4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Hydrology

To help visualize the changes to hydrology and performance measures, a large number of color figures were provided in Appendix A. However, there are many more figures that would be of interest on our website: www.saj.usace.army.mil on the Sparrow Issues page.

One of the performance measures of interest in the WCA is the number of weeks the water depth would be above 2.5 feet (relative to the average ground elevation). When reviewing this performance measure, it is important to remember that there are 1612 weeks in the modeling period of record (from 1965 through 1995). Under RPA02, for example, there were 566 weeks with depths greater than 2.5 feet as compared to 519 for the 95BaseMod2 condition and 475 weeks for the No Action Alternative (Alternative 1 or ISOP2001) condition in southern WCA 3A.

Reasonable and Prudent Alternative (RPA)

The RPA, as given, could not be directly implemented, because releases from S-333 are currently limited by high stage criteria at G-3273. Furthermore, higher canal stages in L-31N, as envisioned in Test 7 Phase II, depended upon the full use of the S-332D pump station. Under the FWS B.O., pumping volume at S-332D pump station was limited during the nesting season (165cfs instead of 500cfs). For example, the maximum stage reached in cell R17C27 would have been about 0.48 feet higher under RPA02 (7.16 feet) than in the 1995BaseMod2 condition (6.65 feet). It should also be noted that increasing the flows southward down L-31N, in addition to raising canal pump criteria, results in higher stages than simply raising the canal pump criteria alone. Under ISOP, additional water is moved down L-31N to help meet the S-333 release requirements. Under the RPA02, slightly more water would enter L-31N due to increased seepage from the higher stages in NESRS. The target flows for RPA02 were 60% of the regulatory release through S-333, when not limited by structural capacity, into NESRS. Although the RPAs could not be directly implemented, several RPAs were modeled to determine the desired hydrologic characteristics in the sparrow regions. RPA02 best represents the sparrow requirements for all the CSSS subpopulations. Detailed descriptions of the RPA model runs can be found on the Corps web site.

Comparisons of 1995BaseMod2, ISOP 2000 (ISOP9d) and ISOP 2001 (ISOP9dR)

NESRS. The stages in NESRS from both ISOP 2000 and ISOP 2001 are similar to the stages from 1995BaseMod2. While the stages from ISOP 2000 and 1995BaseMod2 are virtually identical, the stages of ISOP 2001 are about 0.1 foot lower than 1995BaseMod2 for about 20 percent of the time (Appendix A, pages A-18 and A-19). ISOP 2001 supplies about 9,000 acre-feet/year less into NESRS than does ISOP 2000 (A-42) because more flow is passed through S-12D (which can be used throughout the year). The hydroperiods for all three of the operational scenarios are the same.

The hydrologic conditions under ISOP 2001 are similar to ISOP 2000 at subpopulations B, C, D, and E (A-27 to A-38). At subpopulation F, there is a significant improvement in the stages and consecutive number of nesting days under ISOP 2001 (A-39 to A-41). There is also a reduction in the discontinuous hydroperiod (A-40); however, ISOP 2001 still exceeds the requirement of RPA02.

WSRS. WRSR is also known as New Shark River Slough. ISOP 2001 conditions are similar to the ISOP 2000, with regard to impacts to WSRS, except that the higher stages are slightly reduced (A-20 and A-21) which is a benefit. With the changed closing schedule for the S-12 structures, about 28,000 acre-feet more water (A-42) is passed through the region from WCA3A during ISOP 2001 operations as compared to ISOP 2001. The increase in flow is primarily directed southward from S-12D, which is the most eastward S-12 structure and does not impact the western CSSS subpopulation.

As intended, the stages and hydroperiods in WSRS are lower than 1995BaseMod2 due to the reduction of flows through the S-12s. The reduction benefits the western subpopulation by reducing the number of nesting failures. The stages and consecutive number of nesting days are slightly improved for subpopulation A under ISOP 2001. The number of predicted failures (over the 31-year period of record) at NP205 for ISOP 2001 is the same (five) as under ISOP 2000, RPA00, RPA01, and RPA02. The number of nesting failures for 1995BaseMod2 was 8.

WCA 1. The stages in WCA 1 from both ISOP 2000 and ISOP 2001 are the same as the stages from 1995BaseMod2 (A-4). The wet and dry season hydrologic pattern of ISOP2001 did not changed from ISOP 2000; however, there were slightly fewer weeks of high water events (A-5).

WCA 2A and WCA 2B. The stages of ISOP 2000 were dramatically higher in WCA 2A (A-6) and WCA 2B (A-8) due to the raising of the regulatory curve in WCA 2A. However, ISOP 2001 did not include the elevated regulatory curve in WCA 2A and the stages matched the 1995BaseMod2 conditions. The number of weeks of high water in WCA 2A was reduced from 65 weeks in ISOP2000 to 2 weeks in ISOP2001 (A-7). Similarly, the number of weeks of high water in WCA 2B was reduced from 729 to 260 weeks (A-9).

WCA 3A and WCA 3B. While the stages produced by ISOP 2000 and ISOP 2001 are similar in South WCA 3A to the 1995BaseMod2 stages, there are some slightly lower stages (0 to 0.2 feet) in the stages from 1 to 2.5 feet for ISOP2000 and ISOP2001 (A-10). Similarly, the weeks of damaging high water stages were reduced from 519 weeks in 1995BaseMod2 to 487 weeks for ISOP 2000 and 475 weeks for ISOP 2001 (A-11). The same pattern is seen in South Central WCA 3A (A-12 and A-13). In WCA 3B, both ISOPs produced slightly higher (>0.2 feet) stages (A-14) but did not increase the number of damaging high stages (A-15).

Taylor Slough. The stages in Taylor Slough were essentially unchanged between 1995BaseMod2, ISOP 2000, and ISOP 2001 (A-16 and A-17).

East Coast Agricultural Area. The stages in the agricultural areas east of L-31N show little differences between the 1995BaseMod2 conditions and either ISOP 2000 or ISOP 2001, and

there is no pattern of improvement or detriment (A-47). Although both ISOP 2000 and ISOP 2001 move more water through the L-31N canal, the increased pumping capacity of both S-332D and S-332B moves more water into the ENP. To aid in the moving of the water from the north to the south reaches of L-31N, the lower reach pumping triggers were lowered to increase the ability to move water through the canal and into the ENP.

8.5 SMA. The 1995BaseMod2 stage values remain essentially unchanged for either ISOP 2000 or ISOP 2001 (A-46).

Biscayne Bay. Only South Bay of the greater Biscayne Bay shows significant difference in flows to the bay (A-43). During the wet season, ISOP 2000 showed a 21,000 acre-feet increase and ISOP 2001 showed flows increased by 19,000 acre-feet increase over 1995BaseMod2. During the dry season, ISOP 2000 showed an 13 percent increase and ISOP 2001 had an 11 percent increase over 1995BaseMod2 flows to the bay. Both ISOP 2000 and ISOP 2001 were similar.

Florida Bay. The 1995BaseMod2 flows to Florida Bay are relatively unchanged in either the annual or monthly values for either the ISOP 2000 or ISOP 2001 operations (A-44).

Review of ISOP During 2000 and 2001. Until the modeling database is updated to include the years 2000 and 2001, the RPA targets for the eastern subpopulations will remain unknown. When the database update is complete, the hydro-meteorological conditions can be modeled to produce the RPA targets and compared to the modeled outputs from the ISOP operations for equivalency. Prior to that time, only generalizations about the efficacy of ISOP can be made.

When ISOP was first implemented, the system was in highwater conditions due to Hurricane Irene. ISOP operations were able to dry out all the nesting areas of the CSSS by the spring 2000 nesting season. In CSSS Subpopulation A in 2000, drier than average conditions were produced by April, although a late April above-average rainfall disrupted the nesting season. As 2000 progressed, drought conditions persisted during the wet season in south Florida. During the drier-than-average wet season, ISOP operations were able to produce above average stages in NESRS. During the year 2001, all nesting season requirements were met. Although this kind of analysis does not demonstrate that RPA targets were achieved (since the targets are still unknown), it does demonstrate that ISOP operations were effective at producing the kinds of changes indicated by the RPA for prior years.

Alternative 7 (Preferred Alternative).

The FWS and NPS have stated that Alternative 7 is likely to comply with ESA requirements. As previously noted, Alternative 7 also represents a consensus plan and therefore has support from the Corps, USFWS, NPS, and the SFWMD as the preferred alternative. The USFWS and NPS also concluded that other alternatives are not suitable for providing protections to the CSSS and critical habitat. However, ISOP 2000 and ISOP 2001 (Alternative 1) have been shown to be effective. This section compares the hydrological impacts of Alternative 7 to the ISOP 01 (current operations). (A comparison of Alternative 7 to Base 95 and ISOP 01 is performed in Appendix A.)

Because Alternative 7 represents a dual mode operation (i.e. changing between two L-31N canal levels depending on hydrologic conditions), it could not be modeled directly using the SFWMM version 3.8. To evaluate the results of this alternative, the model was run in both modes (no passing of flood flows down L-31N with higher pumping triggers and passing of flood flows down L-31N with lower pumping triggers). These two model runs, termed ALT 7a and ALT 7b, represent the range of impacts associated with either mode. Performance measures that show both wet and dry year effects can be further evaluated knowing the dry years would be more indicative of model run termed ALT 7a and the wet years would be more indicative of model run termed ALT 7b. The actual benefit or impact would be represented between the two extremes in some areas, or be more like only one extreme in other areas. For example, in the WCA 3A the true impact would be the same as ALT 7b (since water would be moved to L-31N and no other changes would effect this region). For another example, the true impact in the eastern sparrow regions would more likely be the averaged effect of both ALT 7a and ALT 7b.

It should be stressed that the model runs termed ALT 7a and 7b do not represent a two-phase implementation, but rather provide the bounds of effects of the dual mode operation of L-31N in Alternative 7. In many areas, there is little difference between the two model runs that, together, represent the effects of the range of operations in Alternative 7.

NESRS. Alternative 7 is similar to the No Action Alternative (ISOP 2001) in regard to impacts on NESRS (A-62); however, Alternative 7 has 5 fewer dry downs over the 31 years compared to the No Action Alternative (A-63). Alternative 7 supplies about 133,000 acre-feet/year into NESRS whereas the No Action Alternative and RPA02 supply 126,000 and 210,000 acre-feet/year, respectively (A-87). Although the amount delivered into NESRS is less than RPA02; however, Alternative 7 would not cause the significant flooding impacts that could occur in RPA02 in the 8.5 SMA.

No significant differences are shown between Alternative 7 and the No Action Alternative in CSSS subpopulations B, D, and E (A-72 to A-75 and A-78 to A-83). In those cases, Alternative 7 meets or exceeds the requirements of RPA02. In subpopulations C and F (A-75 to A-77 and A-84 to A-86), Alternative 7 average stages, durations, and discontinuous hydroperiod of ALT 7a and ALT 7b would be slightly less than the No Action Alternative but still meet or exceed the RPA02 requirements.

WSRS. Alternative 7 would result in slightly wetter conditions, compared to the No Action alternative, with regard to impacts to WSRS (A-64 and A-65). Although the closing schedule for the S-12 structures is similar to the No Action Alternative, about 36,000 acre-feet more water would be passed through the region from WCA3A (A-87).

The stages and stage duration of Alternative 7 (both ALT 7a and ALT 7b) are similar to the No Action Alternative and show conditions drier than those of RPA02 (A-66 to A-71), which, in this indicator region, is an improvement. The number of predicted nesting failures in the 31-year period of record at NP205 is the same (five) as under both the No Action Alternative and RPA02.

WCA 1. Alternative 7 would not impact WCA 1 (A-48 and A-49). Neither wet nor dry season hydrologic conditions would change from the No Action Alternative.

WCA 2A and WCA 2B. Alternative 7 would not significantly change the hydrologic characteristics of either WCA 2A or WCA 2B from the No Action Alternative (A-50 to A-53).

WCA 3A and WCA 3B. The preliminary stage duration curves indicate that Alternative 7, would be similar the No Action Alternative for ALT7b which represents moving water to L-31N from WCA 3A during high stages (A-54 to A-57). Without the moving of water to L-31N, there would be an increase in the number of weeks high stage in WCA 3A; however there would likely be a decrease in the weeks of high stages as shown by ALT 7b. In WCA 3B, there is likely to be a slight reduction in the number of weeks of high stages (A-58 and A-59).

Taylor Slough. The effect of Alternative 7 is essentially the same as with the No Action Alternative (A-60 and A-61).

East Coast Agricultural Area. Alternative 7 shows no significant pattern changes to the stages in the subject area (A-92). Alternative 7 shows no increases in the peak stage values.

8.5 SMA. The effect of Alternative 7 is the same as with the No Action Alternative in this area (A-91).

Biscayne Bay. The effect of Alternative 7 is negligible to Biscayne Bay areas, when compared to the No Action Alternative, except for the South Bay region (A-88). In South Bay, there is likely to be a slight decrease of about 26,000 acre-feet/year in surface flows. However, this would still represent more freshwater flow than the 1995 Base condition.

Florida Bay. The effect of Alternative 7 would be similar to the No Action Alternative (A-89 and A-90). ALT 7a shows less flow during all months, whereas ALT 7b shows about the same flow for all months. Considering the average of ALT 7a and ALT 7b, there is likely to be only a slight reduction in flows toward Florida Bay.

4.2 Water Quality

Passage of the Everglades Forever Act (EFA) in 1994 required the establishment of a numeric phosphorus criterion for the Everglades Protection Area (EPA). Section 4(e) of the EFA, indicates that the phosphorus criterion would be established based on research results targeted at numerically interpreting the Class III narrative nutrient criterion necessary to meet state water quality standards in the EPA. The phosphorus criterion will be 10 parts per billion (ppb) in the EPA in the event that DEP does not adopt by rule a research-established criterion by December 31, 2003.

The method of determining compliance with the phosphorus criterion in ENP is specifically indicated in section 4(e):

For the Everglades National Park (Park) and the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge), the method for measuring compliance with the phosphorus criterion shall be in a manner consistent with Appendices A and B, respectively of the settlement agreement dated July 26, 1991, entered in case No. 88-1886-Civ-Hoeveler, United States District Court for the Southern District of Florida, that recognizes and provides for incorporation of relevant research.

Appendix A of the settlement agreement refers to the phosphorus limits for the combined inflow to Shark River Slough and the phosphorus limits for the combined inflow to Taylor Slough (S-332 and S-175) and the Coastal Basins (S-18C) as attachments I and II, respectively

As required by Section 9(k) of the EFA, the SFWMD obtained a permit (Non-ECP permit) from the DEP to operate and maintain water management structures within the control of the District which discharge into, within, and from the EPA and are not included in the Everglades Construction Project. The Non-ECP permit includes structures S-332, S-175, and S-18C.

The EFA further states in its' section 10 that by December 31, 2006, the water delivered to the EPA will achieve compliance with all state water quality standards, including the phosphorus criterion, in all areas of the EPA.

The SFWMD has used the settlement agreement as a basis for monitoring total phosphorus concentrations in the C-111 Basin. The results of the monitoring effort are used to document compliance with state water quality standards for discharges to Taylor Slough and the Coastal Basins. The Non-ECP permit requirements are used for all other water quality parameters that have numeric Class III criteria as stated in Section 62-302.530, F.A.C.

Settlement Agreement Requirements

There are specific requirements in the settlement agreement governing water quality compliance issues associated with total phosphorus. The relevant parts for the C-111 basin are as follows:

- The state parties (DEP and SFWMD) must take such action as is necessary so that waters delivered to ENP achieve state water quality standards, including Class III standards, by December 31, 2006.

- The state parties commit to achieving interim phosphorus concentration limits and levels by October 1, 2003, and long-term limits and levels by December 31, 2006. Both an interim and long-term limit is specified for Shark River Slough. However, only a long-term limit is specified for Taylor Slough and the Coastal Basins.

- The long-term concentration limit for Taylor Slough (S-332 and S-175) and the Coastal Basins (S-18C) is 11 ppb. Compliance with the long-term total phosphorus

concentration limits and levels for ENP is determined in accordance with the methodologies and procedures established in the settlement agreement, and its' Appendix A. If a conflict arises in the methods or procedures between the agreement and Appendices, the Appendices prevail. The agreement further stipulates how the USACE is to conduct matters relating to water quality issues associated with any new discharges to the park resulting from the construction of new structures, as follows:

- The USACE is required to apply to FDEP for stormwater management permit(s) pursuant to Section 373.416, F.S., for the construction and operation of new structures which may affect ENP or the Refuge, and shall comply with reasonable permit terms and conditions relating to the abatement of the water quality problems addressed in the agreement.

- New structures to be designed and constructed by the USACE shall be designed and constructed in accordance with the agreement.

- Future projects designed by the United States that affect ENP or the Refuge shall consider the environmental and water quality commitments set forth in the settlement agreement. Attachment II of Appendix A of the settlement agreement discusses the discharge limits and OFW standards for Taylor Slough and Coastal Basins. This section defines how the total phosphorus compliance calculations are made, provides direction on adding new structures to the calculation, and states:

- The basin flow is defined as the total flow through structures S-332, S-175, S-18C, plus any new release points from this basin in the future. All total phosphorus data should be sampled on the same day since a spatial average from the data collected at each structure is used for a compliance calculation. All new structures should also have a consistent monitoring regime to allow for compliance calculations to be made. This intent was made clear in the Fall of 2000, when the Technical Oversight Committee (TOC) indicated that monitoring activities needed to be initiated at the S-355A and S-355B structures discharging into ENP through northeast Shark River Slough. These structures, and the S-332D structure, are not directly under the control of the SFWMD, yet the water quality monitoring program must conform to settlement agreement requirements for compliance calculations.

S-332B

The S-332B emergency overflow weir has overtopped on two occasions since its construction in April 2000. The overflow weir is located on the southwestern side of the detention basin and is approximately 1500 feet in length. These overflows were the result of a 1.7 inch rainfall event in September and a 10.5 inch rainfall event in October of 2000. The overflow data from grab samples show no detects of total mercury or pesticides. During the September event, there did not appear to be a relationship between this storm event and excess delivery of total phosphorus. However, during the larger storm in October, a large load of total phosphorus was transported at S-332B Weir and S-332D into Taylor Slough. The detention basins did not provide much treatment for nutrients at lower levels; however, during the large October storm event, the detention area appeared to provide some removal due to particulate settling.

ISOP 2000 and ISOP 2001

ISOP 2000 operates S-332B at 325 cfs year round. With ISOP 2001, the station is designed to pump 325 cfs from June through January, and 125 cfs from February through March to maintain head water levels between 4.7 and 4.2 feet into a 160-acre seepage reservoir. If flows greater than 120 to 300 cfs (depending on the surrounding water levels) were pumped from the S-332B structure, the water would eventually flow over the weir of the seepage reservoir and enter the ENP as overland flow. It is not believed at this time that a violation of the settlement agreement levels would occur due to the overflows with either ISOP alternative. This is based on the overflow data (September and October 2000 events). The settlement agreements for Taylor Slough are based on a flow-weighted average for all inflow points into the Taylor Slough region. As shown in Table 4.1, inclusion of the S-332B weir discharges of September and October 2000 (during ISOP 2000 operations) into the Taylor Slough total phosphorus concentration calculations raised the flow-weighted average by a maximum of 0.8 ppb, from 8.4 ppb to 9.2 ppb (for the period April 2000 to March 2001) (Mark Shafer, personal communication). Given that higher than average flows occur at S-332D and S-18C during August, September, and October, the impact of the October 2000 discharges from S-332B weir on the 12 month moving flow-weighted average total phosphorus concentration for Taylor Slough would be expected to be less than the maximum 0.8 ppb indicated.

Table 4.1. Long-Term (12-month) Flow-Weighted Average Total Phosphorus Concentration for Taylor Slough Inflows With and Without S332B Weir Inflows.

12-Month Calculation Period		S18C+S174+S332D	S18C+S174+S332D +S332B Weir
Beginning	**Ending**	**Flow-Weighted Average Total Phosphorus Concentrations (ppb)**	**Flow-Weighted Average Total Phosphorus Concentrations (ppb)**
September 99	August 00	8.6	8.6
October 99	September 00	8.5	8.5
November 99	October 00	8.1	8.7
December 99	November 00	8.1	8.7
January 00	December 00	8.1	8.7
February 00	January 01	8.3	9.0
March 00	February 01	8.3	9.1
April 00	March 01	8.4	9.2
May 00	April 01	8.3	9.2
June 00	May 01	8.3	9.1
July 00	June 01	8.3	9.1

Alternative 7

Alternative 7 would not result in adverse impacts to water quality. Alternative 7 would pump 250 cfs from June through February, but only when this pumping would not cause overflow into ENP. If it is determined that overflow would occur, the pumping volume will be

adjusted. Alternative 7 would attenuate water quality impacts from the increased pumping and subsequent overflow by adding an additional 240-acre seepage reservoir to work in conjunction with the existing 160-acre reservoir. The additional seepage reservoir would help reduce weir inflows and provide additional treatment area. Over the 31-year period of record, there were 44 tropical storms that could have triggered the pre-storm operations, and then only if the canal stage, groundwater, surface water, or antecedent rainfall warranted. As indicated by the overflow events of September and October 2000, it is unlikely that these events would violate the flow-weighted average for total phosphorus concentrations entering Taylor Slough.

4.3 Flood Control

L-31N is on the east side of the 8.5 SMA and the ENP is to the north and west. For ISOP 2000 and ISOP 2001 (No Action Alternative), the water surface elevation in the eastern portion of this area would be above ground level about one percent of the year for the 31-year simulation period based on the Rocky Glades Marl Gage G-596. The 95BaseMod2 condition simulation indicated about the same condition. The effect of Alternative 7 on the hydrology (water levels in 8.5 SMA) is the same as the No Action Alternative. To the east of L-31N and C-111, the peak stage indicators in several cells show that the 95BaseMod2 condition and all of the alternatives were nearly equivalent with no pattern of being worse or better.

It should be noted that model runs do not have the ability to use daily forecasts as inputs. In a real-time application of the Alternatives, water managers would use forecasts to help guide day-to-day decisions. The daily use of forecasts should result in better operational decisions than those that are made by the model. Furthermore, if there are model prediction errors in canal stages, the errors would not affect the real-time operations, since the water managers will be using actual data rather than predicted values. Both considerations (use of daily forecasts and use of actual data) should provide a higher level of flood protection than predicted by the model.

4.4 Vegetation

NESRS

The various alternatives are likely to have similar effects on water levels and vegetation in NESRS. All of these operational plans either close the S-333 structure or reroute discharges through the S-334 structure when water levels at G-3273 exceed 6.8 feet. Therefore, any changes in NESRS hydroperiods and resulting shifts in vegetative communities would be similar under each of these alternatives. ISOP 2000, ISOP 2001, and Alternative 7 would produce hydrological conditions very similar to 95BaseMod conditions, with similar effects on vegetative communities.

Over-drainage in the peripheral wetlands along the eastern flank of NESRS has resulted in shifts in community composition, invasion by exotic woody species, and increased susceptibility to fire (FWS 1999a,b).

WSRS and Western Marl Prairies

The WSRS area is primarily influenced by S-12 structure operations. Consequently, any changes in WSRS hydroperiods and resulting shifts in vegetative communities would be similar under each of the alternatives. Each of the alternatives would result in a similar reduction of annual flooding duration in WSRS and the western marl prairies relative to 1995 Base conditions. All of the alternatives should have a similar beneficial effect on the western short-hydroperiod marl prairies by producing shorter hydroperiods that would benefit marl prairie vegetation. The westernmost S-12 structures (A, B, and C) would be closed November 1, January 1, and February 1, respectively. S-12D, which has the least impact of the western sparrow habitats, would remain open year round to allow excess water to leave the WCA areas.

Water Conservation Area 2

In comparison to 1995 Base conditions, all of the alternatives produce substantial increases in the duration of high stage events in WCA 2B. WCA 2B has suffered from lowered water levels that resulted in heavy melaleuca infestations throughout the area (USACE 1999a). Increases in the duration of high stage events in WCA 2B is expected to benefit vegetative communities by slowing the advance of melaleuca.

If the duration of inundation were too high, adverse impacts could occur to vegetation and tree islands in the area. However, the FWS conducted surveys of tree islands to determine the effects of high water conditions during 1994-95 (FWS 2001). The data suggests that water depths in excess of up to 3 feet for weeks to months do not lead to long-term deleterious effects on these habitats. Subsequent observation in the mid and late 1990's confirmed that there were no delayed symptoms due to the 1994-95 water levels.

Water Conservation Area 3

Alternative 7 would provide hydrologic relief to NESRS and WSRS without excessive ponding in WCA 3A. S-12D would remain open and provide an important conduit for excess rainfall inundating WCA 3A during wet years without causing higher water elevations in the western sparrow habitat. Currently, the two most significant causes of habitat degradation in WCA 3A are flood damage to tree islands in the northeastern and southwestern portions of 3A and the loss of peat soils, marshes, and tree islands in the northern portions of WCA 3A as a result of drought conditions and resulting wildfires. ISOP 2000, ISOP 2001, and Alternative 7 would not have adverse effects on vegetation throughout WCA 3A.

Although WCA 3B is drier than pre-drainage conditions, tree islands have remained largely un-impacted in this area from flooding. ISOP 2000, ISOP 2001, and Alternative 7 would not have adverse effects on vegetation throughout WCA 3B.

Eastern Marl Prairies and Taylor Slough

Alternative 7 would impact vegetation in the eastern marl prairie and Taylor Slough similar to the other alternatives, but higher flows from S-332B should increase the beneficial hydrologic impacts to the region.

Florida Bay

Wet season flows dominate the average annual freshwater flow volumes for all of the alternatives and 95BaseMod conditions. There are no substantial differences between the alternatives in average annual or monthly freshwater flow volumes towards Florida Bay, and none of the alternatives would substantially increase or decrease freshwater flows towards Florida Bay relative to 95BaseMod conditions. Consequently, none of the alternatives are expected to produce substantial changes in the Florida Bay salinity regime or significant impacts to mangrove or seagrass communities.

4.5 Fish and Wildlife

All of the alternatives increase hydroperiod duration and ponding depths in NESRS and are expected to benefit aquatic organisms. Populations of marsh fishes are expected to increase with increased hydroperiod duration and an increase in available habitat. Longer maintenance of dry season refugia is expected to increase survival over the dry season. Wading bird populations are expected to benefit from enhancement and expansion of foraging habitat and increases in the aquatic prey base. Increased hydroperiods and the associated reduction in fire frequency are expected to benefit tree island nesting habitat. Similarly, alligators are expected to benefit from the expansion and enhancement of habitat and increases in the prey base. Increases in hydroperiods are also expected to increase alligator abundance, nesting efforts, and nesting success.

Currently, the Rocky Glades/Eastern Marl Prairies are among the most degraded aquatic habitat within the southern Everglades (USACE 1999a). All of the alternatives would provide some benefit for the northern Rocky Glades and northern Taylor Slough by increasing hydroperiod duration and ponding depths. None of the alternatives would produce measurable changes in the central and lower portions of Taylor Slough. In general, increases in hydroperiod duration and ponding depths are expected to benefit fish and wildlife habitat by restoring more natural hydroperiods and reducing woody plant invasion and fire frequency in the northern Rocky Glades. Expansion of aquatic habitat and longer maintenance of dry season solution hole refugia are expected to increase the aquatic prey base and improve foraging habitat for wading birds. Increases in hydroperiods are also expected to increase alligator abundance, nesting efforts, and nesting success.

The occurrence of wading bird nests increased during ISOP implementation in 2000 to 39,480, an increase of 40 percent over the previous year (FWS 2001). Increase nesting in WCA-3, ENP, and Florida Bay were primarily responsible, although there was a substantial decrease of nesting in WCA-1.

In comparison to 1995 Base conditions, all of the alternatives would produce substantial increases in the frequency and depth of high water events in WCA 2A. Alternative 7 would provide benefit to the northern Rocky Glades and northern Taylor Slough (similar to the other alternatives) without substantially adversely affecting habitats located in WCA 2A or WCA 3B because of the continuous pumping of S-12D.

4.6 Protected Species

In accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 1531 *et seq.*) and Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), the Department of the Interior has prepared a Planning Aid Letter and a Coordination Act Report (Appendix C) for the IOP alternatives.

CSSS

Reasonable and Prudent Alternatives

The FWS B.O. presents the FWS RPA to the Experimental Program that would avoid jeopardizing the CSSS. The FWS RPA recommends that the selected IOP produce the following hydrological conditions for protection of the CSSS: 1) A minimum of 60 consecutive days of water levels at or below 6.0 feet NGVD at NP 205 between March 1 and July 15; 2) Ensure that 30%, 45%, and 60% of required regulatory releases crossing the Tamiami Trail enter ENP east of L-67 extension in 2000, 2001, and 2002; respectively (or produce hydroperiods and water levels in the vicinity of CSSS subpopulations C, E, and F that meet or exceed those produced by the 30%, 45%, and 60% targets); and 3) Produce hydroperiods and water levels in the vicinity of CSSS subpopulations C, E, and F that equal or exceed conditions that would be produced by Test 7, Phase 2 operations. ISOP 2000, ISOP 2001, and Alternative 7 meet or exceed 60 consecutive days of water levels at or below 6.0 feet NGVD at NP 205 in 25 of the 31 years (81% of the years) comprising the simulation period, (Alternative 4, described in the February 2001 DEIS, is the only alternative which meets the recommendation 84%, or in 26 of the 31 years). All of the alternatives meet or exceed the 30%, 45%, and 60% targets and meet or exceed conditions that would be produced by Test 7, Phase 2 operations.

Subpopulation A - Cape Sable Seaside Sparrow

All of the project alternatives produce approximately the same number of consecutive days of water levels at or below 6.0 feet NGVD at NP 205 between March 1 and July 15. As stated above, all alternatives meet or exceed this target in 25 of the 31 years comprising the simulation period. In comparison, 95BaseMod conditions meet or exceed this target in 23 of the 31 years that were simulated. Each of the alternatives would result in a similar reduction of annual flooding duration in the CSSS subpopulation A western marl prairie habitat relative to 95BaseMod conditions. The alternatives should have a similar beneficial effect on the western sparrow habitat by producing shorter hydroperiods that would benefit short hydroperiod marl prairie vegetation in the vicinity of CSSS subpopulation A.

Subpopulations C, E, and F - Cape Sable Seaside Sparrow

All of the alternatives meet or exceed the FWS RPA recommendation for production of the 30%, 45%, and 60% regulatory release conditions. All of the alternatives would produce larger increases in annual average ponding depths and hydroperiod duration in the vicinity of CSSS subpopulation E compared to 95BaseMod conditions. The alternatives are expected to

provide the greatest beneficial effects for the eastern marl prairies by restoring longer, more natural hydrologic regimes to the area.

All of the alternatives meet or exceed the FWS RPA recommendation for implementation of Test 7, Phase 2 conditions in the vicinity of CSSS subpopulations C, E, and F; and all of the alternatives provide some benefit for CSSS subpopulations C, E, and F by increasing hydroperiods in the Rocky Glades. None of the alternatives produce measurable changes in the central and lower portions of Taylor Slough.

Subpopulation D - Cape Sable Seaside Sparrow

None of the alternatives produce changes in the average hydroperiods or ponding depths in the vicinity of CSSS subpopulation D compared to 1995 Base conditions. Consequently, none of the alternatives is expected to alter the status of CSSS subpopulation D.

Subpopulation B - Cape Sable Seaside Sparrow

None of the alternatives produce changes in the average hydroperiods or ponding depths in the vicinity of CSSS subpopulation B compared to 1995 Base conditions. Consequently, none of the alternatives is expected to alter the status of CSSS subpopulation B.

Snail Kite

Restoration of longer, more natural hydroperiods in Shark River Slough and peripheral wetlands is expected to improve snail kite habitat in the ENP by creating more favorable conditions for apple snails. Average annual flooding duration and ponding depths in WCA 2 with ISOP 2000, ISOP 2001, and Alternative 7 are greatly improved when compared to 95BaseMod. The reduction of high water stages in WCA 2A, for example, is reduced from 65 weeks to 2 weeks during the 31-year period of record. Average annual flooding duration and ponding depths in WCA 3A are not significantly different for the alternatives. Consequently, none of the alternatives is expected to significantly alter the status of snail kites or their habitat in WCA 3A.

Wood Stork

The quality of foraging habitat in NESRS and the Rocky Glades is expected to improve as a result of increases in annual hydroperiod distribution with ISOP 2000, ISOP 2001, and Alternative 7. Longer hydroperiods are expected to improve foraging habitat by expanding the available habitat for aquatic prey base species and prolonging the availability of dry season refugia for prey species. All of the alternatives are expected to provide the benefit for NESRS and Rocky Glades habitats by providing increases in ponding depths and hydroperiod distributions. None of the alternatives are expected to improve the reduced freshwater flows to the traditional mangrove nesting and foraging habitats of Florida Bay. Consequently, all alternatives may continue conditions that are likely to delay colony formation and decrease the probability of a successful nesting season in Florida Bay.

American Crocodile

None of the alternatives is expected to have a significant effect on the salinity of estuarine habitats preferred by the American crocodile. Consequently, the American crocodile is not likely to be adversely affected by any of the alternatives.

West Indian Manatee

None of the alternatives is expected to have a significant effect on the salinity of estuarine habitats preferred by the West Indian manatee. Consequently, the West Indian manatee is not likely to be adversely affected by any of the alternatives.

Bald Eagle

None of the alternatives is expected to have a significant effect on bald eagle nesting sites or foraging habitat. Consequently, the bald eagle is not likely to be adversely affected by any of the alternatives.

Florida Panther

The Florida panther occurs primarily in upland habitats. Hydrologic effects of the alternatives are expected to be limited to existing or historic wetlands and are not expected to have significant effects on the upland habitats preferred by these species. However, a component of Alternative 7 involves construction of a 240-acre seepage reservoir consisting of former agricultural lands lying immediately northeast of the existing West Water Detention Area (Figure 4). The site extends north from the vicinity of the S-332B discharge pipes to Hamlin Mill Road, and the eastern and southern boundaries are fenced with 3-strand barbed wire fencing. The land is largely in the early stages of old field succession with a margin of tall, dense grasses and woody shrubs. Other than old truck-farm fields, the area includes two mango groves. An approximately 26-acre fenced grove in the east central portion of the area is relatively well manicured, with no ground or shrub layer and orderly rows of mature mango trees forming a closed canopy. An approximately 60-acre site in the northwest corner consists of smaller mango trees, more open canopy, and an overgrown, weedy shrub layer.

Fresh panther tracks were identified in November 2000 along a farm dirt roadway in the northeast corner of the proposed site. The panther database revealed two records of panther located in the project area: both were of panther #16, which was originally collared in 1986, and died in early 2000. The habitats of possible panther utilization are the two mango grove areas, which could serve primarily as movement corridors. The area in question is on the fringe of the panther habitat, and construction of the seepage reservoir would not likely significantly affect the panthers (S. Bass, personal communication with J. Moulding). However, any loss of panther habitat should be carefully considered and would be considered significant. The FWS has expressed their support of the S-332B seepage reservoir due to the overriding benefits to the CSSS and reduction of water quality degradation provided by the seepage reservoir. Further coordination with the FWS would be required prior to any action involving construction of this portion of Alternative 7.

Red-cockaded Woodpecker, Eastern Indigo Snake, and Garber's Spurge

The red-cockaded woodpecker, eastern indigo snake, and Garber's spurge occur primarily in upland habitats. Hydrologic effects of the alternatives are expected to be limited to existing or historic wetlands and are not expected to have significant effects on the upland habitats preferred by these species. Consequently, no adverse effects to the red-cockaded woodpecker, eastern indigo snake, and Garber's spurge are expected as a result of any of the alternatives.

4.7 Agriculture

To analyze agricultural conditions in the areas designated as LEC, which is the area to the east of the L-31N, L-31W, C-111 canal complex, a number of cells were identified and data produced from the 31-year simulation runs for different operational scenarios (Appendix A). These cells are located in a north/south alignment just to the east of the canal complex.

From an agricultural viewpoint, the most important parameter is root zone, which is normally measured from ground surface to a depth of two feet. Thus the most revealing data from the simulation runs is percent of time the water surface is within the root zone. There are concerns from an agricultural view that high water levels in the eastern canals (L-31N, L-31W, and C-111) would induce water levels in the coastal agricultural areas that would encroach on the two-foot root zone criteria and thus damage crops. Analysis of the 31-year simulation runs for specific monitoring cells along a north-south line in the lower east coast area identified one cell where the percent of time water levels would encroach on the two-foot root zone was near 50%, but the percent of time the water level reached or exceeded ground surface was less than 10%. The remaining eight cells experienced water levels at or below the root zone 70%to 100% of the time for Alternative 7.

4.8 Cumulative Impacts

The project area has been subject to federal involvement for many years. The need for flood control, water supply, recreation, and fish and wildlife enhancement has provided a difficult task of balancing various, and sometimes-conflicting needs for the region. In the early years of the C&SF Project, flood control was the overriding goal, and eventually the need for additional water supplies for south Florida required additional modification to the project. The Everglades National Park Protection and Expansion Act of 1989 directed the Corps:

"to construct modifications to the Central and South Florida Project to improve water deliveries into the park and shall, to the extent practicable, take steps to restore the natural hydrological conditions within the park."

Since that time, a number of federal actions have been authorized and implemented that have attempted to improve the flow of water to the ENP without compromising the other needs of the region (i.e., flood control, water supply). The cumulative effects of these actions have been mostly positive. However, some adverse effects have occurred. The 1999 Restudy Plan

(USACE 1999a) has already addressed cumulative effects of lost agricultural land use with the expansion of publicly owned lands in the region.

Cumulative impacts to the ENP in terms of hydrology, water quality, and natural resources has occurred with the many federal projects implemented over the years. However, this proposed action, along with other recent and future projects, should not hinder progress to eventually restore the hydrology of the ENP to more natural conditions.

4.9 Unavoidable Adverse Impacts

Unavoidable adverse impacts could occur with all four alternatives. Impacts to water quality below pump station S-332B would occur with predicted overflow, under all alternatives but Alternative 7, of the seepage reservoir with the alternatives, although the data currently analyzed have not shown this effect. The detention of excess water in the WCAs could also occur with the alternatives, and would likely continue in the future without full implementation of the MWD project.

4.10 The Relationship Between Local Short-Term Uses of Man's Environment and Maintenance of Long-Term Productivity

The proposed project was developed in response to the February 1999 FWS Biological Opinion for the MWD project, Experimental Program, and C-111 Project. The proposed IOP is designed to avoid jeopardizing the CSSS, a federally endangered species occurring within the ENP, during the interim period leading up to completion of the MWD project. The short-term uses of the environment with this project are greatly justified by the potential long-term benefit to this species.

4.11 Irreversible and Irretrievable Commitments of Resources

The proposed project would be in effect only until the full MWD Project is completed. The commitment of resources would be temporary in nature with this project, and the irreversible and irretrievable commitment of resources would be minimal. Loss of marginal Florida panther habitat would occur with implementation of Alternative 7 due to construction of the additional seepage reservoir.

4.12 Energy Requirements and Conservation Potential

Energy use of the preferred plan would be minimal and energy requirements for implementing any of the project alternatives would be similar. Conservation potential for any of the alternatives would be minimal.

4.13 Environmental Commitments

The Corps will continue to operate the water control structures as authorized and approved. The Corps will continue to consult with the FWS, ENP, SFWMD, FFWCC, and other federal,

state, local, tribal, and private interests to improve and modify the operations as circumstances dictate. The Corps will incorporate any commitments required by the appropriate regulatory agencies identified during the NEPA process.