Comprehensive Everglades Restoration Plan Adaptive Management Challenges and Lessons Learned

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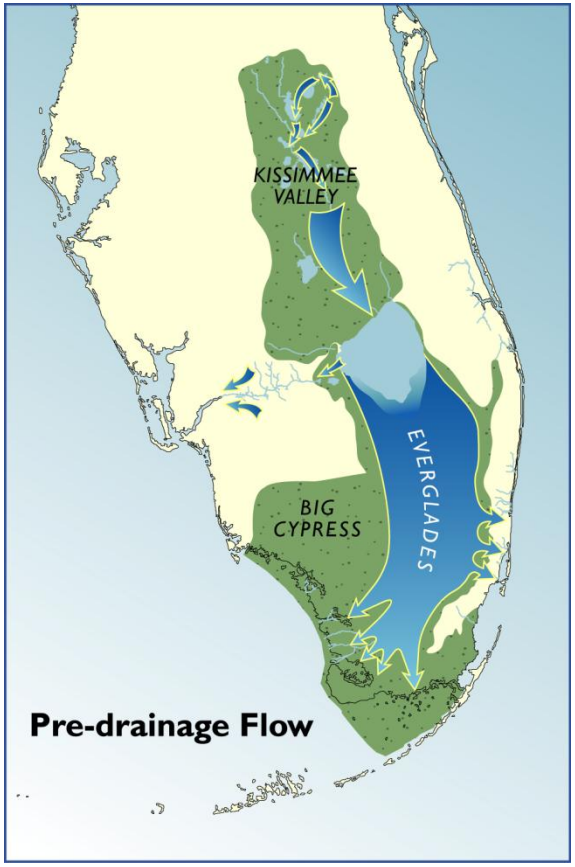
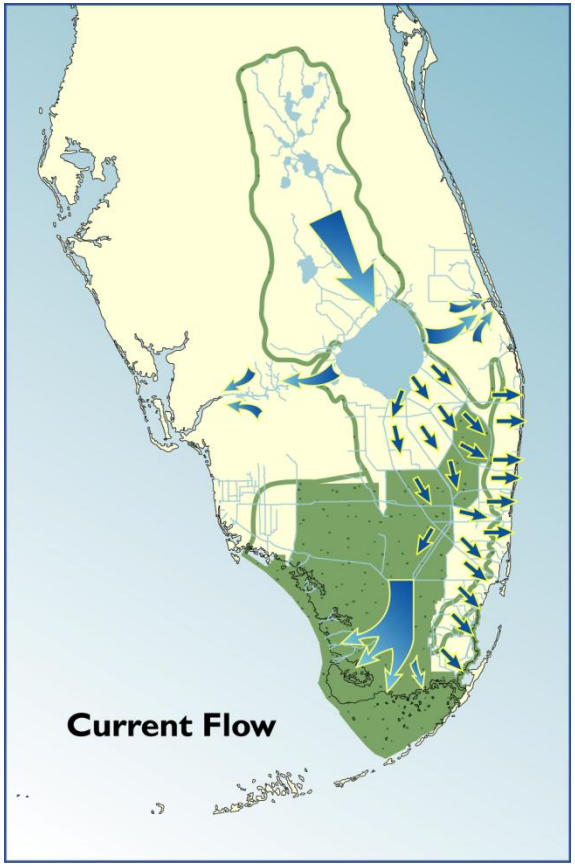
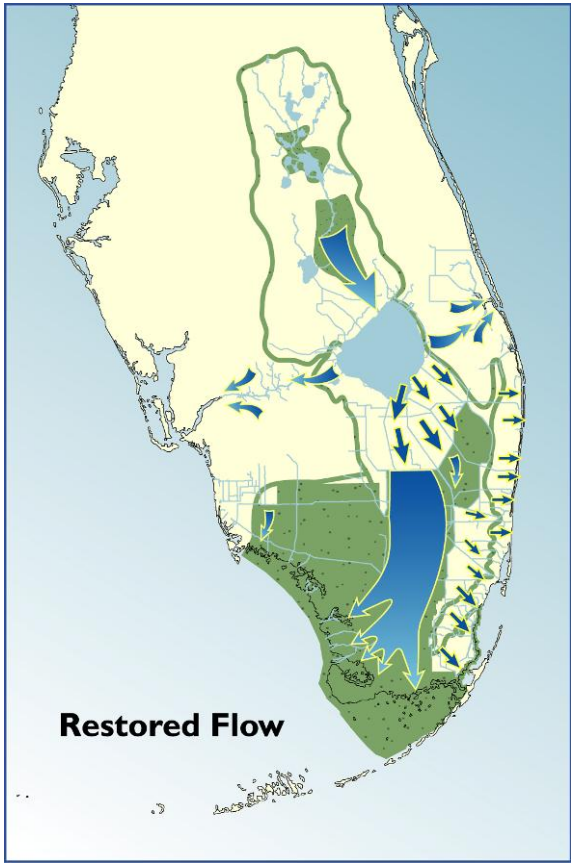
Comprehensive Everglades Restoration Plan (CERP) Adaptive Management (AM) Program Overview

- Everglades Restoration Overview
- CERP Adaptive Management Overview
- Challenges and Solutions
  - Stakeholder Engagement and Collaboration
  - Institutional Change
  - Science Integration Into Decision-Making Process
  - Flexible and Robust Plans and Success Criteria
  - Competing Ecological Demands

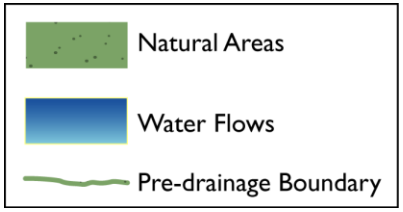
CERP Goal







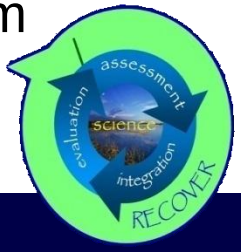
- ✓ Area - 18,000 square miles
- ✓ Population today - 6.5+ million



Definition of Adaptive Management

- **CERP AM Basic Definition:**
  - ***A structured management approach that links science to decision-making in order to improve the probability of restoration success***

- CERP AM Principles
  - Promote stakeholder engagement, interagency collaboration, and conflict resolution
  - Employ a formal science-based management approach using learning to address scientific/technical uncertainties
  - Incorporate flexibility and robustness into planning, design, and construction and operations to address uncertainty
  - Iteratively incorporate scientific information into the decision-making process to allow for changes as implementation proceeds
  - Utilize the most cost-effective approach to maximize ecosystem restoration.



Stakeholder Engagement and Collaboration

Quote: "Restoration would be much easier if there was just one party (myself) made the decisions."

- Collaboration – Challenge
  - Multiple mandates and agendas
  - Increased coordination demands and complexity of issues
  - FACA restricts two-way dialogue with non-agency stakeholders
- Interagency Collaboration – Solution
  - Joint teams with shared decision-making (interagency scientific team – RECOVER) and develop AM plans
  - Use existing FACA-compliant forums with opportunities for two-way dialogue – e.g., South Florida Ecosystem Restoration Task Force

Institutional Change

Quote: "We're already doing it, managing adaptively. AM costs too much. Don't add extra process, we already have enough."

- Integration - Integrate AM activities into existing processes
- Updates and Dialogues – meet with each agency, division, and branch to engage on how best to implement AM
- Mandates – dedicated legal authority and funding
  - 2000 Water Resources Development Act
  - 2003 Programmatic Regulations
  - 2009 USACE HQ Guidance Requiring AM Plans
- Guidance – move beyond theory into technical applications (How to implement AM)
  - 2010 CERP Adaptive Management Integration Guide
  - 2011 CERP Guidance Memorandum on AM in Program and Project Implementation

CERP AM Integration Process

USACE Six Step Planning Process

- Step 1: Identify Problems and Opportunities
- Step 2: Inventory and Forecast Conditions
- Step 3: Formulate Alternative Plans
- Step 4: Evaluate Alternative Plans
- Step 5: Compare Alternative Plans
- Step 6: Select Plans
- Project Life-Cycle: Design
- Project Life-Cycle: Construct
- Project Life-Cycle: Operation and Maintenance

Nine AM Activities For CERP

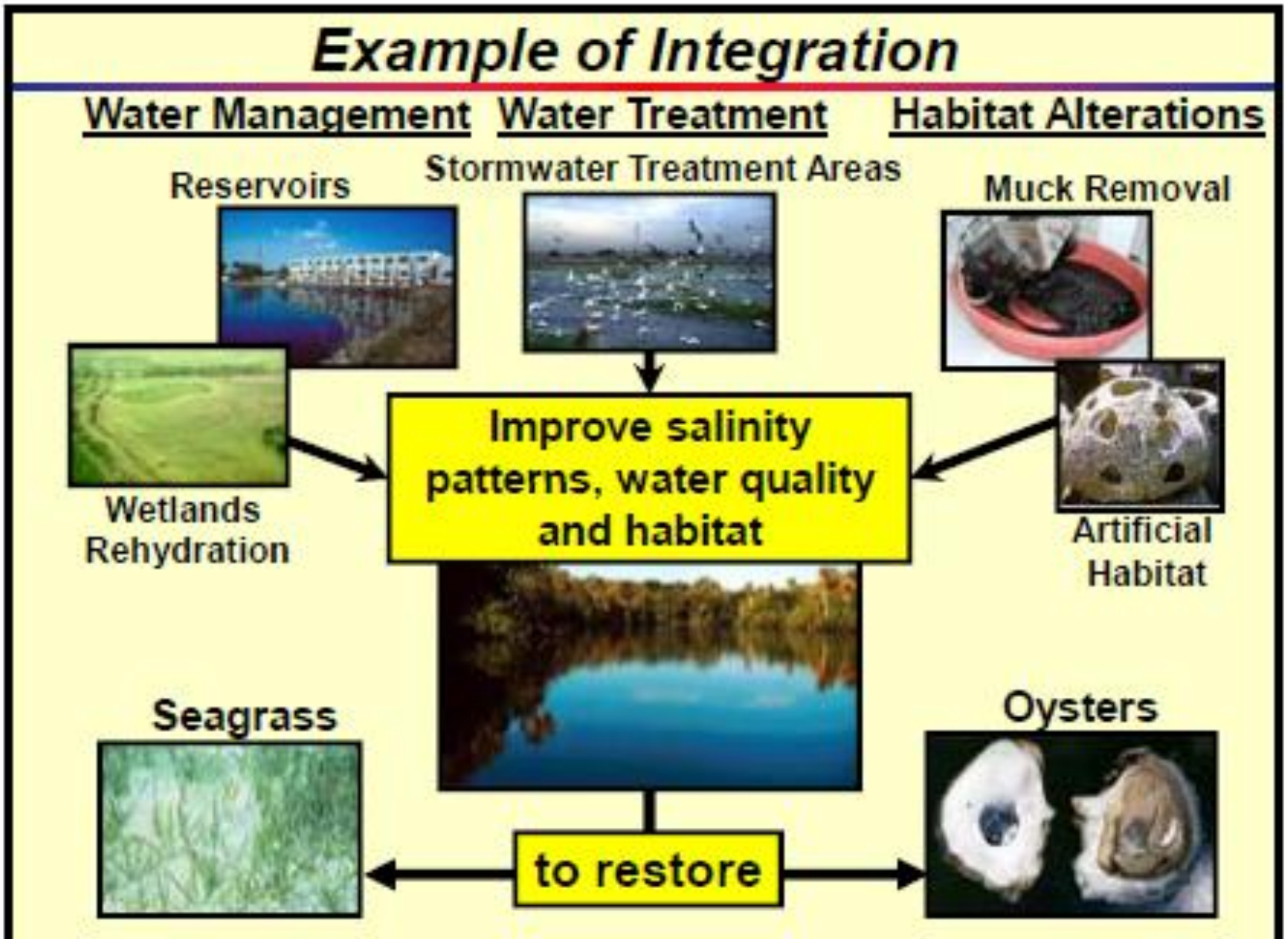
- Activity 1: Stakeholder Engagement and Collaboration
- Activity 2: Establish or Refine Restoration Goals and Objectives
- Activity 3: Identify and Prioritize Uncertainties
- Activity 4: Develop And Apply CEMS, Hypotheses, Performance Measures
- Activity 5: Integrate AM Into Restoration Plan
- Activity 6: Monitor
- Activity 7: Assess
- Activity 8: Decision-Making
- Activity 9: Implementation and Refinement

Science Integration into Decision-Making

Quote: "What do those scientists do all day anyways? Another report from pointy-headed scientists to go on the shelf."

- Feedback Loops
  - Science management feedback loops during planning, design, implementation, and operations
  - Opportunities for dialogue between managers and scientists
- Integrated Performance Reporting
  - Weekly to monthly operations reports to inform operational adjustments
  - Annual reports on status
  - Multi-year synthesis reports explaining trends
- Management Options Matrices
- Decision-Support Tools
  - Tools that integrate restoration performance with other types of management information (cost, legal, policy) to evaluate multiple objectives

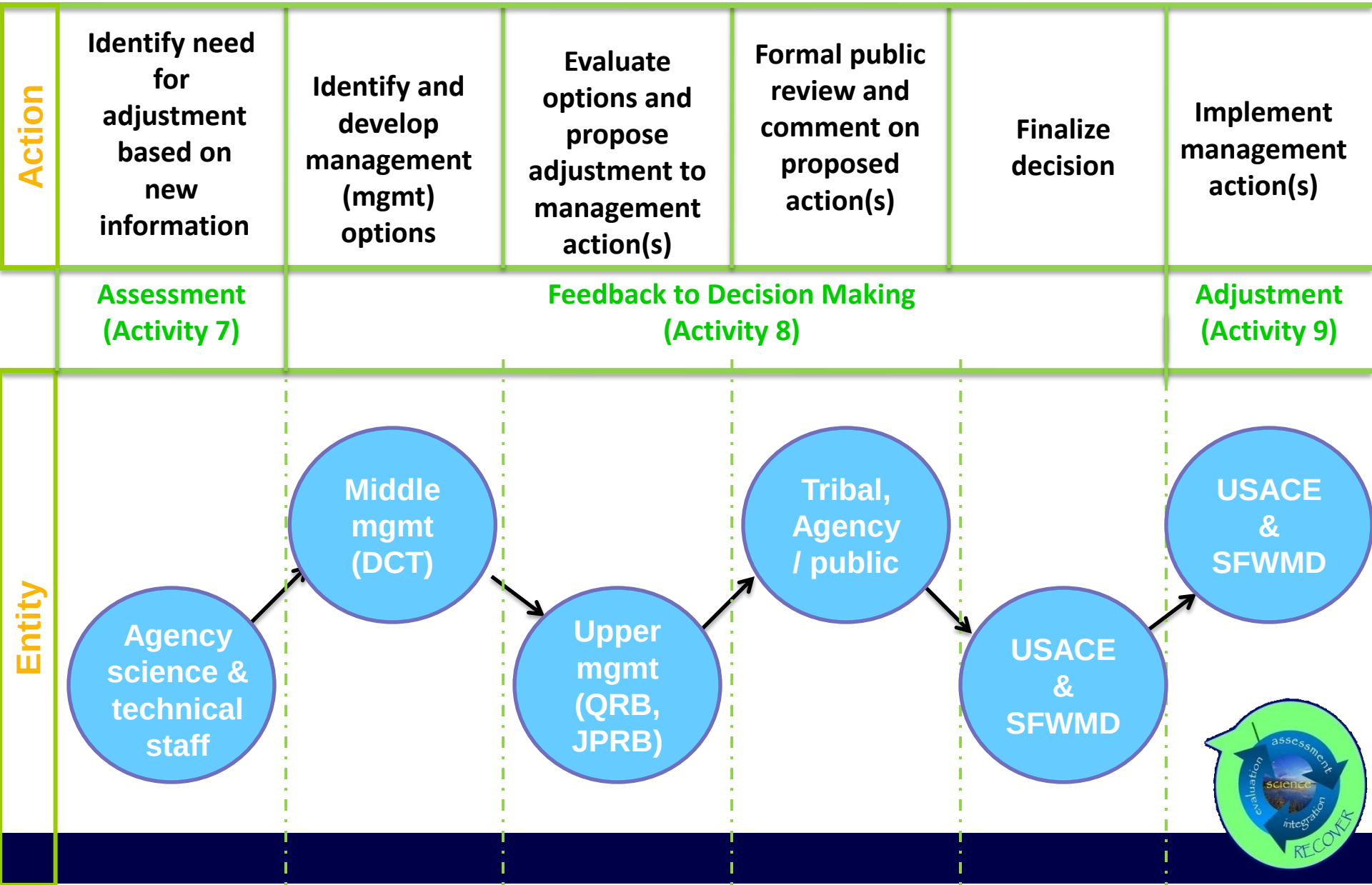
Example of Integration



Management Options Matrix

Stressor/ Attribute Metric	Restoration Target (Timeframe)	Management Option 1	Management Option 2	Management Option 3
Salinity	Salinity range of 10-25 ppt (1 yr)	Change operations to meet flows	Additional storage for operational flexibility	
Oyster Recruitment	Presence/absence adults and larvae (2-3 years)	Seed with juveniles	Stock adults	Change operations to avoid too much or too little flow in key months
Seagrass	Increase biomass and range of *Vallisneria / Halodule* seagrass (2-5 years)	If water quality targets have not been met, then address first	If desired salinity range is met, change operations to adjust flows based on new hypothesis	Implement seagrass plantings in coordination with state, USDOI, and NOAA

Current Feedback to CERP Decision Making Process

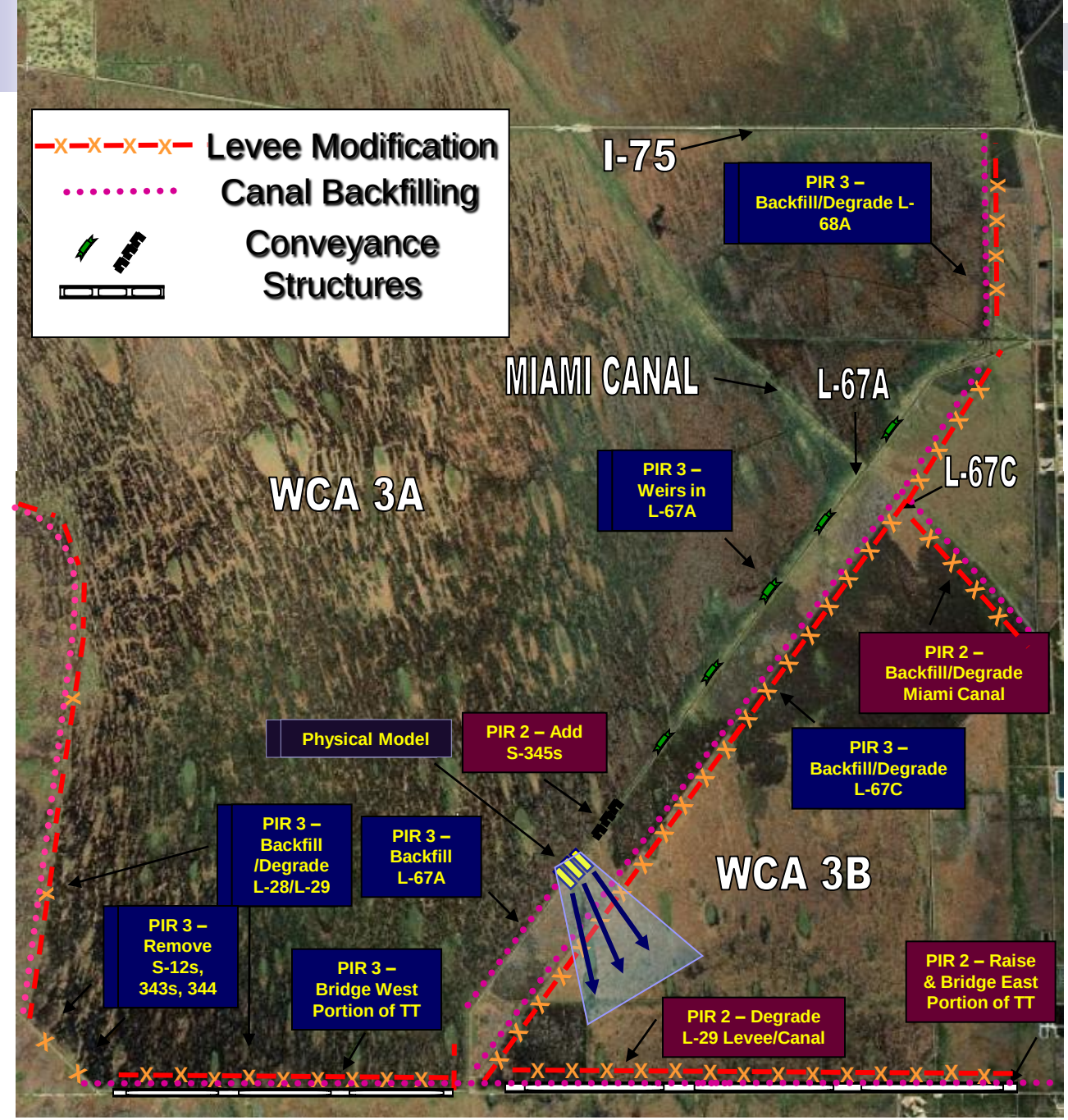


Flexible and Robust Plans

- Flexibility – need opportunities to adjust management actions
- Robust Designs – project/plan performs well under a variety of future scenarios
- Success Criteria – flexibility to meet multiple targets over time and space (interim goals vs. long-term restoration goals)

Flexibility Example: Decomp Physical Model

- Project has three parts
- Pilot project informs future project plans



Competing Ecological Demands

- Multiple Indicators: Integrate multiple performance indicators related to multiple restoration objectives and/or constraints
- Identify Competing Ecological Demands: Alternatives that improve some performance indicators can impact others
- Incorporate Values (Preferences): Stakeholders and partner agencies may value performance towards multiple objectives differently
- Develop New Options: through collaboration new solutions can be identified to minimize impacts in near term or maximize performance in long-term

Multiple Indicators

Table 1. List of System-wide Indicators (SCG Indicators Report)

- Fish and Macroinvertebrates
- Wading Birds (Wood Stork and White Ibis)
- Wading Birds (Roseate Spoonbill)
- Florida Bay Submerged Aquatic Vegetation
- Florida Bay Algal Blooms
- Crocodilians (Alligators and Crocodiles)
- Oysters
- Periphyton-Epiphyton (communities of microscopic algae and bacteria)
- Juvenile Pink Shrimp
- Lake Okeechobee Littoral Zone
- Invasive Exotic Plants

Table 2. Additional RECOVER System-wide/Regional Performance Measures

- High and Low Water Levels
- Sheet Flow
- Wet Prairie
- Duration of Dry Events
- Inundation duration
- Coastal Salinity Gradients
- Ridge and Slough Patterns
- Tidal Creek Patterns
- Lake Okeechobee Stage
- Lake Okeechobee WQ
- Lake Okeechobee Vegetation, Fish Population, Macroinvertabrates

Table 3. Constraints

- TP - TN concentrations, loading
- TP in soils
- Endangered Species Critical Habitat
- Flood Damage Reduction Protection

Table 4. Additional Metrics and Values

- Cost/Benefits
- Recreational Benefits
- Socio-Economic
- Historic Preservation

Example of Different Values (Weights) by Agency

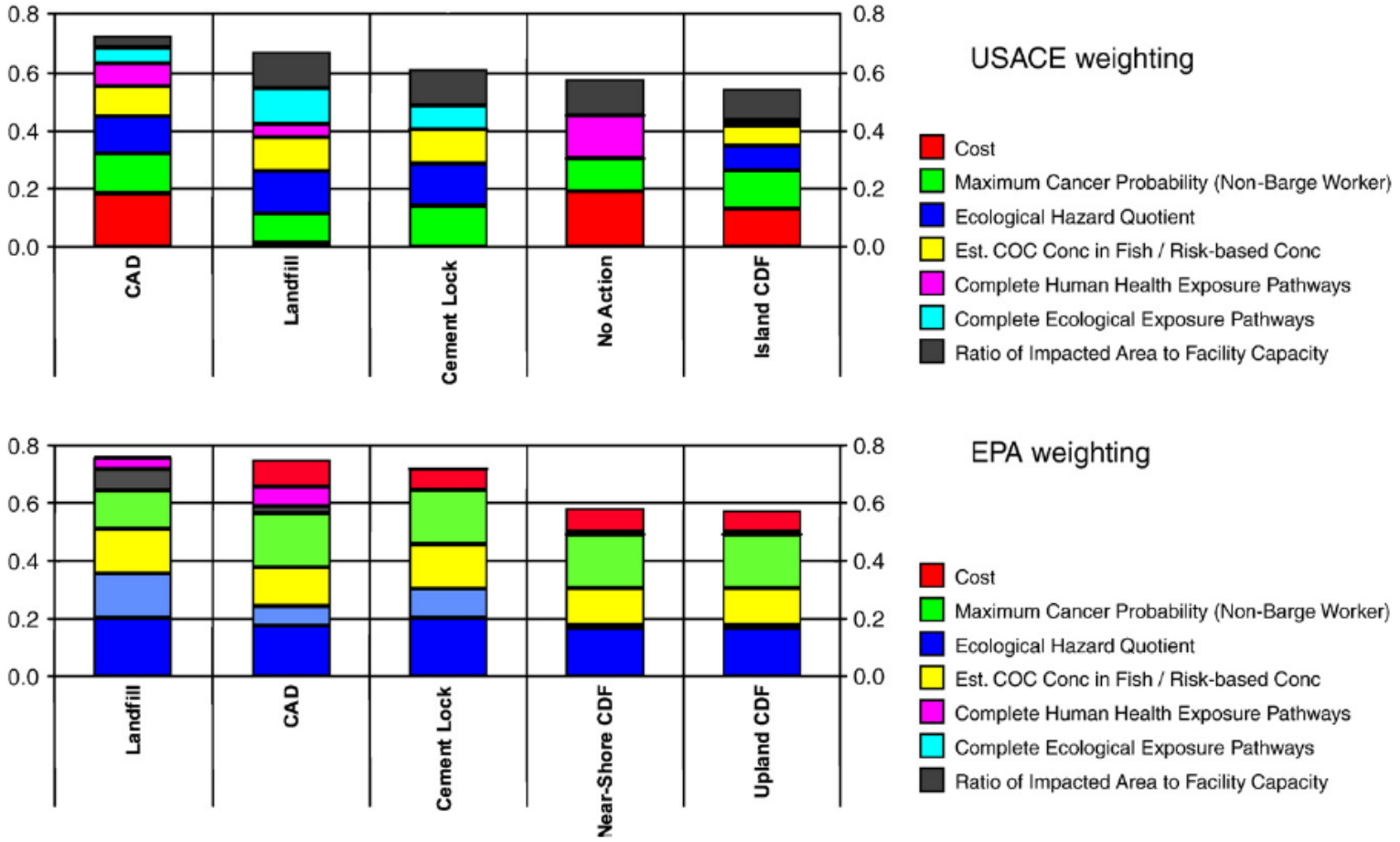
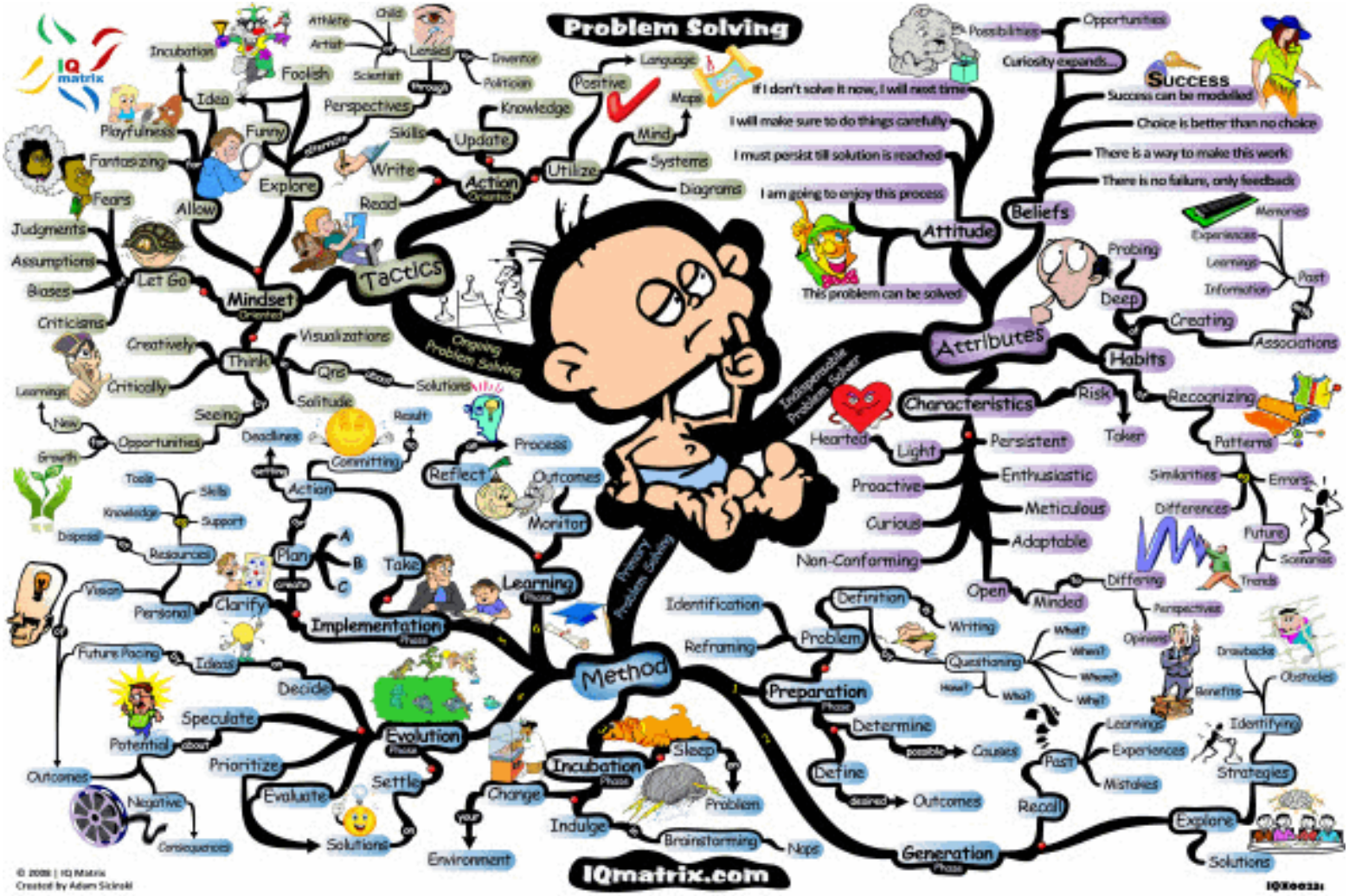


Fig. 5. Comparison of sediment management alternative scores when criteria weightings or related information change.

From I. Linkov, et al., Env. Inter. 32 (2006) 1072-1093

Questions?



CERP Adaptive Management:
http://www.evergladesplan.org/pm/program_docs/adaptive_mgmt.aspx