DRAFT

SUPPLEMENT to the FINAL ENVIRONMENTAL

IMPACT STATEMENT

April 2000

Central and Southern Florida Project

For Flood Control and Other Purposes

Modified Water Deliveries to Everglades National Park

8.5 Square Mile Area

MIAMI-DADE COUNTY, FLORIDA

LEAD AGENCY: Jacksonville District, U.S. Army Corps of Engineers

COOPERATING AGENCIES: U. S. Fish & Wildlife Service and Everglades National Park

This Supplement considers alternatives to mitigate potential flooding within the 8.5 SMA resulting from increased stages associated with the Modified Water Deliveries to Everglades National Park Project (Mod Waters Project). The authorized Mod Waters Project consists of structural modifications and additions to the existing Central and Southern Florida (CS&F) Project to enable water deliveries for the restoration of more natural hydrologic conditions in Everglades National Park. This supplement considers several structural and non-structural plans to achieve the same purpose.

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232-2325 or facsimile 904-232-3442. Additional comments must be received by May 30, 2000.

Supplemental Environmental Impact Statement

Table of Contents

Section Number Page Number

1.0 PURPOSE AND NEED FOR THE CONSIDERED ACTION

1.1 Authorizing Documents

1.1.1 Initial Authorization

1.1.2 Supplemental Authorizations and Agreements

1.2 Project Location

1.3 Project Need or Opportunity

1.4 Project Goal, Requirements and Objectives

1.4.1 Project Goal

1.4.2 Project Requirements

1.4.3 Project Objectives

1.5 Related Environmental Documents

1.6 Decisions to be Made

1.7 Scoping and Issues

2.0 ALTERNATIVES EVALUATED

2.1 Description of the Alternatives

2.2 Issues and Basis for Choice

2.3 Preferred Alternative(s)

2.4 Alternatives Eliminated from Detailed Evaluation

2.5 Comparison of Alternatives

2.6 Mitigation

3.0 AFFECTED ENVIRONMENT

3.1 The Study Area

3.2 Topography

3.3 Geology

3.4 Hydric Soils

3.5 Non-Hydric Soils

3.6 General Hydrology

3.7 Surficial Aquifer System-Biscayne Aquifer

3.7.1 Site Hydrostratigraphy and Hydraulic Properties

3.7.2 Flow Conditions

3.8 Regional Water Supply/Demand

3.9 Water Quality

3.9.1 Pesticides

3.9.2 Nutrients

3.9.3 Metal and Toxic Organic Compounds

3.9.4 Indicator Bacteria

3.9.5 Hurricane Irene Storm Event Sampling

3.9.6 Water Quality Summary

3.10 Vegetation

3.11 Uplands

3.12 Wetlands

3.12.1 Community Classifications

3.12.2 WRAP Analysis

3.13 Fish and Wildlife Resources

3.14 Listed Species

3.15 Air Quality and Noise

3.16 Aesthetic Resources

3.17 Recreational Resources

3.18 Existing Land Use

3.19 Future Land Use

3.20 Zoning

3.21 Infrastructure

3.22 Existing Social Profile

3.23 Existing Economic Profile

3.24 Existing Well Being

3.25 Prime Farmlands

3.26 Unique Farmlands

3.27 Hazardous Materials Impacts

3.28 Cultural Resources

4.0 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

4.1 Summary

4.2 General

4.3 Specific Sources of Information

4.4 Methodologies for Determining Effects

4.4.1 Introduction to the Hydrologic/Hydrogeologic Model

4.4.2 Model Setup

4.4.3 Modeling Parameters/Assumptions

4.4.4 Water Quality

4.4.5 Wetland Resources

4.5 Environmental Consequences of Alternative No. 1

4.5.1 Hydrological Effects of Structural and Operational Alternatives

4.5.2 Regional Water Supply

4.5.3 Water Quality

4.5.4 Upland Vegetation

4.5.5 Wetlands

4.5.6 Fish and Wildlife

4.5.7 Listed Species

4.5.8 Socio-Economics

4.5.9 Aesthetics

4.5.10 Recreational Resources

4.5.11 Air Quality and Noise

4.5.12 Farmlands

4.5.13 Hazardous Materials Contamination

4.5.14 Cultural Resources

4.6 Environmental Consequences of Alternative No. 2B

4.6.1 Hydrological Effects of Structural and Operational Alternatives

4.6.2 Regional Water Supply

4.6.3 Water Quality

4.6.4 Upland Vegetation

4.6.5 Wetlands

4.6.6 Fish and Wildlife

4.6.7 Listed Species

4.6.8 Socio-Economics

4.6.9 Aesthetics

4.6.10 Recreational Resources

4.6.11 Air Quality and Noise

4.6.12 Farmlands

4.6.13 Hazardous Materials Contamination

4.6.14 Cultural Resources

4.7 Environmental Consequences of Alternative No. 3

4.7.1 Hydrological Effects of Structural and Operational Alternatives

4.7.2 Regional Water Supply

4.7.3 Water Quality

4.7.4 Upland Vegetation

4.7.5 Wetlands

4.7.6 Fish and Wildlife

4.7.7 Listed Species

4.7.8 Socio-Economics

4.7.9 Aesthetics

4.7.10 Recreational Resources

4.7.11 Air Quality and Noise

4.7.12 Farmlands

4.7.13 Hazardous Materials Contamination

4.7.14 Cultural Resources

4.8 Environmental Consequences of Alternative No. 4

4.8.1 Hydrological Effects of Structural and Operational Alternatives

4.8.2 Regional Water Supply

4.8.3 Water Quality

4.8.4 Upland Vegetation

4.8.5 Wetlands

4.8.6 Fish and Wildlife

4.8.7 Listed Species

4.8.8 Socio-Economics

4.8.9 Aesthetics

4.8.10 Recreational Resources

4.8.11 Air Quality and Noise

4.8.12 Farmlands

4.8.13 Hazardous Materials Contamination

4.8.14 Cultural Resources

4.9 Environmental Consequences of Alternative No. 5

4.9.1 Hydrological Effects of Structural and Operational Alternatives

4.9.2 Regional Water Supply

4.9.3 Water Quality

4.9.4 Upland Vegetation

4.9.5 Wetlands

4.9.6 Fish and Wildlife

4.9.7 Listed Species

4.9.8 Socio-Economics

4.9.9 Aesthetics

4.9.10 Recreational Resources

4.9.11 Air Quality and Noise

4.9.12 Farmlands

4.9.13 Hazardous Materials Contamination

4.9.14 Cultural Resources

4.10 Environmental Consequences of Alternative No. 6B

4.10.1 Hydrological Effects of Structural and Operational Alternatives

4.10.2 Regional Water Supply

4.10.3 Water Quality

4.10.4 Upland Vegetation

4.10.5 Wetlands

4.10.6 Fish and Wildlife

4.10.7 Listed Species

4.10.8 Socio-Economics

4.10.9 Aesthetics

4.10.10 Recreational Resources

4.10.11 Air Quality and Noise

4.10.12 Farmlands

4.10.13 Hazardous Materials Contamination

4.10.14 Cultural Resources

4.11 Environmental Consequences of Alternative No. 7

4.11.1 Hydrological Effects of Structural and Operational Alternatives

4.11.2 Regional Water Supply

4.11.3 Water Quality

4.11.4 Upland Vegetation

4.11.5 Wetlands

4.11.6 Fish and Wildlife

4.11.7 Listed Species

4.11.8 Socio-Economics

4.11.9 Aesthetics

4.11.10 Recreational Resources

4.11.11 Air Quality and Noise

4.11.12 Farmlands

4.11.13 Hazardous Materials Contamination

4.11.14 Cultural Resources

4.12 Environmental Consequences of Alternative No. 8A

4.12.1 Hydrological Effects of Structural and Operational Alternatives

4.12.2 Regional Water Supply

4.12.3 Water Quality

4.12.4 Upland Vegetation

4.12.5 Wetlands

4.12.6 Fish and Wildlife

4.12.7 Listed Species

4.12.8 Socio-Economics

4.12.9 Aesthetics

4.12.10 Recreational Resources

4.12.11 Air Quality and Noise

4.12.12 Farmlands

4.12.13 Hazardous Materials Contamination

4.12.14 Cultural Resources

4.13 Environmental Consequences of Alternative No. 9

4.13.1 Hydrological Effects of Structural and Operational Alternatives

4.13.2 Regional Water Supply

4.13.3 Water Quality

4.13.4 Upland Vegetation

4.13.5 Wetlands

4.13.6 Fish and Wildlife

4.13.7 Listed Species

4.13.8 Socio-Economics

4.13.9 Aesthetics

4.13.10 Recreational Resources

4.13.11 Air Quality and Noise

4.13.12 Farmlands

4.13.13 Hazardous Materials Contamination

4.13.14 Cultural Resources

4.14 Secondary Impacts

4.15 Cumulative Impacts

4.16 Unavoidable Adverse Impacts

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

4.18 Irreversible and Irretrievable Commitments of Resources Which Would Involve in the Proposed Alternative

4.19 Environmental Commitments

4.20 Compliance with Federal Statutes, Executive Orders, and Policies

4.21 National Environmental Policy Act of 1969

4.22 Endangered Species Act of 1973

4.23 Fish and Wildlife Coordination Act of 1958

4.24 National Historic Preservation Act of 1966

4.25 Clean Water Act of 1972

4.26 Clean Air Act of 1972

4.27 Coastal Zone Management Act of 1972

4.28 Farmland Protection Policy Act of 1981

4.29 Wild and Scenic River Act of 1968

4.30 Marine Mammal Protection Act of 1972

4.31 Estuary Protection Act of 1968

4.32 Federal Water Project Recreation Act

4.33 Fishery Conservation and Management Act of 1976

4.34 Submerged Lands Act of 1953

4.35 Coastal Berrier Resources Act of 1982 and Coastal Barrier Improvement Act of 1990

4.36 Anadromous Fish Conservation Act

4.37 Migratory Bird Treaty Act and Migratory Bird Conservation Act

4.38 Marine Protection, Research and Sanctuaries Act

4.39 Magnuson-Stevens Fishery Conservation and Management Act

4.40 E.O. 11980, Protection of Wetlands

4.41 E.O. 11988, Flood Plain Management

4.42 E.O. 12898, Environmental Justice

5.0 List of Tables

6.0 List of Figures

7.0 Public Involvement

8.0 List of Preparers

9.0 Mailing List

10.0 References Cited

SECTION 1.0

PURPOSE AND NEED FOR THE CONSIDERED ACTION

1.1 AUTHORIZING DOCUMENTS

1.1.1 Initial Authorization

PL 101-229, 13 December 1989 (Section 104). Section 104(a) of the Everglades National Park Protection and Expansion Act authorized the Secretary of the Army to modify the Central and Southern Florida (C&SF) Project to improve water deliveries to ENP and to take steps to restore its natural hydrological conditions.

Section 104(b) – (h) also authorized and directed the Secretary to construct a flood mitigation system for the residential area in the East Everglades and adjacent agricultural areas, if the Secretary determines those areas will be adversely affected by operations of the project. To protect agricultural areas, the Secretary must find that there is a substantial reduction in the area's present economic utility that is attributable solely to the project modification or the residential flood mitigation system. The Secretary was directed to review the operation of the modified project within 18 months, and periodically thereafter, to determine whether agricultural areas are being adversely affected and to protect these areas if necessary. However, any preventive measure shall be implemented in a manner that presents the least prospect of harm to the natural resources of ENP. The Secretary was also directed to coordinate the construction program with the Secretary of the Interior to permit the Park's expansion (land acquisition) program to proceed concurrently.

1.1.2 Supplemental Authorizations and Agreements

Interagency Agreement Between the Department of the Interior, National Park Service, and the Department of the Army (Interagency Agreement No. IA-5000-1-9501, June 1991). This agreement was entered into for the purpose of implementing the provisions of the Everglades National Park Protection and Expansion Act of 1989, with specific reference to modifications of the C&SF Project to improve water deliveries to ENP. The agreement is the current mechanism used by the Department of the Interior to transfer funds to the U.S. Army Corps of Engineers (USACE) for implementation of the project features associated with the Modified Water Deliveries project.

Everglades National Park Protection and Expansion Act of 1989, Amendment (PL 103-219, 9 March 1994). This act amended the original act (PL 101-229) by adding a section pertaining to land acquisition. The amendment allows for the Secretary of the Interior to provide up to 25% of the funding for land acquisition in the Frog Pond, Rocky Glades Agricultural Area, and 8.5 Square Mile Area.

National Park Service Everglades National Park Land Acquisition and Management Grant Agreement (GA5280-5-9007, February 9, 1995). ENP executed this grant agreement with the South Florida Water Management District (SFWMD) for the purpose of transferring funds from the Department of the Interior (DOI) to SFWMD to assist the state in acquiring lands and interests in land in the Frog Pond, Rocky Glades Agricultural Area, and the 8.5 Square Mile Area that affect the restoration of natural water flows to the Park and to Florida Bay. Transfer of funds is contingent upon a requirement that any lands acquired shall be managed in perpetuity for such restoration.

1.2 PROJECT LOCATION

The project area encompasses the 8.5 Square Mile Area (8.5 SMA). The 8.5 SMA, also known as the East Everglades Agricultural and Residential Area, is located about 20 miles southwest of Miami and about 10 miles north of Homestead, in the East Everglades area (Figure 1). The 8.5 SMA is bounded on the east the L-31N flood protection levee, on the west by the ENP expansion area, on the north by SW 104th Street, and on the south by SW 168th Street (Richmond Drive). US 41 (Tamiami Trail) is located about 6.6 miles to the north. The 8.5 SMA is situated immediately east and south of Northeast Shark River Slough (NESRS) and north of the Taylor Slough headwaters.

The 8.5 SMA, for present purposes, encompasses approximately 10 square miles. The area in excess of 8.5 square miles results from the inclusion of lands along the north and west periphery of the 8.5 SMA which were acquired by the USACE in anticipation of constructing the proposed levee and canal system authorized in the 1992 Modified Water Deliveries GDM plan (USACE 1992).

Because the potential effects of this project extend beyond the 8.5 SMA, a larger study (area of potential effect) area more-or-less including the ENP expansion area was also incorporated in the study, depending on the nature of, and potential effects on, the environmental or man-made resource being considered.

The 8.5 SMA is prone to frequent flooding due to its location along the eastern periphery of the historical Everglades. Because this area is west of the protective levee system of the C&SF Project, it is not provided authorized flood protection. Although the 8.5 SMA was initially settled during the 1940s, much of the residential and agricultural development occurred during the 1970s, made possible by reduced groundwater levels resulting from the southward extension

of the L-31N Canal and a protracted dry spell. Since that decade, floods from heavy rains and periodic high ground water have caused damage to property and crop loss.

1.3 PROJECT NEED OR OPPORTUNITY

ENP is located in South Florida in the southernmost portion of the historic Everglades. The historic Everglades was originally a broad, shallow wetland that flowed imperceptibly from Lake Okeechobee to the mangrove zone at the southern tip of Florida. In an effort to control flooding and better manage water in South Florida, a complex system of canals, levees, structures, pumps, and impoundments known as the Central and Southern Florida Flood Control Project (C&SF) was constructed. Congress authorized this project in 1948 and subsequent years.

Following construction of Water Conservation Areas (WCA) 3A and 3B and the southward extension of Levee 67 (L-67 Ext.) in the early 1960's, the natural flows to ENP, located in the southern portion of the project became subject to control by regulation schedule. Discharges were sporadic and based on competing needs to retain water for urban and agricultural use during the dry season, and to maintain flood control capacity during the wet season. As a result of severe impacts to ENP from droughts in the mid-1960's, Congress established a minimum water delivery schedule to protect ENP resources (PL 91-282, June 1970). This minimum delivery schedule remained intact throughout much of the 1970's.

The Flood Control Act of 1968 (PL 90-483) authorized the Everglades National Park-South Dade Conveyance System (ENP-SDCS). The act provided for modifications to the existing C&SF Project for the purposes of improving the supply and distribution of water supplies to ENP while meeting agricultural and urban water needs in south Dade County. The ENP-SDCS, which was completed in 1983, included modifications to the original levee and borrow canal L-31 (currently comprised of L-31N and L-31W) and construction of control structures S-331.

In March 1983, the ENP Superintendent issued a request, referred to as the Seven Point Plan, for actions to protect the Park. The Seven Point Plan was prompted primarily by ENP concerns for the ecological deterioration that occurred in the wake of heavy rainfall in 1982 and 1983 and subsequent regulatory releases triggered by the minimum deliveries schedule. The plan included the following components:

1. Fill in L-28 canal and remove substantial portions of the L-28 levee.
2. Fill in L-67 extension canal and remove the L-67 extension levee.
3. Restore Water Conservation Area 3B (WCA 3B) to the Everglades system.

4. Distribute WCA 3A water deliveries along the full length of Tamiami Trail between L-28 and L-30.
5. Establish a water quality monitoring program.
6. Defer implementation of any new drainage districts.
7. Field test a new schedule for delivery of water to the park.

The SFWMD and USACE subsequently made structural modifications to the L-28 and L-67 Extension canal and levee, and began a rainfall-based water delivery plan for the park. This Experimental Program of Water Deliveries to Everglades National Park (*PL 98-181, Section 1302: Supplemental Appropriations Act of 1984, 30 November 1984*) authorized the modification of PL 91-282 (Minimum Delivery Schedule) and allowed for a two-year experimental program of water deliveries to the park for the purpose of developing an improved schedule. The law also authorized the Secretary of the Army to acquire agricultural lands and construct necessary flood protection measures for the protection of homes affected by the modification of the delivery schedule.

In response to PL 98-181, the USACE completed the *General Plan for Implementation of an Improved Water Delivery Schedule to Everglades National Park, Florida* in January 1985, which was approved by the Secretary on February 28, 1985. This plan recommended (1) the preparation of a General Design Memorandum (GDM) and an Environmental Impact Statement (EIS) addressing modifications to improve water deliveries to ENP, and (2) extension of the two-year time limit specified in PL 98-181 based on a written agreement between USACE, ENP, and SFWMD. The experimental program was eventually extended to January 1, 1989, and later to January 1, 1992 under PL 99-190 and PL 100-676, respectively.

The Everglades National Park Protection and Expansion Act of 1989 (PL 101-229 Section 104) authorized the USACE to construct modifications to the C&SF Project. Alternatives to restore natural hydrologic conditions in the Park were evaluated in a General Design Memorandum (GDM) and Environmental Impact Statement on Modified Water Deliveries (MWD) to Everglades National Park, which was published in 1992. Specifically, the GDM addressed the NESRS portion of water deliveries of the C&SF Project.

The proposed action presented in the GDM included a flood mitigation system for the 8.5 SMA. Implementation of the recommendations for the water deliveries in the GDM would result in an increase in water flows through NESRS. These flows were expected to raise ground water levels and increase the areal extent and frequency of flooding in the 8.5 SMA. The flood mitigation system would prevent this area from being subjected to increased flood risk from higher stages in NESRS as a result of the MWD project. As originally designed, the flood mitigation component of the MWD project consisted of a levee and berm system with a seepage canal to one side. The canal would convey seepage water north and east to a proposed pump station (S-357) at Canal L-31N at the northeast

corner of the 8.5 SMA. S-357 would pump the water north to another proposed structure (S-356, not a part of this project) at the junction of Canal L-31N with Canal L-29 adjacent to US 41. S-356 would then pump the water west for eventual discharge back into NESRS via two additional proposed structures (S-355A and S-355B). During the process of obtaining a Water Quality Certification permit, the Florida Department of Environmental Protection (FDEP) requested that the seepage canal be placed between the outer (larger) levee and the inner (smaller) levee. The inner levee could then function to prevent stormwater runoff from the 8.5 SMA from entering the seepage canal and adversely affecting water quality.

In June 1992, the MWD GDM was approved by the Chief of the Engineering Division, Directorate of Civil Works. This approval fulfilled the requirements of Section 104 of the 1989 ENP Protection and Expansion Act, which directed the Secretary of the Army to select the plan that accomplished the goals of MWD to the maximum extent practicable. A Record of Decision was executed by the USACE in May 1993.

Following project authorization in 1992, there have been several reevaluations of the 8.5 SMA flood mitigation component. Significant improvements to hydrologic modeling capabilities have enhanced our understanding of the restoration requirements of the Everglades ecosystem. The need to integrate the MWD project with the C-111 Project, which has been designed and partially implemented, became evident. The SFWMD, ENP, and others suggested other potential engineering designs that would meet the needs of the 8.5 SMA community while ensuring environmental restoration of NESRS. Consequently, the SFWMD, ENP, and others have suggested the flood mitigation system approved by the Corps in 1992 may no longer represent the best alternative for attaining full restoration of NESRS while simultaneously meeting the need for a flood mitigation system in the 8.5 SMA.

The SFWMD, as the local sponsor, has reviewed the subsequent analysis of the cost of construction, operation, and maintenance of the authorized flood mitigation components, along with new information and technologies. This evaluation prompted the SFWMD Governing Board to request that the USACE evaluate additional alternatives with respect to the 8.5 SMA. Various alternatives were suggested for consideration, which would ensure the natural hydrology of the NESRS is restored while meeting the needs of the residents of the 8.5 SMA.

This Draft GRR/SEIS presents hydrologic modeling simulations, social impact assessments, real estate information, engineering design and cost analysis, environmental impact assessment, and economics calculations. The SFWMD Governing Board will base its selection of an LPA on this information. The USACE and the Department of Interior (DOI) will use this as a decision document for potential future Federal action on this project.

1.4 PROJECT GOAL, REQUIREMENTS, AND OBJECTIVES

1.4.1 Project Goal

The 1992 GDM sought to develop a plan for an improved water delivery system for ENP. The two main objectives of the MWD project were concerned with the park's hydrology and flood protection and/or mitigation. Hydrology is crucial to the Everglades ecosystem and thus is an integral aspect of restoration to the ENP. The hydrology has a direct effect on the plants and animals and has an influence on the overall water quality within the Everglades. Historical flooding and impacts resulting from elevated water levels from the ENP project required flood mitigation for the
8.5 SMA to be a main objective of the MWD project.

At the request of the Governing Board of the SFWMD, the USACE has agreed to develop and evaluate a full array of alternatives to the plan authorized in the 1992 GDM. The overall goal of this particular planning and study effort, therefore, may be stated as follows:

Project Goal *- Facilitate selection of a plan (Locally Preferred Alternative, LPA) for the 8.5 SMA for the Governing Board of the SFWMD. An acceptable plan is one that provides a technical solution for the hydrological and ecological restoration of the Everglades National Park and mitigating for additional flooding impacts in the 8.5 SMA that would result from implementing the MWD project, both as specified in the 1989 Act, while maintaining compatibility with Comprehensive Everglades Restoration Plan Objectives.*

In achieving this goal, each of the alternatives will be evaluated. The evaluation will discuss each alternative in relationship to project requirements and project objectives.

1.4.2 Project Requirements

Project requirements are conditions required of any alternative to be considered viable. Five requirements are fully described in Section 4 of the GRR. These requirements are briefly restated below:

RQ1. *Do not negatively impact higher stages in ENP as specified in the Modified Water Deliveries Project.*

RQ2. *Mitigate for increased stages within the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project.*

RQ3. *Develop a solution that can be permitted by regulatory interests under current and reasonably foreseeable regulations (i.e. water quality, wetlands).*

RQ4. *Ensure no significant impact to existing habitat of endangered or threatened species.*

RQ5. *Maintain current levels of flood protection for agricultural areas east of L-31N.*

1.4.3 Project Objectives

Project objectives have been developed based on these project requirements. These objectives set the basis for determining whether an alternative can meet the project goal. These objectives are fully described in Section 4 of the GRR, and are briefly restated below:

OB1. *Evaluate effects on hydropatterns in the NESRS.*

OB2. *Evaluate impacts to the landowners and residents of the 8.5 SMA resulting from implementation of the Modified Water Deliveries Project.*

OB3. *Analyze Cost Effectiveness.*

OB4. *Analyze Effects to Ecological Functions.*

OB5. *Evaluate effect on conditions favorable to Federal and State Listed Endangered Species survival.*

OB6. *Measure compatibility with Comprehensive Everglades Restoration Plan and C-111 Projects without adversely impacting the current level of flood protection east of L-31N.*

OB7. *Analyze impacts and costs associated with time delays in implementation of alternatives.*

1.5 RELATED ENVIRONMENTAL DOCUMENTS

The following NEPA, design, and planning documents are of immediate relevance to the present SEIS study effort:

- Draft restoration plan for Northeast Shark Slough (ENP 1994)
- GDM and EIS for the Modified Water Deliveries to Everglades National Park (USACE 1992a)
- Water control plan for the Water Conservation Areas and the ENP-South Dade Conveyance System (USACE 1992b)
- Environmental Assessment and Finding of No Significant Impact (FONSI) for Test 7 of the Experimental Program (USACE 1997)
- Central and Southern Florida Project’s Comprehensive Review Study - Final Integrated Feasibility Report and Programmatic Environmental Impact

Statement (USACE/SFWMD 1999)
- Emergency Deviation from Test 7 of the Experimental Program – Final Environmental Assessment (USACE 2000)

1.6 DECISIONS TO BE MADE

This Supplemental Environmental Impact Statement will provide information to the SFWMD to allow them, as the local sponsor, to select a locally preferred alternative for the 8.5 SMA.

In addition, both the USACE and DOI will use this SEIS in its decision making process and each will issue a Record of Decision (ROD).

1.7 SCOPING AND ISSUES

Scoping for the SEIS was initiated in April of 1999 during a pre-scoping meeting with various agencies and stakeholder groups. On June 3, 1999, a scoping letter was distributed by the Jacksonville District Corps of Engineers, which summarized the purpose and history of the project, and outlined seven primary issues raised during the pre-scoping process. The seven issues presented in the June 3, 1999 letter were:

1. Effects on Natural Systems and the Park
2. Social, economic and environmental effects on the residential community within the 8.5 SMA
3. Water management as necessary to assure the continued existence and recovery of the Cape Sable Seaside Sparrow
4. Effects on Native American Interests
5. Effects on farmlands within the 8.5 SMA and adjacent agricultural areas
6. Potential for contamination transport by surface and groundwater to the adjacent environment
7. Secondary and cumulative impacts associated with providing a level of flood protection (incidental or by design) beyond the level provided by flood mitigation.

At this time, the SFWMD had requested that the Corps evaluate a Locally Preferred Alternative (LPA) of full acquisition of the 8.5 SMA in addition to the original plan, and other options that would be consistent with the authorized project objectives of restoring the hydrology of the Park and mitigating the potential flooding effects on the 8.5 SMA. The scoping meeting was held at 6:30 PM, June 21, 1999 at the Miami-Dade Agricultural Extension Office in Homestead, Florida, as previously advertised.

Numerous specific comments and issues were raised during the formal scoping meeting and during subsequent coordination with affected stakeholders. Table

18 (Summary of Public Coordination) lists the meetings held. The following issues were identified as a result of the scoping process:

- Thorough evaluation of all alternatives
- Long-term effects of the alternatives
- Evaluate cumulative impacts
- Need a complete economic analysis of all alternatives and their impacts
- Compatibility with the Restudy
- Historic and cumulative loss of additional areas adjacent to the 8.5 SMA
- Water Quality impairment
- Recreational amenities
- Land use changes required
- Effect of schedule delay for completion of the project
- Validity of data and methodology used in evaluating the alternatives
- Geographic extent of the study

On June 23, 1999 the SFWMD Governing Board requested that the Corps evaluate in the SEIS a full array of alternative local options in addition to the full acquisition plan and the authorized flood mitigation plan. The SFWMD would then use the SEIS process to decide which plan(s) they would support as the local sponsor. Accordingly, a letter dated July 9, 1999 that discussed this change in approach was sent by the USACE to all individuals who received the original scoping letter. The deadline for comments on the June 21 scoping meeting was extended to July 23, 1999 to allow additional time for all interested parties to consider the new information. As a result of the scoping process, the seven issue presented encompasses the significant issues and concerns expressed by cooperating agencies and interested parties.

SECTION 2.0

ALTERNATIVES EVALUATED

2. 1 DESCRIPTION OF THE ALTERNATIVES

The "without project" alternative for the SEIS is the current approved agency action, or the Authorized GDM Plan (Figure 2). As presented here, the without project alternative is Alternative No. 1, (Figure 3A). All alternatives will be compared first to the 1995 base operations plan, and secondarily to Alternative 1. Comparisons to the 1995 operations plan will allow an assessment of each alternative to meet the larger goal of restoring the hydrology and ecology in the NESRS while mitigating adverse hydrologic affects to the 8.5 SMA. Comparison of Alternatives No. 2 through No. 9 to Alternative No. 1 will provide a basis for comparison of the current plan to an alternative plan, and facilitate the decision by the local sponsor (SFWMD) to select a Locally Preferred Alternative. The following alternatives have been developed for evaluation:

Alternative No. 1 Authorized GDM Plan

Alternative No. 2B Modified GDM Plan

Alternative No. 3 Deep Seepage Barrier Plan

Alternative No. 4 Landowner's Choice Land Acquisition Plan

Alternative No. 5 Total Buy-Out Plan

Alternative No. 6B Western Portion of 8.5 SMA as Buffer

Alternative No. 7 Raise All Roads Plan

Alternative No. 8A Western Portion of 8.5 SMA as Flow-way

Alternative No. 9 Adaptive Refinement of GDM Plan

A complete description of each alternative is provided in the General Reevaluation Report (Section 3.4).

2.2 ISSUES AND BASIS FOR CHOICE

The alternatives identified above were conceived over the last 8 years since the publication of the 1992 GDM and FEIS. They have been developed as a result of numerous publicly advertised and informal meetings. Concerns voiced by the residents of the 8.5 SMA, the SFWMD, ENP, Dade County, and others were considered during the SEIS process. The alternatives presented result in best and worst case scenarios for each group or agency with a vested interest. Section 1.4 of this report outlines the project goal, requirements, and objectives against which the environmental consequences will be evaluated. The analysis will be in the form of a planning document consisting of this Draft GRR and Draft SEIS. During the public comment period, the Governing Board will select its preferred alternative. This alternative will be known as the Locally Preferred Alternative (LPA).

2.3 PREFERRED ALTERNATIVE(S)

A preferred alternative(s) has not been selected as part of the preparation of this Draft Supplemental EIS. A preferred alternative will be identified and fully developed in the Final SEIS following the decision of the SFWMD Governing Board and action by the USACE.

2.4 ALTERNATIVES ELIMINATED FROM DETAILED EVALUATION

None of the alternatives presented in Section 2.1 of this report have been eliminated from detailed evaluation. All alternatives are assessed equally in Section 4.0 of this document.

2.5 COMPARISON OF ALTERNATIVES

See Section 4.0 of this document.

2.6 MITIGATION

A specific evaluation satisfying the 404(b)(1) requirements will prepared upon identification of the federally preferred plan (selected alternative). It should be noted that Alternative Nos. 1, 2B, 3, 6B, 7, 8A & 9 include structural features or construction that would or could possibly involve dredging of canals or discharge of dredged or fill material, which would have to be analyzed under this requirement if selected. However, unavoidable impacts to wetland or aquatic resources are expected to be offset by the ecological improvement throughout the area of potential effect (ENP Expansion Area and the 8.5 SMA) that results from the overall restoration achieved by the MWD. Accordingly, separate compensatory mitigation concepts are not included for the various alternatives.

SECTION 3.0

AFFECTED ENVIRONMENT

3.1 THE STUDY AREA

The study area (area of potential effect) encompasses the 8.5 Square Mile Area (hereafter referred to as the 8.5 SMA and the Everglades Park Expansion area). The project area (the 8.5 SMA) presently encompasses approximately ten square miles. The 8.5 SMA, also known as the East Everglades Agricultural and Residential Area, is located in the East Everglades (i.e., that portion of the Everglades between the levee L-31N and the ENP), about 20 miles southwest of Miami and about 10 miles north of Homestead (Figure 1). It is bounded on the east by Levee L-31N, on the west by the eastern Everglades National Park expansion boundary, on the north by SW 104th Street, and on the south by SW 168th Street (Richmond Drive). U.S. Highway 41 lies approximately 6.6 miles to the north. The Project area is situated immediately east of Northeast Shark River Slough and north of the Taylor Slough Headwaters. In addition to the 8.5 SMA, project effects on the ENP Expansion Area (including Northeast Shark River Slough), Northwest Shark River Slough (west of L-67 Extension), Taylor Slough, and the C-111 Basin were assessed.

3.2 TOPOGRAPHY

The 8.5 SMA is located in the Rocky Glades physiographic zone, which occupies the western slope of the Atlantic Coastal Ridge (Figure 4). The Rocky Glades forms a narrow transitional area between the Shark River Slough and Taylor Slough Headwaters physiographic zones (DERM 1980, Schomer and Drew 1982). It also comprises a significant topographical, geological, hydrological, and ecological transition between the Atlantic Coastal Ridge proper and the Everglades trough. The name "Rocky Glades" reflects the fact that limestone is exposed at the surface throughout this area, which due to solution processes has created a solution-riddled, micro-karst topography. Topographic elevations range from 5.0 to 8.5 feet NGVD (Figure 5). The higher elevations (above 7.0 feet) are generally in the east and southeast portions of the project area. Elevations become progressively lower towards the northwest and west.

3.3 GEOLOGY

The limestone bedrock underlying the 8.5 SMA comprises the upper portion of the Miami Limestone geologic unit (Hoffmeister 1974, Hoffmeister et al. 1967, Scott 1992). The Miami Limestone was laid down during the Pleistocene age and occurs at or near the surface in southeast Florida from Palm Beach to Miami-Dade and Monroe counties. This formation includes an eastern (oolitic) and a western (bryozoan) facies (Figure 6). The oolitic facies, which underlies the 8.5 SMA and overlies the bryozoan facies where both are present, consists of white to orangish gray, poorly to moderately indurated, sandy, oolitic limestone (grainstone) with scattered concentrations of fossils. The Miami Limestone is highly porous and permeable (due to the dissolution of carbonate by ground water) and features solution holes and pinnacle rock. It forms much of the Biscayne Aquifer of the surficial aquifer system. The Miami Limestone is thickest along the Atlantic coast (maximum of 40 feet) and thins to the west (Schroeder et al. 1958). The thickness of the Miami Limestone where it underlies the 8.5 SMA is less than ten feet. Subadjacent to the Miami Limestone are limestone, sand, and shell deposits of the Fort Thompson Formation, which in turn is underlain by sand, silt, clay, and carbonate deposits of the Tamiami Formation and Hawthorn Group.

3.4 HYDRIC SOILS

The soils in and surrounding the 8.5 SMA were originally identified as *Rockland* soil, with a narrow finger of *Perrine marl – very shallow phase* extending north along SW 197th Avenue (Jones 1948; USDA-Soil Conservation Service 1958). Both soils historically supported wet rockland prairies and, by today's standards, would be classified as hydric. Subsequent agricultural activities in the 8.5 SMA, particularly rock plowing, have altered soil composition and drainage characteristics. Current soil mapping (Noble et al. 1996) reflects the soil conversion effects as of 1985 (when the contemporary soils were mapped).

Currently there are two hydric soil types mapped within the 8.5 SMA - *Biscayne-Rock Outcrop complex* and *Dania muck, depressional* (Noble et al. 1996). These soils cover approximately 1160 acres (~20%) and 10 acres (< 0.2%), respectively, of the project area (Figure 7). Biscayne-Rock Outcrop complex represents the co-mingling of two hydric soil types - *Biscayne marl* and *Rock outcrop*. Biscayne marl component is a poorly drained, shallow soil with about four inches of grayish-brown calcareous marl overlying limestone bedrock (Miami Limestone) and including scattered small solution holes filled with very dark gray, non-calcareous mucky silt loam. The Rock outcrop component consists of surface exposures of Miami Limestone, a hard and porous limestone with solution holes containing silty clay or clay. The water table remains below the surface (within 10 inches) during normal years but can become ponded during extremely wet periods. Permeability is moderate. Biscayne and Rock outcrop comprise about 60 and 40 percent, respectively, of this soil complex. Dania muck, depressional, the other hydric soil, is a shallow, very poorly drained soil, with black organic muck typically up to 15 inches in depth overlying a soft, porous limestone bedrock. This soil is ponded for nine to twelve months in most years. Permeability is rapid throughout.

3.5 NON-HYDRIC SOILS

The only non-hydric soil mapped in the project area is *Chekika very gravelly loam*, which covers just over 4800 acres (~80%) of the 8.5 SMA (Noble et al. 1996). Chekika is a very shallow, somewhat poorly drained soil with typically a five-inch thick surface layer of dark grayish-brown very gravelly loam overlying hard, porous limestone bedrock. Solution holes within the limestone, filled with silt loam or silty clay loam, extend up to nine inches below surface. The water table remains within the limestone and during most years is between 12 and 36 inches below surface. Permeability is moderate. Chekika soils resulted from mechanic scarification (rock plowing) of the underlying limestone to render the land useful for vegetable farming. Small pockets that escaped rock plowing are likely comprised of Biscayne-Rock Outcrop complex or Dania muck, depressional soils. Rock-plowing subsequent to 1985 (the year the soils were mapped) has probably enlarged the extent of Chekika soils.

3.6 GENERAL HYDROLOGY

The affects of local rainfall are a key component of the local hydrology in the 8.5 SMA. The average rainfall of about 58 inches per year falls on the 8.5 SMA. This water is removed from the surface through evapotranspiration, seepage into the underlying Biscayne Aquifer, inter-flow within the shallow aquifer, and discharge to the L-31N canal. Prior to the construction of the Central and Southern Florida (C&SF) Flood Control Project and placement of Canal L-31N east of the 8.5 SMA, freshwater sheet flow traversed portions of this area on its way towards the Everglades and its eventual discharge to Florida Bay. The

canals and levees that make up the C&SF Project serve to increase the rate at which drainage of the area occurs (Figure 8).

Upon its completion in the early 1950s, it was anticipated Canal L-31N would form the western limits of urban and agricultural development in the region; therefore, significant development of areas west of the canal was not contemplated. Water levels within Canal L-31N are operated to maintain specific water levels in the areas east and west of the canal. During periods of high rainfall, the canal serves to drain the area to the east, thereby providing flood protection for the nearby residential and agricultural areas. Because the associated levee lies to the west of Canal L-31N, the potential for flood relief in the 8.5 SMA is limited. Thus, rainfall in excess of the storage capacity of the local aquifer and soils results in significant standing water within the study area. Although along the southern boundary of the 8.5 SMA a series of surface water flow channels have been constructed within the upper few feet of the limestone bedrock, these channels do not appear to augment drainage of the area to any significant degree. Information provided by Miami-Dade County Department of Environmental Resources Management (DERM) indicates that these channels are not part of a system that drains the water downgradient to a positive outfall.

Because the 8.5 SMA was historically considered to be west of the developable area, formal flood protection levels of service within the area were never established. That is, peak water elevations resulting from a rainfall event of a certain volume and duration event have not been established. Rather, excess rainfall is allowed to pond on the surface within the study area. At times, when flooding in the 8.5 SMA was at its worst, Canal L-31N and its associated pumping stations have been operated in opposition to the normal operating procedures in an effort to reduce this flooding.

Canal L-31N is a component of the Everglades National Park-South Dade Conveyance System (ENP-SDCS). The ENP-SDCS, originally authorized in 1968 (PL 90-483), was intended to improve the supply and distribution of water to Everglades National Park and expand agricultural and urban needs in Miami-Dade County. Since completion of the system in 1983, water levels in Canal L-31N (and L-31W) have been a source of controversy between the ENP and development interests along its eastern perimeter (Light and Dineen 1994).

3.7 SURFICIAL AQUIFER SYSTEM-BISCAYNE AQUIFER

The Biscayne aquifer underlies an area of about 4,000 square miles in Broward, Miami-Dade, Monroe, and Palm Beach Counties, including the 8.5 SMA. The aquifer is the only source of drinking water that supplies about three million people who live primarily in urban areas from Homestead in Miami-Dade County, northward to Boca Raton, in Palm Beach County. The aquifer is also a source of water that is transported by pipeline to the Florida Keys.

The Biscayne is at shallow depths and in some areas is in direct hydraulic connection with streams, canals, and other natural and manmade surface water bodies. Because of this connection, the aquifer, Lake Okeechobee, the three water conservation areas, and the extensive network of canals, control structures, and pumping stations are continually monitored and managed as an integrated hydrologic system. Water conservation areas 3A and 3B encompass nearly all of western Broward and northwestern Miami-Dade County. Water is added to the conservation area by rainfall, by gravity drainage from Hendry County, and by several large pumping stations in Broward and Palm Beach Counties. These pumping stations lift excess wet season water from drainage canals to the conservation areas, thus providing flood control. During dry periods, stored water is released through structures and by seepage under levees to maintain flow to the ENP, to provide recharge to municipal wellfields, and to maintain groundwater levels near the coast for the prevention or retardation of saltwater intrusion (Fish and Stewart, 1991).

The Biscayne aquifer is the only formally named aquifer within the surficial aquifer system in Miami-Dade County. Because it is the principal aquifer in Dade County, it has been declared a sole-source aquifer. The formations composing the aquifer include (in descending order) all or part of the Pamlico sand, Miami Limestone (Miami Oolite), Anastasia Formation, Key Largo Limestone, and the Fort Thompson Formation (all of Pleistocene age), and contiguous, highly permeable beds of the Tamiami Formation of Pliocene and late Miocene age (hydraulic conductivity of 100 ft/day or more). Some geologic formations that compose the Biscayne aquifer extend beyond the area generally ascribed to the aquifer. Thus, to delineate the boundaries of the aquifer, changes in hydraulic properties within the geologic formation must be determined. The key criterion in defining the Biscayne aquifer is the presence of highly permeable limestone or calcareous sandstone in the Fort Thompson Formation, Anastasia Formation, or the Key Largo Limestone (Fish and Stewart, 1991).

3.7.1 Site Hydrostratigraphy and Hydraulic Properties

The Miami limestone includes an oolitic facies to the east (underlying the Atlantic Coastal Ridge), and a bryozoan facies to the west. The 8.5 SMA is directly underlain by the oolitic facies of the Miami limestone (Hoffmeister, 1974). The oolitic facies consists of variably sandy limestone composed of oolites with scattered concentrations of fossils. In the 8.5 SMA, the thickness of the Miami Oolite facies is approximately 16 to 20 feet. Pumping of wells completed in the Miami Oolite indicates that large yields can be obtained in some areas, however, test drilling indicates that the Miami Oolite does not have as well developed a network of cavities as the underlying Fort Thompson Formation. The Miami Oolite is underlain by the Ft. Thompson Formation throughout Miami-Dade County, including the 8.5 SMA. Thickness of the Fort Thompson in the 8.5 SMA is approximately 35 to 40 feet, thinning to the west. Aquifer testing of the Fort Thompson Limestone indicates that the average hydraulic conductivity exceeds

40,000 ft/day. Below the Fort Thompson Limestone are less conductive units of the Tamiami Formation, which reach a total of thickness of approximately 70 feet in the 8.5 SMA. Limestone units with a hydraulic conductivity of 100 to 1,000 ft/day are present within the Tamiami beneath the 8.5 SMA, becoming less conductive to the north, and more conductive to the south. A hydrogeologic cross section is included as Figure 9.

The transmissivity of the surficial aquifer system in Miami-Dade County increases from less than 75,000 ft^2/day in westernmost portion of the county to greater than 1,000,000 ft^2/day in a large area centered around Krome Avenue. The 8.5 SMA is included in this high transmissivity area, which coincides with the greatest thickness of the Fort Thompson Formation in the 8.5 SMA. The decrease in transmissivity to the west corresponds to the thinning of the highly permeable Fort Thompson Formation.

3.7.2 Flow Conditions

The sources of recharge to the surficial aquifer system in Dade County are: 1) Infiltrating rainfall or irrigation water through surface materials to the water table; 2) infiltration of surface water imported by overland flow from the north in the water conservation areas or by canal; 3) infiltration of urban runoff by way of drains, wells, or ponds; and 4) groundwater inflow from southwestern Broward County. Soil types have significant control on the rate of recharge. Seasonal variations occur, with recharge by rainfall greatest during the wet season, and recharge by canal seepage being greatest during the dry season. Most of the water that circulates within the surficial aquifer system is discharged by canals. Pumpage constitutes only a small part of the total discharge from the aquifer, although this effect is amplified because it is greatest during the dry season when recharge and aquifer storage is smallest.

Groundwater contour maps for the surficial aquifer system in Dade County at the end of the wet and dry seasons are included as Figures 10 and 11. The maps represent the average of water levels for September (wet season) and April (dry season) during the period 1974 to 1982. As shown on the figures, groundwater flows from the highest water levels which are maintained in water conservation areas 3A and 3B, toward the east-southeast and southwest. In the 8.5 SMA, groundwater flow is predominantly toward the east-southeast. Groundwater flows into the 8.5 SMA from the east Everglades. Canals, control structures, or well fields cause local variations in the flow pattern. Canals that quickly remove groundwater during periods of high water levels greatly shorten groundwater flow paths compared to predevelopment conditions. However, it is often unclear whether canals act as fully penetrating boundaries or as partly penetrating boundaries of the flow system.

3.8 REGIONAL WATER SUPPLY/DEMAND

Major wellfields are located to the north of the 8.5 SMA near Miami and Ft. Lauderdale. Intensive pumping has lowered the water table near the wellfields and has reversed the natural seaward flow direction in some places. The nearest major wellfield is the Miami Springs-Hialeah wellfield located in Miami.

During 1985, about 786 million gallons per day (mgd) of water was withdrawn from the Biscayne aquifer. More than 72% of this water was used for public supply, 23% for agriculture, and the remainder for domestic and industrial purposes (Randazzo and Jones, 1997). The U.S. Geological Survey (USGS, 1992) reported that in 1990, Miami-Dade County used about 576 mgd of water, with 92% of that water supplied by groundwater, and 98% of that groundwater supply was from the Biscayne aquifer. In the 8.5 SMA, no municipal water service is provided to the residents, therefore drinking water is provided by private supply wells.

3.9 WATER QUALITY

Although water is the lifeblood of the Everglades system, it is also potentially a medium of pollutant transport. The south Florida region, including the 8.5 SMA, presents a unique situation with the coexistence of extensive agricultural and urban areas in close proximity with ecologically sensitive wetlands and marine resources. All are dependant upon the regional water supply. Present delivery of waters to Everglades National Park (ENP) originate from or pass through agricultural areas having the potential to alter or degrade water quality (Sheidt, 1989). The Everglades evolved in a relatively nutrient-poor environment and as a result, the release of nutrients has changed the sawgrass and wet prairie habitat. Cattail monocultures have been found to develop around disturbances such as drainage, canal construction and other human activity. These monocultures have specifically been found in the 8.5 SMA.

The natural quality of water in the Biscayne aquifer typically complies with State Drinking Water Standards and is typically suitable for all urban demands. Poor water quality exists in some coastal areas that are impacted by chemical contamination or saltwater intrusion. Areas that are affected by saltwater intrusion tend to be localized in linear extent due to the constant recharge (high water levels) maintained at the various water control structures which exist throughout southwest Florida. Because the Biscayne aquifer is close to the surface and highly permeable, groundwater is vulnerable to contamination. Rapid urbanization combined with growth of agriculture continues to threaten shallow groundwater from a variety of manmade sources

3.9.1 Pesticides

Pesticides are a concern to the ENP due to the presence of agricultural lands within the flow path of waters flowing to the ENP. ENP natural resource managers undertook a study to assess the threat that pesticides present to the ENP as presented by Sheidt (1989). The study included three objectives: 1) document pesticide use in areas surrounding the ENP; 2) consider the mobility in water of identified pesticides; 3) assess the relative acute toxicity to wildlife of identified pesticides. Pesticide use was documented with difficulty, since agricultural use is not reported to any agency, and information is not often volunteered. The ENP estimates that because of the sub-tropical climate and the variety of crops grown, a variety of pesticides are being applied. A total of 88 compounds were identified by active ingredient or common name, including 41 insecticides, 29 herbicides, 15 fungicides, and 3 fumigants. This estimate is conservative, with additional compounds used on a sporadic basis. Information on the volume of pesticides was estimated based on application rate per acre from the product label for that crop, times the number of applications in a growing cycle, times the harvested crop acreage. A total annual estimate of 8 million pounds of active ingredient was obtained. Approximately 2,808 acres within the 8.5 SMA are used as farmland. Crops include temperate and tropical fruits and vegetables, trees, and ornamental plants.

Pesticides used in south Florida earmarked by the US EPA as likely groundwater contaminants include 5 insecticides and 18 herbicides. It should be noted that EPA lists only those compounds with nationwide use exceeding 1 million pounds annually. The ENP study states that given the variety of specialty crops grown in south Florida, it is conceivable that some of the 65 compounds used here that are not on the list could be leachers or potential groundwater contaminants. A case in point is the insecticide aldicarb, which has a low sales volume but has been detected in groundwater in Florida.

The ENP study found many of the compounds to be highly toxic to birds, mammals, and fish. Overall, the insecticides were found to pose a greater threat in terms of acute toxicity. All of the fungicides for which data were available were toxic to fishes. Most of the herbicides were moderately to slightly toxic. The toxicity was based upon the LD_{50}, or dose causing

mortality to 50% of mammals or birds, or in the case of aquatic organisms, the exposure concentration causing 50% mortality over a specified period of time. Although a compound may be only moderately or slightly toxic based on the $LD_{50,}$ this does not mean that it could not pose a threat to wildlife.

The South Florida Water Management District conducts a program that monitors 68 compounds quarterly in surface water and hydrosoil at 22 locations from Lake Okeechobee south to Dade County. All of the sites are water control structures within the canal system. Since only 36 of the 68 monitored compounds are currently used, over one-half (52) of the 88 local use pesticides are not monitored in this program. Sites within the 8.5 SMA include G-211 and S-331, located in the L-31N canal. The results of the pesticide monitoring program (Table 1) for December 1998, April 1999, and August 1999 for the 8.5 SMA surface water sites show detectable atrazine ranging from 0.012 parts per billion (ug/l) to 0.059 ug/l (Pfeuffer 1998, 1999a, 1999b). Atrazine is easily lost from the soil by leaching, but is relatively non-toxic to mammals and fish. Compounds detected at low levels at G-211 in April 1999 included DDD, DDE, DDT, endosulfan sulfate, and heptachlor epoxide. The DDT concentration of 0.0027 ug/l exceeds the 62-302 FAC surface water quality standard of 0.001 ug/l. Hexazinone was detected in S-331 at 0.032 ug/l in August 1999.

Sediment samples from S-331 had detectable DDE in December 1998 and April 1999, at concentrations of 2.3 ug/kg and 1.5 ug/kg, respectively. DDE was detected in sediment from G-211 in April 1999 at a concentration of 4.1 ug/kg. DDT and related compounds were banned from use in 1973. The large volume used, and the high sorption capacity of these compounds explains the persistence of detections in the sediment samples. The hydrophobicity of the DDT compounds results in a significant bioaccumulation factor. In sufficient quantities, these compounds can have reproductive effects on wildlife and carcinogenic effects in many mammals.

A USGS study of surface water quality impacts due to land use in the East Everglades (Waller 1982) included one residential area within the 8.5 SMA (168th street), the Chekika Hammock State Park just west of the 8.5 SMA, and a rock-plowed tomato field about 6 miles to the south of the

8.5 SMA. The residential sampling site was a vegetated swale that receives runoff from both the pavement and a low-density residential area to the north. Surface water samples for insecticide and herbicide residues were collected during rain events at the sites, with only malathion detected at the ENP-Chekika Hammock facility. Soil at each land use area was analyzed for chlorinated insecticides, PCB's, and chlorinated napthalenes. The rock plowed tomato field had high concentrations of chlordane (220 parts per million (mg/kg)) in the soil. The residential area soils had both chlordane (3 mg/kg) and detectable compounds in the DDT family. The soil cleanup target level for chlordane, per 62-777 FAC, is 3.1 mg/kg.

It should be noted that there have been no studies of pesticides in the 8.5 SMA that focused on water quality in agricultural drainage canals or L-31N during pesticide application periods. The possibility exists that elevated levels of pesticides occur but have not been documented (PEER, 1998).

Groundwater quality characteristics of the Biscayne aquifer were evaluated by USGS in 1978/1979 for seven land use areas within the East Everglades (Waller, 1983). Areas within the 8.5 SMA included Howard Drive agricultural area and the Richmond Drive residential area. Seven monitoring wells were installed at the agricultural area, and two wells in the center of the residential area. The wells were nested, with one well completed to depths of approximately 10 to 15 feet below ground surface (bgs), and one to depths between 35 to 50 feet bgs. Soil samples were also collected from each land use area. The wells and soil samples were analyzed for insecticides, herbicides, and polychlorinated biphenyls once during the sampling program. The results showed that in the Howard Drive agricultural area, no pesticide or herbicides were detected in the groundwater. Soil contained only low concentrations of insecticide residues. In the Richmond Drive area, no pesticide or herbicides were detected in the groundwater. The soil in the Richmond Drive area contained chlordane and compounds in the DDT family.

3.9.2 Nutrients

A water quality analysis of the 8.5 SMA was conducted by PEER Consultants in 1998. Total phosphorus (TP) data for

wells and surface water sampling sites in and around the 8.5 SMA were evaluated. A measure of compliance for phosphorus discharges for the C-111 basin were established in the Modified Consent Decree as less than 10 parts per billion (ug/l) to Shark River Slough and to Taylor Slough. The data were predominantly from the mid 1980's, with the exception of station S-311 which was sampled in 1997 and 1998. No phosphorous was detected at S-311 for the PEER evaluation period. Due to the lack of TP data for groundwater in the 8.5 SMA, water quality data for the L-31N canal was utilized by PEER to determine if land use practices had impacted water quality. The rational behind this evaluation was the fact that modeling indicated groundwater flow in the 8.5 SMA is primarily to the east, and is intercepted by the L-31N canal. The data from L-31N indicated low levels of TP in the surface water, decreasing downstream. The study hypothesized that phosphorous is retained by soils in the 8.5 SMA and does not move outside the project area, although this could not be proved. This conclusion assumes that all groundwater flow from the 8.5 SMA is intercepted by the L-31N canal.

To evaluate TP near septic systems, previous studies in the vicinity of the 8.5 SMA were evaluated by PEER. Water quality in the vicinity of septic systems located just north of Homestead, in Coral Gables, in Hialeah near the Miami airport, and in north Miami-Dade county was monitored and evaluated by Pitt (1975). The average TP concentration was 20 ug/l, with one well above 200 ug/l (in Hialeah). Ayres Associates (1989) monitored groundwater quality for a residential subdivision in Dade County east of the 8.5 SMA. Seven wells had average TP concentrations ranging from 18 to 67 ug/l. The maximum TP concentration observed was 1,200 ug/l.

Anderson and Shaw (1991) evaluated groundwater quality data from the East Everglades to determine impacts from agricultural activities. Wells were installed in old and new agricultural areas east and west of L-31N and C-111, and sampled six times over a two-year period. Monitoring included two wells in the vicinity of the 8.5 SMA. The average TP concentrations for wells located directly in agricultural areas was 9.0 ug/l.

The USGS evaluation (Waller, 1982) of the effects of land use on surface water quality, mentioned in previous sections

of this report, indicated that the rock-plowed tomato field (south of the 8.5 SMA) showed increased concentrations of organic nitrogen, total organic carbon, and orthophosphate from water at background sites in Taylor Slough, reflecting agricultural impacts. In a similar USGS study of the effects of land use on groundwater quality (Waller, 1983), areas within the 8.5 SMA were sampled, including the Howard Drive agricultural area and the Richmond Drive residential area. Potassium, organic carbon, and Kjeldahl nitrogen concentrations were higher than background. At Richmond Drive, Kjeldahl nitrogen was also above background in the groundwater samples. The elevated nutrient levels were attributed to the proximity to organic, peaty soils.

3.9.3 Metals and Toxic Organic Compounds

An evaluation of water quality data for wells in the 8.5 SMA and DERM surface water quality stations LN01 and LN04 was performed by PEER (1998). Wells G-3189, G-3273, G-3201,
G-596, were monitored. The samples were analyzed for volatile organics and semi-volatile organics, and all samples were below detection limits. There were detections of arsenic, barium, chromium, copper, lead, manganese, mercury, nickel, selenium, and zinc.

Analytical data received from DERM was also reviewed by HDR, and included wells GW-24A, GW-24B, and GW-24C located on the north side of the 8.5 SMA near S.W. 202nd Avenue, and well G-696 located near the corner of S.W.197th Avenue and S.W. 136th Street. The sample data were suspect due to inadequate quality control and lack of chain of custody forms, and are therefore not discussed here.

3.9.4 Indicator Bacteria

Coliform bacteria are most commonly used as indicators of domestic sewage and agricultural runoff entering a water body. The coliform group also contains a variety of species occurring naturally in soils. Determination of fecal coliform bacteria concentrations is made to distinguish between enteric and soil coliforms. The bacteria counts indicate the relative amounts of waste matter, both naturally occurring or as sewage discharge, entering a body of water. The USGS study of surface water quality impacts due to land use in the

East Everglades (Waller 1982) included one residential area within the 8.5 SMA

(168th street), the Chekika Hammock State Park just west of the 8.5 SMA, and a rock-plowed tomato field about 6 miles to the south of the 8.5 SMA. In addition to fecal coliforms, the USGS study also measured the number of fecal streptococci bacteria to further distinguish between animal and human bacteria. The streptococci bacteria are more common in animal intestines, therefore the ratio of fecal coliform to fecal streptococci bacteria (FC/FS ratio) gives an indication of the source. A ratio of greater than 4.0 indicates contributions from human sources. In the residential area, the FC/FS ratio (>8) indicates the likelihood that the source of the bacteria is from human sources.

The USGS study by Waller (1983) indicated that groundwater in a shallow monitoring well at the Richmond Drive residential area had FC/FS ratios indicating that humans were not the source of the bacteria.

3.9.5 Hurricane Irene Storm Event Sampling

Sampling of standing surface water from ten locations within the 8.5 SMA was performed following hurricane Irene in October 1999. Sample locations are shown on Figure 12. The samples were analyzed for purgeable halocarbons (EPA method 601), semi-volatile organics (EPA Method 8260), metals, total phosphorous, and total cyanide. In addition, two locations were sampled for fecal coliforms. The coliform locations included SW 168th Street at 197th Avenue, and SW 168th street at 209th Avenue. Detected concentrations from the sampling event are summarized in Tables 2 and 3. The results show detectable metals, nutrients, and a few organic compounds. Total phosphorous exceeds the established criteria of 10 ug/l, ranging from 140 to 930 ug/l. Coliform bacteria was above the State surface water standard (>1000 cfu/100 ml) during most of the sample events.

3.9.6 Water Quality Summary

Conclusions regarding the water quality of the 8.5 SMA can be made based on the data and literature review of studies within and in the vicinity of the 8.5 SMA. Constituents of concern appear to be pesticides, nutrients, and bacteria. Toxic organics and metals do not appear to be a concern, although unidentified problems could exist (see Section 3.26 below).

Although surface water at the L-31N shows detections of pesticide residues to be typically at low levels, it is possible as mentioned in the PEER report, that there have been no studies of pesticides in the 8.5 SMA that focused on water quality in agricultural drainage canals or L-31N during pesticide application periods. The possibility exists that elevated levels of pesticides occur but have not been documented. Also, it is possible that some of the 65 compounds used in Florida are not on the EPA list and could be leachers or potential groundwater contaminants. This would apply to agricultural areas outside of the 8.5 SMA as well.

Nutrient levels appear to be elevated in some agricultural and residential areas. The PEER study hypothesized that phosphorous is retained by soils in the 8.5 SMA and does not move outside the project area, although this could not be proved. This conclusion assumes that all groundwater flow from the 8.5 SMA is intercepted by the L-31N canal. Related studies of total phosphorous associated with septic systems in Miami-Dade County showed elevated levels in groundwater (PEER, 1998).

Data concerning indicator bacteria were limited, but show some evidence that humans may have impacted water quality due to septic systems in the 8.5 SMA. In the Richmond Drive residential area, the FC/FS ratio (>8) indicated the likelihood that the source of the bacteria is from human sources. Hurricane Irene sampling event data show elevated coliforms in standing surface water, although the source (human or animal) was not identified.

3.10 VEGETATION

Historic conditions. Underlain by a unique soil derived from of exposed limestone and marl, the native vegetative communities of the 8.5 SMA and eastern Everglades range from freshwater marsh to wet prairie, dotted by tree hammock trees or islands, developed over mounds of slightly higher elevation than the general ground level. Wetlands in the study area are located within the Rocky Glades region of the Everglades, defined by shallow marl soils over Karst limestone bedrock, which historically formed a natural buffer separating the deeper Everglades marshes from the higher and drier areas along the Atlantic Coastal Ridge (ENP 1994). These wetlands were primarily dominated by short hydroperiod graminoid species interspersed with tropical hardwoods found on bayheads and hammocks. Sawgrass (*Cladium jamaicense*) communities

dominated the long hydroperiod wetlands while muhly grass (*Muhlenbergia capillaris*) and black sedge (*Schoenus nigricans*) dominated the short hydroperiod wetlands mostly influenced by Northeast Shark River Slough (NESRS) and local rainfall.

Davis (1943) compiled a vegetation map of southern Florida characterizing the entire 8.5 SMA as marsh prairie dotted by hammock tree islands and classifying the ecological landscape as southern marl marsh. Included in the 8.5 SMA are four primary of vegetative communities: marsh, prairie, bayhead tree island and tropical hardwood hammock. Other wetland features expected in the undisturbed condition include bayhead/swamp forest, represented as tree islands. Hilsenbeck and Hoffstetter (1980) characterized the vegetation classes in the Eastern Everglades also including the 8.5 SMA. Much of the eastern portion of the project area was categorized as muhly/mixed graminoid grass prairie while the western third was considered a combination of bayheads and tropical hardwood hammock tree islands in successional stages. At the time, many of the western tree islands were in a post-burn recovery condition. Gunderson (1994) suggests these tree islands, and their characteristic teardrop shape, may have formed in the sawgrass marshes and prairies as a result of high-spots, or the accumulation of peat deposits in bedrock depressions upon which the shrubby and forest species were able to establish.

Historically, native upland plant communities were probably sparse in the 8.5 SMA due to low elevations, high water tables, and periodic flooding. However, the eastern portions of the 8.5 SMA lay within a half mile of the western limits of the Miami Rockland pine forests (Davis 1943). Pine uplands may have occurred in the 8.5 SMA prior to its conversion to agricultural and residential land uses. The presence of species more typical of pine uplands which currently occur in the 8.5 SMA such as pineland snowberry (*Chiococca pinetorum*), trema (*Trema* spp.) and probably some lichen species can be attributed more to the altered ecology of the region and recent dispersal than a seed bank from historical presence. These species will likely be eliminated with prolonged increase in hydroperiod.

3.11 UPLANDS

Generally, all uplands have been converted to agricultural or residential land uses classified as upland forest/shrub complex, and native upland communities are no longer present. Land cover mapping prepared by the SFWMD identified areas of pine flatwoods in the southwest corner of the 8.5 SMA (Figure 13). Field reviews identified these areas to be dense stands of Australian pine (*Casuarina* spp.) with a sparse ground cover of sawgrass.

3.12 WETLANDS

Gunderson (1994) describes four herbaceous wetland communities in the Everglades: sawgrass marshes, wet prairies (peat), wet prairies (marl), and sloughs. Wet Prairies (marl) are found in several areas including areas east of the Shark River and Taylor Sloughs. In these areas elevations are slightly higher and correspondingly, hydroperiods are shorter. Wetland hydroperiods gradually increase westward to NESRS and decrease with higher elevations associated with the Atlantic Coastal Ridge to the east. In ENP graminoid communities remain intact, although negatively impacted by regional water management facilities to the north (C–4, L–29, WCA 3) and east (L–31N). Within the 8.5 SMA, limestone and marl are located at or near the surface and can be expected to support, in a natural condition, short stature sawgrass communities and marl wet prairies (Table 4).

The vast majority of wetland features within the 8.5 SMA have undergone varying degrees of disturbance related to land clearing for agricultural or residential improvements and invasion by exotic species. Generally, wetlands with the least amount of disturbance are located in the western areas of the 8.5 SMA. With the exception of the radar field in the northeast corner of the project area, eastern portions of the 8.5 SMA are generally absent of recognizable wetland communities and the central region is dotted by wetland mixed within agricultural and residential land uses. Field reconnaissance found many of the wetland communities to include varying densities of Brazilian pepper (*Schinus terebinthifolius*), Australian pine, and melaleuca (*Melaleuca quinquenervia*). Australian pine forest is very dense, supporting a sparsely vegetated understory and ground cover. A common ground cover species is sawgrass, growing within a thick layer of duff comprised entirely of pine needles. Australian pine can be found in monotypic stands, along marsh and prairie edges, and in abandoned fields. Brazilian pepper is common along roadsides as well as forming dense wooded plots throughout the 8.5 SMA. Its thick shrubby growth form can quickly out-compete native flora and provides minimal habitat for wildlife. Primrose willow (*Ludwigia* spp.) and saltbush (*Baccharis* spp.) are occasionally found along the edges of Brazilian pepper woodlands. Brazilian pepper is a quick invader of abandoned farm fields, due in part to seed dispersal by birds.

Hilsenbeck and associates (Hilsenbeck et al. 1979) discuss the degree to which the native marsh and prairie communities recover from rock plowing. Muhly grass appears to be more resilient compared to sawgrass in areas that have been rock plowed but not farmed. In these instances, a shift from sawgrass to muhly grass dominated wetlands can occur. Abandoned fields which undergo repeated rock plowing followed by farming, are more likely to be colonized by cattail (*Typha* spp.), Brazilian pepper, napier grass (*Pennisetum purpureum*), primrose willow and other undesirable species. Reestablishment of muhly grass in these intensely farmed areas does not occur.

3.12.1 Community Classifications

To adequately evaluate wetland function within the study area, wetland habitat polygons were systematically developed by overlaying 4 basic wetland habitat types (graminoid, herbaceous, shrubby, and forested) over three elevational divisions (<6.5 ft., 6.5 to 7.0 ft., and >7.0 ft NGVD) within the 8.5 SMA. To adequately evaluate wetlands potentially impacted by project operations, wetlands in ENP adjacent to 8.5 SMA were included (marl prairie short hydroperiod wetlands, peat-forming long hydroperiod wetlands, forested wetland systems, and forested exotic wetlands). For purposes of analysis, there are separate categories of wetlands occurring in ENP and in the 8.5 SMA. Wetlands evaluated for this study were delineated according to the following definitions. The distribution of these wetlands is shown on Figure 13.

- **Forested Wetland — ENP**: Predominately native woody and herbaceous species typical to the fringe vegetative community of hardwood hammocks and willow heads.

- **Long Hydroperiod Wetland — ENP**: Marl prairie dominated by sawgrass, typically peat forming and characterized by inundation periods greater than 180 days (6 months) per average year.

- **Short Hydroperiod Wetland — ENP**: Marl prairie dominated predominantly by muhly grass and other graminoid species, characterized by inundation periods ranging from 30 to 180 days (1 to 6 months) per average year.

- **Graminoid Wetland:** Prairie vegetative community dominated by grasses, sedges and rushes typical to short hydroperiod wetlands such as muhly grass, sparse sawgrass, black sedge, arrowfeather (*Aristida purpurascens*), Florida bluestem (*Schizchyrium rhizomatum*), Elliot's lovegrass (*Eragrostis elliottii*), white-topped sedge (*Dichromena* spp.), umbrella sedge (*Fuirena* spp.), bighead rush (*Juncus megacephalus*), arrowhead (*Saggittaria* spp.) and a variety of beakrushes including *Rhyncospora polystachus*, *Rhycospora microcarpa*, and *Rhyncospora divergens*.

- **Herbaceous Wetland - Low to Moderate Soil Disturbance:** Short hydroperiod wetland community dominated by non-woody, non-invasive, relatively desirable species, which demonstrates a soil substrate characterized by previous disturbance, such as farming, recreation, building construction, livestock, and other activities that were relatively short-lived and/or minor in size and scope.

- **Herbaceous Wetland — High Soil Disturbance:** Short hydroperiod wetland community dominated by non-woody but undesirable herbaceous species, which demonstrate a soil substrate characterized by previous disturbance, such

as farming, recreation, building construction, livestock, and other activities that were intensive and continuous throughout a relatively long period of time, leaving distinctive surface scars and obvious landscape alteration.

- **Shrubby Wetland:** Wetland dominated by native woody shrub species, such as salt bush and wax myrtle (*Myrica cerifera*), frequently co-dominated by exotics, such as Brazilian pepper, bottlebrush (*Callistemon ridigus*), and other invasive ornamentals. Herbaceous species could include muhly grass, sawgrass, napier grass, cattail, beard grass (*Andropogon* spp.), sedges, and rushes.

- **Forested Exotic Wetland:** Forested wetland (>50 percent canopy cover) dominated by exotic species such as melaleuca, Australian pine, and Brazilian pepper.

- **Forested Native Wetland:** Forested wetland (>50 percent canopy cover) within the 8.5 Square Mile Area, dominated by native species, such as figs (*Ficus* spp.), red bay (*Persea borbonia*), sweet bay (*Magnolia virginiana*), swamp bay (*P. palustris*), red maple (*Acer rubrum*), coco plum (*Chrysobalanus icaco*), pond apple (*Annona glabra*), and Dahoon holly (*Ilex cassine*).

- **Upland Forest Shrub Complex:** Found throughout the 8.5 SMA associated with parcels of land previously cleared but which are currently abandoned. Characteristic species include primrose willow, Brazilian pepper, Australian pine, melaleuca, saltbush, willow (*Salix caroliniana*), pond apple, Burma reed (*Neyraudia reynaudiana*.), napier grass, cattail, sawgrass, and wide variety of sedges and grasses.

- Agricultural/Residential: Area cleared for farming or residential development mostly devoid of wetland vegetation with the possible exception of ruderal native or exotic species.

3.12.2 WRAP Analysis

To compare relative differences (both losses and gains) in wetland function between the "existing condition" and the nine project alternatives, the Wetland Rapid Assessment Procedure (WRAP) was employed (Miller and Gunsalus 1997) by USFWS. WRAP is a matrix developed to assist in the functional evaluation of wetland sites. The WRAP matrix establishes a numerical ranking for individual ecological and anthropogenic factors (variables) that can strongly influence wetland function. The numerical output for the variables is then used to evaluate current wetland condition. Each wetland type is rated according to its attributes and characteristics. WRAP variables include the following: (1) wildlife utilization, (2) wetland overstory/shrub canopy of desirable species, (3) wetland vegetative ground cover of desirable species, (4) adjacent upland/wetland buffer, (5) field

indicators of wetland hydrology, and (6) water quality input and treatment systems. The acreage of each wetland habitat type (polygon) is then multiplied by the acreage of that habitat type to derive "functional units" for comparison purposes (Table 5).

From December 1999 through February 2000, the WRAP Team conducted a series of on-site field investigations, consisting of 37 survey sites representative of 17 wetland habitat types (polygons) inside and adjacent to the 8.5 SMA to establish the "existing condition" wetland functional conditions.

3.13 FISH AND WILDLIFE RESOURCES

The following discussion of fish and wildlife resources was adapted in part from the Draft Fish and Wildlife Coordination Act Report (USFWS/NPS, 2000) that was prepared specifically for this project. A description of the type and distribution of habitats within the 8.5 SMA and ENP are presented in Sections 3.11 and 3.12.

Conditions within the 8.5 SMA likely provide important resources to opportunistic small animals including raccoons, rabbits, squirrels, songbirds, hawks, kestrels, crows, turkey vultures, frogs, and various reptiles. White-tailed deer were observed in the study area, specifically within ENP, but only limited resources for these large ungulates were apparent within the project area. On-site surveys found the greatest degree of species richness within the forested wetland systems within the ENP lands to the west of the 8.5 SMA, whereas species richness was lowest in wetlands on higher elevations (7.0-8.0 feet NGVD) in the eastern regions of the 8.5 SMA, in close proximity to L–31N.

This eastern region of the 8.5 SMA is dedicated to agricultural and residential land uses, providing only marginal benefits to resident wildlife. High water conditions within the study area have prompted land owners/managers to alter (i.e., ditching) natural landscape features to provide flood relief and optimize agricultural production. It appears that many years of continuous anthropogenic activity in this area is correlated with invasion of exotic species and roadside (including vacant lots) accumulation of human refuse (i.e. household garbage, derelict appliances and vehicles etc.). As a result, reductions in wetland function are more dramatic in the eastern portions of the 8.5 SMA as compared to the west and ENP, and opportunistic flora and fauna with strict resource requirements likely do not thrive.

The change in fish and wildlife diversity and wetland function between the western and eastern portions of the 8.5 SMA correlates with an elevational gradient (increasing elevations from west to east) and land use. Both

elevation and land use are inter-dependent co-variables as lower elevations correlate with frequent flooding that limits the extent and type of land use. Higher elevations are more compatible with agricultural, commercial, and residential land uses.

The following paragraphs provide an overview of wildlife observed within the study 8.5 SMA as presented in the draft CAR.

Avifauna. Avian diversity in this region of south Florida is high. Waterfowl, wading birds, and other bird species that depend upon wetlands for critical resources dominate avian communities here. DERM identified 142 species of birds in the study area (DERM 1999). Common aquatic species include spotted sandpiper (*Actitis macularia*), semipalmated sandpiper (*Calidris pusilla*), lesser yellowlegs (*Tringa flavipes*), greater yellowlegs (*T. melanoleuca*), double-crested cormorant (*Phalacrocorax auritus*), mottled duck (*Anas fulvigula*), anhinga (*Anhinga anhinga*), limpkin (*Aramus guarauna*), great blue heron (*Ardea herodias*), cattle egret (*Bubulcus ibis*), green heron (*Butorides striatus*), little blue heron, black-crowned night heron (*Nycticorax nycticorax*), snowy egret, great egret *(E. alba*), white ibis, and glossy ibis (*Plegadis falcinellus*). Common blackbirds found here include red-winged blackbird (*Agelaius phoeniceus*), eastern meadowlark *(Sturnella magna*), common grackle (*Quiscalus quiscula*), boat-tailed grackle (*Q. major*), and brown-headed cowbird (*Molothrus ater*). Raptors found in the study area include the red-shouldered hawk (*buteo lineatus*), red-tailed hawk (*B. Jamaicensis*), marsh hawk (*Circus cyaneus*), black-shouldered kite (*Elanus caeruleus*), swallow-tailed kite (*Elanus forficatus*), turkey vulture (*Cathartes aura*), and black vulture (*Coragyps atratus*). Other common birds found in the 8.5 SMA include northern cardinal (*Cardinalis cardinalis*), cedar waxwing (*Bombycilla cedrorum*), yellow-billed cuckoo (*Coccyzus americanus*), black-throated warbler (*Dendroica caerulescens*), yellow-rumped warbler (*D. Coronata*), prairie warbler (*D. Discolor*), palm warbler (*D. Pamarun*), mockingbird (*Mimus polyglottos*), house sparrow (*Passer domesticus*), rufous-sided towhee (*Pipilio erythrophthalmus*), American robin *(Turdus migratorius*), Carolina wren (*Thryothorus ludovicianus*), house wren (*Troglodytes aedon*), western kingbird (*Tyrannus verticalis*), white-eyed vireo (*Vireo griseus*), and the non-native European starling (*Sturnus vulgaris*).

Mammals. According to DERM (1999), 21 species of mammals have been recorded in the 8.5 SMA. Of these, 11 were observed by DERM staff in 1997 and 1999. Species observed included the domestic dog (*Canis domesticus*), opossum (*Didelphis marsupialis*), striped skunk (*Mephitis mephitis*), house mouse (*Mus musculus*), cotton mouse (*Peromyscus gossypinus*), raccoon (*Procyon lotor*), black rat *(Rattus rattus*), hispid cotton rat (*Sigmodon hispidus*), eastern cottontail (*Sylvilagus floridanus*), marsh rabbit (*S. palustris*), and grey fox (*Urocyon cinereoargenteus*). Other

mammals recorded in the DERM report for the area include the nine-banded armadillo (*Dasypus novemcinctus*), Florida panther (*Felis concolor coryi*), eastern yellow bat (*Lasiurus intermedius*), bobcat (*Lynx rufus*), evening bat (*Nycticeius humeralis*), whitetail deer (*Odocoileus virginianus*), rice rat (*Oryzomys palustris*), eastern mole (*Scalopus aquaticus*), spotted skunk (*Spilogale putorius*), and freetail bat (*Tadarida brasiliensis*).

Fish, Amphibians, and Other Aquatic Animals. Surveys conducted during December 1999 and January 2000 by the WRAP team recovered some small fish including: least killifish (*Fundulus chrysotus*.), sailfin mollie (*Poecilia latipinna*), pygmy sunfish (*Lepomis* spp.), and mosquito fish (*Gambusia* sp.). Only mosquito fish were found in abundance. One species of frog (*Hyla* spp.) was observed frequently throughout surveys within long and short hydroperiod wetlands, whereas leopard frogs (*Rana* spp.) were observed less frequently. Aquatic invertebrates were abundant and representative of Everglades wetland complexes. Common invertebrates identified include: gyrinid water beetle (*Gyrinus* spp.), giant water bug (*Belastoma* sp.), water strider (Family Gerridae), mayfly (Order Ephemeroptera), water tiger (Order Coleoptera: Dyticidae), aquatic spiders (*Dolomedes* spp.), backswimmers (Order Hemiptera: Corixidae).

3.14 LISTED SPECIES

A variety of species listed as threatened, endangered, or special concern occur or potentially occur in the project. Federally listed species that could occur in the project area or be affected by construction and operation of the proposed action include the snail kite, wood stork, Cape Sable seaside sparrow, Florida panther, and eastern Indigo snake. Species listed by the State of Florida as threatened, endangered, or species of special concern are found in Table 6. It is likely that Florida panthers and eastern Indigo snakes inhabit or frequently utilize the 8.5 SMA. Eastern Indigo snakes could find necessary resources in and around the higher elevations in the eastern portion of the area. However, there is no known record of eastern Indigo snakes in the 8.5 SMA. A deceased panther was found in the ENP just south of 168th St. in January 2000 (USFWS/ENP 2000). It is likely that panthers occasionally utilize habitat within the 8.5 SMA. The primary federally listed species of concern are the snail kite, wood stork, and Cape Sable seaside sparrow (CSSS), due in part to their dependence on specific hydrologic conditions for nesting or foraging.

> **Snail Kite (*Rostrhamu sociabilis plumbeus*). Snail kites, listed as endangered in 1967, require long hydroperiod wetlands that remain inundated throughout the year. This preference is associated with the apple snail, its primary food source, which requires nearly continuous flooding of wetlands for greater**

than one year (USFWS, 1999b). Suitable habitat for the kite includes freshwater marsh, and shallow vegetated lake margins where apple snails can be found. Critical habitat for the snail kite was designated in 1977 and includes WCA 1, 2, and 3A, and portions of ENP as well as Lake Okeechobee shorelines and portions of the St. Johns marsh.

Preferred nesting habitat includes small trees and shrubs such as willow, bald cypress, pond cypress, sweet bay, dahoon holly, southern bayberry, and elderberry. During dry periods when suitable shrubs and trees experience dry conditions, herbaceous vegetation is utilized for nesting (Sykes et al. 1995). During these dry conditions, herbaceous species such as sawgrass, cattail, bulrush, and common reed are used for nest sites. The snail kites breeding season can vary from year to year depending on rainfall and water levels. Ninety-eight percent of nesting attempts occurs between December through July while 89% are initiated between January and June.

Wood Stork (*Mycteria americana*). The Wood stork was listed as endangered in 1984 due to loss of foraging habitat and colony nesting failures (USFWS, 1999b). Preferring freshwater wetlands for nesting, roosting, and foraging, wood storks can be found throughout central and southern Florida. Nests are typically constructed in tree stands within swamps or stands surrounded by large areas of open water. Due to its tactile feeding methods, storks feed most effectively in shallow water settings where prey items are concentrated. During the winter and spring dry seasons when water levels naturally receded, prey items are often further concentrated providing foraging areas with abundant food supplies. Drainage in southern Florida may be responsible for delayed nesting by the stork, moving from an early nesting start in November, to February or March. Initiation of nesting this late is believed to contribute to nest failures and colony abandonment due to the dispersal of prey items associated with the onset of the wet season (May-June). There is no designated critical habitat for the wood stork (USFWS 1999b).

Cape Sable Seaside Sparrow (*Ammodramus maritimus mirabilis)*. The CSSS is an endemic bird species, listed as endangered in March of 1967 and restricted to the fringe uplands of southern Everglades and Big Cypress. Adults are so sedentary that they rarely move more then a few hundred meters unless forced to do so by fires or flooding (USFWS

1999b). The preferred habitat of CSSS appears to be short hydroperiod, mixed marl prairies, usually characterized by muhly grass (*Muhlenbergia capillaris*). These short hydroperiod prairies contain moderately dense, clumped grasses with open space permitting ground movement by the sparrows. Foraging preferences include a variety of soft-bodied insects, grass, and sedge seeds, depending on what is available.

Critical habitat for CSSS, designated August 1977, does not account for the distribution of the present day core sub-populations or areas necessary for the bird to maintain stable populations. Since the 1900s, CSSS has been episodically extirpated from portions of its total range. Bass and Kushlan (1982) recorded two core populations for CSSS and four peripheral populations totaling 6,656 birds (Figure 14). Peripheral population F, the closest population to the 8.5 SMA, on the west edge of the Atlantic Coastal Ridge was the smallest population estimated in 1982 at 112 birds and again in 1992 with similar results. However, field surveys recorded no sparrows in population F for 1993, and estimated 16 birds in the population from 1996-1998 (Curnett et al. 1998).

Nesting occurs from approximately mid-March until the onset of the rainy season (mid-June) (Nott et al. 1998). In dry years, nesting can begin as early as mid-February and continue through early August, with the majority of nesting occurring in the spring when the marl prairies are dry. CSSS raise two to three broods per season, needing at least 80 days to complete an average reproductive cycle of two clutches. The nest cups, constructed of grass, are placed approximately 14 centimeters above the ground level (Werner 1975, Lockwood et al. 1997). Nesting will not be initiated if water levels are greater than 10 cm during the breeding season (Pimm 1996, personal communication *in* USFWS 1999b). When water levels rise above the mean level of nests from ground (~14 cm), sparrows cease breeding (USFWS 1999b). Areas that sustain the short hydroperiod prairies are considered essential for the sparrow to successfully breed and to ensure the survival of the species.

The 1992 GDM/EIS for the MWD project determined that impacts to fish and wildlife resources, including the sparrow, were within acceptable ranges. However, in a letter dated February 19, 1999 from Sam D. Hamilton of the USFWS, a final biological opinion for the Modified Water Deliveries to the

Everglades National Park project, Experimental Water Deliveries Program, and the C-111 Project, was rendered. The opinion of the USFWS was a jeopardy decision regarding impacts related to changes in hydrology. Reasonable and prudent alternatives to the Experimental Program were proposed which would avoid jeopardizing the CSSS including water level management, fire management, and monitoring (USFWS 1999a).

3.15 AIR QUALITY AND NOISE

Primary sources of air pollution originate from transportation, stationary source fuel combustion, industrial processes, and solid waste disposal. Since there are only two paved roads in the 8.5 SMA and no industry, air quality poses little if any environmental threats. The project is located in an air quality attainment area.

Noise levels are associated with surrounding land use. There are no significant noise generating land users within the area of potential effect.

3.16 AESTHETIC RESOURCES

The western portion of the study area overlooks the adjoining ENP parkland. The Everglades have long been renowned for its expansive and picturesque marshes, wet prairies, and tree islands. Aesthetic amenities become increasingly limited toward the eastern sections of the 8.5 SMA due to a preponderance of vegetative barriers.

3.17 RECREATIONAL RESOURCES

Several opportunities for passive recreation, such as hiking, birding, wildlife viewing, and nature photography are currently available in the publicly owned lands in western portions of the 8.5 SMA and adjoining portions of the ENP, including the Chekika Hammock facility. In addition, hunting is temporally allowed within the ENP Expansion Area.

3.18 EXISTING LAND USE

The existing land use for the 8.5 SMA is based on an adaptation of an unpublished land use survey completed by DERM in December 1999. DERM field surveyed the existing land uses on a parcel-by-parcel basis, assigning each parcel to a basic land use category. This unpublished information was used to further refine and, in some instances, re-classify the existing land uses more in line with the Florida Land Use/Cover Classification System. The existing land use classifies those lands purchased by the South Florida Water Management District for the

mitigation project and the East Coast Buffer Project as "public". It should be noted that land acquisitions by the South Florida Water Management District are continuing for both of these projects.

In general, the residential and agricultural uses are located on the east half of the project area and vacant land and wetlands are on the west half (Figure 15). A Florida Power & Light (FPL) right-of-way runs north and south through the study area but remains undeveloped, although the southern portion of this corridor is leased for agriculture production. The area between the canal and SW 194th Avenue from SW 120th Street to 136th Street is a Federal Aviation Administration (FAA) radar facility. Table 7 provides a summary of current land use by number of parcels and amount of acreage for the 8.5 SMA. In the Social Impact Analysis (Appendix E), several land use classifications were grouped together to simplify the land use impact analysis for the various alternatives. Table 8 represents the existing land use information that was utilized for analysis.

About 46.2 percent of land or 2,961 acres within the 8.5 SMA are vacant lands. About 27.0 percent of the vacant land is in public ownership with the remaining 73.0 percent in private ownership. About 41.7 percent (2,673 acres) of the land use are agricultural including row crops, tree crops, specialty farms, mixed agricultural land, and nurseries. In addition, approximately 264 parcels of the agricultural lands are classified as residential with agricultural land. A very small percentage of the area is residential, approximately 360 acres. According to the Miami-Dade County Property Appraiser data and DERM data, the residential land uses and the residential with agricultural lands include a total of 321 houses and 193 trailers. For houses alone, this results in a residential density of 4.14 acres per house. If trailers are considered, the residential density is reduced to 2.59 acres per residential unit. These densities are considerably below the 1:40 acre density required for the area. Commercial properties are minimal in the 8.5 SMA and include only 4 properties consisting of 16 acres. However, it should be noted that the DERM identified four residential units that appear to be involved with some commercial activity.

3.19 FUTURE LAND USE

As required by Florida law, the future use of land is regulated by the adopted comprehensive plan for the governing local jurisdiction. The Comprehensive Development Master Plan (CDMP) for Miami-Dade County (adopted in May 1997 and amended in April 1999) establishes controls for future development in the 8.5 SMA. The Land Use Element and the Land Use Plan Map for 2005 of the CDMP designate the 8.5 SMA as "Open Land." The Open Land classification is intended for uses other than urban development, such as resource-based activities, recreation, and

conservation. The 8.5 SMA is specifically identified in the CDMP as Open Land (Subarea 4, East Everglades Residential Area on Figure 4 of the Land Use Element). This subarea is limited to seasonal agriculture and conditional rural residences. Such residences will be permitted subject to the special regulations prescribed in the East Everglades Zoning Overlay District, further described below. Generally, these residences will be considered at a density of one unit per 40 acres. Consideration of one unit per 20 acres is possible if the dwelling is ancillary to agricultural uses. This ordinance is based on the premise of restricting development within the 10-year floodplain. The 10-year flood elevation within the area has been determined to be 7.7 feet elevation. Consideration of one unit per five acres is possible only after such time as drainage facilities become available to protect the area from a one-in-10-year flood event or for those areas that are currently above the 7.7-foot elevation. Currently, there are approximately 574 acres that are provided flood-protection. Therefore, on these properties, property owners can request a variance to develop their property at a density of 1 unit per 5 acres. Although compatible utilities are allowable, no uses that would affect water quality are permitted.

Considering the East Everglades Zoning Overlay and the minimal land receiving flood protection, the future land use of the 8.5 SMA should be very similar to the existing land use. However, within this area, there are numerous examples where zoning restrictions have not been enforced. If the zoning ordinance continues not to be enforced, then the future land use of the 8.5 SMA may see a slightly greater increase in the amount of potential development in the area.

3.20 ZONING

The County adopted the East Everglades Overlay Zoning Ordinance in 1981 to address the unique problems and implement the special studies of the East Everglades area, of which the 8.5 SMA is a part. The ordinance's provisions are incorporated in Chapter 33B, Article II of the Miami-Dade County Code of Ordinances. The code outlines environmental performance standards for all uses, such as limitations on fill and excavation, landscaping requirements, solid waste, and agriculture management.

The East Everglades is divided into six management areas, each with specific uses and conditions. The 8.5 SMA is outlined as Management Area 1, and is characterized as agriculture with existing residential uses. Management Area 1 is limited to agriculture and one unit per 40 acres as outlined in the Land Use Element. One unit per 20 acres is only allowed if ancillary to an agricultural use less than 40 acres, is occupied by owner or employee, and is not contiguous to property under the same ownership (as deeded on January 14, 1981). Units at a density of one per five acres are allowed only in portions of the Management Area with flood protection and

an established residential character as of January 14, 1981.

The East Everglades Overlay Zoning Ordinance also includes incentives to limit future development within the area by offering transferable development rights. These are called Severable Use Rights and may be applied to urban properties elsewhere in the unincorporated County. For the 8.5 SMA or Management Area 1, the code offers one severable "right" per five acres which is usable as a bonus to other development sites.

3.21 INFRASTRUCTURE

The "Open Land" designation is intended to encourage uses other than urban development, such as resource-based activities, recreation, and conservation. The CDMP discourages the provision of urban services to "Open Land" areas except for improvements necessary to protect public health, safety, and welfare. Therefore, urban services and infrastructure provided to the 8.5 SMA through Miami-Dade County are limited.

EMS and Fire Rescue. Miami-Dade County currently provides fire and emergency services for the 8.5 SMA. Fire rescue services are provided to this area by the following stations: Redlands Station (located at 13150 SW 238th Street), Hammocks Station (located at 10001 Hammocks Boulevard), and Richmonds Station (located at 13390 SW 152nd Street).

The emergency medical services (EMS) division of the Miami-Dade County Fire Rescue Department also is responsible for planning and coordinating all emergency medical rescue activities in the County, including the 8.5 SMA.

Police Services. Miami-Dade County currently provides police services for the 8.5 SMA. Police services are provided to this area by the following stations: Hammocks Police Station (located at 10000 SW 142nd Avenue) and Cutler Ridge Station (located at 10800 SW 211th Street).

Electricity. Electricity is provided to the 8.5 SMA by Florida Power & Light (FP&L). The County is currently in the process of accessing specific information regarding the number of residential and commercial hook-ups in the study area.

Telecommunications. BellSouth currently provides telephone services to the 8.5 SMA.

Water and Sewer Services. Miami-Dade County currently does not provide water and sewer services to the 8.5 SMA.

Solid Waste Services. Miami-Dade County currently does not provide garbage and trash removal service for the 8.5 SMA.

Roads and Transportation. Miami-Dade County currently maintains approximately 6.5 miles of roadway in the 8.5 SMA. These roadways include SW 136th Street and SW 168th Street. The County does not provide mass transit services in the study area.

3.22 EXISTING SOCIAL PROFILE

Accurate demographic data specific to the 8.5 SMA is non-existent. Therefore, 1990 Census Block data disaggregated or collected by county census block, block group or zip code cannot be extracted to accurately reflect the demographics of the area. Complicating this effort is the presence of "uncounted migrant farm labor" and "illegal immigrants". Both published and unpublished data sources have been drawn upon to develop a reasonable "snapshot" of the demographics of the 8.5 SMA. The Social Impact Analysis, Appendix E, provides a more detailed description of this information.

<u>Population.</u> The 1990 Census Block data that includes the 8.5 SMA shows a 1990 population of 828 persons living in 202 households or about 4.1 persons per household. Of this number, 246 American Indians were identified who live outside of the 8.5 SMA. From this, it is estimated that about 582 persons in about 142 households lived in the 8.5 SMA in 1990. The current population of the 8.5 SMA has been estimated by several independent surveys. The "PEER Report" estimated the population of the area at 640 persons living in 375 residences. An independent count by an area resident indicates a minimum of 432 residences with an estimated population of 1728 persons. This latter estimate is reported to include migrant farm workers and illegal immigrants. However, this estimate is most likely high because of the large amount of second homes and weekend homes characteristic of this area.

As shown in the Social Impact Analysis, the estimated current population used for this analysis is based on the number of residential units (208) that have the same mailing and property addresses, based on the Miami-Dade County Property Appraiser Information. The household size was determined to be 4.1 persons per household. This estimate of household size was taken from the 1990 Census and appears to be accurate. Family size for the white population is generally over 2.7 and minority and Hispanic family sizes are typically larger than that of the white population. Therefore because this area is largely Hispanic, a household size of 4.1 appears to be accurate for this area. Therefore, the current population of the 8.5 SMA was determined to be 853 (208 households x 4.1 persons per household).

According to the Social Impact Analysis (Appendix E), the population in the 8.5 SMA is expected to increase by about 84 percent or 717 persons by the year 2015. Between the year 2015 and 2050, the future population is expected to remain constant at 1,570 persons due to the limited area available for future development.

Demographic Data. The Social Impact Analysis (Appendix E) estimated the following demographic data for the 8.5 SMA:

Age

- 34.0 percent of the population are under 17 years of age, including 24.8 percent school age children between 5 years old and 17 years old.
- 63.6 percent of the population are between the ages of 18 years old and 64 years old.
- An estimated 2.4 percent of the population are above the age of 65 years old.

Sex

- 51.1 percent of the population are male
- 48.9 percent of the population are female

Ancestry

- The 1990 Census Data indicates that almost 64.0 percent of the population in the 8.5 SMA are white, 36.0 percent of the population are Hispanic. The 1990 Census Data identified no black persons within the 8.5 SMA.
- An independent survey, completed by a resident, indicates that the Hispanic population represents 75 percent of the 8.5 SMA population. The Hispanic population consists primarily of people of Cuban and Mexican ancestry. There are few residents that trace their ancestry to Central America.

Education. 1990 Census data for census tract 250115, which includes the 8.5 SMA, indicate that 37.2 percent of the population has less than a high school education, while 27.4 percent are high school graduates. About 13.4 percent have an Associate Degree or higher. However because data in this census tract includes the area of Homestead, Florida, it is probable that it is not representative of the 8.5 SMA, which is basically rural in nature. The

8.5 SMA contains no schools and students are bussed to other areas of the county. The presence of migrant farm workers and illegal immigrants would tend to increase the percentage of residents with less than a high school education and reduce the percentage of those with an Associates Degree or higher.

The distribution of future population characteristics, as identified above, is assumed to remain the same as the existing population characteristics. Specific data sets for the 8.5 SMA are not available that would allow for the accurate projection of changes in these population characteristics.

3.23 EXISTING ECONOMIC PROFILE

As with the demographic data in the previous section, disaggregated data on income and employment in the 8.5 SMA is non-existent. Data from a variety of sources was reviewed and the best estimates of these investigations are presented in the Social Impact Analysis (Appendix E) and summarized here.

Income. Per Capita Income within the 8.5 SMA was based on the 1990 Census Data for Census Tract 250115. For this census tract, per capita income data is estimated to range from $14,371 to $20, 782. However because this census tract includes Homestead, Florida, a more typical subdivision, the lower estimate is probably more reflective of the per-capita income in the 8.5 SMA. Similarly, the census data for total income for this census tract ranged from $12.3 million to $17.7 million based on the estimated resident population and per-capita income data. However again because of the inclusion of Homestead, Florida in the census tract, the lower estimate is more reflective of the wages and salaries or earnings to residents in the 8.5 SMA. The two largest sectors of the area economy include farming and wholesale, retail trade, with farming by far the largest.

Poverty data was also obtained from Census Tract 250115. This census tract, in 1990, had an 8 percent poverty level. However, the County as a whole had a 14.2 percent poverty level. Given the reported information that migrant farm workers and illegal immigrants reside in the 8.5 SMA, it may be safe to assume that the percentage of families with incomes below the poverty level is higher than the 8 percent identified for the census tract.

Employment. There are no major employers in the 8.5 SMA. The largest employers include a vegetable processing plant and a few small retail stores. The small retail stores employ no more than 20 people and the processing plant approximately 50 people; however, it is uncertain as to whether these employees reside in the 8.5 SMA. There are also an unknown number of residents who participate in full-time farming activities. Based on 1990 Census Data for this census tract, about 51 percent or about 435

permanent residents are employed. Other than the above identified employment opportunities within the 8.5 SMA, it is assumed that the remainder of the employed population work outside of this area.

The present estimate of employed permanent residents of the 8.5 SMA of 435 persons is expected to increase to about 800 by the year 2015 and remain constant thereafter. This increase is based on the assumption that the present relationship between resident population and employed population will remain constant over the projection period.

Based on 1996 unemployment data for the State of Florida and Miami-Dade County and the 1990 Census Data for the 8.5 SMA, unemployment for the 8.5 SMA is estimated to be between 7.0 and 7.5 percent.

3.24 EXISTING WELL BEING

The Social Impact Analysis (Appendix E), prepared for this project, assessed the existing well being in the 8.5 SMA based on "Community Cohesion" and "Sense of Place".

Community cohesion measures those elements that draw a community together. A majority of the residents in the area share a strong Hispanic heritage. However, the area does not have any schools or churches that would tend to draw these families together. A large number of property owners do not reside in the 8.5 SMA. Many of these absentee property owners spend only weekends in the area. In addition, it has been reported that there are riding or "Social Clubs" that meet in the 8.5 SMA on weekends. The balance of residents versus non-residents who are involved with these clubs is uncertain.

One common interest among residents appears to be the mistrust in governments at all levels. Efforts to purchase properties within the area have galvanized landowners into a cohesive group resisting the government buyout efforts. There exists within the area a strong vocal group of residents who are actively resisting any government efforts to interfere with their lives. Whether this resistance is representative of all residents has not been determined. If this resistance were representative of a majority of property owners, the sense of community cohesion among property owners in the area would be strong. If not representative of the property owners, community cohesion could best be characterized as moderate.

The "sense of place" factor measures those elements that provide residents a sense of well being, such as home ownership, working the land, rural atmosphere, and sense of security. It also includes an active concern and active participation in the decisions that may affect these

elements. Within the 8.5 SMA, there are strong feelings associated with property ownership. Many property owners look upon property ownership as "owning a piece of America". The sense of property ownership is particularly strong among those families that have immigrated from totalitarian political environments. In contrast, data collected by the SFWMD (Dec. 1999) indicate about 1/3rd of the property owners in the area are willing to sell their land to SFWMD. Less than 5 percent (80 property owners) said they are unwilling to sell. The remaining 60 percent were undecided. Further, only a relatively small percentage of property owners have attended public meetings held to discuss the various alternatives that could affect their properties. Several residents in the 8.5 SMA claim they were not notified of these public meetings in a timely manner. This may explain the low level of participation. Overall, the sense of ownership and place within the 8.5 SMA appears to be strong.

3.25 PRIME FARMLANDS

Prime farmland is any land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion. (7 U.S.C. 4201(c)(1)(A)). There is no prime farmland within the 8.5 SMA.

3.26 UNIQUE FARMLANDS

Unique farmland is any land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as, citrus, tree nuts, olives, cranberries, fruits, and vegetables (7 U.S.C. 4201(c)(1)(B)). According to the NRCS district conservationist, most of the 8.5 SMA qualifies as unique farmland, in particular those areas under cultivation or in improved pasture, including horse farms (Christine Kaufman, NRCS, pers. comm., August 1999). There are about 4000 acres of agricultural land within the 8.5 SMA. A variety of row and field crops are grown both within and immediately adjacent to the 8.5 SMA, including okra, sweet potatoes, malanga (tanier/tania), malanga isleña (taro), beans, squash, sugar cane, and corn. Tree groves of lime, mango, and mameys are also present, as are several nurseries that raise a variety of ornamental plants. Also present are several areas of improved pasture and fallow (or abandoned) cropland. The only agricultural land type within the project area that does not qualify as unique farmland appears to be unimproved pasture. Official coordination with NRCS on impacts over unique farmland has been initiated (see form AD-1006, Appendix B).

3.27 HAZARDOUS MATERIALS

A computerized search was undertaken of available regulatory information to be used for evaluating the potential hazardous materials impacts to the 8.5 SMA. Agency databases were searched through VISTA Information Solutions, Inc. (Vista). VISTA completed a search of the entire 8.5 SMA project area. The completeness or accuracy of this information cannot be guaranteed by HDR.

U.S. EPA Lists. The following lists, which are maintained by the U.S. Environmental Protection Agency, were searched and reviewed:

(1) National Priorities List (NPL), Florida, July 1999. The NPL is a listing by state/county providing information on uncontrolled or abandoned hazardous waste sites identified for priority remedial actions. There were no sites within the 8.5 SMA identified in the NPL.

(2) Resource Conservation and Recovery Act (RCRA) Corrective Actions and associated TSD (CORRACTS). This is a list of RCRA facilities undergoing a corrective action after a release of hazardous waste or constituents into the environment. No CORRACT facilities were identified within the 8.5 SMA.

(3) Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). This is a computerized listing provided by the EPA on its World Wide Web site (http:\\www.epa.gov\superfund.htm) identifying facility type (i.e. large, small or limited quantity generator; treatment, storage or disposal facility; transporter; burner/blender; and recycler), site inspections, preliminary assessments and remedial status. The CERCLIS List contains sites which are either proposed on the NPL or sites which are in the screening and assessment phase for possible inclusion. No CERCLIS sites were identified within the 8.5 SMA.

(4) Emergency Response Notification System of Spills (ERNS). The ERNS database is a national database used to collect information on reported releases of oil and hazardous substances. No releases were reported within the 8.5 SMA.

(5) Treatment, Storage and Disposal Facilities (RCRA-TSD). The EPA's Resource Conservation and Recovery Act (RCRA) program identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRA Facilities database is a compilation of TSD facilities. No TSD facilities were identified within the 8.5 SMA.

(6) RCRA Large Generators of Hazardous Wastes (GNRTR). The RCRA program identifies facilities that generate at least 1000 kg/month of non-acutely hazardous waste (or 1 kg/month of acutely hazardous waste). No RCRA large quantity generators were identified within the 8.5 SMA.

(7) RCRA Small Generators of Hazardous Wastes (GNRTR). The RCRA program identifies facilities that generate less than 1000 kg/month of non-acutely hazardous waste. No RCRA small quantity generators were identified within the 8.5 SMA.

State Lists. The Solid Waste, Groundwater, and UST/AST Site Lists of the FDEP were scrutinized for any potential contamination sites in the 8.5 SMA project area. The following computerized listings were reviewed:

(1) Solid Waste Facilities List- GMS-80 (SWLF). This is a list of active and inactive solid waste facilities, incinerators, transfer stations. No solid waste facilities were identified within the 8.5 SMA.

(2) Petroleum Contamination Tracking System/ Dade County Fuel Spills (LUST). The LUST list is a computer printout that identifies petroleum sites by county with the FDEP tracking number, facility name and identification number. The list provides information concerning cleanup responsibility, Early Detection Incentive Program (EDI) application date, date of field inspection by FDEP or county-contracted compliance inspector, EDI eligibility determination and date. It also indicates the assessment and remediation tasks that have been undertaken for the facility. No leaking underground tanks were identified within the 8.5 SMA.

(3) Stationary Tank Inventory System/ Dade County Underground Tank Report (UST's). The UST list is a computer printout that identifies registered underground petroleum storage tanks. Two registered UST sites were identified within the 8.5 SMA, including Heinl's Nursery, Inc., and EL Backhoe Station. Three 8000-gallon fuel oil tanks were registered at Heinl's Nursery. Apparently, the tanks were removed from the site but a removal date was not reported. The EL Backhoe Station contains one active 1000-gallon fuel oil tank.

(4) Stationary Tank Inventory System-Aboveground (AST's). The AST list is a computer printout that identifies aboveground storage tanks registered with the FDEP. The VISTA search indicated four AST site within the 8.5 mile SMA project area, including Oruga Corp., the South Florida Water Management District, Thorpe Aviation, and Valdes Farms. One 550-gallon unleaded gasoline and one 550-gallon diesel tank were reported at Oruga Corp. Two 10,000-gallon aboveground diesel tanks were reported at the South Florida Water Management District. Thorpe Aviation reports one 1000-gallon aviation fuel tank that has been removed, and Valdes Farms reports a 1000-gallon diesel AST and a 1000 gallon unleaded gasoline AST.

Based on the review of available Federal and State lists, it does not appear that the 8.5 SMA has been directly impacted by hazardous or petroleum wastes or products. The presence of underground fuel tanks within the 8.5

SMA constitutes a potential source for petroleum contamination of the Biscayne aquifer due to its close proximity to ground surface, and the shallow water table.

(5) DERM Site Reconnaissance. A reconnaissance of the 8.5 SMA was undertaken by DERM in 1999 to identify land use activities within the 8.5 SMA on a parcel by parcel basis. The DERM site reconnaissance indicates numerous parcels where unregulated activity is taking place. The activities of concern included numerous properties with abandoned automobiles, abandoned boats, unidentified waste piles, pump stations, outhouses, garage and storage sheds, and numerous animal pens. These land use activities could potentially impact soil, groundwater, or surface water quality in the 8.5 SMA.

3.28 CULTURAL RESOURCES

The 8.5 SMA is located along the eastern periphery of the historic Everglades. There are no known prehistoric or historic period archaeological resources located within the 8.5 SMA. However, according to the Florida Division of Historical Resources (FDHR), there are two known sites positioned on tree islands in the ENP expansion area immediately to the north and west. Site DA85 is a black dirt midden site occupied during the Glades II Period (A.D. 750-1200). Site DA1085 is also a black midden site but was occupied during portions of the Glades I (500 B.C.-A.D. 750), Glades II, and Glades III (A.D. 1200-1500) periods. Both sites are located on the north ends of tree islands.

Prehistoric settlement in the NESRS area occurred on tree islands (usually at the more-elevated northern ends) and consist of black dirt middens. Site size is limited by the areal extent of an island's higher northern tips. Archaeological deposits may be buried as much as 2.0 meters below surface. Human burials are occasionally found within the middens or within isolated solution holes in the oolitic limestone (Carr and Beriault 1984). There are (or recently were) approximately 36 tree islands within the 8.5 SMA, according to a detailed East Everglades vegetation map (Hilsenbeck et al. 1979: Maps 1 and 2). Most of the tree islands are quite small (less than 30 meters in length); however, six of the tree islands are large, ranging between 200 and 400 meters in length. Most of the tree islands were classified as mixed bayhead-tropical hardwood tree islands, which are generally less elevated than tropical hardwood tree islands. There a few small-sized tropical hardwood type tree islands are present within the 8.5 SMA.

SECTION 4

ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

4.1 SUMMARY

The following discussion briefly summarizes impacts to significant environmental and socio-economic features. Sections 4.5 through 4.13 discuss the environmental consequences of each alternative. Table 9 provides a Summary Impact Matrix of Environmental Consequences. The following lists the Alternatives evaluated:

- Alternative 1: Authorized GDM Plan
- Alternative 2B: Modified GDM Plan
- Alternative 3: Deep Seepage Barrier
- Alternative 4: Landowner's Choice
- Alternative 5: Total Buy-out
- Alternative 6B: Western Portion of 8.5 SMA as Buffer
- Alternative 7: Raise all Roads
- Alternative 8A: Western Portion of 8.5 SMA as Flow-way
- Alternative 9: Adaptive Refinement of GDM Plan

Water Quality. Simulations indicate that Alternative 1 is expected to have a moderate impact on water quality. During wet years, Alternative No. 1 could result in the discharge of potentially "impacted" waters to the ENP, although there is insufficient data to determine whether the discharges would be in violation of the 1992 Consent Decree. During the dry year simulation, groundwater flow follows the regional pattern to the southeast, with no apparent impact from the L-31N canal.

Alternatives 2B, 3, 4, 5, 6B, 7, 8A are expected to have minimal impacts on water quality). With Alternative 2B, water would be discharged south to a proposed STA prior discharge into the ENP. Under Alternative 3, the proposed seepage barrier would slightly impede groundwater movement toward the east during both wet and years, although some buildup of water on the west side of the barrier is expected. Under Alternatives 4, 5, and 7, groundwater elevations are expected to rise but have little impact on water quality, largely due to the removal of septic fields and agriculturally related contaminants. With Alternative 6B, because surface runoff will be passed south to a proposed STA prior to discharge to ENP, and the extent of developed lands reduced in size, water quality impacts are expected to be low. Water quality impacts under Alternative 8A are also anticipated to be minimal because of reduced contaminant loads resulting from treatment within with the flow-way.

Alternative 9 is anticipated to have moderate impacts during the initial phase (when waters are being passed north along the L-31N Canal) and low impacts during the subsequent phase (when waters are being directed to the new STA).

Wetland Area Changes. Changes in the spatial extent of wetlands were determined for each alternative using hydrologic modeling. Wetland area declined between 2,869 and 2,538 acres compared to existing conditions (95 operations) for structural alternatives (1, 2B, 3, and 9). This reduction appears to be a result of reduction of hydroperiods in the vicinity of levee's and canals. Alternatives 4, 5, and 7 resulted in an increase in wetland area (1,404 ac.). These non-structural options do not incur the impacts of drydown associated with structural options requiring levees and canals.

Listed Species. Adverse effects to listed species, including the eastern indigo snake, snail kite, wood stork, Florida panther, and Cape Sable seaside sparrow are not anticipated. However, additional biological evaluations for the Florida Panther, eastern indigo, and CSSS are will be performed following the selection of a preferred alternative, an included in the Final SEIS.

Farmlands. Unique farmland is any land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, fruits, and vegetables (7U.S.C. 4201(c)(1)(B)). According to the NRCS district conservationist, most of the 8.5 SMA qualifies as unique farmland. Alternatives 3, 4, 5, 6B, 7, and 8A will involve between 2,642 and 1,136 acres of unique farmland depending on the alternative (see Table 9). Alternatives 1, 2B, and 3 will not impact unique farmland.

Cultural Resources. Adverse effects to significant cultural resources (archaeological and historical) are not anticipated. Field investigations reveal an absence of National Register-eligible resources within the 8.5 SMA.

Cost. Structural alternatives, (1, 2B, and 3) are the least costly alternatives ranging between approximately $39 million (Alternative No. 9) and 30 million dollars (Alternative No. 1). Alternative No. 3 requires a seepage barrier and is estimated to cost in excess of $240 million dollars. All other alternatives require either total or partial land acquisition, or purchase of flowage easements, and range in cost between $179 million (Alternative No. 5) and $132 million dollars (Alternative No. 4).

Relocations. Estimated residential relocations are greatest for alternatives 5 (buyout) and 6, (208 and 143 respectively). Alternatives 1, 2, and 9 (structural alternatives) each require only one residential relocation and zero (0) commercial relocations. Alternative No. 5 (buyout) requires approximately four commercial relocations while alternatives 3, 4, and 7, require approximately four and Alternative 8A approximately three. Actual numbers will vary and are dependent on landowner's choice (Alternatives 3, 4, and 7) and cost benefits compared to fee simple costs.

4.2 GENERAL

There are three major sources of information used in the analyses presented in this section: (1) hydrological and hydrogeological simulations from the MODBRANCH Model as generated by the USACE-Jacksonville District's Geotechnical Branch; (2) the draft of the USFWS Coordination Act Report (CAR); and (3) a socio-economic analysis performed by HDR. The modeling output provided the basis for the analysis. The CAR and the socio-economic report were based on the modeling results.

4.3 SPECIFIC SOURCES OF INFORMATION

Details on the three primary information sources are provided below.

MODBRANCH Simulations. Potential environmental consequences of the alternative plans were primarily based on the simulations generated by the MODBRANCH model. MODBRANCH was first developed to evaluate flow and seepage within the canal systems of south Florida. Details on model assumptions, boundary conditions, climatic conditions, and project conditions are presented in Section 4.4 below.

Socio-Economic Analysis Report. This report examined potential effects of the alternative plans on land use patterns, residential and business relocations, and environmental justice. In addition to the modeling output, this report utilized data from the U.S. Census Bureau, unpublished information from a late-1999 land use survey conducted by Miami-Dade County's Department of Environmental Resource Management, and information provided by 8.5 SMA residents.

Coordination Act Report. The Department of Interior has prepared a "Draft Fish and Wildlife Coordination Act Report for the Modified Water Deliveries to Everglades National Park, Florida, the 8½ Square Mile Area General Reevaluation Report and Supplemental Environmental Impact Statement" from NPS and FWS, dated 30 March, 2000. It should be noted that the basis of this DOI comparison is different from the USACE's analysis. The difference is that the USACE's basis (Without Project Condition) is the currently authorized flood mitigation feature (Alt. 1), and the DOI basis of analysis is a theoretical "fully restored condition". The views and recommendations contained in the report are reproduced below (USFWS 2000: 89-95):

Results from the analysis of the performance measures for each of the 8.5 SMA project objectives are detailed in Chapters 5 through 7. A brief narrative of the relative performance of each of the alternatives is provided below. Figures for the structural alternatives in this chapter show differences in water depth between each alternative and the predicted

restored water levels. The data used in the figures were produced by subtracting the water depth at each model cell for an alternative from the restored water depth. Positive numbers (greens) represent areas where the restored water level is higher than the alternative and negative numbers (pinks) represent areas where the alternative caused higher water levels than restored conditions.

Alternative 1

Alternative 1 performed poorly for all of the legislative requirement hydrologic performance measures. This alternative lowers water levels in both the 8.5 SMA and in NESRS (Figure 33) [reproduced in Appendix G] that negate some of the benefits that could be derived from the MWD Project. It also does not provide full structural flood mitigation. In terms of the other objectives, the plan does not provide flood protection and is least compatible with future restoration. The plan performed poorly for wood storks and snail kites and had a WRAP score that reflected a loss of 2,765 functional units from existing conditions.

Alternative 2 [Alternative No. 2B]

Alternative 2 [Alternative No. 2B] performed poorly in the legislative requirements performance measures related to restoration of NESRS, decreasing water depths in more than 35,000 acres in NESRS. The plan provided full structural mitigation. In essence, the plan mitigates for increased water levels by reducing water levels in both the 8.5 SMA and NESRS (Figure 34) [reproduced in Appendix G]. In terms of the other hydrologic performance measures, Alternative 2[B] does not provide flood protection, but does increase the spatial distribution of short-hydroperiod wetlands by draining long period hydroperiod wetlands in ENP. It does not provide flood protection to the 8.5 SMA. It is more compatible with future restoration than Alternative 1 because it would move water to the south, but is still less compatible than other alternatives. Because residents of the 8.5 SMA would be allowed to remain, this alternative would provide the perception of flood protection. However, neither adequate flood mitigation nor protection would be provided. The alternative performed poorly for wood storks and snail kites. The WRAP score reflected a loss of 2,765 functional units from existing conditions. Thus, as with Alternative 1 Alternative 2[B] would result in a loss of functional wetlands if implemented.

Alternative 3

Alternative 3 performed poorly in the legislative requirement hydrologic performance measures pertaining to flood mitigation. It does not provide full structural flood mitigation to more than 4,000 acres within the 8.5 SMA.

Alternative 3 performed well in the re-establishment of hydropatterns in NESRS, increasing water depth over 12,000 acres in NESRS (Figure 35) [reproduced in Appendix G] and performing best for snail kite habitat. For the hydrologic performance measures associated with the other project objectives, the plan ranked high in terms of providing short hydroperiod wetlands, but investigation into the wood stork performance measures demonstrated that the abrupt change from shallow to deep water at the seepage wall boundary would create unnatural drydown patterns and abrupt reductions in stork feeding habitat during the breeding season. It would not provide flood protection to the 8.5 SMA. The permanent nature of the seepage barrier, its placement in the historical flow path, and the likelihood of increased flooding due to relocation of S–356 caused the plan to perform poorly in regards to future restoration. Alternative 3 had a slightly better WRAP score than either Alternative 1 or 2[B], but its implementation would still result in a net loss of 1,175 functional units from existing conditions.

Alternative 4

Alternative 4 performed well in all of the legislative requirement hydrologic performance measures. Full flood mitigation would be achieved through buyout, flowage easements, and life estates. No reductions in hydroperiods or water levels would occur in NESRS. In terms of performance for the other objectives, the plan would be less superior in providing for short hydroperiod wetlands. Damages due to flooding would not occur due to acquisition of the area. This alternative is considered more compatible with future restoration than the structural alternatives, but would be less compatible than full buyout because the residents might experience an increase in flooding due to relocation of S–356. Performance was high for wood stork habitat and moderate for snail kite. Wrap scores for Alternative 4 were the highest of all alternatives evaluated by the procedure. Implementation of this alternative would result in a net gain of 2,248 functional units from existing conditions.

Alternative 5

Alternative 5 performed well in all of the legislative requirement hydrologic performance measures. Full flood mitigation would be achieved through buyout. No water depth or hydroperiod reductions would occur in NESRS. In terms of the performance of the other project objectives, the plan would be less superior in providing for short hydroperiod wetlands. Damages due to flooding would not occur due to acquisition of the area. It is considered more compatible with future restoration than structural options because there would be full flexibility in relocating S–356. Most importantly, restoration of the peripheral wetlands (Figure 9) [reproduced in Appendix G] that were once found in the 8.5 SMA would allow for the full ecological

function to be restored and prevent loss of critical landscape remnants. Performance was high for the snail kite and wood stork. As with Alternative 4, this alternative also had a WRAP score that reflected a net gain of 2,248 functional units from existing conditions.

Alternative 6B

Alternative 6B reduces the spatial extent of lower water levels in NESRS by moving the canal and levee alignment to the east, but it still would reduce water depth over 8,000 acres in NESRS, reducing habitat for the endangered snail kite (Figure 36) [reproduced in Appendix G]. Limiting the protected area to the higher elevations in the 8.5 SMA would allow attainment of full flood protection. In providing 1-in-10 year flood protection to the residents, development is expected to increase and the any future projects related to restoration would have to maintain that level of flood protection. This may require increases in pumping to accommodate the relocation of S–356. This increased pumping would cause additional reductions in water depths in NESRS and additional losses of snail kite habitat. Once this 1-in-10 year flood protection is provided, there would be no potential for restoring water levels to the historic peripheral wetlands in the 8.5 SMA (Figure 9) [reproduced in Appendix G]. Performance was moderate for snail kites. The WRAP score for Alternative 6B suggests implementation of this alternative would result in a net gain of 1,606 functional units.

Alternative 7

Alternative 7 performs well in that no reductions would occur in water depths or hydroperiods in NESRS. Structural flood mitigation would not occur under this alternative because residents would most likely incur more flooding as a result of raising the roads, particularly if the roads are not constructed with adequately sized culverts. The area would not receive flood protection and would be vulnerable to increases in water levels due to relocating S–356. DOI does not consider this alternative reasonable in that raising the roads, in kind, without providing for secondary drainage is at best a temporary remedy and at worst, would cause increased flooding due to the higher retention depths of the roads. Performance was moderate for the snail kite and wood stork. The WRAP score indicates a net gain of 1,290 functional units from existing conditions would occur with implementation of this alternative. All of the improvements to wetland function for this alternative, however, would be confined to ENP. The WRAP score for Alternative 6B suggests implementation of this alternative would result in a net gain of 1,209 functional units.

Alternative 8A [Alternative No. 8A]

Alternative 8 [Alternative 8A] would not significantly impact restoration in NESRS, but it also would not provide structural flood mitigation to most of the 8.5 SMA (Figure 37) [reproduced in Appendix G]. It would not provide flood protection, but would provide for increases in short hydroperiod wetlands. It would be more compatible with restoration due to the minimum of structural components and the orientation of enhanced flow paths and levees along natural flow-paths. Performance was moderate for both the snail kite and wood stork. The WRAP score indicates a net gain of 2,240 functional units from existing conditions would occur with implementation of this alternative. The creation of the flow-way within the western portion of the 8.5 SMA would allow for the creation of functional post-project wetlands.

Alternative 9

Alternative 9 would perform similarly to Alternative 2 [Alternative 2B].

4.4 METHODOLOGIES FOR DETERMINING EFFECTS

The primary component of change in the evaluation of alternatives is the Hydrologic and Hydrogeologic Model. Thus, the determination of environmental impacts that result from the implementation of the model is the primary tool in the analysis process. It is important to understand the model that is used, the assumptions made and the model results. The USACE completed the simulation model for the 8.5 Square Mile Area (8.5 SMA). The model input and output datasets have been reviewed by the various cooperating agencies. A brief discussion or introduction to the model utilized in the simulation is provided below and the conditions that are being evaluated are discussed.

In addition to the hydrologic/hydrogeologic modeling, a suite of geographic information systems (GIS) softwares (ArcView 3.2, ERDAS Imagine 8.4, and pcARC/INFO 3.52) played a key role in the analysis of impacts. GIS was used to manipulate a wide array of GIS datasets, digital aerial photography, and associated databases, and was instrumental in identifying and quantifying spatial impacts of the various alternatives on a wide range of environmental and socio-economic resources in the 8.5 SMA.

4.4.1 Introduction to the Hydrologic/Hydrogeologic Model

The model that has been selected for use in the evaluation of the alternatives for the 8.5 SMA is the MODBRANCH Model. This model is a coupling of two models developed by the United States Geological Survey (USGS), MODFLOW and BRANCH. The model allows both surface and ground water interactions to be simulated by the coupled BRANCH and USGS modular, three-dimensional, finite-difference ground-water flow

(MODFLOW) models, referred to as MODBRANCH. MODFLOW simulates steady and non-steady flow in an irregularly-shaped flow system in which aquifer layers can be confined, unconfined, or a combination of both. BRANCH simulates steady or unsteady flow in a single open-channel reach (branch) or throughout a system of branches (network) connected in a dendritic or looped pattern by solving the one-dimensional equations of continuity and momentum for the river flow. Channel-aquifer flows are leakage through a confining layer or riverbed. Computation of the leakage in the ground water and surface water systems allows these processes to be coupled for simulation purposes.

The ground water flow equation is solved using the finite-difference approximation. The BRANCH model uses a weighted four-point, implicit, finite-difference approximation of the unsteady-flow equations. A leakage term has been added to the equations in the BRANCH model and was coupled through the leakage quantity to the MODFLOW-96 model.

In order to use MODFLOW, initial conditions, hydraulic properties, and stresses must be specified for every model cell in the finite-difference grid. BRANCH input data consist of channel geometry and initial flow conditions defined at all cross-section locations and boundary conditions defined at channel extremities. Primary output from the ground water computational portion of the model is head or water surface elevation. Other output includes the complete listing of input data, drawdown, and water budget data. Time series of computed surface-water flow results can be obtained from the model. Model output, including discrete flow results at every time step or iteration; daily summaries of minimum, maximum, and average flow conditions; monthly flow-volume summaries; hydrograph plots of computed water levels or discharges or comparative plots of computed results versus measured data has been used in the evaluation of the alternatives for the 8.5 SMA.

4.4.2 Model Setup

The MODBRANCH model was used by the USACE in the evaluation of the alternatives. This model was originally developed to evaluate flow and seepage within the canal systems of the southern Florida area including the 8.5 SMA. In general, the model covers an area roughly bounded on the west by the middle of the state, the north by the Tamiami Trail (US 41) and the east and west by the Atlantic Ocean. Thus, the simulation model covers the eastern half of the everglades and much of the C&SF area.

The model consists of approximately 28,700 nodes. Each of the nodes within the model represents a specific hydrologic unit or area within the flow grid. Figure 3 of Appendix A (Hydraulic and Hydrogeologic Model Report) depicts the model flow grid network. Each of the nodes is coded

with hydraulic properties such as conductivity, leakance, and flow potential. The model, once developed, was calibrated to insure that it accurately depicts surface water and ground water flow conditions.

4.4.3 Modeling Parameters/Assumptions

Hydraulic and hydrogeologic simulation models are based on mathematical equations that are used to represent or simulate "real world" conditions. To accomplish this simulation it is necessary that the conditions that drive the model simulation be developed and understood. The conditions which drive this model include Boundary Conditions, Operational Conditions, Climatic Conditions and finally Project or Alternative Conditions. Each of these conditions is described below.

Boundary Conditions. The boundary conditions for the simulation model represent those conditions found at the limit of the model confines. For the purposes of the simulations, model boundary conditions are necessary along the western, northern, and southeastern boundaries of the model. The model boundary conditions on the western and southeastern borders, because of their distance from the 8.5 SMA and their relatively static nature, are of less concern to the model than the northern boundary. The northern boundary, located approximately along the geographic location of Tamiami Trail, on the other hand, is a critical boundary condition. Its criticality is due to its location in respect to the 8.5 SMA and its significance as a location for flow to enter NESRS. For the purposes of the simulation, therefore, the boundary conditions for the north boundary is critical in the simulation of alternative effects.

Three boundary conditions were incorporated in the evaluation of the alternatives. These conditions include: (1) Base 83, (2) Base 95, and (3) Modified Water Deliveries (MWD) or what is known as D13R. Each of these boundary conditions is discussed below.

Base 83. Base 83 conditions represent the hydrologic conditions that were in effect at the time of the authorization of the 1992 GDM plan. Reflection of this Base83 boundary condition is critical to the model and the evaluation of alternatives. Since this boundary condition is that which was in effect at the time of the authorization of the project, it represents the pre-MWD conditions (before any portion of, or modification to, the MWD project was implemented).

Base 95. This represents the conditions along Tamiami Trail as they exist today. That is, these model boundary conditions reflect the conditions that are generally in effect based on the Experimental Water Deliveries Program's operating conditions authorized in 1995. The simulations using these conditions can be used to evaluate current (1999-2000) conditions

and allow engineers and scientists to determine the hydrobiological impacts of the experimental conditions in terms of water flow, water elevation and ecological factors.

MWD Full Implementation (D13R). The implementation of, and modifications to, the MWD project that have been ongoing since the completion of the GDM in 1992 are critical to the evaluation of the impact of alternatives. The simulation model represents the projected conditions along Tamiami Trail in the future with the MWD project in place. That is, the projected flows, water elevations, and other factors that represent how the boundary of the model will see the hydrology of the area are included in the model.

Operating Conditions. The C&SF system and all of the other structures and facilities that control flow to the eastern portion of the Everglades and southern portion of Dade County have rules which govern their operation. Based on many factors including climate conditions, antecedent moisture conditions, water elevations, quantities of flow, and consumptive use needs, the operation of various pumps, gates, and other water control structures are modified. The model has developed several sets of operating procedures intended to accurately simulating the impact of operational changes in the region. Thus, the operating procedures represent how the entire flow control system is operated for a specific scenario. Two operating conditions are recognized in the modeling: 1983 operating conditions and 1995 operating conditions. A third operating condition that includes a facsimile of the C-111 project has also been developed.

Flexibility. Operations of facilities, as discussed above, are governed by various performance rules. These rules specify the conditions that warrant certain operational procedures. Pumps are started and stopped, gates are opened and closed, and facilities are manipulated to move water from place to place and to keep water surface elevations at an appropriate level. The rules are to be considered guidelines. The implementation of these operational rules typically requires physical involvement of SFWMD staff. Thus, depending on staff availability, implementation of the criteria spelled out in the rules are not as rigid as might occur if all facilities were operated by electronic decision making equipment. This is not to say that the operational rules are not followed. Rather, the specific implementation of the operation rule is given some flexibility.

An example of this flexibility may be the operations of a typical pump station. The rules for this hypothetical pump station may call for pumping to begin when the water surface in one area reaches a specified elevation. Pump startup requires an individual to physically be in the pump house to open the gates and begin pump operation. If the manning staff is not present at the exact moment that the water reaches the pump initiation

level the water may be somewhat higher than specified in the rules. Conversely, when water levels have been brought down to a level where the rules call for the cessation of pumping, the pump station staff may not be immediately available. The results may be a lowering of water surfaces on the in-take side to lower levels than the rule specifies. This pump station was operated in accordance with the rules, just with some level of flexibility.

The operational procedures used in the model are specified exactly in the model code. Thus, in our example above, if the model is supposed to simulate that same pump station coming on when the water gets to a certain specified level, it happens. Similarly, at the exact model time step that the intake elevation reaches the pump stop elevation, the pump stops. The simulation model, thus, allows for no flexibility in operating plans.

1983 Operating Procedures. This operational procedure represents the authorized canal levels and operations prior to the implementation of the MWD or the Experimental Water Deliveries Program. Thus, this operation scenario can be expected to simulate the conditions in place prior to MWD authorization or implementation.

1995 Operating Procedures. The 1995 operational procedure reflect system facility operation in a similar manner as it was operated in 1995. This operational procedure is similar to that which is being used today.

C-111 Rules. The C-111 project calls for the placement of water control features south of the 8.5 SMA. These features are to serve a two-fold purpose. They are to be designed and constructed to facilitate continued agricultural practices in the South Dade Agriculture Areas. They are also being designed to aid in the management of the hydrology within the park. Model simulations for the future conditions must be made assuming that the C-111 project is constructed and operational. In general, the location of facilities has been determined for the planned C-111 improvements. However, as of this writing, the operational rules have not been developed or approved for this project. Therefore, a set of general assumed operating conditions were developed for the C-111 portion of the simulation model grid.

Climatic Conditions (Precipitation). The rainfall that occurs is one of the primary driving forces of the regional hydrology. For the purposes of model simulation, actual observed rainfall data is used as the basis for the evaluation. Two years of rainfall data has been developed for the simulation representing both a typical wet and dry year.

1989 – Dry Year. The 1989 rainfall is considered to be a dry year for the purposes of this evaluation. Thus, the effects to the system of lower-than-

average rainfall can be assessed and the impacts of each alternative quantified.

1995 – Wet Year. In contrast to the 1989 precipitation, 1995 is considered to be a wet year. Thus, the simulations in the model utilizing the 1995 rainfall can be expected to produce results similar to that expected for a wet year rainfall. In addition, the 1995 rainfall dataset has been modified to include a hypothetical one-in-10-year rainfall event. This event, introduced in Week 16, allows for surcharging of the surficial aquifer levels to account for a major early season storm and then allows the remainder of the 1995 wet year rainfall to depict relatively severe conditions. It is necessary to include this hypothetical storm for design purposes. That is, the inclusion of the hypothetical 1-in-10-year rainfall into an otherwise typical wet year produces an extreme condition. Designing facilities for this extreme condition will assure that the relatively modest events that are typically expected can be accommodated.

Project Conditions. Project conditions are those conditions that are used in the model simulation to equate to the hydrologic conditions based on the period of implementation for the simulations. The project conditions are dictated based on what each simulation is designed to evaluate. For this study, five project conditions were developed that span the spectrum of project conditions to be evaluated. Additional simulations using other project conditions have been completed by the USACE modeling team to meet the needs of the various cooperating agencies and end-users.

Base 83. The Base 83 condition assumes stage and flow conditions and operations as they existed prior to the MWD project. The Base 83 condition provides the basis for determining whether the impacts of additional flooding in the 8.5 SMA due to implementing the MWD project, as required in the Everglades National Park Protection and Expansion Act of 1989, has been sufficiently mitigated. The water surface elevations resulting from the Base 83 condition were compared to all alternatives to insure that this requirement is achieved.

Base 95. In the period of time that has elapsed since the formulation of 1992 GDM, significant changes to the water conveyance system for the Everglades and south Miami-Dade County have occurred. To account for the additional conveyance systems that have come online, the Base83 condition had to be modified. The condition that includes the modifications to the system that is in effect today is termed Base 95. This Base 95 condition assumes water stage, flow conditions, and operations as they currently exist. This existing condition simulation forms the basis to which impacts of each alternative are measured.

Base 83 Future Without Project. The Base 83 future without project condition is considered to be the scenario wherein the MWD project will be implemented with C-111 in place and the Authorized Plan (Alternative 1) will be constructed. Typically, the development of an EIS and GRR calls for the analysis of the future conditions without project. This normally equates to a future condition with a "do-nothing" alternative. In the case of this work effort, the "do-nothing" alternative is the construction of the Authorized Project.

The simulation model therefore must depict the scenario whereby the Authorized Project had been constructed to determine its impacts. An evaluation of this scenario was presented in the 1992 GDM. However, the simulation tool currently being used for this evaluation is significantly improved over the "Two by Two" model used previously. Thus, for this scenario, the Base 83 - Future Without Project condition assumes that the system is operating according to the 1983 operations with both the MWD project and C-111 in place and the Authorized Plan constructed.

Base 95 Future Without Project. Once the Base 83 future without project conditions is simulated, there is the need to bring those same improvements to existing conditions. As stated above, the Base95 conditions equate to the conditions that are currently in effect within the modeling region. To simulate the "without project" conditions the Base 95 conditions have to be modified to include the MWD and C-111 projects, along with the Authorized Plan. The Base 95 future Without Project is the basis against which all of the alternatives will be compared.

Future With Project. The "future with project" conditions assumes that the MWD project will be implemented and the system is operating according to the 1995 operations with C-111 in place. Each of the other eight alternatives (Alternatives 2B through 9) are simulated for comparison back to Base95 future without project conditions.

Hydrological Effects of Structural and Operational Alternatives. Hydrologic and hydraulic models are designed to simulate real world conditions. Model output has been provided by the USACE that displays the results of the simulation based on a grid-cell by grid-cell representation. To aid in the evaluation of impacts to the 8.5 SMA and the ENP, information on water levels, flows, inundation, and mitigation have been developed and provided. Additionally, ecological information including an estimation of marl-forming short-hydroperiod and peat-forming long-hydroperiod wetlands, endangered species habitat areas, flow to and storage within the ENP have been developed.

As with any mathematical simulation model the validity of the input data used in the model and the assumptions used to drive the simulation are the

critical components for accurate system depictions. The USACE recently completed a draft calibration report for the model used in this study. Based on discussion with the report author, the base model shows good correlation with the historic hydrologic conditions.

4.4.4 Water Quality

The methodology for determining water quality impacts due to the implementation of alternatives is purely qualitative, utilizing groundwater and surface water flow patterns to determine the potential migration pathways of any chemical contaminants or biological constituents. All potential contaminant migration is assumed to be advective, that is, the migration of a potential contaminant flows at the rate and direction of groundwater or surface water drainageway. Since the aquifer is unconfined within the 8.5 SMA, groundwater may sometimes breech the surface during wet periods. No effects due to dispersion or sorption of specific constituents were considered in the water quality alternatives evaluation, although some pesticides/herbicides such as DDT, DDE, or DDD, are detected more frequently in sediment due to their sorptive capacity.

The hydrologic/hydrogeologic modeling performed by the USACE for each alternative was utilized to determine how the elevation and direction of groundwater/surface water flow would be affected by the implementation of each alternative. The USACE created contour maps of simulated head data for week 26 of both the wet (1995) and dry (1989) years for each alternative (Figures 16 through 22). The contours would represent surface water if groundwater breached the surface. These maps were utilized to determine shallow flow patterns within and in the vicinity of the 8.5 SMA. Water would flow from high to low elevation, as depicted by the arrows on each figure. Deeper waters within the Biscayne aquifer would not be affected by shallow canal structures (depths approximately 15 feet below surface). Each alternative is compared to base 1995 conditions.

4.4.5 Wetland Resources

The effect on wetlands as a result of altered hydroperiods and water elevations was approached in two ways, one facilitated by the FWS and the other by the USACE. The FWS used the Wetland Rapid Assessment Procedure (WRAP) as a tool to compare the change in wetland function within the 8.5 SMA and an adjoining area approximately two miles into the ENP. The USACE utilized topographic data and hydrologic modeling to estimate the losses and gains of wetlands within the same area of potential effect.

Marl prairie short hydroperiod wetlands, for the purposes of this study, were defined as any wetland that has a hydroperiod ranging between 30 to

180 days (one to six months, based on an average 1989 - 1995 operating conditions. The water table of short hydroperiod wetlands does not recede greater than –1.0 foot NGVD for more than 30 consecutive days in the driest years, and does not exceed +2.0 feet NGVD for 30 consecutive days in the wettest years. In order to evaluate the areal extent of wetlands for different alternatives, contour maps were prepared of pertinent water levels. Hydrographs of key indicator cells were reviewed and analyzed to discern differences between alternatives. Then, a custom Fortran program was utilized to determine which model cells would be defined as non-wetlands, short hydroperiod wetlands, or long hydroperiod wetlands.

The FWS, in conjunction with the ENP, SFWMD, and HDR prepared a map of wetlands for the study area as defined above. Wetland categories include Forested Wetland-ENP, Long Hydroperiod Wetland-ENP, Short Hydroperiod Wetland-Graminoid, Herbaceous Wetland-Low to Moderate Soil Disturbance, Herbaceous Wetland-High Soil disturbance, Shrubby Wetland, Forested Exotic, Forested Native Wetland, Upland Forest Shrub, and Agricultural/Residential (definitions are provided in Section 3 of this report). Representative wetland sites of each wetland type was "WRAPed" by the WRAP. The WRAP team consisted of representatives for the FWS, ENP, USACE, and DERM. Hydroperiod contour mapping generated from hydrologic models were then used to WRAP each wetland type under the future conditions for each alternative. Wetland acres for each condition were multiplied by the WRAP score for each wetland type, resulting in functional units. The functional units are then used to evaluate each alternative.

Land Management . Alternatives which result in land acquisition necessitate the consideration of restoration and management to enhance, to the extent reasonable, ecological functions. Based on input from the ENP and FWS, it was determined that land purchased that is below elevation 6.5 feet would not require re-contouring. It is assumed that increased hydroperiods resulting from plan implementation would serve to effectively reduce the future establishment of exotic species. Between elevations 6.5 feet and 7.0 feet non-wetland areas (primarily agricultural and residential land uses), removal of approximately 0.5' of soil is recommended to achieve a final elevation that would promote the establishment of desirable hydroperiods and wetland communities. Above elevation 7.0 feet land cover is predominantly upland, and management for wetland resources is not prudent.

Areas purchased and currently dominated by exotic woody vegetation (e.g., Brazilian pepper, Australian pine) will require clearing and grubbing. These areas as well as disturbed herbaceous wetlands (e.g., marshes that support exotic species) will require longer-term management using techniques such as controlled burns and site-specific chemical treatments.

Detailed cost summaries for land restoration and management are presented in Appendix C.

4.5 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 1

4.5.1 Hydrological Effects of Structural and Operational Alternatives

Alternative No. 1 (the future without project alternative) generally consists of a perimeter levee, seepage canal, and interior levee, which follows the northern and western boundaries of the 8.5 SMA. Proposed pump station S-357 is located at the northeastern terminus of the seepage canal adjacent to the L-31N canal.

Model simulations of existing conditions indicate that during the wet season water elevations may occasionally be above ground surface elevations, especially in the western portion of the 8.5 SMA. Alternative No. 1 allows water levels in the ENP Expansion Area to be raised in an effort to meet Natural Systems Model recommended elevations. Alternative No. 1 provides flood mitigation for the entire 8.5 SMA, except for a small area on the eastern boundary adjacent to the L-31N canal. The lack of mitigation in this small area is not considered significant because of its size and elevation change (maximum approximately 0.4 feet). Most importantly, though, the water level is below ground surface. That is, the change in water level elevation in this small area actually occurs below land surface in an area of the highest topography within the 8.5 SMA.

Another important hydrological effect of Alternative No. 1 is its beneficial effect on the NESRS area. Figure 110 of Appendix A shows the duration of continuous inundation based on wet weather conditions. Figure 112, also from Appendix A, shows that the time of inundation in NESRS is increased dramatically. One indicator cell in NESRS shows that the duration of inundation has increased from 113 days in existing conditions to 364 days with Alternative No. 1. This can be expected because seepage flow through the perimeter levee is pumped to Canal L-31N where it flows to the north and re-enters the park. Conversely, however, continuous inundation southwest of the 8.5 SMA is reduced significantly by this same transference of water. The environmental significance of this change in flow patterns is discussed in Section 4.5.3 of this report.

- ***4.5.2 Regional Water Supply***

The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield, located approximately 11 miles northeast of

the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5 SMA, the proposed alternatives will not impact regional groundwater supplies.

- ***4.5.3 Water Quality***

Base 95 conditions for the wet year (1995) show groundwater flow predominantly to the southeast across the 8.5 SMA from the ENP (Figure 16). Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east. Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP during the wet year appear minimal for the existing condition.

Implementation of Alternative No. 1 for the wet year (based on the model simulation) results in water from the ENP flowing to the southeast toward the 8.5 SMA, with shallow waters intercepted by the proposed seepage canal on the western edge of the 8.5 SMA (Figure 17). Shallow groundwater

from the western portion of the 8.5 SMA will also flow toward the west to the proposed canal. This water would discharge to L-31N canal and then be moved into the L-29 canal via proposed structure S-356. The water would eventually be discharged to the ENP from the L-29 canal. Alternative No. 1 could result in the discharge of potentially "impacted" waters to the ENP, although the extent of the "impact" cannot be quantified. Structure S-357 would be considered a point source, which would have to be addressed during permitting. During the dry year simulation, groundwater flow follows the regional pattern to the southeast, with no apparent impact from the L-31N canal.

- ***4.5.4 Upland Vegetation***

Inventories of existing conditions in the project area revealed that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland species. Therefore native upland resources are not an issue of concern.

4.5.5 Wetlands

Assessments presented in the draft Coordination Act Report (CAR) prepared by the FWS and ENP concluded that this alternative creates a "hydrologic edge effect," impacting wetlands near the levee and seepage canal and within ENP. This edge effect would likely cause long-term dry downs to these wetlands during project operations, ultimately resulting in diminished hydroperiods. Shorter hydroperiod wetlands would likely result in

functional loss to short hydroperiod wetlands, and an increase in the potential for frequency of disruptive fires, encroachment of woody vegetation, and further persistence of exotic species.

Long hydroperiod marl prairie wetlands proximal to the levee and canal also would demonstrate functional changes, shifting from the existing vegetative composition to a short hydroperiod community. Forested exotic wetlands should experience no effect from this alternative because the project's features and functions would neither benefit nor hinder ongoing management practices.

WRAP scores for wet and dry season conditions were averaged to calculate a single Functional Units score by habitat type. Results of the WRAP analysis suggest a loss of 2,765 Functional Units (1,127 in ENP and 1,638 within the 8.5 SMA) compared to existing conditions.

Dry down associated with the levee and canal appear to result in the reduction of short hydroperiod marl prairies. Data indicate a reduction of 4,281 acres of this habitat within the area of potential effect while long hydroperiod (peat forming) marl prairie increases by 1,743 acres It is estimated that this alternative results in a total reduction of 2,538 acres of wetland. Tables 10 and 11 provide summary data. Figure 24 depicts the spatial extent of the various habitat types as well as hydroperiod maps.

Approximately 345 acres of wetlands will be directly affected as a result of levee and canal construction. The majority of these impacts (336.1 ac.) are graminoid wetlands below the 7' contour. Aquatic habitats associated with the proposed canal were not assessed by the WRAP team.

4.5.6 Fish and Wildlife

Increases in water depth and hydroperiod throughout the area of potential effect that improve wetland functions will benefit fish and wildlife resources over time. For this alternative, the construction of a canal will also provide an aquatic habitat for fish and wetland dependant species. Natural areas to the east of the proposed levee and canal are generally in a degraded condition (fragmented by roads and exotic species invasion) and provide only moderate habitat to wildlife resources. Habitat quality is expected to continue to degrade east of the levee as anthropogenic activities increase over time.

4.5.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Snail Kite. Snail kites are likely to find more abundant food sources west of the 8.5 SMA in slough areas where water levels are higher. Increases in water depth would likely improve the conditions necessary for apple snails, the snail kite's principle food source. Increased water depths indicated in the modeling data are likely to increase foraging areas for Snail kites. According to the model, the size of suitable habitat is roughly twice the area in wet years as during dry years. The FWS CAR does not identify non-beneficial impacts to the Snail kite.

Wood Stork. Wood storks benefit from seasonal dry-downs to concentrate their food sources into pockets of water, especially during the breeding season. Foraging areas do presently occur in the area of potential effects. Increases in water depths during wet years in the 8.5 SMA and NESRS would encourage the stork to fly elsewhere to a better food source. However, since storks are highly mobile and other foraging areas are available, this alternative will not likely have a significant effect on the Wood stork's feeding area or current breeding cycle.

Cape Sable Seaside Sparrow (CSSS). A Biological Assessment will be prepared for the selected plan (preferred alternative) and incorporated the Final SEIS.

4.5.8 Socio-Economics

Land Use. A detailed discussion of the socioeconomic impacts associated with Alternative No. 1 is provided in Appendix E.

As shown in Table 12, the footprint of Alternative No. 1 exclusively uses publicly owned vacant land (approximately 663 acres) (see Figure 3 in Appendix E). Minimal land use impacts will occur near the southeastern portion of the 8.5 SMA due to the increase in the amount of land above the 10-year flood elevation (7.7 ft NGVD). Currently, only 574 acres of the 8.5 SMA are located above the 10-year flood elevation. With the implementation of Alternative No. 1, an additional 60 acres of land will be rendered above the 10-year flood elevation (Figure 3 in Appendix E). Therefore, there would be a total of approximately 634 acres of land above the 10-year flood elevation. Assuming the development of all privately owned vacant and agricultural lands, approximately 592 acres of the land above the 10-year flood elevation could potentially

be developed for residential uses at a density of 1 unit per 5 acres, with a variance from Miami-Dade County. These lands would accommodate only a portion of the anticipated population growth within the area (118 of the 174 houses needed during the projection period).

If this extent of development were to occur in the area, approximately 547 acres of agricultural lands would be lost to residential development. Utilizing the average annual agricultural income per acre in Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $1.3 million. Assuming the existing estimated mix of residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $0.5 million, with the remainder being lost to non-residents.

The above analysis assumes that the zoning ordinance will be enforced. However, the County has not currently been enforcing the residential density of the 8.5 SMA. The average residential density for the 8.5 SMA area is approximately 1 unit per 3.65 acres rather than the 40 acres specified by the ordinance. Assuming that Dade County will continue not to enforce the density ordinance, there would not be any project induced growth within the 8.5 SMA, since vacant and agricultural lands are available to accommodate the projected future growth of the population. Further, since there are sufficient vacant lands to accommodate future growth for this scenario, no loss of agricultural production is anticipated.

Relocations. Under the original authorized GDM Plan, the USACE purchased 663 acres of land on the western boundary of the 8.5 SMA. The acquisition of this land resulted

in one residential relocation. The total land acquisition cost was $2.4 million and $28,000 for the one residential relocation.

Based on the existing land use of the 8.5 SMA, no additional residential, business, or agricultural lands will be required to construct this alternative. Therefore, there will be no additional relocation of residents associated with Alternative No. 1.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific income data does not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA could be considered as a low-income population. The Miccosukee Tribe of Indians has purchased one parcel within the 8.5 SMA. Currently, this property is unoccupied.

Alternative No. 1 does not displace any private landowners, including residential, commercial and agricultural land. A portion of property owners within the 8.5 SMA may benefit from this alternative. As stated in the Land Use Impact section for this alternative, Alternative No. 1 actually provides 10-year flood protection to an additional 60 acres of land within the 8.5 SMA, including residential, commercial, vacant, and agricultural lands. In addition, Alternative No. 1 will not impact any of the cultural or "Social Clubs" located within the 8.5 SMA.

Even though the population consists primarily of a minority or low-income population, there are no adverse human health or environmental effects associated with Alternative No. 1. Therefore, there are

no environmental justice impacts associated with this alternative.

Because a substantial amount of minority and low-income populations exist within the 8.5 SMA, additional efforts are being made to ensure that they are informed regarding the proposed project and given an opportunity to comment on the alternatives. Efforts include providing public meeting notices in both English and Spanish; providing interpreters at formal public meetings to translate English to Spanish; providing court reporters to record public comment in both languages; and providing English and Spanish advertising on the radio and television. In addition, the Executive Summary portion of the Environmental Impact Statement will be printed in both English and Spanish.

- ***4.5.9 Aesthetics***

Viewing wildlife, wetlands, and relatively pristine open spaces are valued activities. Restoring the southern Everglades ecosystem will enhance the quality of these activities. Restoration means "a healthier environment that will support vigorous plant communities, larger fish and aquatic animal populations, large numbers of wading birds, alligators, and sustainable populations of wide-ranging mammals in a natural setting, in perpetuity " (USACE/SFWMD 1999: 8-16). Improvements

to the hydrologic function of wetlands will enhance the ecological quality and beauty of the area by encouraging native vegetation and discouraging exotic vegetation. The westernmost levee proposed under this alternative, albeit relatively low in elevation, will nonetheless effect a slight improvement over an already picturesque viewshed of the adjoining Save Our Rivers lands and ENP parkland.

- ***4.5.10 Recreational Resources***

The proposed levees will facilitate access onto public land for pedestrian and bicycle traffic (and possibly wheelchairs). Any alternatives including buyout options provide an opportunity for passive recreation of this nature. Activities such as fishing along the canals and hunting, which is being temporally permitted in the ENP Expansion Area, would require regulation by ENP and the Florida Fish and Wildlife Conservation Commission (FFWCC).

4.5.11 Air Quality and Noise

There are no anticipated air quality impacts associated with this alternative. The Project is located in an air quality attainment area.

The U.S. General Services Administration requires that for equipment used on government contracts, the noise levels at the site should not exceed certain limits. Construction activities and their respective

sound level limits at a distance of 50 feet associated with this alternative include blasting (95 dBA) and earthmoving activities (ranging from 75 to 80 dBA). Operation of the pump station also has its own sound level limits at a distance of 50 feet which is 75dBA. The closest residents to the construction activities and pump station are approximately 100 feet so the sound levels will be attenuated (i.e., reduced) to some degree. Noise abatement measures will be considered during the design phase if necessary.

4.5.12 Farmlands

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.5.13 Hazardous Materials Contamination

The alternative analysis for hazardous material contamination is covered under water quality for each alternative. Impacts to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and discharge areas for each alternative. This methodology includes all potential sources of water quality degradation.

4.5.14 Cultural Resources

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.6 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 2B

4.6.1 Hydrological Effects of Structural and Operational Alternatives

Alternative No. 2B generally consists of a perimeter levee, seepage canal, and interior levee which follows the northern and western boundaries of the 8.5 SMA in a similar fashion to Alternative No. 1. A proposed pump station (S-357B) is located at the southwestern terminus of the seepage canal adjacent to Richmond Drive. Water pumped from the seepage canal at this location is conveyed south to a proposed stormwater treatment area (STA) in C-111 project area via a one and one-quarter mile long pipeline.

Model simulations of existing conditions indicate that during the wet season water elevations may at times be above ground surface elevations, especially on the western portion of the 8.5 SMA. Alternative No. 2B allows water levels in the ENP Expansion Area to be raised in an effort to meet Natural System Model recommended elevations. Alternative No. 2B provides flood mitigation for the entire 8.5 SMA, except for a very small area on the eastern boundary adjacent to the L-31N canal. The lack of mitigation in this small area is not considered significant because of its size and elevation change (maximum approximately 0.4 feet). Most importantly though the water level is below ground surface. That is, the change in elevation in this small area actually occurs below land surface in an area of the highest topography within the 8.5 SMA.

Another important hydrological effect of Alternative No. 2B is its beneficial effect on the NESRS area. Figure 110 of Appendix A shows the duration of continuous inundation based on wet weather conditions. Figure 134, also from Appendix A, shows that the time of inundation in NESRS is increased dramatically. One indicator cell in NESRS shows that the duration of inundation has increased from 113 days in existing conditions to 364 days with Alternative No. 2B. As with Alternative No. 1, continuous inundation southwest of the 8.5 SMA is reduced significantly. This occurs not by the transference of water to the north and back into the park but by the conveyance of water south, away from the lower Shark River Slough area. The environmental significance of this change in flow patterns is discussed in Section 4.6.3 of this report.

• 4.6.2 Regional Water Supply

The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield, located approximately 11 miles northeast of

the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5 SMA, the proposed alternatives will not impact regional groundwater supplies.

- ***4.6.3 Water Quality***

Base 95 conditions for the wet year (1995) show groundwater flow predominantly towards the southeast across the 8.5 SMA from the ENP (Figure 16). Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east. Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP from the 8.5 SMA are likely minimal for the existing condition.

Implementation of Alternative No. 2B for the wet year, based on simulated heads, results in water from the ENP flowing to the southeast toward the 8.5 SMA, with shallow waters intercepted by the proposed

seepage canal on the western edge of the 8.5 SMA (Figure 18). Shallow groundwater from the western portion of the 8.5 SMA will also flow toward the west to the proposed canal. This water would then be moved via proposed structure S-357 to a pipeline, which would discharge into a proposed STA to the south. The dry year simulation indicated that groundwater flow would follow the regional pattern to the southeast, with some water flowing to the new canal, with no apparent impact from the L-31N canal (Figure 18). Since water would be discharged to a STA prior to discharge into the ENP, water quality impacts from the implementation of Alternative 2B would likely be minimal.

4.6.4 Upland Vegetation

Inventories of existing conditions in the project area revealed that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland species. Therefore native upland resources are not an issue of concern.

4.6.5 Wetlands

Wetland function analysis WRAP completed for the Draft CAR prepared for this study, concluded that Impacts to wetland resources are the same for Alternative No. 2B as for Alternative No. 1.

Changes in wetland acreage for this alternative is nearly identical as those presented for Alternative No. 1. Predicted reductions in marl-forming short hydroperiod wetlands, equal 4,722 acres while increases in peat-forming longer

hydroperiod wetlands equal 1,853 acres, resulting in a net change of –2,869 acres. Direct impacts incurred by canal and levee construction are the same as those presented for Alternative No. 1 (Tables 10 and 11; Figure 25).

4.6.6 Fish and Wildlife

The effects of this alternative on fish and wildlife resources are similar to those stated in Alternative No. 1. Habitat for fish and wildlife resources will be enhanced within the ENP. Continued habitat degradation within the 8.5 SMA will occur over the 50 year planning period, resulting in a loss of wetland functions and therefore habitat for fish and wildlife resources.

4.6.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Snail Kite. The effects of this alternative on the Snail kite are similar to those stated in Alternative No. 1.

Wood Stork. The effects of this alternative on the Wood stork are similar to those stated in Alternative No. 1.

Cape Sable Seaside Sparrow. A Biological Assessment will be prepared for the selected plan and incorporated the Final SEIS.

4.6.8 Socio-Economics

Land Use. A detailed discussion of the socioeconomic impacts associated with Alternative No. 2B is provided in Appendix E. As shown in Table 13, the footprint of Alternative No. 2B exclusively uses publicly owned vacant land (approximately 663 acres) (See Figure 4 in Appendix E). This land was acquired at a cost of $2.4 million and $28,000 for the one residential relocation. Minimal land use impacts will occur near the southeastern portion of the 8.5 SMA due to the increase in the amount of land above the 10-year flood elevation, an elevation of 7.7 feet. Currently, only 663 acres of the 8.5 SMA are located above the 10-year flood elevation. With the implementation of Alternative No. 2B, an additional 79 acres of land will be rendered above the 10-year flood elevation (Figure 4 in Appendix E). Therefore, there would be a total of approximately 653 acres of land above the 10-year flood elevation (7.7 ft NGVD). The development of all privately owned vacant and agricultural lands, approximately 608 acres of the land above the 10-year flood elevation could potentially be developed for residential uses at a density of 1 unit per 5 acres, with a variance from Miami-Dade County. These lands would accommodate only a portion of the anticipated population growth within the area over the next fifteen years (122 of the 174 houses needed during the projection period).

If this extent of development were to occur in the area, approximately 563 acres of agricultural lands would be lost to residential development. Utilizing the average annual agricultural income per acre in Miami-Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $1.4 million. Assuming the existing estimated mix of

residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $0.6 million, with the remainder being lost to non-residents.

The above analysis assumes that the zoning ordinance will be enforced. However, the County has not currently been enforcing the residential density of the 8.5 SMA. The average residential density for the 8.5 SMA area is approximately 1 unit per 3.65 acres rather than the 40 acres specified by the ordinance. Assuming that the County will continue not to enforce the density ordinance, there would not be any project induced growth within the 8.5 SMA, since vacant and agricultural lands are available to accommodate the projected future growth of the population. Further, since there are sufficient vacant lands to accommodate future growth for this scenario, no loss of agricultural production is anticipated.

Relocations. Under the original authorized GDM Plan, the USACE purchased 663 acres of land on the western boundary of the 8.5 SMA. The acquisition of this land resulted in one residential relocation. The total cost includes $2.4 million from land acquisition and $28,000 for the one residential relocation.

Based on the existing land use of the 8.5 SMA, no additional residential, business, or agricultural lands will be required to construct this alternative. Therefore, there will be no additional relocation of residents associated with Alternative No. 2B.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific

income data do not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA could be considered a low-income population. The Misccouskee Tribe of Indians has purchased one parcel within the 8.5 SMA. Currently, this property is unoccupied.

Alternative No. 2B does not displace any private landowners, including residential, commercial, and agricultural land. A portion of property owners within the 8.5 SMA may benefit from this alternative. As stated in the Land Use Impact section for this alternative, Alternative No. 2B actually provides 10-year flood protection to an additional 79 acres of land within the 8.5 SMA, including residential, commercial, vacant and agricultural lands. In addition, Alternative No. 2B will not impact any of the cultural or "Social Clubs" located within the 8.5 SMA.

Even though the population consists primarily of a minority or low-income population, there are no adverse human health or environmental effects of Alternative No. 2B. Therefore, there are no environmental justice impacts associated with this alternative.

4.6.9 Aesthetics

Viewing wildlife, wetlands, and relatively pristine open spaces are valued activities. Restoring the southern Everglades ecosystem will enhance the quality of these activities. Restoration means "a healthier environment that will support vigorous plant communities, larger fish and aquatic animal populations, large numbers of wading birds, alligators, and sustainable populations of wide-ranging mammals in a

natural setting, in perpetuity" (USACE/SFWMD 1999: 8-16). Improvements to the hydrologic function of wetlands will enhance the ecological quality and beauty of the area by encouraging native vegetation and discouraging exotic vegetation. The westernmost levee proposed under this alternative, albeit relatively low in elevation, will nonetheless effect a slight improvement over an already picturesque viewshed of the adjoining Save Our Rivers lands and ENP parkland.

- ***4.6.10 Recreational Resources***

The proposed levees will facilitate access onto public land for pedestrian and bicycle traffic (and possibly wheelchairs). Any alternatives including buyout options provide an opportunity for passive recreation of this nature. Activities such as fishing along the canals and hunting, which is being temporally permitted in the ENP Expansion Area, would require regulation by ENP and the FFWCC.

4.6.11 Air Quality and Noise

There are no anticipated air quality impacts associated with this alternative. The project is located in an air quality attainment area.

The U.S. General Services Administration requires that for equipment used on government contracts, the noise levels at the site should not exceed certain limits. Construction activities and their respective

sound level limits at a distance of 50 feet associated with this alternative include blasting (95 dBA) and earthmoving activities (ranging from 75 to 80 dBA). Operation of the pump station also has its own sound level limits at a distance of 50 feet which is 75dBA. The closest residents to the construction activities and pump station are approximately 100 feet so the sound levels will be attenuated (i.e., reduced) to some degree.

4.6.12 Farmlands

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.6.13 Hazardous Materials Contamination

The alternatives analysis for hazardous material contamination is covered under water quality for each alternative. Impacts to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and discharge areas for each alternative. This methodology includes all potential sources of water quality degradation.

4.6.14 Cultural Resources

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.7 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 3

4.7.1 Hydrological Effects of Structural and Operational Alternatives

Alternative No. 3 generally consists of a perimeter levee similar to Alternatives 1 and 2B. However, in place of the interior seepage canal and levee, impacts to the 8.5 SMA are mitigated by the placement of a seepage barrier in the limestone. The initial purpose of the seepage barrier is to minimize the seepage that occurs from the ENP to the 8.5 SMA. This relatively impermeable barrier is to be constructed down to an area with low permeability to serve as a seepage reduction "curtain."

Model simulations of existing conditions indicate that during the wet season water elevations may at times be above ground surface elevations, especially on the western portion of the 8.5 SMA. Alternative No. 3 allows water levels in the ENP Expansion Area to be raised in an effort to meet Natural Systems Model recommended elevations. Alternative No. 3, however, was envisioned to be a flood protection alternative. That is, it was thought that the placement of a seepage barrier adjacent to the ENP Expansion Area would virtually eliminate seepage from the Park. Model simulations show a marked reduction in seepage but not enough to provide flood protection or even full area mitigation. Water surface elevations with the seepage barrier are not significantly changed from existing conditions without any alternative in place. The majority of the area of the 8.5 SMA, therefore, is required to have flowage easements purchased such that the property owners are compensated for the additional levels of inundation that occur.

An important hydrological effect of Alternative No. No. 3 is its beneficial effect on the NESRS area. Figure 110 of Appendix A shows the duration of continuous inundation based on wet weather conditions. Figure 141, also from Appendix A, shows that the time of inundation in NESRS is increased dramatically. As with other alternatives the period of continuous inundation within the 8.5 SMA is reduced greatly. The environmental significance of the hydrological changes in flow patterns is discussed in Section 4.7.3 of this report.

• 4.7.2 Regional Water Supply

The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield, located approximately 11 miles northeast of the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5

SMA, the proposed alternatives will not impact regional groundwater supplies.

- ***4.7.3 Water Quality***

Base 95 conditions for the wet year (1995) show groundwater flow predominantly towards the southeast across the 8.5 SMA from the ENP. Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east (Figure 16). Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP during the wet year appear minimal for the existing condition.

Alternative No. 3 consists of a seepage barrier constructed around the perimeter of the 8.5 SMA, tying into the L-31N canal on the north and south sides. The seepage barrier would be installed to an approximate depth of 50 to 70 feet below surface. The simulated wet year head

contours indicate that the barrier would slightly reduce flow from the ENP to the 8.5 SMA (Figure 19). Flow from the 8.5 SMA would be predominantly to the east-southeast toward the L-31N canal at a somewhat reduced gradient. The contours are similar to those generated for Alternative No. 1, with a slight buildup of water on the west side of the wall. Water quality impacts would be similar to Base 95 conditions. During the dry year simulation, groundwater flow follows the regional pattern to the southeast, with slightly reduced flow from the ENP to the 8.5 SMA due to the barrier.

4.7.4 Upland Vegetation

Inventories of existing conditions in the project area revealed that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland communities. Therefore native upland resources are not an issue of concern.

4.7.5 Wetlands

Based on the WRAP analysis, Alternative No. 3 would result in a loss of 1,775 functional units (137 in ENP and 1,638 within the 8.5 SMA). Alternative No. 3 is designed with a seepage barrier without a canal, which minimizes wetland functional loss attributed to dry down associated with seepage into a canal, as is the case with Alternatives 1, 2B, and 9 (Tables 10 and 11; Figure 26).

Total predicted wetland reductions is 1,187 acres although long hydroperiod peat forming wetlands increase by 3,714 acres Short hydroperiod wetlands are reduced by 4,901 acres. Direct impacts to wetlands as a result of seepage barrier construction are

commensurate with those presented for Alternative No. 1.

4.7.6 Fish and Wildlife

The effects of this alternative on fish and wildlife resources are similar to those stated for Alternatives 1 and 2B.

4.7.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Snail Kite. The effects of this alternative on the Snail kite are similar to those stated in Alternative No. 1.

Wood Stork. The effects of this alternative on the Wood stork are similar to those stated in Alternative No. 1.

Cape Sable Seaside Sparrow. A Biological Assessment will be prepared for the selected plan and incorporated the Final SEIS.

4.7.8 Socio-Economics

Land Use. A detailed discussion of the socioeconomic impacts associated with Alternative No. 3 is provided in Appendix E.

As shown in Table 14, the construction footprint of Alternative No. 3 exclusively uses publicly owned vacant land (approximately 663 acres), similar to

Alternatives 1 and 2B (Figure 5 in Appendix E). However, because this alternative will not adequately provide flood mitigation to the 8.5 SMA, flowage easements will be necessary on approximately 1,599 additional parcels encompassing 5,162 acres of land. In general, the cost of flowage easements is generally 90% to 95% of the Fee Simple cost. However, it should be noted that the cost of easements will be limited to the Simple Fee Value of property (modifying Water and Sewage Systems may exceed the Simple Fee Value of the property). Appendix E estimates the total of $54.1 million is considered compensation to land owners for the impacts associated with the periodic flooding of their lands. In addition, approximately $11.7 million has already been spent in Fee Simple acquisition by the USACE (663 acres) and the SFWMD (469 acres).

Minimal land use impacts will also occur near the southeastern portion of the 8.5 SMA due to the increase in the amount of land above the 10-year flood elevation (7.7 ft NGVD) (Figure 5 in Appendix E). Currently, only 574 acres of the 8.5 SMA are located above the 10-year flood elevation. With the implementation of Alternative No. 3, an additional 14 acres of land will be rendered above the 10-year flood elevation. Therefore, there would be a total of approximately 588 acres of land above the 10-year flood elevation. Assuming the development of all privately owned vacant and agricultural lands, approximately 547 acres of the land above the 10-year flood elevation could potentially be developed for residential uses at a density of 1 unit per 5 acres, with a variance from Miami-Dade County. These lands would accommodate only a portion of the anticipated population growth within the area over the next fifteen years (109 of the 174 houses needed during the projection period).

If this extent of development were to occur in the area, approximately 512 acres of agricultural lands would be lost to residential development. Utilizing the average annual agricultural income per acre in Miami-Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $1.3 million. Assuming the existing estimated mix of residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $0.5 million, with the remainder being lost to non-residents. As stated in Appendix E, these losses should be recovered within three years.

The above analysis assumes that the zoning ordinance will be enforced. However, the County has not currently been enforcing the residential density of the 8.5 SMA. The average residential density for the 8.5 SMA area is approximately 1 unit per 3.65 acres rather than the 40 acres specified by the ordinance. Assuming that Miami-Dade County will continue not to enforce the density ordinance, there would not be any project induced growth within the 8.5 SMA, since vacant and agricultural lands are available to accommodate the projected future growth of the population. Further, since there are sufficient vacant lands to accommodate future growth for this scenario, no loss of agricultural production is anticipated.

Relocations. Under the original authorized GDM Plan, the USACE purchased 663 acres of land on the western boundary of the 8.5 SMA. The acquisition of this land resulted in one residential relocation at a cost of $28,000.

Based on the existing land use of the 8.5 SMA, no additional residential, business, or

agricultural lands will be required for the construction footprint of Alternative No. 3.

Approximately 1,599 parcels (5,162 acres) will require the purchase of flowage easements, which will compensate land owners for the impacts associated with the periodic flooding of their lands. It should be noted that the cost of easements will be limited to the Simple Fee Value of the property. Therefore if the cost of the flowage easement plus the cost of modifying water and sewage systems exceeds the Simple Fee Value of the property, then the property owner would have the option of bearing the additional cost or Buy Out.

For those property owners choosing the Buy Out option, additional relocations would result from Alternative No. 3. In addition to the cost of land, these relocations would cost an estimated $28,000 each.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific income data does not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA could be considered as a low-income population. The Misccouskee Tribe of Indians has purchased one parcel within the 8.5 SMA. Currently, this property is unoccupied.

The construction of Alternative No. 3 does not relocate any private landowners, including residential, commercial and agricultural land. Flowage easements will be required on 1,599 parcels (5,162 acres). In some cases where the cost of modifying

water and sewer systems together with the cost of the flowage easement exceeds the Fee Simple Value, the property owner may choose the Buy Out option. If this occurs, additional relocations will result from Alternative No. 3

In addition, a portion of the property owners in the 8.5 SMA may benefit from this alternative. As stated in the Land Use Impact section for this alternative, Alternative No. 3 actually provides 10-year flood protection to an additional 1 acres of land within the 8.5 SMA.

Because of the increased flooding potential on many of the parcels with this alternative, Alternative No. 3 may potentially increase the adverse environmental effects on these minority and low-income populations. These populations will be fairly compensated for the impacts associated with the periodic flooding of their lands through either flowage easements or Fee Simple purchase. However, the adverse environmental effects from this increased flooding may potentially change land use affecting residences, farms and potentially the unique Hispanic cultural aspects of the 8.5 SMA. Therefore, environmental justice impacts may be associated with this alternative.

The USACE will work with these property owners to determine mitigation efforts for these impacts.

- ***4.7.9 Aesthetics***

Viewing wildlife, wetlands, and relatively pristine open spaces are valued activities. Restoring the southern Everglades ecosystem will enhance the quality of these

activities. Restoration means "a healthier environment that will support vigorous plant communities, larger fish and aquatic animal populations, large numbers of wading birds, alligators, and sustainable populations of wide-ranging mammals in a natural setting, in perpetuity" (USACE/SFWMD 1999: 8-16). Improvements to the hydrologic function of wetlands will enhance the ecological quality and beauty of the area by encouraging native vegetation and discouraging exotic vegetation. The westernmost levee proposed under this alternative, albeit relatively low in elevation, will nonetheless effect a slight improvement over an already picturesque viewshed of the adjoining Save Our Rivers lands and ENP parkland.

- ***4.7.10 Recreational Resources***

The proposed levees will facilitate access onto public land for pedestrian and bicycle traffic (and possibly wheelchairs). Any alternatives including buyout options provide an opportunity for passive recreation of this nature. Activities such as fishing along the canals and hunting, which is being temporally permitted in the ENP Expansion Area, would require regulation by ENP and the FFWCC. Any alternatives including buyout options provide an opportunity for passive recreation of this

nature. Such activities would require regulation by ENP and the FFWCC.

- ***4.7.11 Air Quality and Noise***

There are no anticipated air quality impacts associated with this alternative. The project is located in an air quality attainment area.

The U.S. General Services Administration requires that for equipment used on government contracts, the noise levels at the site should not exceed certain limits. Construction activities and their respective sound level limits at a distance of 50 feet associated with this alternative include blasting (95 dBA) and earthmoving activities (ranging from 75 to 80 dBA). The closest residents to the construction activities are approximately 100 feet so the sound levels will be attenuated (i.e., reduced) to some degree.

- ***4.7.12 Farmlands***

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.7.13 Hazardous Materials Contamination

The alternatives analysis for hazardous material contamination is covered under water quality for each alternative. Impacts

to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and discharge areas for each alternative. This methodology includes all potential sources of water quality degradation.

- ***4.7.14 Cultural Resources***

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.8 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 4

- ***4.8.1 Hydrological Effects of Structural and Operational Alternatives***

Alternative No. 4 acknowledges that the higher water levels within the ENP Expansion Area will have a significant effect on inundation within the 8.5 SMA. Since this alternative does not use structural means to mitigate for flooding another method was used. Each property owner is allowed to decide what method of

compensation for the effects of the higher flood levels is appropriate. The three methodologies used for Alternative No. 4 are flowage easements, life-estates with flowage easements, and direct purchase. Direct purchase means that the land becomes government property and the owner or resident vacates the property. Life-estates with flowage easements compensates the owner for the property but allows the owner to remain on the property. At the time of the owner's death, the government acquires full use of the property. Flowage easements allow the landowner to retain full rights of ownership of the property and to be compensated for the increase levels of flooding by granting a flowage easement to the government. Each property owner is informed of the consequences to his or her property based on the increase in elevations within the ENP and will be allowed to decide the appropriate methodology for their own needs.

There is no flood mitigation for this alternative. Therefore, the hydrological effects of the alternative can be considered similar to those of future conditions without any of the alternatives. That is, there is a beneficial effect on the NESRS area adjacent to the 8.5 SMA. Figure 110 of Appendix A shows the duration of continuous inundation based on wet weather conditions. Figure 146, also from Appendix A, shows that the time of inundation in NESRS is increased dramatically.

- ***4.8.2 Regional Water Supply***

The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield, located approximately 11 miles northeast of

the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5 SMA, the proposed alternatives will not impact regional groundwater supplies.

Back to Top

- ***4.8.3 Water Quality***

Base 95 conditions for the wet year (1995) show groundwater flow predominantly to the southeast across the 8.5 SMA from the ENP. Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east. Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP during the wet year appear minimal for the existing condition.

Implementation of Alternative No. 4, resident choice land acquisition, would result in flow from the ENP to the southeast, across the 8.5 SMA (Figure 20). Simulated wet year groundwater/surface

water elevations are slightly higher within the 8.5 SMA than the simulated heads for the Base 95 condition. Shallow groundwater/surface water flow from the 8.5 SMA is toward the L-31N canal, and then flows to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Water quality impacts due to the implementation of Alternative No. 4 would be similar to Base 95 conditions. The dry year simulation indicates that groundwater flow will follow the regional pattern to the southeast (Figure 20).

• 4.8.4 Upland Vegetation

Inventories of existing conditions in the project area revealed that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland communities. Therefore native upland resources are not an issue of concern.

• 4.8.5 Wetlands

The Draft CAR concluded that a combination of proper post-construction management and hydrologic restoration is important to the success of this alternative. These activities would likely improve function of all wetland habitats in the study area and restore portions of existing non-

jurisdictional lands as well. Wetlands that tend to be dominated by exotic species (Forested Exotic Wetlands and Shrubby Wetlands) would likely be converted to Herbaceous Wetlands (Low to Moderate and High Disturbance habitats) through mechanical removal, periodic maintenance, and increased hydroperiods. Additionally, those marginal wetlands that tended to be most impacted by intense land use and could improve by the end of the project's life. Conclusions made in the CAR assume that agricultural/residential lands that fall within the 180-day hydroperiod (generally just below the 7.0-foot. NGVD contour) would be restored to optimally functioning graminoid wetlands with minimum to moderate management intensity. Within the 180-day hydroperiod, re-hydration by modeled flows, periodic (2- to 5-year intervals) prescribed burning, limited mechanical removal of Brazilian pepper, and initial herbicide treatment of particular exotic stands should be completely successful and result in maximum wetland restoration by 2050. Lands that demonstrate lesser hydroperiods would likely require some level of surface scraping and frequent exotic removal to maintain wetland function. The WRAP analysis concluded this alternative would result in a net gain of 2,448 wetland functional units, due largely to the recovery or improvement of degraded wetlands currently found within the 8.5 SMA.

Hydrologic modeling predicts a net of 1,404 acres of wetland. Peat-forming long hydroperiod wetlands account for and increase of 4,976 acres while marl-forming short hydroperiod wetlands account for a reduction of 3,572 acres. Increased hydroperiods appear to result in a shift from short hydroperiod marl forming prairies towards peat forming wetlands.

• 4.8.6 Fish and Wildlife

This alternative will enhance habitat available for fish and wildlife resources through improved hydrology. Wetland functions on publicly acquired parcels are expected to be enhanced and provide better-quality resources for opportunistic small and large mammals, reptiles and avifauna. Wildlife species diversity is expected to increase on lands in public holding.

4.8.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Snail Kite. The effects of this alternative on the Snail kite are similar to those stated in Alternative No. 1.

Wood Stork. The effects of this alternative on the Wood stork are similar to those stated in Alternative No. 1.

Cape Sable Seaside Sparrow. A Biological Assessment will be prepared for the

selected plan and incorporated the Final SEIS.

4.8.8 Socio-Economics

Land Use. A detailed discussion of the socioeconomic impacts associated with Alternative No. 4 is provided in Appendix E.

Under Alternative No. 4, property owners would be given a choice of a government buy-out of their property, the government purchase of flowage easements, or the government purchase of Life Estates, with flowage easements. A detailed description of each of these options is provided in Section 2.

Essentially the footprint of Alternative No. 4 covers the entire 8.5 SMA area (Figure 6 in Appendix E). Therefore, all 1,984 parcels and 6,413 acres would be impacted by this alternative.

In analyzing the potential impacts, the Social Impact Analysis (Appendix E) made several assumptions. The first assumption is that existing resident and non-resident landowners of agricultural lands would opt for a flowage easement in order to maintain the income associated with farming activities. Thus Flowage Easements would be obtained on 2,772 acres of agricultural land. A Flowage Easement would also be obtained on the 306 Acre FAA parcel. Of the remaining private landowners, it was assumed that 1/8th would opt for the Life Estate with Flowage Easement, 3/8th would accept the government Buy Out and ½ would opt for Flowage Easements.

These assumptions result in the following: the Buy Out of 1,514 acres (1,132 already owned), Flowage Easements on 4,654 acres and Life Estates with Flowage Easements on 245 acres.

The cost associated with these assumptions include $29.2 million for land acquisition (includes $11.7 million of land already owned by the USACE and the SFWMD) and $308,000 in relocation costs for the government Buy Out option; $4.6 million for the purchase of Flowage Easements; and $3.3 million for the purchase of Life Estates with Flowage Easements plus end estimated $112,000 associated with future relocations associated with this option.

With the implementation of Alternative No. 4, there will be no increase in the area that is considered above the 10-year flood elevation (Figure 6 in Appendix E). Therefore, this alternative would not result in an increase in development of the 8.5 SMA. It would actually reduce the population of the area due to relocations of some residents. However, if the County continues not to enforce the zoning ordinance, unauthorized residential or commercial development may continue to occur.

Relocations. Under the assumptions made in the Social Impact Analysis (Appendix E), it is estimated that 45 permanent residents or 12 households would be immediately displaced from the area. Non-resident property owners who accept the Government Buy-Out would not be physically impacted by the project and could purchase replacement upland tracts in other areas of the region, if lands are available. It is also estimated that another 16 residents or four households would be displaced over the 50-year period as the government assumes ownership of land through the Life Estates option. Upon the property owner's death, the surviving family members would be displaced. Those property owners who choose to be compensated for the flowage easement

would not be displaced as part of this alternative. However, it should be noted that if the cost of the Flowage Easement together with modifications to water and sewer systems exceeds the Fee Simple Value of the property, then the property owner will be given the option of government Buy Out or bearing the extra expense themselves.

It is estimated that the Buy-Out option of an additional 369 acres and the relocation of 12 households would cost about $0.5 million. The purchase of Life Estates with Flowage Easements on 245 acres and the future relocation of residents is estimated at about $5.8 million. The purchase of flowage easements on 4,654 acres of land is estimated to cost $46.0 million, which would compensate remaining residents and non-residents for the impacts associated with the periodic flooding of their lands.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific income data does not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA could be considered as a low-income population. The Misccouskee Tribe of Indians has purchased one parcel within the 8.5 SMA. Currently, this property is unoccupied.

Alternative No. 4 impacts all property owners to some extent. Some residents will be relocated and others will have the potential for increased flooding on their lands that may adversely impact their ability to live or farm these lands. These landowners will be compensated either by the USACE purchasing flowage easements

or by a Fee Simple land acquisition of the property. Unlike other alternatives, there is no increase in the amount of land above the 10-year flood elevation. Therefore, there are no anticipated benefits to any of the property owners within the 8.5 SMA under this scenario.

Because of the increased flooding potential on many of the parcels with this alternative, Alternative No. 4 may potentially increase the adverse environmental effects on these minority and low-income populations. The adverse environmental effects from this increased flooding may potentially change land uses affecting residences, farms and potentially the unique Hispanic cultural aspects of the 8.5 SMA. In addition, those residents who will be relocated as part of the Buy-Out or Life Estates with Flowage Easements options will be impacted due to the loss of their community and the unique Hispanic culture of the 8.5 SMA. Therefore, environmental justice impacts are associated with this alternative.

The USACE will work with these property owners to determine mitigation effects for these impacts.

4.8.9 Aesthetics

There will be a slight impact on aesthetic resources given the non-structural nature of this alternative. The SOR regulations, which impinge upon those parcels acquired under the SFWMD's 8.5 SMA Wetlands Phase I acquisition project, require that public lands be managed and protected. Improvements such as the removal of refuse, road maintenance, and the removal of exotic vegetation will make this area more attractive and amenable to the public.

- ***4.8.10 Recreational Resources***

The effects of this alternative are similar to those stated in Alternatives 1, 2B, 3, 6B, 8A, and 9 but without the added recreational potential provided by the proposed structures.

4.8.11 Air Quality and Noise

There are no anticipated air quality impacts associated with this alternative. The project is located in an air quality attainment area.

There are no construction activities associated with this alternative, therefore, noise impacts are not an issue.

4.8.12 Farmlands

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.8.13 Hazardous Materials Contamination

The alternatives analysis for hazardous material contamination is covered under water quality for each alternative. Impacts to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and discharge areas for each alternative. This methodology includes all potential sources of water quality degradation.

4.8.14 Cultural Resources

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.9 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 5

4.9.1 Hydrological Effects of Structural and Operational Alternatives

The hydrological effects of Alternatives 5 are generally the same as those discussed for Alternative No. 4. Alternative No. 5 acknowledges that the higher water levels within the ENP Expansion Area will have a significant effect on inundation within the 8.5 SMA. Since this alternative does not use structural means to mitigate for flooding, another method was used. All properties within the 8.5 SMA are to be purchased to eliminate the deleterious effects of increased water levels within the area

There is no flood mitigation for this alternative. Therefore, the hydrological effects of the alternative can be considered similar to those of future conditions without any of the alternatives. That is, there is a beneficial effect on the NESRS area adjacent to the 8.5 SMA. Figure 110 of Appendix A shows the duration of continuous inundation based on wet weather conditions. Figure 146, also from Appendix A, shows that the time of inundation in NESRS is increased dramatically.

• 4.9.2 Regional Water Supply

The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield, located approximately 11 miles northeast of the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5 SMA, the proposed alternatives will not impact regional groundwater supplies. A

buyout of properties within the 8.5 SMA would require environmental site assessments of potentially contaminated sites.

- ***4.9.3 Water Quality***

Base 95 conditions for the wet year (1995) show groundwater flow predominantly to the southeast across the 8.5 SMA from the ENP. Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east. Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP during the wet year appear minimal for the existing condition.

Alternative No. 5 consists of a total buyout of the 8.5 SMA. Water quality impacts due to the implementation of Alternative No. 5 would initially be similar to Base 95 conditions, and Alternative No. 4 (Figure 20). However, over time, water quality would improve due to total elimination of

constituent inputs and outputs to and from the 8.5 SMA, and equilibration of the soils.

4.9.4 Upland Vegetation

Inventories of existing conditions in the project area revealed that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland communities. Therefore native upland resources are not an issue of concern.

4.9.5 Wetlands

The Draft CAR concluded that wetland functional change for this alternative was identical to Alternative No. 4 (increase of 2,448 functional units). Similarly, shifts in wetland coverage remained the same as Alternative No. 4, due to the absence of any structural requirements (Tables 10 and 11; Figure 27).

4.9.6 Fish and Wildlife

This alternative will provide improved habitat for fish and wildlife resources through improved hydrology and management for the control of exotic species throughout the 8.5 SMA.

4.9.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Snail Kite. The effects of this alternative on the Snail kite are similar to those stated in Alternative No. 1.

Wood Stork. The effects of this alternative on the Wood stork are similar to those stated in Alternative No. 1.

Cape Sable Seaside Sparrow. A Biological Assessment will be prepared for the selected plan and incorporated the Final SEIS.

- ***4.9.8 Socio-Economics***

A detailed discussion of the socioeconomic impacts associated with Alternative No. 5 is provided in Appendix E.

Alternative No. 5 is the complete buy-out of the 8.5 SMA by the government for the proposed project (Figure 7 in Appendix E). Therefore, all 1,984 parcels and 6,413 acres will be impacted by this alternative. All private lands would be acquired either through a willing seller program or condemnation. This would include the relocation of approximately 853 residents (approximately 208 households). Approximately 2,642 acres of agricultural land will be purchased under Alternative No. 5. Utilizing the average annual agricultural income per acre in Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $6.5 million. Assuming the existing estimated mix of residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $2.6 million and the loss to non-residents is about $3.9 million.

These losses would be relatively short-lived. According to the U.S. Department of Labor, Bureau of Labor Statistics data as presented in the "Re-Study Report" all displaced farm laborers would be re-employed within one year of losing their job. The loss of proprietors' income however, is expected to take longer, but should recover within three years. In addition, lost production could be made up elsewhere within the County or by applying more intense farming practices.

Relocations. All of the residents will be relocated under Alternative No. 5. In addition, all businesses and farms will also be displaced as part of this alternative. The costs of this alternative includes $98.5 million for land acquisition and an estimated $5.8 million (208 households at $28,000) for relocations.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific income data does not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA could be considered as a low-income population. The Misccouskee Tribe of Indians has purchased one parcel within the 8.5 SMA. Currently, this property is unoccupied.

Because of the total buy-out of all private land with this alternative, Alternative No. 5 may potentially increase the adverse environmental effects on these minority and low-income populations. The relocation of residents within the 8.5 SMA will be adversely impacted due to the loss of their community and the unique Hispanic culture of the 8.5 SMA. Non-residents will also be

impacted due to the fact that many of them have second homes and weekend houses at which they spend time with their families, work their farms, and socialize with neighbors. Therefore, the loss of the community and unique Hispanic culture of the 8.5 SMA will also impact non-residents. Finally, both residents and non-residents who have agricultural land in the 8.5 SMA will be potentially impacted by this loss of income. Therefore, environmental justice impacts are associated with this alternative.

The USACE will work together with these minority and low-income populations to identify potential mitigation for these impacts.

- ***4.9.9 Aesthetics***

There will be a slight impact on aesthetic resources given the non-structural nature of this alternative. The SOR regulations, which impinge upon those parcels acquired under the SFWMD's 8.5 SMA Wetlands Phase I acquisition project, require that public lands be managed and protected. Improvements such as the removal of refuse, road maintenance, and the removal of exotic vegetation will make this area more attractive and amenable to the public.

- ***4.9.10 Recreational Resources***

The effects of this alternatives are similar to those stated in Alternative 1, 2B, 3, 6B, 8A, and 9 without the added recreational potential provided by the proposed structures.

- ***4.9.11 Air Quality and Noise***

There are no anticipated air quality impacts associated with this alternative. The project is in an air quality attainment area.

There are no construction activities associated with this alternative, therefore, noise impacts are not an issue.

- ***4.9.12 Farmlands***

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.9.13 Hazardous Materials Contamination

The alternative analysis for hazardous material contamination is covered under water quality for each alternative. Impacts to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and

discharge areas for each alternative. This methodology includes all potential sources of water quality degradation.

- ***4.9.14 Cultural Resources***

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.10 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 6B

4.10.1 Hydrological Effects of Structural and Operational Alternatives

Alternative No. 6B generally consists of a perimeter levee, seepage canal, and interior levee that generally follow a north-south direction west of 202 Ave. A pump station is located at the southwestern terminus of the seepage canal adjacent to Richmond Drive. Water pumped from the seepage canal at this location is conveyed south to the C-111 system through a one and one-half mile long pipeline.

Model simulations of existing conditions indicate that during the wet season water elevations may at times be above ground surface elevations, especially on the western portion of the 8.5 SMA. Alternative

No. 6B allows water levels in the ENP Expansion Area to be raised in an effort to meet Natural Systems Model recommended elevations. Alternative No. 6B provides flood mitigation for the eastern portion of 8.5 SMA. The western and extreme northeastern portions of the 8.5 SMA are not mitigated. This lack of mitigation falls within an area that will be purchased and thus, is not an issue.

Another important hydrological effect of Alternative No. 1 is its beneficial effect on the NESRS area. Figure 110 of Appendix A shows the duration of continuous inundation based on wet weather conditions. Figure 152, also from Appendix A, shows that the time of inundation in NESRS is increased dramatically. Another positive effect occurs in the western portion of the 8.5 SMA. Lands with a surface elevation of less than 7.0 feet NGVD receive significant inundation. Thus, it can be expected that ecological benefits will be derived in an area that is allowed to experience periodic flooding. The environmental significance of this change in flow patterns is discussed in Section 4.10.3 of this report.

- ***4.10.2 Regional Water Supply***

The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield, located approximately 11 miles northeast of the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5 SMA, the proposed alternatives will not impact regional groundwater supplies. A

buyout of properties within the 8.5 SMA would require environmental site assessments of potentially contaminated sites.

4.10.3 Water Quality

Base 95 conditions for the wet year (1995) show groundwater flow predominantly to the southeast across the 8.5 SMA from the ENP (Figure 16). Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east. Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP during the wet year appear minimal for the existing condition.

Alternative No. 6B consists of a buffer area west of SW 202nd Avenue. A levee and seepage canal would be placed east of SW 202nd Avenue. Simulated wet year head contours indicate that shallow groundwater/surface water from ENP and the 8.5 SMA would flow toward the new canal, where it will be moved via proposed structure S-357 into a spreader canal south of 168th Street (Figure 21). The water would be discharged as overland flow to the south, to a stormwater treatment area. Any impacted groundwater from the 8.5 SMA would be directed south to the proposed STA, where some of the water would flow to the ENP. Residence of the discharged water within the STA should help to reduce the amount of potential contaminants migrating to the ENP. The reduction in size of the developed lands within the 8.5 SMA would further reduce water quality impacts due to

decreased input and output of potential contaminants to and from the 8.5 SMA.

4.10.4 Upland Vegetation

Inventories of existing conditions in the project area revealed that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland communities. Therefore native upland resources are not an issue of concern

4.10.5 Wetlands

Alternative No. 6B incorporates flood protection with levee and seepage canal features that protect mostly agricultural/residential lands approximately 7.0-feet. NGVD and higher, leaving a large western portion of the 8.5 SMA as a hydrologic buffer. These buffer lands would have to be acquired and managed, the Draft CAR concluded that existing wetlands would experience the same level of benefit as described for Alternatives 4 and 5. Similar to other structural alternatives involving the construction and operation of a seepage canal, a hydrologic edge effect is created near the levee and canal. This hinders optimal restoration of agricultural/ residential lands west of the levee and canal. A net gain 1,606 wetland functional units is predicted by the WRAP analysis.

The Draft CAR concluded that throughout the life of the project (50 years), the FAA tract (Graminoid Wetland >7.0 feet) would experience negative hydrologic impacts resulting from the construction of the seepage canal immediately south of the area. This would result in a 20% loss of wetland function due to decreases in vegetative ground cover, the encroachment of woody and exotic species, and the increased potential for disruptive fire.

Considering wetland areal coverage, Alternative 6B results in a net gain of 250 acres of wetland. This appears to be a result of conversion of marl forming prairie towards peat forming prairie due to increased hydroperiods within the area of potential effect.

Direct impacts to wetlands within the 8.5 SMA totals approximately 13 acres. The large difference in wetland impacts between Alternative No. 6B and Alternatives 1, 2B, and 3 is a result of the higher elevation of the canal and levee (approximately 7.9' NGVD) (Tables 10 and 11; Figure 28).

4.10.6 Fish and Wildlife

For lands east of the proposed levee and canal, the effects of this alternative are similar to those stated in Alternative No. 1 and result in reduced habitat quality. For the lands in the proposed buyout area, the effects of this alternative are similar to those stated in Alternative No. 4, and result in habitat improvements for fish and wildlife resources.

4.10.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Snail Kite. The effects of this alternative on the Snail kite are similar to those stated in Alternative No. 1.

Wood Stork. The effects of this alternative on the Wood stork are similar to those stated in Alternative No. 1.

Cape Sable Seaside Sparrow. A Biological Assessment will be prepared for the selected plan and incorporated the Final SEIS.

4.10.8 Socio-Economics

A detailed discussion of the socioeconomic impacts associated with Alternative No. 6B is provided in Appendix E.

Of the 6,413 acres located in the 8.5 SMA, 4,196 acres or about 65 percent of the land will be required to implement Alternative No. 6B (Figure 8 in Appendix E). Table 15 shows the break down of land uses that will be impacted by this alternative. Approximately 2,946 acres of land are privately owned and will need to be acquired at an estimated cost of $66.0 million. About 1,136 acres of this land is agricultural land, utilizing the average annual agricultural income per acre in Miami-Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $2.8 million. Assuming the existing estimated mix of residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $1.1 million and the loss to non-residents is about $1.7 million. These losses would be relatively short-lived. According to the U.S. Department of Labor, Bureau of Labor Statistics data as presented in the "Re Study Report" all displaced farm laborers would be re-employed within one year of losing their job. Ths loss of proprietors' income however, is expected to take longer but should recover within three years. In addition, lost production could be made up

elsewhere within the county or by applying more intense farming practices.

Currently, only 574 acres of the 8.5 SMA are located above the 10-year flood elevation. With the implementation of Alternative No. 6B, an additional 1,643 acres of land will be rendered above the 10-year flood elevation. Therefore, there would be a total of approximately 2,217 acres of land above the 10-year flood elevation (Figure 8 in Appendix E). Assuming the development of all privately owned vacant and agricultural lands, approximately 1,711 acres of the land above the 10-year flood elevation could potentially be developed for residential uses at a density of 1 unit per 5 acres, with a variance from Miami-Dade County. This acreage could accommodate a maximum of 342 new residential units. This capacity is slightly greater than the demand created by the 143 households displaced with Alternative 6B and the 174 new households projected in the future for this area.

If this extent of development were to occur in the area, approximately 1,130 acres of agricultural lands would be lost to residential development. Utilizing the average annual agricultural income per acre in Miami-Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $3.7 million. Assuming the existing estimated mix of residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $1.5 million and about $2.2 million to non-residents.

The above analysis assumes that the zoning ordinance will be enforced. However, the County has not currently been enforcing the residential density of the 8.5 SMA. The average residential density for

the 8.5 SMA area is approximately 1 unit per 3.65 acres rather than the 40 acres specified by the ordinance. Assuming that the County will continue not to enforce the density ordinance, future development of the remaining privately owned area could occur at an even greater density than allowed for in the zoning ordinance.

In contrast to other alternatives, the induced growth resulting from the increased flood protection provided by Alternative No. 6B could potentially result in an increase in the demand for public services.

Relocations. Approximately 586 residents (143 households) will be relocated with the implementation of Alternative No. 6B. The cost of this alternative includes $66.0 million in Fee Simple Land acquisition and an estimated $4.0 million in relocations (143 households x $28,000). In addition, the alternative will also displace 454 agricultural properties. This will result in a loss of income (as identified above) to these property owners.

Due to the large increase in the amount of land above the 10-year flood elevation, opportunities may be available within the 8.5 SMA. However, property owners would still be required to obtain a variance from the County to develop at a 1 unit per 5 acre density.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific income data does not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA could be considered a low-

income population. The Miccosukee Tribe of Indians has purchased one parcel within the 8.5 SMA. Currently, this property is unoccupied.

A portion of the property owners within the 8.5 SMA may benefit from this alternative. As stated in the Land Use Impact section for this alternative, Alternative No. 6B actually provides 10-year flood protection to an additional 1,643 acres of land within the 8.5 SMA, including residential, commercial, vacant and agricultural lands. Much of this property could be used to relocate these populations within the 8.5 SMA.

Because of the amount of privately owned land being purchased with this alternative, Alternative No. 6B may potentially increase the adverse environmental effects on these minority and low-income populations. The relocation of these residents from the 8.5 SMA will be adversely impacted due to the loss of their community and the unique Hispanic culture of the 8.5 SMA. Non-residents will also be impacted due to the fact that many of them have second homes and weekend houses at which they spend time with their families, work their farms, and socialize with neighbors. Therefore, the loss of the community and unique Hispanic culture of the 8.5 SMA will also impact non-residents. Finally, both residents and non-residents who have agricultural land in the 8.5 SMA will be potentially impacted by this loss of income. Therefore, environmental justice impacts are associated with this alternative.

The USACE will work together with these minority and low-income populations to identify potential mitigation for these impacts.

- ***4.10.9 Aesthetics***

This alternative will have negligible impacts on aesthetic resources of the 8.5 SMA and environs.

- ***4.10.10 Recreational Resources***

The proposed levees will facilitate access onto public land for pedestrian and bicycle traffic (and possibly wheelchairs).

- ***4.10.11 Air Quality and Noise***

There are no anticipated air quality impacts associated with this alternative. The project is located in an air quality attainment area.

The U.S. General Services Administration requires that for equipment used on government contracts, the noise levels at the site should not exceed certain limits. Construction activities and their respective sound level limits at a distance of 50 feet associated with this alternative include blasting (95 dBA) and earthmoving activities (ranging from 75 to 80 dBA). Operation of the pump station also has its own sound level limits at a distance of 50 feet which is 75dBA. The closest residents to the construction activities and pump station are approximately 100 feet so the sound levels will be attenuated (i.e., reduced) to some degree.

- ***4.10.12 Farmlands***

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under

the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.10.13 Hazardous Materials Contamination

The alternative analysis for hazardous material contamination is covered under water quality for each alternative. Impacts to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and discharge areas for each alternative. This methodology includes all potential sources of water quality degradation.

4.10.14 Cultural Resources

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.11 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 7

4.11.1 Hydrological Effects of Structural and Operational Alternatives

The hydrological effects of Alternative No. 7 will be similar to those described for Alternatives 4 and 5. Alternative No. 7 acknowledges that the higher water levels within the ENP Expansion Area will have a significant effect on inundation within the 8.5 SMA. Structural means to mitigate for the flooding includes the raising of all roads to elevations above the flooding. Properties are not mitigated for the additional water levels however. Thus, flowage easements as discussed under Alternative No. 4 are to be used to provide

flood elevation mitigation for property owners. Flowage easements allow the landowner to retain full rights of ownership of the property and be compensated for the increase levels of flooding by granting a flowage easement to the government.

There is no flood mitigation for this alternative. Therefore, the hydrological effects of the alternative can be considered similar to those of future conditions without any of the alternatives. That is, there is a beneficial effect on the NESRS area adjacent to the 8.5 SMA. Figure 110 of Appendix A shows the duration of continuous inundation based on wet weather conditions. Figure 146, also from Appendix A, shows that the time of inundation in NESRS is increased dramatically.

- ***4.11.2 Regional Water Supply***

The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield, located approximately 11 miles northeast of the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5 SMA, the proposed alternatives will not impact regional groundwater supplies.

- ***4.11.3 Water Quality***

Base 95 conditions for the wet year (1995) show groundwater flow predominantly to

the southeast across the 8.5 SMA from the ENP. Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east. Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP during the wet year appear minimal for the existing condition.

Alternative No. 7 consists of raising all roads. Water quality impacts due to the implementation of this alternative would be similar to Base 95 conditions, as well as Alternative No. 4 (Figure 20).

4.11.4 Upland Vegetation

Inventories of existing conditions in the project area revealed that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland communities. Therefore native upland resources are not an issue of concern

4.11.5 Wetlands

Because lands would remain in private ownership, habitat management would be difficult on existing public owned lands. Without management, model flows would improve hydrology throughout the study area, but improvements to wetland function would be difficult to estimate. The intensity of agricultural and residential land use would likely increase in areas that do not experience frequent flooding (> 7.0 feet. NGVD) whereas intensity would likely decrease in the lower elevations (≤ 6.5 feet NGVD) where existing land uses would

continue to be vulnerable to inundation. Exotic species cover would potentially increase in area, especially where these species are already established, decreasing wetland function of those tracts. The Draft CAR further concludes that throughout the project's life, as new developments establish, existing wetland functions would be decrease or be lost. As existing land uses diminish in areas receiving too much water to maintain adequate living or cultivation conditions, habitat connectivity and buffer area would increase, thereby improving wetland function. Compared to base 95 existing conditions, overall wetland functions are predicted to increase by 1,290 functional units.

Increased hydroperiods result in a net wetland increase of 1,404 acres throughout the area of potential effect (study area). This is manifest as increased coverage of longer hydroperiod peat-forming prairies and the conversion of marl-forming prairies to peat-forming systems (Tables 10 and 11; Figure 27).

4.11.6 Fish and Wildlife

Increased hydroperiods are expected to provide for some recovery of wetlands in low lying portions of the 8.5 SMA. Consistent with this hydrologic improvement, habitat for fish and wildlife will be enhanced, providing more habitat for wetland dependant species. However, due to the continued occupation of the 8.5 SMA by local residents, management for exotic species is not a viable option, and some amount of future land conversion from open space to residential or agricultural can be expected.

4.11.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Snail Kite. The effects of this alternative on the Snail kite are similar to those stated in Alternative No. 1.

Wood Stork. The effects of this alternative on the Wood stork are similar to those stated in Alternative No. 1.

Cape Sable Seaside Sparrow. A Biological Assessment will be prepared for the selected plan and incorporated the Final SEIS.

4.11.8 Socio-Economics

A detailed discussion of the socioeconomic impacts associated with Alternative No. 7 is provided in Appendix E.

Although there is no structural element of this alternative, land use impacts would still occur to some extent due to the number of flowage easements required (Figure 9 in Appendix E). In essence, all 1,984 parcels within the 8.5 SMA could potentially be impacted by this alternative. The purchase of flowage easements on all of the privately owned land in the 8.5 SMA, an estimated 4,652 acres of land, for a total cost of $53.0 million, is considered compensation to land owners for the impacts associated with the periodic flooding of their land. Other costs include $11.7 million in land already acquired by the USACE and SFWMD and

$2.9 million in fee simple for the roads. These total $67.5 million for this alternative.

Currently, about 574 acres of land within the 8.5 SMA is located above the 10-year flood elevation. No new additional land above this elevation would result with the implementation of Alternative No. 7. Therefore, the expected development of the area above the 10-year flood elevation will remain the same as the existing conditions. These lands could only accommodate only a portion of the anticipated growth over the next fifteen years (107 of the 174 houses needed during this projection period).

Relocations. Under the original authorized GDM plan, the USACE purchased 663 acres of land on the western boundary of the 8.5 SMA. The acquisition of this land resulted in one residential relocation.

Based on the existing land use of the 8.5 SMA no additional residential, business, or agricultural lands will be required for the construction footprint of Alternative No. 7.

Approximately 4,652 acres will require the purchase of flowage easements, which will compensate land owners for the impacts associated with the periodic flooding of their lands. It should be noted that the cost of easements will be limited to the Fee Simple Value of the property. Therefore if the cost of the flowage easement plus the cost of modifying water and sewage systems exceeds the Fee Simple Value of the property, then the property owner would have the option of bearing the additional cost or Buy Out. For those property owners choosing the buy out option additional relocations would result from Alternative No. 7. In addition to the cost of the land, these relocations would cost an estimated $28,000 each.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific income data does not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA could be considered as a low-income population. The Miccosukee Tribe of Indians has purchased one parcel within the 8.55 SMA. Currently, this property is unoccupied.

Alternative No. 7 does not relocate any private landowners, including residential, commercial and agricultural land. However, individual parcels may receive an increased amount of flooding. These landowners will be compensated by the USACE purchasing flowage easements. Some relocations may occur if the cost of the flowage easements together with the modification costs exceed the Fee Simple Value of the property.

Because of the increased flooding potential on many of the parcels with this alternative, Alternative No. 7 may potentially increase the adverse environmental effects on these minority and low-income populations. The adverse environmental effects from this increased flooding may potentially change land use affecting residences, farms and potentially the unique Hispanic cultural aspects of the 8.5 SMA. Therefore, environmental justice impacts may be associated with this alternative.

The USACE will also work with these property owners to determine mitigation efforts for these impacts.

- ***4.11.9 Aesthetics***

There will be a slight impact on aesthetic resources given the non-structural nature of this alternative. The SOR

regulations, which impinge upon those parcels acquired under the SFWMD's 8.5 SMA Wetlands Phase I acquisition project, require that public lands be managed and protected. Improvements such as the removal of refuse, road maintenance, and the removal of exotic vegetation will make this area more attractive and amenable to the public.

4.11.10 Recreational Resources

The majority of the properties in the 8.5 SMA are likely to remain private property. This limits the opportunity for recreation in the project area.

4.11.11 Air Quality and Noise

There are no anticipated air quality impacts associated with this alternative. The project is located in air quality attainment area.

The U.S. General Services Administration requires that for equipment used on government contracts, the noise levels at the site should not exceed certain limits. Construction activities and their respective sound level limits at a distance of 50 feet associated with this alternative include earthmoving activities (ranging from 75 to 80 dBA). The closest residents to the construction activities are approximately 100 feet so the sound levels will be attenuated (i.e., reduced) to some degree.

4.11.12 Farmlands

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.11.13 Hazardous Materials Contamination

The alternatives analysis for hazardous material contamination is covered under water quality for each alternative. Impacts to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and discharge areas for each alternative. This methodology includes all potential sources of water quality degradation.

4.11.14 Cultural Resources

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.12 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 8A

4.12.1 Hydrological Effects of Structural and Operational Alternatives

Alternative No. 8A generally consists of a perimeter levee and interior levee, which run from the northeast portion of the 8.5 SMA to a southwestern terminus adjacent to Richmond Drive. A pump station is located at the southwestern terminus of the seepage canal. Water is pumped from the seepage canal at this location and allowed to flow through a spreader swale south towards the C-111 system.

Model simulations of existing conditions indicate that during the wet season water elevations may at times be above ground surface elevations, especially on the western portion of the 8.5 SMA. Alternative No. 8A allows water levels in the ENP Expansion Area to be raised in an effort to meet Natural System Model recommended elevations. Alternative No. 8A provides almost no flood mitigation for 8.5 SMA. Therefore, flooding of most of the 8.5 SMA must be mitigated by the use of flowage easements similar to Alternative No. 4.

An important hydrological effect of Alternative No. 8A is its beneficial effect on the NESRS area. Figure 110 of Appendix A shows the duration of continuous inundation based on wet weather conditions. Figure 158, also from Appendix A, shows that the time of inundation in NESRS is increased dramatically. Another positive effect occurs to the area southwest of the 8.5 SMA. Periods of inundation in the southern portion of Shark River Slough are extended.

4.12.2 Regional Water Supply The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield,

located approximately 11 miles northeast of the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5 SMA, the proposed alternatives will not impact regional groundwater supplies. A buyout of properties within the 8.5 SMA would require environmental site assessments of potentially contaminated sites.

4.12.3 Water Quality Base 95 conditions for the wet year (1995) show groundwater flow predominantly to the southeast across the 8.5 SMA from the ENP (Figure 16). Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east. Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP during the wet year appear minimal for the existing condition due to flow toward the south and east. Dry season flow generally follows the regional pattern to the southeast.

Alternative No. 8A consists of a proposed flow way through the central buffer area. The flow way would be between two levees, a major levee on the east side of the flow way, and a minor levee on the west side of the flow way. Water would be moved on the south end of the flow way via proposed structure S-357 to the C-111 project area. Simulated wet season head contours for Alternative No. 8 indicate flow from the ENP across the southwestern portion of the 8.5 SMA, toward a depression at proposed structure S- 357, which is located in the southeast portion of the 8.5 SMA (Figure 22). Flow across the northern portion of the 8.5 SMA is toward the southeast, and is intercepted by the L-31N canal. Simulated dry season flow is generally toward the southeast, following the regional flow pattern (Figure 22). The reduction in size of the developed lands within the 8.5 SMA as a result of the implementation of Alternative No. 8A should reduce water quality impacts due to decreased input and output of potential contaminants.

4.12.4 Upland Vegetation

Inventories of existing conditions in the project area revealed

that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland communities. Therefore native upland resources are not an issue of concern

4.12.5 Wetlands

The Draft CAR indicates this plan should maintain good water quality throughout the 8.5 SMA wetlands and provide a similar hydropattern to ENP wetlands as described in WRAP evaluations for Alternatives 4 and 5. Additionally, restoration of agricultural/residential lands west of the levee would be required to maximize the WRAP scores, similar to Alternatives 4 and 5. Some negative effects appear to correlate with the operation of the G–357 pump station because it decreases water levels within a 0.5-mile radius during pumping operations. The WRAP assessment predicts an increase of 2,240 function units under this alternative.

Shorter hydroperiod marl-forming prairies decrease in areal extent by approximately 4,063 acres while longer hydroperiod peat-forming prairies increase in coverage by 4,467 acres (Tables 10 and 11; Figure 29) This suggests a general shift from the short hydroperiod marl-forming communities toward longer hydroperiod peat-forming communities.

4.12.6 Fish and Wildlife

For lands east of the proposed levee, the extent and quality of existing habitat is low, and any potential impacts to fish and wildlife resources are minimal. For lands west of the proposed levee, wetland quality and therefore habitat quality, is anticipated to improve as a result of hydrologic enhancement. The floodway area will also support wetland communities and provide future habitat for fish and wildlife resources.

4.12.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete

analysis will be performed.

Snail Kite. The effects of this alternative on the Snail kite are similar to those stated in Alternative No. 1.

Wood Stork. The effects of this alternative on the Wood stork are similar to those stated in Alternative No. 1.

Cape Sable Seaside Sparrow. A Biological Assessment will be prepared for the selected plan and incorporated the Final SEIS.

4.12.8 Socio-Economics

A detailed discussion of the socioeconomic impacts associated with Alternative No. 8A is provided in Appendix E.

The land use impacts associated with Alternative No. 8A are similar to those of Alternative No. 6B (See Figure 10 in Appendix E). Of the 6,413 acres located in the 8.5 SMA, 5,803 acres or about 90 percent of the land will be required to implement this alternative. Table 16 shows the break down of land uses that will be impacted by this alternative. Some relocations may occur if the cost of the flowage easements together with the modification costs exceed the Fee Simple Value of the property. About 901 acres of this land is agricultural land, utilizing the average annual agricultural income per acre in Miami-Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $2.2 million. Assuming the existing estimated mix of residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $0.9 million and the loss to non-residents is about $1.3 million. According to the "Restudy Report", the loss of proprietors' income should be recovered within three years and displaced farm laborers should be re-employed within a year.

Currently, only 574 acres of the 8.5 SMA are located above the 10-year flood elevation. With the implementation of Alternative No. 8A, an additional 36 acres of land will be rendered above the 10-year flood elevation. Therefore, there would be a total of approximately 610 acres of land above the 10-year flood elevation. Assuming the development of all privately owned vacant and agricultural lands, approximately 569 acres of the land above the 10-year flood elevation could potentially be developed for residential uses at a density of 1 unit per 5 acres,

with a variance from Miami-Dade County. This acreage could accommodate a maximum of 114 new residential units. Therefore, this is not sufficient to accommodate the displaced residents (129 households and the 174 future projected households.

If this extent of development were to occur in the area, approximately 529 acres of agricultural lands would be lost to residential development. Utilizing the average annual agricultural income per acre in Miami-Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $1.8 million. Assuming the existing estimated mix of residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $0.7 million and about $1.1 million to non-residents.

The above analysis assumes that the zoning ordinance will be enforced. However, the County has not currently been enforcing the residential density of the 8.5 SMA. The average residential density for the 8.5 SMA area is approximately 1 unit per 3.65 acres rather than the 40 acres specified by the ordinance. Therefore, the induced growth on the remaining privately owned lands could be significantly higher if the zoning ordinance and variance program are not enforced.

Relocations. Approximately 529 residents (129 households) will be relocated with the implementation of Alternative No. 8A. In addition, the alternative will also displace three commercial properties and 603 agricultural properties. This will result in a loss of income (as identified above) to these property owners. Additional relocations may occur on those properties that flowage easements are required, if the total cost exceeds the Fee Simple Value of the property. The total cost of land acquisition and relocation costs are estimated to be $58.1 million.

Due to the minimal increase in the amount of land above the 10-year flood elevation, opportunities to relocate these households within the 8.5 SMA will be minimal.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific income data does not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA

could be considered as a low-income population. The Miccosukee Tribe of Indians has purchased one parcel within the 8.5 SMA. Currently, this property is unoccupied.

A small portion of the property owners within the 8.5 SMA may benefit from this alternative. As stated in the Land Use Impact section for this alternative, Alternative No. 8A actually provides 10-year flood protection to an additional 36 acres of land within the 8.5 SMA.

Because of the amount of privately owned land being purchased with this alternative, Alternative No. 8A may have adverse environmental effects on these minority and low-income populations. The relocation of these residents from the 8.5 SMA will be adversely impacted due to the loss of their community and the unique Hispanic culture of the 8.5 SMA. Non-residents will also be impacted due to the fact that many of them have second homes and weekend houses at which they spend time with their families, work their farms, and socialize with neighbors. Therefore, the loss of the community and unique Hispanic culture of the 8.5 SMA will also impact non-residents. Finally, both residents and non-residents who have agricultural land in the 8.5 SMA will be potentially impacted by this loss of income. Therefore, environmental justice impacts are associated with this alternative.

The USACE will work together with these minority and low-income populations to identify potential mitigation for these impacts.

4.12.9 Aesthetics Viewing wildlife, wetlands, and relatively pristine open spaces are valued activities. Restoring the southern Everglades ecosystem will enhance the quality of these activities. Restoration means "a healthier environment that will support vigorous plant communities, larger fish and aquatic animal populations, large numbers of wading birds, alligators, and sustainable populations of wide-ranging mammals in a natural setting, in perpetuity "(USACE/SFWMD 1999: 8-16). Improvements to the hydrologic function of wetlands will enhance the ecological quality and beauty of the area by encouraging native vegetation and discouraging exotic vegetation. The westernmost levee proposed under this alternative, albeit relatively low in elevation, will nonetheless effect a slight improvement over an already picturesque viewshed of the adjoining Save Our Rivers lands and ENP

parkland.

4.12.10 Recreational Resources

The proposed levees will facilitate access onto public land for pedestrian and bicycle traffic (and possibly wheelchairs). Any alternatives including buyout options provide an opportunity for passive recreation of this nature. Activities such as fishing along the canals and hunting, which is being temporally permitted in the ENP Expansion Area, would require regulation by ENP and the FFWCC.

4.12.11 Air Quality and Noise

There are no anticipated air quality impacts associated with this alternative. The project is located in an air quality attainment area.

The U.S. General Services Administration requires that for equipment used on government contracts, the noise levels at the site should not exceed certain limits. Construction activities and their respective sound level limits at a distance of 50 feet associated with this alternative include blasting (95 dBA) and earthmoving activities (ranging from 75 to 80 dBA). Operation of the pump station also has its own sound level limits at a distance of 50 feet which is 75dBA. The closest residents to the construction activities and pump station are approximately 100 feet so the sound levels will be attenuated (i.e., reduced) to some degree.

4.12.12 Farmlands

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.12.13 Hazardous Materials Contamination

The alternatives analysis for hazardous material contamination is covered under water quality for each alternative. Impacts to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and discharge areas for each alternative. This methodology includes all

potential sources of water quality degradation.

4.12.14 Cultural Resources

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.13 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE NO. 9

4.13.1 Hydrological Effects of Structural and Operational Alternatives

Alternative No. 9 is a combination of Alternatives 1 and 2B. Although not specifically simulated using the model, it is expected that the hydrological effects will be a combination of those effects identified for Alternatives 1 and 2B. Alternative 9, like Alternatives 1 and 2B consists of a perimeter levee, seepage canal, and interior levee which follows the northern and western boundaries of the 8.5 SMA. A pump station is located at both the northeastern (S-357A) and southwestern (S-357B) terminus of the seepage canal adjacent to the L-31N canal and Richmond Drive, respectively.

Model simulations of existing conditions indicate that during the wet season water elevations may be above ground surface elevations, especially on the western portion of the 8.5 SMA. Alternative No. 9 allows water levels in the ENP Expansion Area to be raised in an effort to meet Natural Systems Model recommended elevations. Alternative No. 9 provides flood mitigation for the entire 8.5 SMA, except for a small area on the eastern boundary adjacent to the L-31N canal. The lack of mitigation in this small area is not considered to be significant because of its size and elevation changes (maximum approximately 0.4 feet). Most importantly, though, the water level is below ground surface. That is, the change in elevation in this small area actually occurs below land surface in an area of the highest topography within the 8.5 SMA.

Another important hydrological effect of Alternative No. 9 is its beneficial effect on the NESRS area. Figure 110 of Appendix A shows the duration of continuous inundation based on wet

weather conditions. Figures 112 and 134, also from Appendix A, show that the time of inundation in NESRS is increased dramatically. The environmental significance of this change in flow patterns is discussed in subsequent section of this report.

4.13.2 Regional Water Supply

The nearest regional water supply wellfield is the Miami Springs-Hialeah Wellfield, located approximately 11 miles northeast of the 8.5 SMA. Due to the proximity of the wellfield, and the limited area of the 8.5 SMA, the proposed alternatives will not impact regional groundwater supplies.

4.13.3 Water Quality

Base 95 conditions for the wet year (1995) show groundwater flow predominantly toward the southeast across the 8.5 SMA from the ENP. Flow is toward the L-31N canal from the 8.5 SMA, and to the L-31N canal from the east (Figure 16). Potentially degraded shallow groundwater or surface water within the 8.5 SMA would presently flow to the L-31N canal, where it would then flow to the south to the C-111 canal, and/or to the east through the C-102 or C-103 canals. Any constituents migrating deeper within the surficial aquifer would flow beneath the L-31N to the southeast. Water quality impacts to the ENP during the wet year appear minimal for the existing condition.

Alternative No. 9 is a refinement of Alternative No. 1, with two proposed structures instead of one. Structure S-357A would discharge to L-31N canal, then water would be moved into L-29 canal via S-356 (at Tamiami canal). Structure S-357B at the south end of the proposed canal would discharge south to a proposed STA. Water quality impacts from the implementation would be a

combination of Alternatives 1 and 2B. Alternative No. 9 could result in the discharge of potentially "impacted" waters to the ENP through discharge into the L-29 canal. The potential point source at structure S-356 would have to be addressed during permitting. Water flowing to the south would be discharged to an STA prior discharge into the ENP, reducing water quality impacts (Figure 18). During the dry year simulation (Alternative No. 1 simulation), groundwater flow follows the regional pattern to the southeast.

4.13.4 Upland Vegetation

Inventories of existing conditions in the project area revealed that natural upland resources have largely been converted to agricultural or residential land use, or no longer support native upland communities. Therefore native upland resources are not an issue of concern

4.13.5 Wetlands

The Draft CAR concluded that Impacts to wetland resources are the same for Alternative No. 9 as for Alternative No. 1 and 2B. Similarly, wetland acreage's are reduced by 2,702 acres, primarily as a result of reductions in shorter hydroperiod wetlands.

As with Alternatives 1 and 2B, Alternative 9 impacts approximately 345 acres of wetlands as a result of levee and canal construction. The majority of these impacts (336.1 ac) are graminoid wetlands below the 7' contour.

4.13.6 Fish and Wildlife

For lands east of the proposed levee, the extent and quality of existing habitat is low, and any potential impacts to fish and wildlife resources are minimal. For lands west of the proposed levee, wetland quality and therefore habitat quality, is anticipated to improve as a result of hydrologic enhancement. The floodway area will also support wetland communities and provide future habitat for fish and wildlife resources.

4.13.7 Listed Species

Florida Panther. Evaluation of this alternative and its impacts to the Florida panther has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Eastern Indigo Snake. Evaluation of the alternatives and their impacts to the eastern Indigo snake has been deferred until the selection of a preferred alternative at which time a complete analysis will be performed.

Snail Kite. The effects of this alternative on the Snail kite are similar to those stated in Alternative No. 1.

Wood Stork. The effects of this alternative on the Wood stork are similar to those stated in Alternative No. 1.

Cape Sable Seaside Sparrow. A Biological Assessment will be prepared for the selected plan and incorporated the Final SEIS.

4.13.8 Socio-Economics

Land Use. A detailed discussion of the socioeconomic impacts associated with Alternative No. 9 is provided in Appendix E.

As shown in Table 17, the footprint of Alternative No. 9 exclusively uses publicly owned vacant land (approximately 663 acres) (Figure 11 in Appendix E). This land was acquired at a cost of $2.4 million and $28,000 for the one relocation. Minimal land use impacts will occur near the southeastern portion of the 8.5 SMA due to the increase in the amount of land above the 10-year flood elevation (7.7 ft NGVD). Currently, only 574 acres of the 8.5 SMA are located above the 10-year flood elevation. With the implementation of Alternative No. 9, an additional 78 acres of land will be rendered above the 10-year flood elevation. Therefore, there would be a total of approximately 652 acres of land above the 10-year flood elevation. Assuming the development of all privately owned vacant and agricultural lands, approximately 606 acres of the land above the 10-year flood elevation could potentially be developed for residential uses at a density of 1 unit per 5 acres, with a variance from Miami-Dade County.

These lands would accommodate only a portion of the anticipated population growth within the area over the next fifteen years (121 of the 174 households anticipated).

If this extent of development were to occur in the area, approximately 561 acres of agricultural lands would be lost to residential development. Utilizing the average annual agricultural income per acre in Miami-Dade County ($2,445), the value of annual agricultural income potentially lost is estimated at about $1.4 million. Assuming the existing estimated mix of residents (40.5%) versus non-residents (59.5%) remains constant, the estimated amount of annual agricultural income potentially lost to residents is about $0.6 million, with the remainder being lost to non-residents. These losses are expected to be temporary and should be recovered within three years.

The above analysis assumes that the zoning ordinance will be enforced. However, the County has not currently been enforcing the residential density of the 8.5 SMA. The average residential density for the 8.5 SMA area is approximately 1 unit per 3.65 acres rather than the 40 acres specified by the ordinance. Assuming that the County will continue not to enforce the density ordinance, there would not be any project induced growth within the 8.5 SMA, since vacant and agricultural lands are available to accommodate the projected future growth of the population. Further, since there are sufficient vacant lands to accommodate future growth for this

scenario, no loss of agricultural production is anticipated.

Relocations. Under the original authorized GDM Plan, USACE purchased 663 acres of land on the western boundary of the 8.5 SMA. The acquisition of this land resulted in one residential relocation.

Based on the existing land use of the 8.5 SMA, no additional residential, business, or agricultural lands will be required to construct this alternative. Therefore, there will be no additional relocation of residents associated with this alternative.

Environmental Justice. As stated in the Section 3 of this document, the majority of the population residing in the 8.5 SMA is Hispanic. In addition, although specific income data does not exist, given the rural nature and the reported presence of migrant farm workers and illegal immigrants within the 8.5 SMA, a substantial percent of the residents within the 8.5 SMA could be considered as a low-income population. The Missocukee Tribe of Indians has purchased one parcel within the 8.5 SMA. Currently, this property is unoccupied.

Alternative No. 9 does not displace any private landowners, including residential, commercial and agricultural land. A portion of these property owners may benefit from this alternative. As stated in the Land Use Impact section for this alternative, Alternative No. 9 actually provides 10-year flood protection to an additional 78 acres of land within the 8.5 SMA, including residential, commercial, vacant and agricultural

lands. In addition, Alternative No. 9 will not impact any of the cultural or "Social Clubs" located within the 8.5 SMA.

Even though the population consists primarily of a minority or low-income population, there are no adverse human health or environmental effects of Alternative No. 9. Therefore, there are no environmental justice impacts associated with this alternative.

4.13.9 Aesthetics

Viewing wildlife, wetlands, and relatively pristine open spaces are valued activities. Restoring the southern Everglades ecosystem will enhance the quality of these activities. Restoration means "a healthier environment that will support vigorous plant communities, larger fish and aquatic animal populations, large numbers of wading birds, alligators, and sustainable populations of wide-ranging mammals in a natural setting, in perpetuity" (USACE/SFWMD 1999: 8-16). Improvements to the hydrologic function of wetlands will enhance the ecological quality and beauty of the area by encouraging native vegetation and discouraging exotic vegetation. The westernmost levee proposed under this alternative, albeit relatively low in elevation, will nonetheless effect a slight improvement over an already picturesque viewshed of the adjoining Save Our Rivers lands and ENP parkland.

4.13.10 Recreational Resources

The proposed levees will facilitate access onto public land for pedestrian and bicycle traffic (and possibly wheelchairs). Any alternatives including buyout options provide an opportunity for passive recreation of this nature. Activities such as fishing along the canals and hunting, which is being temporally permitted in the ENP Expansion Area, would require regulation by ENP and the FFWCC

4.13.11 Air Quality and Noise

There are no anticipated air quality impacts associated with this alternative. The project is located in an air quality attainment area.

The U.S. General Services Administration requires that for equipment used on government contracts, the noise levels at the site should not exceed certain limits. Construction activities and their respective sound level limits at a distance of 50 feet associated with this alternative include blasting (95 dBA) and earthmoving activities (ranging from 75 to 80 dBA). Operation of the pump station also has its own sound level limits at a distance of 50 feet which is 75dBA. The closest residents to the

construction activities and pump station are approximately 100 feet so the sound levels will be attenuated (i.e., reduced) to some degree.

4.13.12 Farmlands

Coordination with the NRCS has been initiated to determine the extent of direct and indirect conversion of farmlands under the Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201(c)(1)(A)). The results of that coordination will be presented in the Final SEIS.

4.13.13 Hazardous Materials Contamination

The alternatives analysis for hazardous material contamination is covered under water quality for each alternative. Impacts to the ENP from ground and surface water originating from the 8.5 SMA are qualitatively evaluated based on flow and discharge areas for each alternative. This methodology includes all potential sources of water quality degradation.

4.13.14 Cultural Resources

Consultation under Section 106 of the National Historic Preservation Act of 1966 (PL 89-665 as amended) has been initiated. A cultural resource assessment survey of the 8.5 SMA (the 10 square mile project area) is underway at the time of writing. The results of the consultation will be presented in the Final SEIS.

4.14 SECONDARY IMPACTS

Secondary impacts will be fully addressed for the preferred alternative and presented in the Final SEIS.

4.15 CUMULATIVE IMPACTS

Cumulative impacts are defined as the impacts on the environment that results from the incremental impact of the considered action when added to other past, present, and reasonably foreseeable future actions. The action involved is to reevaluate the current proposed action (Alternative No. 1) in addition to other alternatives that provide flood mitigation to the 8.5 SMA. All alternatives are considered viable and the selected alternative will ultimately result in improved water deliveries to the NESRS and ENP. Impacts to the environment will vary depending on the alternative selected, and impacts as a result of the selected alternative will be presented in the Final EIS. There are several efforts in various stages of planning and implementation peripheral to the 8.5 SMA project that can be reasonably expected to result in cumulative beneficial effects. Example projects include the Comprehensive Everglades Restoration Project, C-111, and Save Our Rivers (SOR) land acquisition program.

4.16 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts will be addressed for the preferred alternative and presented in the Final SEIS. Unavoidable adverse impacts are not anticipated due to the net environmental benefit of the MWD. The potential for adverse impacts to the CSSS and Florida panther will be addressed for the preferred alternative in the Final SEIS.

4.17 THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE OF LONG-TERM PRODUCTIVITY

All of the proposed alternatives will contribute to the maintenance of long-term productivity.

4.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ALTERNATIVE

The irreversible and irretrievable commitments of resources will be fully addressed in the Final SEIS following the selection of a preferred alternative. For alternatives requiring structural modifications, resources committed would include a combination of State and Federal funding, labor, energy, and project materials to build, operate and maintain.

4.19 ENVIRONMENTAL COMMITMENTS

Commitments necessary to support the preferred alternative will be identified and presented in the Final SEIS.

4.20 COMPLIANCE WITH FEDERAL STATUTES, EXECUTIVE ORDERS, AND POLICIES

Coordination and evaluation of required compliance with specific Federal Acts, Executive Orders and other policies is ongoing for the nine alternatives being considered, in part through the coordination of this draft document. This compliance was established for Alternative No. 1 (current authorized plan) in conjunction with the GDM/EIS on Modified Water Deliveries to ENP (1992). Upon identification of the recommended plan (selected alternative) as a result of this current evaluation, the actions and evaluations to describe the specific compliance with each requirement will be documented and presented in the Final Supplement to the Environmental Impact Statement. The acts, orders, and other policies are listed in sections 4.21 through 4.43.

4.21 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

The project is in compliance with the National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321, et seq. P.L. 91-190

4.22 ENDANGERED SPECIES ACT OF 1973

At this stage of planning, this project is in compliance with the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq. P.L. 93-205. Further coordination will occur following selection of the preferred alternative.

4.23 FISH AND WILDLIFE COORDINATION ACT OF 1958

This project has been coordinated with the U.S. Fish and Wildlife Service (USFWS). A Coordination Act Report (CAR) dated March 31, 2000 was submitted by the USFWS. This project is in full compliance

with the Fish and Wildlife Coordination Act of 1958, 48 Stat. 401, as amended, 16 U.S.C. 661, et seq. P.L. 86-624

4.24 NATIONAL HISTORIC PRESERVATION ACT OF 1966

Consultation with the Florida State Historic Preservation Officer (SHPO), has been initiated in accordance with the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470a, et seq. P.L. 89-655; the Archeological and Historic Preservation Act, as amended and Executive Order 11593.

4.25 CLEAN WATER ACT OF 1972

The project is currently in compliance with The Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq. P.L. 92-500.

4.26 CLEAN AIR ACT OF 1972

At this stage of planning, this project is currently in compliance with Section 309 of the Clean Air Act of 1972, as amended, 42 U.S.C. 1857h-7, et seq. P.L. 91-604.

4.27 COASTAL ZONE MANAGEMENT ACT OF 1972

Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451, et seq. P.L. 92-583

The project is consistent with the Florida Coastal Zone Management Program (see letter dated July 13, 1999 from The State of Florida Department of Community Affairs concurring with our consistency determination in Appendix B).

4.28 FARMLAND PROTECTION POLICY ACT OF 1981

Coordination with the NRCS has been initiated consistent with the Farmland Protection Policy Act of 1980 and 1995, P.L. 97-98 (see letter dated March 10, 2000 Appendix B).

4.29 WILD AND SCENIC RIVER ACT OF 1968

No designated Wild and Scenic river reaches would be affected by project related activities. The Wild and Scenic River Act of 1968, as amended, 16 U.S.C. 1271, et seq. P.L. 90-542 is not applicable.

4.30 MARINE MAMMAL PROTECTION ACT OF 1972

This project is in compliance with the Marine Mammal Protection Act of 1972, 16 U.S.C. 1361, et seq. P.L. 92-522. No impacts are anticipated.

4.31 ESTUARY PROTECTION ACT OF 1968

No designated estuary would be affected by project activities. The Estuary Protection Act of 1968, 16 U.S.C. 1221, et seq. P.L. 90-454 is not applicable.

4.32 FEDERAL WATER PROJECT RECREATION ACT

The principles of the Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1(12), et seq. P.L. 85-72, do not apply to this project.

4.33 FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976

The project is in compliance with the Fishery Conservation and Management Act of 1976, as amended, 16 U.S.C. 1801-1882; P. L. 94-265

4.34 SUBMERGED LANDS ACT OF 1953

The project is in compliance with the State Sovereignty and Submerged Lands program and the Submerged Lands Act of 1953, 43 U.S.C. 1301 et seq.

.4.36 COASTAL BARRIER RESOURCES ACT OF 1982 AND COASTAL BARRIER IMPROVEMENT ACT OF 1990

There are no designated coastal barrier resources in the project area that would be affected by this project. The Coastal Barrier Resources, 16 U.S.C. 3501, et seq. P.L. 97-348 Act, and Coastal Barrier Improvement Act of 1990 are not applicable.

4.35 RIVERS AND HARBORS ACT OF 1899

The proposed work would not obstruct navigable waters of the United States. The proposed action has been subject to the public notice, public hearing, and other evaluations normally conducted for activities subject to the Rivers and Harbors Act of 1899, 33 U.S.C. 401, et seq. The project is in full compliance.

4.36 ANADROMOUS FISH CONSERVATION ACT

As defined in the Anadromous Fish Conservation Act, (16 USC 757a-757g; 79 Stat. 1125) as amended by PL 89-304, anadromous fish species will not be affected.

4.37 MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT

The project is in compliance with the Migratory Bird Conservation Act, 16 U.S.C. 715-715d, 715e, 715f-715r; 45 Stat. 1222 and the Migratory Bird Treaties and other international agreements listed in the Endangered Species Act of 1973, as amended, Section 2(a) (4).

4.38 MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

The Marine Protection, Research and Sanctuaries Act, 33 U.S.C. 1401, et seq. P.L. 92-532 (3[33 U.S.C. 1402](f)) does not apply this project.

4.39 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The Magnuson-Stevens Fishery Conservation and Management Act, as amended in 1996,16 U.S.C. 1801 et seq. P.L. 94-265 does not apply to this project.

4.40 E.O. 11980, PROTECTION OF WETLAND

This project is in compliance with the goals of this Executive Order.

4.41 E.O. 11988, FLOOD PLAIN MANAGEMENT

This project is in compliance with the goals of this Executive Order.

4.42 E.O. 12898, ENVIRONMENTAL JUSTICE

Exeutive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", provides that" each Federal agency shall make achieving environmental justice part of its mission by identifying and addresseing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations."

This project is being developed consistently with E. O. 12898, and is currently in compliance.

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SECTION 5.0

LIST OF TABLES

Table 1. SFWMD Quarterly Pesticide Surface Water and Sediment Monitoring in the 8.5 Square Mile Area - Detected Parameters from Sites S-331 and G-211

Table 2. Surface (Standing) Water Quality Sampling in the 8.5 Square Mile Area – Detected Parameters, Hurricane Irene Post-Storm Event, October 22, 1999

Table 3. Surface (Standing) Water Sampling in the 8.5 Square Mile Area – Coliform Results, Hurricane Irene Post-Storm Event

Table 4. East Everglades - 8.5 Square Mile Area Wetlands Plant Species List

Table 5. Existing Condition WRAP Polygon Scores, Acreages, and Functional Units for the 8.5 Square Mile Area

Table 6. Species Listed by Florida Game and Freshwater Fish Commission as Threatened, Endangered, and Species of Special Concern, Excluding Federally-listed Species

Table 7. Tabulation of Detailed Existing Land Uses

Table 8. Tabulation of Existing Land Use Classifications for Analysis

Table 9. Summary of Impact Matrix

Table 10. Wetland Acreage and WRAP Functional Units by Alternatives

Table 11. Change in Wetland Area and WRAP Functional Units Compared to Existing Conditions

Table 12. Summary of Alternative 1 Land Requirements

Table 13. Summary of Alternative 2 Land Requirements

Table 14. Summary of Alternative 3 Land Requirements

Table 15. Summary of Alternative 6 Land Requirements

Table 16. Summary of Alternative 8 Land Requirements

Table 17. Summary of Alternative 9 Land Requirements

Table 18. Summary of Public Coordination

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SECTION 6

LIST OF FIGURES

Figure 1. Project Location Map

Figure 2. Modified Water Deliveries and C-111 Projects

Figure 3a. Alternative 1-Authorized GDM Plan

Figure 3b. Alternative No. 2B - Modified GDM Plan

Figure 3c. Alternative No. 3 – Deep Seepage Barrier Plan

Figure 3d. Alternative No. 4 – Residents Choice Land

Figure 3e. Alternative No. 5 – Total Land Acquisition Through Buy Out

Figure 3f. Alternative No. 6B – Raise SW 202nd Avenue as a Levee

Figure 3g. Alternative No. 7 – Raise All Roads

Figure 3h. Alternative No. 8A – Flow-way

Figure 3i. Alternative No. 9 – Adaptive Refinement of GDM Plan

Figure 4 Physiographic Setting

Figure 5. Topographic Setting

Figure 6. Distribution of the Miami Limestone Formation

Figure 7. Soils

Figure 8. Hydrologic Setting

Figure 9. Hydrogeologic Cross-Section

Figure 10. Average Dry Season Water Table

Figure 11. Average Wet Season Water Table

Figure 12. Surface (Standing) Water Sampling Sites

Figure 13. Vegetative Communities

Figure 14. Subpopulations of the Cape Sable Seaside Sparrow

Figure 15. Existing Land Use

Figure 16. Simulated Water Elevation Contours – Existing Conditions

Figure 17. Simulated Water Elevation Contours – Alternative No. 1

Figure 18. Simulated Water Elevation Contours – Alternative Nos. 2B & 9

Figure 19. Simulated Water Elevation Contours – Alternative No. 3

Figure 20. Simulated Water Elevation Contours – Alternative Nos. 4, 5 & 7

Figure 21. Simulated Water Elevation Contours – Alternative No. 6B

Figure 22. Simulated Water Elevation Contours – Alternative No. 8A

Figure 23. Simulated Wetland Hydroperiods and Substrate

Conditions – Existing Conditions

Figure 24. Simulated Wetland Hydroperiods and Substrate Conditions – Alternative No. 1

Figure 25. Simulated Wetland Hydroperiods and Substrate Conditions – Alternative Nos. 2B & 9

Figure 26. Simulated Wetland Hydroperiods and Substrate Conditions – Alternative No. 3

Figure 27. Simulated Wetland Hydroperiods and Substrate Conditions – Alternative Nos. 4, 5 & 7

Figure 28. Simulated Wetland Hydroperiods and Substrate Conditions – Alternative No. 6B

Figure 29. Simulated Wetland Hydroperiods and Substrate Conditions – Alternative No. 8A

SECTION 7.0

PUBLIC INVOLVEMENT

As part of the preparation of this Supplemental EIS, affected stakeholders have been afforded several opportunities for public input. Public involvement included numerous public forums to allow for residents, cooperating agencies, and affected stakeholders to present their issues and concerns. Table 18 summarizes public comment and interagency coordination to date.

Meetings held to specifically discuss this project included agency and stakeholder scoping meetings, technical team meetings, and formal public meetings. Numerous verbal and

written comments were received from residents and non-residents, business owners, elected officials, special interest groups, and the environmental community. During formal public meetings, all input was documented on tape by a stenographer and comment cards filled out by attendee were assembled. At the technical meetings, input was received from agency representatives, special interest groups, and other various stakeholders. Cooperative efforts were pursued to gain an understanding of issues and include input in the most effective manner possible.

All public meetings were announced (noticed) at least two weeks in advance while technical meetings were open to all interested parties who were notified via a network of electronic mail and telephone correspondence. In an effort to gather as much information and insight as possible, several visits were made to the
8.5 SMA, hosted by residents, business owners, and government agency and tribal representatives.

SECTION 8.0

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SECTION 9

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Section 10.0

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Table 4. East Everglades- 8.5 Square Mile Area Plant and Animal Species List

Plants	
Species	**Common Name**
Acrostichum danaeifolium *	Leather fern
Agalinis purpurea	False-foxglove
Aletris lutea	Colic-root
Andropogon glomeratus	Bluestem, bushy
Anemia adiantifolia *	Pine fern
Annona glabra	Pond apple
Apteria aphylla	Nodding Nixie

Ardisia elliptica	Shoebutton Ardisia
Ardisia escallonoides	Marlberry
Aristida purpurascens	Three-awn grass
Aster carolinianus	Aster, climbing
Baccharis glomerulifolia	Groundsel tree
Baccharis halimifolia	Saltbush
Bacopa monnieri	Water hyssop
Bacopa caroliniana	Water hyssop
Bidens alba	Spanish needle
Bischofia javanica	Bishopwood
Blechnum serrulatum	Swamp fern
Bletia purpurea *	Pine pink
Boehmeria cylindrica	Button hemp
Buchnera floridana	Bluehearts
Calopogon tuberosus	Grass pink
Cassia bicapsularis	Cassia
Casuarina spp.	Australian pine
Centella asiatica	Coinwort
Cestrum diurnum	Day jessamine
Chara sp.	Stonewort
Chiococca pinetorum	Pineland snowberry
Chloris glauca	Finger grass
Cirsium horridulum	Thistle
Cladium jamaicense	Sawgrass
Conocarpus erecta	Buttonwood
Conoclinium coelestinum	Mist flower
Crinum americanum	String lily
Cyperus haspan	Flatsedge, sheathed
Cyperus odoratus	Sweet rush
Cyperus spp.	Sedges
Diodia virginiana	Buttonweed
Eleocharis atropurpurea	Spike rush
Eleocharis cellulosa	Gulf spike rush
Eleocharis interstincta	Spike rush
Eragrostis elliottii	Lovegrass
Erianthus giganteus	Plumegrass, sugarcane
Eupatorium capillifolium	Dog fennel

Eupatorium leptophyllum	Thoroughwort
Eupatorium sp.	Thoroughwort
Ficus aurea	Strangler fig
Ficus sp.	Strangler fig
Helenium vernale	Everglades daisy
Heliotropium polyphyllum	Heliotrope
Hydrocotyle spp.	Water pennywort
Hymenocallis latifolia	Spider lily
Ipomoea sagitatta	Morning glory, glades
Ilex cassine	Dahoon holly
Juncus megacephalus	Bighead rush
Juncus roemerianus	Black rush
Justicia ovata	Water-willow
Lantana involucrata	Wild sage
Lemna minor	Duckweed
Linum medium var. texanum	Flax, stiff yellow
Lobelia glandulosa	Lobelia
Ludwigia peruviana	Primrose willow
Ludwigia repens	Ludwigia
Ludwigia curtissii	Waterprimrose
Ludwigia sp.	Ludwigia
Lythrum lineare	Loosestrife
Magnolia virginiana	Sweet bay
Mecardonia acuminata	Mecardonia
Melaleuca quinquenervia	Melaleuca
Melothria pendula	Creeping cucumber
Metopium toxiferum	Poisonwood
Mikania scandens	Climbing hemp weed
Mitreola petiolata	Miterwort, stalked
Muhlenbergia capillaris	Muhly
Myrica cerifera	Wax myrtle
Myrsine guianensis	Myrsine
Nephrolepis biserrata	Boston fern
Nephrolepis exaltata	Boston fern
Nephrolepis sp.	Boston fern
Neyraudia reynaudiana	Burma reed
Nymphaea odorata	Water-lily

Nymphoides aquatica	Floating hearts
Oecoclades maculata	African orchid
Osmunda regalis	Royal fern
Oxypolis filiformis	Water dropwort
Parthenocissus quinquefolia	Virginia creeper
Passiflora suberosa	Corky-stemmed passion vine
Pennisetum purpureum	Napier grass
Panicum erectifolium	Panicum, erect leaf
Panicum hemitomum	Maidencane
Panicum repens	Torpedograss
Panicum tenerum	Panicum, blue joint
Peltandra virginica	Arrow arum
Persea palustris	Swamp bay
Phyla nodiflora	Creeping Charlie
Pluchea odorata	Marsh fleabane
Pluchea rosea	Marsh fleabane
Pluchea sp.	Marsh fleabane
Polygonum sp.	Smartweed
Polypodium aureum	Golden polypody
Proserpinaca palustris	Mermaid-weed
Psidium guajava	Guava
Psilotum nudum	Whisk fern
Psychotria nervosa	Wild coffee
Pteris longifolia	Brake fern
Pteris longifolia var. *bahamensis*	Brake fern
Pteris vittata	Brake fern
Ricinus communis	Castor bean
Rhoeo spathacea	Oyster plant
Rhynchospora (*Dichromena*) *colorata*	White sedge
Rhyncospora divergens	Beakrush, spreading
Rhyncospora inundata	Beakrush, horned
Rhyncospora microcarpa	Beakrush, southern
Rhyncospora tracyi	Beakrush, Tracy's
Rivina humilis	Bloodberry
Sabal palmetto	Sabal palm
Sagittaria graminea	Arrowhead, coastal
Sagittaria lancifolia	Arrowhead

Salix caroliniana	Willow
Salvinia rotundifolia	Water fern
Sambucus canadensis	Elderberry
Samolus ebracteatus	Water pimpernel
Sarcostemma clausum	Milk withe
Schinus terebinthifolius	Brazilian pepper
Scirpus validus	Great bulrush
Schizachyrium gracile	Bluestem
Schizachyrium rhizomatum	Bluestem
Schizachyrium semiberbe	Bluestem
Serenoa repens	Saw palmetto
Smilax spp.	Catbriar
Solanum erianthum	Nightshade
Solidago stricta	Goldenrod, willowleaf
Solidago sp.	Goldenrod
Spermacoce glabra	Buttonweed
Sporobolus virginicus	Dropseed
Terminalia cattapa	Tropical almond
Thelypteris augescens *	Abrupt-tip maiden fern
Thelypteris kunthii *	Wood fern
Tillandsia spp.	air plants
Toxicodendron radicans	Poison Ivy
Trema lamarckiana	West Indian trema
Trema micrantha	Florida trema
Trismeria trifoliata	Goldenrod fern
Typha spp.	Cattails
Fishes	
Species	**Common Name**
Notemigonus crysoleucas	Golden Shiner
Erymizon succetta	Lake Chubsucker
Ictalurus nebulosus	Brown Bulhead
Ictalurus natalis	Yellow Bulhead
Notorus gyrinus	Tadpole Madtom
Clarias batrachus	Walking Catfish
Lucania goodei	Bluefin Killifish
Adinia xenica	Diamond Killifish
Fundulus seminolis	Seminole Killifish

Fundulus confluentus	Marsh Killifish
Fundulus chrysotus	Golden Topminnow
Cyprinodon variegatus	Sheepshead Minnow
Jordanella floridae	Flagfish
Gambusia affinis	Mosquitofish
Heterandria formosa	Least Killifish
Poecilia latipinna	Sailfin Molly
Labidesthes sicculus	Brook Silverside
Elassoma evergladei	Everglades Pygmy Sunfish
Micropterus salmoides	Largemouth Bass
Lepomis gulosus	Warmouth
Lepomis punctatus	Spotted Sunfish
Lepomis microlophus	Redear Sunfish
Lepomis marginatus	Dollar Sunfish
Lepomis macrochirus	Bluegill
Enneacanthus gloriosus	Blue-spotted Sunfish
Etheostoma fusiforme	Swamp Darter
Cichlasoma bimaculatum	Black Acara
Amphibians	
Species	**Common Name**
Siren lacertina	Greater Siren
Pseudobranchus striatus	Everglades Dwarf Siren
Notophthalmus viridescens	Peninsula Newt
Amphiuma means	Two-toed Amphiuma
Scapheiopus holbrooki	Eastern Spadefoot
Bufo terrestris	Southern Toad
Bufo quercicus	Oak Toad
Bufo marinus	Giant Toad
Eleutherodactylus planirostris	Greenhouse Frog
Hyla squirella	Squirrel Treefrog
Hyla cinerea	Green Treefrog
Hyla septentrionalis	Cuban Treefrog
Limnaoedus ocularis	Little Grass Frog
Pseudacris nigrita	Florida Chorus Frog
Acris gryllus	Florida Cricket Frog
Rana grylio	Pig Frog
Rana utricularia	Southern Leopard Frog

Gastrophryne carolinensis	Eastern Narrow-mouthed Toad
Reptiles	
Species	**Common Name**
Chelydra serpentina	Snapping Turtle
Sternotherus odoratus	Stinkpot
Kinosternon bauri	Striped Mud Turtle
Kinosternon subrubrum	Florida Mud Turtle
Terrapene carolina	Florida Box Turtle
Chrysemys floridana	Florida Cooter
Chrysemys nelsoni	Florida Red-bellied Turtle
Deirochelys reticularia	Chicken Turtle
Trionys ferox	Florida Softshell
Anolis carolinensis	Green Anole
Anolis sagrei	Brown Anole
Hemidactylus turcicus	Mediterranean Gecko
Hemidactylus garnoti	Indo-Pacific Gecko
Sphaerodactylus notatus	Reef Gecko
Ophisaurus compressus	Island Glass Lizard
Cnemidophorus sexlineatus	Six-lined Racerunner
Leiolopisma laterale	Ground Skink
Eumeces inexpectatus	Southeastern Five-lined Skink
Natrix cyclopion	Florida Green Water Snake
Natrix taxispilota	Brown Water Snake
Natrix fasciata	Florida Water Snake
Liodytes alleni	Striped Swamp Snake
Seminatrix pygaea	Black Swamp Snake
Storeria dekayi	Florida Brown Snake
Thamnophis sirtalis	Eastern Garter Snake
Diadophis punctatus	Southern Ring-necked Snake
Farancia abacura	Mud Snake
Coluber constrictor	Southern Black Racer
Masticophis flagellum	Eastern Coachwhip
Opheodrys aestivus	Rough Green Snake
*Drymarchon corais couperi**	Eastern Indigo Snake
Elaphe guttata	Corn Snake
Elaphe obsoleta	Rat Snake
Lampropeltis getulus	Florida Kingsnake

Cemophora coccinea	Scarlet Snake
Tantilla oolitica	Rim Rock Crowned Snake
Micrurus fulvius	Eastern Coral Snake
Agkistrodon piscivorus	Florida Cottonmouth
Sistrurus miliarius	Dusky Pygmy Rattlesnake
*Alligator mississippiensis**	American Alligator
Mammals	
Species	**Common Name**
Didelphis marsupialis	Opossum
Scalopus aquaticus	Eastern Mole
Lasiurus intermedius	Eastern Yellow Bat
Nycticeius humeralis	Evening Bat
Tadarida brasiliensis	Freetail Bat
Dasypus novemcinctus	Armadillo
Sylvilagus palustris	Marsh Rabbit
Sylvilagus floridanus	Eastern Cottontail
Oryzomys palustris	Rice Rat
Peromyscus gossypinus	Cotton Mouse
Sigmodon hispidus	Hispid Cotton Rat
Rattus rattus	Black Rat
Mus musculus	House Mouse
Urocyon cinereoargenteus	Gray Fox
Procyon lotor	Raccoon
Spilogale putorius	Spotted Skunk
Mephitis mephitis	Striped Skunk
*Felis concolor coryi***	Florida Panther
Lynx rufus	Bobcat
Canis domesticus	Domestic Dog
Odocoileus virginianus	Whitetail Deer
Birds	
Species	**Common Name**
Podilymbus podiceps	Pied-billed Grebe
Phalacrocorax auritus	Double-crested Cormorant
Anhinga anhinga	Anhinga
Ardea herodias occidentalis	Great Blue Heron
Ardea herodias	Great White Heron
Butorides striatus	Northern Green Heron

Egretta caerulea	Little Blue Heron
Bubulcus ibis	Cattle Egret
Egretta rufescens	Reddish Egret
Egretta alba	Great Egret
Egretta thula	Snowy Egret
Egretta tricolor	Tricolored Heron
Nycticorax nycticorax	Black-crowned Night Heron
Nyctanassa violacea	Yellow-crowned Night Heron
Ixobrychus exilis	Least Bittern
*Mycteria americana***	Wood Stork
Plegadis falcinellus	Glossy Ibis
Eudocimus albus	White Ibis
Ajaia ajaja	Roseate Spoonbill
Anas platyrhynchos	Mallard
Anas rubripes	Black Duck
Anas fulvigula	Mottled Duck
Aythya affinis	Lesser Scaup
Oxyura jamaicensis	Ruddy Duck
Lophodytes cucullatus	Hooded Merganser
Mergus serrator	Red-breasted Merganser
Cathartes aura	Turkey Vulture
Coragyps atratus	Black Vulture
Elanoides forficatus	Swallow-tailed Kite
Buteo jamaicensis	Red-tailed Hawk
Buteo lineatus	Red-shouldered Hawk
*Haliaeetus leucocephalus**	Bald Eagle
Circus cyaneus	Northern Harrier
Pandion haliaetus	Osprey
Colinus virginianus	Bobwhite
Aramus guarauna	Limpkin
Rallus elegans	King Rail
Gallinula chloropus	Common Gallinule
Porphyrula martinica	Purple Gallinule
Pluvialis squatarola	Black-bellied Plover
Arenaria interpres	Ruddy Turnstone
Capella gallinago	Common Snipe
Actitis macularia	Spotted Sandpiper

Tringa solitaria	Solitary Sandpiper
Tringa melanoleuca	Greater Yellowlegs
Tringa flavipes	Lesser Yellowlegs
Calidris canutus	Red Knot
Calidirs melanotos	Pectoral Sandpiper
Calidris minutilla	Least Sandpiper
Calidris alpina	Dunlin
Calidris pusilla	Semipalmated Sandpiper
Calidris mauri	Western Sandpiper
Tryngites subruficollis	Buff-breasted Sandpiper
Limnodromus scolopaceus	Long-billed Dowitcher
Micropalama himantopus	Stilt Sandpiper
Himantopus mexicanus	Black-necked Stilt
Steganopus tricolor	Wilson's Phalarope
Larus delawarensis	Ring-billed Gull
Larus atricilla	Laughing Gull
Sterna forsteri	Forster's Tern
Sterna maxima	Royal Tern
Sterna caspia	Caspian Tern
Chlidonias niger	Black Tern
Zenaida asiatica	White-winged Dove
Zenaida macroura	Mourning Dove
Melopsittacus undulatus	Budgerigar
Coccyzus americanus	Yellow-billed Cuckoo
Coccyzus erythropthalmus	Black-billed Cuckoo
Crotophaga ani	Smooth-billed Ani
Tyto alba	Barn Owl
Otus asio	Screech Owl
Bubo virginianus	Great Horned Owl
Athene cunicularia	Burrowing Owl
Strix varia	Barred Owl
Caprimulgus carolinensis	Chuck-will's-widow
Chordeiles minor	Common Nighthawk
Megaceryle alcyon	Belted Kingfisher
Colaptes auratus	Common Flicker
Melanerpes carolinus	Red-bellied Woodpecker
Tyrannus verticalis	Western Kingbird

Muscivora forficata	Scissor-tailed Flycatcher
Myiarchus crinitus	Great Crested Flycatcher
Sayornis phoebe	Eastern Phoebe
Iridoprocne bicolor	Tree Swallow
Riparia riparia	Bank Swallow
Stelgidopteryx ruficollis	Rough-winged Swallow
Hirundo rustica	Barn Swallow
Corvus brachyrhynchos	Common Crow
Troglodytes aedon	House Wren
Thryothorus ludovicianus	Carolina Wren
Mimus polyglottos	Mockingbird
Dumetella carolinensis	Gray Catbird
Toxostoma rufum	Brown Trasher
Turdus migratorius	American Robin
Hylocichla mustelina	Wood Trush
Catharus guttatus	Hermit Trush
Catharus ustulatus	Swainson's Trush
Catharus minimus	Gray-cheeked Thrush
Catharus fuscescens	Veery
Polioptila caerulea	Blue-Gray Gnatcatcher
Bombycilla cedrorum	Cedar Waxwing
Lanius ludovicianus	Loggerhead Shrike
Vireo griseus	White-eyed Vireo
Mniotilta varia	Black and White Warbler
Dendroica magnolia	Yellow Warbler
Dendroica coronata	Yellow-rumped Warbler
Dendroica dominica	Yellow-throated Warbler
Dendroica discolor	Prairie Warbler
Dendroica palmarum	Palm Warbler
Seiurus aurocapillus	Ovenbird
Seiurus noveboracensis	Northern Waterthrush
Geothlypis trichas	Common Yellowthroat
Passer domesticus	House Sparrow
Sturnella magna	Eastern Meadowlark
Agelaius phoeniceus	Red-winged Blackbird
Icterus spurius	Orchard Oriole
Icterus pectoralis	Spotted-breasted Oriole

Icterus galbula	Northern Oriole
Quiscalus major	Boat-tailed Grackle
Molothrus ater	Brown-headed Cowbird
Piranga olivacea	Scarlet Tanager
Piranga rubra	Summer Tanager
Cardinalis cardinalis	Cardinal
Pheucticus ludovicianus	Rose-breasted Grosbeak
Guiraca caerulea	Blue Grosbeak
Passerina cyanea	Indigo Bunting
Passerina ciris	Painted Bunting
Spiza americana	Dickcissel
Carduelis pinus	Pine Siskin
Carduelis tristis	American Goldfinch
Pipilio erythrophthalmus	Rufous-sided Towhee
Passerculus sandwichensis	Savannah Sparrow
Ammodramus savannarum	Grasshopper Sparrow
Poecetes gramineus	Vesper Sparrow
Spizella passerina	Chipping Sparrow
Spizella pussilla	Field Sparrow
Zonotrichia leucophrys	White-crowned Sparrow
Zonotrichia albicollis	White-throated Sparrow
Melospiza lincolnii	Lincoln's Sparrow

* Plants Listed as Threatened by the State of Florida

** Plants Listed as Endangered by the State of Florida

Source: Chapter 581.185, Florida Statutes Chapter 5B-40, Florida Administrative Code. Rules of the Department of Agriculture and Consumer Services, Division of Plant Industry.

* Animals Listed as Federally listed as threatened

** Animals Listed as Federally listed as endangered

Source: 50 CFR 17.11-12 Code of Federal Regulations.
The preceding species list was generated from DERM field inspections during April to May of 1996, lists of vegetative communities and associated plants compiled by Hilsenbeck, Hofstetter and Alexander (1979), and plant community descriptions in the Everglades SWIM plan (SFWMD 1992).

Table 5. Existing Condition WRAP Polygon Scores, Acreages, and Functional Units for the 8.5 Square Mile Area, Miami-Dade County, Florida

Wetland Type	**Score**	**Acres**	**Functional Units**
Everglades National Park			
Forested Wetland	0.91	889	809
Forested Exotic	0.53	3,209	1701
Long Hydroperiod Graminoid	0.88	7,188	6,325
Short Hydroperiod Graminoid	0.90	3,081	2,773
Subtotal		14,367	11,608
8.5 SMA			
Graminoid Wetland <7.0 feet	0.72	1,448	1,043
Graminoid Wetland @>7.0 feet	0.53	300	159
Herbaceous Wetland low-moderate Disturbance <7.0 feet	0.69	572	395
Herbaceous Wetland high Disturbance <7.0 feet	0.56	82	46
Shrubby Wetland < 7.0 feet	0.54	143	73

Forested Exotic Wetland 6.5–7.0 feet	0.51	128	65
Forested Exotic Wetland @>7.0 feet	0.46	7	3
Forested Native Wetland	0.86	15	13
Subtotal		2,594	1,797
TOTAL		16,867	13,405

Source: DCAR, march, 2000

Table 6. Species Listed by Florida Game and Freshwater Fish Commission as Threatened, Endangered, and Species of Special Concern, Excluding Federally-listed Species

Common Name	Scientific Name	Designated Status
Reptiles		
Miami black headed snake	*Tantilla oolitica*	Threatened
American alligator	*Alligator mississipiensis*	Special Concern
Birds		
Roseate spoonbill	*Ajaia ajaja*	Special Concern
Limpkin	*Aramus guarauna*	Special Concern
Little blue heron	*Egretta caerulea*	Special Concern
Tricolored heron	*Egretta tricolor*	Special Concern
Snowy egret	*Egretta thula*	Special Concern
White ibis	*Eudocimus alba*	Special Concern
Fish		

Mangrove rivulus	*Rivulus marmoratus*	Special Concern
Mammals		
Everglades mink	*Mustela vison evergladensis*	Threatened
Mussels		
Florida tree snail	*Liguus fasciatus*	Special Concern

Source: Florida Game and Freshwater Fish Commission 1997.

Table 7. Tabulation of Detailed Existing Land Uses in the 8.5 SMA

Land Use Type	**Acreage**
Residential	211.5
Residential with Agriculture	958.6
Commercial	15.7
Mixed Agriculture	159.8
Mixed Agriculture/Utilities	39.7
Nursery	38.5
Row Crop	1051.7
Specialty Farm	211.6
Tree Crop	313.8
Rural Land in Transition	16.7
Public	1625.2
Undedicated ROW	22.1
Utilities	80.1
Vacant Land	1668.0

TOTALS	6413.0

Source: HDR's adaptation of DERM's 1999 land use survey of the 8.5 SMA

Table 8. Tabulation of Existing Land Use Classifications in the 8.5 SMA Used for Analysis

Land Use Category	No. of Parcels	Acreage
Residential	74*	211
Commercial	4	16
Agriculture	721**	2,774
Public Land	612***	1625
Easements	28****	102
Vacant	545*****	1,685
Totals	1,984	6,413

Notes:

* Does not include 260 residential units on agricultural land (residential w/agriculture). However, acreage includes ½ acre residential land on each of these parcels (132 acres).

** Includes 260 parcels of residential with agriculture, also one 40-acre utility parcel that is actively being farmed.

*** distributed among the following agencies: USACE (259 parcels, 663 acres), SFWMD (160 parcels, 468 acres), Miami-Dade County (185 parcels, 174.1 acres), USDA (5 parcels, 13 acres), Trustees of the Internal Improvement Trust Fund (2 parcels, 0.5 acres), and FAA (1 parcel, 306 acres).

**** Includes 17 parcels of undedicated right-of-way and 2 parcels, 40 acres of powerline corridor.

***** Includes 8 parcels, totaling 17 private acres, of "rural land in transition"

Table 10. Wetland Acreage and WRAP Functional Units by Alternative

Measure	Units	Base 95	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
a. Total Wetlands	Wetland Acres	64,881	62,343	62,012	63,694	66,285	66,285	65,131	66,285	65,285	62,179
b. Long Hydroperiod Peat-forming wetlands	Wetland Acres	58,910	60,653	60,763	62,624	63,886	63,886	63,057	63,886	63,377	60,709
c. Short Hydroperiod Marl-forming Wetlands	Wetland Acres	5,971	1,690	1,249	1,070	2,399	2,399	2,074	2,399	1,908	1,470
d. WRAP Score	WRAP Functional Units	13,405	10,640	10,640	11,630	15,853	15,853	15,011	14,695	15,645	10,640

Table 11. Change in Wetland Area and WRAP Functional Units Compared to Existing Conditions

Measure	Units	Base 95	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
a. Total Wetlands	Change in Acres	NA	-2,538	-2,869	-1,187	1,404	1,404	250	1,404	404	-2,702
b. Long Hydroperiod Peat-forming Wetlands	Change in Acres	NA	1,743	1,853	3,714	4,976	4,976	4,147	4,976	4,467	1,799

c. Short Hydroperiod Marl-forming Wetlands	Change in Acres	NA	-4,281	-4,722	-4,901	-3,572	-3,572	-3,897	-3,572	-4,063	-4,501
d.WRAP Score	Change in WRAP Functional Units	NA	-2,765	-2,765	-1,775	2,448	2,448	1,606	1,290	2,240	-2,765

Table 12. Summary of Alternative 1 Land Requirements

Item	No. of Parcels	Private Acres	Public Acres	Total
Residential	0	0	0	0
Commercial	0	0	0	0
Agriculture	0	0	0	0
Communication	0	0	0	0
Easements	9	0	3	3
Vacant	196	0	343	343
Totals	205	0	346	346

Table 13. Summary of Alternative 2B Land Requirements

Item	No. of Parcels	Private Acres	Public Acres	Total
Residential	0	0	0	0
Commercial	0	0	0	0
Agriculture	0	0	0	0
Communication	0	0	0	0
Easements	9	0	3	3
Vacant	196	0	343	343
Totals	205	0	346	346

Table 14. Summary of Alternative 3 Land Requirements

Item	No. of Parcels	Private Acres	Public Acres	Total
Residential	82*	343	0	343
Commercial	3	14	0	14
Agriculture	621**	2,162	0	2,162
Communication	1	0	306	306
Easements	9***	95	0	95
Vacant	914****	2,116	435*****	2,551
Totals	1,630	4,730	741	5,471

Notes:

* Does not include 238 parcels of residential with agriculture. Each unit is include in the acreage as 0.5 acre per parcel.

** Includes 238 parcels of residential with agriculture and one 40 acre utility parcel

*** Includes 7 parcels (undedicated right-of-way) and two 40 acre utility parcels.

**** Includes 7 parcels of "rural land in transition"

***** 343 acres are part of the structural footprint of Alternative 3.

Table 15. Summary of Alternative 6B Land Requirements

Item	No. of Parcels	Private Acres	Public Acres	Total
Residential	71*	250	0	250
Commercial	0	0	0	0
Agriculture	462**	1,175	0	1,175
Communication	1	0	<1	<1
Easements	17***	96	0	96
Vacant	1,058****	1,586	1,110	2,696
Totals	1,609	3,107	1,110	4,217

Notes:

* Does not include 179 parcels of residential with agriculture. Each unit is included in the acreage as 0.5 acre per parcel.

** Includes 179 parcels of residential with agriculture and one 40 acre utility parcel

*** Includes 15 parcels (undedicated right-of-way) and two 40 acre utility parcels.

**** Includes 514 parcels of public lands and 6 parcels totaling 9 acres of "rural land in transition"

Table 16. Summary of Alternative 8A Land Requirements

Item	No. of Parcels	Private Acres	Public Acres	Total
Residential	83*	333	0	333
Commercial	3	14	0	14
Agriculture	656**	1,932	0	1,932
Communication	1	0	306	306
Easements	22***	95	0	95
Vacant	1,268***	1,711	1,114	2,825
Totals	2,042	4,085	1,420	5,505

Notes:

* Does not include 247 parcels of residential with agriculture. Each unit is included in the acreage as 0.5 acre per parcel.

** Includes 247 parcels of residential with agriculture

*** Includes 16 parcels (undedicated right-of-way)

**** Includes 577 parcels of public lands and 9 parcels of "rural land in transition"

Table 17. Summary of Alternative 9 Land Requirements

Item	No. of Parcels	Private Acres	Public Acres	Total
Residential	0	0	0	0
Commercial	0	0	0	0
Agriculture	0	0	0	0
Communication	0	0	0	0
Easements	9	0	3	3
Vacant	196	0	343	343
Totals	205	0	346	346

Table 18 Summary of Public Coordination				
Meeting / Event	Attended	Date	Site	Purpose
Pre-Scoping Meeting	Various agencies and interested stakeholders	April 1, 1999	Homestead	Introduction meeting, preliminary discussion of work effort for EIS.
Pre-Scoping Meeting (SERA)	Various agencies and interested stakeholders	April 8, 1999	Ft. Lauderdale	Agency and public comment on project.
Scoping Meeting (NEPA requirement)	Public invited - included all residents, agencies, and interested stakeholders	June 21, 1999	Homestead	Project description was presented. Received public comment on project.
Technical Team Meeting	Technical representatives from various agencies.	August 4, 1999	West Palm Beach	Evaluate potential alternatives for further evaluation. Discuss modeling requirements.
Public Comment (Working Group of the SFERTF)	Public, various agencies, and interested stakeholders	Sept. 1-2, 1999	Homestead, Key Largo	Round table discussion with technical panel. Public comment received.
Public Workshop (NEPA requirement)	Public, various agencies, and interested stakeholders	October 6, 1999	Homestead	Presentation of 8.5 SMA alternatives. Public comment received.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	October 7, 1999	Homestead	Discussion of critical issues, modeling needs, and performance measures.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	October 27, 1999	Jacksonville	Modeling and alternatives analysis.

Table 1 8 (Continued) Summary of Public Coordination				
Meeting / Event	Attended	Date	Site	Purpose
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	November 1999	Jacksonville	Modeling requirements and environmental issues.
SFWMD Governing Board Presentation	Governing Board and public	December 15, 1999	West Palm Beach	Presented status of project.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	January 4, 2000	Miami	Local cost issues discussed.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	January 10, 2000	Ft. Lauderdale	Performance measures and modeling.
Public Workshop (Hosted by SFWMD)	Public, various agencies, and interested stakeholders	January 18, 2000	Homestead	Presentation of performance measures, modeling, and schedule. Public comment received.
Technical Team Meeting	Technical representatives from various agencies and interested stakeholders	January 19, 2000	Homestead	Discussion of performance measures.
SFWMD Governing Board Meeting	Governing Board and public	February 23, 2000	West Palm Beach	Present performance measures.