

ANNEX F  
REPORTS PROVIDED BY RECOVER  
TO SUPPORT THE  
PROJECT IMPLEMENTATION REPORT

This page intentionally left blank

**TABLE OF CONTENTS**

F.1	C-111 SPREADER CANAL PROJECT DRAFT SYSTEM-WIDE EVALUATION REPORT UPDATE (February 27, 2007) .....	F-1
	APPENDIX B – PERFORMANCE MEASURE DESCRIPTIONS .....	F-13
F.2	C-111 SPREADER CANAL RECOVER EVALUATION TEAM REGIONAL EVALUATION REPORT TRANSMITTAL LETTER .....	F-15
F.3	C-111 SPREADER CANAL RECOVER PROJECT SYSTEM-WIDE EVALUATION REPORT ADDENDUM FINAL .....	F-19
F.4	C-111 SPREADER CANAL RECOVER CONSISTANCY REVIEW OF PROJECT-LEVEL PERFORMANCE MEASURES (Final June 21, 2004).....	F-39
F.5	C-111 SPREADER CANAL RECOVER CONSISTENCY REVIEW OF PROJECT-LEVEL MONITORING AND RECOMMENDATIONS FOR INCLUSION INTO THE MONITORING AND ASSESSMENT PLAN .....	F-65

This page intentionally left blank

## F.1 C-111 SPREADER CANAL PROJECT DRAFT SYSTEM-WIDE EVALUATION REPORT UPDATE (FEBRUARY 27, 2007)

### 1.0 Introduction and Purpose of Evaluation Update

REstoration COordination and VERification (RECOVER) reviewed the C-111 Spreader Canal (C-111 SC) Project Team final array of alternative plans and developed a system-wide evaluation report in August 2007. The Project Delivery Team (PDT) has requested an update to the system-wide evaluation to address several changes

1. Model Assumptions: recent model assumption changes were limited to comparing two versions of alternative 2D, 2DS (short) that contains an approximately 2 mile aerogjet canal and 2DL (long) that contains an approximately 4 mile long aerogjet canal. Another model assumption change was restricted to the amount of water routed to the aerogjet vs. the rest of the C111. All other model assumptions and post processing techniques have remained the same.
2. New System-wide Insights: The PDT asked if the RECOVER system-wide planning, evaluation, monitoring and assessment efforts had improved our understanding of the contributions the C-111 SC Western Project would make at the system scale.

Due to the limited amount of time allowed to address these two issues, this draft update of the system-wide evaluation only focuses on a general clarification of the project's goals and objectives, new system-wide insights and how the Western PIR, the Eastern PIR and the C-111SC project as a whole fit into the overall adaptive management (AM) approach for CERP. A final draft will incorporate RECOVER's review of the updated modeling output and verify the contributions of the Western PIR to system-wide performance.

#### 1.1 RECOVER and Regional Evaluation Description

The role of RECOVER is to organize and apply scientific and technical information in ways that are most effective in supporting the objectives of the Comprehensive Everglades Restoration Plan (CERP or Comprehensive Plan). One of the primary missions of RECOVER is to work with the project team to evaluate and maximize the contribution made by each project to the system-wide performance of the CERP. The RECOVER Evaluation Team (ET) is charged with the responsibility of conducting system-wide evaluations (previously termed regional evaluations).

The ET is an interagency and interdisciplinary scientific and technical team charged with developing and using performance measures for evaluating alternative plans developed for Project Implementation Reports (PIRs). The purpose of the ET evaluation is to ensure that alternative plans are consistent with the goals and purposes of the CERP. For its evaluations, the ET has developed a suite of approximately 40 ecological performance measures and 8 water supply and flood protection performance measures. Output from the South Florida Water Management Model (SFWMM), which is the primary hydrologic simulation model for the CERP, is used to produce performance measure output. The SFWMM is a regional-scale model that provides simulations of hydrologic conditions at a 2-mile by 2-mile spatial resolution. Because of the large-scale resolution of the model and the relatively small

hydrologic influence of some CERP projects, ET performance measures may not always reveal differences in system-wide performance of project alternative plans. In these cases, RECOVER uses other scientific information to evaluate the potential performance of project alternatives on the system. In the case of hydrologically isolated projects, which is the case for C-111 SC that is at the end of the system, RECOVER can not rely only on regional modeling results for projects. For this project, the scope of RECOVER's evaluations includes reviewing project-level model results and applying best professional judgment.

RECOVER offers four types of evaluations for PDT's: (1) Consistency review of project goals and objectives with the goals and objectives of CERP, (2) Consistency review of project performance measures with RECOVER system-wide performance measures, (3) a system-wide evaluation (formerly "regional evaluation") of the project, and (4) a monitoring plan review. For the purpose of this report, the ET system-wide evaluation does the following<sup>1</sup>:

1. compares the proposed project alternative plans with the expectations of the CERP;
2. describes the performance of each alternative at the system scale using system-wide performance measures, project performance measures, and best professional judgment;
3. identifies improvements to project performance that might improve its system level performance; and
4. provides decision-makers with scientific information needed to recognize the regional performance expectations of specific projects in combination with other CERP projects.

This system-wide evaluation focuses on the Western C-111SC project as the first phase of the project with the understanding that both Western and Eastern phases must be implemented for the project to meet the restoration goals and objectives outlined in the CERP.

## **2.0 Project Background and General Description of Alternative Plans**

### **2.1 Project Goals and Objectives and Consistency with CERP Goals and Objectives**

The C-111 Spreader Canal project was one of the ten projects conditionally authorized for implementation by Section 601(b)(2)(C) of the Water Resources Development Act (WRDA) 2000. The original purposes of the C-111 Spreader Canal Project as stated in the Yellow Book are:

---

RECOVER System-wide evaluation standard operating procedure:  
[http://www.evergladesplan.org/pm/recover/recover\\_docs/et/rec\\_sop\\_reg\\_eval\\_current.pdf](http://www.evergladesplan.org/pm/recover/recover_docs/et/rec_sop_reg_eval_current.pdf)

1. improve deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas,
2. reduce wet season flows in C-111, and
3. decrease potential flood risk in the lower south Miami-Dade County area.

The original project objectives developed by the PDT consistent with the goals above were as follows:

- Improve flow patterns, hydroperiods, and ecological connectivity of the Southern Glades, Model Lands and adjacent natural areas
- Improve habitat, functional quality of existing natural areas and increase spatial extent where practicable
- Improve native plant and animal species abundance and diversity
- Reserve sufficient water for the restoration of the natural system
- Eliminate ecologically damaging flows through C-111 Basin to Barnes Sound and Florida Bay
- Provide ecologically compatible water quality consistent with restoration goals and federal and state requirements applicable to the Southern Glades, Model Lands and ENP

Due to stakeholder concerns and a number of decision-critical uncertainties associated with the entire C-111 SC project, the proposed project was split into two separate projects; the C-111 SC Western project and the C-111 SC Eastern project (see section 4 and 5 of the C-111 SC Western PIR). The Western PIR is intended to help address the following objectives related primarily to increasing flows to Florida Bay via Taylor Slough:

- Restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough to historic levels derived from the pre-drainage models;
- Improve hydroperiods and hydropatterns in the Southern Glades and Model Lands. The hydroperiods will be improved to optimal levels to support historical vegetation patterns as derived from the pre-drainage models; Hydropatterns will be restored to historical sloughs and associated tributaries.
- Return coastal zone salinities to historical, recorded conditions through the redistribution of water that is currently discharged to tide.

The CERP Plan specified ecological, economic, and social well being goals. These include enhancing ecological values by increasing spatial extent of natural areas, improving habitat and functional quality, improving native plant and animal species abundance and diversity; and enhancing economic values and social well being by increasing available fresh water, providing recreational and navigation opportunities, and protecting cultural and archaeological resources and values (USACE and SFWMD, 1999). The CERP Plan also recognized that there were several performance issues that needed to be addressed during detailed project planning and design, including:

1. The plan needs to increase total overland flow to Florida Bay, northeast Shark River Slough and Taylor Slough to fully meet Natural System Model depth and duration targets;
2. The plan needs to improve ecological performance in the Water Conservation Areas by eliminating damaging high and low water conditions;
3. The plan should improve ecological conditions in Biscayne Bay by restoring more natural freshwater inflows;
4. The risks and uncertainties associated with using wastewater reuse as a water source for Biscayne Bay should be closely examined;
5. Restoration targets in the St. Lucie Estuary should be more closely met; and
6. The plan needs to improve ecological performance in the Model Lands and C-111 Basins by providing adequate freshwater to maintain target hydropatterns

The Western PIR's objectives are consistent with the need to increase total overland flow to Taylor Slough by ensuring current and future flows developed by the remaining CERP projects maintained in Taylor Slough. They are also consistent with the desired restoration condition identified in Southern Estuaries salinity performance measure for Florida Bay.

“Provide less abrupt and less extreme decreases in salinity in the northeastern bay. Reduce the frequency, duration, magnitude, and extent of hypersaline conditions throughout the bay. Increase the frequency and extent of lower salinity conditions in the bay. Restoration of timing entails restoration of fresh water flows that continue after the end of the rainy season. This is associated with restoration of the wetland's function as a hydrologic buffer. In the mangrove estuarine areas, lower salinity to oligohaline levels in coastal lakes and basins.”

They are also consistent with more specific goals and objectives defined by the yellow book for the C-111 SC (see Appendix A). However, achievement of these goals and objectives by the C-111 SC project will require several other key CERP and non-CERP projects described in Table 2.

Table 2: CERP and Non-CERP Projects that Influence C-111 SC Benefits

1. Modified Water Deliveries to Everglades National Park Project,	2. Conveyance between Water Conservation Area 3A and Water Conservation Area 3B,
3. Conveyance between Water Conservation Area 3B and Northeast Shark Slough (Tamiami Trail),	4. 8.5 Square Mile Area,
5. Interim Structural and Operation Plan (ISOP) and Interim Operational Plan (IOP),	6. Combined Structural and Operational Plan (CSOP),
7. Biscayne Bay Feasibility Study,	8. Biscayne Bay Coastal Wetlands Project (BBCW),
9. Florida Bay & Florida Keys (FB&FK) Feasibility Study,	10. Save Our Rivers Model Lands and Southern Glades Projects,
11. Florida Power & Light Company South Dade Mitigation Bank,	12. RMC South Florida, Inc. Mitigation Area, and
13. West Dade Wastewater Reuse Technology Feasibility Study	

## 2.2 Additional Project Background

A PDT was formed to prepare a PIR for the implementation of the proposed C-111 SC project. The PDT determined that the proposed project as originally described in the YB could not meet the goals and objectives envisioned for the C-111 SC project (See section 5.2 of the draft Western PIR). The PDT reformulated the proposed project, developing more specific goals and objectives for the planning process that would maximize environmental restoration potential within the project area and that are consistent with CERP restoration goals and objectives. Management measures were formulated that included Stormwater Treatment Areas, canal construction and backfilling, detention areas, and pump stations. Management measures were combined to produce 21 alternative plans that were screened based on constraints such as environmental impacts to adjacent areas, redundancy with other alternatives, costs significantly above projected levels, etc. Subsequent screening of the alternative plans produced a final array of 7 plans that were based on reducing seepage from Taylor Slough and early benefits in Southern Glades/Model Lands.

A major complication to the C-111 SC project is the fact that the 1994 C-111 South Dade General Reevaluation Report (GRR), initiated by the U.S. Army Corps of Engineers and the South Florida Water Management District, was not constructed. The 1994 GRR was focused on four main objectives

- restoration of hydrologic conditions in the C-111 Basin (Taylor Slough and eastern panhandle of ENP);
- projection of Natural Values associated with the ENP;
- elimination of damaging freshwater flows to Manatee Bay/Barnes Sound; and,
- maintenance of flood protection for the C-111 Basin, east of L-31N and C-111.

The following features recommended in the 1994 GRR have not been constructed:

- A spreader canal from C-111 to U.S. Highway 1
- A 50 cfs spreader canal pump
- 10 plugs in the C110
- Backfill the L31W from S176 west to S332

### 2.3 Adaptive Management Approach

An adaptive management approach was developed to address these decision-critical uncertainties over the course of implementing both C-111 SC PIRs

1. What is the volume (and timing) of water which will be available for the spreader canal from S-177 discharges following implementation of all C 111 South Dade/MWD features, and C-111 SC Western features?
2. Based on the amount of water available for the spreader canal, what are the most appropriate alignment and design for the spreader canal in order to maximize ecological restoration without adversely impacting privately owned lands?
3. Will present trends in S-178 water quality improvement continue, or would an infiltration basin and/or source controls be required to sufficiently improve the quality of S-178 discharges to the degree necessary to ensure that water discharged from the future spreader canal is “marsh ready?”
4. How can drainage features best be eliminated for restoration without causing flooding impacts to agricultural lands in the project area?

The Western PIR incorporates the principles of incremental adaptive restoration in the 2006 and 2008 National Research Council (NRC) biennial report on Everglades restoration progress. The principles state that projects faced with decision-critical uncertainties should design project increments to achieve early restoration benefits and learning benefits critical to completing the full project or grouping of projects needed to achieve system-wide restoration performance. The C-111 SC approach is compatible with the overall CERP AM approach supported by the NRC and summarized as follows:

1. The answer to uncertainty #1, specifically, “What is the volume (and timing) of water which will be available for the spreader canal from S-177 discharges following implementation of all C-111 South Dade/MWD features, and C 111 SC Western PIR features?” will become clear following completion of the South Dade/MWD and C-111 SC Western PIR features.
2. The answer to uncertainty #2, specifically, “What is the most appropriate alignment and design for the spreader canal in order to maximize ecological restoration without adversely impacting privately owned lands?” will be answered through construction of a reduced scale spreader canal design test feature (C-111 SC Design Test), which is currently being formulated as a separate project, and documented under a separate NEPA document.
3. The answer to uncertainty #3, specifically, “Will present trends in S-178 water quality improvement continue, or would an infiltration basin and/or source controls be

required to sufficiently improve the quality of S-178 discharges to the degree necessary to ensure that water discharged from the future spreader canal is marsh ready?" will be answered over time. Ongoing monitoring of S-178 discharges will be continued even beyond initiation of the subsequent C-111 SC Eastern PIR. If improvements in water quality over time do not appear to be sufficient to provide reasonable assurances that water discharged from the future spreader canal will be marsh ready, a reduced scale test feature and/or source control program, which would be formulated as separate projects, and documented under a separate NEPA document, will be recommended.

4. To answer uncertainty #4, Western PIR intends to reduce seepage from Taylor Slough and increase more natural flows to Eastern Florida Bay via Taylor Slough. Learning opportunities contained in the operation of the Frog Pond and Aerojet canal will be focused on addressing constraints related to Cape-Sable Seaside Sparrow, agriculture, and potential unintended impacts, as well as through passive AM application coupled with RECOVER/project joint monitoring and assessment, determine how much additional water may be needed to reach full system-wide goals and objectives for Taylor Slough and Florida Bay.

## 2.4 General Description of Alternative Plans

The C-111 SC Project identified their final array of seven project alternative plans.

Alt1C	Includes FPDB and pump for FPDB, consistent with the State Expedited Construction plan; FPDB is approximately 530 acres; the FPDB pump intercepts two thirds of S-176 flow; FPDB maximum depth of 3 feet
Alt1D	Same as Alt1C, plus: two operable structures in the lower C-111, one plug at S-20A, and operational changes at S-20.
Alt2DS and 2DL	Includes FPDB approximately 530 acres with maximum depth of 3 feet, pump for FPDB intercepts one third of S-176 flows, gravity structure upstream of S177 to discharge into Aerojet Canal., two operable structures in the lower C-111, one plug at S-20A, and operational changes at S-20. Alt 2DS and 2DL differ in the length of the Aerojet Canal.
Alt3D	Includes FPDB approximately 530 acres with maximum depth of 3 feet, pump for FPDB intercepts one third of S176 flows, pump upstream of S-177 to discharge into Aerojet Reservoir , two operable structures in the lower C-111, one plug at S-20A, and operational changes at S-20.
Alt4D	Increase pumping at S-332D (maximum of 1,000 cfs), two operable structures in the lower C-111, one plug at S-20A, and operational changes at S-20.
Alt6D	Construct seepage barrier from northern portion of L-31W (just west of S-332D) south along FPDB to the southern end of Aerojet Canal, two operable structures in the lower C-111, one plug at S-20A, and operational changes at S-20.

After the first increment (Western PIR), the PDT will use information feedback from the AM approach to determine the proper trade-offs in restoring the Southern Glades and the Model Lands and better develop the second PIR (eastern). Both PIRs have features that will compete for the overall amount of water being delivered to the project area. The opportunity exists for more water to be available to the project from the implementation of future CERP projects.

## 3.0 Evaluation Methodology and Information Considered

A final array of alternative plans has been modeled using the MODBranch model. All alternatives use the 2050B3 SFWMM as a boundary condition. Plan evaluation was performed by comparing the alternatives with the aforementioned boundary condition to the future without project condition. This comparison included the current authorized features for the 1992 Modified Water Deliveries General Design Memorandum as well as the 1994 C-111 GRR features completely built out (including the 50 CFS S332E pump at C-111N) and land use updated to 2050. The Combined Structural and Operational Plan (CSOP) was

not included in the comparison since it is not currently approved. The following rationale also was considered.

- The location of the CERP C-111 SC project is located at the bottom of the regional water system, therefore, does not affect features upstream. In other words, the spreader project is the receiving body of CERP flows through the S177 structure.
- The SFWMM flows from the future without CERP projects are similar to the with CERP projects at the S177 (critical structure used to determine flows to the spreader canal) (Figure 2). This means that whether or not CERP boundary conditions (system evaluation) or future without boundary conditions are used, similar results should be obtained in the overall evaluation and comparison of alternatives.

#### **4.0 System-wide Performance of Alternatives Plans**

As indicated above, the PDT used an existing MODBranch model to conduct simulations during the PDT's alternative plan evaluation efforts. The existing MODBranch model was developed to simulate three individual years intended to be representative of average (1978), dry (1989), and wet (1995) conditions. As such, the PDT's evaluations are limited to comparisons of each alternative plan to a "pre-drainage" target condition (i.e., canals and structures removed from model domain) for each of the referenced single-year simulations within/near the C-111 basin.

The PDT used three performance measures most closely associated with the reframed subset of project objectives for the western PIR for purposes of quantifying differences between the plan alternatives. Appendix B contains the specifics of the following performance measures: 1) Flow Timing and Distribution; 2) Hydroperiods; and 3) Stage-Based Estuarine Salinity Estimates. Due to project performance dependencies on other CERP projects and the fact that this project does not create any additional "pulls" of water, the performance of each plan alternative is difficult to differentiate.

However, the RECOVER Band 1 system-wide planning and evaluation effort, simulated by the South Florida Water Management Model (SFWMM) version 5.7, includes performance of 10 initial CERP projects anticipated to be implemented in the 2015 timeframe, including the C-111 SC Western PIR. Performance in the southern estuaries subteam area indicates slight decreases of salinity in the Taylor River and Little Madeira Bay, which are downstream of Taylor Slough. This suggests that the performance of C-111 SC Western PIR coupled with the other initial CERP and foundation projects (Modified Waters Deliveries, Rain Driven Operations, and Everglades Agricultural Area Reservoir), reduces in both duration and intensity the peak high salinities that are occurring now and are projected to worsen in the future. This is expected to improve conditions within the estuarine community and contribute to the overall ecological health of the region, consistent with the desired restoration conditions stated above. There are uncertainties related to when those projects will be completed and assumption is made that they will be in time.

## 5.0 Conclusions

As indicated before, this updated system-level evaluation does not include an evaluation of the new modeling output, therefore the following August 2007 conclusions are considered to be draft. RECOVER used tools that the PDT developed to evaluate the Western PIR of the C-111 SC project because the model that RECOVER prefers for evaluating systemwide performance operates at too gross of a scale to perceive the differences between project alternatives. RECOVER has reviewed the performance measures selected by the PDT and finds them adequate for evaluating the difference between alternative plans and generating the benefits of the alternative plans.

RECOVER recommends clearly linking the project monitoring plan to the second PIR (eastern PIR) schedule to ensure that information will be available in time to improve the second PIR. The monitoring plan should also link to potential management actions associated with both PIRs that may be taken to adjust the project based on the new information.

RECOVER encourages the PDT to begin planning for the eastern PIR because the full benefits of the C-111 SC project will not be achieved without the construction of the eastern PIR. RECOVER also encourages the completion of the many projects listed above which CERP and the C-111 SC depends on for the achievement of the project goals and objectives.

RECOVER recommends that future program-level evaluations review additional water to be made available to the suite of Biscayne Bay and Florida Bay projects including this project.

## 6.0 References

USACE and SFWMD, 1999, Central and Southern Florida Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, U.S. Army Corps of Engineers Jacksonville District, Jacksonville, Florida and South Florida Water Management District West Palm Beach, Florida.

## Appendix A: C-111 Spreader Canal Project Goals and Objectives

### Project Goals

1. **Improve habitat and functional quality.** Healthy freshwater wetlands in the Southern Glades will be preserved and productive freshwater wetlands will be established in the Model Lands area. Improvements to Manatee Bay and Barnes Sound will require the establishment and maintenance of a freshwater/salinity balance that will sustain estuarine ecosystems.
2. **Improve native plant and animal species abundance and diversity.** Project design and implementation must seek to balance potentially competing needs of plants and animals that are characteristic of freshwater wetlands with requirements of seagrasses and saltwater fishes. Attention will be given to impacts to endangered species such as the indigo snake, Cape Sable Seaside Sparrow, and manatee that may be present in the project area. Efforts will also be directed to the control of exotic plants and animals, e.g. melaleuca, Brazilian pepper, grass carp and Asian eel.
3. **Reserve sufficient water for the restoration of the natural system.** This goal will be addressed by looking at the seasonal water availability, seasonal salinity fluctuations in Manatee Bay, and the impact of the C-111 Spreader Canal project within the existing, regional water budget. Sufficient water will be defined in terms of both quantity and timing of delivery.

### Project Objectives

1. **Restore more natural flow patterns, hydroperiods and ecological connectivity between the Southern Glades, Model lands and adjacent natural areas.** Hydrologic targets and performance measures will be developed to guide project planning and design. This includes the establishment of site-specific flow patterns and water depth needed to create or sustain freshwater wetlands. Impediments to ecological connectivity, such as berms and roadways, will be evaluated.
2. **Eliminate project-induced ecologically damaging flows through C-111 to Barnes Sound and Florida Bay.** Hydrologic targets and performance measures will be developed to address the distribution between overland flow and tidal creeks and to account for the effect of sea level changes. The need for a transition zone model will be considered. Achievement of this objective is to be accomplished by the backfilling of existing canals and removal of water control structures. Project planning and design phases will evaluate how to implement these components without sacrificing operational flexibility, efficiency and effectiveness.
3. **Provide ecologically compatible water quality consistent with Federal and state requirements applicable to the Southern Glades, Model Lands and Everglades National Park.** Although water quality within the C-111 basin currently meets established water quality standards, the C-111 Spreader Canal project will modify the direction and volume of flow in ways that may result in unacceptable changes to the water quality. Project implementation will involve tasks to: identify the water quality needs of the various wetland, marsh and estuarine ecosystems within the project area, assess potential adverse impacts, and evaluate ways to deliver water of acceptable quality to the natural systems. Efforts to determine applicable Federal, state and local regulatory

requirements will be undertaken. Permitting requirements and associated compliance monitoring regimes will be identified.

## Appendix B – Performance Measure Descriptions

The **flow timing and distribution** performance measure is very similar to that being considered for adoption by RECOVER’s Greater Everglades Subteam. The timing element of the PM quantifies the volume discharged across the transect as a percentage of the total volume discharged across the transect over the course of one year. The distribution element of the PM quantifies the volume discharged across the transect as a percentage of the entire volume being discharged across all transects (i.e., all water flowing to tide) during an individual day, for each day of the year. For MODBRANCH, this “mapping” of the transect’s the annual discharge and contribution to the total volume being discharged to tide are performed for each of the three single-year simulations. The charted relative contributions for each alternative are compared against that of the “pre-drainage” condition for the like year. The degree to which the alternative’s discharges across the transect exhibit a larger/lesser contribution than that of the target is then used to compute an index on a scale from 0.0 to 1.0 (0 deviation from target yields a score of 1.0).

The **hydroperiod performance measure** characterizes the range of hydroperiods experienced within each landscape-scale indicator region (expressed in terms of 30-day classes) and characterizes the relative presence of each hydroperiod class within the indicator region (expressed in terms of percent-area experiencing a hydroperiod within the noted hydroperiod class). This performance measure is intended to be an indicator of (or surrogate for) vegetation community type. Therefore, charted values are discontinuous hydroperiods. The differences in percent-area between the target condition and each alternative are computed for each hydroperiod class. The degree to which the percent area experiencing a given hydroperiod class differs from that of the target condition is then used to compute an index on a scale from 0.0 to 1.0 (0 deviation from target yields a score of 1.0). If the relative abundance/presence of hydroperiods within the indicator region is identical to that of the target condition, the total deviation from target = 0 (and would yield an index score of 1.0).

The **salinity performance measure** is based on stage-salinity relationships/formulae provided by ENP researchers. The performance measure characterizes the range of salinities experienced within each of several estuarine/marine sub-basins (e.g., Long Sound, Joe Bay, Manatee Bay, Barnes Sound, etc.) in terms of salinity class (at 5 ppt intervals) and duration. The basin and year-specific salinity durations exhibited for each alternative are compared against those yielded by the target condition. The degree to which the salinity durations for the alternative differ from that of the target condition is then used to compute an index on a scale from 0.0 to 1.0 (0 deviation from target yields a score of 1.0).

This page intentionally left blank

F.2 C-111 SPREADER CANAL RECOVER EVALUATION TEAM  
REGIONAL EVALUATION REPORT TRANSMITTAL LETTER

This page intentionally left blank



REStoration COordination and VERification (RECOVER)  
Evaluation Team, Regional Evaluation Report

**TRANSMITTAL LETTER**

March 27, 2009

Project Managers and Planning Technical Leads  
C-111 Spreader Canal Project  
Comprehensive Everglades Restoration Plan

Dear Project Team Managers and Planning Technical Leads,

RECOVER has completed its regional evaluation of the C-111 Spreader Canal Project (C-111 SC) alternative plans. The attached addendum should be used in conjunction with the initial report delivered on February 27, 2009.

RECOVER's evaluation of project alternatives fulfills the following requirements as prescribed by the Programmatic Regulations:

1. Support project teams to achieve consistency with the CERP's goals and objectives;
2. Document the performance of the project alternative plans using RECOVER approved system-wide performance measures, project performance measures (when appropriate), and best professional judgment. RECOVER determines the ability of each alternative plan to meet the targets established for each performance measure and describes the resulting effects upon the natural system. When appropriate, RECOVER evaluations include a qualitative analysis on how the project fulfills CERP goals and objectives;
3. Suggest improvements to the project, which if pursued could improve project performance or enhance benefits to the natural system;
4. Provide insight, if possible, and alert the project teams of any inconsistent modeling assumptions for the project as originally modeled in the CERP.

Recommendations discussed within the RECOVER regional evaluation report generally fall into one of three categories:

1. Recommendations that can easily be incorporated into the plan formulation process;
2. Recommendations that are more conceptual in nature, which the Project Team may select to incorporate into preliminary designs to improve project performance; and
3. Recommendations that are crucial to the project, but cannot be addressed prior to the AFB meeting.

Concerning the latter category, RECOVER significantly expedited its regional evaluation to satisfy the need for timely reporting, while bringing forward as much science as possible. Therefore, RECOVER may provide additional information supporting and refining the original regional evaluation, if additional information becomes available from the Project Delivery Team.

Best regards,

RECOVER Evaluation Team

This page intentionally left blank

F.3 C-111 SPREADER CANAL RECOVER PROJECT SYSTEM-WIDE  
EVALUATION REPORT ADDENDUM FINAL

This page intentionally left blank

**C-111 Spreader Canal Project  
System-wide Evaluation Report Addendum\***

**Prepared by RECOVER Evaluation Team (ET)**

**Contributors: Andy Gottlieb and Dan Nehler**

**March 27, 2009**

*\* This document should be used in conjunction with the updated regional evaluation report provided to the PDT on February 27, 2009.*

The following document is a brief addendum to the updated C-111 Spreader Canal (SC) Regional Evaluation provided by RECOVER to the C-111SC Project Delivery Team (PDT). This addendum is focused on three components of the updated Western Project Implementation Report (PIR) (phase I): 1) Specific Performance Measures (PMs) selected and relevance to project and CERP goals, 2) changes in model assumptions, project objectives and related operations, and review of project alternative performance, and 3) new information available from RECOVER including relationship of phase 1 of C-111SC performance within the context of CERP performance under Band 1 conditions (see MISP [http://www.evergladesplan.org/pm/pm\\_docs/integrated\\_schedule/022708\\_task\\_mtg/2e\\_2005\\_misp.pdf](http://www.evergladesplan.org/pm/pm_docs/integrated_schedule/022708_task_mtg/2e_2005_misp.pdf) and Draft RECOVER Band 1 report for details). A fourth section identifies minor updates from the previous evaluation. (Feb 2009).

In the first regional evaluation RECOVER included a short description of the alternatives (C series) and the relationship to system-wide goals of CERP (August 2007). The updated regional evaluation was requested because the C-111SC PDT split the project into two separate PIRs (Western PIR and Eastern PIR) prompting the development of additional model runs including the 2D alternative. During the second round of modeling, alternative 2D was optimized to make better use of available water and two alternatives were created (2DL long and 2DS short). Alternative 2DL is the same as the original 2D alternative, while 2DS is an optimized version of 2D using only one-half of the Aerojet Canal feature.

The following information should be used in conjunction with the draft report provided to the PDT in February 2009.

- I) The three hydrologic PMs utilized by the C-111SC PDT, as noted in RECOVER's PM consistency review ([http://www.evergladesplan.org/pm/recover/recover\\_docs/et/et\\_reviews/et\\_rev\\_c-111\\_pm\\_review.pdf](http://www.evergladesplan.org/pm/recover/recover_docs/et/et_reviews/et_rev_c-111_pm_review.pdf)), are generally consistent with the CERP system-wide goals and objective and relevant to the C-111SC goals. Although the PIR is now phased and the current objectives focus primarily on Taylor Slough and the western components, the PMs selected are still relevant tools to be used with comparisons of alternative performance.
  - a. General Comments:
    - i. Uncertainty- The project team characterized uncertainty with the MODBRANCH model. Little discussion of uncertainty regarding PM targets was provided beyond that of ranking PMs. The RECOVER PM documentation sheets ([http://www.evergladesplan.org/pm/recover/eval\\_team\\_perf\\_measures.aspx](http://www.evergladesplan.org/pm/recover/eval_team_perf_measures.aspx)), the model uncertainty report (2002), and the model needs document

(2005) all provide additional discussion regarding PM and model uncertainty.

- ii. Evaluation of Benefits- Although the methods are described sufficiently, little direct link between the specific change in salinity, flow, or stage is provided. RECOVER reviewed the specific flow and salinity changes in the intermediate spreadsheets noted in the benefits analysis and has included this linkage to provide a better understanding of the relative magnitude of change in performance and the actual projected or estimated conditions (Flow and salinity discussion in section III of this addendum).

b. PM specific comments:

- i. Coastal zone Salinity PM (2.4) and associated acreages used- The focus of phase 1 of the C-111SC project is on Taylor Slough (TS). This is an area of hypersalinity and one of the key reasons to redistribute flows (Lee et al. 2006). Deliveries to TS also directly affect FBs larger acreage (Nuttle et al. 2000). This larger acreage was not used in the calculation of benefits (HUs). Given that changes in TS are the greatest and the focus of the project, and benefits translate directly downstream, it is likely that some portion of the FL Bay acreage should be included in the benefits estimate (Figure 1- salinity series). As noted in the Band 1 figure, benefits likely fall somewhere in between the coastal fringe noted by the project team specific results (Figure 1) and the Band 1 estimated far field effects (Figure 2). This is likely a significant underestimate of the benefits to FL Bay given the constraint of acreage to Barnes Sound, TS, Little Madeira, Blackwater Sound, and Long Sound)
- ii. Location of Flow Transects Used (PM 1.5)- Similar to the issue noted above, the goals of the project related to flow are to redistribute flows from E to W and to provide a temporal shift in flows toward dry season deliveries. Given that phase one is focused on benefits to TS, one should expect a shift in deliveries to the West (w/corresponding reductions to the east). Because no additional water is available a corresponding reduction of inflows to the east should be expected (Figure 3- Transects T3 and T4).
- iii. Vegetation Hydroperiods (PM 2.1)- A project goal identified in the Restudy is to improve deliveries and enhance hydraulic connectivity and sheetflow in the Model Lands and Southern Glades areas. The objective of this metric is to minimize each alternative's deviation from the target.

The resulting measure of agreement with the Target condition was expressed as an index of 0.0 to 1.0 (with 1.0 representing an ideal match to the target, 0.0 representing little/no resemblance to the target condition) for each indicator region for the Baseline condition and each Project Alternative condition. As noted in the RECOVER PM consistency review there are some small differences between this PM and RECOVER PM targets though they are generally consistent. The linear function used to describe benefits is useful but ongoing project monitoring should help to reduce uncertainties regarding specific vegetation community optima and tolerances and their response to changing hydroperiods. Hence, with additional input from ongoing vegetation monitoring being conducted in the Greater Everglades, refinements to the existing linear assumption can be made and applied to future efforts.

## II) Changes in Model Assumptions and Related Alternative Performance:

In the first regional evaluation RECOVER included a short description of the alternatives (C series) and the relationship to system-wide goals of CERP (August 2007). The updated regional evaluation was requested because additional model runs were conducted including the 2D short and 2D long alternatives. The 2D long alternative was added during the second round of modeling. This alternative differs from the short alternative by extending the Aerojet canal by an additional 2 miles (see table 2 of main report for list of alternative descriptions).

- a. Results of the previous model runs are similar to current (Figures 1A-1F) except for the addition of both the 2D long and 2D short alternatives.
- b. The following review of alternative performance focuses on the updated modeling and analysis conducted by the PDT.
  - i. Salinity PM- As noted by the project evaluation of benefits (Table 1), alternatives 2DL, 2DS and 6D perform the best. Although formulation without (FWO) and Existing CERP Baseline (ECB) perform well overall, they do not provide additional benefit to TS which is the focus of phase 1 of the C-111SC project. The actual magnitude of change in salinity is noted in figures 1D-1F for a subset of the basins under the dry year condition (1989). Taylor Slough and Little Madeira show a reduction in the total number of days experiencing the highest (undesirable) salinity classes.
  - ii. Flow PM- Table 2 displays the calculation of benefits associated with the flow PM. Because limited additional storage is available under the with

project scenarios, gains on distribution are expected over those of timing. alternatives 2DS, 2DL and 6D perform the best regarding shifting the distribution of flows to match natural system conditions. RECOVER linked the relative changes noted in the project benefits analysis to the actual magnitude in changes in flow. Figures 4A-4C characterize cumulative flow across transects (Figure 3) for the three best alternatives. There is an approximate 40-50 K acre-ft increase in overall flows under the 2DS and 2DL alternatives which add to the distribution and timing benefits noted in table 2.

Although the project team expressed concerns over high flows at the S-197, it is unclear whether these flows are damaging flows to the estuary. Understanding the return frequency of such events relative to the Natural System Model targets is important to obtaining ecological health. The discussion of the importance of understanding annual and inter-annual variability continues in section C below.

- iii. Vegetation PM- Table 3 displays the calculation of benefits conducted by the PDT. As measured using this metric, under average hydrologic conditions, all of the with project alternatives provide improved vegetation hydroperiod conditions relative to the No Action Alternative. Under dry year conditions, the with-project alternatives are only slightly better than the No Action Alternative. This is not surprising since during dry years there is very little water available to be diverted or detained by project features. Under wet year hydrologic conditions, most of the with-project alternatives provide slightly worse vegetation hydroperiod conditions as measured by this performance metric. Alternative 6D provides the most lift under average and wet year conditions while 2D short provides the best conditions for dry years.

c. PMs and scoring

- i. As noted in the previous evaluation and in the project documentation, the MODBRANCH model run is based on three years (wet, dry and average). In most cases (Flow and Salinity) the project team looked at average annual performance for all three years combined. Although perfectly acceptable, average year potentially underestimates or masks seasonal benefits (and does not allow one to understand return frequencies of specific types of events). Hypersalinity and reduced flows are more of an

issue in dry years. Additionally, within year benefits may be masked as well (see Figures 6A and 6B Southern Estuaries salinity figures from Band 1 where average annual decrease in salinity is approximately 1.1 ppt while monthly shifts may be as high as 4.5 ppt). Either method of analysis is valid given the many ways to divide up or weight the PMs and their components. Looking at annual and interannual variation adds to the ecological intent of the PMs.

III) New information related to system wide goals of CERP:

- a. Other potential information (beyond existing monitoring, etc)- the recent Band 1 model run conducted by RECOVER suggests that C-111 in combination with a suite of 10 projects (identified as Band 1 projects in the MISP\*) produces substantially more benefit over a much larger area (Figure 2- Map identifying far field effects of Band 1 in FL Bay). The C-111 project is an important component in the Band 1 model run helping to increase flows to Taylor Slough and E marshes of the Greater Everglades (Figures 7 and 8- Transect 23 flows and Transect map) and correspondingly start to reduce salinities in FL Bay (Figures 6A and 6B). (Additional model output for the entire suite of RECOVER salinity stations is available for the Band 1 effort is desired. The figures presented identify the far field effects (of band 1) thereby establishing the larger domain benefited by contributions of the C-111 SC project. Both the transect flow results and the salinity results in Band 1 are consistent with the PDT benefits analysis.

IV) Clarifications to February 2009 evaluation:

- a. S-177 Flow assumptions:

Although the S-177 flows under Cerp0 and 2050B3 condition are nearly the same, many of the components of the future without project condition have not yet been implemented (as detailed in the February 2009 report). It is likely more appropriate to compare to existing conditions to determine the differences between with project conditions with CERP and the no action alternative. This will provide a more realistic comparison based on current projects and operations. This has implications on the Greater Everglades boundary model conditions as can be seen by the magnitude of change in flow at the S-177 (Figure 9).
- b. With and without project assumptions and affects on boundary conditions.
  - i. The previous evaluation clearly described that the C-111 SC project is at the lower end of the Greater Everglades System feeding into Southern Estuaries. Because the project is at the end of the GE flowpath, there are

minor effects on the boundary conditions of the Greater Everglades. In general the differences in the split of water between the alternatives (1/3 and 2/3<sup>rd</sup> split) and the effectiveness of the seepage buffer are the two factors effecting the eastern edge of the GE within Everglades National park. Later components of the C-111 SC are expected to provide water to the eastern most components of the Greater Everglades domain (Model lands). As noted in the project flow and salinity documents, the GE boundary provides inflows in to the estuarine component of the project domain.

#### Conclusions:

This addendum to the regional evaluation characterizes changes in model alternative assumptions as well as corresponding performance of the alternatives, and links alternative performance to the system-wide goals of CERP. The PMs selected are consistent with the goals and objectives of the C-111SC project as well as the overarching system-wide goals and objectives of the CERP. The C-111SC PDT documented that due to differences in hydrologic model codes (SFWMM versus Modbranch), scale (regional versus local), temporal and spatial resolution (coarse versus fine), and simulated period of record (36-year continuous versus three individual average, wet, and dry-year simulations), RECOVER system-wide performance measures developed for application with the SFWMM could not be used directly with the Modbranch model. As a result, PMs were designed to detect intended and unintended effects within the study area associated with greater retention and improved distribution of water in eastern ENP. The PDT developed performance metrics that would be capable of measuring ecologically-significant hydrologic stressors which are embedded in RECOVER performance measures, but at a project-level scale and in a manner that is more appropriate for the finer-resolution, basin-specific Modbranch model application being used by the PDT. The applied performance metrics identified by the PDT [Sheetflow timing and distribution (PM 1.5); Hydroperiod-inferred vegetation communities (PM 2.1); and Stage-inferred coastal zone salinities (PM 2.4)] measure changes in the timing of overland flow distribution to Taylor Slough, and hydroperiods and water depths/stages within the study area.

The C-111SC is primarily intended to improve the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough. It is anticipated that these improvements can be realized through the establishment of a hydraulic ridge between Taylor Slough and the C-111 Canal, to reduce seepage from Taylor Slough, and its headwaters. The hydraulic ridge will be established by combining operational changes within the lower C-111 Canal (south of S-177), and the diversion of water that is currently being discharged through S-177, S-18C and S-197 to the existing Aerojet Canal, and an above ground detention area, to be constructed within the SFWMD owned Frog Pond lands. Marsh stage triggers in Taylor Slough, and elsewhere in the

adjacent basin, will be used to manage pumping rates, and to increase the net water distributed west of the existing C-111 Canal system. Although the recommended plan's primary focus is on improvements to Florida Bay, the plan is also intended to improve hydroperiods within the wetlands of the Southern Everglades and Model Lands. This will largely be accomplished by proposed modifications to current operations at structure S-20, installation of an earthen plug in the L-31E Canal near structure S-20A, installation of earthen plugs in the C-110 Canal, in combination with later phases of C-111 and Biscayne Bay Coastal Wetlands projects.

Project model results indicated that Alt 2D (L&S) and Alt 6D provide the greatest restoration benefit to the area in question. Although using three proxy years (Wet, dry and average) is acceptable given the multiple means of evaluating performance, additional benefit will likely be achieved seasonally that can be masked by the average annual performance (see discussion and figures noted above). Because the focus of Phase 1 of C-111 SC project is Taylor Slough and the downstream receiving estuary, the team should recognize the potential additional benefit provided to Florida Bay currently not included in the benefits area calculations. Although the project modeling stops at the coastline, RECOVER Band 1 model run indicates that the C-111 project contributes to the system wide goals of CERP further reducing FL Bay salinities (see transect 23 flows and salinity estimate figures for FL Bay stations). As noted above, the C-111SC is now a phased project. It is important to remember the original goals of the project to rehydrate the Model Lands and Southeastern edge of the Greater Everglades to ultimately achieve the larger system-wide goals and benefits outline in the Yellow Book.

## References Cited

- 1) RECOVER C-111SC Performance Measure Consistency review, 6-21-2004, [http://www.evergladesplan.org/pm/recover/recover\\_docs/et/et\\_reviews/et\\_rev\\_c-111\\_pm\\_review.pdf](http://www.evergladesplan.org/pm/recover/recover_docs/et/et_reviews/et_rev_c-111_pm_review.pdf).
- 2) RECOVER Regional Evaluation of C-111 SC project, 2006.
- 3) RECOVER regional Evaluation of C-111SC project (Phase I), February 2009.
- 4) Upmanu Lall, Donald L. Phillips, Kenneth H. Reckhow and Daniel P. Loucks (Chair), Quantifying and Communicating Model Uncertainty for Decision Making in the Everglades Report of the Comprehensive Everglades Restoration Plan's Model Uncertainty Workshop, U.S. Army Corps of Engineers and South Florida Water Management District, West Palm Beach, FL, January 15 – 17, 2002.
- 3) RECOVER performance measures  
[http://www.evergladesplan.org/pm/recover/eval\\_team\\_perf\\_measures.aspx](http://www.evergladesplan.org/pm/recover/eval_team_perf_measures.aspx)
- 4) Report on Evaluation Tools, Models, Work Plans, and Budgets, Report of the Restoration Coordination and Verification (RECOVER) Evaluation Team, December 2005, [http://www.evergladesplan.org/pm/recover/system\\_wide\\_modeling.aspx](http://www.evergladesplan.org/pm/recover/system_wide_modeling.aspx).
- 5) Lee, N.L., Johns, E., Melo, N., Smith, R.H., Ortner, P., and Smith, Dewitt, On Florida Bay Hypersalinity and Water Exchange, Bulletin of Marine science, 79(2): 301-327, 2006.
- 6) Nuttle, W. K., Fourqurean, J. W. Crosby, B. J., Zieman, J. C., and Roblee, M. B., Influence of Net Freshwater Supply on Salinity in Florida Bay, Water Resources Research, Vol. 36, No. 7, 1805-1822, 2000.

## Tables

## Results for Performance Metric 2.4 Coastal Salinities (from project benefits analysis)

Scenario	Scenario HU Score	Barnes Sound	Manatee Bay	Joe Bay	Little Madeira Bay	Long Sound
Pre-Drainage/Target	27,302	16,902	2,497	3,385	2,361	2,153
FWO	21,938	78%	72%	88%	89%	87%
ECB	21,752	78%	75%	85%	85%	84%
Alt_1C	19,375	63%	66%	89%	90%	90%
Alt_1D	18,623	59%	62%	89%	91%	90%
Alt_2DS	19,602	64%	66%	90%	91%	90%
Alt_2DL	19,796	65%	67%	90%	91%	90%
Alt_3D	19,408	63%	65%	90%	91%	90%
Alt_6D	20,975	72%	75%	88%	88%	87%

## Results for Performance Metric 1.5 Flow Timing, Distribution and Volume

Scenario	Scenario HU Score	Taylor Slough Timing	Taylor Slough Distribution
Pre-Drainage/Target	98,472	100%	100%
FWO	64,142	93%	37%
ECB	65,976	95%	39%
Alt_1C	68,312	92%	47%
Alt_1D	68,935	93%	47%
Alt_2DS	68,724	89%	50%
Alt_2DL	68,394	88%	50%
Alt_3D	67,163	90%	47%
Alt_6D	70,976	93%	51%

## Results for Performance Metric 2.1 Vegetation Hydroperiod

<b>Scenario</b>	<b>Scenario HU Score</b>	<b>Average Year (1978)</b>	<b>Dry Year (1989)</b>	<b>Wet Year (1995)</b>
Pre-Drainage/Target	155,098	100%	100%	100%
FWO	74,619	40%	59%	45%
ECB	75,186	41%	59%	45%
Alt_1C	73,339	42%	59%	40%
Alt_1D	74,275	44%	61%	39%
Alt_2DS	78,805	46%	62%	44%
Alt_2DL	77,081	45%	61%	43%
Alt_3D	76,786	45%	60%	43%
Alt_6D	80,454	47%	60%	48%

Figures

11

Figures 1A-1F: Alternative Salinity in Taylor Slough, Little Madeira, and Taylor River during dry years (Figures A-C are based on old model runs and D-F are based on the current alternative runs).

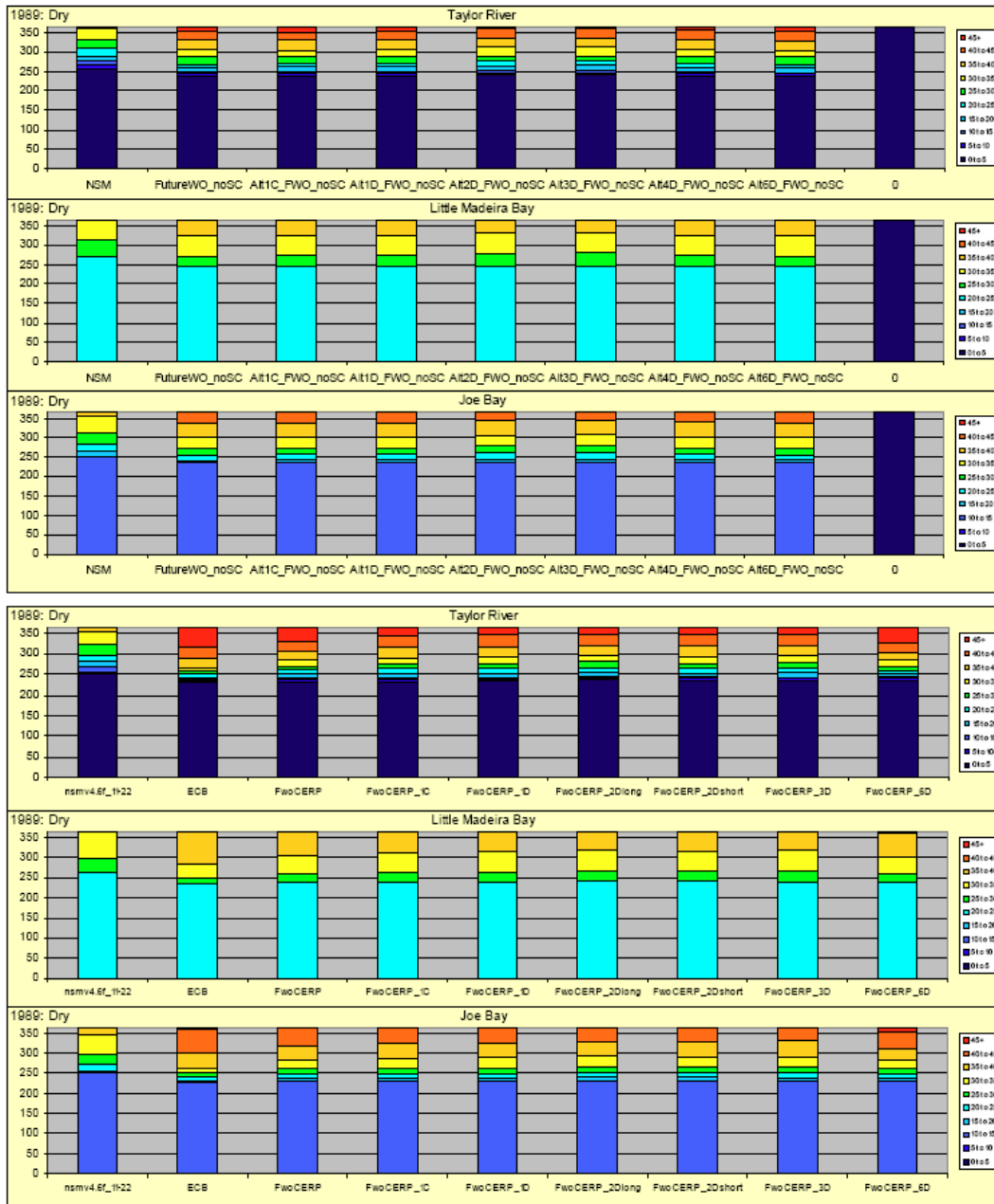


Figure 2: Spatial extent of C-111 project effects within the context of Band 1. C-111 project effects are noted by coastline polygons while ellipses represent the far field effects of Band 1.

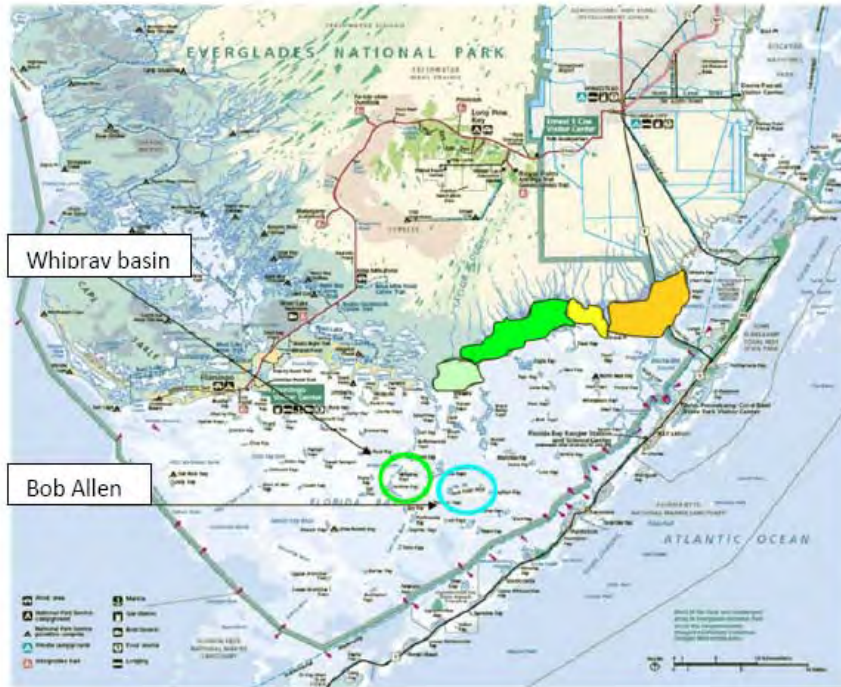
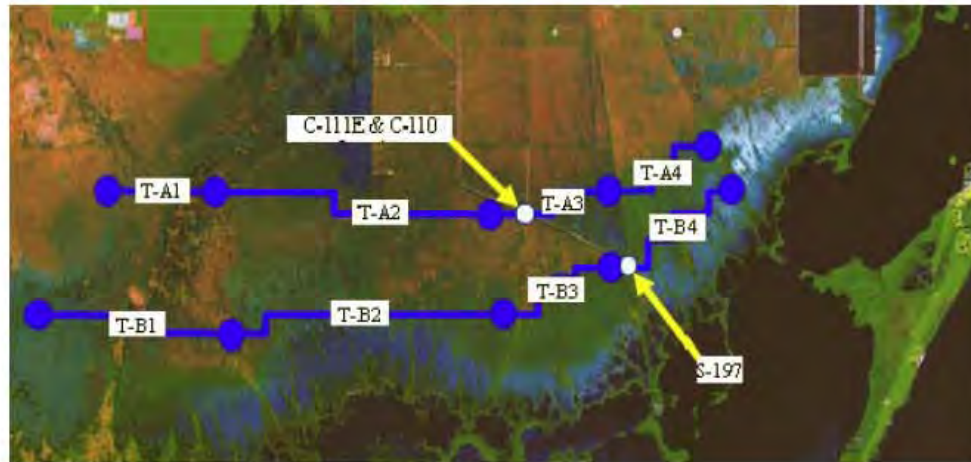
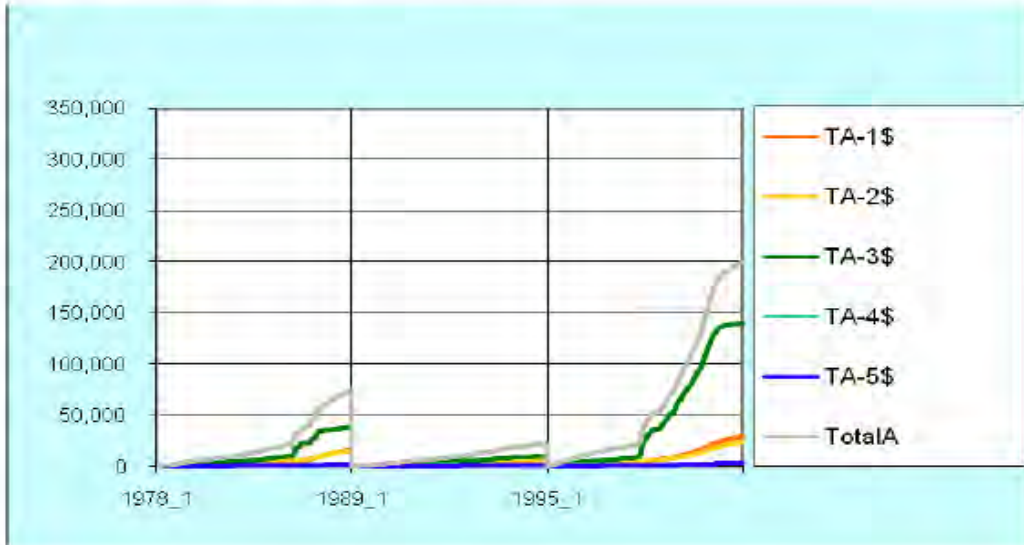


Figure 3: Transect Locations

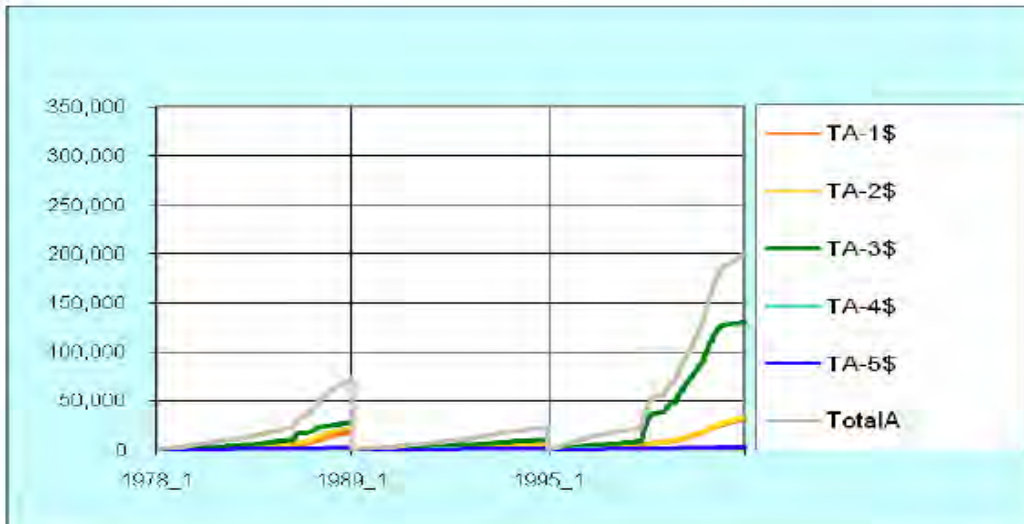


Figures 4 (A-C): Transect flow volumes

4A- Alt 2DShort transect flow volumes:



4B- Alt 2DL transect volumes:



4C- Alt 6 D transect volumes:

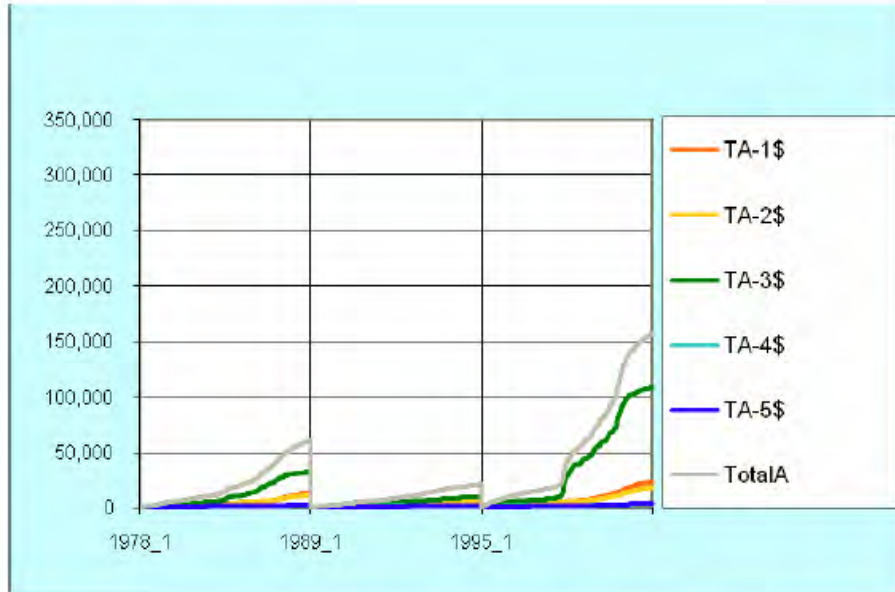


Figure 5: Indicator regions applied to C-111SC project vegetation PM (2.1)

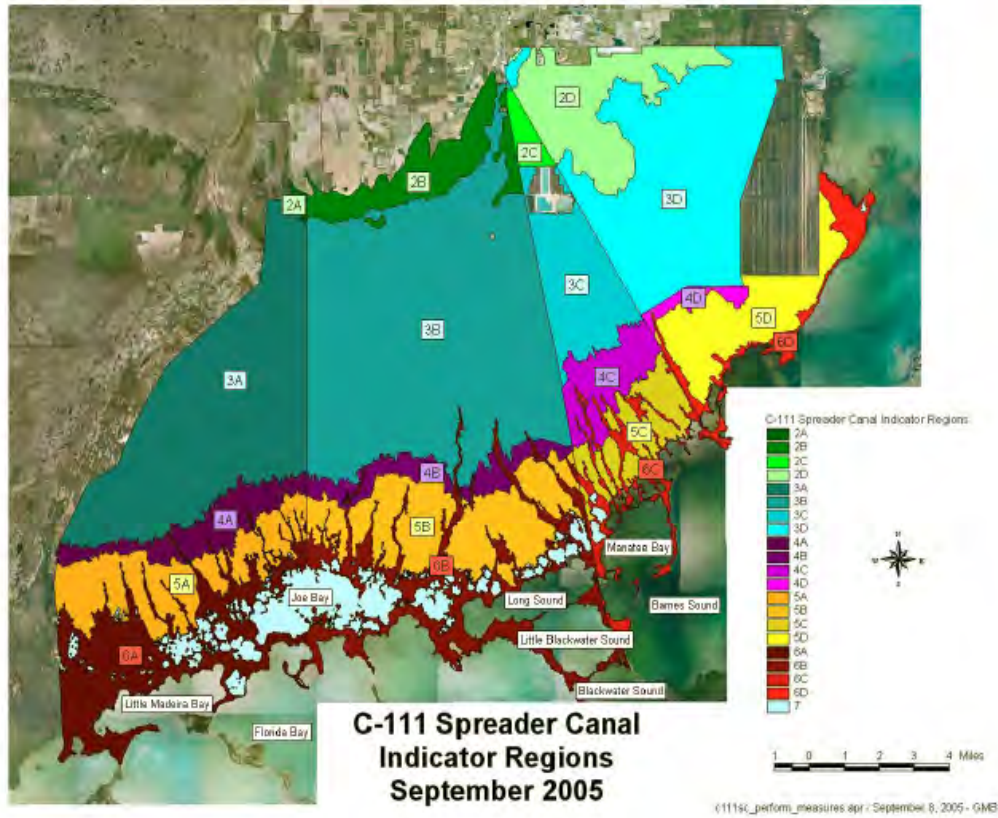


Figure 6 (A and B): Band 1 Monthly mean and average annual salinity

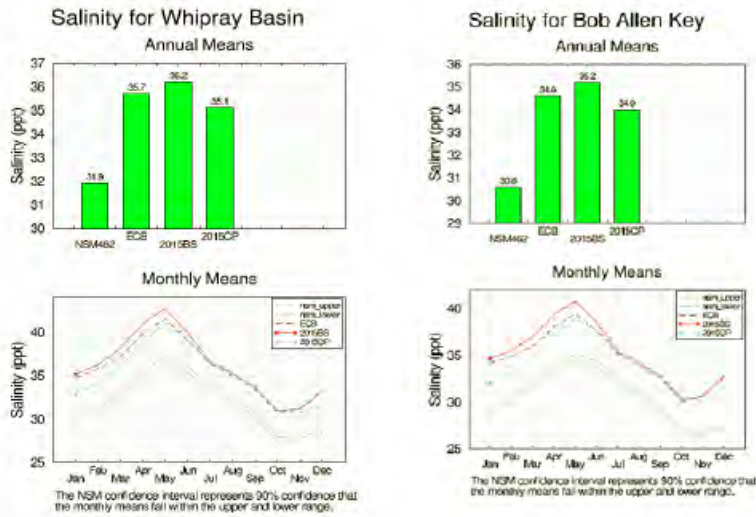


Figure 7- Flow transects from Band 1 model run:

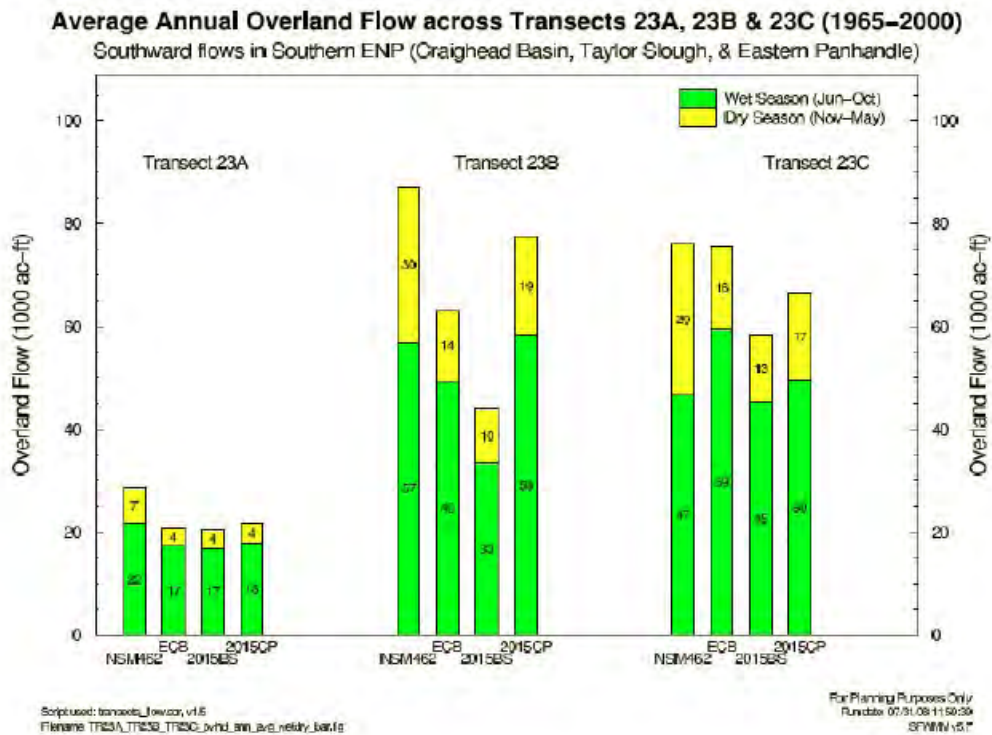


Figure 8- Map with location of flow transects

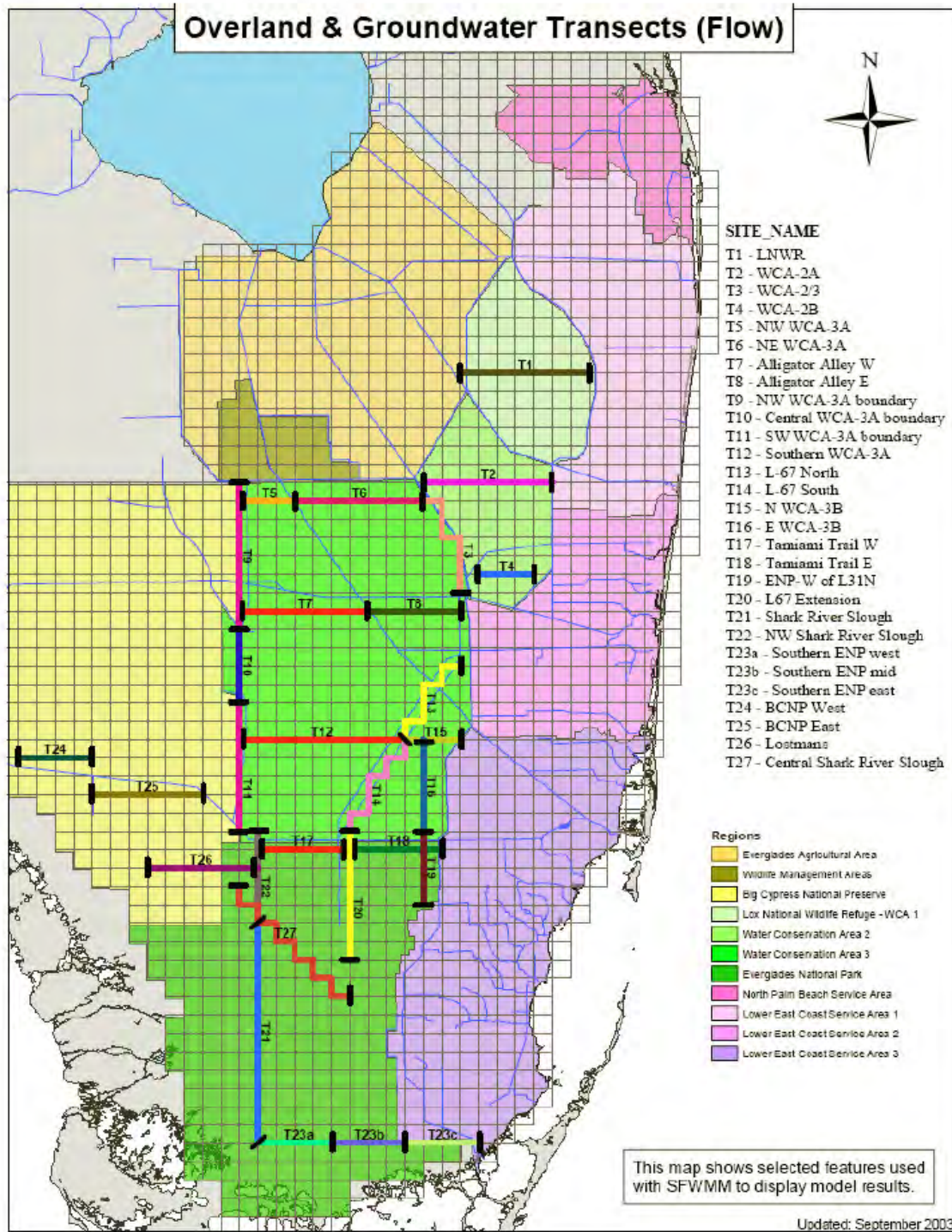
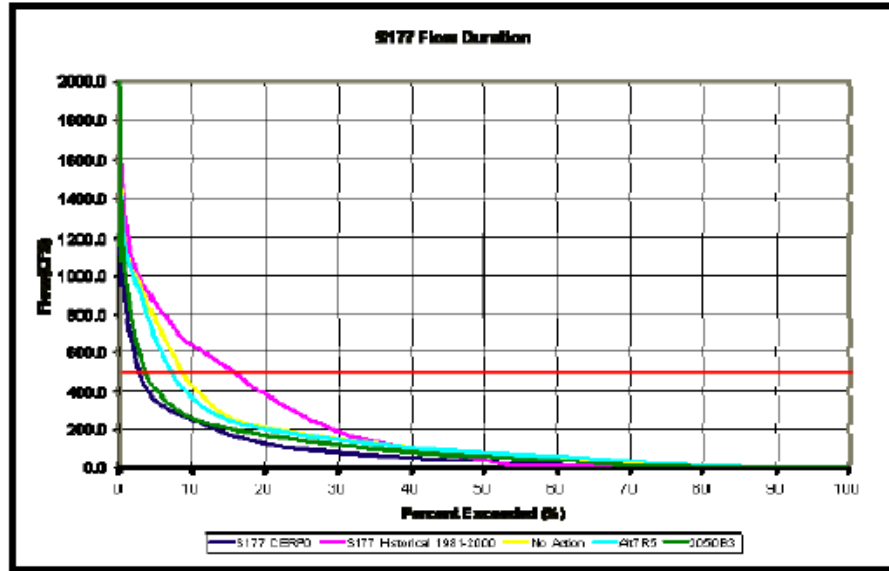


Figure 9- SFWMM flows through the S-177



F.4 C-111 SPREADER CANAL RECOVER CONSISTANCY REVIEW OF  
PROJECT-LEVEL PERFORMANCE MEASURES (FINAL JUNE 21, 2004)

This page intentionally left blank

## FINAL RECOVER PM Consistency Review

Final 6/21/04

*C-111 Spreader Canal (C-11 SC) Project*  
**RECOVER EVALUATION OF PROJECT-LEVEL PERFORMANCE**  
*MEASURES (Final 062104)*

Prepared by the Regional Evaluation Team (RET) and Water Quality Team (WQT)

Contributors: Steve Traxler (FWS), Eric Hughes (EPA), Tom Schmidt (NPS), Gwen Burzycki (Miami-Dade DERM), Patrick Pitts (FWS), Sandra Sneckenberger (FWS), Cheryl Buckingham (Corps), Orlando Ramos-Gines (Corps)

## 1.0 INTRODUCTION

The role of the Restoration Coordination and Verification (RECOVER) team is to organize and apply scientific and technical information in ways that are most effective in supporting the objectives of the Comprehensive Everglades Restoration Plan (CERP). RECOVER links science and the tools of science to a set of system-wide planning, evaluation and assessment tasks. These links provide RECOVER with the scientific basis for meeting its overall objectives of evaluating and assessing Comprehensive Plan performance and refining and improving the plan during the implementation period. RECOVER fulfills this role by working with the project delivery teams (PDTs) to help them meet CERP's system-wide goals and objectives. Specifically, RECOVER reviews the performance measures for project-level evaluation of alternatives for consistency with the system-wide evaluation performance measures developed by RECOVER.

The purpose of this performance measures consistency review is: 1) to identify general compatibility of project-level performance measures with applicable system-wide performance measures, and 2) to provide information to project managers and others, as appropriate, regarding compatibility of project-level and system-wide performance measures of the C-111 SC as submitted to RECOVER in April 2004. RECOVER recognizes and appreciates the time and effort that went into developing these performance measures. The review comments below are intended to enhance the existing set of performance measures. Comments on the specific project-level performance measure are presented in the attached table (Attachment A).

## 2.0 GENERAL DOCUMENT COMMENTS

The C-111 SC PMs are generally well developed. RECOVER does however have suggestions regarding the potential redundancy of PMs, the differentiation between evaluation criteria and performance measures, and areas to provide additional information for document reviewers and developers.

Redundancy and Conflict among PMs – Several C-111 SC PMs address the hydropattern and inundation patterns of the Greater Everglades (GE) wetlands. EC 1.1 (Annual Inundation Patterns), EC 2.1 (Improve Marl Prairie Vegetation Mosaic), and EC 3.7 (Maintain or

Increase Habitat Suitable for Periphyton) all address hydroperiod with different inundation patterns as the targets. RECOVER suggests the PDT examine these PMs for redundancy or conflict with each other. For example, what if WASH shows pre-drainage conditions (the target for EC 1.1) have hydroperiods of less than 130 days (target for EC 2.1) in places where freshwater graminoid marsh is desired.

Additionally, EC 3.2 (Improve Marsh Recession Rates to Support Successful Nesting and Foraging for Wading Birds) and EC 3.5 (Wetland Aquatic Fauna) have identical targets and both identify the aquatic fauna as prey for wading birds. RECOVER suggests the PDT examine these PMs for redundancy.

Utility of PMs and ECs in Evaluating Project Alternatives – RECOVER recognizes that the C-111 SC PDT has done an excellent job of differentiating between performance measures, which will be used to evaluate alternative plans, and evaluation criteria, which will be used as constraints during the screening process. Those designated as performance measures have numeric targets conducive to making decisions in distinguishing between alternatives. Those indicators that use such terms as “minimize”, “maximize”, “increase”, and “no significant decrease” have been designated as evaluation criteria for use in screening alternatives. RECOVER commends the PDT on recognizing and differentiating the use of performance measures and evaluation criteria

Additional Documentation Performance Measure Documentation Sheets (Fact Sheets) – C-111 SC PM fact sheets are generally well developed; RECOVER does however have some suggestions to improve the clarity of some fact sheets. Documentation could be added to several of the PM fact sheets to define terminology, indicate why particular target ranges were chosen, and reference why certain targets were selected (i.e. scientific studies, best professional judgment, etc.). Specific comments on documentation and references are included in Attachment A.

### 3.0 CONSISTENCY WITH RECOVER SYSTEM-WIDE EVALUATION PERFORMANCE MEASURES

There seems to be general compatibility in intent between the project-level performance measures developed by the PDT for the C-111 SC Project and the system-wide evaluation performance measures developed for the Comprehensive Plan by RECOVER. RECOVER does however have suggestions regarding the content, target and classification for several of the performance measures/evaluation criteria. General comments of significance are noted below, while comments on each specific project-level performance measure are presented in the attached table (Attachment A).

**WASH targets vs. NSM targets** – For several hydroperiod PMs, there are slight differences between the targets for C-111 SC PMs and those for RECOVER PMs. Although generally consistent, these differences are noted below:

In EC 1.2 (Reestablish Amplitude and Interannual Water Levels that Reflect Natural Conditions-PM) the C-111SC PM utilizes percent difference from pre-drainage conditions

and uses indicator regions, whereas the GE-E4 targets depend on habitat type of interest (e.g., for ridge and slough/sawgrass plains and marl marsh areas, an envelope is developed using NSM4.6 for amplitude; for Big Cypress the target is to match NSM 4.6 output indicator region by indicator region).

In EC 1.3 (Extreme High and Low Water Depths-PM) the C-111 SC PM defines extreme high and low water events based on the WASH123 model rather than the NSM 4.6.

In EC 4.1 (Reestablish Seasonal and Annual Inflow Volumes That Reflect Natural Conditions-PM), the C-111 SC PM target specifies minimum differences in flow between NSM (pre-drainage) and the alternative, regardless of compatibility with other hydrologic PMs. By comparison, the RECOVER PM GE-E5 target specifies qualified similarity. (RECOVER would also like to note that GE-E5 has been tabled due to the large amount of uncertainty associated with sheetflow calculated by the SFWMM.)

Ecologic and Biologic PMs – In general, the intent of C-111 SC ecologic and biologic PMs were consistent with RECOVER PMs; however, RECOVER noted several ecologic and biologic PMs with slightly different targets. These differences are noted below:

RECOVER recognizes that RECOVER targets for WCA-3 are based on hammock tree islands rather than bayhead tree islands; however, it is important to note the target for this PM is slightly different than RECOVER's GE-E15. GE-E15's target is to minimize deviation from NSM, whereas the C-111SC PM utilizes hard numbers of hydroperiod and water depth for targets.

Documentation in C-111 SC EC 3.1 (Improve Habitat for American Crocodile-PM) is slightly inconsistent with work proposed by Dr. Frank Mazzotti, University of Florida. Dr. Mazzotti's work indicates a target of less than or equal to 20 ppt for the wet season and the first part of the dry season for crocodiles.

EC 3.2 (Improve Marsh Recession Rates to Support Successful Nesting and Foraging for Wading Birds-PM) is generally consistent with RECOVER PM GE-E20 (Long Legged Wading Bird Foraging Conditions). RECOVER does not have PM's that specifically address recession rates. RECOVER PM GE-E20 will utilize the ATLSS wading bird model; the C-111 SC PM will utilize watershed model for water levels, recession rates

EC 3.3 (Cape Sable Seaside Sparrow Nesting Condition Availability) PM is not inconsistent with RECOVER PMs. RECOVER does not have a CSSS PM but has identified Special Issue Indicator Regions for the Sparrow sub-populations. RECOVER chose not to pursue the draft performance measure but it's graphics for Sub-population D indicates the 40 to 80 days are to be between February 15 and July 15 instead of March 1 to July 15.

**Salinity** – RECOVER has identified two potential areas of inconsistency between C-111 SC PMs and RECOVER PMs with regard to salinity targets. Both are noted below:

Although there is no corresponding RECOVER PM for comparison with EC 2.4 (Restore Historic Spatial Extent and Distribution of Oligohaline, Mesohaline, and Estuarine Marsh Flats-PM), this PM is consistent with RECOVER SE PMs in concept. RECOVER suggests coordinating with RECOVER RET SE sub-team when model output describing the pre-drainage salinities are obtained to make targets are consistent with RECOVER targets.

The targets set for EC 5.1 (Minimize Impacts to Eastern Barnes Sound Hard Bottom Communities-PM) are inconsistent with those of RECOVER PM SE-E4 (Salinity Patterns in, and Timing of Freshwater Inputs to, Manatee Bay and Coastal Embayments of Barnes Sound). To review RECOVER PM targets for SE-E4 please visit [http://www.evergladesplan.org/pm/recover/ret\\_perf\\_measures.cfm](http://www.evergladesplan.org/pm/recover/ret_perf_measures.cfm) for the most recent documentation sheet.

**Flood Protection and Water Supply** – Targets for C-111 SC evaluation criteria EC 8.1 through 8.4 and EC 9.1 appear to be inconsistent with RECOVER PMs for flood protection and water supply. The targets for RECOVER flood protection PMs are based on 1983-1993 conditions, years when performance was considered adequate. Additionally, RECOVER PMs WS-E2 (Frequency of Water Restrictions for the Lower East Coast) and WS-E8 (Duration and Severity of Water Restrictions for the Lower East Coast) should be consulted for consistency.

**Terminology** – RECOVER recognizes that EC 2.4 (Restore Historic Spatial Extent and Distribution of Oligohaline, Mesohaline, and Estuarine Marsh Flats-PM) includes salinity classifications of oligohaline, mesohaline, etc. This terminology is normally associated with the Venice classification system. However, the Venice system defines mesohaline as a range of 5 to 18 ppt and polyhaline as 18 to 30 ppt; the C-111SC PM defines mesohaline as 6 to 15 ppt and estuarine (polyhaline) as 16 to 30 ppt. RECOVER suggests using consistent terminology and salinity ranges with the Venice system.

Additionally, RECOVER suggests the C-111 SC PDT clarify in EC 6.1, EC 6.3, EC 6.4, and EC 6.5 that discharges entering natural areas are from STAs/reservoirs rather than untreated water.

**Models** – For EC 3.8 (Maintain or Increase American Alligator Production), RECOVER recognizes the PDT is using RECOVER PM GE-E23; however, RECOVER suggests the PDT consider whether the ATLSS model may be unable to use WASH123 output as its input. The PDT should ensure these models are consistent.

**Uncertainty and CERP Influences** – Some C-111 SC PMs and ECs may be inappropriate for the project, as a number of influences other than those imposed by the project may have significant impacts on the parameters. For example, there are non-CERP influences that significantly impact water quality in the project area. For example, in EC 6.3 (Reduce N levels in Discharges Entering Natural Areas [from STAs/Reservoirs]-PM) it may be worthwhile for the PDT to determine where numeric TN load reduction is expected and if it is applicable to STA's within the project area. If the project is not expected to affect N concentrations, it may be more appropriate to use this as a screening criterion with the target

of “no increase”. Additionally, EC 6.2 (Maintain desirable phosphorus target concentration in natural system areas-PM) and EC 6.5 (Meet Class III WQ Standards from CERP Facilities to natural areas [from STAs/Reservoirs]) appear to be governed by non-CERP influences capable of affecting parameters that the project will be treating/affecting. It may be more appropriate to make these EC a project constraint with the expectation “not to make worse”.

**Consistency Among Projects and RECOVER** – There are several metrics within the BBCW suite of PMs that are also present in neighboring projects like the Florida Bay / Florida Keys Feasibility Study (FBFKFS) and Biscayne Bay Coastal Wetlands (BBCW) Project. RECOVER suggests the PDT review these project PMs, as well as RECOVER PMs to ensure that PM targets, metrics, and evaluation methodologies are consistent. This will enable the comparison of evaluation data among projects and RECOVER.

#### 4.0 CONCLUSIONS

There is general compatibility of intent between the project-level performance measures and evaluation criteria developed for the C-111 SC and the system-wide performance measures of the Comprehensive Plan. Some revisions are suggested to increase the degree of consistency between project and system-wide performance measures. RECOVER suggests reviewing several PMs for redundancy and the additional documentation. Additionally, RECOVER suggests that some of the C-111 SC PMs be reviewed for applicability, uncertainty, and consistency with neighboring projects and RECOVER.

**ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS**

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve flow patterns, hydroperiods and ecological connectivity between the Southern Glades, Model Lands, and adjacent natural areas
<b>EC 1.1 Annual Inundation Patterns (Performance Measure)</b>
<p><b>Target:</b> The target is the range of weeks of inundation and the number of inundation events or an envelope for the duration and number of inundation events that approximate the Wash123D pre-drainage model output for cells in the model categorized by landscape type (vegetation zone) requirements of depth of water table and surface water flow.</p> <p><b>Evaluation Method:</b> Wash123D</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> (GE- E2 Inundation Pattern in the Greater Everglades Wetlands)</p> <p>This PM is consistent with RECOVER GE-E2, including the target and definition of “inundation event”; however, it is unclear if the PM applies to the entire project area or only to the freshwater wetlands in the project area (i.e. marl prairies, forested wetlands, etc.). It may be appropriate to develop and use indicator regions the same as or similar to those developed for the Greater Everglades for use in evaluation of this PM. RECOVER suggests language be added to this PM to show both freshwater and tidal wetland landscape types will be evaluated.</p>
<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve flow patterns, hydroperiods and ecological connectivity between the Southern Glades, Model Lands, and adjacent natural areas
<b>EC 1.2 Reestablish amplitude and interannual water levels that reflect natural conditions (Performance Measure)</b>
<p><b>Target:</b> The target is zero percent difference from pre-drainage seasonal variation of stage for each indicator region. Seasonal variations that are closest to the pre-drainage values are considered more likely to support native vegetation, aquatic fauna and to support the freshwater flows for Florida Bay.</p> <p><b>Evaluation Method:</b> Wash123</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> (GE-E4 Seasonal Amplitude and Interannual Variability of Water Levels in the Greater Everglades Wetlands)</p> <p>This PM is generally consistent with RECOVER PM GE-E4; however, the target is slightly different. GE-E4 targets depend on habitat type of interest (e.g., for ridge and slough/sawgrass plains and marl marsh areas, an envelope is developed using NSM4.6 for amplitude; for Big Cypress the target is to match NSM 4.6 output indicator region by indicator region). The C-111SC PM utilizes percent difference from pre-drainage conditions and uses indicator regions. Additionally, RECOVER suggests defining to which areas within the C-111SC project area this PM applies.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve flow patterns, hydroperiods and ecological connectivity between the Southern Glades, Model Lands, and adjacent natural areas
<b>EC 1.3 Extreme High and Low water depths (Performance Measure)</b>
<p><b>Target:</b> The target is a range for the total duration of extreme high and low water events in weeks and the number of extreme high and low water events or an envelope of occurrences that meet the Wash123D pre-drainage model output for selected cells (groups of cells for different vegetation zones).</p> <p><b>Evaluation Method:</b> Wash123D</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> (GE-E3 Extreme High and Low Water Levels in the Greater Everglades Wetlands) This PM is generally consistent with RECOVER PM GE-E3; however, RECOVER has a definition for extreme high and low water events based on a Natural System Model envelope rather than the WASH 123. RECOVER also suggests defining criteria for extreme high and low water events (see GE-E3). Additionally, RECOVER suggests defining to which areas within the C-111SC project area this PM applies.</p>

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve flow patterns, hydroperiods and ecological connectivity between the Southern Glades, Model Lands, and adjacent natural areas
<b>EC 1.4 Improve hydrologic connectivity between the Southern Glades, model Lands, and adjacent natural areas (Performance Measure)</b>
<p><b>Target:</b> The target condition is water surface elevation differences across a selected set of barriers similar to that predicted by the pre-drainage model developed from Wash123D. Differences of more than one depth category from pre-drainage model predictions are considered poor.</p> <p><b>Evaluation Method:</b> Wash123D</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> (TS-E1 Continuity-Water Surface Elevations Across Barriers) This PM is generally consistent with RECOVER PM GE-E4. RECOVER suggests the phrase “groups of WASH mesh” be expanded to indicate whether it refers to groups of WASH model cells. Additionally, RECOVER suggests documenting if comparisons will be made based on average annual/seasonal differences, and on what time scales comparisons are made (days, weeks, seasons).</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve habitat and functional quality of wetlands and natural areas & increase spatial extent where practicable
<b>EC 2.1 Improve marl prairie vegetation mosaic (Performance Measure)</b>
<p><b>Target:</b> The restoration target is for the distribution and aerial extent of hydroperiods that would support Zone 3 graminoid-dominated freshwater wetlands to match pre-drainage conditions. The specific hydroperiod distribution for evaluation purposes will be determined by the pre-drainage modeling scenario, but it is expected that this scenario will yield results similar to the description in Egler (1952) and the depiction of the Desired Future Condition in Figure 1. Alternatives that maximize the spatial distribution of freshwater marshes and more closely approximate the distribution depicted in Figure 1 (Desired Future Conditions) would be preferred in the absence of a reliable pre-drainage scenario to provide comparisons.</p> <p><b>Evaluation Method:</b> Model not specified and post-processing</p>
<p><b>Is this PM consistent with RECOVER PMs?</b></p> <p>The underlying concept behind this PM and the RECOVER PM's are consistent. RECOVER Indicator Regions 145 East Perrine Marl Marsh and 146 Model Lands Marl Marsh fall within the study area. GE-E2 Inundation Pattern has an inundation target of 140-168 days for IR-145 and 196-224 days for IR 146. They are similar but not identical to the targets in this PM. The purpose of this project PM is to increase spatial extent of marl prairie. The only time there could be a conflict would be if the increase in marl prairie were in a different location that did not include IR's-145 and 146.</p> <p>Although the targets for this PM are generally consistent with RECOVER PM GE-E2, this PM does not appear to differ significantly from EC1.1. Inundation (EC1.1) and hydroperiod (EC2.1) may be redundant. Additionally, this PM could possibly conflict with EC1.1. What if WASH shows pre-drainage conditions in places where freshwater graminoid marsh is desired that have a hydroperiod less than 130 days (minimum hydroperiod for freshwater graminoids)?</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve habitat and functional quality of wetlands and natural areas & increase spatial extent where practicable
<b>EC 2.2 Minimize loss of functional wetlands</b>
<p><b>Target:</b> The target is 0 acres (determined by calculating the acreage of canal and STA) of well-functioning wetland habitat lost.</p> <p><b>Evaluation Method:</b> A wetland evaluation methodology (e.g., W.A.T.E.R, HGM) will be used to compare baseline conditions in the surrounding wetlands with project plan alternatives. Other evaluation methods (soils, habitat suitability for particular species) for wetland function may be available to complement the chosen methodology.</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> This PM appears to be consistent with CERP goals, but there is not necessarily a corresponding RECOVER PM for comparison.</p>

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve habitat and functional quality of wetlands and natural areas & increase spatial extent where practicable
<b>EC 2.3 Maintain bayhead tree island habitat (Performance Measure)</b>
<p><b>Target:</b> In Zone 3 (sawgrass with tree islands) of the Desired Future Condition for South Dade Wetlands MAP (Burzycki, In progress), hydroperiods within the bayheads should not exceed 4 months. Marsh water depths in Zone 3 should not exceed 1.5 ft except in the wettest years. The water table recession in Zone 3 should not exceed 1.5 ft below the ground surface. A duration of -1.5 ft for more than 30 days in any given year would be considered particularly detrimental. (The results of the tree island topographic surveys when available may be used to determine the relative island height at which the 4-month exceedence would be measured.)</p> <p><b>Evaluation Method:</b> Model not specified</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> The targets for RECOVER PM GE-E3 Extreme High and Low Water Levels for IR's 145 and 146 are:</p> <p>IR-145. East Perrine Marl Marsh. No more than 7 high events &gt;1.5 feet and &gt;2 weeks duration. Minimize low events &lt;1.0 foot</p> <p>IR-146. Model Lands Marl Marsh. No more than 7 high events &gt;2.0 feet and &gt;2 weeks duration. Minimize low events &lt;1.0 foot</p> <p>RECOVER recognizes that RECOVER targets for WCA-3 are based on hammock tree islands rather than bayhead tree islands; however, it is important to note the target for this PM is slightly different than RECOVER's GE-E15. GE-E15's target is to minimize deviation from NSM, whereas the C-111SC PM utilizes hard numbers of hydroperiod and water depth for targets.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve habitat and functional quality of wetlands and natural areas & increase spatial extent where practicable
<b>EC 2.4 Restore historic spatial extent and distribution of oligohaline, mesohaline, and estuarine marsh flats (Performance Measure)</b>
<p><b>Target:</b> The restoration target is for the coastal salinity pattern to match pre-drainage conditions. In the absence of both pre-drainage salinity data and supporting research that can correlate vegetation succession patterns with surface water salinity patterns, the following surrogate measure will be used: the distribution and aerial extent of wetlands limited by seasonal surface water salinity &gt; 5 ppt (Figure 1, Zones 2-5) should match pre-drainage projections, and salinity contours in coastal wetlands should also follow pre-drainage projections.</p> <p><b>Evaluation Method:</b> Model not specified</p>
<p><b>Is this PM consistent with RECOVER PMs?</b></p> <p>Although there is no corresponding RECOVER PM for comparison, this PM is consistent with RECOVER SE PMs in concept. RECOVER suggests coordinating with RECOVER RET SE sub-team when model output describing the pre-drainage salinities are obtained to develop targets that are consistent with RECOVER targets.</p> <p>Additionally, the evaluation method section for this PM includes salinity classifications of oligohaline, mesohaline, etc. This terminology is normally associated with the Venice classification system. However, the Venice system defines mesohaline as a range of 5 to 18 ppt and polyhaline as 18 to 30 ppt; the C-111SC PM defines mesohaline as 6 to 15 ppt and estuarine (polyhaline?) as 16 to 30 ppt. RECOVER suggests using consistent terminology and salinity ranges as Venice system.</p>
<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve habitat and functional quality of wetlands and natural areas & increase spatial extent where practicable
<b>EC 2.5 Migration of the saltwater intrusion line toward the coast (Performance Measure)</b>
<p><b>Target:</b> Saltwater intrusion (500 ppm groundwater chloride line) within the project boundary should be shifted toward the bay.</p> <p><b>Evaluation Method:</b> Model not specified</p>
<p><b>Is this PM consistent with RECOVER PMs?</b></p> <p>This PM is generally consistent with RECOVER PM WS-E5, which is targeted towards preventing saltwater intrusion from moving further from the Bay.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve native plant and animal species abundance and diversity
<p><b>EC 3.1 Improve habitat for American Crocodile (Performance Measure)</b></p> <p><b>Target:</b> The target for this criterion is the establishment of seasonally brackish salinity in areas contiguous with the coastal mangrove fringe (Zone 8, Figure 2). Salinity should not exceed 15 ppt in this zone from June through October, or 20 ppt from November through January, based on requirements for estuarine fishes and juvenile crocodiles. Salinity should not exceed 36 ppt during the remainder of the year. Salinity should not change in this zone more than +/- 7 ppt per day during all parts of the year to minimize the potential for osmotic shock to plants and animals.</p> <p><b>Evaluation Method:</b> Wash123D</p>
<p><b>Is this PM consistent with RECOVER PMs?</b></p> <p>This PM is generally consistent with salinity targets in RECOVER PMs for SE-E4 Barnes Sound/Manatee Bay and SE-E2, which includes Joe Bay. Documentation in this PM is unclear for 15 ppt June-Oct and 20 ppt Nov-Jan target. Frank Mazzotti's work indicates a target of less than or equal to 20 ppt for the wet season and the first part of the dry season for crocodiles. RECOVER suggests the PDT document the +/- 7 ppt per day target and its difference from previous scientific work.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve native plant and animal species abundance and diversity
<p><b>EC 3.2 Improve marsh recession rates to support successful nesting and foraging for wading birds (e.g. roseate spoonbill) (Performance Measure)</b></p> <p><b>Target:</b> Provision of acceptable feeding habitat for a sufficient period of time are defined as:</p> <ol style="list-style-type: none"> <li>1.) Dry Season (Nov – Apr) surface water recession rates range between 1 to 4 cm/week. This recession rate assumes successful nesting (an average of at least 1 chick per nest) in at least 7 out of 10 years or 70% of the historical recession rate range, which will result in population growth (Lorenz, 2002).</li> <li>2.) Major non-tidal water control related reversal periods in the dry season will be limited to a rise in surface water levels of 1.5 cm/day (daily average) and a period of 5 days (Frederick and Spalding, 1995).</li> <li>3.) Wet Season water levels (June-October) should range from 0.12 to 0.6 meters in Zones 3-6 to accommodate good development of prey organisms.</li> </ol> <p>The target is restoration that would result in a range of rates, depths, and durations as described for freshwater/brackish non-STA wetlands. The degree to which the target is achieved would be measured based on achieving target hydropatterns within the described range for rates, depths, and duration.</p> <p><b>Evaluation Method:</b> Specific watershed model not specified</p>
<p><b>Is this PM consistent with RECOVER PMs?</b></p> <p>This PM is generally consistent with RECOVER PM GE-E20 Long Legged Wading Bird Foraging Conditions. RECOVER does not have PM's that specifically addresses recession rates. RECOVER PM GE-E20 will utilize the ATLSS wading bird model; the C-111SC PM will utilize watershed model for water levels, recession rates. Additionally, RECOVER suggests that the justification section of the PM documentation sheet provide documentation for wet season water level targets of 0.12-0.6 meter in Zones 3-6.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve native plant and animal species abundance and diversity
<b>EC 3.3 Cape Sable Seaside Sparrow nesting condition availability (Evaluation Criteria)</b>
<p><b>Target:</b> The evaluation target is 40-80 days between March 1 and July 15 that water levels are below ground in selected areas.</p> <p><b>Evaluation Method:</b> Wash123D</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> This PM is consistent with RECOVER PMs. RECOVER does not have a CSSS PM but has identified Special Issue Indicator Regions for the Sparrow sub-populations. RECOVER has chosen not to pursue the draft performance measure but it's graphics for Sub-population D indicates the 40 to 80 days are to be between February 15 and July 15 instead of March 1 to July 15. Additionally, RECOVER suggests the PDT consider whether the target has a constraint of the number of years when the target is met.</p>
<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve native plant and animal species abundance and diversity
<b>EC 3.4 Assure the project contributes to the overall recovery goal for the Florida Panther of a viable population level in South Florida (Evaluation Criteria)</b>
<p>The first measure will be the total combined acreage in the primary zone of all high and medium value Florida panther habitat greater than 2 hectares (ha) within the project study area and non-urban cover types less than 200 meters (m) from high habitat value cover. The second measure will be the total continuous acreage of the first measure that is also interconnected (no more than a 1 kilometer gap) with and included in the Primary Zone previously discussed and illustrated in Figure 4. The third measure will be the total combined acreage of tree islands greater than 0.5 ha in the primary zone.</p> <p><b>Target:</b> The target for all three measures will be no loss of total acreage classified as either high or medium value.</p> <p><b>Evaluation Method:</b> Model not specified</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> Although there is no corresponding RECOVER PM, this PM is consistent with RECOVER PMs. RECOVER notes, however, that targets and evaluation method may change significantly in response to recent panther habitat requirements controversy.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve native plant and animal species abundance and diversity
<b>EC 3.5 Wetland aquatic fauna (Evaluation Criteria)</b>
<b>Target:</b> Wet Season water levels (June-October) should range from 0.12 to 0.6 meters in Zones 3-6 to accommodate good development of prey organisms. Dry Season (Nov – Apr) surface water recession rates range between 1 to 4 cm/week.
<b>Evaluation Method:</b> watershed model not specified
<b>Is this PM consistent with RECOVER PMs?</b> RECOVER notes that this PM seems redundant to EC3.2. Both PMs have identical targets and both identify the aquatic fauna as prey for wading birds.
<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve native plant and animal species abundance and diversity
<b>EC 3.6 Exotic Animal Species (Evaluation Criteria)</b>
<b>Target:</b> Zero acres in zones 2 through 6 (Figure 1), where water management feature depth is greater than the adjacent wetlands by more than 1 meter.
<b>Evaluation Method:</b> Calculated using GIS applications that incorporate historic, baseline, and predicted wetland coverages to compare different plan alternatives.
<b>Is this PM consistent with RECOVER PMs?</b> There is no corresponding RECOVER PM for comparison. RECOVER suggests the PDT add documentation to describe the impact of the elimination of “deep” water habitat on native fishes. Additionally, RECOVER suggests adding documentation to describe the source of the “1 meter below adjacent wetland elevation” target.

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve native plant and animal species abundance and diversity
<b>EC 3.7 Maintain or increase percentage of habitat suitable for periphyton (Evaluation Criteria)</b>
<p><b>Target:</b> Maintain or increase aerial coverage of habitat suitable for benthic mat periphyton communities as defined by output from the Wash123D 2000 base condition.</p> <p><b>Evaluation Method:</b> The Periphyton Habitat Suitability Index (PHSI) is a time-averaged, spatially-variable index that is a function of the average hydroperiod for the simulation period and is partitioned into three models: Benthic Periphyton Suitability Index (BPSI), Floating Periphyton Suitability Index (FPSI), and Epiphytic Periphyton Suitability Index (EPSI).</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> This PM is consistent with RECOVER PM GE-E11. RECOVER suggests the PDT consider whether this PM is redundant to or in conflict with EC1.1 and/or EC2.1. These PMs all address hydroperiod.</p>
<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Improve native plant and animal species abundance and diversity
<b>EC 3.8 Maintain or increase American Alligator production (Evaluation Criteria)</b>
<p><b>Target:</b> For the total CERP project, the evaluation target is to improve total alligator production scores relative to the 2050 base. For implementation runs, the evaluation target is to exceed 2000 base production scores.</p> <p><b>Evaluation Method:</b> ATLSS Alligator Production Index Model</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> This PM is consistent with RECOVER PM GE-E23; however, RECOVER suggests the PDT investigate the ability for the ATLSS model to use WASH123 output as its input. The PDT should check to make sure models are consistent.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Reserve sufficient water for the restoration of the natural system
<b>EC 4.1 Reestablish seasonal and annual inflow volumes that reflect natural conditions (Performance Measure and Evaluation Criteria)</b>
<b>Target:</b> Minimize differences in annual and seasonal flow between the modified and natural system, as determined by the WASH123D, or other appropriate, fine scale, hydrologic model, across specified transects.
<b>Evaluation Method:</b> WASH123D, or other appropriate, fine scale, hydrologic model
<b>Is this PM consistent with RECOVER PMs?</b> (GE-E5 Seasonal and Annual Flow Volume in the Greater Everglades Wetlands) This PM is generally consistent with RECOVER PM GE-E5; however, the GE-E5 target is slightly different from the proposed PM. The GE-E5 target specifies qualified similarity; C-111SC target specifies minimum differences in flow between NSM (pre-drainage) and the alternative, regardless of compatibility with other hydrologic PMs. RECOVER also notes that GE-E5 has been put on hold because of the great amount of uncertainty inherent in this measure (flow) when calculated by the SFWMM. The goal of restoring flows is still consistent.

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Eliminate ecologically damaging flows to Barnes Sound and Fl Bay
<p><b>EC 5.1 Minimize impacts to Eastern Barnes Sound hard bottom communities (Performance Measure)</b></p> <p><b>Target:</b> From 100 meters of mainland, maintain an east-west salinity gradient between US1 to the east and west to the C-107/FP&amp;L outfall canals in Card Sound, of less than or equal to 30 ppt during the wet season (Jun-Nov) and greater than or equal to 30 ppt and less then or equal to 40 ppt during dry season months (Dec-May).</p> <p><b>Evaluation Method:</b> Existing linear regression model developed by Alleman/Aguirre(RET Performance Measure, SE-E4) to link water levels in the watershed east of US 1 (near model node SWEVER 1) to monthly mean salinities in C-111 Geographical Zone 9b.</p>
<p><b>Is this PM consistent with RECOVER PMs?</b></p> <p>The justification and targets for this PM may be inconsistent with RECOVER PM SE-E4. RECOVER recommends that the PDT consider the targets set in SE-E4. SE-E4 for Manatee Bay/Barnes Sound has wet season (June to October) salinities within 5-15 ppt in coastal embayments and Manatee Bay, within 15-30 ppt at the mouths of coastal embayments and Barnes Sound, and within 15-30 ppt within Barnes Sound 90% of the wet season. Dry season (November-May) average salinity should be within 10-19 ppt in coastal embayments and Manatee Bay, within 20-32 ppt at the mouths of coastal embayments and Barnes Sound, and within 20-35 ppt within Barnes sound 90% of the time. Daily average salinity &lt; 35 ppt at all location 95% of the dry season. Additionally, RECOVER suggests clarification should be added to describe where this PM applies with respect to the estuarine zone.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Provide ecologically compatible WQ consistent with restoration goals and federal and state requirements applicable to the Southern Glades, Model Lands, and Everglades National Park.
<b>EC 6.1 Reduce phosphorus levels in discharges entering natural areas (Performance Measure)</b>
<b>Target:</b> Average flow- weighted mean concentration of approximately 10 ppb (EFA) for the surface and groundwater discharging to natural areas (Zone III of Desired Future Condition of Vegetation map) and 6 ppb (settlement agreement) in current existing Marsh Areas (Taylor Slough, Southern Glades, Model Lands, and Coastal Basins).
<b>Evaluation Method:</b> DMSTA will be used for surface TP concentration evaluation, surface and groundwater flow will be evaluated with WASH123D, and TP in groundwater will be evaluated with WASH123D.
<b>Is this PM consistent with RECOVER PMs?</b> This PM appears to be generally consistent with RECOVER PM GE-E7; however, RECOVER suggests the title of this PM should be modified to read "...discharges from STAs/Reservoirs..."

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Provide ecologically compatible WQ consistent with restoration goals and federal and state requirements applicable to the Southern Glades, Model Lands, and Everglades National Park.
<b>EC 6.2 Maintain desirable phosphorus target concentration in natural system areas (Performance Measure)</b>
<b>Target:</b> Maintain a long-term TP concentration of 6 ppb for the annual (arithmetic or geometric) mean in current existing Marsh Areas at ponded water monitoring points (Taylor Slough, Southern Glades, Model Lands, and ENP Coastal Basins).
<b>Evaluation Method:</b> ELM. (WASH123 output will be used as input for ELM west of US1)
<b>Is this PM consistent with RECOVER PMs?</b> There may be no corresponding RECOVER PM for this PM; however, since this appears to be governed by non-CERP influences and is not a parameter related to project constructed features (like STAs or reservoirs) it may be more appropriate to make this parameters a project constraint with the expectation "not to make worse".

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Provide ecologically compatible WQ consistent with restoration goals and federal and state requirements applicable to the Southern Glades, Model Lands, and Everglades National Park.
<b>EC 6.3 Reduce N levels in discharges entering natural areas (Performance Measure)</b>
<p><b>Target:</b> Reduce loads and concentrations of <b>Total nitrogen (TN)</b> concentrations to freshwater and estuarine wetlands to achieve the concentration targets (not exceed historical background) and a load reduction discharging to natural area (Zone III of Desired Future Condition of Vegetation map).</p> <p><b>Evaluation Method:</b> Use Storm Water Management Model (SWMM) to evaluate the TN concentration at the effluent of water discharging to natural system areas. The flow for load calculation will be evaluated with WASH123D.</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> This PM appears to be generally consistent with proposed RECOVER PMs for the assessment of nutrient concentration and loading in the GE; however, it is important to note that increased flows to the area may not allow for reduction of TN load (depending on the reduction in TN concentration). It may also be worthwhile for the PDT to determine where numeric TN load reduction is expected and if it is applicable to STAs/reservoirs in the area. Additionally, RECOVER suggests the title of this PM should be modified to read "...discharges from STAs/Reservoirs..."</p>

<b>CERP Goal:</b> Enhance Ecologic Values
<b>Project Objective/Constraint:</b> Provide ecologically compatible WQ consistent with restoration goals and federal and state requirements applicable to the Southern Glades, Model Lands, and Everglades National Park.
<b>EC 6.4 Minimize TSS in water entering natural areas (Performance Measure)</b>
<p><b>Target:</b> median concentration of 3.0 mg/L as TSS target.</p> <p><b>Evaluation Method:</b> SWMM</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> RECOVER suggests the title of this PM be modified to read "...natural areas from STAs/Reservoirs..."</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<p><b>CERP Goal:</b> Enhance Ecologic Values</p>
<p><b>Project Objective/Constraint:</b> Provide ecologically compatible WQ consistent with restoration goals and federal and state requirements applicable to the Southern Glades, Model Lands, and Everglades National Park.</p>
<p><b>EC 6.5 Meet Class III WQ standards for discharges from CERP facilities to natural areas (Evaluation Criteria)</b></p> <p><b>Target:</b> The discharge of <b>toxicants/pathogens</b> to Natural system area should not increase due to redistribution of flows resulting from this project. Concentration of <b>metals</b> and <b>synthetic organic chemicals</b> in canal sediments should not exceed biological effects thresholds established by State (McDonald. 1994, Chapter 6) or EPA Region IV. <b>Bacteriological levels</b> should not exceed established state or local water quality standards (e.g., F.A.C. 62-302.530; Miami-Dade County Code: 24-11(4)).</p> <p><b>Trace Metals-Total Cd, Total Cu, and Total Zn.</b> Meet Class III water quality standards/Non-ECP/modification structures (S177, S178, S-18C, S332E) Water Quality compliance requirements, No deterioration compared with "without project condition" in water discharging to natural system areas.</p> <p><b>Pesticides/Herbicides:</b> Meet Class III water quality standards/Non-ECP/modification structures (S177, S178, S-18C, S332E) Water Quality compliance requirements, No deterioration compared with "without project condition" in water discharging to natural system areas.</p> <p><b>Hg and MeHg:</b> Bioaccumulation in fish Levels should not exceed biological effect thresholds established by State. (Mosquito fish (<i>Gambusia</i> spp): TL3- 0.077µg/g; Sun fish (<i>Lepomis</i> spp): TL3- 0.077µg/g; Warmouth (<i>Lepomis gulosus</i>): TL4--0.346 µg/g; Largemouth Bass- (<i>Micropterus salmoides floridanus</i>)-Human Health: TL5-300 µg/g.</p> <p><b>Ammonia:</b> Reduce ammonia concentrations from near toxic levels (up to 112 ppb) to concentrations not regarded as toxic (20-50 ppb).</p> <p><b>Evaluation Method:</b> The transport of pollutants (pathogen, trace metals and pesticide/herbicides) of concerns discharged to Natural system areas will be evaluated with SWMM storage treatment module.</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> There is no corresponding RECOVER PM for comparison. RECOVER suggests the title of this PM be modified to read "...natural areas from STAs/Reservoirs..." Additionally, the suite of WQ parameters involved with Class III WQ standards is extensive, and project features (such as STAs and reservoirs) may not influence all these WQ parameters. Based on this, the EC could be influenced by non-CERP influences. RECOVER suggests the PDT clearly describe this EC as a project constraint with the expectation "not to make worse". The project may also consider developing a risk analysis tool especially for endosulfates.</p>

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Take advantage of recreational opportunities where available and consistent with environmental restoration goals.
<b>NOT TO BE REVIEWED BY RECOVER</b>

<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Maintain existing (Dec 2000) levels of flood protection to agricultural and urban lands
<b>EC 8.1 Maintain Existing Urban Flood Protection (Evaluation Criteria)</b>
<b>Target:</b> Minimize the time and number of occurrences of water stages above ground and no worse than 1994 C-111 GRR Planning Condition
<b>Evaluation Method:</b> MODBRANCH
<b>Is this PM consistent with RECOVER PMs?</b> The targets for RECOVER flood protection PMs are based on 1983-1993 conditions, years when performance was considered adequate.

<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Maintain existing (Dec 2000) levels of flood protection to agricultural and urban lands
<b>EC 8.2 Maintain Existing Agricultural Flood Protection –Damages to Combined Row and Truck Crops (Evaluation Criteria)</b>
<b>Target:</b> Condition not to be made worse than 1994 C-111 GRR planning condition
<b>Evaluation Method:</b> SFWMM and MODBRANCH
<b>Is this PM consistent with RECOVER PMs?</b> The targets for RECOVER flood protection PMs are based on 1983-1993 conditions, years when performance was considered adequate.

**ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS**

<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Maintain existing (Dec 2000) levels of flood protection to agricultural and urban lands
<b>EC 8.3 Maintain Existing Agricultural Flood Protection – Damages to Fruit Trees (Evaluation Criteria)</b>
<b>Target:</b> Condition not to be made worse than 1994 C-111 GRR planning condition
<b>Evaluation Method:</b> SFWMM and MODBRANCH
<b>Is this PM consistent with RECOVER PMs?</b> The targets for RECOVER flood protection PMs are based on 1983-1993 conditions, years when performance was considered adequate.

<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Maintain existing (Dec 2000) levels of flood protection to agricultural and urban lands
<b>EC 8.4 Maintain Existing Agricultural Flood Protection – Damages to Nursery Trees (Evaluation Criteria)</b>
<b>Target:</b> Condition not to be made worse than 1994 C-111 GRR planning condition
<b>Evaluation Method:</b> SFWMM and MODBRANCH
<b>Is this PM consistent with RECOVER PMs?</b> The targets for RECOVER flood protection PMs are based on 1983-1993 conditions, years when performance was considered adequate.

ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS

<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Maintain level of service for existing (Dec 2000) and legal users
<p><b>EC 9.1 Municipal and Industrial Water Supply (Evaluation Criteria)</b></p> <p><b>Target:</b> If MODBRANCH or comparable water budget model is utilized to measure changes in water deliveries with various demands not met in the basin, then the alternative should be no worse (adverse impact) than the without project condition.</p> <p><b>Evaluation Method:</b> M+I demands will be measured as wellfield withdrawals in the model. Data input for this model will be produced from permitted water usage information provided by DERM.</p>
<p><b>Is this PM consistent with RECOVER PMs?</b> RECOVER recommends that the PDT investigate compatibility with and use of the targets of existing RECOVER PMs.</p> <p>RECOVER PM WS-E2 (Frequency of Water Restrictions for the Lower East Coast Service Area) targets are to provide at least a 1-in-10 level of service as indicated three or less water years simulated with regionally significant water shortages in the 36-year evaluation period.</p> <p>RECOVER PM WS-E8 (Duration and Severity of Water Restrictions for the Lower East Coast Service Area) targets are for duration to be no more than 18 months with water shortages during the simulation period. Severity target is all water shortages to be Phase 1 “Moderate” Water Shortage in which overall reduction of use is up to 15%.</p>

**ATTACHMENT A: C-111 SPREADER CANAL PROJECT PM CONSISTENCY REVIEW  
RECOVER COMMENTS**

<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Maintain level of service for existing (Dec 2000) and legal users
<b>EC 9.2 Agricultural Water Supply (Evaluation Criteria)</b>
<b>Target:</b> If MODBRANCH or comparable water budget model is utilized to measure changes in water deliveries with various demands not met in the basin, then the alternative should be no worse (adverse impact) than the without project condition.
<b>Evaluation Method:</b> The economic post-processor developed for SSFWMM will be used in this evaluation (MODBRANCH or similar)
<b>Is this PM consistent with RECOVER PMs?</b> RECOVER recommends that the PDT investigate compatibility with and use of the targets of existing RECOVER PMs.  RECOVER PM WS-E2 (Frequency of Water Restrictions for the Lower East Coast Service Area) targets are to provide at least a 1-in-10 level of service as indicated three or less water years simulated with regionally significant water shortages in the 36-year evaluation period.  RECOVER PM WS-E8 (Duration and Severity of Water Restrictions for the Lower East Coast Service Area) targets are for duration to be no more than 18 months with water shortages during the simulation period. Severity target is all water shortages to be Phase 1 “Moderate” Water Shortage in which overall reduction of use is up to 15%.
<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Minimize impacts to cultural, historic, and archaeological resources.
<b>NOT TO BE REVIEWED BY RECOVER</b>
<b>CERP Goal:</b> Enhance Economic Values and Social Well Being
<b>Project Objective/Constraint:</b> Minimize adverse socioeconomic impacts on local and regional economics
<b>NOT TO BE REVIEWED BY RECOVER</b>

F.5 C-111 SPREADER CANAL RECOVER CONSISTENCY REVIEW OF  
PROJECT-LEVEL MONITORING AND RECOMMENDATIONS FOR  
INCLUSION INTO THE MONITORING AND ASSESSMENT PLAN

This page intentionally left blank



## RECOVER Consistency Review of Project-Level Monitoring And Recommendations for Inclusion into the Monitoring and Assessment Plan

### **C-111 Spreader Canal – Western Features**

**February 24, 2009**

#### **Introduction and Purpose of the Evaluation**

RECOVER has been charged with evaluating project-level monitoring plans in regards to consistency with RECOVER's Monitoring and Assessment Plan (MAP 2004) and other relevant guidance (e.g., CGL 12/06), and to determine the need for additional ecological monitoring above and beyond what is already contained in the MAP. As Projects are typically not at the construction stage when this Review is prepared, and that a variety of changes may possibly occur between the above date and operational readiness of the Project, this Review should be considered an interim document. Future developments may require modification of monitoring plans and/or revision of this Review. This document provides RECOVER's recommendations to the Project PDT regarding incorporation of proposed monitoring into the MAP. Processes are in place through the RLG, DCT or QRB to resolve outstanding issues.

Adequate monitoring is needed in order to effectively carry out RECOVER's adaptive management (AM) mission (see AM strategy: [http://www.evergladesplan.org/pm/program\\_docs/adaptive\\_mgmt.aspx](http://www.evergladesplan.org/pm/program_docs/adaptive_mgmt.aspx)). MAP related monitoring generally has as its goal the generation of long-term datasets of sufficient temporal and spatial scope to permit valid interpretation(s) and consequently facilitate effective adaptive management of system-wide restoration over the long-term. Proposed MAP monitoring, as envisioned by the project teams, is ambitious and the reality of finite resources and rising costs are additional considerations that must be included when prioritizing monitoring needs. Also, the degree to which proposed monitoring elements can be implemented, phased in, or ranked, cannot be fully defined outside the holistic MAP perspective and the prudent balance between cost and science. This review should not be construed as assessing the relative merit of monitoring elements proposed by the Projects. The objectives of the Review are to ensure holistic system-wide consistency, and to identify monitoring elements appropriate and necessary to be incorporated into the MAP to drive adaptive management and evaluate progress toward Interim Goals.

Project-level monitoring typically involves monitoring that is: 1) required by permit (implemented by the Project), 2) directly related to project operations (e.g., stage and flow),

and 3) to be used for assessing CERP performance and to adaptively manage individual projects and groups of projects into the future. Project-Level Monitoring Plan elements which address system level responses, and which are amenable to drive the adaptive management process would, as necessary and appropriate, be initiated and assessed under the aegis of RECOVER via incorporation into the MAP. Regulatory requirements may become part of the MAP only if they are consistent with MAP objectives; otherwise they would remain with and be funded by the Project. Incorporation of additional monitoring into the MAP presupposes that appropriate RECOVER funding is available at the time of the required inception of any such monitoring.

### **Objectives of the Monitoring and Assessment Plan**

1. Provide data necessary and appropriate to detect and document restoration-induced change, including the evaluation of progress toward Interim Goals.
2. Provide data necessary and appropriate to implement effective Adaptive Management.

### **Background**

Historically, flows from the eastern Everglades provided sufficient freshwater to sustain estuarine conditions in eastern Florida Bay that were amenable to utilization by mesohaline and oligohaline adapted faunal communities for refugia, reproduction, and general habitat. Estuarine environments are well-documented as being zones of intense productivity which provide benefits that extend beyond local improvement to provide positive support and sustenance to the wider marine and reef-based communities. In short, the eastern Florida Bay environment is a keystone environment having far-reaching consequence and support to a much broader and far-flung community of birds, fish, and invertebrates. Regional drainage, canal construction and operation that occurred in the last century has lowered groundwater levels, facilitated sprawling urban development, construction of roads, levees, and creation of other hydrologic barriers or redirections of surface flow that in consequence has altered the drainage pattern that had heretofore provided the foundation of the estuarine system. The objective of the C-111 Spreader Canal – Western Features project is to incrementally re-establish estuarine condition. The objective of the C-111 Project-Level Monitoring Plan (PLMP) is to provide the necessary science to guide and to learn from these efforts to restore a more natural pattern of freshwater flow. Properly understanding the balance that must exist between rehydration of coastal wetlands, nearshore salinity patterns, water quality (both nearshore and offshore), and structure and viability of associated floral and faunal communities is critical toward maximizing benefits and guiding future restoration efforts.

### **Consistency with the MAP**

The C-111 Project Level Monitoring Plan (PLMP) is consistent with, and complimentary to the MAP, neither duplicating nor replacing this program. The plan acknowledges the guidance present in CGM40, CGM42, and the QASR. The plan details relevance to the performance measures developed by the PDT.

## **RECOVER Recommendations**

### **Including**

#### **Incorporation of PDT-Proposed Monitoring into the MAP**

*Note: Monitoring not recommended for inclusion in the MAP does not imply a technical disagreement with the proposed monitoring element.*

### **General Comments**

#### **Project Proposal – Adaptive Management**

##### **RECOVER Response**

Incorporating AM linkages into the monitoring plan and PIR should greatly reinforce project's contributions to CERP restoration success. RECOVER objective 2 is to provide data necessary and appropriate to implement effective AM. Some if not all of the monitoring parameters could provide this information and some of the linkages are discussed in different sections of the monitoring plan, but the linkages only tie to specific AM decisions in the project operating manual to address the Cape Sable Seaside Sparrow, flood protection, and unacceptable impacts constraints. There is no mention of how the data will link back to management actions and decisions related to achieving restoration performance and overall CERP ecosystem restoration goals and objectives. With a lack of clarity in these monitoring to decision-making linkages, it is difficult to determine if the data is acceptable for AM. Also, for those elements deemed to be project-level monitoring the document is not clear about who is responsible for the data management, analysis, integration, reporting, and long-term "care and feeding" of these efforts. Inference is made that RECOVER would report project performance status as part of the System Status Report, but then indicates specific project-performance workshops will be held as necessary.

Input was previously provided towards incorporating some of these AM linkages, which have not been included in this monitoring plan version. Also, in early conversations the team was asked to use as a template the Biscayne Bay AM plan that incorporates their project level monitoring. In addition, a good reference would be the draft AM guidance manual that discusses the AM activities. Additional input to the ecological subteam has offered specific language to address these comments. Failure of the PIR and monitoring plan to address these AM linkages will result in missed opportunities towards refining and achieving restoration goals, and for cost effective monitoring and subsequent management actions to achieve desired performance.

##### **Additional Cost to MAP**

Effective AM principles and clear links to management actions should decrease project monitoring costs. Depending on how the data management, assessments, and reporting are handled, this could result in increased costs to MAP associated efforts.

#### **Project Proposal - Duration**

Project-level monitoring for the C-111 SC Western project should be conducted for five years and then reassessed to determine how and where monitoring should continue. It may be beneficial to monitor certain aspects for up to 20 years, because

response times of some ecological monitoring parameters to changes in hydrology and water quality are gradual and long-term.

**RECOVER Response**

Re-evaluating the monitoring plan on a routine schedule is a sound approach, and should help to best focus efforts and contain costs. If monitoring targets would be developed for each parameter; upon reaching the target, monitoring could be either discontinued or the effort reduced.

**Additional Cost to MAP**

Monitoring cost will appropriately reflect the phasing of the Project.

**Physical and Water Quality Parameters****Project Proposal - Wetland stage**

Monitoring wetland stage and the discharge of fresh water from the wetland to the estuaries within the project domain, from the Model Lands to the western boundary of Taylor Slough's influence, is essential in order to document project effects. Time series of stage at stations throughout the domain are needed to determine changes in hydroperiods and hydropatterns. Time series of the discharge of fresh water flow through creeks to Florida Bay and Manatee Bay/Barnes Sound is needed to determine changes in the quantity, timing, and distribution of flow to these estuaries. These flow measurements are also necessary to calculate nutrient loads to the estuaries to ensure that the project does no harm to downstream water quality.

**RECOVER Response**

An extensive network of hydrologic monitoring, including stage and discharge monitoring currently exists in the C-111 SC project domain. The set of existing and proposed stations in the hydrometeorologic monitoring plan is expected to be sufficient to assess C-111 SC downstream effects.

**Additional Cost to MAP**

Stage and water level monitoring are properly part of project monitoring, and not appropriate for inclusion in the MAP.

**Project Proposal – Salinity**

The C-111 SC Western project is expected to improve water deliveries to Florida Bay via Taylor Slough, reduce or eliminate ecologically damaging flows to Manatee Bay, Barnes Sound, and the northeastern Florida Bay coastline, and improve hydroperiods and hydropatterns in the southern Everglades and model lands. In order to determine the spatial distribution of salinity changes in the coastal wetlands, additional synoptic surveys of surface water and shallow porewater are proposed by the project team to be measured three times per year. Two additional continuous salinity monitoring stations are proposed in Madeira Bay and West Key Basin to complement and focus the extensive monitoring network already in existence.

**RECOVER Response**

- Synoptic surveys of salinity effects in the coastal wetlands three times per year may not be sufficient, and the adequacy of this approach should be evaluated annually to ensure that the types and quality of data necessary are in fact being generated.
- The two additional salinity monitoring sites are likely advisable.

**Additional Cost to MAP**

The existing salinity monitoring network is funded through a cooperative agreement between the District and ENP; significant cost-savings might be realized by expanding the existing network via the current funding source whose initiating goal was to detect and track the type of salinity changes being considered.

**Project Proposal – Water Quality**

Hydrologic and salinity restoration must also include protection of the oligotrophic (low nutrient) status of the southern Everglades and downstream estuaries. The project will likely result in increased flows through Taylor, McCormick and Alligator creeks, with the concomitant potential of increase loading. The project team proposes additional nutrient sampling within the freshwater wetlands via periphyton tissue nutrient analysis which provides a temporally integrated indication of nutrient status in the wetland. The proposed periphyton samples will be taken from freshwater and seasonally oligohaline marshes twice per year. Additionally, direct sampling of phosphorous and nitrogen in surface water will be performed at nine sites, five in marshes and four on mangrove creeks flowing into Florida Bay. The project team also proposes a baseline study of water and nutrient sources and export from the Western Taylor Slough lakes region, focusing on water flowing into Seven Palm Lake and West Lake and out of McCormick Creek and Alligator Creek.

**RECOVER Response**

- Utilization of periphyton nutrient content to evaluate wetland status is an appropriate, accepted approach.
- The adequacy of the proposed water-column nutrient sampling plan to estimate changes in loads should be evaluated on an annual basis to ensure that the types and quality of data necessary are in fact being generated – this information may be critical toward interpreting changes in the current estuarine nutrient regime as measured by the existing Florida Bay water quality monitoring network, in particular as an explanatory variable to either link or de-link restoration-induced effects from observed changes in algal bloom frequency or severity.
- Understanding the nutrient dynamics in the lakes may be secondary, and not as critical as adequately documenting the delivery of nutrients to the bay. The observed nutrient regime in long residency-time lakes may well be an artifact of exchange.
- Direct sampling of water quality via autosamplers in wetlands may not result in data which can be linked to Project operation, particularly as regards phosphorus. However this type of sampling may provide useful information for nitrogen, which will not be addressed by periphyton analysis. Caution may be advised in utilization of these data for adaptive management purposes.

**Additional Cost to MAP**

No additional monitoring is proposed for inclusion in the MAP.

**Project Proposal – Wetland Soil Dynamics**

**Not in current monitoring proposal.**

**RECOVER Recommendation – Wetland Soil Dynamics**

The PLMP presented to RECOVER for review did not propose monitoring that would document how the C-111 Project may affect change in wetland sediment surface elevation. Accretion rate has been identified by RECOVER as a crucial – and currently under-defined – factor in the long-term success and sustainability of the overall restoration effort as a function of sea-level rise. Understanding how improved hydroperiod may affect soil accretion rate, and the degree to which that rate may keep pace with sea-level rise will provide useful guidance to not only adaptively managing the C-111 Project, but other similar restoration efforts.

**Additional Cost to MAP**

Soil accretion is the end product of plant and biogeochemical processes and must be evaluated over a number of years to be reliably quantified. The additional cost to the MAP would be approximately \$10,000 per year for ten years.

**Flora Monitoring****Project Proposal – Wetland Vegetation and SAV**

The project's modification of hydroperiod and salinity are expected to lead to ecological change toward RECOVER restoration goals and this change will largely occur via changes in plant community structure and cover. Limited project-level wetland vegetation monitoring is proposed, with sampling along transects in the eastern portion of the project domain, including both saline coastal marshes and freshwater marshes. Six sites in which plant community composition, biomass and productivity will be measured annually is proposed. Project-level SAV sampling at four Audubon sites that lack measurements of cover and species composition are proposed to be sampled every six weeks due to the relatively rapid salinity and SAV changes in this region.

**RECOVER Response**

Specific landscape changes including changes in the distribution and configuration of tidal creeks, salt marshes, and mangrove forests and changes in the extent and distribution of exotic plant communities are needed. Changes in SAV are needed to understand causes of prey base change.

**Additional Cost to MAP**

The MAP currently funds vegetation monitoring to produce a spatially and thematically accurate vegetation map of the Everglades ecosystem. Extensive funding is currently being expended to evaluate SAV condition in Florida Bay and Biscayne Bay by the MAP. No additional monitoring is proposed for inclusion in the MAP.

**Faunal Monitoring****Project Proposal - Freshwater Prey Base**

Redistribution of freshwater inflow from the C-111 SC Western project is expected to re-establish a more natural hydroperiod in the southern Everglades marshes and is anticipated to increase the diversity and abundance of wetland prey base fish and invertebrates. Currently the MAP provides funding for aquatic prey base monitoring

in the C-111 SC Western project area. The project proposes to continue existing MAP monitoring and no additional project-level monitoring is proposed.

**RECOVER Response**

Existing MAP monitoring for trophic level aquatic fauna in the C-111 SC Western project area is consistent with project-level monitoring parameters and recommended protocols and is sufficient if maintained at the current level for this area.

**Additional Cost to MAP**

No additional monitoring is proposed for inclusion in the MAP.

**Project Proposal - Saltwater Prey Base**

Project-level funding is proposed to improve the spatial coverage of the prey base sampling network such that it encompasses the broad east-west domain of the C-111 SC project, to provide data along the north-south salinity transects of eastern Joe Bay and Taylor River, and to add missing sampling parameters (hydrologic, SAV, fish) such that the sampling matrix of each site with fish sampling is complete. Six new fish sampling stations are proposed.

**RECOVER Response**

The proposed expansion of the network provides complimentary data and will ensure sufficient spatial coverage, characterization of the prey base response in areas with different salinity regimes, and fill data gaps to assess causes of prey base change.

**Additional Cost to MAP**

No additional monitoring is proposed for inclusion in the MAP

**Project Proposal - Estuarine Fish and Invertebrates**

Redistribution of freshwater inflow from the C-111 SC project is expected to re-establish a positive salinity gradient along a greater portion of the shoreline and to re-establish estuarine conditions in northeastern Florida Bay. These hydrologic changes are expected to increase the diversity and abundance of estuarine fish and invertebrates in shallow nearshore waters. The C-111 SC project proposes to continue existing MAP monitoring and no additional project-level monitoring is proposed.

**RECOVER Response**

Currently MAP provides funding for two projects that monitor estuarine fish and invertebrates in Florida Bay - the Fish and Invertebrate Assessment Network (FIAN) and a project monitoring the distribution and abundance of juvenile spotted seatrout. Existing MAP monitoring for estuarine fish and invertebrates in the C-111 SC Western project area is consistent with project-level monitoring parameters and recommended protocols and is sufficient if maintained at the current level for this area.

**Additional Cost to MAP**

No additional monitoring is proposed for inclusion in the MAP.

**Project Proposal – Cape Sable Seaside Sparrows**

The tentatively selected plan for the C-111 SC Western project based on the latest modeling runs and comparing the ecological condition base to the initial operations regime with project, will increase discontinuous hydroperiod in critical habitat for

Cape Sable Seaside Sparrow (CSSS) sub-population D. Surveys conducted to date for occurrence of CSSS have provided valuable information and need to be continued, including (a) helicopter surveys, intensive ground tracking, and banding surveys by Everglades National Park and (b) vegetation transects that annually observe vegetation, periphyton, soils, and topography by Florida International University. The C-111 SC project proposes two additional vegetation transects and three additional stage monitoring wellpoints to sufficiently characterize and monitor habitat conditions needed by the CSSS in sub-population D.

### **RECOVER Response**

The current MAP does not specifically provide for monitoring of occurrence and nesting of CSSS, but it does include monitoring landscape patterns of include marl prairies and slough gradients that will supplement vegetation mapping and document the trade-off between slough habitat restoration and the extent and quality of habitat in adjacent marl prairies in the southern Everglades. The MAP monitors marl prairie and slough gradients which includes nesting habitats for the major breeding populations of the Cape Sable seaside sparrow. The MAP also includes a monitoring component of vegetation mapping for landscape pattern that includes tussock-forming *Muhlenbergia* and sawgrass communities in the major breeding locations of the Cape Sable seaside sparrow.

### **Additional Cost to MAP**

Cape Sable Seaside Sparrow monitoring is properly part of project monitoring, and not appropriate for inclusion in the MAP. The current level of monitoring being conducted by ENP is considered acceptable at this point to monitor species occurrence, and additional vegetation transects were suggested for the FIU vegetation studies.

### **Project Proposal – Spoonbill Nesting Success**

Redistribution of freshwater inflow from the C-111 SC Western project is expected to reestablish a positive salinity gradient along a greater portion of the shoreline and to reestablish estuarine conditions in northeastern Florida Bay. Restoring more natural hydrologic patterns, including a natural recession of water levels in the dry season and reduction in water management-induced reversals, should allow for improved foraging conditions for spoonbills and an increase in nest productivity. Audubon of Florida's Tavernier Science Center (partially funded by MAP) is responsible for much of the roseate spoonbill nest monitoring in Florida Bay; including monitoring 34 keys historically used as nesting colonies, routinely sampling mainland prey base for the northwest and northeast Florida Bay colonies, and continuously monitoring hydrologic conditions at stations in the southern Everglades. In addition, roseate spoonbills and their nests are counted during serial reconnaissance flight (SRF) surveys conducted by ENP staff (also partially funded by MAP) in areas of the southern Everglades C-111 SC project footprint. The C-111 SC project proposes to continue existing MAP monitoring and no additional project-level monitoring is proposed.

**RECOVER Response**

Existing MAP monitoring of spoonbill nests in the C-111 SC Western project area is consistent with the project-level monitoring parameters and protocols and is sufficient if maintained at the current level for this area.

**Additional Cost to MAP**

No additional monitoring is proposed for inclusion in the MAP.

**Project Proposal - Wading Birds**

Redistribution of freshwater inflow from the C-111 SC Western project is expected to reestablish a more natural hydropattern in southern Everglades' marshes. Restoring more natural hydrologic patterns, including a natural recession of water levels in the dry season and reduction in water management-induced reversals, should allow for improved foraging conditions for wading birds and an increase in nest productivity. Serial reconnaissance flight (SRF) surveys conducted by ENP staff are the primary method of monitoring numbers of wading birds and nests in areas of the southern Everglades C-111 SC project footprint. The project proposes to continue existing MAP monitoring and no additional project-level monitoring is proposed.

**RECOVER Response**

Existing MAP monitoring for wading bird foraging distribution monitoring, wading bird nesting colony location, size and abundance monitoring and wood stork and roseate spoonbill nesting success monitoring in the C-111 SC Western project area is consistent with the project-level monitoring parameters and protocols and is sufficient if maintained at the current level for this area.

**Additional Cost to MAP**

No additional monitoring is proposed for inclusion in the MAP.

**Project Proposal - Juvenile Crocodiles**

Monitoring crocodiles addresses the project objectives of (a) reducing hypersaline conditions in the estuaries and (b) improvement of the quantity, timing, and distribution of freshwater to Florida Bay, by evaluating the extent to which suitable nursery habitat for hatchling and juvenile crocodiles is restored in the nearshore waters and mangrove wetlands of the project area. Diurnal and nocturnal surveys for crocodiles and nests will be conducted annually; crocodiles will be captured, measured and marked when possible; suitable nesting habitat will be searched on foot during the period of nest preparation; and hatchlings will be located, captured and measured. The C-111 SC project proposes to continue existing MAP monitoring and no additional project-level monitoring is proposed.

**RECOVER Response**

Existing MAP monitoring for crocodiles in the C-111 SC Western project area is consistent with the project-level monitoring parameters and protocols and is sufficient if maintained at the current level for this area.

**Additional Cost to MAP**

No additional monitoring is proposed for inclusion in the MAP.

### Summary

Additional cost to MAP may arise from the need to address soil accretion which is a critical factor in the long-term success and sustainability of the overall restoration effort as a function of sea-level. All monitoring will need to be re-evaluated over time to determine if it is working as intended, if additional monitoring is advisable, if monitoring should be expanded or reduced in scope, or terminated or replaced by another monitoring element as the data and the changing landscape of restoration priorities so warrant. Processes are in place through the RLG, DCT or QRB to resolve outstanding issues.

#### RECOVER Project-Level Monitoring Plan Review Team

AT Chair	Concur	Do Not Concur	Comments
Gretchen Ehlinger, USACE	<input checked="" type="checkbox"/>	<input type="checkbox"/>	None.
Patty Goodman, SFWMD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	None.
Greg Graves, SFWMD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	None.
Jana Newman, SFWMD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The team did an excellent job of recognizing those areas where RECOVER MAP data provides data to support their analysis.
Jennifer Stiner, EPJV	<input checked="" type="checkbox"/>	<input type="checkbox"/>	None.

#### RECOVER Assessment Team Chair Approvals

AT Chair	Concur	Do Not Concur	Comments
Gretchen Ehlinger, USACE	<input checked="" type="checkbox"/>	<input type="checkbox"/>	None.
Greg Graves, SFWMD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	None.
Patti Sime, SFWMD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	A general issue is that for those elements deemed to be project-level monitoring, who is responsible for the data management, analysis, integration and long-term "care and feeding".
Steve Traxler, USFWS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Concurrence contingent upon adaptive management links to management actions are incorporated into the document. See the BBCW PIR AM plan and the draft AM manual.

## Appendix – Overview of Existing MAP Monitoring Relevant to C-111 SC Western

The following monitoring elements are currently being addressed in the MAP:

- Interior Gradients of Water Quality (MAP Activity Number 3.1.3.1)
- Coastal Gradients of Flow, Salinity, and Nutrients (MAP Activity Number 3.1.3.3)
- Landscape Pattern – Vegetation Mapping (MAP Activity Number 3.1.3.4)
- Landscape Pattern – Marl Prairie/Slough Gradients (MAP Activity Number 3.1.3.5)
- Trophic Level – Aquatic Fauna Regional Populations (MAP Activity Number 3.1.3.10)
- Trophic Level – Aquatic Fauna Seasonal (MAP Activity Number 3.1.3.11)
- Trophic Level – Wading Bird Foraging, Distribution and Abundance (MAP Activity Number 3.1.3.12)
- Trophic Level – Wading Bird Nesting Colony Location, Size and Timing (MAP Activity Number 3.1.3.13)
- Trophic Level – Wood Stork and Roseate Spoonbill Nesting Success (MAP Activity Number 3.1.3.14)
- American Alligator Distribution, Size, Nesting and Hole Occupancy (MAP Activity Number 3.1.3.15)
- American Crocodile Juvenile Growth and Survival (MAP Activity Number 3.1.3.16)
- South Florida Fish Habitat Assessment Program (MAP Activity Number 3.2.3.3)
- South Florida Seagrass Fish and Invertebrate Assessment Network (MAP Activity Number 3.2.3.5)
- Juvenile Spotted Seatrout Monitoring in Florida Bay (MAP Activity Number 3.2.3.7)
- South Florida Surface Water Monitoring Network (MAP Activity Number 3.5.4.1)

This page intentionally left blank





**US Army Corps  
of Engineers®**

**Jacksonville District**



**South Florida Water  
Management District**