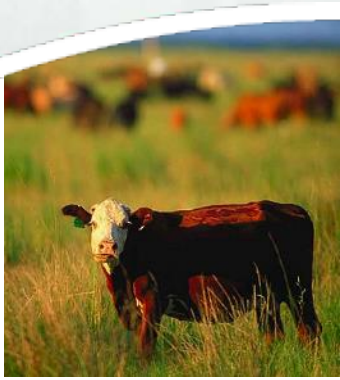
WESTERN EVERGLADES RESTORATION PROJECT

PROJECT DELIVERY TEAM (PDT) MEETING

January 31, 2017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Pop Quiz!

Mark on the screen: How much topographic relief exists in the southern half of WERP's study area (Big Cypress National Preserve area)?

Less than 1 foot difference between lowest-lying areas to highest areas.	~3 foot difference between lowest-lying areas to highest areas.	More than 10 foot difference between lowest-lying areas to highest areas.

Update on WERP scope, schedule, & budget

- Schedule
- LiDAR Contract Status
- 3x3x3 Compliance Update

Update from WERP Modeling Sub-Team

Presented to WERP Project Delivery Team

1/31/2017





H&H Sub-team (modeling)

Completed Activities

- Formed modeling team from Interagency Modeling Center with additional (2) contractual support
- Produced preliminary draft modeling work plan for Western Everglades Restoration Project
- Updated assumptions tables for ECB and FWO scenarios in coordination with LOWP team

H&H Sub-team (modeling)

Ongoing Activities

- Updating selected models from the CEPP toolbox
- Refining mesh within project area; re-evaluated calibration statistics of RSMGL
- Extending RSMGL model domain (originally used in CEPP) to include West and North Feeder canal basins
- Updating topography within model boundary of RSMGL
- Assisting and coordinating with other working groups in the formulation of performance measures
- Scheduled field trips to verify additional systems features, e.g., Tamiami Trail, Loop Rd, etc.

Presentation Topics

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Goal: Provide a general overview of available modeling tools and evolving strategies and concepts that provide modeling information to the Western Everglades Restoration Project

- Evolving WERP Modeling Strategy
  - RSMBN for WERP Region 1 (C139, C139 Annex, STA5/6, Lake Okeechobee, etc…)
  - RSMGL for other WERP Regions (North & West Feeder, L28, L28I, Mullet Slough, Triangle, BCNP, etc…)
  - DMSTA, HEC-RAS, etc.
- Natural System Modeling
  - Natural Systems Regional Simulation Model (NSRSM)

Evolving WERP Modeling - Tools & Strategy





POP QUIZ!

1. TRUE or FALSE?

- WERP will use the models from CEPP, so there is NO work needed on the models to use them in WERP.

TRUE **FALSE**

2. Mark the model outputs on the list below that we will need to evaluate WERP:

- Stages/Water Levels
- Ponding Depths
- Stage Duration/Frequency Curves
- Hydrographs
- Groundwater Flow Vectors
- Overland Flow Vectors
- Basin Water Budgets
- Hydroperiods
- Transect Flows





WERP Modeling Toolbox

Regional Hydrologic Models

- Primary modeling tools used in the Central Everglades assessment. The models provide daily, detailed estimates of hydrology (water levels and flows) across the planning domain.

Sub-regional & Detailed Models

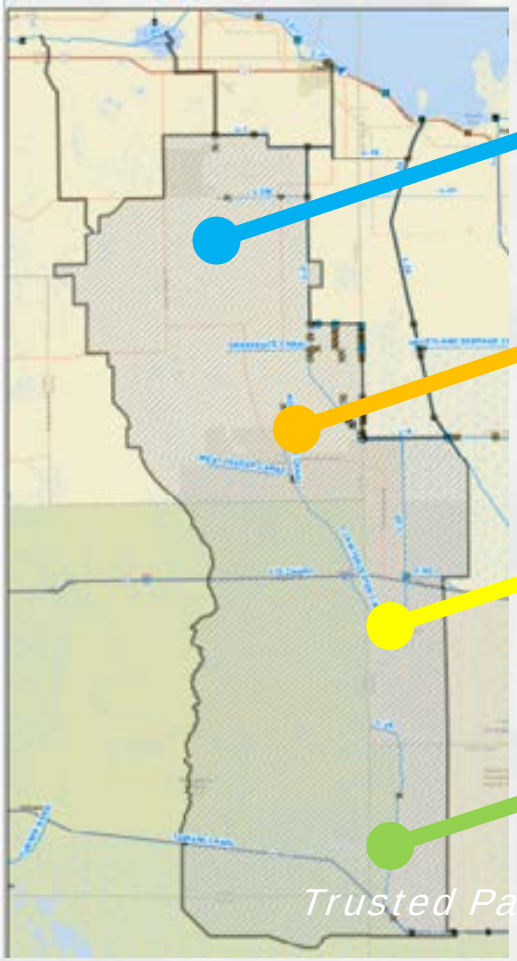
- Smaller scale, more detailed models to help analyze specific areas of interest (e.g. water quality, conveyance of water, etc…)





"Decoupled" Regional Modeling Approach

Initial thinking is that a combination of tools will be used to represent the study area and areas of interest outside of the study area. The RSMBN model is a good candidate to evaluate the Lake Okeechobee & C139 areas and the RSMGL model will be improved to represent the areas further south including North & West Feeder, L28, L28I, Mullet Slough, Triangle, BCNP, etc…)



Lake Okeechobee / Caloosahatchee / C-139 Basin / STA5-6 / North Feeder

West Feeder / Seminole Tribal Area

Downstream of S-190 / Miccosukee Tribal Area / L-28 Triangle

Big Cypress National Preserve

Effects outside of (shaded) study area will also be evaluated.

Regional Hydrologic Modeling

RSMBN (RSM BasiNs)

- A link-node application of the Regional Simulation Model (RSM) specific to Lake Okeechobee and basins in its vicinity
- Previously utilized for the CERP Central Everglades and SFWMD Northern Everglades (Lake Okeechobee Phase 2 Technical Plan and River Watershed Protection Plans) planning initiatives
- Will provide lumped hydrologic representation of Lake Okeechobee, the C139 Basin, STA5&6 and the EAA (if needed) and other northern watersheds including the Caloosahatchee and St. Lucie Estuaries





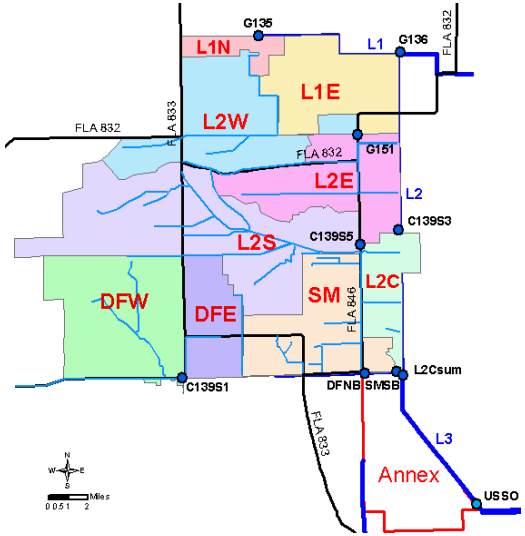
RSMBN (Basins)

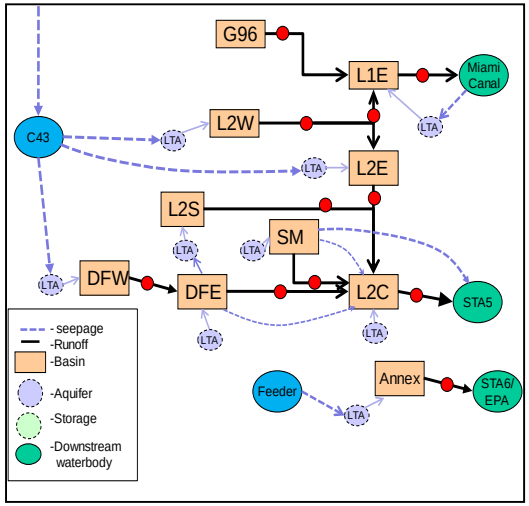
Run Time:
~ 10 minutes

Real World Sub-Basins

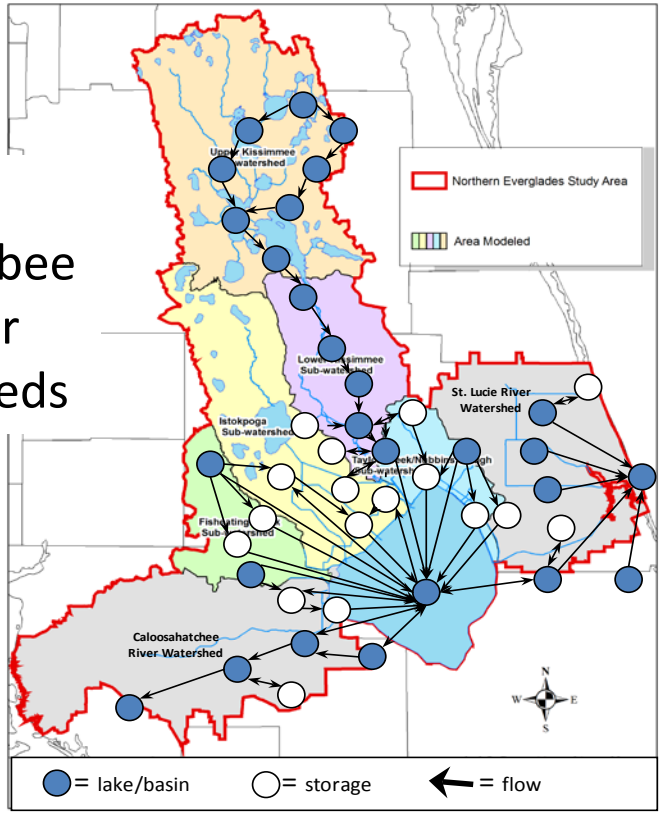
C139 Basin

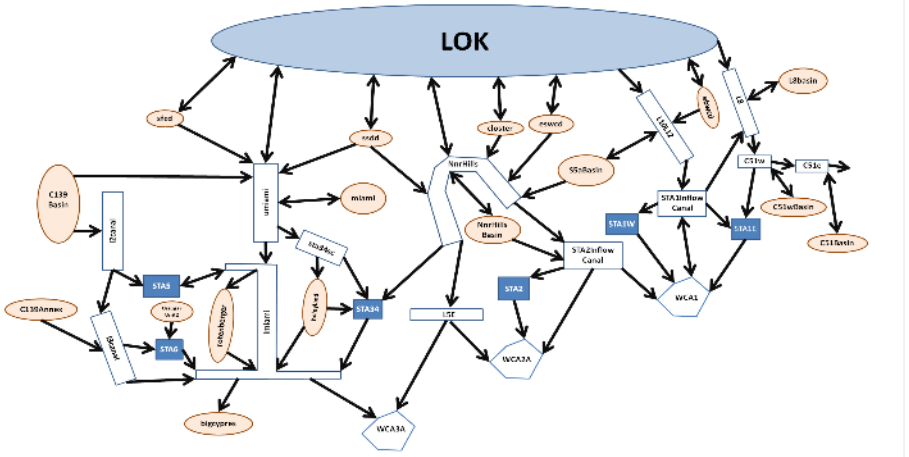
Model Representation





Lake Okeechobee & River Watersheds

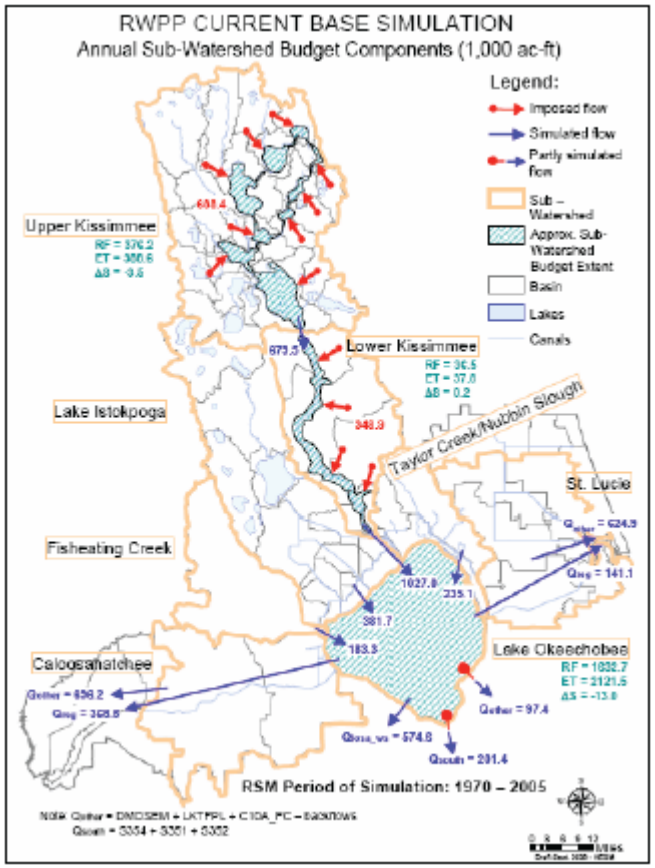


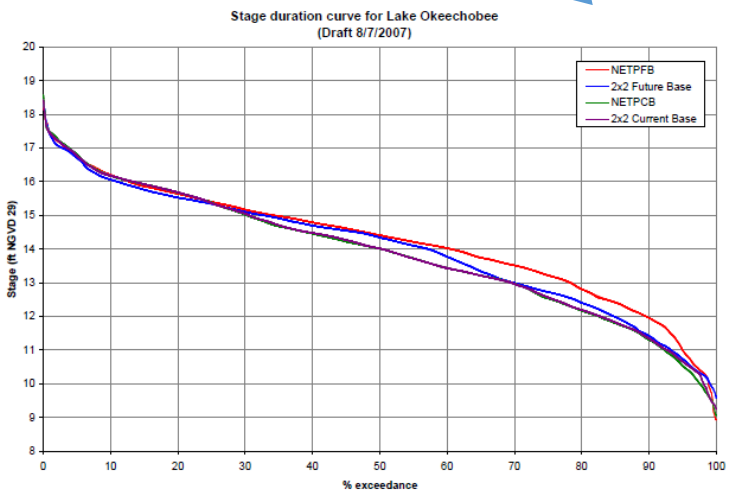


Everglades Agricultural Area

RSMBN Modeling Products

- Stages/Water Levels
- Flow/Discharge at Structures
- Hydrographs
- Water shortage indicators
- Basin Water Budgets
- Stage Duration/Frequency Curves





Regional Hydrologic Modeling

RSMGL (RSM Glades-LECSA)

- A full mesh and canal network application of the Regional Simulation Model (RSM) specific to the Western, Everglades and Lower East Coast service areas
- Previously utilized for the CERP Central Everglades and DECOMP projects
- Will provide detailed (cell-based) stage and flow information on a regional scale and can account for current or proposed changes in system infrastructure and operations.





RSMGL (Glades-LECSA)

From Draft Glades-LECSA Calibration-Validation Report (2010):

Mesh Information:
Number of cells: 5,794
Average size: ~ 1 square mile
Domain size: 5,825 sq. miles

Canal Information:
Number of segments: 979
Average length: ~ 1 mile
Total length: 1,043 miles

Run Time:
~ 1 day

Note: Shaded areas represent work-in-progress expansion or refinement of model mesh for WERP in 2017*.

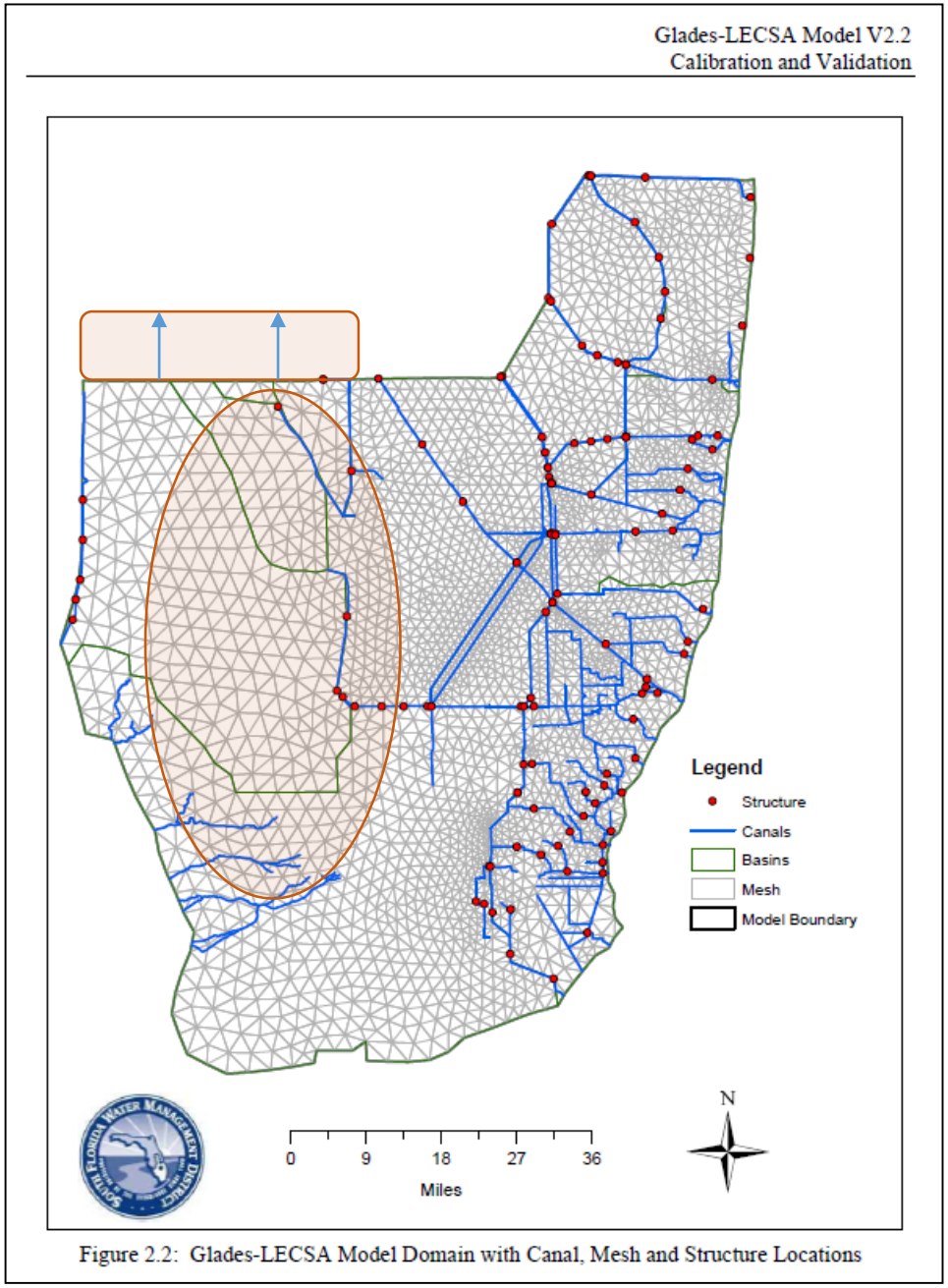
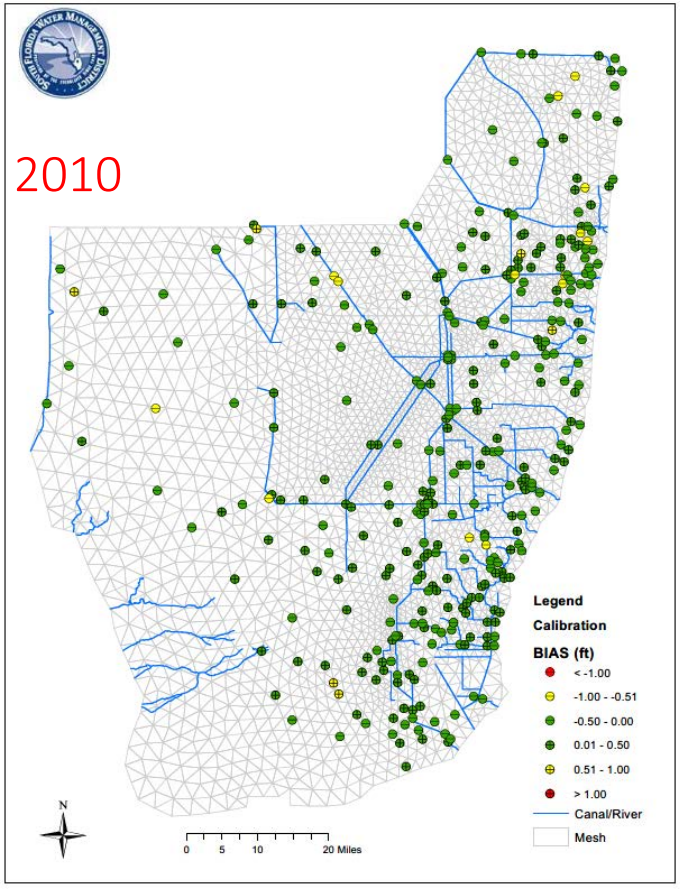
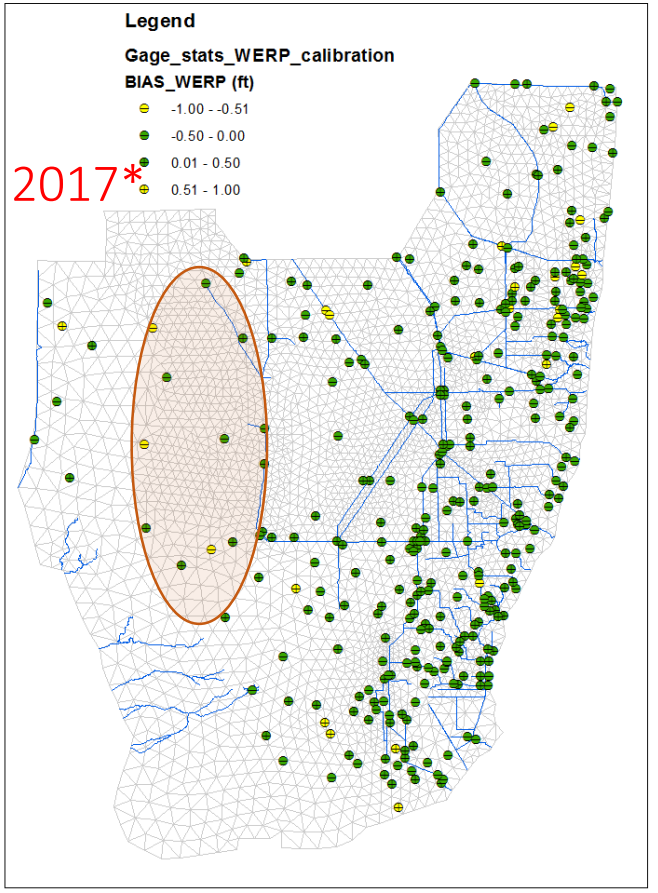


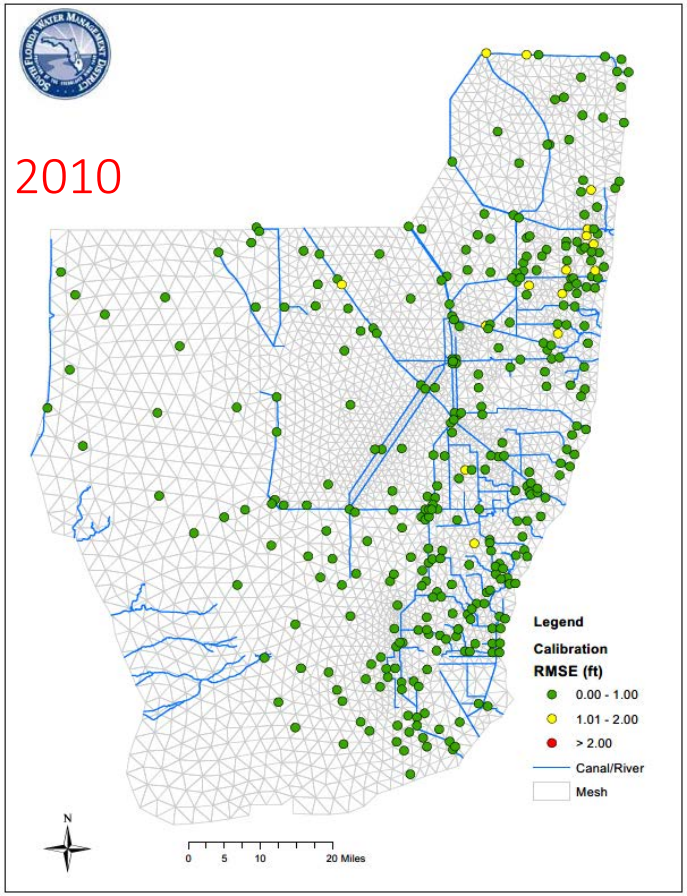
Figure 2.2: Glades-LECSA Model Domain with Canal, Mesh and Structure Locations

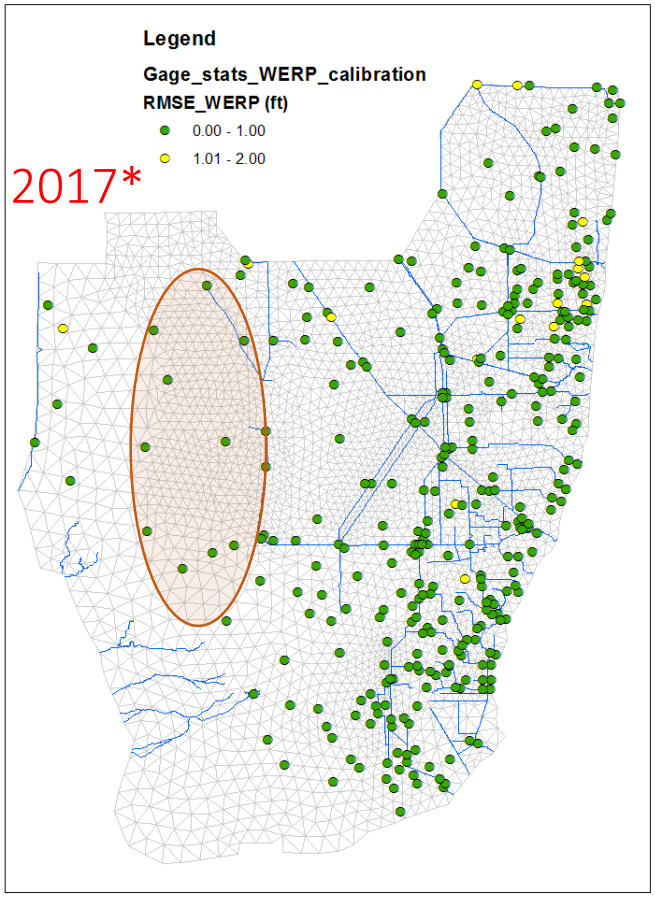
Calibration Performance Comparison: BIAS





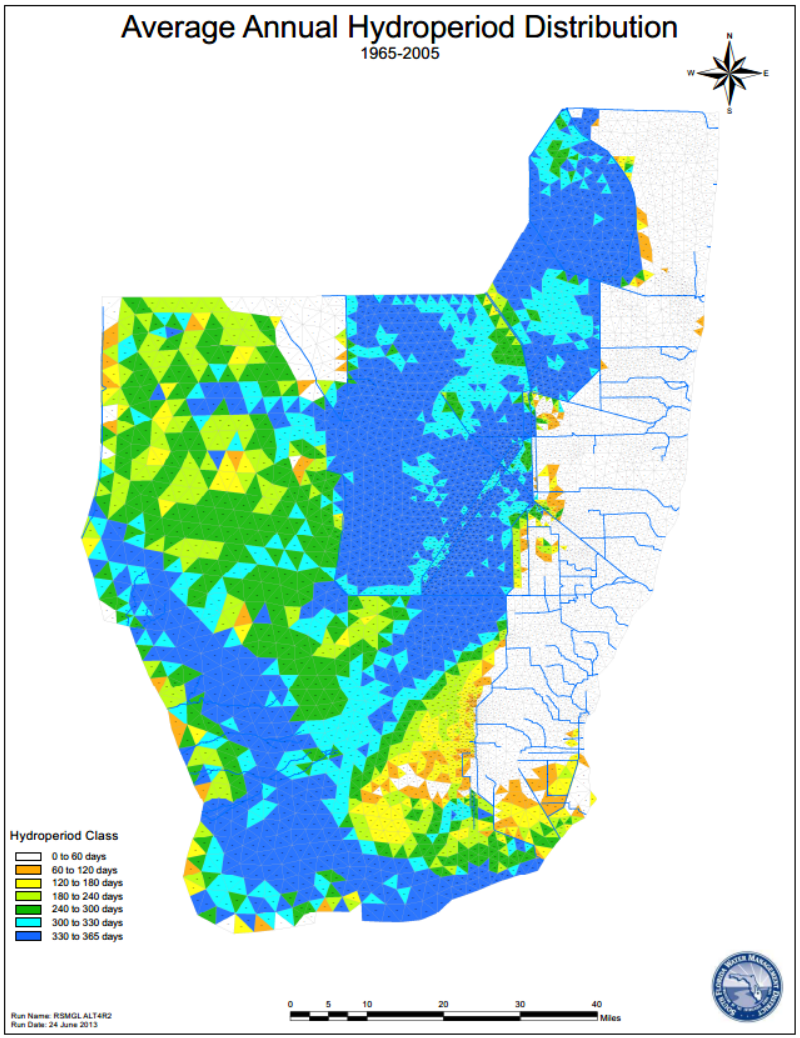
Calibration Performance Comparison: RMSE

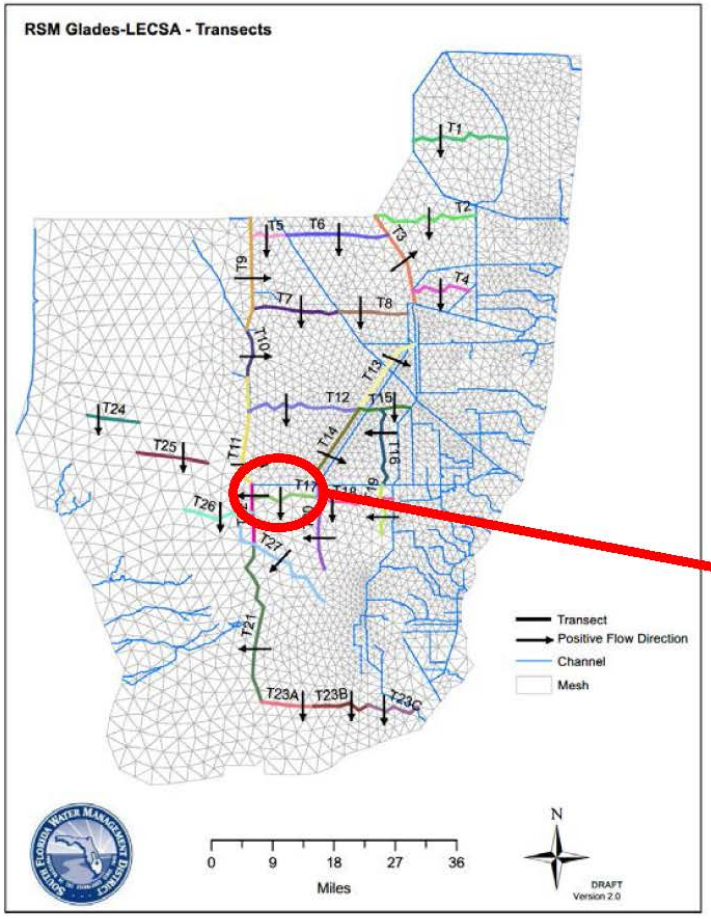


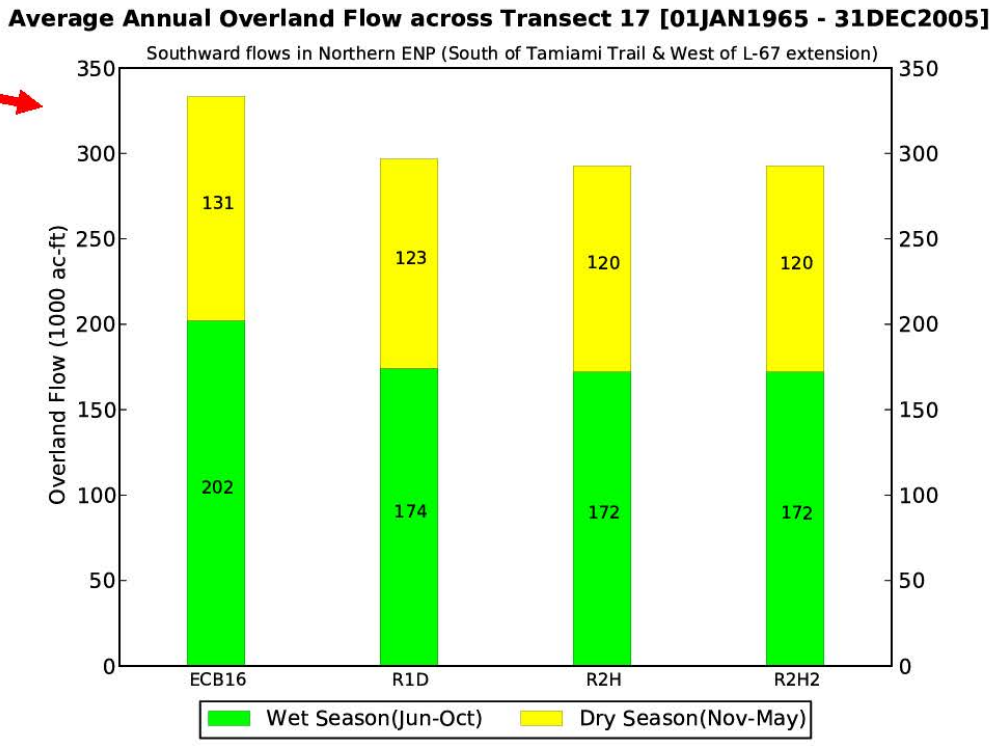


RSMGL Modeling Products

- Stages/Water Levels
- Ponding Depths
- Stage Duration/Frequency Curves
- Hydrographs
- Groundwater Flow Vectors
- Overland Flow Vectors
- Basin Water Budgets
- Hydroperiods
- Transect Flows




RSM Glades-LECSA - Transects
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16
T17
T18
T19
T21
T23A
T23B
T23C
T24
T25
T26
T27
Transect
Positive Flow Direction
Channel
Mesh
0
9
18
27
36
Miles
N
DRAFT
Version 2.0


Average Annual Overland Flow across Transect 17 [01JAN1965 - 31DEC2005]
Southward flows in Northern ENP (South of Tamiami Trail & West of L-67 extension)
Overland Flow (1000 ac-ft)
0
50
100
150
200
250
300
350
131
202
123
174
120
172
120
172
ECB16
R1D
R2H
R2H2
Wet Season(Jun-Oct)
Dry Season(Nov-May)

Sub-regional & Detailed Models

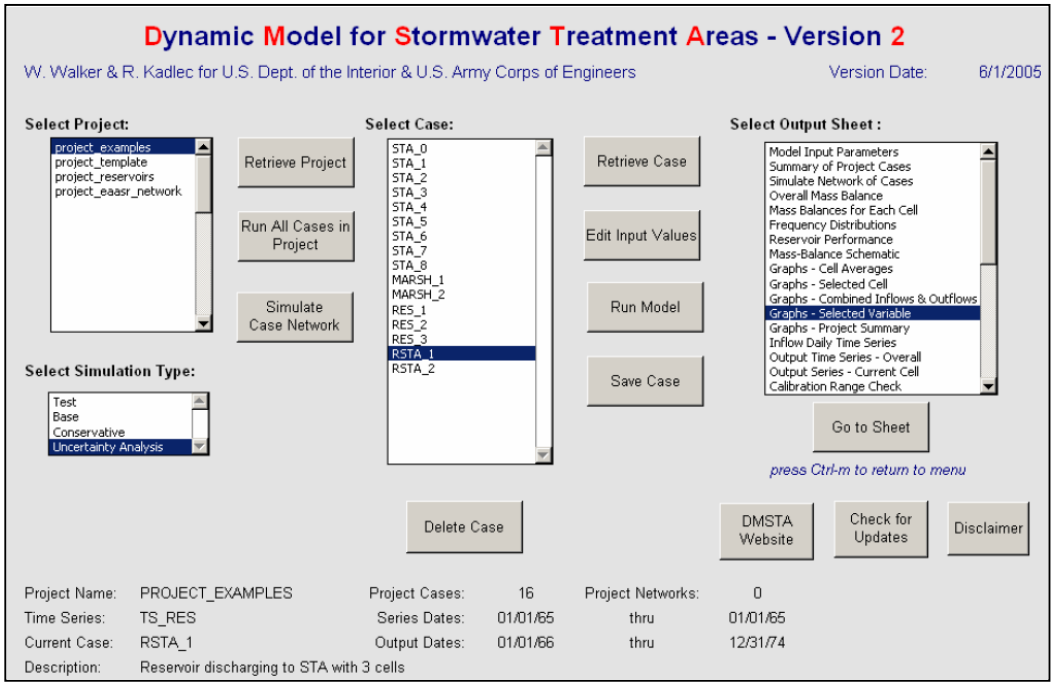
- On an as-needed basis, additional models may be applied to complement or assist the regional hydrologic models in analyzing system features.
- Examples of this type of model application will be shown for assessing water quality considerations and conveyance of water.





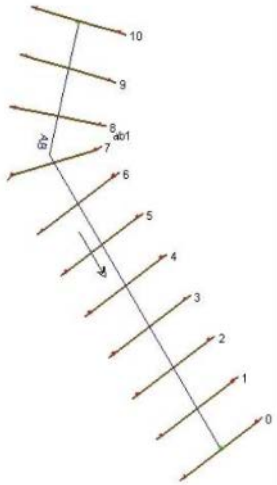
Example: Dynamic Model for Stormwater Treatment Areas (DMSTA)

- Developed for the U.S. Department of the Interior and the U.S. Army Corps of Engineers (Walker and Kadlec 2005)
- Extensively used in south Florida to analyze Stormwater Treatment design, operation & management



Example: HEC-RAS Hydraulic Model

- Hydrologic Engineering Center River Analysis System (HEC-RAS)
  - Developed by the U.S. Army Corps of Engineers
  - Used nation-wide for design and analysis of conveyance systems



Alternative Development & Evaluation Strategy

- Establish Existing Condition (ECB) and Future Without WERP (FWO) baselines as a reference for comparison of project effects
- Currently, three (3) alternative scenarios with varying themes or concepts are proposed.
  - Expected iterations in modeling to refine concepts
  - Eventually agree on a single scenario -> Tentatively Selected Plan (known as “Plan Formulation”)

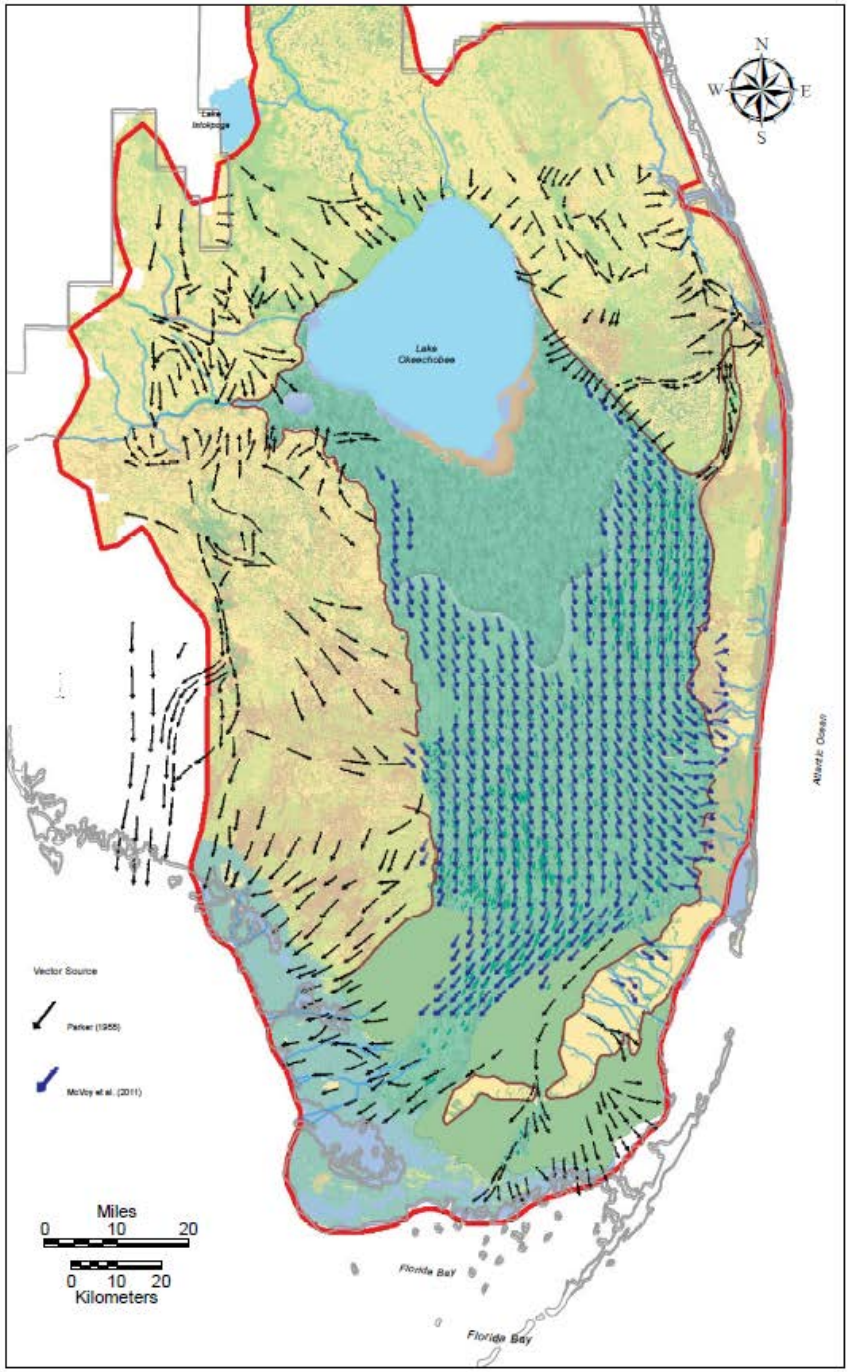




Natural Systems Modeling



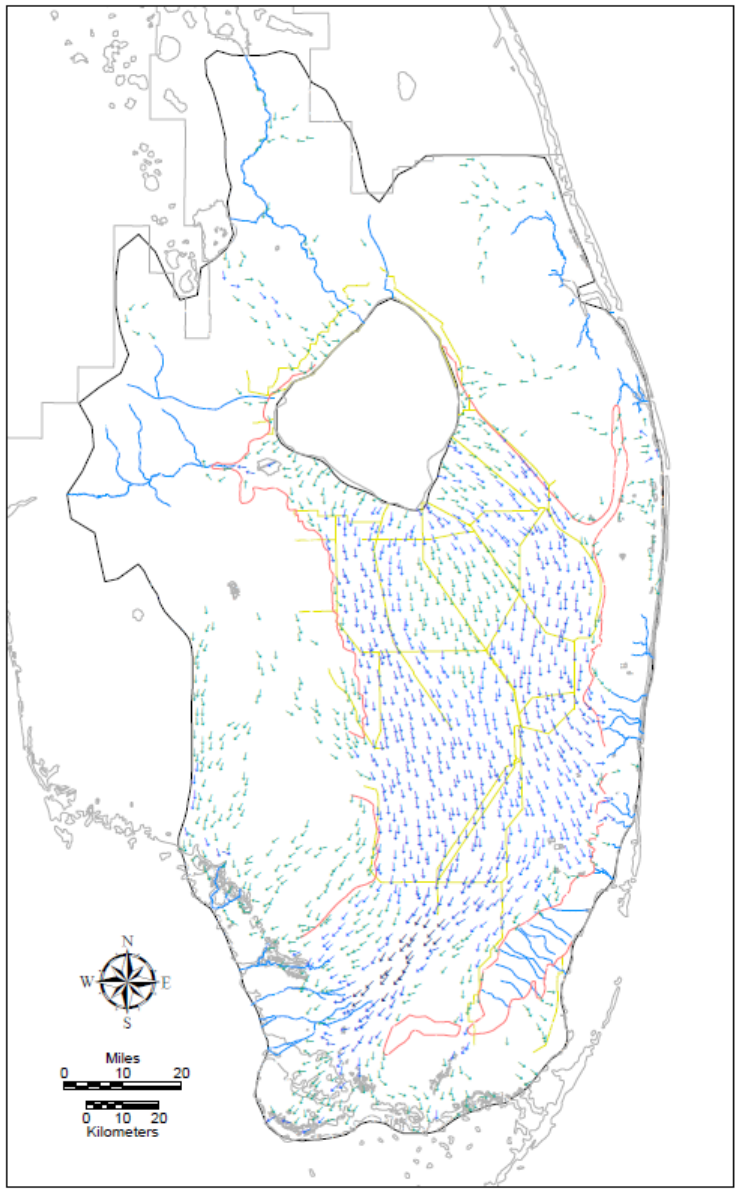




Estimated Flow Directions in the Historic Everglades

(Data helped to inform the development of the NSRSM)

(Sources: Parker, 1955 & McVoy, 2011)



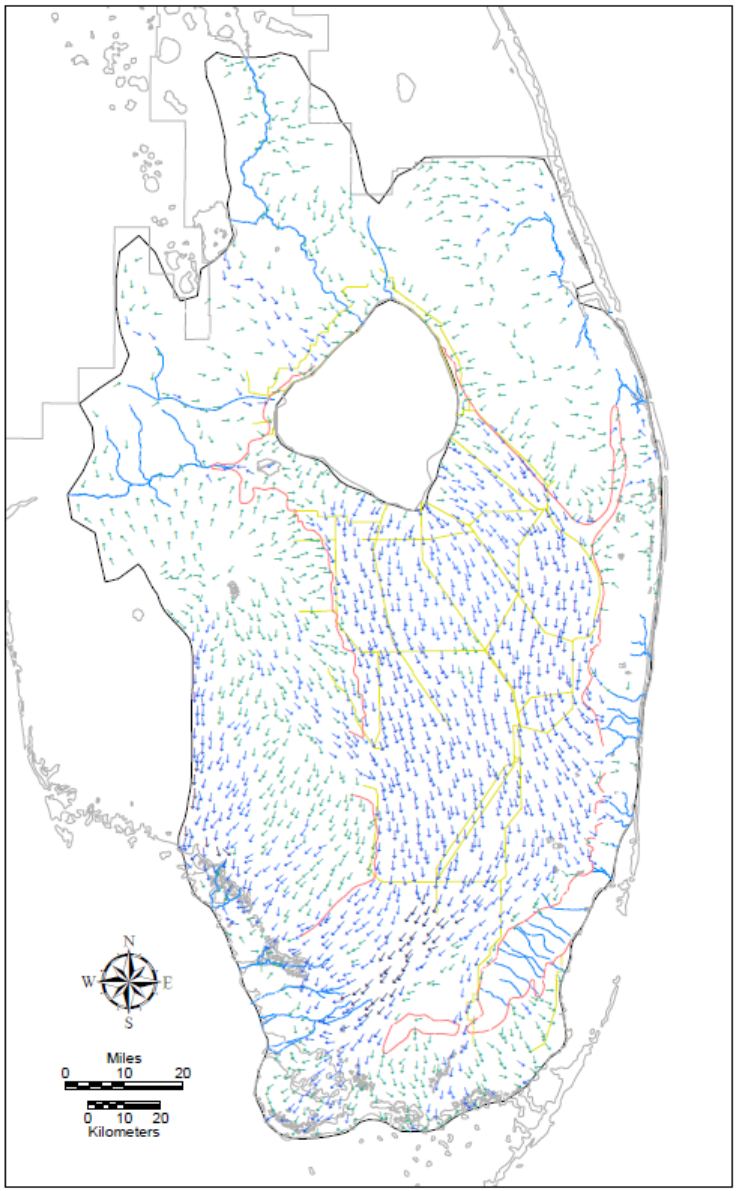


Figure 4. NSRSM v3.5.2 long-term (1966-2005) average monthly flow vectors for the dry and wet seasons.

Perspective on Use of Natural Systems Models

NSRSM v2.0 Peer Review (2006) Panel Comments

"The panel strongly urges careful consideration of the use of model output, and it should not be used to set targets or any other such prescriptions for restoration. Rather it should be used to help estimate how the hydrology has changed and help design restoration experiments. ..output from the NSRSM should be used in conjunction with other models, studies and information to suggest how flows across Tamiami Trail or hydrologic patterns in marl marshes might have changed…. (cont. on next slide)





Perspective on Use of Natural Systems Models

NSRSM v2.0 Peer Review (2006) Panel Comments

"…. NSRSM should be used in an adaptive management framework to help guide management experiments aimed at restoring hydrologic regimes, and more importantly ecological function. *It is not reasonable to use NSRSM to set hard targets for hydroperiod or water levels because of uncertainty in model results and because aspects of the ecology (fire impacts, topography, among others) have been altered between pre-drainage and modern conditions.*" (Italics added)





Questions?





WERP ECO SUB TEAM UPDATE EVALUTATION OF ALTERNATIVES

POP QUIZ!

Mark TRUE or FALSE:

1. Performance measures help us determine which alternate plan accomplishes the project objectives better than the other alternate plans.

TRUE FALSE

2. **Performance measures** are the only tools we will use to check WERP's ecological performance.

TRUE FALSE

WHERE ARE WE? BRAINSTORMED & SCREENED: MANAGEMENT MEASURES (MMs) TO FOCUSED ARRAY

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1. **MMs brainstormed during Participatory Mapping & field trips**
2. **Metrics related to the objectives used for qualitative screening MMs**
3. **Also configured MMs in each subregion, to achieve the objectives per different strategies**
4. **Finalized MM screening based on the qualitative metrics & the configurations**
5. **Consolidated alternatives into focused array**

WERP Restoration Objectives, Metrics in bold

- Reestablish **ecological connectivity of wetland & upland habitats** in the western Everglades with restored freshwater **flow paths, flow volumes & timing, seasonal hydroperiods, & historic distributions of sheetflow.**
- **Restore low nutrient (oligotrophic) conditions** to reestablish and sustain native flora & fauna.
- **Reduce wildfires** that damage the underlying geomorphic condition of the western Everglades.
- Promote **system-wide resilience** in light of future ecological changes and uncertainties.

WE ARE HERE

<u>Toward a TSP</u>: Develop/refine predictive performance measures & targets to evaluate and compare a alternatives to help choose TSP

EVALUATION OF ALTERNATIVES

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Preliminary Management Measure Screening	Formulation of Components & Development of Alternatives	Evaluation of Final Array of Alternatives (i.e. Habitat Unit Quantification)	NEPA Assessment on Final Array & RECOVER Evaluation
Qualitative Screening Criteria	Qualitative Screening Criteria	RECOVER Approved/Adapted Project Performance Measures	RECOVER Approved/ Adapted Performance Measures Ecological Planning Tools (Species Specific Tools) H&H Output

PERFORMANCE MEASURES

Definition:

- **Performance measures are indicators in the natural system that have been determined to be characteristic of a healthy, restored ecosystem.**
  - **Role of Conceptual Ecological Models in CERP**
- **Each performance measure should address at least one or more of the project objectives within the period of analysis.**
- **Performance measures are used to predict performance of alternative plans.**
  - **Metric**
  - **Target**
  - **Spatial Extent (Location)**

CONCEPTUAL ECOLOGICAL MODEL

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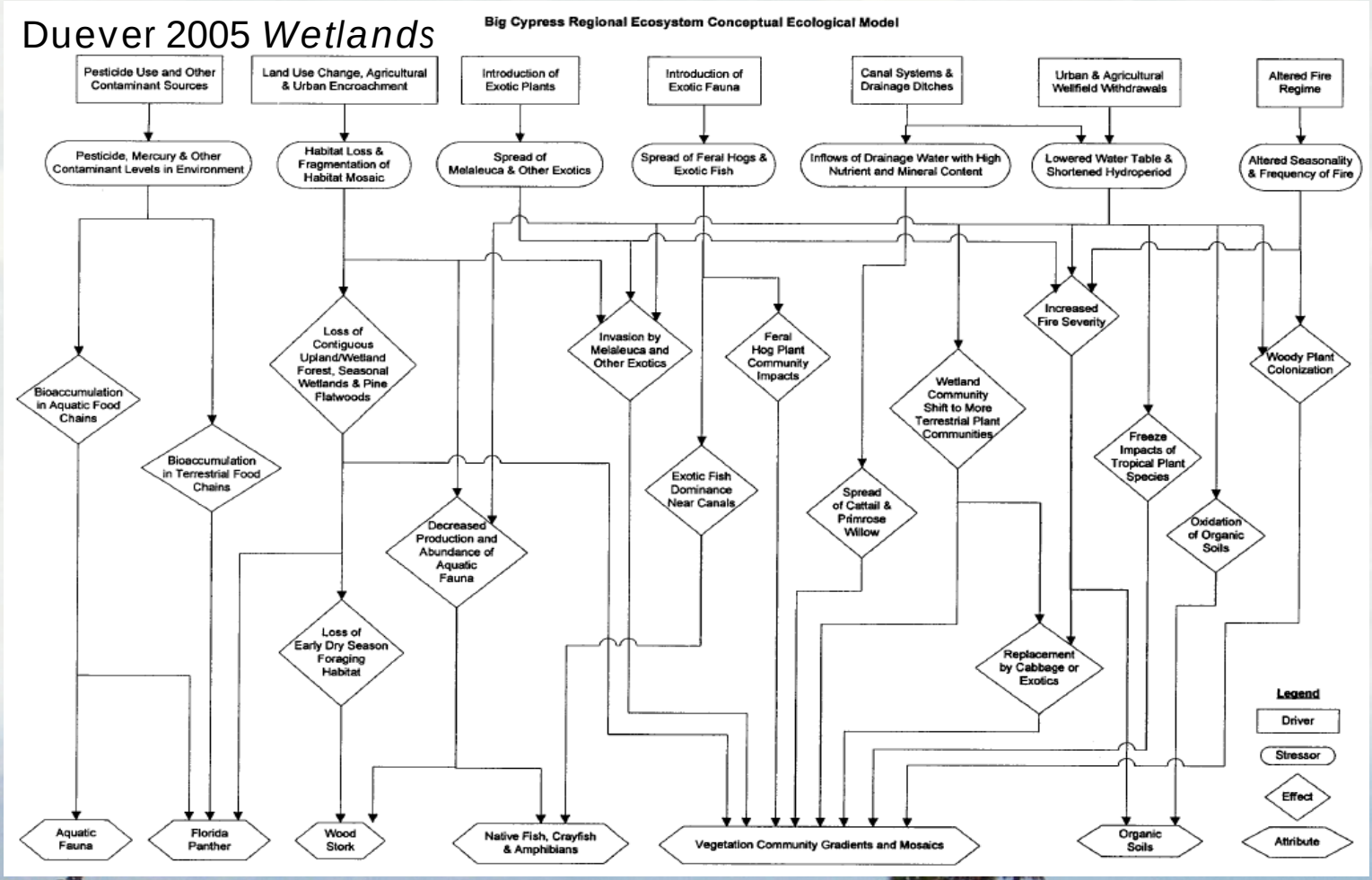
Duever 2005 *Wetlands*



PERFORMANCE MEASURE OVERVIEW

Planning – Big Picture (What's to Come!):

- **Habitat Unit (HU): USACE metric used for environmental benefits and selection of the preferred alternative**
  - **Habitat Suitability Index (HSI):**
    - **Scores assigned (0 = worst and 1 = best) based on performance measure output**
  - **Quantity = Acres**
  - **Quality X Quality = HU**
- **Methodology used to calculate HUs (i.e. Planning Model) requires review by the National Ecosystem Restoration Planning Center of Expertise and subsequent approval by USACE Headquarters Model Certification Panel**

EXAMPLE CENTRAL EVERGLADES PLANNING PROJECT (CEPP)

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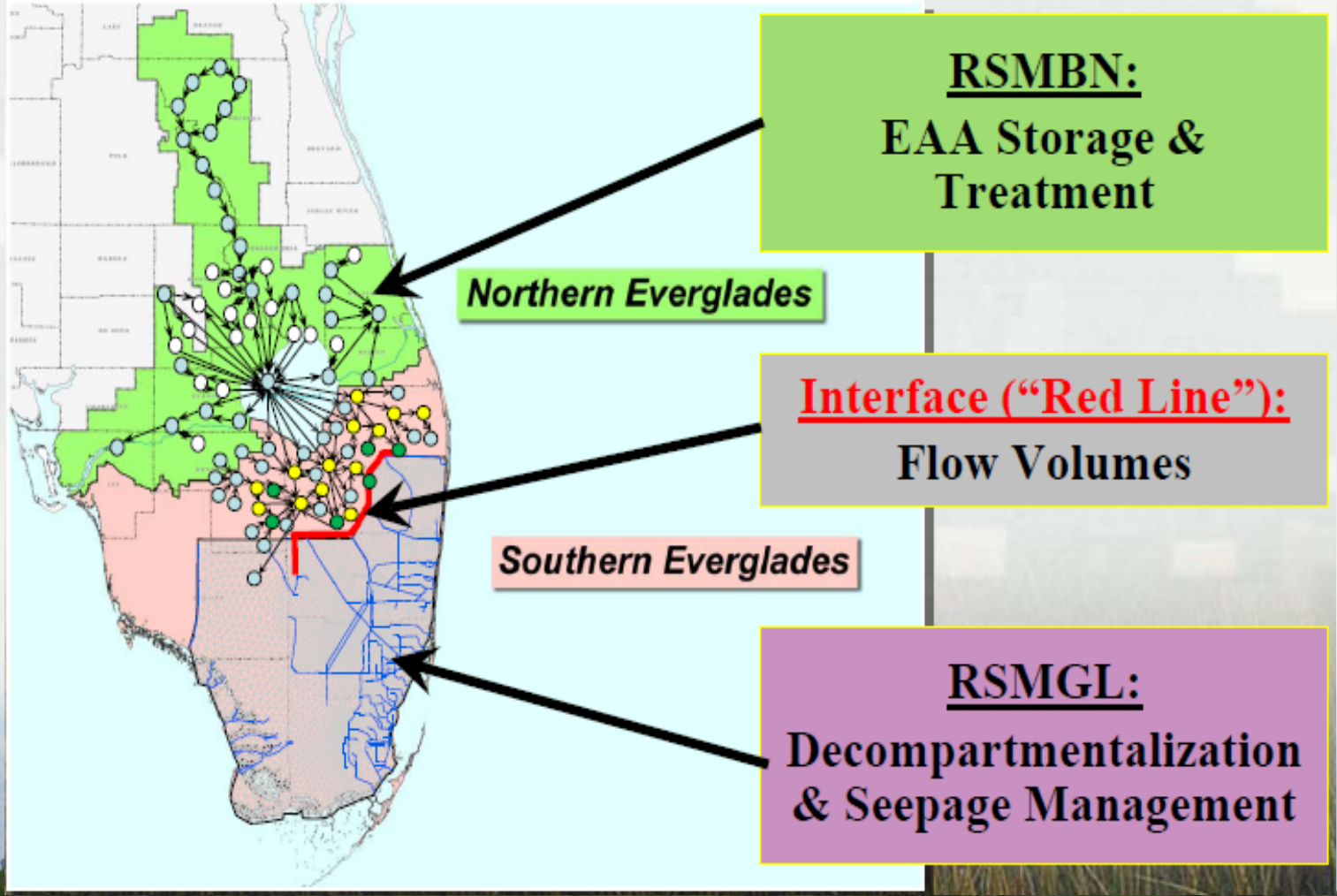

EXAMPLE CENTRAL EVERGLADES PLANNING PROJECT

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STEP 1

Normalize Performance Measures to Common Scale

STEP 2

Combine Performance Measures and Calculate Zone Scores

STEP 3

Calculate Zone HUs for Greater Everglades, Caloosahatchee and St. Lucie Estuaries

STEP 4

Compare Alternatives

METHODOLOGY FOR QUANTIFYING ECOLOGICAL BENEFITS ON THE FINAL ARRAY

Step 1:
Raw performance measures sub-metrics are linearly re-scaled between 0 and 100.

Step 2:
Within each zone, performance measure sub-metrics are combined for each project alternative to produce a net zone benefits score between 0 and 100.

Step 3:
The 0 to 1 benefits score is then multiplied by the acreage of the zone to generate a HU value for the zone.

Step 4:
HU Lift = Alternative – Future Without Project Condition

EVALUATION OF ALTERNATIVES

WE ARE HERE

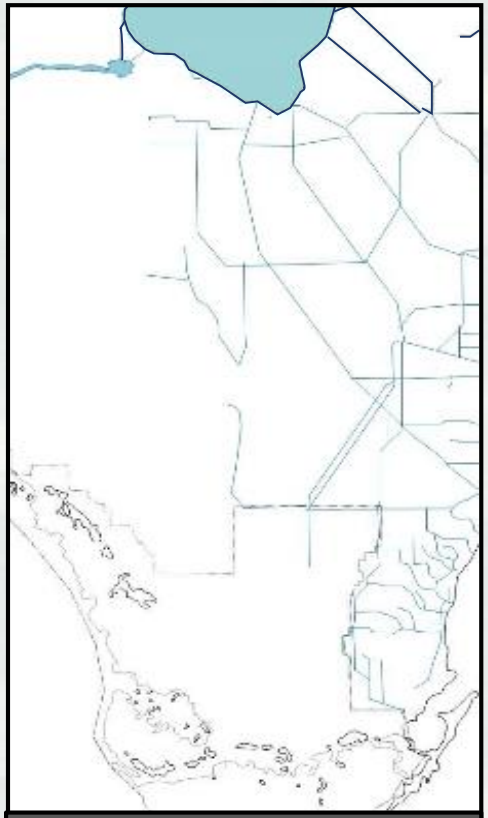
Develop/refine predictive performance measures & targets to evaluate and compare a alternatives to help choose TSP

Next Step 1

- Finish developing H&H model
- Finish developing predictive performance measures (PMs) & targets
- ECO-PCX coordination & approval

Next Step 2

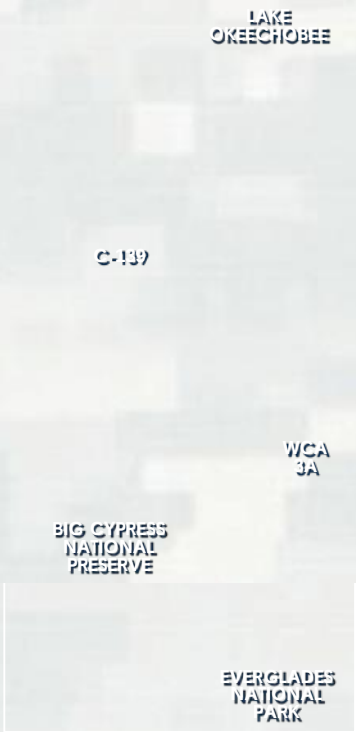
HYDROLOGIC MODEL RUNS: BASE CONDITIONS AND ALTERNATIVES



OUTPUTS:
WATER DEPTHS, DURATIONS, DISTRIBUTION, TIMING

Next Step 3

CALCULATE % OF TARGETS ACHIEVED (PERFORMANCE MEASURES) PER ZONE

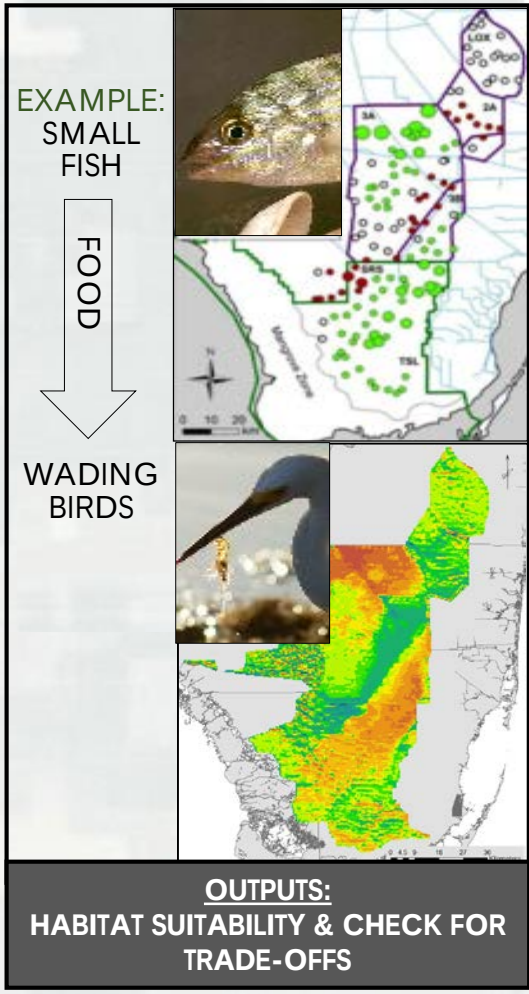


OUTPUTS:
HABITAT UNITS

Use Approach Similar to Prior Studies: PMs apply to zones to calculate habitat quality changes per area.

Next Step 4

ASSESS ADDITIONAL ECOLOGICAL EFFECTS AND SYSTEMWIDE ANALYSIS



OUTPUTS:
HABITAT SUITABILITY & CHECK FOR TRADE-OFFS

WERP PERFORMANCE MEASURES

BUILDING STRONG

WERP OBJECTIVE	PERFORMANCE MEASURES TO BE DEVELOPED OFR WESTERN BASINS					
	ECOLOGIC CONNECTIVITY OF WETLAND AND UPLAND HABITATS	HYDROLOGIC REGIMES OF MAJOR PLANT COMMUNITIES	SHEETFLOW	FIRE RISK	PHOSPHOROUS DYNAMICS	RESILIENCE
Reestablish **ecological connectivity of wetland and upland habitats** in the western Everglades with restored freshwater flow paths, **flow volumes & timing, seasonal hydroperiods, & historic distributions of sheetflow**	x	x	x			
Reduce wildfires that damage the underlying geomorphic condition of the western Everglades				x		
Restore oligotrophic (low nutrient) conditions to reestablish and sustain native flora and fauna					x	x
Promote **system-wide resilience** in light of future change, such as sea level rise and climate change		x				x

Utilizing RECOVER Approved Performance Measures for WCA 3 and ENP Consistent with CEPP

WERP PERFORMANCE MEASURES WCA 3 AND ENP

BUILDING STRONG

Utilizing RECOVER Approved Performance Measures for WCA 3 and ENP Consistent with CEPP

PLANNING REGION	PERFORMANCE MEASURE	DESCRIPTION
Greater Everglades WCA 3A & ENP	**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

WERP VEGETATION PERFORMANCE MEASURE

WERP STUDY AREA

EXAMPLE AQUATIC HABI

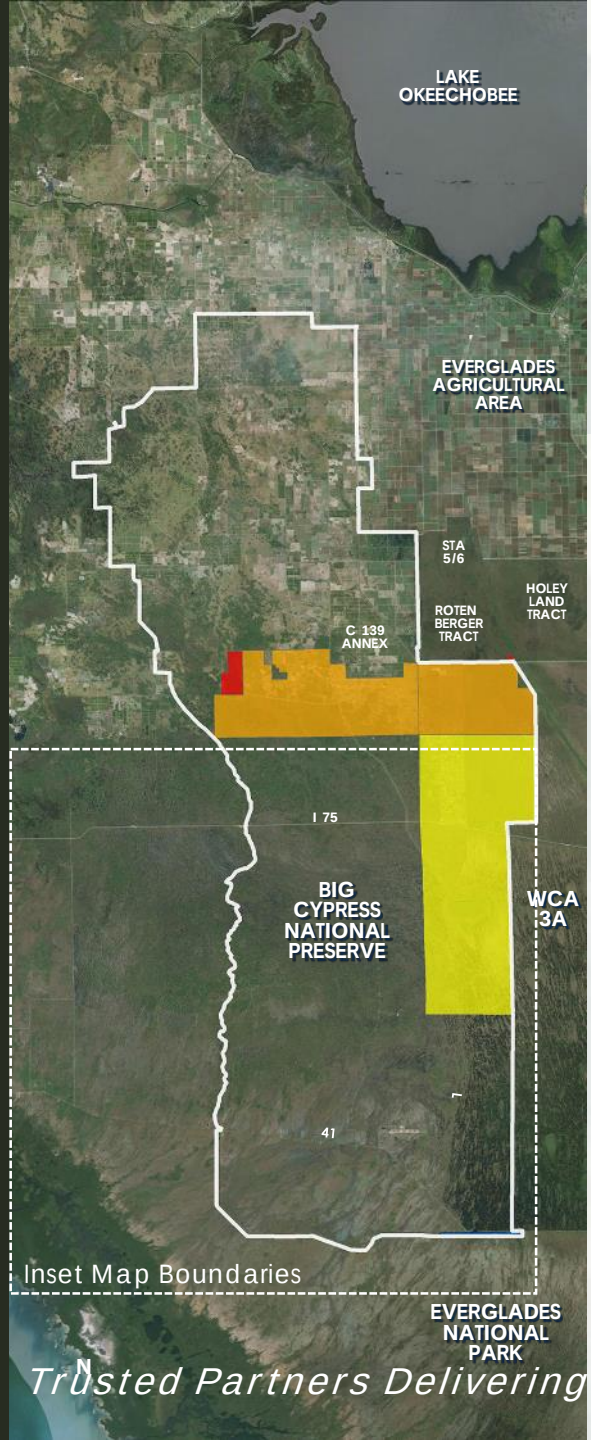
SEMINOLE TRIBE OF FLORIDA (Big Cypress Reservation & Florida Easement)

MICCOSUKEE TRIBE OF INDIANS OF FLORIDA

MICCOSUKEE TRIBE OF INDIANS OF FLORIDA SHERROD RANCH

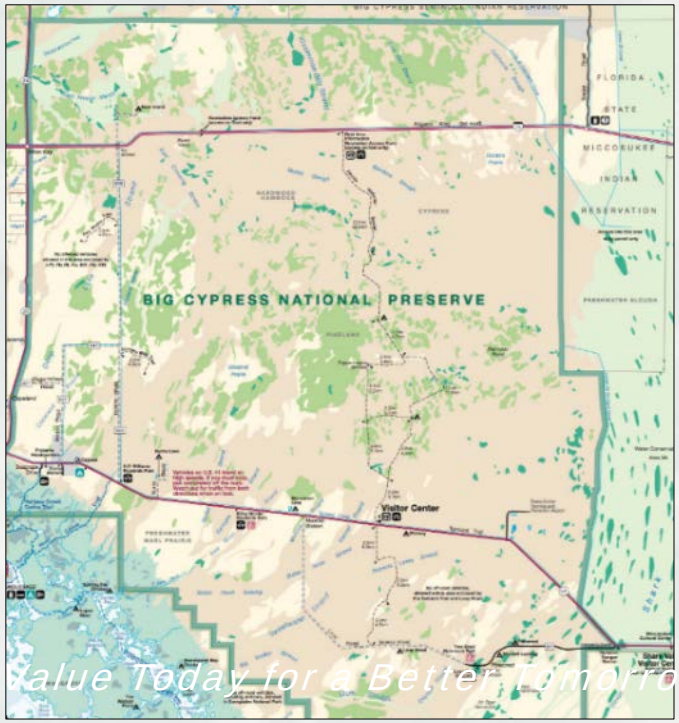
~772,700 acres (~1,200 square miles)

Historically dominated by wetlands



FRESHWATER MARL PRAIRIE

STRAND/HAMMOCK



WERP VEGETATION PERFORMANCE MEASURE

WERP VEGETATION PERFORMANCE MEASURE

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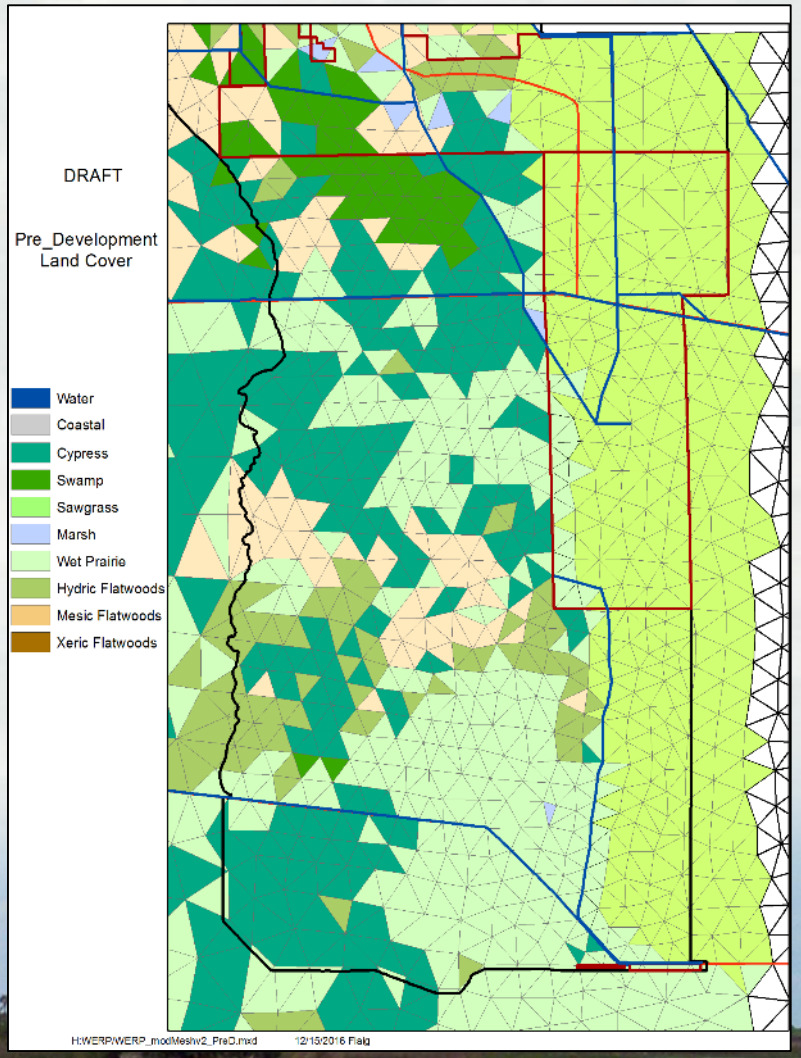
- Metric to evaluate the hydrologic suitability for vegetation communities within Western Basins
- Propose hydrologic metrics
  - Hydroperiod Range
  - Surface Water Depth
  - Ground Water Depth
  - 1 in 10 Year Minimum/Maximum Depth
- Desired restoration condition is to target pre-drainage vegetation



WERP VEGETATION PERFORMANCE MEASURE

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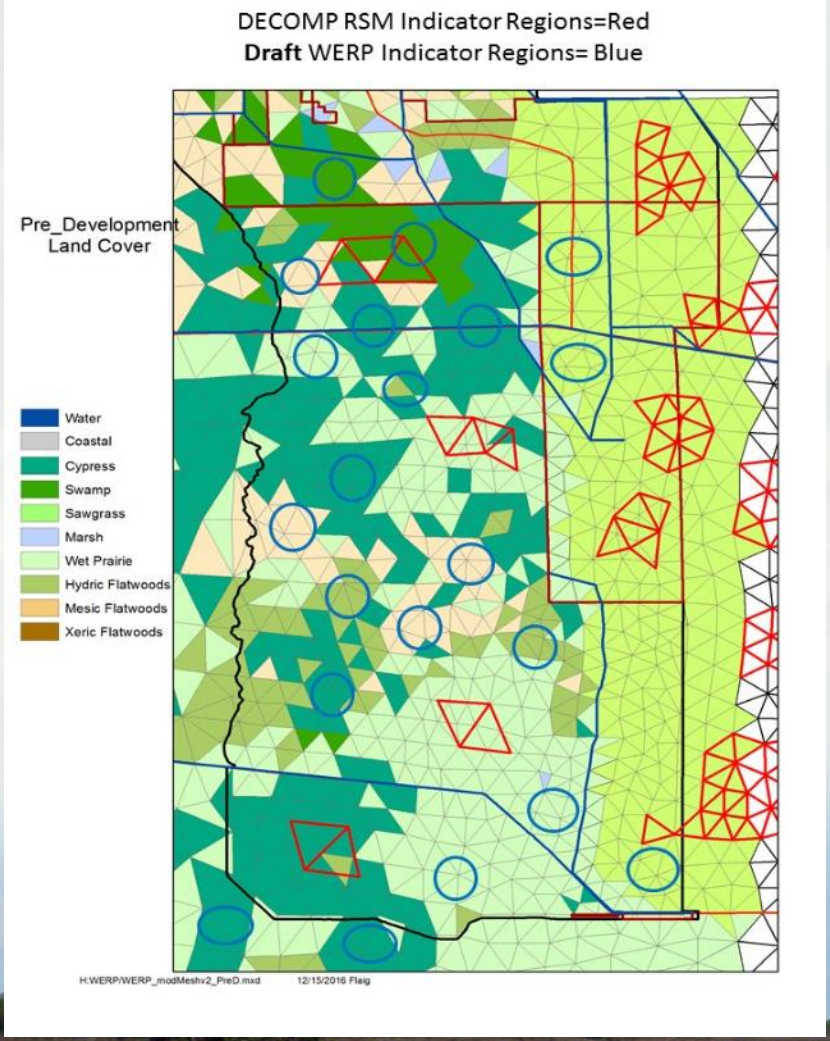
- **Developing locations (i.e. indicator regions) where performance measure will be measured**
- **Indicator Regions**
  - **Represent area affected by the project**
  - **Similar land use**
  - **Similar elevation**



WERP FIRE PERFORMANCE MEASURE

WERP Fire Performance Measure

Things to know about the fire PM...

Are we seeking to prevent *all* fires and prescribed burns?

No. WERP will not prevent all natural fires and we are not trying to eliminate prescribed burning. Our objective is to reduce the risk and intensity of **unabated fires associated with unnatural drought conditions**.

- Restoring hydrology will help to restore the natural level of fire risk and the lower intensity of fires, to better mimic historic fire patterns.
- We may even *increase* opportunities for prescribed burning.

Continued...

WERP Fire Performance Measure

Things to know about the fire PM...

If we reduce unabated, unnatural fires by reducing droughts, are we going to make the basin too *wet*?

No, because this PM works in partnership with other PMs.

The other hydrologic PMs will check that we are not raising water levels too high.

Do we need to include important factors such as fuel types, fuel loads, weather, and microclimate conditions?

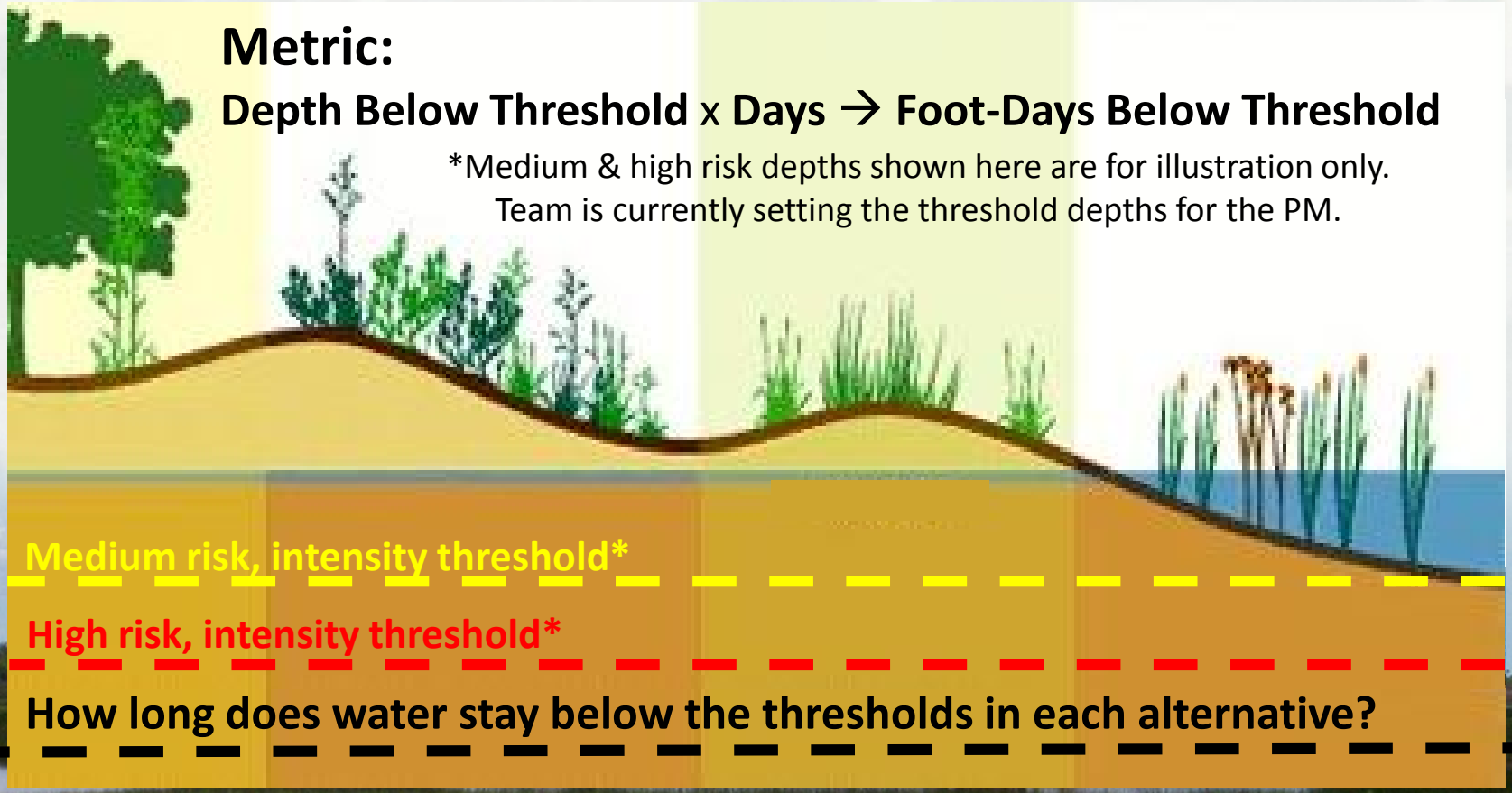
Surprisingly, no, not for our intended use of the PM.

Remember, during planning we use the PM to make a relative comparison across alternate plans. Other factors that are important for fire stay constant across the alternatives. We are primarily changing hydrology across the alternatives.

WERP Fire Performance Measure

Methods...

- Focus on below-ground water levels.
- Identify threshold below-ground water levels and durations below those levels that indicate medium and high risks of wildfire.

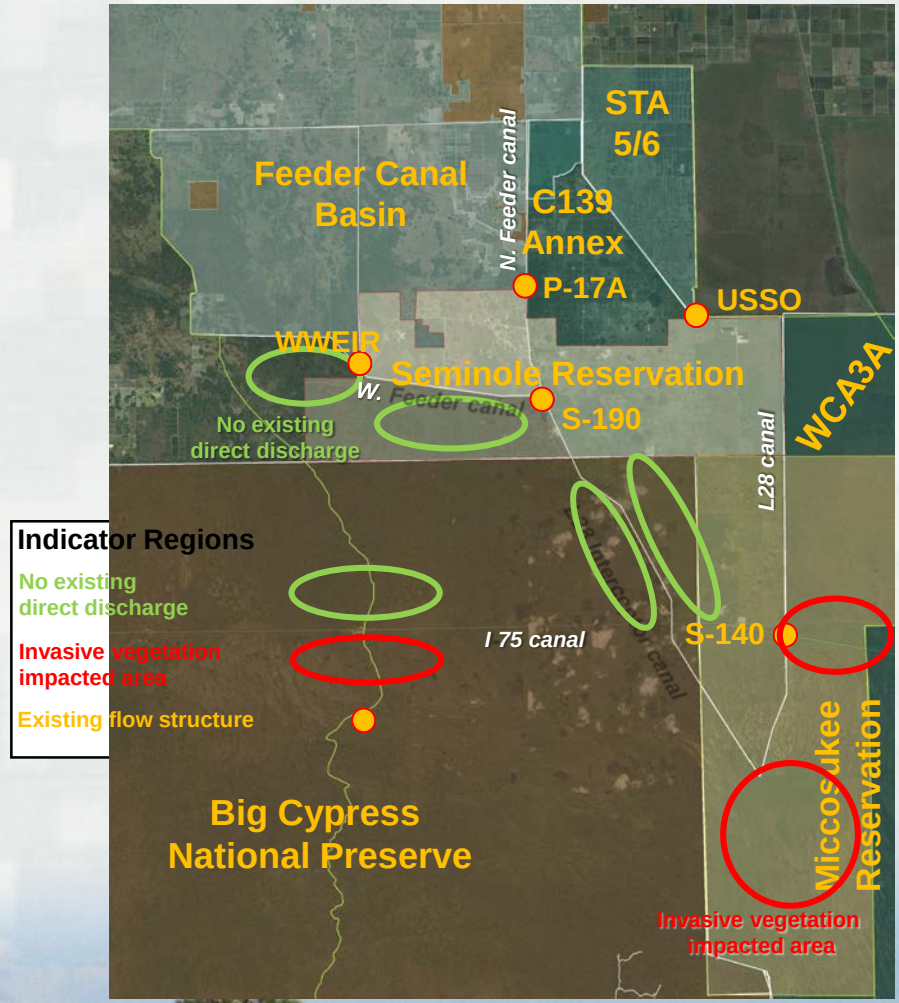


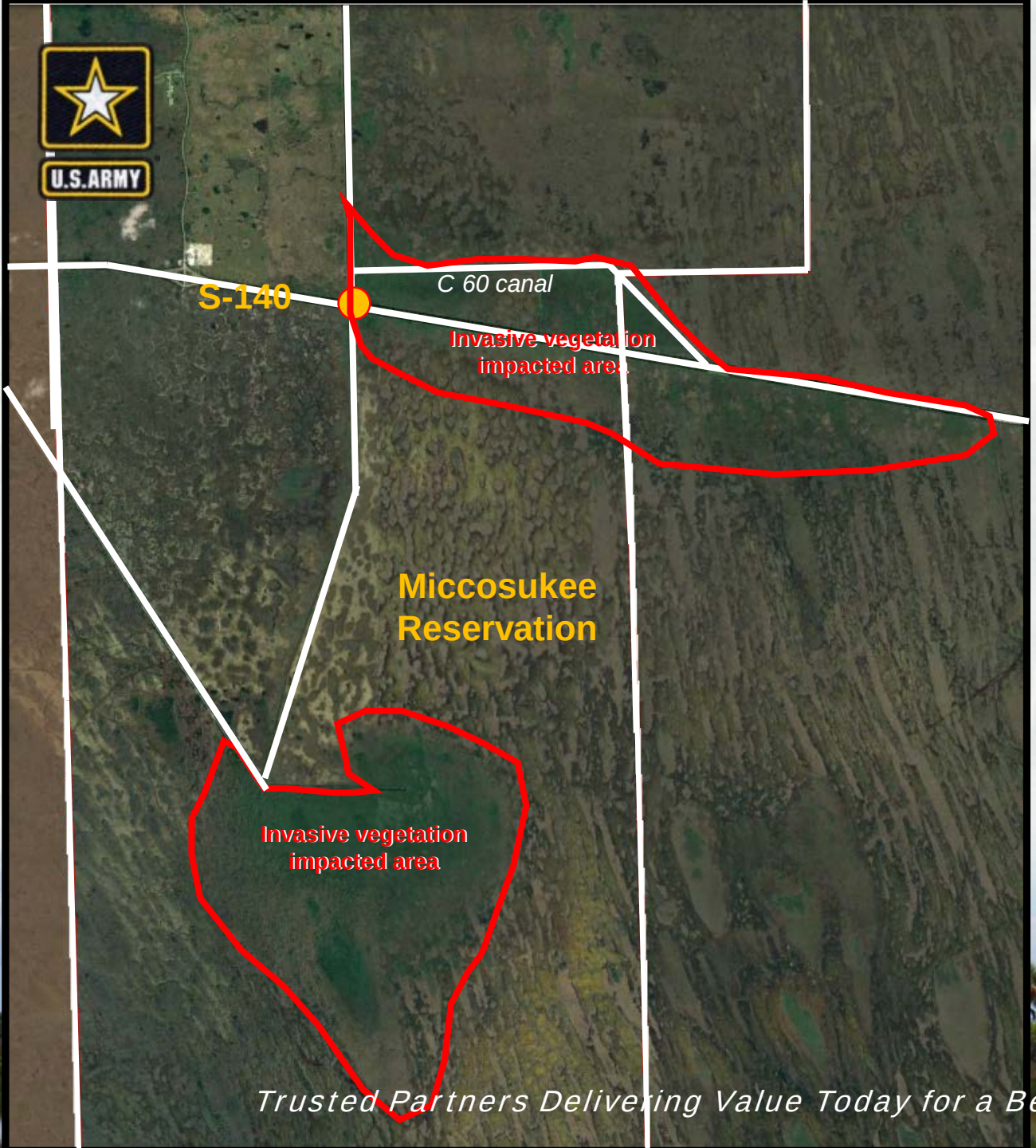
WERP WATER QUALITY PERFORMANCE MEASURE

WATER QUALITY PM

Water Quality Performance Measure: Development status

- Six (6) indicator regions (IR) for assessing alternative performance
- Everglades Phosphorus Gradient Model (EPGM) used to project acres impacted for:
  - Existing Condition Baseline (ECB): Based on present conditions for IRs
  - Future Without (FWO): Assumes existing baseline condition is meeting state water quality requirements
  - Alternative Scenarios (ALT): Assumes management measures implemented and meeting IR water quality protective standard





Water Quality Performance Measure: Developme

- EPGM inputs:
  - Flow – RSM output from Hydrologic team
  - Water Quality – DMSTA TP output from Hydrologic team
- PM assesses benefit acres in response to water quality improvement
  - FWO benefits: ECB acres – FWO acres
  - ALTs benefits: FWO acres – ALT acres
- A scenario score system based on acres of benefit has been developed
- Documentation is being finalized

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WERP RESILIENCE PERFORMANCE MEASURE (preliminary)

WERP RESILIENCE PM

Ideal in WERP to align with USACE definition…

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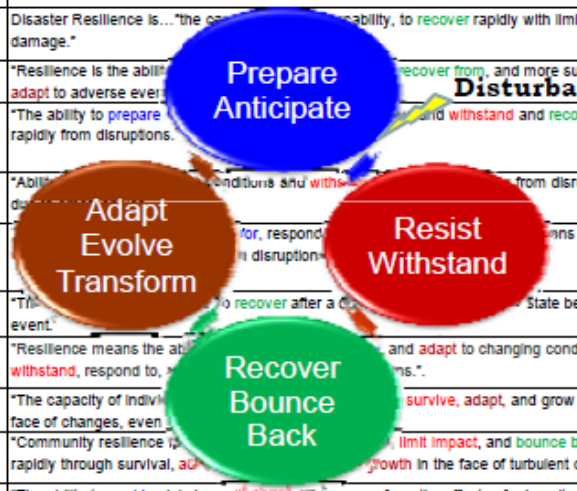
National Academy of Sciences (2012)	"Resilience is the ability to **prepare and plan for**, **absorb**, **recover from**, and more successfully **adapt** to adverse events."
Presidential Executive Order on	"resilience means the ability to **anticipate**, **prepare for**, and **adapt** to changing conditions and **withstand**,

Definitions of Resilience

Study	Definition
American Society of Civil Engineers (2006) http://www.asce.org/ContentArticle=8478	"Resilience refers to the capability to mitigate against significant all-hazards risks and incidents and to expeditiously recover and reconstitute critical services with minimum damage to public safety and health, the economy, and national security."
National Disaster Recovery Framework, Strengthening Disaster Recovery for the Nation (FEMA 2011) http://www.fema.gov/media-library/assets/documents/24647?fromSearch=fromsearch&id=5124	A resilient community has … "an improved ability to withstand, respond to and recover from disasters."
The Infrastructure Security Partnership and Society of Military Engineers (SAME). "Understanding Resilience … Disaster Resilience Begins with You" (2012) http://t…	Disaster Resilience is…"the ca… ability, to recover rapidly with limited damage."
Disaster Resili… 2012) http://ww…	"Resilience is the abilit… ecover from, and more successfully adapt to adverse ever…
Hurricane San… Region (2013) http://portal.hu… gif	"The ability to prepare … and withstand and recover rapidly from disruptions.
Infrastructure R… http://… pdf	"Abil… conditions and withs… from disruption
Coastal Risk R… Army Corps of … http://www.cop… 8_2013-3.pdf	…for, respond… …disruption… …ons and to
Urban Land In… Resilience and… Documents/AR…	"Th… …o recover after a d… …State before the event."
Presidential Ex… http://www.wh… preparing-unit…	"Resilience means the ab… …and adapt to changing conditions and withstand, respond to, … …ns.".
Rockefeller … resilient	"The capacity of indiv… …survive, adapt, and grow in the face of changes, even …
Community and Regional Resilience Institute (CARRI) (2013) http://www.resilientus.org/wp-content/uploads/2013/03/definitions-of-community-resilience.pdf	"Community resilience … …, limit impact, and bounce back rapidly through survival, ad… …growth in the face of turbulent change"
U.S. Army Corps of Engineers Safety of Dams, Policy and Procedures, ER 1110-2-1156 (2014) http://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1110-2-1156.pdf	"The ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or manmade, under all circumstances of use."
Intergovernmental Panel on Climate Change Fifth Assessment Report, "Climate Change 2014: Impacts, Adaptation, and Vulnerability" (2014) http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Glossary_FGD.pdf	"The capacity of a social-ecological system to cope with a hazardous event or disturbance, responding or reorganizing in ways that maintain its essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation"

Key words:
Prepare
Resist
Recover
Adapt

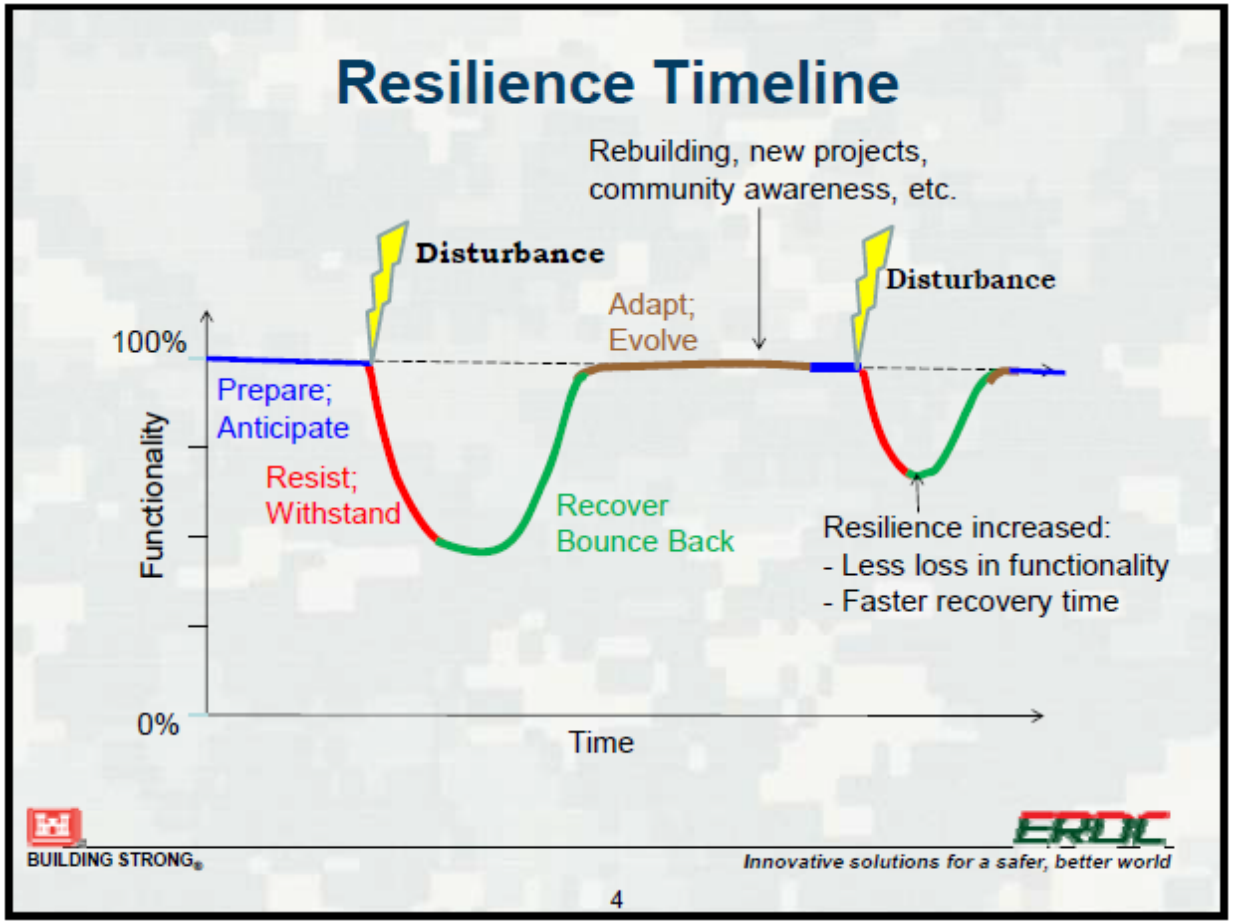


WERP ecosystem resilience:

1. WERP anticipates future changes and prepares the system to perform under those changing conditions.
2. Due to WERP restoration the system better withstands disturbances associated with the future changes.
3. Due to WERP restoration the system recovers more quickly from disturbances.
4. WERP improves the ability of the system to evolve and adapt to future changes.

Note emphasis on future changes & uncertainties. Not limited to climate change.

WERP RESILIENCE PM



Natural resilience can be restored in WERP:

1. Improve **preparedness** (such as operational flexibility and storage, to reduce impacts of changes and disturbances)
2. Improve **resistance** (operational flexibility; reduce evaportranspiration uncertainties; minimize 'finicky' features; increase natural areas and connectivity for natural resistance)
3. Improve **recovery** time after disturbance (deliver clean water when/where needed)
4. Incorporate **adaptability** (increase natural areas and connectivity so species can adapt; minimize 'finicky' features; adaptive management plan)

WERP RESILIENCE PM SCORING

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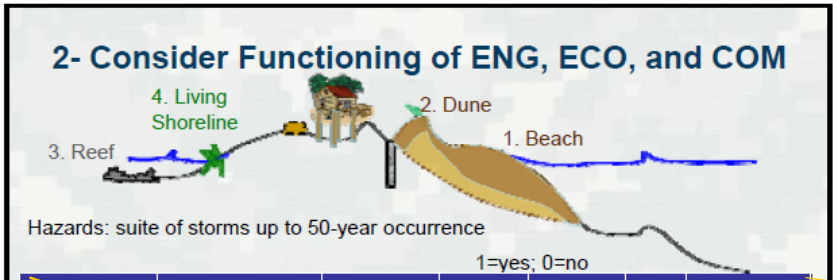
Coastal project example…

Scoring the variables can produce a resilience score.



Critical Element	Functional Obj, F	Recovery Obj, R	Was F met?	Was R met?	F+R	Weighting, W
1. Beach	Prevent surge	3 mos	1	1	2	0.25
2. Dune	Prevent overtopping	3 mos	0	1	1	0.3
3. Reef (bay)	Reduce erosion by 10%	6 mos	0			
4. Living Shoreline (bay)	Reduce erosion by 30%	6 mos	0			

Resilience Metric = {Σ(F+R)*W}/2 = (2*0.25+1*0.3+

Hazards: suite of storms up to 50-year occurrence

1=yes; 0=no

Critical Element	Functional Obj, F	Recovery Obj, R	Was F met?	Was R met?	F+R	Weighting, W
1. Beach	Prevent surge	3 mos	1	1	2	0.25
2. Dune	Prevent overtopping	3 mos	0	1	1	0.3
3. Reef (bay)	Reduce erosion by 10%	6 mos	0	1	1	0.2
4. Living Shoreline (bay)	Reduce erosion by 30%	6 mos	0	1	1	0.25
Resilience Metric = {Σ(F+R)*W}/2 = (2*0.25+1*0.3+1*0.2+1*0.25)/2=						**63%**

WERP RESILIENCE PM SCORING

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Disturbance Type -->	Extreme Drought				
Alt	Prepare	Resist	Recover	Adapt	Score
0	8	7	2	5	4.9
1					0
2					0
3					0

The metric can be a combined score of how resilient each alternative is to one type of disturbance.

Or, the metric can be a combined score of how resilient each alternative is to a “pulse”, “press”, and “ramp”.

Disturbance Type -->	"Pulse" = Discrete Event. Mega-storms					"Press" = Long, slow stress. Extreme Drought					"Ramp" = Change to new normal. Sea Level Rise				
Alt	Prepare	Resist	Recover	Adapt	Score	Prepare	Resist	Recover	Adapt	Score	Prepare	Resist	Recover	Adapt	Score
0	6	4	2	6	3.6	8	7	2	5	4.9	4	6	7	7	6.3
1					0					0					0
2					0					0					0
3					0					0					0

Then combine the “pulse”, “press”, and “ramp” scores to give each alternative its score.

WERP
ENDANGERED SPECIES ACT EVALUATIONS

ENDANGERD SPECIES ACT CONSULTATION

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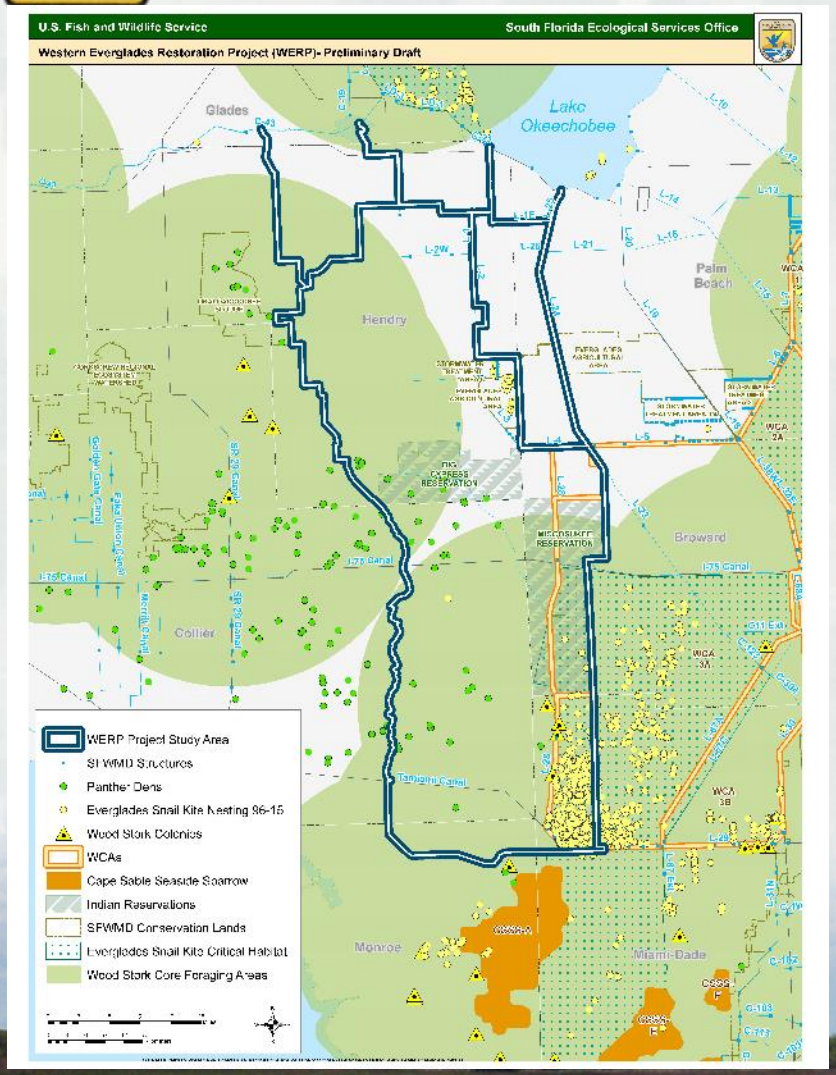

- **Utilize regional hydrologic model output to evaluate potential effects on federally threatened and endangered species.**
  - **Targets developed during recent consultation for the Everglades Restoration Transition Plan**
  - **USFWS Multi-Species Transition Strategy**
  - **Ecological planning tools (species specific models)**

- **USACE and USFWS currently coordinating on model needs**

ECOLOGICAL PLANNING TOOLS

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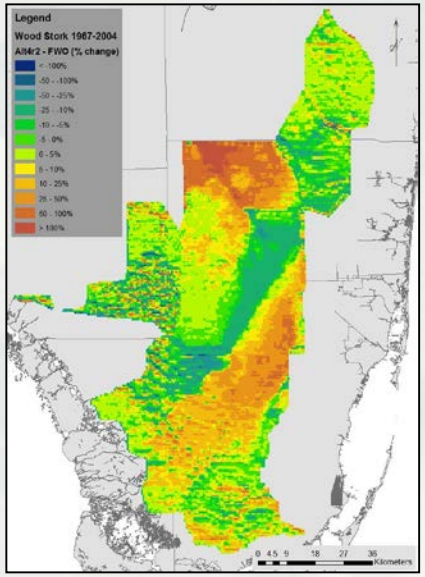
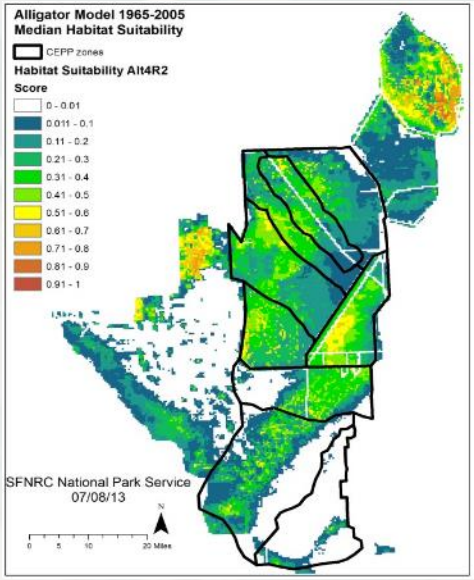
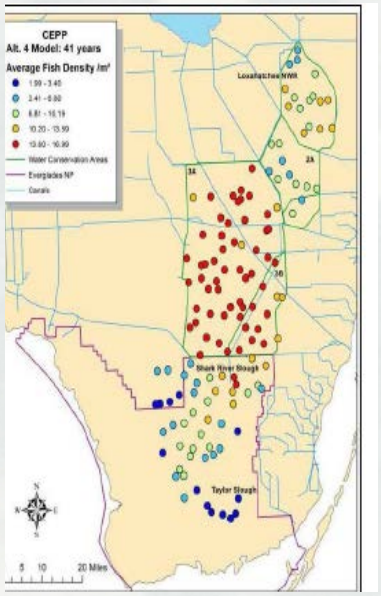
https://www.jem.gov



Great Egret, White Ibis, Wood Stork

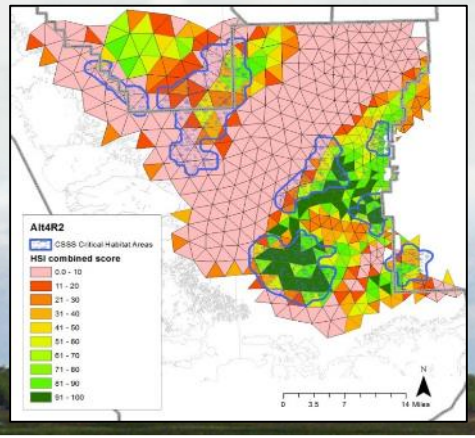


Alligator

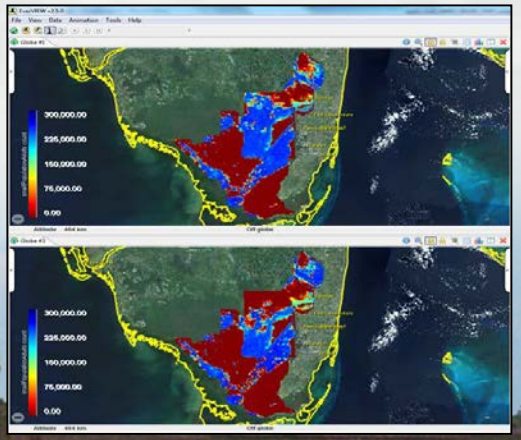


Fish Density

Marl Prairie



Apple Snail



RECOVER REVIEWS

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Per the Programmatic Regulations for CERP:

The REstoration VErification & COordination (RECOVER) interagency science team will also check the ecological effects of WERP. In part, their reviews make sure WERP does not inadvertently have tradeoffs with other Everglades regions.

QUESTIONS?

Water Quality Subteam

Water Quality Sub-team

Update Overview

- Recognition of WQ parameters other than TP
- Existing TP levels (5-year FWM/GM concentrations)
- Project WQ constraints & potential benefit assessment tools
- Future Without Project relies upon meeting WQ requirements
  - Table and map under development
  - Numerical P standards for Everglades Marsh and Miccosukee Alligator Alley Reservation
  - Narrative Class III standards for canals

Water Quality Sub-team

Detailed Discussions

- Seminole Big Cypress Critical Project Summary
- WQ Performance Metric – EPGM and other tools
- STA5/6 summary of P, K, N and SO4
- Potential WQ Treatment: Feeder Canal Basin & C-139 Annex
- Water Quality Definitions (Requirements) table
- Draft numerical interpretations of narrative standards
- Miccosukee Reservation TP results Sep/Oct 2016

Engineering Subteam

Engineering Subteam

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Progress:

- Collected as-built for some canals and levees.
- Ongoing collaboration to develop alternative footprints and maps
- Modeling data collection still on going. Discussed the possible need of topographic data to complement LiDAR data
- Collecting operational data for existing projects and properties for use in model development
- Developed preliminary unit costs for canal plugs and levee degradation
- Acquired detailed information about the Jetport and surrounding areas during site visit held on Jan 27th.

What's next?

- Next subteam meeting is **Monday, Feb. 6th at 1:00-2:30pm**
  - Develop strategies in order to size some of the WERP features
  - Locate potential Cultural Resources within the project footprint
  - Identify critical infrastructure and emergency routes with assistance from Real Estate
  - Modeling team will discuss outcome of field trip to Tamiami Trail culverts and Loop Rd. (Feb 1st)

PDT Questions? Discussion?

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Will WERP be easy? No.

Will WERP be worth it? Yes!

Public Comment

Next Steps & Wrap Up