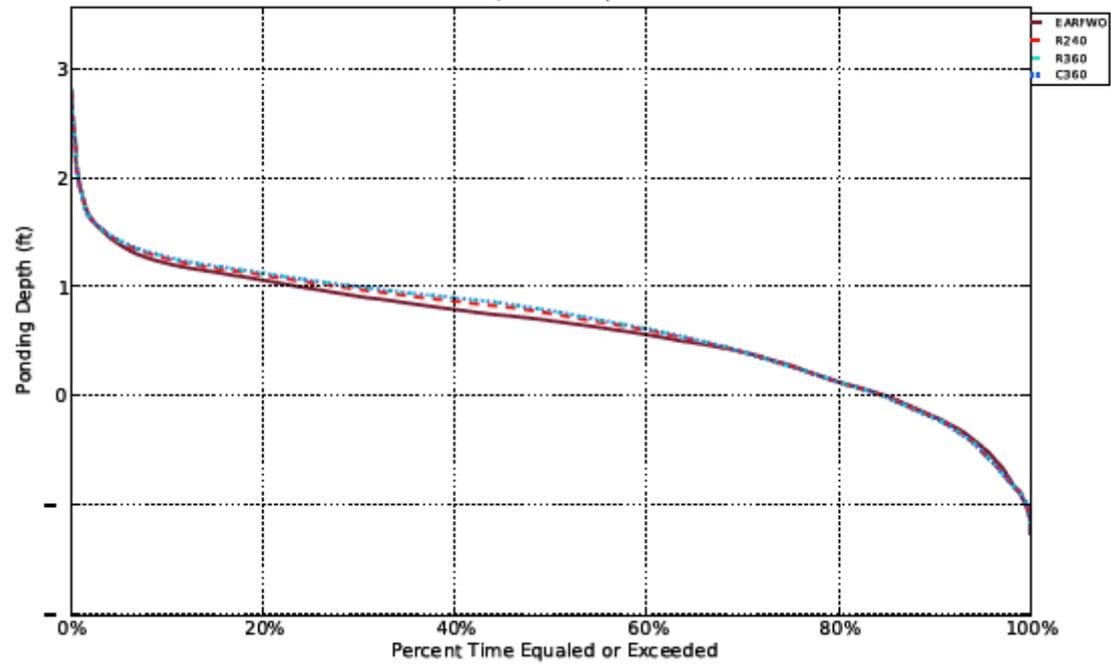
Goal: Increase inundation time → Hydroperiods increase in WCA 3A-NW

# Ponding Depths

## 1965-2005 Depth Duration Curve for WCA 3A-NE



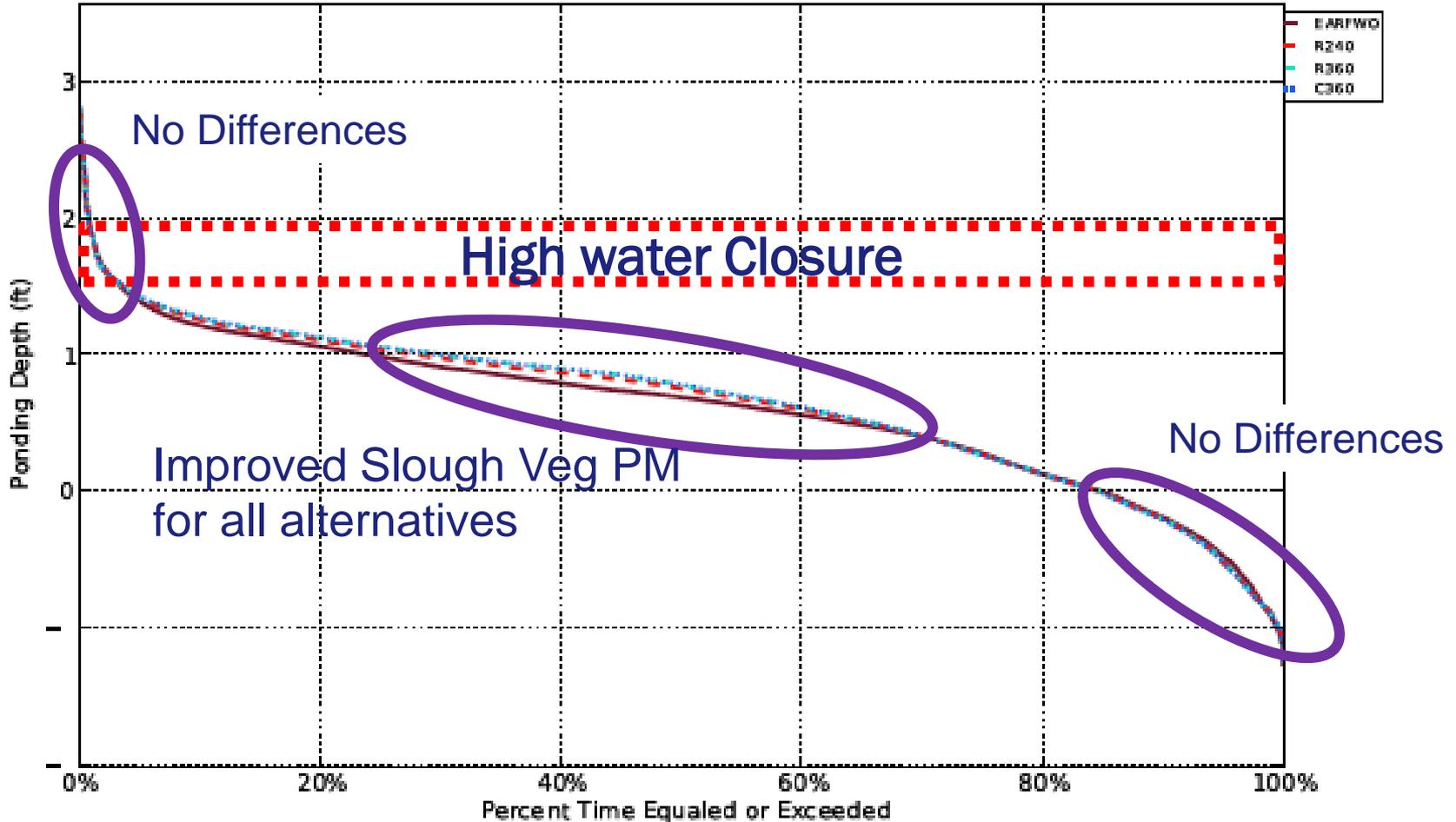
Normalized Duration Curves for WCA3\_3A-NE  
Elev: 10.30 ft, NGVD29; Cell ID: 1392



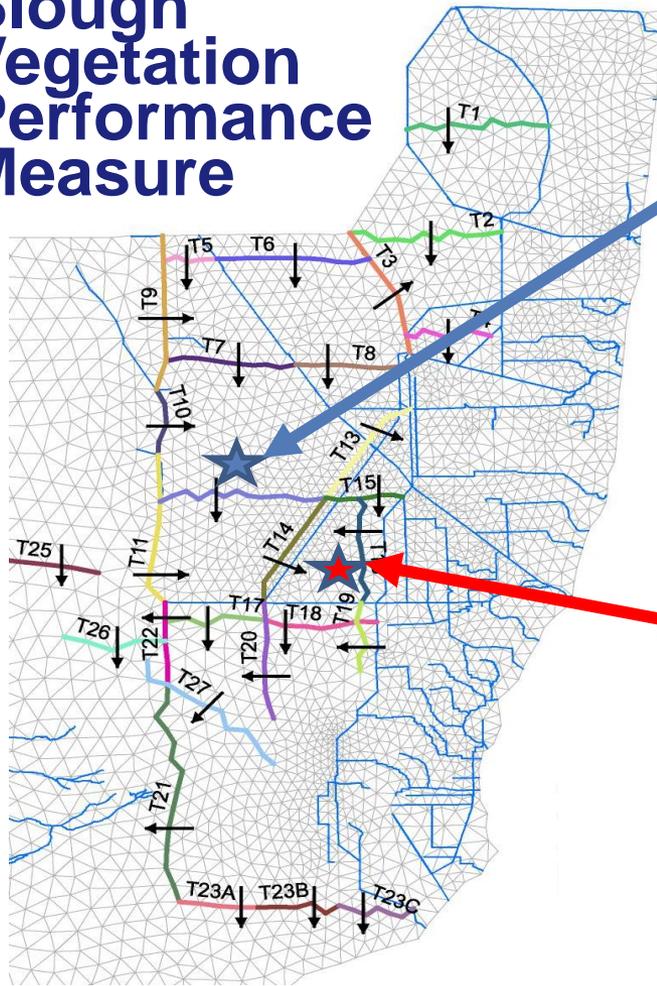
# Stage Duration

Normalized Duration Curves for WCA3\_3A-NE  
 Elev: 10.30 ft, NGVD29; Cell ID: 1392

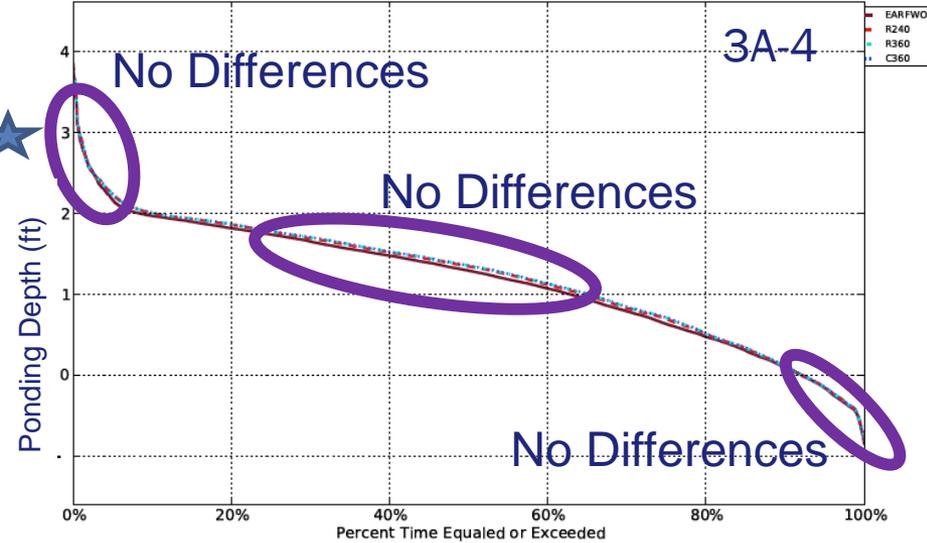
# WCA 3A-NE



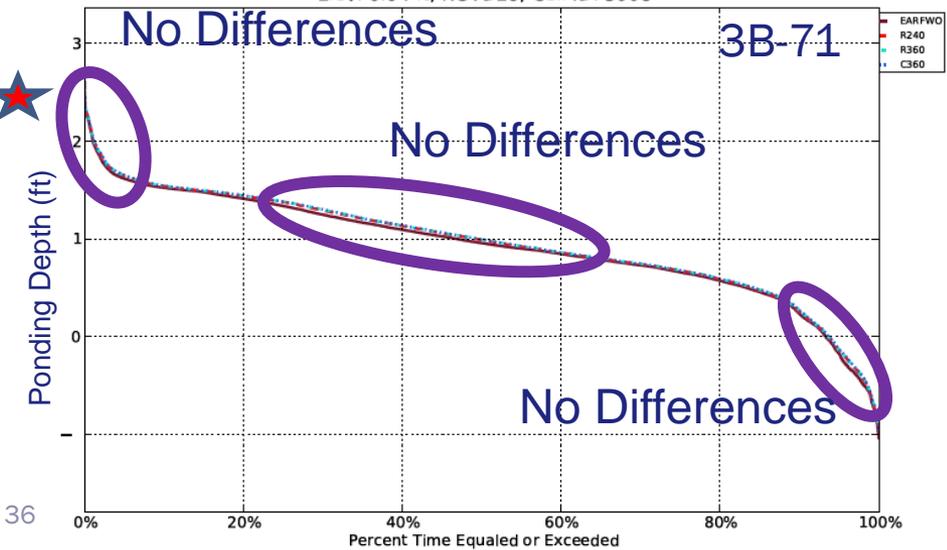
# Slough Vegetation Performance Measure



Normalized Duration Curves for WCA3\_3A-4  
Elev: 8.49 ft, NGVD29; Cell ID: 1351

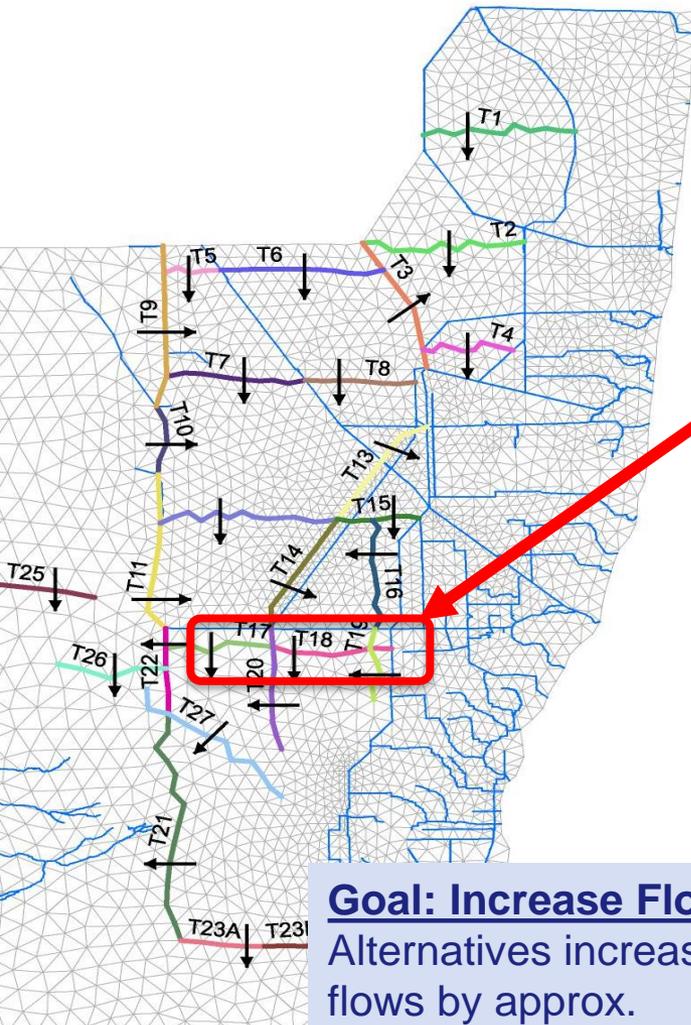


Normalized Duration Curves for WCA3\_3B-71  
Elev: 6.64 ft, NGVD29; Cell ID: 3008

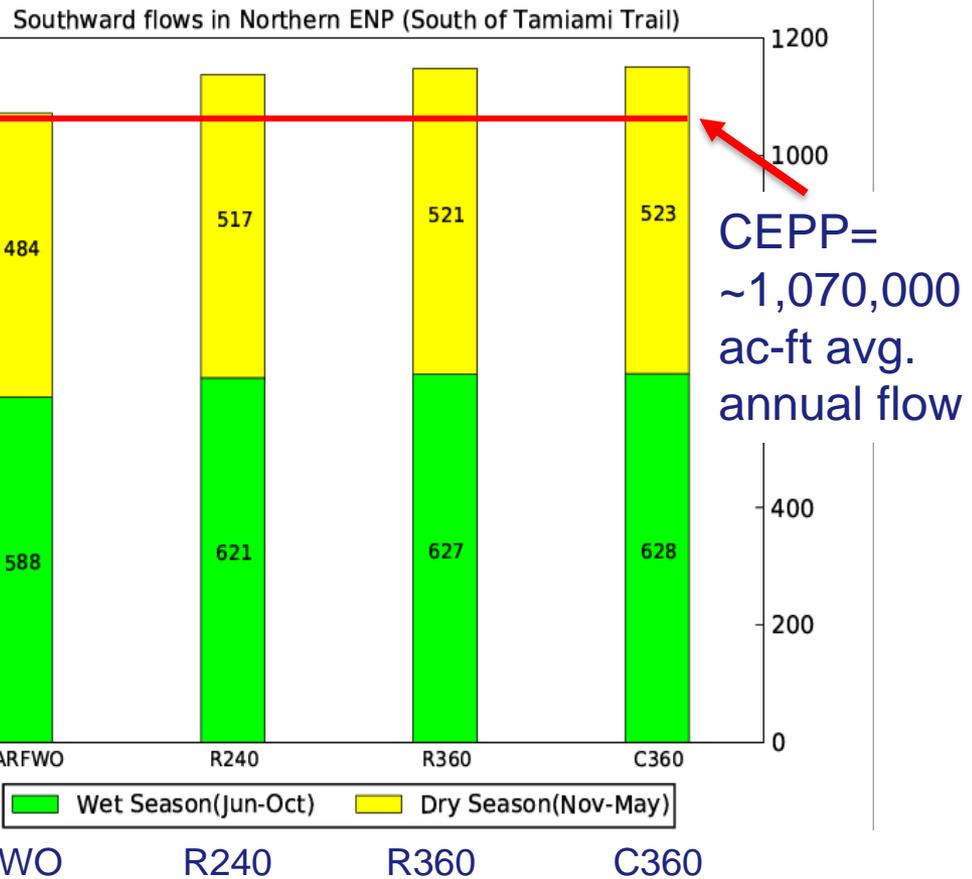


# Transect Flows: Downstream of the “blue line”

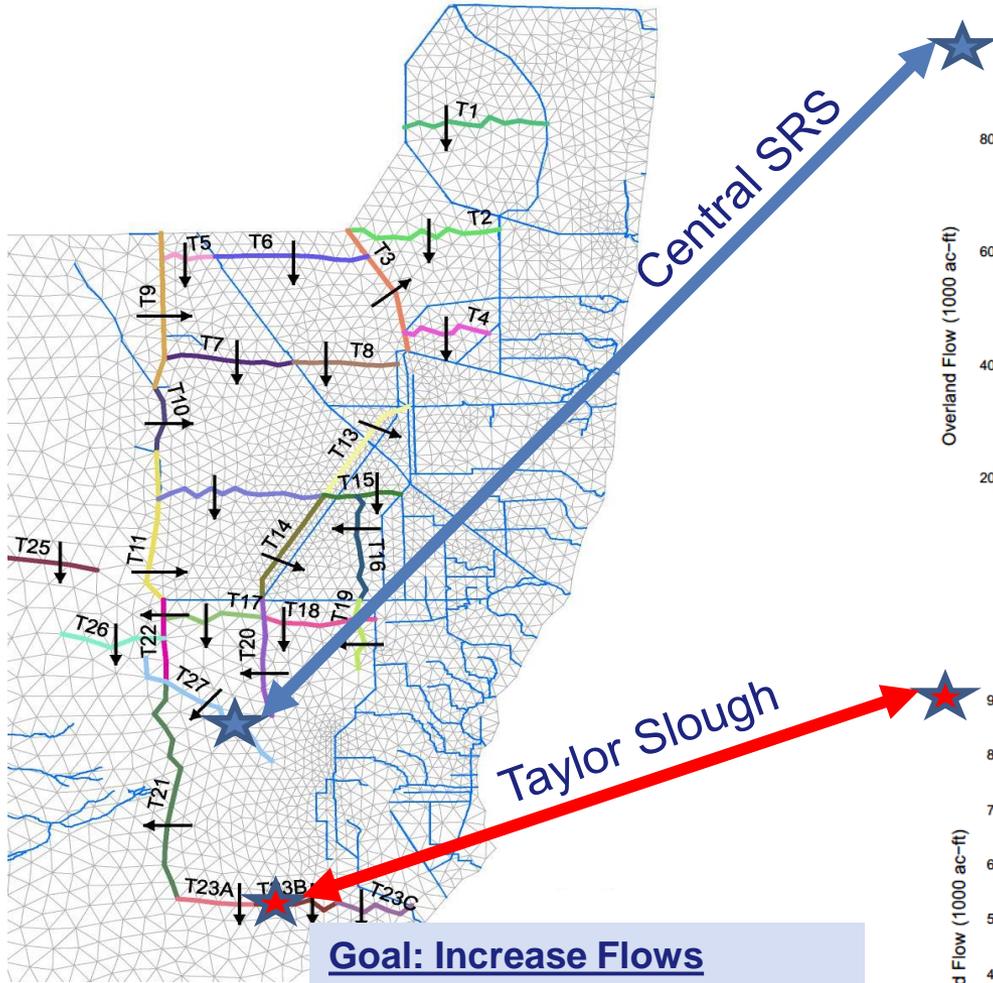
## Overland Average Flow Across Tamiami Trail 1965-2005



**Goal: Increase Flows**  
 Alternatives increase flows by approx. 74,000 ac-ft avg. annual flow

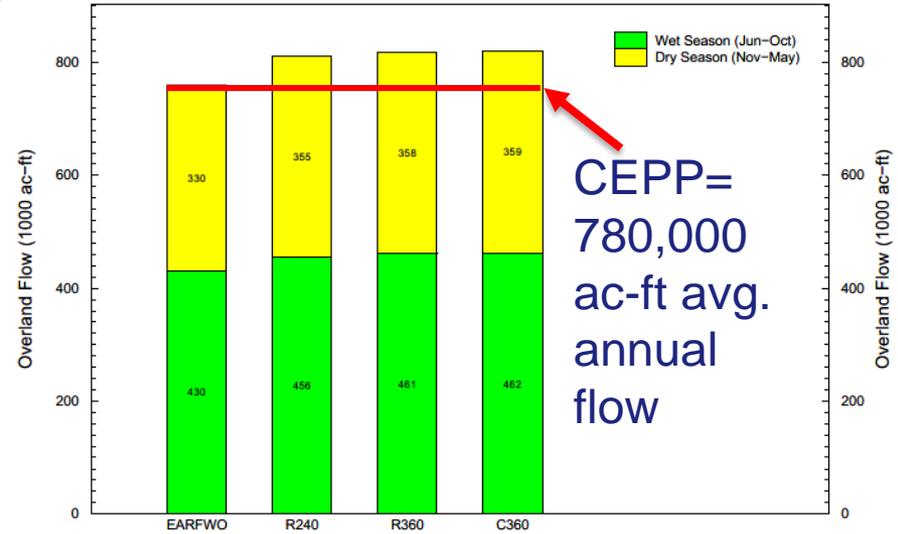


# Transect Flows: Downstream of the "blue line"

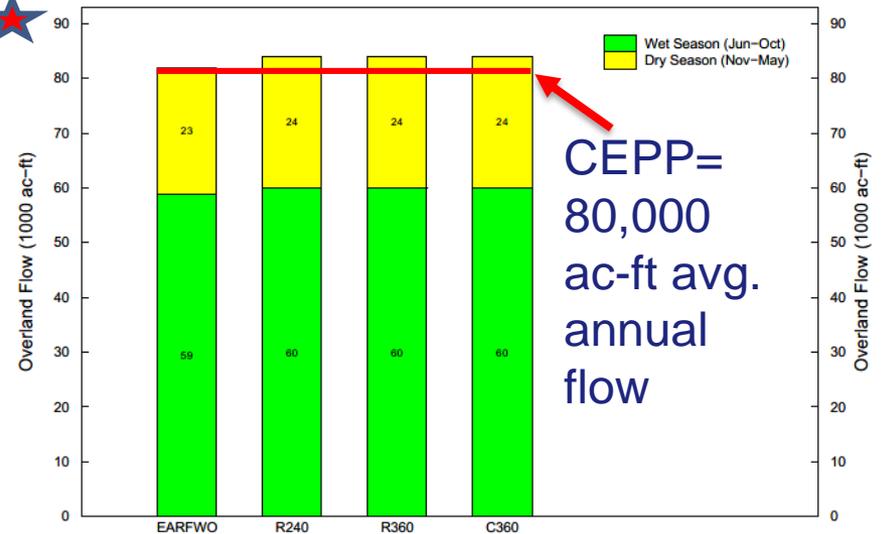


**Goal: Increase Flows**  
 Alternatives increase average annual flows by approx. 57,000 ac-ft in Central SRS and 2,000 ac-ft in Taylor Slough.

**Average Annual Overland Flow across Transect 27**  
 Southwestward flow in Central Shark River Slough



**Average Annual Overland Flow across Transect 23B**  
 Southward flow in Southern ENP (Taylor Slough)



# Greater Everglades Habitat Units

GE Habitat Units	Modeling Scenarios				
Project Region (Zone)	Existing Condition	FWO	R240	R360	C360
Northeast WCA 3A (3A-NE)	44,451	91,372	91,372	92,606	92,606
WCA 3A Miami Canal (3A-MC)	32,847	54,746	56,310	56,310	56,310
Northwest WCA 3A (3A-NW)	30,970	54,198	55,606	55,606	55,606
Central WCA 3A (3A-C)	108,414	111,159	111,159	111,159	111,159
Southern WCA 3A (3A-S)	69,247	68,423	69,247	69,247	69,247
WCA 3B (3B)	55,697	59,125	59,982	59,982	59,982
Northern ENP (ENP-N)	57,557	97,596	100,098	100,098	100,098
Southern ENP (ENP-S)	124,068	169,400	171,786	174,172	174,172
Southeast ENP (ENP-SE)	79,711	83,764	83,764	83,764	83,764
<b>Total Greater Everglades</b>	<b>602,962</b>	<b>789,783</b>	<b>799,324</b>	<b>802,944</b>	<b>802,944</b>

# Greater Everglades Habitat Unit Lift

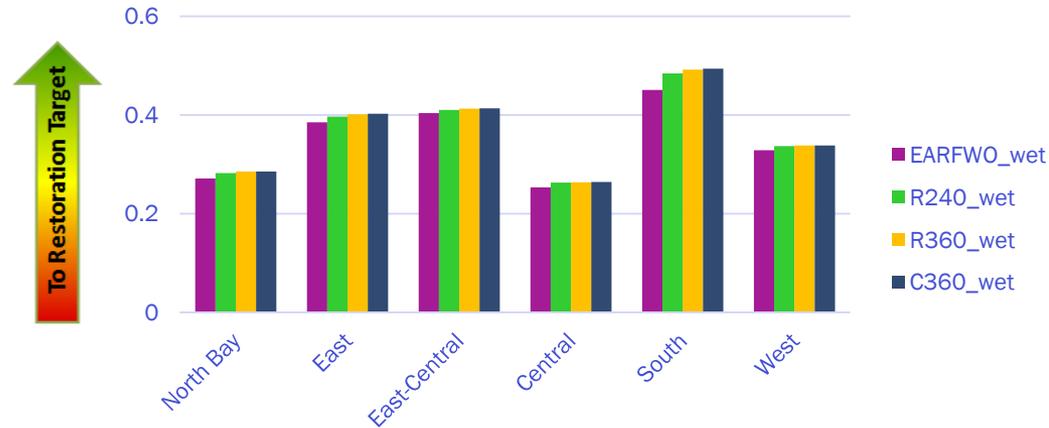
GE Habitat Units	Modeling Scenarios		
Project Region (Zone)	R240	R360	C360
Northeast WCA 3A (3A-NE)	0	+1,234	+1,234
WCA 3A Miami Canal (3A-MC)	+1,564	+1,564	+1,564
Northwest WCA 3A (3A-NW)	+1,408	+1,408	+1,408
Central WCA 3A (3A-C)	0	0	0
Southern WCA 3A (3A-S)	+824	+824	+824
WCA 3B (3B)	+857	+857	+857
Northern ENP (ENP-N)	+2,502	+2,502	+2,502
Southern ENP (ENP-S)	+2,386	+4,772	+4,772
Southeast ENP (ENP-SE)	0	0	0
<b>Total Greater Everglades</b>	<b>+9,541</b>	<b>+13,161</b>	<b>+13,161</b>

# Florida Bay: Max Salinity Perf. Measure (0-1 Scale)

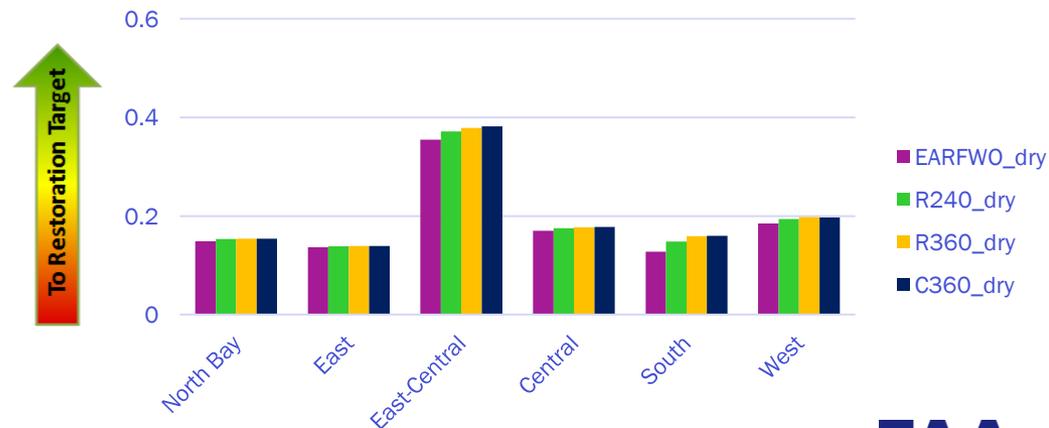
## Florida Bay Performance Measure Zones



Florida Bay Wet Season Salinity: High Salinity Frequency



Florida Bay Dry Season Salinity: High Salinity Frequency



# Florida Bay Habitat Units

FB Habitat Units	Modeling Scenarios				
Project Region (Zone)	Existing Condition	FWO	R240	R360	C360
Florida Bay West (FB-W)	23,700	41,100	44,200	44,200	44,200
Florida Bay Central (FB-C)	8,200	13,950	15,600	15,600	15,600
Florida Bay South (FB-S)	16,600	28,300	30,300	30,300	30,300
Florida Bay East Central (FB-EC)	22,000	34,300	36,100	36,900	36,900
Florida Bay North Bay (FB-NB)	2,150	2,660	2,790	2,790	2,790
Florida Bay East (FB-E)	9,060	9,820	10,200	10,200	10,200
<b>Total Florida Bay</b>	<b>81,700</b>	<b>130,100</b>	<b>139,000</b>	<b>140,000</b>	<b>140,000</b>

Note: Florida Bay Habitat Unit modeling performed by Everglades National Park

# Florida Bay Habitat Unit Lift

FB Habitat Units	Modeling Scenarios		
Project Region (Zone)	R240	R360	C360
Florida Bay West (FB-W)	+3,100	+3,100	+3,100
Florida Bay Central (FB-C)	+1,650	+1,650	+1,650
Florida Bay South (FB-S)	+2,000	+2,000	+2,000
Florida Bay East Central (FB-EC)	+1,800	+2,600	+2,600
Florida Bay North Bay (FB-NB)	+130	+130	+130
Florida Bay East (FB-E)	+380	+380	+380
<b>Total Florida Bay</b>	<b>+9,100</b>	<b>+9,900</b>	<b>+9,900</b>

## Habitat Unit Lift Summary above FWO

Regions	Modeling Scenarios		
Project Region (Zone)	R240	R360	C360
Northern Estuaries	2,169	3,329	4,039
Greater Everglades	9,541	13,161	13,161
Florida Bay	9,100	9,900	9,900
<b>Total Habitat Unit Lift</b>	<b>20,810</b>	<b>26,390</b>	<b>27,100</b>

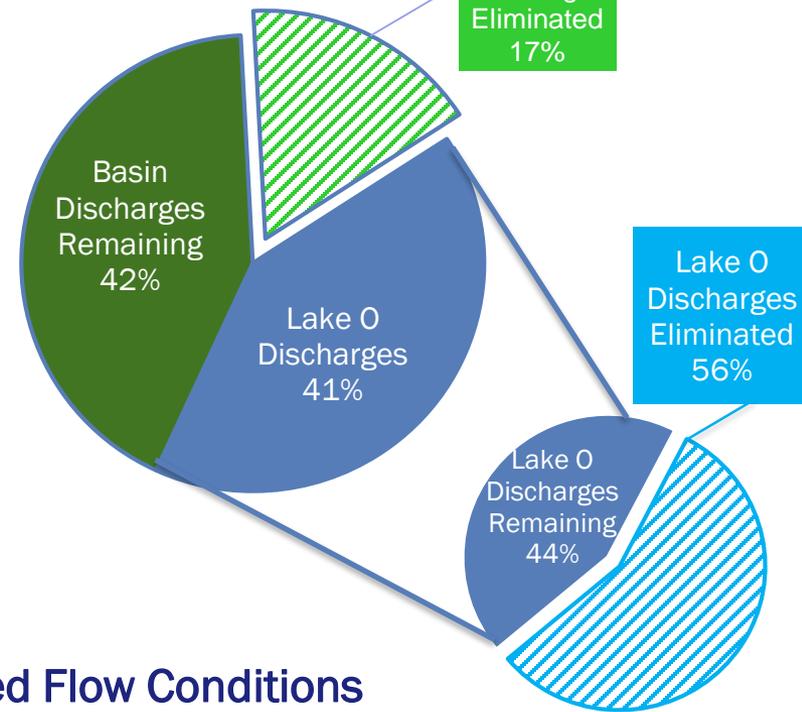
# Alternative R240A



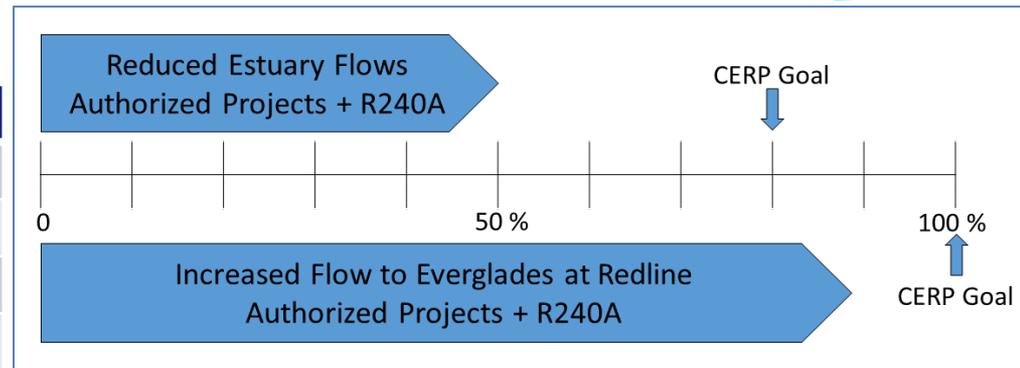
- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements

Region	R240 Habitat Unit Lift
Northern Estuaries	2,169
Greater Everglades	9,541
Florida Bay	9,100
<b>Total HU Lift</b>	<b>20,810</b>

## % Northern Estuary Events Eliminated



## Improved Flow Conditions



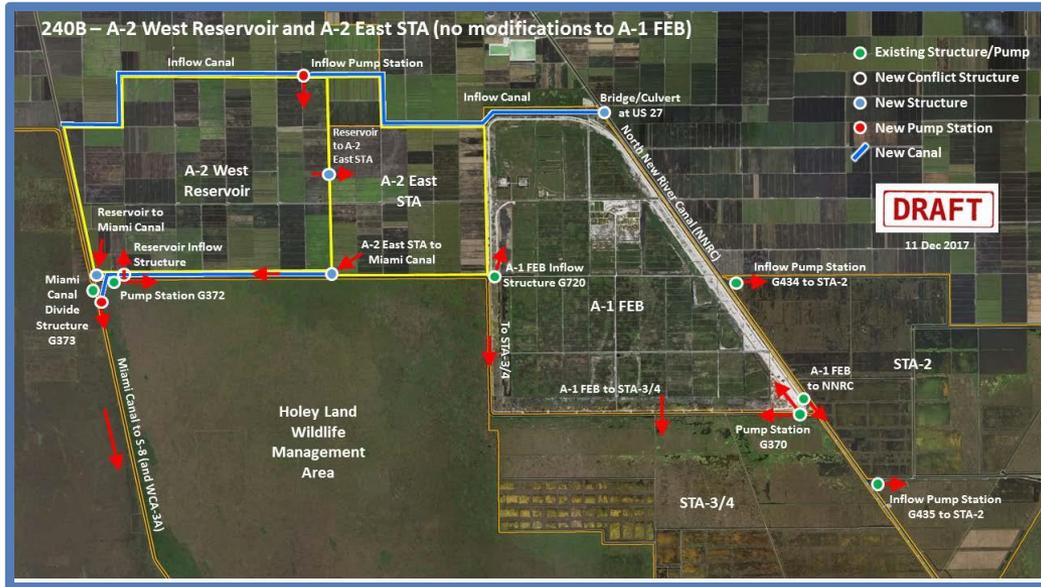
Plan Capital Cost \$1.82B – CEPP New Water Component \$0.40B = **Capital Cost to Implement Plan \$1.42B**

(1)Includes Reservoir, Stormwater Treatment Area, Canal Conveyance Improvement, Recreation Plan and Real Estate Costs

(2)Includes CEPP A2 FEB and A2 Recreation Plan

Note: all costs are in 2018 dollars

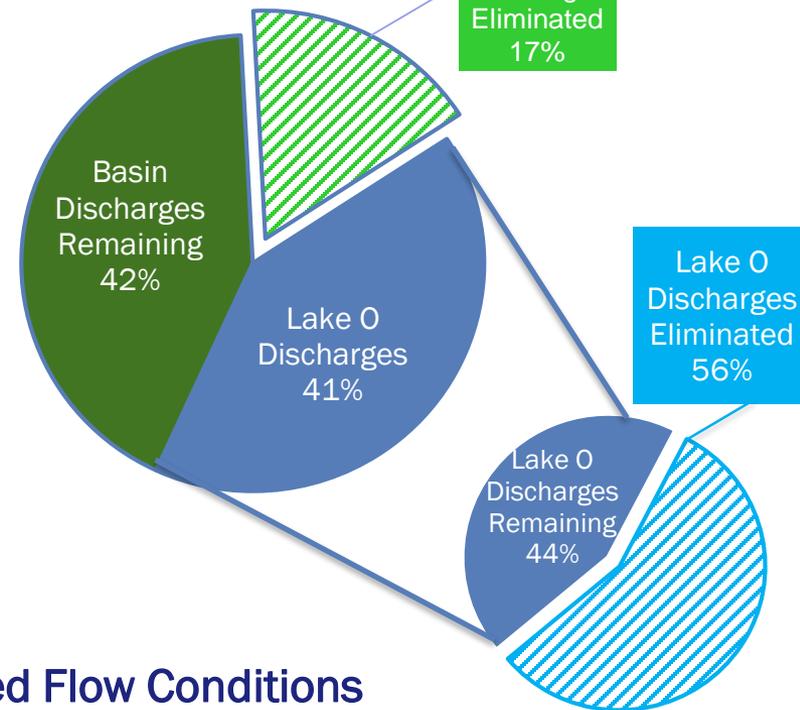
# Alternative R240B



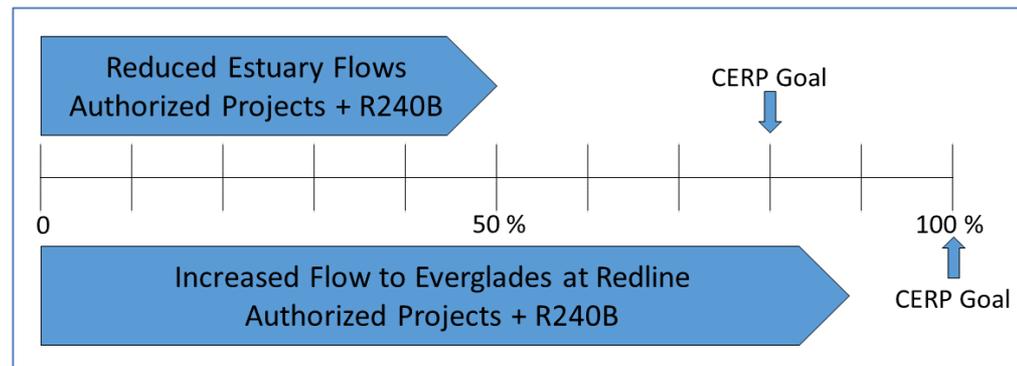
- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements

Region	R240 Habitat Unit Lift
Northern Estuaries	2,169
Greater Everglades	9,541
Florida Bay	9,100
<b>Total HU Lift</b>	<b>20,810</b>

## % Northern Estuary Events Eliminated



## Improved Flow Conditions



Plan Capital Cost \$1.84B – CEPP New Water Component \$0.40B = **Capital Cost to Implement Plan \$1.44B**

(1)Includes Reservoir, Stormwater Treatment Area, Canal Conveyance Improvement, Recreation Plan and Real Estate Costs

(2)Includes CEPP A2 FEB and A2 Recreation Plan

Note: all costs are in 2018 dollars

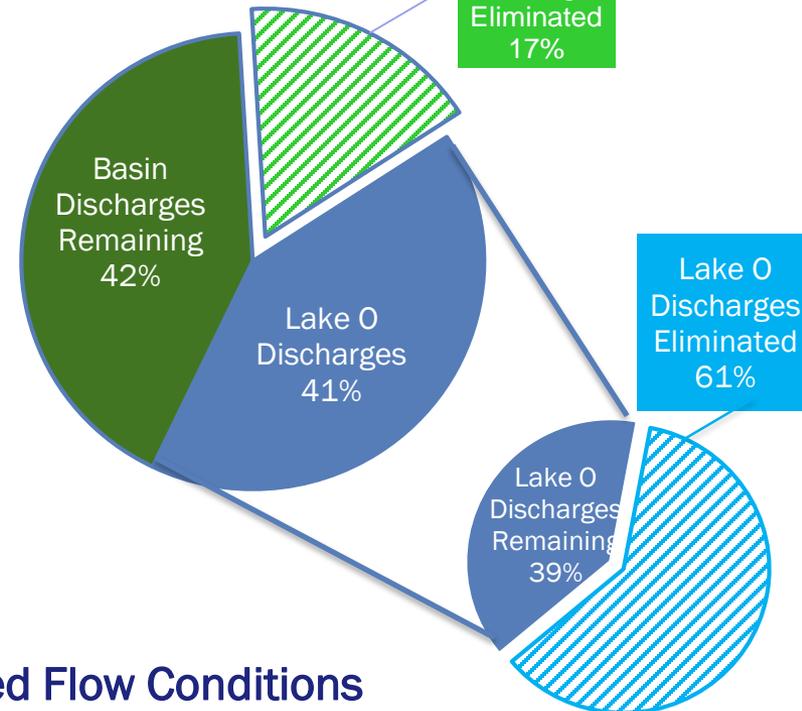
# Alternative R360C



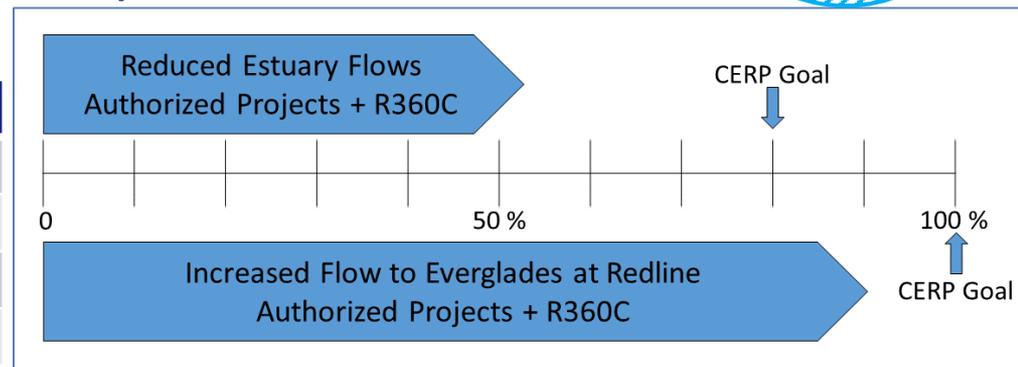
- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements

Region	R360 Habitat Unit Lift
Northern Estuaries	3,329
Greater Everglades	13,161
Florida Bay	9,900
<b>Total HU Lift</b>	<b>26,390</b>

## % Northern Estuary Events Eliminated



## Improved Flow Conditions



Plan Capital Cost \$2.29B – CEPP New Water Component \$0.40B = **Capital Cost to Implement Plan \$1.89B**

(1)Includes Reservoir, Stormwater Treatment Area, Canal Conveyance Improvement, Recreation Plan and Real Estate Costs

(2)Includes CEPP A2 FEB and A2 Recreation Plan

Note: all costs are in 2018 dollars

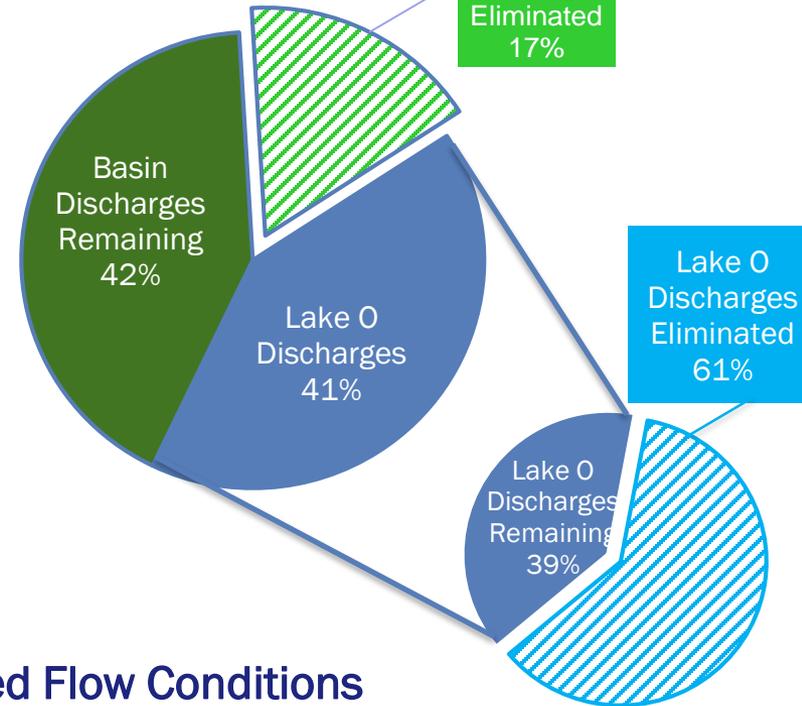
# Alternative R360D



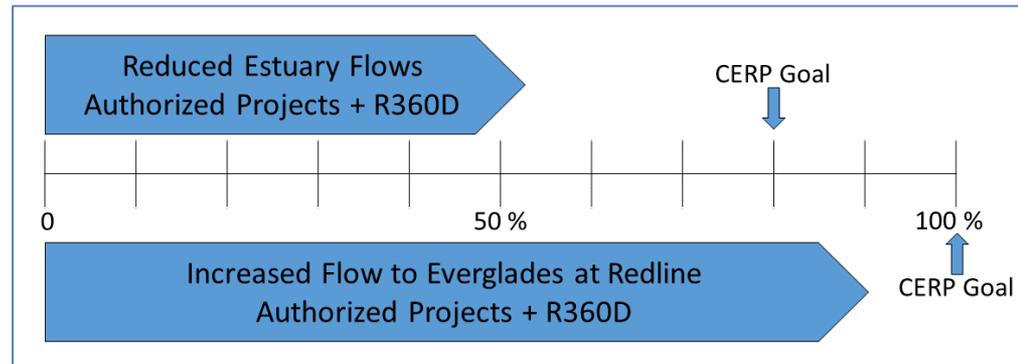
- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements

Region	R360 Habitat Unit Lift
Northern Estuaries	3,329
Greater Everglades	13,161
Florida Bay	9,900
<b>Total HU Lift</b>	<b>26,390</b>

## % Northern Estuary Events Eliminated



## Improved Flow Conditions



Plan Capital Cost \$2.35B – CEPP New Water Component \$0.40B = **Capital Cost to Implement Plan \$1.95B**

(1)Includes Reservoir, Stormwater Treatment Area, Canal Conveyance Improvement, Recreation Plan and Real Estate Costs

(2)Includes CEPP A2 FEB and A2 Recreation Plan

Note: all costs are in 2018 dollars

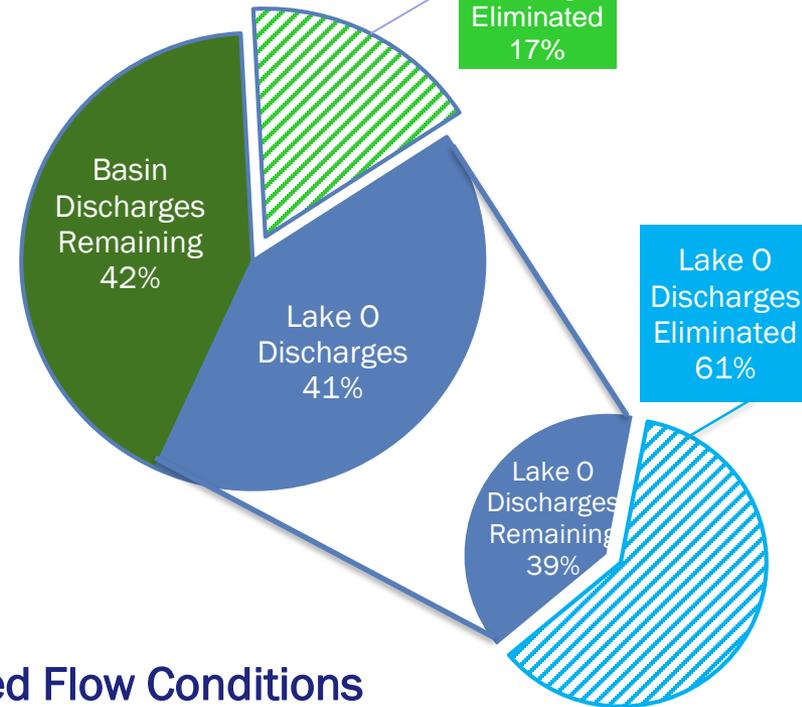
# Alternative C360C



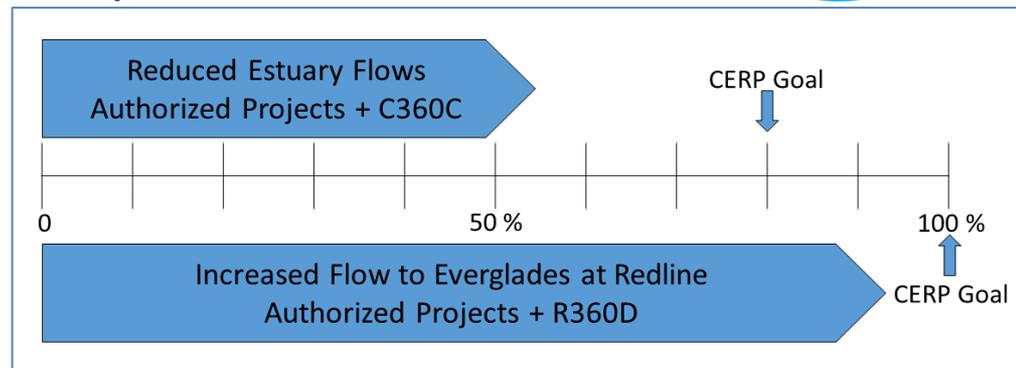
- ✓ Reduces discharges to Northern Estuaries
- ✓ Increased flows to Greater Everglades
- ✓ Meets water quality requirements

Region	C360 Habitat Unit Lift
Northern Estuaries	4,039
Greater Everglades	13,161
Florida Bay	9,900
<b>Total HU Lift</b>	<b>27,100</b>

## % Northern Estuary Events Eliminated



## Improved Flow Conditions



Plan Capital Cost \$2.29B – CEPP New Water Component \$0.40B = **Capital Cost to Implement Plan \$1.89B**

(1)Includes Reservoir, Stormwater Treatment Area, Canal Conveyance Improvement, Recreation Plan and Real Estate Costs

(2)Includes CEPP A2 FEB and A2 Recreation Plan

Note: all costs are in 2018 dollars

## Next Steps

- Submit report to Legislature on or before January 9, 2018
- Prepare Draft Post Authorization Change Report/Feasibility Report
- Submit Post Authorization Change Report to ASA – March 30, 2018

# Public Comment Opportunities

- Public Comment Cards
- Email Address [EAareservoir@sfwmd.gov](mailto:EAareservoir@sfwmd.gov)
- Mailing address:
  - Mike Albert, Project Manager
  - South Florida Water Management District
  - 3301 Gun Club Road, MSC 8312
  - West Palm Beach, FL 33406
- Additional information available at [www.sfwmd.gov/EAareservoir](http://www.sfwmd.gov/EAareservoir)

# DISCUSSION

[www.sfwmd.gov/EAAreservoir](http://www.sfwmd.gov/EAAreservoir)

