Deliverable 4.2 – Final Alternative Cost Estimate Technical Memorandum

Dated November 14, 2005

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SUBJECT: General Engineering Services Work Order No. CN040912-WO05
Evaluation of Alternatives for Elimination of Stormwater Discharges from the North Springs Improvement District (NSID) to the Everglades Protection Area (EPA)

TASK: Task 4 – Cost Estimating for Alternatives

Table of Contents

1. Background

Florida's Everglades Forever Act (EFA), Florida Statute (F.S.) 373.4592, establishes long-term water quality goals designed to restore and protect the Everglades Protection Area (EPA). Figure 1.1 shows an overview of the EPA. As defined in the EFA, the EPA includes Water Conservation Areas (WCAs) 1, 2A, 2B, 3A, 3B, the Arthur R. Marshall Loxahatchee National Wildlife Refuge and the Everglades National Park. The 1994 EFA required the South Florida Water Management District (SFWMD) to apply for a permit from the Florida Department of Environmental Protection (FDEP) to operate and maintain water control structures (pumps, gates, culverts) which discharge into, within or from the EPA, and which are not included in the Everglades Construction Project (ECP).

The SFWMD's permit application was submitted to FDEP in September 1994, and FDEP formally issued Permit #06, 502590709 to the SFWMD on April 20, 1998. This permit, designated as the Non-ECP Permit, provides schedules, strategies and a monitoring program to ensure compliance with state water quality standards to the maximum extent practicable for discharges from the structures. Upon issuance of the Non-ECP permit, the SFWMD initiated the implementation of the permit conditions through the creation of the Everglades Stormwater Program (ESP). Some of the stormwater discharges from the North Springs Improvement District (NSID) basin flow west into WCA-2A, via the NSID Pump Station 1. Therefore, the NSID basin is one of the eight ESP basins. Figure 1.2 shows the limits of the NSID basin and the location of the pump stations.

The long-term goal of the Everglades restoration effort is to combine point source controls, basin-level solutions and regional solutions in a system-wide approach to ensure that all waters in the EPA meet the numeric phosphorus criterion and other applicable state water quality standards. In order to achieve this goal, the SFWMD has developed the Everglades Protection Area Tributary Basins Long-Term Plan for Achieving Water Quality Goals (Long-Term Plan).

During the 2003 legislative session, the 1994 EFA was amended to include reference to the March 17, 2003 Long-Term Plan (with modifications) as the appropriate strategy for achieving the long-term water quality goals of the EPA. The amended EFA was subsequently revised during the same legislative session to address concerns about portions of the amended version. The Long-Term Plan was revised in October 2003 to incorporate direction received from the legislature, as well as to address comments received from various stakeholders and the public.

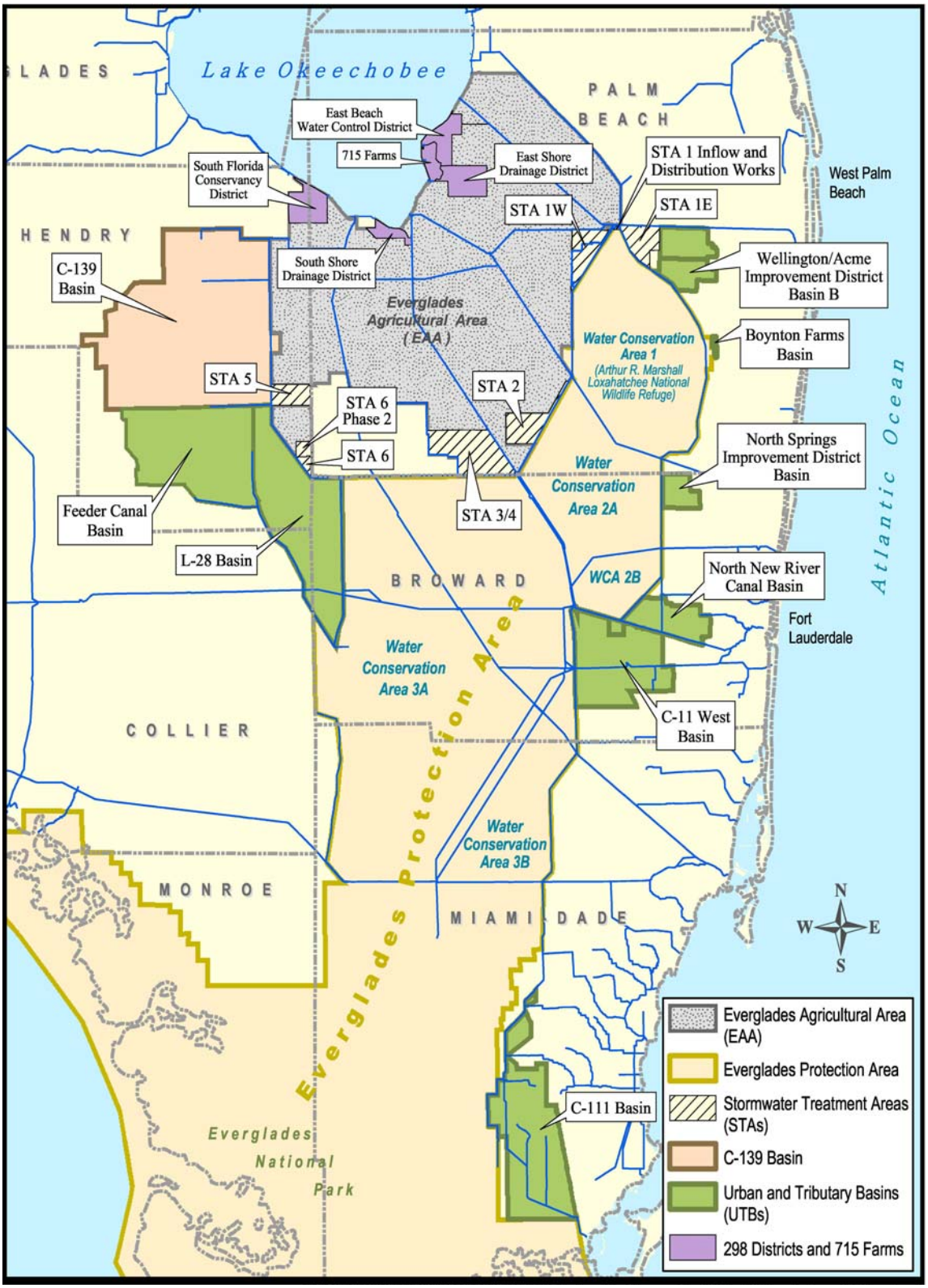

Figure 1.1 – Overview of the Everglades Protection Area and Tributary Basins

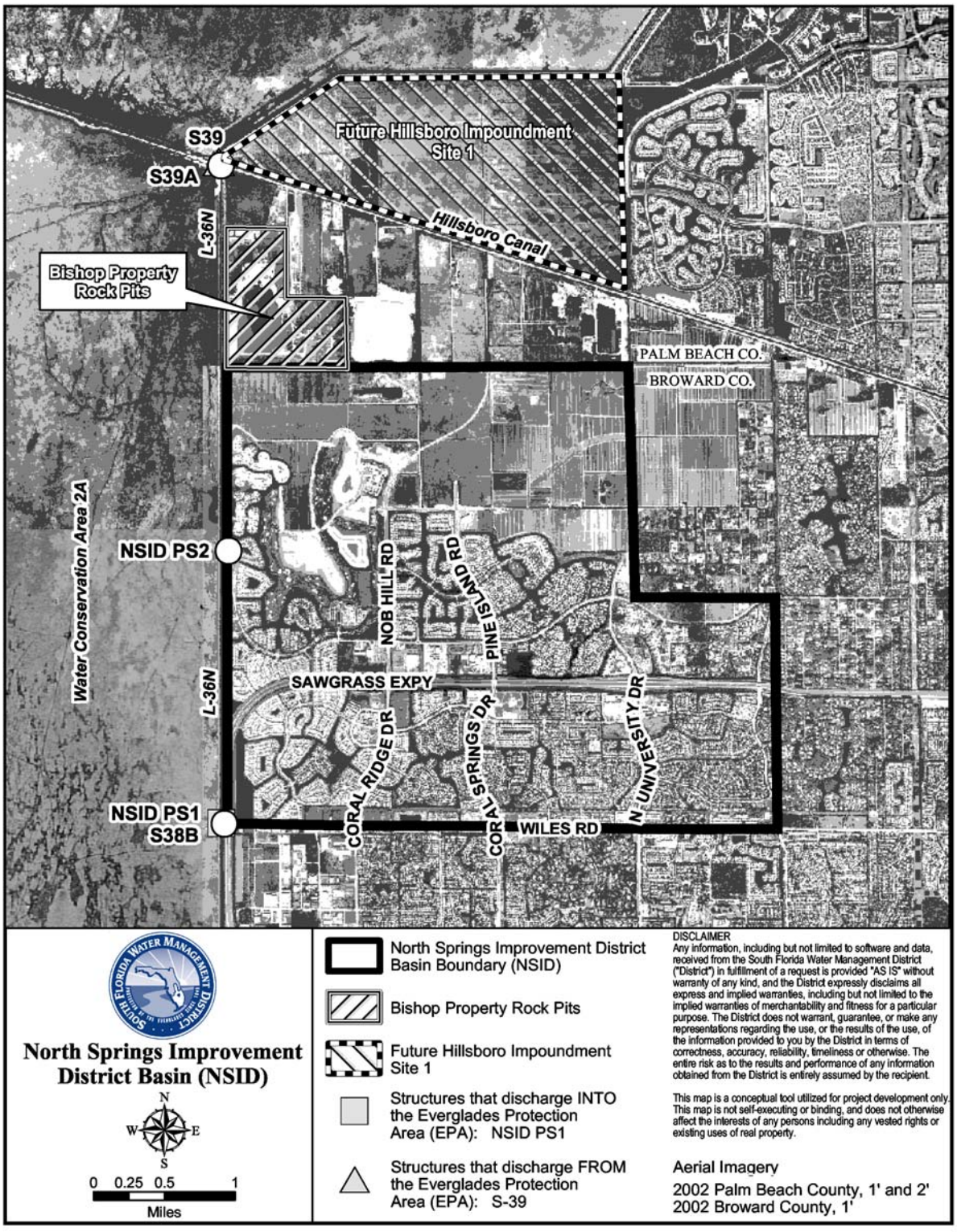

Figure 1.2 – North Springs Improvement District Basin Limits

The October 27, 2003 Long-Term Plan was submitted to the FDEP in December 2003. As recommended by the Long Term Plan, the 2004 Hydrologic & Hydraulic (H&H) Analysis for NSID and Hillsboro basins was performed to determine if there would be any negative impacts from redirecting water currently discharged to WCA-2A instead to the Hillsboro Canal east through the S-39A Structure.

The Long-Term Plan for the NSID basin assumed that the conveyance of NSID basin flows to the Hillsboro Canal and the Hillsboro Site 1 Impoundment would be made by the Comprehensive Everglades Restoration Plan (CERP). Under this assumption, there were no additional project elements included in the Long-Term Plan to implement the alternative that redirected all NSID basin flows to the Site 1 Impoundment. The CERP Site 1 Impoundment Draft Implementation Report (PIR) dated February 2005 includes replacement of the S-39A structure and canal improvements from the proposed pump station east to the Lake Worth Drainage District (LWDD) E-1 Canal. The locations of the Site 1 Impoundment and S-39A Structure are also shown on Figure 1.2.

The Hillsboro Site 1 Impoundment was not included in the analysis for storage or impoundment of flood event discharges. Under typical operation conditions, the Site 1 Impoundment will pump from the Hillsboro Canal when the canal is above its control elevation and the Impoundment is below its design high water level. The South Florida Water Management Model, Version 3.5, (a continuous 31-year simulation) was used to estimate the stage duration curves of water levels within the Site 1 Impoundment. Based on the results of the 31-year simulation model, it was assumed that for this analysis the Impoundment could be filled to capacity prior to a major storm event and it could not be depended on for flood protection. Therefore, in the 2004 H&H Analysis for NSID basin and Hillsboro Canal, all flows from the NSID basin were routed to the Hillsboro Canal and discharged through the G-56 Structure to tide. The analysis, completed in July 2004, concluded that the excess flows from the NSID basin would adversely impact stages within the Hillsboro Canal. The evaluation included an assessment of the potential to connect adjacent Bishop Property sand mines to the NSID water management system for additional surface water storage by gravity conveyance. The Bishop Property was not modeled as an above grade impoundment with pumped inflow. This analysis also showed that providing gravity connection to the Bishop Property would not mitigate the impacts to the Hillsboro Canal. The location of the Bishop Property in relation the Hillsboro Canal is depicted on Figure 1.2.

The SFWMD contracted A.D.A. Engineering, Inc. (ADA) through the General Engineering Services Work Order CN040912-WO05 to evaluate alternatives for potential improvements related to the Hillsboro basin to meet long-term water quality goals for discharges from the NSID basin to the EPA and minimize impacts to the Hillsboro and L-36 canals. Pertinent data from the 2004 H&H Analysis for the NSID and Hillsboro basins will be utilized to define general parameters of the alternatives. Environmental impacts will not be analyzed and no recommendations will be made as a result of the conduct of this evaluation. The results of this evaluation are intended to

assist decision-makers. Planning-level cost estimates of the alternatives including land acquisition, construction, and operation and maintenance (O&M) will be the primary result of this evaluation of alternatives.

The alternatives being evaluated as part of this project are as follows:

- Alternative 1, Improvements to Hillsboro Canal and Associated Improvements – Dredging of portions of the Hillsboro and L-36 canals in combination with modifications to the G-56 Structure required to mitigate for excess discharge from the NSID basin.

- Alternative 2, Bishop Property Impoundment – Construction of an above ground pumped reservoir based on the area and configuration of the Bishop Property to accept the required excess discharge volume from the NSID basin.

2. Scope and Objective

Work Order CN040912-WO05 includes planning-level evaluation and cost estimating of two alternatives to meet long-term water quality goals for discharges from the NSID basin to the EPA and minimize impacts to the Hillsboro and L-36 canals. The Statement of Work of this work order includes the following tasks, subtasks and deliverables:

- Task 1 – Kick-off Meeting
  Deliverables:
  1.1 – Kick-off meeting summary

- Task 2 – Data Review and Alternative Assessment
  Task 2.1 – Data Review and Summary
  Task 2.2 – Extract Pertinent Data from Previous Model and Calculate Excess Volume
  Deliverables:
  2.1 – Data Assessment and Methodology Technical Memorandum
  2.2 – Draft Alternative Assessment Technical Memorandum
  2.3 – Final Alternative Assessment Technical Memorandum

- Task 3 – Schematic Design of Alternatives
  Task 3.1 – Alternative 1, Hillsboro & L-36 Canal Improvements Schematic Design
  Task 3.2 – Alternative 2, Impoundment Schematic Design
  Deliverables:
  3.1 – Draft Alternative Schematic Design Technical Memorandum
  3.2 – Final Alternative Schematic Design Technical Memorandum

- Task 4 – Cost Estimating for Alternatives
  Deliverables:
  4.1 – Draft Alternative Cost Estimate Technical Memorandum
  4.2 – Final Alternative Cost Estimate Technical Memorandum

- Task 5 – Technical Review Meetings for Tasks 2, 3 and 4
  Task 5.1 – Technical Review Meeting for Task 2
  Task 5.2 – Technical Review Meeting for Task 3
  Task 5.3 – Technical Review Meeting for Task 4
  Deliverables:
  5.1 – Task 2 Technical Review Meeting Summary
  5.2 – Task 3 Technical Review Meeting Summary
  5.3 – Task 4 Technical Review Meeting Summary

This Technical Memorandum – Final Alternative Cost Estimate Technical Memorandum (Deliverable 4.2) – summarizes the work items associated with Task 4 of the Statement of Work. As part of Task 4, planning-level costs for construction, operation and maintenance of the alternatives identified in the Final Alternative Schematic Design Technical Memorandum (Deliverable 3.2) will be developed. These cost estimates will equate to a 50-year planning-level present worth cost in 2006 dollars and will be developed in accordance with the methodology and assumptions outlined in the Final Alternative Assessment Technical Memorandum (Deliverable 2.3).

This project has been a fact-finding exercise and was not intended to make an alternative recommendation or define the final arrangement, location and character of the proposed project. The purpose of this project has been to develop information necessary for policy decision makers to determine the most cost effective solution to meet the requirements of the Long-Term Plan.

3. Alternative 1 – Cost Estimate

3.1 Summary of Alternative 1 Design Features

As outlined in Deliverable 3.1 (Final Alternative Schematic Design Technical Memorandum), Alternative 1 will be comprised of the improvements required to the Hillsboro Canal, L-36 Canal and G-56 Structure to accommodate the maximum permitted flows (445 cubic feet per second) discharged under current conditions to WCA-2A from the NSID Basin, after the peak stage in the L-36 Canal reaches the 10-year, 24-hour design storm peak stage. Alternative 1 will include the following specific improvements:

1. Increasing Hillsboro Canal cross-sectional area from the G-56 Structure to the LWDD E-1 Canal and from the proposed Site 1 Impoundment inflow pump station to the S-39 Structure,
2. Increasing L-36 Canal cross-sectional area from the NSID Pump Station # 2 to the S-39A Structure, and
3. Increasing the capacity of the G-56 Structure to accommodate the flow from the NSID Basin.

Figure 3.1 shows the preliminary location and features of the Alternative 1 improvements.

3.2 Alternative 1 Cost Estimate

Alternative 1 was assessed in accordance with the methodology outlined in the Final Alternative Assessment Technical Memorandum (Deliverable 2.3), and the schematic design is summarized in the Final Alternative Schematic Design Technical Memorandum (Deliverable 3.2). As part of these assessments, the Hillsboro Canal was subdivided into two branches:

- West Branch - from the S-39 Structure to the Hillsboro Site 1 Impoundment inflow pump station
- East Branch - from the LWDD E-1 Canal to the G-56 Structure

The alternative assessments indicated that to accommodate the additional flow from the NSID Basin, the Hillsboro West Branch, Hillsboro East Branch and L-36 Canal cross-sectional area would have to be increased. Table 3.1 summarizes the additional required canal cross-sectional area and required excavation or dredging volumes to achieve these areas. To obtain the required additional cross-sectional area for each canal section, the canal bottom was deepened where possible. The deepening of each cross-section along the Hillsboro and L-36 Canals followed the same procedure used in the CERP Site 1 Impoundment Draft PIR. The CERP Site 1 Impoundment Draft PIR called for 2H:1V side slopes. The proposed canal improvements associated with the

Site 1 Impoundment project are not part of this analysis. The improvements to the canals associated with the Site 1 Impoundment project are assumed to be incorporated as part of the CERP initiatives.

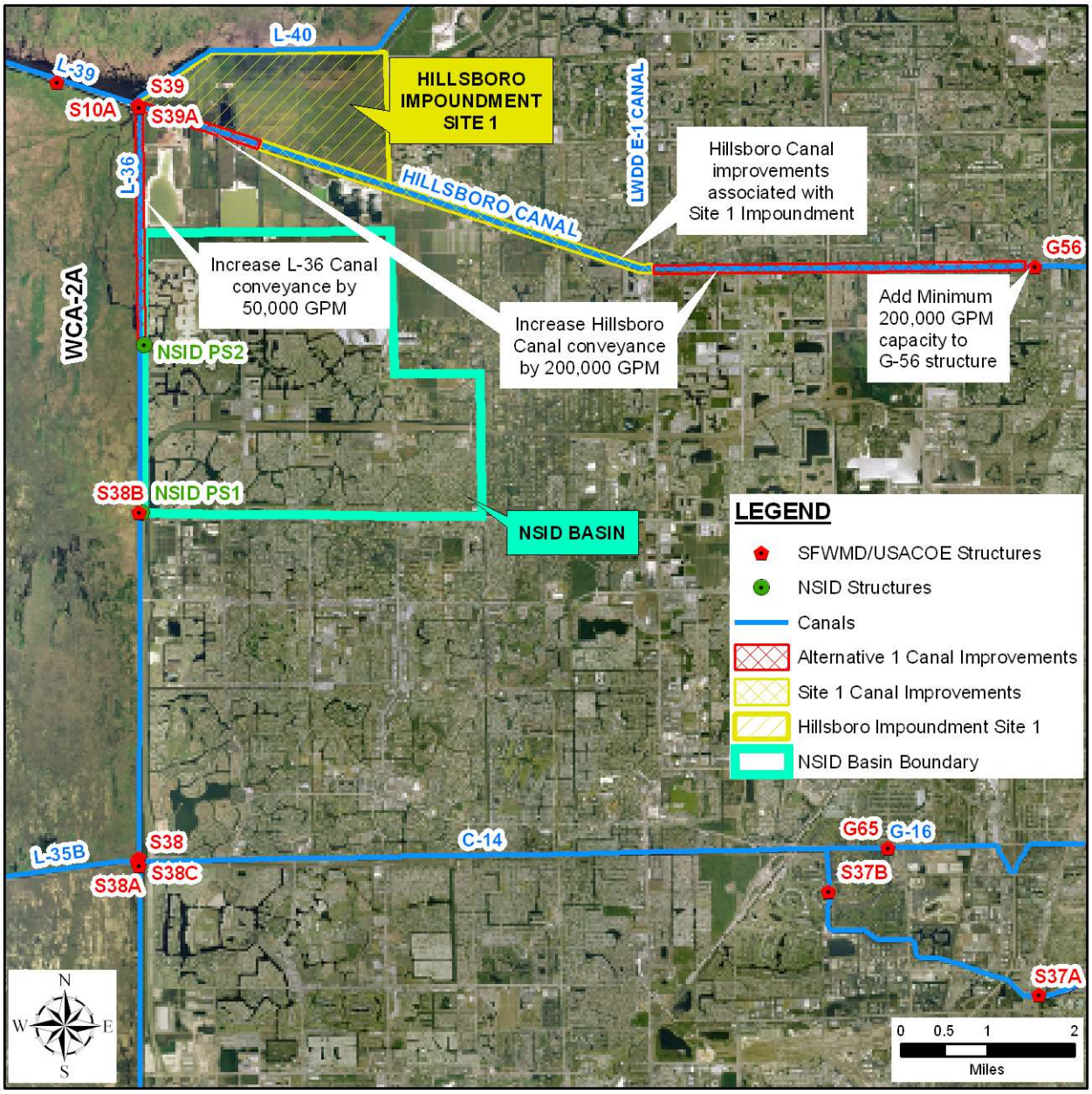

Figure 3.1 – Alternative 1 Design Features

Table 3.1
Alternative 1 Required Canal Improvements Summary

XP-SWMM Link	Link Length (FT)	Q_{exs} Existing Peak Flow (CFS)	V_{exs} Existing Peak Velocity[1] (FT/S)	Stage[2] (FT-NGVD29)	Flow Area at Stage[3] (SF)	Q_{add} Additional Flow Required (CFS)	Flow A_{req} Area Required[4] (SF)	Additional Flow Area Required[5] (SF)	Additional Flow Area Provided[6] (SF)	Additional Canal Cut Area Above Peak Stage[7] (SF)	Incremental Additional Volume[8] (CY)	Cumulative Volume (CY)
L-36 CANAL												
XS11.1	3,729	349.64	1.00	10.18	349.6	111	460.6	111.0	157.3	-	21,725	21,725
XS20	7,895	280.60	1.00	9.31	280.6	111	391.6	111.0	123.5	-	36,113	57,838
XS32	2,838	266.04	1.00	9.27	266.0	111	377.0	111.0	111.3	-	11,700	69,538
HILLSBORO CANAL - WEST BRANCH												
NXS1	1,738	258.96	1.00	9.05	259.0	445	704.0	445.0	450.9	-	29,029	29,029
NXS2	1,959	252.40	1.00	9.02	252.4	445	697.4	445.0	561.7	94.0	47,581	76,611
NXS3	1,966	246.44	1.00	9.01	246.4	445	691.4	445.0	629.9	150.0	56,775	133,385
NXS4	2,127	240.29	1.00	9.01	240.3	445	685.3	445.0	445.0	31.0	37,493	170,878
HILLSBORO CANAL - EAST BRANCH												
NXS18	1,073	2,512.30	2.76	11.51	911.9	445	1,073.4	161.5	196.0	13.0	8,306	8,306
NXS18.1	1,074	2,513.16	2.75	11.43	915.2	445	1,077.3	162.1	196.0	13.0	8,314	16,619
NXS19	2,006	2,802.47	3.09	11.23	906.4	445	1,050.3	143.9	187.6	56.0	18,099	34,719
NXS20	774	2,803.44	3.34	11.06	839.1	445	972.3	133.2	209.6	5.0	6,152	40,871
NXS21	1,446	2,916.59	1.93	11.00	1,512.0	445	1,742.7	230.7	244.3	51.0	15,817	56,688
NXS22	2,147	2,975.05	2.09	10.86	1,421.4	445	1,634.0	212.6	234.9	-	18,680	75,368
NXS23	1,195	4,729.29	3.72	12.20	1,271.0	445	1,390.6	119.6	126.1	-	5,579	80,947
NXS24	1,196	4,729.98	3.94	11.93	1,200.2	445	1,313.1	112.9	124.6	-	5,517	86,464
NXS25	497	4,729.20	3.35	11.87	1,410.0	445	1,542.7	132.7	140.7	-	2,590	89,054
NXS25.2	497	5,790.32	4.13	11.77	1,402.0	445	1,509.8	107.7	177.2	-	3,262	92,316
NXS25.1	994	6,046.45	4.39	11.53	1,378.9	445	1,480.4	101.5	177.2	-	6,524	98,840
NXS26	1,056	6,065.00	4.71	11.21	1,288.0	445	1,382.5	94.5	101.1	-	3,954	102,794
NXS26.1	1,056	6,066.28	4.84	10.85	1,254.7	445	1,346.7	92.0	101.1	-	3,954	106,748
NXS27	986	6,065.15	3.89	10.67	1,558.0	445	1,672.3	114.3	140.7	-	5,138	111,886
NXS27.1	985	6,082.55	3.98	10.46	1,526.7	445	1,638.4	111.7	140.7	-	5,133	117,020
NXS28	1,003	6,081.90	3.62	10.28	1,681.9	445	1,805.0	123.1	178.4	-	6,627	123,647
NXS28.1	1,004	6,081.53	3.61	10.17	1,683.7	445	1,806.9	123.2	178.4	-	6,634	130,281
NXS29	1,847	6,086.15	4.38	9.64	1,391.1	445	1,492.8	101.7	124.0	-	8,484	138,765
NXS30	1,848	6,087.10	4.02	9.26	1,514.6	445	1,625.3	110.7	149.1	-	10,205	148,970
G56US	412	6,086.35	2.75	9.22	2,210.0	445	2,371.6	161.6	172.0	-	2,625	151,595

1 V_{exs} for the L-36 and West Branch of the Hillsboro Canal are less than 0.5 ft/s. A 1.0 ft/s min. velocity was assumed as acceptable velocity for SFWMD Canals. V_{exs} is the peak velocity associated with the peak flow per the XP-SWMM model.

2 Stage at Peak Flow according to link downstream node.

3 Flow areas in accordance with stage corresponding to time of peak flow.

4 Total flow area required below peak stage to accommodate an additional 50,000 gpm (111 cfs) [L-36] and 200,000 gpm (445 cfs) [Hillsboro] flow at V_{exs}.

5 Required flow area below peak stage, computed as the difference between flow area at peak stage and area required.

6 Flow area provided below peak stage.

7 Canal excavation area above peak stage.

8 Total canal excavation volume for additional flow area required.

Acronyms

FT = feet; CFS = cubic feet per second; FT/S = feet per second; SF = square feet; CY = cubic yards; NGVD29 = National Geodetic Vertical Datum of 1929

For some sections of the Hillsboro Canal West Branch, the required area could not be achieved by deepening the canal alone. The canal would have to be widened between approximately 16 and 32 feet in order to achieve the required cross-sectional area. The widening is assumed to occur along the north end of the canal, because this right-of-way should be available as part of the CERP Site 1 Impoundment project. Therefore, it is assumed that there will not be any additional right-of-way required. As for the west branch, some sections of the Hillsboro Canal East Branch required area could not be achieved by deepening the canal alone. The canal will have to be widened between approximately 3 and 19 feet in order to achieve the required cross-sectional area. For cost estimating purposes, it was assumed that there is adequate right-of-way to accommodate this widening. Total required excavation volumes for the Hillsboro Canal West and East Branches are approximately 170,900 and 151,600 cubic yards as depicted in Table 3.1, respectively.

Required additional cross-sectional areas for the L-36 could be achieved by deepening the canal alone. The deepening of the canal cross-sections will be approximately between one to three feet in depth to elevation -3.0 ft-NGVD29. The existing canal bottom elevation is at -1.0 ft-NGVD29. Therefore, a 10H:1V slope will be maintained to match the existing grade. Canal bottom width varies from 28 to 57 feet. Total required excavation volumes for the L-36 Canal is approximately 69,550 cubic yards as depicted in Table 3.1.

As outlined in the Final Alternative Schematic Design Technical Memorandum, to accommodate the additional flow that will be conveyed by the improved Hillsboro West Branch, Hillsboro East Branch and L-36 Canal, the capacity of the G-56 Structure must be increased by 445 cubic feet per second (200,000 gallons per minute). The capacity will be achieved by adding two 96-inch corrugated metal pipe culverts with sluice gates adjacent to the G-56 Structure. These culverts could be located at the north end of the structure, where there is adequate right-of-way available.

The methodology outlined in the Data Assessment and Methodology Technical Memorandum (Deliverable 2.1) was used to develop a 50-year planning-level present worth cost for Alternative 1. The cost estimate includes design, land acquisition, construction, construction management, and O&M costs and is based on unit costs extrapolated from previous studies and current available information relative to the project. The SFWMD provided unit costs when information was not available from literature.

The following approach was implemented in estimating the 50-year planning-level present worth cost for Alternative 1:

1. The 50-year present worth cost is in 2006 dollars.
2. The 50-year present worth capital and O&M costs were escalated as follows:
    a. planning and design costs escalated to the estimated center of the planning and design phase,
    b. land acquisition costs escalated to the estimated center of the land acquisition phase,
    c. construction costs escalated to the center of the estimated construction period, and
    d. annual O&M costs escalated to the year that the cost occurs.
3. Escalation rate was established at 3%, and the discount rate was established at 6-3/8%.
4. Construction management costs were estimated as 7% of the construction cost, respectively, as documented in the Site 1 Impoundment Draft PIR. The contractor's profit was included in the unit costs.
5. Planning and design costs were estimated at 10% of the construction cost.
6. Available unit and O&M costs from information reviewed as part of this project were used to determine the alternative capital and O&M costs.
7. It was assumed that canal dredged material is not contaminated and can be hauled to and disposed in the vicinity of the Site 1 Impoundment area. The excavated material from the L-36 Canal, Hillsboro East and Hillsboro West canal was assumed to go to the Site 1 impoundment.
8. The canal unit excavation cost is assumed to be $6/cubic yard, except for the East Hillsboro Canal Branch. The East Hillsboro Canal Branch has limited access and will possibly require barges to dispose of excavated material and will have less productivity efficiency. Therefore the unit excavation cost for the East Hillsboro Canal Branch is assumed to be $22/cubic yard.
9. For required dredging, excavation and compaction quantities, a 0.85 Compaction Factor and 1.1 Swell Factor will be used as documented in the Site 1 Impoundment Draft PIR.
10. There are no land acquisition costs associated with Alternative 1.
11. The cost of adding a culvert at the G-56 Structure was based on the prorated value given in the Site 1 Impoundment Draft PIR for Structure S-527B.
12. It was assumed that there will not be any recreational costs associated with Alternative 1.
13. A 20% contingency was applied to the overall estimated present worth cost for each alternative.
14. Construction would commence in May of 2006 and have a duration of 2 years.

The overall 50-year planning-level present worth cost for Alternative 1 is $16,823,117. The detailed cost estimate is included in Attachment A.

4. Alternative 2 – Cost Estimate

4.1 Summary of Alternative 1 Design Features

As outlined in Deliverable 2.3, Alternative 2 is comprised of constructing an above-ground impoundment with the location and characteristics of the Bishop Property to accommodate the volume discharged to WCA-2A from the NSID Basin under current conditions. This volume was calculated in Task 3 and presented in Deliverable 3.2 (Final Alternative Schematic Design TM) using the maximum permitted discharge rate (445 cubic feet per second) from the time period the peak stage upstream of NSID Pump Station #1 reaches the 10-year, 24-hour design storm peak stage until the Hillsboro Canal again has capacity to discharge the water to tide. Alternative 2 will include the following specific components:

1. An above ground impoundment with the location and characteristics of the Bishop Property to store the excess runoff volume that would be discharged to WCA-2A during a 100-year, 3-day storm event as outlined under the current permit conditions;
2. A 200,000 gpm pump station to redirect L-36 Canal flows and discharge the runoff volume into the impoundment;
3. Seepage pump station to collect seepage collected from the required perimeter seepage collection canal;
4. Discharge structure to discharge water from the impoundment to the L-36 Canal, once stages in the Hillsboro Canal reach acceptable levels;
5. Emergency overflow structure to allow discharge from the reservoir, when reservoir is full and there is a storm larger than a 25-year, 3-day design storm event; and
6. Cross-sectional area improvements of the portion of the L-36 Canal from the NSID Pump Station #2 to the Bishop Property impoundment pump station and from the Bishop Property impoundment discharge structure to the S-39A Structure.

Figure 4.1 shows the preliminary location and features of the Alternative 2 improvements.

4.2 Alternative 2 Cost Estimate

Alternative 2 was assessed in accordance with the methodology outlined in the Final Alternative Assessment Technical Memorandum (Deliverable 2.3), and the schematic design is summarized in the Final Alternative Schematic Design Technical Memorandum (Deliverable 3.2). As part of those assessments, a total of 3,100 acre-feet (ac-ft) of runoff must be detained within the Bishop Property Impoundment to accommodate the volume discharged to WCA-2A from the NSID Basin under current conditions. This is the runoff volume that would be discharged from the NSID Basin to

WCA-2A through Pump Station # 1 during a 100-year, 3-day storm event between the time the stage upstream of Pump Station #1 reaches the 10-year, 24-hour design storm stage (10.22 ft-NGVD29), until the time the tailwater stage at the S-39A Structure falls below elevation 9.0 ft-NGVD29.

The alternative assessment also indicated that to accommodate the additional flow from NSID Basin, a portion of the L-36 Canal bottom will have to be deepened to provide the required additional canal cross-sectional areas. Table 4.1 summarizes the additional required canal cross-sectional areas and required excavation or dredging volumes to achieve these areas. The L-36 Canal improvements will be required from the NSID Pump Station #2 to the Bishop Impoundment inflow pump station located at the southern end of the Bishop Impoundment and from the Bishop Impoundment discharge structure located on the north end of the Bishop Impoundment to the S-39A Structure. No improvements will be made to the L-36 Canal between the Bishop Impoundment inflow pump station and discharge structures. Total required excavation volumes for the L-36 Canal is approximately 45,850 cubic yards as depicted in Table 4.1.

As outlined in the Final Alternative Schematic Design Technical Memorandum, the proposed design assumptions outlined in the CERP Site 1 Impoundment Draft PIR were used to determine the Bishop Property Impoundment normal pool depth, containment levees, and seepage canals. From the alternative schematic design, the following impoundment features will be required:

1. Approximately 460 acres of land will be required. The Bishop Property encompasses approximately 410 acres. Therefore, the impoundment would require more land than the area available for the Bishop Property.
2. Approximately 18,160 linear feet of containment levee with a top elevation of 25.0 ft-NGVD29 will be required, which will include approximately 469,689 cubic yards of fill material.
3. Approximately 13,900 linear feet of seepage canal with a bottom elevation of -0.5 ft-NGVD29 will be required, which will include approximately 467,222 cubic yards of excavation.

In addition to these design features, a total of four structures will be required to operate the Bishop Property Impoundment:

1. **Inflow Pump Station:** 200,000 gallons per minute (gpm) pump station capacity.
2. **Seepage Pump Station:** 41,300 gpm pump station capacity.
3. **Discharge Structure:** 445 cubic feet per second (cfs) control structure capacity at a 2.2 feet of hydraulic head, which will require two 84-inch corrugated metal pipe culverts with sluice gates.
4. **Emergency Overflow Spillway:** 15-feet weir length with a 70 cfs flow capacity at a design head of 1.5 feet.

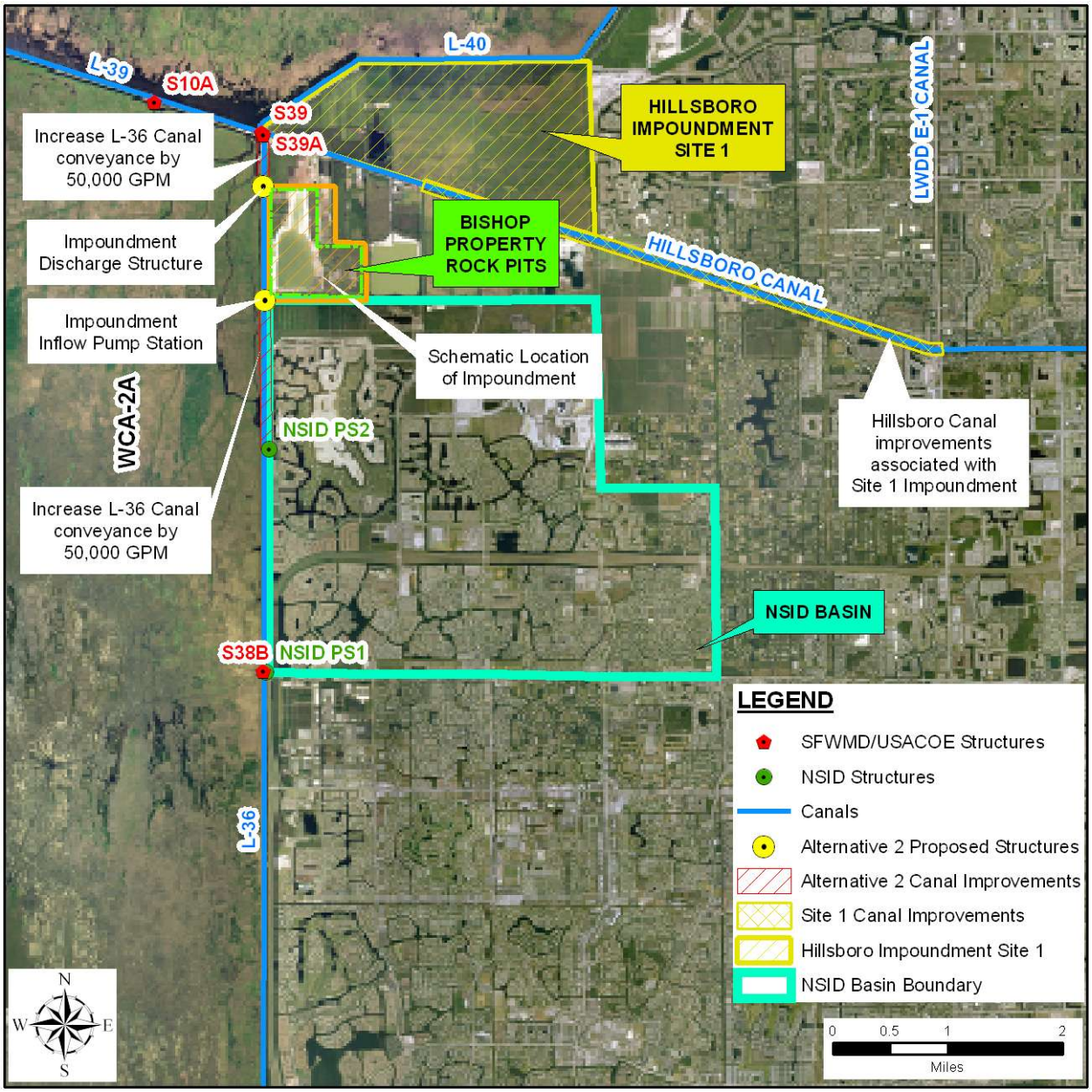

Figure 4.1 – Alternative 2 Design Features

Table 4.1
Alternative 2 Required Canal Improvements Summary

XP-SWMM Link	Link Length (FT)	Q_{exs} Existing Peak Flow (CFS)	V_{exs} Existing Peak Velocity[1] (FT/S)	Stage[2] (FT-NGVD29)	Flow Area at Stage[3] (SF)	Q_{add} Additional Flow Required (CFS)	Flow A_{req} Area Required[4] (SF)	Additional Flow Area Required[5] (SF)	Additional Flow Area Provided[6] (SF)	Incremental Additional Volume[7] (CY)	Cumulative Volume (CY)
L-36 CANAL											
XS11.1	3,729	349.64	1.00	10.18	349.6	111	460.6	111.0	157.3	21,725	21,725
XS20	3,171	280.60	1.00	9.31	280.6	111	391.6	111.0	123.5	14,504	36,229
XS32	2,330	266.04	1.00	9.27	266.0	111	377.0	111.0	111.3	9,605	45,834

1 V_{exs} for the L-36 and West Branch of the Hillsboro Canal are less than 0.5 ft/s. A 1.0 ft/s min. velocity was assumed as acceptable velocity for SFWMD Canals. V_{exs} is the peak velocity associated with the peak flow per the XP-SWMM model.

2 Stage at Peak Flow according to link downstream node.

3 Flow areas in accordance with stage corresponding to time of peak flow.

4 Total flow area required below peak stage to accommodate an additional 50,000 gpm (111 cfs) [L-36] and 200,000 gpm (445 cfs) [Hillsboro] flow at V_{exs}.

5 Required flow area below peak stage, computed as the difference between flow area at peak stage and area required.

6 Flow area provided below peak stage.

7 Total canal excavation volume for additional flow area required.

Acronyms

FT = feet; CFS = cubic feet per second; FT/S = feet per second; SF = square feet; CY = cubic yards; NGVD29 = National Geodetic Vertical Datum of 1929

As for Alternative 1, the methodology outlined in the Data Assessment and Methodology Technical Memorandum (Deliverable 2.1) was used to develop a 50-year planning-level present worth cost for Alternative 2. The cost estimate includes design, land acquisition, construction, construction management, and O&M costs and is based on unit costs extrapolated from previous studies and current available information relative to the project. The SFWMD provided unit costs when information was not available from literature.

The following approach was implemented in estimating the 50-year planning-level present worth cost for Alternative 2:

1. The 50-year present worth cost is in 2006 dollars.
2. The 50-year present worth capital and O&M costs were escalated as follows:
    a. planning and design costs escalated to the estimated center of the planning and design phase,
    b. land acquisition costs escalated to the estimated center of the land acquisition phase,
    c. construction costs escalated to the center of the estimated construction period, and
    d. annual O&M costs escalated to the year that the cost occurs.
3. Escalation rate was established at 3%, and the discount rate was established at 6-3/8%.
4. Construction management costs were estimated as 7% of the construction cost, respectively, as documented in the Site 1 Impoundment Draft PIR. The contractor's profit was included in the unit costs.

5. Planning and design costs were estimated at 10% of the construction cost.
6. Available unit and O&M costs from information reviewed as part of this project were used to determine the alternative capital and O&M costs.
7. It was assumed that canal dredged material is not contaminated and can be hauled to and disposed in Bishop Property lake. The excavated material from the burrow canals was used to complete the construction of the levees.
8. The canal unit excavation cost for the L-36 Canal is assumed to be $6/cubic yard.
9. For required dredging, excavation and compaction quantities, a 0.85 Compaction Factor and 1.1 Swell Factor will be used as documented in the Site 1 Impoundment Draft PIR (Item 5 in Table 3.1).
10. Recent, comparable land acquisition costs for Alternative 2 were not available, and therefore, a range of $50,000 to $200,000 per acre was assumed. The high-level of uncertainty in the cost of land is due to unknown factors and the possibility of locating the impoundment on several land parcels in an area with varying exiting land uses. The appraisal and closing costs for Alternative 2 were assumed to be 10% of the land acquisition costs.
11. Pump station, discharge and control structure costs were derived based on a prorated flow basis from similar structure estimated costs documented in the Site 1 Impoundment Draft PIR and Basin Specific Feasibility Studies for the Everglades Stormwater Program Basins.
12. It was assumed that there will not be any recreational costs associated with Alternative 2.
13. A 20% contingency was applied to the overall estimated present worth cost for each alternative.
14. Construction would commence in May of 2006 and have a duration of 2 years.

The overall 50-year planning-level present worth cost for Alternative 2 is $57,087,726 to $132,649,861. The detailed cost estimate is included in Attachment B.

Attachment A
Alternative 1 Cost Estimate

A.D.A. Engineering, Inc.
Consulting Engineers & Planners

Alternative 1 - Conceptual Cost Estimate for the Elimination of Stormwater Discharges from NSID to the Everglades Protection Area

Date: November 2, 2005

Construction Cost

L-36 Canal

Item	Quantity	Unit of Measure	2006 Cost	Total Cost
Canal Excavation	69,550	CY	$6.00	$417,300
Loading of Excavated Material with a 3 cy FE loader	76,505	CY	$1.34	$102,467
Seeding and Grassing	35	AC	$2,120.00	$74,200
Hauling of Material (5 Miles RT, 20 cy Dump Trailer)	76,505	CY	$5.70	$436,079
			Sub-Total	$1,030,045

Hillsboro Canal: West Branch

Item	Quantity	Unit of Measure	2006 Cost	Total Cost
Canal Excavation	170,900	CY	$6.00	$1,025,400
Loading of Excavated Material with a 3 cy FE loader	187,990	CY	$1.34	$251,783
Seeding and Grassing	18	AC	$2,120.00	$38,160
Hauling of Material (15 Miles RT, 20 cy Dump Trailer)	187,990	CY	$8.85	$1,663,712
			Sub-Total	$2,979,055

Hillsboro Canal: East Branch

Item	Quantity	Unit of Measure	2006 Cost	Total Cost
Canal Excavation	151,600	CY	$22.00	$3,335,200
Loading of Excavated Material with a 3 cy FE loader	166,760	CY	$1.34	$223,349
Seeding and Grassing	53	AC	$2,120.00	$112,360
Hauling of Material (1 Mile RT, 20 cy Dump Trailer)	166,760	CY	$2.50	$416,900
			Sub-Total	$4,087,809

G-56 Structure Modification

Item	Quantity	Unit of Measure	2006 Cost	Total Cost
Structure Modification to 445 cfs	1	LS	$675,000.00	$675,000
			Sub-Total	$675,000

Construction Sub-Total	$8,771,909
Contractor's General Conditions	$250,000
Construction Management (7%)	$631,534
Planning & Design (10%)	$902,191
Contingency (20%)	$2,111,127
Construction Grand Total	$12,666,761
50-Year Present Worth Value	$12,316,184

Operations & Maintenance Costs

Item	Quantity	Unit of Measure	2006 Cost	Total Cost
Vegetation Maintenance of Canals (Includes all 3 canals)	245	AC	$30.90	$7,571
Maintenance Staff	0.25	LS	$125,000.00	$31,250
Telemetry	1	EA	$50,000.00	$50,000
Field Vehicles	2	EA	$23,500.00	$47,000
Gate Maintenance	5	EA	$8,240.00	$41,200

*Operating Costs are assumed to be for a yearly basis

Operations Sub-Total	$177,021
Contingency (20%)	$35,404
Initial O&M Grand Total	$212,425
50-Year Present Worth Value	$4,506,933
Alternative 1 Total Cost	**$12,879,185**
50-Year Present Value for Alternative 1	**$16,823,117**

A.D.A. Engineering, Inc.
Consulting Engineers & Planners

50-Year Present Worth Analysis for Alternative 1

Present Date	1/1/2006	
Escalation Rate (Compounded Annually)	3%	Annually
Discount Rate (Compounded Monthly)	6.375%	Annually

Item	Begin	End	Sub-total	years	Escalated Value	mid-Date	months	Present Worth Value
Construction	5/1/2006	5/31/2008	$12,666,761	2	$13,438,166	5/16/2007	16.45	$12,316,184
Operations & Maintenance	6/1/2008	6/30/2058	$212,425	52	$25,851,266	6/15/2033	329.67	$4,506,933

TOTAL 50-Year Present Worth **$16,823,117**

A.D.A. ENGINEERING, INC.
CONSULTING ENGINEERS & PLANNERS

NSID Basin Alternative 1 Summary

Construction Costs	
Total Construction Costs	$12,666,761
50 Year Present Worth Construction Costs	$12,316,184
Operations Costs	
Total Operations Costs (Initial Year)	$212,425
50 Year Present Worth Operations Costs	$4,506,933
Total Capital Costs	$12,879,185
Total 50 Year Present Worth Costs	$16,823,117

Assumptions:

1. **Escalation rate of 3%**
2. **Discount rate of 6-3/8%**
3. **Construction cost were escalated based on the expected date of occurrence**
4. **Operations Costs are based on a yearly basis and once the pumps are within the SFWMD's possesion.**

Attachment B
Alternative 2 Cost Estimate

NSID Basin Alternative 2 Summary

Construction Costs	
Total Construction Costs	$24,248,339
50-Year Present Worth Construction Costs	$23,577,220
Operations Costs	
Total Operations Costs (Year 2006)	$392,293
50-Year Present Worth Operations Costs	$8,323,127
Land Acquisition Costs	
Total Land Acquisition Costs	$25,300,000 to $101,200,000
50-Year Present Worth Land Acquisitions Costs	$25,187,379 to $100,749,514
Total Capital Costs	$49,940,632 to $125,840,632
Total Present Worth Costs	$57,087,726 to $132,649,861

Assumptions:

1. **Escalation rate of 3%**
2. **Discount rate of 6-3/8%**
3. **Construction cost were escalated based on the expected date of occurrence**
4. **Operations Costs are based on a yearly basis and once the pumps are within the SFWMD's possession.**

A.D.A. ENGINEERING, INC.
CONSULTING ENGINEERS & PLANNERS

Alternative 2 - Conceptual Cost Estimate for the Elimination of Stormwater Discharges from NSID to the Everglades Protection Area

Date: November 2, 2005

Construction Cost

Item	Quantity	Unit of Measure	2006 Cost	Total Cost
Dredging of L-36 Canal	45,850	CY	$6.00	$275,100
Dredging Mobilization & Demobilization	1	LS	$59,000.00	$59,000
Loading of Excavated Material with a 3 cy FE loader	564,379	CY	$1.34	$756,268
Hauling of Material (5 Miles RT, 20 cy Dump Trailer)	564,379	CY	$5.70	$3,216,961
Excavation of Seepage Canals	467,222	CY	$2.60	$1,214,777
Levees	18,160	LF	$172.00	$3,123,520
Seeding and Grassing	71	AC	$2,120.00	$150,520
Inflow Pump Station (200,000 gpm)	1	EA	$4,500,000.00	$4,500,000
Seepage Pump Station (41,300 gpm)	1	EA	$929,250.00	$929,250
Emergency Spillway	1	LS	$45,000.00	$45,000
Discharge Structure (With (2) 84" cmp culverts and sluice gates)	1	EA	$2,750,500.00	$2,750,500
			Sub-Total	$17,020,897

Construction Sub-Total	$17,020,897
Contractor's General Conditions	$250,000
Construction Management (7%)	$1,208,963
Planning & Design (10%)	$1,727,090
Contingency (20%)	$4,041,390
Construction Grand Total	$24,248,339
50-Year Present Worth Value	$23,577,220

Land Acquisition Costs

Item	Quantity	Unit of Measure	Cost	Total Cost
Land Acquisition	460	AC	$50,000 to $200,000	$23,000,000 to $92,000,000
Appraisals & Closing Costs	1	LS	10% of Acquisition Cost	$2,300,000 to $9,200,000
			Acquisitions Sub-Total	$25,300,000 to $101,200,000

Land Acquistions Grand Total	$25,300,000 to $101,200,000
50-Year Present Worth Value	$25,187,379 to $100,749,514

Operating Costs

Item	Quantity	Unit of Measure	2006 Cost	Total Cost
Vegetation Maintenance of Levees	70	AC	$335.00	$23,450.00
Vegetation Maintenance of Seepage Canals	34	AC	$30.90	$1,050.60
Maintenance Staff	0.25	LS	$125,000.00	$31,250.00
Telemetry	3	EA	$50,000.00	$150,000.00
Field Vehicles	2	EA	$23,500.00	$47,000.00
Gate Maintenance	9	EA	$8,240.00	$74,160.00

*Operating Costs are assumed to be for a yearly basis

Operations Sub-Total	$326,911
Contingency (20%)	$65,382
Operations Grand Total	$392,293
50-Year Present Worth Value	$8,323,127

Alternative 2 Total Cost	**$49,940,632 to $125,840,632**
50-Year Present Value for Alternative 2	**$57,087,726 to $132,649,861**

A.D.A. Engineering, Inc.
Consulting Engineers & Planners

50-Year Present Worth Analysis for Alternative 2

Present Date	1/1/2006	
Escalation Rate (Compounded Annually)	3%	Annually
Discount Rate (Compounded Monthly)	6.375%	Annually

Item	Begin	End	Sub-total	years	Escalated Value	mid-Date	months	Present Worth Value
Construction	5/1/2006	5/31/2008	$24,248,339	2	$25,725,063	5/16/2007	16.45	$23,577,220
Operations & Maintenance	6/1/2008	6/30/2058	$392,293	52	$47,740,532	6/15/2033	329.67	$8,323,127
Land Acquisitions	1/1/2006	1/1/2008	$25,300,000 to $101,200,000	2	$26,840,770 to $107,363,080	1/1/2007	12.00	$25,187,379 to $100,749,514

TOTAL 50-Year Present Worth **$57,087,726 to $132,649,861**