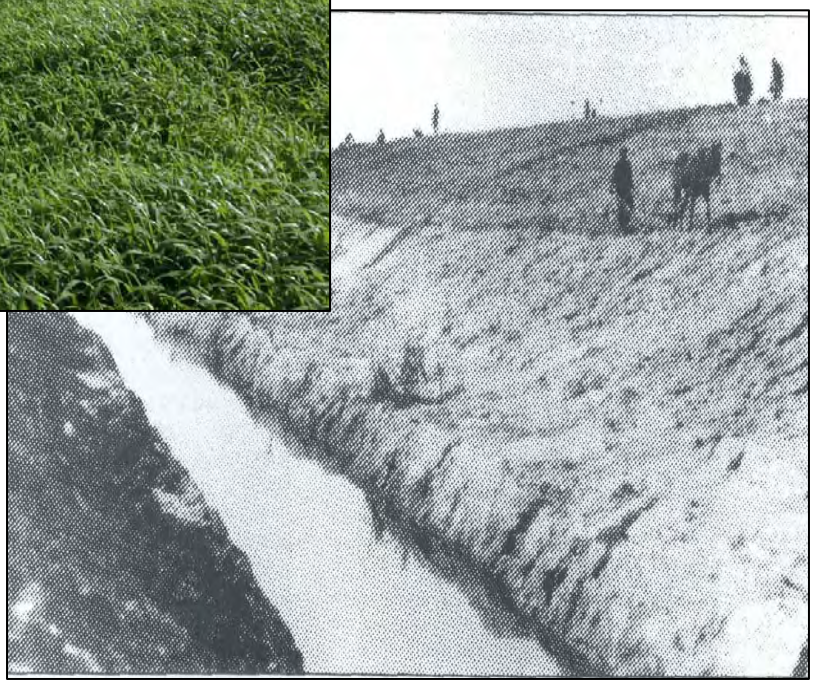
HERBERT HOOVER DIKE MAJOR REHABILITATION
MARTIN AND PALM BEACH COUNTIES

ENVIRONMENTAL ASSESSMENT
AND
PROPOSED FINDING OF NO SIGNIFICANT IMPACT



REACH 1 CUTOFF WALL

U.S. ARMY CORPS OF ENGINEEERS
JACKSONVILLE DISTRICT

DECEMBER 2007

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ENVIRONMENTAL ASSESSMENT
REACH 1 CUTOFF WALL
MARTIN AND PALM BEACH COUNTIES, FLORIDA

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APPENDICES

Appendix A – Groundwater Modeling
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LIST OF ACRONYMS

AA	Assessment Area
Act	Flood Control Act of 1948
bls	Below Land Surface
BMP	Best Management Practices
CFR	Code of Federal Regulations
CAR	Coordination Act Report
C&SF	Central and Southern Florida Project
Corps	US Army Corps of Engineers
dB	Decibels
DDR	Draft Design Report
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EAA	Everglades Agricultural Area
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FFWCC	Florida Fish and Wildlife Conservation Commission
FGFWFC	Florida Game and Freshwater Fish Commission
FMSF	Florida Master Site File
FNAI	Florida Natural Areas Inventory
FNST	Florida National Scenic Trail
GLOTA	Greater Lake Okeechobee Tourist Alliance
HHD	Herbert Hoover Dike
HGS	Hurricane Gate Structure
IPET	Interagency Performance Evaluation Taskforce
Lake	Lake Okeechobee
LOST	Lake Okeechobee Scenic Trail
MRR	Major Rehabilitation Report
MWL	Minimum Water Levee
NEPA	National Environmental Policy Act

NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act of 1966, as amended
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
PSD	Prevention of Significant Deterioration
ROW	Right-of-Way
SFOO	South Florida Operations Office
SFWMD	South Florida Water Management District
SHPO	State Historic Preservation Officer
SPF	Standard Project Flood
SSP	Steel Sheet Pile
UMAM	Uniform Mitigation Assessment Method
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VE	Value Engineering
WCA	Water Conservation Area

GUIDE TO HHD ENVIRONMENTAL DOCUMENTS

Reach 1	**Date**	**Purpose**	**Description**
"Herbert Hoover Dike Major Rehabilitation Report, Draft Environmental Impact Statement, July 1999"	July 1999	Assessed impacts of Alt No 3 (the 2000 MRR preferred alt), seepage berm with relief trench and French drain.	Assessed impacts of Alt No 3 (2000 MRR preferred alternative): seepage berm (40 ft wide) with relief trench (25 ft deep, 2ft wide) and a French drain system (48in diameter perforated culvert wrapped in geotextile fabric) along the landward toe of embankment. Oct 1998 Draft CAR recommended the WRAP be implemented and compensatory mitigation site be located for toe ditch wetlands backfilling.
"Herbert Hoover Dike Major Rehabilitation Report, Reach One, Supplemental Environmental Impact Statement, March 2005" "Herbert Hoover Dike Major Rehabilitation Report, Reach One, Final Environmental Impact Statement, July 2005" Record of Decision Signed by Brigadier General Michael J. Walsh	March 2005 July 2005 Sept 2005	Assessed impacts of Alt No4, partially penetrating cutoff wall, relief trench with inverted filter and relief berm within ROW.	In 2001 a VE study was initiated to reduce RE costs and minimize footprint within functional wetlands. July 2002 recommendations included excavating toe and placing gravel filter and seepage trench lake ward of dike (no tailwater management or ground water management in toe ditch). The design was unsuccessful when implemented during emergency repairs in 2002 and 2003 near South Bay due to the seepage trench conveying ground water into toe ditch and private properties. Alt No4 was developed as the preferred alt: partially penetrating cutoff wall on landward side of dike at 26 ft NVGD with relief trench with an inverted filter and relief berm stopping at the TD. No mitigation necessary because project within ROW.

Herbert Hoover Dike Major Rehabilitation, Glades, Hendry and Palm Beach Counties: Modified Design in Reach 1 and Priority Toe ditch Repairs in Reaches 1, 2, and 3, Environmental Assessment and Finding of No Significant Impact	Dec 2006 January 2007	Assessed Impacts of backfilling toe ditch in identified focus areas.	After Hurricane Katrina the Corps' initiative was to provide the best possible engineering solution to rehabilitate HHD. Following a series of reports including the BCI rpt and IPET rpt the Corps conducted an external ITR on HHD rehabilitation to ensure that the best engineering solution would be implemented. The Corps developed an alternative that was robust, resilient, and redundant that will provide the needed reliability for HHD. Because the solution would take some time to design and implement, the Corps decided to take action where possible by backfilling the toe ditch in the most critical areas of the HHD as an interim risk reduction measure. This EA assessed the impacts of backfilling the toe ditch in the nine focus areas identified and scored previous mitigation created.
Herbert Hoover Dike Major Rehabilitation, Martin and Palm Beach Counties: Reach 1 Seepage Berm and Reach 1A Test Cutoff Wall, Environmental Assessment and Finding of No Significant Impact	April 2007 May 2007	Assessed impacts of Alt No 5 test cutoff wall in R1A and seepage berm in R1 and within the existing ROW.	The preferred alternative (Alt No 5) consists of a seepage berm and impervious partially penetrating cutoff wall implemented at the center of the dike. The EA documented impacts from implementation of a test cutoff wall in Reach 1A and a partial seepage berm in Reach 1 (within the Corps ROW). Functional wetland loss due to the seepage berm and determined if any additional mitigation would be necessary. Previously mitigation covered impacts to the toe ditch wetlands.
Herbert Hoover Dike Major Rehabilitation, Martin and Palm Beach Counties: Reach 1 Cutoff Wall, Environmental Assessment and Finding of No Significant Impact (this document).	Nov 2007	Assesses impacts of a partially penetrating cutoff wall in Reach 1.	In an effort to expedite HHD rehabilitation, the partially penetrating cutoff wall impacts are analyzed in this EA. When the final design footprint is completed for the landside rehabilitation features in Reach 1, an EIS will be produced.

Herbert Hoover Dike Major Rehabilitation, Martin and Palm Beach Counties: Reach One Supplemental Second Draft, Environmental Impact Statement	Forecast dates: Sept 2008 Dec 2008	Assess impacts of full project design, specifically the landside rehabilitation in Reach 1	The Reach 1 EIS will document the impacts of the landside rehabilitation solution in combination with the cutoff wall, including any footprint (real estate) issues.

Definitions	
Seepage Berm	The seepage berm will be constructed of earthen materials (rock, gravel, sand). The primary purposes of the seepage berm are to control internal erosion due to through-seepage and underseepage and add necessary slope stability needed to withstand forces due to the design pools.
Cutoff Wall	The partially penetrating cutoff wall or "hanging cutoff wall" configuration will not completely impede or cutoff seepage because the cutoff wall will not "key" into the confining layer. The tip elevation will not extend down to the Hawthorne formation (the impermeable layer), elevation -200 ft. Typically, a trench is excavated and held open with a slurry mixture, which can be composed of one or more materials (e.g. cement, bentonite, and soil). The primary purpose of the cutoff wall is to block off any pre-existing piping pathways within the embankment and the embankment foundation.
Piping	When water travels from the lake underneath or through the dike, it can carry material (mostly soils and sands) with it, eventually eroding a flow path underground for water to travel more easily through, this is known as piping.

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PROPOSED FINDING OF NO SIGNIFICANT IMPACT
HERBERT HOOVER DIKE REACH ONE
MARTIN AND PALM BEACH COUNTIES, FLORIDA

Based on the information analyzed in the Reach 1A Test Cutoff Wall and Reach 1 Seepage Berm Environmental Assessment (EA), dated May 2007, the September 2005 Environmental Impact Statement (EIS) which covered proposed HHD Reach 1 repairs, and the information presented in this EA reflecting pertinent information obtained from agencies having jurisdiction by law and/or special expertise, I conclude that the proposed action will not significantly impact the quality of the human environment and does not require an EIS. Reasons for this conclusion are, in summary:

a. The proposed action, a partially penetrating cutoff wall, would be built within the existing right-of-way in Reach 1. The Record of Decision for the Final EIS (September 2005) approved implementation of the selected plan within this area.

b. The goal of the rehabilitation of the HHD is to reduce risk to public safety and health by implementing the recommended plan. Levee seepage and stability have a direct effect on the capability of the levee to provide authorized protection. The Flood Control Act of 1948 authorizes levee operation and maintenance as proposed in the preferred alternative (cutoff wall in combination with a landside rehabilitation feature) for the renovation of the HHD in Reach 1.

c. This EA is being circulated with a proposed Finding of No Significant Impact (FONSI) for public and agency review and coordination in compliance with the National Environmental Policy Act.

d. Adverse impacts to protected species are not anticipated. There is no critical habitat for listed endangered species along the dike. Listed species that might be observed in the region include wood stork (E), snail kite (E), eastern indigo snake (T), bald eagle (Species of Special Concern, SSC), and Audubon's crested caracara (T). Special measures will be incorporated during project construction to avoid or minimize adverse effects to any listed endangered, threatened, or species of special concern that may be present (see Environmental Commitments section). The USACE and the South Florida Water Management District (SFWMD) agree to maintain an open and cooperative informal consultation process with the U.S. Fish and Wildlife Service (USFWS) and Florida Fish and Wildlife Conservation Commission (FFWCC) throughout the design, construction, and operation of this rehabilitation project. The proposed action is in compliance with the Endangered Species Act.

e. No significant impacts to groundwater are anticipated from installation of the partially penetrating cutoff wall in Reach 1 since the tip elevation does not extend down to the Hawthorne group (the impervious geological formation). The Hawthorne group is located at an elevation of -130 to -160 ft NGVD 29. The purpose of the cutoff wall is to cutoff any pre-existing pipes (underground flow paths for water caused by erosion) within the HHD embankment and the upper portion of its

foundation. A groundwater modeling study was conducted that analyzed impacts of the partially penetrating cutoff wall. The results indicate that no regional groundwater impacts are anticipated and that local effects are insignificant. Reference EA Section 4.1.1.1 – Groundwater Modeling (p. 38) and Appendix A – Groundwater Modeling.

f. The USACE previously coordinated a consistency determination under the guidelines of the Coastal Zone Management (CZM) Act in the Final EIS, dated September 2005. The State concurred with the determination (Annex D of the Final EIS, dated September 2005) that the proposed action is consistent with the State's CZM programs. The Corps has determined that the modified plan is likewise consistent with the Florida CZM program. The updated Florida CZMP Evaluation can be referenced in Appendix B of this report.

g. The proposed action has been coordinated with the Florida State Historic Preservation Officer in accordance with the National Historic Preservation Act and the Archeology and Historic Preservation Act. Consultation with the State Historic Preservation Officer (SHPO) was initiated August 20, 1999. In a response dated August 7, 2005, the SHPO concurred with the Corps' no adverse effect determination on Reach 1. The project will not have an adverse affect on any historic properties included in or potentially eligible for inclusion in the National Register of Historic places (p. 51). Conditions to protect undiscovered resources will be implemented as follows: Language will be included in construction contract specifications outlining the steps to be taken in the event that undiscovered historical properties are encountered. An informational training session, developed by a professional archaeologist, will be conducted for the contractor's personnel to explain what kinds of archaeological/cultural materials might be encountered during construction of the cutoff wall, and the steps to be taken in the event these materials are encountered. A professional archaeologist will conduct periodic monitoring of the project area during construction to determine if activities are impacting unanticipated cultural resources. The proposed action is consistent with these Acts.

h. The project is in compliance with the Clean Water Act. A water quality certificate has been obtained from the State. All State water quality requirements will be followed. See Section 1.8 – Permits, Licenses, and Entitlements for a list Water Quality Certificates obtained by the Corps.

In view of the above and after consideration of public and agency comments received on the project, I have concluded that the proposed action for the rehabilitation of HHD will not result in a significant adverse effect on the human environment. This Finding incorporates by reference all discussions and conclusions contained in the EA enclosed herewith.

_____ _____

Paul L. Grosskruger Date
Colonel, U.S. Army
District Engineer

HERBERT HOOVER DIKE
ENVIRONMENTAL ASSESSMENT

Proposed Action: The proposed action includes construction of a partially penetrating cutoff wall in Reach 1.

Purpose: The purpose of this document is to provide the decision maker with all necessary information to make an educated decision on the project. The Environmental Assessment covers regulatory requirements, anticipated impacts from implementation of the preferred plan, mitigation completed to offset any anticipated impacts, and public and agency views on the project.

Lead Agency: U.S. Army Corps of Engineers

Executive Summary

The Herbert Hoover Dike (HHD) was originally constructed as a series of embankments by local interests in 1915 around Lake Okeechobee to provide flood protection to the surrounding communities and controlled irrigation for local agriculturists. These embankments were improved to the current levee system by the U.S. Army Corps of Engineers (USACE) during the 1960's. The crest of the dike was raised to its current configuration and additional embankments were constructed on the northwest and northeast shores, with major culvert modifications accomplished in the 1970s. Since then, the dike has been repaired as needed. Within recent years, emergency repairs to control seepage and sand boils have increased, indicating the need for major rehabilitation of the HHD. In response, the USACE produced a HHD Major Rehabilitation Evaluation Report (MRR) with a Draft Environmental Impact Statement (EIS) in November of 2000. The MRR focused primarily on the development and evaluation of alternatives for the rehabilitation of Reach 1 (**Figure ES-1)**, with the intent to release a supplemental MRR for the remaining Reaches.

In July 2002, a Value Engineering (VE) study was completed to further refine the engineering alternatives and attempt to limit the area of environmental impact of the preferred alternative. In addition, emergency repairs and early design documents modified the preferred alternative to further reduce project impacts on wetlands and fish and wildlife habitat. This modified design was presented as the preferred alternative (Alternative No. 4) in the "Herbert Hoover Dike Major Rehabilitation Evaluation Report Reach 1, Final Environmental Impact Statement, dated September 2005".

In September 2005, a Record of Decision was signed for the Herbert Hoover Dike Major Rehabilitation Report, Reach One, and Final Environmental Impact Statement (EIS). This EIS assessed the impacts of a partially penetrating cutoff wall (elevation -10 ft. NGVD 29), a relief trench with inverted filter and a relief berm within the right-of-way (ROW).

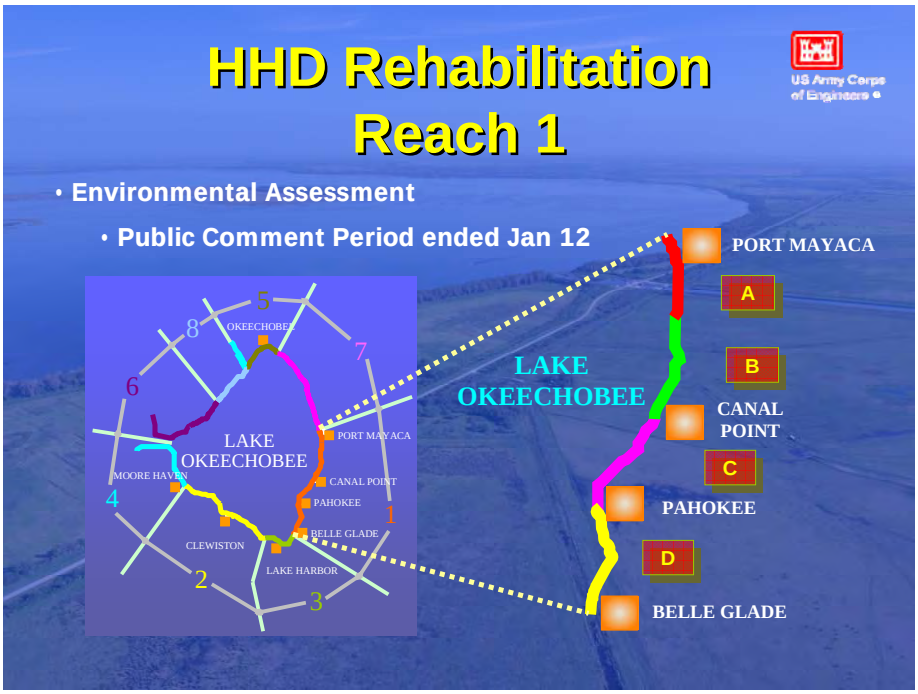

FIGURE ES-1: HHD LOCATION MAP

In the fall of 2005, the New Orleans' levees failed following Hurricane Katrina. A performance evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System followed, resulting in the Final Report of the Interagency Performance Evaluation Task Force (IPET), released June 2006. The non-Federal sponsor also conducted a Technical Evaluation of HHD; released May 2006. In order to incorporate lessons learned from the IPET report and ensure the Corps has the best engineering solution to rehabilitate and reinforce the HHD, the USACE conducted an Independent Technical Review (ITR) on the design for HHD. ITR recommendations have led to a more robust engineering solution for the Preferred Alternative (a cutoff wall in combination with a landside rehabilitation feature).

The Preferred Alternative design offers the best technology in industry to reduce seepage and piping immediately along the dike alignment as well as to offer stability and protection in the long-term. The cutoff wall will block any pre-existing pipes and defects in the embankment foundation, while the landside rehabilitation feature will serve to provide stability to the dike by reducing uplift pressures caused by seepage. The landside rehabilitation feature may consist of one or more of the following: a seepage berm, relief trench, relief well, sand drain, or soil replacement wedge. The landside rehabilitation feature will be determined based on the specific hydrogeologic conditions of the project site.

In January 2007, a Finding of No Significant Impact (FONSI) was signed for the Herbert Hoover Major Rehabilitation, Glades, Hendry and Palm Beach Counties Environmental Assessment (EA) and Finding of No Significant Impact, Modified Design in Reach 1 and Priority Ditch Repairs in Reaches 1, 2 and 3. That EA assessed the impacts of backfilling the toe ditch in identified focus areas. These focus areas were identified as the most critical areas in need of rehabilitation. The toe ditch backfilling was implemented as an interim risk reduction measure

In May 2007, a FONSI was signed for the Herbert Hoover Dike Major Rehabilitation, Martin and Palm Beach Counties, Environmental Assessment and Finding of No Significant Impact, Reach 1 Seepage Berm and Reach 1A Test Cutoff Wall. The EA assessed impacts of a test cutoff wall in Reach 1A and seepage berm in Reach 1 within the existing ROW in an effort to expedite the HHD rehabilitation.

This EA documents the environmental affects of a partially penetrating cutoff wall (elevation -20 to -40 ft. NAVD88) located at the center of the dike in Reach 1B, C, and D (**Figure ES-2**). The impacts of the landside rehabilitation features will be analyzed in a future EIS document when the design footprint is finalized in Reach 1. The following alternatives evaluated in this EA are: (1) No Action Alternative: continue present management practices without implementation of a rehabilitation alternative in Reach 1 and no physical changes in the study area, (2) Preferred Alternative: build an impervious, partially penetrating cutoff wall at the crest of the dike in Reach 1 in combination with a stability landside rehabilitation feature to reinforce the dike, and (3) Alternatives 1 through 4: considered in the September 2005 EIS.

The Consensus Report released October 30, 2007, reaffirms the need to accelerate the rehabilitation of the HHD. The Report conducted by an external panel agrees with the USACE determination that the HHD is in an active mode of failure and has been categorized as a "Dam Safety Action Classification 1 – Urgent and Compelling".

Although this EA evaluates impacts of a partially penetrating cutoff wall, implementation of the landside rehabilitation feature in combination with the cutoff wall will provide the resiliency, redundancy and robustness needed to offer the best, long term engineering solution (Figure ES-3). The implementation of the preferred alternative will be beneficial for the public by increasing safety and health conditions. Impacts to the adjacent water users due to implementation of the cutoff wall as described in the preferred alternative are anticipated to be minimal. This is supported by the groundwater modeling results.

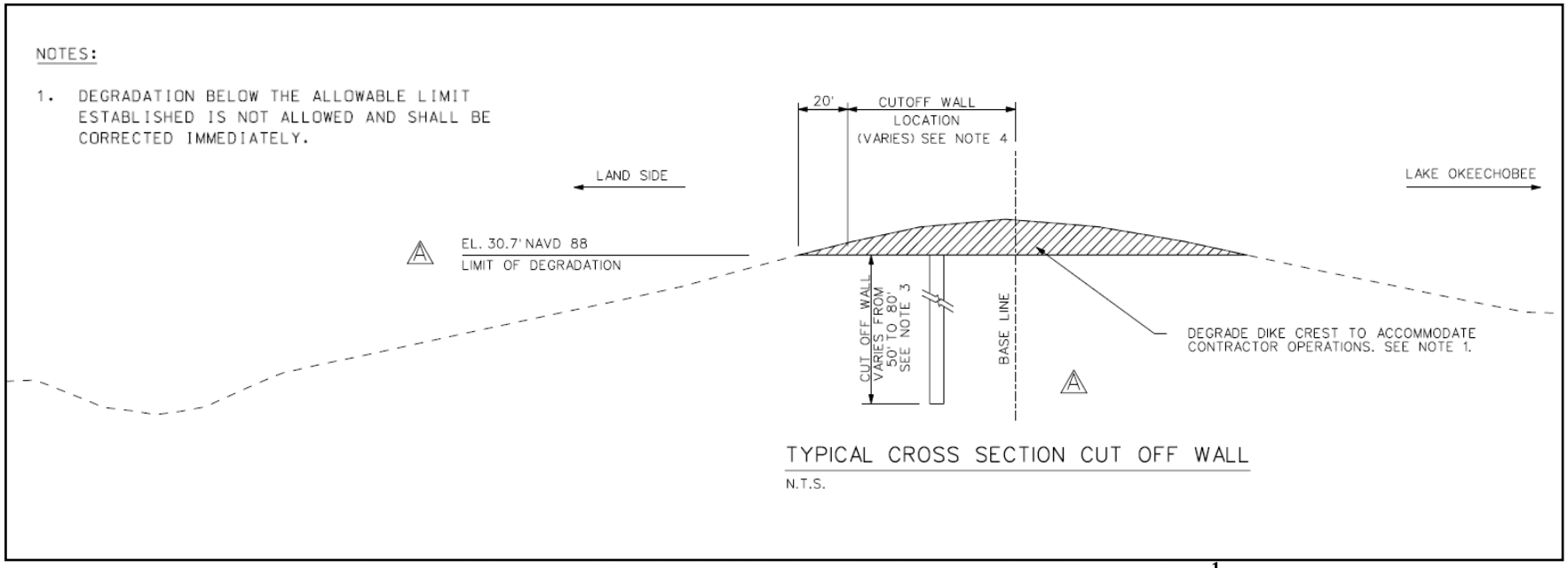

FIGURE ES-2: TYPICAL CROSS SECTION OF THE CUTOFF WALL[1]

[1]Elevation 30.7 ft (NAVD 88) is specified as a limit to degradation. Degradation will not be allowed below that evaluation. This is to provide the contractor adequate work space for the construction operations and will only be done if required by the contractor's methods. The specifications state that the length of the crest degraded is limited to the amount the contractor's approved plans indicate can be restored within 7 days from notification to restore. Lake stages during construction and tropical storms will be monitored by the government and if conditions occur that may pose a risk of overtopping the contractor will be directed to cease operations and restore the crest.

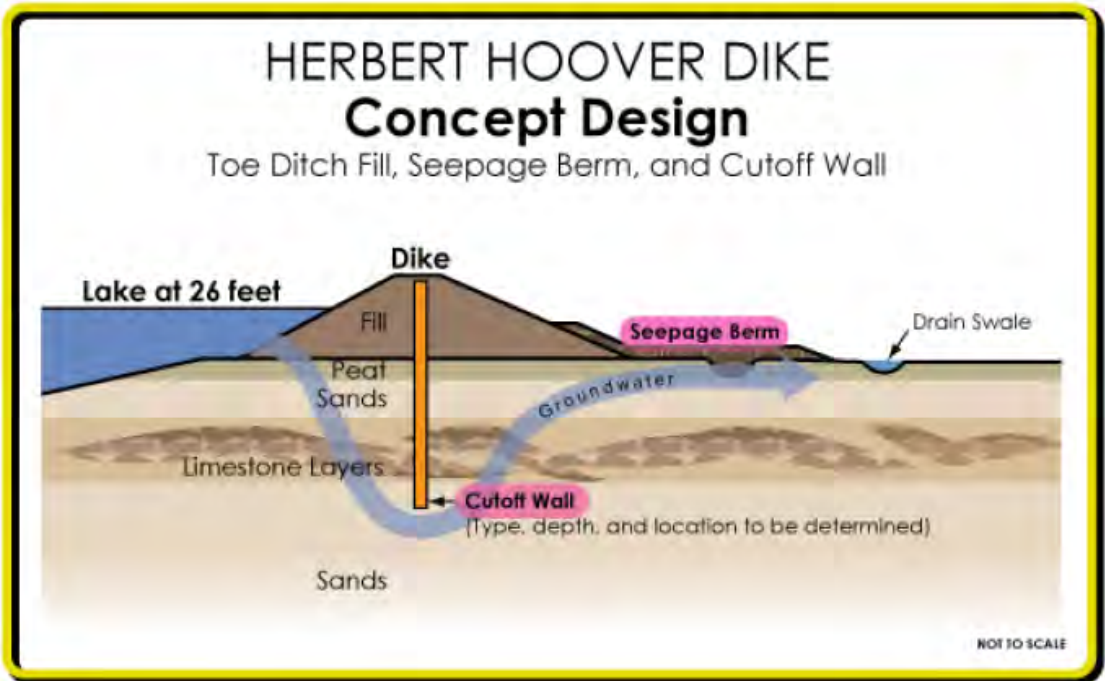

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FIGURE ES 3: LANDSIDE REHABILITATION FEATURE WORKING IN UNISON WITH CUTOFF WALL

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ENVIRONMENTAL ASSESSMENT FOR CUTOFF WALL FOR REACH 1 HERBERT HOOVER DIKE MARTIN AND PALM BEACH COUNTIES, FLORIDA

1.0 PROJECT PURPOSE AND NEED

The Herbert Hoover Dike (HHD) consists of a series of levees, gated culverts and locks that encompass Lake Okeechobee. Construction of this dike began in 1915 as the first embankments around the lake were constructed by local interests and were primarily composed of muck, sand, shell, and marl from adjacent borrow canals. During the 1930s, a Federal interest was initiated as a result of the hurricanes of 1926 and 1928 overtopping the original embankment and causing over 2,600 deaths. The River and Harbor Act, approved July 3, 1930, authorized the construction of 67.8 miles (109 kilometers (km)) of levee along the south shore of the lake and 15.7 miles (25.3 km) of levee along the north shore. Constructed by the Corps between 1932 and 1938, the typical crest height of these levees ranged from 32 to 35 feet (9.8 meters (m) to 10.7 m) above the National Geodetic Vertical Datum of 1929 (NGVD). A major hurricane in 1947 prompted the need for additional flood protection work in Florida. In response, Congress passed the Flood Control Act of 1948 authorizing the first phase of the comprehensive plan for flood protection and other water control. In the 1960's the crest of the dike was raised to its current configuration and additional embankments were constructed on the northwest and northeast shores. This was called the Central and Southern Florida (C&SF) Project. Additionally, major culvert modifications were accomplished in the 1970s. Since then, only as-needed repairs have been made to the HHD at locations where seepage and sand boils have been observed. Sand boils are indicators of the initiation of piping (underground flow paths for water caused by erosion), which can lead to dike instability or erosion of levee materials along internal channels. Increased observances of these activities suggest that major renovations are now necessary, especially along the southern portion of HHD. An unreliable embankment system could result in failure of the system to contain lake waters. Such a failure could be devastating, resulting in human suffering, loss of life, immense property damage (including residential, commercial and agricultural) and destruction of the natural habitat.

1.1 PROJECT AUTHORITY

The Herbert Hoover Dike is a component of the Central and Southern Florida (C&SF) Project. The Flood Control Act (Act), approved by Congress on 30 June 1948, authorized the first phase of a comprehensive plan to provide flood protection and other water control benefits in central and south Florida. The Act included measures for improving control of Lake Okeechobee by constructing or modifying the spillways and other structures, and enlarging the Lake Okeechobee levees to provide the intended flood protection, water storage and water supply. Levee seepage and stability have a direct effect on the capability of the levee to provide the authorized protection. The Act of 1948 authorizes levee operation and maintenance as proposed in the preferred alternative (cutoff wall in combination with a landside rehabilitation feature) for renovation of Reach 1 of the HHD. The authorized level of protection for the safety of the

public corresponds to the Standard Project Flood (SPF) lake level, an elevation of 26.4 ft (NGVD 29).

1.2 PROJECT LOCATION

The existing HHD system is approximately 143 miles (230 km) long, and is located within five counties: Glades, Hendry, Martin, Okeechobee and Palm Beach. The dike is divided into eight segments or "Reaches" for planning purposes. Reach 1, the southeastern segment, is 22.5 miles long and extends from the St. Lucie Canal at Port Mayaca, south to the Hillsboro Canal at Belle Glade (**Figure 1-1**). Reach 1 is further divided into four Subreaches (1A, 1B, 1C, and 1D); Subreaches 1B, C and D are the focus of this EA and equate to 17.6 miles. **Table 1-1** displays the lengths of the four Subreaches.

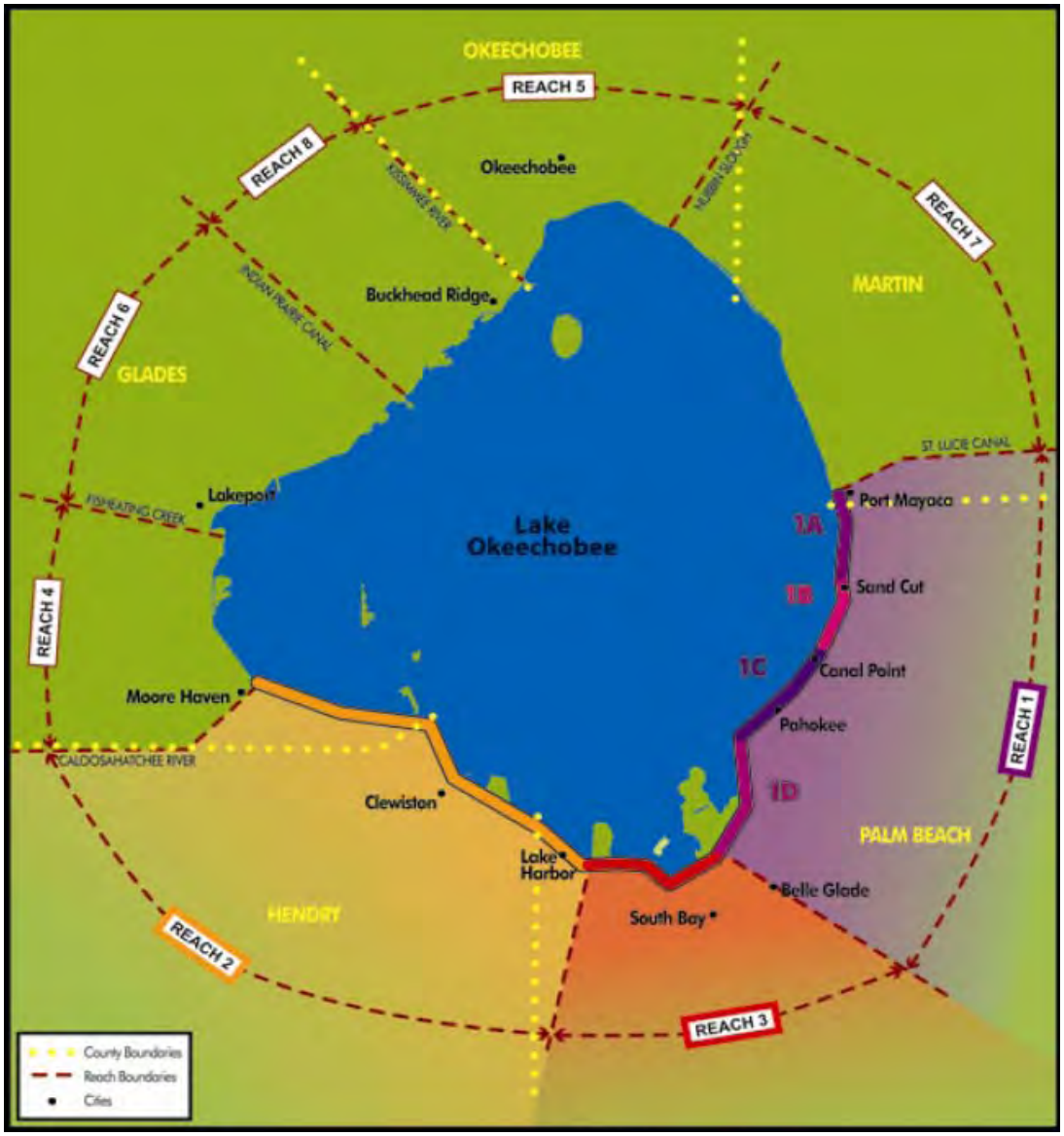

FIGURE 1-1: PROJECT LOCATION MAP

TABLE 1-1: REACH 1 SUBREACH LENGTHS

REACH 1 SUBREACHES	MILES
REACH 1A	4.9
REACH 1B	4.0
REACH 1C	6.2
REACH 1D	7.4
TOTAL	**22.5**

1.3 PROJECT NEED

The Herbert Hoover Dike is constructed largely of local material (e.g., mud, sand, shell fragments, and rock) with porous limestone bedrock underlying the levee. Seepage and sand boils have been observed along Reach 1 of HHD. When water travels from the lake underneath or through the dike, it can carry material (mostly soils and sands) with it, eventually eroding a flow path underground for water to travel more easily through, this is known as piping. Piping is a progressively deteriorating process, typically initiated at the toe followed by continuing erosion backwards from the landside to the lakeside of the dike, resulting in an underground, open conduit between the lake and landside toe which when fully developed, typically leads rapidly to failure or breach of the embankment. **Figure 1-2** demonstrates how water flows or "seeps" from the Lake to the landward side of the dike.

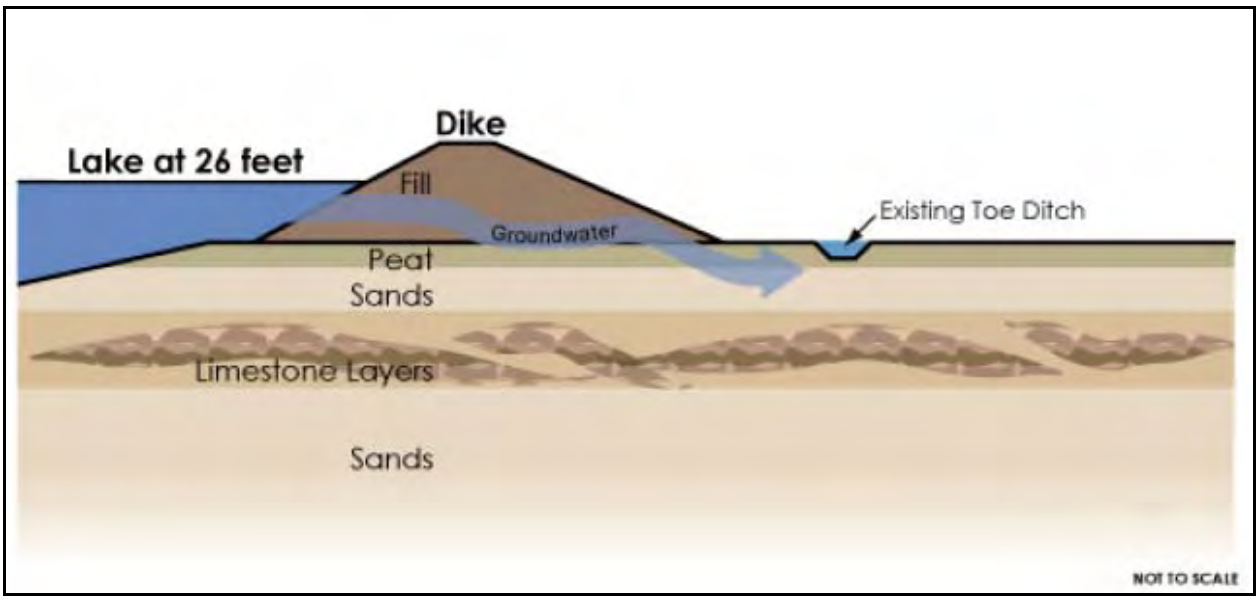

FIGURE 1-2: SEEPAGE AND PIPING UNDERGROUND

A number of piping and sand boil occurrences have been observed along the HHD, these occurrences have required immediate action by the USACE South Florida Operations Office (SFOO) (**Figure 1-3**). The opaque, murky water is a result of the mixture of sands and soils in the water, representing erosion through underground piping. Once pipes have formed, increased seepage becomes more likely causing the piping mechanism to speed up. The most significant occurrences of piping were found along Reach 1 of HHD. Piping and sand boil occurrences have occurred when there is not a high water event, as shown in **Figure 1-4**. This is an evident concern and demonstrates the need for immediate repair and rehabilitation of the dike, especially in the most critical areas. The SFOO identified nine focus areas that were deemed the most critical; these focus areas were covered in the January 2007 EA. The SFOO is in the process of backfilling the toe ditch in these focus areas as an interim risk reduction measure.

The DSAC (Dam Safety Action Classification) External Peer Review Panel has found that the U.S. Army Corps of Engineers Class I designation (Urgent and Compelling) for Herbert Hoover Dike (HHD) under EC 1110-2-6064 "INTERIM RISK REDUCTION MEASURES FOR DAM SAFETY" dated May 31, 2007 is appropriate. It is likely that a failure mode involving piping from seepage has begun at certain locations. The rate at which piping is occurring is dependent on lake level: it is clear that the seepage volume and distress indicators in certain reaches of the structure at reservoir levels above about Elevation 17 feet are cause for concern to the degree that failure is considered very likely when operating at or above these levels for any significant time. The higher the lake level, the shorter the time required for failure to occur. In this context "failure" means an uncontrolled release of water resulting from a catastrophic breach of some portion of the HHD system.

A failure of the system to contain lake waters could be devastating, resulting in human suffering, loss of life, immense property damage (including residential and agricultural) and destruction of the natural habitat. A reasonable and effective rehabilitative effort is required to eliminate this possibility.

FIGURE 1-3: EMERGENCY SEEPAGE MANAGEMENT CONTROL IN TOE DITCH (1995)

FIGURE 1-4: ACTIVE SEEPAGE AND PIPING MANAGEMENT IN TOE DITCH (2003)

1.4 AGENCY OBJECTIVE

The Corps conducted a structural and stability analysis study on the HHD that culminated in a Major Rehabilitation Evaluation Report (MRR), dated November 2000 for Reach 1. The general goal of the MRR was to investigate solutions for a reliable embankment system around Lake Okeechobee to contain the lake waters for flood protection, water supply, and navigation. In July 2002, a Value Engineering (VE) study was completed to further refine the engineering alternatives and attempt to limit environmental impact area of the preferred alternative. In addition, emergency repairs and early design documents modified the preferred alternative to further reduce project impacts to wetlands and fish and wildlife habitat. This modification was presented as the preferred alternative (Alternative No. 4) in the "Herbert Hoover Dike Major Rehabilitation Evaluation Report Reach 1, Final Environmental Impact Statement, dated September 2005". Subsequent to lessons learned from Hurricane Katrina and input from an external, independent team of engineers, the preferred alternative was modified to provide an engineering solution that would immediately address seepage due to piping at the most critical areas of the dike as well as provide a reliable, long-term solution for the rehabilitation of the HHD. See Section 2.0 for a discussion on the Preferred Alternative design and alternatives that were previously considered.

1.5 RELATED ENVIRONMENTAL, PLANNING AND DESIGN DOCUMENTS

The following is a list of related NEPA, design and planning documents listed in chronological order:

- Herbert Hoover Dike Major Rehabilitation Evaluation Report, Draft Environmental Impact Statement, July 1999.
- Final Herbert Hoover Dike Major Rehabilitation Report, November 2000.
- Draft and Final Herbert Hoover Dike Major Rehabilitation Evaluation Report, Reach One, Final Environmental Impact Statement, March 2005 and July 2005. The Record of Decision was signed in September 2005.
- Draft Herbert Hoover Dike Major Rehabilitation, Reaches 2 and 3, Draft Environmental Impact Statement and Engineering Analysis, Palm Beach, Glades and Hendry Counties, Florida, December 2006.
- Central and Southern Florida Project, Major Rehabilitation Evaluation Reports, Supplement-Draft, Herbert Hoover Dike, Reaches 2 and 3, December 2006.

- Herbert Hoover Dike Major Rehabilitation, Glades, Hendry, and Palm Beach Counties: Modified Design in Reach 1 and Priority Toe ditch Repairs in Reaches 1, 2, and 3, Environmental Assessment and Finding of No Significant Impact, January 2007.

- Herbert Hoover Dike Major Rehabilitation, Martin and Palm Beach Counties: Reach 1 Seepage Berm and Reach 1A Test Cutoff Wall Environmental Assessment and Finding of No Significant Impact, May 2007.

- Draft Project Report, Herbert Hoover Dike (HHD), Phase 1A Groundwater Model, Pearce Cheng, Barbara P. Donnell, Earl V. Edris (ERDC), Stephen England (USACE, PHL District), September 2007.

- Herbert Hoover Dike Consensus Report, External Peer Review of DSAC-1 Projects, October 30, 2007.

1.6 DECISION TO BE MADE

The purpose of this current EA is to evaluate impacts to the human environment from installation of a cutoff wall at the center of the dike within the Reach 1B, C and D ROW at a depth of -20 to -50 ft. NAVD88. The preferred alternative includes a cutoff wall in combination with a landside rehabilitation feature that may exceed the current levee ROW. See Section 2.1.2.2 for the landside rehabilitation descriptions.

Once the design for the landside rehabilitation features is complete for Reach 1, a Supplemental EIS will be produced analyzing any impacts of the complete solution. The Corps has determined that expansion of the HHD ROW is a “significant action” under the National Environmental Policy Act and requires preparation of an Environmental Impact Statement (EIS).

1.7 PREVIOUS INTERAGENCY COORDINATION

Informal consultation is in progress. Interagency participation with USFWS, EPA, FDEP, and the Corps has been ongoing. USFWS has informally indicated satisfaction with the existing Coordination Act Report (CAR) and its determinations. Concurrence is expected. The proposed action (install cutoff wall along all of Reach 1B, C, and D at the center of the dike at a depth of -20 to -50 ft. NAVD88) is under consideration by FWS. A scoping power point presentation on the cutoff wall with landside rehabilitation alternatives was sent out to interested agencies on September 28, 2007. A scoping letter was sent out on October 9, 2007. The State Historic Preservation Officer (SHPO) has listed HHD as eligible for inclusion on the National Register of Historic Places for its historic significance. In a letter dated 3 July 2007, The SHPO concurred that the HHD historic properties will not be adversely affected by the proposed rehabilitation plans. Consultation with the SHPO and other interested parties will continue until completion of the project.

1.8 PERMITS, LICENSES, AND ENTITLEMENTS

The proposed HHD repairs are evaluated consistent with Section 404 of the Clean Water Act and does require Water Quality Certification from the FDEP. The Section 402(b) National Pollutant Discharge Elimination System (NPDES) permit will be required for construction activities that disturb more than 5 acres of land. This permit will be acquired prior to the initiation of construction. (Refer also to Section 4.11 Compliance with Environmental Requirements).

The Corps currently has the following water quality certificates (WQC) as of November 2007:

- The Corps received for a permit (DEP File # EE 50-0234604-006), August 16, 2007 to construct a seepage cutoff wall in Reaches 1B, C and D.

- The Corps received for a permit (DEP File #0234604-004), April 3, 2007 to construct 10,000 ft of seepage berm extension along the northern most portion of Reach 1A.

- In Reach 1A, the Corps has a *de minimus* exemption (serves as WQC) to construct the seepage cutoff wall (DEP File # 0234604-005).

- In Reach 1, the Corps has an Environmental Resource Permit (ERP) (serves as WQC) to construct emergency toe ditch backfilling repairs along 20,000 ft of high risk portions of Reach 1 (DEP File # 0234604-003), covered in previous EA.

2.0 ALTERNATIVES

Alternative solutions (Alt. No. 1 through Alt. No. 3) were proposed in the 2000 HHD MRR; the recommended solution at that time was identified as Alt. No. 3 based on engineering and socio-economic decisions. The 2000 MRR addressed consequences of a dike failure, which included population impacts and loss of life, as well as economic and environmental damages. A probabilistic risk and uncertainty model was developed to complement the more traditional analysis methods and provide an additional decision-making tool.

In 2001 a Value Engineering (VE) study was initiated for the project in order to reduce real estate costs and minimize the footprint of the Preferred Alternative No. 3 within functional wetlands. Reference the Value Engineering Study Herbert Hoover Dike Rehabilitation and Repair Reach 1 March 2002.

In September of 2006, an ITR was implemented in response to the need to revisit the design for rehabilitation of HHD, in order to capture lessons learned from the post-Katrina evaluations of the New Orleans and Southeast Louisiana Hurricane System. Reference the Performance Evaluation of the New Orleans and Southwest Louisiana Hurricane Protection System, Draft Final Report of the Interagency Performance Evaluation Task Force (IPET).

2.1 DESCRIPTION OF THE ALTERNATIVES, INCLUDING NO ACTION AND PROPOSED ACTION

2.1.1 No Action Alternative

The No Action Alternative is defined as not taking actions or making physical alterations to improve or repair the HHD within Reach 1. It would maintain the current condition of the dike. The No Action Alternative would not provide acceptable level of risk with current regulation requirements of safety factors relative to dike stability. Without acceptable improvements to the HHD, the safety of the surrounding human and natural environment may be severely impacted with subsequent effects upon the local and regional economies. The continuation of seepage, piping and boils occurring in this area will increase the risk of a failure of the dike. In the event of a total breach, significant impacts to human life (including human suffering and loss of life), and substantial impacts existing soils, vegetation, water resources, habitat, threatened and endangered species, agriculture and property would result. The No Action Alternative does not provide a long-term solution to the seepage and stability problems existing along Reach 1.

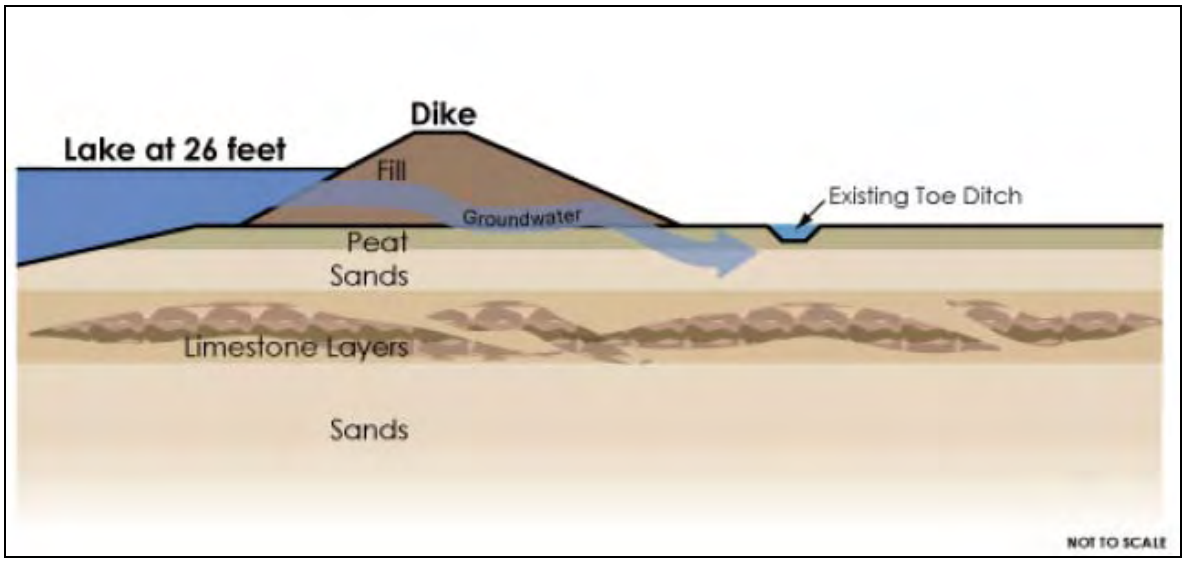

FIGURE 2-1: NO ACTION ALTERNATIVE (EXISTING CONDITIONS)

2.1.2 Alternative No. 5 (Preferred Alternative)

A key lesson learned from the failures of the New Orleans levees following the impact of Hurricane Katrina, and emphasized by the Corps' independent review team (IPET 2006), is the need to provide designs which include resiliency, redundancy and robustness. The recommended plan for rehabilitation of Herbert Hoover Dike (HHD) consists of an integrated solution that addresses internal erosion, slope stability and foundation vulnerabilities. This integrated solution includes two central elements: a landside rehabilitation feature and a cutoff wall (see **Figure 2-2**). The landside rehabilitation features consist of a seepage berm, soil replacement wedge, relief wells, and sand drains. The landside rehabilitation feature chosen for a particular location will be dependent on the specific hydrogeologic site conditions. The total solution for HHD will include one or more of the above listed landside rehabilitation features that will work in unison with a cutoff wall to provide the final solution for rehabilitation of HHD.

2.1.2.1 Cutoff-Wall

The primary purpose of the Herbert Hoover Dike partially penetrating cutoff wall is to block (or cutoff) pre-existing piping pathways and defects within the embankment foundation. These paths may exist anywhere along the alignment of the dike and typically are present below the peat layers and within or just beneath the limestone layers. The embankment was originally constructed using hydraulic dredge and fill techniques; therefore, its composition is characterized by a variety of geologic materials including silts, clays, peat, sand, shell and gravel. The underlying foundation conditions are also non-uniform, with pervious layers of limestone, sand, gravel, and shell providing potential pathways for under-seepage and interim erosion. The cutoff wall will also improve the dike's ability to resist piping through the embankment by providing resistance to seepage through the dike.

A cutoff wall will be implemented in Subreaches 1A, B, C and D (**Figure 2-3**). The cutoff wall will extend from near the crest of the dike to 5-10ft below the limestone layers. The limestone exists at varying depths along the HHD alignment; it is highly transmissive and is one of the

main reasons for the seepage flows at the toe of the embankment. **Figure 2-4** depicts how the cutoff wall will work in unison with a landside rehabilitation feature such as the seepage berm.

Existing structures within Reach 1 include eight culverts and two spillways. The structures will be modified so that the partially penetrating cutoff wall in the dike will be continuous under the structures. The cutoff wall in the vicinity of the structure will be constructed of steel sheet piling (SSP). The SSP cutoff wall alignment will veer off the dike's centerline toward the lakeside, and just in front of the existing structure. The pile tip elevation of the SSP will be to the same depth as the bottom of the dike's cutoff wall. Reinforced concrete floodwalls and slabs will be used to tie the structure's SSP cutoff wall to the existing structure to prevent water from overtopping the structure/cutoff wall system and seeping into the embankment. The SSP structure's cutoff wall will tie into the dike's cutoff wall approximately 150 feet to 500 feet from the centerline of the structure.

Rehabilitation of the Herbert Hoover Dike can be expedited and an increase in the level of protection provided by construction of the cutoff wall. This EA is evaluating the environmental effects of the cutoff wall in Reaches 1 B, C, and D. The effects of the cutoff wall in Reach 1A have already been addressed in the previous EA, dated May 2007. The complete HHD rehabilitation solution does incorporate a cutoff wall in combination with a landside rehabilitation feature. A description of the possible landside rehabilitation features is provided below. However, the landside rehabilitation impacts will be analyzed holistically in a future NEPA document when the landside rehabilitation design and footprint are available for the entirety of Reach 1.

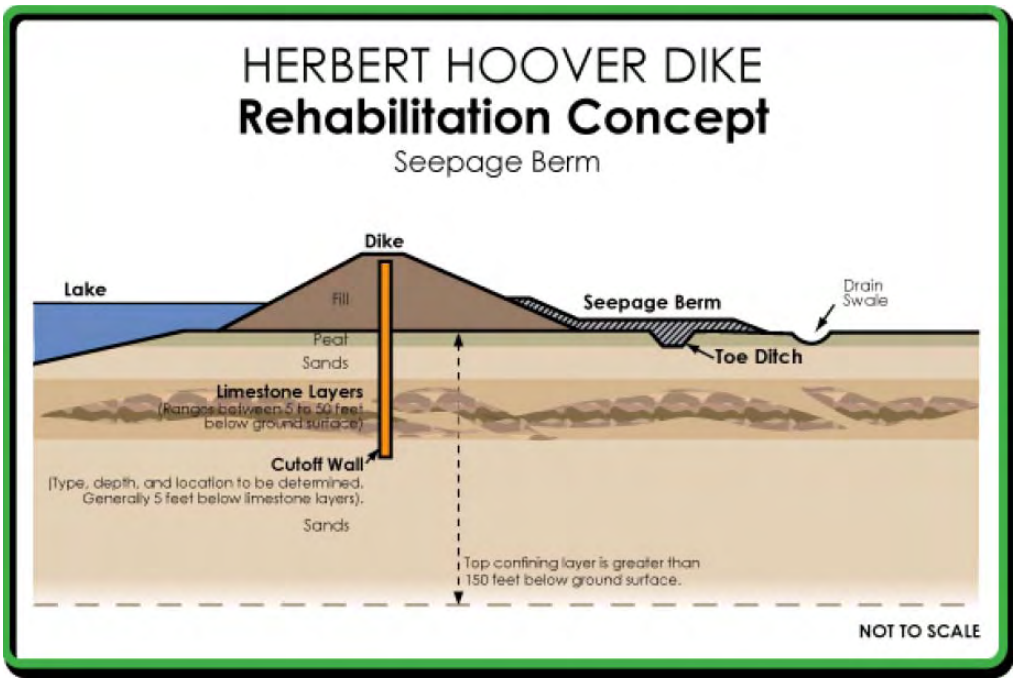

FIGURE 2-2: HHD CONCEPT DESIGN OF CUTOFF WALL AND LANDSIDE REHABILITATION FEATURE

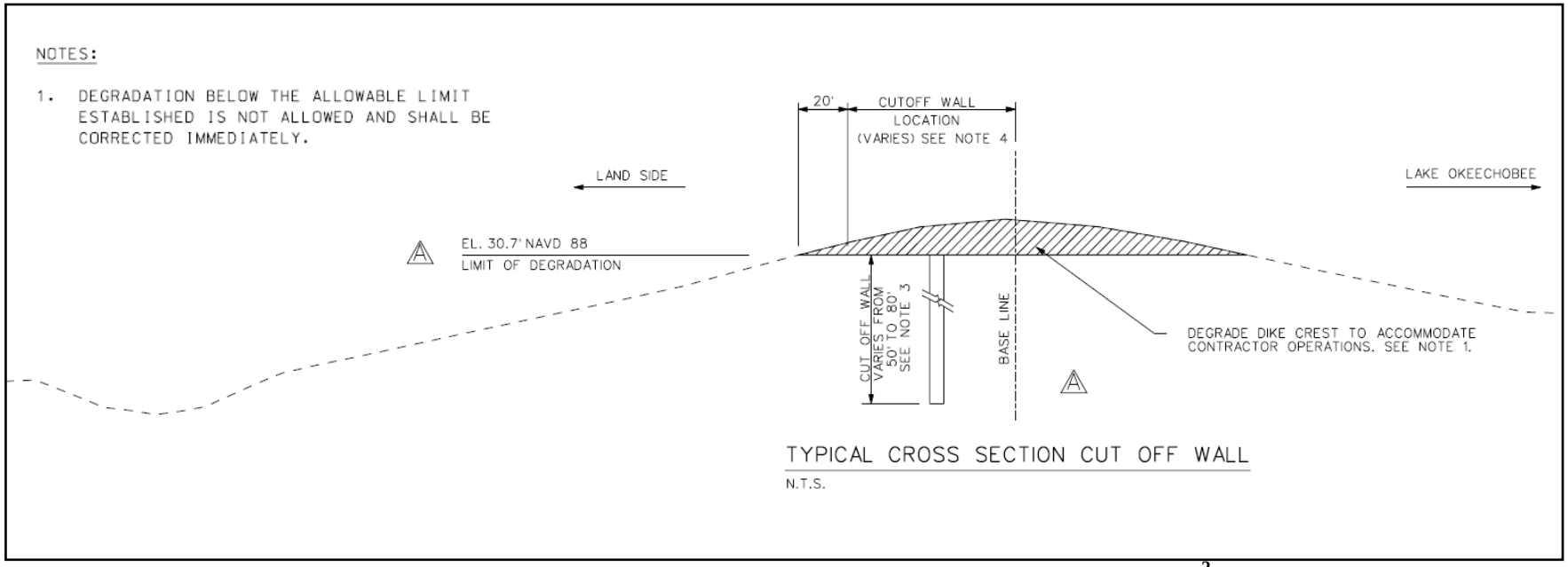

FIGURE 2-3: TYPICAL CROSS SECTION OF THE CUTOFF WALL[2]

[2]Elevation 30.7 ft (NAVD 88) is specified as a limit to degradation. Degradation will not be allowed below that evaluation. This is to provide the contractor adequate work space for the construction operations and will only be done if required by the contractor's methods. The specifications state that the length of the crest degraded is limited to the amount the contractor's approved plans indicate can be restored within 7 days from notification to restore. Lake stages during construction and tropical storms will be monitored by the government and if conditions occur that may pose a risk of overtopping the contractor will be directed to cease operations and restore the crest.

2.1.2.2 Integration of Landside Rehabilitation and Cutoff Wall for Complete Solution

Analyses have shown that neither of these features (landside rehabilitation feature or cutoff wall) on their own will provide the appropriate level of reliability. The primary purposes of the landside rehabilitation features are to control internal erosion due to through-seepage and underseepage and add necessary slope stability needed to withstand forces due to the design pools. The primary purpose of the cutoff wall is to block off any pre-existing piping pathways within the embankment and the embankment foundation that may have developed throughout the long history of seepage and internal erosion and "piping". The solution will combine these features to address concerns such as real estate impacts and the existence of other features, such as highways and railroad lines, which may prevent the full implementation of the landside rehabilitation feature. In these cases, the Jacksonville District will work with its senior leadership and the South Florida Water Management District to develop solutions consistent with the project needs while attempting to consider concerns of all parties. In summary, the approach being applied for the rehabilitation of Herbert Hoover Dike includes the multiple lines of defense to ensure that the project will provide its authorized level of protection for the safety of the public for lake levels corresponding to the Standard Project Flood (SPF) lake level, which is 26.4 ft (NGVD 29).

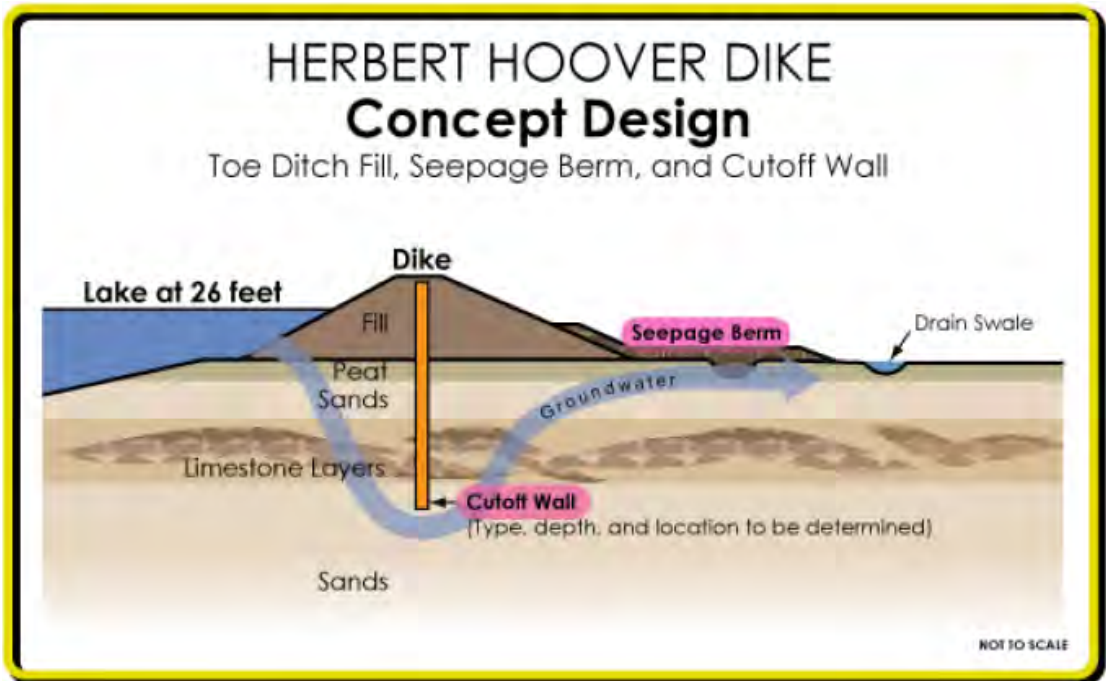

FIGURE 2-4: LANDSIDE REHABILITATION FEATURE WORKING IN UNISON WITH CUTOFF WALL

2.2 DESCRIPTION OF ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

2.2.1 Alternative No. 1

This alternative includes increasing the water level in the drainage ditches and the construction of a stability berm at the landside toe of the levee (**Figure 2-5**). Alternative No. 1 would improve the existing drainage ditches by cleaning out the ditches and re-grading the ditches. Culverts with automatic/manual gates and pumps would be installed to control the water level in the ditches. During critical high water periods, the water level in the ditches would be raised in order to limit the differential head across the levee. Raising the water levels in the ditches would increase the local flooding potential due to rainfall and runoff. Presently, local drainage districts and farmers control most of these ditches.

This alternative does not provide adequate level of protection from the seepage and stability problems that threaten critical areas of Reach 1 of HHD. In addition, this alternative increases local flooding potential in areas immediately adjacent to the dike; therefore, this alternative was eliminated from the alternatives.

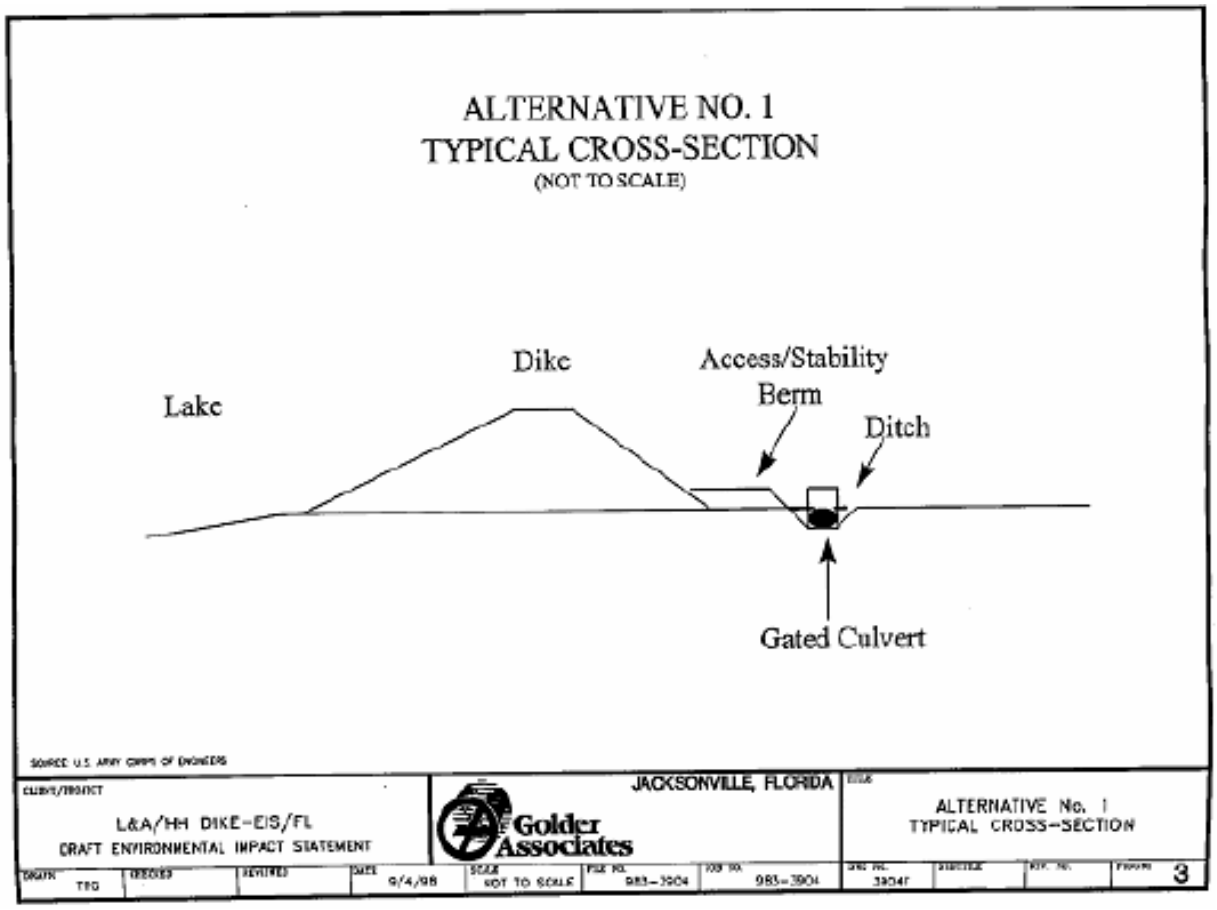

FIGURE 2-5: ALTERNATIVE NO. 1

2.2.2 Alternative No. 2

Alternative No. 2 involves an upstream (lakeside) impervious cutoff wall and a landside stability berm at the toe of the levee (**Figure 2-6**). When the lake is lower than the top of the cutoff wall this is the most positive method of underseepage control because it reduces both uplift pressure and through seepage. The wall would have consisted of a 3 ft (0.9 m) wide, 60 ft (18 m) deep excavation filled with soil-bentonite or soil-cement mixture. The top of the wall would be at an approximate elevation of 25 ft (7.6 m). A landside stability berm as described in Alternative No. 1 would also be constructed. Due, in part, to the lakeside location of cutoff wall leaving the wall susceptible to overtopping during extreme events and erosion during wave attack, this alternative was not selected as the preferred alternative at the time the FEIS was produced in 2005. Further, the landside toe treatment in this alternative would not provide the desired level of protection.

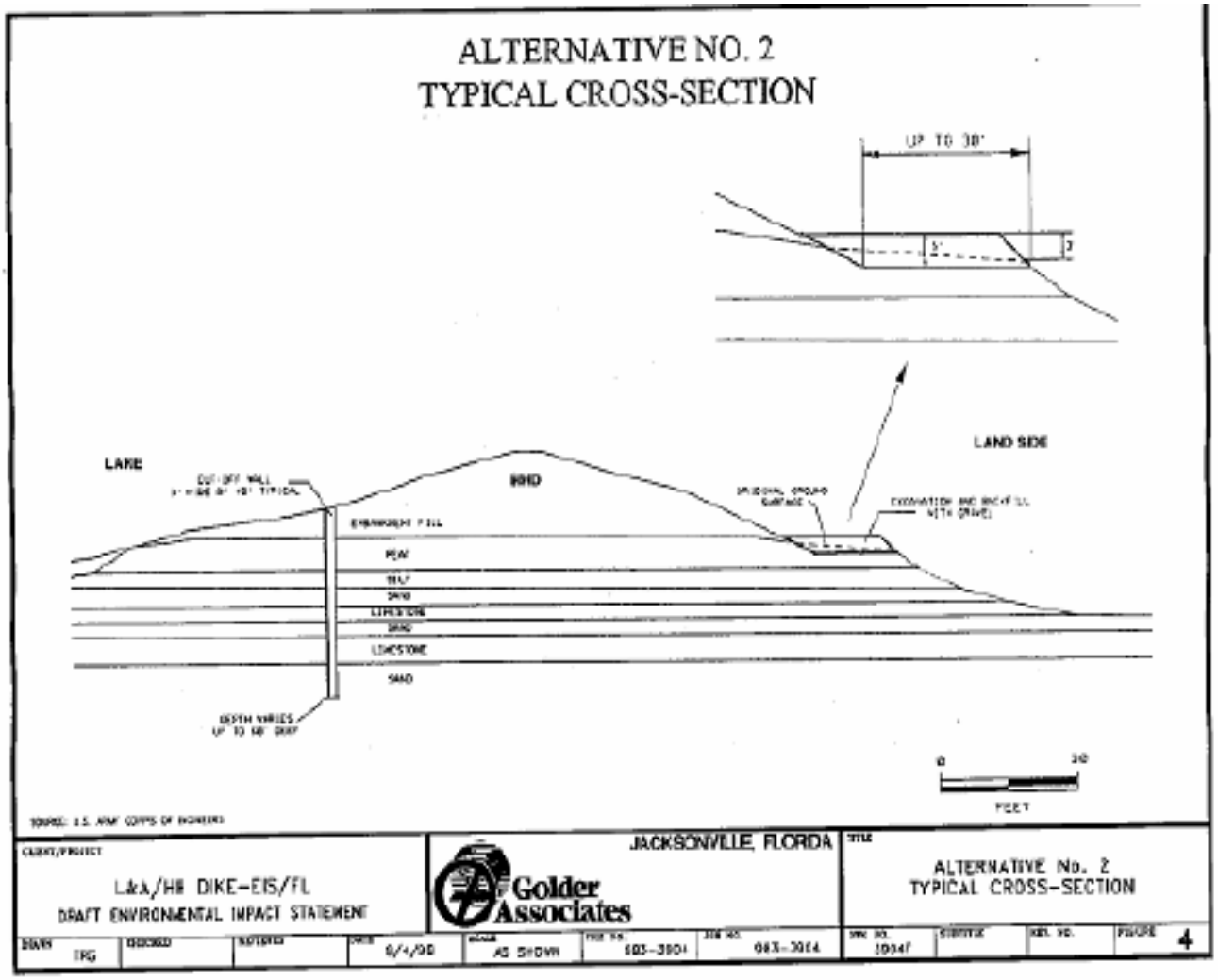

FIGURE 2-6: ALTERNATIVE NO. 2

2.2.3 Alternative No. 3

Alternative No. 3 consists of the installation of a landside rehabilitation feature with a relief trench and a french drain system along the landward toe of the HHD (**Figure 2-7**). In areas where the HHD toe rests on a peat layer, construction of the landside rehabilitation feature would begin with excavation of peat material from the landside toe. No excavation would be performed at higher elevations of the embankment slope. The landside rehabilitation feature would be constructed along the lower portion of the embankment toe. The landward side of the feature would contain perforated culvert. A deep relief trench would be excavated immediately below the culvert within the toe ditch and along its entire length. The feature would prevent the piping of sands and silts from the embankment and its foundation. The relief trench was designed to control uplift pressures and prevent seepage and piping flows from extending landward of the embankment. The perforated culvert system should collect and convey seepage flows to controlled outlets that empty into existing drainage canals. A drainage swale would also be constructed along the landward toe of the berm to collect and convey surface drainage from each side of the drainage berm. In emergency implementation of this alternative on a one-mile stretch of Reach 1, the design demonstrated lack of ability to control seepage that would resurface on adjacent properties. Therefore, this alternative was not selected in 2005.

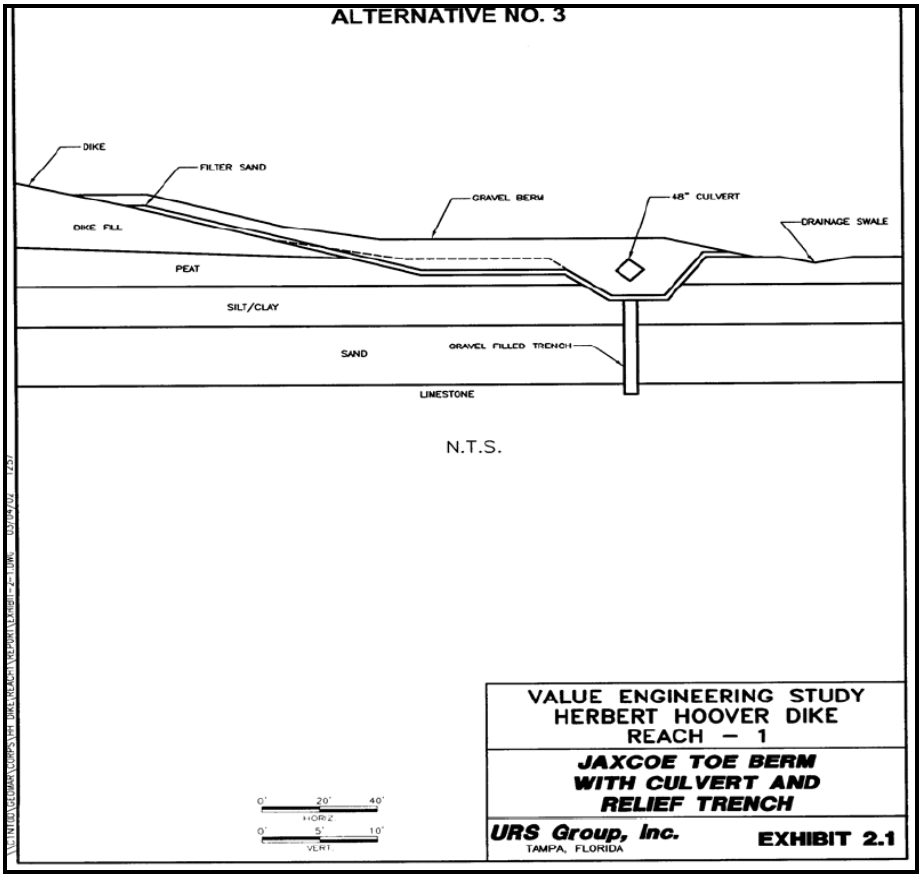

FIGURE 2-7: ALTERNATIVE NO. 3

2.2.4 Alternative No. 4

Alternative No. 4 was the preferred alternative in the FEIS, dated September 2005. The design included a hanging partially penetrating seepage cutoff wall on the landward side of the dike slope and a relief trench with an inverted filter and relief berm at the toe of the landward slope of the dike, stopping at the HHD's toe ditch (**Figure 2-8**). The relief trench and inverted filter would be constructed adjacent to the existing toe ditch and within the HHD footprint at the landward toe. An access road would be built on top of the relief trench. The plan is similar to Alternative No. 3 (MRR preferred alt), but would not contain a closed conduit (perforated culvert), instead using the existing open toe ditch for removal of seepage and utilizes the hanging cutoff wall to prevent piping. The closed conduit would be replaced with the existing open toe ditch for removal of seepage. Seepage water from the seepage toe berm and relief trench would flow freely into the existing toe ditch. The toe ditch geometry may have to be altered on the lakeward side of the ditch due to construction of the trench and drain system. The final design would insure no negative impact on flood control.

The initial decision in 2005 to select this alternative was based on the belief that the selected plan provided adequate margins of safety and protection from dike failure. Recent reviews of dike safety, both external and internal to the Corps, coupled with experiences and lessons learned in the aftermath of Hurricane Katrina, have emphasized the need to design an alternative that provides resiliency, redundancy and robustness. This alternative does not provide resiliency, redundancy and robustness and therefore does not provide the appropriate level of reliability deemed necessary by the Corps.

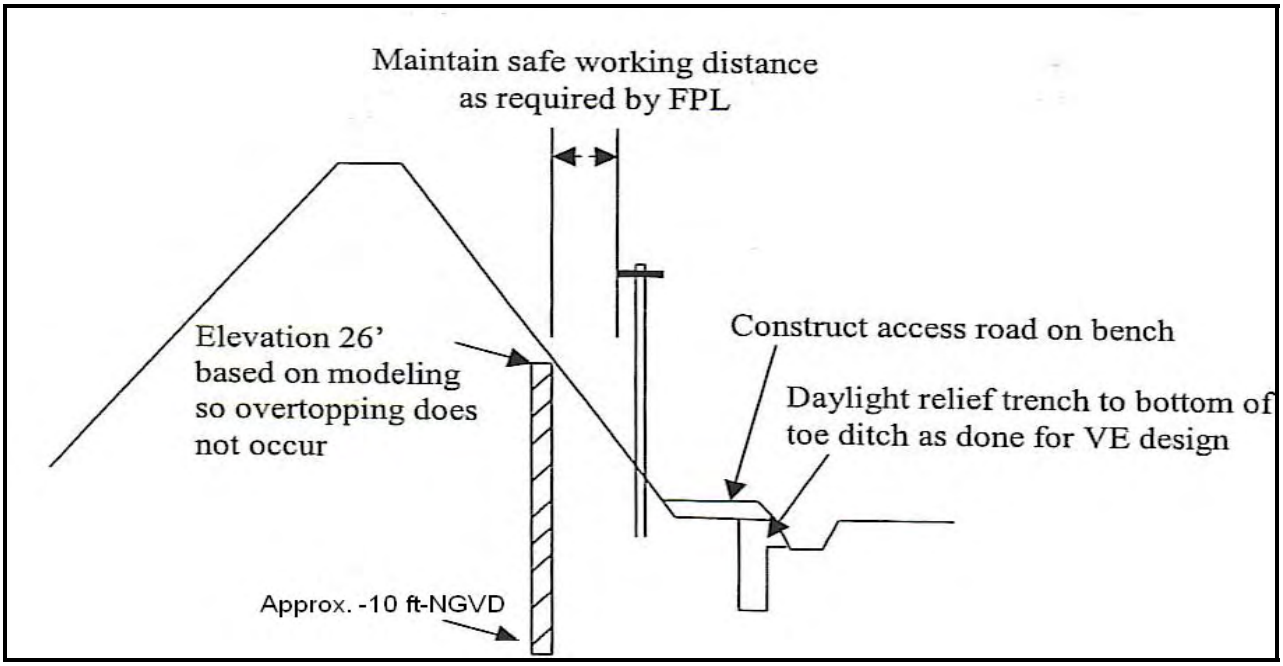

FIGURE 2-8: ALTERNATIVE NO. 4

2.3 COMPARISON OF ALTERNATIVES

Table 4-1 and **Table 4-2** list the alternatives under consideration and summarize the major features and consequences of each of them. See Section 4.0 Environmental Consequences for a discussion on alternative impacts.

3.0 AFFECTED ENVIRONMENT

Water resources, wetlands, threatened and endangered species, state listed species, socio-economics, cultural resources, recreation, hazardous, toxic, and radioactive wastes (HTRW), noise, air quality and aesthetics are discussed in this section. It is anticipated that impacts from the project will be isolated to these environmental resources. This Section does not present effects, but puts forth the baseline environment for comparisons in Section 4.0 - Environmental Consequences. For a more comprehensive, detailed discussion on the existing Reach 1 environmental conditions, reference Section 3.0 of the "Herbert Hoover Dike Major Rehabilitation Evaluation Report, Final Environmental Impact Statement", dated September 2005.

3.1 WATER RESOURCES

Lake Okeechobee receives water principally from direct rainfall and runoff from watersheds of the Kissimmee River, Taylor Creek / Nubbin Slough, Lake Istokpoga and Fisheating Creek which enter the lake from the north. Major outfall canals along Reach 1 include the St. Lucie, West Palm Beach, Hillsboro, and North New River Canals (see **Figure 3-1**). The groundwater throughout the Lake Okeechobee area is usually within 3.28 ft (1 m) of the land surface. This water table generally parallels the land-surface features. Differences in ground elevations are so slight that the water table is a relatively uniform surface with few undulations. The principal source of recharge to the groundwater in this area is derived from local rainfall and by subsurface percolation from the canals into the permeable materials. Discharge from this shallow groundwater reservoir is by evaporation from the land or water surfaces, transpiration by plants, seepage into canals, and pumping from shallow wells. The groundwater flow typically follows a north to south gradient.

The major artesian aquifer underlying this region is the Floridan Aquifer, which occurs from about 1000 ft (300 m) bls to bedrock (Schroeder et al, 1954).

Along Reach 1, there are eight gated culverts, two gated spillways, and one lock and spillway. Control of waters from these structures is primarily the responsibility of the Corps and SFWMD. However, eight private drainage districts assume control of water flow within the region of Reach 1. These are: 1) Mayaca Groves, 2) Palm Beach Groves, 3) Cloister Farms, 4) U.S. Sugar Corporation, 5) East Beach Drainage District, 6) Pahokee (or 715) Farms, 7) East Shore Drainage District, and 8) South Shore Drainage District.

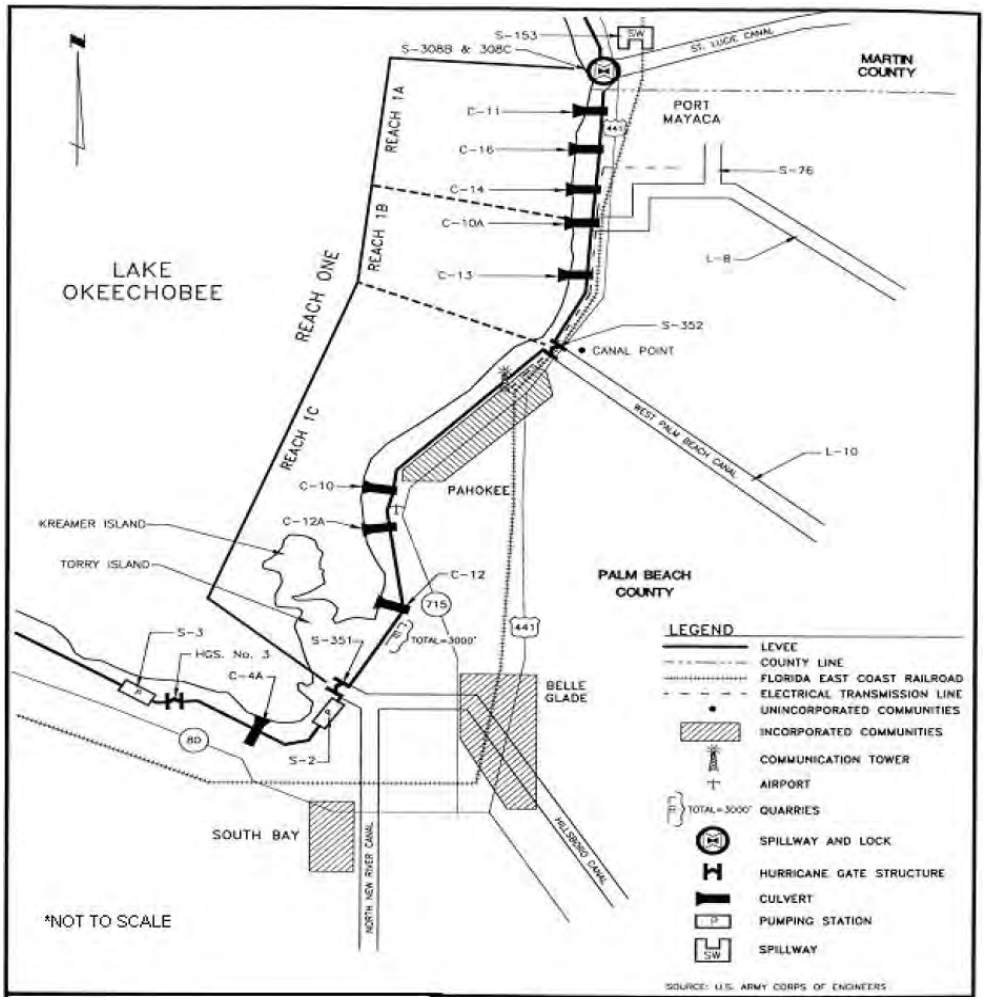

FIGURE 3-1: CANALS AND STRUCTURES AT REACH 1

3.2 WETLANDS IN REACH 1

The toe ditch along the Herbert Hoover Dike was built as part of the dike itself. Fill was excavated along Lake Okeechobee to construct the HHD; as a result, the toe ditch was created. Over the years rainwater and seepage from the Lake have collected in the toe ditch establishing a wetland habitat for fish and wildlife. The toe ditch wetlands vary in width along Reach 1 from approximately 30 ft at the north end of Reach 1A to approximately 2-4 ft at the south end of Reach 1D. Typically the shallower, narrow portions of the toe ditch do not hold standing water during the dry season. The landscape east of the toe ditch varies considerably along the 22.5 miles of Reach 1, consisting of wetlands, roads, railroads, private property, junk yards, airport, park, marina, golf course, nursery and agricultural lands adjacent to the toe ditch. Typical vegetation observed in the toe ditch wetlands or wetlands beyond the toe ditch include Brazilian pepper, cattails, cabbage palm, common reed, cypress, elderberry, hackberry, pennywort, primrose willow, royal palms, strangler fig, southern willow, water lettuce, and water hyacinth. Although wetlands are present on the landward side of Reach 1 may not be considered high

quality ecosystems, they host small fishes and invertebrates and provide usable foraging habitat for wading birds, alligators, and turtles.

3.3 THREATENED AND ENDANGERED SPECIES

There is no critical habitat for listed endangered species along the outer toe of HHD. Protected species that might be observed in the region include the wood stork (E=endangered), snail kite (E; critical habitat inside HHD in Lake Okeechobee littoral zone), and eastern indigo snake (T=threatened). The bald eagle is protected by two other major federal laws: the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA).

3.4 STATE LISTED SPECIES

The burrowing owl and tree snails are species of special concern in Florida, which may be present in the project vicinity.

3.5 SOCIO-ECONOMICS

Agriculture, recreation and tourism all play an important role in socio-economics, which is the relationship between economic activity and social life.

Agriculture in this region is dependent upon the Lake as a source of irrigation water. The regulated lake depths make it possible for farmlands to receive irrigation water year round regardless of rainfall. In the Lake Okeechobee service area, there are an estimated 742,668 acres of irrigated agricultural lands. These agricultural lands and associated activities employ hundreds of people in the area and bring millions of dollars in revenue annually. Agriculture in the vicinity of Reach 1 is dominated by sugarcane, accounting for 90% of land under cultivation. The remaining 10% of cultivated land primarily includes rice, row crops, and sod (David Miller & Associates, 1998). During prolonged droughts, significant volumes of water from the lake are required to supplement local water supplies and to prevent saltwater intrusion into coastal aquifers and wellfields.

Recreation and tourism activities in the area are located primarily in and around Lake Okeechobee. Lake Okeechobee is the largest recreational resource in the region. The Lake has been an historic tourist destination, and the Lake and its associated waterways and shoreline provide a wide variety of water-based recreation activities for local residents and out-of-state visitors, including: fishing, boating, picnicking, sightseeing, camping, swimming, birding, hunting, air boating and hiking.

> *Birding* – heavy waterfowl utilization of Lake Okeechobee attracts tourists and recreational enthusiasts. Common waterfowl species include ring-necked duck (*Aythya collaris*), American widgeon (*Anas americana*), northern pintail (*A. acuta*), green-winged teal (*A. crecca*), Florida duck (*A. fulvigula*), and lesser scaup (*Aythya affinis*).
>
> *Fishing* – Lake Okeechobee supports a variety and abundance of sport fish. Consequently, sport fishing is a major recreation activity on the lake. Lake Okeechobee is currently recognized as supporting one of the best recreational fisheries in the nation.

Additionally, it supports an active commercial fishing industry. This includes several different types of commercial fishing operations and landside support activities, such as marinas and wholesale and retail distribution facilities. The annual value of the wholesale commercial fishing is $2,326,932 and employs 210 people (David Miller & Associates, 1998).

In 1996 the annual value of the recreational resources of the lake was estimated at $78,151,409 (David Miller and Associates, 1998).

There are commercial fisheries on Lake Okeechobee that harvest the American alligator and the Florida soft shell turtle. Alligators are harvested from the lake population to supplement the stock in alligator farming operations. Soft shell turtles are harvested by commercial fishermen, with some individual yields in excess of 30,000 pounds (13,640 kilograms) annually. The majority of the harvest is prepared for shipment to Japan, or sold locally, primarily to the Miccosukee Tribe (Moler & Berish, 1995).

The depth of Lake Okeechobee makes commercial navigation on the lake possible. Commercial navigation of Lake Okeechobee and associated waterways was used to transport 430,000 tons of freight in 1995. Petroleum products, including distillate fuel oil, residual fuel oil, and liquid natural gas, comprise the majority of tonnage shipped. Other commercial navigation includes fleets of day/dinner cruise vessels that operate during the tourist season from Pahokee.

3.5.1 Demographics

Reach 1 mainly falls within Palm Beach County; however a small portion of northern Reach 1 falls in Martin County (see **Figure 1-1**). The towns within these counties that are adjacent to the Dike include Pahokee and Belle Glade. According to data derived from the 2000 U.S. Census Bureau, the total population of these two towns is 20,891 residents. As shown in **Table 3-1** nearly a third of the population is white and more than half of the population is black. The remainder of the population is American Indian, Asian, or another race.

TABLE 3-1: PROJECT AREA POPULATION: ETHNICITY

Project Areas	Total Population	White	Black	American Indian and Alaska Native	Asian	Other Race
Belle Glade	14906	30.30%	50.70%	0.20%	0.20%	8.90%
Pahokee	5985	25.20%	56.10%	0.10%	0.50%	15.20%

To capture available median income, poverty statistics about the area's population Census Tract data for Martin and Palm Beach counties was used. As **Table 3-2** shows, the average median family income for the project area is approximately $26,500. Approximately one-third of the population throughout the study area has an income below the 1999 poverty level. The median household income for the state of Florida is $38,985, with the median household income of the United States at $43,318.

TABLE 3-2: PROJECT AREA POPULATION: INCOME AND POVERTY STATISTICS

Project Areas	Population	Median Household Income in 1999 Dollars	Individuals below Poverty Level	Percentage of Population with Income in 1999 below Poverty Levels
Belle Glade	14,906	$22,715	4,919	33%
Pahokee	5,985	$26,732	1,802	30%

3.6 CULTURAL RESOURCES

The State Historic Preservation Officer (SHPO) has listed HHD as eligible for inclusion on the National Register of Historic Places for its historic significance. In a letter dated 3 July 2007, the SHPO concurs that the HHD historic properties will not be adversely affected by the proposed rehabilitation plans. Consultation with the SHPO and other interested parties will continue until completion of the project.

3.7 RECREATION

A variety of recreation resources are enjoyed year-round on Lake Okeechobee. State Road 717 (near S-351) provides access to Torry Island adjacent to Belle Glade Municipal Golf Course. An existing bike path is located on the north lane of SR 717 that ends at the base of the dike (FDOT, 1998). The Belle Glade Recreation Area on Torry Island includes a multi-laned boat ramp, marina and campground. The J-Mark Fish Camp and Slim's Fish Camp are also located on Torry Island (Greater Lake Okeechobee Tourist Alliance, 1997). Kreamer Island is just north of Torry Island and is renowned for its fishing, bird watching and hunting. It is accessible by boat only, except during extremely low lake levels. In Canal Point, the Canal Point Lion's Club Park is used for recreation. At this park, and along the Palm Beach Canal (¼ mile each way), the area is utilized year round by fishermen and boaters. The rustic recreation facilities in this project area are utilized throughout the year and are important to residents, budget minded tourists, and the local economy.

The U.S. Department of Agriculture, Forest Service, produced the Florida National Scenic Trail Comprehensive Plan, 1986, which proposed a multi-use trail for the top of HHD by authority of the 1968 National Trails System Act (P.L. 90-543, 82 Stat. 9119). Designated as part of the Florida National Scenic Trail in 1993, the Lake Okeechobee Scenic Trail (LOST) is an approximate 110 mile trail encircling Lake Okeechobee. Most of the trail consists of crushed gravel on top of the Herbert Hoover Dike. The LOST is open year round for a variety of uses including hiking, bicycling, bird watching, fishing, and photography. Hunting is not permitted on any section of the trail. The economic effects of recreation activities that occur in the Lake Okeechobee region, because of the lake, have been estimated to be approximately $78M in 1996 figures (GLOTA, 1998).

3.8 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES (HTRW)

A HTRW survey is currently underway for Reaches 1 and 2; results are anticipated by November 19, 2007. The survey results will be included in the final EA. Several site visits have already been conducted with the most recent completed HTRW survey done on August 12, 1998. The HTRW database, aerial photography review and site assessment of the existing conditions found the potential of HTRW contamination within the region of the project site. The Herbert Hoover Dike was free of discolored soil, stressed vegetation, and other factors that may indicate contamination that would require clean-up on the dike. However, several locations adjacent to the dike have the potential of being a source contamination. In the municipality of Pahokee, businesses and private residences have installed a property fence creating a secure backyard boundary, the dike. This may have caused residents in the neighborhood to store materials close to the dike. Although no obvious contamination was observed, the potential of having past spills in these areas does exist. The physical inspection was performed by random spot check and driving along the road in the vicinity of the dike. It should be noted that rainfall and the high seepage rates in the area would have flushed-out most hydrocarbon, or smaller molecule chemical spills. Large molecule (ex. Polychlorinated Biphenyls (PCB's) and metals may be less mobile and these spills may still measure residual levels. During real estate procurement and project construction, further evaluations would be required. The perimeter road has several leaking underground storage tanks and there have been several reported spills around Lake Okeechobee. All of these potential contamination problems are located within towns or along highways that are near the dike.

3.9 AESTHETICS

There are seven public access points to view Lake Okeechobee from the elevated vantage point of the levee crown in Reach 1 as follows:

1. Port Mayaca
2. Canal Point Lions Club
3. East Beach Road
4. Pahokee Marina
5. Jones Pump House
6. Rardin Park
7. Belle Glade Marina

The designated Florida National Scenic Trail (FNST) runs atop the HHD around the entire lake, totaling approximately 115 miles (FDOT, 1998). Panoramic lake and surrounding landscape views vary depending on access and obstruction in the area. The sounds of an occasional boater, airplane, ATV or farm implement can tend to break the otherwise peaceful setting. The levee crown affords panoramic views of the flat agricultural fields to the east and rim canal and Torry Island to the west. Foreground views are dotted with minor visual impediments such as guardrail, power lines, trees, and small structures. Moderate aesthetic values are experienced in this area from atop the levee crown dependent on the time of year and day.

3.10 NOISE

Along Reach 1 there are a number of existing sources currently contributing to the overall ambient noise level. The more predominant of these sources include: vehicular traffic traveling along nearby highways; railroad traffic along the Florida East Coast Railway; single engine aircraft utilizing the Pahokee Airport; small industry (i.e., produce processing and distribution); boat traffic (including airboats) along the rim canal; urban activities in Pahokee and Belle Glade; agricultural equipment (tractors, trucks, etc.); and pumping stations. Rural areas typically have noise levels of 35-55 db. Sound levels along transportation arteries are typically in the range of 70 dB.

3.11 AIR QUALITY

Existing air quality in the affected environment is good to moderate. Over 90 percent of the project area is in Palm Beach County with only a small portion located in Martin County. This project is in an area which has been designated by the Clean Air Act as a Prevention of Significant Deterioration (PSD) Class II area for U.S. Environmental Protection Agency (EPA) regulated air pollutants except ground level ozone. All of Palm Beach County is classified by the FDEP as an Ozone Attainment/Maintenance Area. This project would not be subject to any PSD incremental requirements for these pollutants since the project would fall under the fugitive emissions exemption, as per Rule FAC 62-212.400(a) (b).

In the area of Reach 1, there are a number of existing sources that may affect air quality in the project area. Registered stationary emission sources include thirty stationary air point sources located in Martin County, and close to two hundred stationary air sources in Palm Beach County (FDEP, 1998). Notable registered sources near Reach 1 include the local sugar processing plants. Namely, the Atlantic Sugar Association plant near Belle Glade, and the U.S. Sugar Corporation plant near Clewiston each contribute to the overall air quality of this area. In the area of Reach 1, the prevailing southeast and east-northeast winds may carry vehicle emissions from US 98/441, State Road 715, and the Florida East Coast Railroad. Although these mobile source emissions are not significant, they do currently contribute to the air quality in the area.

Additionally, short-term occurrences of elevated levels of airborne particulate matter may occur periodically from natural fires, controlled burns, and other sources. The potentially unaccounted for volatile organic compound emissions coming from nearby agricultural activities may contribute to the existing air quality as well.

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4.0 ENVIRONMENTAL CONSEQUENCES

This section discusses potential impacts to the existing environment, including direct and indirect effects that may result from implementation of the cutoff wall component of the Preferred Alternative compared to the No Action Alternative. Impacts of the previously considered Alternatives 1 through 4 are summarized. Past, present and future impacts that may result from implementation of the complete rehabilitation solution for HHD are addressed in the Cumulative Impacts section. This chapter is organized by resource topics, with the impacts of the alternatives combined under each resource. Assessment of the No Action Alternative includes an increased probability of unsatisfactory performance of the dike system, or possible dike failure. Assessment of the cutoff wall component of Alternative No. 5 includes impacts to the existing environment associated with construction and function of the cutoff wall. A summary of environmental consequences is displayed in **Table 4-1.** Also, included are the environmental consequences of the previously considered alternatives in **Table 4-2**.

4.1 ENVIRONMENTAL CONSEQUENCES OF NO ACTION ALTERNATIVE AND THE CUTOFF WALL COMPONENT OF THE PREFERRED ALTERNATIVE

4.1.1 Water Resources

No Action Alternative

The No Action Alternative would have no effect on recharge along Reach 1. However, in the event of a failure of the HHD, consequential flooding could have significant effects on agricultural lands, recreation facilities, nurseries, infrastructure, and an airport in the area of the failure. The No Action Alternative does not correct existing stability problems with the HHD, which could result in a major breach of the HHD during a substantial high water event. In addition, the disruption of agricultural water supply at a critical time during the growing season could have detrimental effects on the local economy. Additionally, loss of crops in the vicinity of the breach could be substantial if the breach were to occur in a heavily farmed area. Flooding due to a breach could also result in significant impacts to transportation including supply and evacuation routes. Recreation impacts could include loss of use of parks, camping, and the marina, use of boat ramps, bank fishing, nature viewing, and bird watching. Nursery impacts could include destruction of mango and palm trees. Selection of the No Action Alternative could result in extensive consequences to agricultural lands around Lake Okeechobee, and along Reach 1.

Cutoff wall Component of Alternative No. 5

The Corps anticipates that the preferred project cutoff wall will not significantly impact the regional and sub-regional groundwater based on the following groundwater analyses and conclusions. For detailed information on the modeling conducted please reference Appendix A – Regional Groundwater Modeling.

4.1.1.1 Groundwater Modeling

A Lake Okeechobee sub-regional groundwater model was developed to evaluate the sub-regional groundwater changes associated with the introduction of the cutoff wall into the subsurface

geologic structure underlying Herbert Hoover Dike (Reaches 1 through 3). The steady-state, 3-D groundwater model compared results from the “with project” simulation (with cutoff wall) to the “without project” simulation to evaluate the impact to groundwater anticipated from implementation of the project.

Model Set-Up

Geologic data from multiple sources was collected to construct a conceptual hydro-geologic model, containing 11 subsurface layers. Historical data of rainfall, evapotranspiration (ET), groundwater head, and canal stage were used to define high, medium, and low net recharge and head boundary conditions. Information compiled from permit capacities and specifications was used to define the high and low pumping (zero capacity) rates. The high and low values for net recharge, head boundary conditions, and groundwater pumping were determined from historical field data. These values were used to simulate the extreme hydrologic conditions of the system, so that the results provide reasonable estimates of cutoff wall impacts.

Cutoff Wall Design in Model

The HHD Phase 1A modeling “With Project” scenario cutoff wall has a tip elevation that varies between -15 and -40 feet NGVD29. This corresponds to approximate cutoff wall depths between 47 and 72 feet for a cutoff wall that penetrates the crest of the dike, and the top of the dike crest elevation is approximately 32 feet NGVD29.

Model Runs

Ninety-six model runs were performed to determine the impacts on groundwater flow through 21 cross sections from the "without project" (no cutoff wall, existing conditions) scenario to the "with project" (with cutoff wall in place) scenario, where 48 runs featured various combinations of the high, medium, and low values for net recharge and head boundary conditions, high (permit capacity) and low (zero) pumping rates, and the three most influential hydraulic conductivities by layer (determined from the Stage 1 analysis) were included in each scenario.

Low Net Recharge and High Pumping Scenario

For brevity in this report, a low net recharge and low head boundary condition combined with high pumping rates is evaluated in this EA. This condition is likely the worst case scenario because the steady state model simulates the pumps operating at the maximum permitted capacity continuously during a dry condition (low lake levels and low groundwater recharge). Therefore, any impacts shown in the modeling results (Appendix A) are conservative and in reality the impacts observed would be less than simulated by the model. The simulated impacts to the groundwater table are considered nominal. The groundwater model demonstrated that during this worst case condition, the groundwater wells in Reach 1 did not experience any additional well deficiencies with the cutoff wall in place. There are no changes in pumping capacities from the without project condition to the with project condition. Therefore, no significant impacts are anticipated to the permitted groundwater wells analyzed in the model.

4.1.2 Wetlands in Reach 1

No Action Alternative
Selection of the No Action Alternative would lead to moderate wetland impacts if there should be a failure of the HHD system. These impacts would result from increased water levels due to flooding landward of the HHD.

Cutoff Wall Component of Alternative No.5
Wetland impacts resulting from implementation of the Preferred Alternative No. 5 partially penetrating cutoff wall are not anticipated. Below is a description of previous wetland assessments and mitigation covered in the two previous NEPA documents. No further mitigation is necessary at this time since the cutoff wall will be implemented within the right-of-way.

4.1.3 Threatened and Endangered Species

4.1.3.1 American alligator (*Alligator mississippiensis*)

No Action Alternative
The American alligator should incur only minimal short-term impacts in the event of a dike failure both lakeward and landward of the HHD. Flexibility in habitat usage and mobility should allow this animal to survive in the Lake Okeechobee region even in the event of major water level drop. If a dike failure should occur during nesting season, the impacts lakeward should be minimal since water levels are not expected to decrease significantly during such an event. However, the potential for impacting nests landward of the dike exists in the immediate vicinity of a breach.

Cutoff Wall Component of Alternative No.5
Impacts to the American alligator resulting from implementing Alternative No. 5 would be minimal. Any impacts would be limited to the immediate area of construction.

4.1.3.2 Eastern Indigo Snake (*Drymarchon corais couperi*)

No Action Alternative
The indigo snake would likely only be affected minimally in the event of a dike failure. Low utilization of areas lakeward of the HHD, would limit potential impacts. The levee itself provides useable habitat for the indigo snake, but a dike failure would only directly affect animals in the immediate vicinity. Landward, this animal is rarely observed due to sub-optimal habitat. Any impacts would be minimal, and only in the immediate area of the dike failure.

Cutoff Wall Component of Alternative No.5
Impacts to the indigo snake resulting from implementing Alternative No. 5 would be minimal, and limited to the immediate area of construction. However, to ensure the protection of the indigo snake a monitoring plan will be part of the environmental protection plan (see Section 4.10 Environmental Commitments).

4.1.3.3 Bald Eagle (*Haliaeetus leucocephalus*)

Although the bald eagle has been officially removed from the list of threatened and endangered species under the Endangered Species Act (ESA), the bald eagles are protected by two other major federal laws: The Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA). The bald eagle has been previously coordinated with the USFWS. All environmental commitments previously coordinated will be upheld (see Section 4.10).

No Action Alternative
The slightly lower water levels resulting from a dike failure should impact the bald eagle to a minimal extent. The expected decrease in water level is too minor to significantly affect its foraging activities around the lake.

Cutoff Wall Component of Alternative No.5
Impacts to the bald eagle resulting from implementing Alternative No. 5 are expected to be minimal. However, the existence of an active bald eagle nest could alter construction plans. An active nest within 660 ft (201 m) of the HHD would restrict construction activities during nesting season. Surveys for active bald eagle nests would be conducted prior to construction. Bald eagle nesting areas would be subject to USFWS Nesting Protection Measures, where applicable.

Implementation of the selected alternative should not have any significant impacts to the bald eagle along the remaining reaches of the HHD.

4.1.3.4 Wood Stork (*Mycteria americana*)

No Action Alternative
Impacts to the wood stork in the event of a dike failure would be minimal. Slightly lower lake levels could result in slightly less foraging habitat around the lake. Any nesting colonies could be deserted if de-watered at a critical nesting time during the year; however, reduction in lake level due to breaching would be minimal.

Cutoff Wall Component of Alternative No.5
Impacts to the wood stork resulting from implementing partially penetrating cutoff wall of the preferred alternative are anticipated to be temporary and minimal. The cutoff wall will be implemented at the crest of the dike. Noise resulting from construction machinery may temporarily keep wadding birds such as the wood stork from foraging in the adjacent TOE DITCH wetlands. However, there are numerous other quality wetlands near the project site that the wood stork can utilize to forage in.

4.1.3.5 Everglade Snail Kite (*Rosthrhamus sociabilis plumbeus*)

No Action Alternative
Impacts to the snail kite's significant habitat around Lake Okeechobee would be minimal if there should be a major dike failure. The water level must be sufficiently stable to prevent loss of the apple snail through drying out of the surface. Water loss in this area, in the event of a dike failure would not be great enough to seriously affect successful foraging of the highly mobile snail kite.

Cutoff Wall Component of Alternative No.5
Impacts to the snail kite resulting from implementing this alternative would be minimal, and restricted to the immediate area of construction. Construction activities would be limited to the levee itself and the landward side of the levee where this animal doesn't forage extensively. Aside from temporal disturbance caused by the operation of heavy equipment, no impact is expected lakeward either. Due to the relatively narrow littoral zone, this area provides minimal snail kite foraging habitat, so impacts are unlikely.

4.1.3.6 West Indian Manatee (*Trichechus manatus*)

No Action Alternative
Minimal impacts to the manatee are expected to occur in the event of a dike failure. Expected water level reductions would not be great enough to affect the animal's food supplies or exposure to boat-related injury or death.

Cutoff Wall Component of Alternative No.5
No impacts are anticipated to the manatee resulting from implementation of this alternative. Construction activities would be limited to the levee itself and the landward side where this animal does not occur.

4.1.3.7 Okeechobee Gourd (*Curbita okeechobeensis)*

No Action Alternative
Okeechobee gourd plants that are currently known to exist in the Lake Okeechobee region are limited to the shores of the lake inside of the HHD. Slightly lower lake levels resulting from a major dike failure would minimally impact the existing Okeechobee gourd population in this area. However, given its limited range and habitat requirements, any alteration in the hydrology where this plant currently exists could significantly damage the population. Impacts to these gourds would most likely occur with sustained high water events, rather than low.

Cutoff Wall Component of Alternative No.5
Implementation of this alternative would not likely cause impacts to the Okeechobee gourd. This plant has not been recorded in recent years along the landward extent of Reach 1.

4.1.4 State Listed Species

4.1.4.1 Burrowing Owl *(Athene cunicularia)*

No Action
The No Action Alternative is not anticipated to impact the burrowing owl because the project area is not considered suitable habitat for this species.

Cutoff Wall Component of Alternative No.5
The Alternative No 5 is not anticipated to impact the burrowing owl because the project area is not considered suitable habitat for this species.

4.1.4.2 Tree Snail *(Liguus fasciatus)*

No Action
The No Action Alternative is not anticipated to impact the tree snail because the project footprint on the HHD levee does not contain tree snail habitat.

Cutoff Wall Component of Alternative No.5
The Alternative No 5 is not anticipated to impact the tree snail because the project footprint on the HHD levee does not contain tree snail habitat.

4.1.5 Socioeconomics

No Action
The No Action Alternative would not provide a safe and reliable dike; without dike rehabilitation personal safety is jeopardized and therefore the No Action Alternative is an unacceptable alternative.

Cutoff Wall Component of Alternative No.5
There are no anticipated long-term socioeconomic impacts associated with implementation of the preferred alternative. Positive impacts to the economy will be created by the availability of construction jobs for individuals and/or small businesses, causing a decrease in unemployment for the surrounding towns.

There will be temporary impacts to recreational activities on the lakeside of the HHD near the construction site. Temporary closure of some recreational parks may also result. These few inconveniences are far outnumbered by the tremendous benefit to public safety that will accompany the preferred alternative.

The project will not impact agriculture in this region; no impacts are anticipated to the regional and sub-regional groundwater (see Water Resources – Section 4.1.1).

No impacts are anticipated to commercial navigation because the HHD Reach 1 preferred alternative will not cause any structural blockage of any navigational waters.

4.1.6 Cultural Resources

No Action
The No Action Alternative, with its continued potential for dike failure and catastrophic flooding, could lead to loss of portions of HHD itself and nearby historic properties.

Cutoff Wall Component of Alternative No.5
Coordination and consultation with the Florida State Historic Preservation Officer (SHPO), and other interested parties has been conducted in accordance with the National Historic Preservation Act, as amended (PL 890665); the Archeological and Historic Preservation Act, as amended (PL 93-29; Executive Order 11593 and appropriate Florida Statutes. Initial consultation with the SHPO on Reach 1 was initiated August 3, 1998, and the SHPO concurred with the Corps' no adverse effect determination on Reach 1 in an April 7, 2005 response. The SHPO has listed

HHD as eligible for inclusion on the National Register of Historic Places for its historic significance. In a letter dated 3 July 2007, the SHPO concur the HHD historic properties will not be adversely affected by the proposed rehabilitation plans. Consultation with the SHPO and other interested parties will continue until completion of the project. The project is in compliance with each of the above mentioned Federal laws.

If there are cultural or archeological finds during construction activities on Herbert Hoover Dike, such observations shall be reported immediately to the Site Supervisor so that the appropriate Corps staff and Florida SHPO will be notified to assess the significance of the discovery and devise appropriate actions pursuant to 36 CFR 800.13. Examples of historic, archeological and cultural resources are bones, remains, artifacts, shell, midden, charcoal or other deposits, rocks or coral, evidences of agricultural or other human activity, alignments, and constructed features. Based on the circumstances of the discovery, equity to all parties and in consideration of the public interest, the Corps may cease all activities that may result in the destruction of these resources, suspend all work in accordance with 36 CFR Part 800, and Florida State Regulations 872.05.

Human remains are not anticipated to be recovered from this project. In the unlikely event that human remains are identified they will be treated in accordance with State Regulations 872.05(5). As the Herbert Hoover Dike is on lands owned by the State of Florida and in accordance with Corps Regulation ER 1105-2-100 Appendix C-4.e.(2), The Native American Graves Protection and Repatriation Act does not apply.

4.1.7 Recreational Resources

No Action

Moderate adverse impacts to recreation resources would be anticipated without major repairs to the dike. Piping and boils would continue, requiring emergency repairs to attempt to keep up with the frequency of breaches in the dike. Areas affected would be closed off during construction for safety purposes, with the inclusion of possibly damaged areas awaiting repairs.

Cutoff Wall Component of Alternative No.5

Temporary, short-term impacts are anticipated to parks, campgrounds, bank fishing, and bike trail access to select lake side locations as a result of construction activities and/or access of construction site, equipment, and staging areas. Specifically, some effects to the paved Lake Okeechobee Scenic Trail (LOST) atop the HHD may occur during project construction. Construction activities may limit access to certain parts of the trail, and parts of the trail may be removed.

In Reaches 1A and 1B of the HHD, the LOST is unpaved. In these Subreaches the LOST will be restored consistent with Army Operation and Maintenance (O&M) authority.

In Reaches 1C and 1D the LOST is paved. For these sections the Corps will do the following:

1. The Corps will continue, consistent with its authority and funding, through design refinement to seek to reduce and minimize impacts to the Lake Okeechobee Scenic Trail.

2. As necessary for construction of the Herbert Hoover Dike improvements, the Corps will require its construction contractors to maintain a haul road during construction. Said haul road will not be removed but will be left in place after construction and can be used as a trail when not being used for maintenance, repair, or rehabilitation.

3. The Corps will explore utilization of Section 111 authority of the 1958 River and Harbor Act, Public Law 85-500, to determine if it is appropriate to pay for the cost to remediate impacts to the Lake Okeechobee Scenic Trail out of project funds.

The Corps will prepare a letter report for Reach 1 to request Section 111 authority from the Chief of Engineers to allow replacement of the LOST.

The Herbert Hoover Dike rehabilitation project in Reach 1 will eventually involve the temporary removal of the top of the levee in the vicinity of Pahokee State Park. The construction will impact the marina and may potentially result in its temporary closing, since access is likely to be limited.

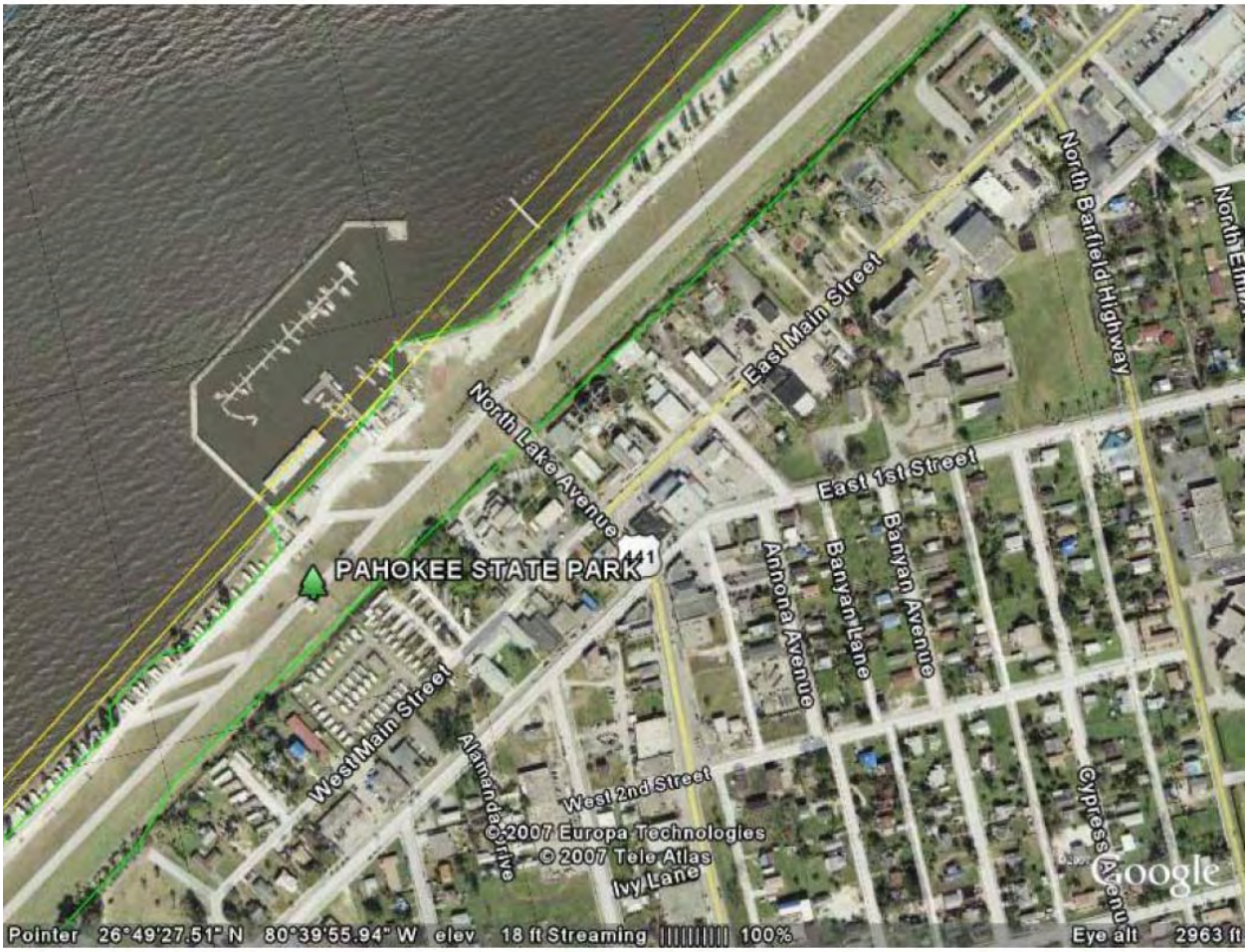

FIGURE 4-1: PAHOKEE STATE PARK AND MARINA

When the cutoff wall contractor prepares an access plan for this area, either the contractor or the Corps will coordinate with the State Park System and potentially the marina concessionaire to minimize the potential for business interruption. A temporary access road either north or south of this area may be implemented.

4.1.8 Hazardous, Toxic, and Radioactive Wastes

The project conditions assume that any HTRW found during any phase of the project would be remediated in accordance with local, state and Federal laws. Therefore, it can be assumed that conditions at future construction sites will be contamination free or of low levels, which would include *de minimis* conditions that generally do not present a material risk of harm to public health or the environment.

No Action
Implementation of the No Action Alternative would not impact HTRW in the project area.

Cutoff Wall Component of Alternative No.5
Implementation of the Preferred Alternative (cutoff wall in combination with a landside rehabilitation feature) is not anticipated to contribute to HTRW in the region. The proposed earth moving activities involve the temporary and permanent displacement of HHD earthen materials. These earthen materials are expected to be free of HTRW given that they were largely placed in the dike by hydraulic means over 50 years ago. An HTRW survey is currently being conducted in Reaches 1 & 2 of the HHD. The HTRW report and findings should be available November 19, 2007. The findings of this report will be incorporated into the final EA.

4.1.9 Aesthetics

No Action
Impacts to aesthetics are anticipated in the short term. Piping and sand boils ruin the integrity of the dike; patches and temporary emergency construction to these areas are ongoing. If these conditions continue without full scale repairs to the dike, aesthetics and safety would be compromised because emergency repairs will increase in frequency. Dust and noise around active construction areas are continual.

Cutoff Wall Component of Alternative No.5
Temporary, short-term impacts to localized areas would result due to construction. Impacts to aesthetic resources within the project area would be due to construction activities and/or access of construction equipment through lands designated for staging, access and construction as well as possible vegetation and tree removal.

4.1.10 Noise

No Action
The No Action Alternative would not increase ambient noise levels in the vicinity of the HHD. Therefore no impacts are expected to result due to selection of this alternative.

Cutoff Wall Component of Alternative No.5
The implementation of this alternative could potentially result in some noise impacts, but would be limited to the sites directly associated with construction activities. Occasional heavy machinery activity in these areas would produce noise levels above 70 dB in localized areas, but would occur sporadically and should not lead to reduced attenuation of animal species or humans living near the area. Staging areas that would be established at suitable locations within the Corps right-of-way may experience potential noise impacts, as well as access routes to the crown road. Such routes include the following:

a. County Road 717 near S-351
b. Hooker Highway off SR 15
c. Paul Rardin Park of SR 715
d. Culvert 12A off SR 715
e. Culvert 10 off SR 715
f. Pahokee State Park off SR 715
g. S-352 off SR 715
h. Culvert 10A off SR 15/700
i. Culvert 14 off SR 15/700
j. Port Mayaca (S-308) off SR 15/700.

4.1.11 Air Quality

No Action
Selection of the No Action Alternative would not impact air quality in the vicinity of the HHD.

Cutoff Wall Component of Alternative No.5
Emissions associated with this alternative would be largely generated from heavy machinery operating for short periods in Reach 1. Construction activities would cause minor short-term air quality impacts in the form of fugitive dust or airborne particulate matter from earthwork and the use of unpaved roads for the project. The area is rural and the existing air quality is good to moderate, additional short-term loadings of internal-combustion engine gases would not substantially impact the quality of the air in the vicinity of the HHD. Every federally funded project must be consistent with state plans for implementing the provisions of the Clean Air Act Amendments (State Implementation Plans). This project is in conformance with the State Implementation Plan and Clean Air Act Section 176 because it would not cause violations of the National Ambient Air Quality Standards.

4.1.12 Water Quality

No Action
The No Action Alternative could increase sediments in surface waters due to flooding.

Alternative No. 5 (Cutoff Wall)
Implementation of Alternative No. 5 is expected to cause temporary minimal impacts on the water quality along Reach 1. Construction activities could result in increased sediment load in the nearby surface waters of toe swales of the dike. However, silt screens and other erosion and turbidity control devices will be used as well as the implementation of Best Management

Practices (BMPs) to minimize the discharge of water containing excessive turbidity; see Section 4.10 Environmental Commitments, for possible turbidity solutions the contractor may choose to implement. These preventive measures will be included in an Environmental Protection Plan (EPP) prior to construction.

TABLE 4-1: SUMMARY OF ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ALTERNATIVES

ENVIRONMENTAL FACTOR	NO ACTION ALT	CUTOFF WALL FROM ALT NO. 5 (PREFERRED ALT)
THREATENED AND ENDANGERED SPECIES	No significant impacts to protected species expected.	No significant impacts to protected species are expected. The USFWS has provided a concurrence letter dated May 9, 2007 stating that the project environmental impacts will be minimal due to the work being implemented within the right-of-way and that no other long-term adverse impacts of the project are anticipated. A Final CAR was prepared by the USFWS and is available as Annex A of the HHD Reach 1 EIS, dated September 2005. The Corps determination for the cutoff wall is "no effect". See Section 4.10 -Environmental Commitments, for specifics on monitoring of endangered and threatened species within the project area. Table 6-1 displays all previous and ongoing coordination with the USFWS.
STATE LISTED SPECIES	No significant impacts to state listed species expected.	No significant impacts to burrowing owl are expected. The USFWS concurs with their findings in the Final CAR, available as Annex A of the HHD Reach 1 EIS, dated September 2005. See Section 4.10 - Environmental Commitments, for specifics on monitoring of state listed species within the project area.
FISH AND WILDLIFE RESOURCES	The implications to fish and wildlife landward of the HHD that may result from dike failure would be limited to the areas of the breach and surrounding habitats. In the area of Reach 1, fish and wildlife habitat is marginal. However, those animals most significantly affected by extensive flooding include those with limited mobility. Amphibians, reptiles, and small mammals would be impacted to a moderate degree.	The cutoff wall may temporarily impact turtles and snakes during construction.

ENVIRONMENTAL FACTOR	NO ACTION ALT	CUTOFF WALL FROM ALT NO. 5 (PREFERRED ALT)
WETLANDS	Selection of the No Action Alternative would lead to minimal wetland impacts if there should be a failure of the HHD system. These impacts would result from increased water levels due to flooding landward of the HHD.	Implementation of the cutoff wall from the preferred alternative will not impact any adjacent existing wetlands.
WATER QUALITY	Increased sediments in surface waters due to flooding.	Construction activities could result in increased sediment load in the nearby surface waters. However, silt screens and other erosion and turbidity control devices will be used as well as the implementation of Best Management Practices (BMPs) to minimize the discharge of water containing excessive turbidity. These preventive measures will be included in an Environmental Protection Plan (EPP).
WATER RESOURCES	The No Action Alternative will not have an effect on the regional groundwater and recharge. However, in the event of a failure of the HHD, consequential flooding could have significant effects on agricultural lands, recreation facilities, nurseries, infrastructure, and an airport in the area of the failure.	The regional and sub-regional impacts to the groundwater from implementation of a partially-penetrating cutoff wall were analyzed in the groundwater modeling report. The low net recharge and low head boundary condition with high pumping condition is evaluated in this EA. This condition is considered the worst case scenario because the model is simulating the pumps running at their maximum permitted capacity continuously in a dry condition (low lake levels and low groundwater recharge). The modeling results (Appendix A) demonstrate that the cutoff wall impacts are insignificant. The figures show that no additional wells are triggered with the cutoff wall under a worst case scenario. In reality the difference in the groundwater table will be less than the simulated amount because not every pump will be running at maximum capacity continuously.

ENVIRONMENTAL FACTOR	NO ACTION ALT	CUTOFF WALL FROM ALT NO. 5 (PREFERRED ALT)
RECREATION	Moderate adverse impacts to recreation resources would be anticipated without major repairs to the dike. Piping and boils would continue, requiring emergency repairs to attempt to keep up with the frequency of breaches in the dike. Areas affected would be closed off during construction for safety purposes, with the inclusion of possibly damaged areas awaiting repairs.	Temporary/short-term impacts to parks, bank fishing, and bike trail, access to select lake side locations may result from construction activities and/or access of construction site, equipment, and staging areas. Specifically, impacts to the paved Lake Okeechobee Scenic Trail (LOST) atop the HHD may occur during project construction. Construction activities may limit access to certain parts of the trail, and parts or the trail may be removed. The Herbert Hoover Dike rehabilitation project in Reach 1 will eventually involve the temporary removal of the top of the levee in the vicinity of Pahokee State Park. The construction will impact the marina and may potentially result in its temporary closing, since access is likely to be limited.
AESTHETICS	Impacts to aesthetics are anticipated in the short term. Piping and sand boils ruin the integrity of the dike; patches and temporary emergency construction to these areas are ongoing. If these conditions continue without full scale repairs to the dike, aesthetics and safety would be compromised because emergency repairs will increase in frequency. Dust and noise around active construction areas are continual.	Temporary/Short-term impacts to localized areas as a result of construction. Possible vegetation & tree removal.
SOCIO-ECONOMICS	Flooding could result in loss of property and life. This could also cause businesses to close and displacement of people from their homes.	Beneficial impacts from local jobs created during construction.
ENERGY REQUIREMENTS AND CONSERVATION	During emergency repairs, field office manual labor and construction equipment fuel would be required to mitigate for a breach or seepage and piping. Filling of sink holes could also be required.	Fuel for the construction machinery.

ENVIRONMENTAL FACTOR	NO ACTION ALT	CUTOFF WALL FROM ALT NO. 5 (PREFERRED ALT)
PUBLIC HEALTH AND SAFETY	Decreased factor of safety (F.S.) at critical areas of dike, increased risk of a breach or failure leading to loss of life and property. Risk involved with mitigating seepage from piping and boils with sand bagging and other fill material.	Increased public health and safety, no adverse impacts to public health and safety.
HISTORIC PROPERTIES	Potential significant adverse effects in event of dike failure.	Coordination and consultation with the Florida State Historic Preservation Officer (SHPO), and other interested parties has been conducted in accordance with the National Historic Preservation Act, as amended (PL 890665); the Archeological and Historic Preservation Act, as amended (PL 93-29; Executive Order 11593 and appropriate Florida Statutes. Initial consultation with the SHPO on Reach 1 was initiated August 3, 1998, and the SHPO concurred with the Corps' no adverse effect determination on Reach 1 in an April 7, 2005 response. The SHPO has listed HHD as eligible for inclusion on the National Register of Historic Places for its historic significance. In a letter dated 3 July 2007, the SHPO concur the HHD historic properties will not be adversely affected by the proposed rehabilitation plans. Consultation with the SHPO and other interested parties will continue until completion of the project. The project will not affect historic properties included in or eligible for inclusion in the National Register of Historic places. The project is in compliance with each of these Federal laws.
INFRASTRUCTURE	No impacts anticipated.	Utility crossings over and/or through the dike have been identified during site inspections. These utilities will need to be relocated to permit construction of the cutoff wall. Consideration of temporary relocation and permanent installation of the utilities will need to be handled on a case by case basis.

4.2 ENVIRONMENTAL CONSEQUENCES OF PREVIOUSLY CONSIDERED ALTERNATIVES

TABLE 4-2: ENVIRONMENTAL COMPARISON OF PREVIOUS ALTERNATIVES

Environmental Components	No Action Alternative	Alternative No. 1 Stability berm/ culvert/ditch	Alternative No. 2 Lakeside cutoff wall/stability berm	Alternative No. 3 Seepage berm/relief trench/French drain	Alternative No. 4 Hanging seepage cutoff wall/relief trench/berm
Location & Climate	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)
Topography	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)
Geology	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)
Soils	Potential for displacement of soils nearest dike failure (3)	Displacement of soils during excavation of peat in toe ditch (1)	Displacement of levee soils for cutoff wall, & peat during excavation of toe ditch (1)	Displacement of soils during excavation of toe ditch (1)	Displacement of levee soils for cutoff wall and relief trench (1)
Hydrology	Flooding may affect existing evaporation and recharge regime(3)	Elevated water level in toe ditches may result in localized flooding (2)	Cutoff wall may lower water table and recharge rates (2)	Perforated culverts in relief trench should not lower recharge rates (1)	Hanging cutoff wall reduces hydrology only in HHD footprint. (1) Minimal effects to water table or recharge rates.
Water Supply	Reduced agriculture water supply at critical times may damage crops (2)	Loss of tail-water control by private interests may cause conflict (2)	Cutoff wall may reduce tail-waters and ag. water supply (2)	Water Supply not significantly affected (1)	Alternative would not significantly affect water supply.
Water Quality	Increased sediments in surface waters due to flooding (2)	Erosion control efforts during construction should minimize impacts (1)	Erosion control efforts during construction should minimize impacts (1)	Erosion control efforts during construction should minimize impacts (1)	Erosion control efforts during construction should minimize impacts (1)
Water Management	Short-term alteration of current water management practices likely (2)	Loss of tail-water control by private interests may cause conflict (2)	Current water management practices not significantly affected (1)	Current water management practices not significantly affected (1)	Current water management practices not significantly affected (1)

0 = No Consequences 1 = Minimal Consequences 2 = Moderate Consequences 3 = Extensive Consequences

Environmental Components	No Action Alternative	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
Vegetation & Cover Types	Native vegetation and crops could be damaged by floodwaters (3)	Impacts limited to vegetation along landward side slopes of levee and in/around toe ditches (1)	Impacts limited to vegetation along landward side slopes of levee and in/around toe ditches (1)	Impacts limited to vegetation along landward side slopes of levee and in/around toe ditches (1)	Impacts limited to vegetation along landward side slopes of levee in HHD footprint (1)
Wetlands	Significant wetland impacts not expected (1)	Significant wetland impacts not expected (1)	Cutoff wall may reduce water supply to landward wetlands nearest HHD (2)	Some wetlands would be converted to covered culverts (2). Mitigation would be required.	Hanging cutoff wall allows seepage under HHD. Water supply to toe ditch wetlands should remain unaffected (1)
Fish & Wildlife	Loss of some wildlife habitat in vicinity of breach (2)	Periodic increase of landward waters may alter some wildlife habitat (1)	Cutoff wall may reduce water supply altering wildlife habitat (2)	Covered culverts would eliminate some foraging habitat along existing toe (2)	Habitat provided by toe ditch would not be eliminated or converted to closed conduit since relief trench adjacent to ditch (1)
Threatened & Endangered Species	No significant impacts to T & E species expected (1)	No significant impacts to T & E species expected (1)	No significant impacts to T & E species expected (1)	No significant impacts to T & E species expected (1)	No significant impacts to T & E species expected (1)
Noise	No Consequences Expected (0)	Minimal, temporary, and localized effects due to construction activities (1)	Minimal, temporary, and localized effects due to construction activities (1)	Minimal, temporary, and localized effects due to construction activities (1)	Minimal, temporary, and localized effects due to construction activities (1)
Air Quality	No Consequences Expected (0)	Minimal, temporary, and localized effects due to construction activities (1)	Minimal, temporary, and localized effects due to construction activities (1)	Minimal, temporary, and localized effects due to construction activities (1)	Minimal, temporary, and localized effects due to construction activities (1)
HTRW	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)	No Consequences Expected (0)
Land Use Agriculture	Extensive crop damage possible (3)	Loss of tail-water control by private interests may cause conflict (2)	Cutoff wall may reduce water supply producing localized affects to agriculture (2)	No significant impacts to agriculture is expected (1)	No significant impacts to agriculture is expected (1)

0 = No Consequences 1 = Minimal Consequences 2 = Moderate Consequences 3 = Extensive Consequences

Environmental Components	No Action Alternative	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
Land Use Urban Land	Loss of property and life possible in worst case scenario (3)	No significant impacts to urban Land Use expected (1)	No significant impacts to urban Land Use expected (1)	No significant impacts to urban Land Use expected (1)	No significant impacts to urban Land Use expected (1)
Land Use Transportation	Flooding may damage roads and railroads (3)	No significant impacts to trans. Features expected (1)	No significant impacts to trans. features expected (1)	Seepage berm may extend into Railroad easement. (1)	No significant impacts to trans. features expected (1)
Land Use Transmission Lines	Flooding may damage transmission line structures, resulting in power outages (2)	Construction activities may necessitate temporary relocation of transmission lines (1)	Construction activities may necessitate temporary relocation of transmission lines (1)	Construction activities may necessitate temporary relocation of transmission lines (1)	Construction activities may necessitate temporary relocation of transmission lines (1)
Aesthetic Resources	No consequences expected (0)	Temporary/Short-term impacts to localized areas as a result of construction. Possible vegetation & tree removal (2)	Temporary/Short-term impacts to localized areas as a result of construction. Possible vegetation & tree removal (2)	Temporary/Short-term impacts to localized areas as a result of construction. Possible vegetation & tree removal (2)	Temporary/Short-term impacts to localized areas as a result of construction. Possible vegetation & tree removal (2)
Recreational Resources	Moderate impacts due to emergency repairs construction areas and areas of breaches and pipings closed off for safety purposes, (2)	Temporary/Short-term impacts to parks, bank fishing, bike trail, access to select lake side locations as a result of construction (2)	More severe impacts to recreation as a result of construction on lakeside face of levee. Possible lake access restrictions, bank fishing, bike trail impacts. Moderate impacts to LOST. (2)	Temporary/Short-term impacts to parks, bank fishing, and bike trail, access to select lake side locations as a result of construction. Moderate impacts to LOST. (2)	Temporary/Short-term impacts to parks, bank fishing, bike trail, access to select lake side locations as a result of construction. Moderate impacts to LOST. (2)
Cultural Resources	Potential significant adverse effects in event of dike failure (2)	Minimal, non-adverse effects (1)	adverse effects (1) Minimal, non-adverse effects (1)	Minimal, non-adverse effects (1)	Minimal, non-adverse effects (1)
Socioeconomics	Flooding may result in loss of property and life (3)	No adverse consequences expected. Possible beneficial impacts to local economy due to construction (0)	No adverse consequences expected. Possible beneficial impacts to local economy due to construction (0)	No adverse consequences expected. Possible beneficial impacts to local economy due to construction (0)	No adverse consequences expected. Possible beneficial impacts to local economy due to construction (0)

0 = No Consequences 1 = Minimal Consequences 2 = Moderate Consequences 3 = Extensive Consequences

4.3 CUMULATIVE IMPACTS

Cumulative impacts are defined in 40 CFR 1508.7 as those impacts that result from:

> *...the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

4.3.1 Past Actions

The Water Resources Development Act of 1992 authorized modifications to the C&SF Project for the Kissimmee River Restoration and the Headwaters Revitalization Projects. Project facilities include pumping stations, control and diversion structures, levees, canals, navigation locks, and railroad bridges. The project provided for an east coast protective levee extending from the Homestead area north to the eastern shore of Lake Okeechobee near St. Lucie Canal. Portions of Lake Okeechobee levees were enlarged, new levees on the northeast and northwest shores of the lake were constructed, the outlet capacity of the lake was increased, and floodway channels with control structures in the Kissimmee River Basin were constructed to prevent over drainage.

The canals, levees, water control structures, and pump stations constructed and modified under the C&SF Project provide flood protection for central and south Florida. However, the C&SF Project has created many problems by converting nearly half of the original Everglades ecosystem to agricultural and urban uses. Natural habitats have been reduced or lost; changes in hydrology have altered the Everglades topography through drainage, soil oxidation, subsidence, and burning; and rivers and estuaries have been subjected to large-volume nutrient-laden discharges from Lake Okeechobee.

Section 528 of the Water Resources Development Act (WRDA) of 1996, entitled *Everglades and South Florida Ecosystem Restoration*, authorized a number of ecosystem restoration studies, formerly referred to as "the Restudy," and now collectively known as the Comprehensive Everglades Restoration Plan (CERP), to attempt to restore some of the natural flows from Lake Okeechobee to the Everglades. The USACE submitted a report to Congress on July 1, 1999, containing the CERP blueprint. The plan was approved as part of WRDA 2000.

The previous EA, dated May 2007 assess impacts of the seepage berm in Reach 1 within the right-of-way (ROW). On March 13, 2007 an interagency team of scientist representing the USACE, USFWS, USEPA, and FDEP used the Uniform Mitigation Assessment Method (UMAM) to assess the quality and value of wetland habitat that will be impacted through implementation of the preferred alternative, specifically areas that would be directly impacted through backfilling of the toe ditch wetlands and adjacent wetlands within the existing ROW with a partial seepage berm. Approximately 40.5 acres of toe ditch and adjacent wetlands within the USACE's existing ROW could be backfilled along the span of Reach 1 from implementation of the partial seepage berm. This would eliminate the foraging potential along these ditches. Although these areas provide less than optimal habitat, a variety of wading birds, small fishes and invertebrates utilize the ditches. Impacts would require mitigative measures.

Applying the UMAM, it was calculated that 12.8 relative functional gain (RFG) units of compensatory mitigation would be required to offset project impacts.

Compensatory mitigation for the proposed work has already been completed. The Corps removed 57 acres of *Melaleuca* adjacent to Reach 2 (near the Alvin Ward Boat Ramp) and has maintained this area. The UMAM was used to determine that the mitigation conducted is equivalent to 17.1 relative functional gain (RFG) units. 3.8 RFG units are accounted for the backfilling of the wetlands in the focus areas covered in the January 2007 EA. 13.3 RFG units remain from the completed mitigation. Since the preferred alternative will result in 12.8 functional loss units, we applied the remaining 13.3 RFG units from the mitigation, resulting in 0.5 RFG units leftover.

57 Melaleuca acres removed = 17.1 RFG[3] units
17.1 RFG – 3.8 RFL[4] units for focus area toe ditch backfill (EA, Jan 07) = 13.3 RFG
13.3 RFG – 12.8 RFL units for toe ditch backfill anywhere in Reach 1 (EA, May 07) = 0.5 RFG units

Therefore, mitigation has been completed for backfill of the entire toe ditch in Reach 1 and there is a net 0.5 RFG unit that can be applied to future project features. See Appendix C of the Reach 1 Seepage Berm and Reach 1A Test Cutoff Wall EA, dated May 2007 for information on previously conducted mitigation and the RFG produced, the UMAM, the scoring sheets that were used to calculate the wetland functional loss units, maps of Reach 1, and photos of the different polygons assessed.

4.3.2 Incremental Effects of the Current Action (Partially penetrating cutoff wall)

The rehabilitation of HHD Reach 1 has incremental effects that contribute to past projects' cumulative effects on the human and natural environment.

4.3.2.1 Human Environment

Past actions have resulted in a dike system that, although state-of-the-art when it was completed, is now recognized as substandard. The incremental effect of the Preferred Plan is a major beneficial contribution to the protection of public health and safety. With implementation of the Reach 1 partially penetrating cutoff wall, adjacent communities, agriculture industry, local businesses (including nurseries), infrastructure (e.g. schools, homes, water control structures, and power lines), recreation (parks, marina, hiking, fishing) and transportation (e.g. roads, railroads, and airport) will receive an increase in risk reduction from a failure of the dike. Since this is a partially penetrating cutoff wall, intended to cutoff pre-existing piping pathways within the embankment and not cutoff groundwater, no effects are anticipated to permitted water supply and irrigation water users, based on the groundwater modeling report.

[3] RFG – relative functional gain units for mitigation efforts.
[4] RFL – relative functional loss from project implementation

4.3.2.2 Natural Environment

Today the natural environment adjacent to Reach 1 of the HHD includes the Lake Okeechobee littoral zone contains emergent vegetation which is a diverse mosaic of native and exotic plants. It provides nesting habitat and food resources for economically important sport fish populations, wading birds, migratory waterfowl, alligator, and federally endangered Everglades snail kites. The structure of the littoral vegetation community largely determines the extent to which it can provide these habitat values. Littoral vegetation structure is influenced both by hydroperiod and phosphorus loading from the lake's eutrophic pelagic region.

Along Reach 1 of the HHD a toe ditch is commonly found except in the Pahokee area. The toe ditch is considered a low quality wetland that supports a variety of wadding birds, alligators and a variety of juvenile and bait fish. This ditch is being filled in as part of an ongoing effort to improve the overall performance of the dike. The impacts have already been mitigated for.

The HHD is composed of irregular, non-homogeneous materials throughout. The embankment was created from adjacent materials consisting of rock, sands, shell, clay and peat. The embankment is approximately at Elevation of 38 ft NAVD 88 (~39 NGVD 29), with 2H: 1V to 5H: 1V slopes on the landward side and 6H: 1V slopes on the lakeside. The existing embankment crest is typically 12 ft wide. The grassy slopes contain habitat for snakes and turtles.

4.3.3 Current and Reasonable Foreseeable Future Actions

The USACE anticipates completing rehabilitation of the HHD in the remaining reaches around Lake Okeechobee to ensure the authorized level of protection.

4.3.3.1 Natural Environment

4.3.3.1.1 Lake Okeechobee Operations

The repair and rehabilitation of the reaches will affect the manageability of Lake Okeechobee. Once the dike is repaired, lake levels can fluctuate closer to historical conditions without jeopardizing the stability of the dike or the communities adjacent to the dike. In addition, the Lake Okeechobee Regulation Schedule Study (LORSS) has been initiated to address continued high lake levels, estuary ecosystem conditions, and lake ecology conditions that have occurred since 2003. The need for a new regulation schedule has been established by the continued deterioration of the Lake Okeechobee littoral zone and both the Caloosahatchee and St. Lucie estuaries. The recommended regulation schedule represents the best operational compromise to improve the environmental health of certain major C&SF ecosystems, while providing for public health and safety and the safe operation of the HHD. A new draft regulation schedule for Lake Okeechobee, with an expected completion February 2008, will balance the environmental health of these ecosystems while providing for public health and safety.

4.3.3.1.2 Water Resources

The St. Lucie canal, between Reaches 1 and 7, feeds the estuaries associated with the St. Lucie Inlet on the east coast, while the Caloosahatchee Canal feeds the Caloosahatchee River Estuary

on Florida's west coast. HHD improvements would provide incremental benefits to estuaries by reducing flows in the discharge canals leaving the lake, local drainage and flood protection impacts are reduced due to increased canal capacity. By increasing the reliability of the HHD embankments, the need to discharge large volumes of water prior to major predicted storm events is reduced. This enables water that would be lost to estuary and ocean discharges to be held and used for existing and future water supply purposes.

Groundwater impacts are not anticipated with implementation of the full project design. The regional groundwater modeling completed, demonstrates that the project will not affect the water table or recharge.

4.3.3.1.3 Environmental

Any wetlands or wildlife habitat within the proposed 500 foot maximum footprint could be impacted or eliminated with the implementation of the project.

Wetlands
Some unavoidable permanent and direct adverse impacts to wetlands will occur due to implementation of the preferred alternative (cutoff wall in combination with a landside rehabilitation feature). Excavation and fill of low quality wetlands will be required along the landward toe of the dike in order to accommodate construction of the proposed landside rehabilitation features.

Fish and Wildlife
With implementation of the preferred alternative (cutoff wall in combination with the landside rehabilitation features), loss of fish habitat and wildlife disturbance, are likely to occur. The foraging habitat for wading birds in the landward toe ditch wetlands would be destroyed during the backfilling of the toe ditch. Additionally, existing reptiles, amphibians, and fishes utilizing these ditches would be lost during this activity. This is a moderate loss, but considering the low quality of these ditches as foraging habitat, and the availability of an extensive network of comparable ditches in the area, not significant in extent.

Threatened and Endangered
The wood stork (a T&E species) has been observed near the toe ditch wetlands. However, because of the low quality of these wetlands and the existence of vast habitat provided by the Lake Okeechobee littoral zone and adjacent canals, the severity of the loss of habitat due to the preferred alternative (cutoff wall in combination with a landside rehabilitation feature) is considered minimal.

4.3.3.2 Human Environment

Once rehabilitation of HHD is complete, the dike will be restored to its authorized level of protection, the standard project flood (SPF). The SPF is an event that is predicted to occur only once every 935 years with lake stages at 26.4 ft elevation (NGVD 29). With this level of protection, the surrounding communities, agriculture industry, local businesses (including

nurseries), infrastructure (e.g. schools, homes, water control structures, and power lines), recreation (parks, marina, hiking, fishing) and transportation (e.g. roads, railroads, and airport) will be protected from the catastrophic impacts of a flood event caused by a breach of the dike.

The full footprint of the rehabilitation of HHD is projected to be a maximum of 500 feet from the dike alignment. The final alternative for Reach 1 will be a combination of one or more of the following features dependent on the geology and adjacent land factors with the cutoff wall: Seepage Berm, Relief Trench, Soil Replacement Wedge, Relief Wells and Drainage Features. The full landside rehabilitation feature will require more land area than the current HHD easement provides, however the full landside rehabilitation feature footprint has not been determined yet. The following types of facilities and infrastructure fall within the 500 ft. maximum distance and therefore may be impacted; an airport, golf course, quarry, parks, improved pasture, agricultural lands, businesses, nurseries, residential areas, roads and railroads. These possible impacts will be addressed in the EIS for alternatives not within the existing ROW for Reaches 1-3.

4.3.3.3 Related Projects

Other current and reasonably foreseeable future actions, the effects of which would affect cumulative impacts, include:

- Hillsboro (Site 1) Impoundment and ASR – This project would supplement water deliveries to the Hillsboro Canal during dry periods, thereby reducing demands on Lake Okeechobee and Loxahatchee National Wildlife Refuge.
- C-44 Basin Storage (C&SF Restudy Component - "B") – This component is expected to provide significant regional water quality benefits, specifically to the St. Lucie River and Estuary and the Indian River Lagoon, in the form of nutrient reduction. In addition, it will enhance the opportunity to moderate damaging releases to St. Lucie estuary from Lake Okeechobee and the surrounding basin, while providing freshwater for the estuary in the dry season for restoration. Benefits include improved health of the St. Lucie Estuary and Indian River Lagoon.
- Lake Okeechobee Watershed Project – Two reservoir-assisted stormwater treatment areas and plugging of select local drainage ditches. Purchase conservation easements within four key basins of Lake Okeechobee to restore the hydrology of isolated wetlands by plugging the connection to drainage ditches and the diversion of canal flows to adjacent wetlands. The purpose of this feature is to attenuate peak flows and retain phosphorous before flowing into Lake Okeechobee.
- Everglades Agricultural Area (EAA) Storage Reservoirs (Phase-1) –This project would improve timing of environmental deliveries to the Water Conservation Areas while reducing damaging flood releases from the Everglades Agricultural Area to the Water Conservation Areas, reducing Lake Okeechobee regulatory releases to estuaries, meeting supplemental agricultural irrigation demands, and increasing flood protection within the Everglades Agricultural Area.
- Lake Okeechobee Aquifer Storage & Recovery Pilot –The goal of this pilot project is to identify the most suitable sites for the aquifer storage and recovery wells near Lake Okeechobee and to identify the optimum configuration of those wells. Additionally, the

pilot project will determine the specific water quality characteristics of waters to be injected.

- Lake Okeechobee Water Retention/Phosphorus Removal Project Water Control Plans: These plans include Taylor Creek (Grassy Island) Stormwater Treatment Area (STA) and Nubbin Slough (New Palm) Stormwater Treatment Area (STA). Construction of two large stormwater treatment areas, acquisition of land conservation easements, and removal of landowner improvements would restore wetlands and improve water quality by removing phosphorus from waters entering Lake Okeechobee.
- Kissimmee River Restoration Project – This restoration of natural flooding in the historic floodplain would reestablish wetland conditions and result in environmental benefits in the lakes in the lower basin southward to Lake Okeechobee.
- Seminole Big Cypress Water Conservation Plan –The intent of this plan is to improve the quality of agricultural water runoff within the reservation, restore storage capacity, and return native vegetation.

Many of the above projects are components of the Comprehensive Everglades Restoration Program (CERP). Once fully implemented, CERP will allow water deliveries and overland flow to follow patterns that are more natural throughout the south Florida ecosystem. Water managers will be better able to send water through canals than they are today, and store water for later use. CERP reservoirs will store excess water from Lake Okeechobee, receive flood control releases that would otherwise go to the estuaries, and collect stormwater runoff from developed areas. The stored water will then improve high and low water levels in Lake Okeechobee, help meet environmental targets in the estuaries, Everglades and other natural areas, and supplement urban and agricultural water supply. These benefits collectively achieve the goals of restoration for CERP. Herbert Hoover Dike rehabilitation will work in conjunction with the goals and objectives of CERP. By increasing the reliability of the embankments, the need to discharge large volumes of water prior to major predicted storm events will be reduced. Water that would normally be lost to estuary and ocean discharges can be held and used for existing and future water supply purposes.

4.4 IRRETRIEVABLE OR IRREVERSIBLE COMMITMENT OF RESOURCES

Significant federal funding would be irretrievably expended during the implementation of Alternative No. 5. In terms of natural resources, impacts are small and limited to the HHD footprint. The commitment of small, low quality wetland areas landward of the HHD (e.g. toe ditch) is irreversible, but has been compensated for by mitigation. Long-term displacement of some wading bird habitat is probably not a reversible action but is not significant in quantity compared to higher-quality wetlands surrounding the Lake, inside HHD littoral zone, along other canals and in the region.

4.5 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Unavoidable adverse effects that would result from implementation of this alternative include the following.

Topography, Geology and Soils
No significant adverse impacts to the topography, geology, and soils are likely to occur due to implementation of the cutoff wall.

Water Resources
The cutoff wall will extend to -5 to -10 ft elevation below the limestone layer. The relatively impermeable layer (Hawthorne group) ranges in elevation of -130 to -160 ft. Based on the configuration of the cutoff wall design the Corps has concluded from the Herbert Hoover Dike Phase 1A Groundwater Model that there will be no effects on regional groundwater (see Section 4.1.1.1 – Groundwater Modeling).

Vegetation and Cover Types
No significant adverse impacts to the vegetation and cover types are likely to occur due to implementation of the cutoff wall. Minimal short-term impacts to vegetation as a result of construction and minor excavation for this alternative are expected. Minimal effects would occur only within the HHD footprint.

Wetlands
There are no wetland impacts due to implementation of the partially penetrating cutoff wall. The cutoff wall will be constructed within the existing ROW.

Fish and Wildlife
Minimal impacts are anticipated with implementation of the cutoff wall during construction because the wall will be implemented within the ROW.

Threatened and Endangered Species
Adverse impacts to threatened and endangered (T&E) species are not likely to occur due to implementation of the cutoff wall. A previous survey was conducted for burrowing owls on Reach 1 and none were found on the project site.

The Corps Endangered Species determination is “no effect”. The Corps is in compliance with the Endangered Species Act of 1973.

Noise
Minor localized noise related impacts during construction operations are expected to occur due to implementation of the cutoff wall.

Air Quality
Minor and localized air quality impacts during construction operations are expected to occur due to implementation of the cutoff wall.

Land Use
Some unavoidable adverse impacts to existing land use elements are likely to occur due to implementation of the preferred alternative (cutoff wall in combination with a landside rehabilitation feature). Local farms are not expected to notice changes in groundwater hydrology from the cutoff wall (see Water Resources section).

Aesthetic Resources

Limited, short-term adverse impacts associated with construction activities would be imposed on aesthetic resources within the project area. These impacts may be mitigated by implementation of a well planned aesthetic measures plan which would account for unavoidable tree and native vegetation removal and dust from earth moving equipment among others. These impacts would be expected to be temporarily adverse at or near to parks, natural areas, residential or urban areas.

Recreation Resources

Temporary/short-term impacts are anticipated to parks, bank fishing, and bike trail, access to select lakeside locations as a result of construction activities and/or access of construction site, equipment, and staging areas. Specifically, some effects to the paved Lake Okeechobee Scenic Trail (LOST) atop the HHD may occur during project construction. Construction activities may limit access to certain parts of the trail, and parts or the trail may be removed.

In Reaches 1A and 1B of the HHD, the LOST is unpaved. In these Subreaches the LOST will be restored consistent with Army O&M requirements.

In Reaches 1C and 1D the LOST is paved. For these sections the Corps will do the following:

1. The Corps will continue, consistent with its authority and funding, through design refinement to seek to reduce and minimize impacts to the Lake Okeechobee Scenic Trail.

2. As necessary for construction of the Herbert Hoover Dike improvements, the Corps will require its construction contractors to maintain a haul road during construction. The haul road will not be removed but will be left in place after construction and can be used as a trail when not being used for maintenance, repair or rehabilitation.

3. The Corps will explore utilization of Section 111 authority of the 1958 River and Harbor Act, Public Law 85-500, to determine if it is appropriate to pay for the cost to remediate impacts to the Lake Okeechobee Scenic Trail out of project funds.

4.6 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Long-term benefits and short-term adverse environmental impacts represent tradeoffs between the local short-term use and the long-term benefits of a project. Long-term productivity would result from an improved HHD offering greater protection from catastrophic dike failure and flooding to the human and natural environments in the Lake Okeechobee area.

Short-term uses associated with the Recommended Plan include construction resources, dollars, and labor expended during road construction. They also include short-term construction-related inconveniencies related to traffic flow, noise, businesses, recreation, and other environmental effects, as discussed in Section 4.0 of this document.

The long term beneficial effects of enhanced flood protection resulting from the implementation of the project greatly outweigh any unavoidable adverse impacts.

4.7 INDIRECT EFFECTS

Indirect effects are not anticipated from implementation of the preferred alternative (cutoff wall in combination with a landside rehabilitation feature). Local residents and farmers adjacent to the cutoff wall in Reach 1 should not experience water supply and drainage impacts as stated under Water Resources in Section 4.5 - Unavoidable Adverse Environmental Effects.

4.8 COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES

The objectives for this project are enhanced local flood control and public safety for property owners and residents close to Reach 1; this is compatible with federal, state, and local objectives.

4.9 CONFLICTS AND CONTROVERSY

The Sugar Cane Growers Cooperative of Florida had concerns regarding unique farmland, benefits of the levee system, and project segmentation.

4.10 ENVIRONMENTAL COMMITMENTS

The U.S. Army Corps of Engineers and contractors commit to avoiding, minimizing or mitigating for adverse effects during construction activities by including the following commitments in the contract specifications:

(1) A survey for bald eagles' nests shall be conducted prior to any construction activities. A preliminary survey has been conducted by the Government, and it will be made available to the Contractor to include in his/her shop drawings.

1. A 660 foot no activity buffer zone shall be maintained around the nest under the following conditions: (a) building construction at any height, and (b) where the project footprint is any size, and (c) the activity will be visible from the nest, and (d) if there is no similar activity within 1 mile of the nest.
    a. If there is existing tolerated activity for similar scope closer than 1 mile from the nest, the buffer zone may be adjusted to the same distance as that activity or structure occurs within the 660 feet.
2. A 330 foot no activity buffer zone shall be maintained around the nest under the following conditions: (a) building construction of any height and (b) project footprint is ½ acre or less and (c) the activity will not be visible from the nest and (d) there is no similar activity within 1 mile of the nest.
    a. If there is existing tolerated activity of similar scope closer than 1 mile from the nest, the buffer zone may be adjusted to the same distance as that activity or structure occurs within the 330 feet for any project footprint larger than 1/2 acre.
    b. The Service and FWC recommend biological monitoring of the nesting territory if new development, specifically residential, commercial, and /or industrial construction, is proposed to occur within 660 feet of the nest tree during the

nesting season (October 1-May 15, Service 1987). If the hatchlings fledge prior to the May 15 date, activity within the 660 foot buffer would be allowed.

c. There are limited exceptions where individual construction projects may be granted closer access to nests; this will be determined by USFWS Florida Ecological Field Offices (FEFO) staff. In the event that construction within the interior of the buffer is unavoidable within nesting season, the Bald Eagle Monitor Guidelines, September, 2006, will be implemented accordingly.

(2) Standard protection measures (standard environmental specifications to be followed by construction personnel) regarding the Eastern indigo snake will be followed during construction. These specifications have been developed for all projects by the Corps in collaboration with the US Fish and Wildlife Service, and include hiring a snake monitor during construction, removal of any animals accidentally discovered, and other measures to protect individual snakes.

(3) The Corps will consult with the Florida Fish and Wildlife Conservation Commission (FFWCC) regarding adopting standardized protection measures should any owls be identified within Reach 1. Results will be coordinated with the USFWS and FFWCC.

If burrowing owls are found to be present in the project area, impacts will be minimized by altering construction schedules to avoid the nesting season and/or burrows will be cordoned off to avoid their direct destruction.

(4) Continued recreation planning will be performed during detailed project engineering and design. In addition, the appropriate FDEP representative will be contacted to insure collaboration on design features with the Scenic Trail Master Plan Coordination and the Lake Okeechobee Scenic Trail. An inventory of park amenities and utilities prior to construction would facilitate a rapid return to pre-construction state for those areas so impacted.

During construction, access to certain parts of the Lake Okeechobee Scenic Trail (LOST) would be restricted, and parts of the trail would be removed.

In Reaches 1A and 1B of the HHD, the LOST is unpaved. In these Subreaches the LOST will be restored consistent with Army O&M requirements.

In Reaches 1C and 1D, the LOST is paved. For these sections the Corps will do the following:

- The Corps will continue, consistent with its authority and funding, through design refinement to seek to reduce and minimize impacts to the Lake Okeechobee Scenic Trail.

- As necessary for construction of the Herbert Hoover Dike improvements, the Corps will require its construction contractors to maintain a haul road during construction. Said haul road will not be removed but will be left in place after construction and can be used as a trail when not being used for maintenance, repair or rehabilitation.

- The Corps will explore utilization of Section 111 authority of the 1958 River and Harbor Act, Public Law 85-500, to determine if it is appropriate to pay for the cost to remediate impacts to the Lake Okeechobee Scenic Trail out of project funds.

(5) Construction crews will be made aware of the potential for the presence of the Okeechobee gourd. If the gourd is found, the USFWS will be notified.

(6) While construction crews are being briefed on the Environmental Protection Plan the following species will be included: gopher tortoises, Eastern indigo snakes, bald eagles, snail kites, wood storks, burrowing owls, and the crested caracara.

(7) The project has obtained a water quality certification under Chapter 373, F.S. and Sections 402 and 404 of the Clean Water Act. A permit application has been completed.

(8) Turbidity screening and diversion will be used to control impacts to the drainage ditches and connected canals. Runoff from the construction site or from storms will be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, and by any measures required by area wide plans approved under paragraph 208 of the Clean Water Act. Temporary and permanent erosion and sedimentation control features or screening will be installed. Temporary velocity dissipation devices will be placed along drainage courses so as to provide for non-erosive flows. Temporary erosion and sediment control measures such as berms, dikes, drains, sediment traps, sedimentation basins, grassing, mulching, baled hay or straw, and silt fences will be maintained until permanent drainage and erosion control facilities are completed and operative. For silt fences, the filter fabric is to be of nylon, polyester, propylene, or ethylene yarn of at least 50 lb/in strength and able to withstand a flow rate of at least 0.3 gal/ft sq/minute. It also would contain ultraviolet ray inhibitors and stabilizers and be a minimum of 36 inches in width.

In addition, during construction, the Corps or Contractor will be responsible to keep construction activities, including refueling and maintenance sites, under surveillance, management, and control to avoid pollution of surface water and groundwater, and to wetlands. All operations will be controlled to minimize turbidity and would conform to all water quality standards as prescribed by Chapter 62-302, State of Florida, Department of Environmental Protection.

4.11 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

4.11.1 National Environmental Policy Act of 1969

Environmental information on the project has been compiled and this Environmental Assessment was prepared in compliance with the National Environmental Policy Act.

4.11.2 Endangered Species Act of 1973

Consultation has been initiated and is ongoing, and will be completed upon coordination of the present Environmental Assessment. The Corps endangered species determination is "no effect". This project is in compliance with the Act.

4.11.3 Fish and Wildlife Coordination Act of 1958

This project has been coordinated with the U.S. Fish and Wildlife Service (USFWS). The Corps endangered species determination is "no effect".

4.11.4 National Historic Preservation Act of 1966 (Inter Alia)

Coordination and consultation with the Florida State Historic Preservation Officer (SHPO), and other interested parties has been conducted in accordance with the National Historic Preservation Act, as amended (PL 890665); the Archeological and Historic Preservation Act, as amended (PL 93-29; Executive Order 11593 and appropriate Florida Statutes. Initial consultation with the SHPO on Reach 1 was initiated August 3, 1998, and the SHPO concurred with the Corps' no adverse effect determination on Reach 1 in an April 7, 2005 response. The project will not affect historic properties included in or eligible for inclusion in the National Register of Historic places. The project is in compliance with each of these Federal laws.

4.11.5 Clean Water Act of 1972

The proposed HHD repairs are subject to Section 404 of the Clean Water Act and would require Water Quality Certification from the FDEP. The Section 402(b) National Pollutant Discharge Elimination System (NPDES) permit will be required for construction activities that disturb more than 5 acres of land. This permit will be acquired prior to the initiation of construction.

The Corps currently has the following water quality certificates (WQC) as of September 2007.

- The Corps received for a permit (DEP File # EE 50-0234604-006), August 16, 2007 to construct a seepage cutoff wall in Reaches 1B, C and D.

- The Corps received for a permit (DEP File #0234604-004), April 3, 2007 to construct 10,000 ft of seepage berm extension along the northern most portion of Reach 1A.

- In Reach 1A, the Corps has a *de minimus* exemption (serves as WQC) to construct the seepage cutoff wall (DEP File # 0234604-005).

- In Reach 1, the Corps has an Environmental Resource Permit (ERP) (serves as WQC) to construct emergency toe ditch backfilling repairs along 20,000 ft of high risk portions of Reach 1 (DEP File # 0234604-003), covered in previous EA.

4.11.6 Clean Air Act of 1972

This project has been coordinated with the Florida Department of Environmental Protection (FDEP), Air Quality Division.

No air quality permits would be required for this project. Per the EPA list, there are no air sheds in Florida that require source control or monitoring. Coordination with the EPA will be ongoing as detailed design information becomes available. This project is in full compliance with the Clean Air Act Section 176.

4.11.7 Coastal Zone Management Act of 1972

A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in the FEIS report (dated September 2005) as Annex D. State consistency review was performed during the coordination of the draft and final EIS. The Corps has determined that the proposed project is consistent with the Florida Coastal Zone Management Program. Continued concurrence is based on adequate resolution of issues identified by state agencies, specifically FDOT and FDEP coordination of impacts to the Lake Okeechobee Scenic Trail (LOST) and repairs, as well as activities involving FDOT right-of-ways and structures.

4.11.8 Farmland Protection Policy Act of 1981

No prime or unique farmland would be impacted by implementation of the cutoff wall. The Herbert Hoover Dike Phase 1A Groundwater Model was prepared by the USACE Engineer Research and Development Center (ERDC) and the Philadelphia District on September 2007. The groundwater modeling results indicate that no significant impacts were present.

4.11.9 Wild and Scenic River Act of 1968

No designated Wild and Scenic river reaches would be affected by project related activities. This act is not applicable.

4.11.10 Estuary Protection Act of 1968

No designated estuary would be affected by project activities. This act is not applicable.

4.11.11 Federal Water Project Recreation Act

The effects of the proposed action on outdoor recreation have been considered and are presented in the Supplemental and Final EIS. Short-term impacts to the Lake Okeechobee Scenic Trail located on top of the dike will require close coordination with FDOT and FDEP in order to return the trail to pre-existing conditions and limit trail closure time. Continued recreation

planning will be performed during detailed project engineering and design. The project is in full compliance.

4.11.12 Migratory Bird Treaty Act and Migratory Bird Conservation Act

No migratory birds would be affected by project activities; however the bald eagle has been identified in the project area (see Section 4.10 for Environmental Commitments). The toe ditch wetlands provide very little quality habitat for migratory birds. Alternative and higher quality habitats are available along the Lake Okeechobee shoreline and in adjacent canals. The project is in compliance with these acts.

4.11.13 E.O. 11990, Protection of Wetlands

No impacts to wetlands are anticipated with installation of the cutoff wall since the cutoff wall will be installed within the existing ROW. This project is in compliance with the goals of this Executive Order.

4.11.14 E.O. 11988, Flood Plain Management

The study is in full compliance. While the considered alternative has no impact on avoidance of development in the flood plain, the recommended plan will directly support a reduction in hazards and risks associated with floods and will minimize the impact of floods on human safety, health and welfare. The recommended plan will have no impact on the restoration and preservation of the natural and beneficial values of the base flood plain.

4.11.15 E.O. 12898, Environmental Justice

Executive Order 12898 requires the Federal government to review the effects of their programs and actions on minorities and low income communities. The study area is known to contain a significant percentage of low income and minority individuals. The preferred alternative that was formulated for the Herbert Hoover Dike would help to ensure the safety of those communities within the study area (e.g. Belle Glade and Pahokee) as well as residents living within the area anticipated to be impacted in the event of a project failure. In addition to ensuring the safety and well being of residents and their property, implementation of the recommended plan, including the cutoff wall, may have a significant beneficial effect on local communities through job creation, increased sale of construction material and other goods necessary to sustain a large construction force for the duration of the project. The project will not have disproportionate adverse effects on minority or low-income populations.

4.11.16 E.O. 13112, Invasive Species

Exotic and invasive plant species are found within drainage swales, connecting canals, wetlands, and some uplands within the project area. However, the project will not contribute to nutrient loading, or otherwise foster the spread of invasive species. Exotic wildlife species are not anticipated to be affected. This project is in full compliance with the Act.

4.11.17 E.O. Conclusion

This project is in compliance with the following Executive Orders: 11990 Protection of Wetlands, 11988 Flood Plain Management, 12898 Environmental Justice, and 13112 Invasive Species.

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5.0 LIST OF PREPARERS AND REVIEWERS

The following individuals listed in Tables 5-1 and 5-2 were responsible for contributing to the preparation, review and technical editing of the Draft EA.

5.1 PREPARERS

TABLE 5-1: LIST OF EA PREPARERS

Name	Affiliation	Discipline/Expertise	Role in Preparing Document
Nancy Allen	USACE	Biologist	Preparation of draft EA
Tien Ho	EPJV, Contractor	Biological Engineer	Preparation of draft EA
Angela Dunn	USACE	Biologist	Preparation of draft EA
Mark D. Shafer	USACE	Environmental Engineer	Water Quality and Permit acquisition
David Pugh	USACE	Archeologist	Provided Cultural Resources Sections

5.2 REVIEWERS

TABLE 5-2: LIST OF EA REVIEWERS

Name	Affiliation	Discipline/Expertise	Role in Preparing Document
Barbara Cintron	USACE (SAJ)	Chief of Environmental Branch, South Florida Section	NEPA Review
David Dollar	USACE (SAJ)	Engineering Technical Lead	Review of the EA
Martin Falmlen	USACE (SAJ)	Hydrology Engineer	Review hydrology portions of the EA
John Bretz	EPJV, Contractor	Project Manager	Consistency Review
Alan D. Shirey	USACE (SAW)	NEPA Specialist	External Independent Technical Review

6.0 PUBLIC INVOLVEMENT

6.1 SCOPING AND ISSUES

Following the completion of the Independent Technical Review (ITR), a news release describing the design recommendations for the rehabilitation of HHD was released on October 5, 2006 to keep the public informed of the decisions resulting from the workshop.

The EA and proposed Finding of No Significant Impact (FONSI) for the focus area toe ditch backfilling were made available to the public by notice of availability dated 11 December 2006, pertinent correspondence regarding this proposed work is available in Appendix C of that report.

Informal consultation is in progress. Interagency participation with USFWS, EPA, FDEP, and the Corps has been ongoing. A scoping power point presentation on the preferred alternative was sent out to interested agencies on September 28, 2007. A scoping letter was sent out on October 9, 2007. SHPO coordination is final and complete. Concurrence is expected with Corps determination to endangered species of "no effect".

6.2 AGENCY COORDINATION

The draft EA will be provided to all supporting agencies for review. Any comments received will be addressed in the final EA. Pertinent correspondence with agencies is available in Appendix C of this EA. Table 6-1 displays all previous coordination with the USFWS.

TABLE 6-1: COORDINATION WITH THE USFWS

Coordination Date	Information Coordinated	Coordination Determination
May 2, 2007	The EA covering Reach 1 Seepage Berm within the right-of-way and Reach 1A Cutoff Wall.	Wetlands being filled along the toe ditch have been mitigated for on and off-site. No other long term adverse impacts of the project are anticipated.
January 16, 2007	The Reach 2&3 EIS for seepage berm and cutoff wall.	Resource issues are the same as Reach 1 and have been addressed in the Final CAR, dated December 2001. Only remaining issue is to identify additional wetland mitigation sites to fully compensate for toe ditch backfilling in Reaches 2&3.

November 24, 2006	The Reach 1 EA for Priority Toe Ditch Backfill, dated Jan 2007. Suspended construction cutoff wall and bench. Toe ditch backfill repairs in Reach 1 to stabilize the outer toe and prevent further deterioration.	Proposed modifications are similar to those proposed in 1999 EIS; mitigation was carried out for toe ditch backfill therefore no additional mitigation is required. Commitments for threatened, endangered and state listed species are still in effect.
April 18, 2005 USFWS letter	The Supplemental Draft EIS, with the review of the new alternative, that was also in the 30% design.	Same as previous letter. Impacts minimized; no mitigation needed at this time. Threatened and Endangered species issues have been addressed with commitments.
March 8, 2004 USFWS Supplement to FCAR	Review of 30% document that eliminates construction in the toe ditch and confines project to the existing HHD footprint	Reduces impacts previously addressed in the Dec. 20, 2001 FCAR & March 4, 2003 Supplemental FCAR. No significant impacts expected except temporary dewatering of toe ditch.
February 23, 2004 USACE letter	New 30% design, additional reduction in impacts, and information on recommended alternative	Wetland impacts have been eliminated with the exception of temporary impacts associated with construction.
October 28, 2003 USFWS letter	Letter documenting review of VE report that modified recommended plan in Subreach 1A to reduce impacts	Request 30% Designs to review prior to submitting a supplement to FCAR
June 27, 2003 USACE letter	VE report recommendations on Subreach 1A only, not entire Reach	Subreach 1A design changes from the original MRER recommendation, eliminating impacts in this subreach that has higher quality wetlands

March 4, 2003 USFWS Supplemental CAR	Review of VE report and modifications to recommended plan design	Reduces impacts on wetlands; No mitigation required. Reminder of commitments to complete bald eagle and eastern indigo snake measures
January 14, 2003 USACE letter	Results of the VE study.	Request for review
December 20, 2001 USFWS Final CAR	Review of draft EIS and impacts associated with alternatives	While filling and excavation of wetlands on landward side of HHD are of lesser concern, impacts to habitat are significant enough to require mitigation; Concerned with any construction that would be proposed on lakeward side of HHD and effects to Lake; Concerned with construction impacts to burrowing owls, bald eagles, and eastern indigo snake. Measures should be implemented.
March 21, 2001 USFWS letter	Compensatory wetland mitigation plan	Supports the mitigation proposed and suggests mitigation credit for future Reaches of HHD could be banked
March 8, 2001 USACE letter	Proposal for wetland habitat loss	Agree functional value of habitat loss should be mitigated. Plan to supplement an existing exotic plant removal program by re-planting the mitigation area with native trees. Request for concurrence

October 30, 2000 USACE letter	The Corps cannot support the mitigation plan outlined by USFWS, but proposes strategy for wetland compensation	The Corps will support exotic plant removal program and investigate enhancement opportunities of existing wetland functions.
February 11, 2000 USFWS Supplement draft CAR	Results of wetland function assessment and mitigation plan proposal	Approximately 35 acres of wetland habitat will be impacted by recommended alternative. Mitigation required. Proposed sites and compensation measures listed. Results of WRAP
June 9, 1999 USFWS Section 7 determination	Determination of effects to threatened and endangered species in project area	Concur with USACE determination of not likely to adversely effect, provided recommendations for the bald eagle and eastern indigo snake are implemented
October 30, 1998 USFWS draft CAR	Draft Environmental Impact Statement	Alternatives 2 and 3 are acceptable, provided mitigation for wetlands is provided; exotic vegetation is removed; Construction avoids active bald eagle nest, protection measures for eastern indigo snake are followed, and impacts to burrowing owls are minimized

6.3 LIST OF RECIPIENTS

Table 6-2 lists the recipients of a notification of availability, a hardcopy, or CD of the draft EA.

The draft EA is posted on the following websites:

- The Corps Environmental planning website, under Palm Beach and Martin Counties:

  http://planning.saj.usace.army.mil/envdocs/envdocsb.htm

- The HHD SAJ webpage, under HHD related information:

  http://www.saj.usace.army.mil/cco/HHD/hhdike.htm/HHD_Reach1_EA

TABLE 6-2: LIST OF SCOPING AND NOA RECIPIENTS

AGENCY	FIRST	LAST	COMPANY / DIVISION
Federal	David	Bernhart	NMFS
Federal	Mark	Bradford	Bureau of Indian Affairs
Federal	Ted	Center	U.S. Department of Agriculture, Aquatic Plant Lab
Federal	Jonathon	Deason	Department of the Interior MS 2340
Federal	George	Hadley	Federal Highway Administration
Federal	Gary	Hardesty	U.S.A.C.E., Program Mgmt. Div.,/CECW-HQ02
Federal	Kenneth	Harvan	U.S. DOI Office of Environmental Policy and Compliance
Federal	Richard	Harvey	U.S. EPA, Region 4
Federal	William	Leary	Council on Environmental Quality
Federal	Audra	Livergood	NOAA/National Marine Fisheries Service
Federal	Neal	McAlily	U.S. Department of Justice
Federal	Ron	Miedema	U.S. EPA
Federal	David	Rackley	NOAA/National Marine Fisheries Service
Federal	Barry	Rosen	FISC
Federal	Paul	Souza	U.S. Fish and Wildlife Service
Federal			National Marine Fisheries Service/Habitat Cons Div
Federal			U.S. Department of HUD
Federal			U.S. Army Corps of Engineers
Federal			FL DOT
Federal			Department of Energy
Federal			U.S. Fish and Wildlife Service
Federal			Everglades National Park
Federal			National Park Service
Federal			U.S. EPA, Region 4
Federal			U.S. Army Corps of Engineers, SAD, Planning

Federal			U.S. EPA
Federal			U.S. Department of Commerce/NOAA
Federal			Bureau of Indian Affairs
Federal			FEMA Insurance & Mitigation Division
Federal			Federal Emergency Mananagement Admin
Federal			7th Coast Guard District
Federal			U.S. Department of Agriculture
Federal			U.S. Geological Survey, WRD
Federal			Federal Maritime Commission
Federal			Advisory Council on Historic Preservation
Federal			U.S. Forest Service - USDA
State	Ernie	Barnett	FDEP - Ecosystem Planning
State	Brian	Barnett	Office of Environmental Service - FL Fish & Wildlife Conservation Commission
State	Sally	Bradshaw	Governor's Office
State	Colleen	Castille	FL Department of Environmental Protection
State	Kenneth	Haddad	FL Fish & Wildlife Conservation Commission
State	Don	Nuelle	SFWMD
State	Jeff	Schardt	FL Department of Environmental Protection - Bureau of Invasive Plant Management
State			Environmental Office (MS-37) Florida DOT
State			Okeechobee Field Station / SFWMD
State			FL Department of Environmental Protection
State			Division of Historic Resources
State			Legislative Library
State			SFWMD
State			Florida State Clearinghouse / FDEP
State			FL Dept of Agriculture & Consumer Services
State			Florida Power and Light
State			House Environmental Protection Committee
State			Everglades Protection & Restoration Program - FL Fish & Wildlife Conservation Commission
State			State Conservationist NRCS
State			Government Responsibility Council
State			Intergovernmental Affairs Policy Unit
County	Houston	Tate	Office of the City Manager
County	Steve	Wilson	City of Belle Glade
County			Hendry County Administration
County			Okeechobee County Administration
County			St. Lucie River Initiative
County			Osceola County Administration
County			St. Lucie County Administration
County			Glades City Board of County Commissioners
County			Glades County Administration
Association			Caloosahatchee River Citizens Association

Association			Friends of Lake Okeechobee
Association			Florida Wildlife Federation
Association			Sierra Club, Loxahatchee
Tribe	Mitchell	Cypress	Seminole Tribe of Florida
Tribe	Billy	Cypress	Miccosukee Tribe of Indians of Florida
Tribe	Terrance	Salt	South Florida Restoration Task Force
Tribe	William	Steele	Seminole Tribe of Florida
Tribe	Craig	Tepper	Seminole Tribe of Florida
Tribe	Steve	Terry	Miccosukee Tribe of Indians of Florida
Agricultural	Steve	Baumgartner	Chamber of Commerce
Agricultural	John Ed	Burdeshaw	Okeechobee Chamber of Commerce
Agricultural	Robert	Daniels	South FL Regional Planning Council
Agricultural	John W.	Dunkelman	Florida Sugar Cane League, Inc.
Agricultural	Patrick	Gleason	Camp Dreser & McKee, Inc.
Agricultural	Tom	Jones	South Florida Agricultural Council
Agricultural	Jeff	Krauskopf	Martin Board of County Commissioners
Agricultural	Ken	Langeland	University of Florida Institute of Food & Agr. Sciences / Center for Aquatic Plants
Agricultural	Barbara	Miedema	Sugar Cane Growers Cooperative
Agricultural	Charles	Schoech	Highlands Glades Drainage District
Agricultural			Everglades Coordinating Council
Other	Susan	Brookman	South FL Watershed Council Inc.
Other	Patrick J.	Gleason	Camp Dreser & McKee, Inc.
Other	Kevin	Henderson	St. Lucie River Initiative
Other	Beverly	Jones	St. Lucie Initiative
Other	Thomas	Macvicar	Macvicar, Frederico & Lamb, Inc.
Other	Phillip	Parsons	Landers & Parsons
Other	Joseph	Spratt	Hendry County Board of County Commissioners
Other	Donald	Stilwell	Lee County
Other			Okeechobee Board of County Commissioners
Other			SW Florida Watershed Council
Marina & Fish Camp	David	Sutton	University of Florida IFAS Research Center
Libraries	Doris	Cutshall	Barron Library
Libraries			Clewiston Public Library
Libraries			Martin County Blake Library
Libraries			Okeechobee County Public Library
Libraries			Loula V. York Branch Library
Libraries			Palm Beach County Library
			Pahokee Water Control District
	Alcee	Hastings	U.S. House of Representatives
	Tim	Mahoney	U.S. House of Representatives
	Bill	Nelson	U.S. Senate
	Mel	Martinez	U.S. Senate

	Joyce	Bear	Cultural and Historic Preservation Tribal Complex
	Robert	Thrower	Tribal Historic Preservation Officer
	Pare	Bowlegs	Tribal Historic Preservation Officer
			Pahokee City Manager
	Kenneth	Schenck	City Manager
			Polk County Administrator
			Martin County Administrator
	J.P.	Sasser	Mayor
			State Director
	Ruth	Clark	
	Wayne	Nelson	
	M. Kent	Brown	
	Lace	Vitunac	
	Art	Darling	
	Vee	Platt	
	Bryan	Beer	
	Nathaniel	Reed	
	Louis	Larson, Sr.	President
	Joe	Collins	
	Bubba	Wade	
	Ricaardo	Lima	
	Charles	Harvey	
	Red	Altman	
	Ron	Ramsey	
	Ron	Hamel	
	Warren	Brown	
	Carroll & Louise	Head	
	Gail	Byrd	
	Lesly	Smith	Town Council President
	Wayne	Jenkins	President
			District II County Commissioner
	Donald	Stilwell	County Manager
	Bonnie	Dearborn	
			Utility Director
	Robert M.	Norton	
	Brian	Oulette	
	Vicki	Smith	
	Cathy	Hilliard	
	Ardis	Hammock	
	Kevin	Stinnette	Indian Riverkeeper
	Terry	Adams	Pahokee Resident
	Felix	Agudo	Pahokee Resident
	Ponciano	Aguirre	Pahokee Resident

	Aucencio	Aldape	Pahokee Resident
	Francis	Allen	Pahokee Resident
	Francis	Allen	Pahokee Resident
	Cynthia	Anderson	Pahokee Resident
	Cynthia	Anderson	Pahokee Resident
	Keith	Babb	Pahokee Resident
	Barbara	Branch	Pahokee Resident
	James	Brewer	Pahokee Resident
	Frederick	Brown	Pahokee Resident
	Jessie	Brown	Pahokee Resident
	Edna	Brown	Pahokee Resident
	Billy	Bryant	Pahokee Resident
	Rodger	Burroughs	Pahokee Resident
	Maria	Camacho	Pahokee Resident
	Pahokee	Chicken INC	Pahokee Resident
	Lakeside Baptist	Church	Pahokee Resident
	Donald	Conran	Pahokee Resident
	Emundo	Cossio	Pahokee Resident
	Thelma	Crady	Pahokee Resident
	Joanne	Culberson	Pahokee Resident
	Philippe	Dadesky	Pahokee Resident
	Leonard	Dobrow	Pahokee Resident
	Pahokee	Elderly Facility LTD	Pahokee Resident
	Cindy	Findley	Pahokee Resident
	Lorenzo	Fonseca	Pahokee Resident
	Lorenzo	Fonseca	Pahokee Resident
	Theodore	Gallo	Pahokee Resident
	Sharon	Glen	Pahokee Resident
	Delia	Gonzalez	Pahokee Resident
	Lewis	Gordon	Pahokee Resident
	Dwight	Graydon	Pahokee Resident
	Apple	Green INC	Pahokee Resident
	Willie	Haslem	Pahokee Resident
	Denise	Hatton	Pahokee Resident
	Helen	Henderson	Pahokee Resident
	Iris	Hodges	Pahokee Resident
	Larry	Hyslope	Pahokee Resident
	Rusty	Hyslope	Pahokee Resident
	Kenneth	Hyslope	Pahokee Resident
	Larry	Hyslope	Pahokee Resident
	Bright	Ideas Educational	Pahokee Resident
	Wayne	Jarriel	Pahokee Resident
	C D	Jernigan	Pahokee Resident

	Ralph	Jones	Pahokee Resident
	Waseem	Kahook	Pahokee Resident
	William	Kennedy	Pahokee Resident
	Clarence	Law	Pahokee Resident
	Marvin	Levins	Pahokee Resident
	Glen	Levins	Pahokee Resident
	Margaret	Lindrose	Pahokee Resident
	Nelson	Lopez	Pahokee Resident
	Nelson	Lopez	Pahokee Resident
	Nelson	Lopez	Pahokee Resident
	Nelson	Lopez	Pahokee Resident
	Nelson	Lopez	Pahokee Resident
	Julio	Lopez	Pahokee Resident
	Jacques	Marzi	Pahokee Resident
	Gayle	McArthur	Pahokee Resident
	Elizabeth	McKeehan	Pahokee Resident
	William	McKinstry	Pahokee Resident
	Linda	McKinstry	Pahokee Resident
	Robert	Miller	Pahokee Resident
	Patsy	Mills	Pahokee Resident
	Georgie	Moon	Pahokee Resident
	Lorine	Mosley	Pahokee Resident
	Ricky	Mosley	Pahokee Resident
	Johnny	Mosley	Pahokee Resident
	Rhonda	Mosley	Pahokee Resident
	Donald	Moss	Pahokee Resident
	Manuel	Moya	Pahokee Resident
	Sean	Murdoch	Pahokee Resident
	Mohammed	Nasir	Pahokee Resident
	Caesar	Orduna	Pahokee Resident
	Norris	Otto	Pahokee Resident
	Richard	Pace	Pahokee Resident
	City of	Pahokee	Pahokee Resident
	First United Methodist Church of	Pahokee	Pahokee Resident
	W C	Parker	Pahokee Resident
	Curtis	Peaden	Pahokee Resident
	Carol	Peaden	Pahokee Resident
	Edilia	Perez	Pahokee Resident
	Edilia	Perez	Pahokee Resident
	Michael	Perullo	Pahokee Resident
	Barbara	Pope	Pahokee Resident
	Maria	Prieto	Pahokee Resident
	Carlo	Raineri	Pahokee Resident

	Billy	Rawls	Pahokee Resident
	Jimmy	Reed	Pahokee Resident
	Terry	Reed	Pahokee Resident
	Pablo	Rodriguez	Pahokee Resident
	George	Rodriguez	Pahokee Resident
	Fernando	Rodriguez	Pahokee Resident
	Paul	Rosenstraus	Pahokee Resident
	Bonifacio	Ruiz	Pahokee Resident
	Gary	Sanders	Pahokee Resident
	Thomas	Sears	Pahokee Resident
	William	Shirley	Pahokee Resident
	Sandra	Simonson	Pahokee Resident
	Carol	Spence	Pahokee Resident
	V R	Suggs	Pahokee Resident
	Clifton	Todd	Pahokee Resident
	Noel	Toribio	Pahokee Resident
	Irvin	Tulloch	Pahokee Resident
	Irvin	Tulloch	Pahokee Resident
	David	Unwin	Pahokee Resident
	Hugo	Varela	Pahokee Resident
	Gail	Wheeler	Pahokee Resident
	Wayne	Whitaker	Pahokee Resident
	Margaret	Wilkinson	Pahokee Resident
	Hilda	Wilkinson	Pahokee Resident
	James	Wilson	Pahokee Resident
	Michael	Woodside	Pahokee Resident
	Jose	Alfaro	Pahokee Resident
	Veronica	Baker	Pahokee Resident
	Jose	Baltazar	Pahokee Resident
	Eric	Baltazar	Pahokee Resident
	Jacinto	Baltazar	Pahokee Resident
	Gerald	Barbarito	Pahokee Resident
	Gerald	Barbarito	Pahokee Resident
	Richard	Barnett	Pahokee Resident
	Francis	Boe	Pahokee Resident
	Neal	Boris	Pahokee Resident
	Margie	Branch	Pahokee Resident
	Billy	Bryant	Pahokee Resident
	Richard	Butler	Pahokee Resident
	First Hispanic	Church	Pahokee Resident
	Darrel	Collier	Pahokee Resident
	Annie	Collins	Pahokee Resident
	Glades Covenant	Community Church	Pahokee Resident

	Beulah	Cook	Pahokee Resident
	T L	Corbett	Pahokee Resident
	Palm Beach	County	Pahokee Resident
		Crouch	Pahokee Resident
	Jorge	Davila	Pahokee Resident
	Juan	De Los Santos	Pahokee Resident
	Armisha	Dent	Pahokee Resident
	Keen	Development CO	Pahokee Resident
	Episcopal	Diocese of Southeast FL	Pahokee Resident
	Scott	Dixon	Pahokee Resident
	Paul	Dixon	Pahokee Resident
	Roy	Eccleston	Pahokee Resident
	Ezequiel	Esparza	Pahokee Resident
	Arthur	Evans	Pahokee Resident
	Boe	Farms	Pahokee Resident
	Boe	Farms	Pahokee Resident
	Boe	Farms	Pahokee Resident
	Camaro	Farms INC	Pahokee Resident
	Everglades	Foliage INC	Pahokee Resident
	Katherine	Fountain	Pahokee Resident
	W A	Fowler	Pahokee Resident
	Lewis	Friend	Pahokee Resident
	Church of	God at Pahokee	Pahokee Resident
	William	Graham	Pahokee Resident
	Willie	Gulley	Pahokee Resident
	Ron	Harrison	Pahokee Resident
	Elvis	Harvey	Pahokee Resident
	Barbara	Hatton	Pahokee Resident
	G J	Henson	Pahokee Resident
	Wilbur	Henson	Pahokee Resident
	Willie	Hickman	Pahokee Resident
	Florida	Ice Manufacturing Corp	Pahokee Resident
	Pahokee	Investments INC	Pahokee Resident
	Pahokee	Investments INC	Pahokee Resident
	D	Jarriel	Pahokee Resident
	Bennie	Jones	Pahokee Resident
	Ahmad	Kahok	Pahokee Resident
	Jamil	Kahok	Pahokee Resident
	Coppock	Kay L Trust	Pahokee Resident
	Diane	Kennedy	Pahokee Resident
	Paul	Kohr	Pahokee Resident
	Richard	Korbly	Pahokee Resident

	Bruce	Ladd	Pahokee Resident
	Milacoya	Latimore	Pahokee Resident
	Jamar	Lawrence	Pahokee Resident
	Glenn	Levins	Pahokee Resident
	Guillermo	Magana	Pahokee Resident
	Michael	Meister	Pahokee Resident
	Bud	Mickins	Pahokee Resident
	Moises	Morales	Pahokee Resident
	Steve	Mosley	Pahokee Resident
	Mary	Myers	Pahokee Resident
	First Union	National Bank	Pahokee Resident
	T&M	of Palm Beach INC	Pahokee Resident
	Berner	Oil INC	Pahokee Resident
	City of	Pahokee	Pahokee Resident
	City of	Pahokee	Pahokee Resident
	City of	Pahokee	Pahokee Resident
	First Methodist Church	Pahokee INC	Pahokee Resident
	Jose	Pantoja	Pahokee Resident
	Kipert	Pelham	Pahokee Resident
	John	Pender	Pahokee Resident
	D T	Potter	Pahokee Resident
	Douglas	Potter	Pahokee Resident
	Board of	Public Instruction	Pahokee Resident
	Lake	Rentals INC	Pahokee Resident
	Antonio	Resendiz	Pahokee Resident
	Gloria	Ricardo	Pahokee Resident
	Beverly	Robinson	Pahokee Resident
	Armando	Rodriguez	Pahokee Resident
	Theresa	Salvatore	Pahokee Resident
	Faith	Sasser	Pahokee Resident
	James	Sasser	Pahokee Resident
	Barbar	Shirley	Pahokee Resident
	Larry	Simmons	Pahokee Resident
	Rosalinda	Spell	Pahokee Resident
	Save a Buck	Storage LLC	Pahokee Resident
	Save a Buck	Storage LLC	Pahokee Resident
	Emmett	Thomas	Pahokee Resident
	Angel	Torres	Pahokee Resident
	Irvin	Tulloch	Pahokee Resident
	Olga	Verduzco	Pahokee Resident
	Edward	Vickers	Pahokee Resident
	Jimmy	Webb	Pahokee Resident
	Allen	Whitaker	Pahokee Resident

	Howard	Wilder	Pahokee Resident
	J E	Wilson & Son INC	Pahokee Resident
	D L	Zaccagnino	Pahokee Resident
	Jose	Zelaya	Pahokee Resident

6.4 COMMENTS RECEIVED AND RESPONSE

Table 6-3 summarizes the public / agency comments received and the USACE response. All public / agency correspondence will be included in its entirety in Appendix C – Pertinent Correspondence.

TABLE 6-3: COMMENT RESPONSE MATRIX

Agency/Public	Comment	USACE Response
EPA-1	Future NEPA documents can be reasonably consolidated to cover the impacts of several reaches, or HHD as a whole.	A list of previously published NEPA documents, will be included in the EA.
EPA-2	We would suggest that all documents have a strong cumulative impacts section to update the public and provide a sense of the cumulative impacts on the HHD rehab as a whole.	Concur. Your recommendations to include a cumulative impact summary for all of the HHD rehabilitation will be incorporated into future NEPA documents.
Roswell Harrington (RH)-1	There is an extensive local historical and archeological database available that the Corps may not have access to.	Thank you for the information. Our archeologist is coordinating with the local county archeologist.
RH-2	How will you mitigate any soil loss that occurs through the loss of groundwater, which maintains the muck soils?	A HHD Phase 1A Groundwater Model was prepared by the USACE Engineer Research and Development Center and the Mr. Stephen England of the Philadelphia District on September 2007. The modeling supports that there will be no regional groundwater effects. Please see Section 4.1.1 – Groundwater Modeling or Appendix A of this report.
RH-3	I maintain a strong differing opinion on what constitutes unique farming practices.	The Farmland Protection Policy Act of 1981 has very specific definitions regarding prime and unique farmland. NRCS has determined that under the following guidelines there is no prime or unique farmland in the project site. Information was obtained for the farmland classification system on the USDA's Natural Resources Conservation Service--National Cooperative Soil Survey website. There is no prime or unique farmland in Hendry, Palm Beach, and Glades counties. The county extension offices were called to confirm these findings. They all supported the fact that there is

		no prime or unique farmland in those three counties. Prime farmland is 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, without intolerable soil erosion, as determined by the Secretary. Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, as determined by the Secretary. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits, and vegetables. Additional information on the definition of prime, unique, or other productive soil can be found in section 1540(c)(1) of the Farmland Protection Policy Act (Public Law 97-98) (7 U.S.C. 4201, et seq.).
RH-4	Historically, the dike has withstood Lake elevations above 20 ft (up to 25 ft). If the operations schedule is maintained; where is the risk?	Thank you for the information. At lake elevations within the regulation schedule, there are numerous occurrences of piping distresses that occur with regular frequency. However, the real danger will occur at higher lake elevations approaching the 100 year flood level and higher. The 100-yr flood can be defined as the lake event which will be equaled or exceeded, on average, once every 100 years, and for lake Okeechobee corresponds to an elevation of about 21.3 ft-NGVD. It does not matter that the lake has never seen this elevation in recorded history, the probability nonetheless exists. While seepage is a natural process that occurs through all soils downstream of a dike, levee, or dam the problem occurs when this seeping water makes its way to ground surface and begins to transport soil particles. If undetected and left to chance, this erosion could persist and work its way back to the lake and which point an underground pipe would exist to allow the lake water to flow through faster, eroding more soils, and eventually resulting in a breach of HHD and uncontrolled loss of lake waters which would inundate hundreds of square miles of land for many months.
RH-5	Tree snails on the Lake Okeechobee ridge area.	Noted. The state listed tree snail has been added to the report.
RH-6	The soils and farming practices are unique.	Refer to Answer 3.

RH-7	No historical information on lost soils type in the Torrey and Pahokee Series.	Noted. Organic soils of all types have sustained losses over the years due to a variety of causes. It will not be possible to mitigate for the loss of these soils.
RH-8	Test results questioned due to drought conditions.	Refer to Answer 2. The groundwater modeling report simulated the effect of the cutoff wall during both wet and dry conditions (the high and low net recharge and head boundary conditions). This EA evaluated the worst case scenario; dry conditions with high pumping. Monitoring will need to be performed over the life of the project and over the course of many water years.
RH-9	Who were the unique farming contacts used to review the determination in the EA?	Refer to Answer 3.

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7.0 REFERENCES

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APPENDICES

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APPENDIX A

GROUNDWATER MODELING

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A. GROUNDWATER MODELING

The groundwater modeling results summarized this Appendix were extracted from the "Draft Project Report, Herbert Hoover Dike, Phase 1A Groundwater Model, dated October 2007" produced by the Engineering Research and Development Center. This report is a draft and is currently undergoing an external Independent Technical Review. Once the report is finalized, it will be made available in its entirety.

The purpose of the HHD Phase 1A modeling effort is to develop and evaluate a Lake Okeechobee sub-regional groundwater numerical model, and evaluate the sub-regional groundwater changes associated with the introduction of the cutoff wall segments into the subsurface geologic structure underlying Herbert Hoover dike (Reaches 1 through 3), the containment levee system that defines the perimeter of Lake Okeechobee surface water storage.

A steady-state, 3-D groundwater model, was developed to qualitatively evaluate the effects of the proposed cutoff wall. The computational results from the "with project", i.e., with wall, simulations were compared to those from the "without project", i.e., no wall, simulations in order to develop order- of-magnitude estimates of changes to the sub-regional groundwater flow. The groundwater flows through 21 cross-sections, seven each in each HHD reach as proposed by ERDC and NAP and approved by SAJ, were compared in this task. These cross-sections were set parallel to the wall at a spacing of 50, 100, 200, 500, 1,000, 5,000 and 10,000 ft from the land-side toe of HHD.

Two major tools, WASH123D and GMS 6.0, were used to simulate the effects of the cutoff wall on regional groundwater. WASH123D computed subsurface flow and GMS 6.0 generated unstructured finite element meshes and set up simulation runs.

A.1 WASH123D

WASH123D [1] is a physics-based finite element numerical model that computes water flow in watershed systems that can be conceptualized as a combination of 1-D channel networks, 2-D overland regimes, and 3-D subsurface media. In the computer program of WASH123D that ERDC maintains, 1-D channel flow is computed by solving the cross-section area-averaged diffusive wave equation, 2-D overland flow by the depth-averaged diffusive wave equation, and 3-D variably saturated subsurface flow by the Richards equation. The steady-state version of the Richards equation, i.e., Eq. (1) was solved with the Galerkin finite element method [2] in WASH123D for all model runs considered in this study.

Eq. (1) $$\nabla \cdot \left[k_r \mathbf{K_s} \cdot \left(\nabla h + \nabla z \right) \right] + q = 0 \,,$$

where h is the pressure head [L]; k_r is the relative hydraulic conductivity [dimensionless]; $\mathbf{K_s}$ is the saturated hydraulic conductivity tensor [L/t]; z is the potential head [L]; q is the source/sink term [$L^3/L^3/t$].

A.2 GMS 6.0

The Department of Defense Groundwater Modeling System (GMS, http://chl.erdc.usace.army.mil/gms) is the most sophisticated groundwater modeling environment available today. The Department of Defense (DOD), in partnership with the Department of Energy, the U.S. Environmental Protection Agency, the U.S. Nuclear Regulatory Commission and 20 academic partners, has developed the DOD Groundwater Modeling System. The GMS provides an integrated and comprehensive computational environment for simulating subsurface flow, contaminant fate/transport, and the efficacy and design of remediation systems. GMS integrates and simplifies the process of groundwater flow and transport modeling by bringing together all of the tools needed to complete a successful study. GMS provides a comprehensive graphical environment for numerical modeling, tools for site characterization, model conceptualization, mesh and grid generation, geostatistics, and sophisticated tools for graphical visualization. There is a WASH123D graphic user interface (GUI) included in GMS 6.0.

A.2.1 Physical Data Input into Model

Geologic data from various sources were compiled to construct the conceptual hydro-geologic model, where 11 subsurface materials were taken into account (see A.2.3). Historical data of rainfall, evapo-transpiration (ET), groundwater head, and canal stage were used to define high, medium, and low net recharge and head boundary conditions (see A.2.4). Compiled permit capacity and specification information was used to define the high and low pumping as the sink term in the model. The high and low values of net recharge, head boundary conditions, and groundwater pumping, determined based on the historical field data, were used to mimic the extreme hydrologic conditions of the modeled system, so that the associated results would provide reasonable estimates on the cutoff wall impact.

Approximately 270 geologic borings have been logged along the HHD alignment in the vicinity of Reaches 1, 2, and 3. The ground surface elevation and depths of these borings vary; however, these borings generally do not penetrate deeper than elevation -50 feet NGVD29. The Corps Jacksonville District has developed cross-sectional representations of the shallow geologic materials along the dike alignment using these borings. Information related to the development of these cross-sections is contained in the Major Rehabilitation Reports (MRR's). Based on discussions with SAJ, these dike alignment borings and cross-sections were used to define Layers 1, 2, and 3A for the Phase 1A model.

A.2.2 Assumptions (Design of cutoff wall)

In the HHD Phase 1A modeling, one "With Project" scenario was studied. The cutoff wall tip elevation in this configuration varies between -15 and -40 feet NGVD29. This corresponds to approximate cutoff wall depths of between 47 and 72 feet, assuming that the cutoff wall is along the dike alignment and the top of the dike is approximately 32 feet NGVD29.

A.2.3 Subsurface Material Layers and Associated Conductivity Ranges

Numerous geologic interpretations have been developed to date for the Surficial Aquifer System (SAS) geology in the vicinity of this model. Layers 2-1, 3A, and L3B-2 were determined to be the most influential layers; therefore, the lowest and highest conductivity[1] values for each of these materials were utilized in different runs while the remaining eight layers were held constant (the average conductivity value for each of the eight materials was used). This was done to limit the analysis to 96 scenarios, allowing the analysis to be completed in the project timeframe while analyzing the most probable scenarios with the greatest groundwater impacts. If the conductivity values (high and low values) for all eleven layers were analyzed, it would require 25,000 model runs. **Table A-5** lists the conductivity values utilized in all 11 layers.

The following subsurface material layers were utilized in the model. See **Figure A-1** for the geological layers. See **Figures A2-A9** for the spatial extent of each the layers.

1. Layer 1 - Undifferentiated Surface Soils including embankment fill for the dike
2. Layer 2-1 - Fine/Organic Layer including peat, clays and silts (East)
3. Layer 2-2 - Sands (West)
4. Layer 3A - Limestone, Rock, Sand and Shell beds
5. Layer 3B-1 – Clay Intrusion in the NW model domain
6. Layer 3B-2 – Sands to Silty Sands
7. Layer 4 - Pinecrest Sand member of Tamiami Formation
8. Layer 5 - Ochopee Limestone member of the Tamiami Formation and the Gray Limestone
9. Layer 6 - Lower Tamiami Formation sands and non-productive sands of the Miocene Peace River Formation
10. Layer 7-1
11. Layer 7-2 - Upper Hawthorn Group and Sand Stone Aquifer

[1] Hydraulic conductivity describes the ease with which water can move through a material. Hydraulic conductivity is expressed in feet per day (ft/d).

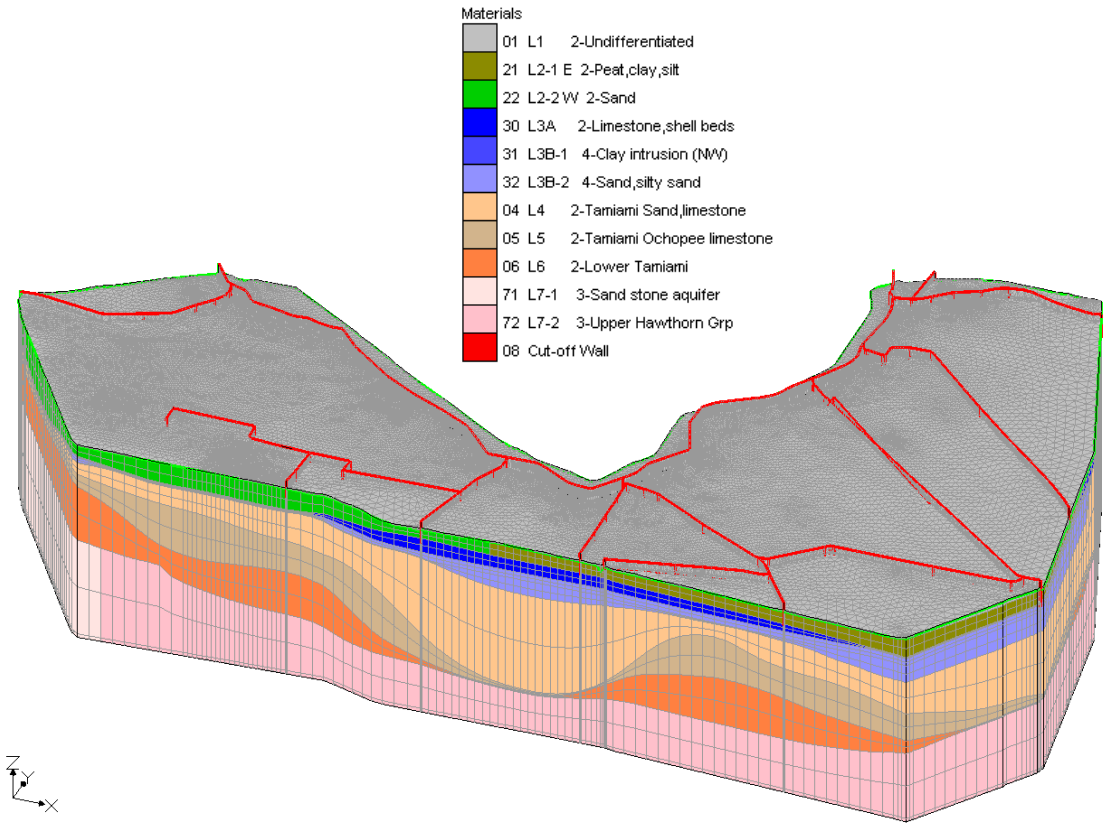
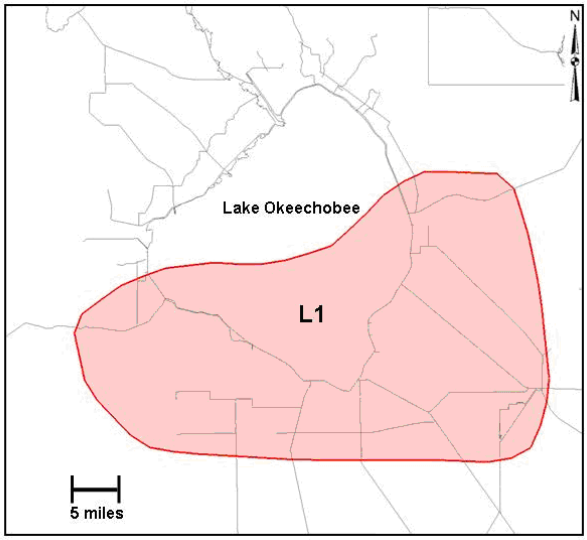


FIGURE A-1: 3-D COMPUTATIONAL MESH OF THE HHD PHASE 1A MODEL

Herbert Hoover Dike – Conceptual Hydro-Geologic Model
Layer 1 Hydraulic Conductivity



General Description
•Undifferentiated surface material
•Material layer is relatively thin

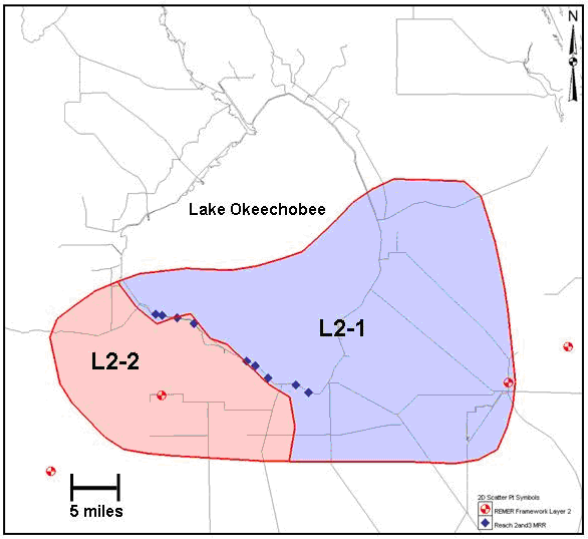
Distribution Methodology
•Uniform distribution across model domain

Conductivity Range (Kh)
•L1(Low) : 0.5 ft/day
•L1(High) : 5 ft/day

Data Source
• Reach 1 Area : Herbert Hoover Dike Major Rehabilitation Evaluation Report, Vol. 2 of 4, Appendix H, November 2000
•Reach 2/3 Area :Major Rehabilitation Evaluation Reports Supplement – Draft Appendices Herbert Hoover Dike Reaches 2 and 3, Appendix G, December 2006
•REMER Hydro-geologic Framework Report, December 2005

FIGURE A-2: HYDRAULIC CONDUCTIVITY CONSIDERED FOR MATERIAL L1 IN THE HHD PHASE 1A MODEL

Herbert Hoover Dike – Conceptual Hydro-Geologic Model
Layer 2 Hydraulic Conductivity



General Description
•Peats, clays, and silts to the East
•Sands to the West

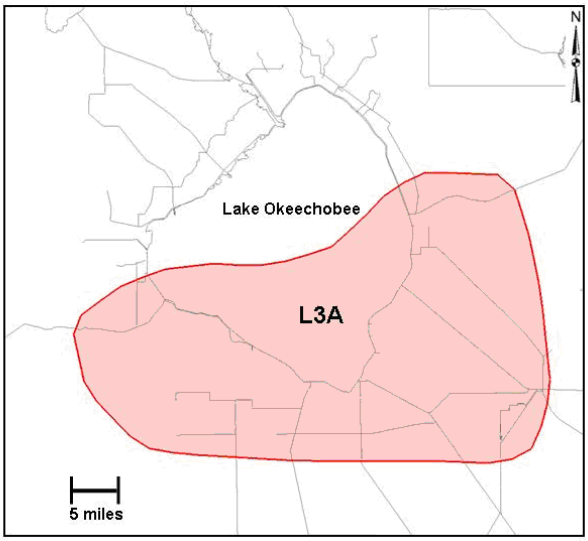
Distribution Methodology
•Sectional model data from MRR's and FGS Mineral Resources mapping used to delineate between peats and sands

Conductivity Range (Kh)
•L2-1(Low) : 0.1 ft/day
•L2-1(High) : 1.0 ft/day
•L2-2(Low) : 1.0 ft/day
•L2-2(High) : 100.0 ft/day

Data Source
• Reach 1 Area : Herbert Hoover Dike Major Rehabilitation Evaluation Report, Vol. 2 of 4, Appendix H, November 2000
•Reach 2/3 Area :Major Rehabilitation Evaluation Reports Supplement – Draft Appendices Herbert Hoover Dike Reaches 2 and 3, Appendix G, December 2006
•REMER Hydro-geologic Framework Report, December 2005

FIGURE A-3: HYDRAULIC CONDUCTIVITY CONSIDERED FOR MATERIALS L2-1 AND L2-2 IN THE HHD PHASE 1A MODEL

Herbert Hoover Dike – Conceptual Hydro-Geologic Model
Layer 3A Hydraulic Conductivity



General Description
•Limestone and shell beds
•Generally shallower than -40 ft. NGVD29
•Thickest on South and East of lake

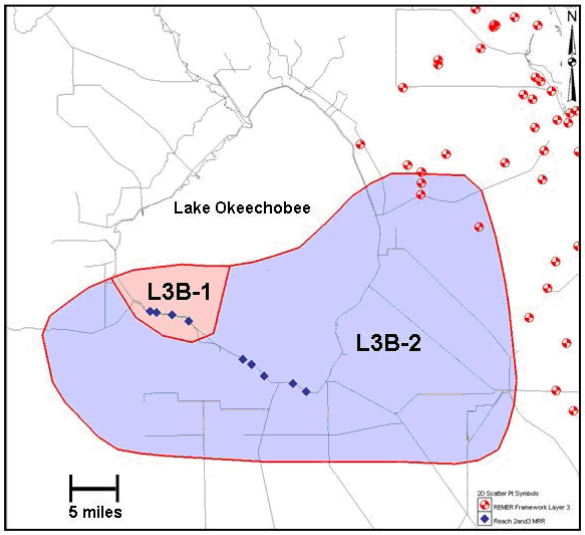
Distribution Methodology
•Uniform distribution across model domain

Conductivity Range (Kh)
•L3A(Low) : 100.0 ft/day
•L3A(High) : 600.0 ft/day

Data Source
• Reach 1 Area : Herbert Hoover Dike Major Rehabilitation Evaluation Report, Vol. 2 of 4, Appendix H, November 2000
•Reach 2/3 Area :Major Rehabilitation Evaluation Reports Supplement – Draft Appendices Herbert Hoover Dike Reaches 2 and 3, Appendix G, December 2006
•REMER Hydro-geologic Framework Report, December 2005

FIGURE A-4: HYDRAULIC CONDUCTIVITY CONSIDERED FOR MATERIAL L3A IN THE HHD PHASE 1A MODEL

Herbert Hoover Dike – Conceptual Hydro-Geologic Model
Layer 3B Hydraulic Conductivity



General Description
•Sands to silty sands
•Clay intrusions in the northwest of model domain (material L3B-1)

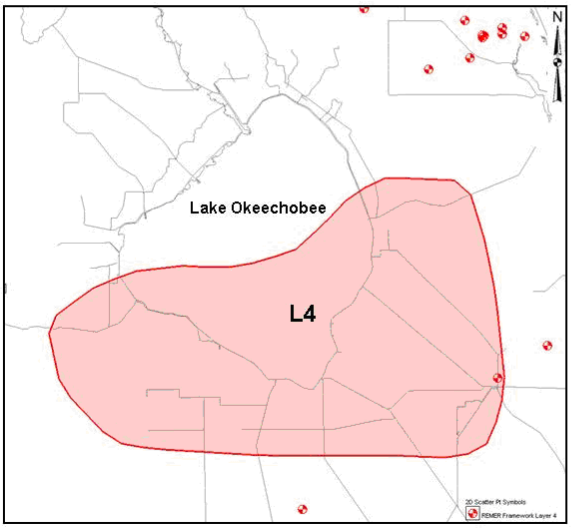
Distribution Methodology
•Areas with clay intrusions have a lower conductivity range

Conductivity Range (Kh)
•L3B-1(Low) : 0.5 ft/day
•L3B-1(High) : 5.0 ft/day
•L3B-2(Low) : 1.0 ft/day
•L3B-2(High) : 100.0 ft/day

Data Source
• Reach 1 Area : Herbert Hoover Dike Major Rehabilitation Evaluation Report, Vol. 2 of 4, Appendix H, November 2000
•Reach 2/3 Area :Major Rehabilitation Evaluation Reports Supplement – Draft Appendices Herbert Hoover Dike Reaches 2 and 3, Appendix G, December 2006
•REMER Hydro-geologic Framework Report, December 2005

FIGURE A-5: HYDRAULIC CONDUCTIVITY CONSIDERED FOR MATERIALS L3B-1 AND L3B-2 IN THE HHD PHASE 1A MODEL

Herbert Hoover Dike – Conceptual Hydro-Geologic Model
Layer 4 Hydraulic Conductivity



General Description
•Sands and Limestone of the Late Pliocene Upper Tamiami Formation
•Caloosahatchee Clay

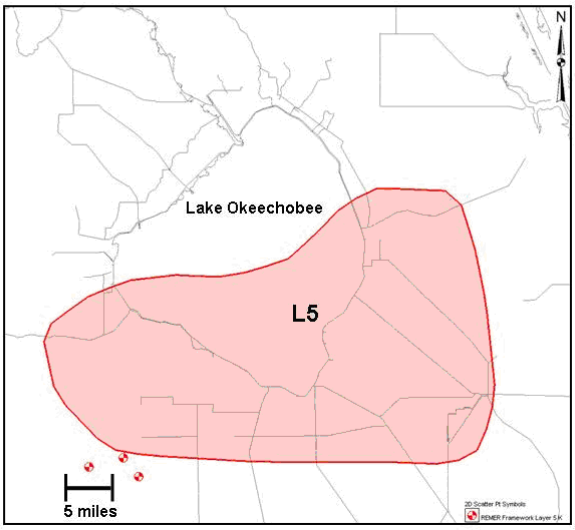
Distribution Methodology
•Uniform distribution across model

Conductivity Range (Kh)
•L4(Low) : 5.0 ft/day
•L4(High) : 30.0 ft/day

Data Source
• Reach 1 Area : Herbert Hoover Dike Major Rehabilitation Evaluation Report, Vol. 2 of 4, Appendix H, November 2000
•Reach 2/3 Area :Major Rehabilitation Evaluation Reports Supplement – Draft Appendices Herbert Hoover Dike Reaches 2 and 3, Appendix G, December 2006
•REMER Hydro-geologic Framework Report, December 2005

FIGURE A-6: HYDRAULIC CONDUCTIVITY CONSIDERED FOR MATERIAL L4 IN THE HHD PHASE 1A MODEL

Herbert Hoover Dike – Conceptual Hydro-Geologic Model
Layer 5 Hydraulic Conductivity



General Description
•Ochopee Limestone member of the Tamiami Formation
•Grey limestone

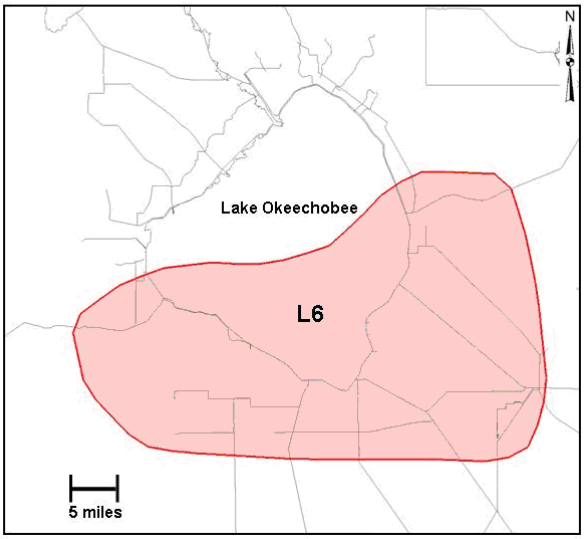
Distribution Methodology
•Uniform distribution across model

Conductivity Range (Kh)
•L5(Low) : 150.0 ft/day
•L5(High) : 750.0 ft/day

Data Source
•REMER Hydro-geologic Framework Report, December 2005

FIGURE A-7: HYDRAULIC CONDUCTIVITY CONSIDERED FOR MATERIAL L5 IN THE HHD PHASE 1A MODEL

Herbert Hoover Dike – Conceptual Hydro-Geologic Model
Layer 6 Hydraulic Conductivity



General Description
•Lower Tamiami Formation
•No conductivity data points in immediate vicinity of HHD model

Distribution Methodology
•Uniform distribution across model

Conductivity Range (Kh)
•L6(Low) : 10.0 ft/day
•L6(High) : 35.0 ft/day

Data Source
•REMER Hydro-geologic Framework Report, December 2005

FIGURE A-8: HYDRAULIC CONDUCTIVITY CONSIDERED FOR MATERIAL L6 IN THE HHD PHASE 1A MODEL

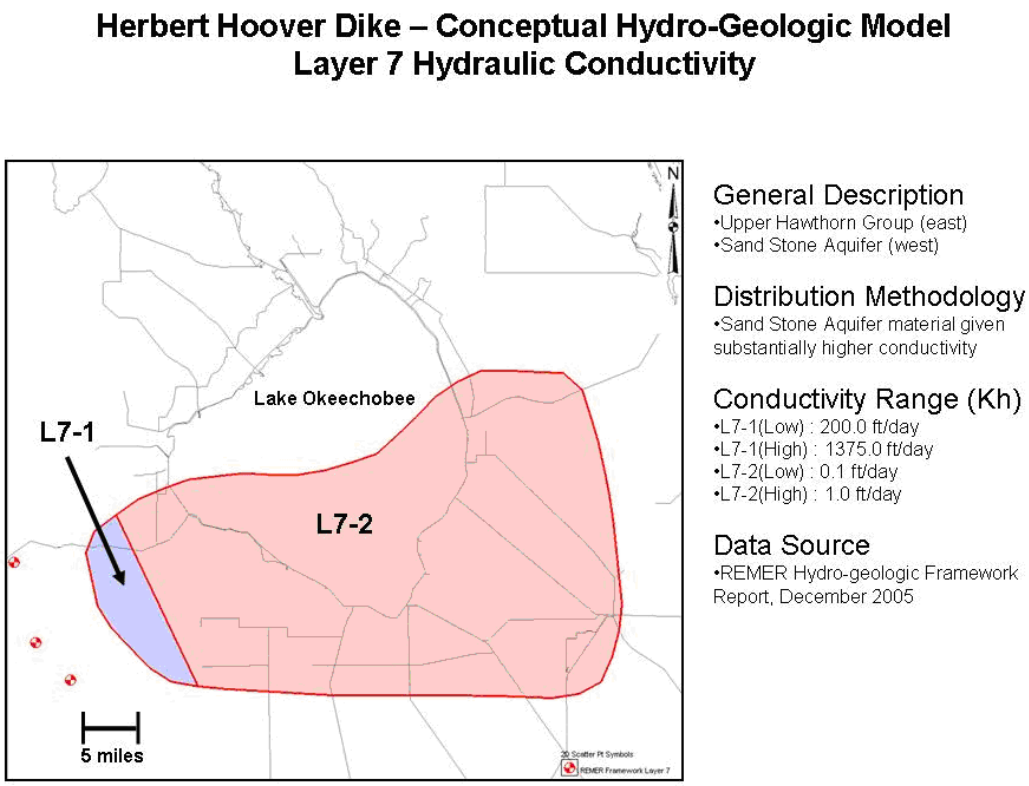


FIGURE A-9: HYDRAULIC CONDUCTIVITY CONSIDERED FOR MATERIALS L7-1 AND L7-2 IN THE HHD PHASE 1A MODEL

A.2.4 Boundary Conditions

The compiled data used to set up the boundary conditions of the HHD Phase 1A model included (1) groundwater heads, (2) canal stages, (3) Lake Okeechobee stages, and (4) rainfall and evapotranspiration.

A.2.4.1 Groundwater Heads

Figure A-10 shows the location of groundwater wells in the vicinity of the model with more than five years of record. Locations marked in red have between five and ten years of data, while locations marked in blue have more than 10 years of data. Groundwater head data was downloaded from the DBHydro data base maintained by South Florida Water Management District (SFWMD) for entire period of record available for each gage. The following description for each gage summarizes the available information. For some gages multiple agencies collected data in the same location. As a result, multiple data sets are available at these locations. **Table A-1** summarizes the canal stage gauges utilized. After screening the collected data, the value of the 95th, 50th, and 5th percentiles were determined for each well location to determine the high, medium, and low values for sensitivity analysis.

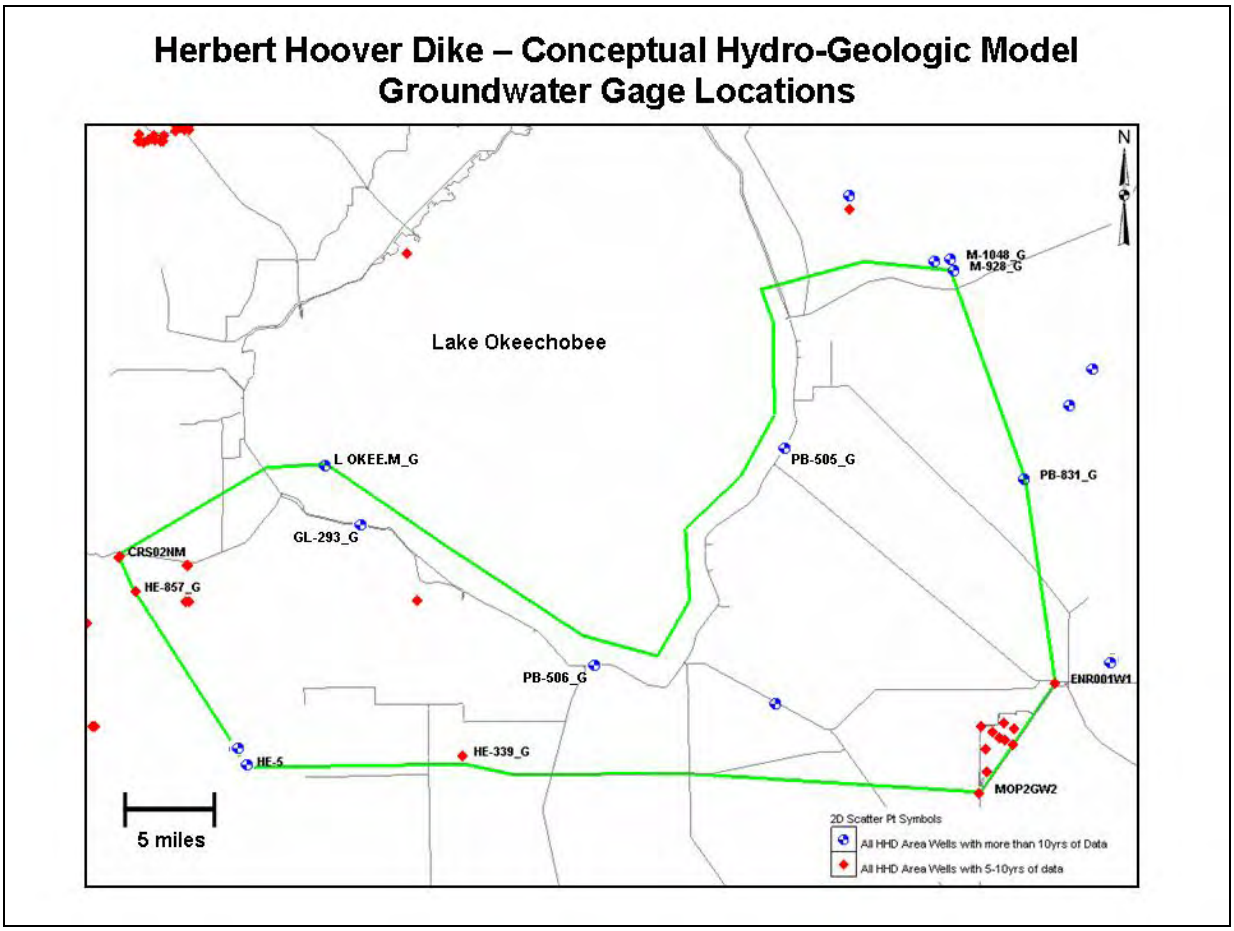


FIGURE A-10: GROUNDWATER HEAD GAGE LOCATIONS CONSIDERED IN THE HHD PHASE 1A MODEL

TABLE A-1: GROUNDWATER STAGES (5TH PERCENTILE USED FOR LOW NET BOUNDARY CONDITIONS)

Well Name	DB Key	Collection Agency	Data Type	Data Start Date	Data End Date	# of Data Values	Max Value	Min Value	95th Percentile	5th Percentile
HE-5	8322	USGS	RAND	29-Oct-80	29-Mar-88	63	26.24	22.29	25.64	22.85
HE-5	TA276	WMD_MOD1	MAX	1-Jan-81	28-Oct-83	903	26.51	22.25	25.75	22.69
HE-339_G	2500	USGS	MAX	1-Oct-73	30-Sep-79	2191	14.74	10.76	13.79	11.39
HE-339_G	2502	USGS	RAND	30-Oct-79	29-Mar-88	86	15.11	10.95	13.31	11.41
MOP2GW1	TA208	WMD_MOD1	MEAN	9-Dec-97	31-Dec-00	1119	14.49	9.5	13.88	10.32
MOP2GW1	H1967	WMD_CR10	MEAN	9-Dec-97	13-Apr-05	2683	14.49	9.5	13.76	11.33
MOP2GW2	H1970	WMD_CR10	MEAN	9-Dec-97	12-Apr-05	2682	14.46	9.49	13.76	11.36
MOP2GW3	H1971	WMD_CR10	MEAN	9-Dec-97	13-Apr-05	2683	14.59	9.4	13.96	11.55
ENR001W1	H1976	WMD_CR10	MEAN	28-Jan-98	5-Mar-07	3297	12.36	8.73	11.46	10.14
ENR001W1	TA207	WMD_MOD1	MEAN	28-Jan-98	31-Dec-00	1069	12.36	9.69	11.43	10.34
ENR001W2	H1977	WMD_CR10	MEAN	28-Jan-98	5-Mar-07	3297	12.37	12.37	11.55	10.23
PB-831_G	2811	USGS	MAX	1-Nov-74	8-Feb-07	11541	23.69	18.53	22.74	19.64
PB-831_G	P0779	WMD_MOD1	MAX	1-Jan-78	31-Dec-04	9620	23.56	18.53	22.75	19.64
M-1048_G	3021	USGS	MAX	25-Sep-74	28-Feb-07	11373	34.05	24.65	32.00	26.30
M-1048_G	TA198	WMD_MOD1	MAX	1-Jan-81	31-Dec-00	7014	33.81	25.85	32.03	26.52
M-928_G	3019	USGS	MAX	1-Oct-73	27-Apr-77	1305	31.98	26	30.98	26.22
M-928_G	3020	USGS	MEAN	20-May-57	30-Sep-73	1155	33.35	20.7	32.56	27.13
CRS02FM	L7465	WMD_CR10	MEAN	3-Nov-99	23-Feb-07	2501	15.59	10.95	14.83	11.70
CRS02FM	UD287	WMD_CR10	MEAN	3-Nov-99	11-Jan-06	2262	15.59	10.95	14.84	11.73
CRS02FS	L7464	WMD_CR10	MEAN	3-Nov-99	23-Feb-07	2587	15.37	9.22	14.36	10.26
CRS02FS	TA204	WMD_MOD1	MEAN	3-Nov-99	31-Dec-00	425	13.69	9.62	13.41	9.88
CRS02NM	L7449	WMD_CR10	MEAN	4-Nov-99	23-Feb-07	2668	14.01	10.38	13.23	11.72
CRS02NM	UD379	WMD_MOD1	MEAN	4-Nov-99	17-Oct-05	2175	13.85	10.38	13.25	11.72
CRS02NS	L7448	WMD_CR10	MEAN	4-Nov-99	23-Feb-07	2614	12.86	9.15	12.19	10.69
CRS02NS	TA205	WMD_MOD1	MEAN	4-Nov-99	31-Dec-00	424	12	10.66	11.79	10.76
HE-857_G	2755	USGS	RAND	9-Oct-85	29-Mar-88	31	20.91	18.16	20.82	18.56
PB-505_G	2830	USGS	MAX	1-Oct-73	30-Sep-86	4661	14.92	9.91	14.45	10.8
PB-506_G	2684	USGS	MAX	26-Sep-73	30-Sep-86	4254	12.6	7.44	11.10	8.86
PB-506_G	2685	USGS	MEAN	5-Nov-69	30-Sep-73	255	12.02	8.74	11.62	9.03
GL-293_G	2797	USGS	MAX	28-Sep-73	30-Sep-86	3923	14.43	8.04	13.62	10.44
GL-293_G	TA211	WMD_MOD1	MAX	9-Jan-81	30-Sep-86	1790	14.27	9.46	13.33	10.37
L OKEE.M_G	JO082	WMD_CR10	MEAN	1-Jul-99	1-Apr-07	2826	18.1	12.84	16.8	12.85
L OKEE.M_G	TA224	WMD_MOD1	MEAN	1-Jan-81	1-Jul-99	6352	18.69	10.74	17.18	11.88

HE-5: This gage is located in Hendry County in the southwestern portion of the HHD Phase 1A model domain. The well has a total depth of 13 ft and is screened at a depth of 8.7 to 13 ft. Two data sets exist in DBHydro for this gage. The maximum data set value is 26.51 ft NGVD29 and the minimum data set value is 22.25 ft NGVD29.

HE-339_G: This gage is located in Hendry County in the southern potion of the HHD Phase 1A model domain. The well has a total depth of 13 ft and is screened at a depth of 11 to 13 ft. Three data sets exist in DBHydro for this gage. The data set collected between 5APR64 and 30SEP73 appears to be significantly lower than the data collected in subsequent years. According to SAJ-EN-GG, this discrepancy may be due to survey elevation corrections with modern technology or the conversions from Price Stage Flow Meters with pen & ink instrumentation to radio control telemetry systems. Because this data appears to be suspect, it was not used in defining the model boundary conditions. For these two data sets, the maximum data set value is 15.11 ft NGVD29 and the minimum data set value is 10.76 ft NGVD29.

MOP2GW1, MOP2GW2, and MOP2GW3: This gage cluster is located in Palm Beach County at the southern end of STA1W in the southeastern potion of the HHD Phase 1A model domain. The three wells in this cluster are in essentially the same horizontal location and have varying depths. MOP2GW1 is the deepest is screened at a depth of 99.65 to 101.65 ft. MOP2GW3 is the shallowest is screened at a depth of 29.5 to 31.5 ft. MOP2GW2 is screened at a depth of 57.26 to 59.26 ft., between the other two wells in the cluster. Generally, the data shows a

slight downward gradient in this area, with the water level in the shallower well being 0.2 foot higher than the deeper well on average. This may be the result of water level fluctuations in the adjacent storm treatment area. Although this downward gradient does increase at times to approximately 0.5 foot for the purposes of this Phase 1A model the water levels in this location was treated as hydrostatic. For these three wells, the maximum data set value is 14.59 ft NGVD29 and the minimum data set value is 9.4 ft NGVD29.

ENR001W1 and ENR001W2: This gage cluster is located in Palm Beach County at the northern end of WCA1. The two wells in this cluster are in essentially the same horizontal location and have varying depths. ENR001W1 is the deeper well and is screened at a depth of 101.1 to 102.1 ft. ENR001W2 is the shallower well and is screened at a depth of 62.97 to 64.97 ft. Generally, the data shows a slight downward gradient in this area, with the water level in the shallower well being less than 0.1 foot higher than the deeper well on average. Although this downward gradient does increase at times to approximately 0.89 foot for a short period of time, for the purposes of this Phase 1A model the water levels in this location was treated as hydrostatic. For these two wells, the maximum data set value is 12.37 ft NGVD29 and the minimum data set value is 8.73 ft NGVD29.

PB-831_G: This gage is located in Palm Beach County in the eastern potion of the HHD Phase 1A model domain. The well has a total depth of 25 ft and is screened at a depth of 21 to 25 ft. Two data sets exist in DBHydro for this gage. The data sets appear to be consistent with one another, with the maximum data set value is 23.69 ft NGVD29 and the minimum data set value is 18.53 ft NGVD29.

M-1048_G and M-928_G: These gages are located in Martin County at the northeastern potion of the HHD Phase 1A model domain. These two wells are located horizontally within 100 ft of one another but have varying depths. M-1048_G appears to be the deeper well and is screened at a depth of 25 to 80 ft. M-928_G appears to be the shallower well with a total depth of 11 ft. The periods of record for these wells only overlap between 25SEP74 and 27APR77. The data from these two wells during that period appear to be relatively consistent. Consequently, the water level in this area was treated as hydrostatic. For M-1048_G, the maximum data set value is 34.05 ft NGVD29 and the minimum data set value is 24.65 ft. NGVD29. For M-928_G, the maximum data set value is 33.35 ft NGVD29 and the minimum data set value is 20.7 ft NGVD29.

CRS02FM, CRS02FS, CRS02NM and CRS02NS: This gage cluster is located in Glades County in the vicinity of Lake Hicpochee in the northwestern potion of the HHD Phase 1A model domain. The four wells are installed in clusters of two, which are approximately 350 ft apart from each another. Each well pair has varying depths. The CRS02NM and CRS02NS well pair is approximately 300 ft south of the Caloosahatchee River. CRS02NM is the deeper well of the pair and is screened at a depth of 54.01 to 59.01 ft. CRS02NS is the shallower well of the pair and is screened at a depth of 17.4 to 22.4 ft. The CRS02FM and CRS02FS well pair is approximately 650 ft south of the Caloosahatchee River. CRS02FM is the deeper well of the pair and is screened at a depth of 38.45 to 43.45 ft. CRS02FS is the shallower well of the pair and is screened at a depth of 17.43 to 22.43 ft. In both well pairs there appears to be a distinct upward gradient. In the CRS02NM and CRS02NS well pair, the

water level in the shallower well is approximately 0.94 foot lower than the deeper well on average, with differentials of up to 1.76 ft. In the CRS02FM and CRS02FS well pair, the water level in the shallower well is approximately 0.88 foot lower than the deeper well on average, with differentials of up to 1.95 ft. In addition to the differentials observed in the well pairs, the wells closer to the Caloosahatchee River (CRS02NM and CRS02NS) appear to be on average several ft lower than the wells further to the south (CRS02FM and CRS02FS). This tends to indicate that the Caloosahatchee River is a groundwater sink in this area. Due to the significant differences in the observed head within this well cluster, the water levels in the shallower wells was used to set the 3-D total head boundary conditions in Layers 1, 2, and 3, while the water levels in the deeper wells was used to set the 3-D total head boundary conditions in Layers 5 and 6.

HE-857_G: This gage is located in Hendry County in the western potion of the HHD Phase 1A model domain. The well has a total depth of 20 ft and is screened at a depth of 12 to 20 ft. Two data sets exist in DBHydro for this gage. The data set that runs between 09NOV77 and 05NOV79 shows a constantly decreasing trend, which may indicate a bad transducer. Because this data appears to be suspect, it was not be used in defining the model boundary conditions. The remaining data set is comprised of a limited number of points, bit was still considered useful for assigning boundary conditions. The maximum data set value is 20.91 ft NGVD29 and the minimum data set value for the remaining data is 18.16 ft NGVD29.

In addition to the groundwater wells discussed above, four additional gages were identified in the immediate vicinity of Lake Okeechobee. The water levels in these four wells were compared to the Lake Okeechobee stage to determine if a hydrostatic groundwater boundary condition assumption based on the Lake stage was appropriate.

PB-505_G: This gage is located in Palm Beach County along the perimeter of Lake Okeechobee, north of the L-10 canal. The well has a total depth of 15.6 ft. The maximum data set value for the well is 14.92 ft NGVD29 and the minimum data set value is 9.91 ft NGVD29. During the overlapping period of record, it appears that the water level in the well is generally below the lake stage under high stage conditions. However, as the lake stage drops, the water level in the well approaches that of the lake stage. Layer 2 is approximately 10-foot thick in this area. Because Layer 2 is comprised of lower permeability materials, it may be dampening the groundwater response to lake stage fluctuations.

PB-506_G: This gage is located in Palm Beach County along the perimeter of Lake Okeechobee, near S3 and S354. The well has a total depth of 15.3 ft and is screened at a depth of 11.4 to 15.3 ft. The maximum data set value for the well is 12.6 ft NGVD29 and the minimum data set value is 7.44 ft NGVD29. During the overlapping period of record, it appears that the water level in the well is generally below the lake stage. The thickness of Layer 2 varies between 5 and 10 ft in this area. Again, because Layer 2 is comprised of lower permeability materials, it may be dampening the groundwater response to lake stage fluctuations.

GL-293_G: This gage is located in Glades County along the perimeter of Lake Okeechobee, near S4. The well has a total depth of 9.0 ft and is screened at a depth of 5.0 to 9.0 ft. The maximum data set value for the well is 14.43 ft NGVD29 and the minimum data set value is

8.04 ft NGVD29. During the overlapping period of record, it appears that the water level in the well is generally below the lake stage under high stage conditions. However, as the lake stage drops, the water level in the well approaches that of the lake stage. The thickness of Layer 2 varies between 5 and 10 ft in this area. With lower permeability materials in Layer 2, it may be dampening the groundwater response to lake stage fluctuations.

L OKEE.M_G: This gage is located in Glades County within the perimeter of Lake Okeechobee, near the Caloosahatchee River. No depth or screen information was available. The maximum data set value for the well is 18.69 ft NGVD29 and the minimum data set value is 10.74 ft NGVD29. During the overlapping period of record, it appears that the water level in the well generally matches the lake stage, except under low stage conditions. This trend does not match that seen in the other perimeter lake wells. One reason for this discrepancy may be due to the thin to non-existent peat, clay and silt (Layer 2) in this area. This puts the lake in direct contact with the more permeable sands the well is screened in. This allows the groundwater level to fluctuate with the lake when Lake Okeechobee is acting as a source to groundwater (higher stage periods). However, as the lake level drops the regional groundwater flow begins to control the water levels in the well. During these periods, groundwater flow appears to flow into Lake Okeechobee.

Due to the differences noted above in the wells along the perimeter of Lake Okeechobee, boundary conditions assigned to the groundwater may differ from the lake stage boundary applied to the surface of the model. This variation in the application of groundwater boundary conditions is consistent with the findings of the System Wide Water Resources Program regional demonstration model developed by ERDC during 2006.

A.2.4.2 Canal Stages

Figure A-12 shows the location of the surface water canal gages in the vicinity of the model with more than five years of record. Stage data was also downloaded from the SFWMD's DBHydro data base for the available period of record for each gage. Stage data for the canals within the model domain were applied to the surface of the model as constant head boundary conditions, which allowed these canals to act as either sources or sinks to groundwater in the HHD Phase 1A model, depending on the other hydro-geologic parameters in the model. Like the groundwater head data, the surface water stage data was collected, processed, and reviewed by NAP and ERDC for its suitability in the Phase 1A model. The values for the 95th, 50th, and 5th percentiles were determined for each data set. These values are defined as the high, medium, and low values for sensitivity analysis. **Table A-2** summarizes the canal stages used for the model boundary conditions.

S153 and S308: These structures are located in Martin County at the confluence of Lake Okeechobee and the St. Lucie Canal (C-44). The headwater stage of S308 reflects the Lake Okeechobee stage, while the tail water stage reflects the stage at the eastern extent of the St. Lucie Canal. The headwater stage of S153 reflects the stage in the Lake Okeechobee exterior perimeter canal C-44A, while the tail water stage reflects the stage at the eastern extent of the St. Lucie Canal.

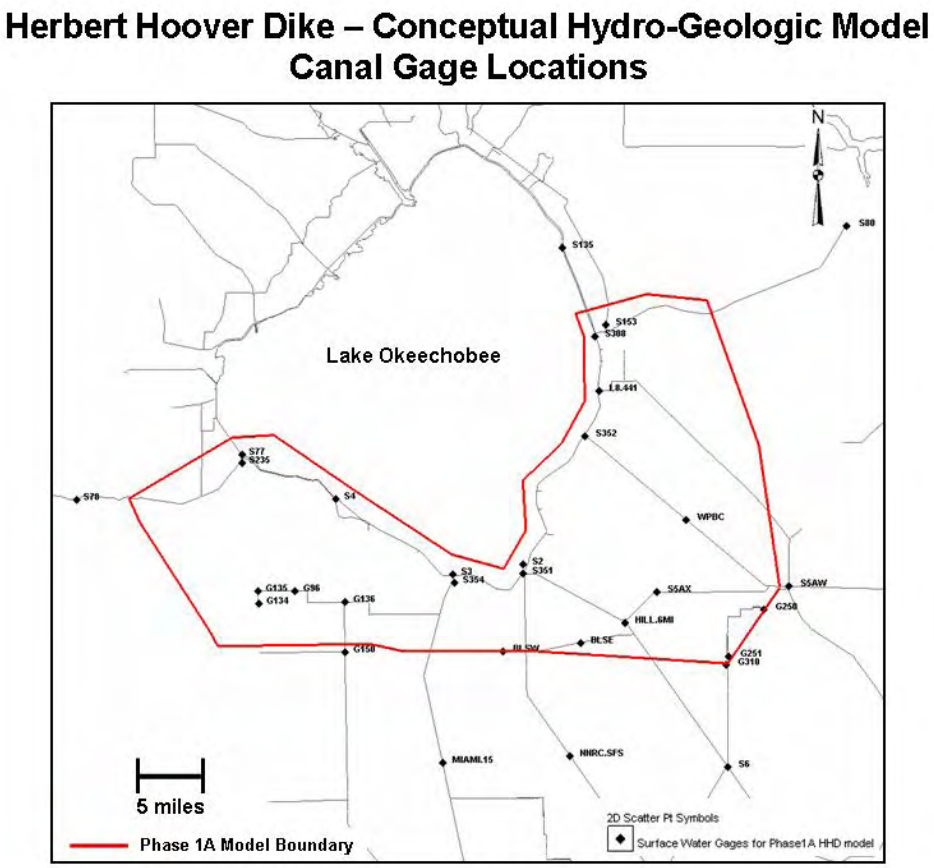


FIGURE A-11: CANAL WATER STAGE GAGE LOCATIONS CONSIDERED IN THE HHD PHASE 1A MODEL

TABLE A-2: CANAL STAGE DATA (5TH PERCENTILE USED FOR LOW NET BOUNDARY CONDITION)

Well Name	DB Key	Collection Agency	Data Type	Data Start Date	Data End Date	# of Data Values	Max Value	Min Value	95th Percentile	5th Percentile
S308_H	TA368	COE	MEAN_MOD1	29660	37621	7716	18.7	8.83	17.33	11.04
S308_T	TA370	WMD	MEAN_MOD1	29660	37621	7715	18.03	8.78	14.85	10.75
S80_H	TA256	WMD	MEAN_MOD1	32051	36691	4830	16.95	9.55	14.53	11.45
S80_T	TA259	WMD	MEAN_MOD1	32052	34739	2621	3.19	-0.83	1.53	-0.17
L8.441	P0817	WMD	MEAN_MOD1	29491	36352	9809	19.04	8.59	16.10	10.86
S352_H	TA371	WMD	MEAN_MOD1	29491	37621	9131	18.66	8.73	17.35	10.97
S352_T	TA372	WMD	MEAN_MOD1	29491	37621	9105	14.31	7.15	12.17	9.49
S5AW_H	TA380	WMD	MEAN_MOD1	31444	37621	6178	12.37	7.68	11.54	9.04
S5AW_T	TA381	WMD	MEAN_MOD1	36978	37621	644	17.82	9.45	16.02	10.11
S351_H	M7418	WMD	MEAN	36607	39146	2540	18.17	9.35	16.78	10.30
S351_T	M7419	WMD	MEAN	36607	39146	2539	12.49	8.96	11.65	9.73
S4_H	TA221	WMD	MEAN_MOD1	29567	36691	7219	14.03	8.24	12.76	10.44
S4_T	TA223	WMD	MEAN_MOD1	29567	36691	7103	18.78	9.76	17.37	11.27
S3_H	6633	WMD	MEAN_TELE	31198	39145	7852	13.03	8.14	11.85	9.84
S3_T	6634	WMD	MEAN_TELE	31228	39145	7848	18.82	9.06	17.13	11.41
S2_H	6562	WMD	MEAN_TELE	31198	39145	7864	13.15	8.87	11.87	9.86
S2_T	6566	WMD	MEAN_TELE	31198	39145	7878	18.9	9.39	17.14	11.38
S135_H	15803	WMD	MEAN_TELE	34590	39145	4554	18.67	8.86	17.47	11.10
S135_T	15802	WMD	MEAN_TELE	34590	39145	4555	14.82	8.82	13.63	11.25
S354_H	M7437	WMD	MEAN_CR10	36622	39146	2525	18.26	9.06	16.63	10.37
S354_T	M7438	WMD	MEAN_CR10	36622	39146	2517	12.73	8.83	11.69	9.64
G404_H	NV6816	WMD	MEAN_TELE	37284	39149	1866	11.86	9.39	11.28	9.79
G404_T	NV6817	WMD	MEAN_TELE	37284	39149	1866	14.77	8.42	14.40	10.47
S77_H	JB168	WMD	MEAN_OMD	35932	37826	1895	17.78	8.78	16.39	9.97
S77_T	J1497	WMD	MEAN_OMD	35932	37826	1895	11.79	8.74	11.36	9.82
S78_H	JB165	WMD	MEAN_OMD	35932	37826	1895	11.73	8.79	11.39	9.91
S78_T	JB166	WMD	MEAN_OMD	35932	37826	1865	5.09	2.18	3.37	2.70
S5AX_H	6660	WMD	MEAN_TELE	31198	38558	5325	13.88	6.22	11.65	9.61
S5AX_T	6661	WMD	MEAN_TELE	31198	36446	4836	15.61	6.27	11.72	9.86
WPBG	5519	WMD	MEAN_TELE	31290	38600	7451	12.96	7.44	11.43	9.30
BLSE	G5163	WMD	MEAN_TELE	35446	39147	3692	14.34	8.53	11.90	9.65
BLSAN	G5164	WMD	MEAN_TELE	35446	39133	3267	13.4	8.84	12.16	10.25
HILL.6MI	4136	WMD	MEAN_TELE	31290	38608	6865	14.08	7.54	11.61	9.64
MIAMI.15	3122	WMD	MEAN_TELE	31290	38103	6678	12.6	7.92	11.85	9.97
S6_H	6664	WMD	MEAN_TELE	31198	39146	7876	12.6	7.59	11.46	9.12
S6_T	6665	WMD	MEAN_TELE	31198	39146	7852	18.16	9.75	17.04	12.11
S8_H	6697	WMD	MEAN_TELE	31290	39140	7851	13.25	7.91	12.14	9.69
S8_T	6698	WMD	MEAN_TELE	31290	39140	7824	14.95	6.36	14.00	9.42
NNRC.SFS	5581	WMD	MEAN_TELE	31444	39142	7591	13.2	7.73	11.77	9.98
S153_H	5159	WMD	MEAN_TELE	31198	39141	7931	19.75	18.07	19.24	18.69
S153_T	5163	WMD	MEAN_TELE	31198	39141	7934	17.88	8.9	14.63	11.24
S235_H	TA216	WMD	MEAN_MOD1	29567	36691	7305	14.22	7.31	12.54	10.34
S235_T	TA218	WMD	MEAN_MOD1	29567	36691	7305	12.69	8.88	11.50	10.59
S5AS_H	P N154	WMD	Mean_MOD2	29491	37986	9496	19.33	8.38	16.09	10.45
S5AS_T	6693	WMD	MEAN_TELE	31198	39180	7842	18.98	9.89	17.12	12.18
G134_H	TA243	WMD	MEAN_MOD1	31594	36717	6998	22.57	17.03	20.44	17.65
G134_T	TA245	WMD	MEAN_MOD1	31594	36717	7108	21.43	15.43	19.28	17.13
G135_H	TA250	WMD	MEAN_MOD1	31594	36717	7108	21.16	15.38	19.21	16.90
G135_T	TA251	WMD	MEAN_MOD1	31594	36717	7108	20.03	12.53	17.67	15.91
G136_H	TA235	WMD	MEAN_MOD1	30426	36717	6292	17.35	9.88	14.50	11.37
G136_T	TA237	WMD	MEAN_MOD1	30426	36717	6292	15.57	8.82	12.42	10.11
G96_H	TA252	WMD	MEAN_MOD1	31594	36717	7108	18.01	10.31	16.68	12.71
G96_T	TA253	WMD	MEAN_MOD1	31594	36717	7108	17.15	10.02	14.52	11.37
G150_H	15521	WMD	MEAN_CR10	33951	39160	4767	18.75	10.68	16.51	11.88
G150_T	15522	WMD	MEAN_CR10	33951	39160	4767	17.38	8.32	14.55	11.09
G250S_H	15870	WMD	MEAN_TELE	34556	39173	4618	11.43	6.56	8.75	7.17
G250_H	15869	WMD	MEAN_TELE	34215	39173	2001	12.12	7.45	11.52	9.19
G250_T	16217	WMD	MEAN_TELE	34215	39173	4914	14.66	6.91	13.40	11.21
G251_H	16218	WMD	MEAN_TELE	34256	39173	4890	13.64	8.12	12.32	9.77
G251_T	16219	WMD	MEAN_TELE	34219	39173	4915	18.43	12.06	17.31	14.63
G310_H	M5154	WMD	MEAN_DWR	36685	37833	1149	9.99	7.22	9.49	8.06
G310_T	M5155	WMD	MEAN_DWR	36685	37833	1149	17.95	11.51	17.25	14.03

L8.441: This gage is located in Palm Beach County at the confluence of Lake Okeechobee and the L8 canal. Since this gage is not a structure used to control flow, only one set of data is available at this gage. The data at this gage shows significantly more variability than that of the Lake Okeechobee gages in the area. These fluctuations are most likely due to fluctuations in drainage to the L8 canal and are not representative in fluctuation of the lake level.

S352: This gage is located in Palm Beach County at the confluence of Lake Okeechobee and the L10 canal. The headwater stage of S352 reflects the Lake Okeechobee stage, while the tail water stage reflects the stage at the heads of the L10 canal.

S351 and S2: These structures are located in Palm Beach County at the confluence of Lake Okeechobee, L14 and L20. S351 is a gated structure that allows water to pass from Lake Okeechobee to the L14 and L20 canals. S2 is a pump station that pumps canal water into Lake Okeechobee. The headwater stage of S351 reflects the Lake Okeechobee stage, while the tail water stage reflects the stage of the downstream canals. The headwater stage of S2 reflects the stage of the downstream canals, while the tail water stage reflects the stage in the Lake Okeechobee.

S354 and S3: These structures are located in Palm Beach County at the confluence of Lake Okeechobee and the L25 canal. S354 is a gated structure that allows water to pass from Lake Okeechobee to the L25 canal. S3 is a pump station that pumps canal water into Lake Okeechobee. The headwater stage of S354 reflects the Lake Okeechobee stage, while the tail water stage reflects the stage of the downstream canal. The headwater stage of S3 reflects the stage of the downstream canals, while the tail water stage reflects the stage in the Lake Okeechobee.

S4: This pump station is located in Glades County at the confluence of Lake Okeechobee and the C20 perimeter canal. The headwater stage of S4 reflects the perimeter canal, while the tail water stage reflects the Lake Okeechobee stage.

S77 and S235: These structures are located in Glades County at the confluence of Lake Okeechobee and the Caloosahatchee River (C-43). The headwater stage of S77 reflects the Lake Okeechobee stage, while the tail water stage reflects the stage of the Caloosahatchee River. The headwater stage of S235 also reflects the stage of the Caloosahatchee River, while the tail water stage reflects the stage in the LD-3 perimeter canal. Because the stage data for S77 is limited, the model used the headwater data from S235 for the Caloosahatchee River and the interior lake gage, L0005, for Lake Okeechobee in this area.

BLSW, BLSE, and HILL.6MI: These gages are located in Palm Beach County along the Bolles Canal. Because these gages are not structures used to control flow, only one set of data is available at each gage.

S5AX: This gage is located in Palm Beach County along Ocean Canal. The headwater and tail water stage of S5AX are similar during the available period of record.

S5AS and S5AW: These structures are located in Palm Beach County at the northern end of Water Conservation Area 1(WCA-1). The headwater stage of S5AS reflects the stage in the L8 canal, while the tail water stage reflects the stage at in WCA-1. The headwater stage of S5AW reflects the stage in L10, while the tail water stage reflects the stage in the L8 canal. Because the tail water stage data for S5AW is limited, the model used the headwater data from S5AS for the L8 canal.

WPBC: This gage is located in Palm Beach County along the L10 canal. Because this gage is not a structure used to control flow, only one set of data is available at this gage.

G134: This gage is located in Hendry County and is a single-barreled corrugated metal pipe culvert, located about one mile below the outlet of the Montura Ranch Estates Reservoir, at the south end of Flaghole Road, about a mile south of Canal L1. The headwater of G134 is to the south of the structure, while the tail water is to the north along the L1 canal.

G135: This gage is located in Hendry County and is a single-barreled corrugated metal pipe culvert, located at the south boundary of the Flaghole Drainage District. Control is affected by stop logs in a riser at the south end of the culvert. The headwater of G135 is to the south of the structure, while the tail water is to the north along the L1 canal.

G96: This gage is located in Hendry County and is a double-barreled, corrugated metal pipe culvert, located in a plug in the L1 borrow canal about three miles east of Flag Hole Road. The headwater of G96 is to the west of the structure, while the tail water is to the east along the L1 canal.

G136: This gage is located in Hendry County and is a three-barreled corrugated metal pipe culvert, located at the bend in L1 about three miles north of SR 832. Control is affected by stop logs in risers in each culvert. The headwater of G136 is to the west of the structure, while the tail water is to the east along the L1 canal.

G150: This gage is located in Hendry County and is a three-barreled corrugated metal pipe culvert, located at the divide line of L-1 and L-2. Control is affected by slide gates at the south side of the culverts. The headwater of G150 is to the north of the structure, while the tail water is to the south.

G251 and G310: These structures are located in Palm Beach County at the southeast corner of the Everglades Nutrient Removal Project. G310 is a pump station located at the south corner of STA-1W. The G251 pump station is located to the east of G310 and is used to pump treated agricultural runoff water from the ENR project into Water Conservation Area 1. The headwater stage of G310 is on the northern side of the pump station, while the tail water is on the southern side of the pump station. The headwater stage of G251 reflects the stage on the western side of the pump station, while the tail water stage reflects the stage on the eastern side of the pump station.

In addition to the gages discussed above, data were collected for the S78, S80, S135, G404, MIAMI_15, S6, S8, and NNRC.SFS surface water gages. Although these gages are not within the model domain, the data from these gages were interpolated to set surface water boundary conditions within the model.

A.2.4.3 Lake Stages

In addition to the structure headwater stage data mentioned above, four stage gages were used to determine lake levels in the interior of Lake Okeechobee. The locations of these gages are shown on **Figure A-12**. Although data were collected for these gages (**Table A-3**), the data was not used in the Phase 1A modeling effort. The data from these gages are similar to the headwater data of the gate structures around the lake. The headwater data for the structures were used to set the lake stage boundary conditions because the headwater data are more consistent with the heads along the model boundary.

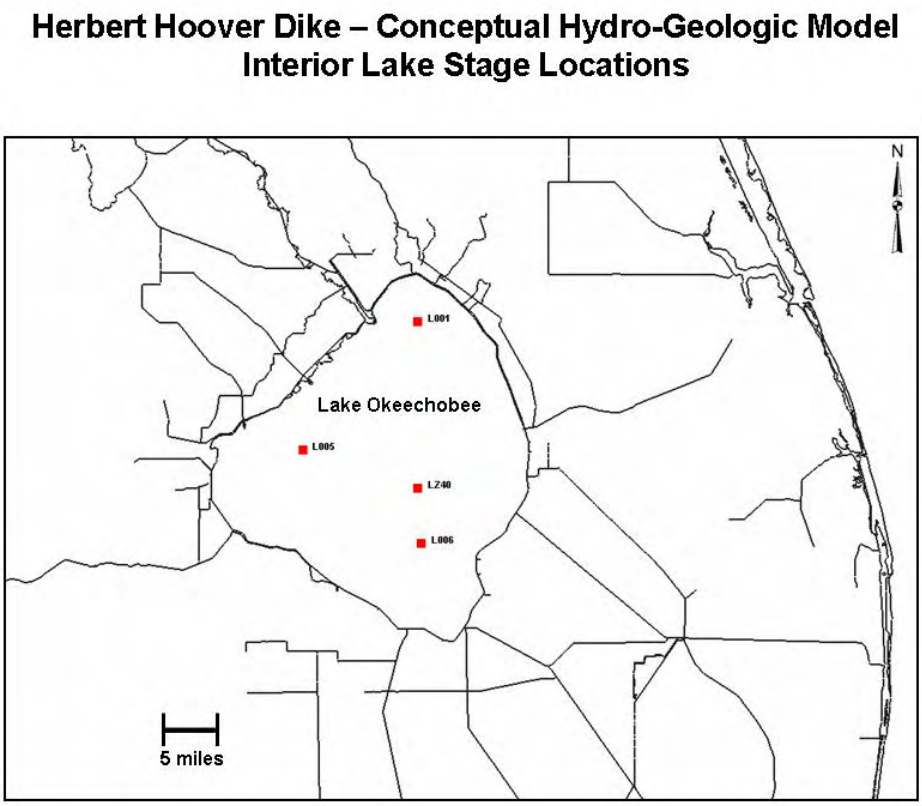


FIGURE A-12: LAKE OKEECHOBEE WATER STAGE GAGE LOCATIONS CONSIDERED IN THE HHD PHASE 1A MODEL

TABLE A-3: SUMMARY OF AVAILABLE LAKE OKEECHOBEE STAGE DATA

Well Name	DB Key	Collection Agency	Data Type	Data Start Date	Data End Date	# of Data Values	Max Value	Min Value	95th Percentile	5th Percentile
L001	16022	WMD	MEAN_CR10	34550	39174	4577	18.99	8.87	17.29	10.88
L006	12519	WMD	MEAN_CR11	33053	39171	5381	18.68	8.86	17.18	11.27
LZ40	16265	WMD	MEAN_CR12	33045	39173	5126	18.7	9.06	17.23	11.14
L005	12509	WMD	MEAN_CR13	32744	39174	5783	18.51	8.84	17.34	11.40

Well Name	DB Key	NGVD29 Maximum	NGVD29 Median	NGVD29 Minimum	Conversion Factor	NAVD88 Maximum	NAVD88 Median	NAVD88 Minimum
L001	16022	**17.29**	**15.12**	**10.88**	-1.217	**16.08**	**13.90**	**9.66**
L006	12519	**17.18**	**15.08**	**11.27**	-1.201	**15.92**	**13.82**	**10.01**
LZ40	16265	**17.23**	**14.98**	**11.14**	-1.26	**16.00**	**13.75**	**9.91**
L005	12509	**17.34**	**15.07**	**11.40**	-1.23	**16.14**	**13.87**	**10.20**

A.2.4.4 Groundwater Net Recharge

Precipitation is generally the primary mechanism for recharging the groundwater system. However, only a portion of precipitation recharges the groundwater due to evapotranspiration, surface runoff, and other factors. The net recharge is the portion of precipitation that infiltrates the groundwater table. According to Appendix A of the EAA Storage Reservoir Revised Draft PIR and EIS, dated February 2006, the average annual precipitation in this area is approximately 55 inches per year. However, this report also notes that "extensive dewatering and pumping operations greatly affect the amount of recharge able to reach the water table". Consequently, it was determined that the maximum net recharge for this area is about 5 inches per year. The low net recharge condition was assumed to be zero inches per year.

A.2.4.5 Groundwater Usage and Withdrawal

Approximately 290 groundwater pumping wells are permitted in the Surficial Aquifer System (SAS) within the Phase 1A model domain. Although actual groundwater withdrawal rates were not available for all wells, the pump capacities for these wells were available based on data obtained from SFWMD and well permits. The location of the wells within the Phase 1A model domain (outlined in red) in **Figure A-13**. A list of the wells and associated capacities included in the model are available in **Table A-4**. Since this is a steady-state model, the pump operations are not varied through time and therefore the model assumes the pumps are running at the maximum permitted capacity continuously. Each well location is color coded by the pump capacity for the well. The majority of the wells within the model domain have pump capacities below 250,000 cubic feet per day. Several wells were identified with expired permits. These wells were not modeled. For the sensitivity analysis simulation, a pumping rate of zero cubic feet per day was used as the minimum pumping value, while the pump capacity at each well was used as the maximum pumping value. The half capacity values were taken as the medium pumping values.

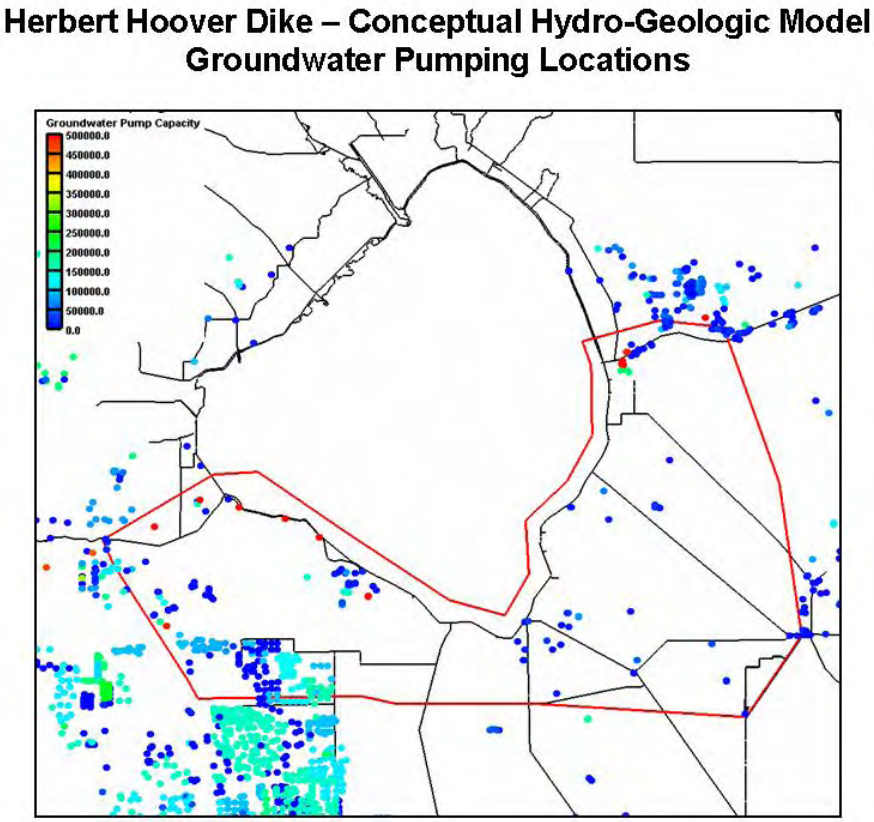


FIGURE A-13: GROUNDWATER PUMPING LOCATIONS CONSIDERED IN THE HHD PHASE 1A MODEL

TABLE A-4: WELLS UTILZED IN THE MODEL

PERMIT NO	PROJECT NAME	NAME	X	Y	AQUIFER	PUMP CAPACITY(cfd)	WELL DIAMETER(in)	CASED DEPTH (ft)	WELL DEPTH(ft)
26-00514-W	AG MECH CITRUS GROVE	1	604081	867935	Tamiami	123,209	10	75	120
26-00740-W	ALFREDO AND FABIAN GARCIA	WELL #1	608100	865972	Aquifer	1,925	4	100	120
26-00740-W	ALFREDO AND FABIAN GARCIA	WELL #2	608412	865788	Aquifer	15,401	4	100	140
26-00631-W	ALICO HILLIARD LANDS	12	610338	851580	Tamiami	96,257	10	90	120
26-00631-W	ALICO HILLIARD LANDS	13	610484	854935	Tamiami	96,257	10	90	120
26-00631-W	ALICO HILLIARD LANDS	14	611242	850344	Tamiami	96,257	10	90	120
26-00631-W	ALICO HILLIARD LANDS	15	612557	851660	Tamiami	96,257	10	90	120
43-00418-W	ALPAT GROVES	5/40/38	803643	977573	Aquifer	96,257	10	105	125
22-00220-W	ALVIN WARD BOAT RAMP FACILITY	1	629982	909556	Aquifer	3,369	4	25	40
26-00720-W	AQUALIFE USA INC	1	601785	872290	Tamiami	14,439	4	110	140
26-00720-W	AQUALIFE USA INC	2	601710	872320	Tamiami	14,439	4	110	140
26-00720-W	AQUALIFE USA INC	3	601960	872320	Tamiami	14,439	4	110	140
26-00486-W	ARBULUT TREE NURSERY	1	602257	870452	Tamiami	115,508	10	60	80
50-02925-W	ATLANTIC SUGAR ASSOCIATION	R-2	829724	836492	Aquifer	0	6	4	19
50-02925-W	ATLANTIC SUGAR ASSOCIATION	R-1	829724	836492	Aquifer	1,348	6	4	19
50-03555-W	ATLANTIC SUGAR MILL	P1	829662	836377	Aquifer	12,898	6	40	50
50-03555-W	ATLANTIC SUGAR MILL	P2	829665	836635	Aquifer	12,898	6	40	50
26-00318-W	BAYROCK GROVES	4	616548	848673	Tamiami	86,631	10	90	140
26-00318-W	BAYROCK GROVES	5	617924	848669	Tamiami	86,631	10	80	140
26-00318-W	BAYROCK GROVES	7	620572	848920	Tamiami	86,631	10	129	159
26-00318-W	BAYROCK GROVES	8	623358	852488	Tamiami	86,631	10	131	171
26-00318-W	BAYROCK GROVES	9	622782	849802	Tamiami	86,631	10	80	130
26-00318-W	BAYROCK GROVES	10	624735	851388	Tamiami	86,631	10	85	125
26-00318-W	BAYROCK GROVES	11	624632	849856	Tamiami	86,631	10	85	125
26-00318-W	BAYROCK GROVES	12	626043	849768	Tamiami	86,631	10	92	132
26-00318-W	BAYROCK GROVES	1	619921	850413	Tamiami	86,631	10	169	217
26-00318-W	BAYROCK GROVES	6	617468	852865	Tamiami	86,631	10	176	216
26-00318-W	BAYROCK GROVES	13	619327	852894	Tamiami	86,631	10	180	220
26-00318-W	BAYROCK GROVES	15	616066	851421	Tamiami	86,631	10	175	215
26-00318-W	BAYROCK GROVES	3	618019	850131	Tamiami	86,631	10	132	172
26-00318-W	BAYROCK GROVES	14	626533	851558	Tamiami	86,631	10	80	120
26-00318-W	BAYROCK GROVES	2	616880	850097	Tamiami	86,631	10	132	172
50-03513-W	BELLE GLADE ELEMENTARY SCHOOL	WELL	763622	859007	Aquifer	9,626	4	30	50
50-07373-W	BIG LAKE PLAZA	1	763418	851193	Aquifer	11,551	3	80	100
43-00732-W	BLOODS HAMMOCK GROVE - BLOCK 33	32-2	805363	978058	Aquifer	11,551	4	80	100
43-00732-W	BLOODS HAMMOCK GROVE - BLOCK 33	32-1	805466	979253	Aquifer	23,102	6	80	100
43-00732-W	BLOODS HAMMOCK GROVE - BLOCK 33	33-1	807122	978874	Aquifer	32,727	6	80	100
43-01749-W	BOOKER PARK	WELL 1	824513	977899	Aquifer	4,813		Assumed to be in Layer 3A	
43-01749-W	BOOKER PARK	WELL 2	824572	977629	Aquifer	6,738		Assumed to be in Layer 3A	
43-01749-W	BOOKER PARK	WELL 3	824368	977484	Aquifer	15,401		Assumed to be in Layer 3A	
50-03785-W	BOURNE FARM TRACTOR SHOP	1	807054	925179	Aquifer	5,775	4	50	100
50-01486-W	TREATMENT PLANT	1	780704	912627	Aquifer	61,604	12	24	42
26-00261-W	CHIPCO GROVE	1	591236	881500	Tamiami	92,406	10	70	170
26-00256-W	CITRUS NURSERY	2	675614	867920	Tamiami	38,503	10	112	146
26-00256-W	CITRUS NURSERY	1	675588	866923	Tamiami	57,754	6	112	146
26-00327-W	CLEGHORN HENDRY COUNTY FARM	2	585617	884417	Tamiami	115,508	8	90	140
26-00327-W	CLEGHORN HENDRY COUNTY FARM	4	585677	881369	Tamiami	115,508	8	90	140
26-00077-W	CLEWISTON FFA CHAPTER	1	620901	870973	Tamiami	0	4	0	55
26-00077-W	CLEWISTON FFA CHAPTER	2	622642	870336	Tamiami	0	4	0	67
26-00077-W	CLEWISTON FFA CHAPTER	3	623844	869486	Tamiami	0	4	0	42
26-00077-W	CLEWISTON FFA CHAPTER	4	622253	871180	Tamiami	0	6	30	40
26-00077-W	CLEWISTON FFA CHAPTER	5	622068	872932	Tamiami	0	6	30	45
26-00077-W	CLEWISTON FFA CHAPTER	6	622223	873651	Tamiami	0	6	30	45

PERMIT NO	PROJECT NAME	NAME	X	Y	AQUIFER	PUMP CAPACITY(cfd)	WELL DIAMETER(in)	CASED DEPTH (ft)	WELL DEPTH(ft)
26-00676-W	CLEWISTON FIELD STATION AT S-2	Well 2	748835	860241	Aquifer	1,925	4	35	50
26-00676-W	CLEWISTON FIELD STATION AT S-2	1	689144	872904	Aquifer	15,401	4		90
26-00572-W	CLEWISTON MILL COMPLEX(	PROPOSED WELL	677767	874328	Tamiami	125,134	10	50	70
26-00582-W	CLEWISTON/LABELLE SCHOOLS	CHS WELL #2	680946	875463	Tamiami	11,551	2	90	120
26-00582-W	CLEWISTON/LABELLE SCHOOLS	CHS WELL #3	679821	875391	Tamiami	11,551	2	80	120
26-00582-W	CLEWISTON/LABELLE SCHOOLS	CHS WELL #1	680941	875840	Tamiami	25,027	4	90	120
26-00383-W	COTTON CITRUS	N	628637	851662	Tamiami	77,005	8	80	160
26-00383-W	COTTON CITRUS	S	629012	848612	Tamiami	77,005	8	80	160
50-04241-W	COURSE	1	750218	860577	Aquifer	28,877	4	20	30
26-00817-W	CRISTO ES PARA TODOS	Well 1	614347	844053	Tamiami	4,813	4	100	200
26-00690-W	DIOCESE OF VENICE FLORIDA	1	622345	846900	Tamiami	2,310	4	100	120
26-00436-W	PACKING HOUSE	W-1	596878	884430	Aquifer	11,551	4	110	140
26-00436-W	PACKING HOUSE	W-2	596878	884430	Aquifer	11,551	4	110	140
26-00436-W	PACKING HOUSE	W	596640	884220	Aquifer	17,326	10	130	170
43-00894-W	DUPUIS RESERVE	5	794677	969277	Aquifer	1,155	4		85
43-00894-W	DUPUIS RESERVE	3	793111	968159	Aquifer	1,925	2		85
43-00894-W	DUPUIS RESERVE	4	796413	969856	Aquifer	1,925	2		85
43-00894-W	DUPUIS RESERVE	5	793243	967580	Aquifer	1,925	4		85
43-00894-W	DUPUIS RESERVE	2	799833	970908	Aquifer	3,850	3		100
43-00894-W	DUPUIS RESERVE	3	794927	969185	Aquifer	3,850	3		100
43-00894-W	DUPUIS RESERVE	1	799478	971605	Aquifer	6,353	4		85
43-00894-W	DUPUIS RESERVE	4	795045	969250	Aquifer	6,738	4		85
43-00894-W	DUPUIS RESERVE	8	793546	967422	Aquifer	15,401	4		85
26-00032-W	FARM	1	661437	878143	Aquifer	144,385	6	0	30
50-04221-W	FIRST FREE METHODIST CHURCH	1	794074	844909	Aquifer	48,128	2	149	149
50-04221-W	FIRST FREE METHODIST CHURCH	2	794074	844909	Aquifer	48,128	2	149	149
26-00013-W	FLAG HOLE	4	637037	850048	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	6	644741	851864	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	7	644167	850060	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	8	642507	849171	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	21	642041	844429	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	22	641970	847479	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	23	642883	847517	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	24	637682	842155	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	25	640166	840376	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	26	639109	842099	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	27	640154	842174	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	28	639014	840257	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	29	636852	838334	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	30	636679	841096	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	32	645069	840188	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	36	642161	833040	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	37	641277	834682	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	46	644916	830893	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	15	634255	844385	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	16	634147	843327	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	18	640185	843013	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	33	642018	838384	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	34	644604	835659	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	35	644591	832960	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	38	647285	835703	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	39	647338	833398	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	41	649787	835954	Tamiami	0	8	0	0

PERMIT_NO	PROJECT_NAME	NAME	X	Y	AQUIFER	PUMP CAPACITY(cfd)	WELL DIAMETER(in)	CASED DEPTH (ft)	WELL DEPTH(ft)
26-00013-W	FLAG HOLE	3	639390	848852	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	10	649548	851652	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	11	649465	849171	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	12	647130	848971	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	13	634207	847248	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	31	644496	842174	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	9	647219	851608	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	14	634255	845977	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	5	642197	851889	Tamiami	0	6	50	109
26-00013-W	FLAG HOLE	40	649393	833085	Tamiami	0	8	0	0
26-00013-W	FLAG HOLE	2	639480	851470	Tamiami	96,257	6	50	64
26-00013-W	FLAG HOLE	17	639396	847505	Tamiami	96,257	6	50	109
26-00013-W	FLAG HOLE	19	644777	847464	Tamiami	96,257	6	50	109
26-00013-W	FLAG HOLE	20	644066	844441	Tamiami	96,257	6	50	109
26-00013-W	FLAG HOLE	1	637085	851720	Tamiami	96,257	6	50	64
50-07066-W	GLADES DAY SCHOOL, INC.	Well 1	766539	858398	Aquifer	19,251	6	30	40
50-01646-W	GLADES SUGAR HOUSE	N.W.S.W	770626	862409	Aquifer	77,005	10	14	30
50-01646-W	GLADES SUGAR HOUSE	S.W.S.W	770626	862211	Aquifer	77,005	10	14	30
50-01628-W	GLADEVIEW - IRRIGATION WELL	1	824024	851548	Aquifer	38,503	2	30	50
22-00217-W	GOLF HAVEN UNIT 2	1	581522	892249	Aquifer	19,251	8	115	145
22-00217-W	GOLF HAVEN UNIT 2	2	581214	889112	Aquifer	19,251	8	115	145
50-03512-W	GOVE GLADEVIEW ELEMENTARY SCHOOL	WELL	760190	849250	Aquifer	9,626	4	30	50
50-02741-W	GREENACRES BRANCH LIBRARY	1	779072	833115	Aquifer	5,775	2	90	100
26-00777-W	DIVISION	Well 1	607447	865791	Tamiami	3,850	4	110	130
26-00777-W	DIVISION	Well 2	607786	865806	Tamiami	3,850	4	100	130
26-00777-W	DIVISION	Well 3	607910	865813	Tamiami	3,850	4	110	130
26-00747-W	GUN RANGE TRAINING FACILITY	WELL #1	589215	880859	Aquifer	6,738	4	80	205
26-00826-W	HERB'S FISH FARM	1	605968	865156	Aquifer	4,813	4	90	110
26-00826-W	HERB'S FISH FARM	2	605819	864826	Aquifer	9,626	4	90	110
26-00826-W	HERB'S FISH FARM	3	605950	864810	Aquifer	9,626	4	90	110
26-00751-W	HOLIDAY INN - CLEWISTON	WELL #1	672533	879526	Aquifer	13,476	4	130	150
22-00334-W	INDIAN HILLS FIRE DEPARTMENT	WELL #1	580845	893336	Aquifer	9,626	4	140	160
43-00041-W	INDIANTOWN COMPANY	W-4	828575	976941	Aquifer	19,251	10	115	115
43-00041-W	INDIANTOWN COMPANY	W-6	827805	977474	Aquifer	28,877	8	125	125
43-00041-W	INDIANTOWN COMPANY	W-7	827520	977692	Aquifer	28,877	8	125	125
43-00041-W	INDIANTOWN COMPANY	W-5	828167	977223	Aquifer	38,503	8	125	125
43-01750-W	INDIANTOWN MIDDLE SCHOOL	WELL 1	826694	977584	Aquifer	28,877	Assumed to be in Layer 3A		
22-00229-W	J.J. WIGGINS YOUTH CENTER	1	617741	908330	Aquifer	11,551	4	70	100
26-00419-W	JACKMAN AND SONS RANCH B	47	664126	842692	Tamiami	96,257	14	60	80
26-00419-W	JACKMAN AND SONS RANCH B	48	667014	842692	Tamiami	96,257	14	60	80
26-00419-W	JACKMAN AND SONS RANCH B	49	669748	842638	Tamiami	96,257	14	60	80
26-00419-W	JACKMAN AND SONS RANCH B	51	671450	837397	Tamiami	96,257	14	60	80
26-00419-W	JACKMAN AND SONS RANCH B	52	664693	831993	Tamiami	96,257	14	60	80
26-00419-W	JACKMAN AND SONS RANCH B	53	667272	832155	Tamiami	96,257	14	60	80
26-00419-W	JACKMAN AND SONS RANCH B	3	662991	832101	Tamiami	163,636	12	0	180
26-00419-W	JACKMAN AND SONS RANCH B	5	668252	832101	Tamiami	163,636	12	0	180
26-00419-W	JACKMAN AND SONS RANCH B	8	670057	831615	Tamiami	163,636	12	0	180
26-00419-W	JACKMAN AND SONS RANCH B	4	662681	832047	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	5	663352	831993	Tamiami	167,487	6	78	110
26-00419-W	JACKMAN AND SONS RANCH B	6	668149	830859	Tamiami	167,487	6	56	78
26-00419-W	JACKMAN AND SONS RANCH B	7	667581	831993	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	8	670418	832101	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	10	671450	834155	Tamiami	167,487	6	0	0

PERMIT_NO	PROJECT_NAME	NAME	X	Y	AQUIFER	PUMP CAPACITY(cfd)	WELL DIAMETER(in)	CASED DEPTH (ft)	WELL DEPTH(ft)
26-00419-W	JACKMAN AND SONS RANCH B	11	667788	832588	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	12	668097	833236	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	13	666663	834047	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	14	662063	836694	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	15	662939	836802	Tamiami	167,487	6	40	62
26-00419-W	JACKMAN AND SONS RANCH B	16	663765	836802	Tamiami	167,487	6	53	85
26-00419-W	JACKMAN AND SONS RANCH B	18	663713	833884	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	9	671192	832804	Tamiami	167,487	6	0	0
26-00419-W	JACKMAN AND SONS RANCH B	17	662527	833830	Tamiami	167,487	6	0	0
26-00504-W	L & L RESTAURANT	1	614660	840389	Aquifer	7,701	4	180	200
26-00082-W	LABELLE PRIVATE DRAINAGE DISTRICT	B-9	605141	858790	Hawthorn	385,027	4	560	755
26-00082-W	LABELLE PRIVATE DRAINAGE DISTRICT	B-10	605141	858790	Hawthorn	385,027	12	600	800
26-00082-W	LABELLE PRIVATE DRAINAGE DISTRICT	W-9	605069	858675	Hawthorn	481,283	12	643	900
43-01889-W	LAKE POINT LLC PROPERTY	P-1	788310	961462	aquifer	577,540	Temporary Dewatering Permit (will not be modeled)		
43-01889-W	LAKE POINT LLC PROPERTY	P-2	788264	963205	aquifer	577,540	Temporary Dewatering Permit (will not be modeled)		
43-01929-W	LAKE POINT RANCHES	P-3	787270	961014	aquifer	192,513	Assumed to be in Layer 3A		
43-01929-W	LAKE POINT RANCHES	P-4	790078	961014	aquifer	192,513	Assumed to be in Layer 3A		
43-01929-W	LAKE POINT RANCHES	P-5	790760	960177	aquifer	192,513	Assumed to be in Layer 3A		
43-01929-W	LAKE POINT RANCHES	P-1	787874	963665	aquifer	577,540	Temporary Dewatering Permit (will not be modeled)		
43-01929-W	LAKE POINT RANCHES	P-2	787979	964977	aquifer	577,540	Temporary Dewatering Permit (will not be modeled)		
22-00348-W	LIPSICK SAND MINE	Dewatering Pump-1	618604	909069	aquifer	192,513	Assumed to be in Layer 3A		
22-00348-W	LIPSICK SAND MINE	Dewatering Pump-2	618604	909069	aquifer	192,513	Assumed to be in Layer 3A		
22-00348-W	LIPSICK SAND MINE	Dewatering Pump-3	618604	909069	aquifer	1,155,080	Assumed to be in Layer 3A		
50-02632-W	LUCERNE HOMES EAST	1	779072	829115	Aquifer	5,775	2	60	70
50-01891-W	LUCERNE HOMES EAST SWIM CLUB	1	779072	829115	Aquifer	4,813	2	80	90
22-00237-W	LUNDY PRESLEY CITRUS	WELL 1	617440	907355	Aquifer	163,636	10	30	90
43-00022-W	MARTIN COUNTY POWER PLANT	10	791637	971322	Aquifer	16,364	4	115	120
26-00518-W	MARY LOU GENERAL STORE	2	615186	874311	Tamiami	3,850	4	120	140
26-00744-W	MC DONALD'S RESTAURANT	WELL #1	674063	879982	Aquifer	5,775	4	100	120
26-00389-W	MEJIA GROVE	1	631802	850272	Tamiami	28,877	Permit Expired (will not be modeled)		
26-00691-W	MILLON FAMILY	1	600099	862827	Tamiami	17,326	4	80	100
26-00691-W	MILLON FAMILY	3	600444	863011	Aquifer	17,326	4	20	40
50-02770-W	MOBIL SERVICE STATION #02-E66	1	762072	829115	Unspecified	24,064	2	35	40
50-01844-W	MOESLY NURSERIES, INC.	1	784072	829115	Aquifer	96,257	4	70	80
22-00359-W	MOORE HAVEN PLANT	Well 1	620786	904442	Aquifer	9,626	4	21	27
26-00450-W	O'CONNOR GROVE	1	602657	860224	Aquifer	173,262	8	300	450
50-03147-W	OSCEOLA COGENERATION PLANT	SW1	801117	907240	Aquifer	28,877	Permit Expired (will not be modeled)		
50-03147-W	OSCEOLA COGENERATION PLANT	SW2	801097	906116	Aquifer	28,877	10	50	80
50-03147-W	OSCEOLA COGENERATION PLANT	SW3	802257	906120	Aquifer	28,877	10	50	80
50-05733-W	SR 98	W-1	803017	905745	Aquifer	13,861	2		50
50-07615-W	PACKING HOUSE	Well 1	765815	863800	Aquifer	24,064	8	70	80
50-07615-W	PACKING HOUSE	Well 2	766338	863800	Aquifer	24,064	8	70	80
50-03880-W	PAHOKEE CLUSTER	RW-2	767422	906220	Aquifer	9,626	Permit Expired (will not be modeled)		
50-03880-W	PAHOKEE CLUSTER	RW-3	767437	906262	Aquifer	9,626	5	0	15
50-03880-W	PAHOKEE CLUSTER	RW-1	767348	906146	Aquifer	38,503	5	0	15
50-04288-W	INSTALL	1	757801	852554	Aquifer	30,802	6	60	70
50-03276-W	FACILITY	1	858137	854662	Aquifer	10,588	2	75	78
50-04654-W	TOWER	1	855337	854795	Aquifer	2,888	2	21	41
50-05906-W	PELICAN LAKE VILLAGE	Pelican Lake Village Well 1	782605	901201	Aquifer	11,551	6	95	100
50-02377-W	PINE RIDGE SOUTH VILLAGE 2	0	784072	829115	Aquifer	8,663	2	60	63
50-02199-W	PINE RIDGE VILLAGE	1	784072	829115	Aquifer	7,701	2	90	100
43-01079-W	PORT MAYACA CEMETERY IRRIGATION	1	791679	966886	Aquifer	4,813	2	90	90
43-01079-W	PORT MAYACA CEMETERY IRRIGATION	1	791679	966886	Aquifer	4,813	2	90	90

The effects of the surface drainage in the EAA must be simulated in order to reasonably replicate the groundwater flow fields within the model. In order to approximate the EAA surface drainage, a constant head boundary condition was applied to the surface of the model in the EAA.

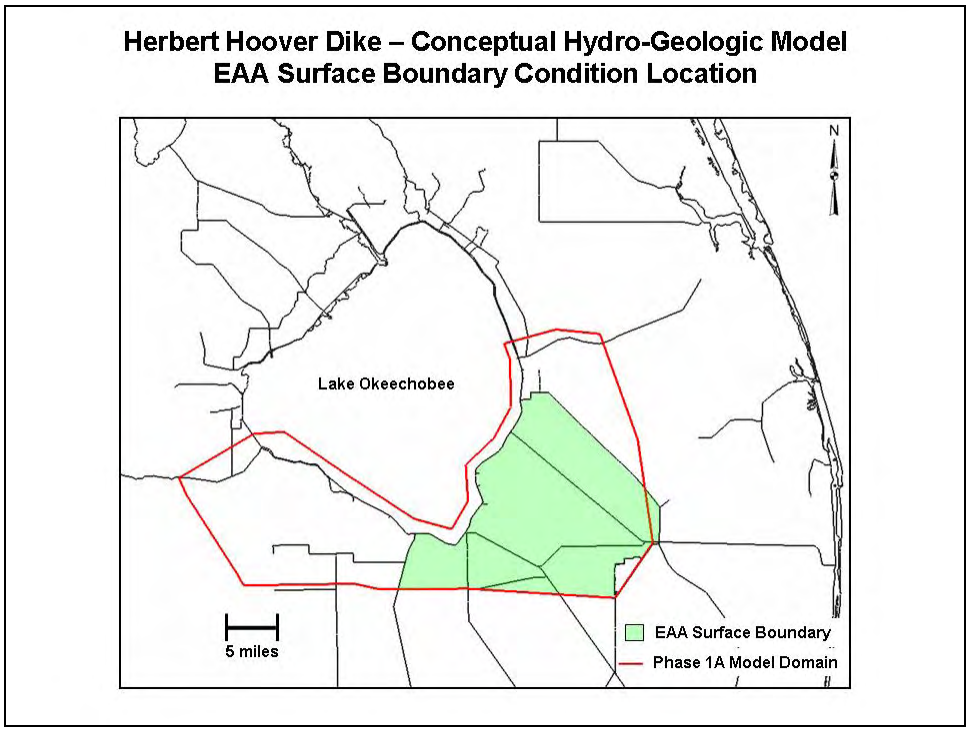


FIGURE A-14: HORIZONTAL EXTENT WITH CONSTANT HEAD BOUNDARY CONDITION APPLIED TO REFLECT WATER LEVEL RESULTING FROM SURFACE WATER PUMPING

A.2.5 Results

This project investigated how much impact the proposed cutoff wall would have on groundwater flow through the 21 specified cross sections. The 3-D steady-state subsurface flow results of the "with project" simulation runs were compared with those of the corresponding "without project" simulation runs. Factors that may affect groundwater flow through the specified cross sections include hydraulic conductivities of the hydrogeologic units, boundary condition, net recharge, and groundwater pumping. A two-stage sensitivity analysis was conducted to effectively achieve the purpose of this study.

In Stage 1, 46 model sensitivity runs were conducted to determine three hydrogeologic units that have more impact than the other eight units on the groundwater flow through the 21 cross sections, where the medium values of boundary condition, net recharge, and pumping were employed to represent an average hydrologic condition.

In Stage 2, 96 model sensitivity runs were conducted to study the change of groundwater flow through the 21 cross sections from the "without project" scenario to the "with project" scenario,

where 48 runs featuring various combination of the high, medium, and low values of net recharge and head boundary conditions, high (permit capacity) and low (zero) pumping rates, and the three most influential hydraulic conductivities determined from the Stage 1 analysis were included in each scenario.

The results from the groundwater modeling study present results as a pressure head difference. This difference is directly proportional to changes in the groundwater table. For example, if the model shows a difference in the pressure head of 2 feet, then the groundwater table in that area will be reduced by 2 feet.

A.2.5.1 Worst Case Scenarios

For brevity in this report, a low net recharge and low head boundary condition combined with high pumping rates is evaluated in this EA. This condition is likely the worst case because the steady state model simulates the pumps operating at the maximum permitted capacity continuously during a dry condition (low lake levels and low groundwater recharge). Therefore, any impacts shown in the modeling results are conservative and in reality the impacts observed would be less than simulated by the model.

The low net recharge condition assumes a net recharge of zero. The low head boundary condition utilizes the groundwater head stages and canal stages within the 5th percentile of minimum groundwater and canal stage values obtained from the groundwater and canal gages, see **Table A-1** and **Table A-2**. Since this is a steady-state model, the pump operations are not varied through time and therefore the model assumes the pumps are running at the maximum permitted capacity continuously.

There are a total of eight possible scenarios for the low net recharge and low head boundary condition with high pumping when considering both high and low conductivity values for the three most influential materials (L-2, Fine/Organic Layer including Peat, Clays and Silts, L-3A Limestone, Rock, Sand and Shell beds and L3B-2, Sands to Silty Sands). Low and high conductivity values were used for each of these materials in different combinations. However, the median value was held constant for the other eight layers (**Table A-5**).

TABLE A-5: SUBSURFACE MATERIAL CONDUCTIVITY VALUES

Layer	Subsurface Material	Horizontal Conductivity (ft/day)
L1	Undifferentiated Surface Soils including Embankment Fill for the Dike	2.8
L 2-1	Fine/Organic Layer including Peat, Clays and Silts (East)	0.10 (low), 1.00 (high)
L 2-2	Sands (West)	10.00
L 3A	Limestone, Rock, Sand and Shell beds	100.00 (low), 600.00 (high)
L 3B-1	Clay Intrusion in the NW model domain	1.0
L 3B-2	Sands to Silty Sands	1.00(low), 100.00 (high)
L 4	Pinecrest Sand member of Tamiami Formation	10.00
L 5	Ochopee Limestone member of the Tamiami Formation and Gray Limestone	400.00
L 6	Lower Tamiami Formation Sands and non-productive sands of the Miocene Peace River Formation	35.00
L 7-1	Sand Stone Aquifer	500.00
L 7-2	Upper Hawthorn Group	0.30

Table A-6 displays the eight pressure head comparisons between “with project" and “without project” runs with low net recharge and low head boundary conditions and high pumping in Stage 2 analysis.

TABLE A-6: WORST CASE MODEL RUNS

ID*	Pressure Head Comparison (w/ project - w/o project)	0.1 ≤ Diff ≤ 0.5 % Occurrences	0.5 ≤ Diff ≤ 1.0 % Occurrences	1.0 ≤ Diff ≤ 2.0 % Occurrences	Diff ≥ 2.0 % Occurrences	MA Error (ft)	RMS Error (ft)	Max Error (ft)
1	Run81 - Run33	16.248%	0.394%	0.117%	0.000%	0.0474	0.1037	1.27
2	Run82 - Run34	2.077%	0.007%	0.000%	0.000%	0.0109	0.0308	0.79
3	Run83 - Run35	16.485%	0.398%	0.110%	0.000%	0.0492	0.1043	2.19
4	Run84 - Run36	2.399%	0.016%	0.000%	0.000%	0.0120	0.0336	2.77
5	Run85 - Run37	28.672%	2.431%	0.549%	0.081%	0.1042	0.2051	3.37
6	Run86 - Run38	4.328%	0.403%	0.073%	0.001%	0.0260	0.0787	8.23
7	Run87 - Run39	32.955%	2.406%	0.638%	0.026%	0.1153	0.2112	4.20
8	Run88 - Run40	5.390%	0.606%	0.100%	0.001%	0.0306	0.0878	3.89

This EA evaluated the impacts of Run 85-Run37because this was considered the worst possible condition[2] out of the eight scenarios evaluated under the high pumping and low net recharge and low head boundary condition. This scenario utilized high conductivity values for L-2 and L-3A and a low conductivity value for L3B-2. These conditions were selected based on the following:

- the cutoff wall fully penetrates the L-2 and L-3A layers (which allow for flow)
- the cutoff wall partially penetrates the L3B-2 layer (consisting of a lower conductivity material) which restricts groundwater flow

This means that any water being transmitted through the upper two layers has to force its way into the L3B-2 layer, flow below the cutoff wall, and then flow up to recharge groundwater in the upper layers. This scenario provides the lowest amount of groundwater recharge during a time when groundwater demand will be at its peak, resulting in the largest system impacts.

Results of the Worst Case Scenario (Run 85-Run37)

The results of the model simulation (Run 85-Run 37) indicate less than 2 ft of change to the groundwater table when the cutoff wall is in place for the majority of Reach 1 (**Figure A-16**). Based on the modeling results there are no sub-regional impacts on the groundwater as a result of the partially penetrating cutoff wall. However, in some cases the possibility exists for localized groundwater impacts up to two feet immediately adjacent to the cutoff wall.

Groundwater impacts obtained from the model are provided in **Table A-9 through Table A-12** displaying the maximum distances for each of the following impact ranges: 0.1 ft, 0.5 ft, 1.0 ft and 2.0 ft. **Table A-9** (see Run 85-Run 37, ID 5) demonstrates that the there are no changes in the water table greater than 2.0 ft with implementation of a cutoff wall in Reach 1A. This change occurs at a maximum of 2,600 ft from the dike. **Table A-10** (ID 5) demonstrates that there are no changes greater than 0.5 ft with implementation of a cutoff wall in Reach 1B. This change occurs at a maximum of 1,600 ft from the dike. **Table A-11** (ID 5) demonstrates that there are no changes greater than 1 ft with implementation of a cutoff wall in Reach 1C. This change occurs at a maximum distance of 1,000 ft from the dike (when measured near pumping wells) and occurs at a maximum distance of 500 ft from the dike (when evaluating the effects of the cutoff wall). **Table A-12** (ID 5) demonstrates that there are no changes greater than 0.5 ft with implementation of a cutoff wall in Reach 1D. This change occurs at a maximum distance of 15,800 ft from the dike.

[2] Run 85-Run 37: This represents the with project scenario minus the without project scenario during a low net boundary condition and low net recharge condition with high pumping. High conductivity values for L-2 and L-3A and the low conductivity value for L3B-2 were utilized for both Run 85 and Run 37.

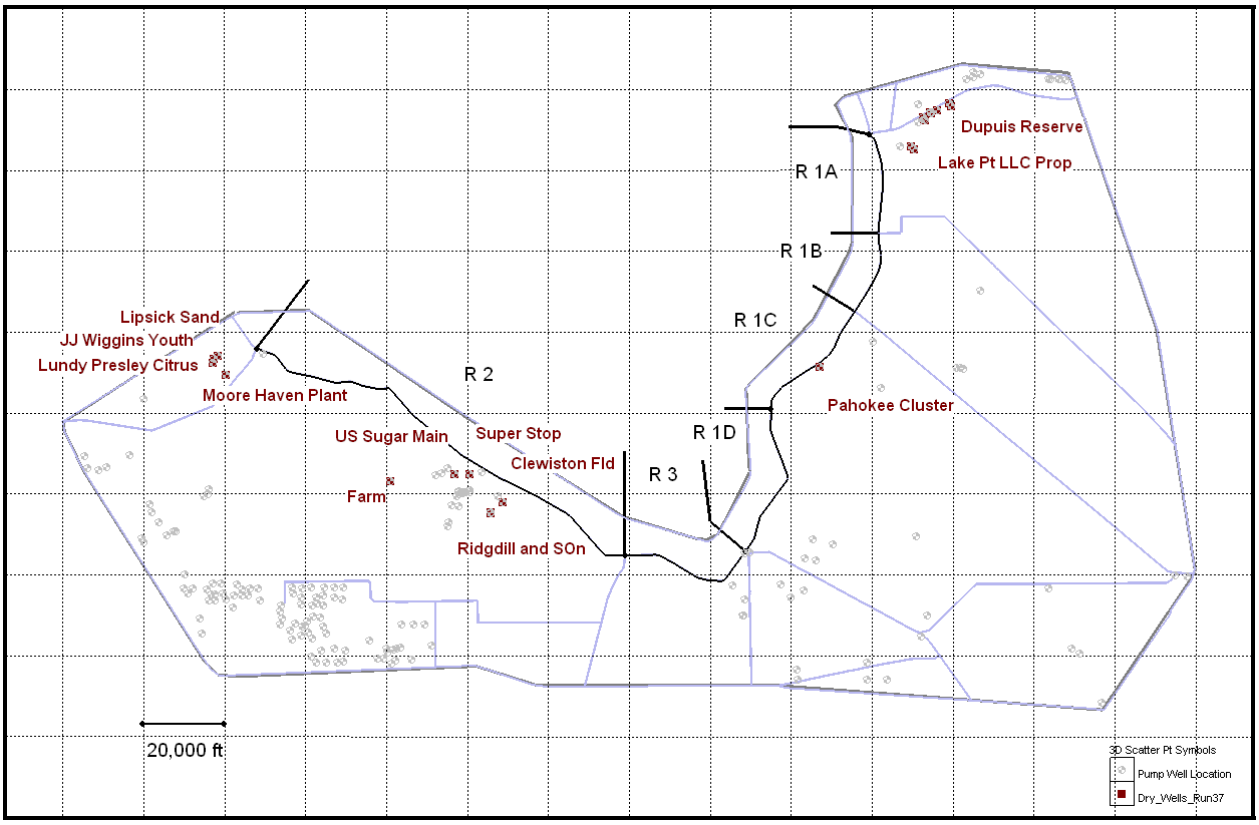


FIGURE A-15: NODAL LOCATIONS CORRESPONDING TO EXTRACTION WELLS DEWATERED DURING SIMULATION RUN 37 (W/O PROJECT)

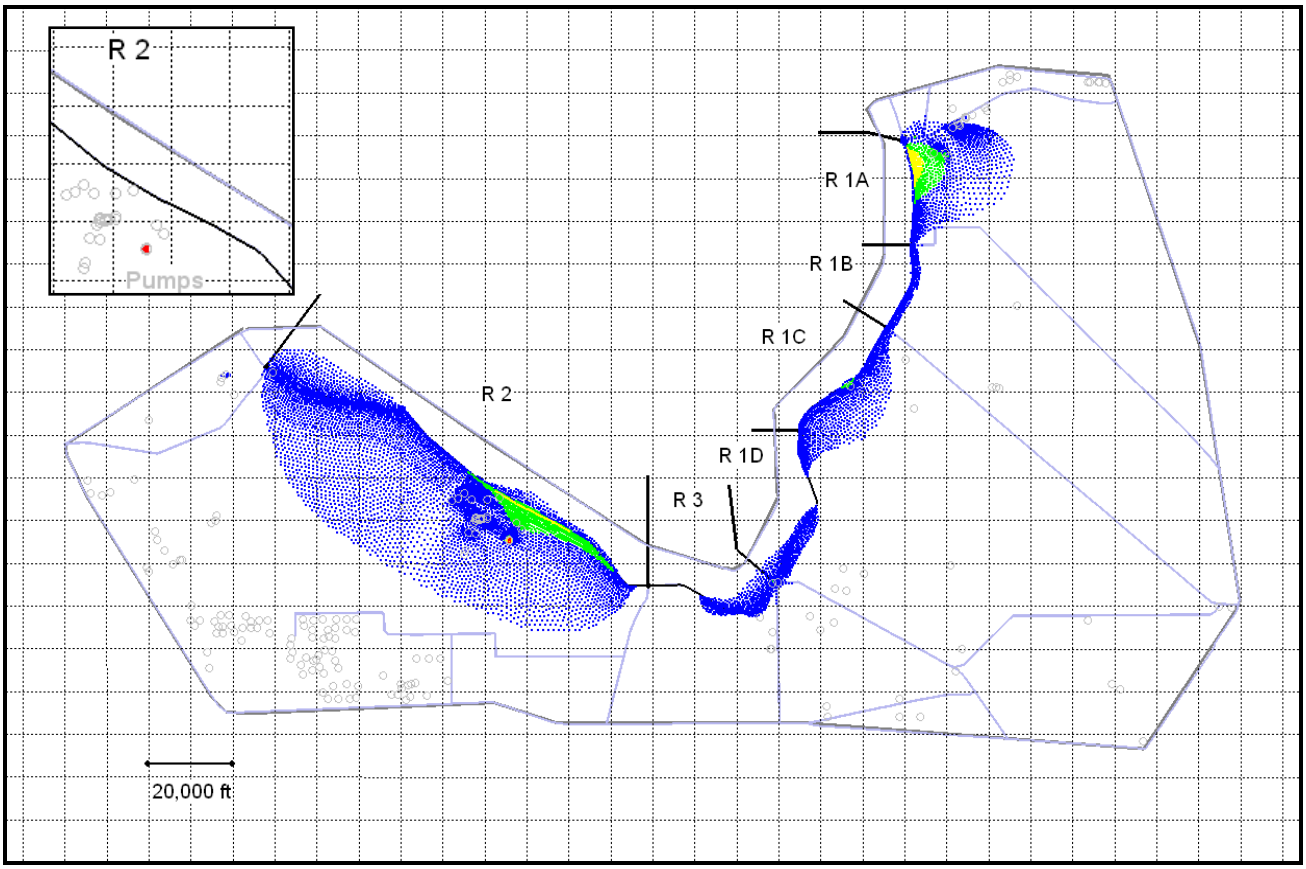


FIGURE A-16: PRESSURE HEAD COMPARISON BETWEEN "WITH PROJECT" AND "WITHOUT PROJECT": LOW NET RECHARGE AND HEAD BOUNDARY CONDITIONS, HIGH PUMPING, HIGH L2-1 K, HIGH L3A K, AND LOW L3B-2 K

.

0.1 ≤ Pressure Head Difference ≤ 0.5	Blue
0.5 ≤ Pressure Head Difference ≤ 1.0	Lime Green
1.0 ≤ Pressure Head Difference ≤ 2.0	Yellow
Pressure Head Difference ≥ 2.0	Red

The "without project" modeling results (Run 37) indicate that there are multiple wells that have groundwater recharge deficiencies Figure A-15; these wells are displayed in **Table A-7**. When the "with project condition" is applied, there are no additional wells that demonstrate a groundwater recharge deficiency (**Figure A-16**). With implementation of the cutoff wall no impacts are anticipated to the groundwater wells.

TABLE A-7: WELLS TRIGGERED DURING THE RUN 37 WITHOUT PROJECT CONDITIONS

Run 37 (w/o project) Dry Well Name	Florida East X-Coordinate	Florida East Y- Coordinate	Nodal Z-Coordinate	Pumping Max Rate, ft/day	Computed Pressure Head, ft
Clewiston_Fld_AT_S-2_1	689144.0	872904.0	14.708	-15401.	-22.2999
Clewiston_Fld_AT_S-2_1	689144.0	872904.0	12.255	-15401.	-19.6974
Clewiston_Fld_AT_S-2_1	689144.0	872904.0	6.735	-15401.	-13.9468
Clewiston_Fld_AT_S-2_1	689144.0	872904.0	1.214	-15401.	-8.3339
DupuisReserve_5(remove)	794677.0	969277.0	19.308	-1155.	-12.8268
DupuisReserve_5(remove)	794677.0	969277.0	18.198	-1155.	-11.6809
DupuisReserve_5(remove)	794677.0	969277.0	17.088	-1155.	-10.5287
DupuisReserve_5(remove)	794677.0	969277.0	10.912	-1155.	-2.8920
DupuisReserve_3(remove)	793111.0	968159.0	17.798	-1925.	-11.5321
DupuisReserve_3(remove)	793111.0	968159.0	16.354	-1925.	-10.0376
DupuisReserve_3(remove)	793111.0	968159.0	10.642	-1925.	-3.1715
DupuisReserve_4(remove)	796413.0	969856.0	19.038	-1925.	-11.9428
DupuisReserve_4(remove)	796413.0	969856.0	17.886	-1925.	-10.7544
DupuisReserve_4(remove)	796413.0	969856.0	11.195	-1925.	-2.8144
DupuisReserve_5	793243.0	967580.0	18.922	-1925.	-14.6395
DupuisReserve_5	793243.0	967580.0	16.351	-1925.	-11.9221
DupuisReserve_5	793243.0	967580.0	10.623	-1925.	-4.2952
DupuisReserve_2	799833.0	970908.0	21.282	-3850.	-13.4932
DupuisReserve_2	799833.0	970908.0	19.490	-3850.	-11.6612
DupuisReserve_2	799833.0	970908.0	11.739	-3850.	-3.0066
DupuisReserve_3	794927.0	969185.0	20.076	-3850.	-17.0589
DupuisReserve_3	794927.0	969185.0	18.629	-3850.	-15.4368
DupuisReserve_3	794927.0	969185.0	17.182	-3850.	-13.7923
DupuisReserve_3	794927.0	969185.0	10.942	-3850.	-4.3807
DupuisReserve_1	799478.0	971605.0	21.032	-6353.	-14.3597
DupuisReserve_1	799478.0	971605.0	19.421	-6353.	-12.6902
DupuisReserve_1	799478.0	971605.0	11.750	-6353.	-3.3365
DupuisReserve_4	795045.0	969250.0	18.737	-6738.	-36.5195
DupuisReserve_4	795045.0	969250.0	17.240	-6738.	-33.9192
DupuisReserve_4	795045.0	969250.0	10.963	-6738.	-8.6453
DupuisReserve_8	793546.0	967422.0	19.214	-15401.	-156.1089
DupuisReserve_8	793546.0	967422.0	16.456	-15401.	-147.0675
DupuisReserve_8	793546.0	967422.0	10.651	-15401.	-31.2515
Farm	661437.0	878143.0	13.398	-144385.	-21.3036
Farm	661437.0	878143.0	12.896	-144385.	-20.6126
Farm	661437.0	878143.0	12.395	-144385.	-19.6357
Farm	661437.0	878143.0	-1.151	-144385.	-4.9136
JJ_Wiggins_Youth	617741.0	908330.0	-82.059	-11551.	-55.4828
Lake_Pt_LLC_Prop_P-4	790078.0	961014.0	-5.739	-192513.	-4.1041
Lake_Pt_LLC_Prop_P-5	790760.0	960177.0	-5.625	-192513.	-4.4699
LipsickSand_combo_180-181-182	618604.0	909069.0	-15.779	-1540107.	-4364.5124
Lundy_Presley_Citrus_WELL_1	617440.0	907355.0	-20.004	-163636.	-173.8924
Lundy_Presley_Citrus_WELL_1	617440.0	907355.0	-21.004	-163636.	-172.8007
Lundy_Presley_Citrus_WELL_1	617440.0	907355.0	-22.004	-163636.	-171.7295
Lundy_Presley_Citrus_WELL_1	617440.0	907355.0	-27.004	-163636.	-150.4321
Lundy_Presley_Citrus_WELL_1	617440.0	907355.0	-32.004	-163636.	-124.8357
Lundy_Presley_Citrus_WELL_1	617440.0	907355.0	-38.277	-163636.	-90.0338
Lundy_Presley_Citrus_WELL_1	617440.0	907355.0	-44.551	-163636.	-57.7232
Moore_Haven_Plant_Well-1	620786.0	904442.0	-6.367	-9626.	-1.2619
Pahokee_Cluster_RW-1-2-3_combo	767437.0	906262.0	16.547	-48129.	-2082.6067
Pahokee_Cluster_RW-1-2-3_combo	767437.0	906262.0	13.784	-48129.	-2055.5511
Pahokee_Cluster_RW-1-2-3_combo	767437.0	906262.0	11.022	-48129.	-2014.2470
Pahokee_Cluster_RW-1-2-3_combo	767437.0	906262.0	3.721	-48129.	-1025.4871
Ridgdill_and_Son_Pump1	686080.0	870502.0	-4.338	-866310.	-587.8874
Ridgdill_and_Son_Pump1	686080.0	870502.0	-13.439	-866310.	-501.2616
Ridgdill_and_Son_Pump2	686080.0	870197.0	-4.055	-866310.	-584.8946
Ridgdill_and_Son_Pump2	686080.0	870197.0	-13.326	-866310.	-490.3329
SuperStop_1-2-3-4-combo	680966.0	879858.0	14.122	-5776.	-17.3918
SuperStop_1-2-3-4-combo	680966.0	879858.0	10.798	-5776.	-13.5933
US_Sugar_Main_combo(275_276)	677297.0	879942.0	-41.779	-134759.	-13.4457
Run 85 (w/ Project): identical dry wells					

Pressure Head Differences for Worst Case Scenarios

The following figures show the pressure head comparison between a pair of "with project" and "without project" runs for the low net boundary and net recharge condition with high pumping condition considered in Stage 2 analysis (eight scenarios). The specification of each pair is defined in the title of each figure. The four brackets are color coded in theses figures as shown below:

0.1 ≤ Pressure Head Difference ≤ 0.5	Blue
0.5 ≤ Pressure Head Difference ≤ 1.0	Lime Green
1.0 ≤ Pressure Head Difference ≤ 2.0	Yellow
Pressure Head Difference ≥ 2.0	Red

A color coded scatter symbol is shown in plain-view where the difference occurs.

Figures A-16 through A-23 show a head difference comparison among the eight combinations of the "k" values for Materials L2-1, L3A, and L3B-2 when both the net recharge and head boundary condition is low and the pumping condition is high.

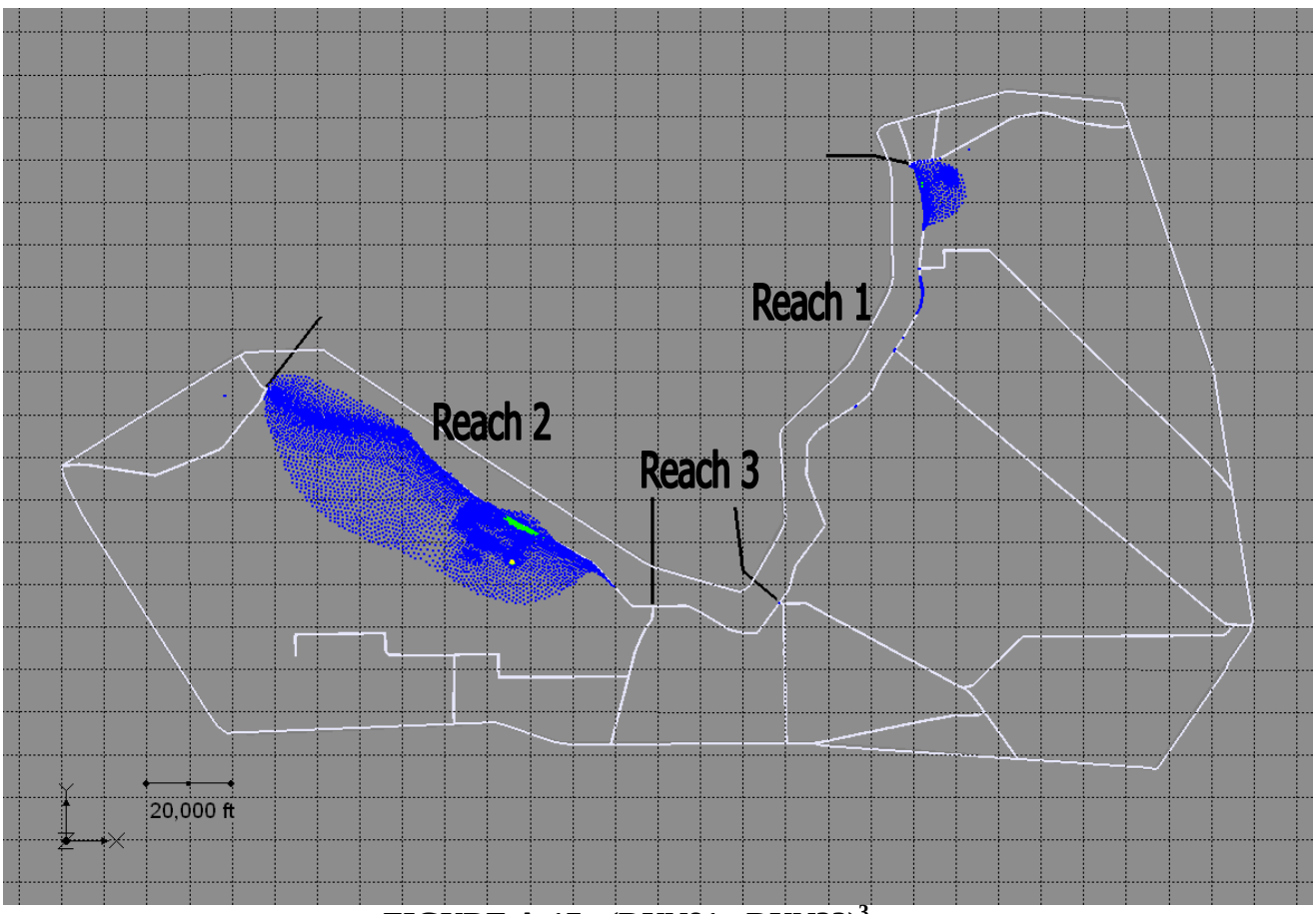


FIGURE A-17: (RUN81 - RUN33)[3]

[3] Pressure head comparison between "with project" and "with project" runs in Stage 2 analysis: low net recharge and head boundary conditions, high L3A K, and high L3B-2 K

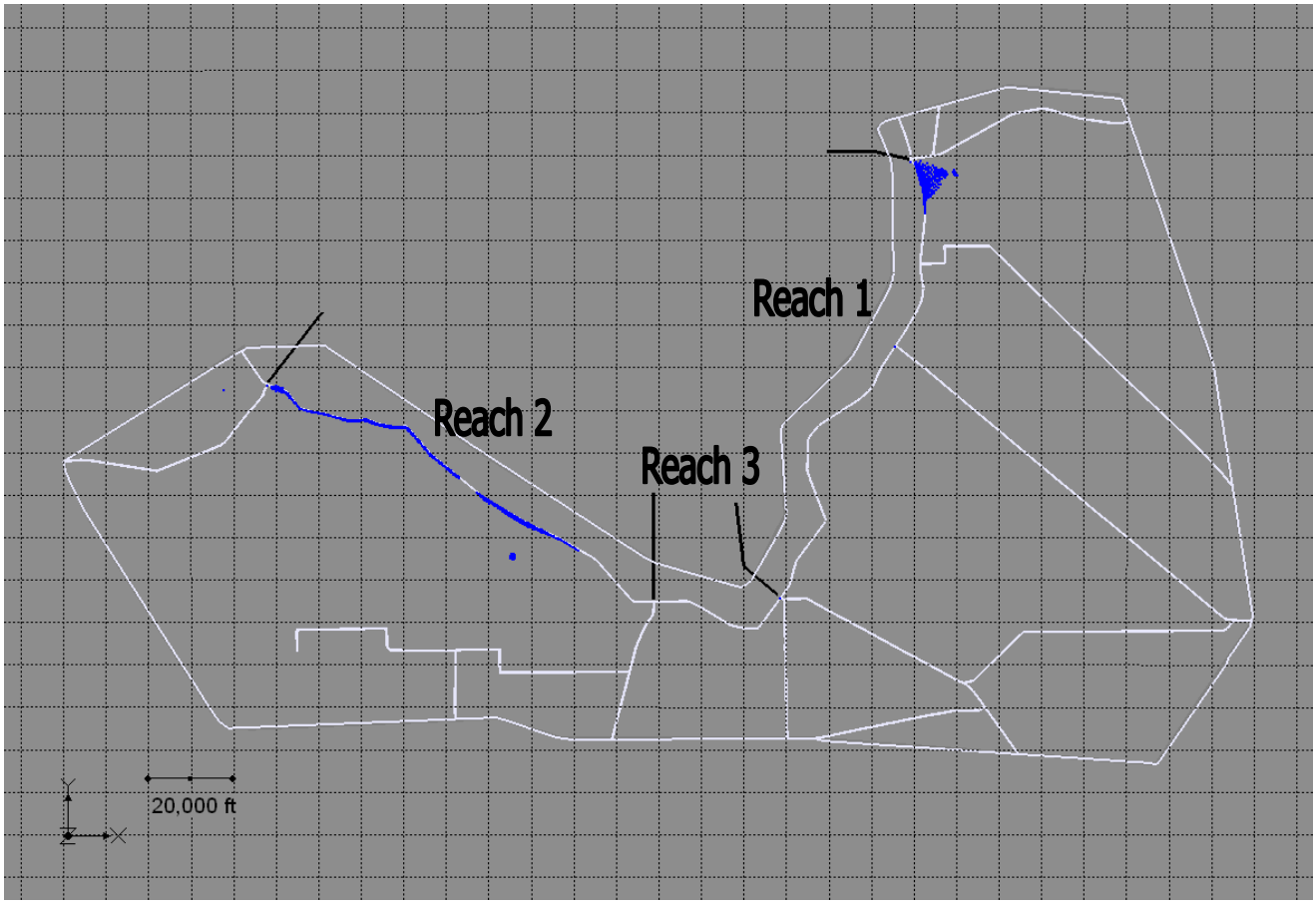


FIGURE A-18: (RUN 82 - RUN34)[4]

[4] Pressure head comparison between "with project" and “with project” runs in Stage 2 analysis: low net recharge and head boundary conditions, high pumping, high L2-1 K, low L3A K, and high L3B-2 K

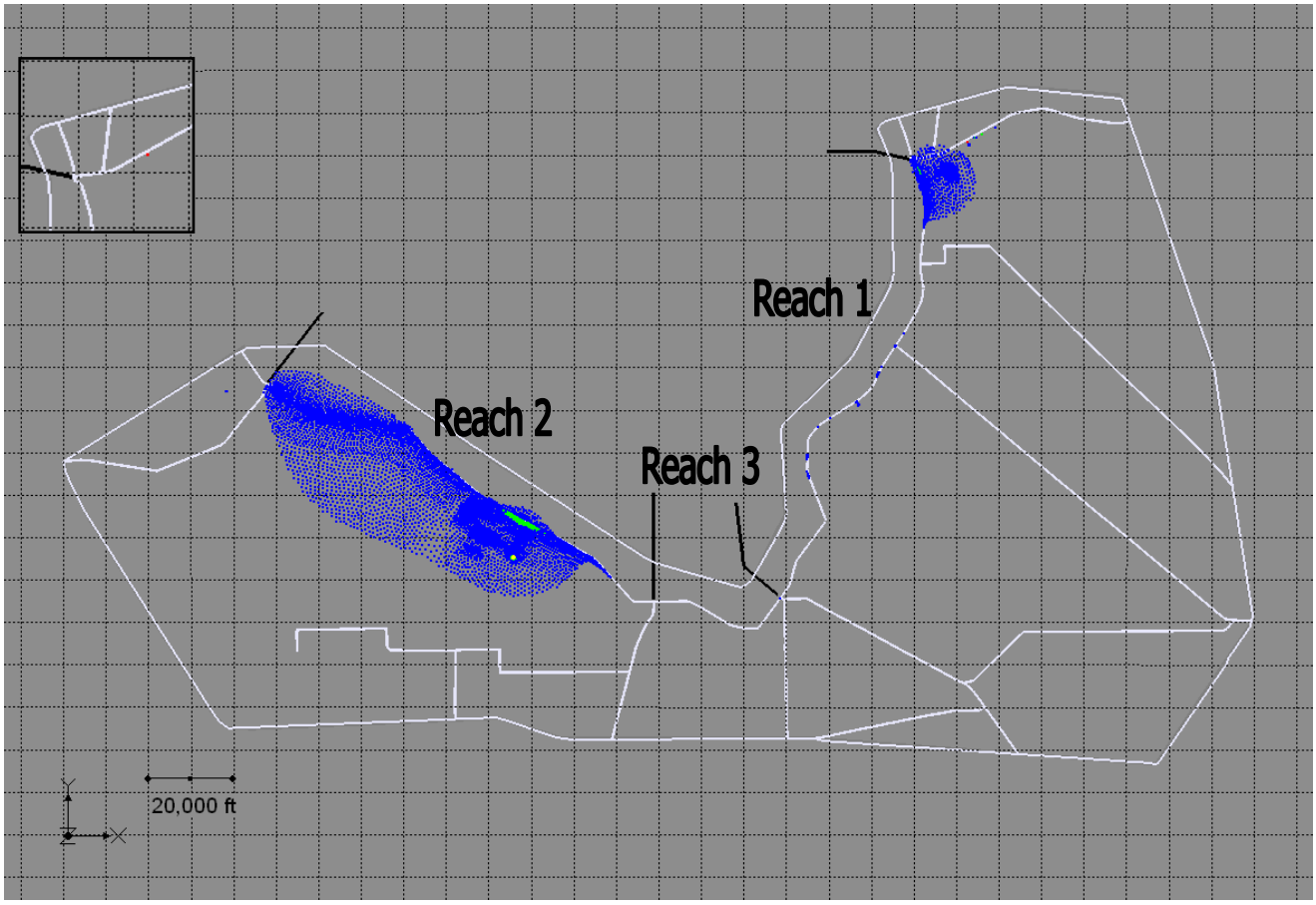


FIGURE A-19: (RUN83 - RUN35)[5]

[5] Pressure head comparison between "with project" and “with project” runs in Stage 2 analysis: low net recharge and head boundary conditions, high pumping, low L2-1 K, high L3A K, and high L3B-2 K.

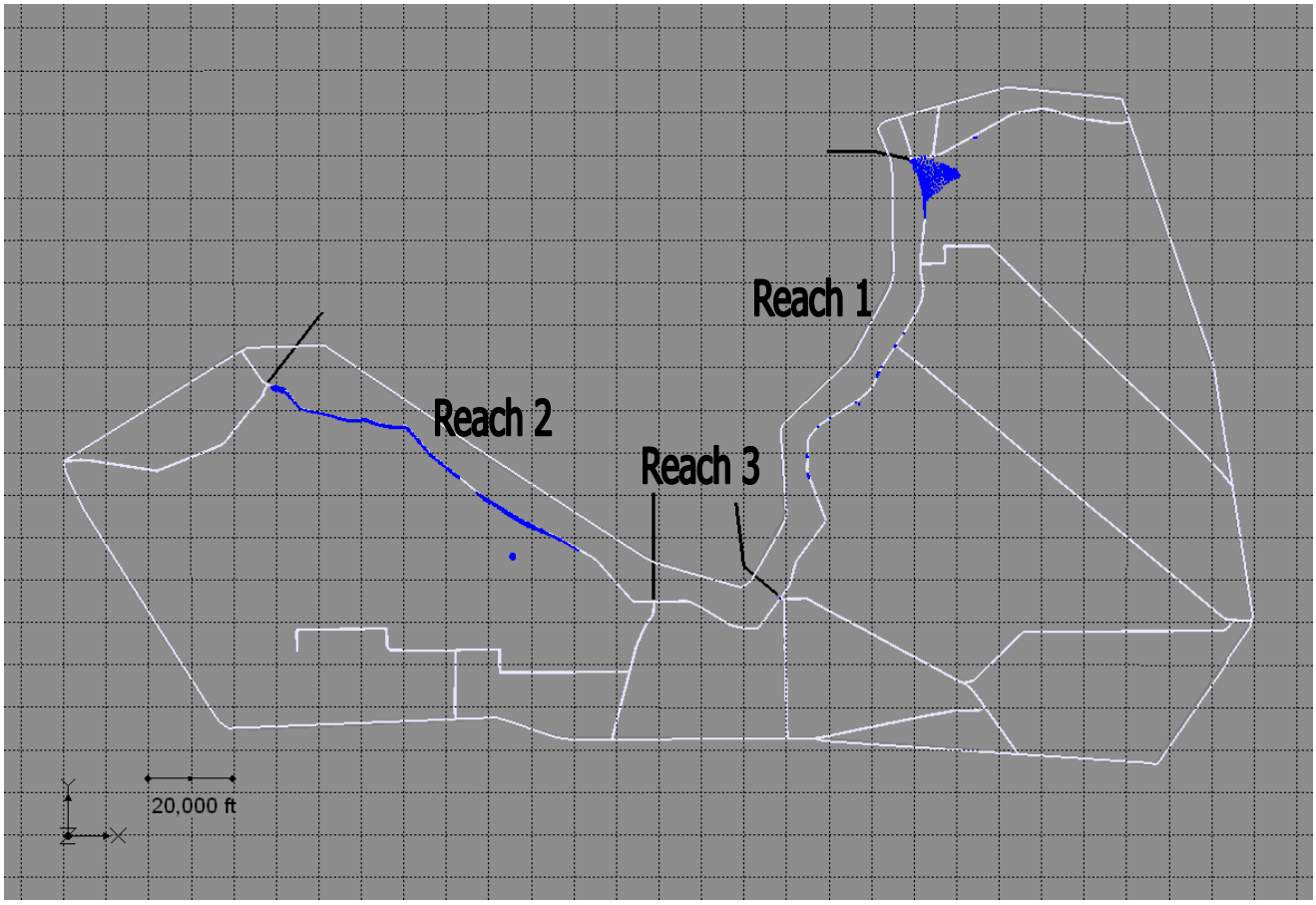


FIGURE A-20: (RUN84 - RUN36)[6]

[6] Pressure head comparison between "without project" and “with project” runs in Stage 2 analysis: low net recharge and head boundary conditions, high pumping, low L2-1 K, low L3A K, and high L3B-2 K.

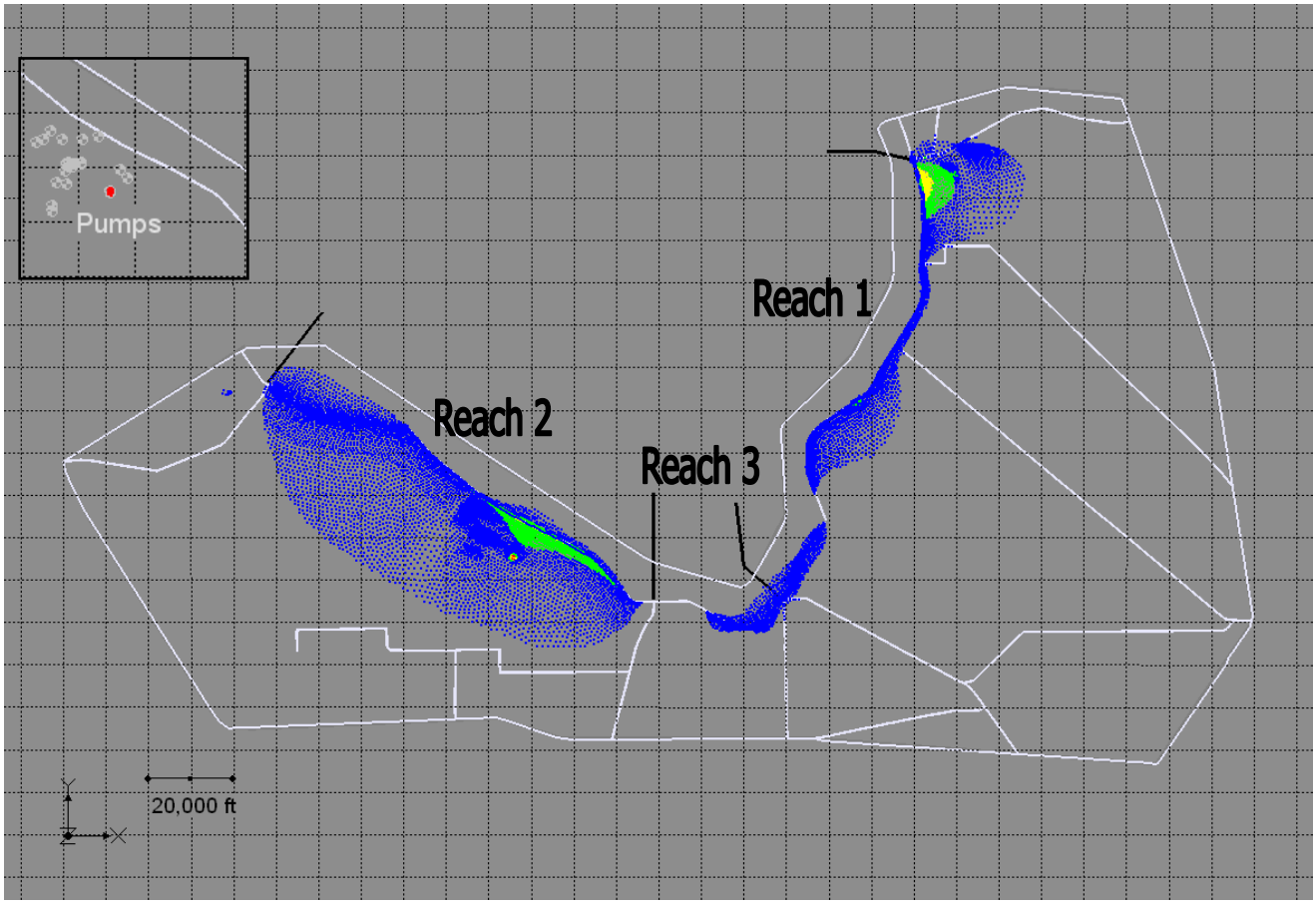


FIGURE A-21: (RUN85 - RUN37)[7]

This run was analyzed in the main body of the EA because it is considered the worst case scenario.

[7] Pressure head comparison between "without project" and “with project” runs in Stage 2 analysis: low net recharge and head boundary conditions, high pumping, high L2-1 K, high L3A K, and low L3B-2 K Run 85-Run 37.

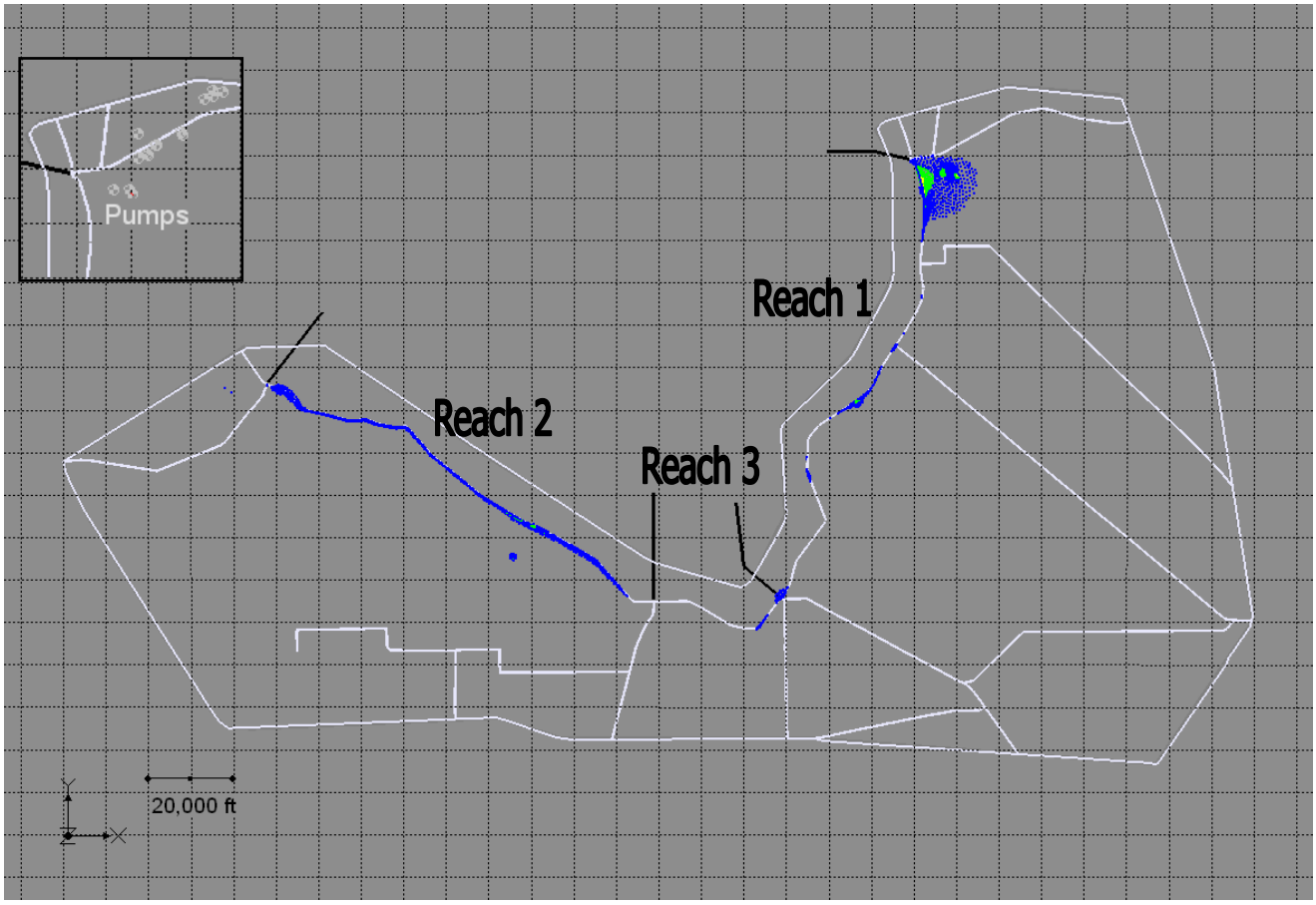


FIGURE A-22: (RUN86 - RUN38)[8]

[8] Pressure head comparison between "without project" and “with project” runs in Stage 2 analysis: low net recharge and head boundary conditions, high pumping, high L2-1 K, low L3A K, and low L3B-2 K.

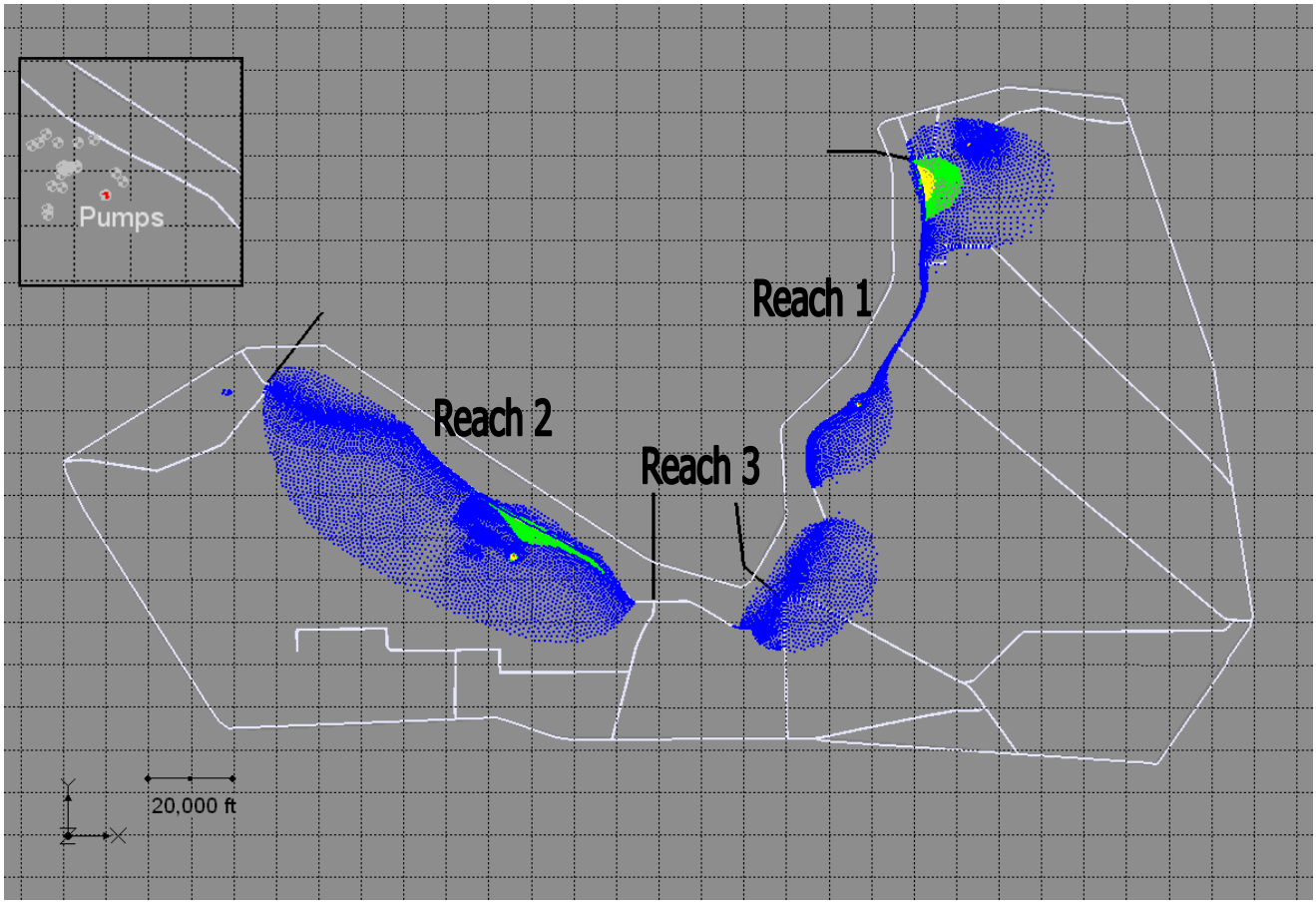


FIGURE A-23: (RUN87 - RUN39)[9]

[9] Pressure head comparison between "without project" and "with project" runs in Stage 2 analysis. Low net recharge and head boundary conditions, high pumping, low L2-1 K, high L3A K, and low L3B-2 K.

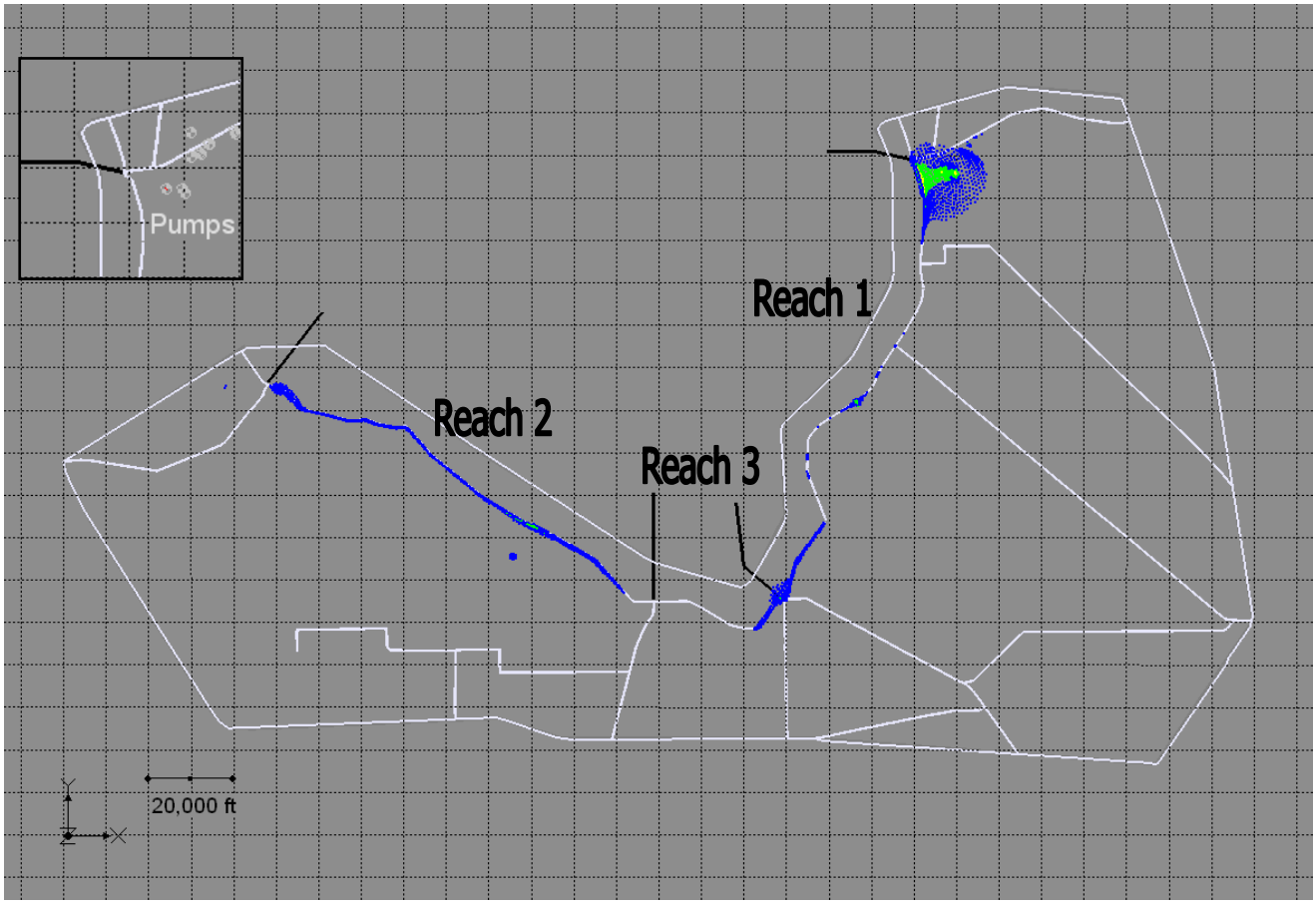


FIGURE A-24: (RUN88 - RUN40) [10]

[10] Pressure head comparison between "without project" and "with project" runs in Stage 2 analysis. Low net recharge and head boundary conditions, high pumping, low L2-1 K, low L3A K, and low L3B-2 K.

Maximum Distances of Groundwater Impacts

Table A-8 summarizes the maximum distances observed in each Subreach for the eight worst case scenarios run separated by the head difference ranges. Groundwater impacts obtained from the model are provided in **Tables A-9 through A-12** (corresponding to Reaches 1A through 1D) displaying the maximum distances for each of the following impact ranges: 0.1 ft, 0.5 ft, 1.0 ft and 2.0 ft. The numbers in red represent the maximum distance of the impact from the dike when measured near pumping wells. The blue number represents the maximum distance of the impact when evaluating the effects of the cutoff wall.

TABLE A-8: APPROXIMATE MAXIMUM DISTANCES OF CUTOFF WALL IMPACT WHEN THE LOW NET RECHARGE AND HEAD BOUNDARY CONDITIONS WITH HIGH PUMPING WAS CONSIDERED

Reach ID	Maximum distance of cutoff wall impact, ft			
	Head difference ≥ 0.1 ft	Head difference ≥ 0.5 ft	Head difference ≥ 1 ft	Head difference ≥ 2 ft
1A	31,100	9,500	3,500	0
1B	4,300	0	0	0
1C	13,600	800	0	0
1D	21,500	100	0	0
2	32,600	4,800	500	0
3	16,000	50	0	0

TABLE A-9: APPROXIMATE MINIMUM AND MAXIMUM DISTANCES (IN FT) FROM THE HHD TO VARIOUS HEAD DIFFERENTIAL VALUES IN REACH 1A

ID*	Pressure Head Comparison (w/ project - w/o project)	0.1 ft ≤Head ≤0.5 ft		0.5 ft ≤Head ≤1.0 ft		1.0 ft ≤Head ≤2.0 ft		Head ≥2.0 ft	
		Distance Min	Distance Max	Distance Min	Distance Max	Distance Min	Distance Max	Distance Min	Distance Max
1	Run81 - Run33	0	13700/10400	0	500	0	0	0	0
2	Run82 - Run34	0	8700/6500	0	0	0	0	0	0
3	Run83 - Run35	0	13700/12800	0	500	0	0	0	0
4	Run84 - Run36	0	9500	0	50	0	0	0	0
5	Run85 - Run37	1200	24500	0	13700/8400	0	2600	0	0
6	Run86 - Run38	0	13500	0	8850/3100	0	5700/700	0	0
7	Run87 - Run39	3200	31100	0	13700/9500	0	13700/3500	0	13700/0
8	Run88 - Run40	0	15700	0	9100	0	8500/200	0	0

TABLE A-10: APPROXIMATE MINIMUM AND MAXIMUM DISTANCES (IN FT) FROM THE HHD TO VARIOUS HEAD DIFFERENTIAL VALUES IN REACH 1B

ID*	Pressure Head Comparison (w/ project - w/o project)	0.1 ft ≤Head ≤0.5 ft		0.5 ft ≤Head ≤1.0 ft		1.0 ft ≤Head ≤2.0 ft		Head ≥2.0 ft	
		Distance Min	Distance Max	Distance Min	Distance Max	Distance Min	Distance Max	Distance Min	Distance Max
1	Run81 - Run33	0	300	0	0	0	0	0	0
2	Run82 - Run34	0	0	0	0	0	0	0	0
3	Run83 - Run35	0	0	0	0	0	0	0	0
4	Run84 - Run36	0	0	0	0	0	0	0	0
5	Run85 - Run37	1500	1600	0	0	0	0	0	0
6	Run86 - Run38	0	100	0	0	0	0	0	0
7	Run87 - Run39	400	4300	0	0	0	0	0	0
8	Run88 - Run40	0	50	0	0	0	0	0	0

TABLE A-11: APPROXIMATE MINIMUM AND MAXIMUM DISTANCES (IN FT) FROM THE HHD TO VARIOUS HEAD DIFFERENTIAL VALUES IN REACH 1C

ID*	Pressure Head Comparison (w/ project - w/o project)	0.1 ft ≤Head ≤0.5 ft		0.5 ft ≤Head ≤1.0 ft		1.0 ft ≤Head ≤2.0 ft		Head ≥2.0 ft	
		Distance Min	Distance Max	Distance Min	Distance Max	Distance Min	Distance Max	Distance Min	Distance Max
1	Run81 - Run33	0	0	0	0	0	0	0	0
2	Run82 - Run34	0	0	0	0	0	0	0	0
3	Run83 - Run35	0	1000/0	0	0	0	0	0	0
4	Run84 - Run36	0	0	0	0	0	0	0	0
5	Run85 - Run37	1900	13300	0	1000/500	0	0	0	0
6	Run86 - Run38	0	1350	0	100	0	0	0	0
7	Run87 - Run39	700	13600	0	1000/800	0	1000/0	0	1000/0
8	Run88 - Run40	0	1000	0	1000/100	0	0	0	0

TABLE A-12: APPROXIMATE MINIMUM AND MAXIMUM DISTANCES (IN FT) FROM THE HHD TO VARIOUS HEAD DIFFERENTIAL VALUES IN REACH 1D

ID*	Pressure Head Comparison (w/ project - w/o project)	0.1 ft ≤Head ≤0.5 ft		0.5 ft ≤Head ≤1.0 ft		1.0 ft ≤Head ≤2.0 ft		Head ≥2.0 ft	
		Distance Min	Distance Max	Distance Min	Distance Max	Distance Min	Distance Max	Distance Min	Distance Max
1	Run81 - Run33	0	0	0	0	0	0	0	0
2	Run82 - Run34	0	0	0	0	0	0	0	0
3	Run83 - Run35	0	0	0	0	0	0	0	0
4	Run84 - Run36	0	0	0	0	0	0	0	0
5	Run85 - Run37	0	15800	0	0	0	0	0	0
6	Run86 - Run38	0	300	0	0	0	0	0	0
7	Run87 - Run39	0	21500	0	100	0	0	0	0
8	Run88 - Run40	0	1500	0	0	0	0	0	0

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APPENDIX B

CZMP EVALUATION

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B. FLORIDA COASTAL ZONE MANAGEMENT PROGRAM FEDERAL CONSISTENCY EVALUATION PROCEDURES

HERBERT HOOVER DIKE MAJOR REHABILIATION REACH 1

1. Chapter 161, Beach and Shore Preservation. The intent of the coastal construction permit program established by this chapter is to regulate construction projects located seaward of the line of mean high water and which might have an effect on natural shoreline processes.

Response: The proposed work project is not seaward of the mean high water line and would not affect shorelines or shoreline processes.

2. Chapters 186 and 187, State and Regional Planning. These chapters establish the State Comprehensive Plan which sets goals that articulate a strategic vision of the State's future. Its purpose is to define in a broad sense, goals, and policies that provide decision-makers directions for the future and provide long-range guidance for an orderly social, economic and physical growth.

Response: The proposed work has been coordinated with the State without objection.

3. Chapter 252, Disaster Preparation, Response and Mitigation. This chapter creates a state emergency management agency, with the authority to provide for the common defense; to protect the public peace, health and safety; and to preserve the lives and property of the people of Florida.

Response: The proposed project purpose is to strengthen and protect the existing lake levee system, thereby ensuring adequate flood control for residents of the region. No action may result in conditions which enhance the possibility of a project failure, resulting in an emergency situation and potentially causing significant damage to persons and property. Therefore, this work would be consistent with the efforts of Division of Emergency Management.

4. Chapter 253, State Lands. This chapter governs the management of submerged state lands and resources within state lands. This includes archeological and historical resources; water resources; fish and wildlife resources; beaches and dunes; submerged grass beds and other benthic communities; swamps, marshes and other wetlands; mineral resources; unique natural features; submerged lands; spoil islands; and artificial reefs.

Response: The proposed project is the least environmentally damaging to the aforementioned resources of all the action alternatives considered. The existing habitat within the project area is of marginal quality and has largely been developed for agriculture, urban and residential uses. Impacts to wetlands have been mitigated for in Reach 1.

5. Chapters 253, 259, 260, and 375, Land Acquisition. This chapter authorizes the state to acquire land to protect environmentally sensitive areas.
Response: At this time it is not known what lands may need to be purchased for completion of the proposed project. Initial indications are that most lands are already within the HHD levee right of way and are therefore in Federal ownership. Any lands that will need to be acquired will be covered under a future EIS when details for those plans are available.

6. Chapter 258, State Parks and Aquatic Preserves. This chapter authorizes the state to manage state parks and preserves. Consistency with this statute would include consideration of projects that would directly or indirectly adversely impact park property, natural resources, park programs, management or operations.

Response: The proposed work may affect Pahokee State Park resources due to construction access (Section 5, pg FEIS-57, dated July 2005). Municipal and county parks may be temporarily affected, however these areas would be returned to their pre-construction condition following completion of the project. Portions of the LOST may be impacted or removed from the dike levee. Impacts will be avoided and minimized to the extent practicable throughout construction activities. The Corps will prepare a letter report requesting Section 111 authorization by the Chief of Engineer's to repair damages to the LOST caused by project implementation.

7. Chapter 267, Historic Preservation. This chapter establishes the procedures for implementing the Florida Historic Resources Act responsibilities.

Response: The proposed action has been coordinated with the Florida State Historic Preservation Officer in accordance with the National Historic Preservation Act and the Archeology and Historic Preservation Act. Consultation with the State Historic Preservation Officer (SHPO) was initiated August 20, 1999. In a response dated August 7, 2005, the SHPO concurred with the Corps' no adverse effect determination on Reach 1. The project will not have an adverse affect on any historic properties included in or potentially eligible for inclusion in the National Register of Historic places. Conditions to protect undiscovered resources will be implemented as follows: Language will be included in construction contract specifications outlining the steps to be taken in the event that undiscovered historical properties are encountered. An informational training session, developed by a professional archaeologist, will be conducted for the contractor's personnel to explain what kinds of archaeological/cultural materials might be encountered during construction of the impoundment, and the steps to be taken in the event these materials are encountered. A professional archaeologist will conduct periodic monitoring of the project area during construction to determine if activities are impacting unanticipated cultural resources. The proposed action is consistent with these Acts. Historic preservation compliance will be completed to meet all responsibilities under Chapter 267.

8. Chapter 288, Economic Development and Tourism. This chapter directs the state to provide guidance and promotion of beneficial development through encouraging economic diversification and promoting tourism.

Response: Contribution from the study area to the State's tourism economy would not be compromised by project implementation. Temporary, short-term impacts may be realized during construction due to effects to municipal and county parks and bank fishing areas. These effects are not expected to be significant. The project would be compatible with tourism for this area and could potentially contribute to overall growth and development of the area therefore, would be consistent with the goals of this chapter.

9. Chapters 334 and 339, Transportation. This chapter authorizes the planning and development of a safe balanced and efficient transportation system.

Response: The proposed project would not impact the existing public transportation system of the area and therefore, would be consistent with the goals of this chapter.

10. Chapter 370, Saltwater Living Resources. This chapter directs the state to preserve, manage and protect the marine, crustacean, shell and anadromous fishery resources in state waters; to protect and enhance the marine and estuarine environment; to regulate fishermen and vessels of the state engaged in the taking of such resources within or without state waters; to issue licenses for the taking and processing products of fisheries; to secure and maintain statistical records of the catch of each such species; and, to conduct scientific, economic, and other studies and research.

Response: The proposed HHD Major Rehabilitation project is located completely inland and would have no affect on saltwater resources either directly or indirectly through discharge downstream. The proposed project is therefore not applicable to chapter 370.

11. Chapter 372, Living Land and Freshwater Resources. This chapter establishes the Game and Freshwater Fish Commission and directs it to manage freshwater aquatic life and wild animal life and their habitat to perpetuate a diversity of species with densities and distributions which provide sustained ecological, recreational, scientific, educational, aesthetic, and economic benefits.

Response: The proposed project has been coordinated with the Florida Game and Fresh Water Fish Commission (GFC) without objection. In a letter dated November 12, 1998, the GFC concurred with findings and recommendations of the U.S. Fish and Wildlife Service for fish and wildlife protection as outlined in the Final CAR (see Final EIS, HHD Major Rehabilitation Report, Martin and Palm Beach Counties, Annex A, dated July 2005). The Corps has agreed to comply with these recommendations as outlined in Section 5.00 of the above listed EIS. Therefore, the work would comply with the goals of this chapter.

12. Chapter 373, Water Resources. This chapter provides the authority to regulate the withdrawal, diversion, storage, and consumption of water.

Response: The proposed project does not involve the transportation or discharge of pollutants. Environmental protection measures will be enforced during construction to avoid inadvertent spills or other sources of pollution.

13. Chapter 376, Pollutant Spill Prevention and Control. This chapter regulates the transfer, storage, and transportation of pollutants and the cleanup of pollutant discharges.

Response: This work does not involve the transportation or discharging of pollutants. Conditions will be placed in the contract to handle any inadvertent spill of pollutants. Therefore, the project would comply with this Act.

14. Chapter 377, Oil and Gas Exploration and Production. This chapter authorizes the regulation of all phases of exploration, drilling, and production of oil, gas, and other petroleum products.

Response: This work does not involve the exploration, drilling or production of gas, oil or petroleum product and therefore does not apply.

15. Chapter 380, Environmental Land and Water Management. This chapter establishes criteria and procedures to assure that local land development decisions consider the regional impact nature of proposed large-scale development. This chapter also deals with the Area of Critical State Concern program and the Coastal Infrastructure Policy.

Response: The work does not involve land development as described by this chapter; therefore, this chapter is not applicable.

16. 388 (Mosquito/Arthropod Control). Chapter 388 provides for a comprehensive approach for abatement or suppression of mosquitoes and other pest arthropods within the state.

Response: The work would not further the propagation of mosquitoes or other pest arthropods.

17. Chapter 403, Environmental Control. This chapter authorizes the regulation of pollution of the air and waters of the state by the Florida Department of Environmental Protection.

Response: A Draft Environmental Assessment has been prepared and will be reviewed by the appropriate resource agencies including the Department of Environmental Protection.

18. Chapter 582, Soil and Water Conservation. This chapter establishes policy for the conservation of the state soil and water through the Department of Agriculture. Land use policies will be evaluated in terms of their tendency to cause or contribute to soil erosion or to conserve, develop, and utilize soil and water resources both onsite or in adjoining properties affected by the project. Particular attention will be given to projects on or near agricultural lands.

Response: Project implementation will include appropriate erosion control plans and measures to ensure compliance.

APPENDIX C

PERTINENT CORRESPONDENCE

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Planning Division
Environmental Branch

TO ADDRESSEES ON THE ENCLOSED LIST:

The Jacksonville District, U.S. Army Corps of Engineers (Corps) is gathering information to help define issues and concerns that will be addressed in two National Environmental Policy Act documents. The first report will be an Environmental Assessment (EA) for the Herbert Hoover Dike Reach 1 Cutoff Wall, Subreaches B, C and D. A previous EA was completed in May 2007 for the Reach 1 Seepage Berm and Reach 1A Test Cutoff Wall. The second report is a Draft Second Supplemental Environmental Impact Statement to the 1999 Draft Environmental Impact Statement (EIS) and 2005 Final Supplement Environmental Impact Statement (FEIS) on the Herbert Hoover Dike (HHD) Major Rehabilitation Evaluation Report. This Draft Supplement will cover the remainder of the area of Reach 1 of the HHD. Reach 1, approximately 22.5 miles (36 km) in length within Martin and Palm Beach Counties, extends from the St. Lucie Canal at Port Mayaca, south to the Hillsboro Canal at Belle Glade, Florida (Figure 1). A Major Rehabilitation Evaluation Report (MRR) was approved by Congress in the Water Resources Development act (WRDA) 2000 that addressed the need to repair the aging dike. The primary objective of this study is to implement a combination of landside rehabilitation features with the cutoff wall in Reach 1 to increase the structural integrity of the HHD.

HHD is urgently in need of repairs. We have began repairs by installing the elements common to all structural solutions, such as filling in the toe ditch in the highest risk areas. This EA for the Reach 1 Cutoff wall for Subreaches B, C and D will reduce the hydraulic pressure on the levee base and provide additional protection as well as allow work to continue along the levee.

The proposed action will be a variant of the selected plan described in the July 2005 FSEIS as it was determined that the cut-off wall with seepage berm would not work for all of Reach 1 nor did it include any lands outside of the ROW in the analysis. The alternatives to be examined in this EIS will be a combination of one or more of the following features, dependent on the geology and adjacent land features, with the cut-off wall: Seepage Berm, Relief Trench, Soil Replacement Wedge, Relief Wells, Sand Column and Drainage Feature. It is necessary to update the July 2005 FSEIS for Reach 1 to include these new landside rehabilitation features and any impacts to lands acquired outside of the ROW.

The Corps solicits your views, comments and information about environmental and cultural resources, study objectives and important features with the described study area, as well as any suggested improvements. Letters of comments or inquiry should be addressed to the letterhead address to the attention of the Planning Division, Environmental Studies Section and received within thirty (30) days of the date of this letter.

Sincerely,

Marie G. Burns
Chief, Planning Division

Enclosures

Allen/CESAJ-PD-ES/3206
Cintron/CESAJ-PD-ES
Dugger/CESAJ-PD-E
Rogalski/CESAJ-DR-C
Burns/CESAJ-PD

L:\Group\PDES\Nancy\HHD\Reach 1/scoping letter HHD Reach1

Ho, Tien SAJ Contractor

From: Allen, Nancy P SAJ
Sent: Monday, October 01, 2007 8:54 AM
To: 'Mike Loden'; 'Laura Carnes'; Ho, Tien SAJ Contractor
Cc: Cintron, Barbara B SAJ; Allen, Nancy P SAJ
Subject: FW: FW: Herbert Hoover Dike Update/Coordination

All,

Comments back from EPA, see below. I sent out the 10 county commissioner power point presentation and an email with our status on HHD. FYI and inclusion in the Reach 1 EA, EIS and Reach 2/3 EIS document.

Nancy
-----Original Message-----
From: Hoberg.Chris@epamail.epa.gov [mailto:Hoberg.Chris@epamail.epa.gov]
Sent: Friday, September 28, 2007 4:44 PM
To: Hughes, Eric H SAJ
Cc: Allen, Nancy P SAJ; Mueller.Heinz@epamail.epa.gov; Mancusi-Ungaro.Philip@epamail.epa.gov; Miedema.Ron@epamail.epa.gov
Subject: Re: FW: Herbert Hoover Dike Update/Coordination

Eric / Nancy - As you know, we have reviewed several EAs and an EIS on HHD rehab for various reaches. Overall, we support the HHD rehab work.

Hopefully, future NEPA documents can be reasonably consolidated to cover the impacts of several reaches, or HHD as a whole. We realize this is not always possible since there may be new requirements, priorities, emergencies or other constraints, and sometimes funding is an issue. Since more HHD EAs and EISs are forthcoming, we would suggest that all documents have a strong cumulative impacts section to update the public and provide a sense of the cumulative impacts on HHD rehab as a whole (rather than only project direct impacts on given reaches) on the resources in the area. THX

-Chris...EPA/Region 4

Christian M. Hoberg
Life Scientist
EPA Region 4
NEPA Program Office
Office of Policy and Management
Atlanta, Georgia 30303-8909
404/562-9619
hoberg.chris@epa.gov

"Hughes, Eric H SAJ" <Eric.H.Hughes@usace.army.mil>
09/28/2007 03:27 PM

To: Chris Hoberg/R4/USEPA/US@EPA
cc: Ron Miedema/R4/USEPA/US@EPA
Subject: FW: Herbert Hoover Dike Update/Coordination

Chris:

FYI

E

-----Original Message-----
From: Miedema.Ron@epamail.epa.gov [mailto:Miedema.Ron@epamail.epa.gov]
Sent: Friday, September 28, 2007 9:49 AM
To: Harvey.Richard@epamail.epa.gov; Fasselt.Veronica@epamail.epa.gov; Hughes.Eric@epamail.epa.gov
Subject: Fw: Herbert Hoover Dike Update/Coordination

FYI,
----- Forwarded by Ron Miedema/R4/USEPA/US on 09/28/2007 09:38 AM -----

"Allen, Nancy P SAJ" <Nancy.P.Allen@usace.army.mil> 09/28/2007 09:15 AM	To	"exchange" <Agustin_valido@fws.gov>, Ron Miedema/R4/USEPA/US@EPA, <stanley.ganthier@dep.state.fl.us>
	cc	"Allen, Nancy P SAJ" <Nancy.P.Allen@usace.army.mil>
	Subject	Herbert Hoover Dike Update/Coordination

Ron, Agustin, Stanley,

I wanted to give you all an update on our progress and schedule for the rehabilitation of the Herbert Hoover Dike. We will have three environmental documents coming out to cover the work to be done in Reaches 1, 2 and 3.

There will be an EA written for the continuation of a Cutoff Wall in Reach 1 B, C and D. We have completed the Regional Groundwater Modeling and have received a Draft Report. I have submitted comments and expect their comments back in 2-3 weeks. When I have the final report, I will provide you a copy if you would like one. The EA should be completed by the first part of January 08. This EA will allow us to keep work moving forward on the Cutoff wall

while providing additional protection to the area. Remember that we already
have a completed EA for the Reach 1 Seepage Berm and Reach 1A Test Cutoff
Wall dated May 2007.

There will also be a Reach 1 EIS to cover the full project design, including
any Real Estate acquisition that may be necessary. As you will note in the
power point presentation, the seepage berm fix may not be the best solution
for all of Reaches 1, 2 and 3. Depending on the geology, infrastructure and
other factors in the area, an alternative landside rehabilitation feature may
be selected in conjunction with the cutoff wall. These landside features are
still under review and analysis. This EIS is scheduled to be completed in
September of 2008.

Finally, as you know we had a draft EIS out for the Reaches 2 and 3.
Headquarters has asked us to include additional analysis (Risk Assessment)
and requested that the MRR/EIS be one document. A National Risk Assessment
Team has been formed and work has started on this effort. We were also
directed to look at system-wide solutions for all of HHD. Because of the
inclusion of the new landside features in combination with the cutoff wall
for Reaches 2/3 and due to our additional requirements, we will be doing
another draft EIS report. We will also have the full footprint including any
Real Estate acquisition needs at that time. The final EIS is scheduled to be
completed by April 2009.

I know that you will probably have lots of questions. Please review the
presentation and send me your thoughts. Thank-you, Nancy Allen

(See attached file: HHD Presentation to 10 County Coalition 14 Sep 07.ppt)
(See attached file: HHD Presentation to 10 County Coalition 14 Sep 07.ppt)

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DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning Division
Environmental Branch

OCT 09 2007

Mr. Christian M. Hoberg
U. S. Environmental Protection Agency, Region IV
NEPA Program Office
Office of Policy and Management
Atlanta Federal Center
61 Forsyth Street
Atlanta, Georgia 30303-8960

Dear Mr. Hoberg:

I am writing on behalf of the Jacksonville District of the U.S. Army Corps of Engineers (Corps). This is in response to your email dated September 28, 2007, which included comments and concerns on the Herbert Hoover Dike (HHD) Rehabilitation Project. Your recommendations to include a cumulative impact summary for all of the HHD rehabilitation, as well as including a list of previously published NEPA documents, will be incorporated into future NEPA documents.

The Corps appreciates your continued support on the HHD rehabilitation/reconstruction projects. Due to urgency of needed repairs, the Corps' approach is to minimize the risk to populations by beginning work in the priority areas while continuing design work on the remainder of HHD. It was the HHD Task Force Commander's judgment, endorsed by the District Engineer, to immediately implement those improvements that were part of all potential future structural modifications. Improvements that can be implemented immediately include cleaning or filling the toe ditch, additional seepage berms and a cutoff wall that reduces the hydraulic pressure on the levee base.

As plans and specifications were developed for Reach 1, it became apparent that the cutoff wall with seepage berm alternative would not work for all of Reach 1. The alternative for Reach 1 will be a combination of one or more of the following features dependent on the geology and adjacent land factors with the cutoff wall: Seepage Berm, Relief Trench, Soil Replacement Wedge, Relief Wells, Drainage Feature and Sand Columns. This variability will cause each Reach of HHD to be designed individually and funding is not available to survey, plan, and design the entire repair at once. Each increment of work completed reduces the risk of failure by increasing structural stability in the affected Reaches and justifies the incremental repair schedule. Through this incremental repair plan, the Corps has been able to take action to reduce piping and increase levee integrity.

We appreciate your ongoing coordination with us in our efforts in the rehabilitation of HHD. If you have any questions or comments concerning our responses to your recommendations, please contact Ms. Nancy Allen by email nancy.p.allen@usace.army.mil or phone 904-232-3206.

Sincerely,

Kenneth R. Dugger
Chief, Environmental Branch

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

May 9, 2007

Stuart J. Appelbaum
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Service Federal Activity Code: 41420-2007-FA-0675
Date Received: April 3, 2007
Project: Herbert Hoover Dike Major Rehabilitation
Counties: Palm Beach and Martin

Dear Mr. Appelbaum:

The Fish and Wildlife Service (Service) has reviewed additional information submitted in an Environmental Assessment (EA) by the U.S. Army Corps of Engineers (Corps), dated April 28, 2007, proposing further work in Reach 1A and Reach 1 of the Herbert Hoover Dike (HHD). This EA covers the Herbert Hoover Dike Major Rehabilitation for the Reach 1 Seepage Berm and Reach 1A Test Cutoff Wall. Reach 1 is located in Palm Beach and Martin Counties, extending from the St. Lucie Canal at Port Mayaca, south to the Hillsboro Canal at Belle Glade. The proposed project area is approximately 22.5 miles along the HHD. The Flood Control Act of 1948 provided authority to construct the dike and authorized repairs and modifications.

The recommended plan for rehabilitation of the HHD consists of an integrated solution that addresses internal erosion, slope stability, and foundation vulnerabilities. The proposal includes two main features: a Reach 1 seepage berm and a Reach 1A partially penetrating cutoff wall. All work under this EA will be conducted within the Corps' existing right of way (ROW). On March 13, 2007, an interagency team of biologists from the Corps, the Environmental Protection Agency, The Florida Department of Environmental Protection, and the Service conducted an inspection of the subject reach, discussed ongoing modifications to the previously proposed design, and used the Uniform Mitigation Assessment Method (UMAM) to evaluate the quality of wetlands potentially affected by the proposed work.

The UMAM evaluation was conducted on Reach 1 to determine the functional units of the habitat to be affected. The team scored the area 150 ft. from the toe of the dike. However, this EA only covers work within the ROW. A future EIS will cover work outside of the ROW once the Corps has a project design for that area and has determined real estate acquisition needs.

TAKE PRIDE IN AMERICA

Stuart J. Appelbaum

The Corps has determined that a total of 16.6 functional units of wetland value will be impacted by the Hebert Hoover Dike project for Reach 1. This wetland value, minus credits (3.8 units) from the emergency toe ditch work already completed on the previous project phase, nets a total loss of 12.8 functional units. The Corps wishes to apply available mitigation credits (13.3 units) from the melaleuca removal project conducted in a previous project segment to cover this additional wetland impact.

If the current plans discussed by the project engineer, Jacob R. Davis, and the environmental lead, Nancy P. Allen, are approved, the Corps may further reduce potential impact on wildlife resources. In addition, certain proposed design changes may result in restored wildlife habitat and an increased amount of aquatic habitat. Because construction would be confined to the existing footprint, environmental impacts would be minimal. Impacts caused by filling wetlands along the toe ditch have been mitigated on and off site. No other long-term adverse effects of the project are anticipated.

We greatly appreciate your cooperation in this rehabilitation project and thank you for your support in the effort to protect important natural resources. If you have any questions regarding this project, please contact Agustin P. Valido at 772-562-3909, extension 298.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Jacksonville, Florida (Jacob R. Davis)
Corps, Jacksonville, Florida (Nancy Allen)
EPA, West Palm Beach, Florida (Ron Miedema)
FWC, West Palm Beach, Florida (Chuck Collins)
Service, Jacksonville, Florida (Miles Meyer)

COORDINATION WITH U.S. FISH AND WILDLIFE SERVICES
FISH AND WILDLIFE COORDINATION ACT

Coordination Date	Information Coordinated	Coordination Determination
May 9, 2007	The EA covering Reach 1 Seepage Berm within the right-of-way and Reach 1A Cutoff Wall.	Wetlands being filled along the toe ditch have been mitigated for on and off-site. No other long term adverse impacts of the project are anticipated.
January 16, 2007	The Reach 2&3 EIS for seepage berm and cutoff wall.	Resource issues are the same as Reach 1 and have been addressed in the Final CAR, dated December 2001. Only remaining issue is to identify additional wetland mitigation sites to fully compensate for toe ditch backfilling in Reaches 2&3.
November 24, 2006	The Reach 1 EA for Priority Toe Ditch Backfill, dated Jan 2007. Suspended construction cutoff wall and bench. Toe ditch backfill repairs in Reach 1 to stabilize the outer toe and prevent further deterioration.	Proposed modifications are similar to those proposed in 1999 EIS; mitigation was carried out for toe ditch backfill therefore no additional mitigation is required. Commitments for threatened, endangered and state listed species are still in effect.
April 18, 2005 USFWS letter	The Supplemental Draft EIS, with the review of the new alternative, that was also in the 30% design.	Same as previous letter. Impacts minimized; no mitigation needed at this time. Threatened and Endangered species issues have been addressed with commitments.
March 8, 2004 USFWS Supplement to FCAR	Review of 30% document that eliminates construction in the toe ditch and confines project to the existing HHD footprint	Reduces impacts previously addressed in the Dec. 20, 2001 FCAR & March 4, 2003 Supplemental FCAR. No significant impacts expected except temporary dewatering of toe ditch.

February 23, 2004 USACE letter	New 30% design, additional reduction in impacts, and information on recommended alternative	Wetland impacts have been eliminated with the exception of temporary impacts associated with construction.
October 28, 2003 USFWS letter	Letter documenting review of VE report that modified recommended plan in Sub-reach 1A to reduce impacts	Request 30% Designs to review prior to submitting a supplement to FCAR
June 27, 2003 USACE letter	VE report recommendations on Sub-reach 1A only, not entire Reach	Sub-reach 1A design changes from the original MRER recommendation, eliminating impacts in this sub-reach that has higher quality wetlands
March 4, 2003 USFWS Supplemental CAR	Review of VE report and modifications to recommended plan design	Reduces impacts on wetlands; No mitigation required. Reminder of commitments to complete bald eagle and eastern indigo snake measures

January 14, 2003 USACE letter	Results of the VE study.	Request for review
December 20, 2001 USFWS Final CAR	Review of draft EIS and impacts associated with alternatives	While filling and excavation of wetlands on landward side of HHD are of lesser concern, impacts to habitat are significant enough to require mitigation; Concerned with any construction that would be proposed on waterward side of HHD and effects to Lake; Concerned with construction impacts to burrowing owls, bald eagles, and eastern indigo snake. Measures should be implemented.
March 21, 2001 USFWS letter	Compensatory wetland mitigation plan	Supports the mitigation proposed and suggests mitigation credit for future Reaches of HHD could be banked
March 8, 2001 USACE letter	Proposal for wetland habitat loss	Agree functional value of habitat loss should be mitigated. Plan to supplement an existing exotic plant removal program by re-planting the mitigation area with native trees. Request for concurrence

October 30, 2000 USACE letter	The Corps cannot support the mitigation plan outlined by USFWS, but proposes strategy for wetland compensation	The Corps will support exotic plant removal program and investigate enhancement opportunities of existing wetland functions.
February 11, 2000 USFWS Supplement draft CAR	Results of wetland function assessment and mitigation plan proposal	Approximately 35 acres of wetland habitat will be impacted by recommended alternative. Mitigation required. Proposed sites and compensation measures listed. Results of WRAP
June 9, 1999 USFWS Section 7 determination	Determination of effects to threatened and endangered species in project area	Concur with USACE determination of not likely to adversely effect, provided recommendations for the bald eagle and eastern indigo snake are implemented
October 30, 1998 USFWS draft CAR	Draft Environmental Impact Statement	Alternatives 2 and 3 are acceptable, provided mitigation for wetlands is provided; exotic vegetation is removed; Construction avoids active bald eagle nest, protection measures for eastern indigo snake are followed, and impacts to burrowing owls are minimized

COPY

RECEIVED
12 July 2007

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Ms. Marie G. Burns, Chief
Environmental Branch - Planning Division
Jacksonville District Corps of Engineers
Post Office 4970
Jacksonville, Florida 32232-0019

July 3, 2007

Re: DHR No. 2007-2429B / Additional Information Received: June 4, 2007
Herbert Hoover Dike Major Rehabilitation
Environmental Assessment and Proposed Finding of No Significant Impact
Martin and Palm Beach Counties

Dear Ms. Burns:

Our office reviewed the above referenced additional information to address the concerns raised by Ms. Laura Kammerer of this office during a May 30, 2007 telephone conversation with you and Mr. David Pugh of your staff regarding the proposed project.

We concur that the proposed rehabilitation on the Herbert Hoover Dike historic property will not be adversely affected. However, if the project plans/design should change, this office must be notified prior to implementation. If minor changes, contact by electronic mail or telephone will be sufficient, if major changes, consultation should occur in writing.

If you have any questions, please contact Laura Kammerer, Deputy State Historic Preservation Officer for Review and Compliance, by telephone at 850-245-6333, or by electronic mail at lkammerer at dos.state.fl.us. Thank you for your interest in protecting Florida's historic properties.

Sincerely,

Frederick P. Gaske

Frederick P. Gaske, Director, and
State Historic Preservation Officer

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ Director's Office (850) 245-6300 • FAX: 245-6436
☐ Archaeological Research (850) 245-6444 • FAX: 245-6452
☑ Historic Preservation (850) 245-6333 • FAX: 245-6437
☐ Historical Museums (850) 245-6400 • FAX: 245-6433
☐ Southeast Regional Office (561) 416-2115 • FAX: 416-2149
☐ Northeast Regional Office (904) 825-5045 • FAX: 825-5044
☐ Central Florida Regional Office (813) 272-3843 • FAX: 272-2340

Roswell Harrington
PO Box 127
Canal Point, Fl. 33438-0127
Phone (561) 755-0114
roswell_harrington@yahoo.com

May 10, 2007

Army Corps of Engineers

To Whom It May Concern:

RE: Herbert Hoover Dike Rehabilitation EA and FONSI on Reach 1 partial seepage berm and Reach cutoff wall, May 2007

After reviewing your response to my comments, I believe a brief introduction might be in order. My father was a high school principal, before he migrated to the area in November, 1928, shortly after the storm. My mother was a school teacher at both Canal Point Elementary and later on at Pahokee Jr. Sr. High, where she taught math, but her love was Florida History. My father worked briefly for Mr. F.E. Bryant directly as a time keeper and then started farming full time. He was friends with Marvin 'Red' Mounts, former Palm Beach County Agriculture Agent and thru him, Dr. Fairchild. He served on the Palm Beach County Soil Conservation Service and the Palm Beach County School Board of Trustees. I was raised then by people who helped pioneer the area and understood it and it's history. While I have tried in my own way and have maintained the family interest in farming, community service and history, I learned from them among others. I farmed with my father from 1984 to his death. I have a Master's Degree in Guidance and Counseling and served among other things on the Palm Beach County Historic Resources Review Board. My comments were proofed by another local farmer, Dale Erickson, whose family came to the area in 1910, and who has a very practicable knowledge of the area and it's history.

I wish to respond to your response to my comments and for simplicity will use your numbering system. My original comments and your response can be found in Table 6-4, the Comment Response Matrix, pages 72 thru 79 of the final draft, whose address is noted below:
(**http://www.saj.usace.army.mil/cco/HHD/Reports/Reach1_EA_Final_May2007.pdf**
)

1. Page 72, RH-2, Not to disparage the State Historic Preservation Office, there is still an extensive local data base, which they may not have access to, as well as others that have made a career on South Florida historical and archeological sites, Dr. Robert Carr, For example, there was a Second and Third Seminole Indian War fort, Fort McCray, located either on the Lake Okeechobee Ridge or on the beach, somewhere between the St. Lucie Canal and the Palm Beach County Line. This fort was first

RH #1

mentioned in the diary that accompanies the Ives map and was erected by the Bureau of Topographical Engineers and while located on that map has since been lost. Besides this link to the Corps history, it was a way station of the Florida branch of the Trail of Tears which started at Fort Jupiter, went to Ft McCray and then across the lake to Fort Center, eventually arriving in Tampa.

2. Page 72-73 RH-3, RH - 4 There seems to be some misunderstanding here. My comment was directed at the loss of muck soils in the farm lands next to the Lake Okeechobee Ridge. You partially addressed this issue previously in the Comment Response Matrix; EPA 3, USGS – 1, USGS – 2), but did not deal with the issue I raised. How will you mitigate any soil loss that occurs thru the loss of ground water that maintains those soils? Secondly any test that occurs must take in to account the fact that the entire Basin is undergoing a severe drought, and there is not a present enough water in the lake to create the usual water 'head' that provides the seepage that maintains those soils. RH #2

3. Page 73, RH 5 I am sorry , but you did not mention that in your previous draft. I am curious, however, because in my own research, I talked with individuals in both agencies that had some of the same concerns that I had. I do maintain a strong difference of opinion with previous statements in this report that say the soil types are not unique and the farming practices are not unique. RH #3

4. Page 73, RH 6, I have to concur in part with your response. In the last 100 yrs, the highest elevation recorded was during the 1947 storm. I refer you to "Okeechobee Hurricane: Killer Storms in the Everglades" by Lawrence E Will, Chapter 30;, "The Dike is Tested" pages 190-192. In this Will recounts that the dike withstood lake levels in excess of 20 feet. It is also interesting to note that the most damage the dike has suffered other than the damage from Wilma, occurred in 1949, in the same locations, with comparable wind speeds and water elevations.

Fifteen years ago, I talked to a USGS geologist, who made a study of the Lake Okeechobee Ridge and lake levels. Unfortunately, this gentleman has since deceased, but I remember that in his conversation that he had postulated the lake ranged in elevation for 9 to 25 feet above sea level.

However this is all by the wayside in that your past and current schedules all have the lake at levels well below this. RH #4

If the schedule is maintained; where is the risk?

5. Page 75, RH – 12 As I noted they were introduced. There was a tamarind tree on my parents property since 1926,(possibly planted by the first owner, the first director of the Canal Point USDA Sugar Cane Experiment Station, Dr. Brandes) but Wilma

destroyed it. I think there is another on the grounds of the Bryant Guest House. But I have found the Tree Snails all up and down on the Ridge within the area mentioned. RH#5

6. Page 75-76 RH 13 As noted in RH 5 response above, The soils are unique and the farming practices are also unique. In fact they vary in the region based upon the type and depth of the muck 'soils'. RH#6

7. Page 76 RH 14. This severe loss has occurred in the 'muck' soils the furtherest from the lake, In the soil types I mentioned, the Torrey and Pahokee Series, there has been historically none of the loss mentioned. The basic nature of the soil is different as well as it's depth and locations. These soils have been maintain by the lake and it's seepage. RH#7

8. Page 78 RH 21 Several times in the document, it was indicated that a test would be done. It will be hard to judge the results as the current water table is severely below normal due to the current drought. I have my doubts and concerns and they are based in part to personal knowledge and research of the impact of the lake on my family's farm, and in part to my own research. RH#8

9 Page 79 RH 22 As noted you have indicated that you have had the report reviewed by people familiar with the soils, but what individuals familiar with the unique farming practices have you contacted? RH#9

Thank you very much for your kind concerns and attentions made to my other comments. If at any time any person wishes to contact me regarding the points or other issues I have raised, please feel free to do so.

Your obedient servant,

Roswell Harrington

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