

APPENDIX F
8.5 SMA
LOCAL COST ANALYSIS

Appendix F
Local Cost Analysis
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SECTION – APPENDIX F

LOCAL COST ANALYSIS

1.0 OVERVIEW

As a result of extensive study by the Corps of Engineers and others it has been determined that structural and operational changes to the Central and South Florida Project are necessary to divert water into areas identified as critical to the restoration of the Everglades. Northeast Shark River Slough (NESRS) has been identified as an area critical to the restoration of the Everglades. In 1992, the U.S. Army Corps of Engineers (USACE) completed a General Design Memorandum (GDM) for the Modified Water Deliveries to Everglades National Park Project detailing a plan for the restoration of NESRS. As part of the MWD project, the USACE determined that a residential and agricultural area within the NESRS basin, the 8.5 Square Mile Area (SMA) in the East Everglades would require flood mitigation as a result of restoration of NESRS.

In 1996 the South Florida Water Management District (SFWMD) awarded a contract to PEER Consultants, P.C. to identify a "locally preferred option" (LPO) as an alternative to the authorized flood mitigation plan provided in the 1992 GDM produced by USACE. The SFWMD also created a District Review Team (DRT) to actively participate in the LPO process. The DRT is composed of

representatives from various levels of local, state and federal government agencies.

In August 1998 PEER Consultants, P.C. completed a report titled, "Alternative Land Use Analysis – Eight and One-Half Square Mile Area – Final Report", this report addressed the hydrologic, water quality and economic analyses of six alternative plans providing flood protection to the 8.5 SMA. This report did not, however, cover secondary drainage, projected future development, provision of local services, and needed infrastructure improvements that are essential to calculating the true costs associated with the six proposed flood protection alternatives.

In 1999 the U.S. Army Corps of Engineers was asked by the SFWMD to reevaluate the original six LPO alternatives and add three new alternatives. The Corps was asked to analyze each and provide the results of this analysis to the SFWMD for their use in making a final decision on a LPO for the 8.5 SMA. In October 1999 the USACE awarded a contract to HDR Engineering, Inc. to develop the GRR and associated documents on the 8.5 SMA. As part of this analysis the SFWMD asked that the cost to local governments for each LPO alternative be analyzed and that information be provided in a separate appendix to the General Reevaluation Report (GRR) being prepared by the Corps on the 8.5 SMA. This appendix will consider the costs associated with all nine LPO alternatives now being considered by the SFWMD.

2.0 PROJECT HISTORY

Everglades National Park (ENP) is located in South Florida in the southernmost portion of the Everglades. The historic Everglades, originally a broad, shallow wetland flowing imperceptibly from Lake Okeechobee to the mangrove zone at the southern tip of Florida, has been modified by drainage development and a complex of canals, levees, structures, pumps, and impoundments known as the Central and Southern Florida Flood Control Project (C&SF). This project, authorized by Congress in 1948 and periodically re-authorized in subsequent years.

With the completion of the project's Water Conservation Areas (WCA) No. 3A and 3B and the southward extension of Levee 67 in the early 1960's, the natural flows to ENP at the southern terminus 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. Delivery of a guaranteed minimum annual water supply in specified monthly quantities, however, created new problems. The release of water to ENP from WCA 3A was still constrained in part by needs of other consumers and the requirement for

disposing of excess water during high water periods. An experimental program for delivering water to ENP was authorized by Congress in 1983 and subsequent years.

In 1989, Congress passed the ENP Restoration and Expansion Act. This Act authorized the Secretary of the Army to construct modifications to the C&SF project to improve delivery of water to ENP. This resulted in the preparation of a General Design Memorandum (GDM) and Environmental Impact Statement (EIS) addressing modifications necessary to construct Modified Water Deliveries (MWD) to ENP. Recommendations in the GDM included a flood mitigation system for the residential area referred to as the 8.5 square mile area (8.5 SMA) in the East Everglades. The 8.5 SMA is located in southern Miami-Dade County, to the south of the Tamiami Trail and west of Levee 31-N (L-31N). Implementation of the recommendations in the GDM will result in an increase in water flows through Northeast Shark River Slough (NESRS) that may raise ground water levels and increase the spatial extent and frequency of flooding in the 8.5 SMA. The flood mitigation system would prevent the area from being subjected to increased flood risk from higher stages in NESRS as a result of modified water deliveries to ENP. The system authorized by the GDM consisted of a double levee surrounding the area to the north and west tied into L-31N. A separate collection canal within the leaved area is designed to pass seepage water and local runoff to a pump station on the east end of the canal that would pump excess water into the L-31N canal for conveyance north.

3.0 NEED FOR GENERAL REEVALUATION REPORT

Various concerns have arisen since the approval and authorization of the flood mitigation system for the 8.5 SMA component of the Modified Water Deliveries to ENP. The South Florida Water Management District (SFWMD) as the local sponsor, the ENP and others have suggested other potential engineering designs to meet the needs of the area residents while ensuring environmental restoration to NESRS. It was determined that the cost of the authorized plan and the permanency of the proposed structures warranted that other potential alternatives be considered. The additional studies and analyses would provide the SFWMD Governing Board sufficient data to decide on and select a locally preferred alternative (LPA). The General Reevaluation Report (GRR) will provide the needed data. If the SFWMD selects an alternative to the previously authorized plan, this document will serve as the groundwork for the revised cost sharing arrangements and other legal agreements between the Federal Government and the local sponsor.

4.0 NEED FOR LOCAL COST ANALYSIS

The cost of each mitigation alternative presented in the GRR is an important factor in the SFWMD's evaluation process to select a LPA. In addition to traditional project costs associated with the design, construction, and operation

and maintenance of the nine mitigation alternatives under consideration, the SFWMD has requested that the U.S. Army Corps of Engineers include an analysis of relevant cost to local governments. This appendix will develop and analyze the impacts of each of the nine alternatives.

5.0 DESCRIPTION OF STUDY AREA

Known as the East Everglades Agricultural and Residential Area, the 8.5 SMA is located in the East Everglades, about 20 miles southwest of Miami and about 10 miles north of Homestead, (See Figure 1). It is bounded on the east by L-31N, on the west by the boundary of ENP, on the north by SW 104th Street, and on the south by SW 168th Street (Richmond Drive). U.S. Highway 31 lies approximately 6.6 miles to the north. The study area is situated immediately west of Northeast Shark River Slough and north of the Taylor Slough headwaters.

6.0 GEOGRAPHIC/WATERSHED

Geographically, the 8.5 SMA lies within a region commonly referred to as the Rocky Glades, which occupies the western slope of the Atlantic Coastal Ridge. The Rocky Glades forms a narrow transitional area between the Shark River Slough and Taylor Slough Headwaters physiographic zones. It also comprises a significant topographical, geological, hydrological, and ecological transition between the Atlantic Coastal Ridge proper and the Everglades trough. Topographic elevations range from 5.0 to 8.5 feet NGVD with the higher elevations (above 7.0 feet) generally in the east and southeast portions of the study area.

The geology of the area is characterized by the highly transmissive, water bearing, unconfined limestone Biscayne Aquifer. The aquifer extends from the Broward-Palm Beach County boundary southward through all of Dade County. It is the sole source of potable water in Dade and Broward Counties and one of the most permeable aquifers in the world. The U.S. Environmental Protection Agency has designated the Biscayne Aquifer as a "sole source" aquifer under the provisions of the Safe Drinking Water Act of 1974. The aquifer is exposed at the surface in most of the area or is covered by a thin mantle of soil and/or plant material. Limestone makes up approximately eighty percent of the volume of the aquifer formation. Water levels within the rock formation annually rise to the surface in response to summer and fall precipitation, inundating vast portions of the area.

Local rainfall is a significant source of freshwater in the area. After intense precipitation, surface water is removed either through evapotranspiration, seepage to the underlying Biscayne Aquifer, or drainage through the L-31N Canal along the eastern portion of the 8.5 SMA. Excess rainfall often inundates most of the 8.5 SMA, which historically contributed to the sheet flow that supplied surface water to the ENP on a regional scale, typically toward the end of the

rainy season. Canals, such as L-31N, tend to speed surface water drainage and preclude the natural seepage process to the underlying aquifer.

7.0 SOCIO-ECONOMIC/POLITICAL

An existing land use survey was completed in October 1998 by ENP (SAIC 1998). In general, the residential and agricultural areas are located on the eastern half of the study area and vacant land and wetlands are on the western half.

Land use within the 8.5 SMA is currently distributed as follows: 41.2% is agricultural, 5.3% is residential, and 46.9% is vacant. The overall existing residential density averages about one unit per 3.65 acres. The agricultural land is utilized primarily for field crops. The western third of the SMA is comprised mostly of mixed wetland hardwoods, freshwater marshes, and wet prairies.

The future use of land is regulated by the adopted comprehensive plan for the governing local jurisdiction, as required by Florida law. 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. Consideration of one unit per five acres is possible only after drainage facilities become available to protect the area from a one-in-10-year flood event.

The East Everglades Overlay Zoning Ordinance, adopted by Miami-Dade County in 1981, includes incentives to limit future development within the area by offering transferable development rights. An "Open Land" classification is designated in the Land Use Element and the Land Use Plan Map for 2005 of the CDMP. This 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 Sub-area 4, East Everglades Residential Area.

8.0 CURRENT FLOODING PROBLEMS

The 8.5 SMA receives only incidental flood protection benefits from the greater C&SF Project. The area is subject to frequent flooding problems. Much of the development in the area occurred during the 1970's, a decade of generally below normal rainfall with no major storms. In 1981, heavy rains associated with Tropical Storm Dennis (August through September) flooded the area and were categorized as an extreme flooding event. This event brought a concern with the flooding of septic tanks and contamination of groundwater. Most recently, Hurricane Irene impacted the 8.5 SMA with water levels similar to those experienced during Tropical Storm Dennis in 1981. Surface water levels in the area remained high long after the passage of the storm resulting in property damage and loss of crops.

Periodic high groundwater stages in the 8.5 SMA have attributed to the following: deterioration in unimproved roads; damage to septic tank systems; damages to potable wells due to septic tank problems; and damages to residences due to flooding. Agricultural interests in the 8.5 SMA have experienced periodic crop losses due to root zone inundation by elevated groundwater.

9.0 FLOOD PROTECTION/MITIGATION NEEDS

The General Design Memorandum for the Modified Water Deliveries Project defines flood protection in the area east of L-31N as protection for a 1 in 10-year event. The authorized plan for the 8.5 SMA only provided for flood mitigation (no increase of flooding for higher stages).

Assuming the authorized Modified Water Deliveries Project is implemented the net increase in water introduced to NESRS is expected to raise groundwater elevations in adjacent development areas of the East Everglades. As a result, the volume of groundwater storage available to retain rainfall runoff would be reduced and the area would be more susceptible to flood damages. The additional increase in flood depths would range from about 0.3 feet in the northern part of the residential area, to about 0.1 feet in the agricultural area. The planned mitigation system outlined in the 1992 GDM is designed to address these increased levels and maintain the current level of flood protection within the 8.5 SMA.

10.0 PROBLEM IDENTIFICATION

Implementation of the authorized plan and most of the alternative plans provide additional flood free acreage within the 8.5 SMA footprint. This study assumes that Miami-Dade county will at some time in the future, through political pressure, be forced to provide a minimum level of municipal services to areas within the 8.5 SMA considered flood free. Providing services to local residents are costs above those required to implement the mitigation project.

11.0 THE PURPOSE OF THE STUDY

In part to answer the request by the SFWMD (project local sponsor), the Corps of Engineers is reevaluating the 1992 designed mitigation system along with eight additional alternatives. As a component of the alternative analysis the development resulting from the implementation of each alternative under several development density scenarios is being assessed. The development of these costs are critical to the SFWMD's decision making process in the selection of an alternative as a locally preferred option. The analysis of alternatives will show the additional costs in local services to area residents generated by providing increased flood mitigation and protection as a result of alternative implementation. Of the two Alternatives forwarded to provide flood protection only Alternative No. 6 was found to provide flood stage reductions. Other

structural alternatives were formulated to mitigate the effects of the MWD Project and provide an incidental reduction in flood stages to the 1 in 10-year flood event. Costs to local governments above project costs are expected to vary based on additional flood protected area produced by each alternative. The study will consider the following services: secondary drainage, road construction and maintenance, police and fire protection, and household garbage and trash removal.

12.0 DESCRIPTION OF EXISTING PUBLIC SERVICES

A survey of services currently provided to the residents of the 8.5 square mile area show very little support provided by the county. For the purpose of this study the following services will be considered: secondary drainage, road maintenance, police and fire protection, and household garbage and trash removal.

12.1 Secondary Drainage - Miami-Dade County does not currently provide secondary drainage to the 8.5 SMA.

12.2 Road Maintenance and Construction – Miami-Dade County currently only maintains S.W. 136th Street (See Figure 3). According to the Miami-Dade County Public Works Department it spends \$2,400 annually to maintain 2.0 miles of paved roads in the 8.5 SMA. (DERM, February 2000)

12.3 Police and Fire Protection – Miami-Dade County provides police services for the 8.5 SMA from the Hammocks and Cutler Ridge Police Stations. The annual costs for police services are estimated at \$295,733. This cost comes from the Miami-Dade County's Office of Budget and Management analysis of historic costs for police services for the area. The analysis was based on a three-year average cost of service to the area. The estimated cost of police protection \$295,733 is divided by the number of residential units (RU) identified by the 1999 DERM inventory, 514. The cost for police protection per RU is \$575. This will be used as the baseline for comparison of costs for police protection in the other alternatives.

12.4 The County provides fire service for the area from the Hammocks, Richmond, and Redland Stations. The annual costs for fire service is estimated to total \$85,053. This cost comes from the Miami-Dade County's Office of Budget and Management analysis of historic costs for providing fire services for the area. The analysis was based on a three-year average cost of service to the area. The estimated cost of fire protection \$85,033 is divided by the number of residential units (RU) identified by the 1999 DERM inventory, 514. The cost for fire protection per RU is \$165. This cost will be used as the baseline for comparison of costs for fire protection in the other alternatives.

12.5 Garbage and Trash Removal – Miami-Dade County does not currently provide household garbage and trash removal service for the 8.5 SMA.

13.0 DESCRIPTION OF EXISTING LAND USE

An existing land use survey was completed in October of 1998 by DERM. In general, the residential and agricultural uses are located in the eastern half of the study area with vacant lands and wetlands predominating the western half. A Florida Power and Light (FPL) right-of-way runs north and south through the study area but remains undeveloped. The area between the canal and SW 194th Avenue from SW 120th Street to 136th Street is a FAA radar facility (306 acres). Land use data for the 8.5 SMA was developed in cooperation with DERM for this study and is shown below in Table 1 and on Figure 2.

**TABLE 1
EXISTING LAND USE 8.5 SMA**

ITEM	ACREAGE	PERCENTAGE
Residential	342	5.33%
Commercial	16	0.25%
Agricultural	2,642	41.20%
Communications	306	4.77%
Easements	102	1.59%
Vacant	3,005	46.86%
Totals		.00%

The largest contiguous residential neighborhood is between 194th Avenue and 202nd Avenue from 120th Street to 140th Street. Other single-family units are scattered throughout the study area. The overall existing density averages one unit per 20 acres. The agricultural land is utilized primarily for field crops. Other products include row crops, groves and ornamentals. These are located mostly in the southeast portion of the 8.5 SMA, east of 212th Avenue and south of the residential area. The west third of the SMA is comprised mostly of mixed wetland hardwoods, freshwater marshes and wet prairies.

Under the SFWMD's Save Our Rivers (SOR) program, 40 parcels covering an estimated 267 acres of the East Coast Buffer land acquisition project have been acquired. These parcels, also referred to as Water Preserve Areas (WPAs), are primarily located in the western one-third of the 8.5 SMA (according to recent FNAI data). Additional SOR lands have been acquired along the southern boundary of the 8.5 SMA (part of the Frog Pond/L-31N Transition Lands). To the extent possible, these acquisitions have been incorporated into the Land Use Data shown in Table 1.

13.1 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 residential unit per 40 acres as outlined in the Land Use Element. One unit residential 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.

14.0 DESCRIPTION OF EXISTING POPULATION AND FUTURE POPULATION (RESIDENT – NON-RESIDENT)

Current Population - Studies of available data in recent reports show a current permanent population of 853 people within the 8.5 SMA. This analysis is based on a survey of data gathered by DERM which shows 514 dwelling units consisting of 321 houses and 193 trailers/mobile homes (residences) in the 8.5 SMA. A check of mail delivery records show of the 514 dwelling units (residences) only 208 actually received mail on a daily basis. Analysis of

demographic information available for Miami-Dade County suggests that the average household size for the rural part of the county is 4.1 people per household. Using this average household size and applying it to the number of dwelling units, that receive mail daily, gives an estimated permanent population of 853 people within the 8.5 SMA. The estimated population of 853 people will be used as the 2000 baseline population for the area.

14.1 Population Projections – Existing Densities - Using population projection factors derived from projections developed by Miami-Dade County for Minor Statistical Area (MSA) 7.6. Table 2 below provides a projection of the estimated population within the 8.5 SMA in ten-year increments from the estimated 2000 baseline population of 853.

TABLE 2
POPULATION PROJECTIONS
2000 – 2050

YEAR	PROJECTION FACTOR	POPULATION	HOUSEHOLDS
2000	1.00	853	208
2010	1.512	1,290	315
2015	1.841	1,570	383
2020	1.841	1,570	383
2030	1.841	1,570	383
2040	1.841	1,570	383
2050	1.841	1,570	383

15.0 DESCRIPTION OF FLOOD FREE ZONE

The USACE defines a 1 in 10-year event as one that has a 10 percent chance of occurring in a given year. Protection from the 1 in 10-year storm event is defined as protecting property such that only minimal damages occur. For such a large

area as the 8.5 SMA, flood protection efforts will protect the lowest parcel of property practicable. (24 Oct 99 MFR on 8.5 SMA Technical Issues)

16.0 DESCRIPTION OF ALTERNATIVES

The following section provides a brief description of each alternative being considered as part of the re-evaluation of the 1992 GDM on the 8.5 SMA.

16.1 Alternative No. 1 – Authorized GDM Plan

Congress authorized the Original GDM Plan for implementation per the General Design Memorandum prepared by the USACE Jacksonville District in 1992. It includes a major levee along the 8.5 SMA perimeter starting at the L-31N on the north side of the area, and moving west and south to high ground on SW 168th Street. A seepage canal will be constructed adjacent to and just inside of the major levee to collect groundwater underflow. A minor levee will be constructed adjacent to and just inside the seepage canal to prevent surface water flow from running into the canal from 8.5 SMA. There is concern that runoff from the 8.5 SMA could possibly be polluted, and the minor levee will keep potentially contaminated water from mixing with the cleaner seepage water from ENP. This alternative offers flood mitigation for all residents of 8.5 SMA. A new pump structure (proposed S-357) will be located in the canal at the northeastern edge of 8.5 SMA near the L-31N canal. This pump will discharge water from the seepage canal into the L-31N canal. Another pump structure (proposed S-356 - not included in this report) will pump from the L-31N canal into the L-29 canal. This will re-circulate cleaner seepage water back to NESRS and ENP. Surface water runoff from within the 8.5 SMA will be contained by the minor levee, and eventually either infiltrate into the ground.

16.2 Alternative No. 2B – Modified GDM Plan

The development of this alternative was a direct result of the completion of the C&SF Restudy plan sent to Congress in July 1999. Many of the scoping comments received requested that the Authorized Plan be modified to accommodate higher flows and stages expected after the Restudy is implemented. Alternative No. 2 was developed by the 8.5 SMA technical team to address this issue. This alternative has the same basic layout of Alternative No. 1, and also provides flood mitigation for all residents of 8.5 SMA. It includes the same basic major levee, seepage canal, and minor levee system along the 8.5 SMA boundary southwest from L-31N to high ground on SW 168th Street. A single pump (proposed S-357) will be installed at the southwest corner of the 8.5 SMA and will discharge seepage water into the C-111 buffer area. As in Alternative No. 1, surface water runoff from within the 8.5 SMA will be contained by the minor levee, and will infiltrate into the ground.

16.3 Alternative No. 3 – Deep Seepage Barrier Plan

Previous studies developed a plan that considered constructing a deep seepage barrier around the protected area to reduce or eliminate groundwater underflow from ENP expansion area to the 8.5 SMA. Under this plan, the outer perimeter levee follows the same alignment as the Authorized Plan, along the 8.5 SMA boundary southwest from L-31N to high ground on SW 168th Street. A seepage barrier, possibly located within the levee, extends down to an undetermined elevation. The seepage barrier will be an engineered barrier or curtain wall such as slurry wall, sheet piles, etc. The barrier must be installed at elevation below the aquifer (estimated 45 to 70 feet). This will eliminate the need for the seepage canal and interior levee. Surface water runoff from within the 8.5 SMA will be contained by the levee, and infiltrate into the ground. The alternative provides very little flood protection within the 8.5 SMA for a 1 in 10-year event (14 acres).

16.4 Alternative No. 4 – Landowner's Choice Land Acquisition

Many of the comments received in the scoping process suggested that the landowner's might respond more favorably to a voluntary land acquisition alternative. Many residents indicated that they would be willing to stay and endure the increased flooding if they were shown the extent of the impact. Therefore, an alternative was developed by the study team that provided for acquisition of land in 8.5 SMA through three means. Current owners have a choice:

- a. Buy-Out: Government purchase (fee simple)
- b. Flowage Easements: Pay property owners cash as mitigation for periodic flooding. Owner retains ownership rights to property.
- c. Life Estates: Owners retain ownership and full use of property for duration of current owner's life. Then the property goes to ownership of the Government.

Modeling would be performed to graphically demonstrate to the owners the elevations and extent of flooding. This will assist the owners in making their choice.

16.5 Alternative No. 5 – Total Buy-Out Plan

Total buyout was originally developed and evaluated as an alternative in the 1992 GDM. The Governor's East Everglades 8.5 SMA Study Committee also considered total buyout as an alternative. Under this plan, all land in 8.5 SMA will be obtained either from willing sellers or by condemnation. No structural improvements are proposed, and no significant changes in operation of existing structures and system will be required.

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

The Governor's East Everglades 8.5 SMA Study Committee developed and evaluated several alternatives that utilized the western portion of the 8.5 SMA as a flow-way or buffer area. This concept was further studied in the PEER Report and the analysis confirmed that it was a feasible concept. Therefore, an alternative was developed for this evaluation that would convert the western portion of the 8.5 SMA to a shallow impoundment to be used as a buffer between the developed area and ENP. This alternative uses a similar concept to the original GDM authorized plan, but was modified to be more compatible with the Central and Southern Florida Project Comprehensive Review Study (Restudy). The eastern portion of the 8.5 SMA is included within flood protection levee and drainage system. The perimeter levee runs approximately along 202nd Avenue down to 168th Street. A seepage canal is located just inside the new levee and is designed to collect groundwater underflow. A second levee located just inside the seepage canal will prevent surface water from running into the seepage canal and mixing with seepage water. A new proposed pumping structure (S-357) located at the southern terminus of the levee/canal system will discharge seepage water through a 120-inch pipe, where it will be released south into the C-111 project area. There will be no major changes to operations of existing structures in the system.

16.7 Alternative No. 7 – Raise All Roads Plan

As mentioned in the discussion of Alternative No. 4, public comments indicated the desire to allow use of the land within the 8.5 SMA after the implementation of MWD project, even without flood mitigation or protection measures. An alternative was developed that would improve roadway features within the area. This would be accomplished by raising all access roads and restoring them in-kind. The roads will be raised so that they will not be flooded as a result of the MWD Project. All areas within the roads will remain unimproved. Roads will be improved only to the condition in which they currently exist (paved will be paved, dirt will be dirt, etc.). Internal drainage could be handled by placing culverts and obtaining flowage easements. Due to the nature of the subsurface in the area, much of the surface water is expected to infiltrate. There is no allowance for relocation or buy-out of residents currently proposed under this plan.

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

This alternative evolved as a modification of the flow-way concept originally evaluated by the Governor's Study Committee. It uses a similar concept to Alternative No. 6 to mitigate for increased sizes at the eastern, most inhabited portion of the area, and keep the western area as a more natural, undeveloped area. This western area will serve as a buffer zone to ENP west of the mitigation levee and as a natural flow-way for diverting flow from ENP to the C-111 area. An interior perimeter levee will start just north of 120th Street, run south and west

around the FAA tract, along 202nd Avenue down to 168th Street. An exterior diversion levee will run approximately parallel to the interior levee and serve as a containment barrier for a natural swale flow-way. The containment levee will be small enough to allow surface water flow from ENP, but big enough to divert flow contained within the flow-way. A new proposed structure (S-357) located at 168th Street levee/canal system will discharge seepage water into the C-111 buffer area. There are no major changes to operations of existing structures proposed under this plan.

16.9 Alternative No. 9 – Adaptive Refinement of GDM Plan

Numerous comments were received during the public comment period referencing the need to develop a plan that would be compatible with the Restudy. This alternative evolved as a plan that is capable of integrating immediately with the system operation for implementation of the MWD Project, but constructed in a manner that can be modified to comply with the Restudy Flows. In other words, build something that meets the needs for now, but will not need to be demolished and reconstructed to meet the needs of future conditions. The result is basically a combination of Alternative No. 1 (Authorized GDM Plan) and Alternative No. 2 (Modified GDM Plan). It has the same layout of levees and seepage canals as Alternatives No. 1 and No. 2. It also includes pumping structures at locations on the northeastern corner of the 8.5 SMA, and at the intersection of the L-31N canal and L-29 canal as proposed in Alternative No. 1. It also includes a future pumping station located at the southern terminus of the seepage canal at the southwestern corner of the 8.5 SMA for construction after the Restudy is implemented.

17.0 ANALYSIS OF RESIDENTIAL LAND USE FUTURE WITHOUT PROJECT – ALTERNATIVE NO. 1

Of the 6,413 acres of land located in the 8.5 SMA, about 574 acres are located above the 10-year flood line, an elevation of 7.7 feet. With the implementation of this alternative an additional 60 acres of land will be rendered flood free. Of the total 634 acres about 625 acres would be available for future residential development. Within these 625 acres, a residential density of 1 unit per 5 acres would be allowed with a variance from Dade County. Since the county hasn't enforced growth ordinances in this part of the county, there would not be any project induced growth within the 8.5 SMA, since vacant or agricultural lands are available to accommodate future population increases.

18.0 ANALYSIS OF RESIDENTIAL LAND USE FUTURE WITH PROJECT – NO CHANGE TO EXISTING DENSITY (ORDINANCES ENFORCED)

18.1 Alternatives Nos. 2, 3, 4, 5, 7, 8, 9. Due to the lack of flood protection provided by these alternatives they were not analyzed in this appendix.

18.2 Alternative No. 6 – Western Portion of 8.5 SMA as a Buffer. Of the 6,413 acres in the 8.5 SMA, 4,196 acres or about 65 percent of the land within the 8.5 SMA would be required to implement this alternative. It is estimated that 586 permanent residents or about 143 RUs would be displaced with the implementation of this alternative. Future development of the 8.5 SMA will be limited to the existing 574 acres located above the 10-year flood line and the additional 1,643 acres of land protected from the 10-year flood with this alternative in place and operating, (See Figure 3). Of the 2,217 acres of flood free land about 1,711 acres would be available to accommodate future residential development. Within these 1,711 acres, a residential density of 1 unit per 5 acres would be allowed with a variance from Miami-Dade County. This acreage could accommodate a maximum of 342 new RUs. In addition to the 143 RUs displaced with the construction of the project there are an additional 174 RUs projected for the area.

19.0 ANALYSIS OF LAND USE FUTURE WITH PROJECT – PROPOSED INCREASES IN DENSITY

19.1 Alternatives Nos. 2, 3, 4, 5, 7, 8, 9. Due to the lack of flood protection provided by these alternatives they were not analyzed in this appendix.

19.2 Alternative No. 6. This alternative provides approximately 1/3 of the eastern portion of the 8.5 SMA with 1 – 10 year flood protection. The remaining portions of the area are converted to short-hydroperiod wetlands through restoration by the government. Of the remaining 1/3 of the 8.5 SMA not converted back to wetlands, approximately 2,217 acres of which 1,711 acres are developable, will face increased development pressure. Development will follow existing transportation corridors into the area with agricultural lands experiencing pressure to convert to residential use. Existing residential uses greater than 1 unit per 5 acres will be pressured to convert to 1 unit per 5 acres as the area reaches build-out.

20.0 ANALYSIS OF LOCAL SERVICES REQUIRED / ALTERNATIVE

20.1 Alternatives Nos. 2, 3, 4, 5, 7, 8, 9. Provide only minimal incidental flood protection therefore do not qualify for additional services and so are not considered here.

20.2 Alternative No. 6 - Secondary Drainage

The county provides no secondary drainage for the 8.5 SMA outside the flood protected footprint under this alternative. Within the 2,217 acre footprint of Alternative No. 6 secondary drainage would be achieved with series of culverts installed during the upgrading of local roads. The culverts would be designed to pass surface waters under the roads and along swales constructed as a part of the road upgrade. Culverts would bisect roads at every intersection and again at

approximately every quarter of a mile along roadways. Given the layout of the existing roadways within the flood protected footprint of Alternative No. 6, 94 culverts would be required at 28 intersections with an additional 59 culverts needed for internal drainage for a total of 153 culverts. Installation of 15-inch culverts is estimated to cost \$22,000 each for a sum of \$3,366,000 for Alternative No. 6.

21.0 ROAD CONSTRUCTION AND MAINTENANCE

21.1 Maintenance. The County continues to provide maintenance to SW 136th Street from the junction of the L31N canal to approximately 202nd Avenue, a distance of two miles. Discussion with DERM indicate that the county incurs a cost of \$1,200 per mile annually to provide this maintenance. Therefore the county would incur an annual expense of \$2,400 to maintain SW 136th Street into the 8.5 SMA. The county would incur an additional maintenance expense of \$20,000 per mile per year to maintain 84,800 LF (16.06 miles) of dirt roads in the flood protected acreage provided by the implementation of Alternative No. 6. This annual maintenance would result in an annual cost of \$321,212 or \$467 per RU to maintain the upgraded roads in the flood protected portion of the 8.5 SMA. Cost of the maintenance of the roads is provided by HDR Engineering, Inc. estimates of cost to raise maintain roads over a twenty-year cycle.

21.2 Construction. Under this alternative 574 acres of the 8.5 SMA are above 7.7 foot elevation. Within that area 25,300 linear feet of roads currently exist that could be upgraded to county standards. The cost to upgrade these roads at \$225 per LF is \$5,692,500. Alternative No. 6 also provides 1,643 acres of additional flood protection within the 8.5 SMA. This equates to an additional 59,500 linear feet of roads that could be upgraded to county standards. The cost to upgrade these roads at \$450 per Linear Foot is \$ 26,775,000 (See Table 3 and Figure 4).

22.0 POLICE AND FIRE PROTECTION

22.1 Police Protection. Police protection in the 8.5 SMA is estimated to cost \$575 per RU. In Alternative No. 1 the existing inventory of 514 RU is provided fire protection at a cost of \$295,550. The normal growth projected over the next fifty years for the 8.5 SMA would add an additional 174 RUs under Alternative No. 6. The additional growth in residents within the flood protected acreage would add \$100,050 to the cost of police protection annually.

22.2 Fire Protection. Fire Protection in the 8.5 SMA is estimated to cost \$165 per RU. In Alternative No. 1 the existing inventory of 514 RU is provided fire protection at a cost of \$85,033. The normal growth projected over the next fifty years for the 8.5 SMA would add an additional 174 RUs under Alternative No. 6. The additional growth in residents within the flood protected acreage would add \$28,710 to the cost of fire protection annually.

23.0 GARBAGE AND TRASH COLLECTION

To provide household garbage and trash collection within the 8.5 SMA will cost the residents of the flood protected area within the 8.5 SMA an additional \$69,600 or \$400 per RU annually.

24.0 COST OF SERVICES

A summary of costs associated with the improvement of roads within the flood protected area for Alternative No. 6 is provided in Table 3. The annual costs provided take into consideration full implementation of Alternative No. 6 and the respective maximum supported population (within current zoning ordinances).

ITEM		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
Secondary Drainage: (3)	C	\$1,320,000	\$1,320,000	\$1,210,000	\$0	\$0	\$3,366,000	\$0	\$1,276,000	\$1,408,000
Road Construction & Maintenance:										
Construction: Road Upgrade	C	\$7,987,500	\$7,987,500	\$6,142,500	\$0	\$0	\$32,467,500	\$0	\$6,727,500	\$7,852,500
Maintenance: (2)		\$117,552	\$117,912	\$102,000	\$2,400	\$0	\$323,612	\$0	\$106,945	\$116,415
Existing Road (SW 136 St)	A	\$2,400	\$2,400	\$2,400	\$2,400		\$2,400	\$0	\$2,400	\$2,400
Upgraded Roads & Culverts	A	\$115,152	\$115,512	\$99,600	\$0		\$321,212	\$0	\$104,545	\$114,015
Police and Fire Protection:										
Police Protection:		\$367,425	\$373,175	\$360,525	\$229,425	\$0	\$426,075	\$357,075	\$272,550	\$370,875
Existing Resident Impacts	A	\$295,550	\$295,550	\$295,550	\$229,425		\$295,550	\$295,550	\$272,550	\$295,550
Induced By Project	A	\$71,875	\$77,625	\$64,975	\$0		\$130,525	\$61,525	\$0	\$75,325
Fire Protection:		\$105,658	\$107,308	\$103,678	\$65,835	\$0	\$122,488	\$102,688	\$78,210	\$106,648
Existing Resident Impact	A	\$85,033	\$85,033	\$85,033	\$65,835		\$85,033	\$85,033	\$78,210	\$85,033
Induced By Project	A	\$20,625	\$22,275	\$18,645	\$0		\$37,455	\$17,655	\$0	\$21,615

